S-TURB

Turbine Flowmeter

User Manual

CONTENT

I. General

1.1 Introduction

S-TURB turbine flow meter consists of turbine flow sensor and display instrument and it is made by us using foreign state-of-the-art technologies, which is an ideal gauge for measuring of liquid flow.

The flow meter is characterized by simple structure, high precision and easy installation and repair. The product may be used in a wide range of industries, including oil industry, chemical industry, metallurgy, water supply, paper-making, environment protection and food industry.

It is applicable for use in closed pipes to measure flow of liquid which will not erode stainless steel (1Cr18Ni9Ti), 2Cr13, Al2O3 and hard alloy and is free of impurities such as fiber and granules. If this product is used in association with display instruments with special functions, it can be used for purpose of automatic definite quantity control and alarming in case of excessive amount.

1.2 Product Features

1. The sensor is of hard alloy bearing thrust type, which may guarantee the   precision and improve the wear resistance performance as well.

2．Simple and firm structure, easy for installation and dismantling.

3．Wide range of measuring with very low lower flow velocity limit.

4．Small loss of pressure,fine repeat ability and high precision.

5．High resistance to electromagnetic interference and vibration.

1.3 Working Principle

When liquid flows through the casing of sensor, the impulse of fluid will provide the blade with a rotation moment as there is an angle between the blade of impeller and the flow direction. The blade will rotate as the friction moment and the fluid resistance are overcome and it will reach a stable speed when the moments are at balance. Under certain conditions, the rotation speed of blade will be in direct proportion to the flow velocity. Due to the magnetic conductivity of blade, when located in the magnetic field generated by signal detector (made of permanent magnet steel and coils), the rotating blade will cut the magnetic lines and periodically change the flux through the coil, thereby inducing electrical impulse signals at both ends of the coil. The induced signals, after amplified and rectified by amplifier, will form a continuous rectangular impulse wave with certain amplitude which may be remotely transmitted to display instrument indicating the instant flow and the cumulative   flow of fluid. Within a certain range of flow, the impulse frequency f is in direct proportion to the instant flow of fluid flowing through the sensor, which is shown in the equation below:

$$Q = 3600 \times \frac{f}{k}$$

Wherein:

f- Impulse frequency [Hz];

k- Instrument factor of sensor [1/m3], which is given by checklist. If [1/L] is used as the unit,

the equation will be: $Q = 3.6 \times \frac{f}{k}$

Q- Instant flow of liquid (in operation) [m3/h];

3600- Conversion factor.

Instrument factor of each sensor will be filled out in verification certificate by the manufacturer. The instant flow and cumulative flow will be displayed when the value of k is loaded into associated display instrument.

1.4 Major Technical Performance

1. Nominal drift diameter:（4～200）mm, refer to Table 1 for the basic parameters;

2. Medium temperature:（-20～80）°C; Split type (－20～120) °C;

High temperature type please noted before ordering.

3. Ambient temperature:（-20～70）°C;

4. Precision: ±0.5%, ±1％;

5. Detector signal transmission wiring system: three-wire voltage impulse (three-core shield wire);

6. Power supply:

   1) TB3WE Three Wire

   External Power:12~24VDC/30mA(-20%~+15%),if no output can be as low as 6V

   Battery:Lithium battery 3.6V(2/13Ah)/0.4mA

   2)TB2WE Two Wire

   12~24VDC/4-20mA(-20%~+15%)

7. Transmission distance: the distance between the sensor and the display instrument may be as far as 1000m;

8. Local display power supply: 3.6V (Lithium battery, may be used continuously for more than 3 years);

9. Display mode: local LCD displays instant flow and cumulative flow;

10. Output Signal

a)TB3WE Three Wire

1)Pulse Output:High level voltage amplitude≥5V, low level<0.5V

2)Three sire 4-20mA linearity correction current output(need ground wire)(load resistance≤800Ωat 24V)

3)RS485 communication:flowmeter with RS485 interface, communication distance≤1200mm.

b)TB2WE Two Wire

1) Two wire 4~20mA linearity correction current output(need ground wire)(load resistance≤600Ωat 24V)

2) Origin Pulse output:High level≥5V(power supply voltage-1V),Low level<0.5V

Table 1

| S-TURB-LWGY ☐		☐☐☐	☐	☐	☐	Description			
Type	N					Sensor with Pulse(without local display)			
	A					4-20mA Transmitter (without local display)			
	B					Local display, powered by 3.6V battery;			
	C					Local display with 4～20mA, powered by DC24V;			
	RS485					With RS485,local display type, DC24V;			
	HART					With HART,local display type, powered by DC24V;			
Nominal diameter		4				Normal flow range m3/h	0.04～0.25	Extended flow range m3/h	0.04～0.4
		6					0.1～0.6		0.06～0.6
		10					0.2～1.2		0.15～1.5
		15					0.6～6		0.4～8
		20					0.8～8		0.45～9
		25					1～10		0.5～10
		32					1.5～15		0.75～15
		40					2～20		1～20
		50					4～40		2～40
		65					7～70		3.5～70
		80					10～100		5～100
		100					20～200		10～200
		125					25～250		12.5～250
		150					30～300		15～300
		200					80～800		40～800
Explosion protection						Not marked, without explosion protection			
			B			Explosion protection type			
Precision class				A		Precision: Class 0.5			
				B		Precision: Class 1.0			
Turbine type					A	Normal flow range			
					B	Extended flow range			
Note: Sensors with pipe diameter of DN4～DN40 are of thread connections with maximum operating pressure of 6.3Mpa. Sensors with pipe diameter of DN50～DN200 are of flange connections with maximum operating pressure of 2.5Mpa. Sensors with pipe diameter of DN4～DN10 are provided with front and rear straight pipe sections and filters. Please specify when placing an order if flange connections are required for pipe diameter of DN15～DN40. Please specify when placing an order for high pressure type and special requirements.									

1.5 Overall Dimension

The installation types of sensors vary according to specifications, which may be connected either by thread or flange. The installation types are shown in Fig. 1, Fig. 2, Fig.3, Fig. 4 and Fig. 5. The installation dimensions are shown in Table 2.

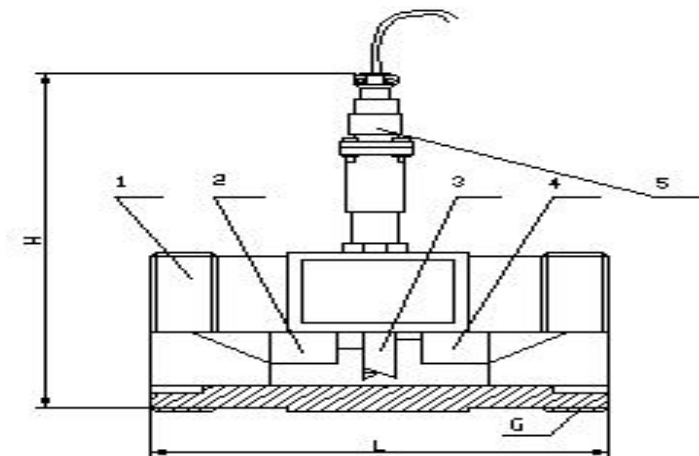Fig. 1 Structure of DN4～DN10 sensor and installation dimension diagram
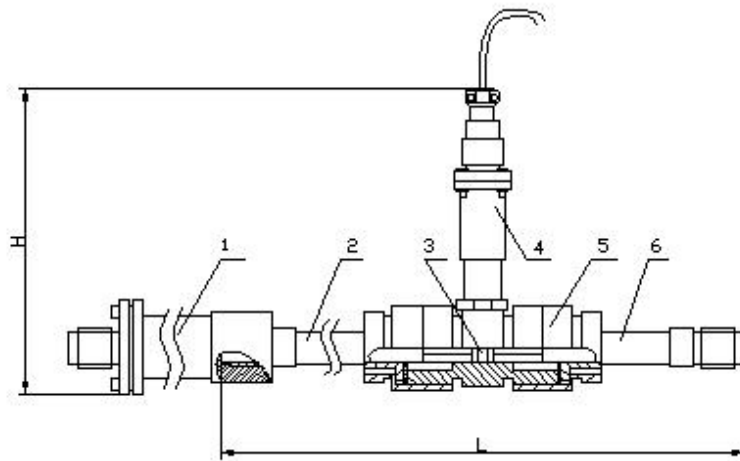
Filter 2. Front straight pipe section 3. Impeller 4. Preamplifier 5. Casing 6. Rear straight pipe section

Fig. 2 Filter structure diagram
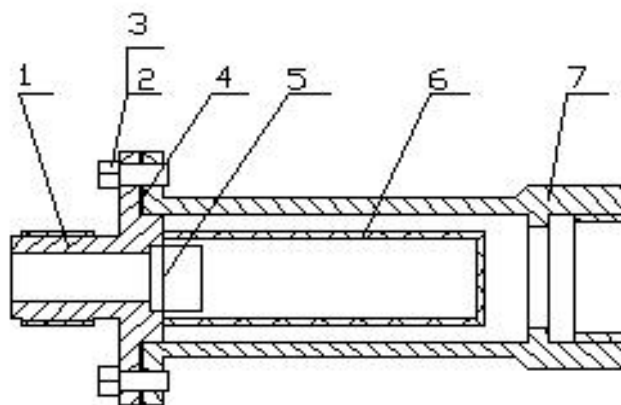
Clamp ring 2. Bolts 4×14 3. Washer 4. Sealing washer 5. Steel wire 1Cr18Ni9Ti-0.8×2.5 6. Filter screen 7. Base

Fig. 3 Structure of DN15～DN40 sensor and installation dimension diagram

Casing   2．Front guide part   3．Impeller   4．Rear guide part   5．Preamplifier

Fig. 4   Structure of S-TURB-LWGY—50～200 sensor and installation dimension diagram
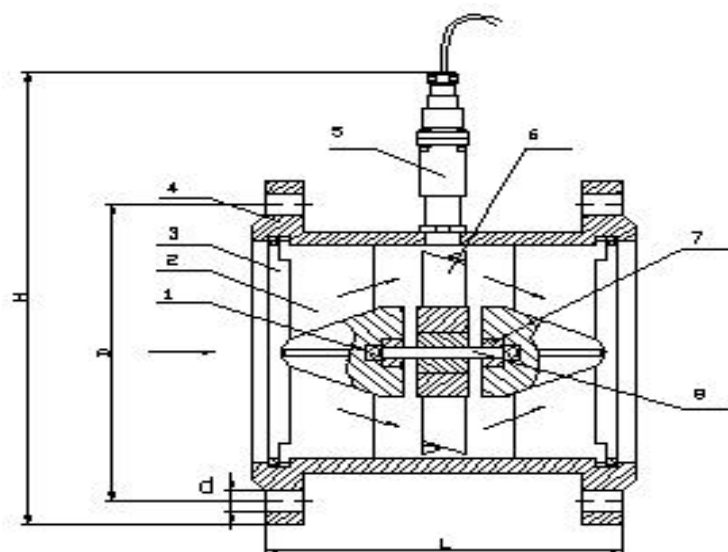
Ball bearing   2．Front guide part   3．Expansion ring   4．Casing   5．Preamplifier
6．Impeller   7．Bearing   8．Shaft

II. Installation Requirements
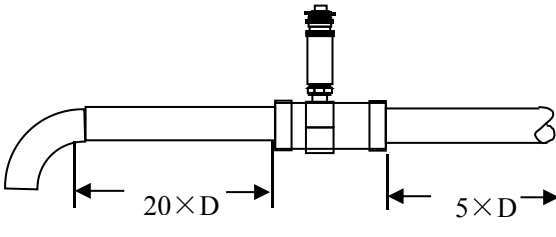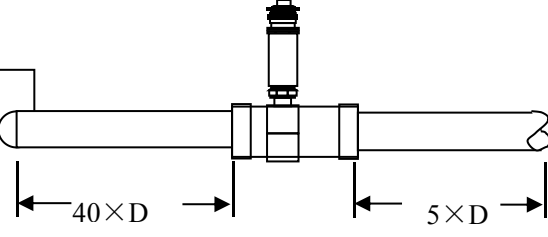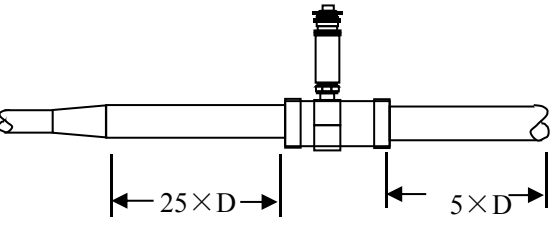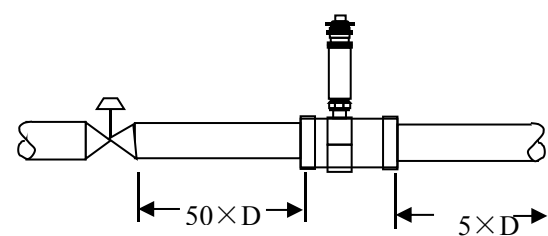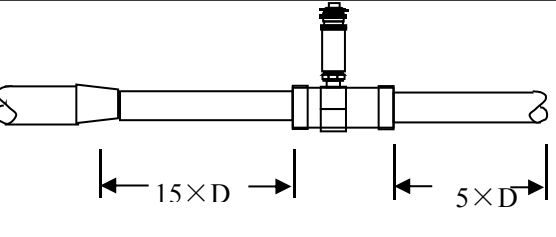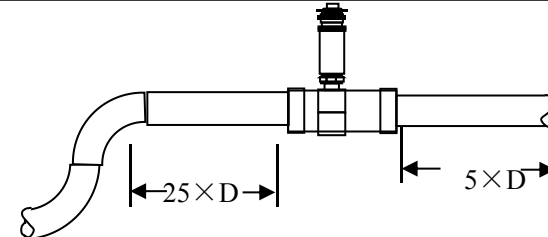
Flow meter may be installed horizontally or vertically. In the latter case the fluid shall be flowing from downward and fulfill the pipe to avoid bubbles; the flowing direction of liquid shall be consistent with the direction indicated by the arrow on casing of the sensor; as far as front and rear straight pipe sections are concerned (see Fig. 6), at upstream there shall be front straight pipe section at least 10 times of nominal drift diameter in length and at downstream no less than 5 times of nominal drift diameter in length. The internal wall of pipe sections shall be smooth and clean, free of defects such as indent, fouling and peeling. The pipe axis of the sensor shall be aligned with that of the neighboring pipe and the washers used for connection and sealing may not be embedded into depth of the pipe cavity; the sensors shall be kept away from foreign electric field and magnetic field, effective shielding measures shall be taken in case of necessity to avoid external interference.

In order that the normal transfer of liquid will not be affected by maintenance, it is recommended that bypass pipes be installed at position of sensor.

In case of open air installation, water proof measures shall be taken for purpose of amplifier and plug of the sensor. The wiring between sensor and display instrument is shown in Fig. 5.

When fluid contains impurities, filter shall be additionally installed. The number of filter screen meshes is determined in accordance with the flow and impurity, normally 20 to 60 meshes. When fluid is mixed with free gases, gas eliminator shall be additionally installed. The complete pipe system shall be well sealed. The user shall fully understand the erosion nature of the measured medium to protect the sensor from being eroded.

Fig. 6 Requirements on straight pipe section for installation of flow meter

One 90° elbow	20×D 5×D	Two 90° elbows for two planes	40×D 5×D
Concentric expander	25×D 5×D	Control valve half-open	50×D 5×D
Concentric shrinkage wide open valve	15×D 5×D	Two 90° elbows for one plane	25×D 5×D

III. Operation

◆ When sensor is used, the liquid to be measured shall be clean and free of impurities such as fiber and granules.

◆ When sensor is used, it shall be at first slowly filled with liquid, then open the outlet valve (which should be installed behind the flow meter). It is prohibited to render the sensor under impact of high-velocity fluid when it is not filled with liquid.

◆ The maintenance interval for sensor is in general half a year. In case of maintenance and cleaning, attention shall be paid not to damage the parts in the measuring cavity, particularly the impeller. During assembly, watch carefully the positional relation between guide part and impeller.

◆ When the sensor will be out of service for a long time, the internal liquid shall be cleaned. After dried, the sensor shall be provided with protection sleeves at both ends to protect against dust and it shall be placed in dry conditions for storage.

◆ The associated filter shall be cleaned on regular basis and the internal liquid shall be

cleaned when it is out of service for a long time. Similar to sensor, the filter shall also be provided with dust protection and stored in dry conditions.

◆ The transmission wire of sensor may be overhead or buried (iron bushing shall be provided in the latter case).

◆ Prior to installation of sensor, the connection thereof with display instrument or oscilloscope shall be finished. Then switch on the power, blow the impeller with mouth or move the impeller with hand to make it rotate quickly, see if there is any reading. Install the sensor if there is reading. In case of no reading, the related sections shall be inspected to eliminate any fault.

Basic Information

There're two types:

- Three Wire Type: TB3WE, can with RS485 or battery powered
- Two Wire Type: TB2WE, can with 4-20mA output, and original pulse

3.1 Wiring

Warning:
Before wiring,cut off the external power.Wiring with electric is strongly prohibit.
Big terminal is the terminal must be used,some small terminal is for additional function.

3.1.1TB3WE Three-Wire System Electric Wiring

1.Main power supply and output signal terminals

(3-digit under-hang spinning terminals in the left).

Fout	(-)	(+)

Fout:Pulse Signal Output Terminal
"-"is the power supply "-" or current flow terminal
"+"is external 12-24VDC power "+"

When "+" "-"connect (or battery type power on),pulse output from "Fout".

2.Auxiliary Wire(small terminal)

The three-wire between main terminal and auxiliary terminal are pulse output switch.

If insert into the outside F0,there will be pulse output.

If insert into the inside NC,then no pulse output.

For two wire current type,only insert outside F0 while testing.

If use current,must insert inside NC to disconnect pulse output. Or else,the current will not be accuracy.

3.Battery Powered Type

+3V6	3V6-	B-	A+

1).Battery Wiring(the right side 1 and 2 in small terminal)

  +3V6: Connect 3.6V battery "+"

  3V6-: Connect 3.6V battery "-"

2)Communication Wiring

 (the left side 3 and 4 in small terminal, if without RS485,no terminal here)

  B-:Connect RS485 "B-"

  A+:Connect RS485"A+"

3.1.2 TB2WE Two-Wire System Electric Wiring

1.Main power supply and output signal terminals

Fout	(-)	(+)

"-":4-20mA output terminal

"+":15-24V power "+" terminal

"+" Connect with +24V external power, current output from "-" to computer/sample resistance of the display. After flow through some load resistance like sample resistance,then back to power "-".

2.Auxiliary Wire(3-digit small terminal)

4-20mA current output type with no auxiliary small terminals.

Fout: Pulse output terminal

When "+" "-" connect with external power then work,pulse output from "Fout".

The three-wire near main terminal are pulse output switch.

If connect to the outside F0,there will be pulse output.

If connect to the inside,then no pulse output.

For two wire current type,only insert outside while testing.

If use current,must insert inside NC to disconnect pulse output. Or else,the current will not be accuracy.

This pulse is origin pulse without any modify,usually use while doing calibration; Output signal is the open-collector output include 2K7 pull-up resistor.

System wiring please refer to the appendix "TB3WE three wire" and "TB2WE Two Wire".

3.2 Local LCD Operation Instruction

3.2.1 User Menu Operation

(1)Working Menu

After power-on,meter will be self-checking first,after then it will enter into LCD(figure 1)working display status.

```
┌─────────────────────────────────────┐
│                                      │
│              XXXXX                   │
│                                      │
│            XXXXX.XXXm3               │
│                                      │
│            XXXX.XXm3/h               │
│                                      │
└─────────────────────────────────────┘
```
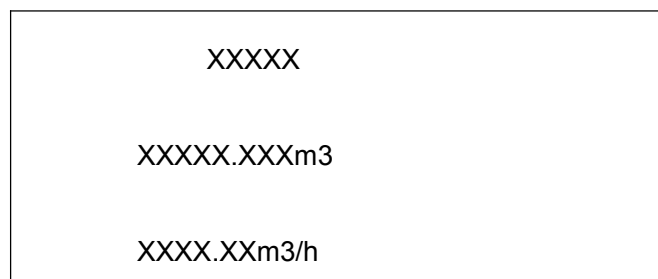
Chart 1 TB2/3WE working screen (Figure One)

The first line: High level of Accumulative flow; 5 fixed integer part number. If no,it'll display as "0".

The second line: Low level of Accumulative flow;3 decimals part number after the 5 fixed integer number. The unit is the same with instant flow non-time part.

The third line:Instantaneous Flow; 5 or 6 integers and automatic keep 2 or 1 decimals. The unit can be set.

Press "<" or "+" to change the screen from Working Screen 1 and 2

```
┌──────────────────────────────┐
│                              │
│     T=xxx.xx ℃               │
│                              │
│                              │
│     P=xxx.xxkPa              │
│                              │
│     F=xxx.xxHz               │
│                              │
│                              │
│     Enter pass word:xxxx     │
│                              │
└──────────────────────────────┘
```

Chart 2 TB3WE Three-wire System working screen (Figure Two,Sub Screen)

```
┌──────────────────────────────┐
│                              │
│     T=xxx.xx ℃               │
│                              │
│                              │
│     P=xxx.xxkPa              │
│                              │
│   xxx.xxHz          xx.xxmA  │
│                              │
│     Enter pass word:xxxx     │
│                              │
└──────────────────────────────┘
```
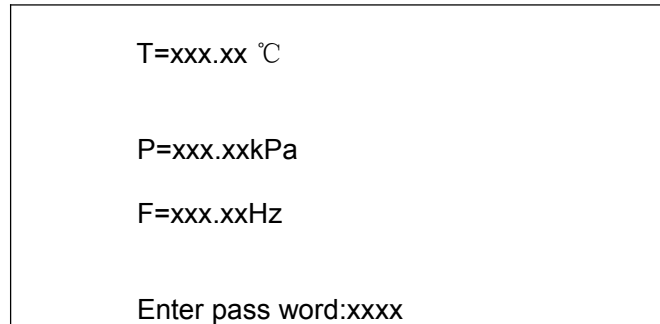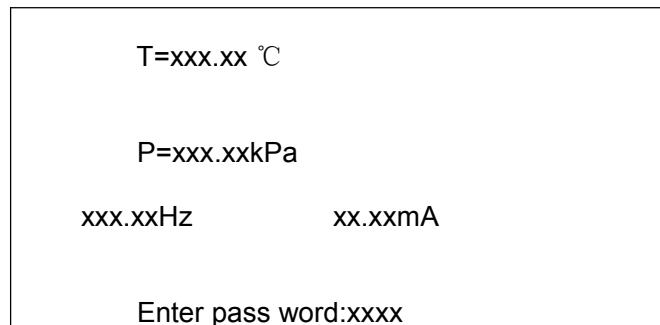
Chart 3 TB2WE Three-wire System working screen (Figure Two,Sub Screen)

From Up to Down:

The first line:Temperature value setting for temperature compensation calculation,shows"T≡999.9℃",reserving 1 decimal.

The second line:Pressure value setting for pressure compensation calculation,,shows"P≡99999.99kPa",reserving 2 decimals.

The third line:For TB3WE is frequency value.

          For TB2WE is frequency value(left side) and current output(right side)

The four line:password entering set state.

Press the enter key of "<"(about 1.2seconds) to enter password initial input state.

Press the key of "+"(about 1.2seconds) to cancel entering state and return to figure two Subsidiary LCD.

Press "+"key in the input state to change the value of cursor circularly.

Press the shift key"<" to change the position of input cursor.

Press "<"key (about 1.2seconds) at the input state to submit the password.

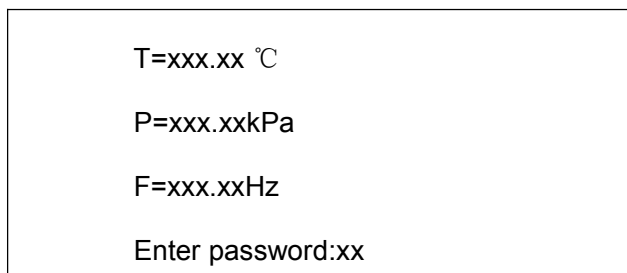If right,enter to menu.if incorrect,return to initial input state.

```
T=xxx.xx ℃

P=xxx.xxkPa

F=xxx.xxHz

Enter password:xx
```

Chart 4 Password Initial Input State

Password:User menu password 2010

3.2.2 User's Data Setting

1.Input operation

In the input state:

Pree "+"key in a long time to exit the input state.

Pree "<"key to confirm and save the input.

Press "+"key in the input state to change the value or symbol of cursor circularly.

Press "<"key to move the current cursor one position towards the right.

Max.8 digits inputting is allowed.(including the symbol,decimal).

2.Menu Operation

In the menu browse:

Press "+" key for page down;

Press"<"key for page up;

Long Press"<"key for entering into the sub-menu;

Long press "+" key for returning to the working screen figure 2;

In the sub-menu,long press "+" key to quit out;long press "<"key to enter into modified state;In the modified state,press "+" key for downward selecting;press "<"for upward selecting;long press "<"key for confirmation and saving.

Attention:When the parameter setting,it should long press "<"key for saving the displaying.Otherwise,the setting is invalid.

User Parameter Setting Menu

| Sub-menu Series#	Display of menu	Definition	Alternative options or range of value		
1	Flow Unit select	Flow Unit select (default 0)	0：m³/h	1：m³/m	
			2：l/h	3：l/m	
			4：t/h	5：t/m	

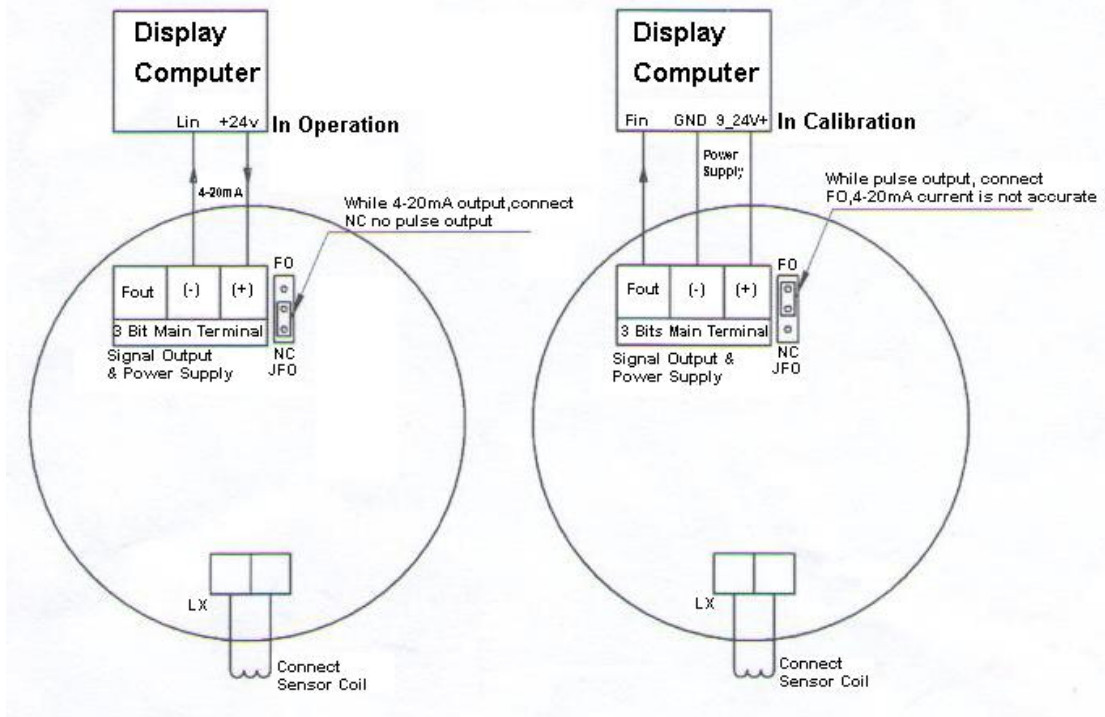|			6：kg/h 7：kg/m
2	Algorithm Selection	Algorithm Selection （default 0）	00:Conventional Volume flow 01:Conventional mass flow 02:Volume flow of conventional gases 03:Mass flow of conventional gases
3	Flow Coefficient	Flow Coefficient (default 3600)	Set the meter coefficient with the unit of P/m3
4	Maximum Output Flow	Max. Flow (default 1000)	When the meter outputs 4~20mA analog signal, must set the value and the value cannot be zero,the unit should be accordance with the flow unit.
5	Density setting	Density setting (default 1.0)	When Algorithm Selection is setting to mass flow(01,03),it must set this item,the unit is kg/m3
6	Temperature Setting	Temperature Setting (default 0.0)	Setting the temperature calculated value,when choose 02,03,04,06 algorithm,it must set this item,the unit is Celsius degree.
7	Absolute pressure setting	Gas Absolute pressure set （default 101.325）	Setting the absolute pressure of gas,when choose 02,03 algorithm,it must set this item,the unit is Kpa.(when vacuum is 0.0,it will cause the flow is 0)
8	Low flow cut off	Set percentage of resection pulse input (Default 1%)	The value is between 0~100
9	485 Address	Set RS485 communication No. (Default 1)	For three-wire system TB3WE only.The meter uses RS485 communication should set this item,and should not equal to other equipment in the same system,the range is 0~255.
10	Damping time	Set current output damping time (Default 4s)	Setting current and displaying damping time,it is for avoiding the current's fluctuation too big along with the flow rate.The range is 2~32.
11	Reset Cumulant	Reset cumulant	If need to Reset cumulant,choose YES and press "E" key.

Appendix

Appendix 3: TB3WE Three-wire System Turbine Flow Meter Wiring Scheme
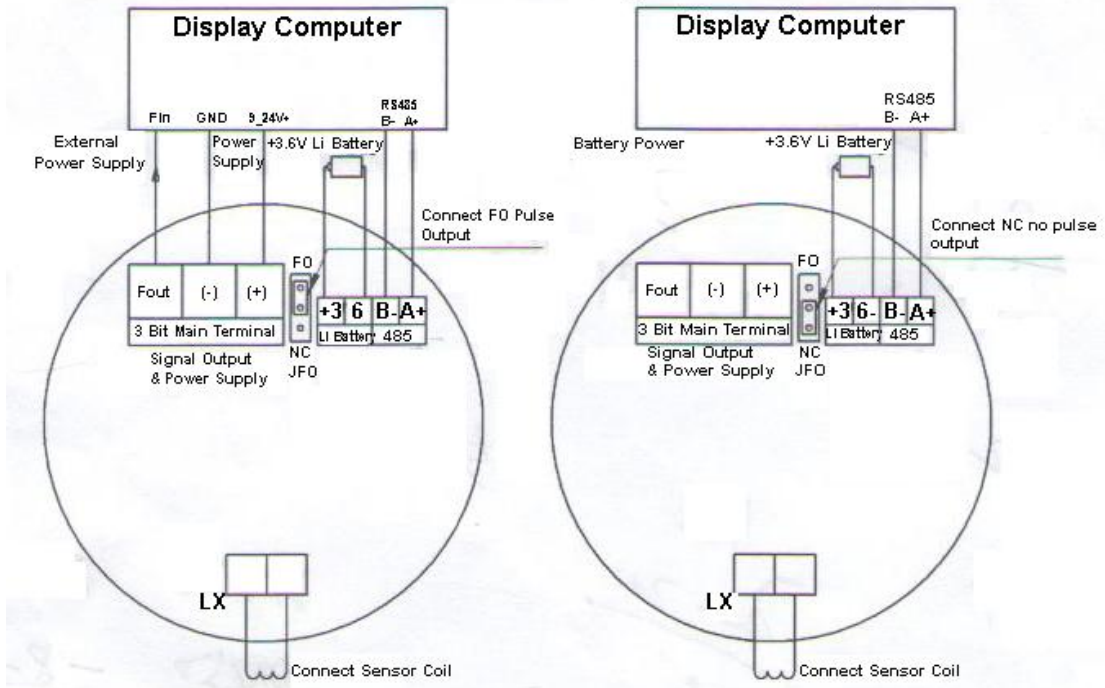
Appendix 2: TB2WE Two-wire System Turbine Flow Meter Wiring Scheme

Trouble Shooting

	Trouble	Analyse
1	There's liquid flow in the pipe,but the instant flow on the flow meter is 0	1.Check the wire connection is all correct or not 2.Inside parameters are changed 3.Signal collection coil is broken, signal can not transmit correctly.In this case,even there's liquid flow, coil can not transmit signal to the display part. Impeller is stuck by something,check the impeller.
2	There's no liquid flow through, but there's flow display on the flow meter	1.Pipe has strenuous vibration, suggest to do take some vibration damping measures. 2.Flow meter grounding well or not. 3.There's magnetic field interference, for example: frequency converter, electrical machine, magnetic valve or others. f there's 50HZ power frequency interference,it may influence the normal work of the flow meter. Power frequency interference calculation Q=3600f/k (f=50HZ,K= flow meter factor), After calculation,you can check if there's power frequency interference or not. In this case, suggest to change installation location. 4.The stop valve on the pipe is not fully closed. Check the valve.
3	Flow meter work normally, but the measured value is not accuracy.	1.Flow meter parameters inside has some problem. Check the parameters. 2.Installation pipe can not reach the requirement, may have gas inside or high viscosity. In this case,pls follow the user manual and installation instruction strictly. 3.Inside flow meter may has some problem. In this case,pls take off the flow meter, and use mouth to blow air to the flow meter, impeller should work normally, if abnormal,pls contact with us.
4	intelligent turbine flowmeter work normally, local display work normally, but the current output is not correct	1.Check the forth display of the parameters, to check the flow range in the flow meter is the same as the name plate or not. 2.Flow meter current output chip is broken or not.

S-TURB

Turbine Flow Meter

With Hart Electronics Manual

(Support temperature and pressure compensation)

1. Flow Meter Electrical Parameters

Power supply 15~24VDC/4-20mA (-20%~+15%).

(1) Two-wire 4~20mA linear correction current output (loop load ≤500Ω at 24V).

(2) Optically isolated programmable pulse output: high level ≥ 5V (supply voltage -1V); low level <0.5V; open collector output with 2K pull-up resistor. An additional 12-24V power supply is required.

(3) Temperature measurement supports Pt100 and Pt1000, and pressure measurement supports the piezoresistive pressure sensor with resistance less than 3.5K.

(4) Communication supports HART protocol general commands and a small number of proprietary extension commands.

For the flow measurement range, please refer to the selection table of the relevant structure body.

2. Description

VT2WXXA Two-Wire the third-generation circuit, its signal measurement circuit is an improved classic analog amplification filter circuit, suitable for a variety of complex field environments.

(1) Improved classic analog amplification filter front-end circuit:

The new analog amplification filter front-end circuit increases the input impedance, which reduces waveform distortion at the low end. It has better applicability to small-diameter gas measurement below DN25. The K2 and K3 filter capacitor parameters were re-adjusted according to the input rate of 1-2-5-10, taking into account DN15-20, and the filter above DN350 was slightly weakened. At the same time, K2 and K3 symmetry are beneficial for synchronous adjustment. The circuit of the optical isolation pulse output is improved, and the adaptability to the high frequency and the output drive is improved. Increased filtering and protection of the power input section improves reliability and immunity to power supply noise. The usage of the switch

parameters is detailed in the attached table.

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(2) Back-end flow calculation display circuit:

The new back-end main control board can select various measurement modes of temperature and pressure from the Chinese/English prompt software menu, and improve the temperature and pressure measurement accuracy. The data is processed by 12864 liquid crystal display. The signal remote transmission circuit uses a 4-20 mA current output for two-wire system and can add HART communication. There is also an isolated program-controlled pulse that can be set to output the original signal frequency / / correction frequency / / 0-1KHZ linear frequency output / / calibration engineering pulse / / upper or lower limit alarm.

1) Pulse output mode:

A. Signal frequency output: directly output the frequency of the probe detection signal in real time.

B. Corrected frequency output: The frequency of the signal that is linearly corrected to the average K value is corrected by the 5-point flow coefficient.

C. Frequency output: Output the converted frequency, and the frequency value is linearly calculated according to the full-scale flow output 1000Hz.

D. Pulse count: Output the converted pulse. The number of pulses is calculated by dividing the cumulative flow rate of each calculation cycle by the pulse equivalent. The maximum output is only 1000 pulses per calculation period. If the actual number of pulses in the calculation period is greater than 1000 , it will automatically accumulate to the next calculation cycle output; the minimum is only allowed to output 4 pulses per cycle. If the actual number of pulses in the calculation cycle is less than 4 pulses, it will automatically accumulate to the next calculation cycle output; the effective level of the output pulse Is high.

Note: The engineer needs to set the appropriate pulse equivalent factor based on the current applicable object.

E. Upper limit alarm output—The alarm flow output alarm is higher than the set alarm, and the alarm level transistor is turned on low.

F, lower limit alarm output - lower than the set alarm flow output alarm, the alarm level

transistor is low.

2) Current output:

The current output is linear 4-20mA and the output range is [4-22.4] mA. When the instantaneous flow rate is less than or equal to the lower limit cut-off flow rate, or when the signal frequency is 0, the output current is 4 mA; in other cases, the current output is 4 mA according to the cut-off flow rate, and the full-scale flow output 20 mA linearly calculates the output current value, if the calculated current value exceeds 22.4 mA. , the highest output is 22.4mA.

3) HART function:

The transmitter supports the HART function. The supported HART commands and detailed descriptions can be found in the HART Communication chapter.

4) Use environment:

Due to the different ambient temperature, the display response speed of the LCD screen also changes. If the LCD refresh rate is too fast at low temperatures, the display may be unclear. Use the "Environmental Temperature" option in the engineer menu to set the LCD screen to a refresh rate of -20 °C for use at low temperatures.

3. The Circuit Wiring

(1) Main power supply and output signal terminal block

(intermediate 2-position large hanging frame spin-type terminal)

⊖	⊕
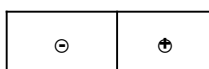
"⊖" is the 4~20mA current output.   "⊕": for 15~24V power supply

"⊕"is connected to the +24V external power supply. The flow current output flows from the

"⊖"end to the sampling resistor of the computer or display meter, and flows back to the "-" end of the power supply after passing through the load such as the sampling resistor. These two terminals are the wiring that must be used.

(2) Auxiliary wiring (3-bit low terminal)

V+	Fout	Vss

"V+" is connected to the "+" terminal of the power supply (+12-24V); "Fout" is the pulse output terminal; "Vss" is connected to the power supply "-" terminal.

This pulse output **must be used with the main current loop powered**. The output is a cut-off optically isolated pulse, usually used when calibrating and collecting the frequency and pulse signal or using the alarm function; the output signal is the collector with 2K pull-up resistor Open output

(3) Temperature and pressure wiring (6-bit small terminal)

TRH	TRL	PIH	PVH	PVL	PIL

TRH and TRL tap the Pt100 or Pt1000 to measure both ends of the platinum resistance.
When Pt100 is selected, the double jumper on the temperature board should be shorted; when Pt1000, the double jumper on the temperature board should be disconnected.

The 200uA constant current source of the PIH and PIL taps the pressure sensor's IN+ and IN-, PVH and PVL tapped pressure sensing mV outputs VO+ and VO-. Generally, a silicon piezoresistive sensor is used, which requires **a bridge equivalent resistance of 1-3K5, a zero-point positive bias output, and a sensitivity greater than a full-scale output of 25 mV/mA.**

4. Flow Meter Working Interface

The flow meter working interface includes two interfaces, one is the main interface and the other is the auxiliary interface. Figure:
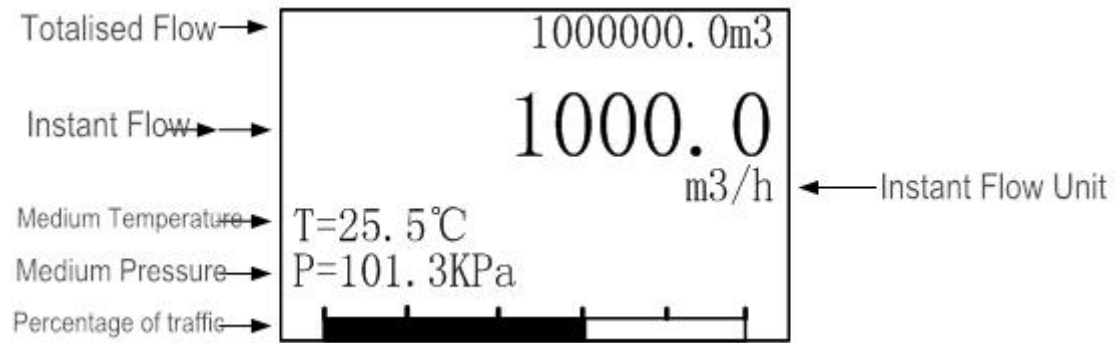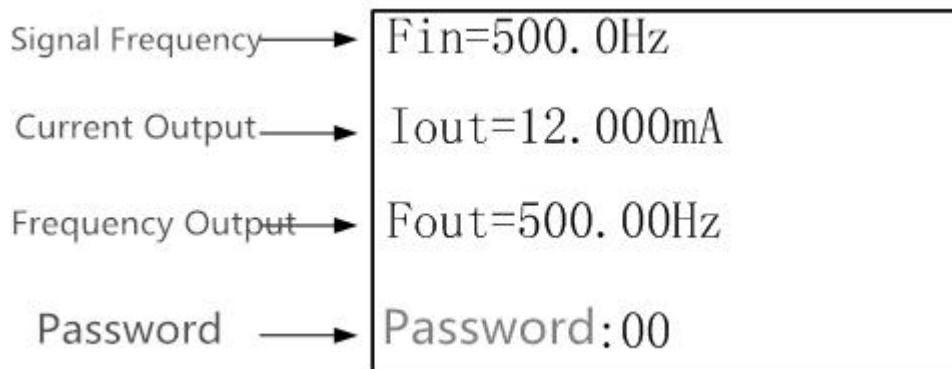
Chart 1 main work interface

Chart 2 auxiliary work interface

Switch between the main interface and the auxiliary interface by pressing the '+/S' left button and the '</E' button.

The left button is + and the page is turned down, and the long press is S to exit. Right click to <turn up the page, long press to enter and confirm.

In the auxiliary interface, long press '</E' left button to enter the password input state. The user can press the '+/S' key to select the password number that needs to be entered at the current input position, and press the '</E' key to move the input cursor position. After entering the 2-digit password, long press '</E' to enter the function setting menu corresponding to the password; in the password input state, long press '+/S' to return to the auxiliary interface and continue to update the displayed measurement value.

About the refresh rate of the main and auxiliary work interfaces. In the engineer menu, there is the "Environmental Temperature" setting item. If -10 °C is selected, each cycle (about 2 seconds) is refreshed once; if -20 °C is selected, the main interface is refreshed every four calculation cycles (about 8 seconds), the auxiliary interface is refreshed every 2 cycles (about 4 seconds).

6

5. Flow Meter Parameter Setting Menu

The flow meter menu includes a total of three groups: user menu, engineer menu, and manufacturing menu. The engineer menu must have the expertise of the operator to set the menu content. **The manufacturing Menu** is set and calibrated by the factory when the flow meter is out. After the factory, **the parameter setting must be modified under the condition of the corresponding equipment. Otherwise, the flow meter will be incorrectly measured or invalidated!**

In the menu, long press the '</E' key to enter the parameter modification state of the selected item. If it is a digital input type parameter, input the number by the '+/S' key, and the '</E' key moves the input cursor position. After the input is completed, Press and hold the '</E' key to confirm the input. The transmitter automatically updates the setting parameters and stores them. If the parameter is the option type, select the item by '+/S' or '</E'. Press and hold the '</E' key to confirm, the transmitter automatically updates the setup parameters and stores them.

User Menu

In the password input state of the auxiliary interface, enter the "22" password to enter the user menu. The user menu structure is as shown below.

The various menu functions and parameters are as follows:

Menu No.	Menu Display	Meaning	Selection or range of values
1	unit selection	flow unit selection (default 0)	0：m^3/h **Automatically add N when algorithm 2** 1：m^3/m 2：l/h 3：l/m 4：t/h 5：t/m 6：kg/h 7：kg/m

7

2	algorithm selection	algorithm selection(default 0)（Default 0）	0: Normal volume flow (whether gas or liquid) 1: regular mass flow (condition density) 2: standard gas volume flow 3: Conventional gas mass flow rate (standard density) 4: Saturated steam temperature compensation 5: saturated steam pressure compensation 6: Overheated steam temperature and pressure compensation **7:Specific algorithm(customized by user)**
3	Flow coefficient K [P/m3] [P/m3] XXX. XXXXXXXX	flow coefficient (Default 3600.0)	Set the meter flow coefficient, **Not 0**
4	fluid density kg/m3 XXXX. XXXX	density setting (default 1000.0)	Both algorithms 1 and 3 must be set to, The unit is kg/m3 and **cannot be 0**
5	full output flow XXXXXX. XX	full output flow (Default 1000)	This value must be set and **must not be 0.** Unit is consistent with the flow unit
6	lower cut flow % XX. X	sets the percentage of cut flow and full flow.	The value is between 0 and 20. The default value is 1.0%.
7	upper limit alarm flowXXXXXX. XX	Alarm Flow （Default 990.0）	This value does not have to be set, **Usually Not 0.** Unit is consistent with the flow unit
8	lower limit alarm flow XXXXXX. XX	alarm flow (Default 10.0)	This value does not have to be set, **Usually not 0.** Unit is consistent with the flow unit
9	damping time XX	set output current Damping time (Default is 4s)	Set the damping time for current output and frequency smoothing to avoid large fluctuations in output current and frequency. The range is 2~32
10	HART Address	Set HART communication number	ranges from 0 to 15 (default 0)
11	Cumulative amount is cleared Enter the password XX	Clear the accumulated amount	To clear the accumulated amount, enter the password 70 And press the "E" button

Table 1   User Menu Parameter Description

Engineer Menu

In the auxiliary interface password input state, enter the "33" password into the engineer menu. The menu functions are as follows:

No.	Function	Description
1	Language	Set menu display language (default 0) 0：Chinese 1：ENGILISH
2	**Pulse Selection** **Signal Frequency** Set the pulse output type	Select the output type as required Signal frequency / correction frequency / frequency output / equivalent pulse / upper limit alarm / lower limit alarm The initial calibration should select the signal frequency and correct the output selectable frequency output.
3	**Pulse Equivalent** **in m3 = 1**	Valid only for pulse output. The meaning is how many cumulative flow units are represented per pulse (min value 0,001 = 1 puls per liter)
4	**Pressure display** **measuring**	Set display fluid pressure mode: measurement / default / calculation / off Set to off, the fluid pressure item is not displayed on the main interface.
5	Default Pressure Pc≡[kPa] 0．00	When selected as the default or pressure measurement is greater than 2 times the range Use this default pressure to display identity and calculate
6	Reference Pressure P0=[kPa] 101．325	Absolute pressure sensor with reference pressure of 0 When the gauge pressure sensor is used, the reference pressure is the local atmospheric pressure value, in kPa.
7	**temperature display** **measuring**	Set display fluid temperature mode: measurement / default / calculation / off Set to off, the fluid temperature item is not displayed on the main interface.

8	Default Temperature Tc≡[℃] 20．00	When selected as default or platinum resistance is broken Use this default temperature to display identity and calculate
9	Set the temperature measurement type Pt=1000	Pt100 and Pt1000 platinum resistance type selection And to change the temperature board jumper, the Pt100 double jumper is shorted
10	Set the standard temperature 0℃	Select different systems with a temperature value of 0/20, in degrees Celsius Usually the natural gas industry uses 20 ° C, the other uses 0 ° C
11	Ambient temperature -10 °C set the minimum working environment temperature	Set to "-10°C" working interface to display normally every calculation cycle; When the low temperature environment is set to "-20°C", the working interface will display once for 4 calculation cycles (about 8 seconds), and the refresh will be slower.
12 12A - 12J	**Flow correction factor** **Ci（Qi%）** Set the corresponding flow correction factor at the percentage of full flow	The percentage of flow Qi ranges from 0 to 120%; The flow coefficient Ci range is 0.8~1.2 (C=standard flow rate/the measured flow rate of this meter) Note: 5 points correction, when performing flow correction Each percentage point is incremented and can only appear once. Ci defaults to 1.0.

Table 2 Engineer Menu Function Description

6. HART Communication

The transmitter supports two-wire 4~20mA meters to communicate with the HART general commands listed in the table below.

Command	Action object	Parameter meaning	Description

0	Read transmitter information	Transmitter information	None
1	Read transmitter main variable	Flow unit + flow value	None
2	Read output current and percentage	Output current + flow percentage	None
3	Read output current and dynamic variable	Current + instantaneous flow + frequency + cumulative low + cumulative high	After four dimensions have units
11	Read transmitter information	Transmitter information	None
12	Read transmitter information	Read transmitter information（MESSAGE）	Custom content can be written by command number 17
13	Read transmitter information	Transmitter Information（TAG+DESCRIPTION +DATE）	Custom content can be written by command number 18
14	Read transmitter information	transmitter information	None
15	Read upper and lower limits and damping	Flow unit + full flow + cut flow + damping	None
16	Read transmitter information	Transmitter information（FAN）	can be customized by command number 19
17	Write Transmitter Information .	Transmitter Information（MESSAGE）	After written, it can be read and verified by the 12th command

18	Write Transmitter Information .	Transmitter Information （TAG+DESCRIPTION +DATE）	can be read and verified by command 13 after writing.
19	Write Transmitter Information .	Transmitter Information . （FAN）	it can be read and verified by command No. 16. after writing
34	Modify Damping	Damping	None
35	Modify upper and lower limits and units	Unit + full flow + cut flow	None
40	Output Current	Output Current Value （4~20mA Range）	Execute this command, the transmitter will immediately output the specified current value.
44	Modifying Units	Flow Units	None
45	Calibrate the 4mA current	The current value of the transmitter output measured by the precision ammeter	First use the 40 command, output 4mA current, then measure the actual output value, use this command to calibrate
46	Calibrate the 20mA current The current value of the transmitter output measured by the ammeter	First use the 40 command, output 20mA current，	Then measure the actual output value and use this command to calibrate
110	Read extended dynamic variables	Transmitter extended dynamic variable (temperature + pressure)	The first variable is temperature; the second variable is pressure

Table 5   Transmitter HART Command

See HART SPEC V5 and above for details and definitions of HART commands.

Attachment: Troubleshooting

1) **Conventional volume flow and conventional gas mass flow in algorithm selection:**

The conventional volumetric flow rate in the algorithm refers to the flow rate of the working condition indicating that the flow rate is not compensated, and is used for liquid or uncompensated working condition gas. The standard gas volume flow rate is calculated according to the gas equation, and the conventional gas mass flow rate is calculated by multiplying the standard volume by the standard density.

2) **Flow correction factor:**

In the flow calculation, the flow rate is corrected by calculating the flow rate according to the basic formula. The correction factor is usually set to the percentage point of the calibration point relative to the full-scale flow rate; the correction factor C = standard flow rate / measured flow value when not corrected. Linear interpolation between points. When not corrected, C=1, and the corrected value is limited to the range of 0.8-1.2.

3) **Pulse output type and usage:**

The signal pulse in the pulse output type is the output that tracks the original signal pulse and is typically used for initial calibration. The correction frequency is used for the frequency output after multi-segment polyline correction. The frequency output is an instantaneous flow linear output of 0-1000 Hz, and the output frequency is 1000 Hz at full flow. The correction factor C value linear correction and compensation calculation are valid for the frequency output, and are usually used for the corrected output. The pulse output is calculated as the cumulative flow rate. There is a maximum and minimum limit for the output value of each calculation cycle. The appropriate pulse equivalent must be selected so that the number of pulses per cycle is lower than the limit of the upper limit of 1000 pulses.

4) **Pulse equivalent:**

The pulse equivalent is the output factor and its value is the flow unit/pulse. That is, how many unit flows per pulse represents, and the value must be such that the pulse output is controlled within 1000 pulses per measurement period.

**5) Temperature and pressure calibration during production and maintenance:**

The temperature calibration should have a standard resistance box or a standard resistance corresponding to the calibration value. After connecting the resistors in the corresponding menu, press the "E" key to confirm. If the value is normal, confirm the save again. If you modify it, press "+" to change the confirmation prompt to modified and press "E" to save the value. At Pt100, the temperature double jumper should be shorted. At Pt1000, the temperature double jumper should be disconnected.

6) Calibration of output current:

For the calibration of the output current, connect the standard ammeter to the current loop. After confirming the 4/12/20mA item, press the "E" key to confirm that there should be an approximate current output. At this time, the actual display value of the ammeter is entered and confirmed. calibration. Usually three points per calibration should be performed.

7) Use of HART:

The use of HART should connect the Communicator to both ends of the 250 ohm sampling resistor in the current loop. A resistance deviation of more than 20% or a zero current of less than 3.9 mA may cause HART communication to fail. Pay special attention to the current when the current is not enough to make the zero current less than 3.9mA.
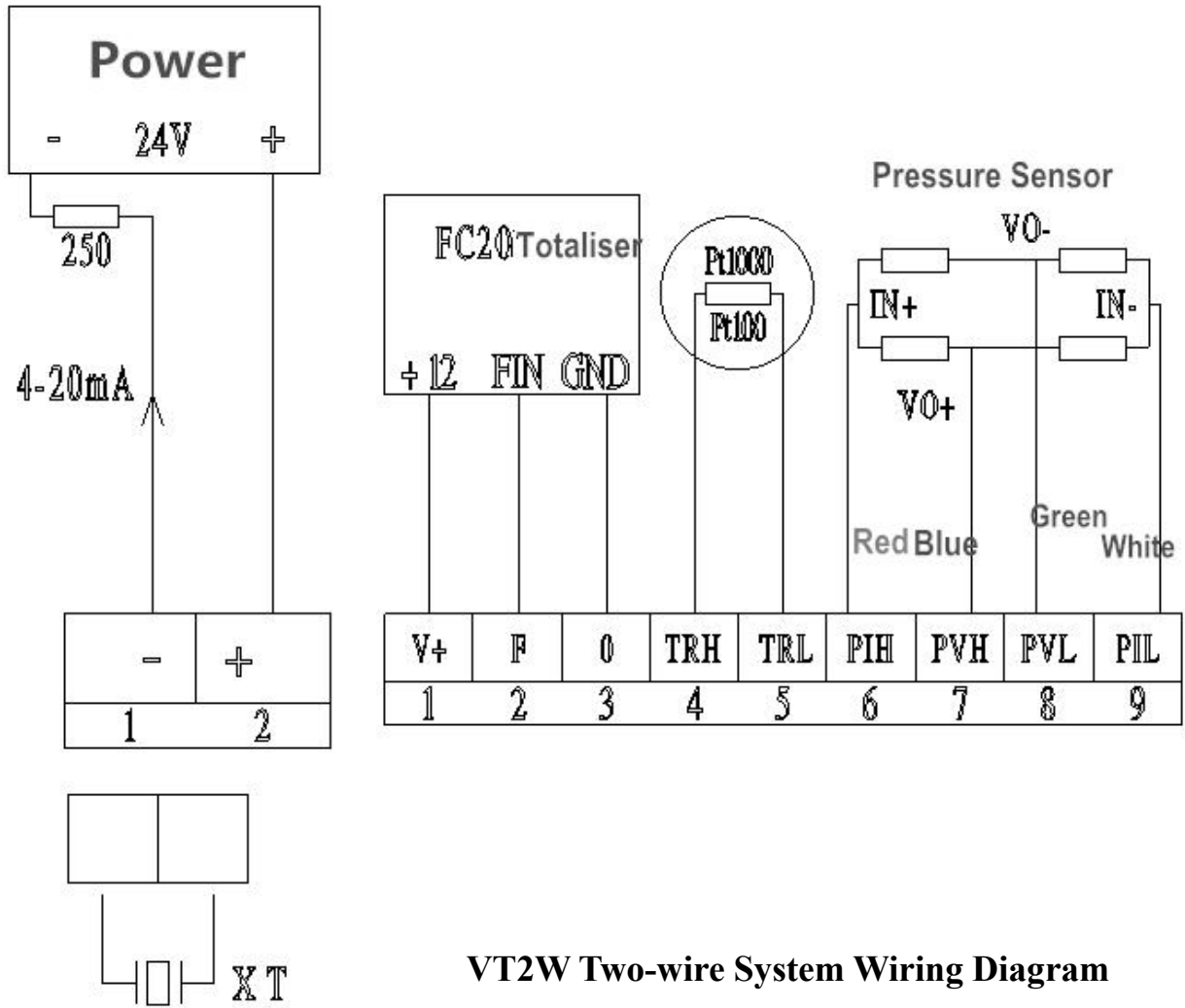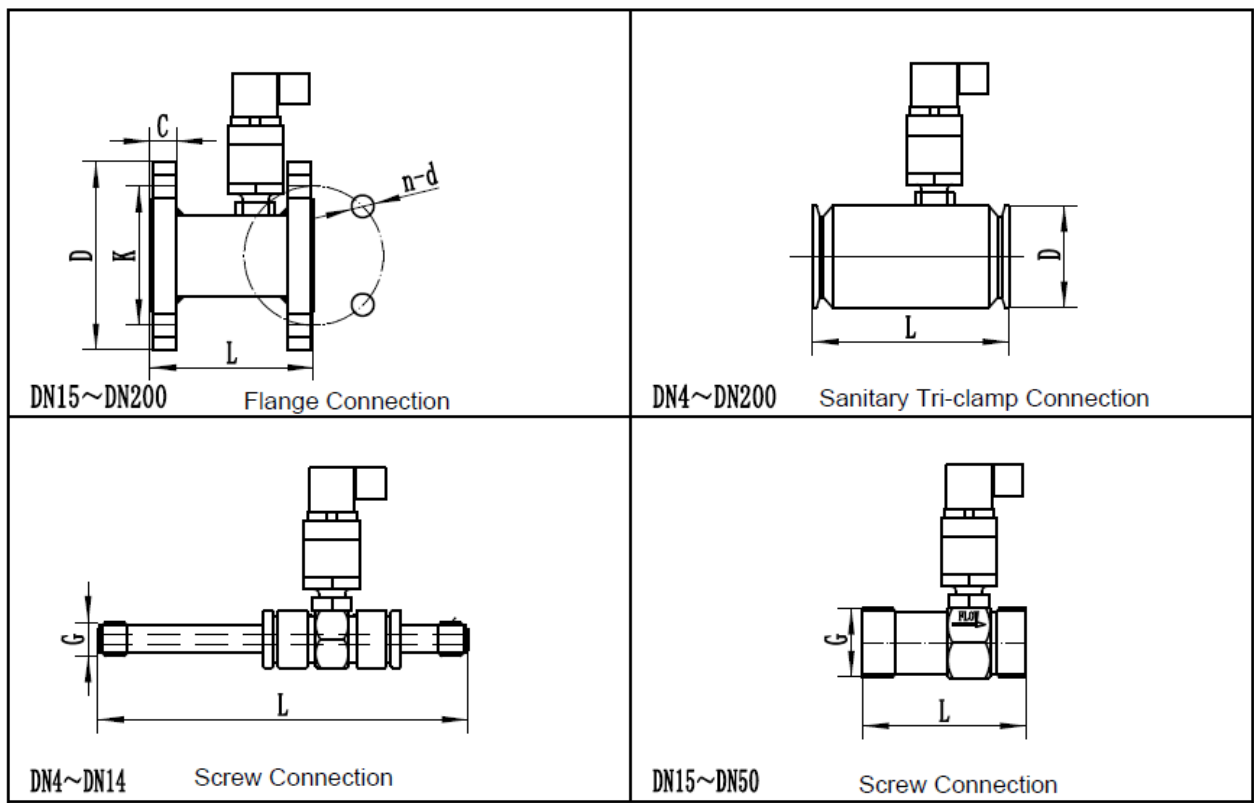
VT2W Two-wire System Wiring Diagram

DIMENSION
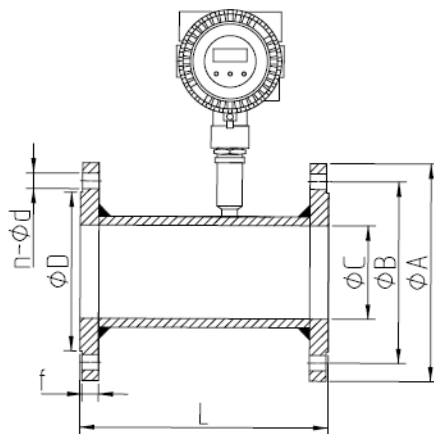
Diameter	A(mm)	B(mm)	C(mm)	D(mm)	L(mm)	f(mm)	n-⌀d(mm)
DN15	95	70	15	51	75	12	4-⌀15
DN20	100	75	20	56	80	14	4-⌀15
DN25	125	90	25	67	100	14	4-⌀19
DN32	135	100	32	76	120	16	4-⌀19
DN40	140	105	40	81	140	16	4-⌀19
DN50	155	120	50	96	150	16	4-⌀19
DN65	175	140	65	116	175	18	4-⌀19
DN100	210	175	100	151	220	18	8-⌀19
DN125	250	210	125	182	250	20	8-⌀23
DN150	280	240	150	212	300	22	8-⌀23
DN200	330	290	200	262	360	22	12-⌀23

DN15～DN200	Flange Connection
DN4～DN200	Sanitary Tri-clamp Connection
DN4～DN14	Screw Connection
DN15～DN50	Screw Connection

| （mm） | Flange Connection | | | | | | Screw Connection | Sanitary Connection |
	L（mm）	D（mm）	K（mm）	d（mm）	n	C（mm）	G	
4	225						G 1/2	50.5
6	225						G 1/2	50.5
10	345	90	60	14	4	16	G 1/2	50.5
15	75	95	65	14	4	16	G 1	50.5
20	80	105	75	14	4	18	G 1	50.5
25	100	115	85	14	4	18	G1 1/4	50.5
32	120	140	100	18	4	18	G1 1/2	50.5
40	140	150	110	18	4	19	G 2	64
50	150	165	125	18	4	21	G2 1/2	77
65	175	185	145	18	4	21	G 3	91
80	200	200	160	18	8	23		106
100	220	220	180	18	8	23		119
125	250	250	210	18	8	25		
150	300	285	240	22	8	25		
200	360	340	295	22	12	27		
250	400	405	355	26	12	29		
300	450	460	410	26	12	32		

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