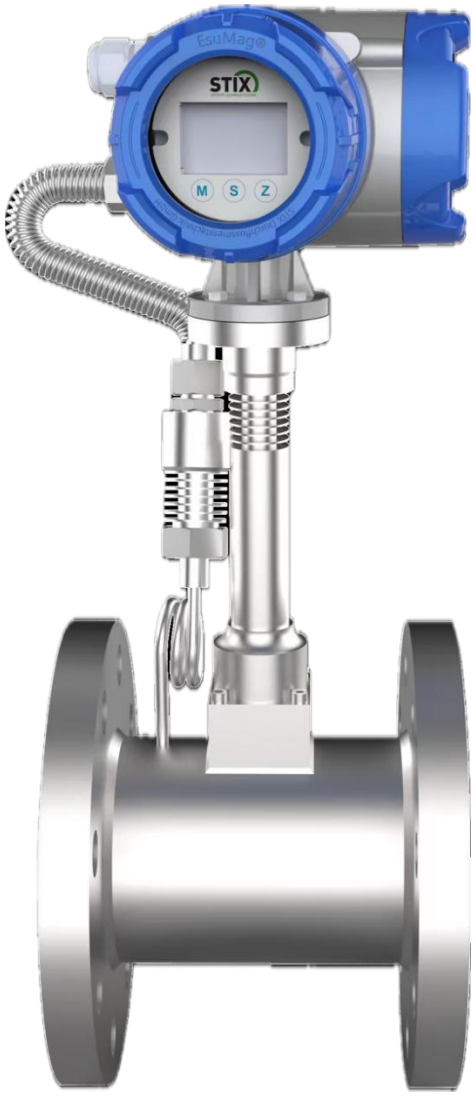


STIX
DURCHFLUSSMESSTECHNIK

EsuSwirl Series

Vortex Flowmeter

ESM KF300 Serie

STIX Durchflussmesstechnik GmbH
Info@stix-flowmeter.de

Tabel of content

1. About this Manual

Thank you for choosing our product.

Through this manual, we strive to make you accurately understand the measurement principle of vortex flowmeter, related concepts, technical terms as well as the correct methods and conditions for installation and application.
Symbols and meanings used in this manual:

Graphic symbol	Meaning
 Warning!	Incorrect or non-conforming operation and use in vio- lation of the requirements of this manual may result in damage to instruments and equipment
 Pay attention!	Important concepts, definitions, or methods
 Watch out!	Improper or careless operation and application can cause the meter to not function properly or even be damaged
	Grounding mark
	Specifications and requirements that must be followed when using essential safety meters

2. Safety matters

2.1 User

Vortex flowmeters are precision instruments manufactured in accordance with ISO:9001 quality system using the latest technologies and processes and in compliance with relevant EU standards. Improper installation and use may re- sult in abnormal operation and damage of instruments and even process control equipment. Engineers and technicians who install, set up and wire the products must read this manual carefully and understand its exact meaning, working and process conditions at the application site before using the instrument.

2.2 Storage and handling


Watch out!

- Storage temperature: -40°C~80°C
- Relative humidity: 20~90%
- During storage and handling, the instrument should be placed in the packaging box to avoid bump or impact.

2.3 Application Conditions


Warning!

Before installation, ensure that the maximum temperature and pressure of the medium under test do not ex- ceed the nominal temperature and pressure. Determine whether the measured medium is pure, and the medi- um does not contain granular substances, so as to avoid the damage of granular material to the sensor.

2.4 Safety standards and specifications

Installation, wiring and use of this product shall comply with the requirements set forth in this Manual, as well as general international safety codes, accident prevention measures and relevant local standards.

2.5 Intrinsic safety and explosion protection

- Intrinsically safe and explosion-proof vortex flowmeter should be used in dangerous places where com- bustible gas and air mixture exists or may exist on the measurement site;
- Intrinsically safe and explosion-proof vortex flowmeter must be used in conjunction with the appropriate safety grid certified intrinsically safe and explosion-proof;
- The installation, wiring and associated equipment of the intrinsic safety instrument system shall comply with the relevant standards and specifications of the country where it is located.

2.6 Environmental Protection

The packaging of this product is made of paper materials which can be naturally degraded or recycled in accordance with ISO:14001 specification and will not cause pollution to the environment.
For discarded products, please give to professional recycling companies or send back to us, so as not to pollute the environment.

3. Overview

3.1 Measurement Principles

When a cylindrical resistance body is vertically inserted into the fluid, vortices will be produced alternately on both sides of the body. As the fluid moves in the downstream direction, vortices are formed, which is called Karman vortex street, as shown in Figure 1. The drag body that produces the vortex street is called a vortex generator. Experiments show that the frequency of the vortex is proportional to the velocity, which can be expressed by the following formula:

$$f=Sr\frac{V}{(1-\frac{4d}{\pi D})d}$$

Where: f- vortex frequency
V- Average flow rate in tube
d- cylinder face width
D- Inside diameter of the pipe
Sr- Strauhal number

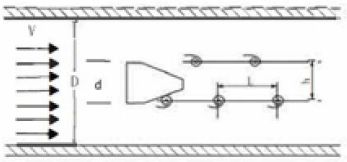


Figure 1 Schematic diagram of vortex formation

It is proved by experiments that when the distance h between two columns of vortices and the distance L between two vortices in the same column satisfy the formula h/L=0.281, the asymmetric vortices can maintain a stable state. When the fluid Reynolds number Re is in the range of 5000-150000, Sr is basically unchanged. Therefore, when the column width d and Strauhal number Sr are fixed, the frequency f of the vortexes is proportional to the average flow rate of the fluid, that is, proportional to the flow rate Q and independent of the parameters such as pressure, tempera- ture and density.
When the vortex is generated on both sides of the cylinder, the sensor is subjected to the alternating lift force perpendicular to the flow direction to generate signals. The change frequency of the lift force is the frequency of the vortex.

After the sensor sends the signal to the converter to amplify and shape, the pulse signal linearly proportional to the flow rate is directly output or converted into the standard signal output of 4 ~ 20mA.

3.2 Technical parameters

Measuring medium	Gas, liquid, steam
Measurement accuracy	Liquid level 1, gas level 1.5
Medium temperature	Room temperature -25°C -80°C; High temperature -25°C -250°C or -25°C -300°C
Measure flow rate	Gas 5-50m/s; 0.5-7m/s for liquids
Working pressure	1.6MPa; 2.5MPa; 4.0MPa(can be produced on order)
Watch head material	Die cast aluminum
Working power supply	DC24V±10% 5W
Output signal	RS485(modbus RTU); 4-20mA (load resistance less than 600Ω)
Operating mode	Conventional, earthquake-resistant
Display mode	Display can be rotated 180 degrees

4. Connect cables

4.1 Preparations for Cable Connections

- Before wiring, the wiring methods and requirements of other unit meters or systems used in conjunction with vortex flowmeters should be carefully read;
- When connecting external cables, it is recommended to use two-core shielded cable and make the cable connection well sealed;
- The safety and explosion-proof products should be selected in line with the relevant standards of the safety instrument cable and make sure that the cable parameters meet the requirements of the safety and explosion-proof instrument system;

- The working voltage range is DC18~30V. Dc voltage higher than DC30V will cause damage to the instrument, should take measures to prevent the supply voltage is higher than 30V
- 24V DC power supplied to vortex flowmeters should meet IEC-1010-1 or equivalent standard SELV safe ultra-low voltage;

The KF300 temperature-pressure-compensated vortex flowmeter is specifically designed for high-performance intelligent vortex flow transmitters.
Before using the KF300, please read this manual carefully and follow the instructions provided in this manual to complete your operation. If you have any questions or find any other problems during use, please contact us promptly. We will respond as soon as possible and solve your problem.

4.2 Performance metrics

Supply voltage 1: Calibration voltage: 12V to 30V DC;

Supply voltage 2: Operating voltage: 3.6V DC;

Operating temperature range: -20℃ to +70℃ (with backlit LCD display)

-40 ° C to +85 ° C (no LCD display);

4.3 Main functions of KF300

Output: Equivalent pulse output, optional 4-20mA output.

Configuration functions: Configuration of engineering units, measured medium, medium density, range,display, alarm values, etc. And it has the function of clearing the cumulativeflow.

Alarm current: Compliant with Namur NE43 output (alarm current value 3.6mA / 22.5mA).

Alarm function: Alarm upper and lower limits can be set. Below the lower limit, the LCD showsa flashing down arrow; Above the upper limit LCD display has an up arrow flashing.

Monitor dynamic variable functions: instantaneous flow, percentage, cumulative flow, frequency, temperature value, pressure value, etc.

Flow calibration function: 2 to 5 corrections can be made to the K coefficient of the instrument; Local configuration function: Configure the engineering unit, measured medium, medium density, range, display, alarm value, etc., and have the function of clearing
cumulative flow and data recovery; LCD display function: Backlit, three-line display. The first line shows instantaneous flow. The second line shows the cumulative flow. The third line can show percentages, output current, temperature value, pressure value, density value, etc. At the same time, multiple engineering units can be displayed on the LCD screen.

Data backup and recovery: The manufacturer can back up the range and other configuration information before leaving the factory. When the instrument fails to work properly due to illegal adjustments made by the user on-site, the input damping "05678" can restore it to the factory state.

The instrument has power-off protection and flow accumulation functions.

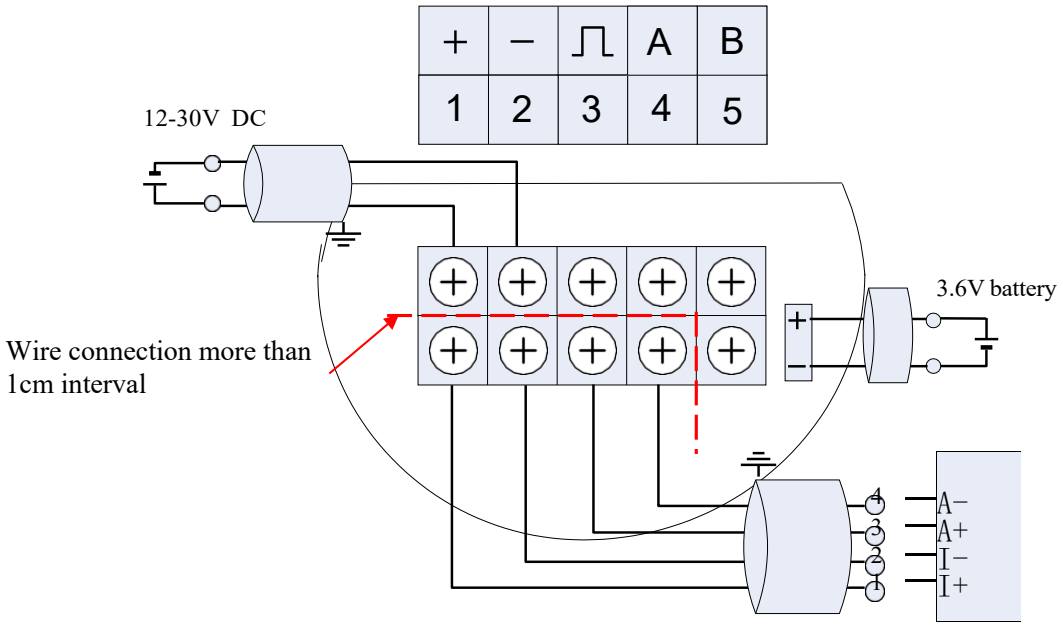
5. Hardware part

5.1 Terminal board wiring instructions

Terminal boards are used to connect external power supplies and output pulses, as well as external connections to pressure sensors and temperature sensors. This board card requires an external supply voltage range of DC12V to 30V when outputting pulses and 4 to 20mA.
The following lists several commonly used wiring methods.

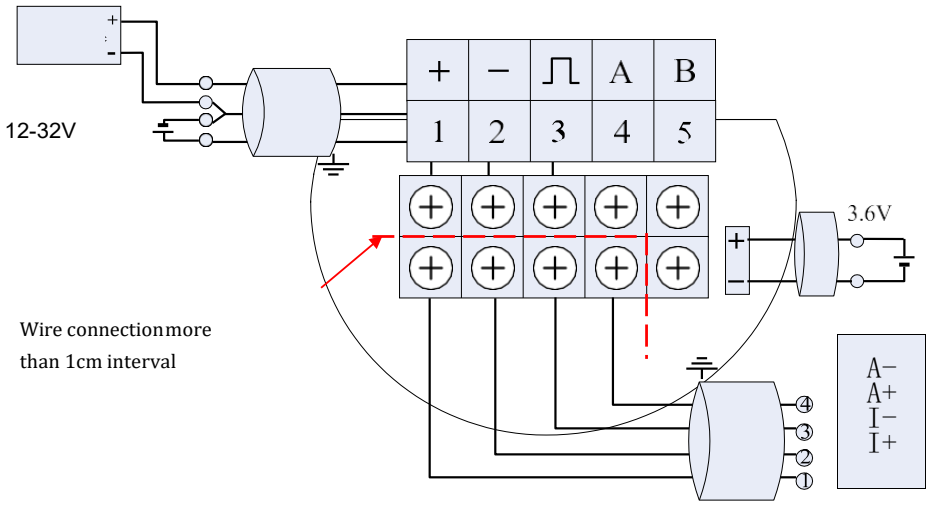
5.2 Dual power supply + pressure sensor

RS485 type wiring with H880TDZ-485 terminal board as follows:



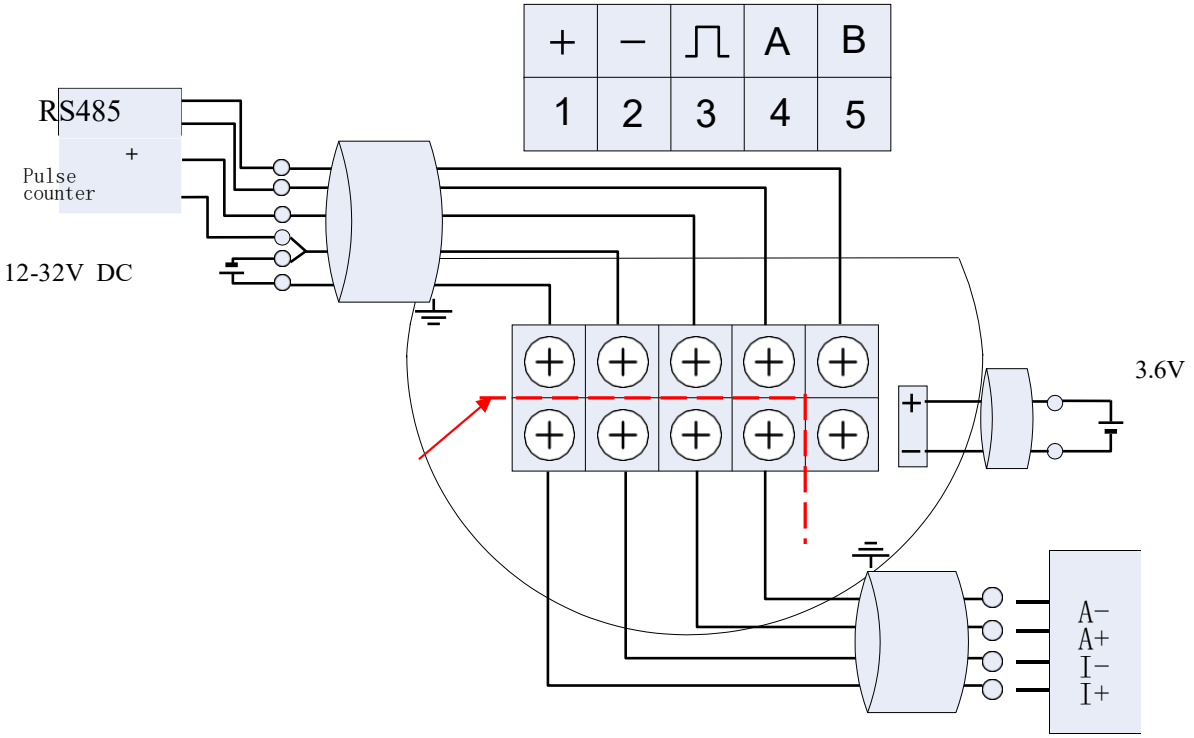
5.3 Dual power supply + pulse output + pressure sensor

RS485 type wiring with H880TDZ-485 terminal board as follows



5.4 485 communication + dual power supply + pressure sensor + pulse output

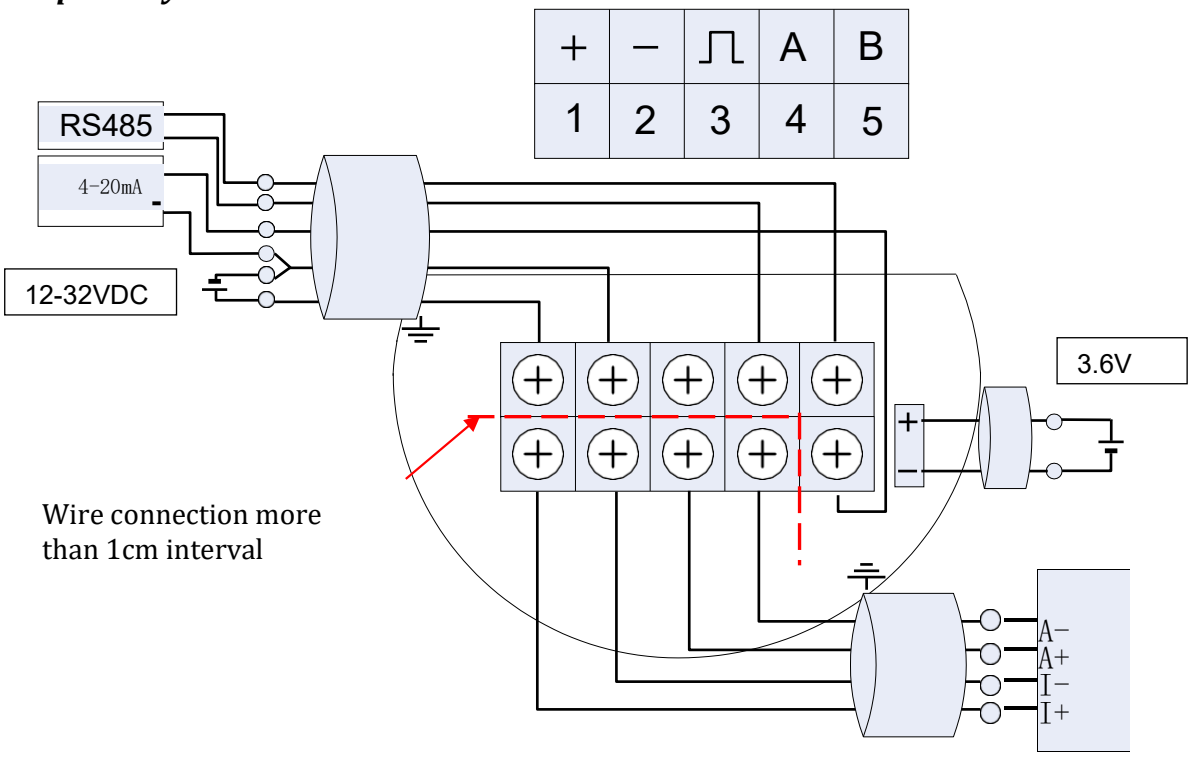
RS485 type with pulse output wired with H880TDZ-485 terminal board as follows:



5.5 485 communication + dual power supply + pressure sensor + current output

RS485 type with current output wiring with H880TDZ-485 terminal board as follows:

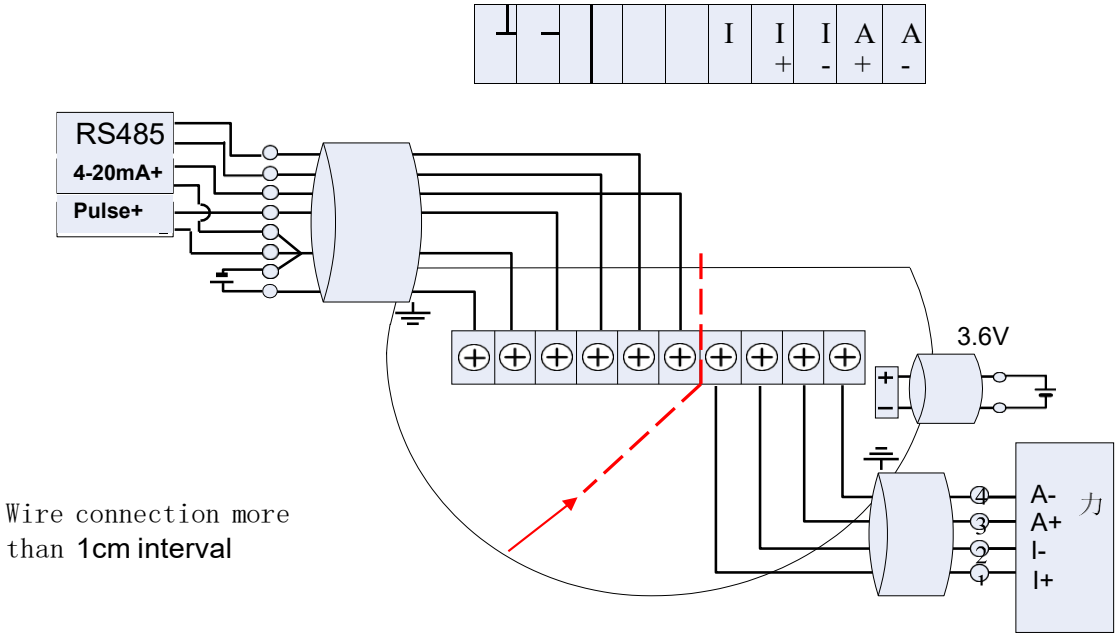
Note: Standard products do not have current output! If you need a current output, orderit separately



Wire connection more than 1cm interval

Battery-powered type uses H880BATDZ terminal wiring as follows:

Note: The standard product does not have current output! If you need a current output, order it separately!

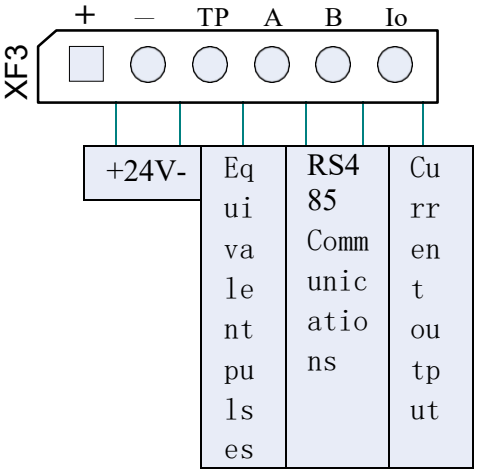


Instructions: Pulse wiring: +, -;⎍ Current wiring: +, -, I; RS485 wiring: +, -, A, B.

6. Motherboard interface description

Power and output interfaces

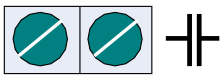
Socket XF3 is used for external power supply, output pulses, 485 communication and current output.



7. Liquid crystal display, key interface

Insert the LCD plug into the socket XF4 of the MF300 smart vortex flowmeter board card. Three buttons have been connected to the LCD module.

8. Vortex street sensor

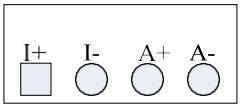


Socket XT [2P green terminal] to the MF300 smart vortex flowmeter board card.

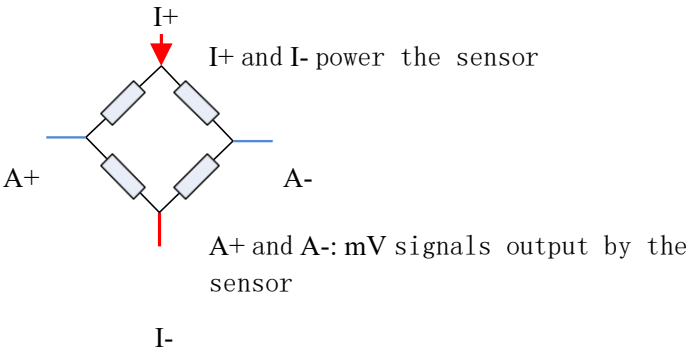
9. Pressure sensor

The I+, I-, A+, A- of the motherboard socket XF2 are used to connect to external terminals, where I+, I- are used to connect to the power input terminals of the sensor, and A+, A- are the signal output terminals of the sensor.
The bridge impedance of the pressure sensor is required to be between 3 and 6K ohms. This circuit supplies a current of approximately 0.3mA to the diffused silicon sensor as long as the sensor output does not exceed 50mV@0.3mA.

Socket XF2 is defined as follows:

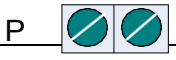


I+: Sensor excitation + I-:
A+: sensor output + A-: sensor output -



10. Temperature sensor

The temperature sensor uses PT1000 or PT100 and supports two-wire connection. Connect T+ and T- to XF5 [2P green terminal].



Connect Pt1000 or Pt100

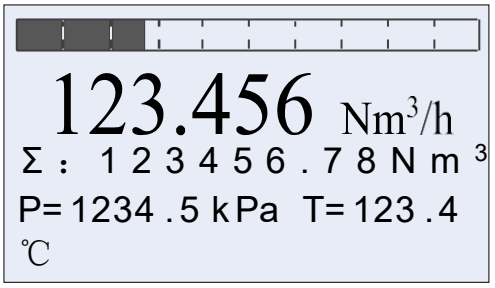
Installation Notes: The main circuit board must be securely fastened to the housing (for the purpose of reliable grounding) before testing can be conducted!

11. Display

Users can set the variables displayed on the LCD either through configuration software or by pressing keys. The LCD features a 128*64 dot matrix display and supports multi-variable display. This instrument supports two display modes:

11.1 Three-line display mode

When the third line display is enabled, it shows as shown in the following figure:



Progress bar showing the current percentage shows instantaneous flow, up to six digits

Show cumulative flow, up to 9 9999999999

Show frequency, density, pressure, temperature, current, percentage, flow rate

Other display instructions

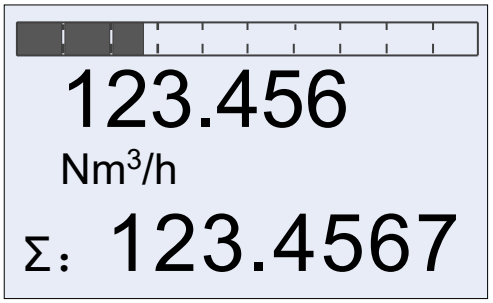
If the pressure or temperature sensor is set to "Auto Capture" mode and sensor failure is detected, the corresponding value will be replaced by the "manual" setting value and will flash. Here the manual setting values refer to the "gas pressure" and "gas temperature" that are entered in the menu. In the normal display state, hold down the M key and set the frequency, pressure, temperature, density, current, percentage, flow rate to be displayed on the third line.

The third line shows the variable prompt as follows:

Prompt	F:	Den:	P:	T:	Curr:	Per:	P= T=	V:
Display variables	Frequency	Density	Pressure	Temperature	Current	Percentage	Pressureand temperature	Flow rate

11.2 Two-line display mode

When the third row display is turned off, the second row display is fixed, as shown in the following figure:

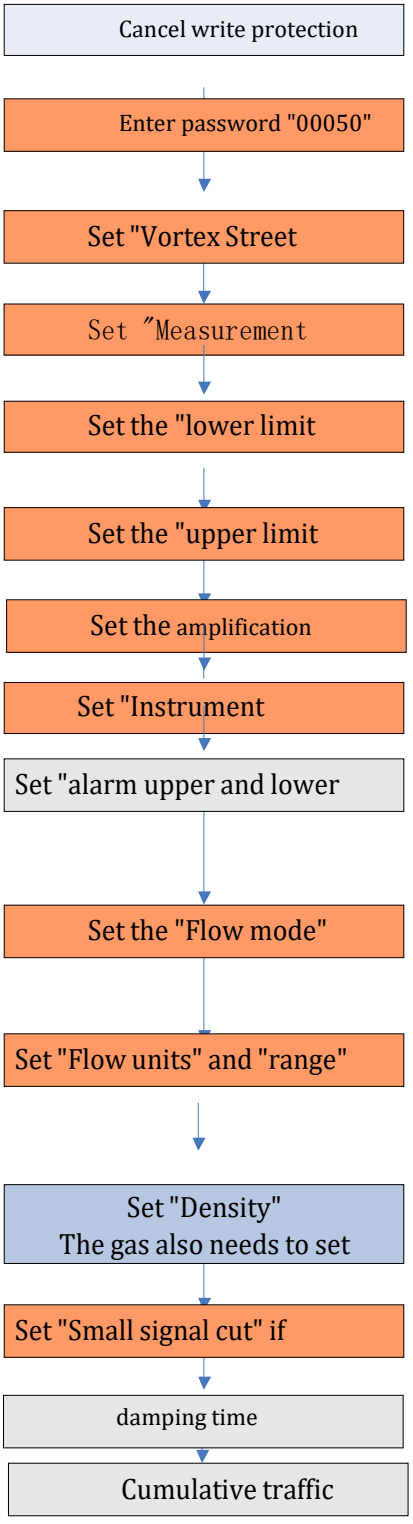


Progress bar showing the current percentage shows instantaneous flow, up to six digits

Show cumulative flow, up to 99999999999

12. The process of using keys

When using keys, it is recommended to follow the following operating procedures:



It should be confirmed that the current write protection is "off",which allows changes to the Settings.

When the prompt shows "Code", enter the password "00050" to enter "Signal Monitoring", and continue to press the Z key to"scroll down" to enter the setting of "Vortex Street Caliber".

select the correct caliber

correct type of medium to be measured: gas or liquid

Set the appropriate lower limit flow based on the type of medium beingmeasured and the caliber.
The actual measured lower limit is about 70% of the set value.

The upper limit flow is by default 10 times the lower limit flow, and the actual measured upper limit is about twice the set value. The upper limit flow value can be manually modifiedwhen the actual required range ratio exceeds 20:1.

Set the amplification factor corresponding to the lower limit flow(the minimum signal). Usually around 400 will do.

It depends on the caliber and the medium being measured.

Set alarm upper and lower limits (fixed in %) if necessary.To set the flow

mode, you can choose:
Liquid volume(Liquid Qv), Liquid mass (Liquid Qm)Gas volume (Gas Qv), gas mass (Gas Qm)
Steam volume (Steam Qv)
Superheated Steam mass (PT) (Steam(P/T))
Saturated steam mass(T) (Sat_Steam(T))
Saturated steam mass (P) (Sat _Steam (P)

Set the instantaneous flow unit, as well as the upper limit of measurement.
The lower limit of measurement is fixed to 0; Cumulative flowunits are determined based on instantaneous flow units.

For liquids, set the density according to the type of mediumbeing measured;
For gases, set density, gas pressure, and gas temperature
Set correctly according to the flow mode and the pressure/temperature collection mode.

If necessary, set the amount of small signal excision (fixed in %)

If necessary, set the damping time (with the unit fixed at seconds)

Ulative flow clears 0

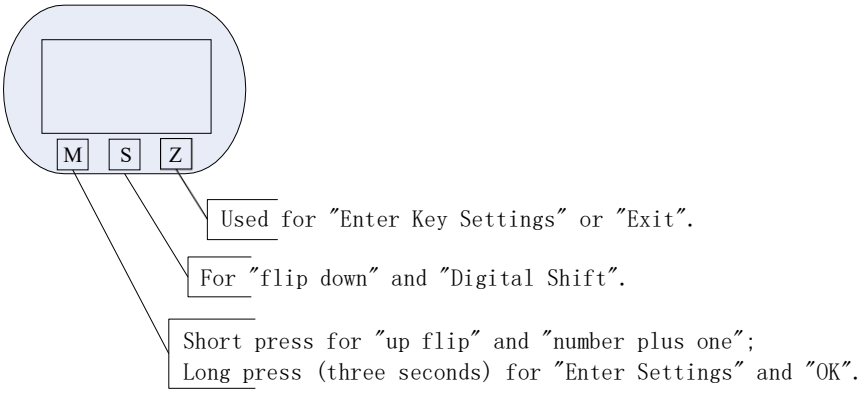
Instructions:

1. Indicate items that must be done;
2. An item that must be done and is easy to forget or make mistakes with.

13. Detailed description of the live key function

13.1 Basic description of key functions

This product supports the "three-button" operation mode. The basic functions of the three buttons are as follows:



13.2 Enter the on-site configuration

In "Normal Display" status, press the "Z" key to enter "Live Configuration". "Live Configuration" parameters can be set using the "Direct Digital Input" and "Menu Selection" methods.

13.3 Exit Live configuration

In "Live Configuration" mode, press the "Z" key to exit "Live Configuration" and enter "Display" mode.
Note: This instrument records the status of the last exit button setting. Press "Z" to return to the status of the last exit.

13.4 Data Setting Method

On-site setting parameters are divided into two types: "menu selection" and "direct digital input".

13.5 Menu Selection" setting method

Press and hold the M key, move the underline to the second line, indicating that Settings can be changed.
Press the M key short to scroll up options, or press the S key to scroll down options.
During the data setting process, hold down the M key to save the Settings. After saving, the underline automatically moves to the first line;

13.6 Direct Numeric Input setting method

1. Hold down the M key and move the underline to the second line, indicating that the Settings can be changed.
2. Press the M key briefly to switch the symbol.
3. Press the S key to shift to the right, the underline moves to the first digit position, indicating it can be modified. Press the M key briefly, and the number increments by one.
4. Press the S key again to set the numbers in sequence. The setting method is exactly the same as that for the first digit.
5. During the data setting process, hold down the M key to save the set data; Or press Z to exit the Settings.

For example, the original range cap is 200, and the new input range cap is 400. Here's an example of an English menu display.

First press the "Z" key to enter the key Settings function. Press the "M" key briefly to move the Settings forward one position; Press the "S" key and move the Settings back one place.Follow the prompts to go to setting the "Range Cap".	Set range limit interface Range 100% 200.000
Press and hold the "M" key for more than three seconds to enter the range limit setting function. At this point, an underscore below the set number indicates that Settings have been entered.	Start setting the range capinterface Range100% 200.000
1. Pressing the "M" key at this point will switch between "+" and "-". If a "-" is displayed, it indicates that a negative number will beentered. 2. Press the "S" key at this point and shift the setting bit to the rightby one bit. Start entering the data. If the highest bit is set, the number that can be entered is between 0 and 9; If it's any other digit, you can also choose the decimal point. 3. When you finish typing, press and hold the "M" key for three seconds to end the data setting. And save the data into the instrument 4. When entering data, press the "Z" key to exit the current Settings, 5. go back to the previous level menu, or return to the "Normal Display" status.	

Special Note:

1. During the setup process, hold down the "M" key for three seconds to save and end the data setup;
2. During the setup process, press the "Z" key to exit the current setup without saving. Or go back to the previous level menu.
3. After completing or exiting the Settings, you remain in the current Settings interface.

14 Live configuration features

14.1 Basic functions (no password required)

Parameter Number	Prompt	Setup methods	Notes	Default values
1	Write protection	Selection	On, Off	close
2	Lower alarm limit (%)	Set number	-200 ~ 200	-100
3	Alarm upper limit (%)	Set number	-200 ~ 200	200
4	DN	Read- only	--	DN50
5	Traffic mode	Selection	Liquid volume (Liquid Qv) Liquid mass (Liquid Qm) Gas volume (Qv) Gas mass (Gas Qm) Steam volume (Steam Qv) Steam mass (PT) (Steam(P/T)) Saturated steam mass (T) (Sat_Steam(T)) Saturated steam mass(P) Sat_Steam(P))	Gas volume (Gas Qv)
6	Flow volumeunits Or Flow mass units	Selection	Volume unit support: Nm3/h, Nm3/m, Nm3/sl/s, l/m, l/h m3/s, m3/m, m3/h, m3/dScf/s, Scf/m, Scf/h cf/s, cf/m, cf/h USG/s, USG/ m, USG/ h UKG/s, UKG/ m, UKG/ hbbl/h, bbl/d Mass unit support: g/s, g/m, g/h kg/s, kg/m, kg/h, kg/dt/m, t/h, t/d lb/h, lb/d Note: Cumulative flow units are determined based on instantaneous flow units. See Table of Correspondence between instantaneous flow Units and cumulative flow Units.	m3/h
7	Range upper limit	Set number	0 to 999999 (6 digits)	1000
8	Density (kg/ m3)Density (g/c m3)	Place number	Gas density (unit: kilograms per cubic meter) Liquid density (unit: grams per cubic centimeter)	1.205
9	Operating pressure (Kpa)	Set number	-101.325 to 999999 (6 digits)	0
10	Operating temperature (° C)	Set umber	-999999~999999 (6 digits)	20
11	Small flow excision (%)	Set umber	0-20	5
12	Damping (S)	Set umber	0 to 64	2.0
13	Decimal places	Selection	0,1,2,3	1
14	Display mode	Selection	2 Line Display (2_line Display) : Show only instantaneous and cumulative traffic 3 Line Display (3_line Display) : Add a third line display	Three lines displayed
15	Cumulative traffic clears	Select	"Yes" clears the accumulated traffic "No" does not perform the operation	"No"
16	Cumulative number of traffic overflows	Read- only	--	--
17	Instrument coefficient K	Read- only	--	--
18	Password	Set numbers	0-99999	00000
19	Contrast	Selection	1 to 5 The larger the number, the darker the font	3
20				

14.2 Advanced features (for manufacturer use, different passwords required)

Enter different passwords to access different special features.

Parameter Number	rompt	Setup methods	Notes	Default values
50	Password	Set numbers	**Enter ****50 to set items 50.1 to50.11.** **Enter ****60 to set 60.** **Enter ****63 to set 63.** **Enter ****40 to Settings 40.1 to 40.2.** **Enter ****11 to view items 11.1 to11.3.** **Enter ****90 to set items 90.1 to 90.3.** **Enter ****70 to enter Settings70.1 to70.11.** **Enter ***721 to set 721.1 to 721.4.** **Enter ***741 to enter Settings 741.1 to741.4.**	00000
50.1	Signal monitoring	Read-only	LCD displayexample: 300.00 CH 2-2.1 Here: 300.00 is the current magnification CH2 is the currentchannel number 2.1 is the overamplification factorof the current signal	
50.2	DN	Selection	Options: DN **, DN10, DN15, DN20, DN25, DN32, DN40, DN50, DN65, DN80,DN100, DN125, DN150, DN200,DN250, DN300, DN350, DN400, DN450, DN500, DN 600; Note: DN** is a customcaliber for configuration software; ➢ DN15 indicates a 15mm caliber. After changing the vortex streetdiameter, the lower limit flow rate,maximum magnification, instrumentcoefficient (K value) must be reset. Seethe "**Special Notes**" at the back of the table.	DN50
50.3	Medium	Selection	GasLiquid Note: After changing the medium, the lower limit flow rate, maximum amplification factor, instrument coefficient(K value) must be reset. See the "**Special Notes**" at the end of the table.	Gas
50.4	Lower limitflow	Set number	Determine based on the caliber andthe medium being measured.	35
50.5	Upper limitflow	Set The number	The upper limit flow automatically defaults to 10 timesthe lower limit flow, and the actual measured upper limit is 2.0 times the set value. **The upper limit flow value can bemanually modified when theactual required range ratio exceeds 20:1.**	350

50.6	Magnification	Number setting	It is recommended to be between 200and 1000. Usually around 400.	500
50.7	Instrument coefficientK	Set the number	Determine based on the caliber and the medium being measured. **The unit is fixed at 1/ m ³.** **That is, set how many pulses correspondto 1 m ³ of volume flow.**	9100
50.8	Output pulse units	Selection	Supported units include: m^3, N m^3, t,kg, Scf, cf, USG (American gallon), UKG(British gallon), bbl (barrel), lb (pound).	m^3
50.9	Output pulse coefficient	Set number	Enter the number of output pulses corresponding to one "pulse coefficient unit". If you want to output the original pulse, set the "instrument coefficient (K value)"and the "output pulse coefficient" to the same value, and set the "pulse coefficientunit" to m^3.	9100
50.10	Automatic magnification	Selection	On, off	open
50.11	Activate inhibition rate	Selection	1 to 5	3
60	Five- point correction frequency i Five-point correction coefficient i i is 1, 2, 3, 4, 5.	Set number	Five-point correction frequency i: 0 to 999999 (6 bits). Five-point correction coefficient i: 0.5 to2.0. Where "five-point correction frequency 1" is the frequency of the first correction point. "Five-point correction factor 1" is the K correction factor for the first correction point. See 7.2 for specific Settings.	
63	Working Mode	Selection	F_1: Seismic resistance mode; F_2: Standard mode; F_3: Turbo mode F_4: Test mode Note: Generally choose F_2.	
40.1	4mA calibration	Set number	Calibration steps: ➢ Press and hold the "M" key for three seconds to enter calibration; ➢ Press the M key briefly to reduce the current; Press the S key to increase the current step to 16 microamperes; ➢ Press and hold the M key for three secondsto save the calibration; Or press the Z keyto exit without saving.	
40.2	20mA calibration	Set number		

11.1	Version	Read-only	Version number	
11.2	Maximum frequency	Read-only	The frequency value corresponding to the upper limit flow.	
11.3	Minimum frequency	Read-only	The frequency value corresponding to the lower limit flow.	
90.1	Modbus Addr.	Set number	1 to 247	1
90.2	Modbus Baud.	Selection	"38400, "19200, "9600, "4800, "2400 "1200, ""600	9600
90.3	Modbus Parity	Selection	No parity, odd parity, even parity	No verification
70.1	Temperature acquisition	Selection	Manual input Auto-collect (Auto)	Auto Capture(Auto
70.2	Pressure collection	Selection	Manual input Auto-collect (Auto)	Auto Capture(Auto
70.3	Temperaturelow point calibration	Set number	0 to 2000. Unit: Ohm. Enter the calibration resistance value.	
70.4	Temperaturehigh point calibration	Set number	100 to 5000. Unit: Ohm. Enter the calibration resistance value.	
70.5	Standardcondition temperature	Selection	0 ℃，15 ℃， 20 ℃	20 ℃
70.6	Atmospheric pressure	Set number	Enter the local atmospheric pressure.The default value is 101.325KPa. If using an absolute pressure sensor, setthis value to 0.	101.325
70.7	Pressure zero calibration	Set number	-101.3 to 40,000, units kpa. Enter the calibration pressure value.	
70.8	Pressure full point calibration	Set number	-101.3 to 40,000, units kpa. Enter the calibration pressure value.	
70.9	Low pressure cut-off value	Set number	0 to 100. Units: kpa. ➢ If set to 0, the low-pressure excision is cancelled. ➢ Not 0, when the absolute value of the measured pressure is less than the "low pressure excision value", the excisionis 0kpa.	0
70.10	Pressure migration	Set number	-40,000 to 40,000. Units: kpa. Enter the actual pressure value to achieve the migration.	0
70.11	Temperature migration	Number placement	-200 to 850. Units: ° C. Enter the actual temperature value to achieve migration.	0

721.1	Collect the value at The temperature low point	Set number	-999999 to 999999 (6 digits).	
721.2	Temperaturelow point resistance	Set number	0 to 2000. Unit: Ohm.	
721.3	Temperaturehigh Point collection value	Set number	-999999~999999 (6 digits)	
721.4	Temperaturehigh point resistance	Set number	100 to 5000. Unit: Ohm.	
741.1	Pressure Zero collection value	Set number	-999999 to 999999 (6 digits).	
741.2	Pressure zero value	Set number	-101.3 to 40,000, units kpa.	
741.3	Pressure full point collection value	Set number	-999999~999999 (6 digits)	
741.4	Pressure full point value	Set number	-101.3 to 40,000, units kpa.	

Special Notes:

- After modifying the "vortex street aperture" using the keys, you must reset the"lower limit flow", "upper limit flow", "maximum magnification" and"instrument coefficient K" according to the aperture and the measured medium,otherwise the instrument may malfunction. [If the aperture is changed throughthe configuration software, these parameters will automatically retrieve the default values]
- The setting of the lower limit flow rate, CH selection, and magnification factor is crucial to whether the vortex street works well. Please set them carefully according to the actual application.
- The actual operating range of the H880WJ is 70% of the lower limit flow settingto 200% of the upper limit flow setting. The ratio of the upper limit flow to the lower limit flow should be less than 30:1.
- Users may set the frequency range reasonably based on actual operating conditions and other conditions, especially in helical vortices, insertable vortexstreets, or steam measurements.
- The amplification range is 20 to 2000 times, which can be adjusted according

  to the on-site signal, noise, vibration and other conditions.

The "diameter", "lower limit flow rate", "minimum frequency" and "instrumentSensor K " can be set as follows:

DN	Sensor K	Gas			Liquid		
		Minimum flow m³/h	Minimum Frequency	Lower limit	Minimum flow m³/h	Minimum Frequency	Lower limit
15	350000	3.2	311	5.03	3.2	37	5.03
20	145000	5.6	226	4.95	5.6	27	4.95
25	80000	9	200	5.09	9	23	5.09
32	35000	15	146	5.18	15	17	5.18
40	19000	23	121	5.08	23	14	5.08
50	9100	35	88	4.95	35	11	4.95
65	4260	61	72	5.11	61	8	5.11
80	2300	90	58	4.97	90	7	4.97
100	1200	140	47	4.95	140	6	4.95
125	580	220	35	4.98	220	4	4.98
150	345	300	29	4.72	300	4	4.72
200	145	550	22	4.86	550	3	4.86
250	73	880	18	4.98	880	2	4.98
300	43	1250	15	4.91	1250	2	4.91
350	27	1500	11	4.33	1500	2	4.33
400	18	1800	9	3.98	1800	1	3.98
450	13	2000	7	3.49	2000	1	3.49
500	9	2600	7	3.68	2600	1	3.68
600	5	3300	5	3.24	3300	1	3.24

15 Table of the correspondence between instantaneous flow units and cumulative flow units

When the instantaneous flow unit is set, the cumulative flow unit is also automatically determined. The correspondence table is as follows:

Instantaneous flow units	Corresponding to cumulativeflow units
Nm^3/h, Nm^3/m, Nm^3/s	Nm^3
m^3/d, m^3/h, m^3/m, m^3/s	m^3
l/h, l/m, l/s	L
Scf/s, Scf/m, Scf/h	Scf
cf/s, cf/m, cf/h	cf
USG/s, USG/ m, USG/ h	USG
UKG/s, UKG/ m, UKG/ h	UKG
bbl/h, bbl/d	bbl
g/h, g/m, g/s	g
kg/d, kg/h, kg/m, kg/s	kg
t/d, t/h, t/m	t

15.1 Determination of the instrument coefficient K value

The instrument coefficient K value, for a vortex flowmeter, refers to how many pulses correspond to 1m3 of flow.
The default instrument coefficient K value in the current configuration software is determined based on the generator of a certain manufacturer. The instrument coefficient K value (in 1/m3) varies significantly for different generators and needs to be entered based on the actual situation.
The instrument coefficient K value for the time of the meter under test can be determined based on the relationship between the number of pulses output by the standard meter and the number of pulses output by the meter under test over a certain period of time.

15.2 Determination of the K correction factor in user calibration

For vortex flowmeters, the actual instrument coefficient K values vary over different flow segments. That is to say, when the flow is different, the cumulative flow corresponding to the same number of pulses is actually different. To further improve the accuracy of the vortex flowmeter, this circuit board provides 2 to 5 points of instrument coefficient K value correction.
For example, for a vortex flowmeter with D=80mm, the measured medium is liquid, and the true instrument coefficient K values at different flow segments are as follows.

<20 Hz	40	80	> 100
2200	2100	2100	2000

Then you can choose a 4-point user calibration, and in "Manufacturer Calibration" -> "Linear Correction", the instrument coefficient K value is 2100. Then enter the calibration data as follows:

Frequency	K correction coefficient	Calculation formula
20	0.954545	2100/2200 = 0.954545
40	1	2100/2100 = 1
80	1	2100/2100 = 1
100	1.05	2100/2000 = 1.05

Note: The instrument coefficient K value is 2100, indicating a flow rate of 1m3 for every 2100 pulses collected. When the flow frequency is greater than 100Hz, it actually corresponds to 1m3 flow for every 2000 pulses. At this point, when 2000 pulses are collected, according to K=2100, the calculated flow rate will be 2000/2100= 0.9523m3. This value is smaller than the actual value of 1m3 and then multiplied by the "K correction factor", the corrected flow value is 0.9523× (2100/2000) =1 m ^{3}.

15.3 Instructions for setting the equivalent pulse factor

- Step 1: Set the pulse coefficient unit. Supported units include: m3, n-m3, t, kg, Scf, cf, USG (American gallon), UKG (British gallon), bbl (barrel), lb (pound), which can be set through configuration software or by pressing keys.
- Step 2: Set the output pulse coefficient:
- Set the "pulse factor unit" and "output pulse factor", that is, one "pulse unit", for example, the number
- of output pulses corresponding to 1m3, by setting with HART software or by pressing a key to complete the setting of the equivalent pulse factor (output pulse factor)
- Since the calculation of the equivalent pulse is based on the flow rate corrected by the instrument coefficient K, the pulse output by this instrument is the K corrected equivalent pulse, which corrects the linear error and thus has higher accuracy compared to the original pulse.

15.4 Output original pulse description

If you need to output the original pulse, follow these steps:

- Set the pulse unit to m3.
- Set the number of pulses for 1m3 output based on the current instrument coefficient K value, that is, set the data for both "instrument coefficient (K value)" and "output pulse coefficient" to be the same.
- Set all five K correction coefficients to "1".
- At this point, the output is the original pulse signal.

Note: If the instrument coefficient K value correction is retained, the obtained pulse accuracy will be higher, which is more conducive to verification.

15.5 Notes on temperature and pressure compensation

- The pressure sensor uses a diffused silicon sensor a type of gauge pressure sensor. 2)
- The temperature sensor uses PT1000.
- the Atmospheric pressure is set to the default value of 101.325KPa.
- The "default working pressure" value set, if the "atmospheric pressure" is set to the local atmospheric pressure or the default value, corresponds to the differential pressure. If "atmospheric pressure" is set to 0, it corresponds to absolute pressure.
- The temperature measured by the temperature sensor, as well as the manually set "default operating temperature", is fixed in ° C.

15.6 Pressure sensor calibration

When calibrating a pressure sensor, it is necessary to ensure that "pressure acquisition" is automatic acquisition (Auto) and that an external pressure sensor is attached.
The pressure sensor provides two-point calibration. Pressure calibration can be done through "Pressure Sensor Calibration" on the "Calibration" page of Modbus configuration debugging software; Or you can manually enter the calibration pressure value by pressing a key to complete the pressure calibration.

Key calibration process:

- Set the "Pressure Acquisition" item to Auto Acquisition; (Parameter 70.7) The sensor gives zero pressure, enters "Pressure Zero Calibration"
- enters the current pressure value (in kPa), and confirms;(Parameter No. 70.8) The sensor is given the full-point pressure, enters "Pressure Full-point Calibration" inputs the current pressure value (in kPa), and confirms.

Note: Both "Pressure Zero calibration" and "pressure Full Point calibration" must be calibrated to ensure that the collected pressure is correct.
Note: Since the pressure collection interval is approximately 4 seconds. For better results, the calibration operation should be carried out after the input pressure has stabilized for more than 10 seconds.

15.7 Small pressure removal

If you need to stabilize it at 0kPa at low pressure, you can set the "Low pressure excision value".
When the "low pressure cut-off value" is not 0, if the absolute value of the measured pressure is less than the "low pressure cut-off value", the cut-off is 0kpa.
The "low pressure cut-off value" can be set by configuration software or by key (Parameter No. 70.9).

15.8 Pressure migration at any point

If there is a fixed deviation in the pressure value, Youdaoplaceholder0 point migration can be performed by

pressing "Pressure Migration" (parameter number 70.10). That is enter the current actual pressure value (in kPa) to eliminate the deviation.

15.9 Temperature sensor calibration

When calibrating the temperature sensor, it is necessary to ensure that "temperature acquisition" is automatic acquisition (Auto) and an external temperature sensor is attached.
The temperature sensor provides two-point calibration. If using PT1000, it is recommended to calibrate with resistors around 1000 ohms and 2000 ohms. If using PT100, it is recommended to calibrate with resistors of around 100 ohms and 200 ohms.

Temperature calibration can be done through "Temperature Sensor Calibration" under the "Calibration" interface of Modbus configuration debugging software; Or you can manually enter the calibration resistance value by pressing the key to complete the temperature calibration.

Key calibration process:

(Parameter No.70.1) Set the "Temperature Acquisition" item to Auto Acquisition; (Parameter 70.3) Given the resistance value corresponding to the low point temperature [e.g. 1000 ohms] go to "Temperature Low Point Calibration", enter the current resistance value (unit: ohms), and confirm;

(Parameter No. 70.4) Given the resistance value corresponding to the high point temperature [e.g., 2000 ohms] enter "Temperature High Point Calibration", input the current resistance value (unit: ohms), and confirm.
Note 1: Both "Temperature Low Point calibration" and "Temperature High Point calibration" must be calibrated to ensure that the collected temperature is correct.
Note 2: This product supports Pt100 and Pt1000. During calibration, you need to provide standard resistances of approximately 100 (1000) ohms and 200 (2000) ohms respectively externally depending on the sensor being used, and input the actual resistance values respectively to complete the calibration.
Note that the temperature collection interval is approximately 4 seconds. For better results, the calibration operation should be carried out after the resistance value is greater than 10 seconds.

15.10 Instructions for vortex flow mode Settings

In the Settings of this section, "pressure" refers to the default "operating pressure" (parameter No. 9); The "temperature" mentioned refers to the default "operating temperature" (parameter 10); "Density" refers to the "density" of the gas or liquid (parameter 8).
In the following description, the gauge pressure sensor is used by default, that is, "atmospheric pressure" (parameter 70.6) cannot be set to 0. If "atmospheric pressure" is set to 0 the corresponding "operating pressure" also needs to enter the absolute pressure value.

15.11 Gas Qv

A. Measure the working condition volume as follows:
Density: Set to density at 20 ° C (not included in the calculation) Pressure: 0.0KPa
Temperature: 20°C
B Measure the volume under standard conditions as follows: Density: Standard density (not included in the calculation) Pressure: Operating pressure (gauge pressure KPa) Temperature: Operating temperature (degrees Celsius)

15.12 Gas mass flow rate (Gas Qm)

Given the current density, set it as follows: (where the state transition coefficient is 1) Density: Set to the current actual density
Pressure: 0.0KPa
Temperature: 20℃
Given the standard density, set up as follows: (at this point, the internal state transitions according to temperature and pressure)
Density: Standard density (density at 20 ° C) Pressure: Operating pressure (gauge pressure KPa)
Temperature: Operating temperature (degrees Celsius)

15.13 Liquid volume (Liquid Qv)

A measure the volume by setting it up as follows:
Density: 1.0 or current density (not included in the calculation)

15.14 Liquid mass (Liquid Qm)

A. Set the current density as follows:
B. Density: Set to the current actual density

15.15 Steam volume flow rate (Steam Qv)

Density: 1.0 or current density (not included in the operation) Pressure: 0.0KPa (not included in the calculation)
Temperature: 20 °C (not involved in the calculation)

15.16 Steam mass flow rate

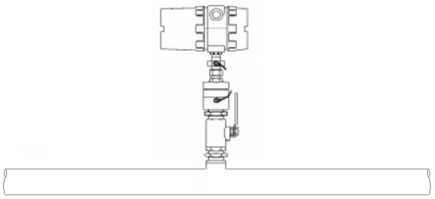
Superheated Steam mass (PT) (Steam(P/T)):
Pressure: Operating pressure (gauge pressure KPa)
Temperature: Operating temperature (degrees Celsius)
If the temperature sensor is faulty or not connected, calculate the steam density based on the input operating temperature.
If the pressure sensor is faulty or not connected, calculate the steam density based on the input operating pressure.

Saturated steam mass (T) (Sat_Steam(T):
Temperature: Operating temperature (degrees Celsius)
If the temperature sensor is faulty or not connected, calculate the steam density based on the input operating temperature.

Saturated steam mass (P) (Sat_Steam(P) :
Pressure: Operating pressure (gauge pressure KPa)
If the pressure sensor is faulty or not connected, calculate the steam density
based on the input operating pressure.

16 Install

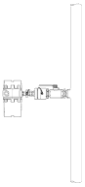
Pay attention! A stable flow field is a prerequisite for accurate measurements with a hot meter. Therefore, please pay attention to the following points during the meter installation process.



a. Installation Methods

- Horizontal installation

The maximum working pressure for horizontal installation is 1.6MPa.



- Vertical installation

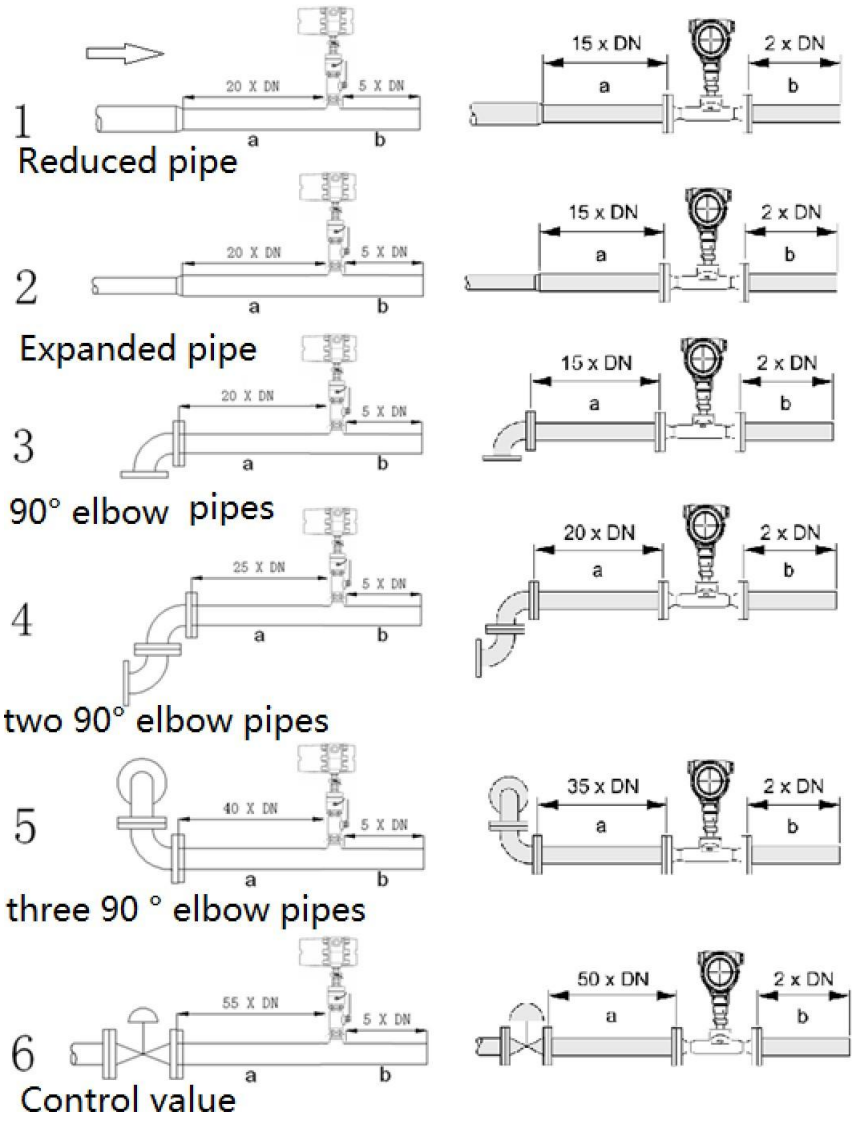
The working pressure of vertical installation shall not exceed 1.6MPa.

b. Pipe section installation requirements

If the interference sources (such as pipe bends, tapered pipes, valves, T-shaped pipes, etc.) are located in the intake pipe of the hot meter, take measures to minimize the impact on the measurement performance.
The diagrams below describe the minimum recommended straight pipe section lengths for different types of pipe. If the measurement space is large enough, the length of the straight pipe section should be extended as far as possible. When other factors are not considered, the minimum recommended length of the straight pipe section for the sensor is: Front straight pipe segment: minimum 20×DN

Pay attention! Straight back pipe section: Minimum 5 x DNRecommended values are all minimum values, usually increasing the length will improve the measuring performance of the flowmeter.

- If there are two or more interference sources in the front straight pipe section of the meter, the maximum recom- mended length of the front straight pipe is the absolute minimum.
- It is recommended that the control valve be installed behind the vortex flow meter.
- For lighter gravity gases such as helium and hydrogen, double the length of the straight front section.



a = front straight section b = back straight section

Pay attention!

Try to install the control valve and buffer cut-off valve behind the vortex flowmeter.

17 Sales and Services

17.1 Quality assurance

Only original spare parts supplied by the manufacturer shall be used. Service work should be carried out by qualified personnel only.

The manufacturer offers a range of services to support the customer after the warranty period has expired. These include repair, maintenance, technical support and training.

Please contact our customer service department if your flow meter does not work properly or requires repair.

17.2 Spare parts availability

The manufacturer adheres to the basic principle that functionally adequate spare parts for each device or each important accessory part will be kept available for a period of 3 years after delivery of the last production run for the device. This regulation only applies to spare parts which are subject to wear and tear under normal operating conditions.

17.3 Availability of services

The manufacturer offers a range of services to support the customer after the warranty period. These include repair, maintenance, technical support and training.

18 Disclaimer

18.1 General

The manufacturer shall not be liable for any damages of any kind arising from the use of its product, including but not limited to direct, indirect, incidental and consequential damages. This exclusion of liability does not apply if the manufacturer has acted intentionally or with gross negligence. If any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, to the extent such law applies, some or all of these disclaimers, exclusions or limitations may not apply to you. Each product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our terms and conditions. The manufacturer reserves the right to change the content of its documents, including this disclaimer, in any way, at any time, for any reason, without prior notice, and will not be liable in any way for the consequences of such changes.

18.2 Product liability and warranty

The operator is responsible for the suitability of the equipment for its intended use. The manufacturer accepts no responsibility for the consequences of misuse by the operator. Improper installation or operation of the equipment will invalidate the warranty. In addition, the respective "General Terms and Conditions" on which the sales contract is based apply.

18.3 Documentation

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To prevent injury to the user or damage to the equipment, it is essential that you read the information in this document and comply with applicable national standards, safety requirements and accident prevention regulations. If this document is not in your native language and you have any problems understanding the text, we advise you to contact your local office for assistance. The manufacturer cannot accept responsibility for any damage or injury caused by misunderstanding the information in this document. This document is intended to help you establish operating conditions that will allow safe and efficient use of this equipment. The document also describes special considerations and precautions that must be taken into account.

Appendix 1 Flow range table

Pipe bore (mm)	Pipe type		Insert type	
	Liquid (m^3/h)	Gas (m^3/h)	Liquid (m^3/h)	Gas (m^3/h)
15	1.2-6	4-28		
20	1.5-10	6-40		
25	2-16	8-50		
32	2.5-20	18-150.		
40	3-25	25-180.		
50	3.5-40	35-300.		
65	6.5-70.	50-500.		
80	12-130.	80-800.		
100	18-160.	120-1200.		
125	25-250.	180-1800.		
150	50-400.	320-2600.		
200	70-700.	560-5500.	70-700.	560-5500.
250	140-1200.	890-8000.	140-1200.	890-8000.
300	200-1800.	1360-11000.	200-1800.	1360-11000.
400			350-3000.	2750-27000.
500			500-4000.	4500-43000.
600			700-5600.	6200-60000.
800			900-7200.	11000-110000.
1000			1300-12000.	17000-170000.

Appendix 2 KF300 Intelligent Temperature and Pressure compensation vortex Flowmeter

Modbus Protocol instructions for Use

1 Simple Description of the protocol

This product uses the standard MODBUS-RTU mode. Supported feature codes include:
Feature code: 03 reads the value of the hold register, including Settings such as configuration data;
Function Code: 04 reads the value of the input register, which here refers to reading the dynamic variable. Function Code: 06, write a hold register.
Function Code: 16, write multiple hold registers.
MODBUS operating principles are based on the "register" concept, and its standard function numbers are essentially read and write operations on specified "registers". Based on this concept, some commonly used parameters are set as "registers" to be compatible with other systems.

1.1 Communication parameter Settings

Parameter Names	Range of values	Default values
Converter address	1-247	1
Baud rate	9600	9600
Data bit	8	8
Parity check	no	no
Stop position	1	1

1.2 Communication data format

Supported data types:

1. **Float: Floating-point data**
    a. Floating-point numbers in 4-byte standard IEE-754 format;
    b. For example: taking 100.0 (in hexadecimal: 0x42, 0xC8, 0x00, 0x00) as an example, the order oftransmission is: 0x42, 0xC8, 0x00, 0x00.
2. **Unsigned short:** 2-byte **unsigned integer number**
    a. For example: For 4660 (in hexadecimal: 0x12,0x34), the order of transmission is: 0x12,0x34.
3. **Unsigned char:** unsigned number of a single **byte**

1.3 Communication interface data format

1.3.1 Command 03(Read Hold Register)

Example: Read the upper limit of the range of the master variable (assuming its current value is 100.0), andthe corresponding register starts at 524 (hexadecimal 0x020C).

Request message

Address	**Feature Code**	**RegisterAddress**	**Numberofregisters**	**CRCcheck**
0x01	0x03	0 x02, 0 x0C	0 x02 0 x00	0 x05, 0 xB0

Response message:

Addr ess	Feature Code	Data length	Data	CRC check
0x01	0x03	0x04	0x42,0xC8,0x00,0x00	0x6F,0xB5

1.3.2 Command 04 (Read the input register, read the variable)

Example: Read the cumulant (assuming its current value is 100.0), the corresponding register starts at 1034 (0x040A in hexadecimal).

Request message:

Address	Feature Code	Register Address	Number of registers	CRC check
0x01	0x04	0 x04, 0 x0A	0 x02,0x00	0 x50, 0 xF9

Response message:

Address	Feature Code	Data length	Data	CRC check
0x01	0x04	0x04	0x42, 0xC8, 0x00, 0x00	0x6E,0x02

1.3.3 Command 16 (Write Hold Register)

Example: Set the upper limit of the master variable range to 100.0, and the corresponding register starts at524 (0x020C in hexadecimal).

Request message

Address	Feature Code	Register Address	Number of registers	Data length	Data	CRC check
0x01	0x10	0 x02, 0 x0C	0 x02,0 x00	0x04	0x42, 0xC8, 0 x00, 0x00	0x7F,0x1C

Response message:

Address	Feature Code	Register Address	Number of registers	CRC check
0x01	0x10	0 x02, 0 x0C	0 x02, 0 x00	0 x80, 0 x73

2 Register description

2.1 Input register list (dynamic variable)

Register address (Hexadecimal)	Parameter names	Access Type	Data Length (word)	Datypes	Instruct.
0x0404	Instantaneous flow	R	2	float	Register 0x021C stores the unit of instantaneous flow
0x040A	Cumulative flow values	R	2	float	Register 0x021D stores the unit of cumulative traffic
0x0423	Pressure value	R	2	float	
0x0425	Temperature value	R	2	float	
0x0427	Density value	R	2	float	

2.2 Keep the register list (configuration data)

Register address Hexadecimal	Parameter names	"Visit" Type	Data Length (word)	Data types	Instructions
0x021C	Instantaneous Flow units	R/W	1	unsigned short	{ 188 , "Nm3/h" }, { 189 , "Nm3/min" }, { 190 , "Nm3/s" }, { 29 , "m3/d" }, { 19 , "m3/h" }, { 131 , "m3/min"}, { 28 ,"m3/s" }, { 138, "l/h" }, { 17, "l/min" }, { 24, "l/s" }, { 185, "Scf/h" }, { 123, "Scf/m" }, { 186, "Scf/s" }, { 130, "cf/h" }, { 15 , "cf/m" },

					{ 26 , "cf/s" }, { 136, "USG/h" }, { 16 , "USG/m" }, { 22 , "USG/s" }, { 30 , "UKG/h" }, { 18 , "UKG/m" }, { 137, "UKG/s" }, { 135, "bbl/d" }, { 134, "bbl/h" }, { 253, "special_Qv" } { 79, "t/d" }, { 78, "t/h" }, { 77, "t/min" }, { 76, "kg/d" }, { 75, "kg/h" }, { 74, "kg/min"}, { 73, "kg/s" }, { 72, "g/h" }, { 71, "g/min" }, { 70, "g/s" }, { 83, "lb/d" }, { 82, "lb/h" }, { 254, "special_Qm" }
0x021D	Cumulative flow units	R	1	unsigned short	{ 43, "m3" }, { 41, "l" }, { 172, "Nm3"}, { 168, "Scf" }, { 112, "cf" }, { 40, "USGal" }, { 42, "UKgal" }, { 46, "bbl"}, { 61, "kg" }, { 60, "g" }, { 62, "ton"}, { 63, "lb"}, { 253, "special"}, { 254, "special"},