

Temperature-pressure compensated gas turbine flowmeter

Operating instruction



Introduction

About this set of user manual

This instruction is the guide for the use of the gas turbine flowmeter. Do not use it on other models. Users who use gas turbine flowmeters for the first time must carefully read this operation manual. It is also helpful to re-understand the knowledge and experience of users who have used it. Please read the content carefully and apply it in practice after fully understanding it.

It is suggested that after the normal operation of the equipment starts, the operating manual should be given to the equipment operators and maintenance personnel for use, and the operation and production should be carried out according to the instructions.

The company will continue to study and improve the gas turbine flowmeter products. Sometimes the content of this user manual may be different from the products and details purchased by the user. If the user has any questions about the products purchased or the content of the user manual, please contact the company.

Warning for your safety, please read the following safety warning carefully before using the instrument.

1. The fluid will not corrode the material of the meter body and the contact parts.
2. When measuring flammable gases, take precautions against fire or explosion.
3. When dealing with hazardous gases, the manufacturer's safety operation specification must be followed.
4. When working in dangerous environment, the correct operation steps should be followed.
5. Do not purge the turbine flowmeter with compressed air.
6. Pay attention to the turbine blade inside the flowmeter, even small scratches or gaps can affect the accuracy.
7. For best results, the instrument calibration period shall not exceed one year

I.An overview

1.1 application

The temperature-pressure compensated gas turbine flowmeter integrates gas turbine flow sensor and flow converter, and its main performance index reaches the international advanced level. It is an ideal instrument for gas metering in petroleum, chemical industry, electric power, metallurgy industry and boilers, as well as urban natural gas, gas regulating station and gas trade metering.

1.2 working principle

When the airflow enters the flow timing, it first passes through the rectifier with special structure and accelerates. Under the action of the fluid, the turbine overcomes the resistance moment and friction moment and starts to turn. When the torque reaches equilibrium, the speed is stable, and the turbine speed is proportional to the gas flow rate, and the magnetic field is changed periodically through the magnets on the rotating signal board, so that the pulse generator can output pulse signals with frequency proportional to the flow rate. The microprocessor in the converter counts and computes the pulse signal to obtain the working condition flow rate, and at the same time detects the temperature and pressure of the medium, converts the working condition volume flow rate into the standard volume flow rate according to the volume correction model, and accumulates the standard volume total amount.

1.3 product structure

The basic structure of the temperature-pressure compensating gas turbine flowmeter is shown in figure 1-1. It is mainly composed of a surface body, a movement (front guide, middle guide, rear guide), a connecting base and a converter

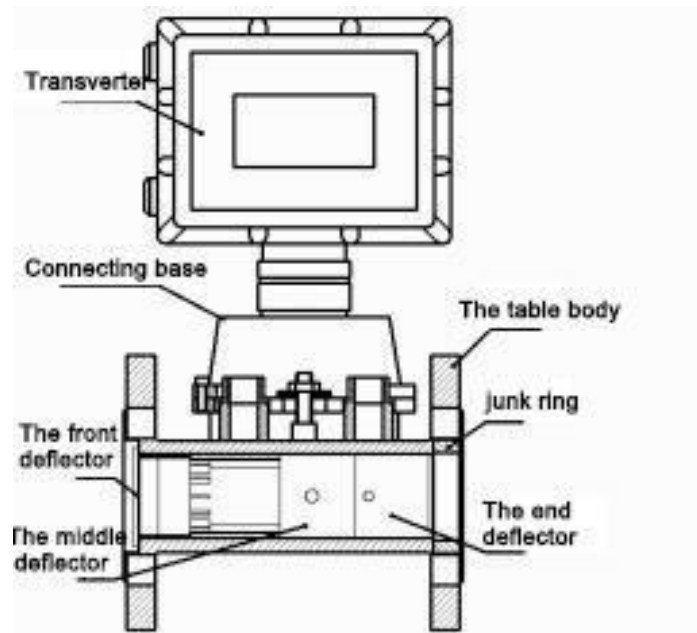


FIG. 1-1 flange connected turbine flowmeter structure diagram

II.Instrument type

2.1 Threaded connection type



2.2 Flange type



III. Technical parameters

3.1 flow characteristic

*2 Diameter (mm)	Normal flow range (m3/h)		Pressure loss of the largest *1 (kPa)
25	S1	2-20	1.5
	S2	5-70	
50	S1	6-100	0.5
	S2	10-160	1.0
80	S1	13-250	1.0
	S2	20-400	2.5
100	S1	20-400	1.0
	S2	32-650	1.5
	S1	50-1000	1.0

150	S2	80-1600	2.0
200	S1	80-1600	0.5
	S2	125-2500	1.0
250	S1	125-2500	0.5
	S2	200-4000	1.5
	S1	200-4000	1.0
	S2	320-6500	1.5
Accuracy class			
1.5 class (1.0 class Need to custom-made)			

Explain:

*1 The maximum pressure loss is the pressure loss when the flowmeter works at the maximum flow point. The medium is air at room temperature.

*2 DN20, DN32, DN65 and DN125 are non-GB products and need to be customized.

3.2.General features

measured medium	No impurity, medium or low velocity gas		
Executive standard	Measurement of gas flow in enclosed ducts - turbine flow sensor (GB/T18940-2003)		
Verification regulation	turbine flowmeter (JJG1037-2008)		
Instrument diameter and connection	Flange type	Stainless steel body	DN25-DN300
		carbon steel	DN350、DN400
	Threaded connection type	Stainless steel body	DN25、DN40、DN50
The standard of the flange	Usual standard	GB/T 9113-2000	
	Other standards	International pipe flange	such as: German standard DIN、American-Standard ANSI、Japanese Industrial Standards JIS
		Domestic pipe flange	Such as: chemical standards, machinery standards
The screw thread standard	regular size	Inch pipe thread (external thread) (reference standardGB/T7307-2001)	
	Other specifications	Internal thread, NPT thread, etc	

3.3Dielectric strength level

connection type	Diameter range		Conventional pressure rating	Customized pressure rating
	Stainless	DN25-DN100		6.3MPa and below
		DN150、DN200		4.0MPa and below

Flange type	steel	DN250、DN300	1.6MPa	2.5MPa and below
	Carbon steel material	N350、DN400		-
Threaded connection type	DN25、DN40、DN50			4.0MPa and below

3.4Material description

type	valve body		impeller
threaded connection	304 (DN25-DN50)		aluminum alloy
flanged joint	304 (DN25-DN300)	carbon steel (DN350、DN400)	

explain:

- * rectifying sheet material: dn25-dn150 is ABS, DN200 is cast aluminum alloy;
- * temperature-pressure compensation connection base is made of cast aluminum alloy;
- * the shell material of the converter is die-cast aluminum alloy;

3.5Electrical specification

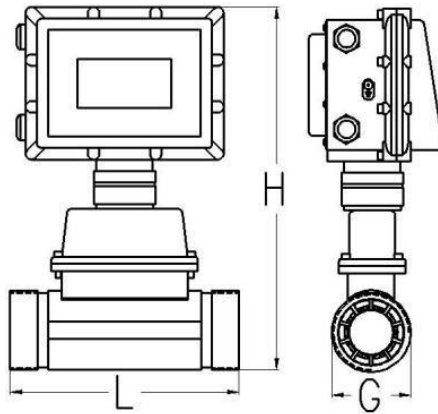
type	Compensation of temperature and pressure	
power supply	DC24V	3.6V lithium battery
power dissipation	<2W	<800uA
waterproofing grade	IP65	
explosive-proof grade	ExdIICT6 Gb	
electrical interface	M20*1.5 Internal thread (NPT thread to be customized)	

3.6Operating condition

verification conditions	calibrating apparatus	1. Gas flow verification device of standard meter method 2.Sonic nozzle gas flow prover 3.Bell jar gas flow prover	
	environmental conditions	environment temperature	20℃
		relative humidity	75%
service conditions	medium temperature	-30℃～+80℃	
	environment temperature	-20℃～+60℃	
	relative humidity	5%～90%	
	atmospheric pressure	86kPa～106kPa	

IV. Installation notes

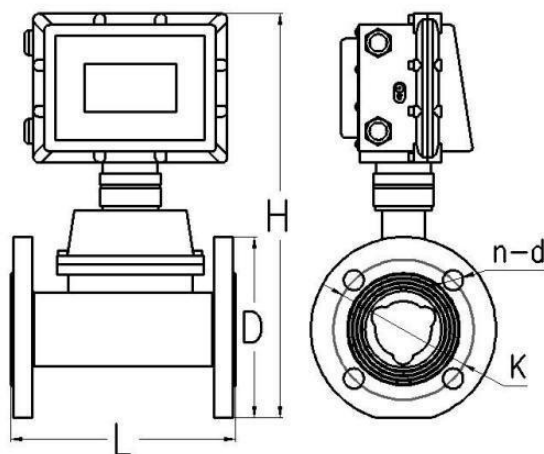
4.1 Installation dimension



Meter diameter (mm)	L (mm)	H (mm)	G (external thread
25	170	310	G2
40	140	310	G2
50	220	325	G2 1/2

Threaded connection dimensions

)



Flange connection type dimensions

Meter diameter (mm)	L (mm)	D(mm)	K (mm)	H (mm)	d (mm)	n (count)	The standard pressure
25	200	115	85	330	14	4	

50	200	165	125	370	18	4	1.6MPa
80	240	200	160	400	18	8	
100	300	220	180	425	18	8	
150	450	285	240	485	22	8	
200	500	340	295	545	22	12	
250	500	405	355	605	26	12	
300	300	460	410	670	26	12	
350	350	520	470	730	26	16	
400	400	580	525	790	30	16	

4.2 Installation site

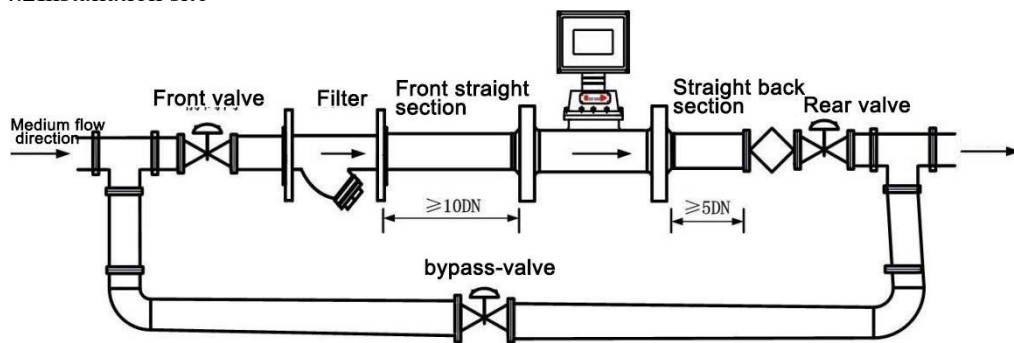


Figure 4-3 typical installation piping system

4.3 Installation precautions

Figure 4-3 typical installation piping system

1. It is strictly prohibited to weld the pipeline flange on the flow meter. The flow meter shall be removed before welding.
2. Before installing the flow meter, the sundries, welding slag and dust in the pipeline should be cleaned.
3. In order to facilitate maintenance and not affect the normal flow of fluid, it is recommended to set up bypass pipes as shown in figure 4-3 above.
4. Filters must be installed to prevent impurities from entering the meter.
5. The flow meter should be installed horizontally. It is recommended to install steel telescopic device (compensator) at the back of the straight pipe section behind the flowmeter. The telescopic device must meet the requirements of nominal diameter and nominal pressure of pipeline design. The telescopic device is used to compensate the pipe stress and to facilitate the installation and disassembly of flow meters.
6. If vertical installation is required, it shall be noted when ordering, and the products shall be configured accordingly. When installing and using, the airflow direction should be from top to bottom.
7. When the meter is installed in the outdoor use, it is recommended to add a protective cover, so as to avoid rain immersion or hot sun exposure, which will affect the service life of the meter.
8. There should be no strong external magnetic field interference and strong mechanical vibration around the flowmeter.
9. The flow meter shall be reliably grounded, but shall not be Shared with the ground wire of the strong power system.

V.Wiring instructions

5.1 Temperature and pressure compensation function configuration table

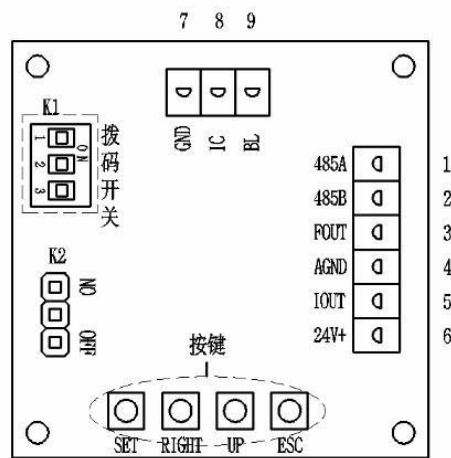
power mode		supply	display	output mode							
				pulse	pulse equivalent	electricity		IC card	RS485	alarm	
						two-wire 4-20mA	three-wire 4-20mA			AH	AL
battery AND DC24V	●	●	●	●	●	●	●	○	○		
Symbol description: ● standard ○ selection											

Note:

*1 pulse refers to the impeller speed is proportional to the pulse signal, its frequency is proportional to the instantaneous flow;

*2 pulse equivalent refers to the pulse signal (the same as the IC card signal) output every time the unit cumulant (e.g., 10m³, 1m³ or 0.01m³) is reached; *3 battery model ER34615, life of more than 2 years.

5.2 Terminal instructions



7	GND	IC Card signal output negative end	
8	IC	IC card signal output positive	
9	BL	Battery voltage undervoltage alarm output terminal	

5.3 Wiring instructions

(1). Pulse output wiring instructions

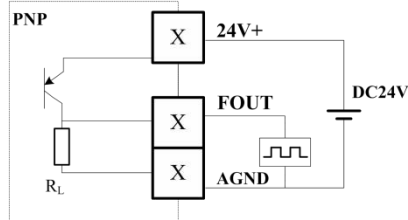


Figure 5-2 pulse output wiring diagram

(2) 4-20ma output wiring instructions of two-wire system

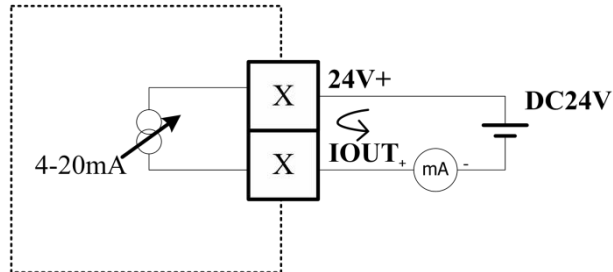


Figure 5-3 two-wire 4-20ma output wiring diagram

(3) 3-wire system 4-20ma current output wiring instructions

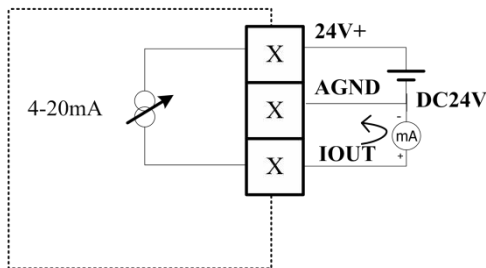
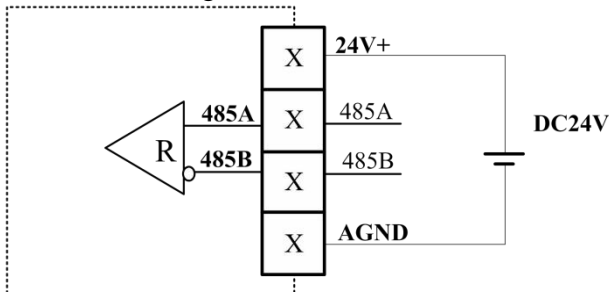


Figure 5-4 3-wire 4-20ma output wiring diagram

(4) RS485 communication function wiring instructions



5-5 RS485 communication output wiring diagram

Figure

(5) IC card signal wiring instructions

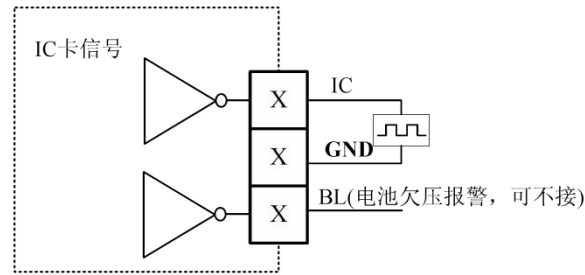


Figure 5-6 IC card signal wiring diagram

(6) three-wire power supply alarm output (optional)

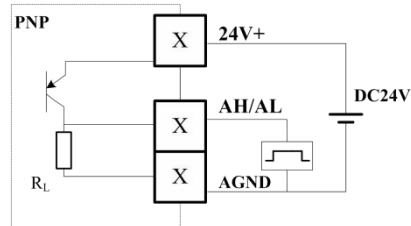
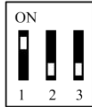
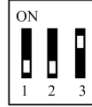


Figure 5-7 three-wire system power supply alarm output wiring diagram

Note: 1. Default low level, high level effective, high level > 2.8v, low level < 0.2v, pulse width can be set, see the menu for details.2. IC card signal output is available under any power supply.

5.4 Description of the dial code switch

Switch position	Schematic diagram	Corresponding function
1-ON;2-OFF;3-OFF		1.Original pulse output 2.Standard condition 0-1000hz output 3.Corrected frequency output
1-OFF;2-ON;3-OFF		Equivalent pulse output
1-OFF;2-OFF;3-ON		Raw pulse output

Note:Dial code corresponding to the pulse output interface FOUT.

VI.Operating instructions

6.1 basic structure of converter

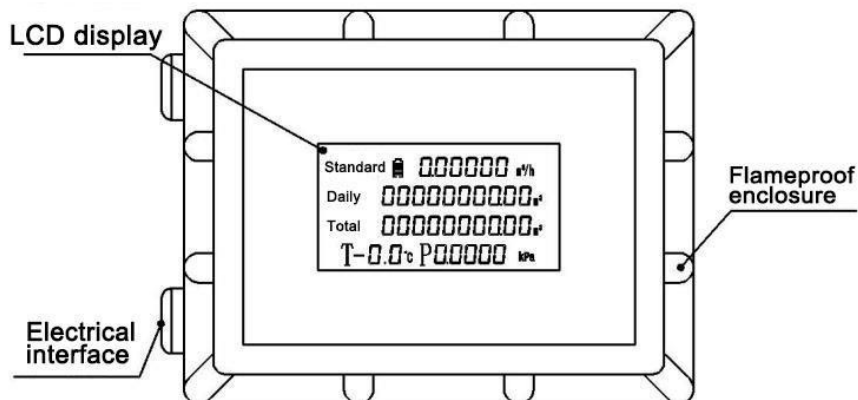


FIG. 6-1 basic structure diagram of the converter

6.2 key description

As shown in FIG. 6-1, the keys are 4-key: "SET", "RIGHT", "UP" and "ESC".

The key symbol	Functional specifications
SET	Page down, browse key, modify, confirm, store key
RIGHT	The shift key
UP	Add keys and page up
ESC	Exit key (do not save modified content)

6.3 Description of auxiliary interface

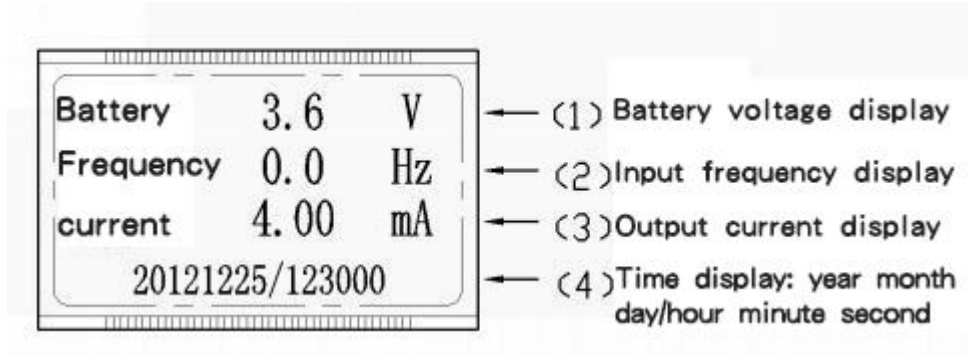


FIG. 6-3 schematic diagram of auxiliary interface

6.4 Password function description

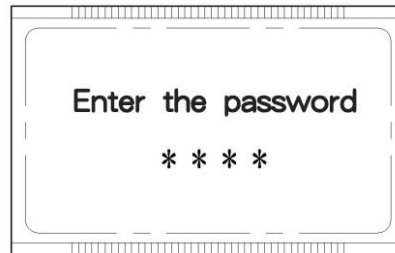


Figure 6-4 schematic diagram of password screen

Enter the password	Password function	Enter password status
1234	Modify p4-p25 screen parameters	After entering the correct password, press the SET key to enter the parameter setting
5555	Cumulative flow cleared	After entering the correct password, press the SET key to enter the reset prompt Press the SET key to return to the measurement interface

6.5 Function menu description

Set the screen code	The parameter name	meaning
P04	pulse	Select the operating condition or standard condition, corresponding to the main display screen to display the operating condition flow or standard condition flow
	Pulse equivalent *1	Set pulse equivalent, 4 digit, decimal point can float, unit is m3(also effective for IC card signal output)
	The pulse width *1	Set the pulse width, three digits, the unit is ms, duty cycle 1:1, need to set Set it as an integer multiple of 10ms. If it is less than 10ms, it will be counted as 10ms.(also effective for IC card signal output)

P05	frequency	Set the upper and lower frequency limits. When the collection frequency is greater than the upper frequency limit, the upper limit will be displayed Value, 0 is displayed when the collection frequency is less than the lower limit. Accuracy is 0.1hz.
	Standard of flow 0-1000hz /original pulse output/corrected pulse output	Set frequency output mode (one out of three) : Original pulse output, standard condition flow 0-1000hz, corrected pulse output (corresponding terminal board dial code switch K1)
	Temperature XX compensation	Select temperature compensation mode: automatic compensation, set compensation, no compensation
	Pressure XX compensation	Select pressure compensation method: automatic compensation, set compensation, no compensation
P06	Temperature upper limit *2	Set the temperature limit, three significant figures, the unit is °C
	Lower limit of temperature *2	Set the temperature limit, three significant figures, the unit for °C
	Upper limit of pressure *2	Set the upper limit of pressure, 5 significant digits, in kPa
	Lower limit of pressure *2	Set the pressure lower limit, 5 significant digits, in kPa
P07	Damping time	Set damping time, 1~9 seconds
	Temperature setting	When the P05 screen temperature compensation is set to "temperature setting compensation", set the compensation temperature Degrees, 3 digits, the unit is °C
	The pressure setting	When the pressure compensation setting of P05 screen is "pressure setting compensation", set the compensation pressure Force, five digits, in kPa
	Atmospheric	Set the local atmospheric pressure in kPa
P08	pressureaddress	Set instrument address, 01~247 (decimal)
	protocol	Select communication protocol, protocol 0, protocol 1 (recommended)
	Baud rate	Set communication baud rate, data bit length, parity mode, stop bit length
P09	The system time	Set the time in year, month, day/hour, minute and second
P10	composition mol	Set composition mol correction, Set to "no" (not enabled)
	Property values	Set property value correction to "no" (not enabled)
P11	Saturated steam	Set to saturated steam, set to "no" (not enabled)
	Superheated steam	Set whether to superheated steam, set to "no" (not enabled)

P12	Alarm 1	Set whether the first alarm value is enabled, select "yes" or "no"
	Output electrical level	Set the output level of the first alarm value, select "low" or "high"
(optional)	Alarm parameters	Set the alarm parameter of the first alarm value and select "working condition" : instantaneous flow in working condition Quantity (m3/h);Select "standard condition" : instantaneous flow in standard condition (m3/h);Select the temperature (°C);Select "pressure" (kPa)
	The alarm value	Set the corresponding alarm threshold, 6 digits, one digit return x%
P13 (optional)	Alarm 2	Set whether to enable the second alarm value, select "yes" or "no"
	Output level	Same thing as P12
	Alarm parameters	Same thing as P12
	The alarm value	Same thing as P12
P14	Record the way	Set recording mode, recording contents are: recording time, alarm status and accumulator Instantaneous flow, temperature, pressure
	Record the cycle	Set record time period, unit min
	backlight	Backlight setting: normally on, normally off, automatically on, 30s on (only in 24V power supply) Time action Light: turn on backlight: turn off backlight Automatic lighting: when the current is greater than 8mA, automatic lighting for 30s: 30s on, 30s off, intermittent lighting
	pressure	Set pressure display mode, gauge pressure/absolute pressure
P15	Full value	Set the maximum flow rate corresponding to the standard condition, 6 digits, and the corresponding current output full range value
	Zero value	Set the minimum flow corresponding to the standard condition, 6 digits, when the actual flow is less than this value , the current output is 4mA, and the instantaneous quantity is cut off
	cumulants	Standard case cumulant, 10 significant digits, fixed 2 decimal places

	Working accumulator	Working condition accumulator, 10 significant digits, 2 decimal points fixe
P16	Frequency 1 *3	Set the coefficient to correct the first point frequency, 4 significant digits, unit Hz,F1
	Amendment 1	Set the coefficient to correct the first coefficient, 5 significant digits,K1
P17	The frequency of 2	Set the coefficient to correct the frequency of the second point, 4 significant digits, unit Hz,F2
	Fix 2	Set the coefficient to correct the second point coefficient, 5 significant digits,K2
	The frequency of 3	Set the coefficient to correct the third point frequency, 4 significant digit, Unit Hz, F3
	Revised 3	Set the coefficient to correct the third point coefficient, 5 significant digits,K3
P18	The frequency of 4	Set the coefficient to correct the fourth frequency, 4 significant digits, unit Hz, F4
	Correction 4	Set the coefficient to correct the fourth coefficient, 5 significant digits,K4
	The frequency of 5	Set the coefficient to correct the fifth frequency, 4 significant digits, unit Hz,F5
	Fixed 5	Set the coefficient to correct the fifth coefficient, 5 significant digits,K5
P19	Frequency of 6	Set the coefficient to correct the sixth frequency, 4 significant digits, unit Hz,F6
	Revision 6	Set the coefficient to correct the sixth coefficient, 5 significant
	*4 Instrument coefficient	Set instrument coefficient, 10 digits, decimal point can float
P20 (for factory internal debugging)	The thermal resistance	Select the type of thermal resistance and set the calibrated stable resistance value
	Temperature value	Temperature calibration value
P21 (Factory internal commissioning)	Pressure 1	Set pressure calibrate first point pressure in kPa
	Voltage 1	First point pressure calibration value
P22 (Factory internal commissioning)	Pressure 2	Set pressure calibrate second pressure, unit kPa
	Voltage 2	The second pressure calibration value
P23	Pressure 3	Set pressure calibrate the third point pressure, unit kPa
(Factory internal commissioning)	Voltage 3	The third point is the pressure calibration value

P24 (Factory internal commissioning)	Pressure 4	Set pressure calibration point pressure, unit kPa
	Voltage is 4	Fourth, pressure calibration value
P25 (Factory internal commissioning)	Pressure5	Set pressure calibration fifth pressure, unit kPa
	Voltage 5	Fifth pressure calibration valu

Description:

The fault phenomenon	Failure analysis	Detection methods and solutions
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*1: when setting the equivalent pulse, the resolution should not be too high and the equivalent pulse width should not be too large to avoid output saturation.

Such as: DN50 calibre gas turbine flowmeter, flow range 6-65m³/h, set the pulse equivalent of P04 screen to 0.001, pulse width to 50ms, this means that for every 0.001 m³ flow accumulated, a pulse width of 50ms and duty cycle of 50% will be output when the pulse impulse, that is, the maximum frequency rate of output is 1000/ (50*2) =10Hz, The upper limit of the flow rate is 0.001*10*3600=36 m³/h. When the instantaneous flow rate is greater than 36 m³/h, the frequency of the output equivalent pulse is still 10Hz, that is, the output saturation.

*2 when the actual collection value is higher than the upper limit and lower than the lower limit;

*3 the original pulse refers to the pulse output without instrument coefficient compensation (see note *4); Correction pulse refers to the output pulse after the instrument coefficient compensation;

*4: instrument coefficient compensation, i.e., multi-point polyline correction for instrument coefficient K (see P16), 6 points can be set in total, (Fi, Ki) (i=1, 2, 3..., 6)

(1) Fi is the original frequency, which is proportional to the flow rate, unit Hz;

Ki is the compensation coefficient at the corrected frequency point, dimensionless, and the relationship with the instrument coefficient K (P16 parameter) is as follows:

$$K_i = K_{ic} / K.$$

Where K_{ic} is the actual coefficient at the Fi frequency point, which is generally obtained by the real flow calibration.

(2) multi-point polyline correction principle

The frequency corresponding to the current flow Q_c is F_c:

A. if F_c < F₁

$$Q_c = F_c / K_1 * K$$

B. If F_n < F_c ≤ F_{i+1} (i=1, 2, ..., 7)

$$Q_c = (F_c - F_i) / (F_{i+1} - F_i) * K_i + F_i / K_i = F_n / K_i * K$$

C. F_c > F_i (i=1/2.../8), Fi is the frequency of the last correction point according to the specific parameters inserted in the table.

$$Q = F_c / K_i * K.$$

VII. Breakdown maintenance

There is a flow through the meter Instantaneous flow is zero	Internal instrument parameters have been modified	Please check whether the instrument parameters are correct according to the verification certificate. If the parameters are wrong, please put in the correct parameters
When there is no flow through the meter, When there is no flow through the meter, The meter shows the instantaneous flow The meter shows the instantaneous flow	The gauge pipe stop valve is not properly closed	Check valve
	The pipe is vibrating violently	It is suggested to add vibration reduction measures
	The meter is not well grounded	Please check the ground
	There is strong electromagnetic interference on site, too close to high power equipment such as frequency converter, motor, solenoid valve	By determining whether the instantaneous flow value is the value of electromagnetic interference ($Q=3600f/k$, $f=50\text{Hz}$, k = coefficient of the instrument), it can be used to determine whether the instrument is affected by power frequency interference. If it exists, it is suggested to change the installation location.
Instrument normal measurement, measurement values are not accurate	Instrument temperature and pressure acquisition error (temperature and pressure compensation type)	The test instrument shows whether the temperature and pressure are the same as the medium in the pipe Cause, if different for temperature, pressure sensor damage, need to return to the factory repair
	There is a problem with the internal parameters of the instrument	Please check whether the instrument parameters are correct according to the verification certificate Wrong number, please put the correct parameter
	The meter movement is damaged	Need to contact with company personnel or return to the factory for testing
Instrument normal measurement, site LCD normal, instrument, The current output is incorrect	Instrument wiring error	If there is no current output, check whether the instrument wiring is wrong
	Error in meter range parameter	If there is current output, but the current value is not correct, the test instrument parameter Whether the variable limit and the range marked on the gauge nameplate Whether the variable limit and the range



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