

Thermal gas mass flow meter

GT600B



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1. Product Description

The **GT600B thermal gas mass flow meter** is designed based on the principle of thermal diffusion, which uses the constant temperature difference method to accurately measure the gas. the utility model has the advantages of small volume, high digitization degree, convenient installation and accurate measurement. the sensor part consists of two reference grade platinum resistance temperature sensors. When the instrument is working, one sensor continuously measures the medium temperature T1, the other sensor self-heats to the medium temperature T2, which is used to sense the fluid flow rate, called the speed sensor. The temperature $\Delta T = T_2 - T_1$, $T_2 > T_1$, when there is fluid flowing, the gas molecules collide with the sensor and take away the heat of T2, so that the temperature of T2 is lowered to keep ΔT unchanged, it is necessary to increase T2. the supply current, the faster the gas flow rate, the more heat is removed, and the gas flow rate and the added heat have a fixed function relationship this is the principle of constant temperature difference.

$$V = \frac{K [Q / \Delta T]^{1.87}}{\rho_g}$$

Among them — Fluid specific gravity(related to density), V — Flow rate, K — Balance factor, Q — Heating amount(related to specific heat and structure), ΔT — Temperature difference. Since the temperature of the sensor is always automatically higher than the medium temperature by about 30°C, the thermal gas flow meter does not require temperature compensation in principle. Thermal gas mass flow meter for medium temperature range is -40~450°C.

① Fluid specific gravity and density

$$\rho_g = \rho_n \times \frac{101.325 + P}{101.325} \times \frac{273.15 + 20}{273.15 + T}$$

among them: P_g _ Dielectric density under working conditions(kg/m³), P_n _ Medium density under standard conditions (101.325 Kpa, 20°C) (kg/m³), P _ Working condition pressure (kPa), T _ Working temperature(°C) It can be seen from equations (1) and (2) that the relationship between flow rate and operating pressure, gas density, and operating temperature has been determined. the constant temperature differential heat mass flow meter is not only affected by temperature, but also is not affected by pressure. the thermal gas mass flow meter is a true direct mass flow meter, and the user does not have to correct the pressure and temperature.

2. Technical features

Thermal gas mass flow meters have the following technical advantages:

- The real mass flow meter does not require temperature and pressure compensation for gas flow measurement, and the measurement is convenient and accurate. a mass flow rate of the gas or a standard volume flow can be obtained,
- Wide range ratio, can measure gas flow rate up to 120Nm/ s down to 0.1Nm/ s, can be used for gas leak detection,
- The seismic performance is good and the service life is long. The sensor has no moving parts and pressure sensing parts and is immune to the influence of vibration on the measurement accuracy,
- Easy to install and maintain. Non-stop production installation and maintenance can be achieved where field conditions permit (requires special customization),
- Digital design. The overall digital circuit measurement, accurate measurement and convenient maintenance,
- Using RS485 communication, factory automation and integration can be realized.
- Oxygen, nitrogen, hydrogen, chlorine and multi-component gas measurements.
- Blast furnace gas and coke oven gas measurement.
- Natural gas, liquefied gas, flare gas, and other gas flow measurement.
- Measurement of primary and secondary air flow in the blast furnace of a power plant.
- Flow measurement of ventilation or exhaust systems in underground mines.
- Flue gas measurement.

3. Technical Specification Table

Performance	Technical Parameters	
Structure type	Plug-in	Pipeline
Measuring medium	Common steady-state gases (unstable media such as acetylene and boron trichloride are not measurable)	
Pipe diameter range	DN65 ~ 4000mm	DN15 ~ 2000mm
Flow rate range	0.1 to 120Nm/s	
Accuracy	1 to 2.5 percent	
Operating temperature	sensor: -40 ~ +45°C / converter: -20 ~ +45°C	
Working pressure	Medium pressure $\leq 4.0\text{MPa}$ ($\geq 4.0\text{MPa}$ Agreement supply)	Medium pressure $\leq 1.6\text{MPa}$ ($\geq 4.0\text{MPa}$ Agreement supply)
Power supply	(DC 24V) $\geq 12\text{W}$	
Responding speed	1s	
Output signal	4-20mA (1500V Optical isolation, Maximum load 500ohm), RS485 (1500V Optical isolation)	
Call the police	1-2 normally open contacts	
Type of supply	Integrated structure	
Pipe material	Carbon steel, stainless steel, plastic, etc.	
Live display	Four-line LCD display	
Display content	Mass flow rate, standard volume flow rate, cumulative flow rate, standard flow rate, etc.	
Protection level	IP65, IP67, IP68	
Sensor material	stainless steel	stainless steel, carbon steel

4. Product structure and operating principle

4-1. Structural Description

A)The **GT600B thermal gas mass flow meter** integrated insertion type should be inserted into the axis of the measured pipeline,so the length of the measuring rod depends on the size of the pipeline diameter.This should be specified when ordering.If it cannot be inserted to the axis of the pipeline,the manufacturer will provide a calibration coefficient for accurate measurement.

B)The integrated full pipe type can be connected using flange connections,threaded connections,or clamp connections.

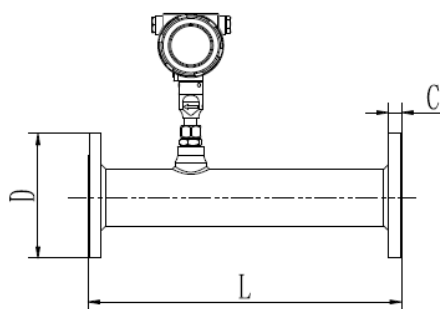


Figure 1

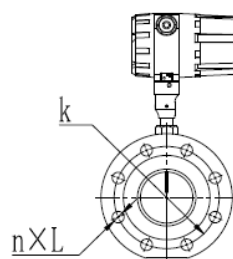


Figure 2

GB/T9119-2000 PN1.6Mpa(16bar) Flat, protruding panel flat welded steel pipe flange

Nominal diameter (DN)	Flange outer diameter (D)	Center hole diameter (K)	Screw hole (n*L)	Thread specification	Flange thickness (C)	Instrument installation length (L)
15	95	65	4*14	M12	12	160
20	105	75	4*14	M12	14	160
25	115	85	4*14	M12	14	160
32	140	100	4*18	M16	16	160
40	150	110	4*18	M16	16	180
50	165	125	4*18	M16	18	180
65	185	145	4*18	M16	20	180
80	200	160	8*18	M16	20	180
100	220	180	8*18	M16	20	200
125	250	210	8*18	M16	20	200
150	285	240	8*22	M20	22	200
200	340	295	12*22	M20	22	200
250	405	355	12*26	M24	24	200
300	460	410	12*26	M24	24	200

4-2. Card mounted mounting

Unit: mm

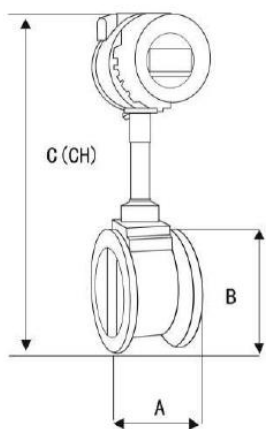


Figure 3

Caliber DN	B	C (CH)	A
15-25	55	390(455)	70
32	55	390(455)	70
40	80	385(440)	85
50	90	390(450)	85
65	105	400(470)	85
80	120	420(480)	85
100	140	440(500)	85
125	165	465(530)	90
150	194	490(560)	100
200	248	545(610)	102
250	300	595(650)	115
300	350	645(710)	130

- ① For DN15 ~ DN80 can be used pipe thread connection.
- ② Only the maximum rated pressure data of 1.6Mpa is given in the table, and it can be customized above the rated pressure.
- ③ The integral full tube can be flanged, threaded and snap-fit.

4-3. Plug-in mounting size

Unit: mm

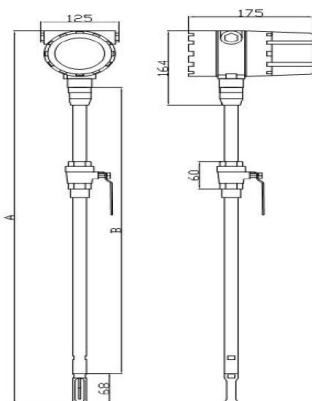


Figure 4

- ① The integral plug-in type should be inserted into the axis of the pipe to be tested, so the length of the measuring rod depends on the diameter of the measuring pipe. It should be stated when ordering.
- ② If it cannot be inserted into the pipe axis, the factory will provide the calibration factor to complete the accurate measurement.

5. Option

5-1. The flow range

caliber	Base range (air) (Nm ³ /h)	Extended range (air) (Nm ³ /h)	Oxygen base range (Nm ³ /h)	Combustible gas range (Nm ³ /h)
10	0.5-28	0.03-30	0.5-14	0.5-5
15	0.5-65	0.07-65	0.5-32	0.5-10
20	0.5-100	0.12-110	0.5-55	0.5-20
25	0.5-175	0.18-180	0.5-89	0.5-28
32	0.5-290	0.3-290	0.5-144	0.5-45
40	0.5-450	0.5-450	0.5-226	0.5-70
50	1-600	0.5-700	0.7-352	0.7-110
65	1.5-1,000	1-1,200	1.2-600	1.2-185
80	2-1,500	1.5-1,800	2-900	2-280
100	3-2,300	3-2,800	3-1,420	3-470
125	4.5-3,500	4-4,400	4.5-2,210	4.5-700
150	6.5-5,200	6-6,300	6.5-3,200	6.5-940
200	12-9,000	12-11,500	12-5,650	12-1,880
250	18-14,500	18-17,500	18-8,830	18-2,820
300	25-21,000	25-25,000	25-12,720	25-4,060
350	35-28,000	35-34,500	35-17,000	35-5,600
400	45-36,500	45-45,000	45-22,600	45-7,200
450	60-46,500	60-57,000	60-29,000	60-9,200
500	70-57,000	70-70,000	70-35,300	70-11,280
600	100-81,000	100-101,000	100-50,600	100-16,300
700	140-110,000	140-138,000	140-69,000	140-22,100
800	180-150,000	180-180,000	180-90,000	180-29,000
900	230-185,000	230-230,000	230-115,000	230-36,500
1,000	290-230,000	290-280,000	290-140,000	290-45,500
2,000	1,150-900,000	1,150-1,130,000	1,150-560,000	1,150-185,000

Note:

- Determination of the upper and lower limits of the range:
A Determination of the lower limit: Since the lower limit of the thermal gas mass flow meter can measure extremely low flow rates, such as 0.1 Nm/s, it is not necessary to consider the lower limit in the selection
B Determination of the upper limit: Generally, the choice is higher, and there should be more than 20%
Because the actual flow is easy to estimate the error
C Mixing gas range: For mixed gas, the user should give the molar ratio of the standard and the mixed gas (the percentage of each component to the total flow), and then the range is determined by the manufacturer It is usually calibrated with air and then multiplied by a conversion factor
D Explosion-proof product upper limit: 1) the maximum flow rate is preferably less than 17m/s
- Standard state flow: flow at a temperature of 20 ° C and a pressure of 101.325 KPa
- The unit of instantaneous flow rate can be Nm³/h, Nm³/min, L/h, L/min, t/h, t/min, kg/h and kg/min
- Conversion of working condition flow and standard condition flow: Q Standard condition: Standard state flow (Nm³/h) Q Working condition : Working condition flow(m³/h) T: Working medium temperature (°C)
P: Working medium pressure (gauge pressure KPa)
- Flow rate calculation formula

$$V = Q / (\pi \times (\frac{D}{2} / 1000)^2) / 3600$$

Q Standard condition: Standard state flow (Nm³/h)

Q Working condition: Working condition flow(m³/h)

T: Working medium temperature (°C)

P: Working medium pressure (gauge pressure KPa)

V: medium standard flow rate (Nm/S) Q: standard state flow (Nm³/h) D: measuring pipe diameter (mm)

6. Product installation and operation

6.1 Cable installation method

Terminal block description and wiring method:

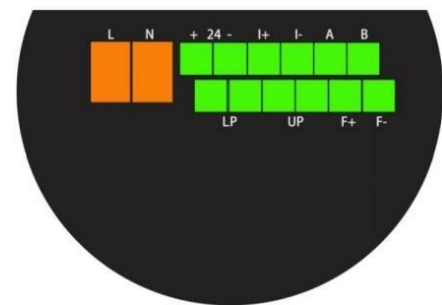
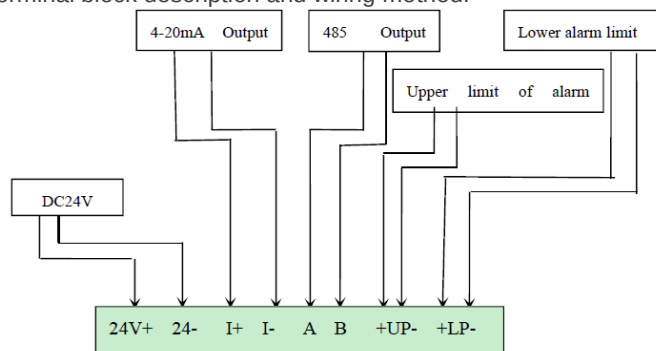
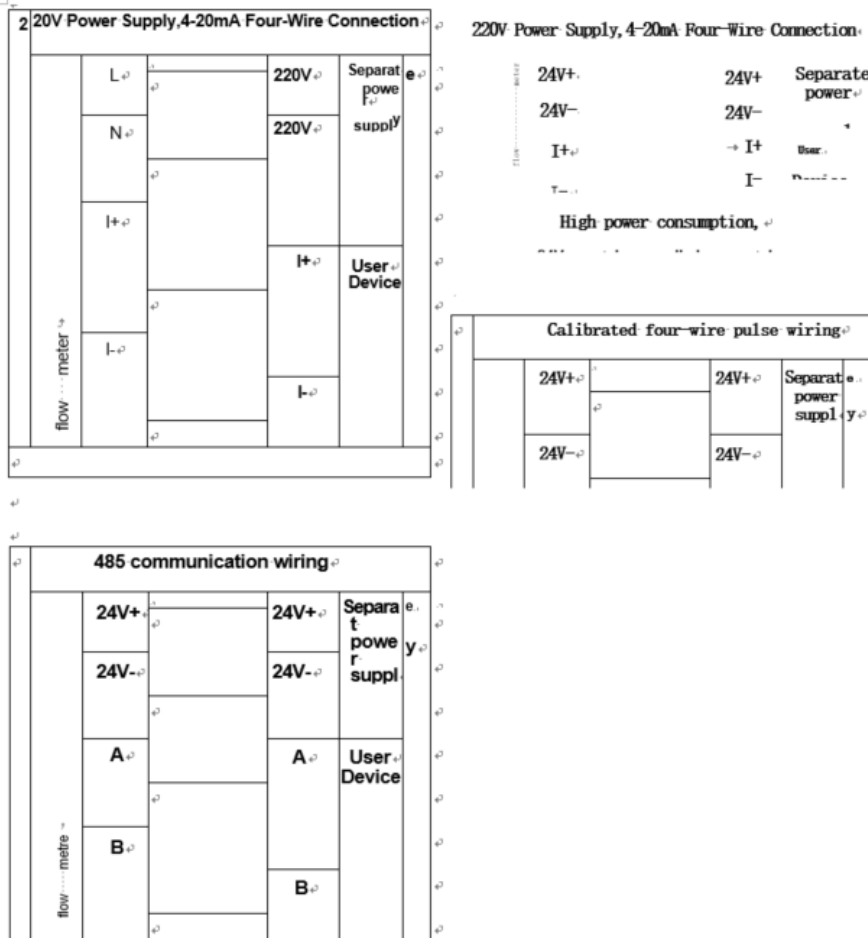


Figure 5

Wiring Mark	Description	Remarks
L	External 220VAC power supply L terminal	Must not use 220V and 24V simultaneously
N	External 220VAC power supply Terminal	
24+	External 24VDC power supply positive terminal	Must not use 24V and 220V simultaneously
24-	External 24VDC power supply negative terminal	
I+	4-20mA output positive terminal	4-20mA uses four-wire system design
I-	4-20mA output negative terminal	

A	RS485 communication A terminal	
B	RS485 communication B terminal	
LP	Lower limit flow alarm	Relay mode(non-polarized), max. 220V 5A driving capacity
UP	Upper limit flow alarm	Relay mode (non-polarized), max 220V 5A driving capacity
F+	Pulse output positive terminal	



High power consumption, 24V must be supplied separately, High power consumption, 24V must be supplied separately, and 220 power supply is connected in the same way and 220 power supply is connected in the same way

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6.2 Field instrument installation

If the instrument is installed outdoors, the instrument sun shield should be added to avoid sun and rain.

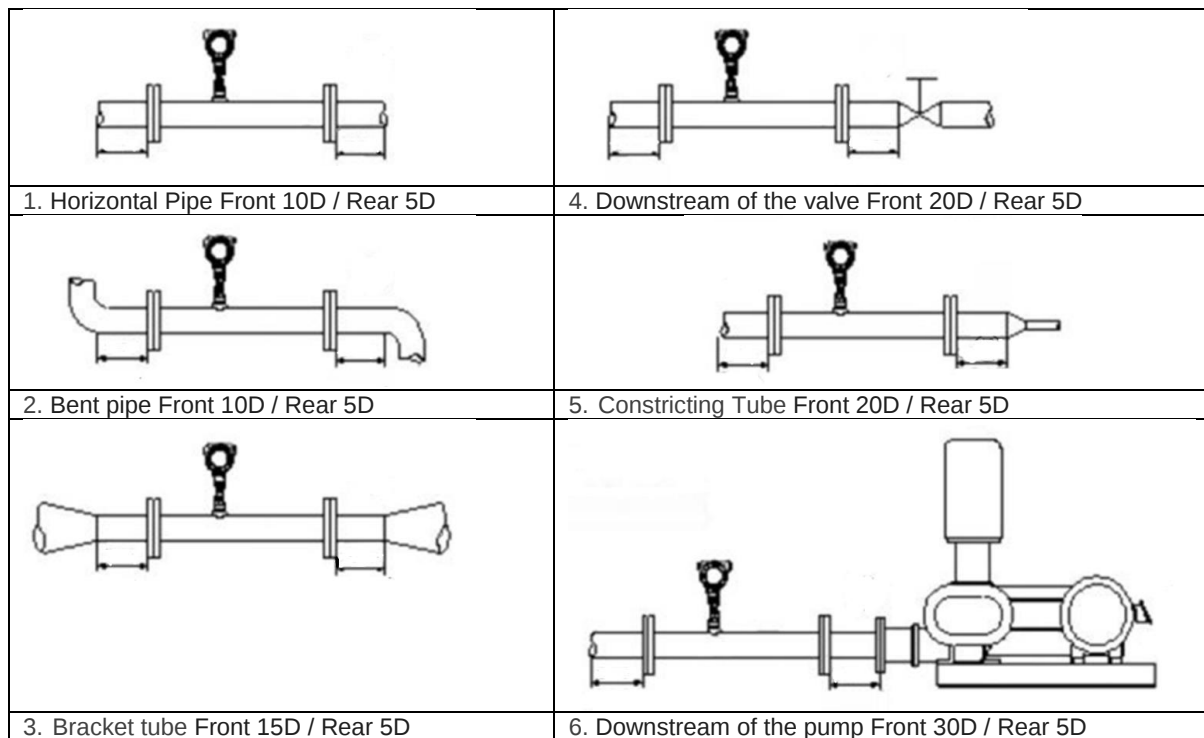
Do not install in places subject to strong vibration.

Do not expose to an environment containing a large amount of corrosive gases.

Do not share the power supply with equipment that pollutes the power supply such as inverters or welders. if necessary, install a clean power supply for the converter.

6.2.1 Installation location and requirements for piping

(1) When installing the instrument, keep away from elbows, obstacles, reducers, and valves to ensure a stable flow field. on the other side, a long upper straight pipe is required. the front straight pipe length is greater than 10d, and the rear straight pipe length is long. more than 5D. the following figure shows the length of the straight pipe required for several situations that are often encountered in the field:

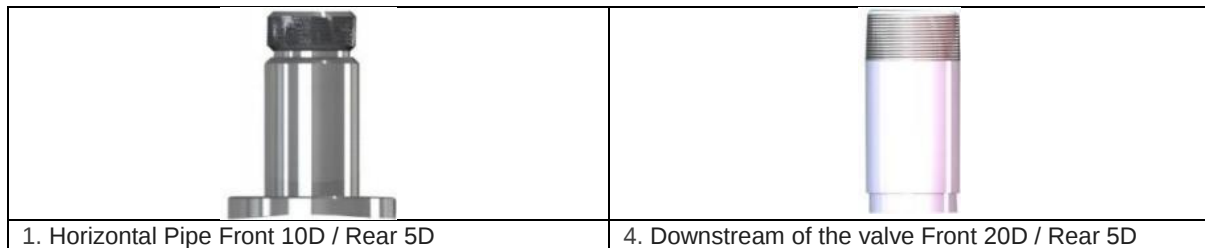


Straight pipe section before and after installation
Figure 6

Item	Details
Responding speed	1s
Output signal	4-20mA (photoelectric isolation, maximum load 500 ohm), RS-485 (lightning protection)
Alarm	1-2 normally open contacts, 24V / 0.5A
Structure type	Plug-in and pipeline
Type of supply	Split structure, integrated structure
Pipe material	Carbon steel, stainless steel, plastic, etc.
Live display	Four-line LCD display
Display content	Mass flow rate, standard volume flow rate, cumulative flow rate, standard flow rate, etc.
Protection level	IP65, IP67, IP68
Sensor material	Stainless steel, carbon steel

(2) When the site cannot meet the requirements of the straight pipe section, the gas rectifier can be connected in series to greatly reduce the requirements for the straight pipe section.

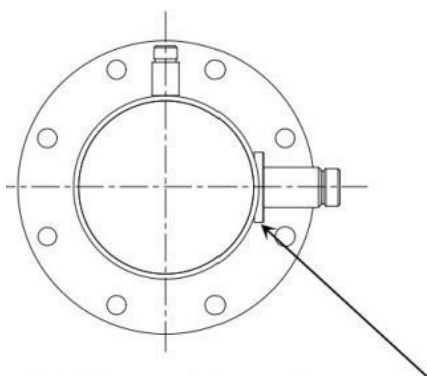
6.2.1 2. Base of the thermal gas mass flow meter



Welding operations are prohibited in explosive environments.

Operations in environments with special requirements for welding should be carried out in accordance with the relevant guidelines.

The base is divided into standard type and simplified type according to different installation methods, and the base should be located at the top of the pipe section direction during installation, and the axis of the base through hole should be perpendicular to the pipe axis. Ideal base welding position and welding process. (as shown below)



The base must be processed by wire cutting to create an arc with the same outer diameter as the pipeline before welding, in order to ensure the sealing quality of the weld.

Ideal base welding position

Refer to the diagram in Appendix 1(Compact Thermal Gas Mass Flow Meter)

- 1)Before installing the compact thermal gas mass flow meter, please confirm the actual internal diameter and wall thickness of the pipeline.
- 2)Insert the remaining parts of the thermal gas mass flow meter into the dedicated ball valve, calculating the insertion depth based on the actual internal diameter and wall thickness of the pipeline. at this step, a rough size can be inserted, and the nut can be hand-tightened.
- 3)Rotate the sensor connecting rod so that the marked arrow aligns with the direction of medium flow.
- 4)Based on the data measured on site, convert it to the corresponding scale on the sensor connecting rod, and then lock the nut.
- 5)If you are installing this device horizontally, the display can be flexibly installed at 90°, 180°, or 270° to meet your actual needs on site.

Refer to the figure in Appendix 2(Full Tube Thermal Gas Mass Flow Meter)

- Please confirm again before pre-installation. Prepare the connection methods for the sections and related items for flange connections such as gaskets and bolts.
- Production must be halted prior to installation, and strict adherence to the factory's relevant regulations is required.

The full pipe-type instrument is factory-assembled with the sensor correctly positioned on a dedicated pipe segment, making it relatively simpler for users to install the pipeline on-site compared to field insertion installations. First, select a suitable installation point on the pipeline, then cut the pipe to the required length of the associated pipe segment, and install the corresponding flange and bolts. Ensure that the fluid flow rate matches the flow label indicated on the full pipe-type thermal mass flowmeter. additionally, the display screen must be perpendicular to the horizontal plane, and the axis of the pipeline should be parallel to the horizontal plane, with an allowable error not exceeding $\pm 2.5^\circ$. finally, tighten the instrument using bolts.

7. Model Selection

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Code		Description	
GT600S series		Thermal Gas Mass Flowmeter	
Meter type	T		Thread
	F		Flange
	IX		Insertion IT: Thread connection IF: Flange connection ITF: Tapered flange connection
Ball valve	YX		YT: Thread ball valve YF: Flange ball valve
	N		No
Nominal diameter		XX	DN10.....DN4000
Material	Sensor probe	04	SUS304
		16	SUS316L
	Ball valve	N	Not included.
		04	SUS304
		16	SUS316L
Pressure Level		1	1.6 MPa
		2	2.5 MPa
		4	4.0 MPa
Connection		T	Thread
		A	ANSI flange.
		D	DIN flange.
		J	JIS flange.
		O	Other
Max. Temperature		1	-40 ~220°C
		2	-40 ~350°C
Power supply		A	220V AC
		D	24V DC
Output		1	RS485, 4...20mA, Pulse
		2	HART, RS485, 4...20mA, Pulse
		3	Relay outputs, RS485, 4...20mA, Pulse
Structure Type		I	Integrated type
		R ()	Remote separated (5): 5meter cable (10): 10meter cable

8. Selection chart

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Category	Code	Product Series
DTRTMF	Thermal gas mass flow meter	
Nominal diameter (unit: mm)	10	DN10
	15	DN15
	20	DN20
	25	DN25
	...	...
	900	DN900
	A30	DN3000 and above by analogy
Power supply mode	U	24VDC
	A	220VAC
Accuracy grade	A	1
	B	1.5
Use environment	P	General type
	EX	Explosion-proof type
Output mode	1	Pulse output-three-wire system
	2	4~20mA current output-Four-wire system RS485 communication, Modbus
	3	Protocol (Four-wire system)
	4	Hart protocol
	5	4G
	X	Other special customizations
Sensor material	6	SUS316L
	H	HC
	X	Other special customization
Body material	M4	SUS304
	M6	SUS316
	MC	HC
	XX	Other special customization
Connection mode	1	Flange mounting type
	2	Flange connection type
	3	Clamp connection type
	4	Threaded connection type
	5	Insertion type-ball valve installation
	6	Insertion type-flange installation
	7	Online pluggable type
	X	Other special customization
Pressure class	0	Vacuum
	1	1.6MPa
	2	2.5MPa

	3	4.0MPa
	4	6.3MPa
	5	10MPa
	6	ANSI 150LB
	7	ANSI 300LB
	8	ANSI 600LB
	XX	Other special customizations
Display	Q	Display flow
	V	Display flow velocity
	T	Display temperature
	P	Display pressure
Transmitter type	S	Integrated
	L	Split type-round head
	F	type-square head
	XX	Other special customizations