

**Thermal Gas Mass Flow meter**  
**MT100M series**  
**Installation and operation guide**

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## ※Safety Information※

Thank you for purchasing our quality thermal gas Mass flowmeter with independent research and development.

We have written this guide to provide the persons responsible for the installation, operation and maintenance of your flow meter with the product specific information they will need.

In order to prevent damage to instrument and make the instrument in the best performance and stable operation, please read this manual thoroughly before installation.

Please have a safekeeping of this manual and together with the instrument after reading.

Please pass this manual to technical department of end user to keep.

This manual classifies important grade of safety attentions by Caution and Warning.



### Caution

Error operation in case of ignoring the tips might cause the personal injury, or damage to the instrument and property.

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### Warning

Error operation in case of ignoring the tips might cause the personal injury, or major accident.

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This manual contents the following icons:



Indicates safety attention which are dangerous.



Indicates safety attention which are needed to pay attention to.



Indicates safety attention which are forbidden.



**Select explosion-proof instrument for explosive environment application.**

Confirm whether the nameplate of instrument has the identifiers of explosion-proof certification and temperature class, the instrument can not be used in explosive environment without those identifiers.



**The explosive-proof temperature class of instrument must meet the explosion-proof and temperature of environmental requirements on site.**

When the instrument is in used explosion-proof environment, make sure that the explosion-proof certification and temperature class of instrument meet to the requirements on site.

 **No opening while working in explosive environment.**

Before wirings, please power instrument off.

 **The protection class of instrument must meet the working condition requirements on site.**

The requirement of protection class on site should be under, or the same as the protection class of instrument to ensure that the instrument is working fine.

 **Confirm the power type**

Customers can select the power type : 220VAC or 24VDC ( Please state it when ordering ) .Please confirm the power type before installation.

 **Confirm the working environment of instrument and medium temperature.**

The environment on site and the maximum medium temperature should be under the nominal value of instrument. ( the details of nominal value are shown in Part 2 Specification )

 **No hot-tapped installation and maintenance while the medium temperature is too high.**

When temperature of measuring medium is higher than the temperature that human can bear, or higher than the temperature of possible danger, should shut down or do cooling process to reach a safety temperature, and then do hot-tapped operation.if there are no conditions to do hot-tapped operation, should shut down to avoid dangers.

 **Confirm the ambient pressure of instrument and medium pressure.**

The ambient pressure on site and the maximum medium pressure should be under the nominal value of instrument. ( the details of nominal value are shown in Part 2 Specification )

 **No hot-tapped installation and maintenance while the medium pressure is too high**

When absolute pressure of measuring medium is higher than 5 times standard atmospheric pressure, or higher than the pressure of possible danger, should shut down or do reducing pressure to reach a safety pressure, and then do hot-tapped operation.if there are no condition to do hot-tapped operation, should shut down to avoid dangers.

 **Extra requirements of special medium**

The properties of some gas are special, it is needed to order special product, please check the manual of special product thoroughly to make sure whether it meets the requirements on site before installation.

 **No hot-tapped installation and maintenance while the medium is dangerous gas**

When the medium may cause injury to humans, no hot-tapped installation and maintenance, should shut down or do security processing to reach a safety condition, and then do hot-tapped operation. If there are no conditions to do hot-tapped operation, should shut down to avoid dangers. The dangerous gases are such as gas and chlorine, etc.

 **If doubting that the instrument in the event of failure, please do not operate it.**

If there are something wrong with the instrument or it had been damaged, please contact us.

## Part 1 Introduction

Thermal gas mass flow meter is designed on the basis of thermal dispersion, and adopts method of constant differential temperature to measuring gas flow, it has advantages of small size, easy installation, high reliability and high accuracy, etc.

The meter contains two platinum resistance temperature sensors, the thermal principle operates by monitoring the cooling effect of a gas stream as it passes over a heated sensor. Gas flowing through the sensing section passes over two sensors one of which is used conventionally as a temperature sensor, whilst the other is used as a heater, the temperature sensor monitors the actual process values whilst the heater is maintained at a constant differential temperature above this by varying the power consumed by the sensor, The greater the gas velocity, the greater the cooling effect and power required to maintain the differential temperature, the measured heater power is therefore a measure of the gas mass flow rate.

The format of gas velocity and power is shown as below:

$$V = \frac{K[Q/\Delta T]^{1.87}}{\rho_g} \dots\dots\dots (1)$$

Where,

$\rho_g$  is special gravity of medium

$V$  is velocity

$K$  is balance coefficient

$Q$  is heater power

$\Delta T$  is the differential temperature

The medium temperature range of meter is -40~220°C.

In the format (1), the specific gravity of medium is related to the density:

$$\rho = \rho_n \times \frac{101.325 + P}{101.325} \times \frac{273.15 + 20}{273.15 + T} \dots\dots\dots (2)$$

Where,

$\rho_g$  is the medium density in working condition (kg/m<sup>3</sup>)

$\rho_n$  is the medium density in standard condition, 101.325kPa and 20°C (kg/m<sup>3</sup>) .

$P$  is the pressure in working condition (kPa) .

$T$  is the temperature in working condition (°C) .

In the formats (1) and (2), there is a certain function relationship between the velocity and pressure in working condition, medium density, the temperature in working condition.

Due to the sensor temperature is always 30 °C higher than the medium temperature ( environment temperature ), and the meter adopts method of constant differential temperature , therefore the meter don't need to do temperature and pressure compensation in principle.

## Part 2 Specification

### Features:

- Measuring the mass flow or volume flow of gas.
- Don't need to do temperature and pressure compensation in principle with accurate measurement and easy operation.
- Wide range, 0.5Nm/S~100 Nm/S is for gas, the meter also can be used for gas leak detection.
- Good vibration resistance and long service life, no moving parts and pressure sensor in transducer, no vibration on the measurement accuracy.
- Easy installation and maintenance, if the conditions on site are permissible, the meter can achieve a hot-tapped installation and maintenance. (Special order of custom-made)
- Digital design, high accuracy and stability.
- Configuring with RS485 or HART interface to realize factory automation and integration.

Description	Specification
Measuring medium	Various gases (except the acetylene)
Pipe size	DN10-4000mm
Velocity	0.1-100Nm/s
Accuracy	±1-2.5%
Working temperature	Sensor: -40℃~+220℃ Transmitter: -20℃~+45℃
Working pressure	Insertion sensor: medium pressure≤1.6MPa Flange sensor: medium pressure≤1.6MPa Special pressure please contact us
Power supply	Compact type: 24VDC or 220VAC, power consumption≤18W Remote type: 220VAC, power consumption≤19W
Response time	1s
Output	4-20mA (optoelectronics isolation, maximum load 500Ω), plus, RS485 (optoelectronics isolation) and HART
Alarm output	1-2line relay, normally open state, 10A/220V/AC or 5A/30V/DC
Sensor type	Standard insertion, hot-tapped insertion and Flanged
Construction	Compact and remote
Pipe material	Carbon steel, stainless steel, plastic, etc
Display	4 lines LCD Mass flow, volume flow in standard condition, Flow totalizer, Date and Time, Working time, and Velocity, etc.
Protection class	IP65
Sensor housing material	Stainless steel (316)

## Part 3 Mechanical Construction

### 3. 1 Appearance



Fig.1 Standard insertion Flow Meter  
(Pipe size DN100-500)



Fig.2 Flanged Flow Meter  
(Pipe size DN15-80)



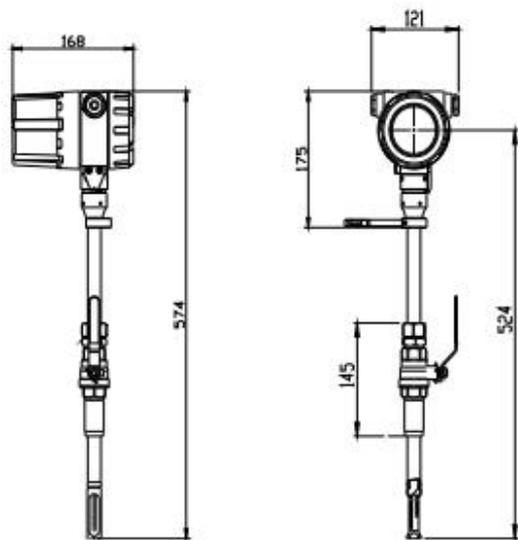
Fig3.Hot-tapped insertion Flow Meter

(Pipe size DN100-4000. Special requirements please contact us)

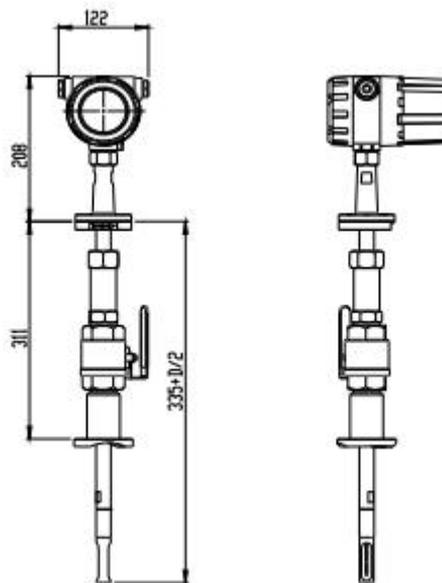
The insertion sensor of compact insertion flow meter should be inserted to axis of pipe, and the length of the insertion sensor is decided by pipe size, please confirm the pipe size when ordering, if the insertion sensor can't be inserted to axis of pipe, the manufacturer will provide a calibration factor to achieve an accurate measurement.

### 3.2 Dimensions

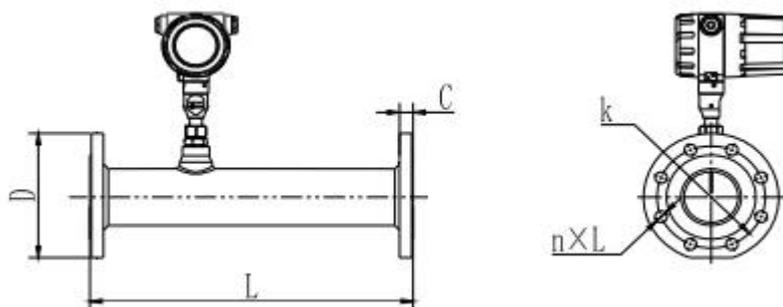
Dimensions of standard insertion sensor



Dimensions of hot-tapped insertion sensor



Dimension of flanged sensor



PN1.6MPa Plane and surface plate flat welding steel pipe flanges (Unit: mm)

Nominal diameter	Flange outer diameter	Center hole	Screw hole	Screw thread	Sealing face		Flange thickness	Pipeline length
					d	f		
DN	D	K	nxL				C	L
15	95	65	4x14	M12	46	2	14	250
20	105	75	4x14	M12	56	2	16	250
25	115	85	4x14	M12	65	2	16	250
32	140	100	4x18	M16	76	2	18	350
40	150	110	4x18	M16	84	2	18	350
50	165	125	4x18	M16	99	2	20	280
65	185	145	4x18	M16	118	2	20	280
80	200	160	8x18	M16	132	2	20	280
100	220	180	8x18	M16	156	2	22	280

For DN15-80, the meter can be made with threading to connect.

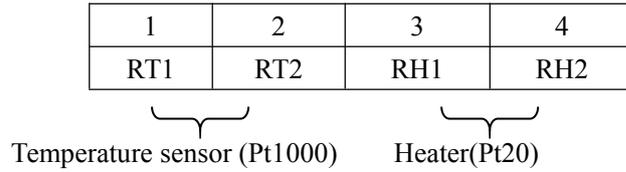
The above table is used for rated pressure of 1.6MPa, if the rated pressure is more than 1.6MPa, please contact us for special order.

## Part 4 Wiring

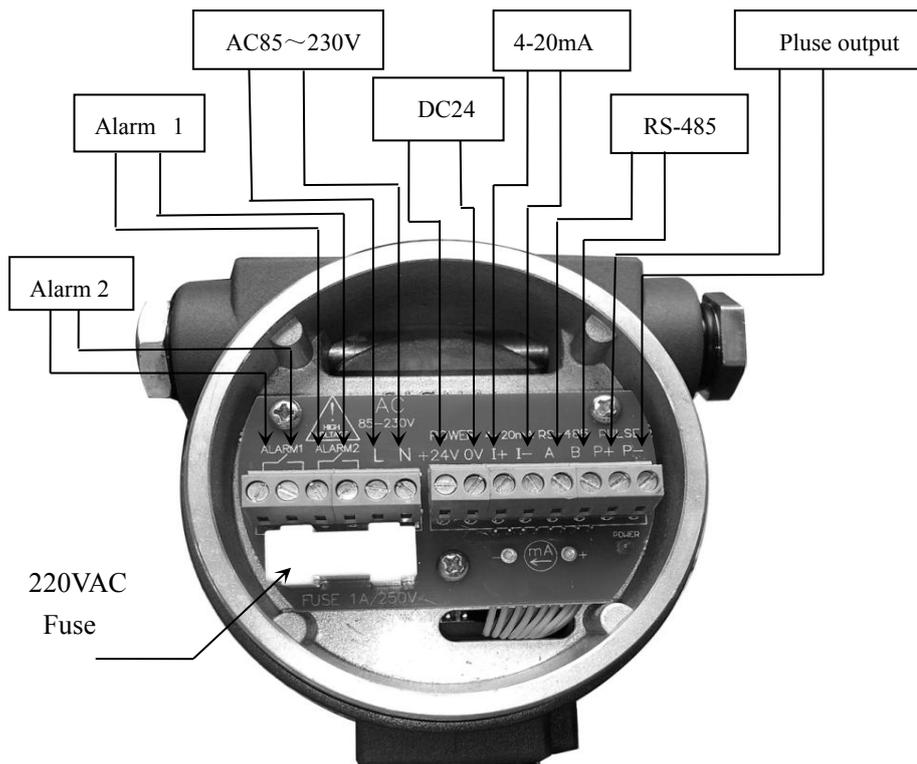
 No operation when the meter is working.

 Confirm the power supply type.

### 4.1 Instruction of Sensor Wirings

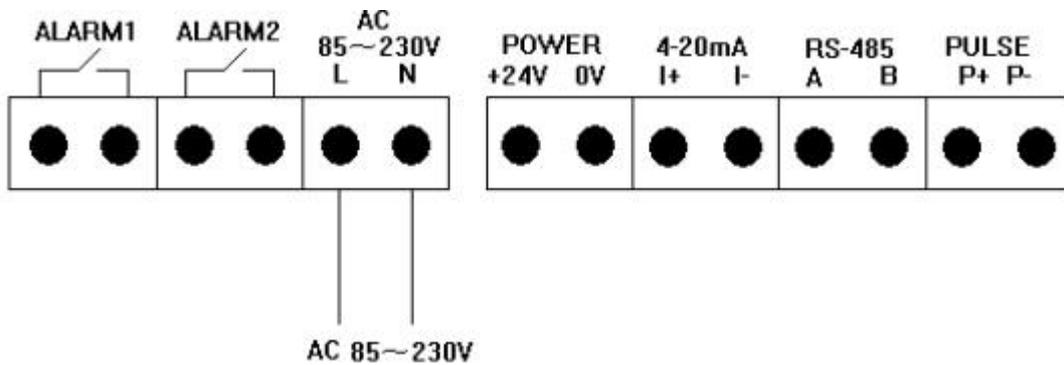


### 4.2 Instruction of Transmitter Wirings

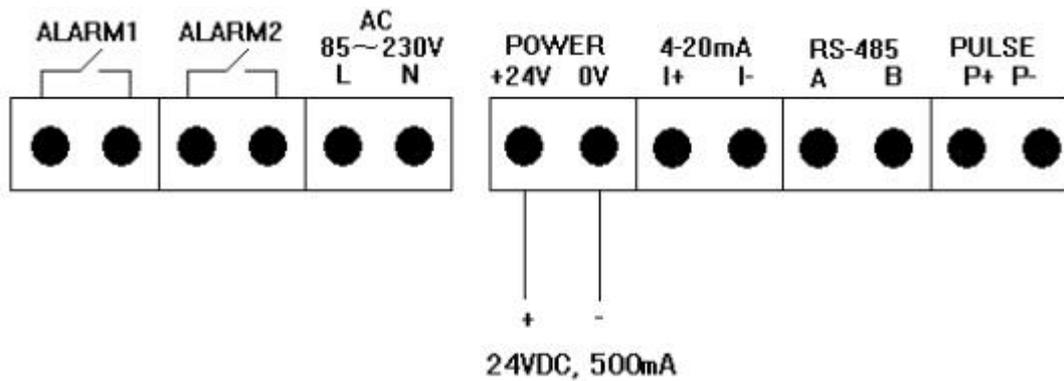


### 4.3 The wirings of power supply

#### 1.AC power supply

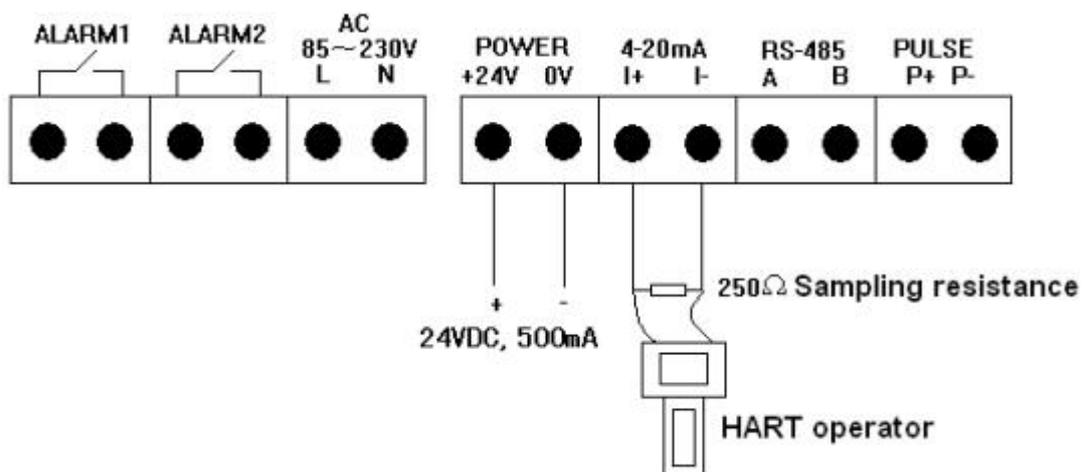


#### 2.DC power supply

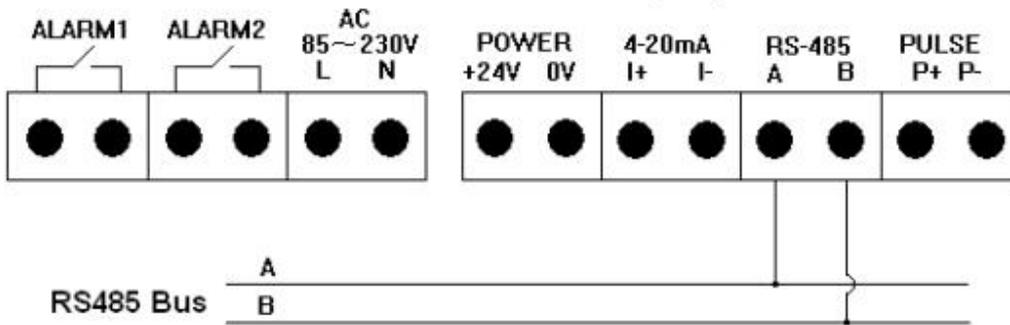


### 4.4 the wirings of output

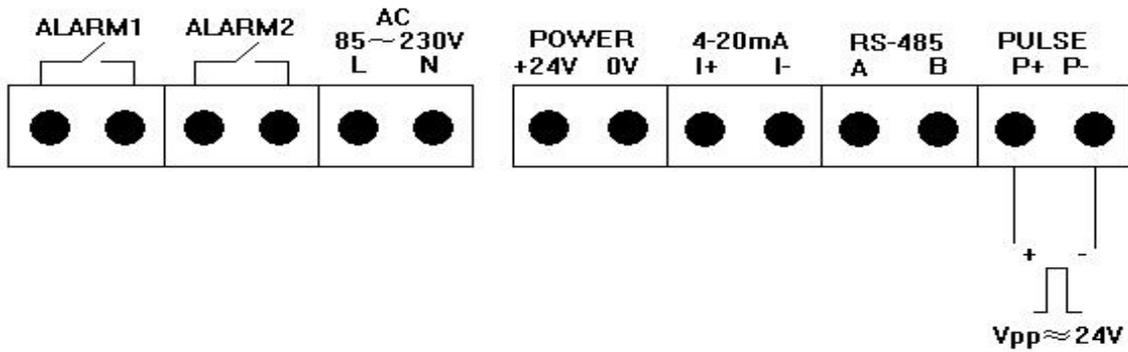
#### 1. the wirings of four-wire 4-20mA output and HART operator



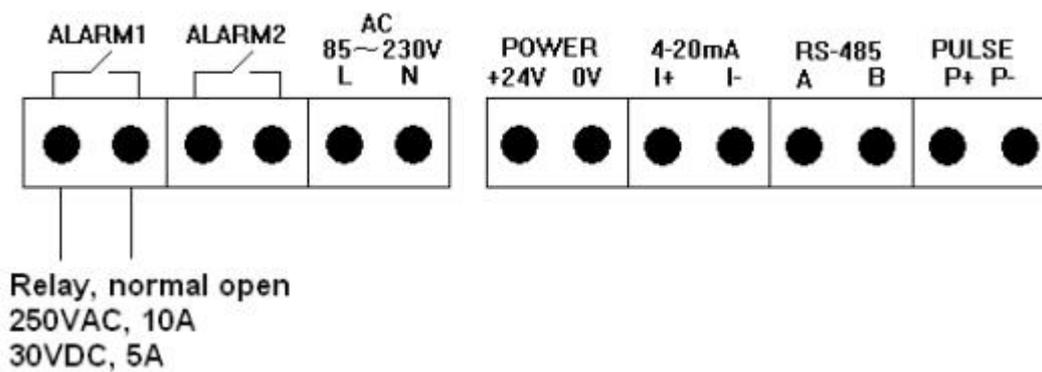
2. The wirings of RS485 output



3. The wirings if pulse output



4. The wirings of alarm output



## Part 5 Installation

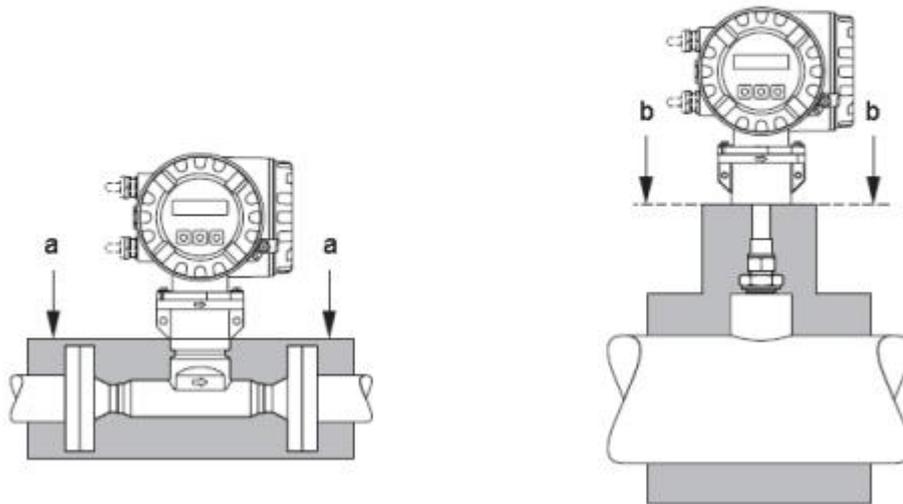
### 5.1 Installation Position

Thermal meters require a fully development flow profile as a prerequisite for correct flow measurement. For this reason, please note the following points when installing the device.

- Observe the recommended inlet and outlet requirement.
- Good engineering practice is necessary for the associated pipe work and installation.
- Ensure correct alignment and orientation of the sensor.
- Take measures to reduce or avoid condensation (e.g. install a condensation trap, thermal insulation, etc.)
- The maximum permitted ambient temperatures and the medium temperature range must be observed.
- Install the transmitter in a shaded location or use a protective sun shield.
- For mechanical reasons, and in order to protect the pipe, it is advisable to support heavy sensors.
- No installation in where large vibration exists.
- No exposure in the environment containing a lot of corrosive gas.
- No sharing power supply with frequency converter, electric welding machine and other machines which can make power-line interference, if necessary, please add power conditioner for transmitter power supply.

### Thermal insulation

When the gas is very humid or saturated with water (e.g. Bio Gas), the piping and flowmeter body should be insulated to prevent water droplets condensing on the measuring sensor.



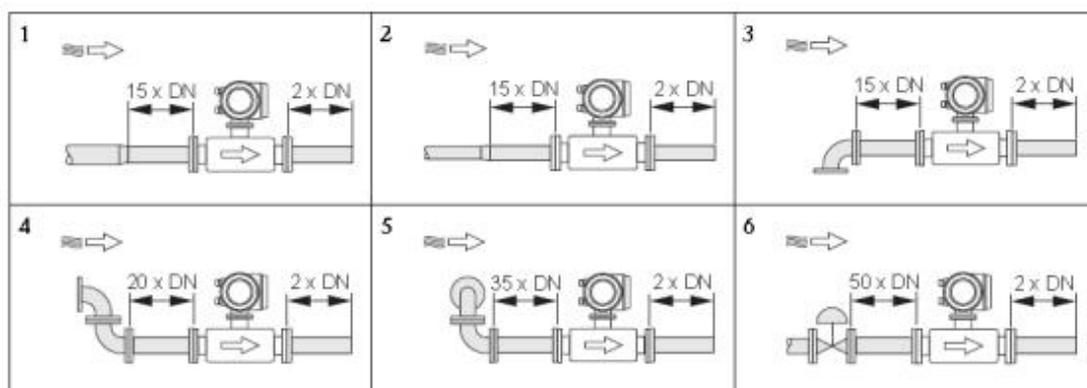
- a Maximum insulation height for the flanged sensor.
- b Maximum insulation height for the insertion sensor.

The thermal dispersion principle is sensitive to disturbed flow conditions.

- As a general rule, the thermal flowmeter should always be installed as far away as possible from any flow disturbances. For further information please refer to ISO 14511.
- Where two or more flow disturbances are located upstream of the meter, the recommended inlet length for the flow disturbance causing strongest disturbance must be used. E.g. where a valve is mounted before a bend, upstream of the flowmeter, 50x DN of pipe work is required from the valve to the flowmeter.
- For very light gases such as Helium and Hydrogen all upstream distance should be doubled.

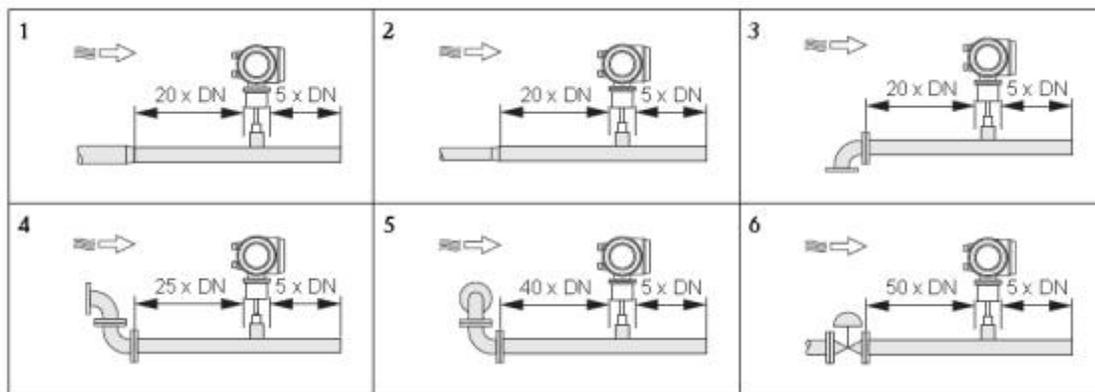
**The minimum recommendations for inlet and out runs (without flow conditioner) are:**

**Flanged sensor**



1=Reduction, 2=Expansion, 3=90° elbow or T-piece, 4=2x90° elbow, 5=2x90° elbow (3-dimensional), 6=Control valve.

**Insertion sensor**



1=Reduction,2=Expansion,3=90° elbow or T-piece, 4=2x90° elbow,  
5=2x90° elbow (3-dimensional), 6=Control valve or pressure regulator.

A specially designed perforated plate flow conditioner can be installed if it is not possible to observe the inlet runs required.

## 5.2 Pipework requirements

- Good engineering practice should be followed at all times.
- Correct preparation, welding and finishing techniques.
- Correctly sized gaskets.
- Correctly aligned flanges and gaskets.
- Connecting pipe work should match the internal diameter of the flowmeter.
- Maximum pipe diameter mismatch should not exceed
  - 1mm (0.04 inch) for diameters < DN200 (8" )
  - 3mm (0.12 inch) for diameters ≥ DN200 (8" )
- New installation should be free of metallic and abrasive particles to prevent damage to the sensing elements on start-up.

For further information please refer to ISO 14511.

## 5.3 Installation Steps

The base of thermal flowmeter



The base of Hot-tapped insertion type

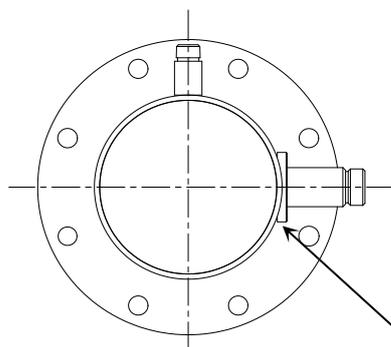


The base of standard insertion type

 **No welding in explosive environment.**

 **Carry out the welding operation in accordance with the requirements of special environment.**

When installing, place the base on the top of pipe, and make the through-hole of base be perpendicular to axis of pipe. The good welding location of base and welding process is as below.



Before Welding, the base should be processed as the same as the circular arc of pipe to ensure sealing

Good welding location of base

### The installation of standard insertion type

Identify an appropriate location for the flow meter.

Confirm the inner diameter and wall thickness of pipe

- Place the other part of meter into ball valve, and calculate the insertion depth according to the inner diameter and wall thickness of pipe, this step doesn't need to screw the nut by hand.
- Turn the connecting rod of sensor to make the mark direction of sensor as the same flow direction.
- According the calculated data on site, ensure the insertion depth by corresponding calibration on the connecting rod, and then screw the nut tightly.
- If the meter is horizontal installation, the display of the meter can be installed in the

direction of 90° , 180° or 270° to meet various requirements.

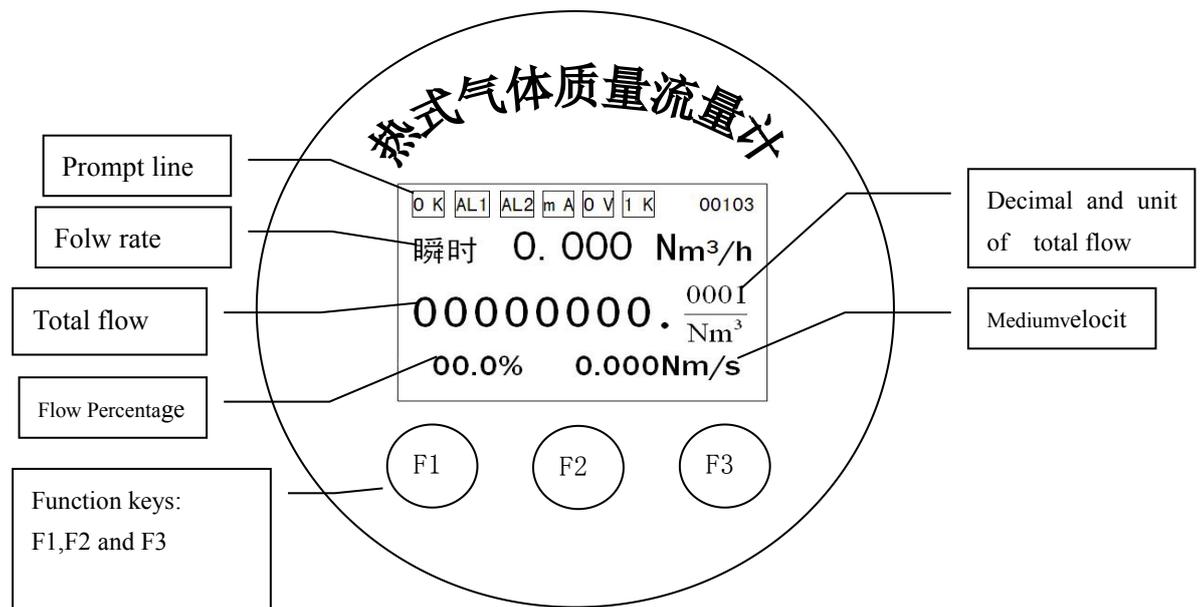
### The installation of hot-tapped insertion type

- Before installation, please conform the connection type and install fittings.
- Before installation, the site must be shut down, and strictly follow the rules of factory.
- Identify an appropriate location for the flow meter.
- According to length requirement of meter, cut the pipe, and install the flanges and bolts on the pipe.
- Ensure the mark direction of meter is as the same flow direction, the display is perpendicular to horizontal plane, the axis of piping is paralleled horizontal plane, the error can't be more than  $\pm 2.5$ , and then fix the meter by bolts.

## Part 6 operation and programming

### 6.1 Display

The display of meter in working status is shown as below.



#### The prompt line:

`OK` The meter can do self-checking, if the system is normal after self-checking, it will display `OK`, else it will display `ERR`, the error information can be checked in "Self-Test" set-up menu.

`AL1` Alarm information, `AL1` means path 1 alarming, and `AL2` means path 2 alarming

**mA** If the current output is more than 20mA, it display **mA**, else it will be blank.

**OV** If the operation parameters overflow, it display **OV**, else it will be blank.

**1K** For convenience of display and read, when the total flow is more than 10 000 000, it display **1K**, and the display total flow multiplied by 1000.

00103 information of communication status, the first three digits indicate meter address: the fourth digit indicates parity check (0: none; 1: odd; 2: even); and the fifth digit indicates baud rate (0: 1200; 1: 2400; 2: 4800; 3: 9600), if the meter address is 1, no parity check, and the baud rate is 9600, it will display "00103"

After powering on, the meter will do self-checking, if the system is normal after self-checking, it will display **OK**, else it will display **ERR**, the error information can be checked in "Self-Test" set-up menu.

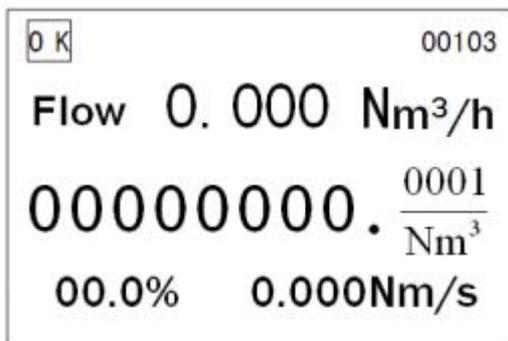
When the meter works fine or after powering on, the meter will do self-checking.

If the system is abnormal after self-checking, the meter will display the submenu of error self-checking (Details in self-checking menu), 1~2 seconds later, the meter will enter the main menu automatically, else the meter will enter the main menu directly.

The meter has three function keys: F1, F2 and F3. F1 is Shift Key, F2 is Enter/Next Key, and F3 is Modify Key, (if there are some special functions of keys, please follow the instruction below the LCD).

## 6.2 Parameters Setup

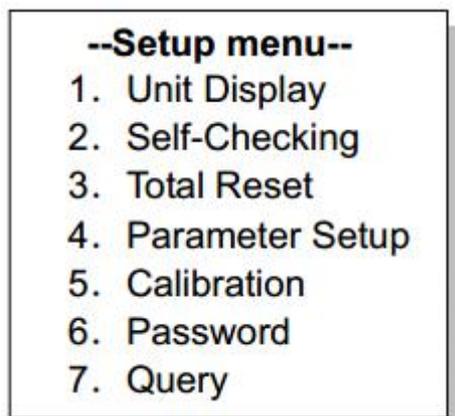
### 6.2.1 Main Menu



In main menu, press F2 to enter setup menu.

In setup menu, press F1 and F2 at the same time to enter main menu.

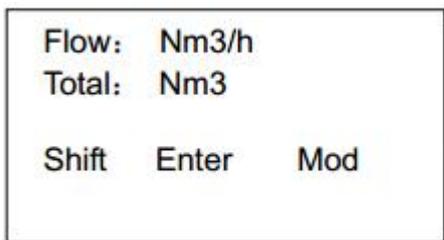
### 6.2.2 Setup Menu



In main menu, press F2 to enter setup menu.

In setup menu, press F1 to select submenu, and press F2 to enter submenu.

### 6.2.3 Unit Display



Flow: Nm3/h  
Total: Nm3  
Shift Enter Mod

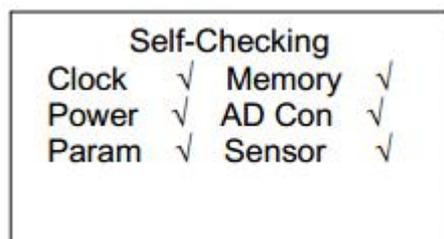
In setup menu, press F1 to select "Unit Display", and press F2 to enter. Press F1 to select the unit of flow or total, and press F3 to modify the unit.

Flow: The unit of flow rate, the unit can be selected Nm<sup>3</sup>/h, Nm<sup>3</sup>/min, t/h, t/min, kg/h and kg/min.

Total: The unit of total flow, The unit can be selected Nm<sup>3</sup>, NI, t and kg.

Select the needed unit, and then press F2 Enter key, the main menu will display with the selected unit.

### 6.2.4 Self-Checking



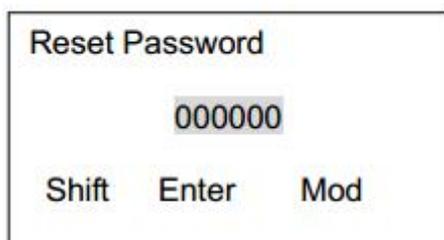
Self-Checking  
Clock ✓ Memory ✓  
Power ✓ AD Con ✓  
Param ✓ Sensor ✓

In setup menu, press F1 to select "Self-Checking", and press F2 to enter.

If the meter display **ERR** in main menu, press keys to enter this sub-menu to check the details of running status, ✓ is ok, and x means this option is abnormal.

After powering on, the meter will do self-checking, if there are one of some abnormal options, the meter will display the self-test menu, When the meter is running, it also can enter this menu to check the running status of meter.

### 6.2.5 Total Reset



Reset Password  
000000  
Shift Enter Mod

In setup menu, press F1 to select "total Reset", and press F2 to enter. Press F1 to password, input reset password (default password is 000000), press F1 to shift digit, and press F3 to change the digit is number. After inputting password, press F2 to enter total reset submenu.

Total Reset  
0000000.0000  
Reset Enter Reset

In order to prevent error operation, press F1 and F3 keys at the same time to do total reset.  
After finishing total reset, the display shows 0000000.0000  
In this sub-menu, press F2 key to enter running time reset.

Running Time Reset  
00000000 min  
Reset Enter Reset

The unit of running time is minute.  
The largest time is with 8 digits, and the reset operation is as the same as total reset.  
After resetting, press F2 key to return main menu.

#### 6.2.6 Parameter Setup

Password Setup  
000000  
Shift Enter Mod

In setup menu, press F1 to select "Parameter setup", and press F2 to enter.  
Input reset password (default password is 000000), press F1 to shift digit, and press F3 to change the digits number.  
After inputting password, press F2 to finish password setup and enter language setup.

Language/语言  
English  
Shift Enter Mod

Press F3 to select the display language, and then press F2 to finish selection and enter Equivalent ID.

Equivalent ID  
0100.000 mm  
Shift Enter Mod

Equivalent ID is used to input the inner diameter ID pipe. For rectangular tube, it needs to input an equivalent inner diameter. The unit is mm.  
The range is 0000.000~9999.999.  
Press F2 to enter filter coefficient.

Filter Coe 00  
  
Shift Enter Mod

Filter coefficient, if the flow has a big fluctuation, increase this value to get a stable reading.  
The range is 0~32, 0 means no filter.  
Press F2 to enter low flow cutoff.

Low Flow Cutoff  
  
000000.000  
  
Shift Enter Mod

Low flow cutoff, Cut off the low flow according to the actual situation, and the unit is the same as flow rate.  
The range is 0000.000~9999.999.  
Press F2 to enter Density is Standard Condition.

Density SC  
  
1.0000 Kg/m3  
  
Shift Enter Mod

Density in Standard Condition.  
(20°C, 101.325KPa)  
That is used for flow rate display.

Medium: 00  
Air  
Conversion Coe: 01.0000  
  
Shift Enter Mod

The conversion coefficient in meter is reference value, if necessary, modify this value. The meter contain the conversion coefficient of 59 gases, if the medium is mixed gas, it needs to calculate the coefficient. The density and conversion coefficient of common gas are shown in appendix 3.  
Press F2 to enter Full scale flow.

Full Scale Flow  
  
0000000.000  
  
Shift Enter Mod

Full scale flow, Corresponding to 4-20mA output, and the unit is the same as flow rate  
The range is 0000.000~9999.999.  
Press F2 to enter RS485 communication.

Address: 001  
Baud: 9600  
Parity: None  
  
Shift   Enter   Mod

RS485 communication setup.  
The meter's address range:0~255, Baud rate can be selected 1200,2400,4800 and 9600.  
Parity check can be selected none, odd and even.  
Press F2 to enter HART setup.

HART Address: 00  
Protect: Close  
  
Shift   Enter   Mod

Hart communication setup.  
The HART address range:00~15.Protect is "Close",the HART operator can write data.  
Protect is "Open ", the HART operator can't write data.  
Press F2 to enter frequency output.

Output: Pulse  
Freq: 0000-5000Hz  
Range: 0000100.000  
  
Shift   Enter   Mod

Frequency output Pulse and Equivalent.  
If Pulse(Flow rate) is selected, the first value of Freq is the frequency of pulse which is corresponding to the frequency of pulse which is corresponding to maximum flow.  
Press F3 to enter equivalent output.

Output: Equivalent  
Coe: 0000.0000  
  
Shift   Enter   Mod

If Equivalent(Total flow ) is selected, set the equivalent coefficient, The largest coefficient is 1000.  
Press F2 to enter path 1 alarm.

Alarm 1: upper flow  
Alarm: +000000.000  
Diff: 000.000  
  
Shift   Enter   Mod

Path 1 alarm. Set the alarm of upper flow(Upper limit of flow rate),lower flow (Lower limit of flow rate ),upper temp (Upper limit of temperature ) and none.  
Difference value is used to prevent alarm vibration around high alarm value, the difference value can make the alarm vibration in control area,but reduce the control precision at the same time,Set this value according application and experience.

Alarm 2: upper flow  
Alarm: +000000.000  
Diff: 000.000  
  
Shift    Enter    Mod

Path 2 alarm, The setup is the same as path 1 alarm.

Date and Time:  
2012-05-16  
09:13:29  
  
Shift    Enter    Mod

The date and time affect the data query and saving, Therefore, set the date and time before recording data.

### 6.2.7 Calibration

The parameters in this submenu are very important, In order to prevent unauthorized operation or wrong operation. it needs to input password before entering this submenu.

Password  
  
000000  
  
Shift    Enter    Mod

In setup menu, press F1 to select "Calibration", and press F2 to enter.  
Input the right password to enter calibration submenu.  
Press F2 to enter zero voltage value.

Zero Volt: Measure  
0.6500V  
Please confirm the flow is 0  
  
Shift    Enter    Mod

Zero voltage value is used to set the voltage value while the flow rate is 0.  
Before calibration, confirm the flow in pipe is zero, and waiting for more than 30s to steady the flow, Press F1 and F3 keys at the same time until the meter displays success.  
This value is can be input manually. Press F3 to select "Input", input this value manually, and then press F2 to enter R value.  
Note: Don't input zero voltage value when the meter is running.

Zero Volt: Input  
0.6500V  
Please confirm the flow is 0  
  
Shift    Enter    Mod

R Value (0°C):  
1000.000 Ω

Shift   Enter   Mod

The resistance value is used to input the resistance value of temperature sensor.  
Press F2 to enter velocity table.

Velocity table: 01  
Volt: 00/0000 V  
Vel: 000.000 Nm/s

Shift   Enter   Mod

Velocity table, Set the voltage and velocity in more than 40 sections.  
After calibration, Input the voltage and velocity from small section to large section (The velocity is zero in section 00).  
Press F2 to enter flow correction.  
Note: The meter calculates the flow by velocity table, please don't modify the data in the table.

Flow correct: section 0  
Flow: 0000000.000  
Coe: 000000.0000

Shift   Enter   Mod

Flow correction, it can correct the flow in 5 sections.

Current: 4mA  
Actual: 00.0000

Shift   Enter   Mod

Current calibration, if there is deviation in current output, use this submenu to calibrate current output.  
Press F2 to enter zero and coefficient of current.

Zero: +0.0000  
Coe: 1.0000

Shift   Enter   Mod

Current zero and coefficient calibration.  
Note: Please don't modify these values when the meter is running.

## 6.2.8 Password

In this submenu, it can modify the password of total reset, setup and calibration.

```
Password
Total  Reset  Calibration
Shift  Enter   Mod
```

In setup menu, press F1 to select "password", and press F2 to enter.

In this menu, it can set the password of total reset, parameter reset and calibration.

```
Setup Password:
Old: 000000
New: 000001
Shift  Enter   Mod
```

After inputting old and new password, Press F2 to save setup, the LCD will display "Success", and then return to main menu.

```
Setup Password:
Old: 000000
New: 000001
Shift  Enter   Mod
```

## 6.2.9 Query

```
Day Record
Month Record
Year Record
Shift  Enter   Mod
```

In setup menu, press F1 to select "Query", and then press F2 to enter.

In query submenu, there are day, month and year records.

```
Day Record
2012-04-02
80.03 Nm3
Shift  Enter   Mod
```

In query submenu, press F1 to select Day Record, and then press F2 to enter.

In day record, press F1 to shift cursor position, and press F3 to modify the date.

For example, the "80.03 Nm3" is the totalizer on April 2nd, 2012.

The method of querying Month and Year Records is the same as querying Day Record.

## Appendix 1 Troubleshooting and Repair

<b>Fault</b>	<b>Cause</b>	<b>Solution</b>
No display	1. No power supply	Get power supply
	2. SMPS is damaged	Get power supply, if the power indicator light is out, it means that the SMPS is damaged, please contact supplier.
	3. The wiring of DC24V are reversed	Check the wirings, make the wirings right.
	4. The position of LCD is wrong	Reinstall the LCD.
	5. The LCD is damaged	Check the power indicator light, if the light is on, it means that the LCD is damaged. Please contact supplier.
Low velocity	1. The wirings of sensor are reversed	Rewiring or reinstall the sensor.
	2. The sensor is dirty	Clean sensor
	3. The sensor is damaged	Return to supplier
	4. Some parameters of flow setting are wrong	Check the parameters setting
Abnormal velocity and large fluctuation	1. Some parameters of velocity setting are wrong	Check the parameters setting
	2. Fluid properties is pulsating in turn	Adjust the system filter
	3. The sensor is dirty	Clean sensor
	4. The sensor is damaged	Return to supplier
Abnormal 4-20mA output	1. The setting of 20mA range is wrong	Right settings
	2. The Transmitter has fault	Return to supplier
	3. The connection is not a loop circuit	Check the connection
Abnormal frequency output	1. Some parameters of frequency setting are wrong	Right settings
	2. The Transmitter has fault	Return to supplier
	3. The connection cable is damaged	Check the connection
Abnormal alarm	1. Some parameters of setting are wrong	Right settings
	2. The meter has no alarm function	Contact supplier
	3. The relay is damaged	Return to supplier
Abnormal RS485 output	1. The setting of baud rate and address are wrong	Right setting
	2. The wirings are reversed	Rewiring
	3. The connection cable is damaged	Check the connection

## Appendix 2 The Density and Conversion

### Coefficient of Common Gas

According to different gas on site, the calibration in lab translates the flow rate of actual gas on site into flow rate of air, and then begins to calibrate the flow rate at present.

Therefore, when using the meter on site, the meter displays mass flow or volume flow of actual gas.

When translating the flow rate of gas into flow rate of air, there is a conversion coefficient table of different gas.

Table 1 The Density and Conversion Coefficient of Common Gas

	Gas		Specific heat (Kal/g*°C)	Density (g/l,0°C)	Conversion Coefficient
0	Air		0.24	1.2048	1.0000
1	Argon	Ar	0.125	1.6605	1.4066
2	Arsine	AsH <sub>3</sub>	0.1168	3.478	0.6690
3	Boron Tribromide	BBr <sub>3</sub>	0.0647	11.18	0.3758
4	Boron Tribromide	BCl <sub>3</sub>	0.1217	5.227	0.4274
5	Boron Tribromide	BF <sub>3</sub>	0.1779	3.025	0.5050
6	Borane	B <sub>2</sub> F <sub>6</sub>	0.502	1.235	0.4384
7	Carbon Tetrachloride	CCl <sub>4</sub>	0.1297	6.86	0.3052
8	Carbon Tetrafluoride	CF <sub>4</sub>	0.1659	3.9636	0.4255
9	Methane	CH <sub>4</sub>	0.5318	0.715	0.7147
10	Acetylene	C <sub>2</sub> H <sub>2</sub>	0.4049	1.162	0.5775
11	Ethylene	C <sup>2</sup> H <sup>4</sup>	0.3658	1.251	0.5944
12	Ethane	C <sup>2</sup> H <sup>6</sup>	0.4241	1.342	0.4781
13	Allylene	C <sup>3</sup> H <sup>4</sup>	0.3633	1.787	0.4185
14	Propylene	C <sup>3</sup> H <sup>6</sup>	0.3659	1.877	0.3956
15	Propane	C <sup>3</sup> H <sup>8</sup>	0.399	1.967	0.3459
16	Butyne	C <sup>4</sup> H <sup>6</sup>	0.3515	2.413	0.3201
17	Butene	C <sup>4</sup> H <sup>8</sup>	0.3723	2.503	0.2923
18	Butane	C <sup>4</sup> H <sup>10</sup>	0.413	2.593	0.2535
19	Pentane	C <sup>5</sup> H <sup>12</sup>	0.3916	3.219	0.2157
20	Carbinol	CH <sup>3</sup> OH	0.3277	1.43	0.5805
21	Ethanol	C <sup>2</sup> H <sup>6</sup> O	0.3398	2.055	0.3897
22	Trichloroethane	C <sup>3</sup> H <sup>3</sup> Cl <sup>3</sup>	0.1654	5.95	0.2763
23	Carbon Monoxide	CO	0.2488	1.25	0.9940
24	Carbon Dioxide	CO <sup>2</sup>	0.2017	1.964	0.7326
25	Cyanide	C <sup>2</sup> N <sup>2</sup>	0.2608	2.322	0.4493
26	Chlorine	Cl <sup>2</sup>	0.1145	3.163.	0.8529
27	Deuterium	D <sup>2</sup>	1.7325	0.1798	0.9921
28	Fluoride	F <sup>2</sup>	0.197	1.695	0.9255
29	Germanium Tetrachlori	GeCl <sup>4</sup>	0.1072	9.565	0.2654
30	Germane	GeH <sub>4</sub>	0.1405	3.418	0.5656

31	Hydrogen	H <sub>2</sub>	3.4224	0.0899	1.0040
32	Hydrogen Bromide	HBr	0.0861	3.61	0.9940
33	Hydrogen Chloride	HCl	0.1911	1.627	0.9940
34	Hydrogen Fluoride	HF	0.3482	0.893	0.9940
35	Hydrogen Iodide	HI	0.0545	5.707	0.9930
36	Hydrogen Sulfide	H <sub>2</sub> S	0.2278	1.52	0.8390
37	Helium	He	1.2418	0.1786	1.4066
38	Krypton	Kr	0.0593	3.739	1.4066
39	Nitrogen	N <sub>2</sub>	0.2486	1.25	0.9940
40	Neon	Ne	0.2464	0.9	1.4066
41	Ammonia	NH <sub>3</sub>	0.5005	0.76	0.7147
42	Nitric Oxide	NO	0.2378	1.339	0.9702
43	Nitrogen Dioxide	NO <sub>2</sub>	0.1923	2.052	0.7366
44	Nitrous Oxide	N <sub>2</sub> O	0.2098	1.964	0.7048
45	Oxygen	O <sub>2</sub>	0.2196	1.427	0.9861
46	Phosphorus Trichloride	PCl <sub>3</sub>	0.1247	6.127	0.3559
47	Phosphorane	PH <sub>3</sub>	0.261	1.517	0.6869
48	Phosphorus Pentafluoride	PF <sub>5</sub>	0.1611	5.62	0.3002
49	Phosphorus Oxychloride	POCl <sub>3</sub>	0.1324	6.845	0.3002
50	Silicon Tetrachloride	SiCl <sub>4</sub>	0.127	7.5847	0.2823
51	Silicon Fluoride	SiF <sub>4</sub>	0.1692	4.643	0.3817
52	Silane	SiH <sub>4</sub>	0.3189	1.433	0.5954
53	Dichlorosilane	SiH <sub>2</sub> Cl <sub>2</sub>	0.1472	4.506	0.4095
54	Trichlorosilane	SiHCl <sub>3</sub>	0.1332	6.043	0.3380
55	Sulfur Hexafluoride	SF <sub>6</sub>	0.1588	6.516	0.2624
56	Sulfur Dioxide	SO <sub>2</sub>	0.1489	2.858	0.6829
57	Titanium Tetrachloride	TiCl <sub>4</sub>	0.1572	8.465	0.2048
58	Tungsten Hexafluoride	WF <sub>6</sub>	0.0956	13.29	0.2137
59	Xenon	Xe	0.0379	5.858	1.4066

## Appendix3 Upper Range Value of Common Gas

(Unit:Nm<sup>3</sup>/h.The follow table can be extended)

Nominal Diameter(mm)	Air	Nitrogen	Oxygen	Hydrogen(H <sub>2</sub> )
15	65	65	32	10
25	175	175	89	28
32	290	290	144	45
40	450	450	226	70
50	700	700	352	110
65	1200	1200	600	185
80	1800	1800	900	280
100	2800	2800	1420	470
125	440	4400	2210	700
150	6300	6300	3200	940
200	1000	1000	5650	1880
250	17000	17000	8830	2820
300	25000	25000	12720	4060
400	45000	45000	22608	7200
500	70000	70000	35325	11280
600	100000	100000	50638	16300
700	135000	135000	69240	22100
800	180000	180000	90432	29000
900	220000	220000	114500	77807
1000	280000	280000	141300	81120
1200	400000	400000	203480	91972
1500	600000	600000	318000	101520
2000	700000	700000	565200	180480

The flow rate in standard condition: The flow rate is in the condition of 20℃ temperature and 101.325KPa pressure.

The unit of flow rate is optional: Nm<sup>3</sup>/h, Nm<sup>3</sup>/min, L/h, L/min, t/h, t/min, kg/h or kg/min,

The reduction formula of flow rate in working condition and flow rate in standard condition:

$$Q_s = \frac{0.101325+p}{0.10325} * \frac{273.15+20}{273.15+t} * Q_n$$

Q<sub>s</sub>: The flow rate in standard condition (Nm<sup>3</sup>/h).

Q<sub>n</sub>: The flow rate in working condition (m<sup>3</sup>/H).

t: The medium temperature in working condition(℃).

p: The medium pressure in working condition (Gauge pressure,MPa)