

# Thermal Mass Flow Meter

## RF3700



**Integral/ Remote Structure**



**High Accuracy:  $\pm 1\%$**



**Velocity: 0.1 ~ 100Nm/s**



**IP65 Enclosure Protection**

**Product  
Datasheet**

# ROCKSENSOR AT A GLANCE (ABOUT US)

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Rocksensor deals in a wide range of highly accurate industrial automation instruments ensuring that even the complex industrial processes happen efficiently.

To fulfill the needs of our clients we make sure that our instruments work in even the harsh environmental conditions offering accurate recordings and communication.

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KEY APPLICATION INDUSTRIES

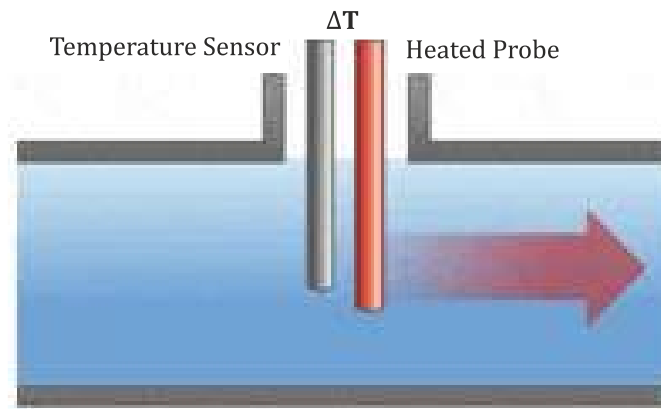
- Oil and Gas sector
  - Cement
  - Metal
  - Pulp and Paper
  - Agriculture
  - Textiles
- Chemicals
  - Power
  - Water
  - Pharmaceutical
  - Fertilizer
  - Plastics and HVAC

## 1. Introduction

Thermal mass flow meters, also known as thermal dispersion or immersible mass flow meters comprise a family of instruments for the measurement of the total mass flow rate of a fluid, primarily gases, flowing through closed conduits. Thermal gas mass flow meter is designed on the basis of thermal dispersion, and adopts method of constant differential temperature to measure gas flow. It has advantages of small size, easy installation, high reliability and high accuracy, etc.

## 2. Working Principle

Thermal flow meters use the thermal properties of the gases to measure the flow of a gas flowing in a pipe or duct. The flowmeter contains two platinum resistance temperature sensors. The thermal flow meter 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, while other is used as a heater. The temperature sensor monitors the actual process values while the heater is maintained at a constant differential temperature. The greater the gas velocity, the greater the cooling effect and power required to maintain the differential temperature. The measurement of heater power is therefore a measurement of the gas mass flow rate.



$$m = \frac{Kq}{(C_p(T_2 - T_1))}$$

The mass flow ( $m$ ) is calculated on the basis of the measured temperature difference ( $T_2 - T_1$ ), the meter coefficient ( $K$ ), the electric heat rate ( $q$ ), and the specific heat of the fluid ( $C_p$ ).

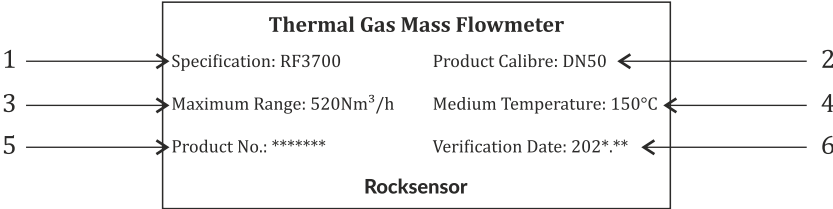
## 3. Features

- Compact size, easy installation, high reliability and high accuracy
- Can be used for gas leak detection
- Reference accuracy up to  $\pm 1\%$
- Configuration with RS485 or HART Interfaces
- Available in Insertion and Flange Connection Type
- No need for temperature or pressure compensation
- Good vibration resistance, no moving parts
- Standard 4-20 mADC Analog/ Pulse Output
- Suitable for medium temperature up to  $150^\circ\text{C}$

## 4. Key Applications

- Compressed Air
- Natural gas in boiler rooms or dryers
- Carbon dioxide gas in breweries
- Biogas & aeration in sewage treatment plants
- Generating Gases (e.g. Argon, Nitrogen, Carbon Dioxide, Helium, Oxygen)
- Gas leak detection

5. Identification



1. Specifications
2. Line Size
3. Maximum Range
4. Medium Temperature
5. Product Serial Number
6. Verification Date

6. Technical Specifications

| Parameters                 | Details                                                                                              |                      |
|----------------------------|------------------------------------------------------------------------------------------------------|----------------------|
| Measuring Medium           | Gas (Except Acetylene & Steam)                                                                       |                      |
| Velocity                   | 0.1-100Nm/s                                                                                          |                      |
| Accuracy                   | ±2.5%/ ±1.5% Reading (Insertion)                                                                     | ±1% Reading (Flange) |
| Response Time              | 1s                                                                                                   |                      |
| Output                     | 4-20mA(optoelectronic isolation,maximum load 500Ω),Pulse RS485 (optoelectronic isolation) & HART     |                      |
| Power Supply               | Compact : 24VDC or 220VAC; Power Consumption: ≤18W<br>Remote Type : 220VAC; Power Consumption : ≤19W |                      |
| Working Pressure           | Insertion type ≤1.6Mpa                                                                               |                      |
|                            | Flange type ≤4.0Mpa                                                                                  |                      |
|                            | Tri-clamps ≤1.6MPa                                                                                   |                      |
|                            | Threads ≤4.0Mpa                                                                                      |                      |
| T <sub>ambient</sub>       | (-)20°C ~ 50°C                                                                                       |                      |
| T <sub>medium</sub>        | (-)20°C ~ 150°C (customisalbe high temperature upto 400°C in remote version)                         |                      |
| Transmitter Housing        | Die-cast Aluminium                                                                                   |                      |
| Cable Entry                | M20*1.5 standard, 1/2"NPT Optional                                                                   |                      |
| Ingress Protection         | IP65 / Explosion Proof                                                                               |                      |
| Display                    | 4 Digit LCD, Mass Flow, Volume Flow, Flow Totalizer, etc.                                            |                      |
| Flow Units                 | Nm3/h, Nm3/min, kg/h, kg/min or more                                                                 |                      |
| Alarm Output               | 2 relays, 3A/250VAC, 3A/30VDC                                                                        |                      |
| Structure Type             | Remote or Integral                                                                                   |                      |
| Cable Length (Remote type) | Standard 10 meters                                                                                   |                      |
| Pipe Material              | Carbon Steel, Stainless Steel, Plastic, etc.                                                         |                      |
| Insertion type             | Size : DN32~DN4000mm                                                                                 |                      |
|                            | Rod, Valve, Sensor material : Standard SS304 / SS316L / SS316                                        |                      |
| Flange type                | Size : DN10~DN300 (Can be designed for size above DN300)                                             |                      |
|                            | Flange Standard : ANSI, DIN                                                                          |                      |
|                            | Tube materials : Standard SS304/SS316L/ SS316                                                        |                      |
|                            | Sensor materials : Standard SS304/SS316L / SS316<br>Flange materials : Standard SS304/SS316L/ SS316  |                      |
| Tri-clamp type             | Size : DN10~DN100                                                                                    |                      |
|                            | Tube materials : Standard SS304/ SS316<br>Sensor materials : Standard SS316                          |                      |
| Thread type                | Size : DN10~DN100                                                                                    |                      |
|                            | Tube materials : Standard SS304/SS316L/ SS316<br>Sensor materials : Standard SS304/SS316L / SS316    |                      |

## 7. Dimensional Drawings

### 7.1 In-Line type

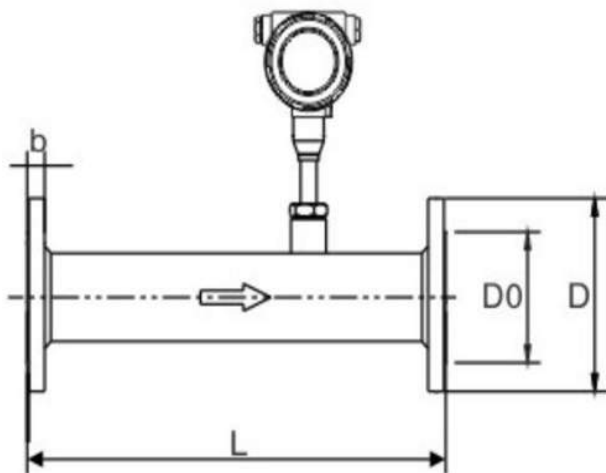


Figure 1

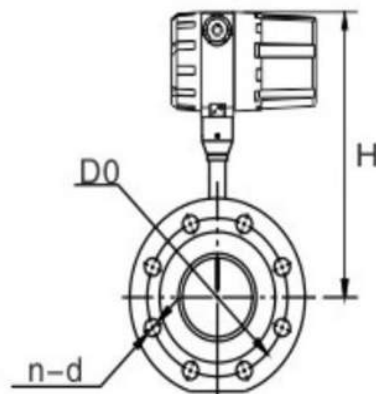


Figure 2



Integrated Type

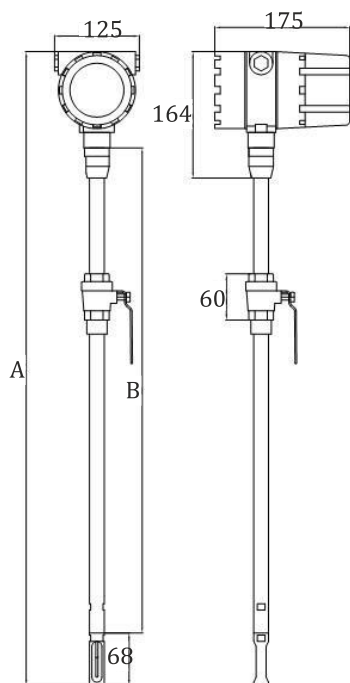


Remote Type

### 7.2 Flange Type

| Nominal Diameter<br>DN | Pressure Rating<br>MPa | Length of Shape<br>L | Shape Width<br>L | D0 Diameter of Central Hole | D of Flange Diameter<br>r | Screw Hole<br>S<br>n-d | Thread Specifications | Flange Thickness<br>sb |
|------------------------|------------------------|----------------------|------------------|-----------------------------|---------------------------|------------------------|-----------------------|------------------------|
| 25                     | 1.6                    | 305                  | 268              | 85                          | 115                       | 4*14                   | M12                   | 16                     |
| 32                     | 1.6                    | 310                  | 272              | 100                         | 140                       | 4*18                   | M16                   | 18                     |
| 40                     | 1.6                    | 320                  | 275              | 110                         | 150                       | 4*18                   | M16                   | 18                     |
| 50                     | 1.6                    | 396                  | 280              | 125                         | 165                       | 4*18                   | M16                   | 20                     |
| 65                     | 1.6                    | 410                  | 288              | 145                         | 185                       | 4*18                   | M16                   | 20                     |
| 80                     | 1.6                    | 420                  | 296              | 160                         | 200                       | 8*18                   | M16                   | 20                     |
| 100                    | 1.6                    | 457                  | 308              | 180                         | 220                       | 8*18                   | M16                   | 22                     |
| 125                    | 1.6                    | 500                  | 320              | 210                         | 250                       | 8*18                   | M16                   | 22                     |
| 150                    | 1.6                    | 500                  | 335              | 240                         | 280                       | 8*22                   | M20                   | 24                     |

### 7.3 Insertion type



**Integrated Type**



**Remote Type**

### 8. Flow & Velocity Table

| Size | Min Velocity<br>(Nm/S) | Max Velocity<br>(Nm/s) | Min Flow<br>(Nm <sup>3</sup> /h) | Max Flow<br>(Nm <sup>3</sup> /h) |
|------|------------------------|------------------------|----------------------------------|----------------------------------|
| 10   | 0.1                    | 100                    | 0.028274334                      | 28.27433385                      |
| 15   | 0.1                    | 100                    | 0.063617251                      | 63.61725116                      |
| 20   | 0.1                    | 100                    | 0.113097335                      | 113.0973354                      |
| 25   | 0.1                    | 100                    | 0.176714587                      | 176.7145866                      |
| 32   | 0.1                    | 100                    | 0.289529179                      | 289.5291786                      |
| 40   | 0.1                    | 100                    | 0.452389342                      | 452.3893416                      |
| 50   | 0.1                    | 100                    | 0.706858346                      | 706.8583463                      |
| 65   | 0.1                    | 100                    | 1.194590605                      | 1194.590605                      |
| 80   | 0.1                    | 100                    | 1.809557366                      | 1809.557366                      |
| 100  | 0.1                    | 100                    | 2.827433385                      | 2827.433385                      |
| 125  | 0.1                    | 100                    | 4.417864664                      | 4417.864664                      |
| 150  | 0.1                    | 100                    | 6.361725116                      | 6361.725116                      |
| 200  | 0.1                    | 100                    | 11.30973354                      | 11309.73354                      |
| 250  | 0.1                    | 100                    | 17.67145866                      | 17671.45866                      |
| 300  | 0.1                    | 100                    | 25.44690047                      | 25446.90047                      |
| 350  | 0.1                    | 100                    | 34.63605897                      | 34636.05897                      |
| 400  | 0.1                    | 100                    | 45.23893416                      | 45238.93416                      |
| 450  | 0.1                    | 100                    | 57.25552605                      | 57255.52605                      |
| 500  | 0.1                    | 100                    | 70.68583463                      | 70685.83463                      |
| 600  | 0.1                    | 100                    | 101.7876019                      | 101787.6019                      |
| 700  | 0.1                    | 100                    | 138.5442359                      | 138544.2359                      |
| 800  | 0.1                    | 100                    | 180.9557366                      | 180955.7366                      |
| 900  | 0.1                    | 100                    | 229.0221042                      | 229022.1042                      |
| 1000 | 0.1                    | 100                    | 282.7433385                      | 282743.3385                      |



## 9. Model Selection Table

| RF3700                                                                                 |  | Thermal Mass Flow Meter |                          |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
|----------------------------------------------------------------------------------------|--|-------------------------|--------------------------|---|---|---|---|---|---|---|----|----|---------------------|-----|--|--|--|--|--|--|--|
| Code                                                                                   |  | 1                       | 2                        | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |                     |     |  |  |  |  |  |  |  |
| Line Size (DN)                                                                         |  | DN10 ~ DN4000           | Standard Line Sizes      |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
|                                                                                        |  |                         |                          |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| Structure                                                                              |  | Integral                | C                        |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| Remote                                                                                 |  |                         |                          |   |   |   |   |   |   |   |    |    | R                   |     |  |  |  |  |  |  |  |
| Sensor Type                                                                            |  | Insertion               | I                        |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| Flange                                                                                 |  |                         |                          |   |   |   |   |   |   |   |    |    | F                   |     |  |  |  |  |  |  |  |
| Triclamp                                                                               |  | C                       |                          |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| Thread                                                                                 |  | S                       |                          |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| Body Material                                                                          |  | SS304                   | S1                       |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| SS316L                                                                                 |  |                         |                          |   |   |   |   |   |   |   |    |    | S2                  |     |  |  |  |  |  |  |  |
| SS316*                                                                                 |  | S3                      |                          |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| *Body Material includes tube and sensor material for sensortype flange/Thread/Triclamp |  |                         |                          |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| *Body Material includes Rod, Valve and Sensor material for insertion type              |  |                         |                          |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| Process connection                                                                     |  |                         | Flange Size (DN10~300mm) |   |   |   |   |   |   |   |    |    | PN16/PN25/PN40(DIN) | D** |  |  |  |  |  |  |  |
| A15: 150#, A30: 300# (ANSI)                                                            |  |                         |                          |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| Thread Size (DN10~100mm)                                                               |  |                         | T                        |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| Tri-clamp Size (DN10~100mm)                                                            |  |                         | TC                       |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| Insertion Size (DN32~4000mm)                                                           |  |                         | I                        |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| Flange Materials                                                                       |  |                         | SS304                    |   |   |   |   |   |   |   |    |    | S1                  |     |  |  |  |  |  |  |  |
| SS316L                                                                                 |  |                         |                          |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| SS316                                                                                  |  |                         | S3                       |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| None                                                                                   |  |                         | N                        |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| Explosion Proof Option                                                                 |  | N                       | None                     |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| E                                                                                      |  | Flameproof Exd          |                          |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| Signal Output                                                                          |  | RS                      | 4-20 mA + Pulse + RS485  |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| HT                                                                                     |  | 4-20 mA + Pulse + HART  |                          |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| Power Supply                                                                           |  | AC                      | AC 85-250V               |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| DC                                                                                     |  | DC 20-36V               |                          |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| Working Temperature                                                                    |  | T1                      | (-)20℃ ~ 150℃            |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
| Working Pressure                                                                       |  | 16                      | 1.6 MPa                  |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
|                                                                                        |  | 25                      | 2.5 MPa                  |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |
|                                                                                        |  | 40                      | 4.0 MPa                  |   |   |   |   |   |   |   |    |    |                     |     |  |  |  |  |  |  |  |

### Example: RF3700-10CIS1DS216T1ACRSE

RF700 - Thermal Mass Flowmeter

10 - Line Size (DN) : DN10 ~ DN4000

C - Structure : Integral

I - Sensor Type : Insertion

S1 - Body Material : SS304

D - Process Connection : Flange (DN10~300mm) -- PN16/PN25/PN40 (DIN)

S2 - Flange Material : SS316L

16 - Working Pressure : 1.6 MPa

T1 - Working Temperature : (-)20°C ~ 150°C

AC - Power Supply : AC 85-250V

RS - Signal output : 4-20 mA + Pulse + RS485

E - Explosion Proof Option : Flame

\*For any customisation, contact our sales team



Appendix 1: 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 of air & then begins to calibrate the flow rate at present. Therefore, when using the meter on site, the meter displays mass flow/ volume flow of actual gas. When converting the flow rate of gas into flow rate of air, there is a conversion coefficient table of different gases.

| Sr. No. | Gas Name                                                         | Specific Heat (Cal/g/°C) | Density (g/l, 0°C) | Conversion Coefficient |
|---------|------------------------------------------------------------------|--------------------------|--------------------|------------------------|
| 1.      | Air                                                              | 0.24                     | 1.2048             | 1.0000                 |
| 2.      | Argon (Ar)                                                       | 0.125                    | 1.6605             | 1.4066                 |
| 3.      | Arsine (AsH <sub>3</sub> )                                       | 0.1168                   | 3.478              | 0.6690                 |
| 4.      | Boron Tribromide (BBr <sub>3</sub> )                             | 0.0647                   | 11.18              | 0.3758                 |
| 5.      | Boron Trichloride (BCl <sub>3</sub> )                            | 0.1217                   | 5.227              | 0.4274                 |
| 6.      | Boron Trifluoride (BF <sub>3</sub> )                             | 0.1779                   | 3.025              | 0.5050                 |
| 7.      | Borane (B <sub>2</sub> H <sub>6</sub> )                          | 0.502                    | 1.235              | 0.4384                 |
| 8.      | Carbon Tetrachloride (CCl <sub>4</sub> )                         | 0.1297                   | 6.86               | 0.3052                 |
| 9.      | Carbon Tetrafluoride (CF <sub>4</sub> )                          | 0.1659                   | 3.9636             | 0.4255                 |
| 10.     | Methane (CH <sub>4</sub> )                                       | 0.5318                   | 0.715              | 0.7147                 |
| 11.     | Acetylene (C <sub>2</sub> H <sub>2</sub> )                       | 0.4049                   | 1.162              | 0.5775                 |
| 12.     | Ethylene (C <sub>2</sub> H <sub>4</sub> )                        | 0.3658                   | 1.251              | 0.5944                 |
| 13.     | Ethane (C <sub>2</sub> H <sub>6</sub> )                          | 0.4241                   | 1.342              | 0.4781                 |
| 14.     | Allylene (C <sub>3</sub> H <sub>4</sub> )                        | 0.3633                   | 1.787              | 0.4185                 |
| 15.     | Propylene (C <sub>3</sub> H <sub>6</sub> )                       | 0.3659                   | 1.877              | 0.3956                 |
| 16.     | Propane (C <sub>3</sub> H <sub>8</sub> )                         | 0.399                    | 1.967              | 0.3459                 |
| 17.     | Butyne (C <sub>4</sub> H <sub>6</sub> )                          | 0.3515                   | 2.413              | 0.3201                 |
| 18.     | Butene (C <sub>4</sub> H <sub>8</sub> )                          | 0.3723                   | 2.503              | 0.2923                 |
| 19.     | Butane (C <sub>4</sub> H <sub>10</sub> )                         | 0.413                    | 2.593              | 0.2535                 |
| 20.     | Pentane (C <sub>5</sub> H <sub>12</sub> )                        | 0.3916                   | 3.219              | 0.2157                 |
| 21.     | Carbinol (CH <sub>3</sub> OH)                                    | 0.3277                   | 1.43               | 0.5805                 |
| 22.     | Ethanol (C <sub>2</sub> H <sub>6</sub> O)                        | 0.3398                   | 2.055              | 0.3897                 |
| 23.     | Trichloroethane (C <sub>3</sub> H <sub>3</sub> Cl <sub>3</sub> ) | 0.1654                   | 5.95               | 0.2763                 |
| 24.     | Carbon Monoxide (CO)                                             | 0.2488                   | 1.25               | 0.9940                 |
| 25.     | Carbon Dioxide (CO <sub>2</sub> )                                | 0.2017                   | 1.964              | 0.7326                 |
| 26.     | Cyanide (C <sub>2</sub> N <sub>2</sub> )                         | 0.2608                   | 2.322              | 0.4493                 |
| 27.     | Chlorine (Cl <sub>2</sub> )                                      | 0.1145                   | 3.163              | 0.8529                 |
| 28.     | Deuterium (D <sub>2</sub> )                                      | 1.7325                   | 0.1798             | 0.9921                 |
| 29.     | Fluoride (F <sub>2</sub> )                                       | 0.197                    | 1.695              | 0.9255                 |
| 30.     | Germanium Tetrachloride (GeCl <sub>4</sub> )                     | 0.1072                   | 9.565              | 0.2654                 |
| 31.     | Germane (GeH <sub>4</sub> )                                      | 0.1405                   | 3.418              | 0.5656                 |
| 32.     | Hydrogen (H <sub>2</sub> )                                       | 3.4224                   | 0.0899             | 1.0040                 |
| 33.     | Hydrogen Bromide (HBr)                                           | 0.0861                   | 3.61               | 0.9940                 |
| 34.     | Hydrogen Chloride (HCl)                                          | 0.1911                   | 1.627              | 0.9940                 |
| 35.     | Hydrogen Fluoride (HF)                                           | 0.3482                   | 0.893              | 0.9940                 |
| 36.     | Hydrogen Iodide (HI)                                             | 0.0545                   | 5.707              | 0.9930                 |
| 37.     | Hydrogen Sulphide (H <sub>2</sub> S)                             | 0.2278                   | 1.52               | 0.8390                 |
| 38.     | Helium (He)                                                      | 1.2418                   | 0.1786             | 1.4066                 |
| 39.     | Krypton (Kr)                                                     | 0.0593                   | 3.739              | 1.4066                 |
| 40.     | Nitrogen (N <sub>2</sub> )                                       | 0.2486                   | 1.25               | 0.9940                 |
| 41.     | Neon (Ne)                                                        | 0.2464                   | 0.9                | 1.4066                 |
| 42.     | Ammonia (NH <sub>3</sub> )                                       | 0.5005                   | 0.76               | 0.7147                 |
| 43.     | Nitric Oxide (NO)                                                | 0.2378                   | 1.339              | 0.9702                 |
| 44.     | Nitrogen Dioxide (NO <sub>2</sub> )                              | 0.1923                   | 2.052              | 0.7366                 |
| 45.     | Nitrous Oxide (N <sub>2</sub> O)                                 | 0.2098                   | 1.964              | 0.7048                 |
| 46.     | Oxygen (O <sub>2</sub> )                                         | 0.2196                   | 1.427              | 0.9861                 |
| 47.     | Phosphorous Trichloride (PCl <sub>3</sub> )                      | 0.1247                   | 6.127              | 0.3559                 |

|     |                                                    |        |        |        |
|-----|----------------------------------------------------|--------|--------|--------|
| 48. | Phosphorane (PH <sub>3</sub> )                     | 0.261  | 1.517  | 0.6869 |
| 49. | Phosphorous Pentafluoride (PF <sub>5</sub> )       | 0.1611 | 5.62   | 0.3002 |
| 50. | Phosphorous Oxychloride (POCl <sub>3</sub> )       | 0.1324 | 6.845  | 0.3002 |
| 51. | Silicon Tetrachloride (SiCl <sub>4</sub> )         | 0.127  | 7.5847 | 0.2823 |
| 52. | Silicon Fluoride (SiF <sub>4</sub> )               | 0.1692 | 4.643  | 0.3817 |
| 53. | Silane (SiH <sub>4</sub> )                         | 0.3189 | 1.433  | 0.5954 |
| 54. | Dichlorosilane (SiH <sub>2</sub> Cl <sub>2</sub> ) | 0.1472 | 4.506  | 0.4095 |
| 55. | Trichlorosilane (SiHCl <sub>3</sub> )              | 0.1332 | 6.043  | 0.3380 |
| 56. | Sulphur Hexafluoride (SF <sub>6</sub> )            | 0.1588 | 6.516  | 0.2624 |
| 57. | Sulphur Dioxide (SO <sub>2</sub> )                 | 0.1489 | 2.858  | 0.6829 |
| 58. | Titanium Tetrachloride (TiCl <sub>4</sub> )        | 0.1572 | 8.465  | 0.2048 |
| 59. | Tungsten Hexafluoride (WF <sub>6</sub> )           | 0.0956 | 13.29  | 0.2137 |
| 60. | Xenon (Xe)                                         | 0.0379 | 5.858  | 1.4066 |

## Appendix 2: Upper Range Value of Common Gases

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

| Nominal Diameter (mm) | Air    | Nitrogen (N <sub>2</sub> ) | Oxygen (O <sub>2</sub> ) | 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                   | 4400   | 4400                       | 2210                     | 700                        |
| 150                   | 6300   | 6300                       | 3200                     | 940                        |
| 200                   | 10000  | 10000                      | 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 above flowrate is in standard condition at 20°C Temperature and 101.325 kPa Pressure.
- The other flowrate unit options are: Nm<sup>3</sup>/h, Nm<sup>3</sup>/min, L/h, L/min, t/h, t/min, kg/h or kg/min.
- Equation for flowrate correlating the Working Flowrate and Standard Flowrate:

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

Q<sub>s</sub> = Flow rate in standard condition (Nm<sup>3</sup>/h)

Q<sub>n</sub> = Flow rate in working condition (m<sup>3</sup>/h).

t = Medium temperature in working condition (°C)

p = Medium pressure in working condition (Gauge pressure, kPa)

## Field Instrumentation Range



### Pressure Measurement

- Smart Differential Pressure Transmitter
- Smart Gauge Pressure Transmitter
- Smart Absolute Pressure Transmitter
- Miniature Pressure Transducer without display
- Sanitary Gauge/ Absolute Pressure Transmitter

- Submersible Pressure Transmitter
- Remote Seal Differential P.T. with capillary
- Remote Seal Differential P.T. Direct Mount
- Remote Seal Gauge/Absolute P.T. with capillary
- Remote Seal Gauge/Absolute P.T. Direct Mount



### Flow Measurement

- Coriolis Mass Flowmeter
- Thermal Gas Mass Flowmeter
- Positive Displacement Flowmeter
- Electromagnetic Flowmeter
- Vortex Flowmeter

- Turbine Flowmeter
- Variable Area Flowmeter
- Clamp On Ultrasonic Flowmeter
- Inline Ultrasonic Flowmeter
- Portable Ultrasonic Flowmeter



### Level Measurement

- RADAR Level Transmitter Horn Antenna
- Compact RADAR Level Transmitter
- RADAR Level Transmitter Sanitary
- RADAR Level Transmitter
- Guided Wave RADAR Level Transmitter
- Guided Wave RADAR Level Transmitter
- RADAR Level Transmitter Lens Antenna

- RADAR Level Transmitter Rod Antenna
- Ultrasonic Level Transmitter
- Microwave Barrier Level Switch
- Admittance Level Switch Series
- Vibrating Rod Level Switch Series
- Tuning Fork Level Switch Series



### Temperature Measurement

- Head Mount Temperature Transmitter
- Temperature Transmitter for Sanitary Applications

- DIN Rail Temperature Transmitter
- Field Mount Temperature Transmitter

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