CERTIFIED ISO 9001:2015 COMPANY

*Measuring & Beyond*

CE

# MIAL INSTRUMENTS PVT. LTD.

www.mialinstruments.com

**MTF 500/600**

INLINE / INSERTION THERMAL GAS MASS FLOW METER

# MIAL MTF 500 Inline & MTF 600 Insertion Thermal Gas Mass Flowmeter

MTF 500

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:

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

Where: $\rho_g$ is specific gravity of medium

V is velocity

K is balance coefficient

Q is heater power

Δ T is differential temperature

MTF 600

The medium temperature range of meter is -40 Deg C 220 Deg C

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

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

Where: $\rho_g$ is the medium density in working condition ($kg/m^3$)

$\rho_n$ is the medium density in standard condition, 101.325kPa and 20 Deg C ($kg/m^3$)

P is the pressure in working condition (kPa)

T is the temperature in working condition (Deg C)

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

The sensor temperature is always 30 Deg C higher than the environmental temperature (medium temperature) and the meter adopts the method of constant differential temperature due to which there is no need to execute temperature and pressure compensation in meter's reading.

# Specifications

## Features

- Measuring the mass flow or volume flow of gas
- No need to perform temparature and presure compensation to provide accurate measurement and easy operation
- Wide range: 0.5 ~ 100Nm/s for gas. The meter can be used for gas leak detection.
- Good vibration resistance and long service life. No moving parts and pressure sensor in transducer, no vibration influence on the measurement accuracy.
- Easy installation and maintenance. If the conditions on site are permissible, it 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


MTF 500 Inline thermal mass flow meter

MTF 600 Insertion thermal mass flow meter

| Description | Specifications |
|---|---|
| Measuring Medium | Various gases (Except the acetylene) |
| Pipe Size | DN15-DN1300 (flange), DN50-4000 (insertion) |
| Velocity | 0.1～100 Nm/s |
| Accuracy | ±1.0% |
| Working Temperature | Transmitter: -20℃～+45℃ , Sensor: -40℃～+200℃<br>-40℃～+350℃（optional），-40℃～+450℃ (optional) |
| Working Pressure | Insertion Sensor: medium pressure≤ 1.6MPa |
| Power Supply | Compact type: 24VDC or 220VAC, Power consumption ≤18W<br>Remote type: 220VAC, Power consumption ≤19W |
| Response Time | 1s |
| Output | 4-20mA (optoelectronic isolation, maximum load 500Ω), Pulse,<br>RS485 (optoelectronic isolation) and HART |
| Alarm Output | 1-2 line Relay, Normally Open state, 10A/220V/AC or 5A/30V/DC |
| Sensor Type | Standard Insertion, Hot-tapped Insertion and Flange |
| 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) |

# Mechanical Construction

## Appearance


Flanged Flow Meter

(Pipe size DN15-DN200)

MTF 500 Inline thermal mass flow meter

MTF 600 Insertion thermal mass flow meter

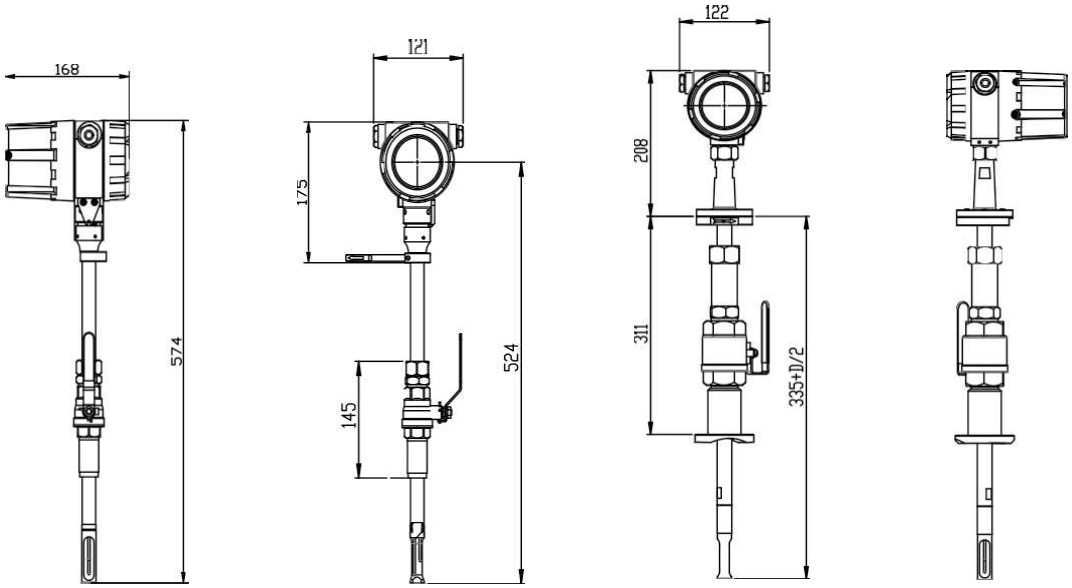
Hot-tapped Insertion Flow Meter

(Pipe size DN50-DN4000. Special requirements please contact us)

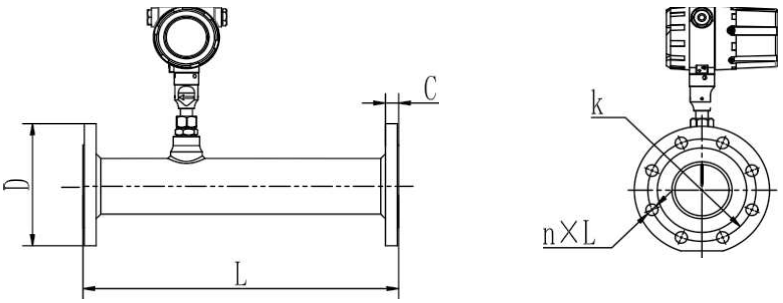
The insertion sensor of compact insertion flow meter should be inserted to axis of pipe, and the length of the insertion sensor is decided by pipe size, please confirm the pipe size while ordering. If the insertion sensor can't be in serted to axis of pipe, the manufacturer will provide a calibration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

## Dimensions

Dimensions of standard insertion sensor Dimensions of hot-tapped insertion sensor




The dimensions 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 |
|---|---|---|---|---|---|---|---|---|
| DN | D | k | n×L | | d | f | C | L |
| 15 | 95 | 65 | 4×14 | M12 | 46 | 2 | 14 | 280 |
| 20 | 105 | 75 | 4×14 | M12 | 56 | 2 | 16 | 280 |
| 25 | 115 | 85 | 4×14 | M12 | 65 | 2 | 16 | 280 |
| 32 | 140 | 100 | 4×18 | M16 | 76 | 2 | 18 | 350 |
| 40 | 150 | 110 | 4×18 | M16 | 84 | 2 | 18 | 350 |
| 50 | 165 | 125 | 4×18 | M16 | 99 | 2 | 20 | 350 |
| 65 | 185 | 145 | 4×18 | M16 | 118 | 2 | 20 | 400 |
| 80 | 200 | 160 | 8×18 | M16 | 132 | 2 | 20 | 400 |
| 100 | 220 | 180 | 8×18 | M16 | 156 | 2 | 22 | 500 |

For DN15-DN80, 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.

# 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*℃) | Density (g/l, 0℃) | Conversion Coefficient |
|---|---|---|---|---|
| 0 | Air | 0.24 | 1.2048 | 1.0000 |
| 1 | Argon (Ar) | 0.125 | 1.6605 | 1.4066 |
| 2 | Arsine ($AsH^3$) | 0.1168 | 3.478 | 0.6690 |
| 3 | Boron Tribromide ($BBr^3$) | 0.0647 | 11.18 | 0.3758 |
| 4 | Boron Trichloride ($BCl^3$) | 0.1217 | 5.227 | 0.4274 |
| 5 | Boron Trifluoride ( $BF^3$) | 0.1779 | 3.025 | 0.5050 |
| 6 | Borane ($B^2H^6$) | 0.502 | 1.235 | 0.4384 |
| 7 | Carbon Tetrachloride ($CCl^4$) | 0.1297 | 6.86 | 0.3052 |
| 8 | Carbon Tetrafluoride ($CF^4$) | 0.1659 | 3.9636 | 0.4255 |
| 9 | Methane ($CH^4$) | 0.5318 | 0.715 | 0.7147 |
| 10 | Ethylene ($C^2H^4$) | 0.3658 | 1.251 | 0.5944 |
| 11 | Ethane ($C^2H^6$) | 0.4241 | 1.342 | 0.4781 |
| 12 | Allylene ($C^3H^4$) | 0.3633 | 1.787 | 0.4185 |
| 13 | Propylene ($C^3H^6$) | 0.3659 | 1.877 | 0.3956 |
| 14 | Propane ($C^3H^8$) | 0.399 | 1.967 | 0.3459 |
| 15 | Butyne ($C^4H^6$) | 0.3515 | 2.413 | 0.3201 |
| 16 | Butene ($C^4H^8$) | 0.3723 | 2.503 | 0.2923 |
| 17 | Butane ($C^4H^{10}$) | 0.413 | 2.593 | 0.2535 |
| 18 | Pentane ($C^5H^{12}$) | 0.3916 | 3.219 | 0.2157 |
| 19 | Carbinol ($CH^3OH$) | 0.3277 | 1.43 | 0.5805 |
| 20 | Ethanol ($C^2H^6O$) | 0.3398 | 2.055 | 0.3897 |

| | | | | |
|---|---|---|---|---|
| 21 | Trichloroethane ($C^3H^3Cl^3$) | 0.1654 | 5.95 | 0.2763 |
| 22 | Carbon Monoxide (CO) | 0.2488 | 1.25 | 0.9940 |
| 23 | Carbon Dioxide ($CO^2$) | 0.2017 | 1.964 | 0.7326 |
| 24 | Cyanide ($C^2N^2$) | 0.2608 | 2.322 | 0.4493 |
| 25 | Chlorine ($Cl^2$) | 0.1145 | 3.163. | 0.8529 |
| 26 | Deuterium ($D^2$) | 1.7325 | 0.1798 | 0.9921 |
| 27 | Fluoride ($F^2$) | 0.197 | 1.695 | 0.9255 |
| 28 | Germanium Tetrachloride($GeCl^4$) | 0.1072 | 9.565 | 0.2654 |
| 29 | Germane ($GeH_4$) | 0.1405 | 3.418 | 0.5656 |
| 30 | Hydrogen ($H_2$) | 3.4224 | 0.0899 | 1.0040 |
| 31 | Hydrogen Bromide (HBr) | 0.0861 | 3.61 | 0.9940 |
| 32 | Hydrogen Chloride (HCl) | 0.1911 | 1.627 | 0.9940 |
| 33 | Hydrogen Fluoride (HF) | 0.3482 | 0.893 | 0.9940 |
| 34 | Hydrogen Iodide (HI) | 0.0545 | 5.707 | 0.9930 |
| 35 | Hydrogen Sulfide ($H_2S$) | 0.2278 | 1.52 | 0.8390 |
| 36 | Helium (He) | 1.2418 | 0.1786 | 1.4066 |
| 37 | Krypton (Kr) | 0..0593 | 3.739 | 1.4066 |
| 38 | nitrogen ($N_2$) | 0.2486 | 1.25 | 0.9940 |
| 39 | Neon (Ne) | 0.2464 | 0.9 | 1.4066 |
| 40 | Ammonia ($NH_3$) | 0.5005 | 0.76 | 0.7147 |
| 41 | Nitric Oxide (NO) | 0.2378 | 1.339 | 0.9702 |
| 42 | Nitrogen Dioxide ($NO_2$) | 0.1923 | 2.052 | 0.7366 |
| 43 | Nitrous Oxide ($N_2O$) | 0.2098 | 1.964 | 0.7048 |
| 44 | Oxygen ($O_2$) | 0.2196 | 1.427 | 0.9861 |
| 45 | Phosphorus Trichloride (PCI3) | 0.1247 | 6.127 | 0.3559 |
| 46 | Phosphorane ($PH_3$) | 0.261 | 1.517 | 0.6869 |
| 47 | Phosphorus Pentafluoride ($PF_5$) | 0.1611 | 5.62 | 0.3002 |
| 48 | Phosphorus Oxychloride ($POCl_3$) | 0.1324 | 6.845 | 0.3002 |
| 49 | Silicon Tetrachloride ($SiCl_4$) | 0.127 | 7.5847 | 0.2823 |
| 50 | Silicon Fluoride ($SiF_4$) | 0.1692 | 4.643 | 0.3817 |
| 51 | Silane ($SiH_4$) | 0.3189 | 1.433 | 0.5954 |
| 52 | Dichlorosilane ($SiH_2Cl_2$) | 0.1472 | 4.506 | 0.4095 |
| 53 | Trichlorosilane ($SiHCl_3$) | 0.1332 | 6.043 | 0.3380 |
| 54 | Sulfur Hexafluoride ($SF_6$) | 0.1588 | 6.516 | 0.2624 |
| 55 | Sulfur Dioxide ($SO_2$) | 0.1489 | 2.858 | 0.6829 |
| 56 | Titanium Tetrachloride ($TiCl_4$) | 0.1572 | 8.465 | 0.2048 |
| 57 | Tungsten Hexafluoride ($WF_6$) | 0.0956 | 13.29 | 0.2137 |

**USA OFFICE ADDRESS**

MIAL INSTRUMENTS PVT. LTD
Downtown Republic Center
325 N. St.Paul Street, Suite 3100
Dallas 75201, Texas, USA

MIAL® INSTRUMENTS PVT.LTD. Measuring & Beyond
www.mialinstruments.com
Email : info@mialinstruments.com

**FACTORY ADDRESS**

MIAL INSTRUMENTS PVT. LTD.
856/6 GIDC Makarpura, Vadodara-390010
Gujarat, India
Ph : +91 9913449547/9913449548