

# GOLDi Gas Turbine Meter

## 1. INTRODUCTION

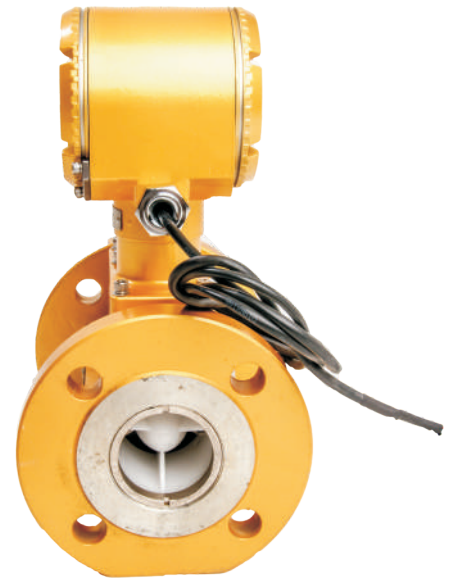
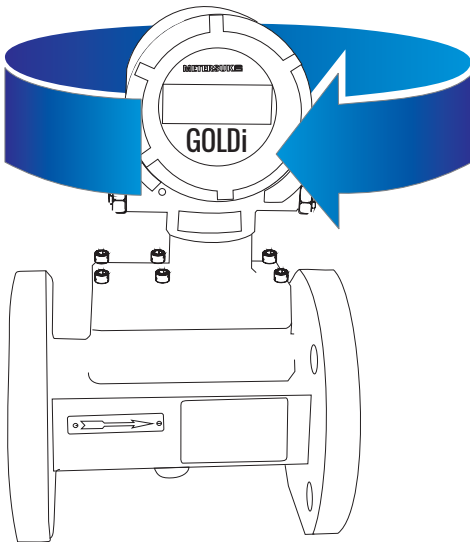
GOLDi Gas Turbine Flow Meter is a new high precision measuring instrument which has high accuracy and good reliability.

It can measure all kinds of single-phase gas and be widely applied to measure gas in oil, chemical, industry, metallurgy, electric power and combustion gas in cities.

GOLDi Gas Turbine Flow Meter has excellent measuring performance both at low pressure and high pressures and could be applied to measure rapid flow rate gas especially the accurate measurement of the natural gas.



## 340° Rotating Head



**Where installed with the Pulsed Output Operational to conform to current UK gas regulations, a Gas Safety Barrier is required.**



GOLDiGate Safety Barrier - Manufactured to BSEN 60079-11-2007 Standards



## 2. CHARACTERISTICS

- High precision, good repeatability and wide measuring scale ratio, to 1:20 (or wider).
- Equipping integrative two-stage flow conditioner, the length of straight pipe should be larger than two times of nominal diameter before the flow meter and larger than nominal diameter behind the flow meter.
- Well-connected reaction structure and distinctive sealing structure make sure the reliability of the bearing providing long life and using self lubricating bearings.
- All technical parameters fully comply with ISO9951. The length of the instrument's case is 3 times of nominal diameter and the performance of the whole is technically highly advanced.
- The accumulator of the flow meter could be turned 340° freely and the users can read it easily under various installation conditions.
- Very low power consumption and can operating with inner battery or external power by using advanced micro-power consumption technology
- Using high performance MCU and special filter method, adopting floating calculation and powerful embedded software with five segment coefficients self-correcting.
- Has very low power consumption and can operate for more than 15 years continuously with inner battery of one 2#3.6 VDC lithium battery by using new micro power technology.
- Real time data storage function prevents data from loss when power disappears or exchange battery, all instrumental parameters can be kept permanently.
- Explosion-proof function and the explosion proof grade is ExdIIBT4 or ExialIBT4.

## 3. STRUCTURE & PRINCIPLES

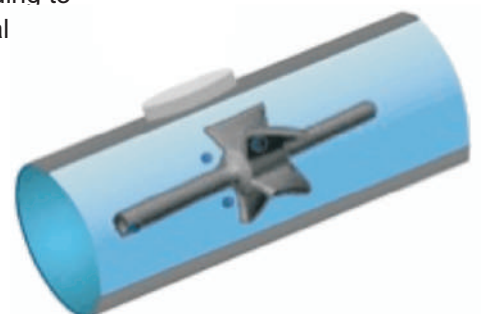
### 3.2 Principle of the turbine flow meter

The fluid is rectified and accelerated in the deflector ahead (or the flow conditioner), when it enters the meter. The turbine vanes that make an angle of direction of the fluid begin to swirl after it overcome rub moment and fluid obstruction moment.

The angular frequency is proportional to the volume flow rate within a certain scope of fluid velocities.

The pulse signal is derived from the coil terminals of the magneto-sensor according to principle of electro magnetic induction; the frequency of the signal is proportional the fluid volume flow rate. The signal is delivered to the flow accumulator after having been amplified, filtered and shaped.

Then the accumulator displays the gas total volume on the LCD screen.



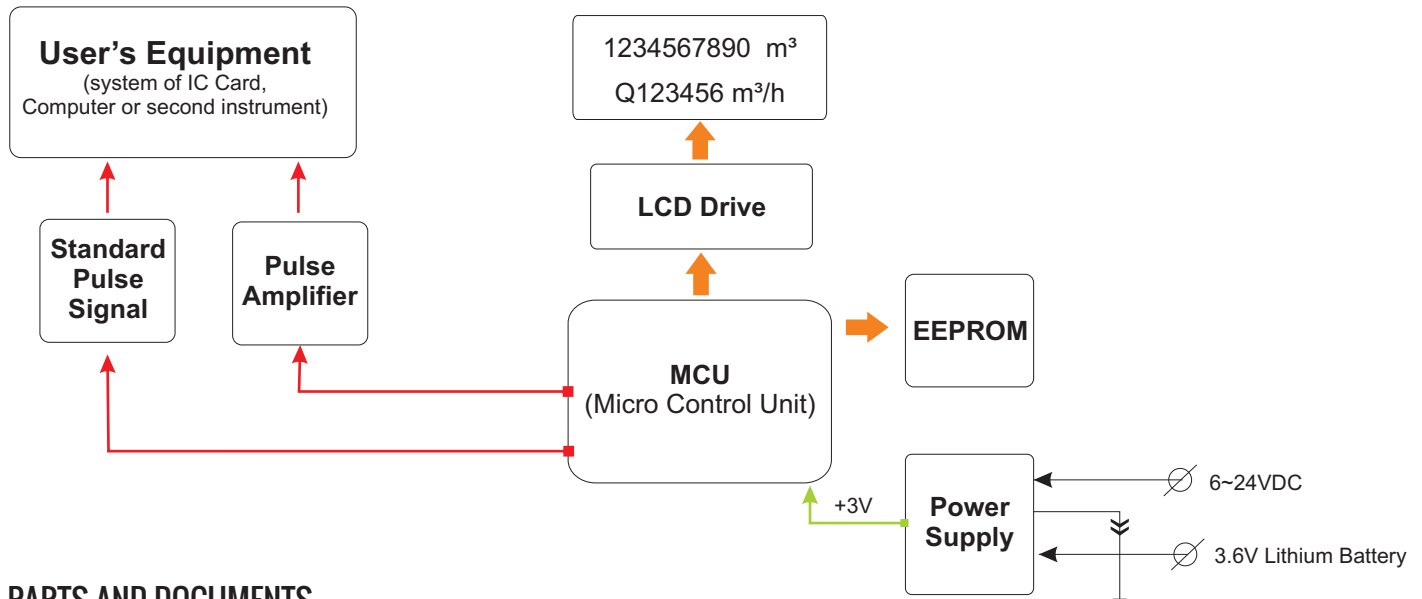
3.2 Principle of the flow accumulator

The flow accumulator consists of detect data channels of flow rate, microprocessor unit, driver circuit of Liquid Crystal Display (LCD), interface of the output signal and other auxiliary circuit. Figure 1 shows the operation principle. Multi-channel signals from sensors are transformed and sent to microprocessor to calculate according to the gas equation. The results can be displayed locally and transmitted to remote hosts.

Gas equation can be defined as follows  $V_0 = V \cdot \frac{P_s T_0}{P_0 T}$

- |  |   |
|--|---|
| $V_0$ Volume under standard conditions (m <sup>3</sup> ) | $T_0$ Absolute temperature under standard conditions (23.15 and it can be changed 273.15k if necessary)         |
| $V$ Volume under operation conditions (m <sup>3</sup> )  | $T$ Absolute temperature of the medium measured (273.15 +t)K  |
| $P_s$ Pressure setting in the instrument                 | $t$ Temperature of the medium measured which is detected by the temperature sensor or setting in the instrument |

3.3 Principle Diagram of the flow rate accumulator



4. PARTS AND DOCUMENTS

The package you received should contain the following :-

- GOLDi Turbine Gas Meter
- Built-in pulse cable
- Top hat filter
- GOLDiGate Safety/Insulation Barrier (if applicable)
- Copy of Calibration Certificate (if applicable)
- Installation, Operation and Maintenance Manual (PDF format)

You should check the meter and accessories with the order acknowledgement and the delivery note, to ensure you have received all the items. Any damages caused during transport should also be noted and advised to Meters UK.

## 5. NAME PLATE DETAILS

The meter is equipped with a main label. The figure 1. below shows what the label looks like. The label contains information such as flow range, pressure rating, accuracy, flow temperature and the serial number. Please refer to the table to check for size and dimensions. Only use the meter in the indicated ranges for flow, pressure and temperature.

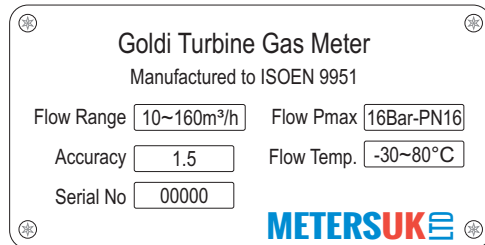


Figure 1

## 6. INSTALLATION

### 6.1 Procedure

Inspect the **ambient operating conditions** with the meter's requirements before installation, avoid external strong magnetic jamming and strong mechanical oscillation near the flow meter, to ensure the flow meter works properly.

#### Outdoor installation.

An enclosure is recommended, direct sunlight and wet conditions will damage the operation, external installations will require a 'Gas Corrector' being installed.

#### Indoor installation.

The meter should be installed vertically or horizontally, the flow direction must be same as the direction mark on the flow meter, straight pipes with the length of 2 DN and 1DN should be reserved upstream and downstream of the installed flow meter respectively.

The meter should be installed with the same central axis of the pipe, and prevent seal gasket and butter into the pipe. The meter must be connected with the ground reliable earthing source, please do not using the ground of high electric voltage system. User is not allowed to arbitrary change the connecting mode of the explosion-proof system and the interface of leading wires. Any changes should comply with relative requirements within the standard of GB3836.1 ~ 2.

Slowly open valve, gradually increase flow rate, when starting meter to prevent instantaneous gas shock from damaging turbine vanes (Opening time > 15s).

#### WARNING:

The meter should not be installed until all debris in the pipe work is removed. Please ensure a Witches Hat Commissioning Filter is installed upstream.

### Straight Pipe

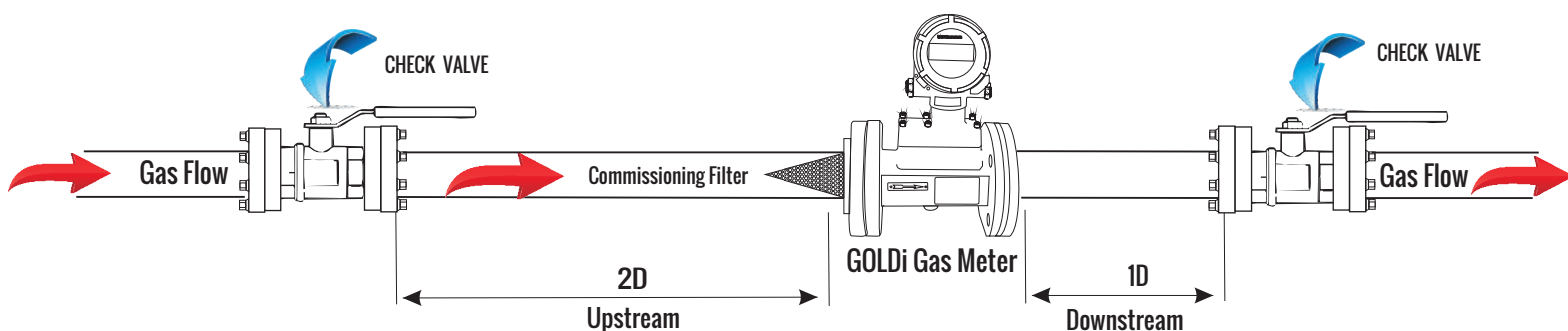


Figure 2

Elbow Pipe

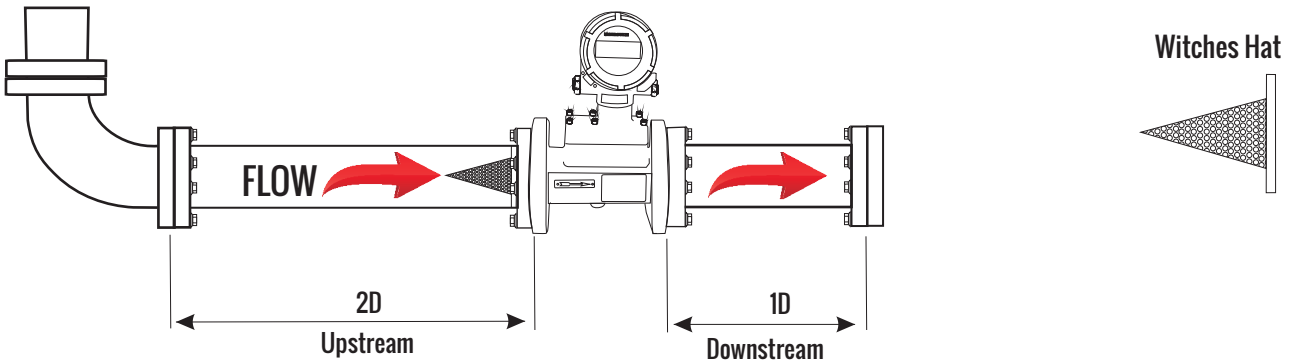


Figure 3

Concentric Reducer Pipes

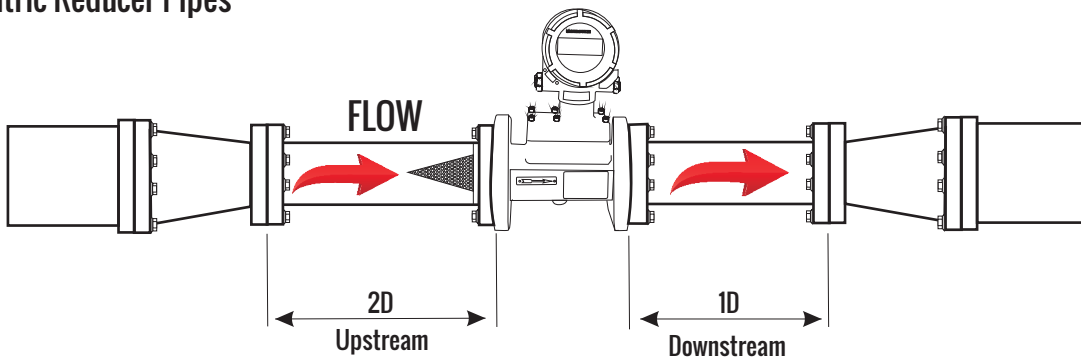


Figure 4

6.2 TOP HAT - Gas Strainer/Filter

Uniquely designed by Meters UK for the filtration of debris and the protection of gas equipment during the commissioning and start up periods.

KEY FEATURES

- Easily Installed between flanges without modification
- No need to make special tool pieces
- Constructed to work at high differential pressures
- Clearly seen by virtue of its elongated signal arm
- Manufactured to ISOEN970 Standards
- Stainless Steel woven wire gauze 20 mesh aperture

Top Hat - Gas Strainer/Filter

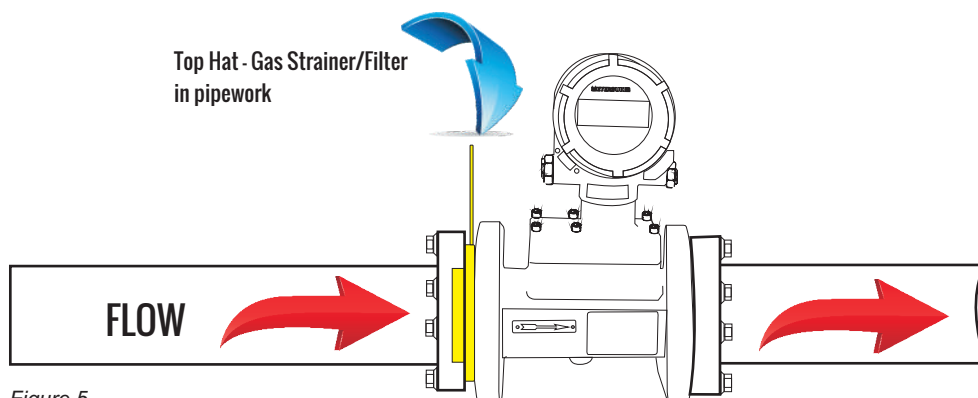
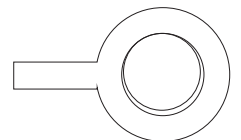
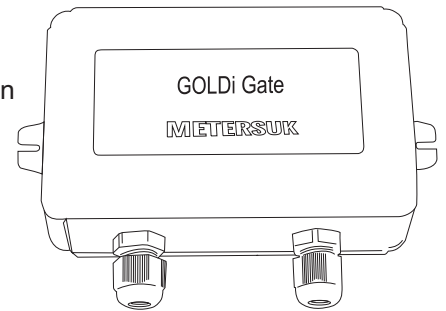


Figure 5

## 6.3 System connections

Where the pulse output of the meter is connected onwardly to a electrical connection within any potential area of gas escape to confirm to current regulations a **Gas Safety Barrier (GOLDi Gate) must be installed.**



## 7. TECHNICAL SPECIFICATIONS

### 7.1 Standard

The technical specifications of GOLDi Gas Turbine Flow Meter comply with ISO9951.

### 7.2 Electrical Specifications

#### 7.2.1 Output Signal

Standard pulse signal:

Output pulses in serial mode (output of the collector at the open's circuit,  $V_o < 7.5VDC$  electric source (max), the pulse period is 50ms,  
Each pulse stands for 1 m<sup>3</sup> standard volume.

Maximum Current = 75 mAmps

Wiring -- 4 Wire



#### 7.2.2 Explosion Proof Specifications

Explosion proof sign is ExdIIBT4 or ExialIBT4. Operate under the explosive gas ambience below T4 group IIB grade.

#### 7.2.3 Gas Meter Battery

The battery is displayed in the Meter head and is 3.6 Volt Lithium, Size C

### 7.3. Technical specifications

#### 7.3.1 Table 1: Type. Basic Parameters Note:

- 1 - The turbine wheel material is high grade Stainless-Steel.
- 2 - The flow rate range will be larger when operating pressure increases

### 7.4. Basic Parameter Notes & Characteristic Curve

Figure 6 shows the typical characteristics curve of the meter, Y co-ordinate axis stands for basic error of the meter, and X co-ordinate axis is percentage of the maximum flow rate of the meter.

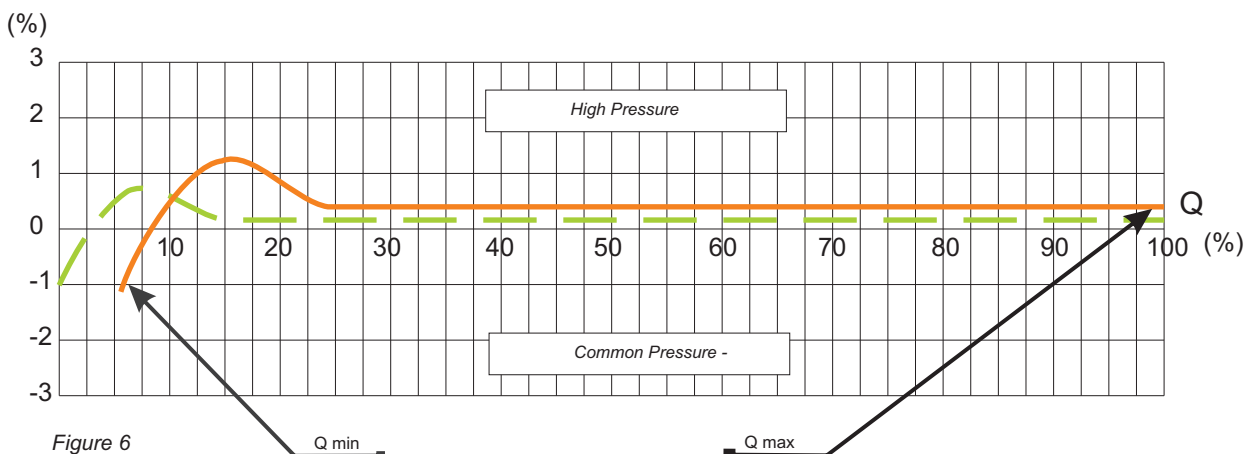


Figure 6

7.4.1 Pressure loss of the flow meter

The pressure loss relates to the turbine's running, the friction in the pipe and the speed and director of the liquid. Pressure loss  $\Delta P$  can be calculated by the following formula under the operating conditions:

$$\Delta P = \Delta P_{Q_{max}} \cdot \frac{\rho_0}{1.205} \cdot \frac{P_a + P_g}{P_0} \cdot \frac{P_0}{T_g} \cdot \left(\frac{Q}{Q_{max}}\right)^2$$

$\Delta P_{Q_{max}}$  pressure loss of the biggest flow rate under standard conditions, when the medium is dry air (at 20°C, 101.325kPa,  $\rho=1.205\text{kg/m}^3$ )

$\rho_0$  Medium density under standard conditions (20°C, 101.325kPa;  $\rho= 1.205 \text{ kg/m}^3$ )

$T_0$  Absolute temperature under standard conditions (293.15k and it can be changed to 273.15k, if necessary)

$P_a$  Local atmospheric pressure (kPa)

$T_g$  Absolute temperature of the medium under operating conditions. (273.15+t)k

$P_g$  Pressure of the flow meter at the measuring point (kPa)

$Q$  Flow rate under operating conditions ( $\text{m}^3\text{h}$ )

$P_0$  Standard atmospheric pressure (101.325kPa)

$Q_{max}$  The biggest flow rate under operating conditions ( $\text{m}^3\text{h}$ )

OUTLINE DIMENSIONS

Outline dimensions of the flow meter is shown in Figure 7 & 8. The marking dimensions are listed in Table 1. The meters are connected with flanges, flange size complies with the Standard of GB/T9112-9113-2000.PN16.

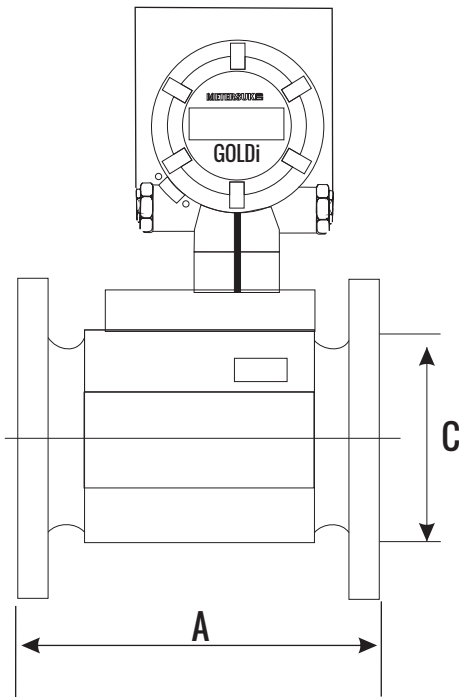


Figure 7

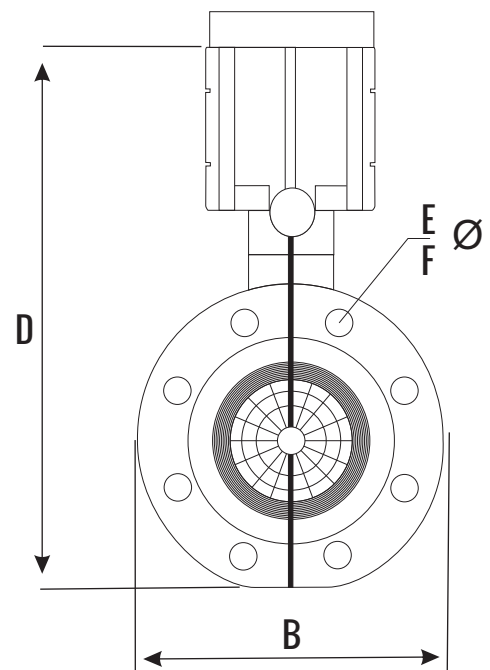


Figure 8

MUK CODE	Part No.	SIZE Metric	SIZE BSP	Flow Range (m <sup>3</sup> /h)	Kg	DIMENSIONS IN MM					
						Fl to Fl (A)	Fl (B)	PCD	Height (D)	(BH) Bolt Holes	Ø F
805800	TGM50(LF) G40	50	2.0'	6 - 65	8	200	165	99	313	4	18
805801	TGM50(LF) G100	50	2.0'	8 - 160	8	200	165	99	313	4	18
805802	TGM80(LF) G100	80	3.0'	8 - 160	14	240	200	132	343	8	18
805803	TGM80(LF) G250	80	3.0'	20 - 400	14	240	200	132	343	8	18
805804	TGM100(LF) G160	100	4.0'	13 - 250	18	300	220	156	361	8	18
805805	TGM100(LF) G400	100	4.0'	32 - 650	18	300	220	156	361	8	18
805806	TGM150(LF) G400	150	6.0'	32 - 650	30	450	285	211	426	8	22
805807	TGM150(LF) G1000	150	6.0'	80 - 1600	30	450	285	211	426	8	22
805808	TGM200(LF) G650	200	8.0'	50 - 1000	30	600	340	266	470	12	26
805809	TGM200(LF) G1600	200	8.0'	130 - 2500	30	600	340	266	470	12	26

Table 1

## 8. OPERATION

### 8.1 Ambient Conditions

Ambient temperature: - 30°C ~ + 55°C

Relative humidity : 5% ~ 95%

Atmosphere Pressure: 86kPa ~ 106 kPa

### 8.2 Flow Conditions

- Range of the flow temperature: -30°C ~ +80°C
- The flow should be no swirling single-phase flow (include air), without sundries such as granules and fibre
- Range of the flow temperature and pressure should be within the specifications of the flow meter.

### 8.3 Operation of the accumulator

#### 8.3.1 Displaying pattern

8.3.1.1 Normal operating and indicator is shown in Table 2.

LCD Screen	Definition	Display Format		
		Indicator	Data	Unit
10 bits of upper line	Standard flow rate accumulator		xxxxxxx.xx The decimal point will right shift with data increasing till the format is xxxxxxxxxx	Nm <sup>3</sup>

NOTE: Q□ and t are displayed in turn at an interval of 2 seconds

Table 2



### 8.4 Insufficient Voltage Indicator

When the voltage of the inner battery is below 3.1V, the battery sign "" in the LCD flashes regarding 2 second as period to indicate insufficient voltage, then users should change the battery within one month to make sure the meter operates normally.

When the external power supply (5~24VDC) is connected, the inner battery is automatically disconnected immediately, and the flow meter is powered by the external power supply (total power consumption 1W)

## 9. TROUBLE SHOOTING

When displaying flow rate value is different from the actual one, it is should first check whether the pipe system is fit to the designed installation requirements of the flow meter.

### 9.1 Common trouble and troubleshooting

Refer to table 3 below.

Problem	Probable cause	Trouble shooting
No accumulation counting when actual flow appears.	<ol style="list-style-type: none"> <li>Flow rate in pipe is smaller than the starting flow rate.</li> <li>Sensing chip has broken or turbine vane not rotating.</li> </ol>	<ol style="list-style-type: none"> <li>Adjust medium flow rate to fit the operating conditions of the flow meter.</li> <li>Check sensing chip or mechanical elements, and wash bearing.</li> </ol>
Accumulator counts automatically or flow rate signal output appears when no actual flow	<ol style="list-style-type: none"> <li>Connecting ground of the flow meter is not very well or connect the ground of strong power system.</li> <li>Voltages of the inner or external power supply are not stable, or inner electric jamming or strong external</li> </ol>	<ol style="list-style-type: none"> <li>Connect ground tightly not connect to the ground of strong power system.</li> <li>Maintain power circuit of the flow meter, or adopt proper shielding method.</li> </ol>
Display of instantaneous flow rate is unstable	<ol style="list-style-type: none"> <li>Dirt has attached on turbine vanes, or ferromagnetic material lies in bottom part of inner wall of the magneto sensor shell.</li> <li>Bearing abraded in deep degree, some turbine vanes touch inner wall of the shell.</li> <li>Connecting ground of the flow meter is not very well or connect the ground of strong power system, or strong external magneto jamming exists.</li> </ol>	<ol style="list-style-type: none"> <li>Wash turbine vanes, exclude dirty thing in inner wall of the shell.</li> <li>Replace bearing and axis, re-install new vanes.</li> <li>Adopt shielding method and exclude magneto jamming.</li> </ol>
Accumulation is different from actual one	<ol style="list-style-type: none"> <li>Actual flow rate is beyond normal measuring range of the flow meter.</li> <li>Low accuracy of the flow meter.</li> </ol>	<ol style="list-style-type: none"> <li>Adjust flow rate in pipe to fit the normal measuring range of the flow meter.</li> <li>Re-calibrate and input instrumental coefficient again.</li> <li>Adjust and calibrate again.</li> </ol>
No response when replacing new battery or pressing key	<ol style="list-style-type: none"> <li>Failure of power on reset circuit.</li> </ol>	<ol style="list-style-type: none"> <li>Press reset key (K4).</li> <li>Re-install battery (short the positive and negative poles of the battery box for a while at first)</li> </ol>

Table 3

### 9.2 Safety and reliability

To get the accuracy expected and normal working life, the turbine flow meter should operate in the allowance flow rate range and under the authorized running conditions.

Over speed turning of the turbine and the solid in the pipes could make the flow meter attrite and damage ahead of time. So selecting proper specifications, correct installation and suitable operation and maintenance could make sure that the instruments run normally.

### 9.3 Filter

Because the impurity and scrape in the pipes could short the turbine flow meter working life, when the impurity in the measured mediums is bigger than 50um, must install the filter and monitor the pressure difference between the beginning and end in the filter to change or clean the filter's core in time and make sure the filter work in good conditions to avoid flowing distortion.

### 9.4 Overload

The flow rate pulsation usually appears and is high sometimes because the pressure pulses in the pipes under the operation of the turbine flow meter.

GOLDi Gas Turbine Flow Meter is designed based on the maximum flow rate authorized by the ISO9951.

The instrument wouldn't damage when the time of the overloading 120%Qmax is shorter than 30 minutes. Suggest install the flow snubbing in the downstream of the instrument to make sure that the flow rate overloading is below 120%Qmax under high pressure condition.

### 9.5 Ability of anti-interference

The well-connected integrative two-stage rectifier equipped in the GOLDi Gas Turbine Flow Meter has been detected under the low and high interference conditions authorized by the ISO9951, the length of straight pipe requirement is larger than 2 times of nominal diameter before the flow meter and larger than nominal behind the flow meter.

## 10. CALIBRATION

The GOLDi Turbine Gas Flow Meter is calibrated according to the specification JJG 19894 (Appraised regulations for Velocity Flow Meter)

Awkward  
Location ?

Need an  
EASY  
installation ?

Difficult  
Access ?

You **NEED** a  
**FLEXiREXi**

Flexible Bellow and Thermal Expansion Compensator

