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FN Mass Flow Meter (Bio Gas)

KC-7730B



FN Mass Flow Meter(KC-7730B)

Product Introduction

Golden Rule's KC-7730B high-precision FN mass flow meter is used in industrial settings to detect gas flow under natural pressure conditions and for flow rate adjustment and measurement. It is available in threaded, LOK fitting, and flange configurations and is equipped with a microprocessor for simultaneous flow rate measurement, flow rate adjustment, and diagnostics. Instantaneous mass flow, total flow, and environmental settings can be configured, and the meter is displayed on a 2 x 16 LCD panel. The programmable transmitter allows for easy configuration via the RS-485 communication port, Golden Rule's high-performance interface software, or the instrument panel display (remote control switch). Golden Rule's KC-7730B is designed based on differential pressure flow measurement technology. Its two FN sensors enable precise measurement of low pressures and, as pressure increases to ultra-high pressures, reduce error, resulting in improved flow rate accuracy. In addition, the flow meter can provide users with density, enthalpy, etc. in addition to the flow rate value by using a built-in flow rate function that considers the compression coefficient, expansion coefficient, and viscosity coefficient, which is two levels higher than the existing temperature and pressure compensation method.



Product Features

(For multi-measurement)

- 5-Multi-Measurement: Instantaneous/Total, Volume/Mass Flow, Temperature, Pressure, Density, and Heat Indicator
- Automatic Mixed Gas Calculation Function (8-Channel 4-20mA Input)
- Power Supply: DC 24 V $\pm 10\%$, 60mA / AC 100-240 V $\pm 10\%$, 10 watts (Optional)
- Output Accuracy: $\pm 0.1\%$, $\pm 2.5 \mu A$
- Interface (RS-485) for on-site adjustment in case of flowmeter malfunction
- Direct mass flow measurement eliminates the need for separate temperature and pressure compensation
- Simple signal processing and calibration in the field
- Direct calculation of expansion coefficient and Reynolds correction values for flow functions
- Outstanding long-term stability and excellent reproducibility
- Easy to adapt to different applications
- No moving parts
- Significantly reduced upstream piping requirements (10 to 5D)
- Wide measurable flow rate range: 20:1 (optional 35:1)
- Speed response to flow rate changes Fast (0.1 sec)
- Capable of measuring high-pressure gases (up to 400 barg)
- Capable of measuring high-temperature fluids up to 400°C
- Automatic flow rate calculation function (4-20 mA input: Basic Mode <optional>)
- CE, Ex (IP67)

- General type KC-7730B
- Explosion-proof KC-7730B-FM153K

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Product Performance

- Accuracy
 - Full Scale $\pm 0.5\%$ / R.D. $\pm 1.0\%$
 - Option: Full Scale $\pm 0.1\%$ / R.D. $\pm 0.5\%$
- Reproducibility
 - $\pm 0.2\%$ of Full Scale
- Sensor Accuracy
 - $< 0.05\%$ of span
- Pressure Range
 - 20 mmAq to 300 mmAq
 - 86 mmAq to 3,000 mmAq
 - 143 mmAq to 5,000 mmAq
- Response Time < 0.1 sec
- Measuring Range (0.1 to 100) m/sec
- Functions
 - Display Indications:
 - Instantaneous & Totalized, Volume, Mass Measurement
 - Communication: Instantaneous, Totalized, Volume, Mass, Temperature, Pressure, Density, Calorie Measurement
 - Turndown Ratio 20:1 (Optional 35:1)

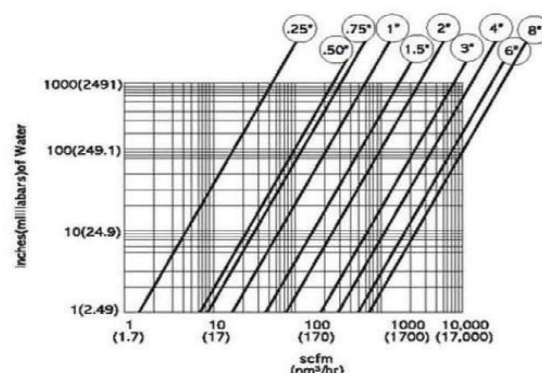
Operating Specifications

- Fluid
 - Biogas, polluted gas, low-pressure gas
- Power Supply
 - DC 24 V $\pm 10\%$, < 60 mA AC 100-240 V $\pm 10\%$, < 10 Watts (Optional)
- Output Signal (Standard)
 - Linear DC 4 to 20 mA, 4-Wire, Pulse RS-485 (Optional)
- Pressure Drop
 - 0.1 to 0.3 Bar

Bio gas Flow Ranges(바이오가스 유량 범위)				
Pipe Size		Minimum	Maximum	Pressure / Temp'
A	B	Nm ³ /h	Nm ³ /h	Pressure / Temp'
50A	2-inch	4.8	160 (digester)	250mmAq / 30~40°C
80A	3-inch	20	700 (generator)	1,250mmAq / 1,350mmAq / 1,500mmAq / 25~30°C
80A	3-inch	2.9	100 (digester)	250~300mmAq / 20~30°C
80A	3-inch	43	1,700 (biogas purification facility)	3Barg / 30°C
80A	3-inch	29	1,150 (biogas purification facility)	3Barg / 30°C
100A	4-inch	10	350 (digester) / 300 (digester)	250~300mmAq / 25~30°C
100A	4-inch	65	2,600 (biogas purification facility)	3Barg / 30°C
125A	5-inch	8.6	300 (generator)	50~200mmAq / 20~35°C
125A	5-inch	42	1,500 (digester)	50~300mmH ₂ O / 30~35°C
150A	6-inch	57	2,000 (digester)	50~300mmH ₂ O / 30~35°C
150A	6-inch	45	1,800 (biogas purification facility)	3Barg / 30°C
150A	6-inch	14.3	500 (digester)	200mmAq / 35~40°C
150A	6-inch	28	1,000 (digester)	250mmAq / 30°C
200A	8-inch	120	4,200 (biogas purification facility)	3Barg / 30°C
200A	8-inch	86	3,000 (digester)	50~300mmH ₂ O / 30~35°C
250A	10-inch	114	4,000 (digester)	50~300mmH ₂ O / 30~35°C
250A	10-inch	141	4,930 (biogas purification facility)	0.1~6.5Barg / 30°C
300A	12-inch	86	3,000 (digester)	50~300mmH ₂ O / 30~35°C
350A	14-inch	114	4,000 (digester)	50~300mmH ₂ O / 30~35°C

Notes:

- Air and nitrogen flow rates at standard conditions: 21°C (70°F) and 21°C (70°F) scfm: 0°C, Nm³/h 1 atm. For other gases, contact the factory.
- Flow charts are available; contact the factory.
- Maximum flow rates are limited for hazardous area and high-temperature versions; contact the factory.



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- **Fluid & Environment Temperature**

Gas: -40 to 100°C (-50 to 212°F) Optional: -70 to 400°C (-94 to 752°F)

Pipe Temperature: 300°C or higher (572°F)

Environment: -4 to 176°F (-20 to 80°C) Optional: -70 to 100°C (-94 to 212°F)

- **Fluid Pressure Range (Assembly Part)**

Compression Fitting: 500 psig (35 barg)

150 lb, JIS 10k RF, PN16 DIN Flange ((-40 ~ 150) °C ((-40 ~ 302) °F)) : 230 psig (15.9 barg)

150 lb, JIS 10k RF, PN16 DIN Flange (121 °C (250 °F)) : 185 psig (12.8 barg)

150 lb, JIS 10k RF, PN16 DIN Flange (400 °C (752 °F)) : 155 psig (10.7 barg)

NPT ((-40 ~ 150) °C ((-40 ~ 302) °F)) : 508 psig (35 barg)

- **Liquid Crystal Display**

Display indications: Instantaneous & totalized, volume, mass measurement

Numeric character array 2 x 16 backlit LCD & alarm function

Adjustable via remote control switch on the instrument panel or via Windows via RS-485S interface

Adjustable variables: Flow rate range: (0 ~ 100) %

Flow rate units: m³/h (m³), L/h (L), mL/h (mL), Nm³/h (Nm³), Sm³/h (Sm³), kg/h (kg)

Response Time / Correction Value: (0.1) sec / 0.5 ~ 5Zero & Span

- **Total Flow**

10-digit engineering units (9,999,999,99.9 Count),

Flow rate and total flow decimal point (0000. / 000.0 / 00.00 / 0.000)

Resettable via software or LCD remote control switch

- **Software (Optional):** Area code 1~249, 966~115,200 bps

Windows® Software 16MB RAM required (minimum 8MB RAM required)RS-485S communication:

Instantaneous, total flow, volume, mass, temperature, pressure, density, and heat measurement

Additional Functions: Zero Cut-Off Adjustment, Linearization Adjustment, Save/Load Adjustment, Flowmeter Conditions Check

Main Body Specifications

- **Fluid Wetted Parts**

FN Sensor – STS316 (Option: STS316L)

Flow Body – Seamless STS304 (Option: STS316, STS316L)

- **Flow Meter Body**

Waterproof IP67 & Case for Explosion-Proof Areas (Ex d IIC T6: Hydrogen Explosion-Proof)

- **Wire Connections**

2 x ½" PF or Exp Cable Gland (SS) 22C

Flow Meter Connections (Optional)

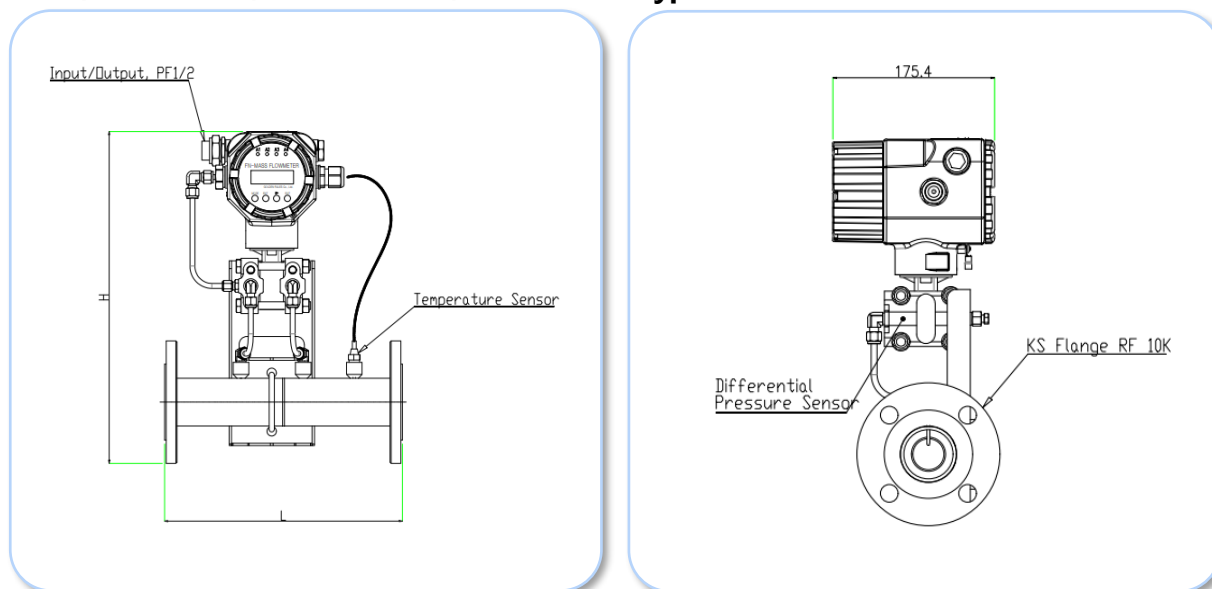
Thread, Cone & Thread Tubing (400Bar), Lok, ANSI 150lb Flange, JIS 10k RF Flange

- **Certifications**

Ex (Ex d IIC T6) / CE (Full CASE) / KCS Certificate / Atex Certificate

FN Mass Flow Meter(KC-7730B)

Drawing Dimension Specifications & Chart KC-7730B_ Orifice, Flow Nozzle, Venturi Nozzle, Venturi Cone Type



※ The shape of the sensor may change depending on the manufacturer's circumstances. -> Refer to the detailed approval drawing.

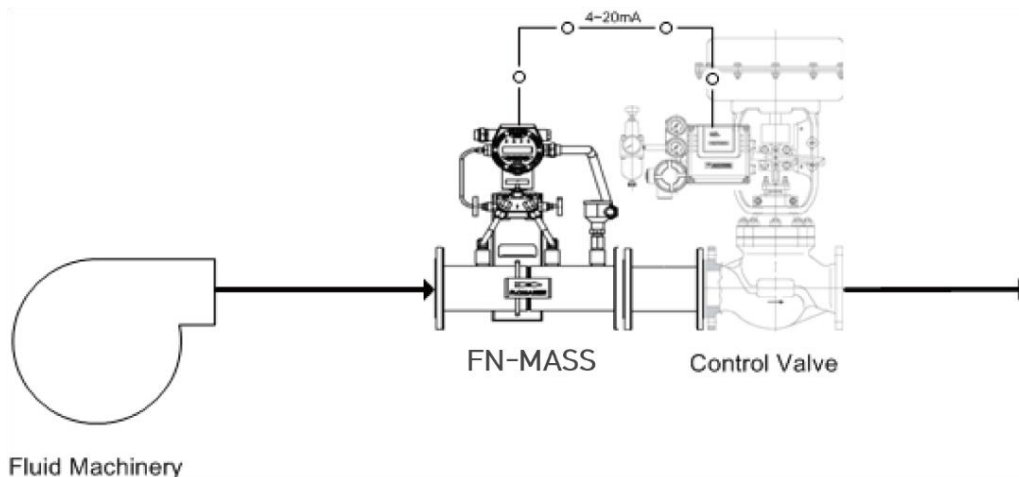
Unit : mm

Size	H	L
50A	420	300
65A	442	300
80A	442	350
100A	451	400
125A	508	409
150A	540	451
200A	575	522
250A	626	602
300A	684	672

FN Mass Flow Meter(KC-7730B)

The FN mass flow meter provides the following control options using current output signals:

- | | |
|---|-----------------------------|
| 01 – Mass flow rate (kg/h) control | 02 – Heat (MJ/h) control |
| 03 – Volumetric flow rate (m ³ /h) control | 04 – Pressure (kPa) control |



Its fast response speed allows it to meet customer needs, and its precision control of $\pm 0.1\%$ F.S. allows it to achieve energy savings, minimizing losses in industrial settings.

Upstream and downstream straight pipe conditions (KC-7730B)

Vertical pipe length required for measurement			
Piping condition	KC-7730B Smart- IN™		Orifice Plate(3)
	Upstream(1)	Downstream (2)	
90° Elbow or T-Joint	10D	5D	28D
Zoom out (4:1)	10D	5D	14D
Expansion (4:1)	10D	5D	30D
After the control valve	10D	5D	32D
Two 90° elbows (same horizontal plane)	10D	5D	36D
Two 90° elbows (different horizontal planes)	10D	5D	62D

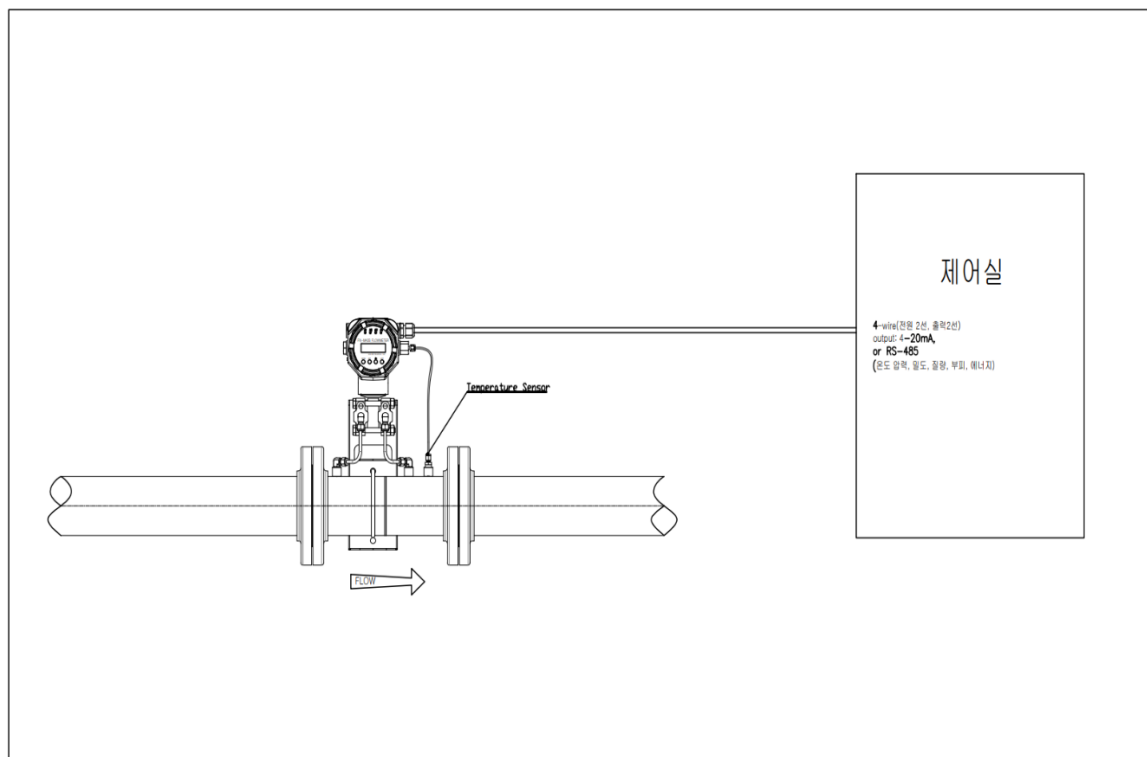
Note :

- The straight pipe diameter multiplier (D) is the straight pipe required between obstructions upstream of the flow meter.
- The required straight pipe length can be shortened by adjusting for field conditions.
- For comparison with our flow meter, this is the required straight pipe length for an orifice flow meter with a diameter ratio of 0.7, as per ISO-5167.
- Contact the manufacturer for pressure effects.

FN Mass Flow Meter(KC-7730B)

Schematic and Advantages of the Integrated FN Mass Flow Meter

1. Significantly reduced installation costs.
2. 2. As a direct-type FN mass flow meter, it boasts significantly higher accuracy ($\pm 0.5\%$ F.S.) than conventional differential pressure meters.
3. 3. Wide flow range for high-temperature, high-pressure, and high-flow measurement (turndown ratio: 35:1).
4. 4. As an FN mass flow meter, the straight pipe section is short (10D upstream and 5D downstream).
5. 5. Simultaneous monitoring of five data points (flow rate, temperature, pressure, density, and heat) in a central monitoring panel is possible through communication output.
6. 6. As an integrated mass flow meter with temperature/pressure sensor/flow computer, installation is simple.



FN Mass Flow Meter(KC-7730B)

Order Code

Type **Conn' Size** **Body** **Power** **Output** **Display** **Direc.** **Press'** **Option**
KC-7730 - - - **P** - **V** - - - -
1 **2** **3** **4** **5** **6** **7** **8** **9** **10** **11** **12**

Type	Code 1
Liquid	L
Gas	G
Steam	S
Bio Gas	B

Connection	Code 2
Thread	T
Tri-clamp	C
Lok Fitting	L
DIN / ANSI / JIS Flange	D / A / J
Agency approved, customer specified	W

Size	Code 3
2" (DN50)	5
2-1/2" (DN65)	6
3" (DN80)	7
4" (DN100)	8
5" (DN125)	9
6" (DN150)	10
8" (DN200)	11
10" (DN250)	12
12" (DN300)	13

Body1	Code 4
General Type	G
Explosion-Proof Type	E

Body2	Code 5
Integral type	1
Remote type	2
Agency approved, customer s pecified	W

Body3	Code 6
IP66	1
IP67	2

Input Power	Code 7
DC 24V	2
AC 220V	3
Agency approved, customer specified	W

Output	Code 8
DC 4~20 mA, Pulse active, RS-485	1
Agency approved, customer specified	W

Display	Code 9
No Readout	NR
Digital Display	DD
Agency approved, customer specified	W

Flow Direction	Code 10
Horizontal / Left -> Right	1
Horizontal / Right -> Left	2
Vertical / Lower -> Upper	3
Vertical / Upper -> Lower	4
Agency approved, customer specified	W

Pressure Range	Code 11
Low Pressure (Max. 10 bar)	L
Medium Pressure (Max. 30 bar)	M
High Pressure (Max. 200 bar)	H
Agency approved, customer specified	W

Option	Code 12
FN Sensor Mat'l : 316SS, 316LS S	FM
DP Sensor Mat'l : 316LSS	DM
High Press. (max.50 Bar)	HP
Agency approved, customer specified	W

FN Mass Flow Meter(KC-7730B)

Flow Measurement Principle

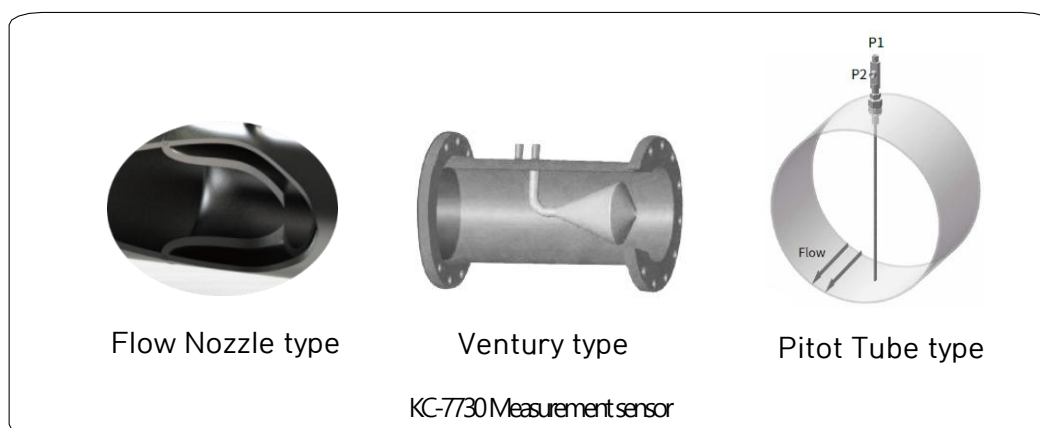
Differential Pressure Mass Flow Sensor

– FN Mass Flow Sensor (Orifice, Flow Nozzle, Venturi Nozzle, Pitot)

Orifice Pipe Size: D-0.5D / Corner / Flange

Absolute Pressure and Differential Pressure Sensor: STS316, STS316L

Temperature Sensor: RTD Pt100 (3-wire)



Golden Rule's unique FN-Mass Flow meter guarantees exceptional accuracy for industrial flow meters, as well as robustness and reliability under high temperatures and pressures.

This is the world's first direct-calculation FN-Mass Flowmeter, a differential pressure mass flow meter. Designed with orifice plates, flow nozzles, and venturi tubes to minimize pressure loss, the sensor measures flow rate using proprietary, patented calculations. This new technology has earned Golden Rule's New Technology Certification. This is a new-concept mass flow transmitter that derives flow rates through sophisticated calculations under the variable physical properties of real fluids. It is capable of engineering demanding industrial conditions. Developed with proprietary domestic technology, it minimizes industrial losses and ensures technical freedom. It also offers superior accuracy and stability. Furthermore, it can be used with a variety of fluids. The straight pipe length required by conventional differential pressure flow meters has been supplemented through various experimental data to maintain the desired accuracy even in short straight pipe sections. A communication network (RS-485) can be configured to monitor the progress of the mass flow meter, and an automatic valve can be installed to control mass flow rates according to user settings. Orifices, flow nozzles, venturi tubes, venturi cones, and pitots are manufactured in compliance with the ISO-5167 standard, and are manufactured under the ISO-9001 and ISO14001 quality management systems.

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Flow calculation formula

Term	Real gas	Perfect gas
Equation of state	$pV = ZRT$	$pV = RT$
Compressibility factor	Z	$Z = 1$
Isothermal deviation factor	$Y = \frac{p}{V} \left(\frac{\partial V}{\partial p} \right)_T = 1 - \frac{p}{Z} \left(\frac{\partial Z}{\partial p} \right)_T$	$Y = 1$
Isobaric deviation factor	$X = \frac{T}{V} \left(\frac{\partial V}{\partial T} \right)_p = 1 - \frac{T}{Z} \left(\frac{\partial Z}{\partial T} \right)_p$	$X = 0$
Isonentropic exponent (κ)	$\kappa = - \frac{V}{p} \left(\frac{\partial p}{\partial V} \right)_s = \frac{\gamma}{Y}$	$\kappa = \gamma = \frac{c_p}{c_v}$

coefficient of gas expansion

$$\varepsilon = \sqrt{\left(\frac{\kappa \tau^{2/\kappa}}{\kappa - 1} \right) \left(\frac{1 - \beta^4}{1 - \beta^4 \tau^{2/\kappa}} \right) \left(\frac{1 - \tau^{(\kappa-1)/\kappa}}{1 - \tau} \right)}$$

κ = isentropic exponent

τ = pressure ratio

β = diameter ratio

Flow calculation formula

$$q_m = \frac{C}{\sqrt{1 - \beta^4}} \varepsilon \frac{\pi}{4} d^2 \sqrt{2 \Delta p \rho_1}$$

$$q_v = \frac{q_m}{\rho_1}$$

q_m = mass flow rate[kg/s]

q_v = volumetric flow rate[m³/s]

ρ_1 = upstream density[kg/m³]

Δp = differential pressure[Pa]

FN Mass Flow Meter(KC-7730B)

◆Simply select to suit the application

Application	Type		Mass Flowmeter	
			FN-MASS FLOWMETER	
Object of Measurement	Liquid		O	
	Gas		O	
	Vaper		O	
	steam		O	
Application	control		O	
	Monitor		O	
	Supply		O	
Operating condition	Temperature		Gas	– 40 to 100°C (Option:400°C)
			Liquid & Oil	–40 to 100°C(Option:400°C)
			Steam	–20 to 200°C(Option:400°C)
	Pressure		10 barg / 30 barg / Max 200 barg	
	Pressure loss		Negligible	
	Range ability		Large	
Installing condition	Bore		Ø10 to Ø500	
	Straight	upstream	7D	
	Pipe length	downstream	3D	
	Piping work		Required	
	Explosion-proofing		O	
Performance	Accuracy		Gas	±0.5% F.S(Option: 0.1%)
			Liquid & Oil	±0.5% F.S(Option: 0.1%)
			Steam	±0.5% F.S(Option: 0.1%)
	Velocity		Gas	0.1~100 m/s
			Liquid & Oil	0.1~100 m/s
			Steam	0.1~100 m/s

FN Mass Flow Meter(KC-7730B)

◆ Digester Biogas

Sewage treatment plants, livestock manure, landfills, and food waste biogas

We are experiencing significant difficulties due to problems with biogas flow meters currently installed nationwide.

Our FN mass flow meter is a viable alternative to imported flow meters.

It eliminates hunting and offers high accuracy when measuring biogas containing contaminants such as moisture, particles, and dust.

◆ Orderer: Cheongju Environmental Business Office ~ 1 unit

- Fluid: Biogas
- Pipe Diameter: 350A (Digester Main)
- Fluid Temperature: 25~40°C
- Flow Rate: 50~1,000 Nm³/h
- Operating Pressure: 50~300 mmAq
- Design Pressure: 500 mmAq
- For measurement at the rear of the digester tank

◆ Environmental Management Corporation Project

- Fluid: Biogas
- Pipe Diameter: 100A (Gas Holder Main)
- Flow Rate: 50 ~ 500 Nm³/hr
- Fluid Pressure: 50 ~ 250 mmH₂O
- Fluid Temperature: 40 ~ 60°C
- Delivery Quantity: 1 Set

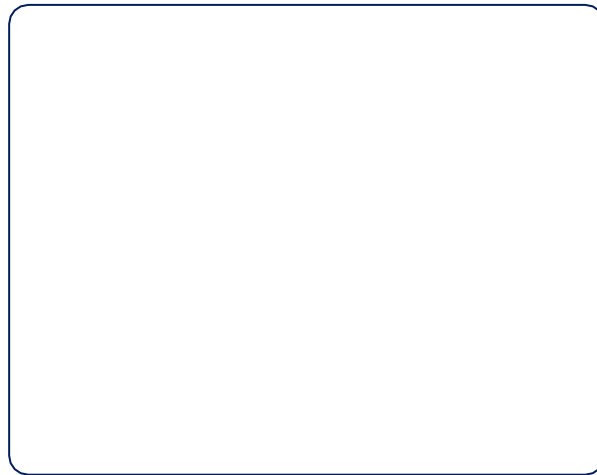
Based on the expertise accumulated over the past 15 years in supplying thermal mass flow meters in the anaerobic biogas field, this is a domestically developed differential pressure mass flow meter specifically for biogas. Biogas, which exits the digester tank under natural pressure (25-250 mmH₂O), is not only extremely low pressure, but also contains significant moisture, dust, and particles, making it impossible to measure with existing flow meters.

Our FN mass flow meter has proven to be the optimal solution by addressing these issues through a program.

◆ Why Existing Flow Meters Cannot Be Used

- Thermal mass flow meters measure using temperature differences, which can lead to moisture-induced flow rate hunting and errors.
- Turbine flow meters cannot be used because the rolling elements that hold the turbine blades in place have corroded.
- Vortex flow meters are designed for high-pressure lines and cannot measure low pressure due to hunting.
- Ultrasonic flow meters are very expensive and require maintenance due to contaminants, resulting in poor accuracy.
- Conventional simple differential pressure flow meters cannot measure low pressure lines and errors occur due to temperature and pressure in each season..

**Air & Gas & Steam & Liquid
Mass Flowmeter
Specialized Manufacturer**



Certified in accordance with

KC Q ISO 9001 : 2015

KC Q ISO 14001 : 2015

GOLDEN RULES Co.,Ltd