

2-5

www.goldenrules.co.kr

FN Mass Flow Meter

(compressed air)

KC-7730A



FN Mass Flow Meter(KC-7730A)

Product Introduction

Golden Rule's KC-7730A high-precision FN mass flow meter is used in industrial settings to detect gas flow and for flow rate adjustment and measurement. This LOK fitting, flange-type, microprocessor-based mass flow meter simultaneously measures, adjusts, and diagnoses flow rates. It supports instantaneous mass flow rates, total flow rates, and environmental settings, and is displayed on a 2 x 16 LCD panel. The programmable transmitter allows for easy configuration via the RS-485S communication port, Golden Rule's high-performance interface software, or the instrument panel display. (Remote control switch setting)

Golden Rule's KC-7730A is designed based on differential pressure flow measurement technology. It features a built-in direct calculation of the flow rate function, considering the compression coefficient, expansion coefficient, and viscosity coefficient, two steps above the conventional temperature and pressure compensation method. This allows the flow meter to provide users with density, enthalpy, and other parameters in addition to the flow rate.

Product Features(For multi-measurement)

- 5-Multi-Measurement: Instantaneous/Totalized, Volume/Mass Flow, Temperature, Pressure, Density, and Heat Indication
- Power Supply: DC 24 V $\pm 10\%$, < 100 mA
- Output Accuracy: $\pm 0.1\%$, $\pm 2.5\ \mu\text{A}$
- Interface (RS-485) for on-site adjustment in case of flow meter malfunction
- Direct mass measurement of the flow function eliminates the need for separate temperature and pressure compensation
- Simple signal processing and calibration in the field
- Built-in direct calculation of the flow function for compressibility, expansion, and viscosity
- Outstanding long-term stability and excellent reproducibility
- Best price-to-performance ratio
- Easy adaptation to different applications
- No moving parts
- Significantly reduces upstream piping requirements (10 to 5D)Wide measurable flow rate range: 20:1 (optional 35:1)Supports compressed air measurement (up to 10 Barg)
- Fast response to flow rate changes (0.1 sec)Up to Capable of measuring high-temperature fluids up to 400°C (optional)
- Automatic flow rate calculation function (4-20 mA input: Basic Mode (optional)
- CE, Ex(IP67)

FN Mass Flow Meter(KC-7730A)

Product Performance

- Accuracy
F.S $\pm 0.5\%$ / R.D $\pm 1.0\%$
(Option : $\pm 0.75\%$ R.D)
- Reproducibility
 $\pm 0.5\%$ of Full Scale
- Sensor Accuracy
< 0.2% of span
- Response Time
< 0.1초
- Measuring Range
(0.1 ~ 100) m/sec

- Functions

Display Indications: Communication: Instantaneous,
Totalized, Volume, Mass,

5-Multi-Measurement (Communication)

Instantaneous, Total, Volume, Mass, Temperature,
Pressure, Density, and Heat

- Turndown Ratio

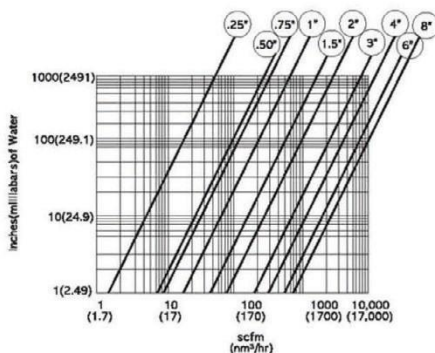
35:1 (Optional 50:1)

Air Flow Ranges(공기 유량 범위)							
Pipe Size (배관경)		Minimum (최소)		Maximum (최대)		Weight (중량)	
A	B	Nm ³ /m	Nm ³ /h	Nm ³ /m	Nm ³ /h	방폭	일반
15A	1/2-inch	0.13	8.0	1.33	80	5kg	3kg
20A	3/4-inch	0.27	16	2.7	160	5kg	3kg
25A	1-inch	0.4	24	120	240	6kg	4kg
40A	1 1/2-inch	0.98	59	9.8	590	7.2kg	5.2kg
50A	2-inch	1.53	92	15.3	920	8.6kg	6.6kg
80A	3-inch	3.3	200	33.3	2000	11kg	9kg
100A	4-inch	5.83	350	58.3	3500	16.2kg	14.2kg
150A	6-inch	12.7	760	127	7600		
200A	8-inch	21.7	1300	217	13,000		

Operating Specifications

- Fluid
compressed air
- Power Supply
DC 24 V $\pm 10\%$, < 100 mA
- Output Signal (Standard)
Linear DC 4 ~ 20 mA HART, 4-Wire, Pulse(Std.)
RS-485 (Option)
- Pressure Drop
0.1 ~ 0.3 Bar

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



FN Mass Flow Meter(KC-7730A)

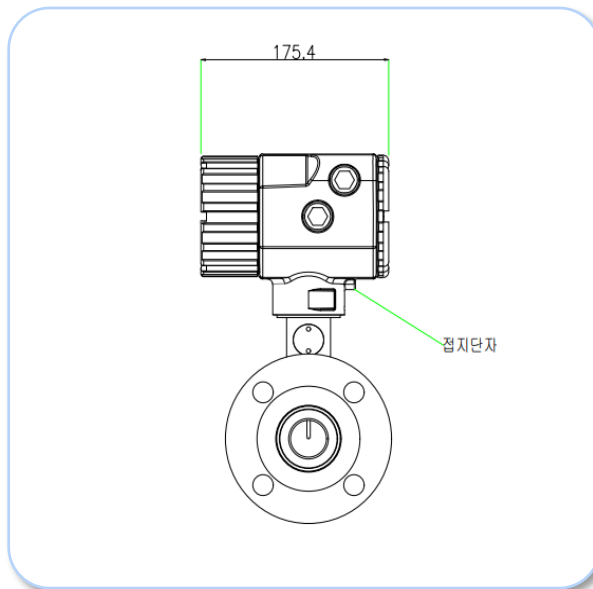
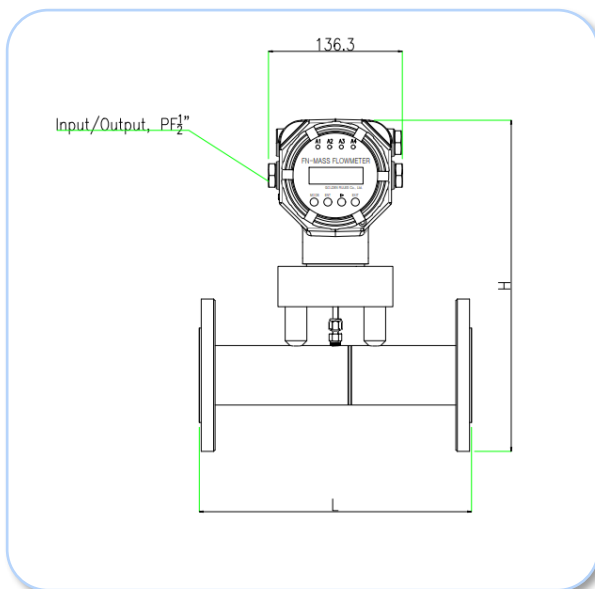
- **Fluid & Environment Temperature**
 - Gas : -40 ~ 100 °C (-50 ~ 212 °F) Optional : -70 ~ 400 °C (-94 ~ 752 °F)
 - Pipe Temperature : 300°C or higher (572°F)
 - Environment : -4 ~ 176 °F (-20 ~ 80 °C) Optional : -70 ~ 100 °C (-94 ~ 212 °F)
- **Fluid Pressure Range (Assembly Part)**
 - Compression Fitting: 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-7730A)

Drawing Dimension Specifications & Diagram I



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

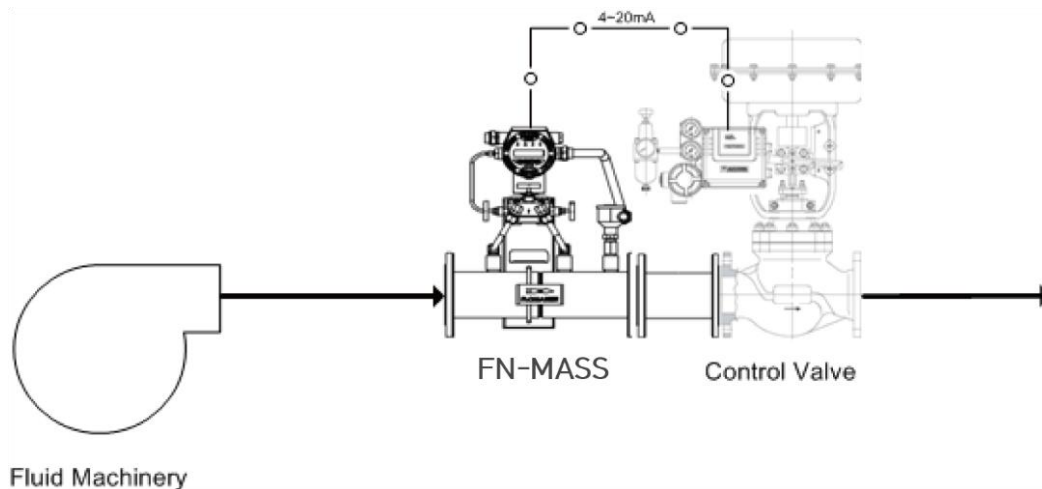
Unit : mm

Size	H	L
15A	375	300
20A	380	300
25A	390	300
32A	402	300
40A	406	300
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-7730A)

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-7730A)

Vertical pipe length required for measurement			
Piping condition	KC-7730A 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

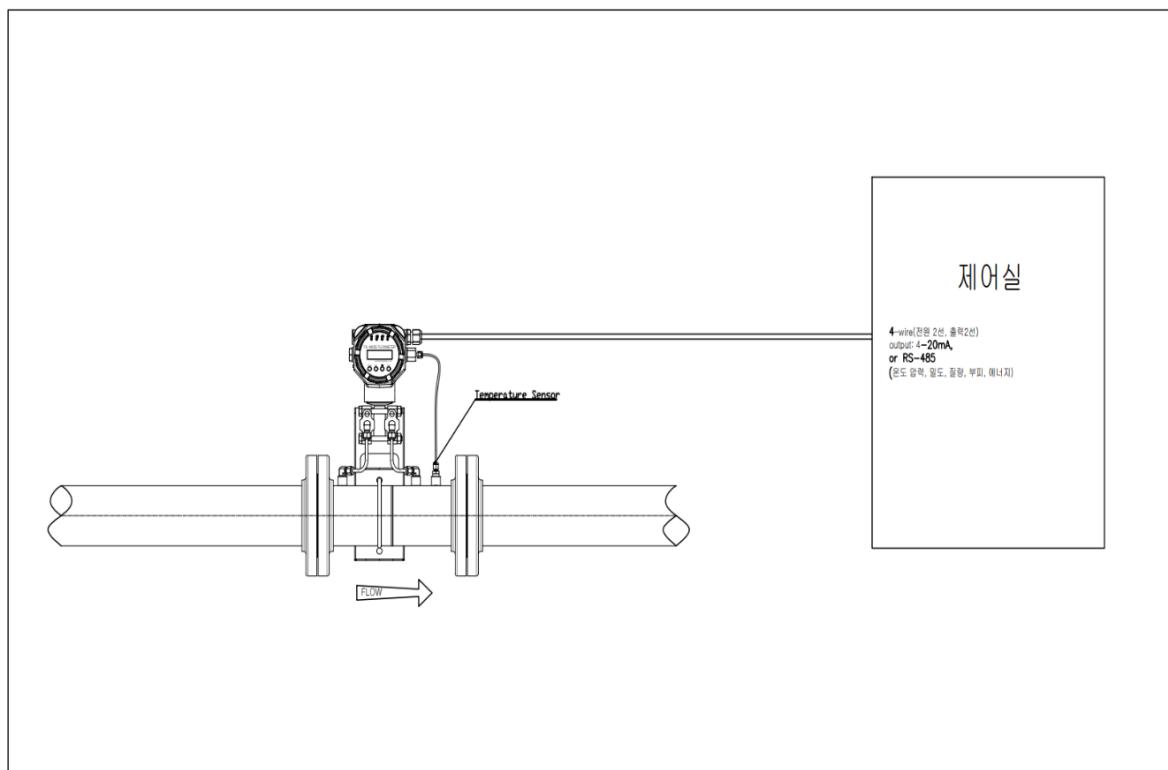
Note :

- 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-7730A)

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-7730A)

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
1/2" (DN15)	1
3/4" (DN20)	2
1" (DN25)	3
1-1/2" (DN40)	4
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 specified	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

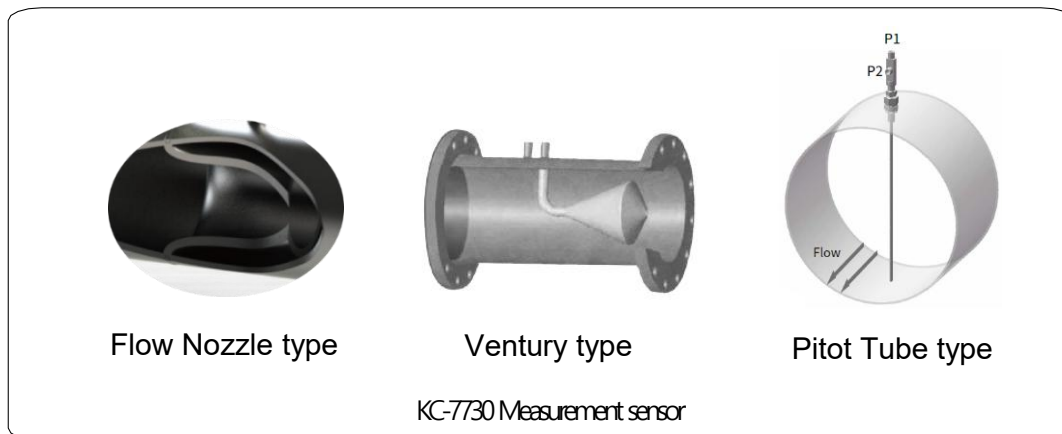
Differential Pressure Mass Flow Sensor

– 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.

FN Mass Flow Meter(KC-7730B)

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	$X = \frac{T}{V} \left(\frac{\partial V}{\partial T} \right)_p = 1 - \frac{T}{Z} \left(\frac{\partial Z}{\partial T} \right)_p$	$X = 0$
Isentropic 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]

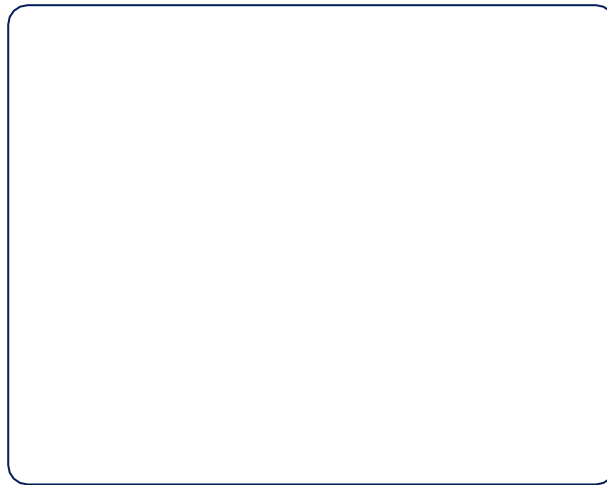
Δp = differential pressure[Pa]

FN Mass Flow Meter(KC-7730A)

◆Simply select to suit the application

Application	Type		Mass Flowmeter	
			FN-MASS FLOWMETER	
Object of Measurement	Liquid		○	
	Gas		○	
	Vaper		○	
	steam		○	
Application	control		○	
	Monitor		○	
	Supply		○	
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 Ø300	
	Straight	upstream	7D	
	Pipe length	downstream	3D	
	Piping work		Required	
	Explosion-proofing		○	
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

**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