

FN Mass Flow Meter (Steam) KC-7730S



FN Mass Flow Meter(KC-7730S)

Product Introduction

Golden Rule's KC-7730 high-precision FN mass flow meter is used in industrial settings to detect steam flow and adjust and measure flow rates.

Available in threaded, LOK fitting, and flange configurations, the microprocessor-based meter simultaneously measures, adjusts, and diagnoses flow rates. Instantaneous mass flow rates, total flow rates, 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-485S communication port, Golden Rule's high-performance interface software, or the instrument panel display (remote control switch). Golden Rule's KC-7730 is designed based on differential pressure flow measurement technology. Its two FN sensors Reduce errors as pressure increases from low to high, 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 takes into account the compression coefficient, expansion coefficient, and viscosity coefficient, which is two steps higher than the existing temperature and pressure compensation method.



• Integrated & Separate KC-7730-S

Product Features

(For multi-measurement)

Multi-measurement: Instantaneous/total, volumetric/mass flow rate, temperature, pressure, density, and heat output.

- Power Supply: DC 24 V $\pm 10\%$, 60 mA / AC100-240 V $\pm 10\%$, 10 watts (optional).
- Output accuracy: $\pm 0.1\%$, $\pm 2.5 \mu\text{A}$.
- Interface (RS-485) allows field adjustment in case of flow meter 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.
- Best price-to-performance ratio.
- Easy adaptation to different applications.
- No moving parts.
- Significantly reduced upstream piping requirements (10 to 5D).
- Wide measurable flow rate range: 20:1 (optional: 35:1).
- Fast response to flow rate changes. (0.1 sec
-)Capable of measuring high-pressure gases (up to 200 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)

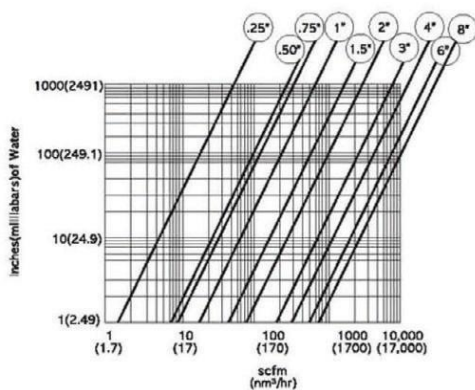
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Product Performance

- Accuracy
F.S. $\pm 0.5\%$ / R.D. $\pm 1.0\%$
(Option: $\pm 0.1\%$ of F.S. / $\pm 0.5\%$ R.D.)
- Reproducibility
 $\pm 0.2\%$ of Full Scale
- Sensor Accuracy
<0.05% of span
- Pressure Compensation
0.1 to 0.2 bar or less
- Response Time
<0.1 sec
- Measuring Range
(0.1 to 100) m/sec
- Functions
Display Instructions: Instantaneous & Total, Volume, Mass Measurement5-Multi-Measurement Communication): Instantaneous, Total, Volume, Mass, Temperature, Pressure, Density, Calorie Measurement
- Turndown Ratio
20:1 (Optional 35:1)

Operating Specifications

- Fluid
Steam
- Power Supply
DC 24 V $\pm 10\%$, <100 Ma
AC 100-240 V (Optional)
- Output Signal (Standard)
Linear DC 4 to 20 mA, HART, 4-Wire, Pulse (Std.)
RS-485 (Optional)
- Pressure Drop0.1 to 0.3 Bar or less



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Steam Flow Range

Pipe Size		Pressure / Temp'		Flow Range (kg/h)		Flow Range (Ton/h)	
A	B	Barg	'C	Minimum	Maximum	Minimum	Maximum
25A	1-inch	6	120	2.85	100		
40A	1 ¼-inch	16	200			1.4	50
40A	1 ¼-inch	8	179			25	80
40A	1 ¼-inch	16	200			2.5	50
50A	2-inch	16-17	200-205	285.71	10,000		
50A	2-inch	8	179			20	120
50A	2-inch	8	150~200	14.28	500		
65A	2 ½-inch	8	179			65	650
65A	2 ½-inch	8	180	57.14	2,000		
80A	3-inch	7.9	179.5	85.71	3,000		
80A	3-inch	4~5	152	57.14	2,000		
100A	4-inch	7.9 7.0 2	179.5	57.14 200 21.42	2,000 7,000 750		
125A	5-inch	7.9	179.5	71.42	2,500		
150A	6-inch	2	133.2	85.71	3,000		
200A	8-inch	7.9	179.5	428.57	15,000	10	100
200A	8-inch	38	400				
250A	10-inch	8	19.56			8	80
250A	10-inch	8	210			1.1	11
250A	10-inch	8	150~200			0.23	8.33
300A	12-inch	8	210	314.28	11,000	1.1	11
400A	16-inch	8	176	1857.14	65,000		

포화증기 유량 범위표 (The quality flow range of saturated steam)

단위[kg/h]

Pressure(Mpa)		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.5	2.0
Temperature(°C)		120.23	133.54	143.62	151.84	158.94	164.96	170.41	175.36	179.88	187.96	198.40	212.37
Density(kg/m³)		1.129	1.651	2.163	2.66	3.170	3.667	4.162	4.655	5.147	6.127	7.602	10.005
25A	Standard Low Limit	14	17	19	22	23	25	27	28	30	33	36	42
	Standard High Limit	140	170	190	220	230	250	270	280	300	330	360	420
32A	Standard Low Limit	26	30	34	38	41	44	47	50	52	57	63	73
	Standard High Limit	260	300	340	380	410	440	470	500	520	570	630	730
40A	Standard Low Limit	31	38	44	48	53	57	60	64	67	73	82	94
	Standard High Limit	310	380	440	480	530	570	600	640	670	730	820	940
50A	Standard Low Limit	52	63	73	81	88	95	101	107	112	122	136	157
	Standard High Limit	520	630	730	810	880	950	1010	1070	1120	1220	1360	1570
65A	Standard Low Limit	90	106	121	134	146	158	168	178	187	204	227	261
	Standard High Limit	900	1060	1210	1340	1460	1580	1680	1780	1870	2040	2270	2610
80A	Standard Low Limit	122	148	170	188	205	221	235	249	261	285	318	365
	Standard High Limit	1220	1480	1700	1880	2050	2210	2350	2490	2610	2850	3180	3650
100A	Standard Low Limit	175	212	242	269	293	315	336	355	374	408	454	522
	Standard High Limit	1750	2120	2420	2690	2930	3150	3360	3550	3740	4080	4540	5220
125A	Standard Low Limit	262	318	363	404	440	473	504	533	561	612	681	783
	Standard High Limit	2620	3180	3630	4040	4400	4730	5040	5330	5610	6120	6810	7830
150A	Standard Low Limit	300	423	484	538	596	631	672	711	747	815	908	1044
	Standard High Limit	3000	4230	4840	5380	5960	6310	6720	7110	7470	8150	9080	10440
200A	Standard Low Limit	700	846	969	1076	1173	1261	1344	1421	1494	1630	1815	2088
	Standard High Limit	7000	8460	9690	10760	11730	12610	13440	14210	14940	16300	18150	20880
250A	Standard Low Limit	1050	1269	1453	1641	1759	1892	2016	2132	2241	2245	2722	3132
	Standard High Limit	10500	12690	14530	16410	17590	18920	20160	21320	22410	22450	27220	31320
300A	Standard Low Limit	1750	2116	2422	2690	2932	3153	3369	3553	3736	4076	4536	5220
	Standard High Limit	17500	21160	24220	26900	29320	31530	33690	35530	37360	40760	45360	52200

FN Mass Flow Meter(KC-7730S)

- **Fluid & Environment Temperature**

Steam: -20 to 200°C (-4 to 392°F) Optional: 210 to 400°C (410 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 Properties: Insulation Index / Density / Viscosity / Enthalpy / Compressibility

- **Fluid Pressure Range (Assembly)**

Compression Fitting: 500 psig (35 barg)

150 lb, JIS 10k RF, PN16 DIN Flange (-40 to 150°C (-40 to 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 to 150 °C (-40 to 302 °F)): 508 psig (35 barg)

- **Liquid Crystal Display**

Display indications: Instantaneous & Totalized, Volume, Mass Measurement

2 x 16 Numerical Character Array 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 to 100) %

Flow Rate Unit: 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 ~ 5

Zero & 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, etc.)

- **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)**

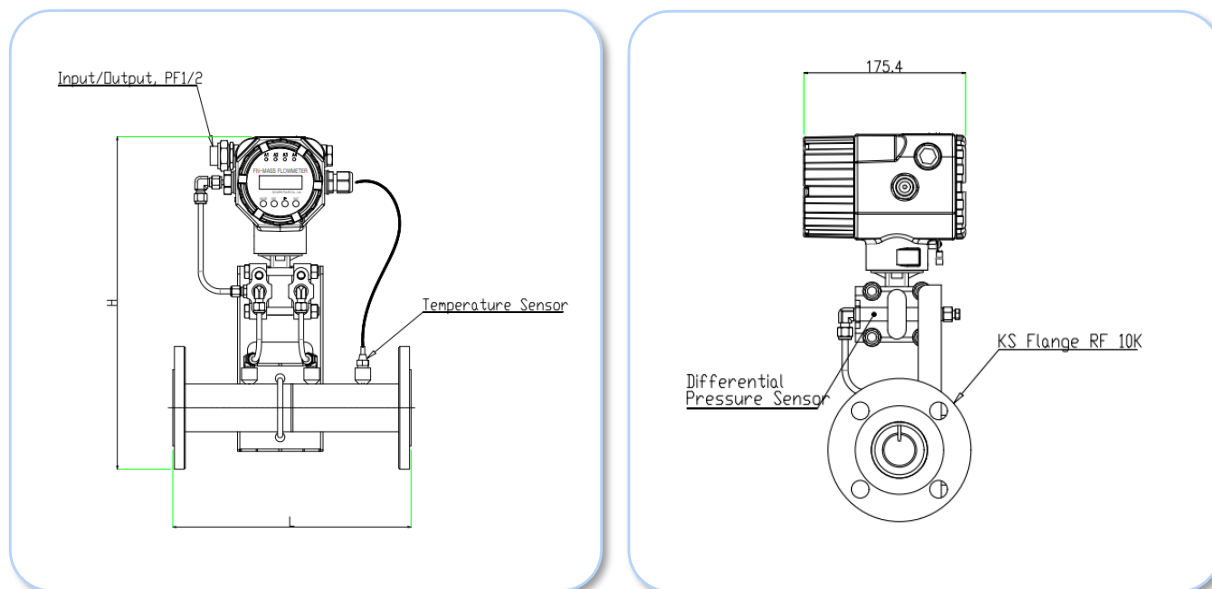
Thread, Cone & Thread Tubing (400 Bar), Lok, ANSI 150lb Flange, JIS 10k RF Flange

- **Certifications**

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

FN Mass Flow Meter(KC-7730S)

Drawing Dimension Specifications & Diagram KC-7730S_ Steam



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

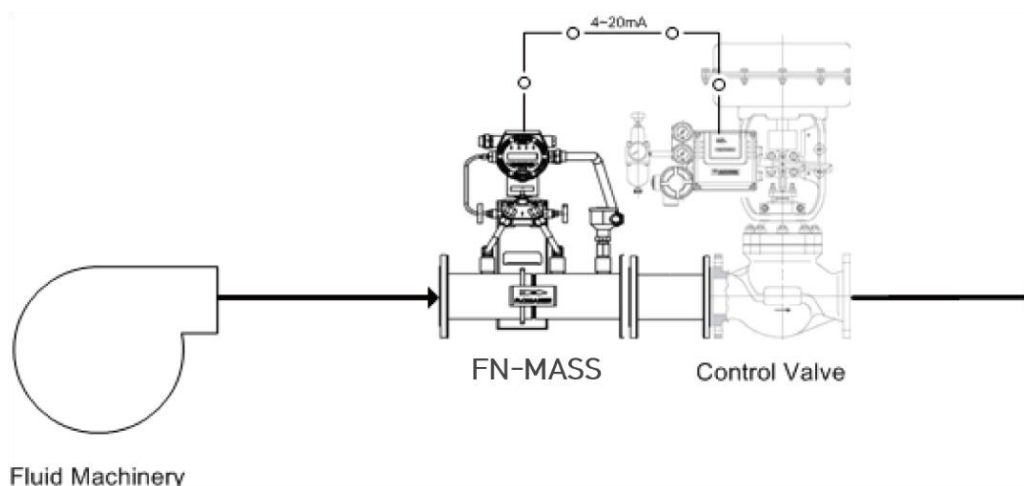
Unit : mm

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-7730S)

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-7730S steam inline type)

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

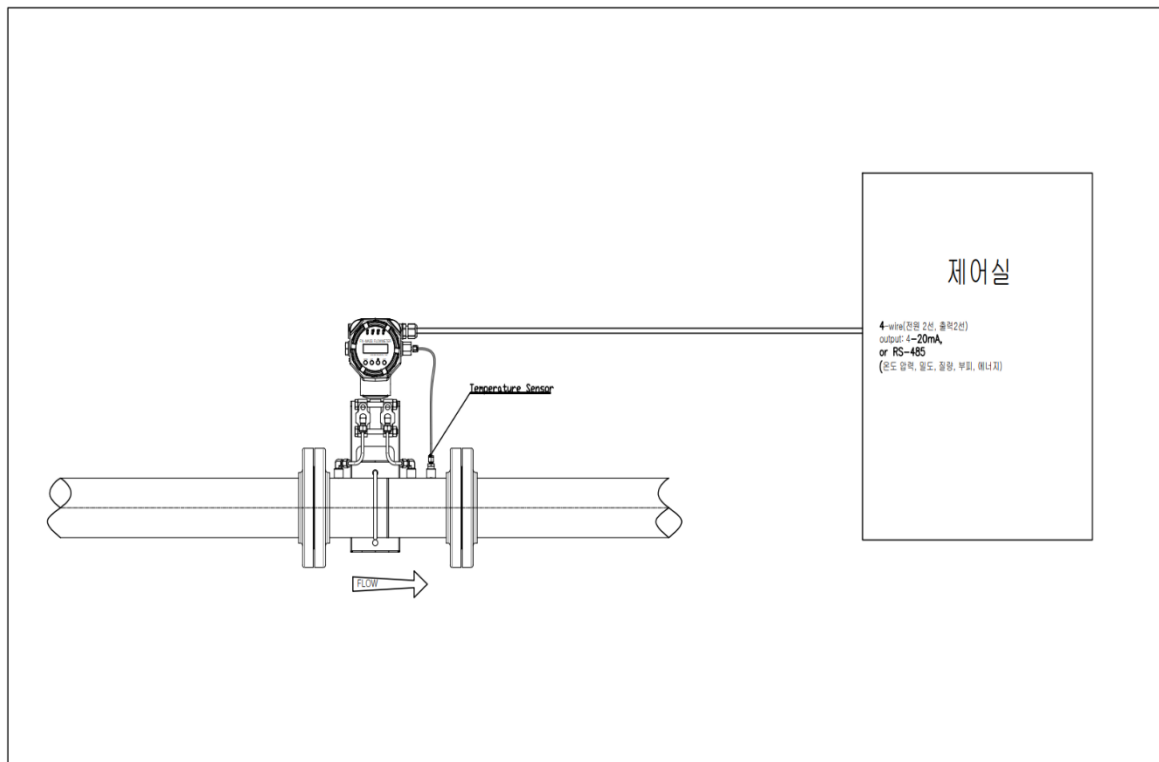
Note :

- 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-7730S)

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-7730S)

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-7730S)

Flow Measurement Principle

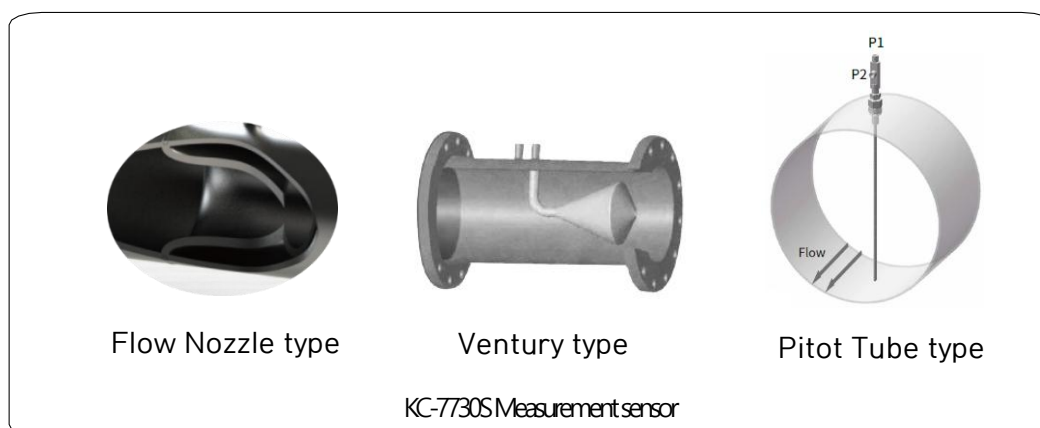
Differential Pressure Mass Flow Sensor

– 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-7730S)

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-7730S)

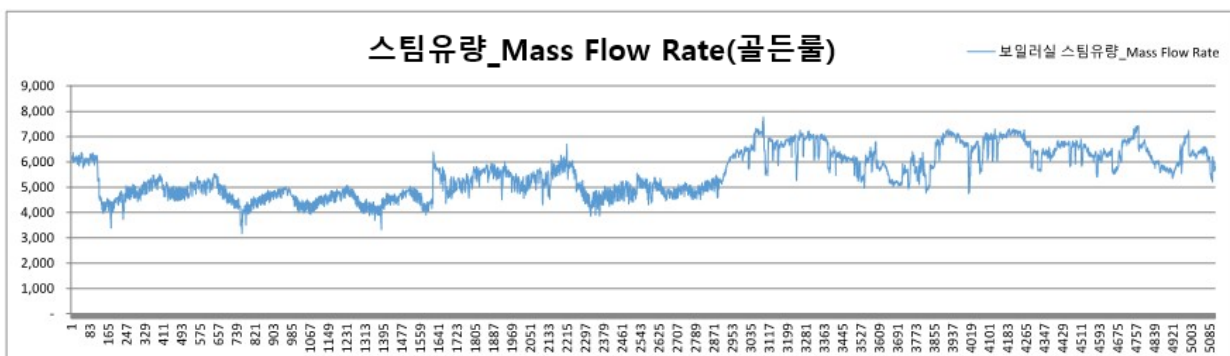
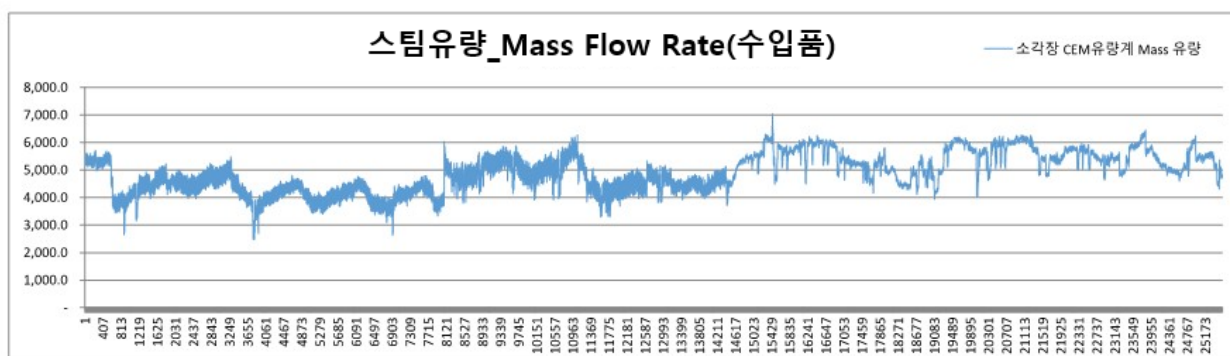
◆Simply select to suit the application

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

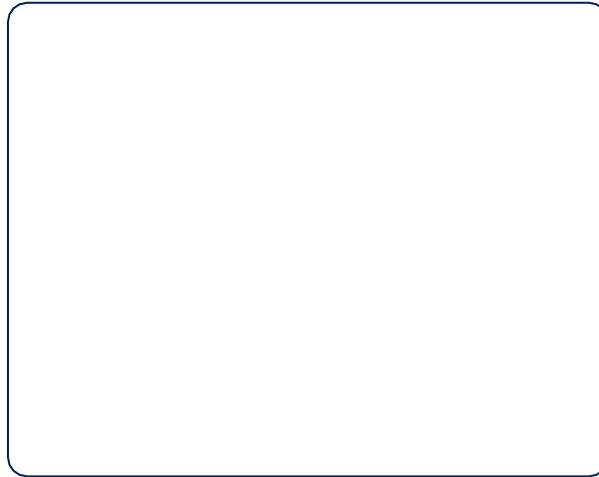
FN Mass Flow Meter(KC-7730S)

◆Steam flow meter comparison data

스팀유량계 비교데이터 (23.03.01 00:00~23.03.20 10:00) 173°C/7.5bar/200A



**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