

■ GENERAL

The **O3000** flowmeter consists of an orifice plate and a metal tube variable area flowmeter (AM3000). It is designed to measure bypass flow by using a small flowmeter attached to the branch pipe, and thus to enable the measurement of flow rates in large pipes at low cost. The indicators are selectable from the local indication type, electric transmitter type, and electric transmitter type with HART® communication.

■ FEATURES

- Cost effective
The measuring method using an orifice plate enables the measurement of flow rates in medium- to large-size main pipes at low cost.
- Omni-direction support (except O3□□□- AP)
Supports all directions from bottom to top, top to bottom, left to right, and right to left.
- HART® communication
- Explosion-proof
Certified by TIIS, KOSHA, NEPSI, ATEX and IECEx.
- Indicator protection category: IP67

■ STANDARD SPECIFICATIONS

- Measured fluid : liquids (up to viscosity 3 mPa.s) and gases in general (not suitable for slurry and steam)
 - Main pipe size : 15 A (1/2") to 300 A (12")
Contact us for 350 A or more.
 - Process connection
 - Screw connection : Rc tapered female thread and NPT female thread, pipe size: 15 A (1/2") to 100 A (4")
 - Flange connection : JIS5KFF/10KFF-RF/20KRF, ANSI/ASME/JPI class:150/300RF, pipe size: 15 A (1/2") to 300 A (12")
 - Wafer connection : JIS5K/10K/20K, ANSI/ASME/JPI class: 150/300, pipe size: 15 A (1/2") to 300 A (12")
- Contact us for specifications other than the above.
- Fluid temperature : -20°C to 120°C (general type), or -20°C to 200°C (high-temperature type)
 - Fluid pressure : up to 2 MPa
 - Maximum differential pressure : 30 kPa (standard) for liquids, or 40 kPa (standard) for gases
 - Indication accuracy : ±5% F.S.
 - Rangeability (scale range) : 10 : 2
 - Indicator protection category : IP67
 - Paint color

Painted part	Color
Measuring tube (only for carbon steel) Indicator body	Jade green (Munsell 7.5 BG4/1.5)
Indicator cover Transmitter	Light gray (Munsell N7.5)



■ MAXIMUM FLOW RATE BY MAIN PIPE SIZE

Main pipe size (JIS)		Flow rate of water in m ³ /h (density 1.0g/cm ³ , viscosity 1.0 mPa·s)				Flow rate of air in m ³ /h (normal) at 0°C, 1 atm							
		Diff. pressure: 30 kPa		Diff. pressure: 50 kPa		Diff. pressure: 40 kPa		Diff. pressure: 50 kPa					
15A	1/2B	0.27	to	1.8	0.27	to	2.3	5.5	to	53	5.9	to	59
20A	3/4B	0.35	to	4	0.38	to	5.1	9	to	110	9.8	to	130
25A	1B	0.46	to	6.8	0.58	to	8.8	14	to	200	15	to	220
32A	1 1/4B	0.75	to	11	0.96	to	14	23	to	330	26	to	360
40A	1 1/2B	1	to	15	1.3	to	20	31	to	450	34	to	500
50A	2B	1.7	to	25	2.1	to	32	49	to	730	54	to	800
65A	2 1/2B	2.7	to	41	3.4	to	53	81	to	1200	89	to	1300
80A	3B	3.6	to	58	4.6	to	75	110	to	1700	120	to	1800
100A	4B	6	to	99	7.7	to	120	190	to	2900	210	to	3100
125A	5B	9.2	to	150	13	to	190	280	to	4500	310	to	4900
150A	6B	14	to	210	18	to	270	400	to	6300	440	to	6900
200A	8B	24	to	360	30	to	470	680	to	11000	750	to	11000
250A	10B	35	to	570	45	to	740	1100	to	16000	1200	to	18000
300A	12B	50	to	820	64	to	1000	1500	to	24000	1700	to	26000

The maximum flow range can be set within the range specified for each main pipe according to the size.

Note 1: The above values are based on the condition when an SGP pipe (JIS G 3452 Carbon steel pipes for ordinary piping) is used for the main pipe. When using other pipes, multiply the above value by the value obtained by (inside diameter of pipe to be used / inside diameter of SGP pipe)².

Inside diameter of SGP pipe

Main pipe size	50A	65A	80A	100A	125A	150A	200A	250A	300A	350A	400A	450A	500A
	2B	2 1/2B	3B	4B	5B	6B	8B	10B	12B	14B	16B	18B	20B
Inside diameter (mm)	52.9	67.9	80.7	105.3	130.8	155.2	204.7	254.2	304.7	339.8	390.6	441.4	492.2

Note 2: The maximum flow range is based on the flow rate of water of 1.0g/cm³ density and 1.0 mPa·s viscosity. When measuring liquids of other density, calculate the value equivalent to water by the following formula and refer to the above table:

$$Q_w = Q \times \sqrt{\frac{\rho_o \times 6.31}{7.31 - \rho_o}}$$

Q_w : Flow rate equivalent to water

Q : Flow rate of the measured liquid

ρ_o : Density of the measured liquid in g/cm³

Note 3: The maximum flow range is based on the flow rate of air at 0°C, 1 atm. When measuring gases in other conditions, calculate the value equivalent to air at 0°C, 1 atm by the following formula and refer to the above table.

$$Q_A = Q \times C_p \times C_t \times C_p$$

Q_A : Flow rate equivalent to air

Q : Flow rate of the measured gas

C_p : Conversion factor for density

$$C_p = \sqrt{\frac{\rho}{1.293}}$$

ρ : Density of the measured gas [kg/m³ (normal)]

C_t : Conversion factor for the temperature

$$C_t = \sqrt{\frac{273+t}{273}}$$

t : Temperature of the measured gas [°C]

C_p : Conversion factor for pressure

$$C_p = \sqrt{\frac{0.1013}{0.1013+p}}$$

p : Pressure of the measured gas [MPa]

MODEL CODE (GENERAL TYPE)

Model code										Detailed specification code			Specifications		
O3	□	□	□	-	□	□	-	□□□	-	□	□	/		□	□
Flow direction of the main pipe	1														Bottom to top
	6														Left to right
	7														Right to left
	8														Top to bottom
Indicator functions	L														Local indication
	E														Electric transmitter
	H														Electric transmitter + HART communication
Explosion-proof	W														Non-explosion-proof
	E														Flameproof
	S														Intrinsic safety
Process connection	- S														Screw connection
	- F														Flange connection
	- W														Wafer connection
Valve part	N														No
	C														Yes
Main pipe size	- 015														15 A (1/2")
	to														to
	- 300														300 A (12")
Measuring tube material	- 1														Class 1: carbon steel
	- 2														Class 2: SUS304
	- 3														Class 3: SUS316
Gasket material	N														Nitrile rubber (NBR)
	F														Fluoro carbon rubber (FPM)
	E														Ethylene propylene rubber (EPDM)
Flameproof certification	/	C	E												NEPSI
	/	E	E												ATEX
	/	J	E												TIIS
	/	K	E												KOSHA
	/	X	E												IECEX
Intrinsic safety certification	/	C	I												NEPSI
	/	E	I												ATEX
	/	J	I												TIIS
	/	K	I												KOSHA
	/	X	I												IECEX
Cable entry	/	M	2												M20×1.5 (F)
	/	G	1												G1/2 (F)
	/	N	1												NPT1/2 (F)

■ MATERIALS (GENERAL TYPE)

Description		Class 1	Class 2	Class 3
Measuring tube	Screw connection	SCS14		
	Flange connection (JIS-10K)	Size: 40 A or less SUS304	SUS304	SUS316
		Size: 50 A or more SS400/SGP		
	Wafer connection (JIS-10K)	Size: 200 A or less SCS14	Size: 200 A or less SCS14	Size: 200 A or less SCS14
Size: 250 A or more SS400		Size: 250 A or more SUS304	Size: 250 A or more SUS316	
Orifice plate		SUS304	SUS304	SUS316
Valve part body/axis		SCS14/SUS316		
Indicator	Body	SUS304	SUS304	SUS316
	Float	SUS316/PTFE		
	Case	ADC12		
Coupling		SCS14		
Strainer		SUS304	SUS304	SUS316
1/2" pipes		SUS304	SUS304	SUS316
1/2" tees		SCS13	SCS13	SCS14
Plug		SUS304	SUS304	SUS316
Half union		SUS316		
Pipeline		SUS304	SUS304	SUS316
Gasket		NBR, FPM, or EPDM	NBR, FPM, or EPDM	NBR, FPM, or EPDM

Abbreviation for materials

NBR : Nitrile butadiene rubber

FPM : Fluoro carbon rubber

EPDM : Ethylene propylene rubber

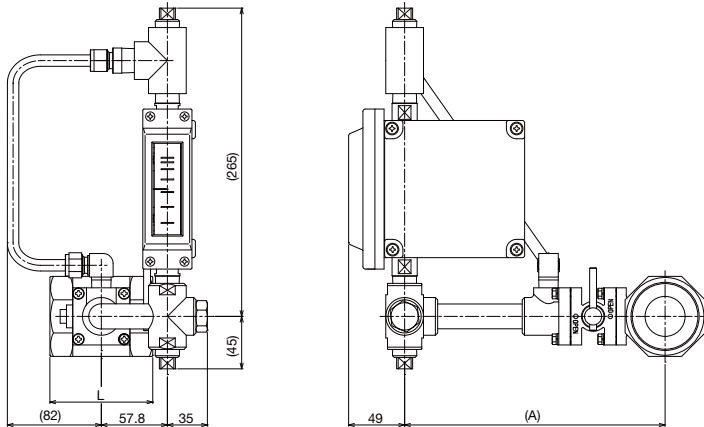
■ TEMPERATURE RANGE (GENERAL TYPE)

Fluid temperature range [°C]	Indicator	Explosion-proof
0 to 120	Internal tube type	Non-explosion-proof, intrinsic safety, flameproof
-20 to 120	External tube type	Non-explosion-proof, intrinsic safety

Maximum fluid temperature [°C]	Gasket material
80	NBR
80	EPDM
120	FPM

DIMENSIONS (GENERAL TYPE)

Screw connection, main pipe size: 15 A to 50 A
Indicator: local indication



Main pipe size	L	(A) ^{*1}	Approx. mass ^{*2} (kg)
15A	70	203	3.8
20A	70	205	3.8
25A	70	209	3.9
32A	74	217	4.1
40A	85	220	4.3
50A	90	228	4.8

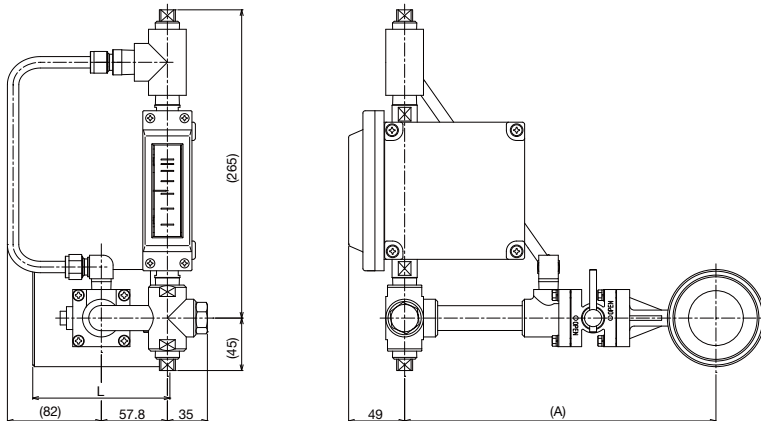
*1 40 mm shorter without the valve part.

Mass of valve part: approx. 0.4kg

100 mm longer for the electric transmitter type.

*2 Including the local indicator and valve part.

Screw connection, main pipe size: 65A to 100 A
Indicator: local indication



Main pipe size	L	(A) ^{*1}	Approx. mass ^{*2} (kg)
65A	120	273	5.6
80A	120	280	6.2
100A	160	295	9.6

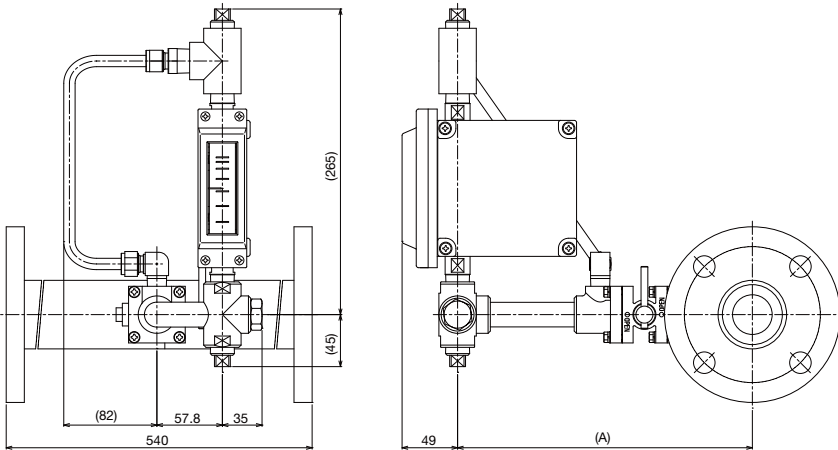
*1 40 mm shorter without the valve part.

Mass of valve part: approx. 0.4kg

100 mm longer for the electric transmitter type.

*2 Including the local indicator and valve part.

Flange connection, main pipe size: 15 A to 300 A
Indicator: local indication

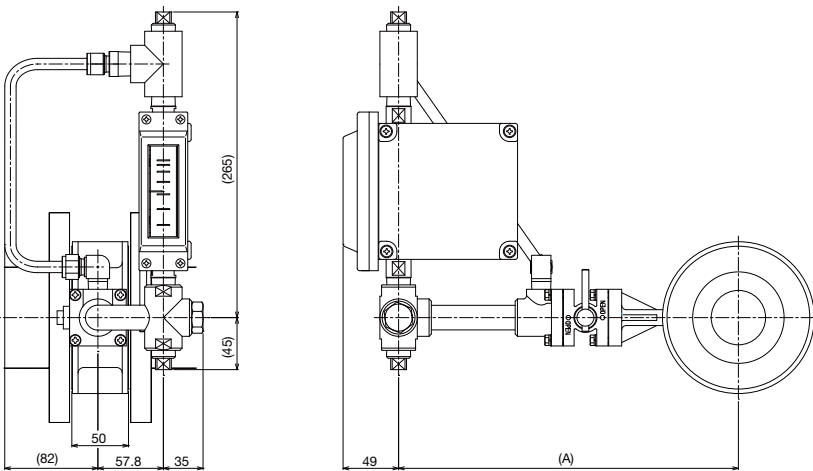


Main pipe size	(A) ^{*1}	Approx. mass ^{*2} (kg)
15A	241	5.8
20A	244	6.4
25A	247	7.6
32A	252	8.7
40A	255	9.2
50A	261	11
65A	269	14
80A	275	15
100A	288	18
125A	300	23
150A	313	30
200A	339	39
250A	364	57
300A	390	65

*1 40 mm shorter without the valve part.
Mass of valve part: approx. 0.4 kg
100 mm longer for the electric transmitter type.

*2 For JIS10K flange rating, including the local indicator and valve part.

Wafer connection, main pipe size: 15 A to 300 A
Indicator: local indication



Main pipe size	(A) ^{*1}	Approx. mass ^{*2} (kg)
15A	259	4.8
20A	262	4.3
25A	270	4.4
32A	272	4.6
40A	278	4.6
50A	285	4.8
65A	295	5.1
80A	300	5.3
100A	313	5.9
125A	328	7.5
150A	343	8.4
200A	365	9.8
250A	397	20
300A	419	21

*1 40 mm shorter without the valve part.
Mass of valve part: approx. 0.4 kg
100 mm longer for the electric transmitter type.

*2 For JIS10K flange rating, including the local indicator and valve part.

MODEL CODE (HIGH TEMPERATURE TYPE)

Model code										Detailed specification code			Specifications
O3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-	<input type="checkbox"/>	<input type="checkbox"/>	-	<input type="checkbox"/>	<input type="checkbox"/>	/	<input type="checkbox"/>	<input type="checkbox"/>	
Flow direction of the main pipe	1												Bottom to top
	6												Left to right
	7												Right to left
Indicator functions	L												Local indication
	E												Electric transmitter
	H												Electric transmitter + HART communication
Explosion-proof	W												Non-explosion-proof
	E												Flameproof
	S												Intrinsic safety
Fixed code				-	A	P							
Main pipe size							-	050					50 A (2")
								to					to
							-	300					300 A (12")
Measuring tube material									-	1			Class 1: carbon steel
									-	2			Class 2: SUS304
									-	3			Class 3: SUS316
Gasket material											N		Nitrile rubber (NBR)
											F		Fluoro carbon rubber (FPM)
											E		Ethylene propylene rubber (EPDM)
Flameproof certification										/	C	E	NEPSI
										/	E	E	ATEX
										/	J	E	TIIS
										/	K	E	KOSHA
										/	X	E	IECEX
Intrinsic safety certification										/	C	I	NEPSI
										/	E	I	ATEX
										/	J	I	TIIS
										/	K	I	KOSHA
										/	X	I	IECEX
Cable entry										/	M	2	M20×1.5 (F)
										/	G	1	G1/2 (F)
										/	N	1	NPT1/2 (F)

Contact us for main pipes for the top-to-bottom flow direction.

■ MATERIALS (HIGH TEMPERATURE TYPE)

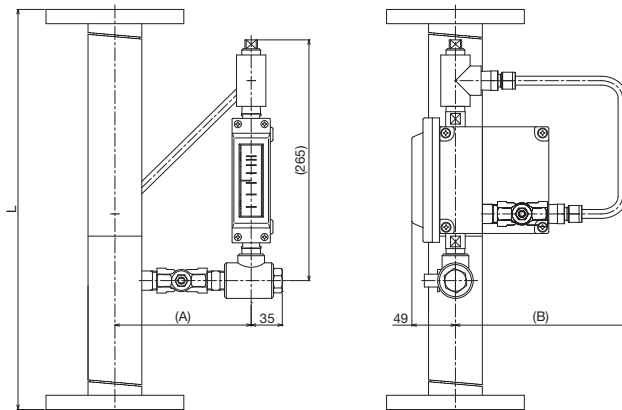
Description		Class 1	Class 2	Class 3
Measuring tube	Flange connection (JIS-10K)	SS400/SGP	SUS304	SUS316
Orifice plate		SUS304	SUS304	SUS316
Indicator	Body	SUS304	SUS304	SUS316
	Float	SUS316/PTFE		
	Case	ADC12		
Strainer body		SUS304 or SCS14	SUS304 or SCS14	SUS316 or SCS14
Strainer		SUS304	SUS304	SUS316
1/2" ball valves		SCS14A		
1/2" pipes		SUS304	SUS304	SUS316
1/2" tees		SCS13	SCS13	SCS14
Plug		SUS304	SUS304	SUS316
Half union		SUS316		
Pipeline		SUS304	SUS304	SUS316
Gasket (strainer part)		NBR, FPM, or EPDM	NBR, FPM, or EPDM	NBR, FPM, or EPDM

■ TEMPERATURE RANGE (HIGH TEMPERATURE TYPE)

Fluid temperature range [°C]	Indicator	Explosion-proof
0 to 135	Internal tube type	Flameproof (TIIS)
0 to 149	Internal tube type	Non-explosion-proof, intrinsic safety, flameproof (other than TIIS)
-20 to 200	External tube type	Non-explosion-proof, intrinsic safety

■ DIMENSIONS (HIGH TEMPERATURE TYPE)

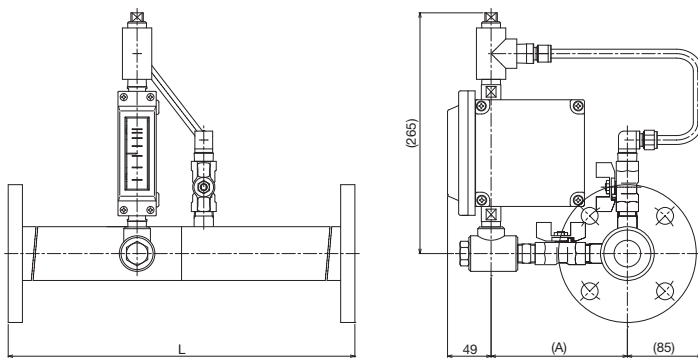
Indicator: local indication
 Flow direction: vertical (bottom to top)



Main pipe size	L ^{*1}	(A)	(B)
50A	540	163	207
65A	540	171	215
80A	540	178	221
100A	540	190	234
125A	540	203	246
150A	540	216	259
200A	540	241	285
250A	620	267	310
300A	690	292	336

*1 For JIS10K flange rating.
 Contact us for the top-to-bottom flow direction.

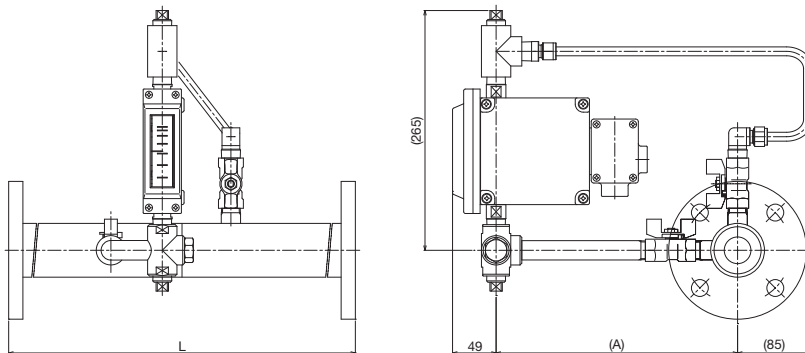
Indicator: local indication
 Flow direction: horizontal (left to right)



Main pipe size	L ^{*1}	(A)
50A	540	163
65A	540	171
80A	540	178
100A	540	190
125A	540	203
150A	540	216
200A	540	286
250A	620	312
300A	690	357

*1 For JIS10K flange rating.
 The above dimensions also apply to the right-to-left flow direction.

Indicator: electric transmitter, non-explosion-proof, intrinsic safety
 Flow direction: horizontal (left to right)



Main pipe size	L ^{*1}	(A)
50A	540	272
65A	540	280
80A	540	286
100A	540	299
125A	540	312
150A	540	374
200A	540	400
250A	620	426
300A	690	451

*1 For JIS10K flange rating.
 The above dimensions also apply to the right-to-left flow direction.

INDICATOR FUNCTIONS

● Local indication

Ambient temperature : -30 to 80°C

Dimensions of the indicator

Internal tube type

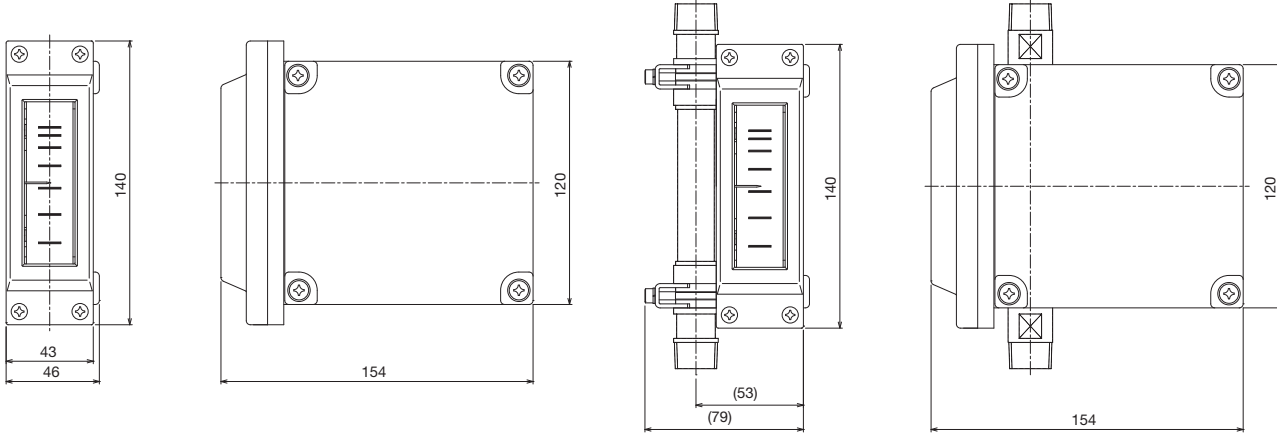
Approx. mass: 1.1 kg

Fluid temperature: 0 to 149°C

External tube type

Approx. mass: 1.2 kg

Fluid temperature: -20 to 200°C



● Local indication + electric transmitter

● Local indication + electric transmitter + HART communication

Power supply voltage : 10 to 30 V DC between transmitter terminals

10 to 28V DC for intrinsically safe circuits

Current output : 4 to 20 mA DC

Effective output range from 4.0 to 21.6 mA, or 22.8 mA under abnormal conditions (3.75 mA also available as an option)

Allowable load resistance : 830Ω or less for electric transmitter (580Ω or less/24 V DC)

230 to 830Ω for electric transmitter + HART communication

(Load resistance of 230Ω or more is required for HART communication.)

The allowable load resistance for each power supply voltage can be determined by following formula:

Allowable load resistance \leq (power supply voltage [V] - 10)/0.024 [Ω] (including the resistance value for the circuit wiring)

Output accuracy : $\pm 1.0\%$ F.S. (against the flow scale)

Temperature change effect : 10 μ A/°C

Low cut off : 0 to 20% (7% F.S. by default)

Damping : 0 to 20s (1s by default)

Cable entry : Non-explosion-proof / intrinsic safety : M20×1.5, G1/2, NPT1/2, water-proof connector

Flameproof : M20×1.5, NPT1/2, packing type cable gland

Note: Use the EXPC-16B flameproof cable gland by Shimada Electric Co. for the TIIS-certified flameproof type.

The diameter of the cable gland attached to our products is $\phi 6$ to $\phi 12$ ($\phi 10$ to $\phi 12$ as standard).

Transmitter structure : Protection category : IP67

Intrinsic safety : Ex ia IIC T3/T4

(temperature class : T4 for TIIS-certified products, T1 to T6 for NEPSI-certified products)

Flameproof : Ex d IIC T3 to T6

(temperature class : T4 for TIIS-certified products, T3 to T4 for NEPSI-certified products)

Ambient temperature : Non-explosion-proof : -20 to 70°C

Intrinsic safety : -20 to 60°C

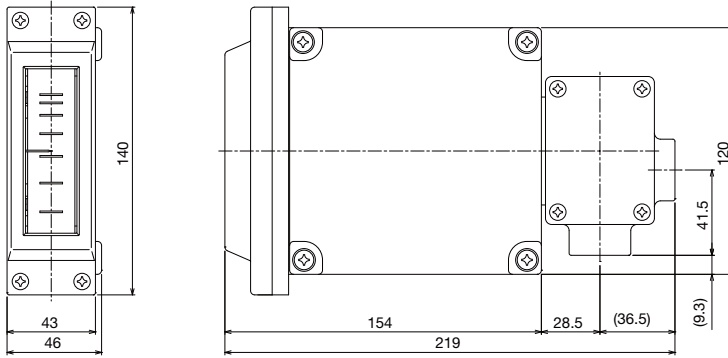
Flameproof : -20 to 55°C for TIIS-certified products, or -20 to 60°C for other certified products

Insulation resistance : 20 MΩ or more/500 V DC (between the power supply batch terminal and the indicator case)

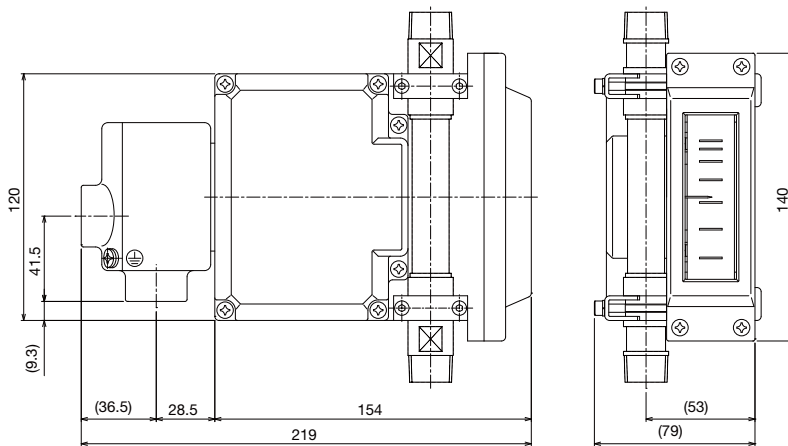
Withstand voltage : 500 V AC/1 min. (between the power supply batch terminal and the indicator case)

Dimensions of the indicator

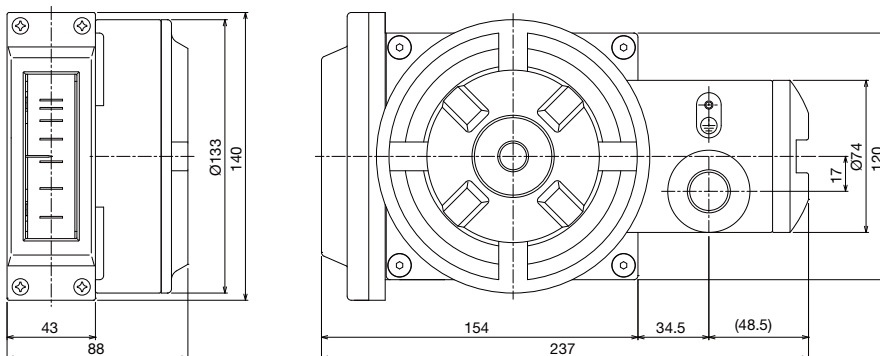
Internal tube type : non-explosion-proof / intrinsic safety (approx. mass: 1.3 kg, fluid temperature: 0 to 149°C)



External tube type : non-explosion-proof / intrinsic safety (approx. mass: 1.5 kg, fluid temperature: -20 to 200°C)

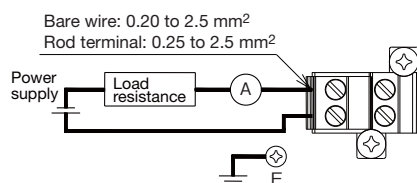


Internal tube type : flameproof (approx. mass: 2.3 kg, fluid temperature: 0 to 149°C)

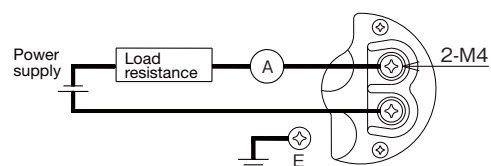


● Terminal and wiring

Non-explosion-proof / intrinsic safety type



Flameproof type



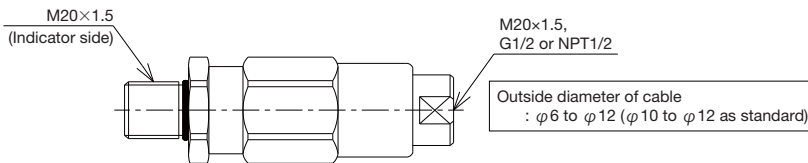
■ FLAMEPROOF TYPE

The flameproof type is selectable from the following options for additional functions such as the electric transmitter type or electric transmitter + HART® communication type.

Certified by	Explosion-proof rating	Fluid temperature	Ambient temperature
TIIS	Ex d IIC T4	-20 to +135°C	-20 to +55°C
NEPSI	Ex d IIC T3 to T6 Gb Ex tD A21 IP6X T85°C	T3: up to +150°C T4: up to +135°C T5: up to +100°C T6: up to +85°C	-20 to +60°C
ATEX	II2G Ex db IIC T6 ... T3 Gb II2D Ex tb IIIC T85°C Db		
KOSHA	Ex d IIC T6 ... T3		
IECEX	Ex db IIC T6 ... T3 Gb Ex tb IIIC T85°C Db		

Note: Use the dedicated packing type cable gland specified below for the TIIS-certified flameproof type.

- Cable gland for the TIIS-certified flameproof type: EXPC-16B by Shimada Electric Co.



■ INSRINSC TIC SAFETY TYPE

The intrinsic safety type is selectable from the following options for additional functions such as the electric transmitter type or electric transmitter + HART® communication type.

Certified by	Explosion-proof rating	Fluid temperature	Ambient temperature
TIIS	Ex ia IIC T4	Internal tube type : up to +150°C External tube type : up to +165°C	-20 to +60°C
NEPSI	Ex ia IIC T1 to T6 Gb	Internal tube type : T3 to T6: up to +150°C External tube type : T1 to T6: up to +430°C *	-20 to +60°C
ATEX	II2G Ex ia IIC T3/T4 Gb	Internal tube type : T4: up to +150°C External tube type : T4: up to +165°C T3: up to +200°C	-20 to +60°C
	II2D Ex ia IIIC T150°C Db	Internal tube type : up to +150°C External tube type : up to +200°C	-20 to +50°C
KOSHA	Ex ia IIC T3/T4	Internal tube type : T4: up to +150°C External tube type : T4: up to +165°C T3: up to +200°C	-20 to +60°C
IECEX	Ex ia IIC T3/T4 Gb	Internal tube type : T4: up to +150°C External tube type : T4: up to +165°C T3: up to +200°C	-20 to +60°C
	Ex ia IIIC T150°C Db	Internal tube type : up to +150°C External tube type : up to +200°C	-20 to +50°C

* This product supports fluid temperatures of up to 200°C.

- Intrinsic safety rated values for the electric transmitter type, and electric transmitter + HART® communication type.

	Rated value
Maximum voltage for the intrinsically safe circuit	28 V DC or less
Maximum current for the intrinsically safe circuit	93 mA or less
Maximum power consumption for the intrinsically safe circuit	650 mW or less
Capacitance inside the intrinsically safe circuit	5 nF or more
Inductance inside the intrinsically safe circuit	0.2 mH or more

■ CAUTIONS FOR INSTALLATION

1. Upstream/downstream straight pipe length

Upstream/downstream straight pipe length are required to obtain stable and accurate measurement results.

The required pipe length varies depending on the diameter ratio and piping layout. Refer to JIS Z 8762-2 : 2007 for details.

The following table shows the approximate length required for each pipe.

	Elbow/Tees	Gate valve (full-open)
Upstream straight pipe length	10D	12D
Downstream straight pipe length	4D	4D

- D: Inside diameter of the pipe.
 - The straight pipe length is measured from the upstream surface of the main orifice plate.
2. Flow direction this product covers all directions including bottom-to-top, top-to-bottom, left-to-right, and right-to-left by changing the direction of the indicator part. The direction can be changed with ease on the site.
 3. This product uses magnetic couplings for displacement transmission and therefore can be affected by magnetic fields. Avoid using it on or near magnetic fields and keep it away from magnetic materials.
 4. When using this product next to one another, keep a distance of at least 10cm between the center of the pipes where the indicator is installed, to avoid interference between them. Also keep a distance of at least 20cm from the side of the indicator for operation and maintenance reasons.

* Specification is subject to change without notice.

 TOKYO KEISO CO., LTD.

Head Office : Shiba Toho Building, 1-7-24 Shibakoen, Minato-ku, Tokyo 105-8558

Tel : +81-3-3431-1625 (KEY) ; Fax : +81-3-3433-4922

e-mail : overseas.sales@tokyokeiso.co.jp ; URL : <https://www.tokyokeiso.co.jp>