



# Excellent Vortex Flowmeter SMART TYPE EX DELTA SMART TYPE EX DELTA•DIA

**GENERAL SPECIFICATION  
GS.No.GBD641-9-E**

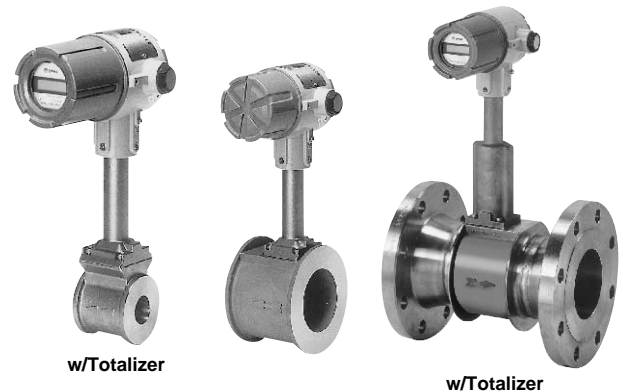
## ■ GENERAL

The smart type EX DELTA has newly been developed being added the following smart functions onto the existing standard type EX DELTA.

i.e.: various conversion computing, intelligent functions those of setting, changing, self-diagnosis and loop check with calling of range and every factor to be entried. Furthermore, additionally provided communication function utilizing a Smart Communication Unit (EL2300), can execute those operations such as setting and calling of each parameter and also communication with an upper ranked computer. There are two types of the sensors, one is fixed type and the other is replaceable type. In case of the latter, check and replace are possible without interrupting of metering flow.

## ■ FEATURES

1. Materialization of 2 wires transmission system for cost reduction and simplification of a system to be applied.



2. Ease to data setting.
3. Maintenance cost saving means increasing of security operation.
4. Maintenance operation such as range and parameter setting, and calibration can be performed.

## ■ GENERAL SPECIFICATIONS

### ● EX DELTA Meter Body

Item		Description		
Sensor type		Fixed sensor	Fixed sensor	Replaceable sensor
Nominal size		10,15, 25, 40, 50, 80, 100, 150mm	50, 80, 100, 150, 200, 250, 300mm	50, 80, 100, 150, 200, 250, 300mm
Body style		Wafer type	Flanged type(RF is standard)	Flanged type (RF is standard)
Flange rating		JIS 10, 16, 20, 30K ANSI/JPI 150, 300		
St'd. connecting pipe		Nominal wall thickness Sch. 40 or Sch.80		
Applicable fluid		liquids, gases and steam*1		
Flow range		See flow range table (P4, 5)		
Operating temp. range		-30~+300°C Nominal size 200~300mm with flange material SFVC2A...0~300°C (Temp. limitation depends on the flange material used)		Standard type :-30~+300°C High temp. type :-30~+420°C However, Min. temp. for Nom. size,200~300mm is specified as 0° due to limitation in material component
Max. operating pressure		Depends on flange rating (Design pressure :5.00MPa)		
Accuracy		Select one from the following two ranges according to the given operating conditions ① ±1% of indicated reading or better * ② ±1% of full scale or better *2 (* : In analog output, ±0.1% of full scale is added)		
Repeatability		±0.2% or better		
Material	Body	SCS14A Nom. size 10mm...SCS14A+SUS316	SUS316 or SCS14A (Nom. size 200~300mm...Flange material is SUS316 or SFVC2A.)	
	Bluff body (Delta shaped)	SUS316 or SCS14A		
	Adapter	SUS304 or SCS13A		
Instauration		No restrictions to cause loss of accuracy on physical orientation (Maintainability and waterproof work for cable entry should be taken into consideration)		
Coating color (Measuring Pipe)		Nominal size 10~300mm :Remains unfinished (because of stainless steel material) Nominal size 200~300mm :Diallyl phthalate resin finished Munsell 7.5G7/2.5 (SFVC2A only)		

\*1:With 10mm,steam measurement is unacceptable. \*2:Accuracy of 10mm in nom.size is ±2% or better with respect to the max. rated flowrate.

### ● EX DELTA•DIA Meter Body

Item		Description		
Sensor type		Fixed sensor	Fixed sensor	Replaceable sensor
Nominal size		15, 25, 40, 50, 80mm	50, 80mm	50, 80mm
Body style		Wafer type	Flanged type (RF is standard.)	Flanged type (RF is standard.)
Flange rating		JIS 10, 16, 20, 30K ANSI/JPI 150, 300		
Materials	Body	SUS316 or SCS14A		
	Bluff body (Diamond shaped)	SUS316		
	Adapter	SUS304 or SCS13A		
Installation		No restrictions to cause loss of accuracy on physical orientation (Maintainability and waterproof work for cable entry should be taken into consideration.)		
Finish (Measuring Pipe)		Remains unfinished (because of stainless steel material)		

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## ■ CONVERTER SPECIFICATIONS

Item	Description	
Model	PA25(No Display)	PA25S (w/Totalizer, Digital Indicator)
Mounting	Select one of the followings : ①Integral with flowmeter ②Separate type (installed on 2" pipe)	
Waterproof construction	IP66 (dusttight/weathertight)-IEC/EN 60529, JIS C 0920 -- NEMA TYPE 4X	
Explosionproof construction	Select one of the followings : ①Non-explosionproof construction                      ③Flameproof construction FM:Class 1, Div.1 Groups B, C & D ②Flameproof construction TIIS: ExdIIB+H <sub>2</sub> T4      ④Flameproof construction CSA:Class 1, Div.1 Groups B, C & D	
Ambient temperature	Non-explosionproof construction : -40~+80°C Explosionproof construction : -20~+60°C	Non-explosionproof construction : -20~+60°C Explosionproof construction : -20~+60°C
Ambient humidity	5~100%RH without dew condensation	
Material	Aluminum alloy	
Housing finish	Finished in baked melamine Finish Munsell 7.5G7/2.5 (Cover : Munsell 10G5/5.5)	
Output	Current signal 2 wires system (Both as Power line) Select one of the followings : ①Scaled pulse Pulse level : 0/1=4/20mADC Pulse width : 10~1000ms (St'd : 50ms) ②Unscaled pulse (Vortex synchro-nized pulse) Pulse level : 0/1=4/20mADC Pulse width : 200μs ③Analog 4~20mADC at 0~FS Time constant : 0~100s (St'd : 2.5s)	
Display (Option)	Display : 7 segments LCD Content : One of the following 4 ways display is possible with switching over of an internal switch or a EL2300 ①Totalizing flow throughput : 6 digits Unit of totalizing : Same as scaled pulse output Unit of flow rate indication : Refer to *2 · Upon power interruption, Totalized counts are held by non-volatilized memory · Totalized counts are resettable by an internal switch or EL2300 ②Actual instantaneous flow rate : 7 digits (3 1/2 digits are effective) Unit of flow rate indication : Refer to *2 ③% Instantaneous flow rate : Unit of display : % FS Discrimination : 0.1% Full scale : Same as that of analog output ④8 scaled % Bar graph Display : % FS Full scale : Same as that of Analog output	
Power supply	12~45V DC (See Load Resistance Range curve) NOTE: If you connect OVAL communication unit EL2300, use a power supply below 35V DC.	
Cable entry	G1/2 internal threads (Flameproof construction TIIS converter is furnished with pressure tight gasketed lead-in) In case of FM/CSA approved flameproof construction, an NPT1/2 female adapter is bonded in place.	
Cable *1	Converter to receiving instrument : 1.25mm <sup>2</sup> Min., 2-conductor shield cable Sensor to converter : 1.25mm <sup>2</sup> Min., 3-conductor shield cable (applicable to separate type) Finished cable outside diameter : Non-explosionproof φ13.5mm Max Flame-proof φ 8.5~ φ11mm	
Transmission length	Converter to receiving instrument : 1km Max Sensor to converter : 200m Max (applicable to separate type)	
Communication	HART Protocol Communication *3	
Computation	· Actual flow rate computation (Liquid, Gas, Steam) · Temp./Press. correcting computation (Gas)	

\*1 : Use cables heat resistant to 70°C or higher.

\*2 : Unit of Totalized flow counts of Flow and Instantaneous Flow rate Indication can be selected from following table.

Unit of Instantaneous Flow rate Unit of Totalized Flow	Computation	
	Actual Flow	Temp./Press Correcting
L/min, L/h, m <sup>3</sup> /min, m <sup>3</sup> /h, kL/min, kL/h	○	×
L, m <sup>3</sup> , kL	○	×
L/min (normal), L/h (normal), m <sup>3</sup> /min (normal), m <sup>3</sup> /h (normal),	×	○
L (normal), m <sup>3</sup> (normal)	○	○
g/min, g/h, kg/min, kg/h, t/min, t/h	○	○
g, kg, t	○	○
ton (US)/min, ton (US)/h	○	○
ton (US)	○	○

\*3 : In case a specification for Pulse output is given, Communication function is available only under the following conditions:

- ① During flow interruption
- ② Upon Power "ON" (Continuous communication is available if started within 15 sec. after Power "ON" )

- Guidelines to set the analog output and indicator full scale are given below:  
3 times the minimum flowrate ≤ Full scale ≤ 1.3 times the max. flowrate  
For minimum and maximum flowrates, refer to the section "Flow Ranges."  
If you want to set up a full scale outside the range above, consult the factory.

●Flange Rating and Max. Operating Pressure (MPa)

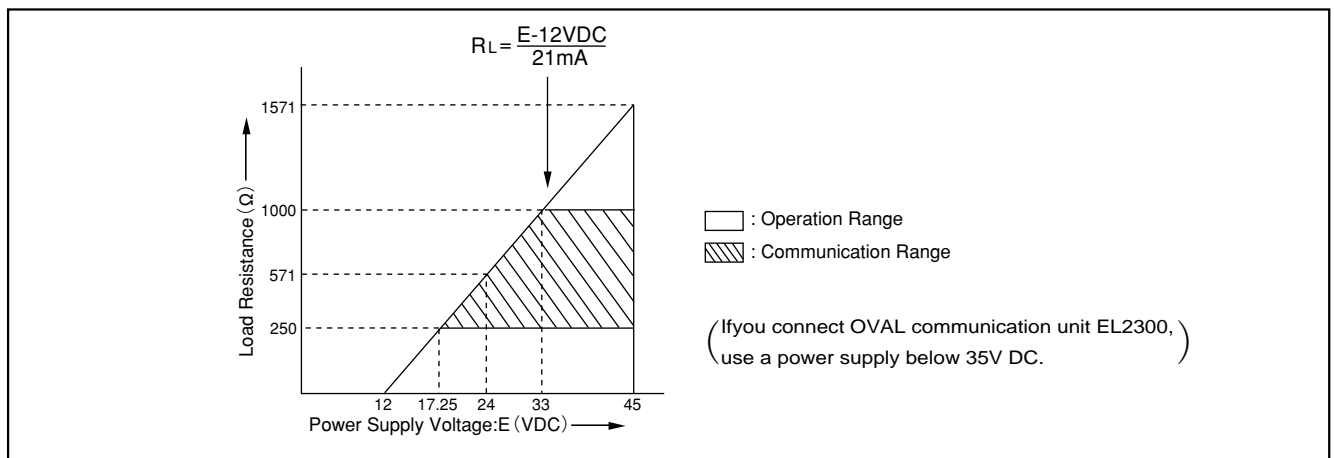
Nominal size 10~300mm(with material SUS316 or SCS14A)

Flange Rating Operating Temperature	JIS10K	JIS16K	JIS20K	JIS30K	ANSI/JPI 150	ANSI/JPI 300
Below 220°C	1.18	1.96	2.45	4.51	1.23	3.20
220~300°C	0.98	1.77	2.26	4.22	1.02	2.91
300~350°C	—	1.57	1.96	3.82	0.84	2.80
350~420°C	—	—	—	2.94	0.56	2.72

Nominal size 200~300mm(with flange material SFVC2A)

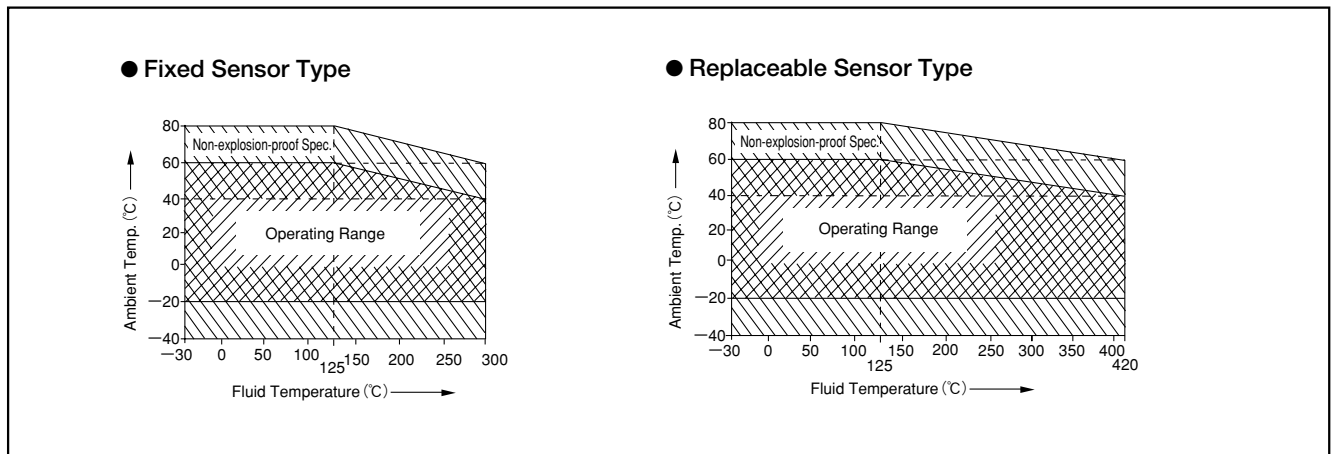
Flange Rating Operating Temperature	JIS10K	JIS16K	JIS20K	JIS30K	ANSI/JPI 150	ANSI/JPI 300
Below 220°C	1.18	2.45	3.04	4.51	1.32	4.31
220~300°C	0.98	2.26	2.84	4.22	1.02	3.87
300~350°C	—	2.06	2.55	3.82	0.84	3.70
350~420°C	—	1.57	1.96	2.94	0.56	2.88

●Acceptable Load Resistance Range



●Ambient Temperature Range

If the fluid temperature exceeds 125°C, derate according to the diagram below.



## ■ SCALED PULSE UNITS AND TOTALIZED INDICATED UNITS

The table below shows the scaled pulse units and conversion into units other than volume flow rate, such as normal flow rate, determine it by referring to Tables A through H.

Applicable Fluid	Nominal Size mm (inch)	Max. Rate m <sup>3</sup> /h (Unscaled pulse freq., Hz)	Nom. Meter Factor L/P (Nom. unscaled pulse unit)	Output Freq. (Hz) *1	Converter PA25		
					Scaled Pulse unit		
					Min.	Standard	Max.
Liquids	10 (3/8)	2.8 (453.8)	0.001714	162Q	0.1 L/P	1 L/P	100 L/P
	15 (1/2)	6.0 (312.2)	0.005338	52.0Q	1 L/P	10 L/P	100 L/P
	25 (1)	20 (344.3)	0.01613	17.2Q	1 L/P	10 L/P	1 m <sup>3</sup> /P
	40 (1 1/2)	48 (292.7)	0.04556	6.10Q	10 L/P	100 L/P	1 m <sup>3</sup> /P
	50 (2)	79 (219.2)	0.1001	2.78Q	10 L/P	100 L/P	10 m <sup>3</sup> /P
	80 (3)	172 (143.6)	0.3328	0.835Q	10 L/P	100 L/P	10 m <sup>3</sup> /P
	100 (4)	296 (108.7)	0.7567	0.367Q	10 L/P	100 L/P	10 m <sup>3</sup> /P
	150 (6)	645 (74.0)	2.422	0.115Q	100 L/P	1 m <sup>3</sup> /P	100 m <sup>3</sup> /P
	200 (8)	1130 (44.7)	7.021	0.0396Q	100 L/P	1 m <sup>3</sup> /P	100 m <sup>3</sup> /P
	250 (10)	1750 (35.9)	13.54	0.0205Q	1 m <sup>3</sup> /P	1 m <sup>3</sup> /P	1000 m <sup>3</sup> /P
300 (12)	2510 (30.0)	23.24	0.012Q	1 m <sup>3</sup> /P	1 m <sup>3</sup> /P	1000 m <sup>3</sup> /P	
Gases	10 (3/8)	8.5 (1378)	0.001714	162Q	1 L/P	10 L/P	100 L/P
	15 (1/2)	33 (1717)	0.005338	52.0Q	1 L/P	10 L/P	100 L/P
	25 (1)	130 (2339)	0.01613	17.2Q	10 L/P	100 L/P	1 m <sup>3</sup> /P
	40 (1 1/2)	290 (1768)	0.04556	6.10Q	10 L/P	100 L/P	1 m <sup>3</sup> /P
	50 (2)	490 (1360)	0.1001	2.78Q	100 L/P	1 m <sup>3</sup> /P	10 m <sup>3</sup> /P
	80 (3)	1380 (1152)	0.3328	0.835Q	100 L/P	1 m <sup>3</sup> /P	10 m <sup>3</sup> /P
	100 (4)	2370 (870.0)	0.7567	0.367Q	100 L/P	1 m <sup>3</sup> /P	10 m <sup>3</sup> /P
	150 (6)	5160 (591.8)	2.422	0.115Q	1 m <sup>3</sup> /P	10 m <sup>3</sup> /P	100 m <sup>3</sup> /P
	200 (8)	9100 (360)	7.021	0.0396Q	1 m <sup>3</sup> /P	10 m <sup>3</sup> /P	100 m <sup>3</sup> /P
	250 (10)	14000 (287)	13.54	0.0205Q	1 m <sup>3</sup> /P	10 m <sup>3</sup> /P	1000 m <sup>3</sup> /P
300 (12)	20100 (240)	23.24	0.012Q	1 m <sup>3</sup> /P	10 m <sup>3</sup> /P	1000 m <sup>3</sup> /P	

## ■ EX DELTA·DIA FACTORED PULSE UNITS

Nominal Size mm (inch)	Max. Rate m <sup>3</sup> /h (Unfactored pulse freq., Hz)	Nom. Meter Factor (L/P)	Correction pulse unit *		
			Minimum	Standard	Maximum
15 (1/2)	6.0 (322.5)	0.005168	1 L/P	10 L/P	100 L/P
25 (1)	20 (375.4)	0.01480	1 L/P	10 L/P	1 m <sup>3</sup> /P
40 (1 1/2)	48 (242.4)	0.05500	10 L/P	100 L/P	1 m <sup>3</sup> /P
50 (2)	79 (190.7)	0.1151	10 L/P	100 L/P	10 m <sup>3</sup> /P
80 (3)	172 (121.1)	0.3946	10 L/P	100 L/P	10 m <sup>3</sup> /P

Note: Unit of a built-in totalizer is same as the correction pulse unit.

## ■ FLOW RANGES

### ● Liquid Service

Select the minimum flow rate from Table A (based on Sp. Gr.) or Table B (based on viscosity), whichever is greater.

**Table A (based on specific gravity): EX DELTA**

Unit in m<sup>3</sup>/h

Size mm \ Sp. Gr.	Minimum Flowrate								Max. Rate
	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	
10	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	2.8
15	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	6
25	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.7	20
40	1.7	1.5	1.4	1.3	1.3	1.2	1.2	1.1	48
50	2.7	2.5	2.3	2.2	2.1	2.0	1.9	1.8	79
80	6.0	5.5	5.1	4.7	4.6	4.6	4.6	4.6	172
100	11	11	11	11	11	11	11	11	296
150	33	33	33	33	33	33	33	33	645
200	68	62	57	54	50	48	46	44	1130
250	149	136	126	118	111	106	101	96	1750
300	214	195	181	169	159	151	144	138	2510

**Table A (based on specific gravity): EX DELTA·DIA**

Unit in m<sup>3</sup>/h

Nominal size mm (inch) \ Sp. Gr.	Minimum Flowrate								Maximum Flowrate
	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	
15 (1/2)	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	6
25 (1)	1.4	1.3	1.2	1.1	1.1	1.0	1.0	0.9	20
40 (1-1/2)	2.4	2.2	2.0	1.9	1.8	1.7	1.6	1.5	48
50 (2)	3.8	3.5	3.2	3.0	2.9	2.7	2.6	2.5	79
80 (3)	8.4	7.6	7.1	6.6	6.2	5.9	5.7	5.4	172

**Table B (based on viscosity)**

Unit in m<sup>3</sup>/h

Size mm	Accuracy \ K. Viscosity	Minimum Flowrate											
		1	2	3	5	10	15	20	25	30	40		
10	±2%FS		0.3	0.4	0.6	1.1	Beyond Measurement						
15	±1%RD	0.8	1.6	2.4	3.9								
	±1%FS	0.4	1.2	1.8	2.9								
25	±1%RD	1.6	3.1	4.6	7.6	16	Beyond Measurement						
	±1%FS				1.8	5.9						11	15
40	±1%RD	2.4	4.7	7.0	12	24	35	Beyond Measurement					
	±1%FS				2.8	6.5	14					22	29
50	±1%RD	3.0	6.0	9.0	15	30	45	60	Beyond Measurement				
	±1%FS				3.6	7.1	15	24				34	42
80	±1%RD		8.9	14	23	45	67	89	110	130			
	±1%FS				11	16	26	38	53	82			
100	±1%RD		12	18	29	58	87	120	150	180	230		
	±1%FS				14	21	28	45	55	96			
150	±1%RD				43	86	130	170	220	260	340		
	±1%FS							41	51	61	100		
200	±1%RD					113	170	230	280	340	450		
	±1%FS								68	81	110		
250	±1%RD						140	210	280	350	420	560	
	±1%FS										140		
300	±1%RD							170	250	340	420	500	680
	±1%FS									180	230		

● In the shadowed area , determine on the basis of specific gravity (Table A).

● RD : Reading, FS : Full Scale

## ●Gas Service

In this table, flow rates are specified in [actual] base. Therefore, in case of [normal] base, make it sure to convert the flow rate to [actual] condition and determine the flow range and the nominal diameter based on this table.

size mm	Accuracy	Dens.kg/m <sup>3</sup>	Minimum flow rate (m <sup>3</sup> /h)									Max. flow rate (m <sup>3</sup> /h)	
			0.38	0.7	1.2	2.0	3.6	6	11	19	34		(60)
Table "C"	10	±2% of Full scale	4.5	3.3	2.6	2.2	1.8	1.5	1.3	1.1	0.9	0.7	8.5
	15	±1% of Reading	—	—	12	7.2	4.0	3.2	2.6	2.2	1.8	1.5	33
		±1% of Full scale	9.4	6.9	5.4	4.6	3.8	3.2	2.6	2.2	1.8	1.5	
	25	±1% of Reading	68	37	22	13	10	8	7	6	5	4	130
		±1% of Full scale	23	17	13	12	10	8	7	6	5	4	
	40	±1% of Reading	110	57	33	20	16	13	11	9	8	6	290
		±1% of Full scale	39	29	23	19	16	13	11	9	8	6	
	50	±1% of Reading	110	73	43	31	26	22	18	15	12	10	490
		±1% of Full scale	63	46	37	31	26	22	18	15	12	10	
	80	±1% of Reading	200	108	80	67	56	47	38	32	26	22	1100( 1380)
		±1% of Full scale	140	101	80	67	56	47	38	32	26	22	
	100	±1% of Reading	260	174	140	115	95	80	66	55	45	37	1850( 2370)
		±1% of Full scale	240	174	140	115	95	80	66	55	45	37	
	150	±1% of Reading	520	380	300	260	210	180	150	120	110	110	4180( 5160)
200	±1% of Reading	900	670	520	440	370	310	250	250	250	250	7000( 9100)	
250	±1% of Reading	2000	1470	1120	980	800	680	560	490	490	490	10500(14000)	
300	±1% of Reading	2900	2100	1600	1400	1150	970	840	840	840	840	15000(20100)	
Table "D"	Type of Gas	Dens. kg/Nm <sup>3</sup>	Gas pressure (MPa (gauge)) at 20°C									Gas viscosity	
	Acetylene	1.175	—	—	0	0.08	0.23	0.55	0.9	1.65	3	—	0.00943 (mPa·s)
	Argon	1.785	—	—	—	0.02	0.12	0.26	0.55	1.05	2	3.6	0.007
	Ammonia	0.771	—	0	0.07	0.21	0.42	0.75	1.45	2.55	4.6	—	0.0092
	Carbon Monoxide	1.250	—	—	0	0.07	0.21	0.42	0.85	1.55	2.8	—	0.0166
	Ethane	1.357	—	—	0	0.06	0.18	0.37	0.8	1.4	2.6	—	0.0085
	Ethylene	1.264	—	—	0	0.07	0.21	0.42	0.85	1.55	2.8	—	0.0097
	Air	1.293	—	—	0	0.07	0.20	0.4	0.85	1.5	2.7	—	0.017
	Oxygen	1.429	—	—	0	0.05	0.17	0.35	0.75	1.35	2.5	4.4	0.0192
	Hydrogen	0.0899	0.35	0.73	1.33	2.3	4.2	—	—	—	—	—	0.0084
	Carbon Dioxide	1.977	—	—	—	0.01	0.1	0.23	0.5	0.95	1.7	3.3	0.0138
	Nitrogen	1.251	—	—	—	0.07	0.21	0.42	0.85	1.55	2.8	—	0.0166
	City Gas	0.802	—	0	0.06	0.17	0.38	0.7	1.4	2.45	4.5	—	0.01
	Natural Gas	0.828	—	0	0.06	0.16	0.37	0.68	1.35	2.4	4.3	—	0.0107
	Freon-12	5.533	—	—	—	—	0	0.02	0.12	0.27	0.56	1.1	0.0127
	Propane	2.020	—	—	—	0.01	0.09	0.22	0.49	0.9	1.7	3.2	0.0075
Butane	2.703	—	—	—	0	0.04	0.14	0.34	0.65	1.2	2.4	0.0069	
Methane	0.717	—	0	0.08	0.2	0.44	0.8	1.55	2.8	—	—	0.0103	

Note: In nominal size 15mm, figures marked © indicate ±2% of Full scale Figures in brackets ( ) in the max. rate indicate with ±1.5% of readings. Accuracy of 10mm in nom.size is ±2% or better with respect to the max. rated flowrate.

### How to Determine the Minimum Flow Rate

Find a value nearest (lower side) to the applicable gas pressure in Table D, follow the same column upwards and find a value intersecting the desired nominal size in Table C for the minimum flow rate. If is desired to determine the minimum flow rate more accurately, calculate it as follows:

#### EXAMPLE 1

Find the minimum flow rate where: Fluid:Air, Temperature:20°C, Pressure:0.5MPa (gauge) and nominal size: 80mm.

SOLUTION:Minimum flow rate at 0.4MPa and 0.85MPa of air with respect to nominal diameter 80mm in Table D are 47m<sup>3</sup>/h and 38m<sup>3</sup>/h, respectively, from Table C. The minimum flow rate at 0.5MPa is therefore determined by proportion as follows:

$$Q_{min}=38+\frac{0.85-0.5}{0.85-0.4}\times(47-38)\approx 45\text{m}^3/\text{h}$$

It can also be determined by calculating the actual density. Actual density of air  $\rho$  at 20°C at 0.5MPa is

$$\rho=1.293\times\frac{273.15}{273.15+20}\times\frac{0.1013+0.5}{0.1013}\approx 7.04\text{kg}/\text{m}^3$$

From Table C, the minimum flow rate at a density of 6 and nominal size 80mm is 47m<sup>3</sup>/h; at a density of 11 is 38m<sup>3</sup>/h. The minimum flow rate at a density of 7.04 therefor can be found by proportion as follow:

$$Q_{min}=38+\frac{11-7.04}{11-6}\times(47-38)\approx 45\text{m}^3/\text{h}$$

#### EXAMPLE 2

Find the minimum flow rate and applicable nominal size where: Fluid:Carbon dioxide, Temperature: 5~30°C, Pressure:0.8~1.5MPa, Max. flow rate:1800m<sup>3</sup>/h(normal)

SOLUTION:First,we find the actual max. flow rate and determine the nominal diameter. If there is some latitude in temperature and pressure, the maximum flow rate should be calculated on the basis of the high end in temperature and in pressure. The actual maximum flow rate is therefore computed as follows:

$$Q_{Max.}=1800\times\frac{273.15+30}{273.15}\times\frac{0.1013}{0.1013+0.8}\approx 228\text{m}^3/\text{h}$$

It follows that the nominal size is 40mm and the minimum flow rate is based on the low end in temperature and in pressure. From Tables D and C, the minimum flow rate at 40mm size and 0.95MPa pressure is 9m<sup>3</sup>/h, at 1.7MPa, it is 8m<sup>3</sup>/h. We then obtain the minimum flow rate by proportional way as

$$Q_{min}=8+\frac{1.7-1.5}{1.7-0.95}\times(9-8)\approx 8.3\text{m}^3/\text{h}$$

NOTE:In cases where obtained results of calculation are figures with decimal places,omit fraction below the decimal point in the maximum flow rate,or count fractions as a whole number in the minimum flow rate.

● Saturated Steam Service

(Accuracy : Better than ±1% Reading) Unit in kg/h (Nom. size 15~40mm) t/h (Nom. size 50~300mm)

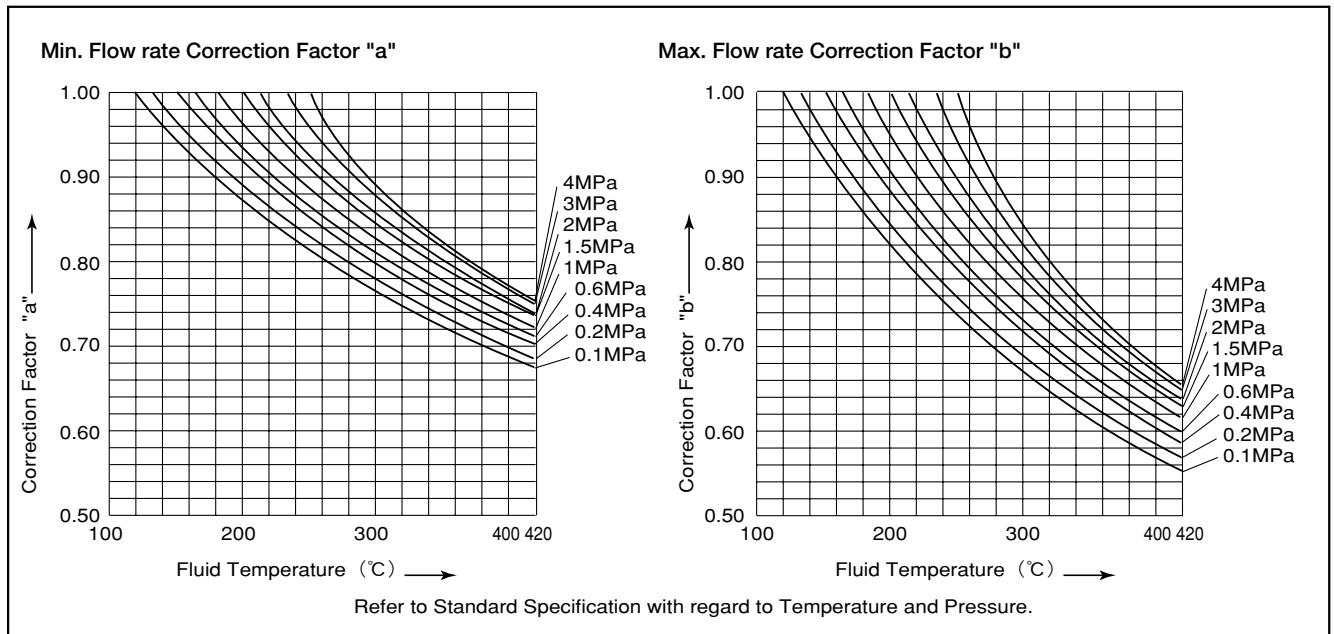
Pressure MPa (gauge)	15mm(1/2")		25mm(1")		40mm(1 1/2")		50mm(2")		80mm(3")		100mm(4")		150mm(6")		200mm(8")		250mm(10")		300mm(12")	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
0.049	△5.5 10	29	14	112	△22 29	250	0.04	0.42	0.08	0.95 (1.19)	0.14	1.60 (2.04)	0.30	3.61 (4.46)	0.52	6.05 (7.82)	1.14	9.09 (12.1)	1.64	12.9 (17.3)
0.098	△6 10	37	20	146	△25 29	326	0.05	0.55	0.09	1.23 (1.55)	0.16	2.08 (2.66)	0.34	4.70 (5.90)	0.59	7.88 (10.1)	1.31	11.8 (15.7)	1.87	16.8 (22.6)
0.196	△8 10	54	21	212	33	475	0.06	0.80	0.12	1.80 (2.25)	0.21	3.03 (3.87)	0.44	6.84 (8.44)	0.77	11.4 (14.8)	1.71	17.1 (22.9)	2.45	24.5 (32.8)
0.294	10	71	24	278	39	620	0.07	1.04	0.15	2.35 (2.95)	0.25	3.95 (5.06)	0.53	8.94 (11.0)	0.92	14.9 (19.3)	2.04	22.4 (29.9)	2.92	32.0 (42.9)
0.392	11	87	27	342	45	764	0.08	1.29	0.17	2.89 (3.63)	0.28	4.87 (6.23)	0.61	11.0 (13.5)	1.06	18.4 (23.8)	2.34	27.6 (36.8)	3.36	39.5 (52.8)
0.490	13	103	30	406	51	906	0.09	1.53	0.19	3.43 (4.31)	0.32	5.78 (7.40)	0.68	13.0 (16.1)	1.19	21.8 (28.2)	2.63	32.8 (43.7)	3.76	46.9 (62.7)
0.588	14	119	34	469	56	1040	0.10	1.77	0.20	3.97 (4.98)	0.35	6.68 (8.55)	0.75	15.1 (18.6)	1.31	25.3 (32.6)	2.89	37.9 (50.6)	4.14	54.2 (72.5)
0.686	15	135	37	532	61	1180	0.10	2.00	0.22	4.50 (5.65)	0.38	7.58 (9.70)	0.81	17.1 (21.1)	1.42	28.6 (37.0)	3.14	43.0 (57.3)	4.50	61.4 (82.2)
0.785	16	151	39	595	65	1320	0.11	2.24	0.24	5.03 (6.32)	0.40	8.47 (10.8)	0.88	19.1 (23.6)	1.53	32.0 (41.4)	3.38	48.1 (64.1)	4.85	68.7 (91.9)
0.883	17	167	42	658	70	1460	0.12	2.48	0.25	5.57 (6.98)	0.43	9.36 (11.9)	0.94	21.1 (26.1)	1.64	35.4 (45.7)	3.62	53.1 (70.9)	5.18	75.9 (101)
0.981	18	183	45	721	74	1610	0.13	2.72	0.27	6.10 (7.66)	0.46	10.3 (13.1)	1.00	23.2 (28.6)	1.74	38.8 (50.1)	3.85	58.3 (77.7)	5.51	83.2 (111)
1.08	19	199	47	784	78	1740	0.13	2.95	0.28	6.63 (8.32)	0.49	11.1 (14.2)	1.05	25.2 (31.1)	1.84	42.2 (54.5)	4.07	63.3 (84.4)	5.83	90.4 (121)
1.18	20	215	50	846	82	1880	0.14	3.18	0.30	7.15 (8.98)	0.51	12.0 (15.4)	1.11	27.2 (33.5)	1.93	45.5 (58.8)	4.28	68.3 (91.1)	6.13	97.6 (130)
1.27	21	230	52	907	86	2020	0.15	3.42	0.31	7.67 (9.63)	0.53	12.9 (16.5)	1.16	29.1 (35.9)	2.03	48.8 (63.0)	4.48	73.2 (97.7)	6.42	104 (140)
1.37	22	246	54	969	90	2160	0.15	3.65	0.33	8.20 (10.2)	0.56	13.7 (17.6)	1.21	31.1 (38.4)	2.12	52.1 (67.3)	4.68	78.3 (104)	6.71	111 (149)
1.47	23	262	57	1030	94	2300	0.16	3.88	0.34	8.72 (10.9)	0.58	14.6 (18.7)	1.26	33.1 (40.9)	2.21	55.5 (71.7)	4.88	83.3 (111)	6.99	119 (159)
1.57	24	278	59	1090	98	2440	0.16	4.12	0.35	9.26 (11.6)	0.60	15.5 (19.9)	1.31	35.1 (43.4)	2.30	58.9 (76.0)	5.08	83.3 (117)	7.27	126 (168)
1.67	25	294	61	1150	101	2580	0.17	4.35	0.37	9.78 (12.2)	0.63	16.4 (21.0)	1.36	37.1 (45.8)	2.38	62.2 (80.4)	5.27	93.4 (124)	7.55	133 (178)
1.77	26	310	63	1220	105	2720	0.18	4.60	0.38	10.3 (12.9)	0.65	17.3 (22.2)	1.41	39.2 (48.4)	2.47	65.7 (84.8)	5.46	98.5 (131)	7.86	140 (188)
1.86	27	326	66	1280	109	2860	0.18	4.83	0.39	10.8 (13.6)	0.67	18.2 (23.3)	1.46	41.2 (50.8)	2.55	69.0 (89.1)	5.64	103 (138)	8.26	148 (198)
1.96	27	342	68	1340	112	3000	0.19	5.07	0.41	11.3 (14.2)	0.69	19.1 (24.5)	1.50	43.2 (53.3)	2.63	72.4 (93.5)	5.82	108 (144)	8.66	155 (207)
2.94	35	502	87	1970	145	4410	0.24	7.45	0.52	16.7 (20.9)	0.90	28.1 (36.0)	1.94	63.5 (78.4)	3.85	106 (137)	7.53	159 (212)	12.8	228 (305)
3.92	43	667	106	2620	175	5860	0.29	9.90	0.63	22.2 (27.8)	1.08	37.3 (47.8)	2.35	84.4 (104)	5.11	141 (182)	9.86	212 (282)	17.0	303 (405)
4.22	45	717	111	2820	184	6300	0.30	10.6	0.66	23.9 (29.9)	1.13	40.2 (51.4)	2.46	90.8 (112)	5.50	152 (196)	10.6	228 (304)	18.2	326 (436)

△: Accuracy:±1% Full scale ( ) :Accuracy:±1.5% Reading

● Superheated Steam Service

The superheated steam flow range is determined by first finding the correction factors "a" and "b" for the min. rate and max. rate, respectively, from the curves below and

then multiplying the applicable nominal diameter and pressure readings in the saturated steam flow range table by these correction factors.



EXAMPLE : Find the flow range of superheated steam where Nominal diameter : 50mm, Pressure : 1MPa (gauge) and Temperature 250°C

SOLUTION : From the curves, correction factors are : a=0.890, b=0.840. So we obtain

Min. flow rate  $Q_{min} = 0.890 \times 130 = 115.7 \text{ kg/h}$   
 Max. flow rate  $Q_{max} = 0.840 \times 2720 = 2285 \text{ kg/h}$

IMPORTANT: 1. In applications where flow rate momentarily exceeds the max. rate, hold that peak value within 1.6 times the max. rating.

2. In a ±1% of full scale specification, if the flow range is  $\frac{\text{Full scale flow rate}}{\text{Min. flow rate}} < 4$ , then a ±2% of full scale is applied.

## ■ SCALED PULSE UNIT FOR FIXED CONVERSION

When it is required that a volume flow rate (flow rate in terms of volume) be reduced to the equivalent flow rate under standard conditions (normal flow rate) or to the mass flow rate in a fixed conversion by multiplying a conversion factor, the scaled pulse unit is determined by the unit selector graphs given below.

\* Available factored pulse units may vary depending on nonstandard models and on the meter factor after meter calibration.

### ● Case 1

1. "Conversion factor" is calculated by the following equation;

$$\text{Conversion factor} = \frac{273.15}{T+273.15} \times \frac{P+0.101322}{0.101322} \times \frac{Z_0}{Z}$$

(Except where significant influence is anticipated, it is assumed that  $Z_0/Z=1$ )

where T=Operating temp. (°C)

P=Operating press. (MPa [gauge])

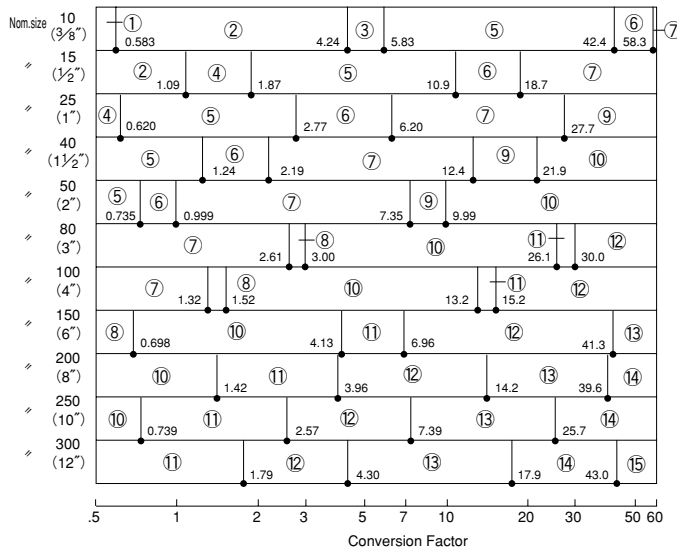
Z<sub>0</sub>=Compressibility coefficient under standard conditions.

Case	Fluid Type	Type of Conversion	Reference
1	Gases	Conversion into standard conditions (normal flow rate)	Tables A, B
2	Saturated Steam	Conversion into mass flow rate	Tables C, D
3	Gases, Superheated steam	Conversion into mass flow rate	Tables E, F
4	Liquids	Conversion into mass flow rate	Tables G, H

Z=Compressibility coefficient under operating conditions.

2. Follow your way to the right in the nominal bore size column of the given meter in Table A and find the segment number (①,②,etc.) that agrees with the conversion factor you have just computed. Example:Nom. size 50mm,  $0.735 \leq \text{⑥} < 0.999$
3. In Table B, find the scaled pulse unit relative to the segment number.

**Table A ● Conversion Factor — Segment Graph**



**Table B ● Segment — Scaled Pulse Output**

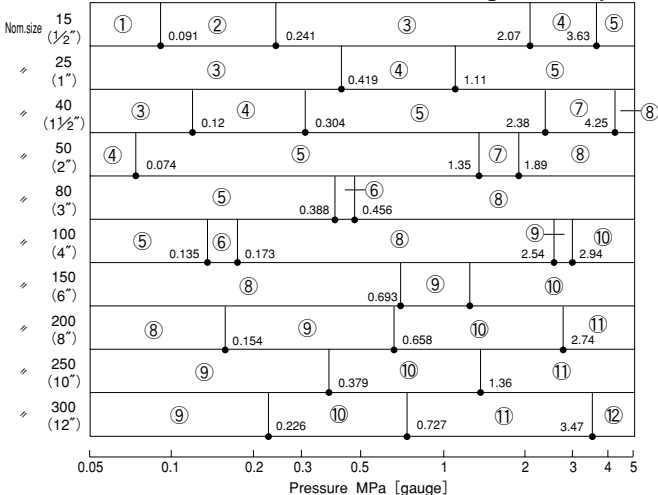
Segment No.	Scaled pulse output unit : [normal]		
	Minimum	Standard	Maximum
①	1 L/P	1 L/P	10 L/P
②		10 L/P	100 L/P
③	10 L/P	100 L/P	100 L/P
④			100 L/P
⑤	100 L/P	1 m <sup>3</sup> /P	1 m <sup>3</sup> /P
⑥			10 m <sup>3</sup> /P
⑦	100 L/P	1 m <sup>3</sup> /P	10 m <sup>3</sup> /P
⑧			100 m <sup>3</sup> /P
⑨	1 m <sup>3</sup> /P	10 m <sup>3</sup> /P	10 m <sup>3</sup> /P
⑩			100 m <sup>3</sup> /P
⑪	1 m <sup>3</sup> /P	10 m <sup>3</sup> /P	1000 m <sup>3</sup> /P
⑫			1000 m <sup>3</sup> /P
⑬	10 m <sup>3</sup> /P	100 m <sup>3</sup> /P	10000 m <sup>3</sup> /P
⑭			10000 m <sup>3</sup> /P
⑮	100 m <sup>3</sup> /P	1000 m <sup>3</sup> /P	100000 m <sup>3</sup> /P

### ● Case 2

1. Follow your way to the right in the nominal size column of the given meter in Table C and find the segment number (①,②,etc.) that agrees with the saturated steam pressure.

2. In Table D, find the scaled pulse unit relative to the segment number.

**Table C ● Pressure(Gase Pressure) — Segment Graph**



**Table D ● Segment — Scaled Pulse Output**

Segment No.	Scaled pulse output unit : [normal]		
	Minimum	Standard	Maximum
①	1 g/P	10 g/P	100 g/P
②	10 g/P	100 g/P	100 g/P
③			1 kg/P
④	100 g/P	1 kg/P	1 kg/P
⑤			10 kg/P
⑥	100 g/P	1 kg/P	100 kg/P
⑦			10 kg/P
⑧	1 kg/P	10 kg/P	100 kg/P
⑨			1 t/P
⑩	10 kg/P	100 kg/P	1 t/P
⑪			10 t/P
⑫	100 kg/P	1 t/P	10 t/P

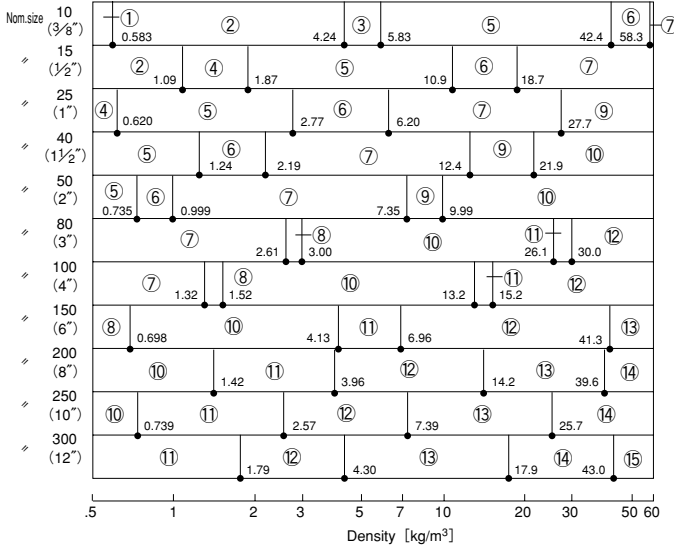


• **Case 3**

1. Follow your way to the right in the nominal size column of the given meter in Table E and find the segment Number (①, ②etc.) that agrees with the density when in use.

2. In Table E, find the scaled pulse unit relative to the segment number.

**Table E • Density — Segment Graph**



**Table F • Segment — Scaled Pulse Output**

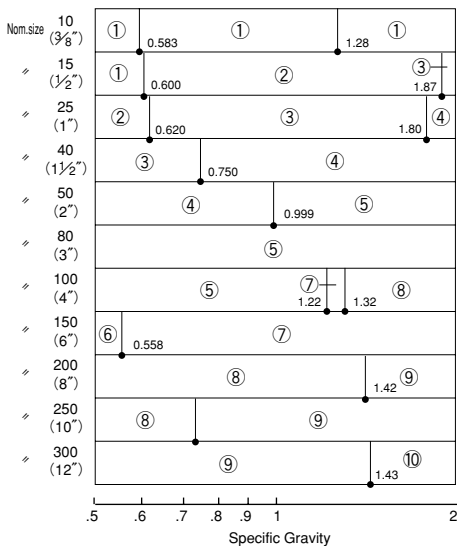
Segment No.	Scaled pulse output unit : [normal]		
	Minimum	Standard	Maximum
①	1 g/P	1 g/P	10 g/P
②		10 g/P	100 g/P
③	10 g/P		100 g/P
④		100 g/P	100 g/P
⑤	100 g/P		1 kg/P
⑥		100 g/P	1 kg/P
⑦	1 kg/P		10 kg/P
⑧		1 kg/P	100 kg/P
⑨	1 kg/P		10 kg/P
⑩		10 kg/P	100 kg/P
⑪	10 kg/P		1 t/P
⑫		10 kg/P	1 t/P
⑬	100 kg/P		10 t/P
⑭		100 kg/P	10 t/P
⑮	100 kg/P		1 t/P

• **Case 4**

1. Follow your way to the right in the nominal size column of the given meter in Table G and find the segment Number (①, ②etc.) that agrees with the density when in use.

2. In Table H, find the scaled pulse unit relative to the segment number.

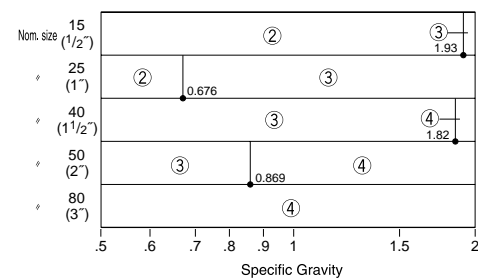
**Table G • Specific Gravity — Segment Graph**  
• EX DELTA



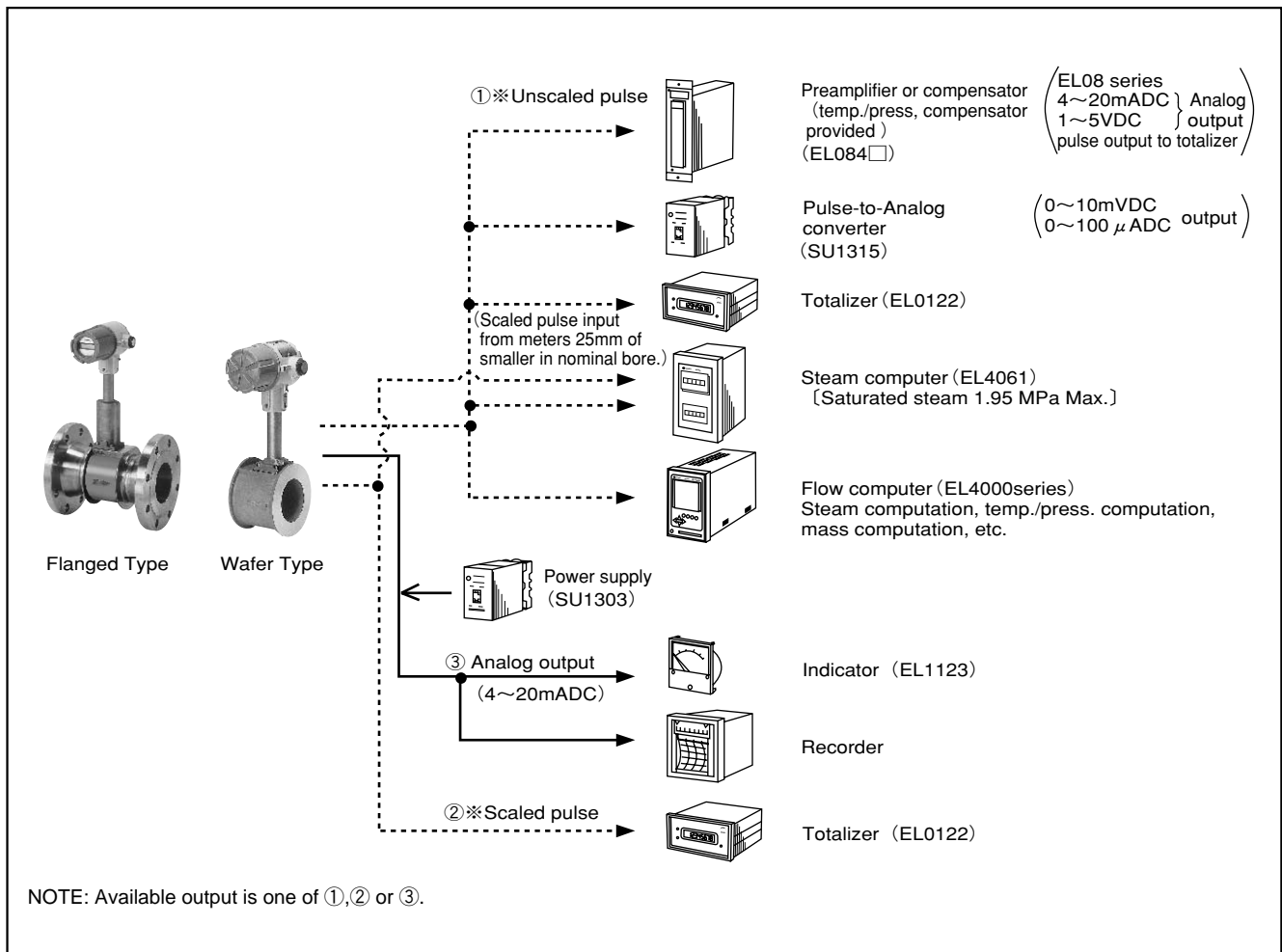
**Table H • Segment — Scaled Pulse Output**

Segment No.	Scaled Pulse Output Unit : [normal]		
	Minimum	Standard	Maximum
①	100 g/P	1 kg/P	10 kg/P
②	1 kg/P	10 kg/P	100 kg/P
③	1 kg/P	10 kg/P	1 t/P
④	10 kg/P	100 kg/P	1 t/P
⑤	10 kg/P	100 kg/P	10 t/P
⑥	10 kg/P	100 kg/P	100 t/P
⑦	100 kg/P	1 t/P	10 t/P
⑧	100 kg/P	1 t/P	100 t/P
⑨	100 kg/P	1 t/P	1000 t/P
⑩	1 t/P	10 t/P	1000 t/P

• **EX DELTA • DIA**



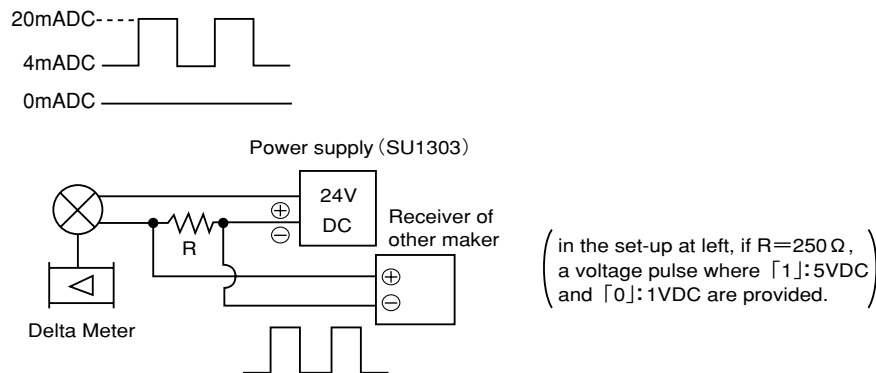
## ■ HOOK-UP WITH RECEIVING INSTRUMENTS



- Shown above are typical examples, Depending on individual applications and specifications, hookup with many other electrical instruments are acceptable.
- For any arrangement with an electrical instrument, indicator, recorder, etc. other than those supplied by OVAL, a 24VDC power supply is required. Use OVAL Model SU1303 power supply.
- As to individual receiving instruments, see respective General Specification sheets.

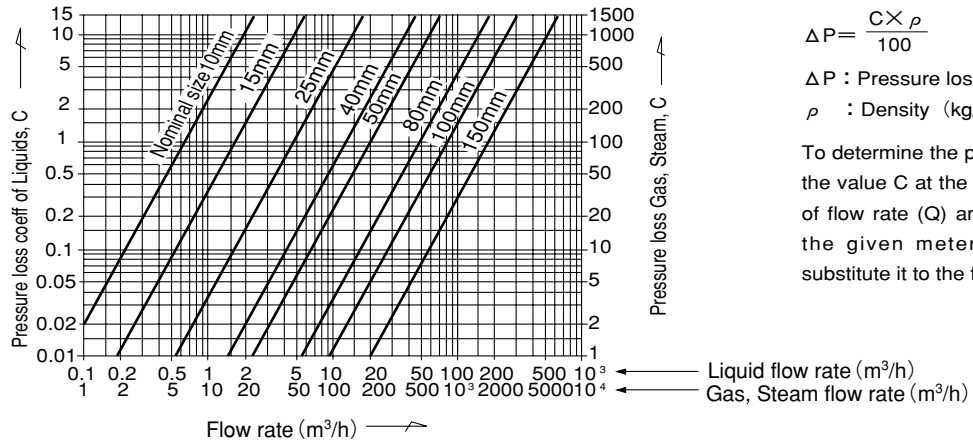
※ That the un-factored and factored pulse output levels are 「1」: 20mADC and 「0」: 4mADC, respectively, means as illustrated below.

Therefore, if you plan to use any instrument designed to accept a voltage pulse signal, couple a resistor in series as shown. The resistance value of load resistor is given in the Acceptance Load Resistance Range on Page 3.

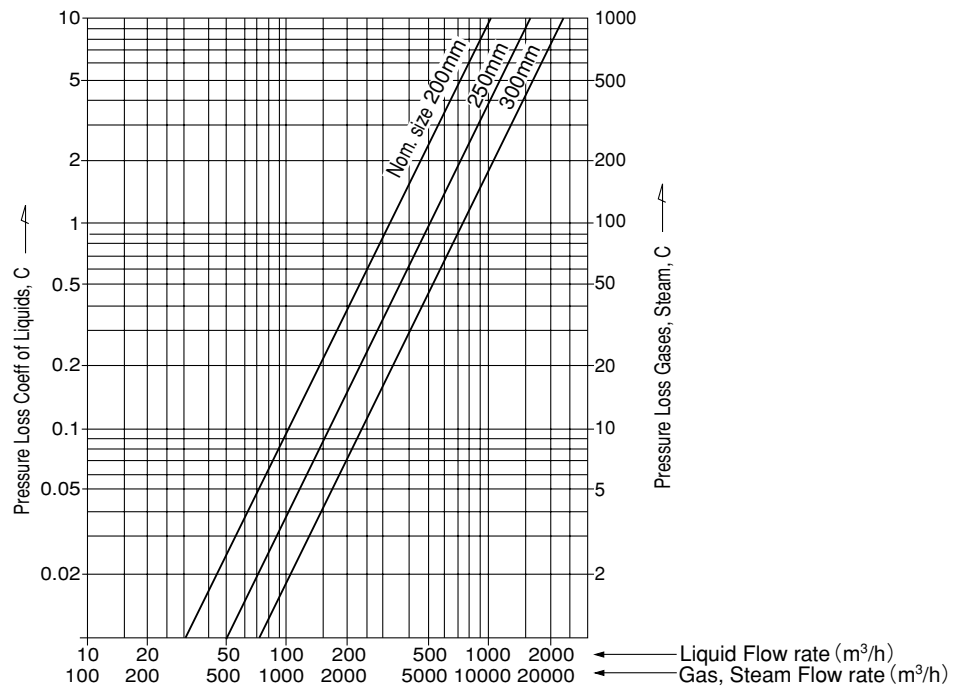


## ■ PRESSURE LOSS

### ● Nominal size 10 ~150mm



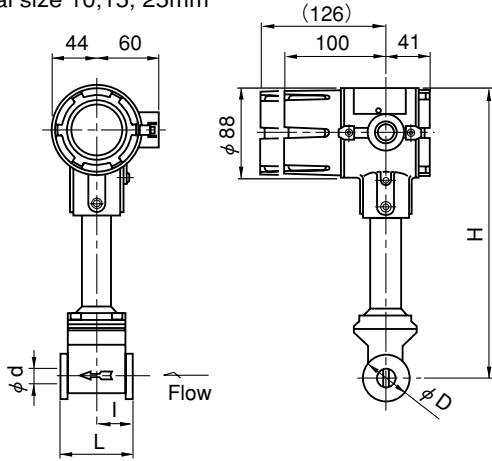
### ● Nominal size 200, 250, 300mm



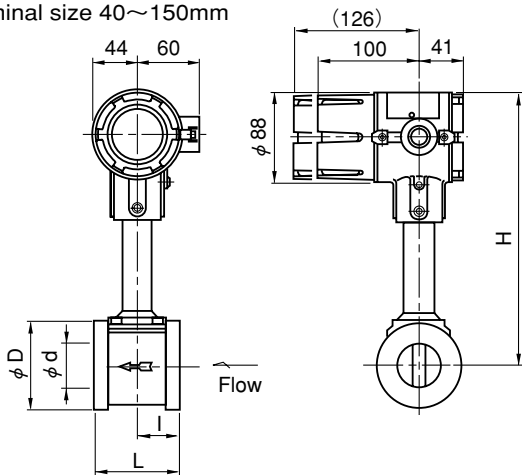
■ EX DELTA OUTLINE DIMENSIONS [INTEGRAL TYPE] (Unit in mm)

**Wafer Type**

- Nominal size 10, 15, 25mm



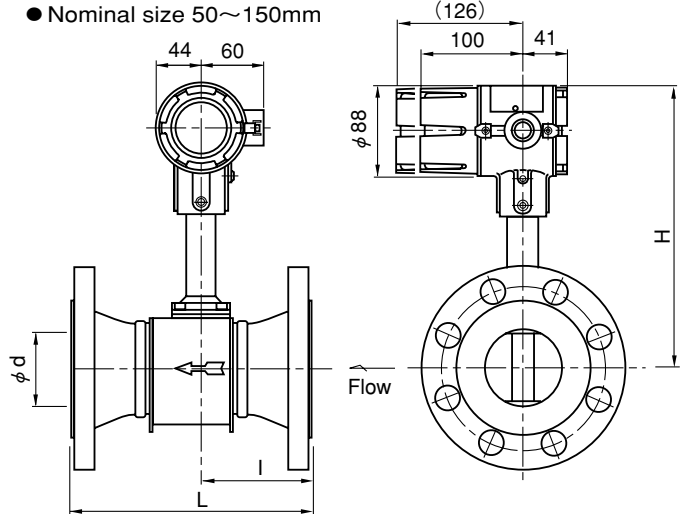
- Nominal size 40~150mm



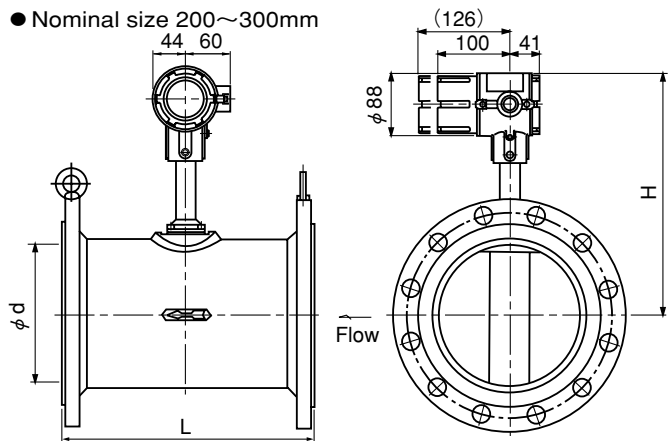
Nominal size mm (inch)	L	I	φd (Meter I.D.)	φD	H	Approx. Mass (kg)	
						No Display	w/Display
10 (3/8")	65	32.5	10	40	277	2.6	2.9
15 (1/2")	65	32.5	14.5	40	277	2.6	2.9
25 (1")	65	32.5	26.6	67	277	3.2	3.5
40 (1 1/2")	80	40	37.6	81	262	3.9	4.2
50 (2")	80	40	48.5	91	266	4.0	4.3
80 (3")	100	40	72.4	126	282	6.8	7.1
100 (4")	125	48	95.2	156.2	302	10.5	10.8
150 (6")	165	54	140.3	214.9	332	20.4	20.7

**Flanged Type**

- Fixed Sensor Type
- Nominal size 50~150mm



- Nominal size 200~300mm



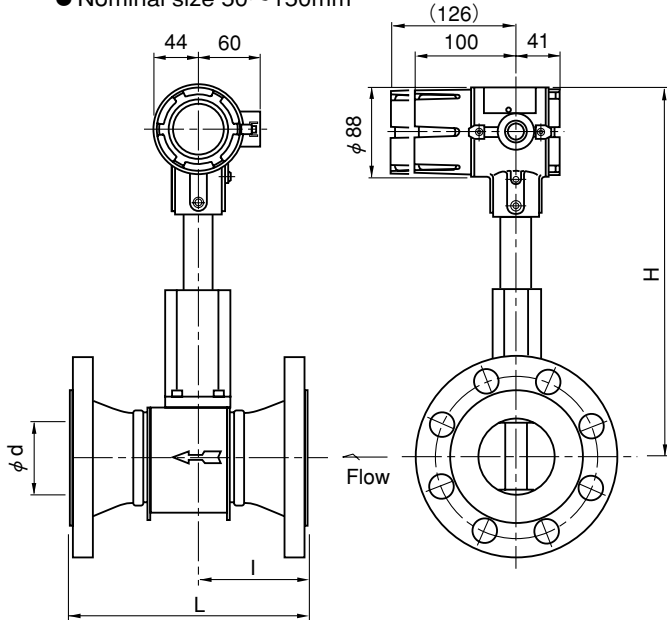
Nominal size mm (inch)	Frange Rating	L	I	φd (Meter I.D.)	H	Approx. Mass (kg)	
						No Display	w/Display
50 (2")	JIS10K	173	86.5	48.5	266	9.0	9.3
	JIS20K(16K)	181	90.5			9.2	9.5
	JIS30K	191	95.5			11.3	11.6
	ANSI 150	204	102			9.9	10.2
	JPI 150	—	—			10.0	10.3
	ANSI 300 JPI 300	217	108.5			11.8	12.1
80 (3")	JIS10K	219	99.5	72.4	282	15.2	15.5
	JIS20K(16K)	233	106.5			17.9	18.2
	JIS30K	243	111.5			21.9	22.2
	ANSI 150	237	108.5			18.0	18.3
	JPI 150	—	—			—	—
	ANSI 300 JPI 300	255	117.5			22.5	22.8
100 (4")	JIS10K	250	110.5	95.2	302	21.2	21.5
	JIS20K(16K)	264	117.5			25.2	25.5
	JIS30K	274	122.5			31.8	32.1
	ANSI 150	274	122.5			26.5	26.8
	JPI 150	—	—			26.6	26.9
	ANSI 300 JPI 300	294	132.5			36.0	36.3
150 (6")	JIS10K	322	132.5	140.3	332	36.2	36.5
	JIS20K(16K)	342	142.5			43.7	44.0
	JIS30K	352	147.5			52.8	53.1
	ANSI 150	340	141.5			66.4	66.7
	JPI 150	—	—			46.5	46.8
	ANSI 300 JPI 300	359	151			46.6	46.9
200 (8")	—	350	—	199.9	347	65.6	65.9
250 (10")	—	450	—	248.8	369	66.0	66.3
300 (12")	—	500	—	297.9	391	38.3	39.1
						68.8	69.1
						88.8	89.1

Note: Figures in the brackets show the dimensions for built-in display

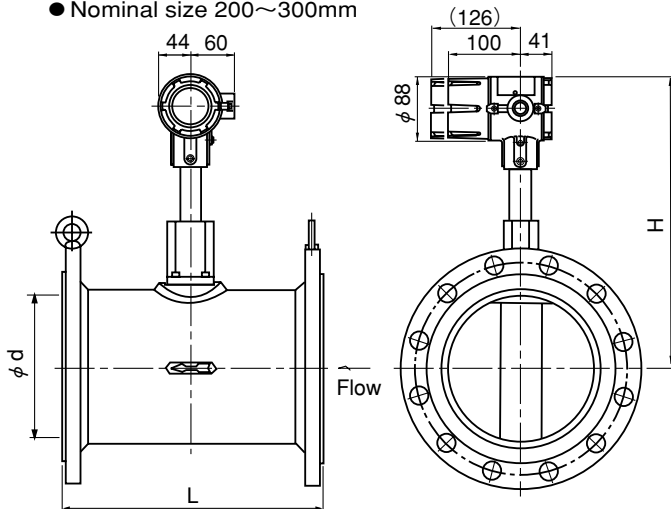
Note: In case of explosionproof construction rated FM/CSA, an NPT1/2 female thread adapter is bonded to the cable connection.

■ Replaceable Sensor Type

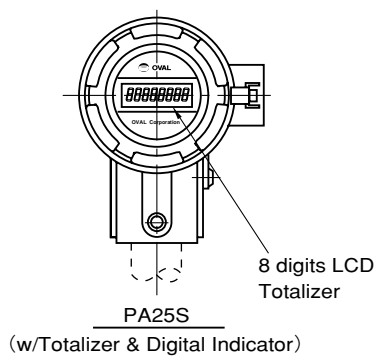
● Nominal size 50~150mm



● Nominal size 200~300mm



● Converter



① Direction of mounting of the converter is changeable with 90° step being rotated around the center of a mounting bracket.

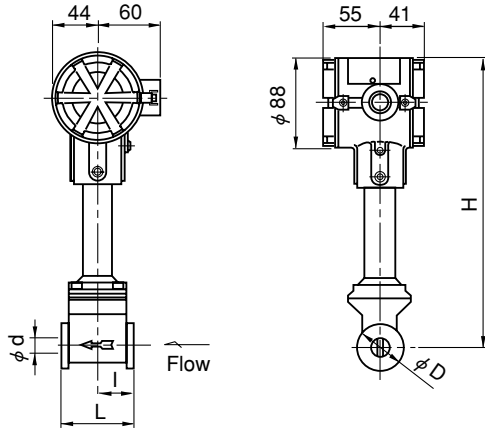
② Direction of a display is also changeable with 90° step being rotated within the converter.

Nominal size mm (inch)	Frang Rating	L	I	φd (Meter I.D)	H	Approx. Mass (kg)	
						No Display	w/Display
50 (2")	JIS 10K	173	86.5	48.5	347	9.6	9.9
	JIS20K(16K)	181	90.5			9.8	10.1
	JIS30K	191	95.5			11.9	12.2
	ANSI 150	204	102			10.5	10.8
	JPI 150					10.6	10.9
	JPI 300	217	108.5			12.4	12.7
80 (3")	JIS 10K	219	99.5	72.4	363	15.8	16.1
	JIS20K(16K)	233	106.5			18.5	18.8
	JIS30K	243	111.5			22.5	22.8
	ANSI 150	237	108.5			18.6	18.9
	ANSI 300	255	117.5			23.1	23.4
	JPI 300					23.1	23.4
100 (4")	JIS 10K	250	110.5	95.2	383	21.8	22.1
	JIS20K(16K)	264	117.5			25.8	26.1
	JIS30K	274	122.5			32.4	32.7
	ANSI 150	274	122.5			27.1	27.4
	JPI 150					27.2	27.5
	JPI 300	294	132.5			36.6	36.9
150 (6")	JIS 10K	322	132.5	140.3	413	44.3	44.6
	JIS20K(16K)	342	142.5			53.4	53.7
	JIS30K	352	147.5			67.0	67.3
	ANSI 150	340	141.5			47.1	47.4
	JPI 150					47.2	47.5
	JPI 300	359	151			66.2	66.5
200 (8")	—	350	—	199.9	428	39.4	39.7
250 (10")	—	450	—	248.8	450	69.4	69.7
300 (12")	—	500	—	297.9	472	89.4	89.7

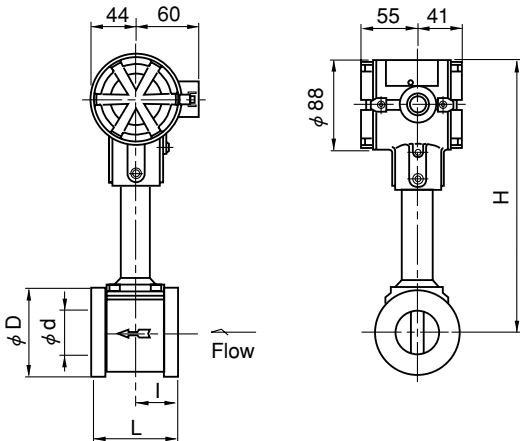
■ EX DELTA OUTLINE DIMENSIONS [SEPARATE TYPE] (Unit in mm)

Wafer Type

● Nominal size 10, 15, 25mm



● Nominal size 40~150mm

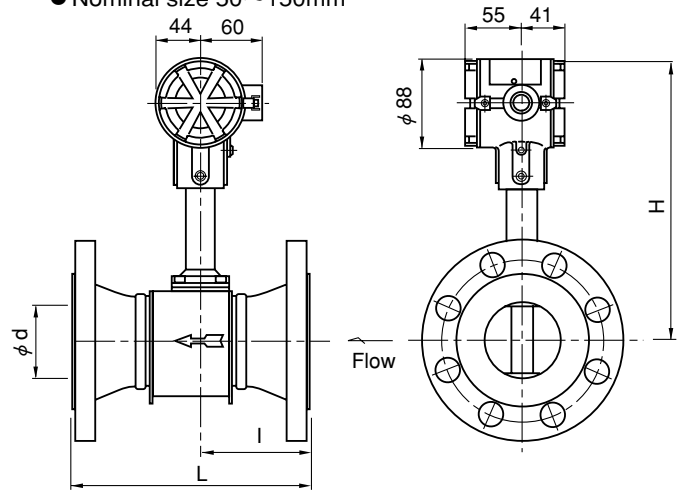


Nominal size mm (inch)	L	I	$\phi d$ (Meter I.D)	$\phi D$	H	Approx. Mass (kg)
10 (3/8")	65	32.5	10	40	277	2.4
15 (1/2")	65	32.5	14.5	40	277	2.4
25 (1")	65	32.5	26.6	67	277	3.0
40 (1 1/2")	80	40	37.6	81	262	3.7
50 (2")	80	40	48.5	91	266	3.8
80 (3")	100	40	72.4	126	282	6.6
100 (4")	125	48	95.2	156.2	302	10.3
150 (6")	165	54	140.3	214.9	332	20.2

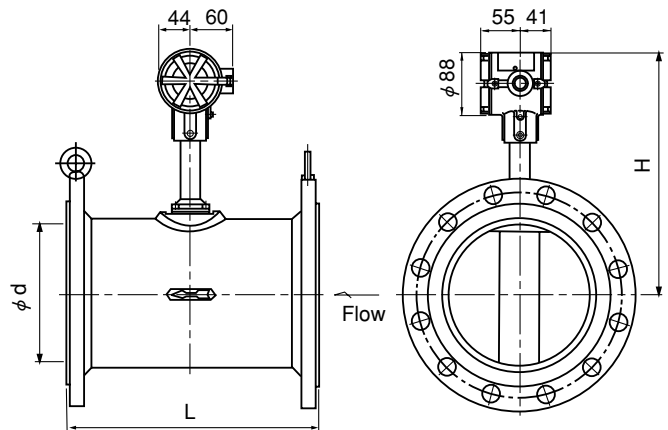
Flanged Type

■ Fixed Sensor Type

● Nominal size 50~150mm



● Nominal size 200~300mm



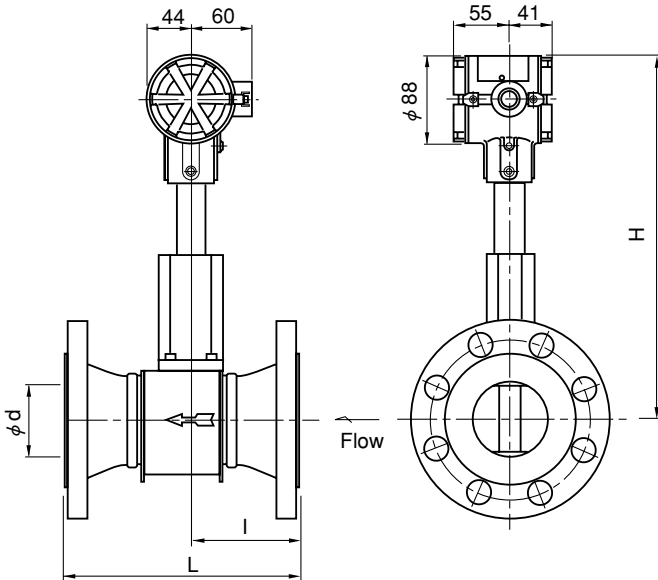
Nominal size mm (inch)	Flange Rating	L	I	$\phi d$ (Meter I.D)	H	Approx. Mass (kg)
50 (2")	JIS10K	173	86.5	48.5	266	8.8
	JIS20K(16K)	181	90.5			9.0
	JIS30K	191	95.5			11.1
	ANSI 150	204	102			9.7
	JPI 150					9.8
	ANSI 300	217	108.5			11.6
80 (3")	JIS10K	219	99.5	72.4	282	15.0
	JIS20K(16K)	233	106.5			17.7
	JIS30K	243	111.5			21.7
	ANSI 150	237	108.5			17.8
	JPI 150					
	ANSI 300	255	117.5			22.3
100 (4")	JIS10K	250	110.5	95.2	302	21.0
	JIS20K(16K)	264	117.5			25.0
	JIS30K	274	122.5			31.6
	ANSI 150	274	122.5			26.3
	JPI 150					26.4
	ANSI 300	294	132.5			35.8
150 (6")	JIS10K	322	132.5	140.3	332	43.5
	JIS20K(16K)	342	142.5			52.6
	JIS30K	352	147.5			66.2
	ANSI 150	340	141.5			46.3
	JPI 150					46.4
	ANSI 300	359	151			65.4
200 (8")	—	350	—	199.9	347	38.6
250 (10")	—	450	—	248.8	369	68.6
300 (12")	—	500	—	297.9	391	88.6

Note: Figures in the brackets show the dimensions for built-in display

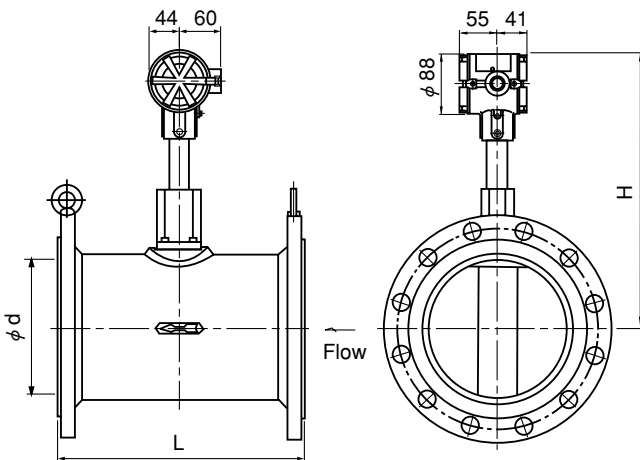
Note: In case of explosionproof construction rated FM/CSA, an NPT1/2 female thread adapter is bonded to the cable connection.

■ Replaceable Sensor Type

● Nominal size 50~150mm

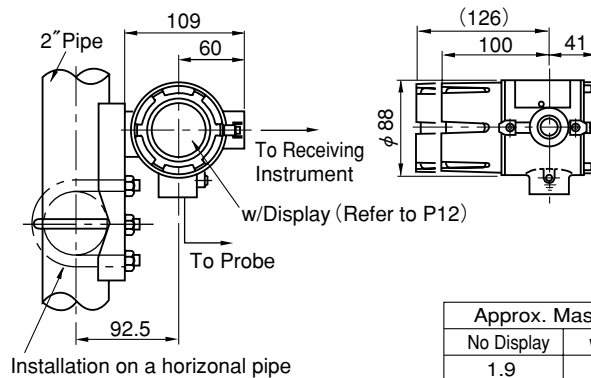


● Nominal size 200~300mm



Nominal size mm (inch)	Frang Rating	L	I	$\phi d$ (Meter I.D)	H	Approx. Mass (kg)
50 (2")	JIS10K	173	86.5	48.5	347	9.4
	JIS20K (16K)	181	90.5			9.6
	JIS30K	191	95.5			11.7
	ANSI 150					10.3
	JPI 150	204	102			10.4
	JPI 300	217	108.5			12.2
80 (3")	JIS10K	219	99.5	72.4	363	15.6
	JIS20K (16K)	233	106.5			18.3
	JIS30K	243	111.5			22.3
	ANSI 150	237	108.5			18.4
	JPI 150					
	JPI 300	255	117.5			22.9
100 (4")	JIS10K	250	110.5	95.2	383	21.6
	JIS20K (16K)	264	117.5			25.6
	JIS30K	274	122.5			32.2
	ANSI 150	274	122.5			26.9
	JPI 150					27.0
	JPI 300	294	132.5			36.4
150 (6")	JIS10K	322	132.5	140.3	413	44.1
	JIS20K (16K)	342	142.5			53.2
	JIS30K	352	147.5			66.8
	ANSI 150	340	141.5			46.9
	JPI 150					47.0
	JPI 300	359	151			66.0
200 (8")	—	350	—	199.9	428	39.4
250 (10")	—	450	—	248.8	450	69.4
300 (12")	—	500	—	297.9	472	89.4

SEPARATE TYPE CONVERTER



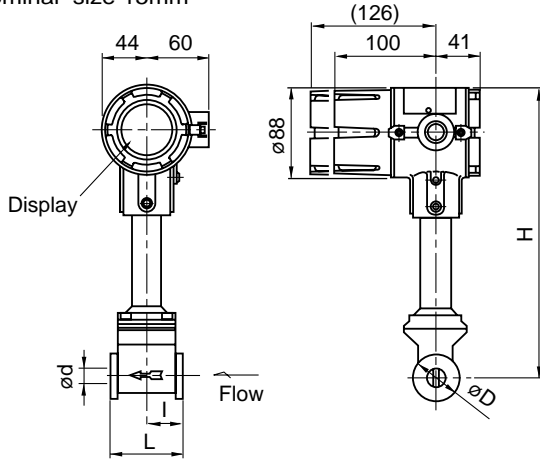
Approx. Mass (kg)	
No Display	w/Display
1.9	2.1

**EX DELTA • DIA OUTLINE DIMENSIONS (Unit in mm)**

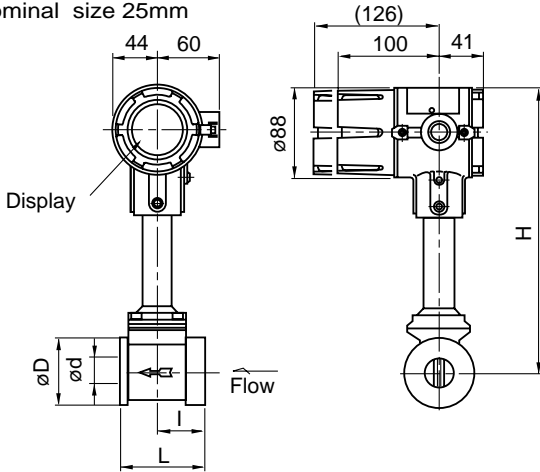
**[INTEGRAL PREAMP TYPE]**

**Wafer Type**

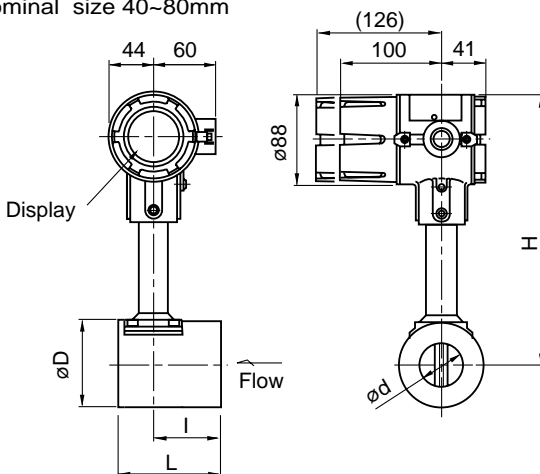
- Nominal size 15mm



- Nominal size 25mm



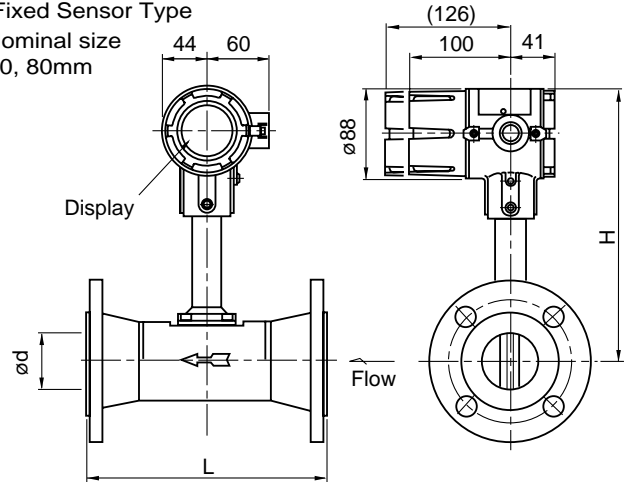
- Nominal size 40~80mm



**Flanged Type**

- Fixed Sensor Type

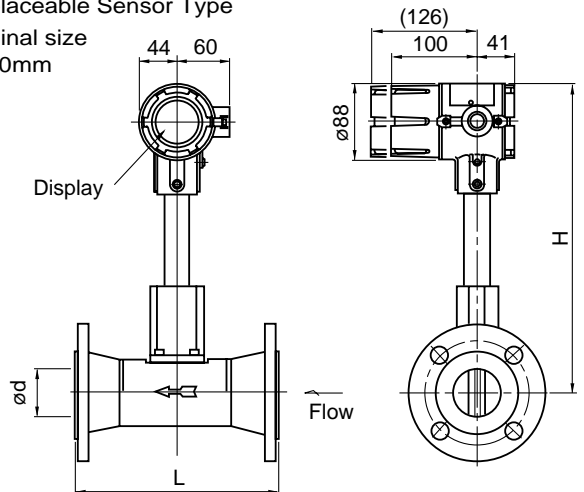
- Nominal size 50, 80mm



Nominal size (mm)	L	ød (Meter i.D.)	H
50 (2")	229	52.7	266
80 (3")	254	78.1	282

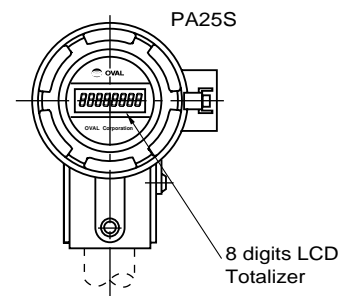
- Replaceable Sensor Type

- Nominal size 50, 80mm



Nominal size (mm)	L	ød (Meter i.D.)	H
50 (2")	229	52.7	34.7
80 (3")	254	78.1	36.3

- Converter PA25S (w/Totalizer)



1. Direction of mounting of the converter is changeable with 90° Step being rotated around the center of a mounting bracket.
2. Direction of a display is also changeable with 90° step being rotated within the converter.

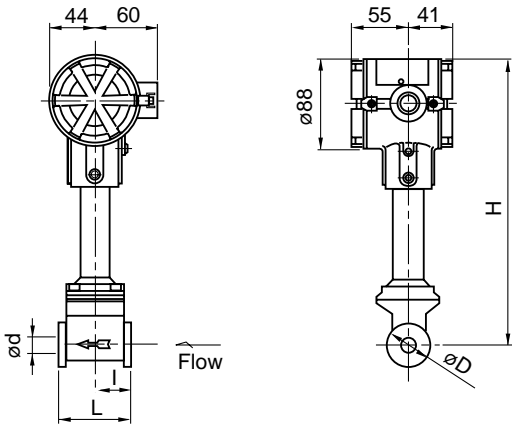
Nominal size (mm)	L	I	ød (Meter i.D.)	øD	H	Approx. Mass (kg)	
						Non Display	w/Display
15 (1/2")	65	32.5	14.5	40	277	2.6	2.9
25 (1")	80	47.5	26.6	67	270	3.2	3.5
40 (1 1/2")	100	67	41.2	82	261	3.9	4.2
50 (2")	125	85	52.7	92	266	4.0	4.3
80 (3")	125	85	78.1	127	282	6.8	7.1



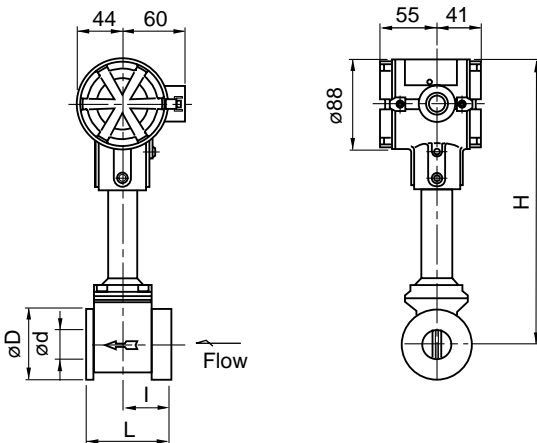
**[SEPARATE-MOUNT PREAMP TYPE]**

**Wafer Type**

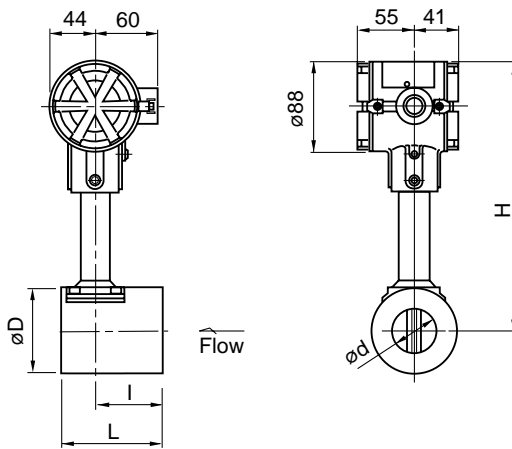
- Nominal size 15mm



- Nominal size 25mm



- Nominal size 40~80mm

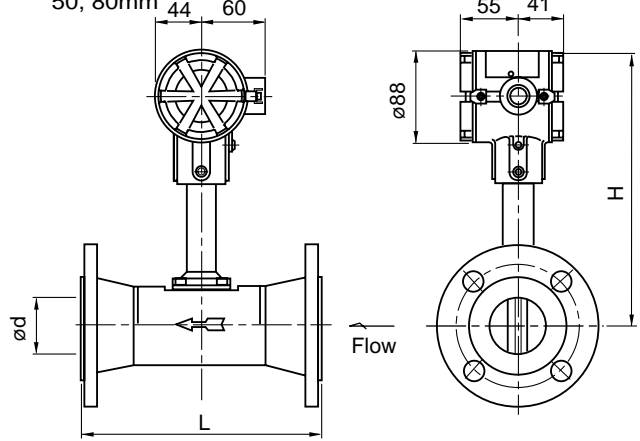


Nominal size (mm)	L	I	ød (Meter i.D.)	øD	H	Approx. Mass (kg)
15 (1/2")	65	32.5	14.5	40	277	2.4
25 (1")	80	47.5	26.6	67	270	3.0
40 (1 1/2")	100	67	41.2	82	261	3.7
50 (2")	125	85	52.7	92	266	3.8
80 (3")	125	85	78.1	127	282	6.6

**Flanged Type**

Note: Figyres in the brackets show the dimensions for a built-in display.

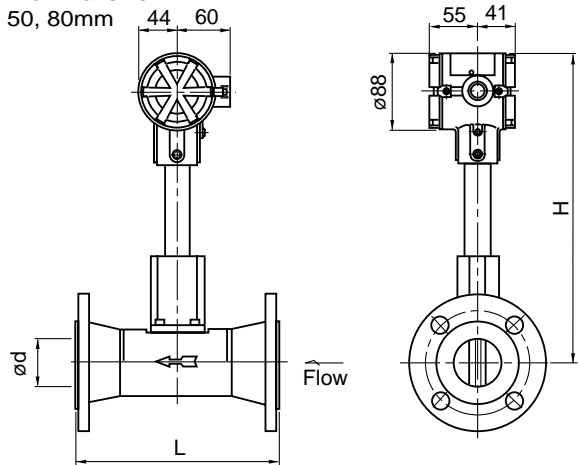
- Fixed Sensor Type
- Nominal size 50, 80mm



Nominal size (mm)	L	ød (Meter i.D.)	H
50 (2")	229	52.7	266
80 (3")	254	78.1	282

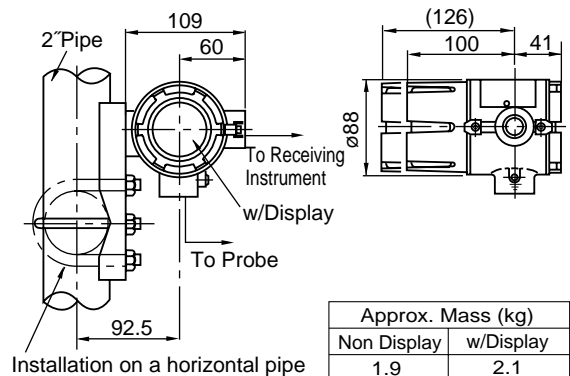
- Replaceable Sensor Type

- Nominal size 50, 80mm



Nominal size (mm)	L	ød (Meter i.D.)	H
50 (2")	229	52.7	347
80 (3")	254	78.1	363

**SEPARATE-MOUNT PREAMP**



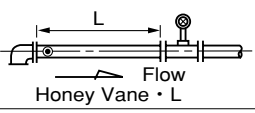
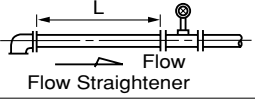
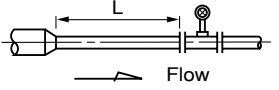
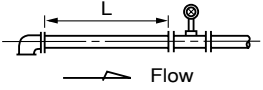
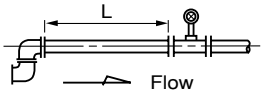
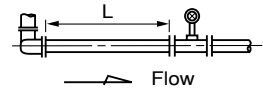
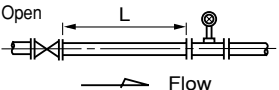
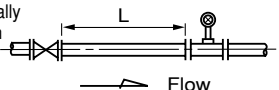
Approx. Mass (kg)	
Non Display	w/Display
1.9	2.1

## ■ INSTALLATION CONDITIONS

### 1. TYPICAL PIPING INSTRUCTIONS

It is generally required that the flow pattern of a fluid flowing in and out of an inferential type flow meter be as uniform as possible for higher accurate metering performance.

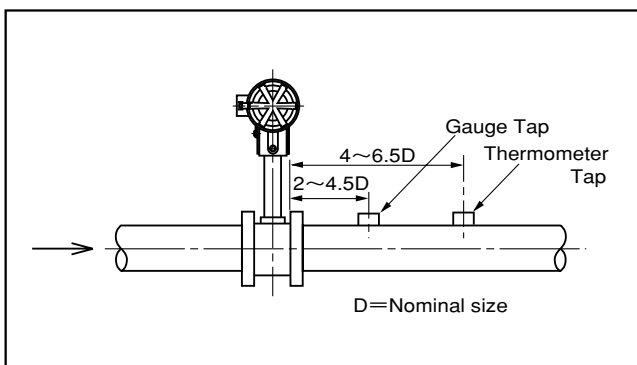
All account of this, proper flow straightening measures have to be applied for piping installation of EX DELTA. The standard piping instructions are shown in the following table.

No.	Piping Arrangement	Straight Pipe Length(L)	Remark
1	 OVAL's Flow-Straightener Honey Vane • L	8D	Refer to Point, 4  Applicable to Nominal size, >25mm
	 Flow Straightener	12D	
2	 Flow	15D Min.	A concentric reducer is installed at the upstream of a meter.
3	 Flow	23D Min.	An elbow is installed at the upstream of a meter.
	 Flow	25D Min.	Two elbows are installed at the upstream of a meter.
	 Flow	40D Min.	Two elbows are vertically installed at the upstream of a meter.
4	 Fully Open Flow	15D Min.	A full-Open gate valve is installed at the upstream of a meter.
5	 Partially Open Flow	50D Min.	A partially open gate valve, sharp orifice or something that markedly disturbs the flow pattern is upstream of meter.

Note 1: Sch.40 or Sch.80 pipe shall be used for the flow straightener.

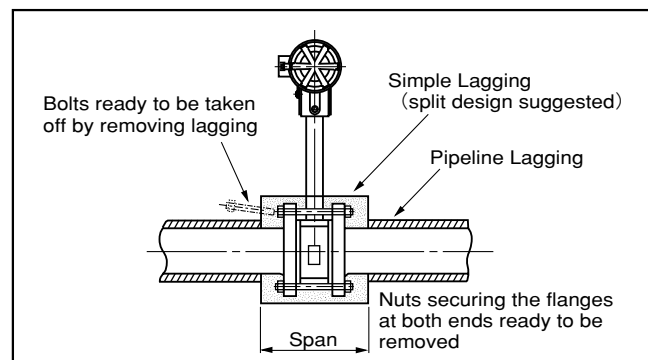
2: A short pipe section, 5D or longer shall be provided down steam of the meter.

3: Taps for pressure gage and/or thermometer should be located down steam of the meter.(Fig. below)



### 2. LAGGING WORK

If it is desired to thermally insulate the pipeline, simple lagging (without mortar finish) is suggested to facilitate servicing. This arrangement will permit taking off the flowmeter connecting bolts without destroying the lagging.



### 3. ITEMS TO BE NOTED IN PROCESS CONDITION

(1) Prevention of Cavitation:

For liquid flow application, line pressure higher than a value calculated from the following equation shall be applied in order to prevent the flow from cavitation.

$$P \geq 2.60 \Delta P + 1.25 P_o \quad (\text{MPa [absolute]})$$

where, P : Line pressure (MPa)

$\Delta P$  : Pressure loss (MPa)

$P_o$  : Vapor pressure of a liquid (MPa [absolute])

(2) Fluctuation:

In case EX DELTA is installed in the line where blower such as a roots blower and compressor those can generate fluctuated pressure, performance of the flowmeter can be affected by flow fluctuation. Allowable fluctuation pressure is calculated from the following equation.

$$N < 22 \rho V^2 \quad (\text{Pa})$$

where, N : Fluctuation pressure (Pa)

$\rho$  : Density (kg/m<sup>3</sup>)

V : Min. Velocity (m/s)

### 4. SPACE SAVING (Reducing of Meter run)

In case span of the meter run is limited due to limit of installation space and a specified straight pipe can not be secured, combination of Honey vane · S and a short length pipe composing Honey vane · L is useful for reduction of total length of the upstream straight pipe.

EX DELTA · SS providing a built-in Honey vane is available with accuracy  $\pm 2\%$  RD for liquid service.

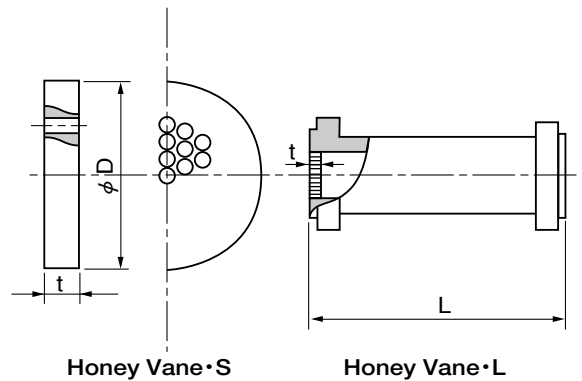
Consult the factory for accuracy requirement.

#### ●Honey Vane

##### Outline Dimensions

Nom.size (mm)	$\phi D \times 1$ (mm)	Honey Vane · S	Honey Vane · L
		t (mm)	L (mm)
25	75	3.5	200
40	90	5.4	320
50	105	6.9	400
80	134	10.2	640
100	159	13.3	800
150	220	19.6	1200
200	268	26	1600
250	331	32.3	2000
300	376	38.7	2400

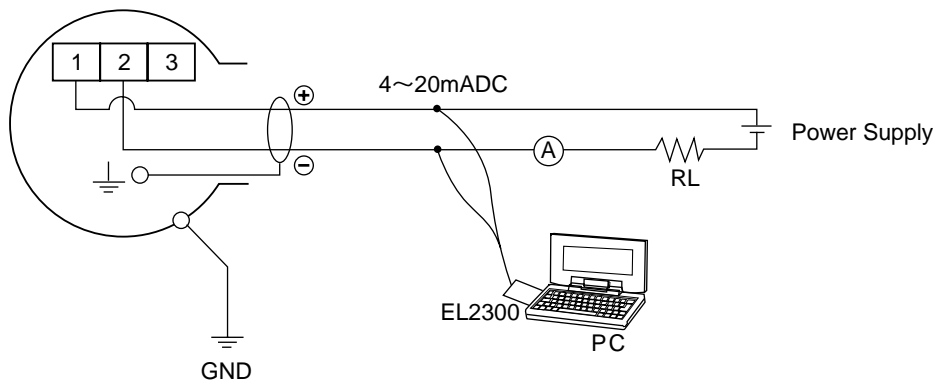
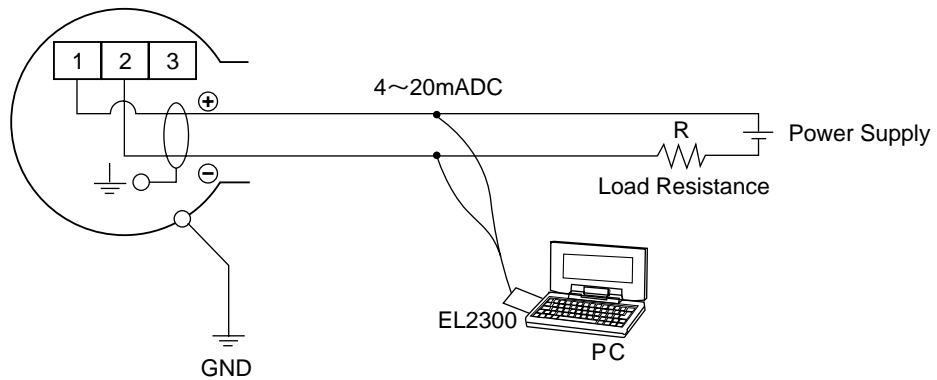
\*1. JIS10K



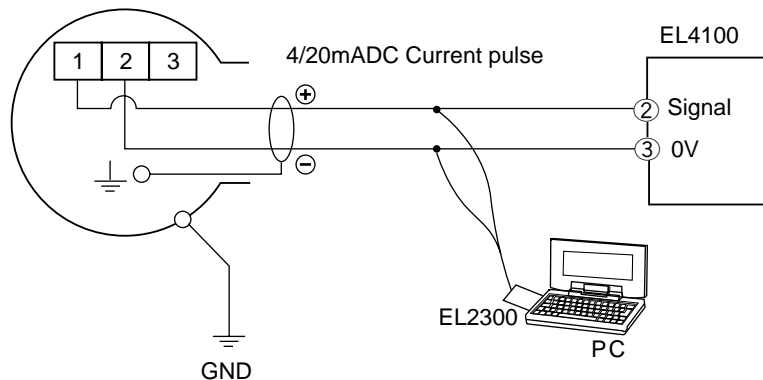
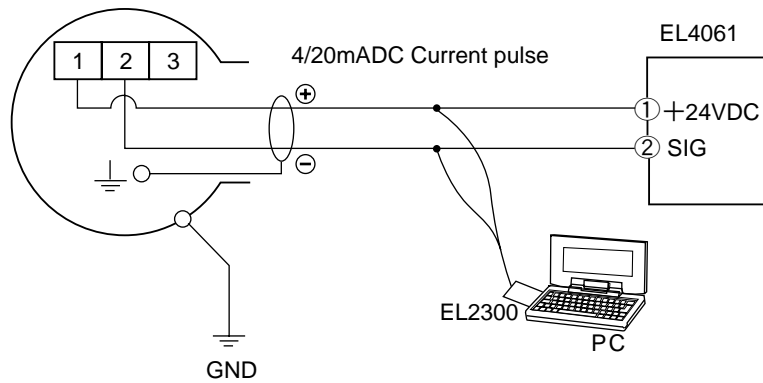
©Flange face to face span of EX DELTA · SS is the same as that of standard EX DELTA. (Refer to P12,13)

## ■ WIRING CONNECTIONS (an example)

### Analog Output



### Pulse Output



※For EL2300 : Smart Communication Unit. Refer to GS No.GEL102-E

## ■ EX DELTA PRODUCT CODE EXPLANATION

Item	Code No.															Description			
	①	②	③	④	⑤	⑥	⑦	—	⑧	⑨	⑩	⑪	—	⑫	⑬		⑭	⑮	
<b>Model</b>	V	X																EX DELTA	
<b>Body style</b>			W															Wafer type (Nominal size: 10~150mm)	Fixed sensor type
			F															Flanged type (size: 50~300mm) RF is St'd.	
			R																Flanged type (size: 50~300mm) RF is St'd.
<b>Application</b>			1															Standard	
<b>Nominal size</b>			0	1	0													10mm	
			0	1	5													15mm	
			0	2	5													25mm	
			0	4	0													40mm	
			0	5	0													50mm	
			0	8	0													80mm	
			1	0	0													100mm	
			1	5	0													150mm	
			2	0	0													200mm	
			2	5	0													250mm	
		3	0	0													300mm		
<b>Material</b>																		N	SCS14A (Nominal size 10~150mm) SUS316 (Nominal size 200~300mm)
																		C	SUS316+SFVC2A (Nominal size 200~300mm) Note 1
																		Z	Other than above
<b>Flange rating</b>																		1	JIS 10K
																		2	JIS 16K
																		3	JIS 20K
																		4	JIS 30K
																		5	ANSI 150 Note 2
																		6	ANSI 300 Note 2
																		7	JPI 150
																		8	JPI 300
																		9	Others
<b>Sensor construction</b>																		1	Nominal size > 40mm
																		2	Nominal size = 10, 15, 25mm (Separate sensor type)
<b>Applicable fluid</b>																		G	Gas, Steam (<300°C) Note 3
																		L	Liquid (<300°C)
																		S	High temp. application for Gas, Steam (Over 300°C and <420°C) Note 3
																		H	High temp. application for Liquid (Over 300°C and <420°C)
<b>Converter construction</b>																		1	Integral type
																		2	Separate type
<b>Explosionproof construction</b>																		0	None (non-explosionproof)
																		1	Flameproof construction (TIIS) Note 4
																		3	Flameproof construction (FM)
																		4	Flameproof construction (CSA)
<b>Display</b>																		0	None
																		1	Totalizer, Digital Indicator Note 5
<b>Output Signal</b>																		4	Unscaled pulse: Smart type
																		5	Scaled pulse: Smart type
																		6	Analog: Smart type

Note 1. Body material for a meter with 200~300mm nominal size, Pipe;SUS316+Flange;SFVC2A, however, not applicable for approved object in high pressure security regulation.

Note 2. Flange serration for ANSI standard : ASME/ANSI B 16.5—1996.

Note 3. With 10mm, steam measurement is unacceptable.

Note 4. Make it sure to use Pressure tight packing in case.

Note 5. Display item is selected by Internal switch or EL2300 from one of the following items:

- (1) 6 digits Totalizer
- (2) Digital instantaneous flowrate indicator
- (3) % instantaneous flowrate indicator
- (4) 8 divided bar graph indicator.

## ■ EX DELTA・DIA PRODUCT CODE EXPLANATION

Item	Product Code															Description				
	①	②	③	④	⑤	⑥	⑦	—	⑧	⑨	⑩	⑪	—	⑫	⑬		⑭	⑮		
Model	V	X																EX DELTA		
Body style			W															Wafer type (Nominal sizes: 15~80mm)	Fixed sensor type	
			F															Flanged type (sizes: 50, 80mm) RF is std.	See Note 4.	
			R															Flanged type (sizes: 50, 80mm) RF is std.	Replaceable sensor type	
Application			2															Diamond shaped bluff body		
Nominal size				0	1	5												15mm		
				0	2	5												25mm		
				0	4	0												40mm		
				0	5	0												50mm		
				0	8	0												80mm		
Material																		N	SCS14A (Nominal sizes 15, 25 wafer type)	
																		C	SUS316	
																		Z	Special (other than above)	
Flange rating																		1	JIS 10K	
																		2	JIS 16K	
																		3	JIS 20K	
																		4	JIS 30K	
																		5	ANSI 150	See Note 1.
																		6	ANSI 300	See Note 1.
																		7	JPI 150	
																		8	JPI 300	
																		9	Other	
Sensor construction																	2	Separate sensor type		
Applicable fluid																		L	Liquid	
																		H	High temp. application for liquid (Over 300°C and <420°C)	
Converter construction																		1	Integral type	
																		2	Separate type	
Explosionproof construction																		0	None (non-explosionproof)	
																		1	Flameproof construction (TIIS)	Note 2
																		3	Flameproof construction (FM)	
																		4	Flameproof construction (CSA)	
Display																		0	None	
																		1	Totalizer, Digital Indicator	Note 3
Output Signal																		4	Unscaled pulse: Smart type	
																		5	Scaled pulse: Smart type	
																		6	Analog: Smart type	

Note 1. Flange serration for ANSI standard : ASME/ANSI B 16.5—1996.

Note 2. Make it sure to use Pressure tight packing in case.

Note 3. Display item is selected by Internal switch or EL2300 from one of the following items:

- (1) 6 digits Totalizer
- (2) Digital instantaneous flowrate indicator
- (3) % instantaneous flowrate indicator
- (4) 8 divided bar graph indicator.

Note 4. Applicable item.

Nominal size (mm)	15	25	40	50	80
Wafer type	O	O	O	O	O
Flanged type	—	—	—	O	O

O : Standard    — : Option

■ When making inquiries, please specify the following:

Fill in the blanks or check  with ✓ mark.

Item	Description
1. Fluid to the metered	
2. Flow range	Max. _____ Normal _____ Min. _____ <input type="checkbox"/> m <sup>3</sup> /h(normal) <input type="checkbox"/> m <sup>3</sup> /h(actual) <input type="checkbox"/> kg/h
3. Temp. range	Max. _____ Normal _____ Min. _____ °C
4. Press. range	Max. _____ Normal _____ Min. _____ <input type="checkbox"/> MPa (gauge)
5. Density or Sp. Gr.	Density _____ <input type="checkbox"/> kg/m <sup>3</sup> (normal), <input type="checkbox"/> kg/m <sup>3</sup> (actual) Sp. Gr. _____
6. Viscosity	_____ <input type="checkbox"/> mPa·s, <input type="checkbox"/> mm <sup>2</sup> /s at _____ °C
7. Connections	Nominal size _____ <input type="checkbox"/> mm, <input type="checkbox"/> ", Flange rating <input type="checkbox"/> JIS _____ KRF <input type="checkbox"/> ANSI _____ RF
8. Flow straightening pipe	<input type="checkbox"/> Req'd (Flow straightener and downstream pipe) <input type="checkbox"/> Not req's (Prepare a straight pipe of specified length, I.D., Sch. No.)
9. Compensation	<input type="checkbox"/> Temp./Press. comp. <input type="checkbox"/> Pressure comp. <input type="checkbox"/> Temp. comp.
10. Compensation range	Temp. _____ ~ _____ °C, Pressure _____ ~ _____ MPa (gauge)
11. Compensation ref.	Ref. temp. _____ °C Press. ref. _____ MPa (gauge)
12. Compensation coeff. (gas measurement)	Z (service conditions) = _____ Zo (standard conditions) = _____
13. Accuracy test	<input type="checkbox"/> Req'd <input type="checkbox"/> Not Req'd
14. Converter	Type : <input type="checkbox"/> Integral construction <input type="checkbox"/> Separate construction Explosionproof construction : <input type="checkbox"/> Non-explosionproof <input type="checkbox"/> Flameproof
15. Output	<input type="checkbox"/> Unscaled pulse, <input type="checkbox"/> Scaled pulse, Pulse unit _____ / P <input type="checkbox"/> Analog output, Full scale _____ ~ _____ / h
16. Receiving instrument	<input type="checkbox"/> Separate-mount LCD counter <input type="checkbox"/> Remotely located receiver (Specify model and spec.)
17. Miscellaneous	

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The specification as of Aug., 2004 is stated in this GS Sheet. Specifications and design are subject to change without notice.

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**Sales Representative:**