



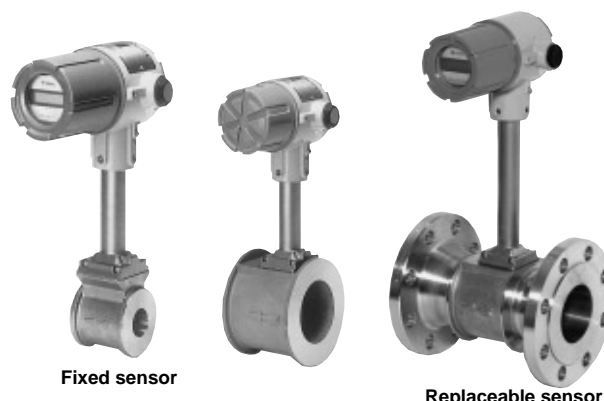
**Excellent Vortex Flowmeter  
SMART TYPE EX DELTA  
SMART TYPE EX DELTA•DIA**

**GENERAL SPECIFICATION  
GS.No.GBD641E-14**

**■ GENERAL**

The smart type EX DELTA has been evolved with the following smart functions.

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 (EL2310), 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 replacement are possible without interrupting flow measurement.



**■ 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 increase 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		
<b>Sensor type</b>		Fixed sensor	Fixed sensor	Replaceable sensor
<b>Nominal size (mm)</b>		10,15, 25, 40, 50, 80, 100, 150	15, 25, 40, 50, 80, 100, 150, 200, 250, 300	15, 25, 40, 50, 80, 100, 150, 200, 250, 300
<b>Body style</b>		Wafer type	Flanged type(RF is standard)	Flanged type (RF is standard)
<b>Flange rating</b>		JIS 10, 16, 20, 30K ANSI/JPI 150, 300		
<b>St'd. connecting pipe</b>		Nominal wall thickness Sch. 40 (※1)		
<b>Applicable fluid</b>		Liquids, gases and steam (※2)		
<b>Flow range</b>		See flow range table (P5,6,7,8)		
<b>Operating temp. range (※3)</b>		-30 to +300°C		Standard type :-30 to +300°C High temp. type :-30 to +460°C (※4)
<b>Max. operating pressure</b>		Depends on flange rating (Design pressure :5.00MPa)		
<b>Accuracy</b>		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 (※5) (* : In analog output, ±0.1% of full scale is added)		
<b>Repeatability</b>		±0.2% or better		
<b>Material</b>	<b>Body</b>	SCS14A Nom. size 10mm···SCS14A+SUS316	SUS316 or SCS14A (Nom. size 200 to 300mm···Flange material is SUS316 or SFVC2A.)	
	<b>Bluff body (Delta shaped)</b>	SUS316 or SCS14A		
	<b>Adapter</b>	SUS304 or SCS13A		
<b>Instauration</b>		No restrictions to cause loss of accuracy on physical orientation (Maintainability and waterproof work for cable entry should be taken into consideration)		
<b>Finish (Measuring Pipe)</b>		Nominal size 10 to 300mm :Remains unfinished (because of stainless steel material) Nominal size 200 to 300mm :Phthalate resin finished Munsell 2.5G8/2 (SFVC2A only)		

※1 : If different from piping of standard nominal wall thickness, consult the factory.    ※2 : With 10mm, steam measurement is unacceptable.  
 ※3 : With nominal size 200 to 300mm. and flange material SFVC2A, the allowable operating temperature covers a range above 0°C due to temperature limitations by flange material.  
 ※4 : In case of explosionproof use, the max. operating temp. is 420°C.  
 ※5 : Accuracy of 10mm in nom. size is ±2% or better with respect to the max. rated flowrate.

**● EX DELTA•DIA Meter Body**

Item		Description		
<b>Sensor type</b>		Fixed sensor	Fixed sensor	Replaceable sensor
<b>Nominal size</b>		15, 25, 40, 50, 80mm	50, 80mm	50, 80mm
<b>Body style</b>		Wafer type	Flanged type (RF is standard.)	Flanged type (RF is standard.)
<b>Flange rating</b>		JIS 10, 16, 20, 30K ANSI/JPI 150, 300		
<b>Materials</b>	<b>Body</b>	SUS316 or SCS14A		
	<b>Bluff body (Diamond shaped)</b>	SUS316		
	<b>Adapter</b>	SUS304 or SCS13A		
<b>Installation</b>		No restrictions to cause loss of accuracy on physical orientation (Maintainability and waterproof work for cable entry should be taken into consideration.)		
<b>Finish (Measuring Pipe)</b>		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 configuration	IP66 (dusttight/weathertight)-IEC/EN 60529, JIS C 0920 -- NEMA TYPE 4X	
Explosionproof configuration (※1)	Select one of the followings : ①Non-explosionproof configuration ②Flameproof configuration TIIS: ExdIIB+H <sub>2</sub> T4 ③Flameproof configuration ATEX: ExdIIB+H <sub>2</sub> T1 to T6 ④Flameproof configuration FM:Class 1, Div.1 Groups B, C & D ⑤Flameproof configuration NEPSI:ExdIICT4 (Hydrogen only)	
Ambient temperature	Non-explosionproof configuration : -40 to +80°C Explosionproof configuration : -20 to +60°C	Non-explosionproof configuration : -20 to +60°C Explosionproof configuration : -20 to +60°C
Ambient humidity	5 to 100%RH without dew condensation	
Material	Aluminum alloy	
Housing finish	Finished in baked melamine Finish Munsell 2.5G8/2 (Cover : Munsell 2.5BG5/6)	
Output	Current signal 2 wires system (Both as Power line) Select one of the followings : (※4) ①Scaled pulse Pulse level : 0/1=4/20mADC Pulse width : 10 to 1000ms (St'd : 50ms) ②Unscaled pulse (Vortex synchronized pulse) Pulse level : 0/1=4/20mADC Pulse width : 200μs ③Analog 4 to 20mADC at 0 to FS Time constant : 0 to 100s (St'd : 2.5s)	
Display (Option)	Display : 7 segments LCD Content : One of the following 4 displays is possible with switching over of an internal switch or a EL2310 ①Totalizing flow throughput : 6 digits Unit of totalizing : Same as scaled pulse output Unit of flow rate indication : Refer to (※3) • Upon power interruption, Totalized counts are held by non-volatilized memory • Totalized counts are resettable by an internal switch or EL2310 ②Actual instantaneous flow rate : 7 digits (3 1/2 digits are effective) Unit of flow rate indication : Refer to (※3) 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 to 45V DC (See Load Resistance Range curve) NOTE: If you connect OVAL communication unit EL2310, use power supply below 35V DC.	
Cable entry	G1/2 internal threads (Flameproof configuration TIIS converter is furnished with pressure-tight gasketed lead-in) In case of FM/CSA approved flameproof configuration, an NPT1/2 female adapter is bonded in place.	
Cable (※2)	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 Flameproof φ 8.5 to φ11mm	
Transmission length	Converter to receiving instrument : 1km Max Sensor to converter : 200m Max (applicable to separate type)	
Communication	HART Protocol Communication (※4)	
Computation	• Actual flow rate computation (Liquid, Gas, Steam) • Temp./Press. correcting computation (Gas)	

※1: Flameproof model withstands operating temperatures up to 420°C. ※2: Use cables heat resistant to 70°C or higher.

※3: Flowrate measurement units are selectable from the table below through calculation. Instant flowrate units are available in combination within the heavy-line frame.

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)	○	○

※4: In case a specification for Pulse output is given, Communication function is available only under the following conditions:  
 ①During flow interruption ②Upon Power "ON" (Continuous communication is available if starts within 15 sec. after Power "ON" )

※5: If you desire to transform the factored or unfactored pulse output into an open collector output, consult the factory.

● 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)

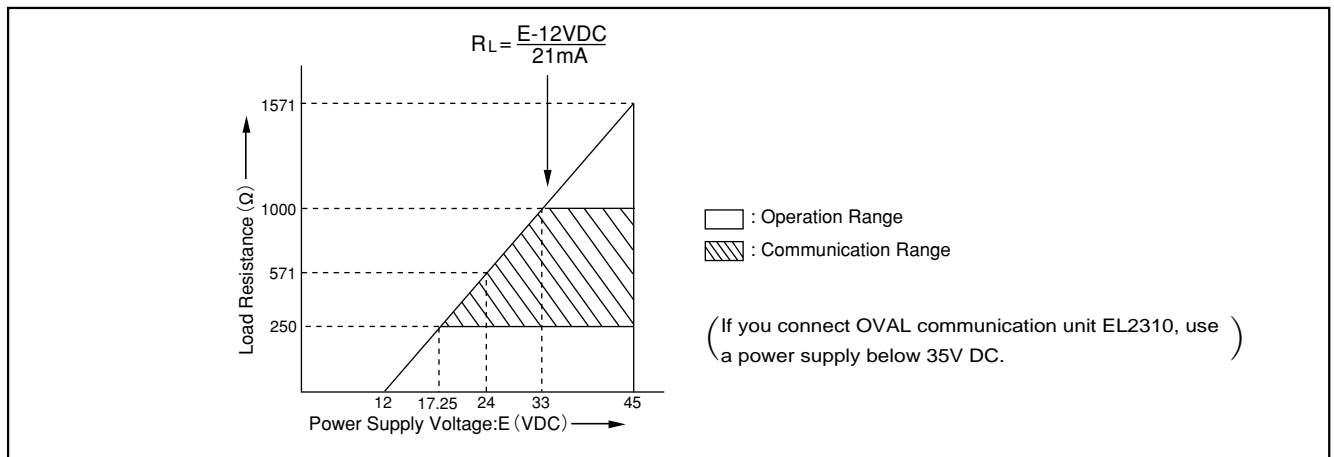
Nominal size 10 to 300mm (with material SUS316 or SCS14A)

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	1.27	3.35
220 to 300°C	0.98	1.77	2.26	4.22	1.02	3.06
300 to 350°C	—	1.57	1.96	3.82	0.84	2.96
350 to 420°C	—	—	—	2.94	0.57	2.81
420 to 460°C	—	—	—	—	0.42	2.71

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

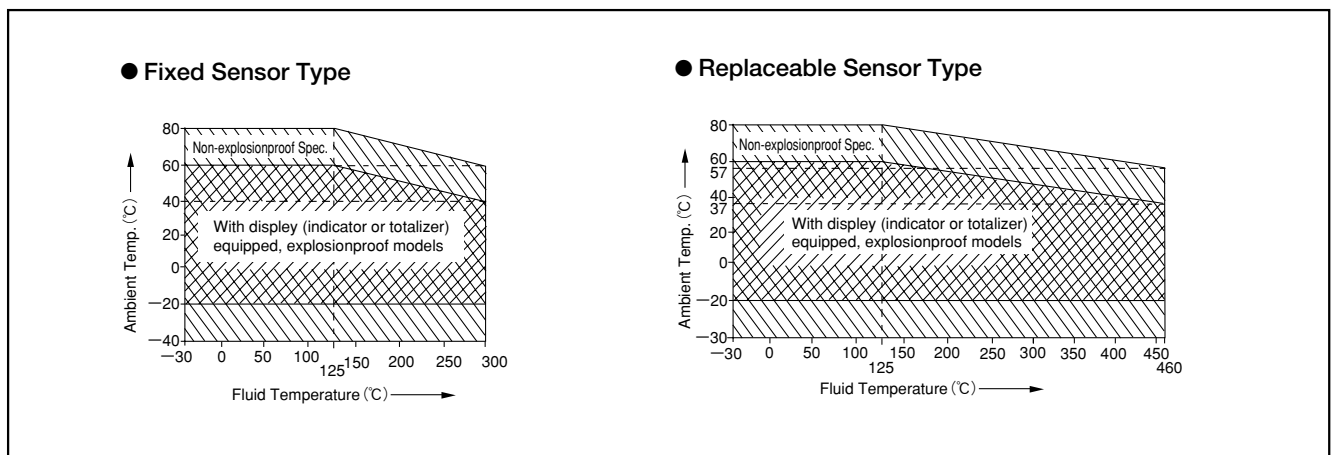
Flange Rating Operating Temperature	JIS10K	JIS16K	JIS20K	JIS30K	ANSI/JPI 150	ANSI/JPI 300
Below 220°C	1.18	2.45	3.04	4.51	1.32	4.31
220 to 300°C	0.98	2.26	2.84	4.22	1.02	3.87
300 to 350°C	—	2.06	2.55	3.82	0.84	3.70
350 to 420°C	—	1.57	1.96	2.94	0.56	2.88

●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 totalized indicated units in volume flow rate. For fixed 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 Q : Volume flow m <sup>3</sup> /h	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	

※1: Depending on specials and the meter factor after meter calibration, the selectable factored pulse output units may vary.

**■ 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)	Scaled 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 scaled 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

Nominal 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	0.4	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	1.6	1.4	1.4	1.3	1.3	1.2	1.1	48
50	2.8	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	51	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 \ 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	Viscosity mm <sup>2</sup> /s	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										
15	±1%FS	0.4	1.2	1.8	2.9										
25	±1%RD	1.6	3.1	4.6	7.6	16	Beyond Measurement								
25	±1%FS				1.8	5.9						11	15	19	
40	±1%RD	2.4	4.7	7.0	12	24	35	Beyond Measurement							
40	±1%FS				2.8	6.5	14					22	29	35	
50	±1%RD	3.0	6.0	9.0	15	30	45	60	Beyond Measurement						
50	±1%FS				3.6	7.1	15	24				34	42	59	
80	±1%RD		8.9	14	23	45	67	89	110	130	Beyond Measurement				
80	±1%FS					11	16	26	38	53			82		
100	±1%RD		12	18	29	58	87	120	150	180	230	Beyond Measurement			
100	±1%FS					14	21	28	45	55	96				
150	±1%RD				43	86	130	170	220	260	340	Beyond Measurement			
150	±1%FS							41	51	61	100				
200	±1%RD					113	170	230	280	340	450	Beyond Measurement			
200	±1%FS								68	81	110				
250	±1%RD					140	210	280	350	420	560	Beyond Measurement			
250	±1%FS										140				
300	±1%RD					170	250	340	420	500	680	Beyond Measurement			
300	±1%FS									180	230				

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

● RD : Reading, FS : Full Scale

**● Minimum measurable flowrate (minimum detectable flowrate)**

Fluid (Viscosity 1mPa•s)

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

Nominal size mm \ Sp. Gr.	Measurable flowrate							
	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2
10	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
15	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2
25	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5
40	1.2	1.1	1.0	1.0	0.9	0.9	0.8	0.8
50	1.9	1.8	1.6	1.5	1.5	1.4	1.3	1.3
80	4.2	3.8	3.6	3.3	3.3	3.3	3.3	3.3
100	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
150	24	24	24	24	24	24	24	24
200	48	43	40	38	36	34	32	31
250	105	95	88	83	78	74	71	68
300	150	137	127	118	112	106	101	97

●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)
10	±2% of Full scale		4.8	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		134	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)

Gas (Viscosity 0.017mPs·s)		Minimum flow rate (m <sup>3</sup> /h)									
Size mm	Dens. kg/m <sup>3</sup>	0.38	0.7	1.2	2	3.6	6	11	19	34	60
10		3.1	2.3	1.8	1.6	1.3	1.1	0.9	0.8	0.6	0.5
15		6.5	4.8	3.7	3.2	2.7	2.2	1.8	1.5	1.3	1.1
25		16	12	9.0	7.8	6.4	5.4	4.5	3.7	3.1	2.6
40		27	20	16	14	11	9.1	7.4	6.2	5.1	4.3
50		44	33	25	22	18	15	13	11	8.4	6.9
80		96	71	54	47	39	33	27	23	19	16
100		165	122	93	81	67	56	46	39	32	26
150		359	265	202	176	145	122	100	83	69	57
200		629	464	354	308	253	214	175	146	120	99
250		1400	1030	738	681	560	472	386	322	265	220
300		2000	1470	1130	976	803	677	553	461	380	315

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 it 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 in proportion to as follows:

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

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

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

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 therefore can be found in proportion to as follows:

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

EXAMPLE 2

Find the minimum flow rate and applicable nominal size where: Fluid: Carbon dioxide, Temperature: 5 to 30°C, Pressure 0.8 to 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 the low end in pressure. The actual maximum flow rate is therefore computed as follows:

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

It follows that the nominal size is 40mm and the minimum flow rate is based on the low end in temperature and the high end 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 in proportional way as:

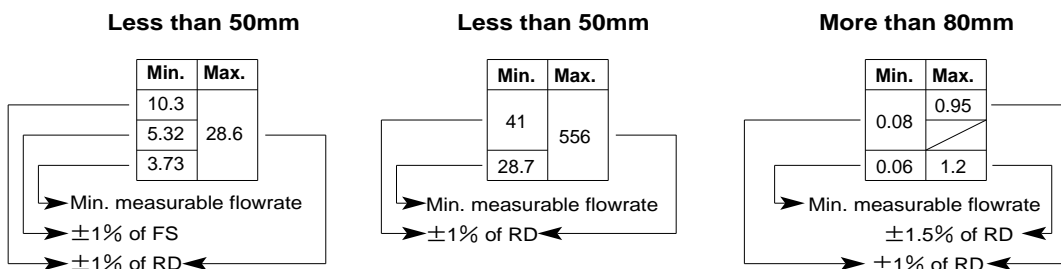
$$Q_{min} = 8 + \frac{1.7 - 1.5}{1.7 - 0.95} \times (9 - 8) \approx 8.3m^3/h$$

NOTE:In cases where obtained results of calculation are figures with decimal places, round off fraction below the decimal point in the maximum flow rate, or round out fractions to a round number in the minimum flow rate.

● Saturated Steam Service

Pressure MPaG	Unit : kg/h								Unit : t/h												
	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.	
0.05	10.3		18.8		29.1		37.2		426	0.08	0.95	0.14	1.6	0.3	3.63	0.52	6.08	1.15	9.13	1.64	13
	5.32	28.6	13.1	113	22	252	35.9			0.06	1.2	0.1	2.06	0.21	4.48	0.37	7.91	0.8	12.1	1.15	17.4
	3.73		9.15		15.4		25.2				0.1	1.24	0.16	2.1	0.34	4.74	0.59	7.95	1.31	11.9	1.88
0.1	10.6		19.4		30		41		556	0.1	1.24	0.16	2.1	0.34	4.74	0.59	7.95	1.31	11.9	1.88	17
	6.08	37.4	15	147	25.1	329	35.9			0.07	1.56	0.11	2.69	0.24	5.86	0.42	10.3	0.914	15.9	1.32	22.8
	4.26		10.5		17.6		28.7				0.12	1.82	0.21	3.06	0.45	6.92	0.78	11.6	1.72	17.4	2.46
0.2	11		20.2		33		53.9		812	0.12	1.82	0.21	3.06	0.45	6.92	0.78	11.6	1.72	17.4	2.46	24.8
	7.99	54.7	19.7	215	23.1	480	37.8			0.09	2.28	0.15	3.92	0.31	8.55	0.55	15	1.21	23.2	1.73	33.3
	5.6		13.8		23.1		37.8				0.15	2.38	0.25	4.01	0.53	9.06	0.93	15.1	2.06	22.7	2.95
0.3	11.4		23.5		39.4		64.5		1060	0.15	2.38	0.25	4.01	0.53	9.06	0.93	15.1	2.06	22.7	2.95	32.5
	9.56	71.5	16.5	282	27.6	629	45.2			0.1	2.99	0.18	5.14	0.38	11.1	0.65	19.7	1.44	30.3	2.07	43.6
	6.7		16.5		27.6		45.2				0.17	2.94	0.28	4.94	0.61	11.1	1.07	18.7	2.37	28	3.39
0.4	11.7		27		45.3		74.2		1310	0.17	2.94	0.28	4.94	0.61	11.1	1.07	18.7	2.37	28	3.39	40.1
	11	88.2	18.9	347	31.8	775	51.9			0.12	3.69	0.2	6.33	0.43	13.8	0.75	24.3	1.66	37.4	2.37	53.7
	7.7		18.9		31.8		51.9				0.19	3.49	0.32	5.87	0.69	13.2	1.2	22.2	2.65	33.3	3.8
0.5	12.4		30.3		50.8		83.2		1550	0.19	3.49	0.32	5.87	0.69	13.2	1.2	22.2	2.65	33.3	3.8	47.6
	8.63	104	21.2	412	35.6	920	58.2			0.13	4.38	0.22	7.52	0.48	16.3	0.84	28.8	1.86	44.4	2.66	63.8
											0.21	4.04	0.35	6.79	0.76	15.3	1.32	25.7	2.92	38.5	4.19
0.6	13.6		33.4		56		91.6		1790	0.21	4.04	0.35	6.79	0.76	15.3	1.32	25.7	2.92	38.5	4.19	55
	9.51	121	23.4	477	39.2	1060	64.1			0.15	5.06	0.25	8.7	0.53	18.9	0.93	33.4	2.05	51.4	2.93	73.8
											0.24	5.12	0.41	8.62	0.89	19.4	1.55	32.6	3.42	48.9	4.91
0.8	16		39.1		65.6		108		2280	0.24	5.12	0.41	8.62	0.89	19.4	1.55	32.6	3.42	48.9	4.91	69.9
	11.2	153	27.4	605	46	1350	75.2			0.17	6.43	0.29	11	0.62	24	1.09	42.4	2.4	65.2	3.44	93.6
											0.27	6.2	0.46	10.4	1.01	23.5	1.76	39.4	3.89	59.2	5.57
1	18.1		44.4		74.6		122		2760	0.27	6.2	0.46	10.4	1.01	23.5	1.76	39.4	3.89	59.2	5.57	84.6
	12.7	186	31.1	733	52.2	1630	85.4			0.19	7.78	0.33	13.3	0.71	29.1	1.23	51.3	2.72	78.9	3.9	113
											0.35	8.89	0.59	14.9	1.28	33.8	2.24	56.6	4.94	84.9	7.08
1.5	23		56.5		94.8		155		3960	0.35	8.89	0.59	14.9	1.28	33.8	2.24	56.6	4.94	84.9	7.08	121
	16.1	266	39.5	1050	66.4	2340	109			0.24	11.1	0.41	19.1	0.9	41.7	1.57	73.6	3.46	113	4.96	162
											0.41	11.5	0.7	19.4	1.52	44	2.67	73.7	5.89	110	8.83
2	27.5		67.4		114		185		5160	0.41	11.5	0.7	19.4	1.52	44	2.67	73.7	5.89	110	8.83	158
	19.2	347	47.2	1370	79.2	3050	130			0.29	14.5	0.49	24.9	1.07	54.3	1.87	95.9	4.13	147	6.18	211
											0.47	14.3	0.81	24	1.75	54.3	3.3	91	6.78	136	10.9
2.5	31.6		77.5		131		213		6370	0.47	14.3	0.81	24	1.75	54.3	3.3	91	6.78	136	10.9	195
	22.1	429	54.3	1690	91.1	3770	149			0.33	17.9	0.57	30.8	1.23	67.1	2.31	118	4.75	182	7.63	261
											0.53	17	0.91	28.6	1.97	64.8	3.93	108	7.62	162	13
3	35.5		87.1		147		240		7590	0.53	17	0.91	28.6	1.97	64.8	3.93	108	7.62	162	13	232
	24.9	511	61	2010	103	4490	168			0.37	21.4	0.64	36.7	1.38	80	2.75	141	5.34	217	9.09	311
											0.64	22.6	1.09	38.1	2.38	86.1	5.22	144	10.1	216	17.3
4	42.9		106		177		290		10100	0.64	22.6	1.09	38.1	2.38	86.1	5.22	144	10.1	216	17.3	309
	30.1	680	73.7	2670	124	5970	203			0.45	28.4	0.77	48.8	1.67	106	3.66	187	7.03	288	12.1	414
											0.74	28.4	1.27	47.9	2.83	108	6.56	181	12.7	271	21.7
5	50		123		206		337		12600	0.74	28.4	1.27	47.9	2.83	108	6.56	181	12.7	271	21.7	388
	35	854	85.8	3360	145	7500	236			0.52	35.7	0.89	61.3	1.98	133	4.59	235	8.83	362	15.2	520

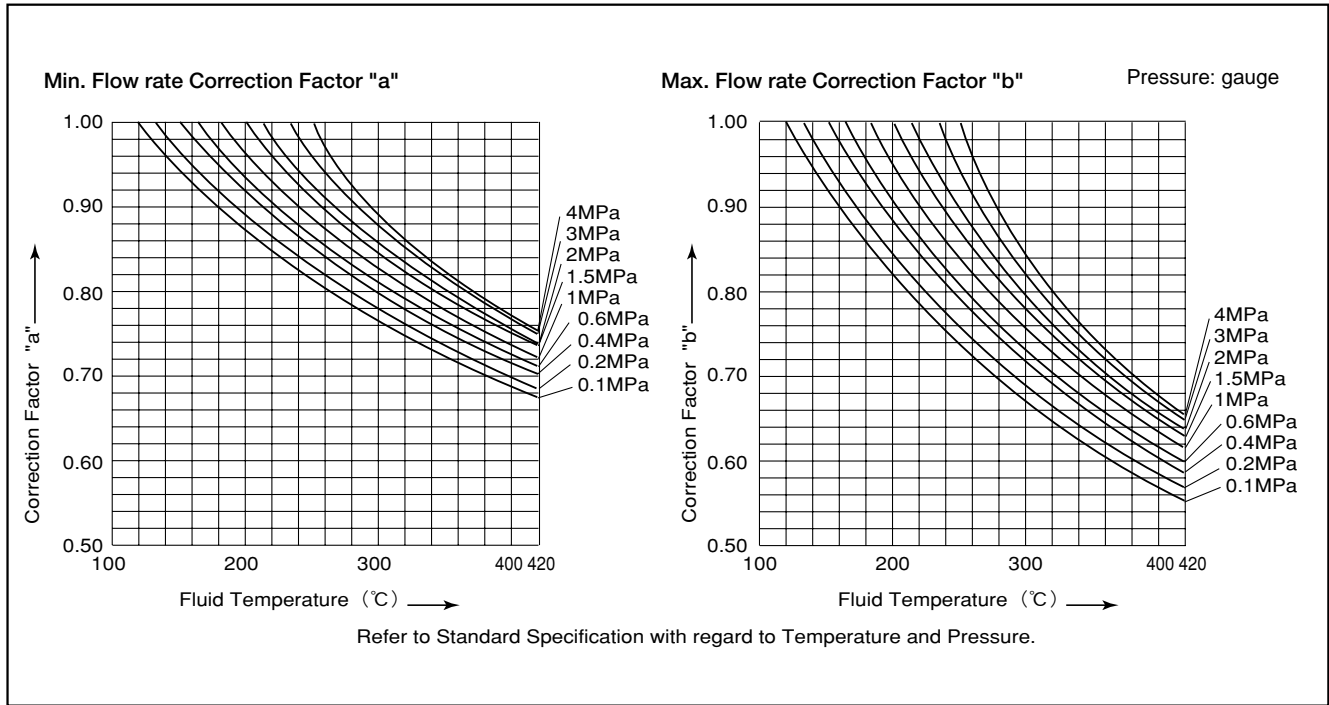
● Explanation of tables



● **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 for both of gas and steam, 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])

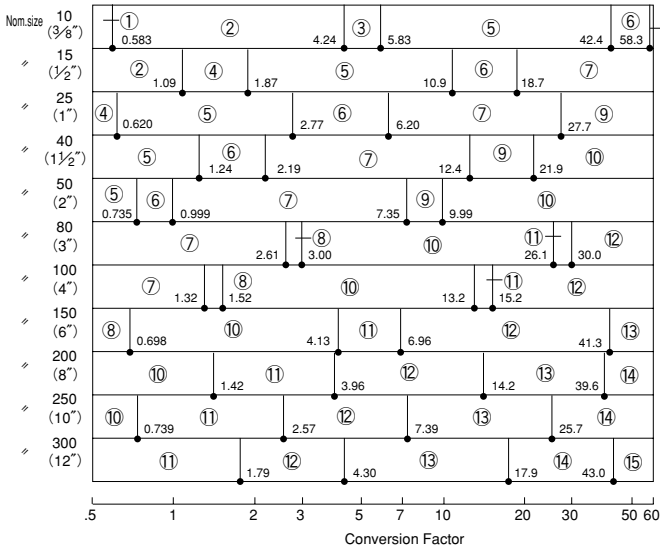
Z<sub>0</sub>=Compressibility coefficient under standard conditions.

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

Z=Compressibility coefficient under operating conditions.

- 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,  $0.735 \leq \text{⑥} < 0.999$
- 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**

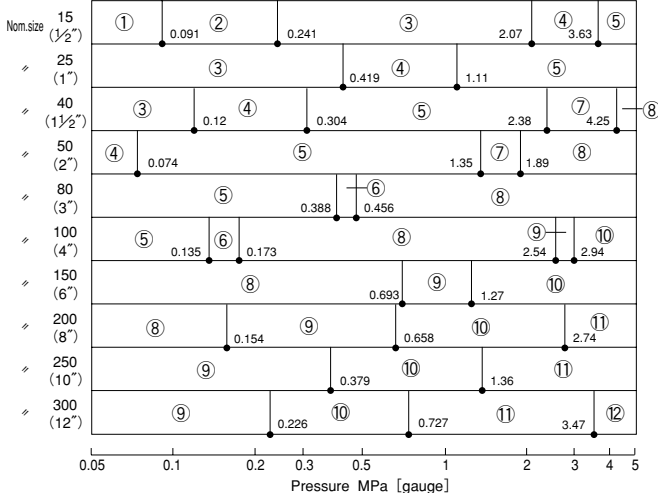
Segment No.	Scaled pulse output unit : [normal]		
	Minimum	Standard	Maximum
①	1 L/P	1 L/P	10 L/P
②		10 L/P	100 L/P
③		100 L/P	100 L/P
④	10 L/P	100 L/P	100 L/P
⑤			1 m³/P
⑥	100 L/P	1 m³/P	1 m³/P
⑦			10 m³/P
⑧			100 m³/P
⑨	1 m³/P	10 m³/P	10 m³/P
⑩			100 m³/P
⑪			1000 m³/P
⑫	10 m³/P	100 m³/P	1000 m³/P
⑬			10000 m³/P
⑭	100 m³/P	1000 m³/P	10000 m³/P
⑮			100000 m³/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			100 g/P
③			1 kg/P
④	100 g/P	1 kg/P	1 kg/P
⑤			10 kg/P
⑥	1 kg/P	10 kg/P	100 kg/P
⑦			10 kg/P
⑧			100 kg/P
⑨	10 kg/P	100 kg/P	1 t/P
⑩			10 t/P
⑪	100 kg/P	1 t/P	10 t/P
⑫			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

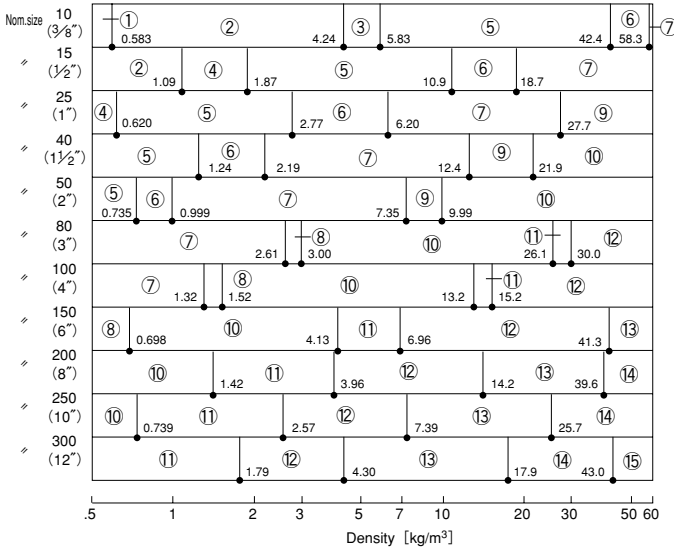


Table F ● Segment — Scaled Pulse Output

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

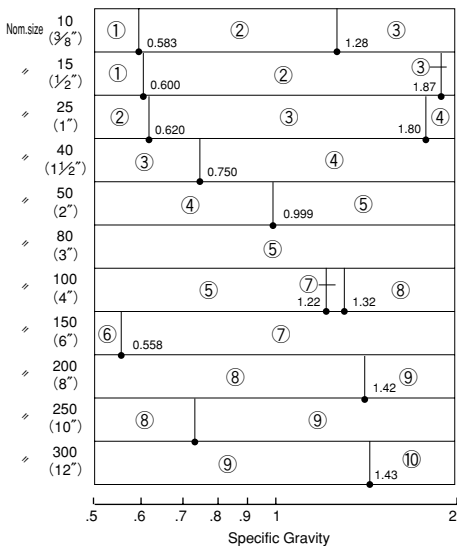
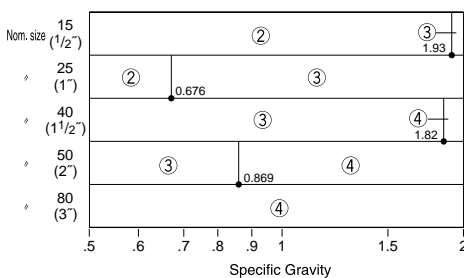


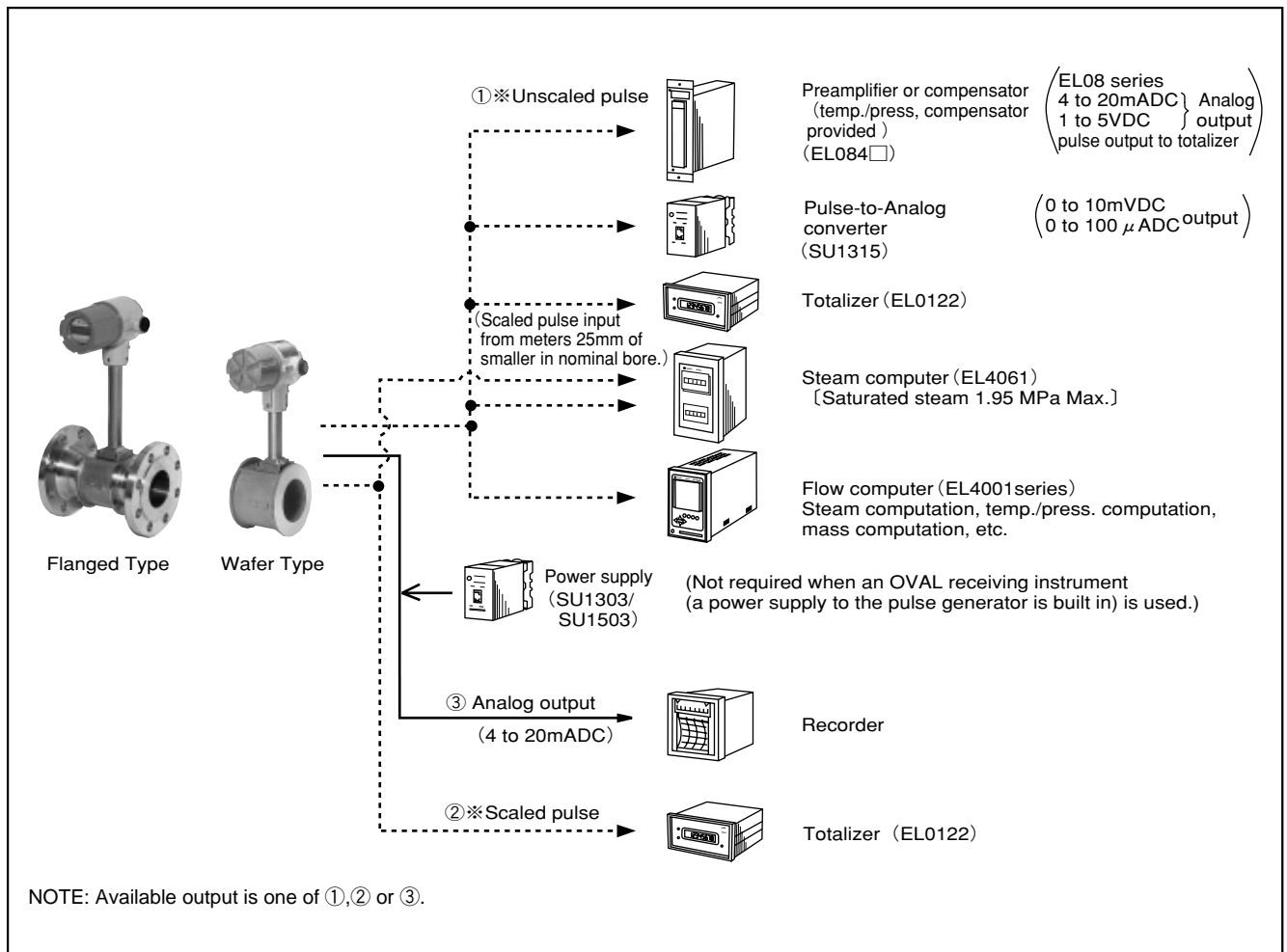
Table H ● Segment — Scaled Pulse Output

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

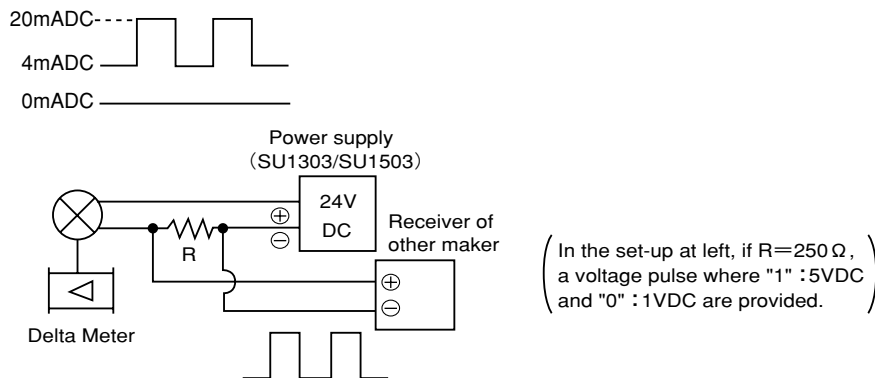


■ HOOK-UP WITH RECEIVING INSTRUMENTS



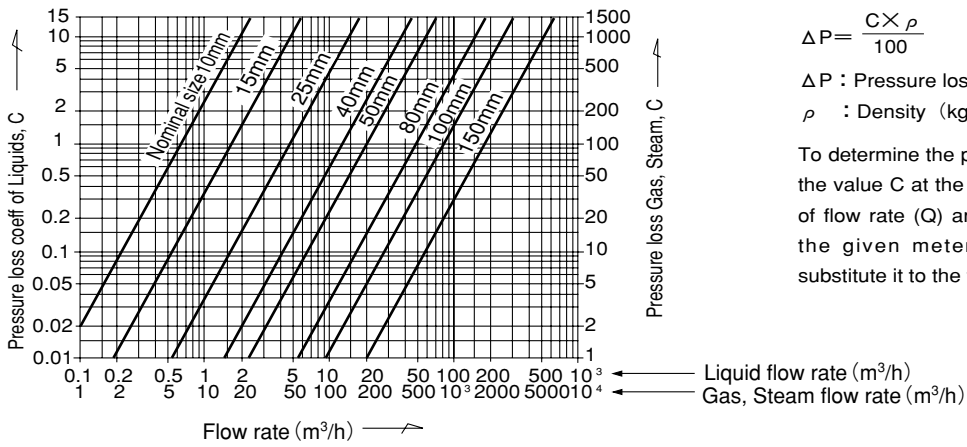
- Shown above are typical examples. Depending on individual applications and specifications, hookup with many other electrical instruments are acceptable.
- For any arrangement with an electrical instrument, indicator, etc. other than those supplied by OVAL, an external power supply is required. Use OVAL Model SU1303/SU1503 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 to 150mm



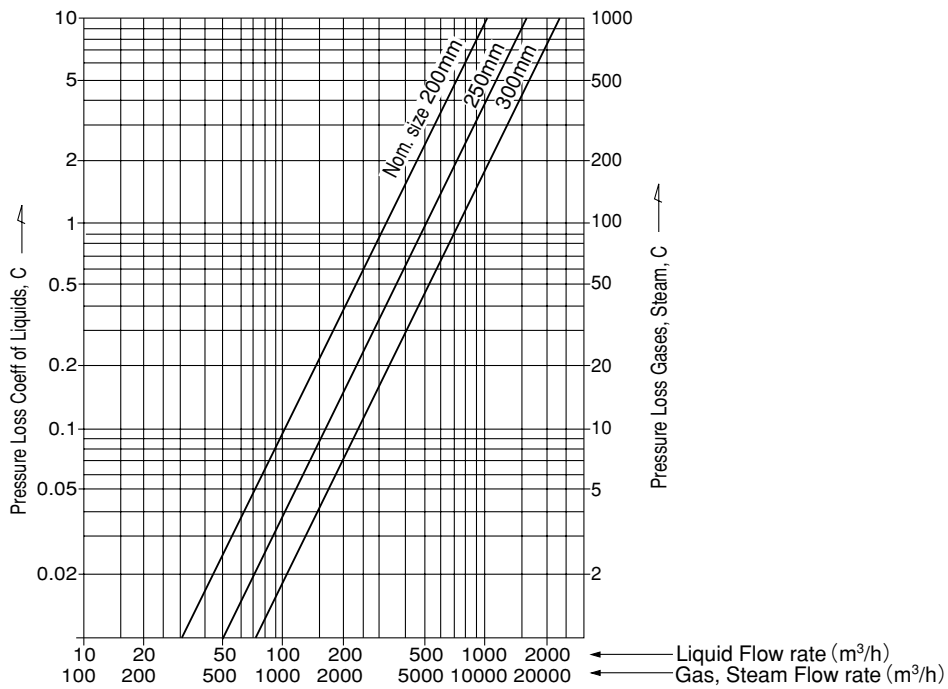
$$\Delta P = \frac{C \times \rho}{100}$$

$\Delta P$  : Pressure loss (kPa)

$\rho$  : Density (kg/m³)

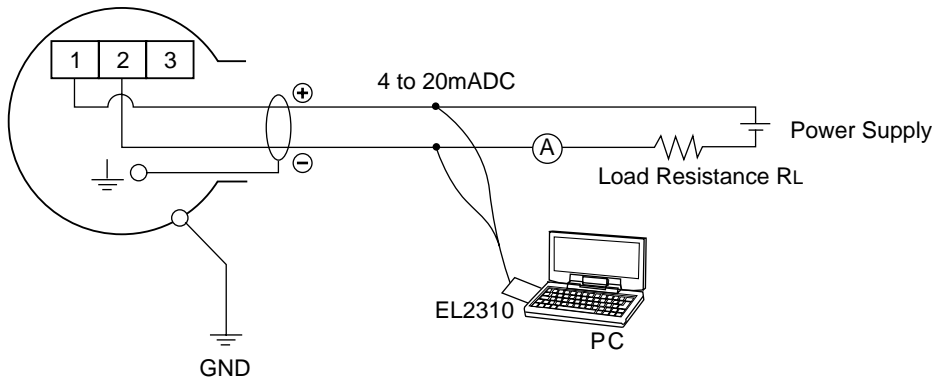
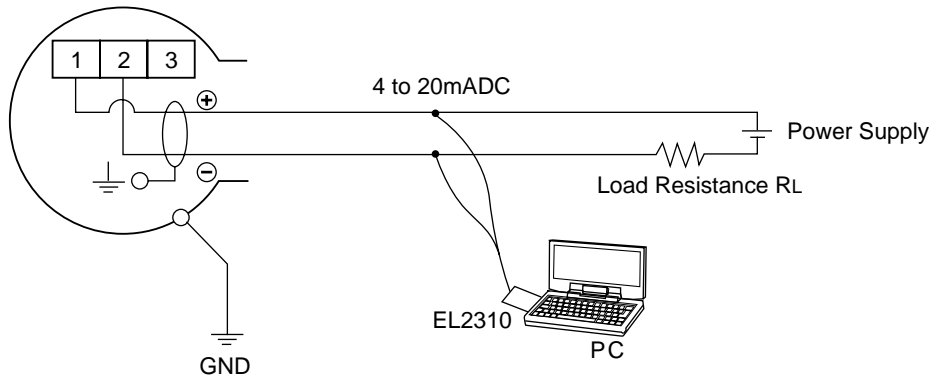
To determine the pressure loss, find the value C at the intersecting point of flow rate (Q) and slanted line of the given meter diameter and substitute it to the formula above.

- Nominal size 200, 250, 300mm

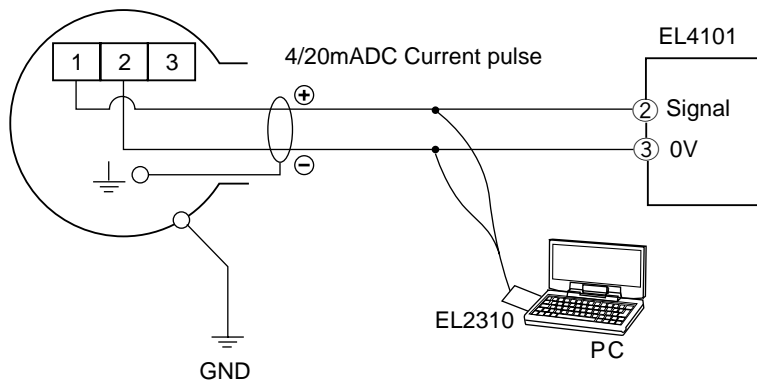
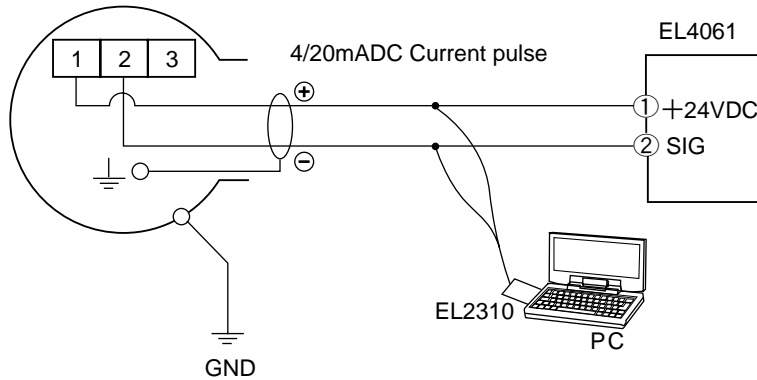


■ WIRING CONNECTIONS (an example)

Analog Output



Pulse Output

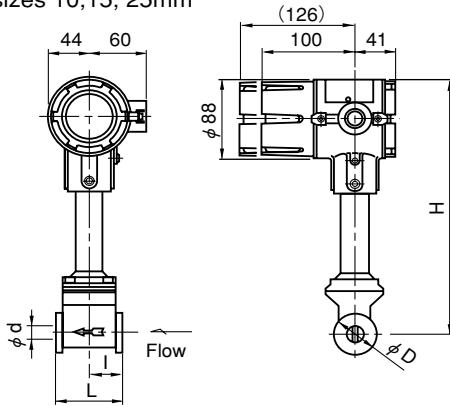


※For EL2310 : Smart Communication Unit. Refer to GS No.GEL104E.

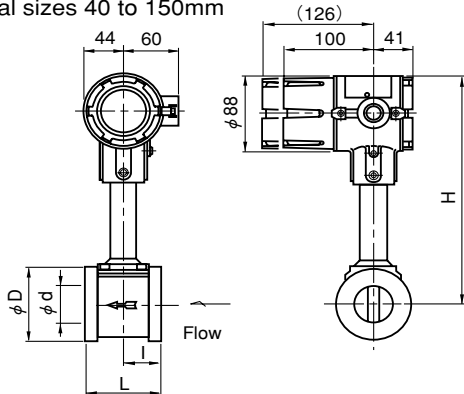
■ EX DELTA OUTLINE DIMENSIONS [INTEGRAL TYPE] (Unit in mm)

**Wafer Type**

- Nominal sizes 10,15, 25mm



- Nominal sizes 40 to 150mm



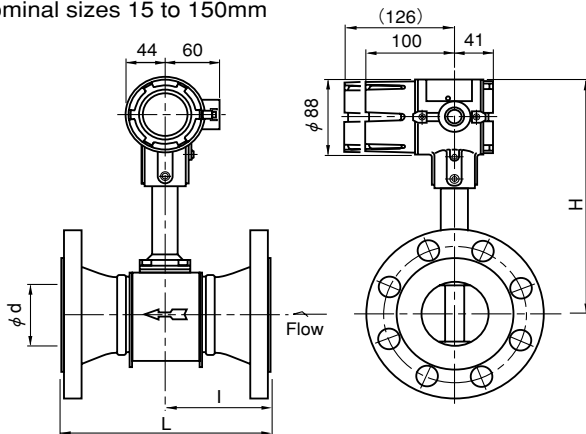
Nominal size mm (inch)	L	I	φ d (Meter I.D.)	φ D	H	Approx. Weight (kg)	
						No Display	w/Display
10 (3/8")	65	32.5	10	40	276	2.6	2.9
15 (1/2")	65	32.5	14.5	40	276	2.6	2.9
25 (1")	65	32.5	26.6	67	276	3.2	3.5
40 (1-1/2")	80	40	37.6	81	261	3.9	4.2
50 (2")	80	40	48.5	91	265	4.0	4.3
80 (3")	100	40	72.4	126	281	6.8	7.1
100 (4")	125	48	95.2	156.2	301	10.5	10.8
150 (6")	165	54	140.3	214.9	331	20.4	20.7

Nominal size mm (inch)	Flange Rating	L	I	φ d (Meter I.D.)	H	Approx. Weight (kg)			
						No Display	w/Display		
15 (1/2")	JIS 10K(16K)	142	71	14.5	276	3.9	4.2		
	JIS 20K					5.3	5.6		
	JIS 30K	158	79			3.5	3.8		
	ANSI 150					167	83.5	4.1	4.4
	JPI 150								
25 (1")	JIS 10K(16K)	152	76	26.6	276	5.9	6.2		
	JIS 20K					6.9	7.2		
	JIS 30K	174	87			5.1	5.4		
	ANSI 150					186	93	6.3	6.6
	JPI 150								
	40 (1-1/2")	JIS 10K(16K)	171			85.5	37.6	261	8.0
JIS 20K		8.4		8.7					
JIS 30K		201	100.5	10.5	10.8				
ANSI 150				213	106.5	8.0			8.3
JPI 150						8.0			8.3
50 (2")		JIS 10K	173	86.5	48.5	265			9.0
	JIS 20K(16K)	9.2					9.5		
	JIS 30K	204	102	11.3			11.6		
	ANSI 150			217			108.5	9.9	10.2
	JPI 150							10.0	10.3
	80 (3")	JIS 10K	219	99.5			72.4	281	11.8
JIS 20K(16K)		15.2			15.5				
JIS 30K		237	108.5	17.9	18.2				
ANSI 150				255	117.5	21.9			22.2
JPI 150						18.0			18.3
100 (4")		JIS 10K	250	110.5	95.2	301			22.5
	JIS 20K(16K)	21.2					21.5		
	JIS 30K	274	122.5	25.2			25.5		
	ANSI 150			294			132.5	31.8	32.1
	JPI 150							26.5	26.8
	150 (6")	JIS 10K	322	132.5			140.3	331	26.6
JIS 20K(16K)		36.0			36.3				
JIS 30K		340	141.5	36.2	36.5				
ANSI 150				359	151	43.7			44.0
JPI 150						52.8			53.1
200 (8")		—	350	—	199.9	346			66.4
250 (10")	—	450	—	248.8	368	46.5	46.9		
300 (12")	—	550	—	297.9	390	65.6	65.9		
						66.0	66.3		

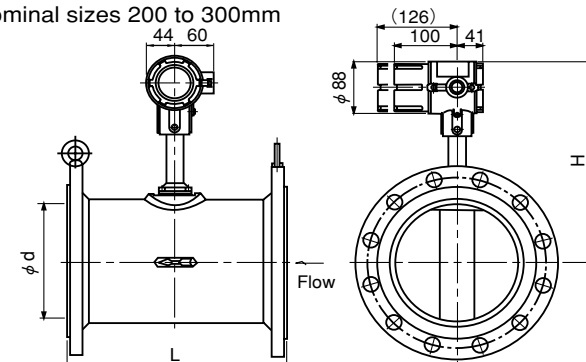
**Flanged Type**

- Fixed Sensor Type

- Nominal sizes 15 to 150mm



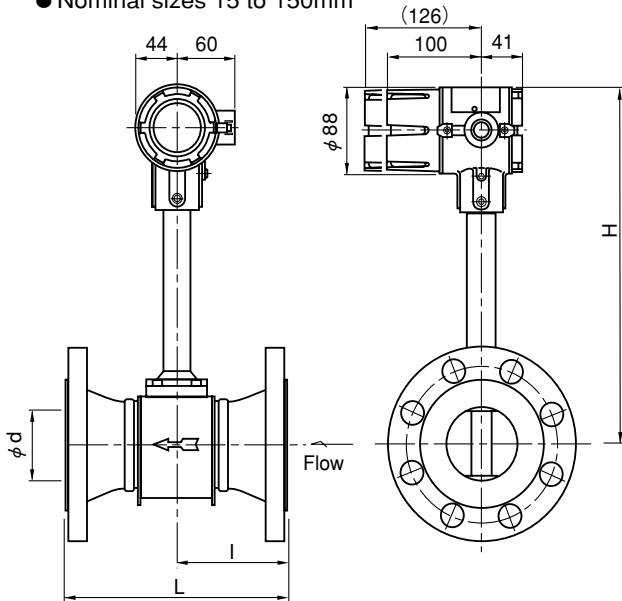
- Nominal sizes 200 to 300mm



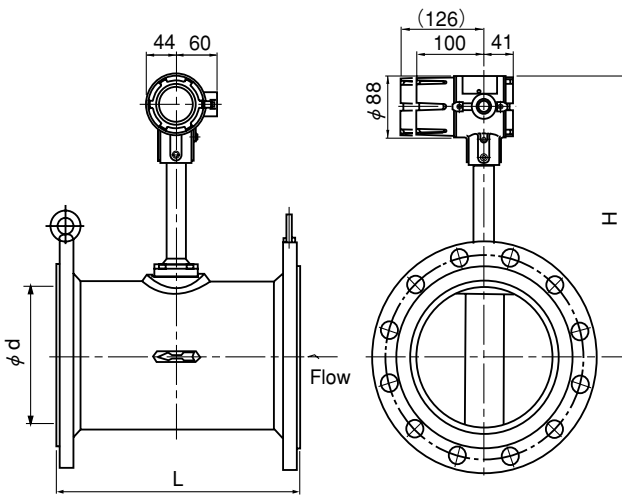
※ : Irrespective of flange rating, a flange thickness having a higher rating is selected as long as the flange O.D. and bolt holes remain the same.

■ Replaceable Sensor Type

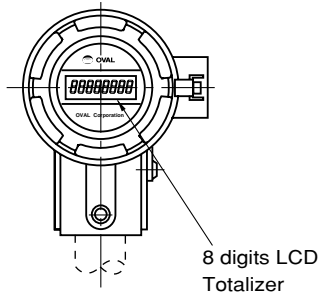
● Nominal sizes 15 to 150mm



● Nominal sizes 200 to 300mm



● Converter



(w/Totalizer & Digital Indicator)

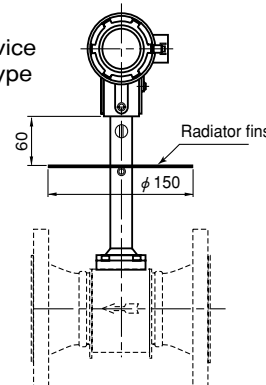
- ① Direction of mounting of the converter is changeable with 90° step being rotated around the center of a mounting bracket.
- ② Direction of a display is also changeable with 90° step being rotated within the converter.

Note: Figures in the brackets show the dimensions with built-in display.  
 Note: Dim.  $\phi$  D is the I.D. of bluff body.  
 Note: In case of explosionproof configuration rated FM, an NPT1/2 female thread adapter is bonded to the cable connection.

Nominal size mm (inch)	Flange Rating	L	I	$\phi$ d (Meter I.D.)	H	Approx. Weight (kg)		
						No Display	w/Display	
15 (1/2")	JIS 10K(16K)	142	71	14.5	356	4.5	4.8	
	JIS 20K	152	76			5.9	6.2	
	JIS 30K		158			79	4.1	4.4
	ANSI 150	167				83.5	4.7	5
	JPI 150					174	87	5.7
	ANSI 300	186					93	6.9
JPI 300	JIS 10K(16K)		171	85.5	26.6	356	6.5	6.8
25 (1")	JIS 20K	175	87.5	7.5			7.8	
	JIS 30K	185	92.5	11.1			11.4	
	ANSI 150	201	100.5	8.6			8.9	
	JPI 150	213	106.5	8.6			8.9	
	ANSI 300		173	86.5			9.6	9.9
	40 (1-1/2")	JIS 20K(16K)		181	90.5	48.5	346	9.8
JIS 30K		191	95.5	11.9	12.2			
ANSI 150		204	102	10.5	10.8			
JPI 150		217	108.5	10.6	10.9			
ANSI 300			219	99.5	12.4			12.7
JPI 300		JIS 10K		233	106.5			72.4
50 (2")	JIS 20K(16K)	243	111.5	18.5	18.8			
	JIS 30K	243	111.5	22.5	22.8			
	ANSI 150	237	108.5	18.6	18.9			
	JPI 150	255	117.5	23.1	23.4			
	ANSI 300		250	110.5	21.8	22.1		
	JPI 300	JIS 10K		264	117.5	95.2	382	25.8
80 (3")	JIS 20K(16K)	274	122.5	32.4	32.7			
	JIS 30K	274	122.5	27.1	27.4			
	ANSI 150	294	132.5	27.2	27.5			
	JPI 150		322	132.5	36.6			36.9
	ANSI 300	342		142.5	36.8			37.1
	JPI 300		JIS 10K	342	142.5	140.3	412	44.3
100 (4")	JIS 20K(16K)	352	147.5	53.4	53.7			
	JIS 30K	352	147.5	67.0	67.3			
	ANSI 150	340	141.5	47.1	47.4			
	JPI 150	359	151	47.2	47.5			
	ANSI 300		250	110.5	66.2			66.5
	JPI 300	JIS 10K		274	122.5	199.9	427	66.6
150 (6")	JIS 20K(16K)	294	132.5	39.4	39.7			
	JIS 30K	294	132.5	69.4	69.7			
	ANSI 150	350	—	89.4	89.7			
	JPI 150		—	—	—			—
	ANSI 300	—		—	—			—
	JPI 300		—	—	—	—		
200 (8")	—	—	—	—	—	—	—	
250 (10")	—	—	—	—	—	—	—	
300 (12")	—	—	—	—	—	—	—	

※ : Irrespective of flange rating, a flange thickness having a higher rating is selected as long as the flange O.D. and bolt holes remain the same.

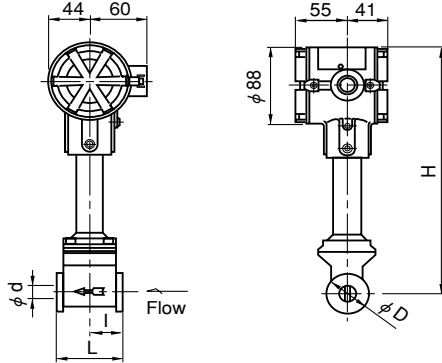
■ High-temperature service Replaceable Sensor Type



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

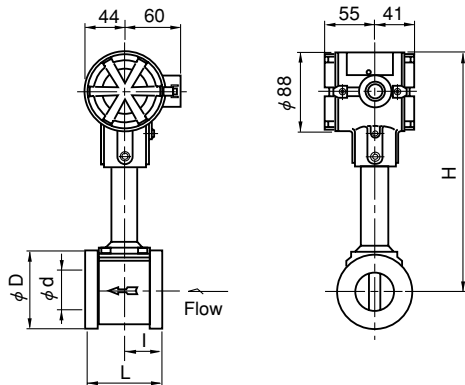
**Wafer Type**

● Nominal sizes 10,15, 25mm



Nominal size (mm)	L	I	φ d (Meter I.D)	φ D	H	Approx. Weight (kg)
10 (3/8")	65	32.5	10	40	276	2.4
15 (1/2")	65	32.5	14.5	40	276	2.4
25 (1")	65	32.5	26.6	67	276	3.0
40 (1-1/2")	80	40	37.6	81	261	3.7
50 (2")	80	40	48.5	91	265	3.8
80 (3")	100	40	72.4	126	281	6.6
100 (4")	125	48	95.2	156.2	301	10.3
150 (6")	165	54	140.3	214.9	331	20.2

● Nominal sizes 40 to 150mm

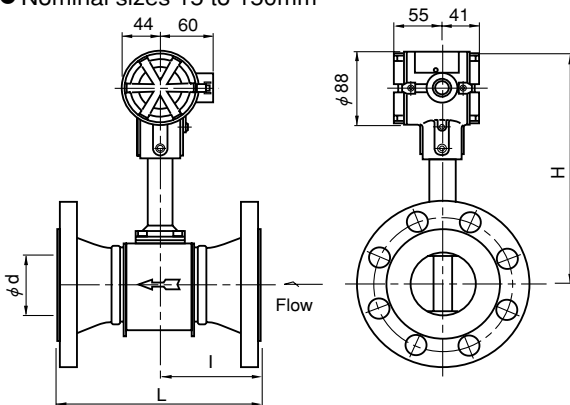


Nominal size (mm)	Flange Rating	L	I	φ d (Meter I.D)	H	Approx. Weight (kg)
15 (1/2")	JIS 10K(16K)	142	71	14.5	276	3.7
	JIS 20K					5.1
	JIS 30K	152	76			3.3
	ANSI 150	158	79			3.9
	JPI 150					
	ANSI 300	167	83.5			
25 (1")	JIS 10K(16K)	152	76	26.6	276	5.7
	JIS 20K					6.7
	JIS 30K	158	79			4.9
	ANSI 150	174	87			6.1
	JPI 150					
	ANSI 300	186	93			
40 (1-1/2")	JIS 10K(16K)	171	85.5	37.6	261	7.8
	JIS 20K	175	87.5			8.2
	JIS 30K	185	92.5			10.3
	ANSI 150	201	100.5			7.8
	JPI 150					7.8
	ANSI 300	213	106.5			10.2
50 (2")	JIS 10K	173	86.5	48.5	265	8.8
	JIS 20K(16K)	181	90.5			9.0
	JIS 30K	191	95.5			11.1
	ANSI 150	204	102			9.7
	JPI 150					9.8
	ANSI 300	217	108.5			11.6
80 (3")	JIS 10K	219	99.5	72.4	281	15.0
	JIS 20K(16K)	233	106.5			17.7
	JIS 30K	243	111.5			21.7
	ANSI 150	237	108.5			17.8
	JPI 150					
	ANSI 300	255	117.5			22.3
100 (4")	JIS 10K	250	110.5	95.2	301	21.0
	JIS 20K(16K)	264	117.5			25.0
	JIS 30K	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")	JIS 10K	322	132.5	140.3	331	36.0
	JIS 20K(16K)	342	142.5			43.5
	JIS 30K	352	147.5			52.6
	ANSI 150	340	141.5			66.2
	JPI 150					46.3
	ANSI 300	359	151			46.4
200 (8")	—	350	—	199.9	346	65.4
250 (10")	—	450	—	248.8	368	65.8
300 (12")	—	550	—	297.9	390	68.6

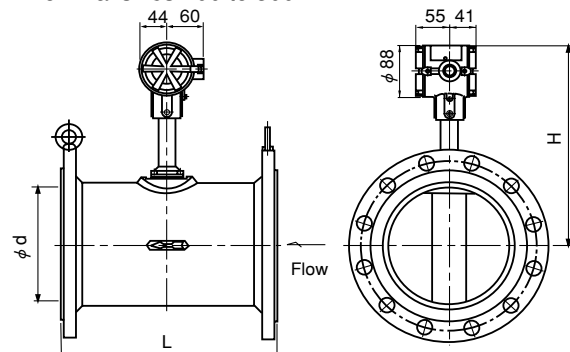
**Flanged Type**

■ Fixed Sensor Type

● Nominal sizes 15 to 150mm



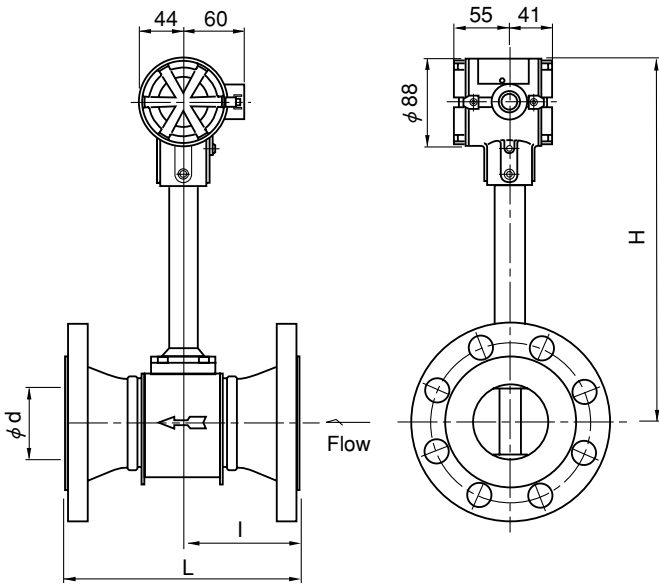
● Nominal sizes 200 to 300mm



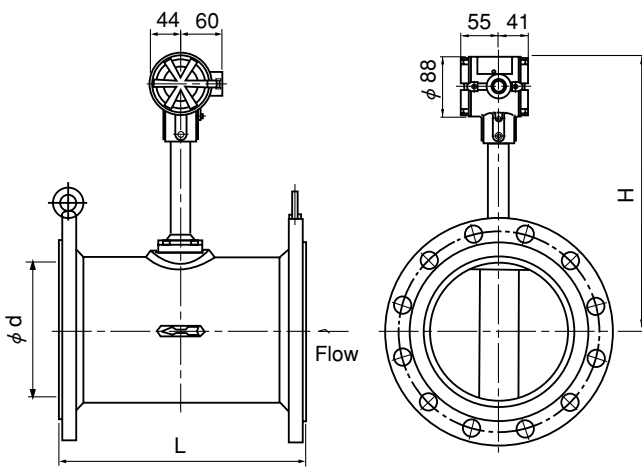
※ : Irrespective of flange rating, a flange thickness having a higher rating is selected as long as the flange O.D. and bolt holes remain the same.

Note: Figures in the brackets show the dimensions with built-in display.  
 Note: Dim.  $\phi$  D is the I.D. of bluff body.  
 Note: In case of explosionproof configuration rated FM/CSA, an NPT1/2 female thread adapter is bonded to the cable connection.

- Replaceable Sensor Type
- Nominal sizes 15 to 150mm



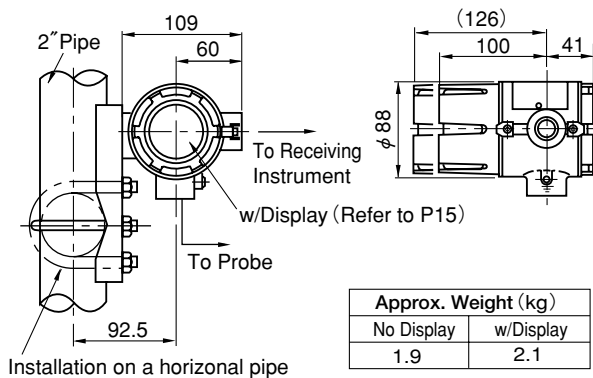
- Nominal sizes 200 to 300mm



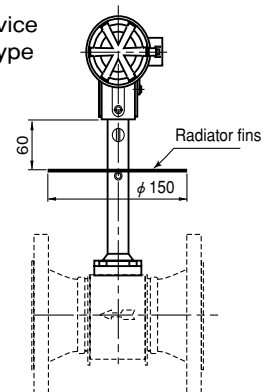
Nominal size (mm)	Flange Rating	L	I	$\phi$ d (Meter I.D.)	H	Approx. Weight (kg)
15 (1/2")	JIS 10K(16K)	142	71	14.5	356	4.3
	JIS 20K					5.7
	JIS 30K	152	76			3.9
	ANSI 150	158	79			4.5
	JPI 150					
	ANSI 300	167	83.5			
25 (1")	JIS 10K(16K)	152	76	26.6	356	6.3
	JIS 20K					7.3
	JIS 30K	158	79			5.5
	ANSI 150	174	87			6.7
	JPI 150					
	ANSI 300	186	93			
40 (1-1/2")	JIS 10K(16K)	171	85.5	37.6	342	8.4
	JIS 20K	175	87.5			8.8
	JIS 30K	185	92.5			10.9
	ANSI 150	201	100.5			8.4
	JPI 150					8.4
	ANSI 300	213	106.5			10.8
50 (2")	JIS 10K	173	86.5	48.5	346	9.4
	JIS 20K(16K)	181	90.5			9.6
	JIS 30K	191	95.5			11.7
	ANSI 150	204	102			10.3
	JPI 150					10.4
	ANSI 300	217	108.5			12.2
80 (3")	JIS 10K	219	99.5	72.4	362	15.6
	JIS 20K(16K)	233	106.5			18.3
	JIS 30K	243	111.5			22.3
	ANSI 150	237	108.5			18.4
	JPI 150					
	ANSI 300	255	117.5			22.9
100 (4")	JIS 10K	250	110.5	95.2	382	21.6
	JIS 20K(16K)	264	117.5			25.6
	JIS 30K	274	122.5			32.2
	ANSI 150	274	122.5			26.9
	JPI 150					27.0
	ANSI 300	294	132.5			36.4
150 (6")	JIS 10K	322	132.5	140.3	412	44.1
	JIS 20K(16K)	342	142.5			53.2
	JIS 30K	352	147.5			66.8
	ANSI 150	340	141.5			46.9
	JPI 150					47.0
	ANSI 300	359	151			66.0
200 (8")	—	350	—	199.9	427	39.4
250 (10")	—	450	—	248.8	449	69.4
300 (12")	—	550	—	297.9	471	89.4

※ : Irrespective of flange rating, a flange thickness having a higher rating is selected as long as the flange O.D. and bolt holes remain the same.

SEPARATE TYPE CONVERTER



- High-temperature service Replaceable Sensor Type

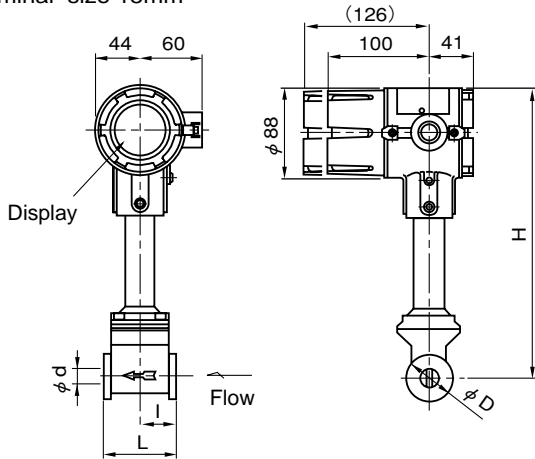


**EX DELTA • DIA OUTLINE DIMENSIONS (Unit in mm)**

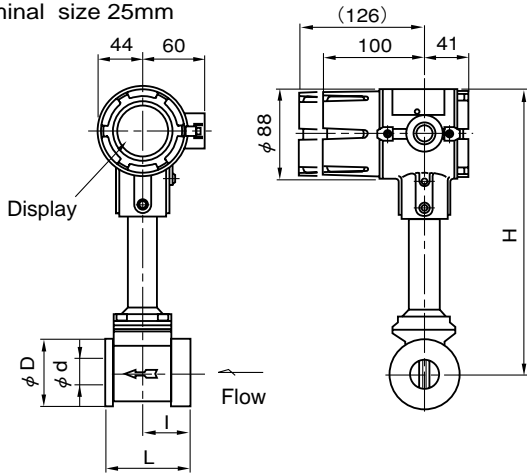
**[INTEGRAL PREAMP TYPE]**

**Wafer Type**

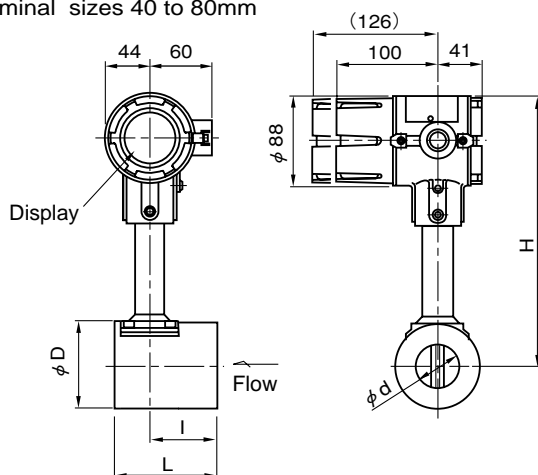
● Nominal size 15mm



● Nominal size 25mm



● Nominal sizes 40 to 80mm

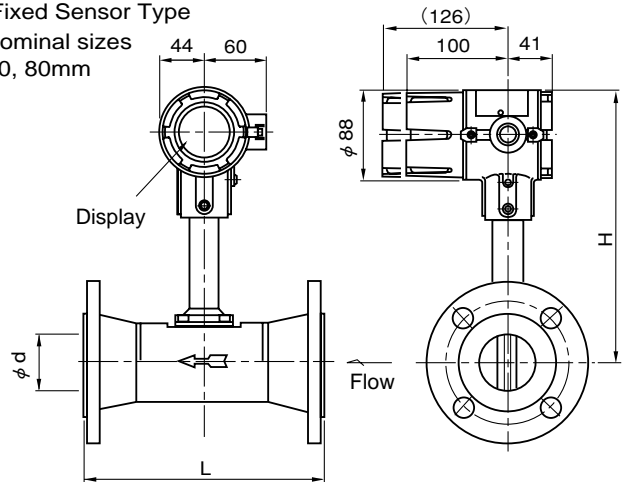


Nominal size (mm)	L	I	φd (Meter i.D.)	φD	H	Approx. Weight (kg)	
						Non Display	w/Display
15 (1/2")	65	32.5	14.5	40	276	2.6	2.9
25 (1")	80	47.5	26.6	67	276	3.2	3.5
40 (1 1/2")	100	67	41.2	82	261	3.9	4.2
50 (2")	125	85	52.7	92	265	4.0	4.3
80 (3")	125	85	78.1	127	281	6.8	7.1

**Flanged Type**

■ Fixed Sensor Type

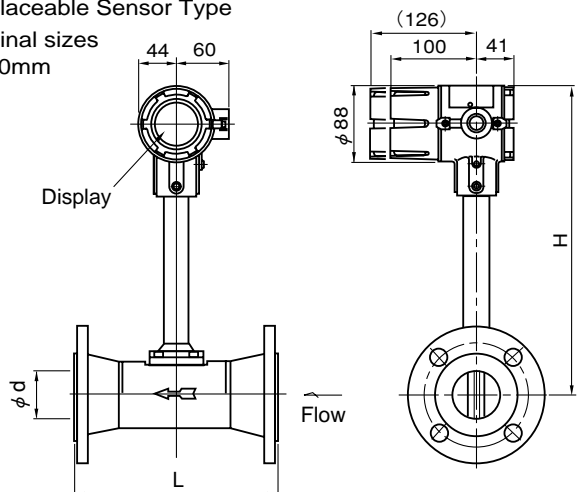
● Nominal sizes 50, 80mm



Nominal size (mm)	L	φd (Meter i.D.)	H
50 (2")	229	52.7	265
80 (3")	254	78.1	281

■ Replaceable Sensor Type

● Nominal sizes 50, 80mm

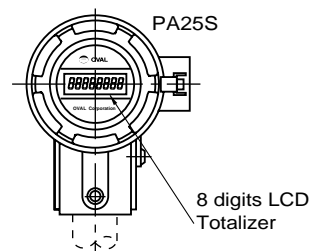


Nominal size (mm)	L	φd (Meter i.D.)	H
50 (2")	229	52.7	346
80 (3")	254	78.1	362

High-temperature service, replaceable model is provided with radiator fins on the adapter. (See P15)

※ : Irrespective of flange rating, a flange thickness having a higher rating is selected as long as the flange O.D. and bolt holes remain the same.

■ Converter PA25S (w/Totalizer)

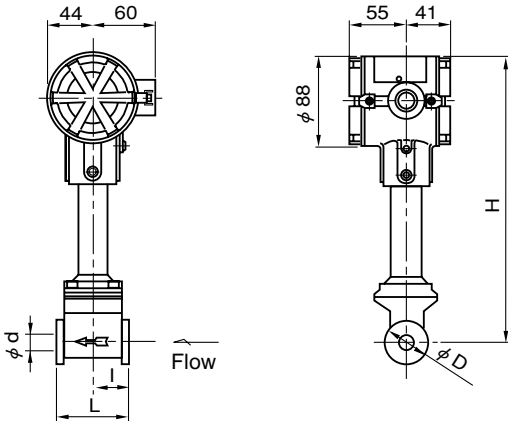


1. Direction of mounting of the converter is changeable with 90° step being rotated around the center of a mounting bracket.
2. Direction of a display is also changeable with 90° step being rotated within the converter.

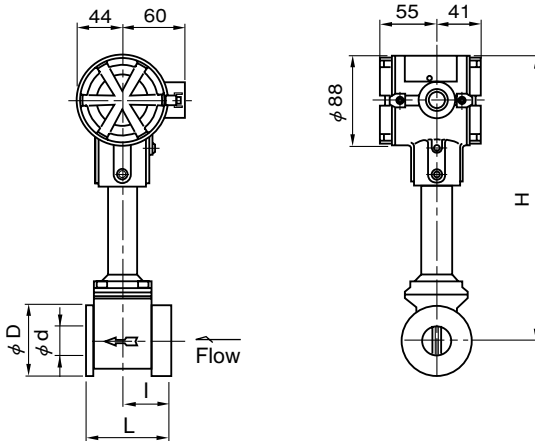
[SEPARATE-MOUNT PREAMP TYPE]

**Wafer Type**

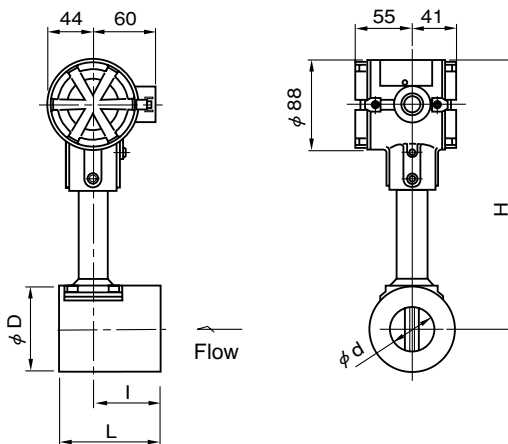
● Nominal size 15mm



● Nominal size 25mm



● Nominal sizes 40 to 80mm

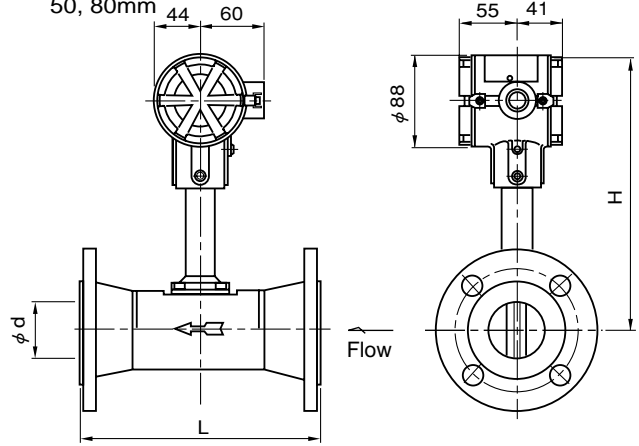


Nominal size (mm)	L	I	φd (Meter i.D.)	φD	H	Approx. Weight(kg)
15 (1/2")	65	32.5	14.5	40	276	2.4
25 (1")	80	47.5	26.6	67	276	3.0
40 (1 1/2")	100	67	41.2	82	261	3.7
50 (2")	125	85	52.7	92	265	3.8
80 (3")	125	85	78.1	127	281	6.6

**Flanged Type**

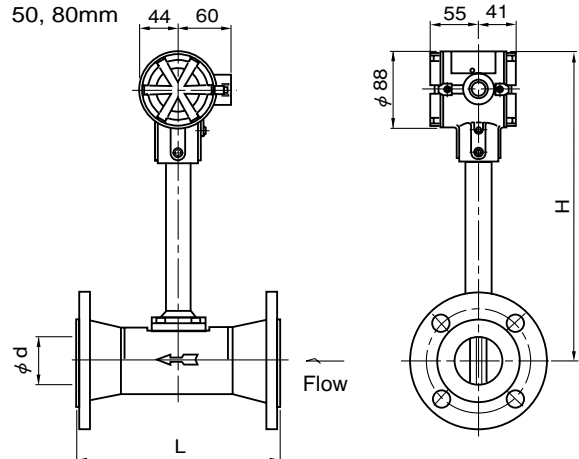
Note: Figures in the brackets show the dimensions for a built-in display.

■ Fixed Sensor Type  
● Nominal sizes 50, 80mm



Nominal size (mm)	L	φd (Meter i.D.)	H
50 (2")	229	52.7	265
80 (3")	254	78.1	281

■ Replaceable Sensor Type  
● Nominal sizes 50, 80mm

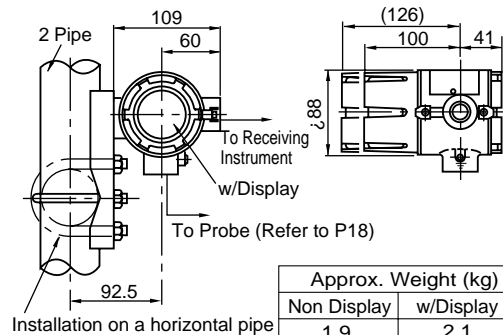


Nominal size (mm)	L	φd (Meter i.D.)	H
50 (2)	229	52.7	347
80 (3)	254	78.1	362

High-temperature service, replaceable model is provided with radiator fins on the adapter. (See P17)

※ : Irrespective of flange rating, a flange thickness having a higher rating is selected as long as the flange O.D. and bolt holes remain the same.

**SEPARATE-MOUNT PREAMP**



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

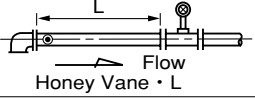
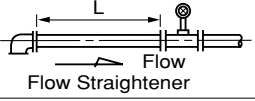
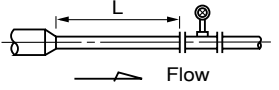
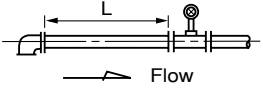
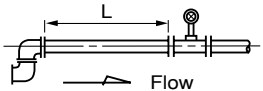
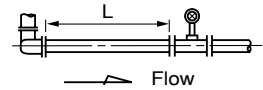
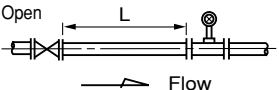
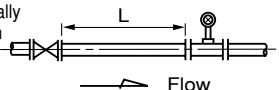
**■ INSTALLATION CONDITIONS**

**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.

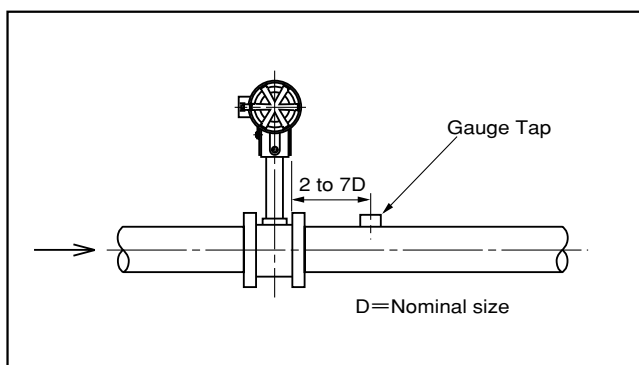
(1) Use an OVAL flow straightener or provide a specified straight pipe (ISO-5167 compliant).

No.	Piping Arrangement	Straight Pipe Length(L)	Remark
1	 OVAL's Flow-Straightener Honey Vane • L	8D	Refer to Point 4 on P21.  Applicable to Nominal size, >25mm
	 Flow Straightener	12D	
2	 Reducer	15D Min.	A concentric reducer is installed at the upstream of a meter.
3	 Elbow	23D Min.	An elbow is installed at the upstream of a meter.
		25D Min.	Two elbows are installed at the upstream of a meter.
		40D Min.	Two elbows are vertically installed at the upstream of a meter.
4	 Fully open gate valve	15D Min.	A full-open gate valve is installed at the upstream of a meter.
5	 Partially Open gate valve	50D Min.	A partially open gate valve, sharp orifice or something that markedly disturbs the flow pattern is upstream of a meter.

Note 1:Sch. 40 pipe is standard in the application above. Use Sch. 40 pipe for standard piping. If you plan to use pipes different in nominal pipe thickness, consult the factory. (Compatible with Sch. 80 piping, too.)

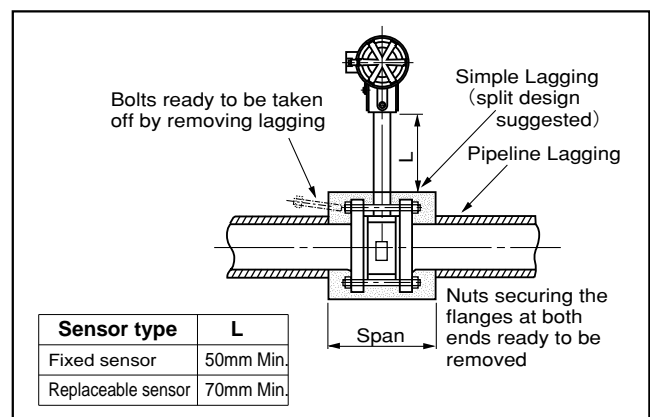
2:A short pipe section, 5D or longer shall be provided down stream of the meter.

3:For pressure detection, provide the probe downstream of the flowmeter (see figure below). To avoid disturbances in the flow, temperature detection should be made downstream of the flowmeter and, at the same time, upstream of the control valve.



**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.



- ※ With high-temperature service, replaceable model, the required length is L=40mm min. from radiator fins.
- ※ If heat retention is required, lagging should be made no more than dim. "L" below the neck of preamplifier.

**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.

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

where, P : Line pressure (MPa)

$\Delta P$  : Pressure loss (MPa)

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

(2) Pressure 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.

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

where, N : Fluctuation pressure (Pa)

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

V : Min. Velocity (m/s)

Even at shutdown, pressure pulsation in the process fluid can produce a false output. If pressure pulsation is excessive, take the following measures:

- ① Locate the source of flow fluctuation downstream of the flowmeter.
- ② Install a pulsation attenuator.
- ③ At shutdown of the flow, shut off valves upstream and downstream of the flowmeter.
- ④ Provide a digital filter (to prevent false pulse output at shutdown).

**4. SPACE SAVING (Reduction 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.

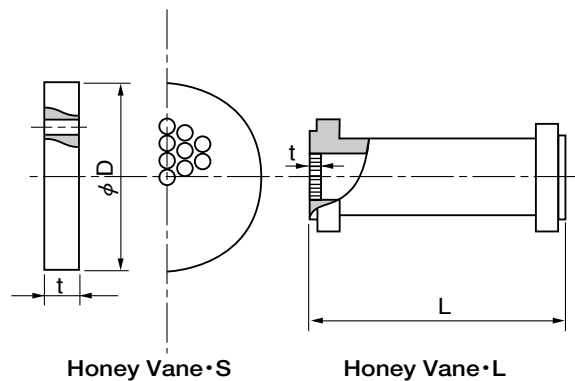
EX DELTA · SS providing a built-in Honey vane is available with accuracy  $\pm 2\%$  RD for liquid service. Consult the factory for accuracy requirement.

**●Honey Vane**

**Outline Dimensions**

Nom.size (mm)	$\phi D \cdot 1$ (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

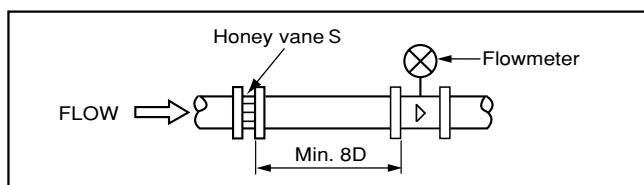
\*1. JIS10K



©Flange face to face span of EX DELTA · SS is the same as that of standard EX DELTA. (Refer to P14,15)

**●Installation of Honey Vane S**

- ① Locate the Honey Vane S upstream of the flowmeter.
- ② Provide a short pipe (8D or longer) between Honey Vane S and flowmeter.



■ EX DELTA PRODUCT CODE EXPLANATION

Item	Code No.																Description			
	①	②	③	④	⑤	⑥	⑦	—	⑧	⑨	⑩	⑪	—	⑫	⑬	⑭		⑮	⑯	
Model	V	X																	EX DELTA	
Body style			W																Wafer type (Nominal size: 10 to 150mm)	Fixed sensor type
			F																Flanged type (size: 15 to 300mm) RF is St'd.	
			R																	Flanged type (size: 15 to 300mm) RF is St'd.
Application			1																Standard (Triangular bluff body)	
Nominal size			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		
Material																			N	SCS14A (Nominal size 10 to 150mm)
																			C	SUS316 (Nominal size 200 to 300mm)
																			Z	SUS316+SFVC2A (Nominal size 200 to 300mm) (※1)
																				Other than above
Flange rating						1														JIS 10K
						2														JIS 16K
						3														JIS 20K
						4														JIS 30K
						5														ANSI 150 (※2)
						6														ANSI 300 (※2)
						7														JPI 150
						8														JPI 300
						9														Others
Sensor configuration						1														Nominal size >40mm (Integral sensor type)
						2														Nominal size =10, 15, 25mm (Separate sensor type)
Applicable fluid						G	—													Gas, Steam (<300°C) (※3)
						L	—													Liquid (<300°C)
						S	—													High temp. application for Gas, Steam (Over 300°C and <460°C) (※3)
						H	—													High temp. application for Liquid (Over 300°C and <460°C)
Converter configuration						1														Integral type
						2														Separate type
Explosionproof configuration						0														None (non-explosionproof)
						1														Flameproof configuration (TIIS) (※4)
						2														Flameproof configuration (ATEX)
						4														Flameproof configuration (FM)
						7														Flameproof configuration (NEPSI)
Display						0														None
						1														Totalizer, Digital Indicator (※5)
Output Signal						4														Unscaled pulse: Smart type
						5														Scaled pulse: Smart type
						6														Analog: Smart type
Version code																		A		

(※1) : Body material for a meter with 200 to 300mm nominal size, Pipe; SUS316+Flange; SFVC2A, however, not applicable for approved object in high pressure safety regulation.

(※2) : Flange serration for ANSI standard : ASME B 16.5—1996.

(※3) : With 10mm, steam measurement is unacceptable.

(※4) : Make it sure to use pressure tight packing in case.

(※5) : Display item is selected by internal switch or EL2310 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	⑯			
<b>Model</b>	V	X															EX DELTA		
<b>Body style</b>			W														Wafer type (Nominal sizes: 15 to 80mm)	Fixed sensor type (※4)	
			F														Flanged type (sizes: 50, 80mm) RF is std.		
			R															Flanged type (sizes: 50, 80mm) RF is std.	Replaceable sensor type
<b>Application</b>			2														Diamond shaped bluff body		
<b>Nominal size</b>			0	1	5	-											15mm		
			0	2	5	-											25mm		
			0	4	0	-											40mm		
			0	5	0	-											50mm		
			0	8	0	-											80mm		
<b>Material</b>																	N	SCS14A (Nominal sizes 15, 25 wafer type)	
																	C	SUS316	
																	Z	Special (other than above)	
<b>Flange rating</b>																	1	JIS 10K	
																	2	JIS 16K	
																	3	JIS 20K	
																	4	JIS 30K	
																	5	ANSI 150	(※1)
																	6	ANSI 300	(※1)
																	7	JPI 150	
																	8	JPI 300	
																	9	Other	
<b>Sensor configuration</b>																	2	Separate sensor type	
<b>Applicable fluid</b>																	L	Liquid	
																	H	High temp. application for liquid (Over 300°C and < 460°C) (Flanged Replaceable sensor type)	
<b>Converter configuration</b>																	1	Integral type	
																	2	Separate type	
<b>Explosionproof configuration</b>																	0	None (non-explosionproof)	
																	1	Flameproof configuration (TIIS)	(※2)
																	2	Flameproof configuration (ATEX)	
																	4	Flameproof configuration (FM)	
																	7	Flameproof configuration (NEPSI)	
<b>Display</b>																	0	None	
																	1	Totalizer, Digital Indicator	(※3)
<b>Output Signal</b>																	4	Unscaled pulse: Smart type	
																	5	Scaled pulse: Smart type	
																	6	Analog: Smart type	
<b>Version code</b>																	A		

(※1) : Flange serration for ANSI standard : ASME B 16.5—1996.

(※2) : Make it sure to use pressure tight packing in case.

(※3) : Display item is selected by internal switch or EL2310 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.

(※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 tick in .

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'd (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. _____ to _____ °C , Pressure _____ to _____ 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 configuration <input type="checkbox"/> Separate configuration Explosionproof configuration : <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 _____ to _____ / h
16. Receiving instrument	<input type="checkbox"/> Separate-mount LCD counter <input type="checkbox"/> Remotely located receiver (Specify model and spec.)
17. Miscellaneous	

The specification as of Jan., 2010 is stated in this GS Sheet. Specifications and design are subject to change without notice.



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初版	改訂	印刷
97.5	10.1	