



Extra wide range, T/P sensor built-in flowmeter

Hybrid Multi DELTA

GENERAL SPECIFICATION
GS.No.GBD621E-3



■ GENERAL

Included among the requirements for compressed air service flowmeters (for control of energy saving) are a wide range coverage from low-level air leaks to the maximum load (max. flowrate), low pressure loss, and inexpensive price.

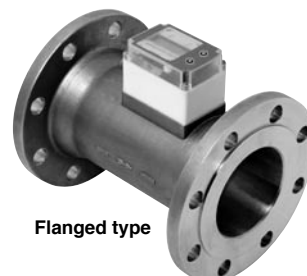
Based on the hybrid technology that combines two different types of sensors - Karman vortice and thermal - in the specialized field of OVAL, the Hybrid Multi DELTA came into existence as a solution to your flow metering needs. With its exceptionally wide 1:700 rangeability (at 0.6 MPa pressure), this meter is ideal for the environmentally conscious operator seeking a thoroughgoing reduction of compressed air consumption

■ FEATURES

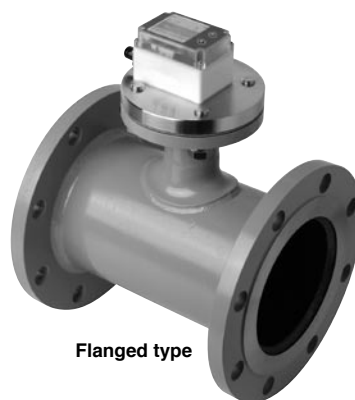
1. Thanks to its extra wide flow range as a compressed air service, energy saving flowmeter, it can measure fluid flows without concern for the magnitude of flowrate or for later flowrate changes when so installed as to match the existing pipeline size.
2. Extra wide range, yet it meets the prerequisite of "low price" as a small size, energy saving flowmeter.
3. Designed to be practically unsusceptible to mist present in the compressed air.
4. Not only the control of compressed air consumption, but also it is sensitive enough in small flow ranges - to the extent of detecting leaks. It enables the operator to grasp numerically the quantity of leakage downstream of the meter at production shutdown.
5. A "Low pressure loss" design - a prerequisite for every compressed air energy saving meter.



Screw connection type



Flanged type



Flanged type



Insertion type

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■ GENERAL SPECIFICATIONS

Item		Description								
Type		Integral type						Insertion type		
Model		TV1025	TV1040	TV1050	TV1065	TV1080	TV1100	TV1150	TV2150	
Metered fluid		Compressed air and nitrogen								
Nominal size		25mm	40mm	50mm	65mm	80mm	100mm	150mm	150mm	
Process connection		Rc1 (Female)	Rc 1・1/2 (Female)	Rc 2 (Female)	Flanged (JIS 10K RF)			Flanged (JIS 10K RF)	Flanged (50A JIS 10K FF)	
Flow range [m³/h (normal)] (※1)		Pressure at 0.5MPa G	0.6 to 360	1.2 to 864	1.8 to 1440	3 to 2160	4.2 to 2880	7.2 to 5040	16 to 11520	
		Pressure at 0.6MPa G	0.6 to 420	1.2 to 1008	1.8 to 1680	3 to 2520	4.2 to 3360	7.2 to 5880	16 to 13440	16 to 13440
		Pressure at 0.7MPa G	0.6 to 480	1.2 to 1150	1.8 to 1920	3 to 2880	4.2 to 3840	7.2 to 6720	16 to 15360	16 to 15360
Material	Meter body	A5052			SCS13A			STPG	SUS304	
	Flanges	—			SCS13A			SS400	SUS304 (※2)	
	Sensor unit	SUS316			SUS316			SUS316	SUS316	
	Others	Display:PC (Polycarbonate) and PBT (Polybutylene terephthalate) mixture resin, Sealing gaskets: Viton, etc.								
Fluid temp.		0 to 50°C								
Ambient temp.		0 to 50°C								
Pressure range		0 to 0.78MPa (Option 0 to 0.98MPa)								
Guaranteed accuracy of flowrate	Accuracy (linearity and pressure effectincl.)	±5% of reading ±0.05% of max. flowrate								
	Reproducibility	±2% of reading ±0.05% of max. flowrate								
	Temperature characteristic	±0.2% / °C of reading								
	Analog output	±0.5% of analog output full scale (to be added to “accuracy” above).								
Guaranteed accuracy of indicated pressure		±4kPa								
Guaranteed accuracy of indicated temperature		±3°C								
Display		7-segment 8-digit LCD (backlit with measurement units) Display is rotatable in 90°C steps. • Instant rate : m³/h (normal), L/min (normal), m³/h, L/min, etc. • Resettable total and grand total : m³ (normal), m³, etc. • Temperature : °C • Pressure : kPa abs LED x2 (Lights upon alarm.)								
Output (※3)		Flow pulse : Open collector output Pulse width : 1 ms default (1 to 240 ms adjustable) Flow analog : 4 to 20mADC, Max. load resistance : 500Ω Flow alarms : 2 points, open collector outputs								
Factored pulse unit		0.001 m³ (normal) P		0.01 m³ (normal) P			0.1 m³ (normal) P			
Alarm		• 2 independent settings selectable (setpoint, hysteresis, high and low alarm select) • Can set lower limit alarm. (Can disalarm around 0 flow.)								
Pressure loss		10kPa max.								
Required straight pipe length		Upstream side : 20D, Downstream side : 3D min.								
Flowmeter response		4 sec. max.								
Power		24VDC±10% Max.150mA (4 to 20mA required for analog output is excluded.)								
Cable		Terminated with connector at one end, 4-conductor shielded cable (3 meters long approx.) furnished as standard accessory. The other cable end is left loose.								
Orientation		Horizontal or vertical								
Application EU directive		EMC directive 2004/108/EC								
Application EN standard		EN55011 : 1998/A1 : 1999/A2 : 2002 Group 1, Class B EN61000-6-23 : 2001								
Enclosure ratings		Non-explosionproof, indoor use, IP65								
Weight (kg)		1.9	2.6	3.3	8.1	8.8	11.4	27	3.5	

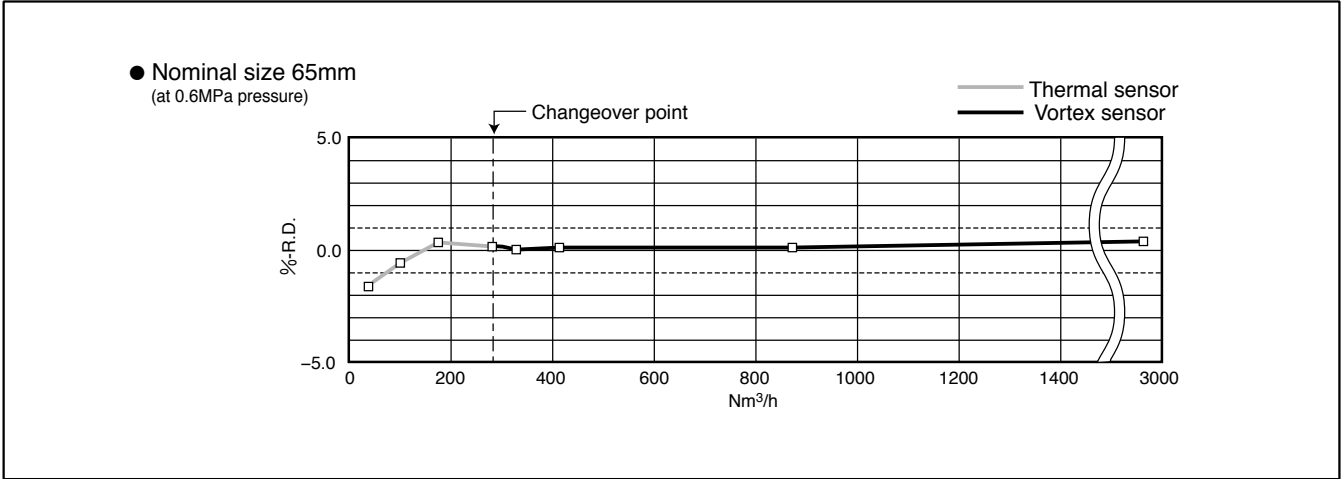
※1 : Max. operating flowrate varies with pressure. Flowrates converted at standard 0°C and 1 atm conditions are shown.

To find the max. operating flowrate - 25mm : 600× (gage press. (MPa) +0.1), 40mm : 1440× (gage press. (MPa) +0.1),
 50mm : 2400× (gage press. (MPa) +0.1), 65mm : 3600× (gage press. (MPa) +0.1), 80mm : 4800× (gage press. (MPa) +0.1),
 100mm (max. flowrate) : 8400× (gage press. (MPa) +0.1) [Unit : m³/h (normal)]. The max. operating flowrate is limited to the flowrate at 0.7MPa however.

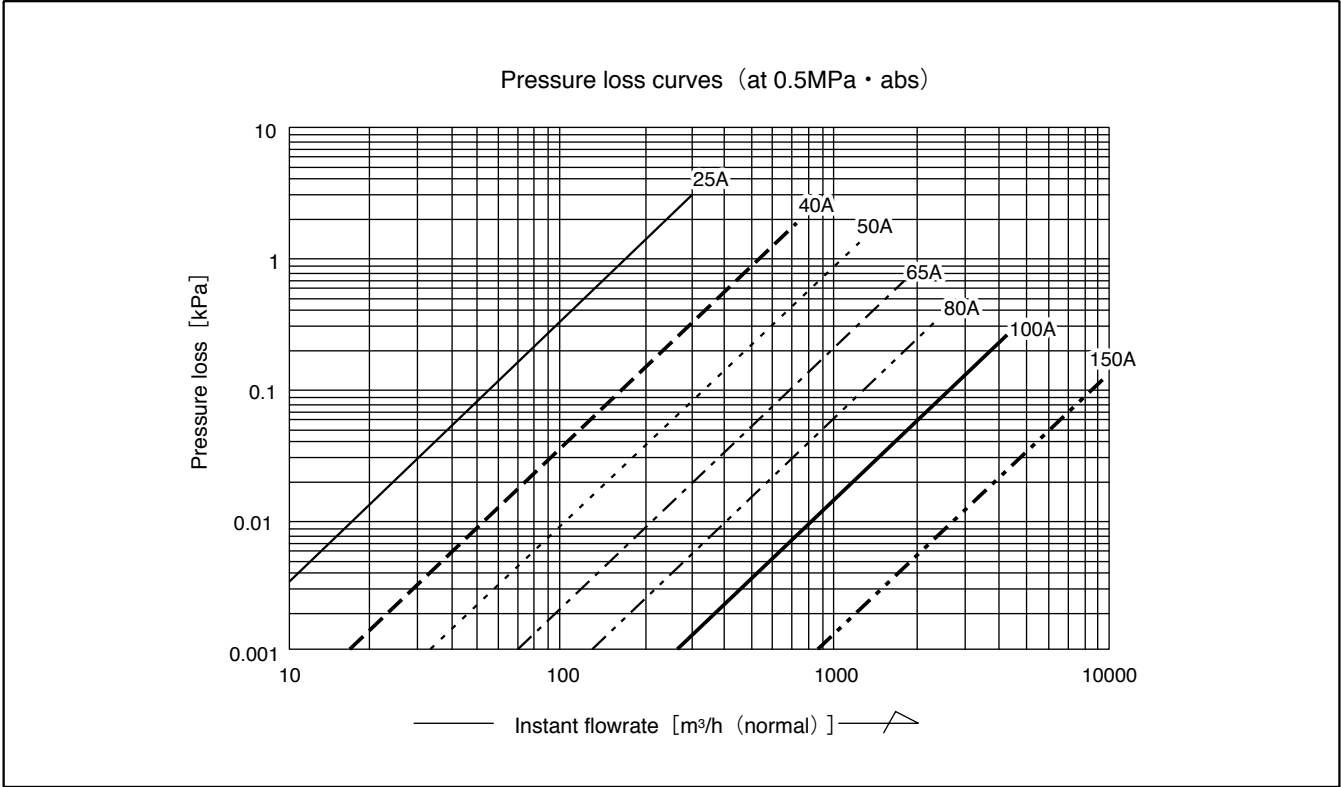
※2 : 50A flange on the mounting nozzle.

※3 : Any two output points are selectable. (See "output" of product code for combination.)

METER ERROR TEST DATA



PRESSURE LOSSES



Pressure losses not shown in the graph above can be calculated by the following formula :

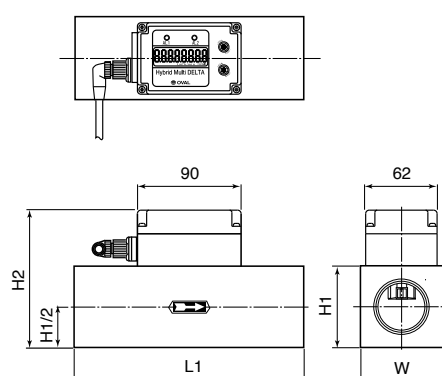
$$\Delta P = \frac{K \times (Q)^2}{P}$$

- Δ P : Pressure loss [kPa]
K : Constant (See table at right.)
Q : Instant flowrate [m³/h(normal)]
P : Line pressure [MPa abs.]

Nominal size	K
25A	1.7×10 ⁻⁵
40A	1.7×10 ⁻⁶
50A	4.3×10 ⁻⁷
65A	1.0×10 ⁻⁷
80A	2.8×10 ⁻⁸
100A	7.0×10 ⁻⁹
150A	7.0×10 ⁻¹⁰

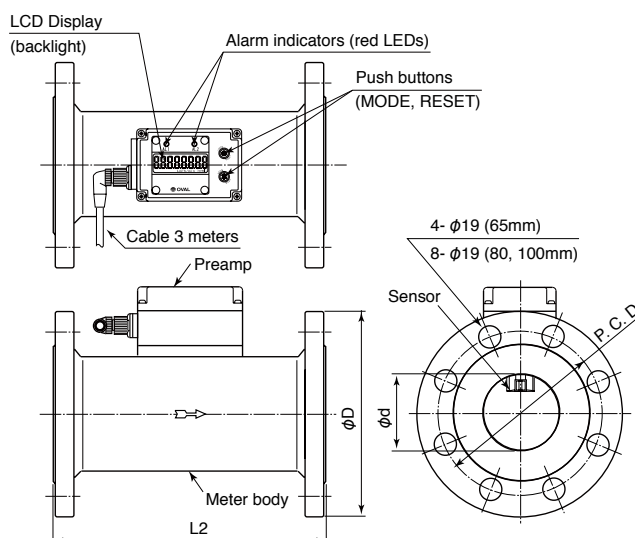
■ DIMENSIONS [Unit in mm]

● Integrally mounted type - 25, 40, 50mm



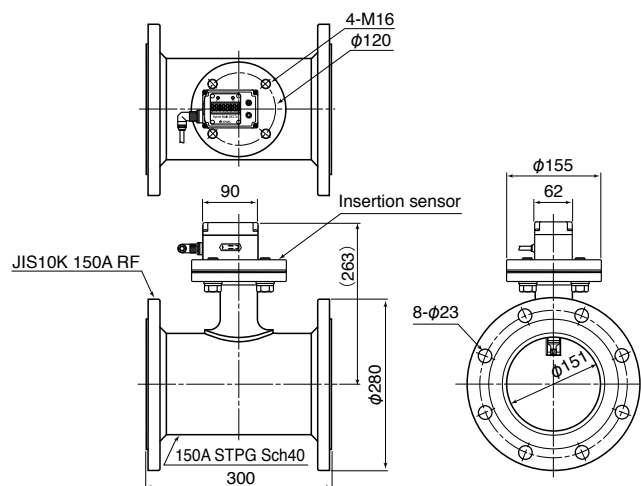
Nom. size	L1	W	H1	H2	Connecting screw
25mm	160	63.0	57.5	118	Rc1 (Female)
40mm	200	71.5	71.5	132	Rc1·1/2 (Female)
50mm	220	83.0	83.0	143.5	Rc2 (Female)

● Integrally mounted type - 65, 80, 100mm

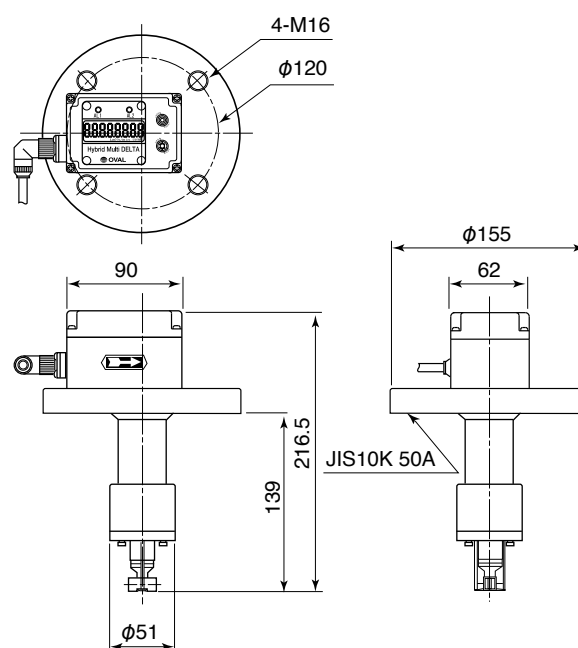


Nom. size	L2	D	d	P.C.D	Connecting flange
65mm	235	175	65.6	140	JIS 10K 65A
80mm	250	185	77.7	150	JIS 10K 80A
100mm	250	210	101.8	175	JIS 10K 100A

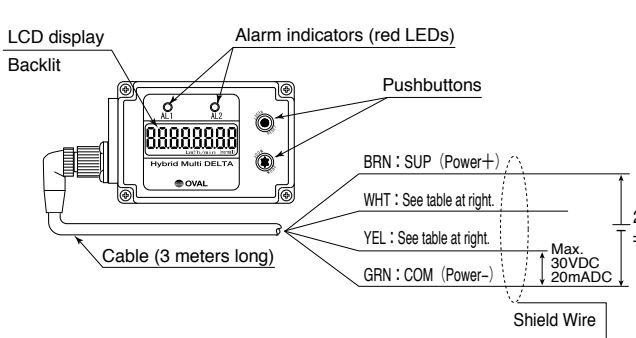
● Integrally mounted type - 150mm



● Insertion type - 150mm



■ WIRING CONNECTIONS



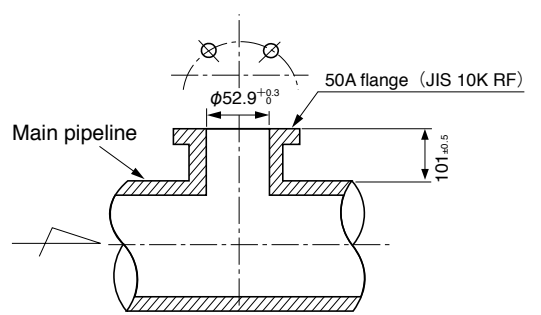
	Specification	WHT wire	YEL wire
1	Factored pulse output + single alarm	Alarm 1 output	Pulse flow output
2	Analog flow output + single alarm	Analog flow output	Alarm 1 output
3	Factored pulse output + analog flow output	Analog flow output	Pulse flow output
4	Two alarms	Alarm 1 output	Alarm 2 output
5	Factored pulse output + analog press. output	Analog press. output	Pulse flow output
6	Factored pulse output + analog temp. output	Analog temp. output	Pulse flow output

■ PARTS REQUIRED FOR INSERTION TYPE

● Mounting nozzle

Given below are the dimensions required for installing the meter (mounting nozzle).

Mounting nozzle dimensions



NOTE: Be sure to align the phase of mounting flange bolt holes.
50A flange face must be parallel to the longitudinal centerline of main pipeline within a $\pm 0.5^\circ$ angle.
Meter accuracy may suffer unless these requirements are met.

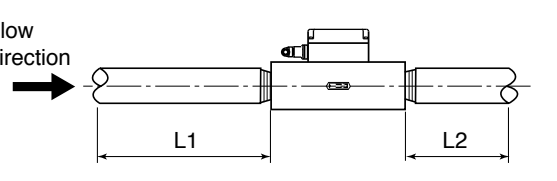
◎ **Gasket**
Use a gasket 2-millimeter thick. A gasket that falls short of this requirement may cause a loss of meter accuracy.

◎ **Bolts**
Use stainless steel hex bolts M16×45 (with flat washer and spring washer).

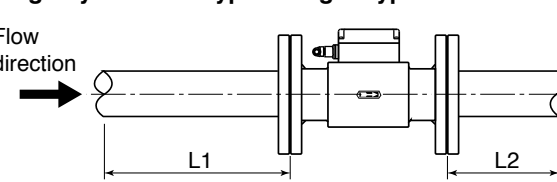
• Mounting nozzles, gaskets and bolts are available as option.

■ REQUIRED STRAIGHT PIPE LENGTHS

● **Integrally mounted type / screw-in type**



● **Integrally mounted type / flanged type**



Nominal size (mm)	Inside dia. (D) (mm)	Upstream pipe (L1) (mm)	Downstream pipe (L2) (mm)
25	25	500 Min.	75 Min.
40	40	800 Min.	120 Min.
50	50	1000 Min.	150 Min.
65	65	1300 Min.	195 Min.
80	80	1600 Min.	240 Min.
100	100	2000 Min.	300 Min.
150	150	3000 Min.	450 Min.

■ PRODUCT CODE EXPLANATION

● Integrally type

Item	Code No.														Description
	①	②	③	④	⑤	⑥	—	⑦	⑧	⑨	⑩	—	⑪	⑫	
Model	T	V													Hybrid Multi DELTA
Type			1												Standard (temp. and press. sensors incorporated)
Nom. size			0	2	5	—									25mm (Rc1)
			0	4	0	—									40mm (Rc1・1/2)
			0	5	0	—									50mm (Rc2)
			0	6	5	—									65mm (65A Flanged)
			0	8	0	—									80mm (80A Flanged)
			1	0	0	—									100mm (100A Flanged)
			1	5	0	—									150mm (150A Flanged)
Meter body material							A								A5052 (Nom. size 25 to 50mm)
							N								SCS13A (Nom. size 65 to 100mm)
							F								SS400 (Nom. size 150mm)
Meter body category								1							Always “1”
Probe construction									2						Nom. size 25, 40, 50, 65mm
									3						Nom. size 80, 100mm
									4						Nom. size 150mm
Metered fluid									G	—					Gas service (compressed air and nitrogen)
									H						Gas service (compressed air and nitrogen) option 0.98MPa
Process connection											1				Rc (taper female threads)
											2				Flanged (JIS 10K) (*1) (*2)
Display												1			Totalizer, digital indicator
Output (*3)													1		Factored pulse +1 alarm (connector terminated)
													2		Analog flow +1 alarm (connector terminated)
													3		Factored pulse +analog flow (connector terminated)
													4		2 alarms (connector terminated)
													5		Factored pulse +analog pressure (connector terminated)
													6		Factored pulse +analog temperature (connector terminated)
Version														A	

*1 : 65mm : 65A, 80mm : 80A, 100mm : 100A, 150mm : 150A flange (The operating pressure is within the max. operating pressure.)

*2 : Nominal size 150mm is applicable to JIS 10K flange only.

*3 : 4- conductor shielded cable 3 meters long is provided with connector.

● Insertion type

Item	Code No.														Description
	①	②	③	④	⑤	⑥	—	⑦	⑧	⑨	⑩	—	⑪	⑫	
Model	T	V													Hybrid Multi DELTA
Type			2												Insertion type (temp. and press. sensors incorporated)
Nom. size			1	5	0	—									150mm
Meter body material							S								SUS304
Meter body category								2							SGP
								3							STPG Sch. 40
Probe construction									4						Nom. size 150mm
Metered fluid									G	—					Gas service (compressed air and nitrogen)
Process connection											2				Flanged (JIS 10K)
Display												1			Totalizer, digital indicator
Output (*1)													1		Factored pulse +1 alarm (connector terminated)
													2		Analog flow +1 alarm (connector terminated)
													3		Factored pulse +analog flow (connector terminated)
													4		2 alarms (connector terminated)
													5		Factored pulse +analog pressure (connector terminated)
													6		Factored pulse +analog temperature (connector terminated)
Version														A	

*1 : 4- conductor shielded cable 3 meters long is provided with connector.

Sales Representative:

■ SENSOR UNIT CONSTRUCTION

The key to successful extra-wide flow range achievement is a "hybrid" arrangement of a vortex sensor and a thermal sensor (flow sensor + temperature sensor).

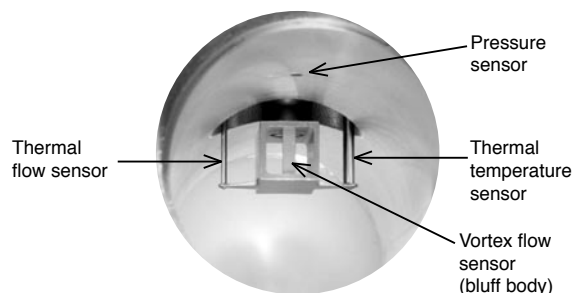
The vortex sensor has advantage in large flow ranges, but not in small flow ranges. Conversely, the thermal sensor has advantage in large flow ranges, but not in large flow ranges.

A hybrid arrangement of these sensors complements their shortcomings one another to achieve an extremely broad flow range.

OVAL has also made further improvements on sensor style, compensation, and switchover techniques.

The inlet to the vortex sensor has a rectangular cross section to allow greater fluid velocity compared with a round counterpart. During measurement of Karman vortices, the built-in pressure sensor and temperature sensor work together to compensate for pressure and temperature in obtaining the mass flowrate.

Changeover from the thermal sensor to the vortex sensor, and vice versa, does not take place at a fixed point. Rather, the force of vortices is detected and is used to calculate optimum changeover point, thereby extending the flow range the vortex sensor can handle down to the extent possible. (Patent granted)



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