CAT.No.CBE007E-5

OVAL

Liquid

Multipath Ultrasonic Flowmeter for Liquid Measurement

Psonic-L4

We add value to the flow

OVAL Corporation

Various fields of technical expertise incorporated into one product: Psonic-L4

Electronics technology + Calibration technology + Mechanical design and processing technology + Sensor technology + Computational fluid dynamics technology

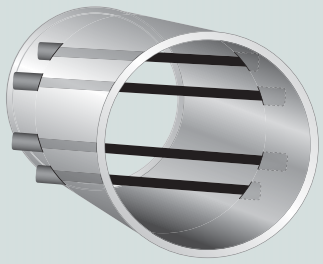
High accuracy ±0.15%RD at actual flow calibration: best suited for custody transfer

Features Simple structure, reliable, made-in-Japan
No moving parts, no pressure loss, no maintenance required
Approvals: TIIS, ATEX, KCs, and compliance with OIML R117-1
Smart appearance with no exposed cables

The parallel path system provides long-term stability and redundancy

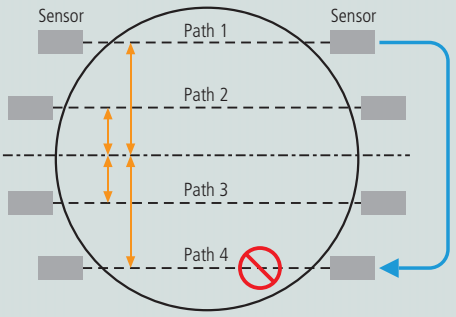
Parallel path system allows long-term stability

Small attenuation of ultrasonic waves allows strong signal reception. Compared to the reflection method, ultrasonic waves are less likely to be affected by risks such as dirt inside the pipe.



4-path system provides redundancy

To continue the measurement in case of sensor failure, the Psonic-L4 is capable of supplement processing. The possible downtime can be minimized.



※: ⃠ represents missing signal/measurement.

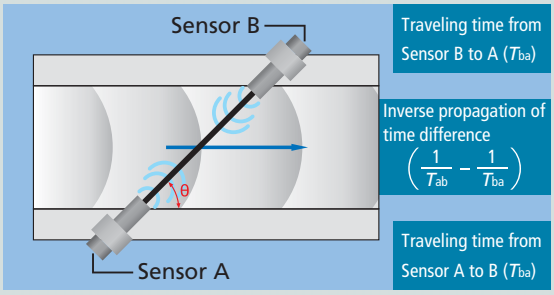
Supplementing process in case of missing signal

If measurement data from a certain path is missing, flow measurement will continue by supplementing the signals from the path in the symmetrical position.
For example, the left figure shows that the measurement data from Path 4 is missing. In this case, the data from Path 1 will substitute the missing data from Path 4 to continue the measurement.

Measurement Principle

Propagation time and flow velocity (flow rate)

The ultrasonic flowmeter measures the time of ultrasonic wave transmitted from one sensor and received by the other. This time duration is called "propagation time."
When there is no flow, the propagation time from sensor A to sensor B (Tab) and the propagation time from sensor B to sensor A (Tba) should be the same. However, once the fluid is flowing, ultrasonic signal is affected by the flow, creating a difference between propagation times Tab and Tba. The ultrasonic flowmeter measures propagation times Tab and Tba, then calculates the flow velocity from the difference in propagation times, and provides the flow rate by multiplying the flow velocity by the cross-section area of the pipe.



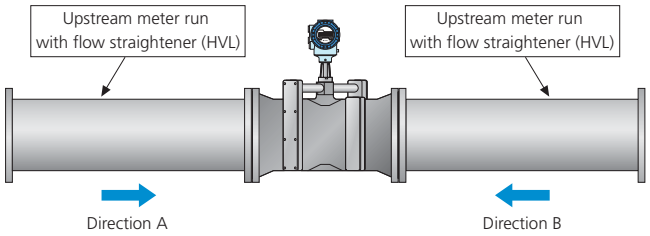
$$V=\frac{1}{2\cos\theta}\left(\frac{1}{Tab}-\frac{1}{Tba}\right)$$

V: Flow velocity [m/s] L: Distance between sensors [m]
θ: Angle between inner pipe axis and course of ultrasonic wave [°]
Tab: Time for propagation from Sensor A to Sensor B [s]
Tba: Time for propagation from Sensor B to Sensor A [s]

∴Q=V×A×K Flow rate = Velocity × Cross-section Area × Coefficient

New flowmeter for custody transfer of petroleum products

- Suitable for custody transfer application of petroleum products
- Capable of bi-directional measurement
- Bi-directional measurement simplifies pipeline layout: lower pipe installation cost
- No strainer required: reduces running cost



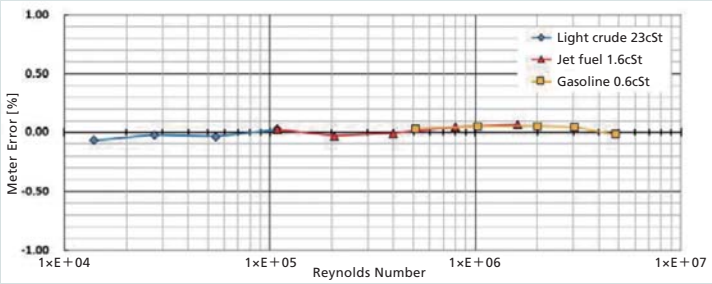
Extensive self-diagnostic functions

To achieve superior performance stability as a liquid flowmeter (especially for the measurement of petroleum products), the Psonic-L4 is equipped with extensive self-diagnostic functions.

Hardware failure detection	Transmitting circuit error / Receiving circuit error / ROM check error
Measured value soundness confirmation notice	High limit alarm / Low limit alarm
Sensor failure or partially-filled pipe detection	No reception error
Zero-point adjustment incomplete notification	Incomplete error
Flow velocity distribution abnormality detection	Drift detection / Swirl detection
Behavior during an error	● Status output ● Error indicator on LCD display ● Specified value of pulse and analog output (HIGH, LOW, HOLD, NONE)

High accuracy: ±0.15%RD

With its 4-path method, the Psonic-L4 achieved the accuracy of ±0.15%RD. Conducting the calibration test at ISO/IEC17025 accredited facility ensures the traceability required in custody transfer applications.



■ Under the condition where an upstream meter run with flow straightener (10D) and a downstream meter run (5D) are installed

■ OIML R117-1 Evaluation Report

Applications

- Custody transfer for:
  - Offshore loading/off-loading
  - Pipelines
  - FPSO
- Stockpile/shipment control at FSO
- Strict control of production lines

For the measurement of costly liquids,
"Maintenance-free"
is becoming an increasingly important aspect along with accuracy.

[General Specifications]

Item	Description	
Applicable fluids	Oil, heavy oil, other liquids (Homogeneous liquids through which an ultrasonic wave propagates)	
Nominal size	100, 150, 200, 250, 300mm	
Process connection	JIS10, 20, 30K RF, JPI150, 300 RF, ASME150, 300 RF	
Body material	SCS13A	
Ambient temp. range	–20 to +60℃	
Fluid temp. range	–20 to +120℃	
Max. operating pressure	Design pressure: 8MPa at 120℃ (vary with flange rating)	
Viscosity range	0.1 to 400mm²/s (0.1 to 400cSt)	
Flow velocity range	–10 to +10m/s	
Factory calibration accuracy	±0.15%RD	1) Calibration at the same Reynolds number as operating condition (High accuracy calibration) (w/ flow straightener and downstream pipe)
	±0.5%RD	2) Calibration without matching the Reynolds number to operating condition (Standard) (w/ flow straightener and downstream pipe)
	±1.0%RD	3) Only with single flowmeter
Transmitter structure	Integrally mounted	
Analog output	Insulated active output 4 to 20mA, Maximum load resistance: 600Ω, Accuracy: ±0.1% FS	
Pulse output	Insulated open collector output (Max. 30VDC, 50mA, ON-voltage: 1.5V or less) 2 output or voltage pulse output (15V±5%) 2 output Max. frequency: 10kHz	
Status output	Insulated photo MOS relay output (Max. 30VDC, 50mA, ON-voltage: 1.5V or less) Alarm output / reverse flow detection	
Output transmission distance	Max. 1km	
Power supply	85 to 240VAC 50/60Hz, 20 to 30VDC	
Power consumption	Max. 10W	
IP rating	IP66	

[Flow Range]

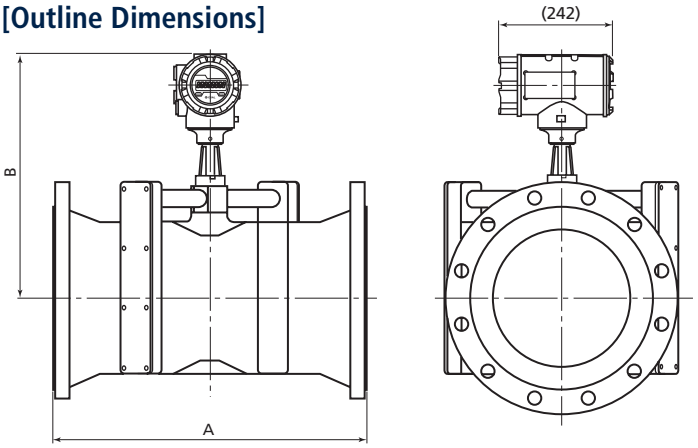
Nominal size (mm)	Min. measurable flow rate (m³/h) Standard low cut (0.1m/s)	Min. flow rate (m³/h)	Max. flow rate (m³/h)
100	2.7	13	270
150	6.0	30	600
200	10.0	50	1000
250	16.0	80	1600
300	23.0	110	2300

※ The minimum flow rate shall be either 0.5m/s or that at Re=8,000, whichever is the larger.
(The above-mentioned values represent the values at 0.5m/s)

[Approvals]

Explosionproof	TIIS: Transmitter terminal part: Ex d IIB T4 Transmitter operation part: Ex d[ia] IIB T4 Transducer part: Ex ia IIB T4 ATEX: II1/2G Ex d ia IIB T4 Ga/Gb KCs: Ex d ia IIB T4 Ga/Gb
Other standards	OIML R117-1: 2007 OIML D11: 2004 High Pressure Gas Safety Act (Japan)

[Outline Dimensions]



Nominal size	Flange	A (mm)	B (mm)	Approx. weight (kg)
100mm	JIS10K	450	411	52
	JIS20K			56
	JIS30K			62
	ASME150/JPI150			57
	ASME300/JPI300			66
150mm	JIS10K	490	436	82
	JIS20K			90
	JIS30K			104
	ASME150/JPI150			85
	ASME300/JPI300			102
200mm	JIS10K	540	462	111
	JIS20K			121
	JIS30K			139
	ASME150/JPI150			121
	ASME300/JPI300			144
250mm	JIS10K	590	487	148
	JIS20K			169
	JIS30K			199
	ASME150/JPI150			161
	ASME300/JPI300			201
300mm	JIS10K	650	513	178
	JIS20K			205
	JIS30K			252
	ASME150/JPI150			212
	ASME300/JPI300			258

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