TECHNICAL GUIDANCE

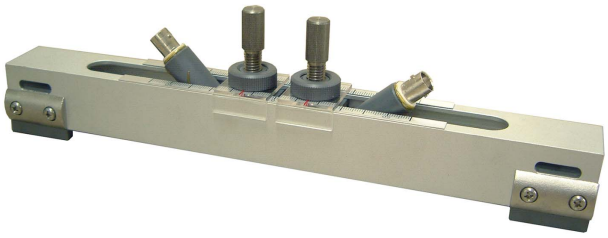
CLAMP-ON TYPE

UL310

ULTRASONIC FLOWMETER

GENERAL

UL310 is "Time flight" type Ultrasonic Flowmeter for liquids.
Since the ultrasonic receiver required for the flow measurement is installed by the clamp-on system from the exterior of piping, it does not contact the measuring fluid at all, and also there are no worries about generating of particles and mixing of metallic ion to the fluid. It is suitable for the measurement of flow rate of pure water and ultrapure water for semiconductor industry.



FEATURES

- ❏ The resistance to bubbles has been sharply improved by the new signal process method "DSP" (Digital Signal Processor). If bubbles are contained in the fluid, the transmission of the ultrasonic signal is impeded and the measurement of signal gets impossible to be made. Signal process technology has been adopted for UL310, and even if the bubbles are contained in the fluid, the stable measurement of signal can be made. (It is not possible to measure the signal in case of many bubbles contained in the fluid.)
- ❏ The particles are not generated and the metallic ion are not mixed to the fluid because of the perfect non-contacting measuring method adopted.
- ❏ There is no pressure loss due to no obstacle in the flow path.
- ❏ This unit is not influenced by the pressure or conductance of measuring fluid.
- ❏ No moving part, and excellent long-time stability.
- ❏ Indication, totalization, electric current, pulse and alarm output are provided as standard.

MEASURING PRINCIPLE

As shown in Fig.1 the ultrasonic is transferred from A to B and B to A in turn with a angle of ψ. The required duration of transfer of two directions is different when measuring medium is moving from upstream to downstream. The duration of transfer is expressed by the following formula.

$$tAB = 2L / (Co + VmCOS\ \psi)$$
$$tBA = 2L / (Co - VmCOS\ \psi)$$

Where

2L:	Distance between A and B
Vm:	Average velocity of medium
Co:	Sonic speed in stable medium
tAB, tBA:	Duration of transfer of Ultrasonic from A to B and B to A

By measuring the difference of the transfer duration, the average velocity of medium can be calculated. The calculation is done by the following formula:

$$2Vm\cos\psi = 2L / tAB - 2L/tBA$$
$$= 2L\ (tBA - tAB) / (tBA \times tAB)$$
$$Vm = L\ (tBA - tAB) / (\cos\psi \times tBA \times tAB)$$

The distance between A and B (L) and the angle (ψ) are known, and the average velocity is mathematically calculated.

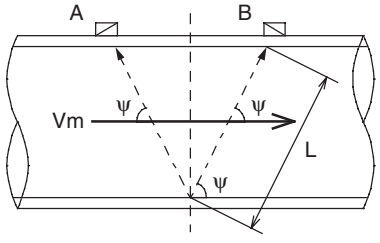


Fig. 1

STANDARD SPECIFICATION

- Measuring method : Ultrasonic time flight type (V path or Z path)
- System components : Sensor, Converter, Exclusive cable × 2 (with BNC connector)
- Installation sensors : Clamp-on type
- Measuring fluid : Liquids (Sonic velocity 1000 to 2200m/s) (Not suitable for liquids containing many bubbles and solids)
- Fluid temperature : Max.60°C at surface of pipe on which sensor is installed
- Pipe material : SGP, Stainless steel, PVC, PVDF, Others (Lining materials are also available. Consult factory for details)
- Measuring pipe size : Min.25mm, Max.300mm (Refer to table 1 for choice and installation of sensor.)
- Measuring range : Minimum full scale velocity; 0.3m/s
  Maximum full scale velocity; 10m/s
- Accuracy : Velocity more than 1m/s, Reynolds' number more than 10000
  ±2% of indicated value
  Velocity less than 1m/s
  Error ±2cm/s velocity
- Indication : 16 digit, 2 row LCD (with back light)
  Contents of display; Flow rate and Total flow
- Power supply : 90 to 250V AC, 50/60Hz (AC version)
  24V DC ± 10% (DC version)
- Power consumption : AC version; Max. 8VA
  DC version; Max. 5W
- Cable entry
  For power and output : 3 × G3/8 with water tight glands
  For sensor : 2 × BNC connector
- Output
  1) Current output; 4 to 20mA DC
  Max. load : 500Ω
  2) Pulse output; Open collector
  Load rating : 30V DC, 50mA
  Pulse width : Based on the number of output pulse per second "pps" (PULSE/s)
  10 to 1000pps; 0.5ms
  5 to 10pps; 50ms
  Less than 5pps; 100ms
  3) Flow rate alarm output/Preset output
  Open collector (1 point)
  Load rating : 30V DC, 50mA
  Operation mode : NO/NC selectable
- Setting of time constant : 0 to 100s
  Effective for Indication, Current output and Pulse output
  (However, even when the time constant is set up at zero, response may be delayed by 0.1 seconds.)
- Setting of low cut off : 0 to 30% F.S.
  Effective for Indication, Current output and Pulse output
- Setting of parameter : By key operation of the converter panel
- Function : Simulation output
- Painting of converter : Epoxy resin painting (Silver)
- Enclosure
  Sensor : Water tight (IP65)
  Converter : Water tight (IP65)
- Material
  Sensor housing : PVC
  Sensor installation rail : Aluminum
  Converter housing : Aluminum alloy
- Sensor signal cable : Standard 10m (Max. 40m available on request)

Table 1. Sensor choice table

Pipe material	**Nominal pipe size D** (mm)	**Sensor installation** *3	**Sensor rail length** (mm)	**Support rail**	**Code of sensor** *5 **combination**
Resin *1	25 ≦ D ≦ 50	V	280	Provided	2
	65 ≦ D ≦ 100	V	280	Not provided	1
	125 ≦ D ≦ 300	V	480 *4	Not provided	3
Metal *2 PVDF	25 ≦ D ≦ 100	V	280	Not provided	1
	125 ≦ D ≦ 300	Z	480 *4	Not provided	4

*1 Resin: PVC or others (Except PVDF)

*2 Metal: SGP, Stainless steel or others (Less than sch.60. In case more than sch.80, consult factory for details)

*3 V: Reflex mode (V path), Z: Diagonal mode (Z path)

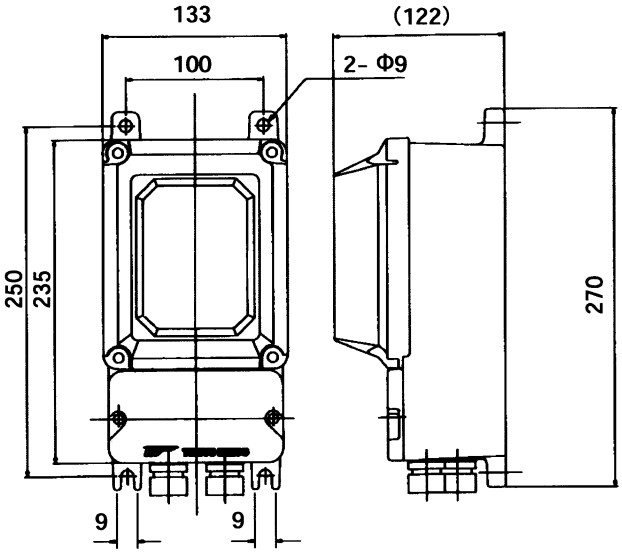
*4 In case of "480mm" type sensor length, the nominal size is for "more than 125mm", but the installation is possible from 65mm. When the nominal size is for "more or less than 100mm" or if there may be the possibility to change the piping, "480mm" type sensor rail length shall be selected.

*5 Refer to the MODEL CODE

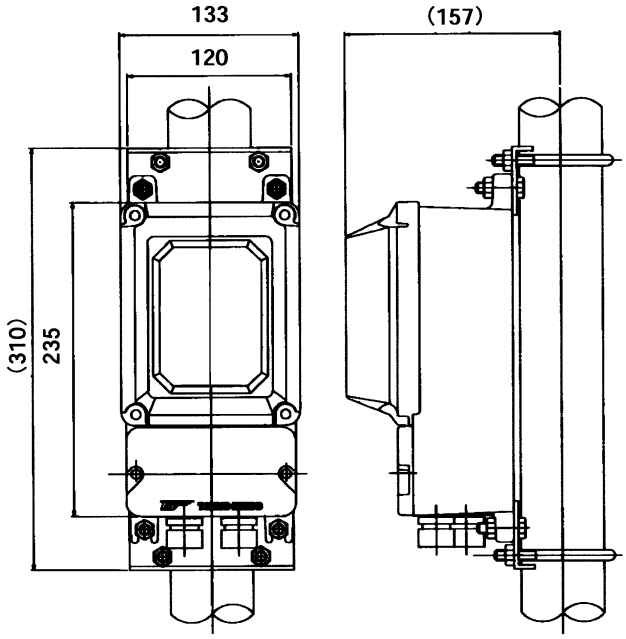
DIMENSIONS

CONVERTER

● Wall mount type

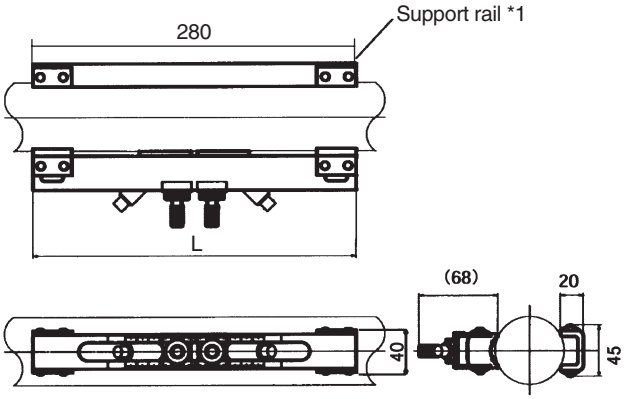


● 2" pipe mount

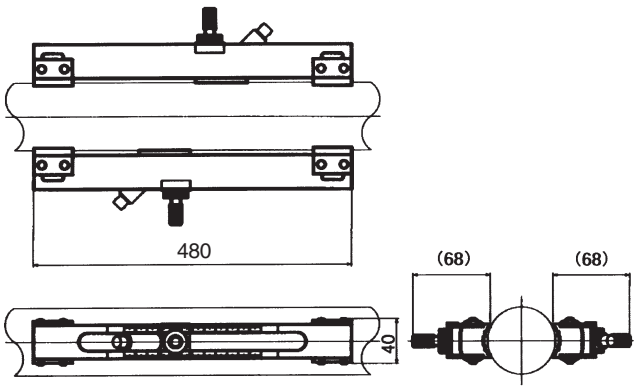


SENSOR

● Reflex mode (V path)



● Diagonal mode (Z path)



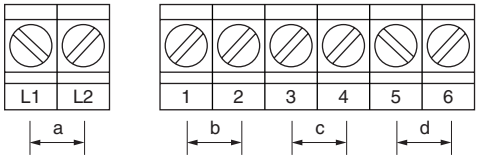
Nominal pipe size	L (mm)
100mm ≧	280
125mm ≦	480

*1 Support rail is to be used for the resin pipe less than 50mm.

MEASURING RANGE

Inner pipe diameter (mm)	Possible setting range (m^3/h)	
	Minimum	Maximum
25	0 to 0.531	0 to 17.67
32	0 to 0.869	0 to 28.95
40	0 to 1.358	0 to 45.23
50	0 to 2.121	0 to 70.68
65	0 to 3.584	0 to 119.4
80	0 to 5.429	0 to 180.9
100	0 to 8.483	0 to 282.7
125	0 to 13.26	0 to 441.7
150	0 to 19.09	0 to 636.1
200	0 to 33.93	0 to 1130
250	0 to 56.02	0 to 1767
300	0 to 76.35	0 to 2544

ELECTRICAL CONNECTION



Mark	Terminal symbol		Polarity	Description
a	CN1	L1	+	Power supply *
		L2	–	
b	CN2	1	+	Current output
		2	–	
c		3	+	Pulse output (Open collector)
		4	–	
d		5	+	Alarm output (Open collector)
		6	–	

* Non polarity for AC version

MODEL CODE

● SENSOR

Model code					Description
UFS310	– ✻	✻	✻		
Sensor combination	– 1				V path, Sensor rail 280mm, Without support rail
	– 2				V path, Sensor rail 280mm, With support rail
	– 3				V path, Sensor rail 480mm, Without support rail
	– 4				Z path, Sensor rail 480mm, Without support rail
Sensor rail band		1			For Nominal diameter 25mm metal pipe (With 2 bands)
		2			For nominal diameter 25mm to 250mm (With 2 bands) *Except 25mm metal pipe
		4			For nominal pipe diameter 300mm (With 4 bands)
Sensor cable length			1		10m [Standard]
			2		20m
			3		30m
			4		40m (Two 20m cables are connected with a relay connector)
Additional functions				(Blank)	NA
				/Z	Provided *1

● CONVERTER

Model code					Description
UFC310	– ✻	✻	A		
Power supply	– A				90 to 250V AC
	– D				24V DC
Mounting		1			Wall mount type [Standard]
		2			2" pipe mount type
Version			A		Version code
Additional functions				(Blank)	NA
				/Z	Provided *1

*1 If special specification is required, fill "/Z" at the end of CODE, and describe it.

SUGGESTIONS

1) Straight length 10D for upstream and 5D for downstream is recommended for accurate measurement. In case pump or valve, expanding piping provided at the upstream 15D straight run is required. (D: Nominal diameter of process piping)
2) The pipe line is to be always full of liquid.
3) It is recommended to install control valves at the downstream side of sensor.
4) It is recommended to provide water tight covers for sensor in case of outdoor installation to avoid problems caused by degradation of grease.

* Specification subject to change without notice

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