

OUTLINE

The UL330R "Time-Flight" type clamp-on ultrasonic flowmeter measures flow rates in plastic piping (PVC, PE) ranging from 25 to 300 mm in nominal diameter and stainless steel piping ranging from 25 to 400 mm in nominal diameter.

A detector (an ultrasonic sensor) is mounted outside an existing piping by clamping method, so that it does not get into contact with the measuring fluid at all, and there are no concerns about the mixture of solid material and metallic ion into the fluid, the corrosion of sensor by chemical, and the pressure loss by installing the flowmeter.

FEATURES

- ❑ The sensor of the UL330R ultrasonic flowmeter is clamped on just outside of an existing pipe without requiring any piping modification.
- ❑ By adopting a DSP and an AD converters, the flow measurement has been speeded up, and the resistance to bubbles has been improved.
- ❑ Because of the noncontact measurement method, the formation of bubbles and the mixture of metallic ion have been completely prevented.
- ❑ Installing the flowmeter does not cause the pressure loss because of no obstacles in the measuring pipe.
- ❑ The ultrasonic flowmeter is not affected by the pressure or conductivity of fluids.
- ❑ Excellent in long-term stability because of no moving part.
- ❑ Providing the following functions: Forward/backward flow rate display, totalizing display, analog output, pulse output, status output.

MEASUREMENT PRINCIPLE

As shown in Fig. 1, when the ultrasonic wave is propagated in the fluid in ψ angle, there is the difference in propagation time between A to B and the reverse direction. The propagation time for each direction is calculated by the following formula.

$$t_{AB} = 2L / V_{AB} = 2L / (C_0 + V_m \cdot \cos \psi)$$

$$t_{BA} = 2L / V_{BA} = 2L / (C_0 - V_m \cdot \cos \psi)$$

Where,

2L : Distance between A and B

V_m : Average fluid velocity

C_0 : Ultrasonic propagation velocity in resting state of fluid

t_{AB} , t_{BA} : Ultrasonic propagation time between A to B and B to A

V_{AB} , V_{BA} : Ultrasonic propagation velocity A to B and B to A.

ψ : Propagation angle of the ultrasonic wave



The average fluid velocity (V_m) can be calculated by measuring the difference in the propagation time as follows:

$$2V_m \cdot \cos \psi = 2L / t_{AB} - 2L / t_{BA}$$

$$\psi = 2L (t_{BA} - t_{AB}) / (t_{BA} \times t_{AB})$$

$$\text{Hence, } V_m = L (t_{BA} - t_{AB}) / (\cos \psi \times t_{BA} \times t_{AB})$$

Since the distance (2L) between A to B and the angle ψ are known, the average fluid velocity (V_m) can be calculated. The flow rate can be calculated from the above V_m and the cross-sectional area of pipe, displayed and outputted.

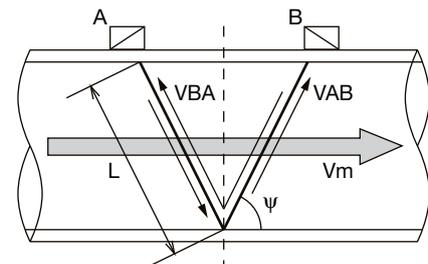


Fig. 1 Measurement Principle

STANDARD SPECIFICATIONS

- Measuring method : Ultrasonic time-flight type (Ultrasonic path: Reflex mode / V path or Diagonal mode / Z path)
- Construction : Sensor, Converter, Exclusive coaxial cable with BNC connector, sensor fixing rail
- Sensor mounting : Piping clamp-on type
- Measuring fluid : Liquids in which Ultrasonic waves propagate
*Refer to P5.[POINTS TO BE CHECKED BEFORE MODEL SELECTION]
- Measurable fluid sonic velocity range : 1,000 to 2,500m/s
- Measurable fluid kinematic viscosity range : 0.30 to 40.00mm²/s
- Fluid temperature : Up to 90°C (Surface temperature of piping)
- Measurable pipe with Nominal diameter : Plastic piping PVC (VP, H1VP [JIS K 6741]), PE (Wall thickness ≤ 10 mm); 25 to 300 mm Stainless steel piping [JIS G 3459/JIS G 3468] Wall thickness ≤ Sch20; 25 to 400 mm Refer to Table 1 for Sensor Selection and Mounting Method.
Note : The flowmeter is not applicable for lined piping.
- Measurable flow velocity range : 0 to 10m/s
- Settable full scale flow velocity range : Minimum 0.3m/s to maximum 10m/s
- Accuracy : ±2% of the reading at the condition that flow velocity is 1m/s or more and Reynolds number is 10000 or more.
: Flow velocity error is ±2cm/s at the condition that flow velocity is less than 1m/s.
- Display : 16-digit, 2-line alphanumeric LCD (with backlight) and status display LEDs (3 pieces)
Display data : Flow rate, totalizing flow rate, various status
- Power supply : 100 to 240V AC 50/60Hz (85 to 264V AC 50/60Hz is acceptable)
- Power consumption : 12 VA or less
- Cable entry : For power/output (M20 × 1.5, 3 pieces); With waterproof cable gland (Applicable cable diameter: φ8.0 to φ13.0) For sensor; Waterproof BNC connector (2 pieces)

- Outputs
 - 1) Analog output : 4 to 20mA DC, Load resistance: 500Ω or less
 - 2) Pulse output : Open collector output Load rating 30 V DC, 50mA, Low level 2V or less
Pulse width : 0.5ms (max.1000pps), 50ms (max.10pps), 100ms (max.5pps), 500ms (max.1pps), 1s (0.5pps or less):
It is selected by the number of the maximum setting pulses.
 - 3) Status output : Open collector output Load rating 30VDC, 50mA, Low level 2V or less
Status 1 : Hold output
Status 2 : Empty pipe detection
Status 3 : Forward or backward flow detection
- Damping setting : 0 to 100s (Settable in increments of 1s step)
* Valid for display, analog output and pulse output.
There is a response delay of 0.5s, even if damping is set to 0s.
- Low cutoff setting : 0 to 30% of the maximum flow rate (Settable in increments of 1%)
* Valid for display, analog output and pulse output.
- Parameter setting : Set with the key switches on the front panel of converter.
- Other additional functions
 - 1) Analog and pulse simulation output function (For loop check)
 - 2) Forward/backward direction measuring function
- Converter mounting method : Mounted onto the wall or 2 inch pipe
- Enclosure : Converter / IP65 Jet-proof, Sensor / IP65 Jet-proof (guaranteed with BNC connectors coupled)
- Material : Sensor housing / Heat-resisting ABS Sensor mounting rail / Aluminum Converter housing / Heat-resisting ABS
- Painting of converter: Housing cover = Blue Housing body = Light gray
- Sensor ambient temperature : -10 to 70°C
- Converter ambient temperature and humidity : -20 to 50°C, 10 to 90% RH (No dew condensation)
- Sensor signal cable : Standard 10m (Up to 60m)
- Weight: : Converter: Approx. 1.0 kg (Excluding metal fitting)
A set of sensors: Approx. 0.2 kg
A set of sensor rails: Approx. 0.7 kg (320 mm short rail)
Approx. 1.1 kg (620 mm long rail)

Table 1. Sensor selection table

Pipe material	Nominal pipe size (D)	Sensor	Sensor installation	Sensor rail length	Sensor rail fpr support	Code of sensor combination
Plastic piping PVC (VP, H1VP [JIS K 6741]) PE (Wall thickness ≤ 10 mm)	25A ≤ D ≤ 40A	A Sensor (2MHz)	V	320 × 2pc	320 × 1pc	1
	50A ≤ D ≤ 150A		Z		Not provided	5
	200A ≤ D ≤ 300A					
Stainless steel piping JIS G 3459/JIS G 3468 Wall thickness ≤ Sch20	25A ≤ D ≤ 150A	A Sensor (2MHz)	V	320 × 2pc	Not provided	5
	150A ≤ D ≤ 300A		Z			
	300A ≤ D ≤ 400A	C Sensor (1MHz)		620 × 2pc		4

Note 1 : Flow rates in PVC pipes of Sch80 may not be measurable with the above sensor installation conditions, depending on the nominal diameter. Contact us in advance.

Note 2 : Select the UL350 for stainless steel piping of nominal diameter larger than 400A (up to 1000A), stainless steel piping of Sch40, and polyethylene (PE) piping whose wall is thicker than 10 mm.

Note 3 : "V" in the sensor installation column denotes V path, reflex mode and "Z" denotes Z path, diagonal mode.

Note 4 : Two sensor rails must be installed for each piping even if V path, reflex mode is specified for sensor installation. Even if V path, reflex mode is specified for sensor installation, Z path, diagonal mode may have to be selected instead, due to the effects of possible piping distortion, inside deposits, or external noises.

Note 5 : For the case of plastic piping of nominal diameter 40A or smaller, two sensor rails, a main sensor rail and a reinforcing sensor rail, must be installed for each piping to prevent piping distortion.

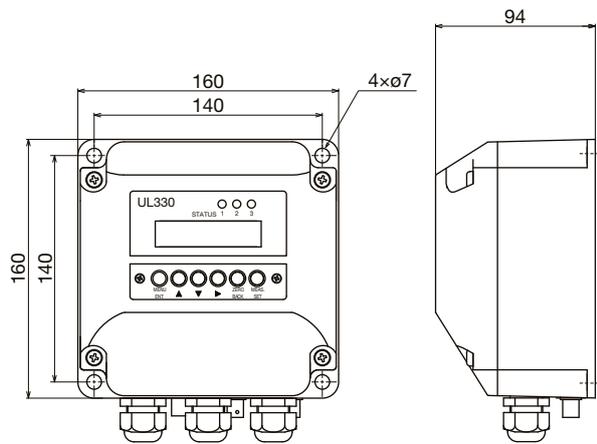
Note 6 : When the size of measuring pipes is unknown (larger than 400A) or when the piping material may be changed to something other than those listed in the above selection table, the UL330R may not work well for measuring flow rate.

Note 7 : See the sensor combination in MODEL CODE.

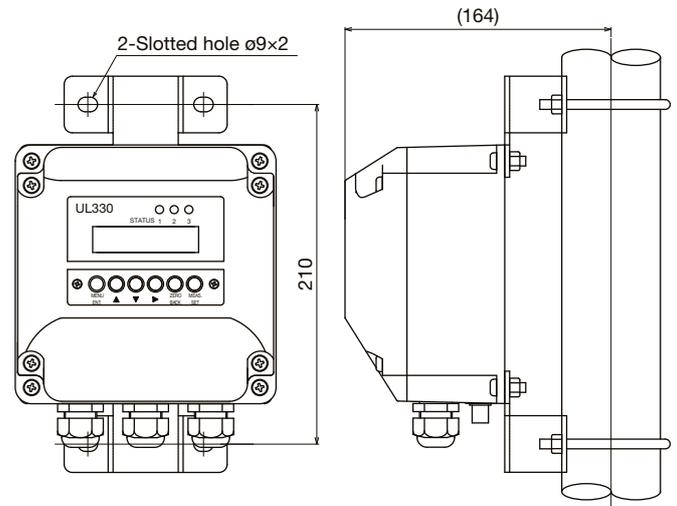
DIMENSIONS

CONVERTER

- Wall mount type

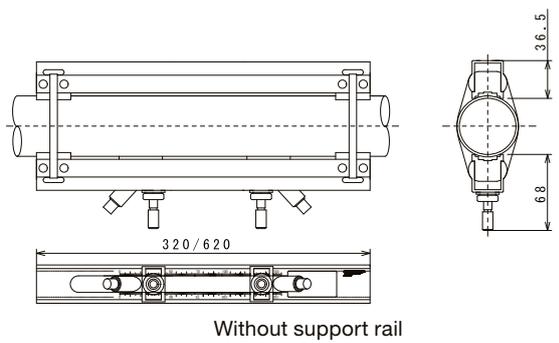
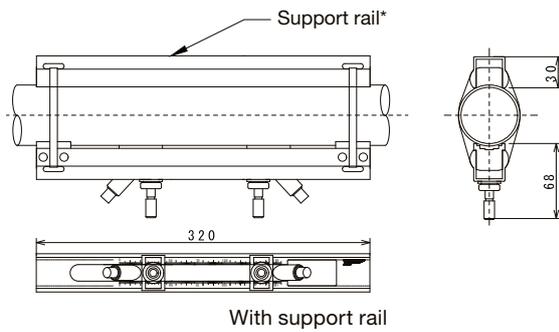


- 2" pipe mount

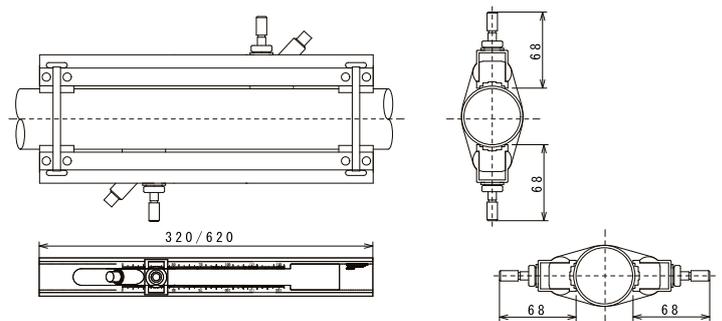


SENSOR

- Reflex mode (V path)



- Diagonal mode (Z path)



* Support rail is to be used for the resin pipe from 25 to 40mm.

* Refer to Table 1 Sensor selection table.

FLOW RATE RANGE/SIZE

Nominal diameter (mm)	Possible scale range (m ³ /h)	
	Minimum	Maximum
25	0.684	22.80
32	1.167	38.91
40	1.568	52.27
50	2.556	85.21
65	4.192	139.7
80	5.857	195.2
100	9.948	331.6
125	15.00	500.1
150	21.28	709.4
200	36.80	1226
250	57.07	1902
300	81.25	2708
350	101.3	3377
400	133.2	4442

[Note]
 The above-mentioned flow rates have been calculated for the SUS Sch. 10s pipes, at the minimum range flow velocity of 0.3m/s and maximum range flow velocity of 10m/s.
 (The flow rate range may differ slightly, depending on the piping standard.)

WIRING DIAGRAM

CN1			CN2									
Power supply (AC)			Analog output 4 to 20mA DC		Totalized pulse output		External totalization reset		Status output			
(3P)			(2P)		(2P)		(2P)		ST1	ST2	com	ST3
L1	L2	FG	+	-	+	-	+	-	+	+	com	+

Note 1 :
 ST1 (Status 1) : Hold output
 ST2 (Status 2) : Empty pipe detection
 ST3 (Status 3) : Forward or backward flow detection
 Note 2 :
 The detachable connectors are used.

MODEL CODE

● Sensor

Sensor Model code				Description
UFS330	A			A sensor (2MHz)
	B			C sensor (1MHz)
Sensor combination	1			Short sensor rail × 2 pcs, Sensor rail for support × 1 pc (*)
	4			Long sensor rail × 2 pcs (*)
	5			Short sensor rail × 2 pcs (*)
Cable length	1			10m (Standard)
	2			20m
	3			30m
	4			40m
	5			50m
	6			60m
Additional functions	(Blank)			NA
	/Z			Provided

*: Refer to table 1. Sensor selection table.

● Converter

Converter Model code				Description
UFC330	A			
Power supply	A			100 to 240V AC 50/60Hz
	-			
Mounting	1			Wall mount type
	2			2" pipe mount type
Serial output	1			Standard
	-			
Additional functions	(Blank)			NA
	/Z			Provided

POINTS TO BE CHECKED BEFORE MODEL SELECTION

It may be unable to make measurement when falling into the following conditions.

Contact us in advance. When it cannot be judged whether it is suitable, we are prepared to make preliminary test by the actual equipment.

1) Liquid

- The liquid containing a lot of bubbles (over 2% only as a guide).
- The liquid containing slurry and solid material (over 5Vol.% only as a guide).
- The liquid of low Reynolds number (less than Re.10000 only as a guide).
- Liquids other than water such as lean chemical solutions, oils, waste waters and hot spring water.
- Liquids which attenuate Ultrasonic waves (Typical example:acetic acid)

*This flowmeter cannot be used for High concentration acetic acid aqueous solution (above 50%) .

2) Piping

- The inside wall of carbon steel pipe is rusty.
- Adhesion and sediment are in a pipe.
- The outside surface of cast iron pipe is coarse.
- Pipe made of PVDF with thickness more than 9mm.
- Pipe made of PP with thickness more than 15mm.
- SGPW pipe [The galvanized steel pipe for water service (white gas pipe)]
- Lined pipe

3) Straight runs

The accurate flow measurement requires straight runs both upstream and downstream of the flow sensor as shown at the next page.

PRECAUTION FOR USE

- 1) Pipe shall be always filled with fluid.
- 2) In the case of horizontal piping, please do not mount a sensor on the upper and the lower part of piping.
- 3) When you wrap a sensor in an insulating material, be careful not to exceed the ambient temperature limits of a sensor.
- 4) In order to prevent the sensor grease from degrading when installed outside, we recommend you to mount the waterproof cover which covers a sensor assembly.

REQUIRED STRAIGHT RUNS

D : Nominal diameter

Reference : JEMIS-032, JEMIMA

Classification	Required upstream straight length	Required downstream straight length
90 bend		
Tee		
Expansion pipe		
Reducer		
Valve		
Pump		

* Specification is subject to change without notice.

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