

OUTLINE

UL6400 is the portable type ultrasonic flowmeter driven by an built-in battery.

Anytime and anywhere, the handy ultrasonic flowmeter measures the various kinds of liquid flow rate just by clamping the sensor on the surface of the existing process lines and by easy setting-up of parameters.

FEATURES

- ❑ Wide measuring ranges
A set of UL6400 covers the wide ranges of flow measurement from 15 mm to 1500 mm in pipe sizes.
- ❑ Portable and easy to handle
With all instruments and accessories packed, you can carry and store a rugged plastic trunk with casters anywhere you want.
- ❑ Battery driven
The built-in battery allows UL6400 to work as long as 14 hours without charging. The attached AC adapter makes UL6400 work continuously while charging the battery.
- ❑ High performances
Not only the flow rate and total flow, but also the measuring status, error messages and battery power are displayed. Data are stored in the USB memory for further data processing.
- ❑ Compensation of flow rate in low Reynolds number domain
Inputting the kinematic viscosity compensates the flow rate in the low Reynolds number domain using inhouse calculation function.
- ❑ Lining pipe
By inputting the lining data, flow rate in lining pipe is measured without time-consuming calculation.

APPLICATIONS

- (1) Flow measurement of process lining where no flowmeters are installed
One UL6400 can measure a multiple of flow lines where no flowmeters are installed. It saves your cost by applying it for various services.
- (2) Checking of existing flowmeters
Bring UL6400 to the subject pipe lines for checking of the existing flowmeters. You can compare the flow rate measured by existing ones with the one by UL6400.
- (3) Checking of pump performance
For checking of the pump discharge flow rate by the portable UL6400.
- (4) Temporary flow measurement
For temporary flow measurements in such services as start-up, periodical flow checks and during malfunctioning of the existing flowmeters including applications in remote area without power source.
- (5) For corrosive liquids
The non-contact measurement where the sensor is installed on the exterior surface of pipe ensures the anti-corrosion and anti-erosion. UL6400 is compatible with the pipes with linings also.







OVERALL SPECIFICATION

- Measuring method : Ultrasonic time flight system
- Sensor installation : Clamp on pipe
- Measurable pipe size : 15 mm to 1500 mm
Pipe outside diameter must be 20 mm or more
- Measuring fluid : The liquids which ultrasonic waves transmit through
 - Fluid status
 - Recommended velocity : 0.5 to 20 m/s
 - Allowable kinematic viscosity : 100 mm²/s or less
- Fluid temperature : -40°C to 120°C at the exterior surface of the pipe
- Pipe materials : Carbon steel, Stainless steel, PVC, PP, FRP, Lining materials
- Required straight runs : Upstream 10 D or more
Downstream 5 D or more
Where 90° elbows are installed at upstream and downstream pipe.
“D” Nominal diameter.

SENSOR SPECIFICATION

- Sensor type and installation method

Size	Type of sensor and number of rail	Installation method
15 to 150 mm	Small size sensor with 1 rail	V mode 
50 to 250 mm	Medium size sensor with 1 rail	V mode 
200 to 750 mm	Medium size sensor with 2 rail	V mode 
400 to 1500 mm	Medium size sensor with 2 rail	Z mode 

- Sensor rail material : Aluminum with alumite treatment
- Protection class : IP67 (Equivalent to NEMA 6)
- Ambient temperature : -40 to 70°C
- Sensor cable length : 3 m

CONVERTER SPECIFICATION

- Supply voltage : built-in lithium battery
Continuous operation for approximately 14 hours,
Rechargeable in 8 hours
- AC adapter : 90 to 264 VAC, 47 to 67 Hz
Charging output : 13.2 V
- Display : 4.3 inch TFT-LCD with backlight by LED

- Contents of display
 - No.1 and No.2 screen : Selectable from flow rate, total flow, flow velocity, Reynolds No., Ultrasonic propagation velocity, ultrasonic signal propagation status or else
 - No.3 screen : Bar graph presentation
 - No.4 screen : Error message presentation
- Material of housing : Polyamide PA12 covered with TPE (Thermo plastic elastomers)
- Protection class : IP65 (Equivalent to NEMA 4)
- Ambient temperature : -20 to 55°C
- External memory : USB memory

ACCURACY

- Accuracy : ±1.0 % of the reading for pipe size 50 mm or more and velocity 0.5 m/s or more
: ±3.0 % of the reading for pipe size less than 50 mm and velocity 0.5 m/s or more
- Note : Above accuracy is based on the following calibration conditions.
Measuring fluids : Water at 20°C
Upstream straight runs : 10 D

PRODUCT COMPONENTS

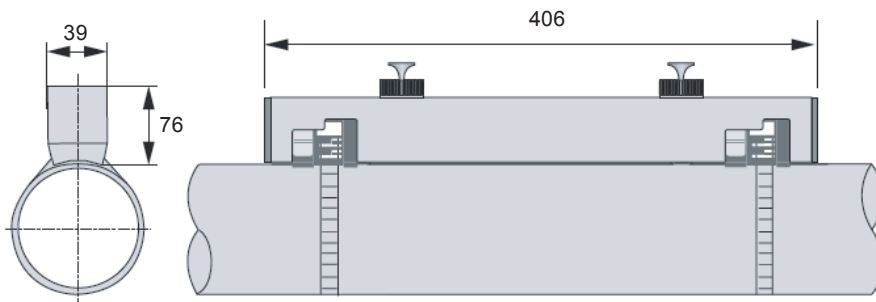
OTHERS

- Material of trunk : Polypropylene

Items	Quantity
Converter	1
Small size sensors with 3 m cable	2
Medium size sensors with 3 m cable	2
Sensor rail	2
Bands for mounting sensor rails	4
Straps for mounting sensor rails for large size pipe	4
Sensor grease	1
AC power adapter including 4 kinds of plugs	1
Measuring scale	1
USB memory 2 GB	1
Carrying bag	1
Trunk with casters	1

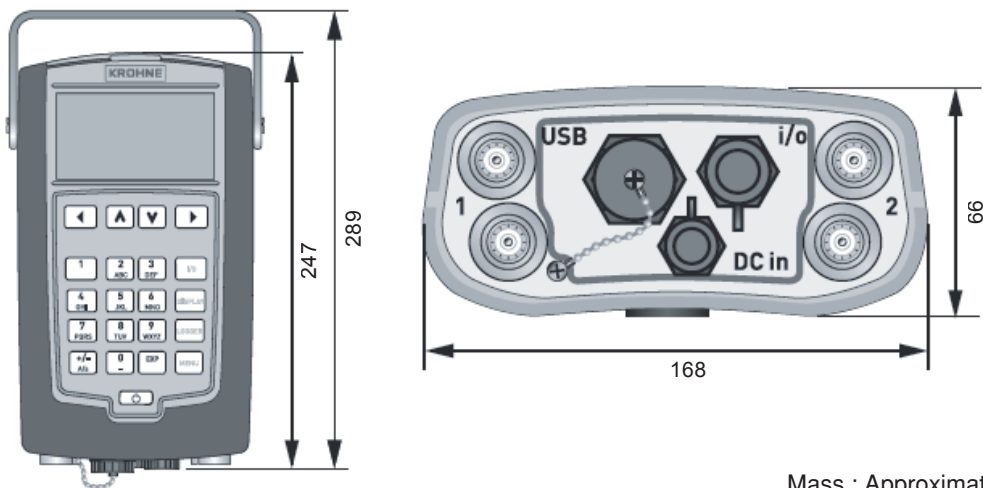
DIMENSIONS

● Sensor



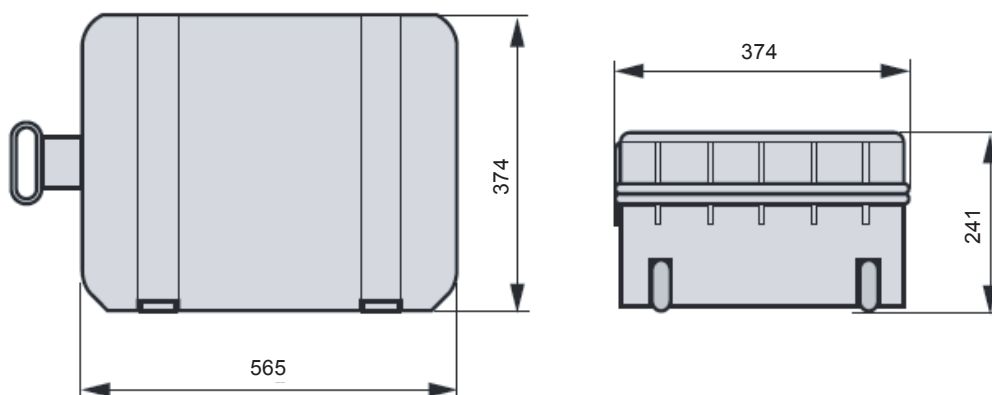
Mass : Approximately 1.7 kg including cable

● Converter



Mass : Approximately 1.7 kg

● Trunk with casters



Total mass : Approximately 14 kg

MEASURING 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 "B to A" (the reverse direction). The propagation time for each direction is calculated by the following formula.

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

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

Where,

2L : Distance between A and B

V_m : Average fluid velocity

C_o : Ultrasonic propagation velocity in still fluid

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

difference in the propagation time as follows:

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

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

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

Since the distance (2L) from 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. The result is displayed and outputted.

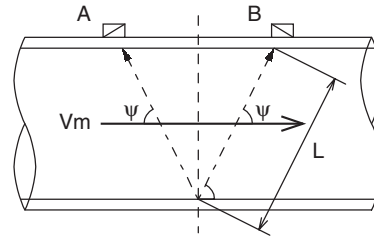


Fig.1 Measurement principle

POINTS TO BE CHECKED BEFORE USING

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

Contact us in advance.

(1) Liquid properties

- Liquids containing a lot of bubbles
- Liquids containing slurry and solid material
- Liquids (solutions and waste water or the like) of which properties (concentration, density, viscosity) are not stable.

(2) Measuring pipe

- The inside wall of carbon steel pipe is rusty.
- Adhesion and sediment are in a pipe.
- Lining pipes which have gap between inside surface of pipe and lining material.

PRECAUTION FOR USE

- (1) The accurate flow measurement requires straight runs both upstream and downstream.
- (2) Pipe shall be always filled with fluid.
- (3) In the case of horizontal piping, please do not mount a sensor on the top or the bottom of piping.

* Specification is subject to change without notice.

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