Fuji Ultrasonic Flowmeter Series

Liquid flow rate measurement over a wide range

Measurement not hampered by entry of bubbles and solid matter

Strong lineup
Features of ultrasonic flowmeter in flow rate measurement

1. Total cost reduction allowed by elimination of piping installation
2. Can be installed even while facility is in operation.
3. Non-invasive measurement eliminates the need of maintenance.
4. Battery-driven portable flowmeter allows measurement at various locations in the field.
5. Strong lineup meets various needs.

Ultrasonic Flowmeter Lineup

**Duosonics**

- Hybrid type (type: FSH, FSW)
  - 4 to 20mADC (1 point)
  - Integrated pulse, etc. (DO 3 point)
  - Communication (1 point) (RS232/485)
  - Flow velocity distribution

- 2 Lines type (type: FSH, FSG, FSD)
  - 4 to 20mADC (1 point)
  - Integrated pulse, etc. (DO 3 point)
  - Communication (1 point) (RS232/485)

**TIME DELTA-C**

- Compact type (type: FSV, FSG, FSD, FLS)
  - 4 to 20mADC (1 point)
  - Integrated pulse, etc. (DO 3 point)
  - Communication (1 point) (RS232C/485)

**M-Flow PW**

- Compact type (type: FLR, FLS)
  - 4 to 20mADC (1 point)
  - Integrated pulse, etc. (DO 2 point)
  - Communication (1 point) (RS232/485)

**Portaflow-C**

- Portable type (type: FSC, FSD)
  - 4 to 20mADC
  - SD memory card (USB port is used)

**Connected devices**

- Recorder (PHL)
- Recorder (PHF)
- Recorder (PHU)
- Integrating meter
- Controller with integrating function (PXH)
- Personal Computer
Select one according to the type of fluid to be measured.

<table>
<thead>
<tr>
<th>Fluid to be measured</th>
<th>Name and type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean liquid without air bubbles</td>
<td>Duosonics (FSH, FSW)</td>
</tr>
<tr>
<td>Sewage, wastewater</td>
<td>○</td>
</tr>
<tr>
<td>High-viscosity liquid</td>
<td>○</td>
</tr>
<tr>
<td>Petroleum, oil</td>
<td>○</td>
</tr>
<tr>
<td>Corrosive liquid</td>
<td>○</td>
</tr>
<tr>
<td>Abrasive slurry</td>
<td>○</td>
</tr>
<tr>
<td>Fiber slurry</td>
<td>○</td>
</tr>
<tr>
<td>Low-speed fluid</td>
<td>○</td>
</tr>
<tr>
<td>Pulsating fluid</td>
<td>○</td>
</tr>
<tr>
<td>High-temperature fluid</td>
<td>×</td>
</tr>
<tr>
<td>High-pressure fluid</td>
<td>○</td>
</tr>
</tbody>
</table>

*Measurement may not be made depending on conditions.*

**Measurement principle**

**Transit time propagation time difference method**

Ultrasonic wave pulses are made to propagate diagonally from the upstream side and the downstream side with the sensor installed on the exterior of piping. Time difference caused by the flow is detected and used for the measurement of the flow rate.

**Pulse Doppler method**

Ultrasonic pulses are transmitted into the liquid. Flow velocity distribution is calculated to find the flow rate, taking advantage of the nature of Doppler frequency of the echo from reflectors such as air bubbles and particles in fluid that fluctuates according to flow velocity.

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<tr>
<td>Duosonics (FSH, FSW)</td>
<td>2 Lines type (FSH, FSG, FSD)</td>
</tr>
<tr>
<td>Transit time +Pulse Doppler method</td>
<td>Transit time</td>
</tr>
<tr>
<td>1 line or switching between 2 lines</td>
<td>1 line or 2 lines</td>
</tr>
</tbody>
</table>
High-accuracy hybrid ultrasonic flowmeter

Ultrasonic flowmeter based on a new concept of using pulse Doppler method and propagation time difference method in combination

Features:
- Increased range of applicable fluids achieved by automatic switching
- High accuracy (0.5-1%) achieved by pulse Doppler method adopted for the first time in the world
- Flow velocity distribution in piping viewed in real time
- High-speed response: 0.2 seconds (Depends on piping conditions.)
- Relaxation of linear pipe length conditions allowed
- Significant improvement of resistance to air bubbles

Pulse Doppler method
- Ultrasonic pulses are transmitted into liquid. Flow velocity distribution is calculated to find the flow rate, taking advantage of the nature of Doppler frequency of the echo from reflections such as air bubbles and particles in fluid that fluctuates according to flow velocity.
- Suitable for nebulous liquid

Propagation time difference method
- Ultrasonic wave pulses are made to propagate diagonally from the upstream side and the downstream side. Time difference caused by the flow is detected and used for the measurement of the flow rate.
- Suitable for clean liquid

Hybrid Type Duosonic
Detector model : FSW  Flow transmitter type : FSH

Features:
- Expansion of applicable fluid domain enabled by automatic switching
- High accuracy of 0.5 to 1%
- Flow velocity distribution within the piping is visible
- Quick response (0.2 sec.)

Specifications:
Sensor type : FSWS12 : for φ40 to φ200mm/-40 to 100˚C
FSWS21 : for φ100 to φ400mm/-40 to 80˚C
FSWS40 : for φ200 to φ650mm/-40 to 80˚C
FSWS50 : for φ500 to φ1000mm/-40 to 80˚C
Measurement range : -4 to 0 to +32m/s (min. 0.3m/s)
Response Time : 0.2 sec. or less
Output signal : 4 to 20mA/DC, pulse output, alarm output
Communication function : RS485 or RS232C
Accuracy : 0.5 to 1.0% of rate
Structure : IP67 Watertight for both flow transmitter and detector
Power-supply voltage : 100 to 240VAC or 20 to 30VDC
Cable length between detector and flow transmitter: 150m max.

Compact Type TIME DELTA-C
Detector model : FSG, FSD, FLD, FLS  Flow transmitter type : FSV

Features:
- Small, lightweight flow transmitter having a high tolerance for air bubbles in liquid
- High accuracy measurement (1.0% of rate)
- Setting operation can be performed from the front side of the flow transmitter.
- With RS232C/RS485 communication function provided (optional)

Specifications:
Sensor type : FLSE1 : for φ25 to φ100mm/-20 to 100˚C
FLSE2 : for φ50 to φ225mm/-20 to 100˚C
FSGS3 : for φ50 to φ300mm/-40 to 80˚C
FSGS4.5 : for φ200 to φ600mm/-40 to 80˚C
FSD22 : for φ13 to φ100mm/-20 to 100˚C
FSD32 : for φ50 to φ400mm/-40 to 200˚C
Measurement range : -32 to 0 to +32m/s (min. 0.3m/s)
Response Time : 0.2 sec. or less
Output signal : 4 to 20mA/DC, pulse output, alarm output
Communication function : RS485 or RS232C
Accuracy : 1.0% of rate
Power-supply voltage : 100 to 240VAC or 20 to 30VDC
Compact M-Flow PW
Detector model: FLS  Flow transmitter model: FLR

Features:
- Converter as compact as 140 x 130mm in size (front face)
- High-speed response of 0.2 seconds
- Accuracy: 1.5 to 2% of rating
- Low-cost flowmeter ideal for measurement of clean fluid

Specifications:
Sensor type: FLSE12 : for φ25 to φ100mm/-20 to 100˚C or 120˚C
FLSE22 : for φ50 to φ225mm/-20 to 100˚C or 120˚C
FLSE31 : for φ65 to φ400mm/-20 to 80˚C
FLSE41 : for φ300 to φ600mm/-20 to 80˚C
Measurement range : -10 to 0 to 10m/s (min.0.3m/s)
Response Time : 0.2 seconds
Output signal : 4 to 20mA DC, Pulse output, Alarm output
Communication function : RS485 or RS232C
Accuracy : 1.5 to 2% of rate
Structure: Waterproof detector and converter structure conforming to IP65
Power-supply voltage: 100V to 120VAC, 200 to 240VAC, or 20 to 30VDC
Cable length between detector and converter: 30m max.

2 Lines Type
Detector model: FSG, FLD  Flow transmitter model: FSH

Features:
- High resistance to air bubbles in liquid.
- Simultaneous 2-line
- High-accuracy measurement of 1.0% of rating
- Rarely affected by temperature and pressure fluctuation of fluid.

Specifications:
Sensor type: FSGS3 : for φ50 to φ400mm/-40 to 80˚C
FSGS5 : for φ200 to φ6000mm/-40 to 80˚C
FSD32 : for φ50 to φ400mm/-40 to 200˚C
Measurement range : -32 to 0 to 32m/s (min. 0.3m/s)
Response Time: within 0.5 seconds
Output signal: 4 to 20mA DC, Pulse output, Alarm output
Communication function : RS485 or RS232C
Accuracy : 1.0% of rate
Power-supply voltage : 100V to 240VAC or 20 to 30VDC
Cable length between detector and converter: 150m max.

Portable Portaflow -C
Detector model: FLD  Flow transmitter model: FSC

Features:
- The measurement data can be stored in a SD Large memory card for a long time
- Consumed heat quantity can be measured
- Designed for 12 hours of continuous operation with its own built-in battery
- Provided with a printer (option)

Specifications:
Sensor type : FSD22 : for φ13 to φ100mm/-40 to 100˚C
FSD12 : for φ50 to φ300mm/-40 to 100˚C
FSD32 : for φ50 to φ400mm/-40 to 200˚C
FSD41 : for φ200 to φ1200mm/-40 to 80˚C
FSD51 : for φ200 to φ6000mm/-40 to 80˚C
Measurement range : -32 to 0 to 32m/s (min. 0.3m/s)
Response Time: within 1 second
Analog output signal : 4 to 20mA DC
Analog input signal : 4 to 20mA DC / 1 to 5VDC
Accuracy : 1.0% of rate
Power-supply voltage : 100V to 240VAC, Built-in battery
SD memory card: Saves instantaneous value, total value, etc
Options: With printer, Flow velocity profile
1. **Measuring system for the paint flow rate**
   The flow rate of thick paint is measured by a detector mounted on the pipe already constructed.

2. **Flow rate measurement in a water purifying system for semi-conductors**
   **Advantages of using an ultrasonic flowmeter for the system**
   - 1) It can be easily mounted on the exterior of a pipe, helping reduce mounting cost.
   - 2) As a sensor, it can operate without coming into contact with fluid, so the fluid is not affected by metallic ions.
   - 3) This meter, compact and lightweight, can be easily carried and mounted.

3. **Ideal for flow rate measurement of liquid flowing within large-diameter pipes**
   - Ultrasonic flowmeters are much more economical than electromagnetic flowmeters when used for fluid within a pipe whose diameter is 200mm or larger.
   - Resistance to bubbles 5 times as large as that of conventional products (our company ratio)

   Ultrasonic flowmeter is more economical for measurement of flow in pipe whose diameter is 200mm or larger.

4. **Flow rate measurement in the air-conditioning field**
5. **Drain flow rate measurement**
   - Handled with Duosonics that has high resistance to air bubbles

6. **Facility diagnosis**
   - Facility optimization diagnosis allowed by measurement of flow velocity distribution within piping

7. **Flow rate measurement of mayonnaise and dressing**
   - Accurate measurement of high-viscosity and low-velocity fluid allowed by Duosonics

8. **Flow rate measurement of corrosive fluid**
   - Non-contact measurement by M-Flow PW ideal for corrosive fluid in glass, metallic, and plastic pipes

9. **A system for measuring heat transfer and efficiency.**
   - Heat is transferred by water flow in the process or HVAC loop.
     - It can be mounted on the pipe already constructed.
     - Small, lightweight and easy to mount

10. **Flow rate measurement in cooking oil production line**
    - Unlike mechanical or Coriolis type, maintenance is not required.

11. **Portaflow C ideal for checking flow rate in the field**
    - Handy Portaflow C not requiring power supply is ideal for checking flow rate in the field.

Non-contact measurement by M-Flow PW ideal for corrosive fluid in glass, metallic, and plastic pipes

Heat transmitter

Heat source

Load

Flowmeter with printer ideal for data management also available
### Specifications

**Name**
- Duosonics
- TIME DELTA-C
- M-Flow PW
- Portaflow-C

<table>
<thead>
<tr>
<th>Name</th>
<th>Transmitter model</th>
<th>Detector model</th>
<th>Appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duosonics</td>
<td>FSH</td>
<td>FSW</td>
<td>![Image]</td>
</tr>
<tr>
<td>TIME DELTA-C</td>
<td>FSV</td>
<td>FSG, FSD</td>
<td>![Image]</td>
</tr>
<tr>
<td>M-Flow PW</td>
<td>FLR</td>
<td>FLS, FSG, FSD</td>
<td>![Image]</td>
</tr>
<tr>
<td>Portaflow-C</td>
<td>FSC</td>
<td>FLS</td>
<td>![Image]</td>
</tr>
</tbody>
</table>

**Measurement method**
- Pulse Doppler method
- Propagation time difference method

**Resistance to air bubbles**
- Ideal
- Good
- Not usable
- Good

<table>
<thead>
<tr>
<th>Detector type</th>
<th>Inside diameter of applicable pipes (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>type : FWS21</td>
<td>40 to 100 mm (-40 to 80°C)</td>
</tr>
<tr>
<td>type : FSGS4</td>
<td>50 to 200 mm (-40 to 80°C)</td>
</tr>
<tr>
<td>type : FSE12</td>
<td>50 to 100 mm (-40 to 80°C)</td>
</tr>
<tr>
<td>type : FSD22</td>
<td>50 to 120 mm (-40 to 100°C)</td>
</tr>
</tbody>
</table>

**Measurement Range**
- ±4m/s (0.3m/s min.)
- ±32m/s (0.3m/s min.)
- ±10m/s (0.3m/s min.)
- ±32m/s (0.3m/s min.)

<table>
<thead>
<tr>
<th>Measurement range method</th>
<th>±4m/s (0.3m/s min.)</th>
<th>±32m/s (0.3m/s min.)</th>
<th>±10m/s (0.3m/s min.)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>(Propagation time difference method)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Number of measured lines**
- 1 line or switching between 2 lines
- 1 line or 2 lines
- 1 line
- 1 line
- 1 line

**Response Time**
- within 0.2 seconds (Pulse Doppler method)
- within 0.2 seconds
- within 0.2 seconds
- within 0.2 seconds
- within 1 second

<table>
<thead>
<tr>
<th>Response Time method</th>
<th>within 0.2 seconds (Pulse Doppler method)</th>
<th>within 0.2 seconds</th>
<th>within 0.2 seconds</th>
<th>within 0.2 seconds</th>
</tr>
</thead>
</table>

**4 - 20mADC output**
- ✓
- ✓
- ✓
- ✓
- ✓

**Pulse output**
- ✓
- ✓
- ✓
- ✓
- ✓

**Alarm output**
- ✓
- ✓
- ✓
- ✓
- ✓

**Communication function**
- RS485 or RS232C
- RS485 or RS232C
- RS485 or RS232C
- RS485 or RS232C
- SD memory card (USB port is used)

**Accuracy**
- 0.5% to 1% of rate
- 1.0% of rate
- 1.5/2% of rate
- 1.0% of rate

**Power-supply voltage**
- 100 to 240VAC, 50/60Hz or 20 to 30VDC
- 100 to 120VAC 50/60Hz or 200 to 240VAC or 20 to 30VDC
- 100 to 240VAC 50/60Hz Built-in battery

**Length of dedicated cable between detector and converter**
- 150m max.
- 30m max.
- 150m max.

**Display unit of converter**
- Graphic LCD (with backlight)
- Character LCD (with backlight)
- Graphic LCD (with backlight)

**External dimensions of converter (mm)**
- 240(H)×247(W)×134(D)
- 170(H)×142(W)×70(D)
- 210(H)×120(W)×65(D)

**Mass of converter**
- About 5.0kg
- About 5.0kg
- About 1.5kg
- About 0.8kg
- About 1.0kg

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**Cautions on safety**

* Be sure to read the instruction manual before using the flowmeter.

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