PORTAFLOW-C is a portable type ultrasonic flowmeter utilizing the transit time measuring method, using a clamp-on type detector.

It is a compact and lightweight instrument incorporating the latest electronics and digital signal processing technologies, realizing high performance and easy operation.

**FEATURES**

1. **Compact and lightweight**
   The adoption of the latest electronics and digital signal processing technologies has reduced the size and weight of the flow transmitter by 30% and 30%, respectively, in comparison with the Fuji conventional portable flowmeter (Model FSC). (in comparison to our existing model)

2. **Battery operation**
   The flowmeter is designed for 12 hours of continuous operation via built-in battery which is rechargeable in 3 hours with the exclusive power adapter.

3. **Full variety of detectors**
   The flowmeter is suitable for various types of detectors applicable for small to large diameter pipe (pipe inner diameter ø13 to ø6000mm) and low to high temperature (−40 to +200°C).

4. **High accuracy and high-speed response**
   The flowmeter is designed for high accuracy (±1.0%).
   Response time is within 1 second.

5. **Improved anti-bubble characteristic**
   Anti-bubble characteristic is greatly improved by digital signal processing.

6. **Excellent performance and easy operation**
   Large graphic LCD that is outside but easy to read.
   Minimum number of function keys are used for page selection, allowing easy setting.
   While battery is working, the flowmeter is water resistant and tolerates exposure to rain.

7. **Large capacity storage by SD memory card**
   Measured data is periodically stored in SD memory card. For example, in the case of 256MB (option), it can be saved about 1 year measurement data(in case of saving period 30 seconds, 14 kinds of saved data). Available up to 8MB.

8. **Serial communication**
   Use of a USB port allows easy connection to a personal computer. Measured date collection panel and Loader software for PC (standard) which is available for display and change of parameter (site setting) are prepared.

9. **Heat quantity (calorie) measurement**
   Heat quantity (calorie) may be measured by temperature input, making energy management easy for cooling and heating.

10. **Graphic printer connection (option)**
    Easy recording with the Integral type printer.

11. **Flow velocity profile measurement (option)**
    Flow profile may be observed in real time.

**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Measuring objects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement fluid: Uniform liquid in which ultrasonic waves can propagate.</td>
</tr>
<tr>
<td>Turbidity of fluid: 10000 mg/L or less</td>
</tr>
<tr>
<td>State of fluid: Well-developed turbulent or laminar flow in a filled pipe.</td>
</tr>
<tr>
<td>Fluid temperature: −40 to +200°C</td>
</tr>
<tr>
<td>Measuring range: 0--±0.3 to ±32m/s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Piping conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicable piping material: Select from carbon steel, stainless steel, cast iron, PVC, FRP, copper, aluminum, acrylic or material of known sound velocity.</td>
</tr>
<tr>
<td>Pipe size: Flow rate measurement ø13 to ø6000mm</td>
</tr>
<tr>
<td>Flow velocity profile measurement ø40 to ø1000mm</td>
</tr>
</tbody>
</table>
Lining material: Select from no lining, tar epoxy, mortar, rubber, Teflon, pyrex glass or material of known sound velocity. Note) No gap allowed between the lining and the pipe.

Straight pipe length:
10D or more upstream and 5D or more downstream (D: internal pipe diameter)
Refer to Japan Electric Measuring Instruments Manufacturers’ Association’s standard JEMIS-032 for details.

Performance specifications

Accuracy rating:

<table>
<thead>
<tr>
<th>Pipe inner diameter</th>
<th>Flow velocity range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø13 to ø50mm</td>
<td>2 to 32m/s</td>
<td>±1.5% of rate</td>
</tr>
<tr>
<td>0 to 2m/s</td>
<td>±0.03m/s</td>
<td></td>
</tr>
<tr>
<td>ø50 to ø300mm</td>
<td>2 to 32m/s</td>
<td>±1.5% to 1.5% of rate</td>
</tr>
<tr>
<td>0 to 2m/s</td>
<td>±0.02 to 0.02m/s</td>
<td></td>
</tr>
<tr>
<td>ø300 to ø6000mm</td>
<td>1 to 32m/s</td>
<td>±1.0% to 1.5% of rate</td>
</tr>
<tr>
<td>0 to 1m/s</td>
<td>±0.01 to 0.02m/s</td>
<td></td>
</tr>
</tbody>
</table>

Note1) Reference conditions are based on JEMIS-032.
Note2) Refer to the 4 pages for the accuracy according to kind of detector.

Flow transmitter (Type: FSC)

Power supply:
Built-in battery: Exclusive lithium button battery (5000m Ah)
Continuous operation time, approx. 12 hours (without printer, back light OFF, output current not used and at normal ambient temperature (20°C))
Recharging time, approx. 3 hours (power adapter used)
Recharging temperature range: 0 to +40°C
Power consumption: Min. 3W and Max. 16W
The consumption varies depending on the use conditions.

Power adapter: Exclusive power adapter 90V to 264V AC (50/60Hz), 70VA or less.

LCD:
Semi-transmissive color graphic display 240 × 320 (with back light)
Measurement value (instantaneous flow rate, integrated flow rate) and various settings are displayed.
Excellent visibility even outdoors in direct sunlight.

LED display:
Status display when using AC power adapter.
DC IN (green): Power supply status
CHARGE (red): Battery charging underway

Operation keypad:
11 buttons
(ON, OFF, ENT, ESC, MENU, △, ▽, ◀, ◀, LIGHT, PRINT)

Power failure backup:
Measurement value is backed up by nonvolatile memory.
Clock backup with lithium battery (effective term, 10 years or more)

Response time: 1 second

Analog output signals:
4 to 20mA DC, one point (load resistance, 600Ω or less)
Instantaneous velocity, instantaneous flow rate or heat quantity (calorie) after scaling.

Analog input signal:
4 to 20mA DC, one point (input resistance, 200Ω or less)
4 to 20mA DC, one point (input resistance, 200Ω or less)
or 1 to 5V DC, one point
Used to input temperature for heat quantity measurement, etc.

SD memory card:
Used for data logger function and recording screen data.
Available up to 8GB (Option256MB)
Compliant media
• SD memory card: speed class 2, 4, 6
• SDHC memory card: speed class 4, 6
Format
• FAT16: 64MB to 2GB
• FAT32: 4GB, 8GB
Otherwise, reading and saving are impossible.
File format
• Date logger: CSV file
• Screen date: Bit map file

Serial communication:
USB port (device* compatible):
Mini B receptacle
Connectable number of Mini B receptacles: 1 unit
Transmission distance: 3m max.
Transmission speed: 500kbps
Data:
Instantaneous velocity, instantaneous flow rate, total value, heat quantity (calorie) value, error information, logger data, etc.
* Device: Connected plug from PC

Printer (option):
To be mounted on top of transmitter unit
Thermal line dot printing
Note) When the Chinese display is selected, printing is made in kanji characters.

Ambient temperature:
−10 to +55°C (Without printer)
−10 to +45°C (With printer)

Ambient humidity:
90%RH or less

Type of enclosure: IP64 (Without printer)
Enclosure case: Plastic case
Outer dimensions:
H210 × W120 × D65mm (Without printer)
H320 × W120 × D65mm (With printer)
Weight:
1.0kg (Without printer)
1.2kg (With printer)

Various functions

Display language:
Selectable from Japanese, English, German, French, Spanish or Chinese (switchable by key operation).

Clock display function:
Time (year, month, day, hour, minute) display (configurable)
Monthly error: about 1 minutes at normal temperature (20°C).
Instantaneous value display function:
- Instantaneous velocity, instantaneous flow rate display (The flow in reverse direction is displayed with minus “−.”)
- Numeric value: 10 digits (decimal point equals 1 digit)
- Unit: Metric/English system selectable
- Metric system
  - Velocity: m/s
  - Flow rate: L/s, L/min, L/h, kL/d, ML/d, m³/s, m³/min, m³/h, m³/d, km³/d, Mm³/d, BBL/s, BBL/min, BBL/h, BBL/d, kBBL/d, MBBL/d
- English system
  - Velocity: ft/s
  - Flow rate: gal/s, gal/min, gal/h, gal/d, kgal/d, Mgal/d, ft³/s, ft³/min, ft³/h, ft³/d, Mft³/d, BBL/s, BBL/min, BBL/h, BBL/d, kBBL/d, MBBL/d

Total value display function:
- Display of forward or reverse total (reverse is displayed as minus)
- Numeric value: 10 digits (decimal point is corresponding to 1 digit)
- Unit: Metric/English system selectable
- Metric system
  - Flow rate total: mL, L, m³, km³, Mm³, mBBL, BBL, kBBL
- English system
  - Flow rate total: gal, kgal, ft³, kft³, Mft³, mBBL, BBL, kBBL, ACRE-ft

Consumed heat quantity (calorie) display function:
- Display of consumed heating medium
- Metric system
  - Heat flow: MJ/h, GJ/h
  - Total heat quantity: MJ, GJ
- English system
  - Heat flow: MJ/h, GJ/h, BTU/h, kBTU/h, MBTU/h, kWh, MWh
  - Total heat quantity: MJ, GJ, BTU, kBTU, MBTU, kW, MWh
- J : Joule
- BTU : British thermal unit
- W : Watt

Computation function of consumed heat quantity (calorie):
This function calculates the heat quantity received and sent with liquid (water) in cooling and heating.

Temperature display function:
- Fluid temperature be displayed by current input from temperature transmitter.
- Metric system
  - Temperature unit: °C or K
- English system
  - Temperature unit: °F or K

Site data storage function:
- Max. 32 locations (sites) data (pipe size, material, fluid type and etc) can be stored into built-in non-volatile memory.
- Damping: 0 to 100sec (every 0.1sec) configurable for analog output and velocity/flow rate display
- Low flow cut: Equivalent to 0 to 5m/s

Output setting function:
- Current output scaling, output type, burnout setting and calibration

Serial communication function:
- Instantaneous velocity, instantaneous flow rate, total value, heat flow, error information, received waveform, analog input, velocity/profile data, logger data, etc. may be downloaded to personal computer.

Logger function:
- Instantaneous velocity, instantaneous flow rate, total value, heat flow, error information, received waveform, analog input, velocity/profile data can be saved in a SD memory card.

Waveform display function:
- Bi-directional received waveforms may be displayed.

Graph display function:
- Flow rate trend graph may be displayed.

Printing function (option):
- Hard copy output of a screen
- Periodic printing (type: text, graph)
- Logger date (type: text, graph)

Flow velocity profile measurement (option):
- Flow velocity profile may be observed in real time using the exclusive detector (option).
- (Refer to page 5 for details.)

Detector (Type: FSS)

Type of detector:

<table>
<thead>
<tr>
<th>Classification</th>
<th>Type</th>
<th>Internal pipe diameter (mm)</th>
<th>Fluid temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle diameter</td>
<td>FSSC</td>
<td>ø50 to ø1200</td>
<td>-40 to 120°C</td>
</tr>
<tr>
<td>Small diameter</td>
<td>FSSD</td>
<td>ø13 to ø300</td>
<td>-40 to 100°C</td>
</tr>
<tr>
<td>Large diameter</td>
<td>FSSE</td>
<td>ø200 to ø6000</td>
<td>-40 to 80°C</td>
</tr>
<tr>
<td>High temperature</td>
<td>FSSH</td>
<td>ø50 to ø400</td>
<td>-40 to 200°C</td>
</tr>
</tbody>
</table>

Mounting method: Mounting on outside of pipe
Sensor mounting method:
- V or Z method
Signal cable:
- Exclusive coaxial cable, 5m (Included with FSC)
Connection method:
- Transmitter side
  - Exclusive connector
- Detector side (FSSE)
  - Screw terminal
- Others: BNC connector

Detector (Type: FSS)
MEASURING PRINCIPLE

With ultrasonic pulses propagated diagonally between the upstream and downstream sensors, flow rate is measured by detecting the time difference obtained by the flow of fluid.

MOUNTING OF DETECTOR

CONFIGURATION DIAGRAM

1) When V method is used for mounting

2) When Z method is used for mounting

DETECTOR SELECTION GUIDE (ACCURACY % of rate)

<table>
<thead>
<tr>
<th>TYPE</th>
<th>Mounting method</th>
<th>Inner diameter of piping ø [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>12 15 25 50 100 150 200 250 300 400 600 1200 3000 6000</td>
</tr>
<tr>
<td>FSSC</td>
<td>V</td>
<td>±1.5  to 2.5</td>
</tr>
<tr>
<td></td>
<td>Z</td>
<td>±1.0</td>
</tr>
<tr>
<td>FSSD</td>
<td>V</td>
<td>±1.5</td>
</tr>
<tr>
<td></td>
<td>Z</td>
<td>±1.0</td>
</tr>
<tr>
<td>FSSE</td>
<td>V</td>
<td>±1.5</td>
</tr>
<tr>
<td></td>
<td>Z</td>
<td>±1.5</td>
</tr>
<tr>
<td>FSSH</td>
<td>V</td>
<td>±1.0</td>
</tr>
<tr>
<td></td>
<td>Z</td>
<td>±1.0</td>
</tr>
</tbody>
</table>

*1) When FSSD or FSSH is mounted using the Z method, guide rail (option) is required additionally.
*2) For the pipe inner diameter of ø13mm, the sensor mounting dimension may be 0.0mm or less depending on pipe material and thickness. When the sensor mounting dimension is 0.0mm or less, measurement error is about 2 to 5%.

<Description of the table>
It shows pipe thickness of each material that the sensor mounting size is to be 0.0mm, when fixing a pipe. If the fluid is the one other than water, and if the sound velocity of fluid is faster than the one of water, the sensor mounting size is to be 0.0mm or more.

<table>
<thead>
<tr>
<th>Required min. pipe thickness (fluid: water) (Unit: mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel pipe</td>
</tr>
<tr>
<td>Stainless steel pipe</td>
</tr>
<tr>
<td>Ductile cast iron pipe</td>
</tr>
<tr>
<td>PFA pipe</td>
</tr>
<tr>
<td>PEEK</td>
</tr>
<tr>
<td>Copper pipe</td>
</tr>
<tr>
<td>PVCYDF</td>
</tr>
<tr>
<td>Cast-iron pipe</td>
</tr>
<tr>
<td>Acrylic pipe</td>
</tr>
<tr>
<td>Aluminum pipe</td>
</tr>
<tr>
<td>Polypropylene</td>
</tr>
</tbody>
</table>
FLOW VELOCITY PROFILE DISPLAY FUNCTION (OPTION)

Flow velocity profile can be observed in real time using the dedicated detector from the outside. It is specifiable by the code symbol of flow transmitter.

APPLICATION

Pulse Doppler method is applicable to observe flow velocity profile in real time, display the flow status in the pipe, and decide the appropriate measurement location. Also, it can be used for diagnosis of flow and laboratory test.

SPECIFICATIONS

- **Measuring fluid:** Uniform liquid in which ultrasonic waves can propagate.
- **Turbidity of fluid:** Axisymmetric flow in a filled pipe.
- **Fluid temperature:**
  - −40 to +100°C (FSDP2)
  - −40 to +80°C (FSDP1, FSDP0)
- **Air bubble quantity:** 0.02 to 15Vol% (Velocity is 1m/s)
- **Pipe size:**
  - Small type sensor: ø40 to ø200mm
  - Middle type sensor: ø100 to ø400mm
  - Large type sensor: ø200 to ø1000mm
- **Measurement range:**
  - 0 to ±0.3: ±Maximum Velocity (depending on the pipe diameter)
  - Refer to chart, table.1.
  - Note) This function is to observe flow velocity profile, and it may be different from actual flow rate.

DETECTOR FOR FLOW VELOCITY PROFILE MEASUREMENT (TYPE: FSDP)

- **Mounting method:** Mounting on outside of existing pipe
- **Ambient temperature:** −20 to +80°C
- **Ambient humidity:** 100% RH or less
- **Type of enclosure:** IP67 (with waterproof BNC connector provided.)
- **Material:**
  - Sensor housing: PBT
  - Guide frame: Aluminum alloy
  - Mounting belt: Plastic cloth belt/316 stainless steel

Measurement principle

**<Pulse Doppler method>**

- Ultrasonic pulses are transmitted through the fluid flow. Entrained bubbles and microscopic particles within the fluid create frequency phase shifts (Doppler effect.) The resulting doppler shifts are integrated across the inside pipe diameter cross section. The resulting profile curve is a real-time dynamic display of the flow profile within the pipe.

![Diagram of Flow Velocity Profile Measurement](image)

The above shows an example when using two sensors. One detector displays the flow velocity profile for a radius.

Block diagram

1. **Using one sensor**

   ![Diagram of Single Sensor](image)

2. **Using two sensors**

   ![Diagram of Two Sensors](image)
PC Loader software

- Equipped as standard
  - PC/AT compatible machines. (Operation on custom built PCs or shop-brand PCs cannot be guaranteed.)
  - Major functions: Performs parameter (site setting) display /change of the main unit and collects measured data.
  - Instantaneous velocity, instantaneous flow rate, total value, error information, received waveform, analog input, logger data, etc. may be downloaded in a personal computer.
- O/S: Windows2000/XP/Vista* or Windows 7 (Home Premium, Professional)
- Memory requirement: 128MB or more
- Disk unit: Windows2000/XP/Vista or Windows 7 (Home Premium, Professional)-compatible CD-ROM drive
- Hard disk drive capacity: Free space of 64MB or more
- * Windows Vista: Use it in basic mode. It is not available for Windows Aero.

Table.1

Maximum measurement range of Pulsed Doppler method.
When nominal thickness of a stainless pipe of pipe material is Sch20s and the fluid is water, the maximum measurement range varies depending on the outer diameter of pipe, nominal thickness, material, or fluid type.

<table>
<thead>
<tr>
<th>Diameter</th>
<th>FSDP2</th>
<th>FSDP1</th>
<th>FSDP0</th>
</tr>
</thead>
<tbody>
<tr>
<td>40A</td>
<td>6.56</td>
<td>52.7</td>
<td>72.7</td>
</tr>
<tr>
<td>50A</td>
<td>5.31</td>
<td>6.52</td>
<td>86.5</td>
</tr>
<tr>
<td>65A</td>
<td>4.12</td>
<td>125A</td>
<td>147</td>
</tr>
<tr>
<td>80A</td>
<td>3.69</td>
<td>50A</td>
<td>118</td>
</tr>
<tr>
<td>90A</td>
<td>3.08</td>
<td>60A</td>
<td>147</td>
</tr>
<tr>
<td>100A</td>
<td>2.63</td>
<td>100A</td>
<td>179</td>
</tr>
<tr>
<td>200A</td>
<td>2.04</td>
<td>4.05</td>
<td>239</td>
</tr>
<tr>
<td>250A</td>
<td>3.30</td>
<td>6.38</td>
<td>604</td>
</tr>
<tr>
<td>300A</td>
<td>2.78</td>
<td>5.41</td>
<td>735</td>
</tr>
<tr>
<td>350A</td>
<td>2.51</td>
<td>4.90</td>
<td>820</td>
</tr>
<tr>
<td>400A</td>
<td>2.20</td>
<td>4.31</td>
<td>951</td>
</tr>
<tr>
<td>450A</td>
<td>3.86</td>
<td>500A</td>
<td>2118</td>
</tr>
<tr>
<td>500A</td>
<td>3.48</td>
<td>4.65</td>
<td>2358</td>
</tr>
<tr>
<td>550A</td>
<td>3.17</td>
<td>600A</td>
<td>2879</td>
</tr>
<tr>
<td>600A</td>
<td>2.91</td>
<td>550A</td>
<td>3096</td>
</tr>
<tr>
<td>650A</td>
<td>2.71</td>
<td>650A</td>
<td>3357</td>
</tr>
<tr>
<td>700A</td>
<td>2.52</td>
<td>700A</td>
<td>3618</td>
</tr>
<tr>
<td>750A</td>
<td>2.35</td>
<td>750A</td>
<td>3879</td>
</tr>
<tr>
<td>800A</td>
<td>2.21</td>
<td>800A</td>
<td>4140</td>
</tr>
<tr>
<td>850A</td>
<td>2.08</td>
<td>850A</td>
<td>4400</td>
</tr>
<tr>
<td>900A</td>
<td>1.97</td>
<td>900A</td>
<td>4902</td>
</tr>
</tbody>
</table>

CODE SYMBOL

<Flow transmitter>

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Description**
  - <Specification>
    - Standard
  - <Converter>
    - Basic system
    - Basic system + Printer
  - <Flow velocity profile measurement>
    - None
    - Provided (detector to measure flow velocity profile is separately required.)
  - <Power adapter>
    - AC power + power cord (125V AC) for Japanese and North American use
    - AC power + power cord (250V AC) for European and Korean use
    - AC power + power cord (250V AC) for Chinese use
  - Modification No.
  - <SD memory card>
    - None
    - Provided (256MB)
  - <Bound instruction manual/Language>
    - None (Factory-set language: English)
    - Provided/Japanese
    - English
    - Chinese
  - <Detector>
    (for transit time)

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

- **Description**
  - <Senser type>(4th digits)
    - ø50 to ø1200mm
  - <Guide rail>(5th digits)
    - None
    - Stainless belt (1.0m ×2)
    - Plastic cloth belt (3m ×1)
    - SS belt fasten with screws (1.0m ×4)
  - Wire \(≤\) ø1500mm
  - <Tag plate> (10th digit)
    - None
    - Provided
  - <Acoustic coupler> (7th digit)
    - Silicone grease (HIGH-Z)
    - Silicone grease (G40M)
  - <Water-proof treatment>(9th digit)
    - None
    - Provided (with signal cable 10m)
    - *Submersible in water for 5 days
  - <Bound plate>(15th digit)
    - None
    - Provided

*1: Normally select silicone grease as acoustic coupler. Silicone grease is tube (100g).
Select silicone-free grease for semiconductor manufacturing equipment or the like that is vulnerable to silicone. The silicone-free grease is water-soluble and, therefore, cannot be used in environment exposed to water or on piping subjected to a condensation. Since the grease does not set, a periodic maintenance (cleaning, refilling every about 6 months at normal temperature) is necessary.

*2: Please refer to the table 1 to select the mounting belt at 6th digits.

Table 1: How to select at 6th digits.

<table>
<thead>
<tr>
<th>Mounting method</th>
<th>ø300mm</th>
<th>ø600mm</th>
<th>ø1200mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>V method</td>
<td>B, A, or C</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>Z method</td>
<td>C</td>
<td>D</td>
<td>D</td>
</tr>
</tbody>
</table>
**CODE SYMBOL**

<table>
<thead>
<tr>
<th>Detector</th>
<th>for flow velocity profile measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>S</td>
</tr>
<tr>
<td>P 2</td>
<td>P 3</td>
</tr>
<tr>
<td>Y</td>
<td>&lt;Terminal mold&gt;</td>
</tr>
<tr>
<td>Y</td>
<td>&lt;Structure&gt;</td>
</tr>
<tr>
<td>Y</td>
<td>Modification No.</td>
</tr>
</tbody>
</table>

### OPTIONAL ITEMS

<table>
<thead>
<tr>
<th>Name</th>
<th>Specifications</th>
<th>Arrange-ment No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Battery</td>
<td>Special type Li-ion battery (7.4V, 2500mAh)</td>
<td>ZZP*TK7N6384P1</td>
</tr>
<tr>
<td>2 AC power</td>
<td>Special type power adapter and 90 to 264V AC, 50/60Hz</td>
<td>ZZP*TK7N6380C4</td>
</tr>
<tr>
<td>3 Power code</td>
<td>Japan, North America: 125V AC 2m Europe, Korea: 250V AC 2m China: 250V AC 2m</td>
<td>ZZP<em>TK7N6621P1 ZZP</em>TK7N6608P1 ZZP*TK7N6609P1</td>
</tr>
<tr>
<td>4 Printer</td>
<td>To be mounted on top of converter Thermal serial dot system (8 x 384 dot)</td>
<td>ZZP*TK4J2634C1</td>
</tr>
<tr>
<td>5 Printer roll paper</td>
<td>Maker: SEIKO I SUPPLY Co. Ltd. Specifications: Thermal roll paper Width: 58mm×ø48mm</td>
<td>ZZP*TK7N6381P1</td>
</tr>
<tr>
<td>6 Silicone grease</td>
<td>Maker: Shin-Etsu Chemical Co., Ltd. Type: · For standard use G40M, 100g · For silicone free 100g · For high temperature KS62M, 100g</td>
<td>ZZP<em>TK7G7979C1 ZZP</em>TK7G7980C1 ZZP<em>TK7G7980C2 ZZP</em>TK7G7980C3 ZZP<em>TK7G7980C4 ZZP</em>TK7P1943C1</td>
</tr>
<tr>
<td>7 Signal cable</td>
<td>Special type signal cable, 5m × 2 (connector on both - sides)</td>
<td>ZZP*TK7N7795C1</td>
</tr>
<tr>
<td>8 Extension signal cable</td>
<td>Special type coaxial cable with BNC connector · 10m × 2 · 50m × 2</td>
<td>ZZP<em>TK468664C3 ZZP</em>TK468664C4</td>
</tr>
<tr>
<td>9 Analog input/output cable</td>
<td>6-core cable, 1.5m, with connector</td>
<td>ZZP*TK4J2639C1</td>
</tr>
<tr>
<td>10 Mounting belt /wire</td>
<td>Plastic cloth belt Stainless wire Nominal diameter ø200 to ø500mm ø200 to ø1000mm ø200 to ø2000mm ø200 to ø6000mm Stainless steel belt</td>
<td>ZZP<em>TK7K7679C1 ZZP</em>TK7K7680C1 ZZP<em>TK7K7680C2 ZZP</em>TK7K7680C3 ZZP<em>TK7K7680C4 ZZP</em>TK7K7898C3 ZZP<em>TK7K7898C4 ZZP</em>TK7K7980C5 ZZP*TK7K1943C1</td>
</tr>
<tr>
<td>11 Guide rail for high-temperature sensor (In mounting by the Z method)</td>
<td>Mounting bracket material: Aluminum alloy+SUS304 For FSSH</td>
<td>ZZP*TK4J5917C3</td>
</tr>
<tr>
<td>12 Guide rail for small type detector (In mounting by the Z method)</td>
<td>Mounting bracket material: Aluminum alloy+plastic For FSSD3 (L=540mm)</td>
<td>ZZP*TK4J5917C1</td>
</tr>
<tr>
<td>13 SD memory card</td>
<td>Maker: Apacer Technology, Inc. Type: AP-ESD256TPSR Capacity: 256MB</td>
<td>ZZP*TK7N6388P1</td>
</tr>
<tr>
<td>14 USB cable</td>
<td>Maker: Sunwa Supply Inc. Type: KU-AMB510 Specifications: Mini USB cable (1.0m)</td>
<td>ZZP*TK7N6622P1</td>
</tr>
<tr>
<td>15 Signal cable conversion cord</td>
<td>M4 clamp terminal / BNC jack, L=150mm</td>
<td>ZZP*TK4X6530P1</td>
</tr>
</tbody>
</table>

### SCOPE OF DELIVERY

**<Flow transmitter : FSC>**

Name of unit | Scope of delivery
---|---
1 Basic system | 1) Conversion unit 2) Power adapter and Power connector conversion cord 3) Power cord 4) Analog input/output cord (1.5m) 5) USB cable (1m) 6) Carrying case 7) Strap 8) Special type signal cable (5m × 2) 9) CD-ROM (Instruction manual and Loader software for PC)
2 Option | 1) Printer unit + rolled paper (1 roll) 2) SD memory card (256MB) 3) Bound instruction manual (including a detector)

**<Detector : FSS, FSD>**

Name of unit | Scope of delivery
---|---
1 Detector for propagation time difference (FSS) | 1) Sensor unit 2) Signal cable conversion code (included with FSSE) 3) Mounting belt/wire 4) Silicone grease (Article specified)
2 Detector for flow velocity profile (FSDP) | 1) Detector unit 2) Mounting belt/wire 3) Silicone grease (100g)

Note 1) Silicon grease is for filling a gap between a detector and a pipe joint area. It is provided with a detector. Since silicon grease does not become hardened, if you use it in the long term, periodic maintenance is required. (Under the condition of room temperature, semiannual cleaning and refill is recommended.)

Note 2) When you order a detector alone, an instruction manual is not provided. Please request, if necessary (Onerous).
### Conditions on straight pipe

<table>
<thead>
<tr>
<th>Type</th>
<th>Length of upstream straight pipe</th>
<th>Length of downstream straight pipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>90° bend</td>
<td><img src="#" alt="Diagram" /></td>
<td><img src="#" alt="Diagram" /></td>
</tr>
<tr>
<td>Tee</td>
<td><img src="#" alt="Diagram" /></td>
<td><img src="#" alt="Diagram" /></td>
</tr>
<tr>
<td>Diffuser</td>
<td><img src="#" alt="Diagram" /></td>
<td><img src="#" alt="Diagram" /></td>
</tr>
<tr>
<td>Contraction pipe</td>
<td><img src="#" alt="Diagram" /></td>
<td><img src="#" alt="Diagram" /></td>
</tr>
<tr>
<td>Valve</td>
<td><img src="#" alt="Diagram" /></td>
<td><img src="#" alt="Diagram" /></td>
</tr>
<tr>
<td>Pump</td>
<td><img src="#" alt="Diagram" /></td>
<td><img src="#" alt="Diagram" /></td>
</tr>
</tbody>
</table>

(D: Nominal diameter of pipe)

Note) Source: Japan Electric Measuring Instruments Manufacturers' Association (JEMIS-032)
Flow transmitter

- Weight: Approx. 1.0kg
- DC power input
- Analog input/output
- Sensor (upstream)
- Sensor (downstream)
- 2-M4, Depth5 (both sides)
- USB port
- SD memory card slot
- Power switch

OUTLINE DIAGRAM (Unit:mm)
Flow transmitter (with printer)

- **Weight**: Approx. 1.2kg

---

**OUTLINE DIAGRAM (Unit:mm)**

- **Flow transmitter (with printer)**
  - **Flow**
  - **Transmitter** (with printer)
  - **Weight**: Approx. 1.2kg
  - **Approx. 320±4.5**
  - **65±1.8**
  - **120±1.8**

- **PortaFlow**
  - **Power switch**
  - **USB port**
  - **SD memory card slot**

- **Dimensions**:
  - **2-M4, Depth 5 (both sides)**
  - **Sensor (downstream)**
  - **Sensor (upstream)**
  - **Analog input/output**
  - **DC power input**

---

**Specifications**:

- **Flow**: Approx. 320±4.5
- **Depth**: 65±1.8
- **Length**: 120±1.8
OUTLINE DIAGRAM (Unit:mm)

**<Shipment style (V method)>**

**<Extended style (Longest, V method)>**

**<Separate style (Z method)>**

Detector: Type FSSC

<table>
<thead>
<tr>
<th>Type</th>
<th>Diameter (mm)</th>
<th>L</th>
<th>H</th>
<th>W</th>
<th>Weight Approx. (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSDP2</td>
<td>40 to 200</td>
<td>260±1.2</td>
<td>70</td>
<td>57</td>
<td>0.8</td>
</tr>
<tr>
<td>FSDP1</td>
<td>100 to 400</td>
<td>260±1.2</td>
<td>72</td>
<td>57</td>
<td>0.9</td>
</tr>
<tr>
<td>FSDP0</td>
<td>200 to 1000</td>
<td>350±2.0</td>
<td>90</td>
<td>85</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Detector FSDP (Detector for flow velocity profile measurement)

<table>
<thead>
<tr>
<th>Code color</th>
<th>Clip color</th>
<th>Mark</th>
<th>Code color</th>
<th>Clip color</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black (BK)</td>
<td>Red (R)</td>
<td>(+)</td>
<td>Green (G)</td>
<td>Black (BK)</td>
<td>(+)</td>
</tr>
<tr>
<td>White (W)</td>
<td>Black (BK)</td>
<td>(−)</td>
<td>Yellow (Y)</td>
<td>Red (R)</td>
<td>(+)</td>
</tr>
<tr>
<td>Red (R)</td>
<td>Red (R)</td>
<td>(+)</td>
<td>Brown (BN)</td>
<td>Black (BK)</td>
<td>(−)</td>
</tr>
</tbody>
</table>

Analog input/output cable

Weight: approx. 0.1 kg
Detector for special application

Pipe size: ø13 to 100mm (300mm max.)
Fluid temperature: −40 to 100°C
Type: FSSD□□□1-Y□

Specification

- Sensor frequency: 2MHz
- Mounting method: V method, Z method (FSSD3)
- Fluid temperature: −40 to 100°C
- Applicable pipe material: PVC, SS, carbon steel pipe, copper pipe, aluminum pipe, etc.
  [In case lining is removed from the pipe, Measurement can not be conducted]
- Rated accuracy of combination with the flow transmitter
  (Applicable piping: plastic, metal pipe)

<table>
<thead>
<tr>
<th>Internal diameter (mm)</th>
<th>Velocity</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø13 to ø50</td>
<td>2 to 32m/s</td>
<td>±1.5% to ±2.5% of rate</td>
</tr>
<tr>
<td></td>
<td>0 to 2m/s</td>
<td>±0.03 to ±0.05m/s</td>
</tr>
<tr>
<td>ø50 to ø100 (ø300)</td>
<td>2 to 32m/s</td>
<td>±1.0% of rate</td>
</tr>
<tr>
<td></td>
<td>0 to 2m/s</td>
<td>±0.02m/s</td>
</tr>
</tbody>
</table>

- Mounting belt: according to specified code of symbol.
- Material: PBT, guide rail: aluminum alloy + plastic
- Type of enclosure: IP52
- Acoustic coupler: according to specified code of symbol.
- Mass: 0.6kg, 0.8kg

OUTLINE DIAGRAM (unit: mm)

<Detector>

Scope of delivery

- Detector, acoustic coupler and set of the mounting belt according to specified code of symbol

NAME DRAWING NO.

- Silicon grease (GM40M) ZZP*45231N5
- Silicon-free grease (HIGH-Z) ZZP*T7M0981P1

OPTIONAL ACCESSORIES
**Detector for special application**

Pipe size: ø50 to 400mm  
Fluid temperature: –40 to 200°C  
Type: FSSH1□□1-Y□

**Specification**  
- Sensor frequency: 2MHz  
- Mounting method: V method (ø50 to 250mm) or Z method (ø150 to 400mm)  
- Fluid temperature: –40 to 200°C  
- Applicable pipe material: PVC, SS, carbon steel pipe, copper pipe, aluminum pipe, etc.  
  [In case lining is removed from the pipe, Measurement can not be conducted]  
- Rated accuracy of combination with the flow transmitter  
  (Applicable piping: plastic, metal pipe)

<table>
<thead>
<tr>
<th>Internal diameter (mm)</th>
<th>Velocity</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø50 to ø300</td>
<td>2 to 32m/s</td>
<td>±1.0% of rate</td>
</tr>
<tr>
<td>ø300 to ø400</td>
<td>0 to 2m/s</td>
<td>±0.02m/s</td>
</tr>
<tr>
<td></td>
<td>0.75 to 32m/s</td>
<td>±1.0% of rate</td>
</tr>
<tr>
<td></td>
<td>0 to 0.75m/s</td>
<td>±0.0075m/s</td>
</tr>
</tbody>
</table>

- Mounting belt: according to specified code of symbol.  
- Material: sensor housing: SUS304  
  guide rail: SUS304 + aluminum alloy  
- Type of enclosure: IP52  
- Acoustic coupler: according to specified code of symbol.  
- Mass: 1.6kg

**OUTLINE DIAGRAM (unit: mm)**

**CODE SYMBOL**

**OPTIONAL ACCESSORIES**

<table>
<thead>
<tr>
<th>Name</th>
<th>Drawing No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guide rail for high-temperature sensor (Z method)</td>
<td>ZZP**TK4J5917C3</td>
</tr>
<tr>
<td>High-temperature grease(KS62M)</td>
<td>ZZP**TK7G7983C1</td>
</tr>
</tbody>
</table>

**Scope of delivery**  
- Detector, acoustic coupler and set of the mounting belt according to specified code of symbol
Detector for special application

Pipe size: ø200 to 6000mm
Fluid temperature: -40 to 80°C
Type: FSSE1□□Y□□

Specification
- Sensor frequency: 0.5MHz
- Mounting method: V or Z method
- Fluid temperature: -40 to 80°C
- Applicable pipe material: PVC, SS, carbon steel pipe, copper pipe, aluminum pipe, etc.
  * In case lining is removed from the pipe, Measurement cannot be conducted
- Also applicable to water-proof type according to specified code of symbol (submerged resistant structure for 5days including 10m cable)
- Rated accuracy of combination with the flow transmitter (Applicable piping: plastic, metal pipe)

<table>
<thead>
<tr>
<th>Internal diameter (mm)</th>
<th>Velocity</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>ø200 to ø300</td>
<td>2 to 32m/s</td>
<td>±1.5% of rate</td>
</tr>
<tr>
<td></td>
<td>0 to 2m/s</td>
<td>±0.03m/s</td>
</tr>
<tr>
<td>ø300 to ø1200</td>
<td>0.75 to 32m/s</td>
<td>±1.5% of rate</td>
</tr>
<tr>
<td></td>
<td>0 to 0.75m/s</td>
<td>±0.013m/s</td>
</tr>
<tr>
<td>ø1000 to ø6000</td>
<td>1 to 32m/s</td>
<td>±1.0% of rate</td>
</tr>
<tr>
<td></td>
<td>0 to 1m/s</td>
<td>±0.02m/s</td>
</tr>
</tbody>
</table>

- Mounting belt: according to specified code of symbol.
- Material: Sensor housing PBT, Sensor cover SUS304
- Type of enclosure: IP67 (silicon rubber is filled up on the terminal block when connecting work)
- Acoustic coupler: according to specified code of symbol.
- Mass: 1.2kg

OUTLINE DIAGRAM (unit: mm)

Code Symbol

<table>
<thead>
<tr>
<th>Description</th>
<th>&lt;Detector&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;Sensor type&gt;(4th digits)</td>
<td>E</td>
</tr>
<tr>
<td>&lt;Guide rail&gt;(5th digits)</td>
<td>Provided</td>
</tr>
<tr>
<td>&lt;Mounting belt&gt;(6th digits)</td>
<td>None Wire ø1500mm</td>
</tr>
<tr>
<td>Wire ø6000mm</td>
<td></td>
</tr>
<tr>
<td>&lt;Acoustic coupler&gt; (7th digit)</td>
<td>None Silicone rubber (KE348) Silicon-free grease (HIGH-Z) Silicone grease (G40M)</td>
</tr>
<tr>
<td>&lt;Water-proof treatment&gt;(9th digit)</td>
<td>None Provided (with signal cable 10m)</td>
</tr>
<tr>
<td>&lt;Tag plate&gt; (10th digit)</td>
<td>Provided</td>
</tr>
</tbody>
</table>

Optional Accessories

<table>
<thead>
<tr>
<th>Name</th>
<th>Drawing No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire rope for mounting the sensor</td>
<td>ZZP*TK745007P1</td>
</tr>
<tr>
<td>Spring</td>
<td>ZZP*TK464686BC1</td>
</tr>
<tr>
<td>Wire rope (up to ø500mm)</td>
<td>ZZP*TK464686BC2</td>
</tr>
<tr>
<td>Wire rope (up to ø1000mm)</td>
<td>ZZP*TK464686BC3</td>
</tr>
<tr>
<td>Wire rope (up to ø1500mm)</td>
<td>ZZP*TK464686BC6</td>
</tr>
<tr>
<td>Wire rope (up to ø3000mm)</td>
<td>ZZP*TK464686BC13</td>
</tr>
<tr>
<td>Wire rope (up to ø6000mm)</td>
<td></td>
</tr>
<tr>
<td>Silicone rubber (KE348W)</td>
<td>ZZP*45735N2</td>
</tr>
<tr>
<td>Silicone-free grease (HIGH-Z)</td>
<td>ZZP*TK7M0981P1</td>
</tr>
<tr>
<td>Silicone grease (G40M)</td>
<td>ZZP*45231N5</td>
</tr>
</tbody>
</table>

Scope of delivery
- Detector, acoustic coupler and set of the mounting belt according to specified cord of symbol
- Signal cable conversion cord

Code Symbol

<table>
<thead>
<tr>
<th>Description</th>
<th>&lt;Signal cable conversion cord&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;Signal cable conversion cord&gt;</td>
<td>ZZP*TK745007P1</td>
</tr>
</tbody>
</table>
Checked items before purchase

Following conditions may cause failure of the measurement or to reduce the accuracy by this flow meter. Please consult and ask Fuji Electric for checking with actual equipment previously if you have hard to judge the appropriate application.

1) Fluid
   • If fluid contains a large amount of bubbles (approx. 12vol% or more at 1m/s flow rate)
   • If fluid has bad turbidity 10000(mg/L) or more,
   • If fluid contains slurry or solid materials (about 5wt%)
   • If flow rate is low Reynolds No.10000 or less,
     (reference: flow rate 5m³/h with ø100mm)
   • If it is circulating oil, liquid medicine of low concentration, waste liquid and hot spring,

2) Pipe
   • If inside pipe is rusty carbon steel pipe,
   • If inside pipe having adhering substances and sediment
   • If outer surface of cast-iron pipe is rough,
   • If pipe wall is tick such as ruinous pipe, (PP material 15mm or more, PVDF material 9mm or more)
   • If it is SGPW pipe,
   • If lining pipe is removed from pipe,
   • If it is rubber pipe,

3) Length of the straight pipe
   • For accurate measurement, straight pipes are needed between up and down stream side of the measuring part.
   • Please meet the straight pipe conditions according page2.

Caution on use

1) Do not damage the sensor or signal mounted on the pipe.
2) Make sure to fill the fluid inside the pipe to measure .
3) When you use horizontal pipe, it is recommended to install the sensor horizontally.
4) When you use the grease as acoustic coupler to install the sensor for outdoor use, it is recommended to install the waterproof cover to prevent from the degradation.
Caution on Safety

*Before using this product, be sure to read its instruction manual in advance.