# SPOOL PIECE ULTRASONIC FLOWMETER

DATA SHEET FST

FST is an in-line ultrasonic flowmeter with three parallel measuring paths. With the latest digital signal processing technology and the calculation algorithm, it can deliver highly precise flow measurement. RS-485 communication is also available as option.

## FEATURES

1. High accuracy: ±0.2% of rate
   Using the new algorithm for calculating the flow velocity, it can measure any type of fluid with high accuracy.
2. Low maintenance
   With no moving parts, it has long-term stability while requiring only minimal maintenance work.
3. Bubble resistant
   By using the advanced anti-bubble measurement technology, the interference from air bubbles is greatly eliminated.
4. For any liquid from -40°C to +150°C
   Non conductive fluid including oil, mixed liquid, purified water can be measured.
5. Easy-to-operate
   • Backlit LCD and front keys
   • Troubleshooter provided
   • Can be vertically or horizontally installed

## SPECIFICATIONS

### 1. General specifications

- **Measuring principle:**
  Transit time difference method
  Parallel 3-path with the advanced ABM (anti-bubble measurement) system
- **Diameter (mm):**
  50, 80, 100
- **Flow velocity range:**
  Minimum 0 to 0.3 m/s or -0.3 to 0 m/s
  Maximum 0 to 10 m/s or -10 to 0 m/s
- **Flow range:**

| Diameter (mm) | 50 | 80 | 100 |
|---|---|---|---|
| Minimum ($m^3/h$) | 0 to 2.13 | 0 to 4.65 | 0 to 7.99 |
| Maximum ($m^3/h$) | 0 to 70.6 | 0 to 154.8 | 0 to 266.0 |

- **Dimensions and weight:**
  Refer to outline diagram
- **Power supply:**
  100-240 V AC (+10% -15%), 50/60 Hz or 20-30V DC
- **Power consumption:**
  Approx. 20 VA (AC power)
  Approx. 6 W (DC power)
- **Grounding:**
  D-class grounding with ground resistance of 100Ω or less
- **Varistor:**
  Attached to the power supply terminal
- **Surge arrester:**
  Attached to the analog output terminal
- **Enclosure:**
  IP66
- **Ambient temperature:**
  -40°C to +60°C
- **Ambient humidity:**
  90% RH or less

### 2. Fluid conditions

- **Applicable fluid:**
  Liquid (uniform liquid through which ultrasonic wave can propagate; and liquid that won't corrode stainless steel 316)
- **Bubble content:**
  ≤ 12 vol%
- **Turbidity:**
  10,000 mg/L or less
- **Flow profile:**
  fully-developed turbulent or laminar flow in a fully-filled pipe
- **Temperature:**
  -40°C to +150°C
- **Pressure:**
  Up to flange rating
- **Kinematic viscosity:**
  ≤ 100 $mm^2/s$

### 3. Detector

- **Wetted parts material:**
  Flow cell: stainless steel 316L
  Flange: stainless steel 316L
  Sensor wetted parts: stainless steel 316L
- **Detecto r material:**
  Housing: SCS13

- **Process connections:**
  Flange (horizontal or vertical mounting)
- **Flange rating:**
  JIS10K/JIS20K
  ANSI class 150/300
  DIN PN16/40

## 4. Performance

- **Accuracy:**
  - Reading and pulse output:
    ±0.2% of rate (flow velocity 1 m/s to 10 m/s)
    ±0.002 m/s (flow velocity 0.5 m/s to 1 m/s)
  - Analog output:
    Above indicated accuracy ±0.01 mA (at the ambient temperature of 25°C)
- **Reference condition:**
  - Fluid: water
  - Straight run requirements: 10D on inlet side
    5D on outlet side
    (D: pipe diameter)
  - Measurement period: 600s
  - Pipe wall thickness: schedule 40
  - Fluid temperature: 0°C to 35°C
- **Response time:**
  1.2 s (standard)

## 5. Flow transmitter

- **Analog output signal:**
  4–20 mA DC (insulated), 1 point
  Allowable load resistance: ≤ 600Ω
- **Contact output:**
  Forward total, reverse total, alarm, acting range, flow switch, or total switch
  User configurable
  - Type: transistor output (isolated, open collector)
  - Contact capacity: 30 V DC, 50 mA
  - 2 points
  - Normal: ON or OFF, selectable
  - Frequency: 100 P/s max.
    (Pulse width: 5, 10, 50, 100, 200, 500, 1000 ms)
- **Communication (option):**
  RS-485 (MODBUS), isolated, arrestor incorporated
  No. of connectable modules: up to 31
  Baud rate: 9600, 19200, 38400 bps
  Parity: none/odd/even, selectable
  Stop bit: 1 or 2 bit, selectable
  Cable length: up to 1 km
  Data: Flow velocity, flow rate, forward total, reverse total, status, etc.
- **Display:**
  16-digit 2-line backlit LCD
  2-color LED (green: normal, red: at error)
- **Language:**
  Japanese (katakana), English, French, German, Spanish (switchable)
- **Flow velocity/flow rate indication:**
  8 digits numerals (decimal point is counted as 1 digit)
  Instantaneous flow rate, instantaneous flow velocity (minus indication for reverse flow)
  Unit:

| | |
|---|---|
| Flow velocity | m/s |
| Flow rate | L/s, L/min, L/h, L/d, kL/d, ML/d, $m^3$/s, $m^3$/min, $m^3$/h, $m^3$/d, $km^3$/d, $Mm^3$/d |

- **Total value indication:**
  Integrated value of forward flow or reverse flow (reverse flow is indicated with minus symbol)
  8 digits numerals (decimal point is counted as 1 digit)
  Unit: mL, L, $m^3$, $km^3$, $Mm^3$
- **Housing material:**
  Aluminum alloy
- **Coating:**
  Urethane resin
- **Finish color:**
  Silver
- **Cable entry:**
  G1/2
  Plastic water-proof gland + rubber plug
- **Terminal:**
  Euro-style terminal

## 6. Functional specifications

- **Setting**
  By using 4 keys (ESC, △, ▷, ENT)
- **Zero point adjustment:**
  By setting zero or clearing zero
- **Damping:**
  For analog output or velocity/flow rate indication, 0 to 100 seconds
  (In 1-second steps)
- **Low flow cut-off:**
  0 to 5 m/s in terms of flow velocity
- **Alarm:**
  For hardware error or process error
  Contact output available
- **Output burnout:**
  Analog output: hold, overscale, underscale, or zero
  Flow rate total: hold or count
  Burnout timer: 10 to 900 seconds (in 1-second steps)
- **Output limit:**
  High/low limit for analog output is available in the range from 0.8 mA to 23.2 mA
- **Bi-directional range:**
  Forward and reverse ranges configurable independently.
  Hysteresis: 0% to 20 % of working range
  Working range applicable to digital output.
- **Auto 2 range:**
  Two ranges configurable independently
  Hysteresis: 0% to 20 % of working range
  Working range applicable to digital output.
- **Flow switch:**
  High limit and low limit are configurable independently
  Contact output can be activated while the instantaneous flow rate is beyond the high/low limit.
- **Total switch:**
  High limit for total flow
  Contact output can be activated when the total flow has exceeded the high limit.
- **Total preset:**
  Total flow returns to the user-defined preset value every time a user resets the total.
- **Data backup at power outage**
  on nonvolatile memory

### 7. EU Directive Compliance CE

**LVD (2014/35/EU)**

EN 61010-1

**EMC (2014/30/EU)**

EN 61326-1 (Table 2)
EN 55011 (Group 1 Class A)
EN 61000-3-2 (Class A)
EN 61000-3-3
EN 61326-2-3

**RoHS (2011/65/EU)**

EN 50581

■ **Parameter loader software**

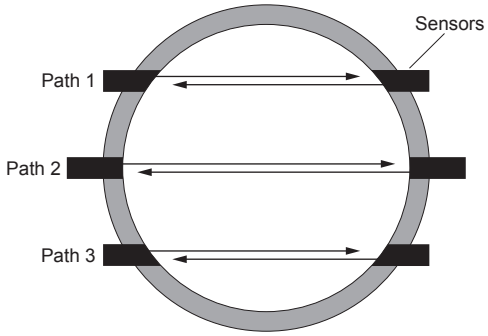
Provided as a standard accessory.

- For IBM PC compatible
- Allows a user to configure or to change parameter values.
- Supported OS:
  Windows 7 (Home Premium, Professional), Windows 8 (Professional), Windows 10 (Enterprise)
- Memory:
  ≥ 128 MB
- Drive:
  CO-ROM drive compatible with Windows 7 (Home Premium, Professional), Windows 8 (Professional), Windows 10 (Enterprise)
- Hard-disk space:
  ≥ 52 MB

Note 1) To use serial communication, select “D” in 10th code.
Note 2) Communication interface converter:
For a PC which supports the RS-232C serial interface, a RS-232C to RS-485 converter is required.
If your PC does not support the RS-232C serial interface, an USB to RS-232C converter is additionally required.
<Recommended products>
RS-232C to RS-485 converter:
OMRON K3SC-10 interface converter (insulated)
*A D-sub connector cable is required.
USB to RS-232C converter:
SANWA SUPPLY USB–CVRS

## PRINCIPLE

Parallel 3-path measurement




By measuring the flow with three parallel paths simultaneously, and averaging them, the flowmeter obtains the flow rate with ±0.2% of rate accuracy.

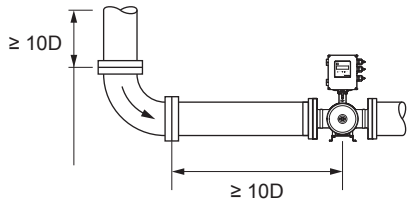
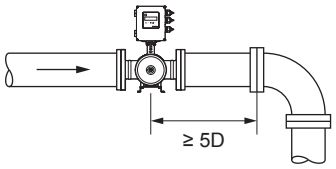
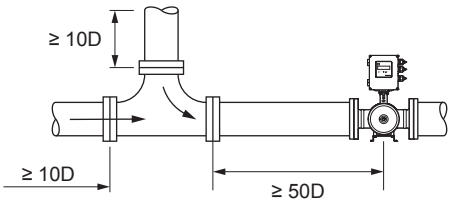
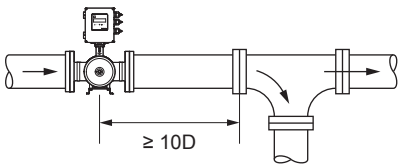
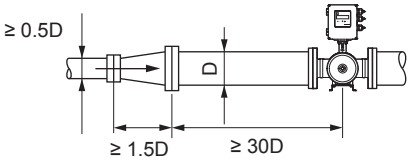
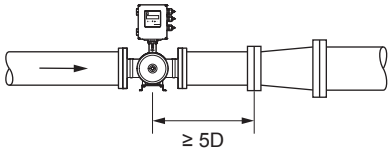
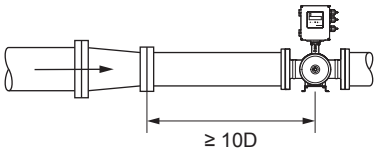
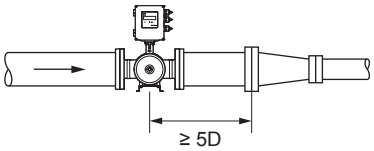
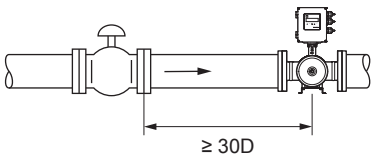
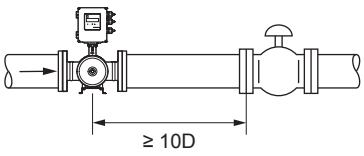
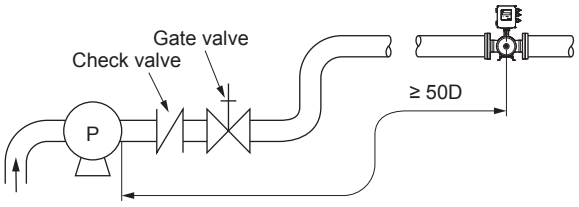
## CHECK BEFORE ORDER

In the following conditions, the flowmeter may not be able to deliver enough accuracy or the measurement may be unavailable.
Consult us if you have any concerns. We can arrange a trial measurement before order.

1. Liquid
   - Liquid contains a large amount of bubbles (12 vol% or more, at a flow rate of 1 m/s)
     For example: circulating oil
   - Liquid has a turbidity of 10000 mg/L or more
     For example: waste liquid, hot spring water
   - Liquid contains slurry and/or solid matters (about 5 wt%)
     For example: waste liquid, hot spring water
   - Low Reynolds number (10000 or less)
     (Flow rate of 5 $m^3$/h, in a 100-mm diameter pipe)
     *Flow rate is proportional to diameter
   - Liquids that can corrode pipe inner surface
     For example: chemical solutions, liquid that contains solid matters
   - High viscosity liquid (kinematic viscosity of 200 $mm^2$/s or more)
2. Pipe straight run
   - For accurate measurement, a certain length of straight run is required. Check if it is possible to meet the straight run requirements given in Page 4.

# PIPE REQUIREMENTS

(D: inside diameter of pipe)

| | Upstream | Downstream |
|---|---|---|
| 90° bend |  |  |
| T-shaped pipe |  |  |
| Expanding pipe |  |  |
| Tapered pipe |  |  |
| Valves |  <br>In the case where a flow control valve exists on upstream side |  <br>In the case where a flow control valve exists on downstream side |
| Pump |  | |

(Note)The source : JEMIS-032

## CODE SYMBOLS

| | 4 | 5 | 6 | 7 | 8 | | 9 | 10 | 11 | 12 | ← Digit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FST | 1 | | | | 1 | - | | | | Y | |

| Digit | Description |
|---|---|
| 4 | <Enclosure><br>Non-explosion-proof<br>1 |
| 5 | <Diameter><br>50A<br>80A<br>100A<br>D<br>F<br>G |
| 6 | <Flange rating and material><br>JIS 10K / SS 316L<br>JIS 20K / SS 316L<br>ANSI 150LB / SS 316L<br>ANSI 300LB / SS 316L<br>DIN PN16 / SS 316L<br>DIN PN40 / SS 316L<br>1<br>2<br>3<br>4<br>5<br>6 |
| 7 | <Power Supply><br>100–240 V AC, 50/60 Hz<br>20–30 V DC<br>1<br>4 |
| 8 | Revision code<br>1 |
| 9 | <Parameter setting / tag plate><br>None<br>With setting<br>With setting + tag<br>With tag<br>Y<br>A<br>B<br>C |
| 10 | <Communication><br>None<br>RS-485<br>Y<br>D |
| 11 | <Mounting / cable entry position><br>Horizontal / on downstream side<br>Horizontal / on upstream side<br>Horizontal / on the right side seen from upstream<br>Horizontal / on the left side seen from upstream<br>Vertical / on bottom side (flow is upward)<br>A<br>B<br>C<br>D<br>E |
| 12 | <Cable entry><br>G1/2 plastic water-proof gland + rubber plug<br>Y |

## SCOPE OF DELIVERY

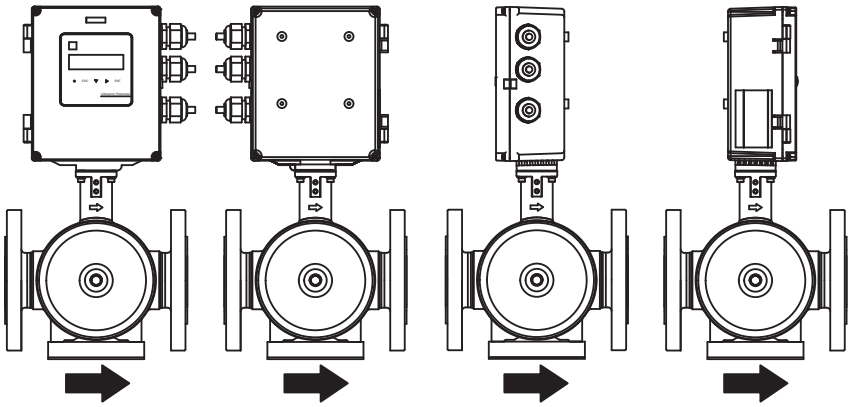
1. Flowmeter
2. CD-ROM (contains Japanese/English/Chinese instruction manual, parameter loader software)

Note) Bolts, nuts, and gaskets used for connecting with flange are not provided.

## ORDERING INFORMATION

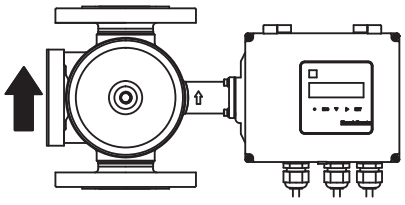
1. Code symbols
2. Tag number, as needed (up to 8 alphanumeric characters)
3. If you order a parameter set version, fill the parameter specification table on the next page and send us.

## MOUNTING / CABLE ENTRY POSITION



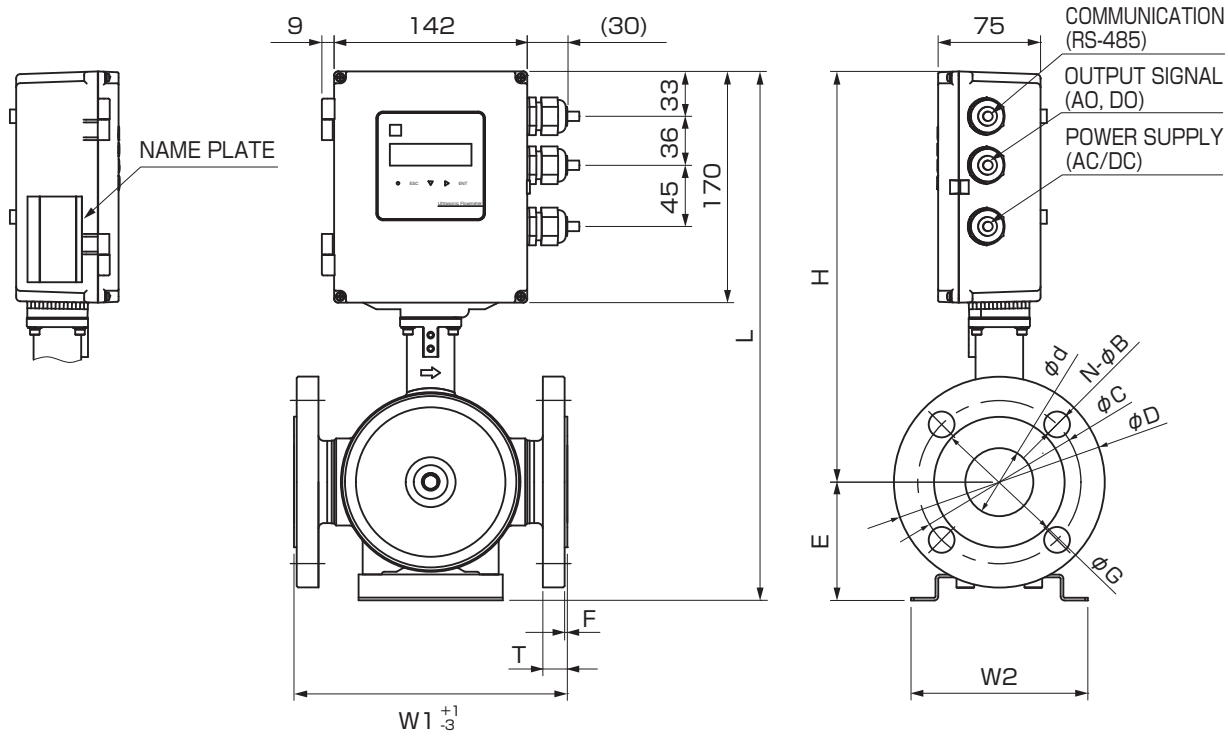
11th code A　11th code B　11th code C　11th code D

**The arrow indicates the flow direction.**
The flow direction setting can be changed.



11th code E

## OUTLINE DIAGRAM (Unit : mm)




### BODY DIMENSIONS

| PIPE SIZE | 50A | 80A | 100A |
|---|---|---|---|
| W1 | 200 | 300 | 300 |
| W2 | 130 | 160 | 160 |
| φd | 50 | 74 | 97 |
| H | 303 | 315 | 326 |
| E | 87 | 120 | 129 |
| L | 390 | 435 | 455 |

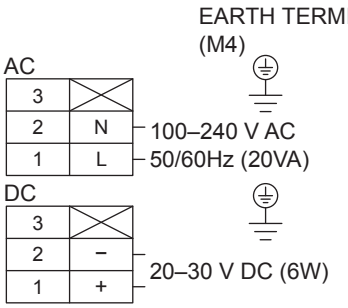
### FLANGE DIMENSIONS (6th DIGIT)

| PIPE SIZE | | 50A | 80A | 100A |
|---|---|---|---|---|
| JIS 10K FLANGE (FF) (CODE: 1) | φD | 155 | 185 | 210 |
| | φC | 120 | 150 | 175 |
| | N-φB | 4-19 | 8-19 | 8-19 |
| | T | 16 | 18 | 18 |
| | F | — | — | — |
| | φG | — | — | — |
| | MASS. (kg) | 13 | 18 | 23 |
| ANSI 150LB FLANGE (RF) (CODE: 3) | φD | 150 | 190 | 229 |
| | φC | 120.7 | 152.4 | 190.5 |
| | N-φB | 4-19 | 4-19 | 8-19 |
| | T | 19.1 | 23.9 | 23.9 |
| | F | 1.6 | 1.6 | 1.6 |
| | φG | 92.1 | 127 | 157 |
| | MASS. (kg) | 13 | 21 | 27 |
| DIN PN16 FLANGE (RF) (CODE: 5) | φD | 165 | 200 | 220 |
| | φC | 125 | 160 | 180 |
| | N-φB | 4-18 | 8-18 | 8-18 |
| | T | 18 | 20 | 20 |
| | F | 3 | 3 | 3 |
| | φG | 102 | 138 | 158 |
| | MASS. (kg) | 14 | 21 | 24 |

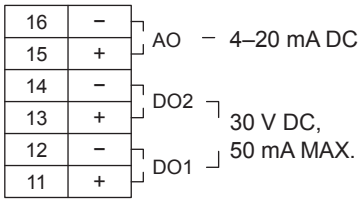
| PIPE SIZE | | 50A | 80A | 100A |
|---|---|---|---|---|
| JIS 20K FLANGE (RF) (CODE: 2) | φD | 155 | 200 | 225 |
| | φC | 120 | 160 | 185 |
| | N-φB | 8-19 | 8-23 | 8-23 |
| | T | 18 | 22 | 24 |
| | F | 1.6 | 2 | 2 |
| | φG | 96 | 132 | 160 |
| | MASS. (kg) | 13 | 21 | 26 |
| ANSI 300LB FLANGE (RF) (CODE: 4) | φD | 165 | 210 | 254 |
| | φC | 157 | 168.1 | 200 |
| | N-φB | 8-19 | 8-22 | 8-22 |
| | T | 22.3 | 28.6 | 31.8 |
| | F | 3 | 1.6 | 1.6 |
| | φG | 92.1 | 127 | 157 |
| | MASS. (kg) | 15 | 25 | 35 |
| DIN PN40 FLANGE (RF) (CODE: 6) | φD | 165 | 200 | 235 |
| | φC | 125 | 160 | 190 |
| | N-φB | 4-18 | 8-18 | 8-22 |
| | T | 20 | 24 | 24 |
| | F | 3 | 3 | 3 |
| | φG | 102 | 138 | 162 |
| | MASS. (kg) | 15 | 22 | 28 |

# CONNECTION DIAGRAM

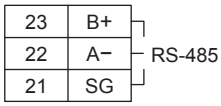
(1) Power supply




(2) Output

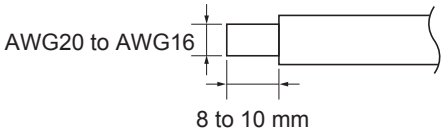



(3) RS-485 (option)

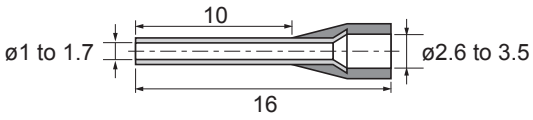



## Allowable wire

- Wire
  Size: AWG20 (0.5 mm$^2$) to AWG16 (1.5 mm$^2$)
  Strip length: 8–10 mm




- Recommended wire ferrule
  Weidmueller
  http://www.weidmuller.com
  Wire end ferrule with insulating collar



<Parameter specification table>

| Item | | | Initial value | Set value | Item | | | Initial value | Set value |
|---|---|---|---|---|---|---|---|---|---|
| ID No | | | 0000 | | Output conditions | Total output | Total mode | Stop | |
| Language | | | English | | | | Total rate | 0 $m^3$ | |
| Measuring conditions | System unit | | Metric | | | | Total preset | 0 $m^3$ | |
| | Flow unit | | $m^3/h$ | | | | Pulse width | 50.0 ms | |
| | Total unit | | $m^3$ | | | | Burnout (total) | Hold | |
| Output conditions | Damping | | 5.0 s | | | | Burnout timer | 10 s | |
| | Low flow cut-off | | 0.150 $m^3/h$ | | | DO1 output type (Note) | | Not used | |
| | Display | 1st line | Flow velocity (m/s) | | | DO1 output action | | ON when actuated | |
| | | 1st line decimal point position | ****.*** | | | DO2 output type (Note) | | Not used | |
| | | 2nd line | Flow rate ($m^3/h$) | | | DO2 output action | | ON when actuated | |
| | | 2nd line decimal point position | ****.*** | | | Operation mode | | Standard | |
| | Analog output | Kind | Flow rate | | | | | | |
| | | Range type | Single range | | | | | | |
| | | Full scale 1 | 15.000 $m^3/h$ | | | | | | |
| | | Full scale 2 | 0.000 $m^3/h$ | | Communication | Communication mode | | RS-485 | |
| | | Hysteresis | 10.00 % | | | Baud rate | | 9600 bps | |
| | | Burnout (current) | Hold | | | Parity | | Odd | |
| | | Burnout timer | 10 s | | | Stop bit | | 1 bit | |
| | | Output low limit | -20 % | | | Station No. | | 1 | |
| | | Output high limit | 120 % | | | | | | |
| | | Rate limit | 0.000 $m^3/h$ | | | | | | |
| | | Rate limit timer | 0 s | | | | | | |

Note:
If you select the total rate in the DO1 output type and/or the DO2 output type, set the pulse width and the total rate in the way that both of the condition 1 and the condition 2 indicated below are satisfied.
If you select the automatic 2-range, the bidirectional rage, or the bidirectional and automatic 2-range in RANGE TYPE, use the value of FULL SCALE 1 or FULL SCALE 2, whichever is larger, for FULL SCALE in the following equations.

Condition 1: $$\frac{\text{FULL SCALE [m}^3\text{/s]}}{\text{TOTAL RATE [m}^3\text{]}} \leq 100\ \text{[Hz]}$$

Condition 2: $$\frac{\text{FULL SCALE [m}^3\text{/s]}}{\text{TOTAL RATE [m}^3\text{]}} \leq \frac{1000}{2 \times \text{PULSE WIDTH [ms]}}$$

【Remarks】

【Reference】

| | Unit |
|---|---|
| Flow velocity | m/s |
| Flow unit | L/s, L/min, L/h, L/d, kL/d, ML/d<br>$m^3/s$, $m^3/min$, $m^3/h$, $m^3/d$, $km^3/d$, $Mm^3/d$ |
| Total rate | mL, L, $m^3$, $km^3$, $Mm^3$ |



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