Fuji Electric

SPOOL PIECE ULTRASONIC FLOWMETER FOR HAZARDOUS LOCATION

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. HART or 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 -10°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
  20-30 V DC
- **Power consumption:**
  Approx. 20 VA (AC power)
  Approx. 6 W (DC power)
- **Grounding:**
  A-class grounding with ground resistance of 10Ω or less
- **Varistor:**
  Attached to the power supply terminal
- **Surge arrester:**
  Attached to the analog output terminal
- **Enclosure:**
  IP67
- **Ambient temperature:**
  -10°C to +60°C
- **Ambient humidity:**
  90% RH or less
- **Vibration tolerance:**
  1 G, 10–200 Hz

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:**
  -10°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

- **Detector 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.
  - HART
    Transmission distance: up to 1 km (when the wire with the following specifications is used)
    Capacitance: ≤ 0.07 μF/km
    Conductor resistance: ≤ 17.8 Ω/km
    Load resistance: 250 Ω to 600 Ω
- **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:**
  M20 internal thread
  Either of the followings are provided:
  - M20 × 1.5 blind plugs
  - Cable glands with pressure-proof packing
- **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

8. Ex-proof certifications

Certification	Ex-proof specification
ATEX	Certificate number：CML 17ATEX1032X Ex db ia[ia Ga] II C T4 Ga/Gb Ambient temperature : -10°C to +60°C
IECEx	Certificate number：IECEx CML 17 .0017X Ex db ia[ia Ga] II C T4 Ga/Gb Ambient temperature : -10°C to +60°C
Japanese explosion-proof certification	Certificate number: CML 17JPN1326X Ex d ia[ia Ga] II C T4 Ga/Gb Ambient temperature : -10°C to +60°C
NEPSI	Ex db ia[ia Ga] II C T4 Ga/Gb Ambient temperature : -10°C to +60°C

Temperature class	Maximum fluid temperature
T4	130°C
T1 to T3	150°C

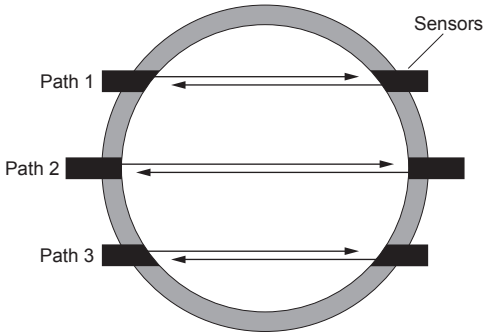
■ **Parameter loader software (RS-485 communication)**
Provided as a standard accessory.
• For IBM PC compatible
• Allows a user to configure or to change parameter values.
• Supported OS:
Windows 7 (Home Premium, Professional), Windows 8 (Professional), Windows 10 (Enterprise)
• Memory:
≥ 128 MB
• Drive:
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

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.

PRINCIPLE

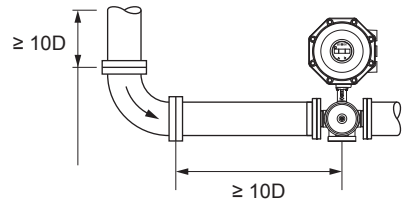
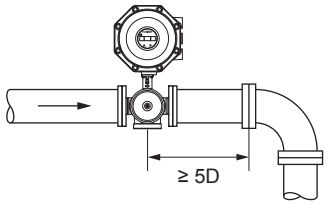
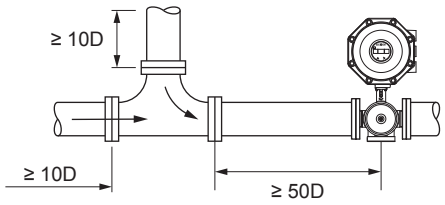
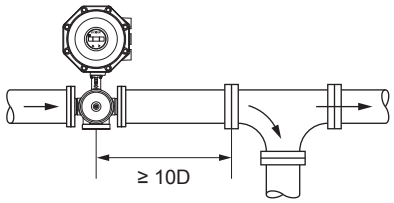
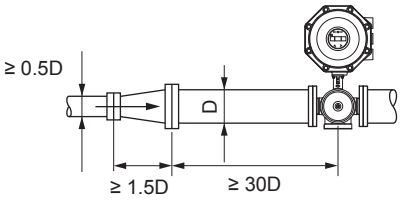
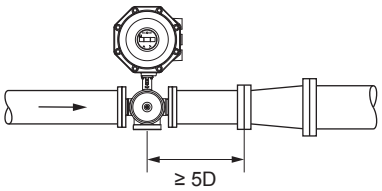
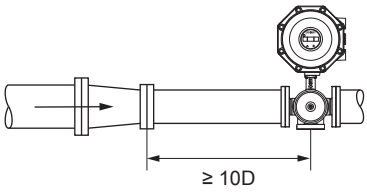
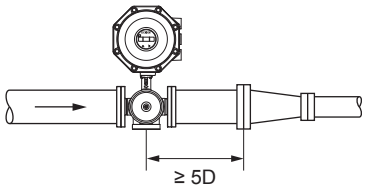
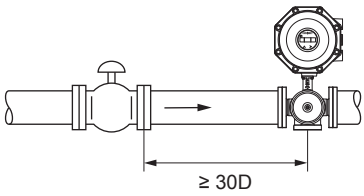
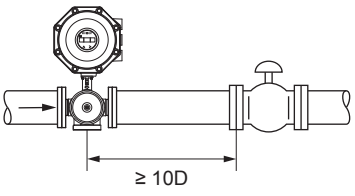
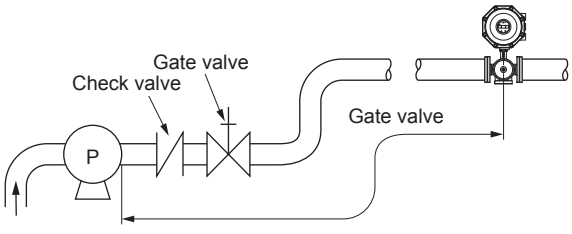
Parallel 3-path measurement



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

PIPE REQUIREMENTS

(D: inside diameter of pipe)

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

(Note)The source : JEMIS-032

CODE SYMBOLS

FST

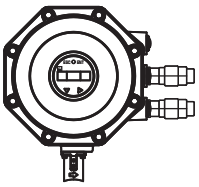
4 5 6 7 8 9 10 11 12 ← Digit

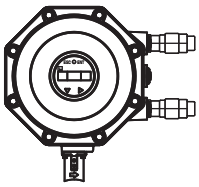
1 -

Digit	Description	Note
4	<Enclosure> ATEX / IECEx Japanese Ex certification NEPSI	 2 3 4
5	<Diameter> 50A 80A 100A	 D F G
6	<Flange rating and material> JIS 10K / SS 316L JIS 20K / SS 316L ANSI 150LB / SS 316L ANSI 300LB / SS 316L DIN PN16 / SS 316L DIN PN40 / SS 316L	 1 2 3 4 5 6
7	<Power Supply> 100–240 V AC, 50/60 Hz 20–30 V DC	 1 4
8	<Revision code>	1
9	<Parameter setting / tag plate> None With setting With setting + tag With tag	 Y A B C
10	<Communication> None RS-485 HART	 Y D H
11	<Mounting / cable entry position> Horizontal / on downstream side Horizontal / on upstream side Horizontal / on the right side seen from upstream Horizontal / on the left side seen from upstream Vertical / on bottom side (flow is upward)	 A B C D E
12	<Cable entry> Three M20 × 1.5 blind plugs (4th code 2 or 4) Two cable glands with pressure-proof packing (4th code 3) Three cable glands with pressure-proof packing (4th code 3)	 Note Note	 B C D

Note) The number of cable glands for Japanese ex-proof version

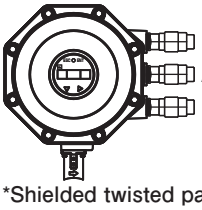
The 12th code "C"



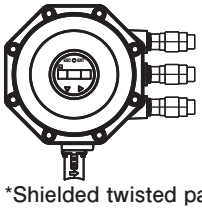


*Shielded twisted pair cable

The 12th code "D"

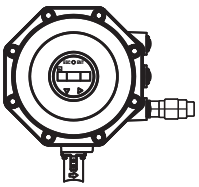


*Shielded twisted pair cable

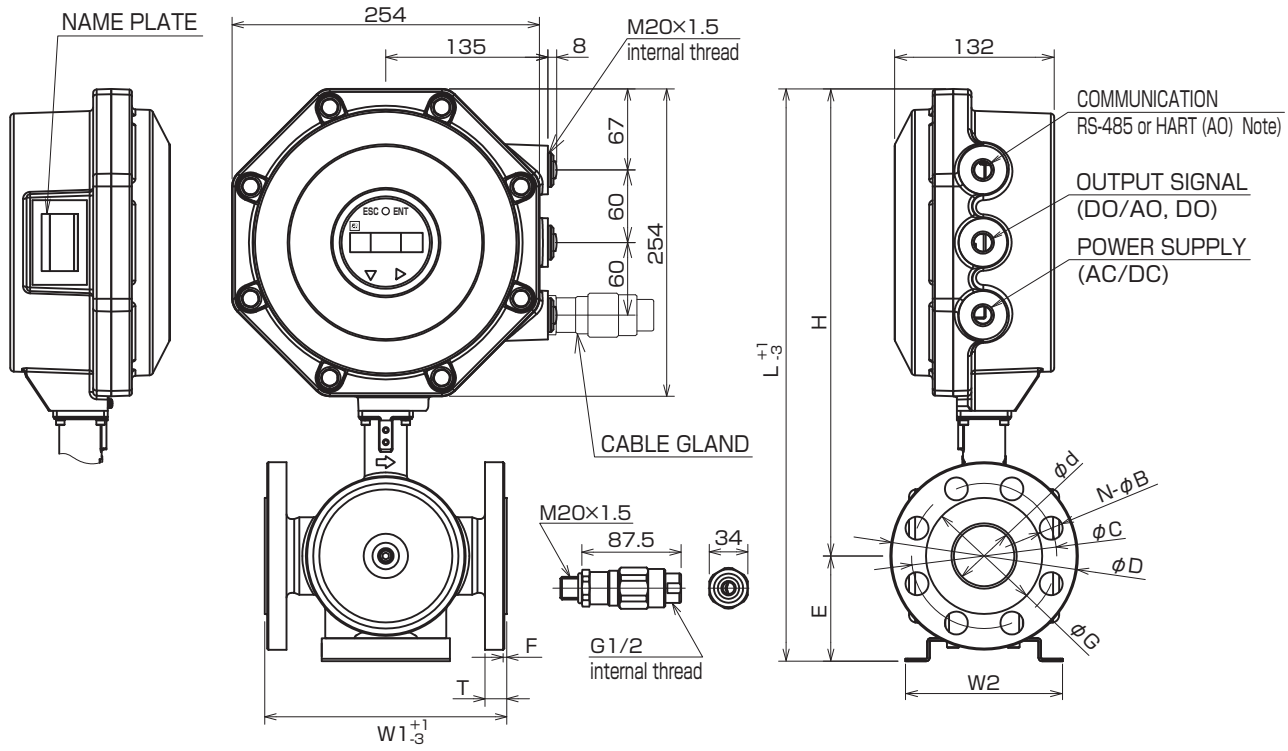


*Shielded twisted pair cable

If you need only one cable gland, consult us.



OUTLINE DIAGRAM (Unit : mm)



BODY DIMENSIONS

PIPE SIZE	50A	80A	100A
W1	200	300	300
W2	130	160	160
φd	50	74	97
H	386	398	409
E	87	120	129
L	473	518	538

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)	17	22	27
ANSI 150LB FLANGE (RF) (CODE: 3)	φD	150	190	229
	φC	120.7	152.4	190.5
	N-φB	4-19.1	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)	17	25	31
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)	18	25	28

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)	17	25	30
ANSI 300LB FLANGE (RF) (CODE: 4)	φD	165	210	254
	φC	127	168.1	200
	N-φB	8-19.1	8-22	8-22
	T	22.3	28.6	31.8
	F	2	1.6	1.6
	φG	92.1	127	157
	MASS. (kg)	19	29	39
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)	19	26	32

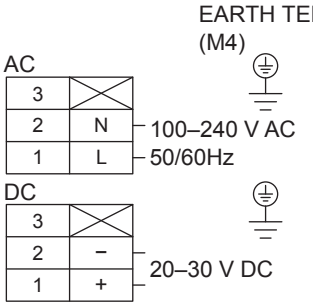
Notes on wiring port for HART communication

For HART communication, use a shielded twisted pair cable and connect it through the HART (AO) port to the AO terminals. Do not use the output signal port for HART communication.

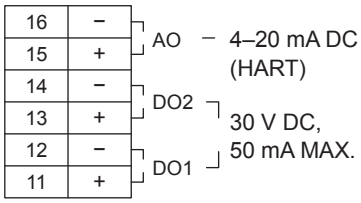
WIRING PORT	HART		RS-485	
	YES	NONE	YES	NONE
COM.	HART (AO)	UNUSED	RS-485	UNUSED
OUTPUT SIG.	DO	AO, DO	AO, DO	AO, DO

CONNECTION DIAGRAM

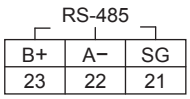
(1) Power supply



(2) Output

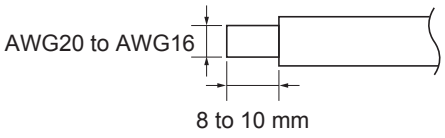


(3) RS-485 (option)

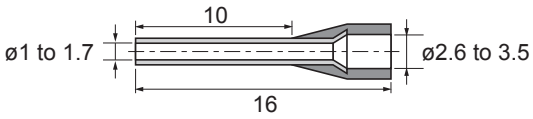


Allowable wire

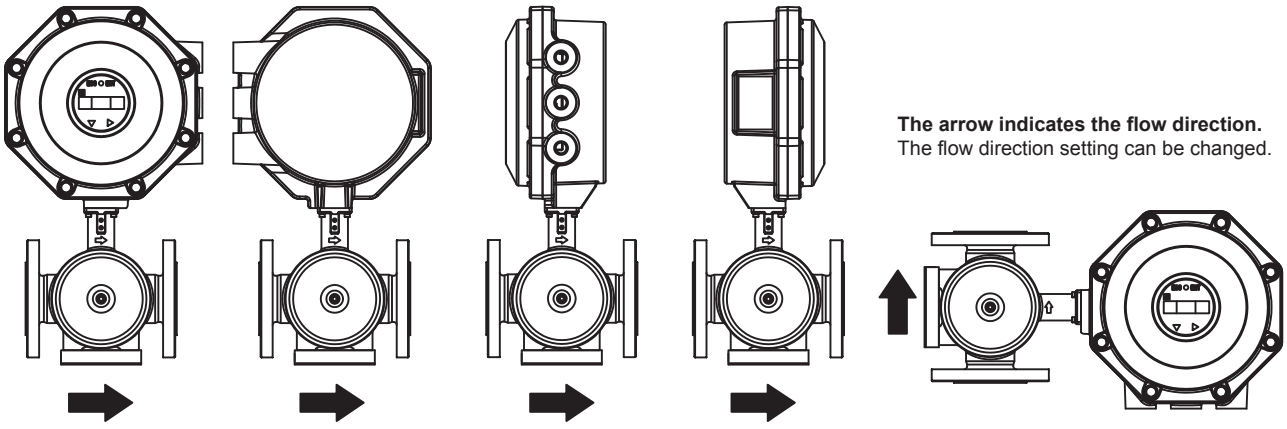
- Wire
  Size: AWG20 (0.5 mm^2) to AWG16 (1.5 mm^2)
  Strip length: 8–10 mm



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



MOUNTING / CABLE ENTRY POSITION



11th code A | 11th code B | 11th code C | 11th code D | 11th code E

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

SCOPE OF DELIVERY

1. Flowmeter
2. Magnet bar
3. 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.

<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		HART	
		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 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

Information in this catalog is subject to change without notice.
Read the instruction manuals thoroughly before using the products.

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Printed in Japan