

ULTRASONIC FLOWMETER TIME DELTA-C

TYPE: FSV-2, FSS, FLYD

The latest advance in high performance transit time flow measurement

Superior signal processing and best-in-class anti-bubble performance in a compact and lightweight package



Detector (FSSC)



Flow transmitter (FSV...S)

- **High accuracy measurement** : 1.0% of rate
- **Superior anti-bubble performance** : Our Advanced ABM method * is adopted.
- **Maintenance free operation** : Non-invasive setup with no moving parts
- **Compact and lightweight** : Size and mass reduced by 2/3 (compared with model FLV).
- **Flexible communication functions** : RS-485 (MODBUS) (option)
- **Wide application range** : $\phi 13$ to $\phi 6000\text{mm}$ applicable pipe diameters
Extendable rail type detector up to $\phi 50$ to $\phi 1200\text{mm}$
- **Quick and easy setup** : Simple menu guided setup from the front panel or PC interface

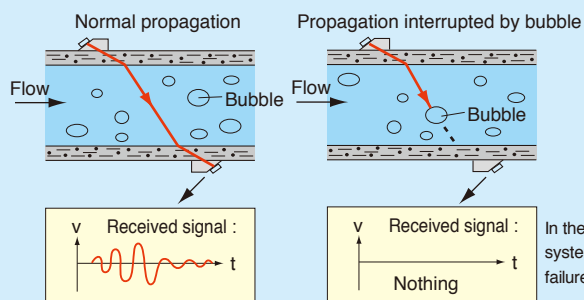
* Advanced ABM method: anti-bubble measuring method.

Applicable pipe diameter is $\phi 13\text{mm}$ to $\phi 6000\text{mm}$

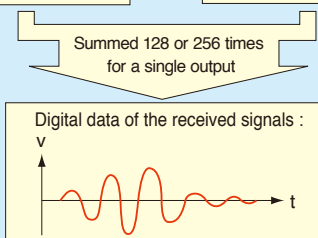
- High accuracy measurement of fluid flow rate: 1.0% of rate
- Quick response: 0.2 sec. or less (quick response mode)
- Minimal Influence by the pressure of measured fluid and temperature
- Superior anti-bubble performance
(Advanced AMB method * is adopted.)

* Advanced AMB method: anti-bubble measurement method

- Advanced received signal digital processing results in higher performance flow measurement



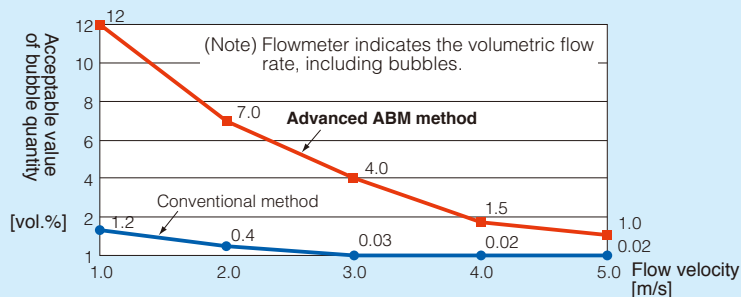
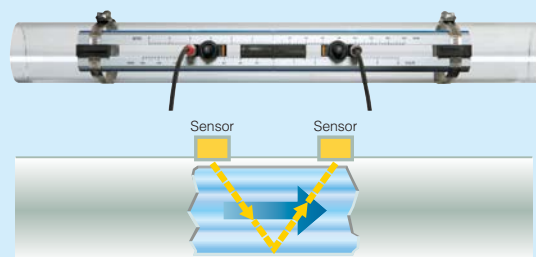
In the case of an analog system, measurement failure will occur.



Synchronized summation of received signals

Measuring principle

With ultrasonic pulses propagated diagonally between the upstream and downstream sensors mounted on the exterior of the pipe, the flow rate is measured by detecting the time difference caused by the flow.



(Note) Flowmeter indicates the volumetric flow rate, including bubbles.

Explanation of the extendable rail type detector (type: FSSC)

Normal	Extended on rails	Z method
pipe diameter $\phi 50$ to $\phi 300\text{mm}$ <V method>	pipe diameter up to $\phi 600\text{mm}$ <V method>	pipe diameter up to $\phi 1200\text{mm}$ <Z method> (rail removed)

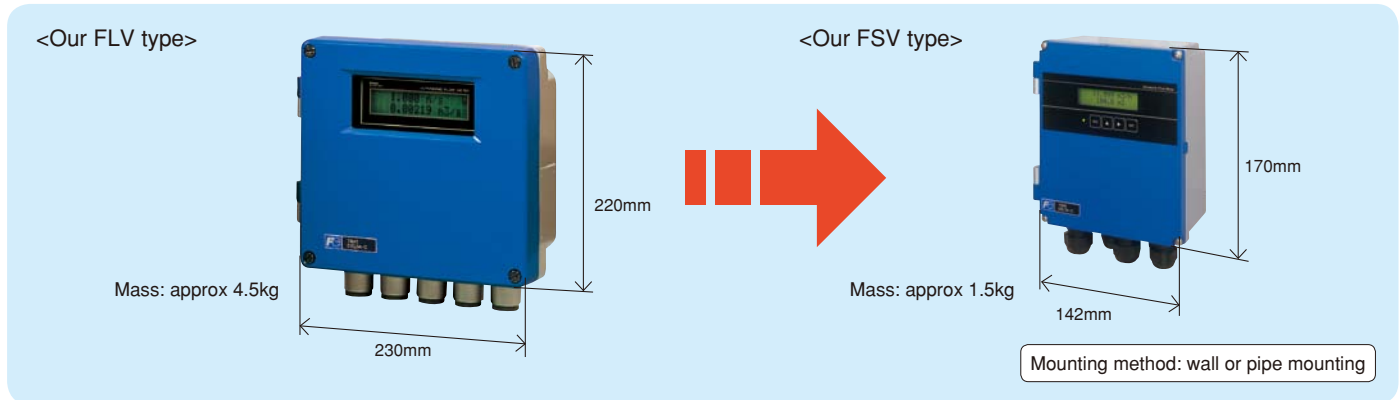
(A detector is simply attached to the exterior of the piping.)

Classification	Appearance	Detector type	Applicable pipe inner diameter (mm)	Measured fluid temperature	Mounting/structure
Extendable rail type		FSSC	$\phi 50$ to $\phi 1200$	-20 to 120°C	<ul style="list-style-type: none"> · V or Z method mounting · Jet structure (equivalent to IP65) · Submersible type available
Compact type		FSSA	$\phi 25$ to $\phi 225$	-20 to 100°C	<ul style="list-style-type: none"> · V method mounting · Jet structure (equivalent to IP65)
Small diameter type		FSSD	$\phi 13$ to $\phi 100$	-40 to 100°C	<ul style="list-style-type: none"> · V mounting method · Splash-proof structure (equivalent to IP52)
High temperature type		FSSH	$\phi 50$ to $\phi 400$	-40 to 200°C	<ul style="list-style-type: none"> · V or Z method mounting · Splash-proof structure (equivalent to IP52)
Large diameter type		FSSE	$\phi 200$ to $\phi 6000$	-40 to 80°C	<ul style="list-style-type: none"> · V or Z method mounting · Watertight structure (equivalent to IP67) · Submersible type available

Both the mass and volume of the flow transmitter are reduced by 2/3!

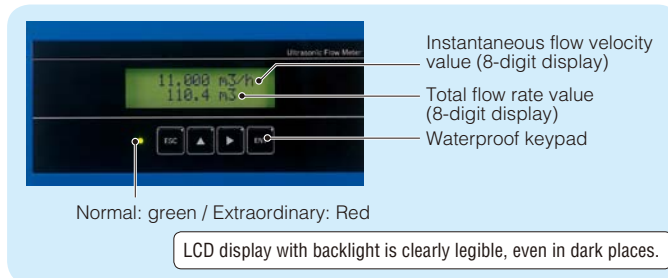
■ Compact and lightweight flow transmitter (1/3 size of model FLV)

Easy to carry and install on a system



■ Operation can be performed from the outside panel (In case of IP66 type)

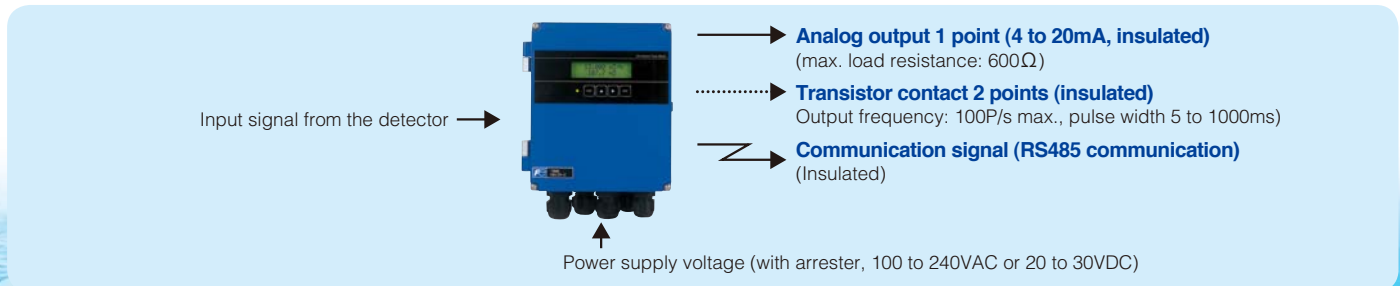
Various settings can be made from the front side without opening the cover of the flow transmitter. (Parameter setting, input of mounted pipe data, automatic calculation of mounting dimensions and similar)



■ Parameter setting and data collection can be performed via optional PC communications interface.



■ Signal and process interfaces are designed with functionality as priority.



■ Fully equipped with extensive functions

Zero adjustment	one-touch adjustment while the flow is stopped
Damping	Used to reduce the fluctuation of the measured value. Setting range: 0 to 100 sec. (setting per 0.1 sec.)
Low flow rate cut	Output may be cut when the flow rate is low. Setting range: 0 to 5m/s (setting in 0.01m/s unit)
Alarm contact output	Contact output at condition of hardware and process faults
Output burnout	When measurement cannot be made because the pipe is empty or bubbles are entrained in the fluid, contact output is activated while analog output is held.
Forward and backward ranges	Ranges may be set arbitrarily. The digital output of the operation range is available.
Auto 2-range	2 forward ranges are independently configurable. Digital output of operation is available.
Flow switch	Contact output is made when the upper or lower limit values of the instantaneous flow rate are reached
Total value switch	Contact output is made when the upper limit value of the total flow rate (forward) exceeds the setting value.
Display of various units	Unit may be set in m/s, 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
Multilingual display	The display language may be selected from 5 choices, including Japanese (Katakana), English, French, Spanish and German.

■ Related products

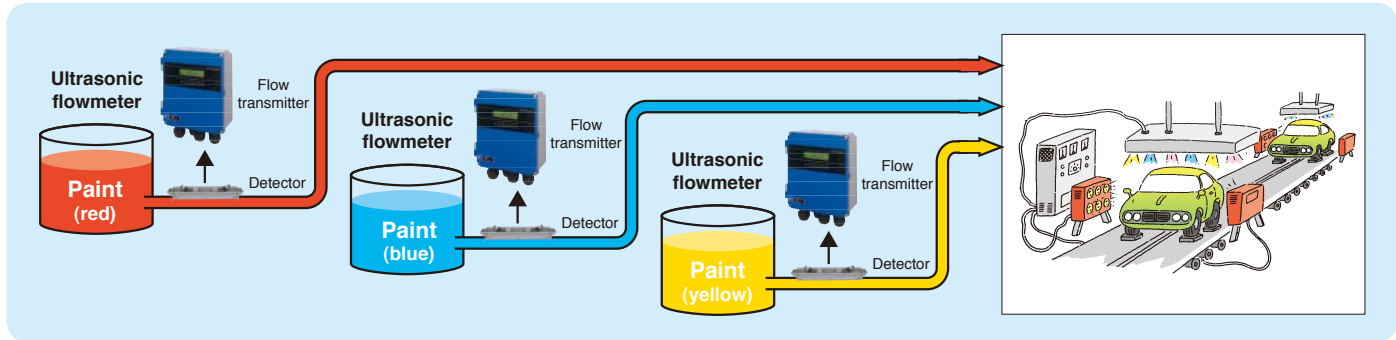
Our product lineup includes such models as: consumed energy calculation, simultaneous measurement of 2 pipes, dual-path measurement. (Refer to the catalog No. 21A1-E-0024)

Application example

■ The ultrasonic flowmeter is a liquid flowmeter used in various applications.

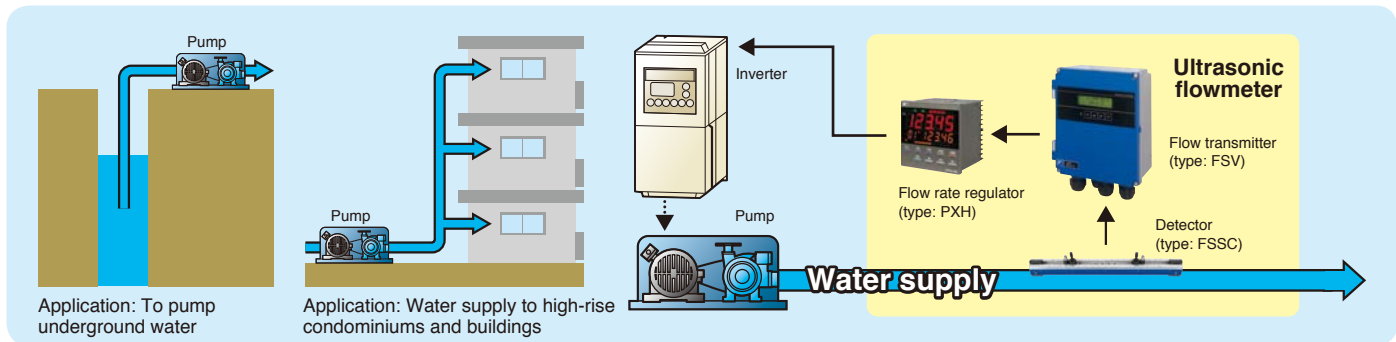
1. Measuring system for the paint flow rate

The flow rate of thick paint is measured by a detector mounted on the pipe already constructed.



2. An energy-saving system for measuring and controlling the flow rate of a pump

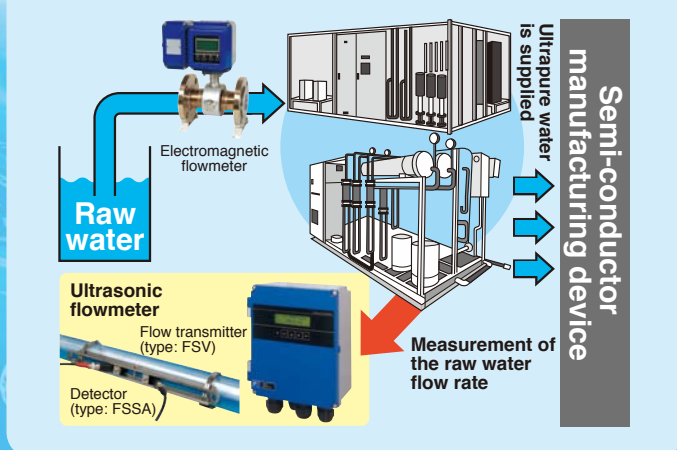
A detector is attached to the already constructed pipe to measure the flow rate at the pump outlet, and a regulator is used to implement inverter control of the pump.



3. Flow rate measurement in a water purifying system for semi-conductors

Advantages of using an ultrasonic flowmeter for the system

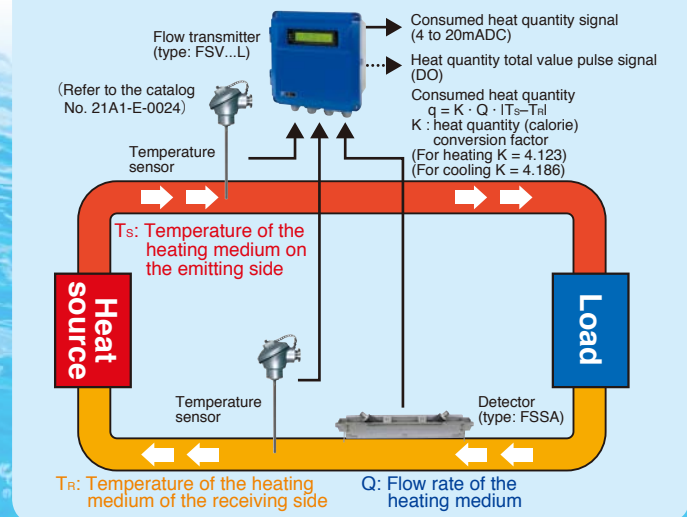
- 1) It can be easily mounted on the exterior of a pipe, helping reduce mounting cost.
- 2) As a sensor, it can operate without coming into contact with fluid, so the fluid is not affected by metallic ions.
- 3) This meter, compact and lightweight, can be easily carried and mounted.



4. Consumed energy calculation function

Calculates the thermal energy received and sent with liquid (water) in cooling and heating.

- It can be mounted on the pipe already constructed.
- Small, lightweight and easy to mount

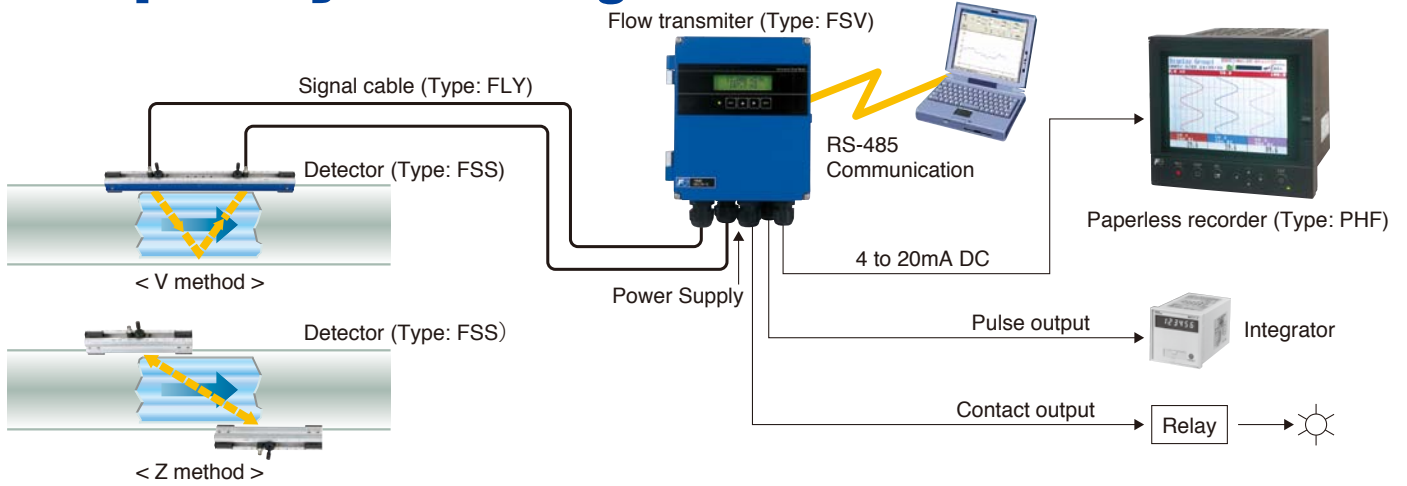


Major applications



- Backup for the already constructed flowmeter
- Water supply and sewage systems leakage investigation of water pipe and investigation of the flow direction in the water distribution pipe
- Power plant flow rate measurement of the boiler water supply, condenser circulating pump and turbine oil
- Various plants flow rate measurement of cooling water, plating solution and corrosive liquid
- Food manufacturing plant flow rate measurement of raw material and washing water
- Semiconductor manufacturing plant flow rate measurement of pure water
- Air-conditioning equipment flow rate measurement of hot water and chilled water in heating and cooling
- Hot spring Measurement of suction quantity

Example of system configuration



CODE SYMBOL

Flow transmitter

1	2	3	4	5	6	7	8	9	10	11	12	13
F	S	V		Y	2			Y				
				E								
				Y								
				D								
				Y								
				1								
				4								
				S								
				H								
				Y								
				A								
				Y								
				Y								
				A								
				B								
				C								
				A								
				B								
				C								

Description
(Language) (4th digits)
Standard
(Communication) (5th digit)
None
RS485
(6th digit)
Single measuring path
(Power supply) (7th digit)
100 to 240VAC 50/65Hz
20 to 30VDC
(Case structure) (9th digit)
IP66
IP67
(Wire connection port) (10th digit)
Weatherproof gland provided
Union (for plica) with gland [G1/2 female screw] (when "H" is specified 9th digit)
(Combination with an explosion-proof detector) (11th digit)
None
(Parameter setting) (12th digit)
None
A Setting provided
B Setting provided + tag
C Tag
(Mounting method) (13th digit)
A Pipe mount (if the 9th digit is S)
B Wall mount
C Pipe mount (if the 9th digit is H)



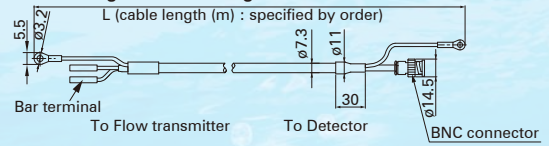
Signal cable

1	2	3	4	5	6	7	8	
F	L	Y					1	
				D				
				0:0:5				
				0:1:0				
				0:1:5				
				0:2:0				
				0:2:5				
				0:3:0				
				0:3:5				
				0:4:0				
				0:4:5				
				0:5:0				
				0:5:5				
				0:6:0				
				0:6:5				
				0:7:0				
				0:7:5				
				0:8:0				
				0:8:5				
				0:9:0				
				0:9:5				
				1:0:0				
				1:1:0				
				1:2:0				
				1:3:0				
				1:4:0				
				1:5:0				
				Z:Z:Z				

Description
<Type of detector> (4th digit)
For FSSA, FSSC, FSSD, FSSH, FSSE (Note)
<Cable length: m> (5, 6, 7 digits)
5m
10m
15m
20m
25m
30m
35m
40m
45m
50m
55m
60m
65m
70m
75m
80m
85m
90m
95m
100m
110m
120m
130m
140m
150m
Others (Contact us)

Note) When detector is FSSA, length of signal cable is up to 60m.

Outline diagram detector signal cord



SCOPE OF DELIVERY

- Flow transmitter (provided with U-bolt and nuts for pipe mount)
- Detector (provided with mounting fixture and acoustic coupler)
- Signal cable
- CD-ROM (contains instruction manual, loader software)

Detector

1	2	3	4	5	6	7	8	9	10	
F	S	S		1				1		
				C						
				A						
				D						
				E						
				H						
				1						
				Y						
				A						
				C						
				D						
				E						
				Y						
				A						
				B						
				C						
				Y						
				A						
				Y						
				A						

Description
<Sensor type> (4th digit)
Extendable rail type (φ50 to φ1200mm)
Compact type (φ25 to φ225mm)
Small diameter type (φ13 to φ100mm)
Large diameter type (φ200 to φ6000mm)
High temperature type (φ50 to φ400mm)
<Guide rail> (5th digit)
Provided
<Mounting belt> (6th digit)
None
Stainless belt (1.0m×2)
SS belt fasten with screws (1.0m×4)
Wire ≤ φ1500mm
Wire ≤ φ6000mm
<Acoustic coupler> (7th digit) *1
None
Y Silicon rubber (KE348)
A Silicone-free grease (HIGH-Z)
B Silicone grease (G40M)
C Silicone grease (G40M)
<Watwe-proof treatment> (9th digit)
None
A Provided (with signal cable 10m) *2
<Tag plate> (10th digit)
None
A Provided

*1) Normally select silicone rubber as acoustic coupler. Silicone rubber in tube (100g) is furnished. If you place an order for several units, 1 tube may suffice for every 5 units. 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) It is selectable only for FSSC type and FSSE type.

Specifications

Applicable subjects and operation environment

Applicable fluid	Homogeneous liquids capable of ultrasonic wave propagation Bubble quantity: 0 to 12Vol% (reference diameter 50A, water and flow velocity of 1m/s) Turbidity of fluid: 10000 degrees (mg/L) or less Straight pipe length: upstream side 10D or more, downstream 5D or more (D: pipe inner diameter) State of flow: fully developed turbulent or laminar flow in round pipe filled with fluid					
Applicable piping and fluid temperature	Classification	Detector type	Pipe size (inner diameter) ϕ (mm)	Mounting method	Fluid temperature range (°C) (Note 2)	Applicable pipe material (Note 1)
	Compact type	FSSA	25 to 50	V method	-20 to +100	Plastic (PVC, Others)
			50 to 225			
	Extendable rail type	FSSC	50 to 600	V method	-40 to +120	Plastic (PVC, Others)
			300 to 1200	Z method		
	Small diameter type	FSSD	13 to 100	V method	-40 to +100	Metal pipe (Stainless steel, Carbon steel, Copper, Aluminum, Others)
	Large diameter type	FSSE	200 to 1000	V method	-40 to +80	
500 to 6000			Z method			
High temperature type	FSSH	50 to 200	V method	-40 to +200		
		150 to 400	Z method			
Note 1) Please select the FSSC type and FSSE type if following condition. - When pipe material is PP and pipe wall thickness is 15mm or more - When pipe material is PVDF and pipe wall thickness is 9mm or more* - When pipe material is cast iron pipe, lining pipe, old steel pipe or others through which the ultrasonic signal could not be transmitted easily. Lining material: Tar epoxy, mortar, rubber, etc. * If the lining is not properly glued to a pipe, the measurement may be impossible. Note 2) If silicone-free grease is used as an acoustic couplant, the fluid temperature range is 0 to 60°C, regardless of the detector. Note 3) Please order a guide rail separately for Z method mounting. Order number : ZZP*TK4J5917C3						
Flow velocity range	0 to ± 0.3 ± 32 m/s					
Power supply voltage	100 to 240VAC 50/60Hz or 20 to 30VDC					
Power consumption	15VA or less (AC power supply), 6W or less (DC power supply)					
Signal cable (between the detector and converter)	Coaxial cable (60m max. for compact type detector (FSSA), 300m max. for others) Heat resistance: 80°C					
Installation environment	Non-explosive area not exposed to direct sunlight, corrosive gas or heat radiation					
Ambient temperature	Flow transmitter: -20 to 55°C Detector: -20 to 60°C					
Ambient moisture	90% RH max.					
Grounding	Class D (100 Ω)					
Arrester	Provided as standard at the power supply					

Performance specifications

Accuracy rating	Classification	Detector type	Pipe size (inner diameter) ϕ (mm)	Flow velocity (m/s)	Accuracy	
					Plastic pipe	Metal pipe
	Compact type	FSSA	25 to 50	3 to 32	$\pm 2.0\%$ of rate	-
				0 to 2	± 0.04 m/s	-
	Extendable rail type	FSSC	50 to 200	2 to 32	$\pm 1.5\%$ of rate	
				0 to 2	± 0.03 m/s	
			200 to 1200	2 to 32	$\pm 1.0\%$ of rate	
				0 to 2	± 0.02 m/s	
	Small diameter type	FSSD	13 to 50	2 to 32	$\pm 1.5\%$ to $\pm 2.5\%$ of rate	
				0 to 2	± 0.03 to ± 0.05 m/s	
			50 to 100	2 to 32	$\pm 1.5\%$ of rate	
				0 to 2	± 0.03 m/s	
	Large diameter type	FSSE	200 to 300	2 to 32	$\pm 1.5\%$ of rate	
				0 to 2	± 0.03 m/s	
300 to 1200			0.75 to 32	$\pm 1.5\%$ of rate		
			0 to 0.75	± 0.0113 m/s		
1200 to 6000			1 to 32	$\pm 1.0\%$ of rate		
			0 to 1	± 0.02 m/s		
High temperature type	FSSH	50 to 200	2 to 32	$\pm 1.0\%$ of rate		
			0 to 2	± 0.02 m/s		
		150 to 400	0.75 to 32	$\pm 1.0\%$ of rate		
			0 to 0.75	± 0.0075 m/s		
Response time	0.5 sec. (standard mode), 0.2 sec. depending on setting (quick response mode)					

Functional specifications

Analog signal	4 to 20mA DC (1 point), Load resistance: 600Ω max.	
Digital output	Forward total, reverse total, alarm, acting range, flow switch, total switch assignable arbitrarily Transistor contact (isolated, open collector) · Output: 2 points · Normal: ON/OFF selectable · Contact capacity: 30VDC, 50mA · Output frequency: 100P/s max. (pulse width: 5, 10, 50, 100, 200, 500, 1000ms)	
Serial communication RS-485 (option)	RS-485(MODBUS), isolated Connectable quantity: 31 units Baud rate: 9600, 19200, 38400bps Parity: None/Odd/Even selectable	Stop bits: 1 or 2 bits selectable Cable length: 1km max. Data: Flow velocity, flow rate, forward total, reverse total, status, etc.
Display device	2-color LED (Normal: green, Abnormal: red), LCD display (2 lines of 16 digits, back light provided)	
Indication language	Japanese (Katakana), English, French, German, Spanish (switchable)	
Flow velocity / flow rate indication	Instantaneous flow velocity / instantaneous flow rate indication (minus indication for reverse flow) Numerals: 8 digits (decimal point is counted as 1 digit) English and metric units selectable.	
	Metric system	Inch system
Unit:	Velocity m/s	ft/s
	Flow rate L/s, L/min, L/h, L/d, kL/d, ML/d, m ³ /s, m ³ /min, m ³ /d, km ³ /d, Mm ³ /d, BBL/s, BBL/min, BBL/h, BBL/d, kBBL/d, MBBL/d	gal/s, gal/min, gal/h, gal/d, kgal/d, Mgal/d, ft ³ /s, ft ³ /min, ft ³ /d, Kft ³ /d, Mft ³ /d, BBL/s, BBL/min, BBL/h, BBL/d, kBBL/d, MBBL/d
Total indication	Forward or reverse total value indication (negative indication for reverse direction) Numerals: 8 digits (decimal point is counted as 1 digit) English and metric units selectable.	
	Metric system	Inch system
Unit:	Total mL, L, m ³ , km ³ , Mm ³ , mBBL, BBL, KBBL	gal, kgal, ft ³ , kft ³ , Mft ³ , mBBL, BBL, kBBL, ACRE-ft
Setting function	Setting available with 4 keys (ESC, △, ▷, ENT) on the flowmeter front	
Zero adjustment	Set zero/Clear available	
Damping	0 to 100s (setting per 0.1 sec.) for analog output and flow velocity/flow rate indication	
Low flow rate cutoff	0 to 5m/s in terms of flow velocity	
Alarm	Digital output available for Hardware fault or Process fault	
Burnout	Analog output: Hold /Over-scale/Under-scale/zero (selectable) Flow rate total: Hold/Count (selectable) Burnout timer: 0 to 100s (every 1s)	
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	2 forward ranges configurable independently / Hysteresis: 0 to 10% of working range / Working range applicable to digital output	
Flow switch	Lower limit, upper limit configurable independently (Digital output available for status at actuated point)	
Total switch	Upper limit of the forward total settable (Digital output available when actuated)	
External total preset	Preset total settable upon contact input setting	
Backup of power failure	backup by non-volatile memory	

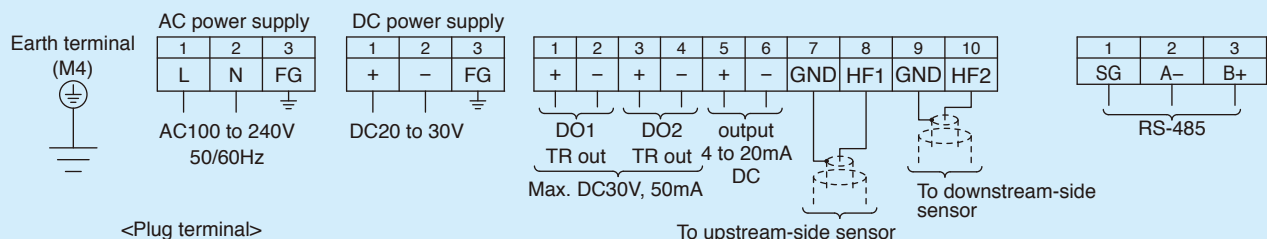
Physical specifications

Type of enclosure	Flow transmitter: IP66 or IP67				
Mounting method	Mounted on wall or by 2B pipe / Detector: Clamped on existing piping.				
Acoustic couplant	Silicone rubber, silicone grease or silicone-free grease				
Note: The acoustic couplant is a medium that eliminates the gap between detector and pipe.	Type	Silicone rubber (type:KE-348W)	Silicone grease (type:G40M)	Silicone-free grease (type:HIGH Z)	Grease for high temperature (type:KS62M)
	Fluid temperature	-40 to +150°C	-30 to +150°C	0 to +60°C	-30 to +250°C
	Teflon piping	Not usable	Good	Good	Good
Outer dimensions, mass	See outline diagrams.				

Loader software (standard accessory)

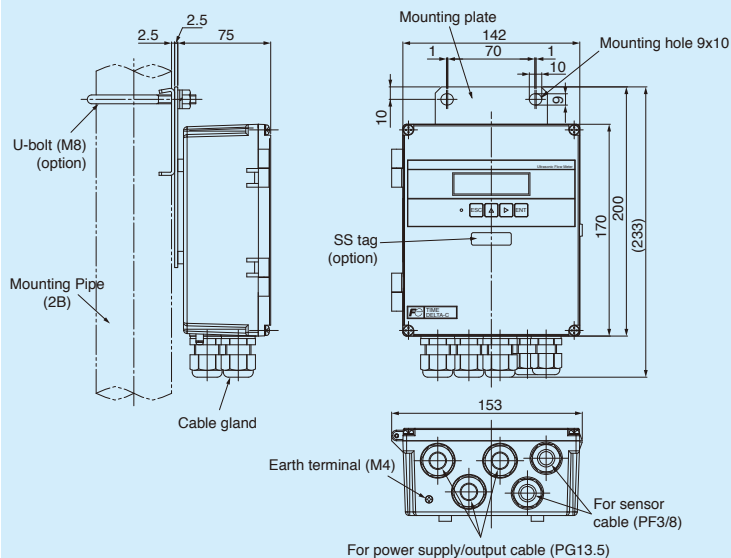
Compatible PC model	PC/AT compatible instrument
Main function	Software for setting/change of the main unit parameters and for collection of the measured data on PC
OS	Windows 2000/XP/7/8
Memory requirement	125MB min.
Hard disk capacity	Minimum free space of 52MB or more

Connection diagram

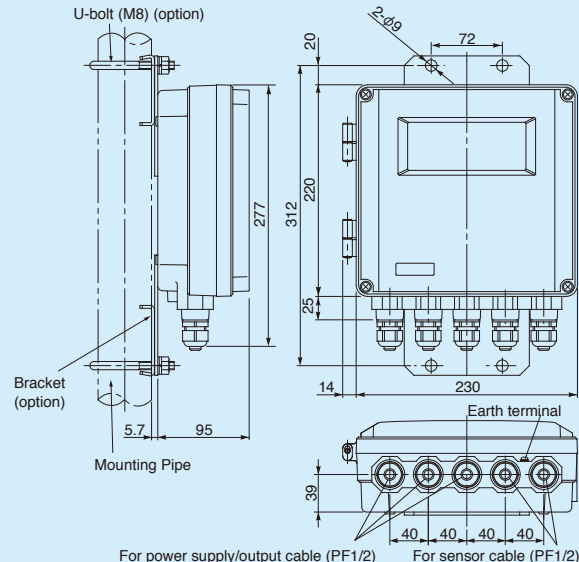


Outline diagram of the flow transmitter (unit: mm)

● IP66 type Flow transmitter Type: FSV...S (Weight: 1.5kg)

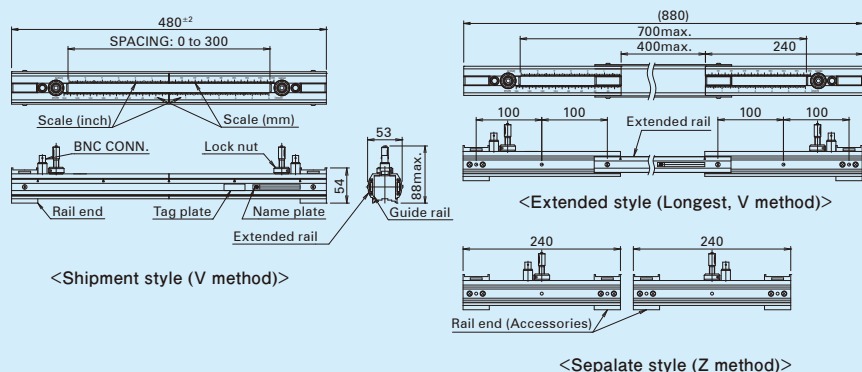


● IP67 type flow transmitter Type FSV...H (Weight: 4.5kg)



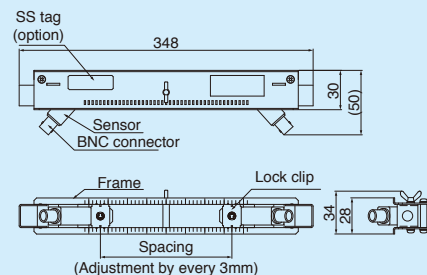
Outline diagram of detector (unit: mm)

● Extendable rail type detector Type: FSSC (diameter ϕ 50 to ϕ 1200, Weight: 1kg)



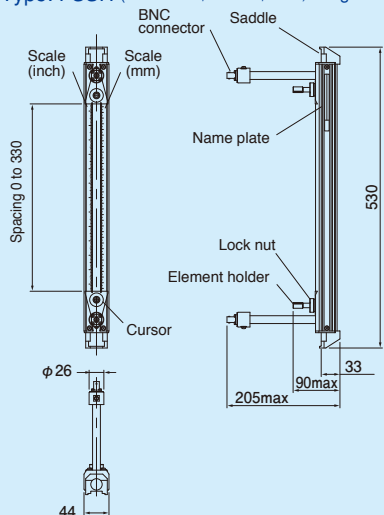
● Compact type detector

Type: FSSA (diameter ϕ 25 to ϕ 225, Weight: 0.4kg)



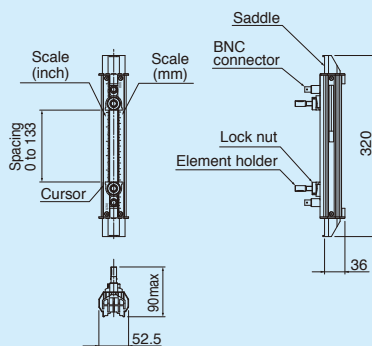
● High-temperature sensor

Type: FSSH (diameter ϕ 50 to ϕ 400, Weight: 1.6kg)



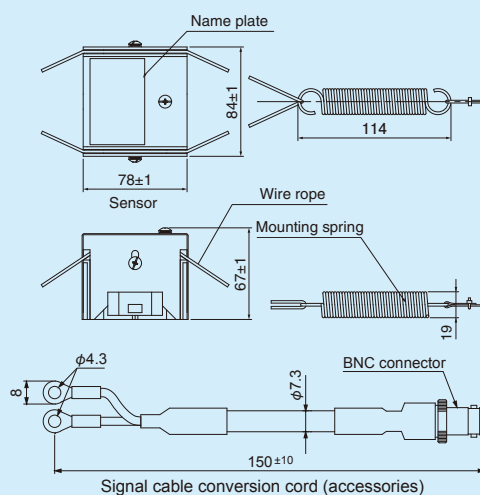
● Small diameter sensor

Type: FSSD
(diameter ϕ 13 to ϕ 100, Weight: 0.6kg)



● Large diameter sensor

Type: FSSE (diameter ϕ 200 to ϕ 6000, Weight: 1.2kg)



⚠ Caution on Safety

* Before using products in this catalog, be sure to read their instruction manuals in advance.

FE Fuji Electric Co., Ltd.

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