

# ULTRASONIC FLOWMETER TIME DELTA-C

**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

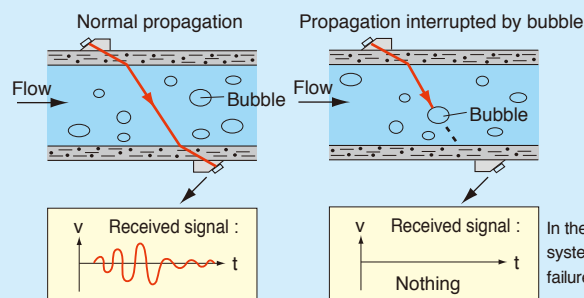
\* Advanced ABM method: anti-bubble measuring method.

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

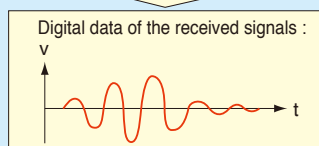
- High accuracy measurement of fluid flow rate: 1.0% of rate
- Quick response: 0.2 sec. or less (quick response mode)
- Minimal Influence by the pressure of measured fluid and temperature
- Superior anti-bubble performance  
(Advanced AMB method \* is adopted.)

\* Advanced AMB method: anti-bubble measurement method

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

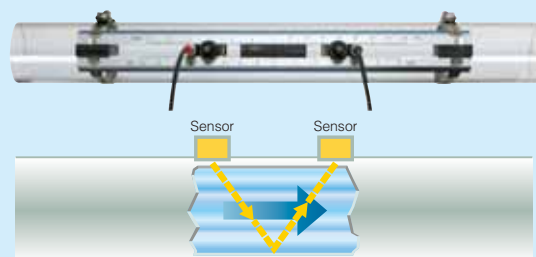
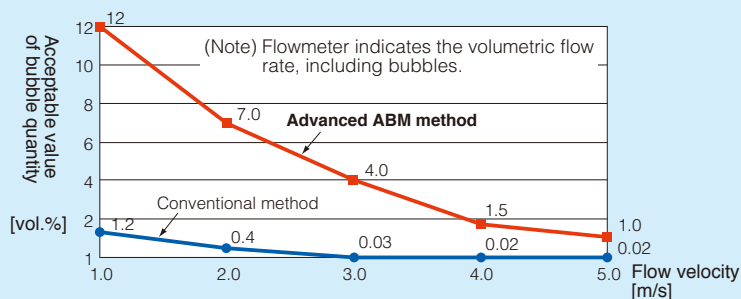


Summed 128 or 256 times for a single output



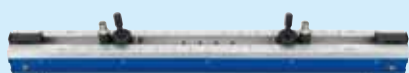
Synchronized summation of received signals

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



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

### Normal



pipe diameter  $\phi 50$  to  $\phi 300\text{mm}$  <V method>

### Extended on rails



pipe diameter up to  $\phi 600\text{mm}$  <V method>

### Z method



pipe diameter up to  $\phi 1200\text{mm}$  <Z method>  
(rail removed)

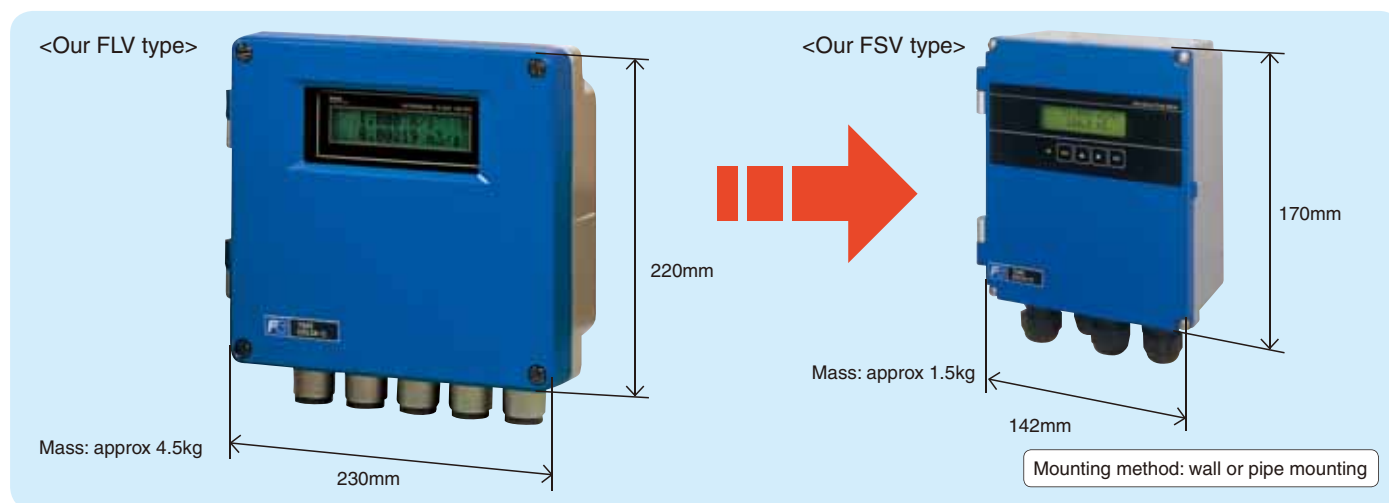
(A detector is simply attached to the exterior of the piping.)

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"> <li>· V or Z method mounting</li> <li>· Jet structure (equivalent to IP65)</li> <li>· Submersible type available</li> </ul>
Compact type		FSSA	$\phi 25$ to $\phi 225$	-20 to 100°C	<ul style="list-style-type: none"> <li>· V method mounting</li> <li>· Jet structure (equivalent to IP65)</li> </ul>
Small diameter type		FSSD	$\phi 13$ to $\phi 100$	-40 to 100°C	<ul style="list-style-type: none"> <li>· V mounting method</li> <li>· Watertight structure (equivalent to IP67)</li> </ul>
High temperature type		FSSH	$\phi 50$ to $\phi 400$	-40 to 200°C	<ul style="list-style-type: none"> <li>· V or Z method mounting</li> <li>· Splash-proof structure (equivalent to IP52)</li> </ul>
Large diameter type		FSSE	$\phi 200$ to $\phi 6000$	-40 to 80°C	<ul style="list-style-type: none"> <li>· V or Z method mounting</li> <li>· Watertight structure (equivalent to IP67)</li> <li>· Submersible type available</li> </ul>

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

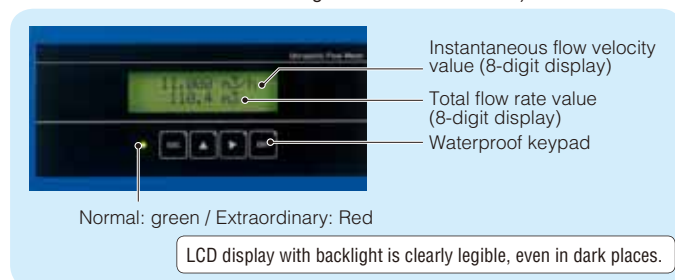
### ■ Compact and lightweight flow transmitter (1/3 size of model FLV)

Easy to carry and install on a system



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

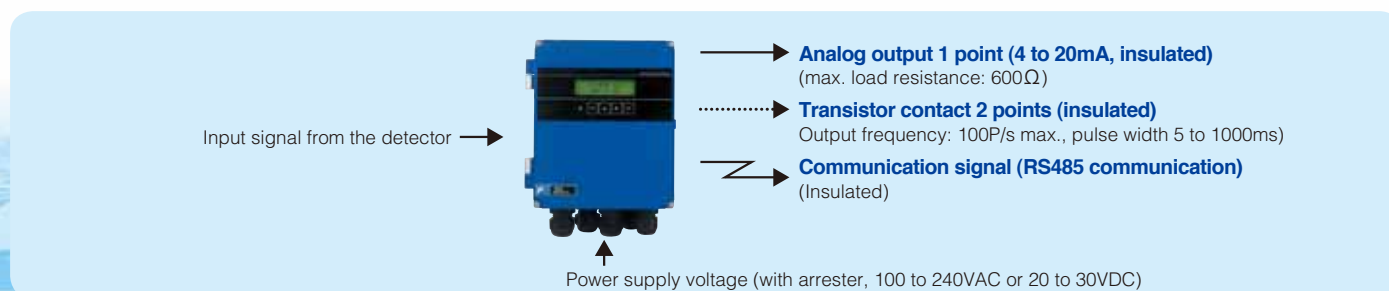
Various settings can be made from the front side without opening the cover of the flow transmitter. (Parameter setting, input of mounted pipe data, automatic calculation of mounting dimensions and similar)



### ■ 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, m³/s, m³/min, m³/h, m³/d, Km³/d, Mm³/d
Multilingual display	The display language may be selected from 5 choices, including Japanese (Katakana), English, French, Spanish and German.

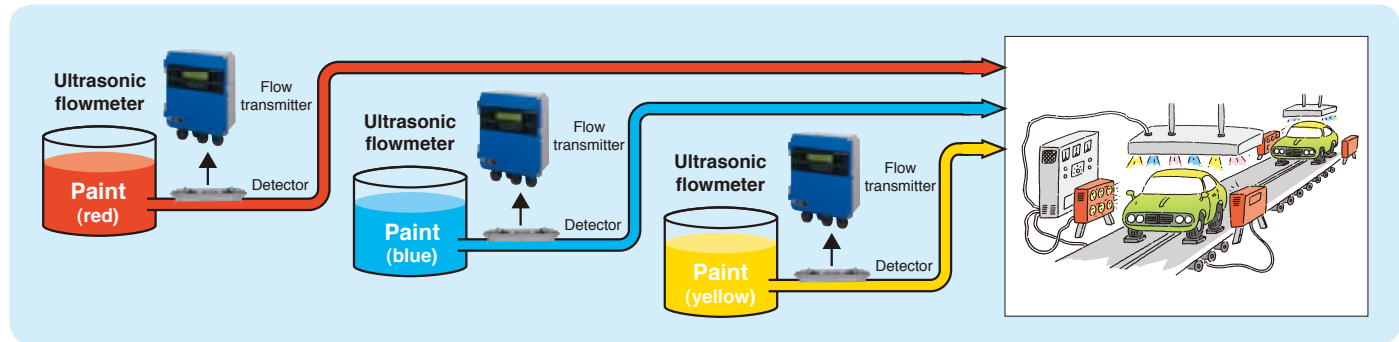


## Application example

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

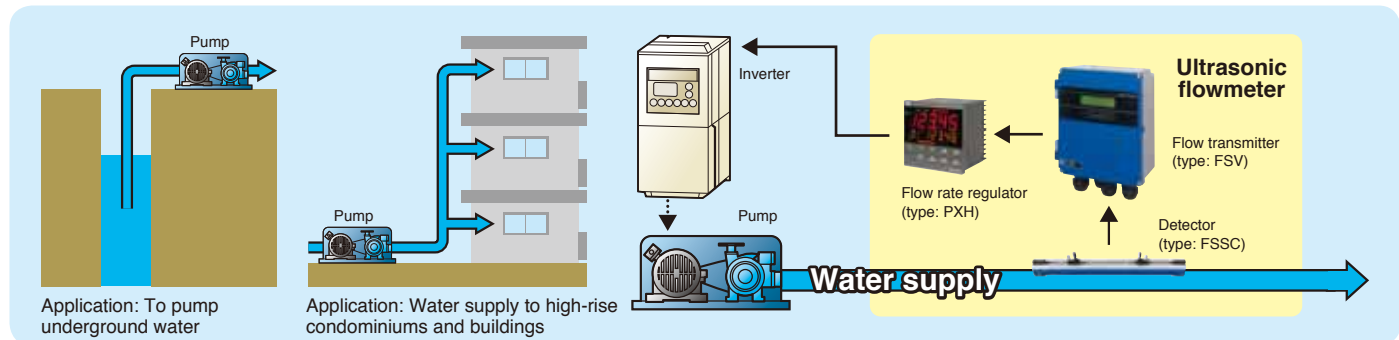
### 1. Measuring system for the paint flow rate

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

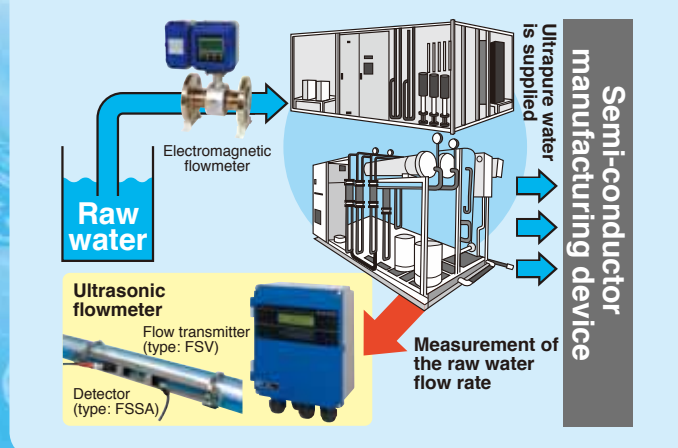
A detector is attached to the already constructed pipe to measure the flow rate at the pump outlet, and a regulator is used to implement inverter control of the pump.



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

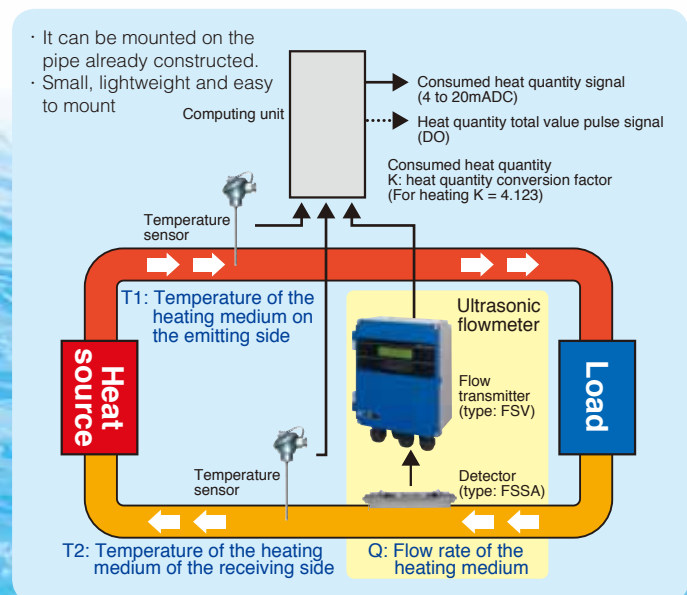
Advantages of using an ultrasonic flowmeter for the system

- 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. A system for measuring heat transfer and efficiency

Heat is transferred by water flow in the process of HVAC loop

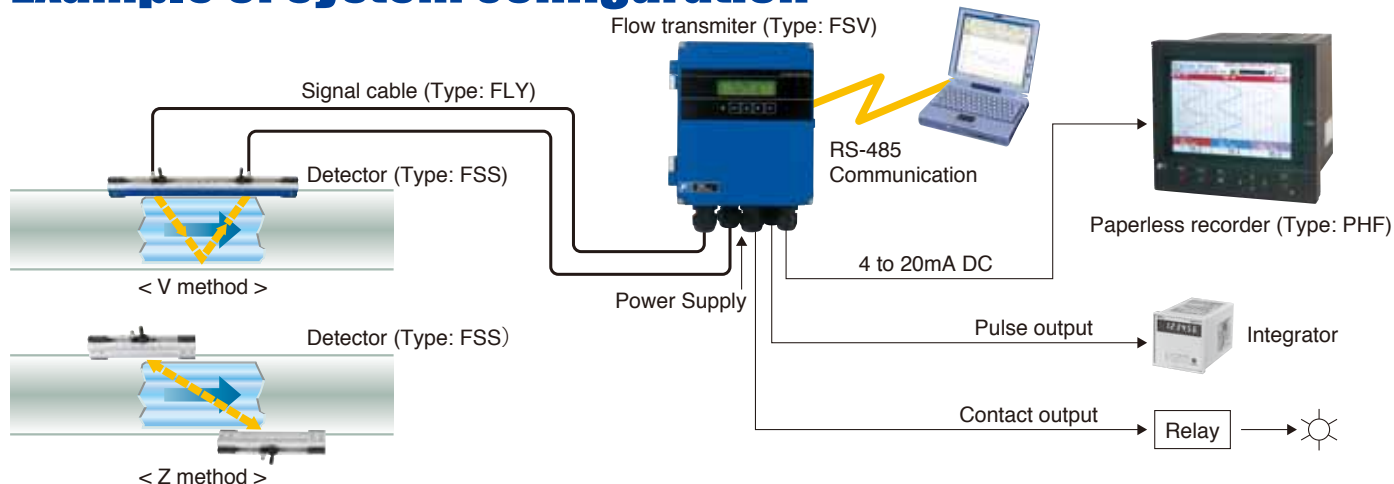


### Major applications



- 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		
Description												
(Language) (4th digit)				Standard								
E				(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								
				Setting provided								
				Setting provided + tag								
				Tag								
				(Mounting method) (13th digit)								
				Pipe mount (if the 9th digit is S)								
				Wall mount								
				Pipe mount (if the 9th digit is H)								

### Detector

1	2	3	4	5	6	7	8	9	10
F	S	S			1				
Description									
<Sensor type> (4th digit)				Extendable rail type (φ 50 to φ 1200mm)					
				Compact type (φ 25 to φ 225mm)					
				Small diameter type (φ 13 to φ 100mm)					
				Large diameter type (φ 200 to φ 6000mm)					
				High temperature type (φ 50 to φ 400mm)					
				<Guide rail> (5th digit)					
				Provided					
				<Mounting belt> (6th digit)					
				None					
				Stainless belt (1.0m×2)					
				SS belt fasten with screws (1.0m×4)					
				Wire ≤ φ 1500mm					
				Wire ≤ φ 6000mm					
				<Acoustic coupler> (7th digit) *1					
				None					
				Silicon rubber (KE348)					
				Silicone-free grease (HIGH-Z)					
				Silicone grease (G40M)					
				<Watwe-proof treatment> (9th digit)					
				None					
				Provided (with signal cable 10m) *2					
				<Tag plate> (10th digit)					
				None					
				Provided					

### Signal cable

1	2	3	4	5	6	7	8
F	L	Y					1
Description							
<Type of detector> (4th digit)				For FSSA, FSSC, FSSD, FSSH (Note)			
				For FSSE			
				<Cable length: m> (5,6,7digits)			
				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			
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				0:6:0			
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				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			

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

### 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)

\*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.

## 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	Classifi cation	Detector type	Pipe inner diameter (mm)	Mounting method	Fluid temperature range (Note 2)	Applicable pipe material  • Plastic (PVC, etc.) • Metal pipe (SS, steel pipe, copper pipe, aluminum pipe, etc.) (Note 1)
	Extendable rail type	FSSC	$\phi$ 50 to $\phi$ 600	V method	-40 to 120°C	
			$\phi$ 600 to $\phi$ 1200	Z method		
	Compact type	FSSA	$\phi$ 25 to $\phi$ 225	V method	-20 to 100°C	
	Small diameter type	FSSD	$\phi$ 13 to $\phi$ 100	V method	-40 to 100°C	
	Large diameter type	FSSE	$\phi$ 200 to $\phi$ 6000	V or Z method	-40 to 80°C	
	High temperature type	FSSH	$\phi$ 50 to $\phi$ 250	V method	-40 to 200°C	
			$\phi$ 150 to $\phi$ 400	Z method (Note 3)		
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 hard to penetrate the ultrasonic wave such as cast-iron pipe, lining pipe and old carbon steel pipe etc., Note 2) If silicone-free grease is used as an acoustic couplant, the fl uid 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 $\pm$ 0.3 …… $\pm$ 32m/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	95% RH max.					
Grounding	Class D (100Ω)					
Arrester	Provided as standard at the power supply					

### ■ Performance specifications

Accuracy rating	Classifi cation		Detector type	Pipe size (inner diameter)	Flow velocity	Accuracy	Applicable pipe material
	Extendable rail type		FSSC	$\phi$ 50 to $\phi$ 200	2 ~ 32m/s	$\pm$ 1.5% of rate	Plastic, metal pipe
					0 ~ 2m/s	$\pm$ 0.03m/s	
				$\phi$ 200 to $\phi$ 1200	2 ~ 32m/s	$\pm$ 1.0% of rate	
					0 ~ 2m/s	$\pm$ 0.02m/s	
	Compact type		FSSA	$\phi$ 50 to $\phi$ 225	2 ~ 32m/s	$\pm$ 1.0% of rate	Plastic
					0 ~ 2m/s	$\pm$ 0.02m/s	Plastic, metal pipe
				$\phi$ 25 to below $\phi$ 50 $\phi$ 50 to $\phi$ 225	2 ~ 32m/s	$\pm$ 2.0% of rate	
					0 ~ 2m/s	$\pm$ 0.04m/s	
	Small diameter type		FSSD	$\phi$ 13 to below $\phi$ 50	2 ~ 32m/s	$\pm$ 1.5% ~ $\pm$ 2.5% of rate	
					0 ~ 2m/s	$\pm$ 0.03 ~ $\pm$ 0.05m/s	
				$\phi$ 50 to $\phi$ 100	2 ~ 32m/s	$\pm$ 1.0% of rate	
					0 ~ 2m/s	$\pm$ 0.02m/s	
	Large diameter type		FSSE	$\phi$ 200 to below $\phi$ 300	2 ~ 32m/s	$\pm$ 1.5% of rate	
				0 ~ 2m/s	$\pm$ 0.03m/s		
$\phi$ 300 to $\phi$ 1200				0.75 ~ 32m/s	$\pm$ 1.5% of rate		
				0 ~ 0.75m/s	$\pm$ 0.0113m/s		
$\phi$ 1000 to below $\phi$ 6000				1 ~ 32m/s	$\pm$ 1.0% of rate		
				0 ~ 1m/s	$\pm$ 0.02m/s		
High temperature type		FSSH	$\phi$ 50 to below $\phi$ 300	2 ~ 32m/s	$\pm$ 1.0% of rate		
				0 ~ 2m/s	$\pm$ 0.02m/s		
			$\phi$ 300 to $\phi$ 400	0.75 ~ 32m/s	$\pm$ 1.0% of rate		
				0 ~ 0.75m/s	$\pm$ 0.0075m/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(MODBUS), isolated		
RS-485 (option)	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.		
	Unit:	Metric system	Inch system
	Velocity	m/s	ft/s
	Flow rate	L/s, L/min, L/h, L/d, kL/d, ML/d, m³/s, m³/min, m³/d, km³/d, Mm³/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, ft³/s, ft³/min, ft³/d, Kft³/d, Mft³/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.		
	Unit:	Metric system	Inch system
	Total	mL, L, m³, km³, Mm³, mBBL, BBL, KBBL	gal, kgal, ft³, kft³, Mft³, 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 10% 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)		

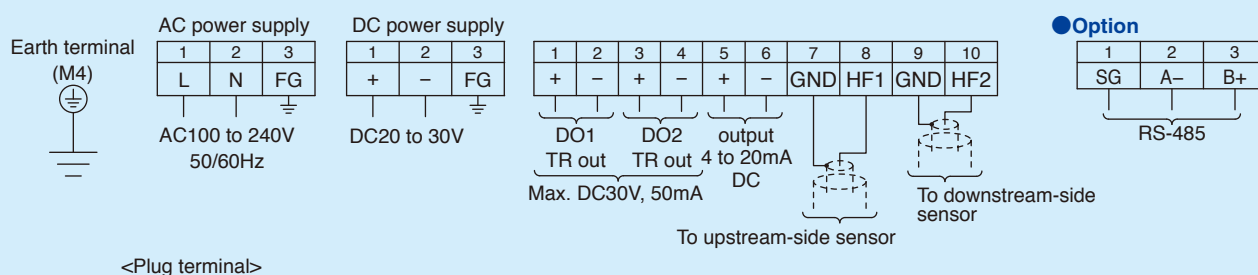
## Physical specifications

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)

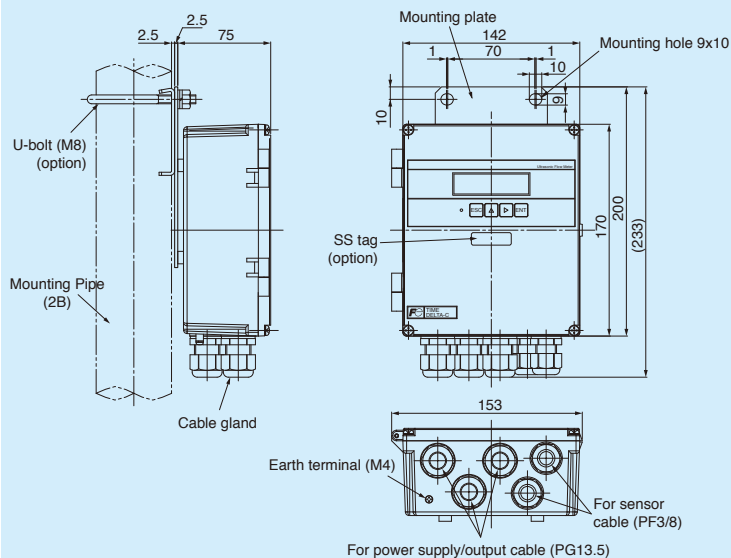
Compatible PC model	PC/AT compatible instrument Operation is undefined for PC98 series (NEC)
Main function	Software for setting/change of the main unit parameters and for collection of the measured data on PC
OS	Windows 2000/XP/7
Memory requirement	125MB min.
Hard disk capacity	Minimum free space of 52MB or more

## Connection diagram

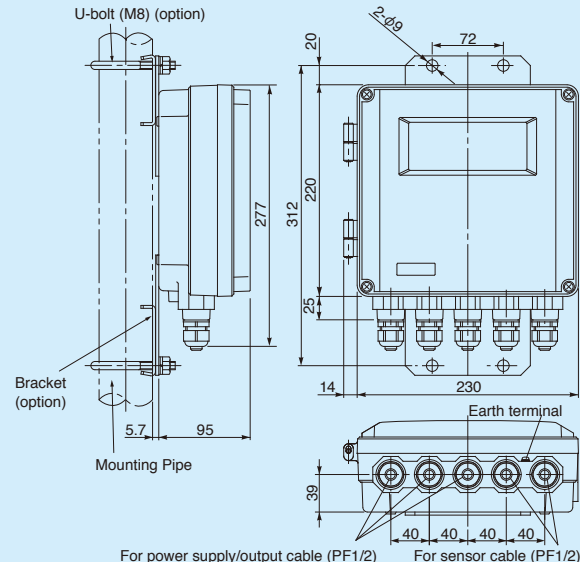


## Outline diagram of the flow transmitter (unit: mm)

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

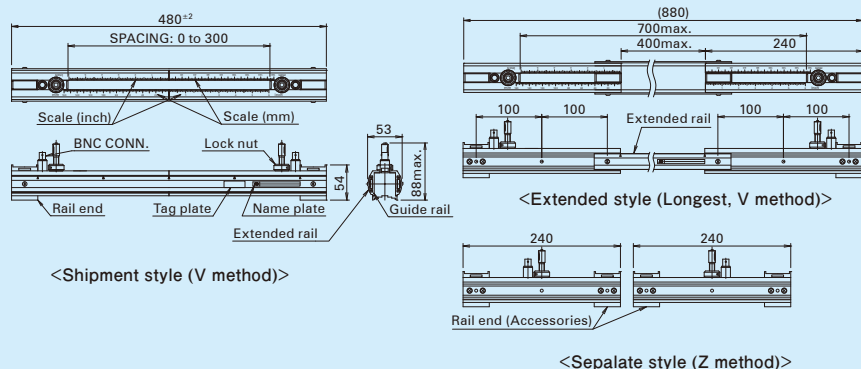


### ● IP67 type flow transmitter Type FSV...H (Weight: 4.5kg)



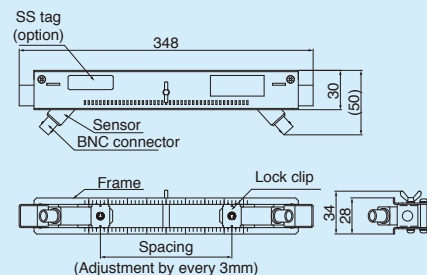
## Outline diagram of detector (unit: mm)

### ● Extendable rail type detector Type: FSSC (diameter $\phi$ 50 to $\phi$ 1200, Weight: 1kg)



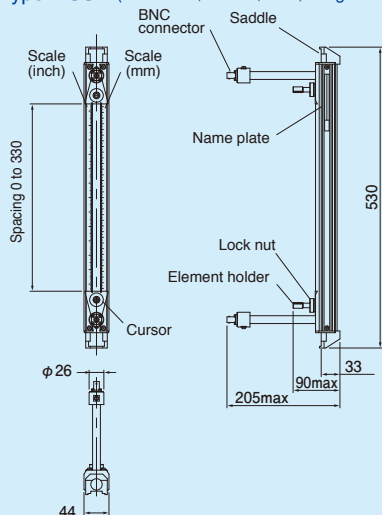
### ● Compact type detector

Type: FSSA (diameter  $\phi$  25 to  $\phi$  225, Weight: 0.4kg)



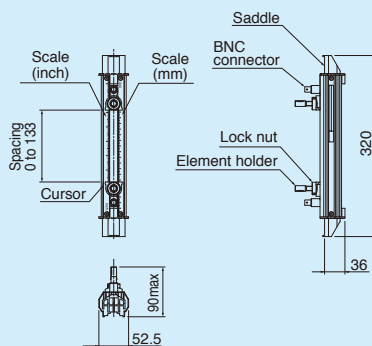
### ● High-temperature sensor

Type: FSSH (diameter  $\phi$  50 to  $\phi$  400, Weight: 1.6kg)



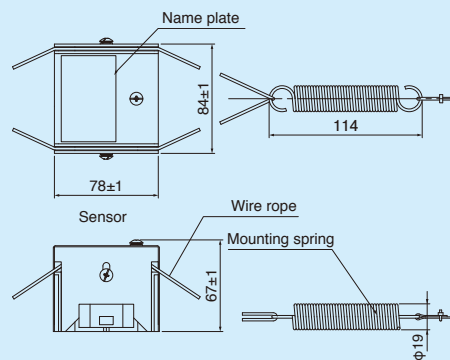
### ● Small diameter sensor

Type: FSSD (diameter  $\phi$  13 to  $\phi$  100, Weight: 0.6kg)



### ● Large diameter sensor

Type: FSSE (diameter  $\phi$  200 to  $\phi$  6000, Weight: 1.2kg)



## ⚠ Caution on Safety

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

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