e-Front runners

Fuji Instrumentation & Control

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 (FLS)

Flow transmitter (FSV)

- **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-232C or RS-485 (MODBUS) (option)
- **Wide application range** : ϕ13 to ϕ6000mm applicable pipe diameters
- **Quick and easy setup** : Simple menu guided setup from the front panel or PC interface

* Advanced ABM method: anti-bubble measuring method.

Fuji Electric Systems Co., Ltd.

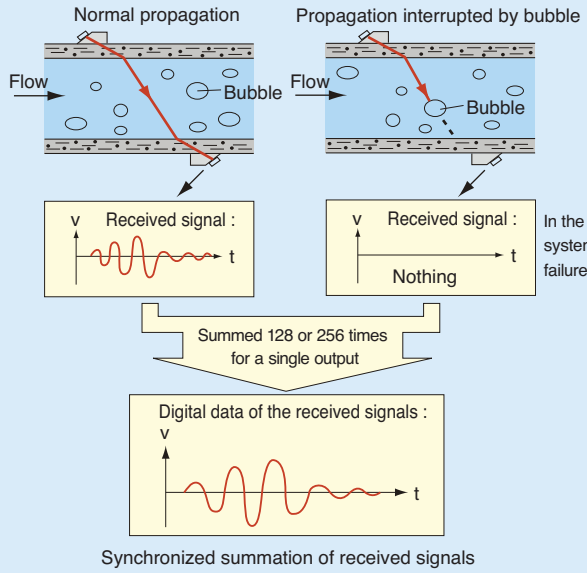
ECNO:636a

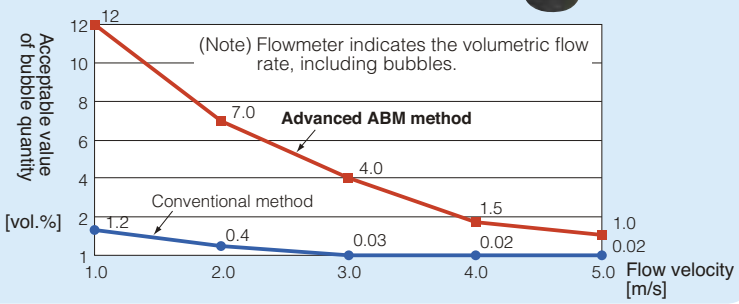
Applicable pipe diameter is ϕ13mm to ϕ6000mm

- 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 ABM method: anti-bubble measurement method

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





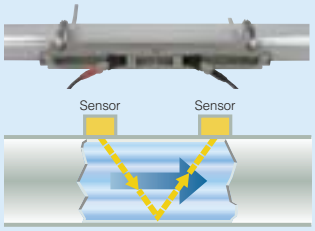
A wide range of detectors is available, and no piping work is required

(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
Compact type		FLSE1	ϕ25 to ϕ100	-20 to 100	· V method mounting · Jet structure (equivalent to IP65)
		FLSE2	ϕ50 to ϕ225		
Small diameter type		FLD2	ϕ13 to ϕ100	-40 to 100	· V mounting method · Watertight structure
High temperature type		FLD3	ϕ50 to ϕ400	-40 to 200	· V or Z method mounting · Splash-proof structure
Common type		FLW1	ϕ50 to ϕ400 (ϕ50 to ϕ250 for the V method)	-40 to 80	· V or Z method mounting · Watertight structure (equivalent to IP67) · Submersible type available
Large diameter type		FLW4	ϕ200 to ϕ1200	-40 to 80	
		FLW5	ϕ200 to ϕ6000		

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.



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

<Our FLV type>

<Our FSV type>

Mounting method: wall or pipe mounting

■Operation can be performed from the outside panel

(via a waterproof keypad)

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)

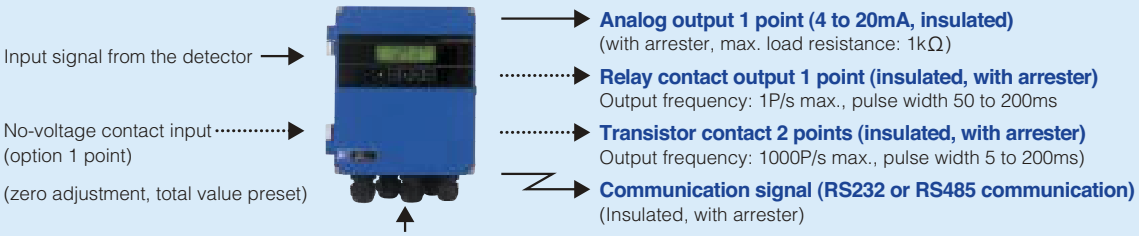
LCD display with backlight is clearly legible, even in dark places.

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

PC loader software for the setting of various parameters and the collection of measured data is a standard accessory

(Note) The communication cable for PC loader is an optional accessory. (Type: ZZP*FSVTK4J1236)

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



■Fully equipped with extensive functions

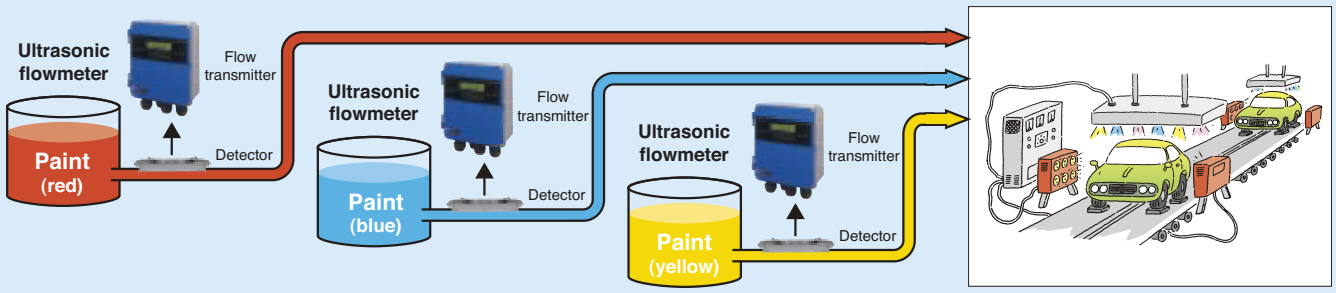
Zero adjustment	one-touch adjustment while the flow is stopped
Damping	Used to reduce the fluctuation of the measured value. Setting range: 0 to 100 sec. (setting per sec.)
Low flow rate cut	Output may be cut when the flow rate is low. Setting range: 0 to 5m/s (setting in 0.01m/s unit)
Alarm contact 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, KL/h, ML/d, m^3/s, m^3/min, m^3/h, Mm^3/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.

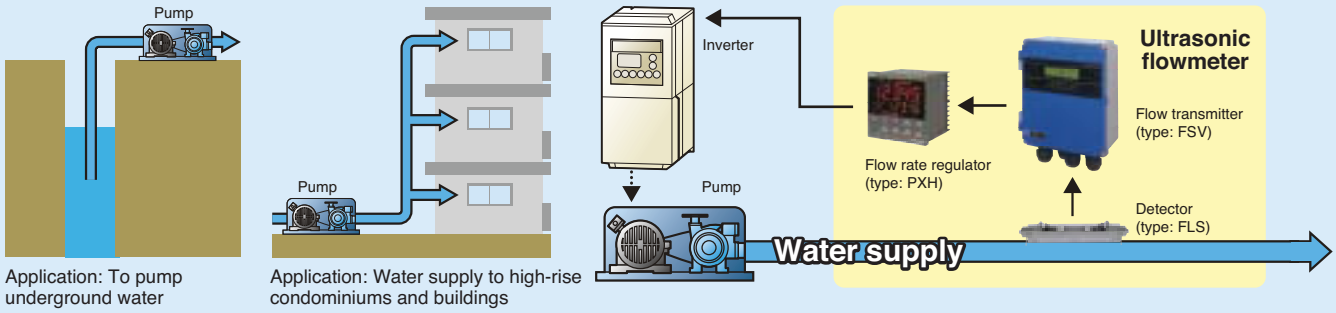
1. Measuring system for the paint flow rate

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

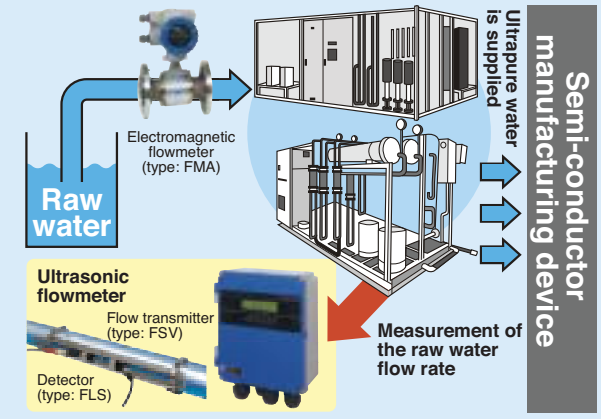
A detector is attached to the already constructed pipe to measure the flow rate at the pump outlet, and a regulator is used to implement inverter control of the pump.



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

Advantages of using an ultrasonic flowmeter for the system

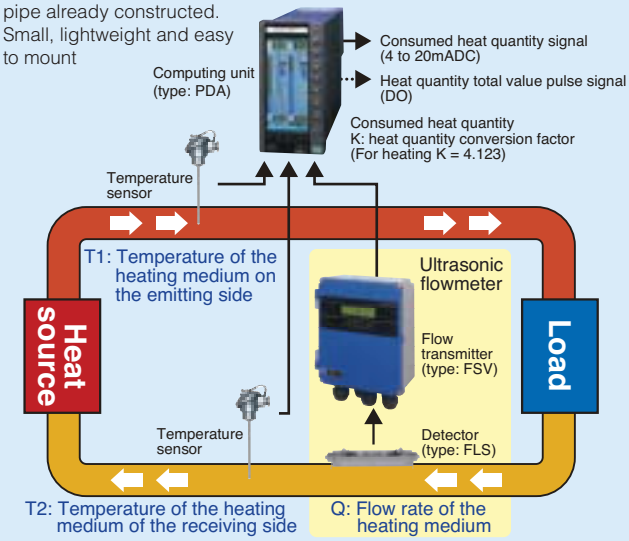
1) It can be easily mounted on the exterior of a pipe, helping reduce mounting cost.
2) As a sensor, it can operate without coming into contact with fluid, so the fluid is not affected by metallic ions.
3) This meter, compact and lightweight, can be easily carried and mounted.



4. A system for measuring heat transfer and efficiency

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

・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 plan ..... 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

CODE SYMBOL

Flow transmitter

1	2	3	4	5	6	7	8	9	10	11	12	13	Description
F	S	V			Y		1	–	S	Y	Y		
			S										(Language) (4th digit)
			E										Standard (Japanese)
													Standard (English)
				Y									(Communication) (5th digit)
				A									None
				B									RS232C+DI
													RS485+DI
					Y								(6th digit)
													Single measuring path
						1							(Power supply) (7th digit)
						4							100 to 240VAC 50/65Hz
													20 to 30VDC
								S					(Case structure) (9th digit)
													Standard (IP66)
									Y				(Wire connection port) (10th digit)
													Weatherproof gland provided
										Y			(Combination with an explosion-proof detector) (11th digit)
													None
											Y		(Parameter setting) (12th digit)
													None
											A		Setting provided
											B		Setting provided + tag
											C		Tag
												A	(Mounting method) (13th digit)
													Pipe mount
												B	Wall mount

Detector, Compact type

1	2	3	4	5	6	7	8	9	10	Description
F	L	S	E				2	–	Y	
			E							Version (4th digit)
										Standard
				1	2					Type (5th and 6th digits)
				2	2					Small diameter detector (φ25 to φ100mm) } V method
										Small detector (φ50 to φ225mm) } V method
						Y				Acoustic coupler (7th digit) (Note)
						A				None
						B				Silicone rubber
										Silicone-free grease
									Y	Optional specification (10th digit)
									B	None
										Tag

Note: Normally silicone rubber is selected as an acoustic couplant. Silicone rubber is provided in a tube (100g). If you place an order for several units, 1 tube may suffice for every 5 units.
Select silicone-free grease for semiconductor equipment or similar that is vulnerable to silicone. The silicone-free grease is water-soluble and cannot therefore be used in an environment exposed to water or on piping subject to condensation. Since the grease does not set, periodic maintenance (cleaning, refilling every about 6 months at normal temperatures) is necessary.
Note: Select silicone grease for Teflon-coated piping.

Detector, submersible type

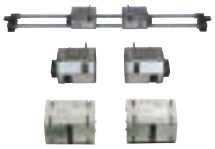
1	2	3	4	5	6	7	8	9	10	11	Description
F	L	W					2	–			
			1	2	1						Type (4th, 5th and 6th digits)
			1	1	1						Small sensor, submersible type (φ50 to φ400) } V method
			4	1	1						Small sensor, submersible type*2 (φ50 to φ400) } V method
			5	1	1						Middle sensor, submersible type (φ200 to φ1200) } V or Z method
			5	0	1						Large sensor, submersible type (φ200 to φ6000) } V or Z method
											Large sensor, submersible type*2 (φ200 to φ6000) } V or Z method
						Y					Optional specification (7th digit)
						A					None
											Tag indication provided
								B	Y		Signal cable (9th and 10th digits)
								C	Y		10m
								D	Y		20
								E	Y		30
								F	Y		40
								G	Y		50
								H	Y		60
								J	Y		70
								K	Y		80
								L	Y		90
								M	Y		100
								N	Y		110
								P	Y		120
								Q	Y		130
								R	Y		140
								Z	Y		150
											Others
										Y	Mounting method (11th digit)
										2	Standard
											Z method mounting (for small sensor)

*2: For old pipes, cast iron pipes, mortar lining pipes or others, through which ultrasound signal cannot easily be transmitted, select FLW11 or FLW50.
*5: Silicone rubber (KE-348W) is provided as a standard acoustic couplant.

Scope of delivery
Flow transmitter (when you choose pipe mount option provided with a U-bolt for pipe mounting)
Detector (provided with a mounting fixture and acoustic couplant)
*in case of conpact type detector acoustic couplant is option.
CD-ROM (contains an instruction manual and loader software for PC communication)

Optional accessories
(1) Signal cable (type: FLY)
Cable between detector and flow transmitter
Note: Cable is attached for a submersible detector.
(2) Loader cable (type: ZZP*FSVTK4J1236)

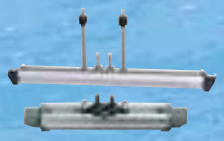
Detector, common / large diameter type



1	2	3	4	5	6	7	8	9	10	11	Description
F	L	W					2	–	Y	Y	
			1	2	0						Type (4th, 5th and 6th digits)
			1	1	0						Small sensor, submersible type (φ50 to φ250) } V method
			4	1	0						Small sensor, submersible type*2 (φ50 to φ250) } V method
			5	1	0						Middle sensor, submersible type (φ200 to φ1200) } V or Z method
			5	0	0						Large sensor, submersible type (φ200 to φ6000) } V or Z method
											Large sensor, submersible type*2 (φ200 to φ6000) } V or Z method
						Y					Optional specification (7th digit)
						A					None
											Tag indication provided
										Y	Mounting method (11th digit)
										2	Standard
											Z method mounting (φ50 to φ400 for small sensor)

*2: For old pipes, cast iron pipes, mortar lining pipes or others, through which the ultrasound signal cannot easily be transmitted, select FLW11 or FLW50.
*5: Silicone rubber (KE-348W) is provided as a standard acoustic couplant.

Detector, small diameter/ high temperature type



1	2	3	4	5	6	7	8	9	Description
F	L	D				S	1	–	Y	
			2	2	0					Type (4th, 5th and 6th digits)
			3	2	0					Small diameter sensor (φ13 to φ100) V method
										High-temperature sensor *1 (φ50 to φ400) V or Z method
						S				Belt, acoustic couplant (7th digit)
										For fixed type
									Y	Coaxial cable (9th digit)
										None

*1: For turbid fluid, old pipes, cast iron pipes, mortar lining pipes or similar, through which the ultrasound signal cannot easily be transmitted, use the guide rail TK4C6164C1 (optional) and mount the sensor using the Z method.
*5: Silicone rubber (KE-348W) is provided for small diameter sensors and high-temperature grease (KS62M) for high-temperature sensors as a standard acoustic couplant.

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 inner diameter (mm)	Applicable pipe material	Mounting method	Fluid temperature range (Note 3)
	Compact type	FLSE12	ϕ25 to ϕ100	Plastic (PVC, etc.) (Note 1)	V method	-20 to 100°C Heat shock resistance 140°C for 30 min.
			ϕ50 to ϕ100	Metal pipe (SS, steel pipe, copper pipe, aluminum pipe, etc.) (Note 2)		
		FLSE22	ϕ50 to ϕ225	Plastic (PVC, etc.) (Note 1) Metal pipe (SS, steel pipe, copper pipe, aluminum pipe, etc.) (Note 2)		
	Small diameter type	FLD22	ϕ13 to ϕ100	Plastic (PVC, etc.) (Note 1) Metal pipe (SS, steel pipe, copper pipe, aluminum pipe, etc.) (Note 2)	V method	-40 to 100°C
	Common type	FLW11, 12	ϕ50 to ϕ400		V or Z method	-40 to 80°C
	Large diameter type	FLW41	ϕ200 to ϕ1200			
		FLW50, 51	ϕ200 to ϕ6000			
	High temperature type	FLD32	ϕ50 to ϕ400			-40 to 200°C
	Note 1: If the pipe material is PP or PVDF, select FLW1, FLW4 of FLW5. Note that the wall thickness is 15mm or less for PP, 9mm or less for PVDF. Note 2: For cast iron pipes, lining pipes, old steel pipes or similar, through which the ultrasonic signal cannot easily be transmitted, select FLW11, FLW41 or FLW50. Lining material: Tar epoxy, mortar, rubber, etc. * In case the lining suffers from peeling-off, measurement may be impossible. Note 3: If silicone-free grease is used as an acoustic couplant, the fluid temperature range is 0 to 60°C, regardless of the detector.					
Flow velocity range	0 to ±0.3 ····· ±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 (FLS), 300m max. for other 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 80°C					
Ambient moisture	95% RH max.					
Grounding	Class D (100Ω)					
Arrester	Provided as standard at the output and power supply					

Performance specifications

Accuracy rating	Classification	Detector type	Pipe size (inner diameter)	Accuracy	Flow velocity	Applicable pipe material
	Compact type	FLSE12	ϕ25 to ϕ50	2.0% of rate	2 to 32m/s	Plastic
				0.04m/s	0 to 2m/s	
			ϕ50 to ϕ100	1.0% of rate	2 to 32m/s	
				0.02m/s	0 to 2m/s	
			ϕ50 to ϕ100	2.0% of rate	2 to 32m/s	Metal pipe
				0.04m/s	0 to 2m/s	
		FLSE22	ϕ50 to ϕ225	1.0% of rate	2 to 32m/s	Plastic
				0.02m/s	0 to 2m/s	
			ϕ50 to ϕ225	2.0% of rate	2 to 32m/s	Metal pipe
				0.04m/s	0 to 2m/s	
	Small diameter type	FLD22	ϕ13 to ϕ50	2.5% of rate	2 to 32m/s	Plastic, metal pipe
				0.05m/s	0 to 2m/s	
			ϕ50 to ϕ100	1.5% of rate	2 to 32m/s	
				0.03m/s	0 to 2m/s	
	Common type	FLW12	ϕ50 to below ϕ300	1.0% of rate	2 to 32m/s	
	High temperature type	FLD32		0.02m/s	0 to 2m/s	
	Large diameter type	FLW51	ϕ300 to ϕ6000	1.0% of rate	1 to 32m/s	
				0.01m/s	0 to 1m/s	
	Common type	FLW11	ϕ50 to below ϕ300	1.5% of rate	2 to 32m/s	
	Large diameter type	FLW41		0.03m/s	0 to 2m/s	
		FLW50	ϕ300 to ϕ6000	1.5% of rate	1 to 32m/s	
				0.015m/s	0 to 1m/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: 1kΩ max.
Digital output	Forward total, reverse total, alarm, acting range, flow switch, total switch assignable arbitrarily (1) Mechanical relay contact (isolated, socket provided, arrester incorporated) · Output: 1 point · Normal: Open/Close selectable · Contact capacity: 240VAC/30VDC, 1A · Output frequency: 1P/s max. (pulse width: 50, 100, 200ms) (2) Transistor contact (isolated, open collector, arrester incorporated) · Output: 2 points · Normal: ON/OFF selectable · Contact capacity: 30VDC, 0.1A · Output frequency: 1000P/s max. (pulse width: 5, 10, 50, 100, 200ms)
Digital input (option)	1 point (no-voltage contact)/Set zero, preset total assignable
Serial communication (option)	RS-232C equivalent or RS-485, isolated, arrester incorporated Connectable quantity: 1 unit (RS-232) /up to 31 units (RS-485: MODBUS) Baud rate: 9600, 19200, 38400bps Parity: None/Odd/Even selectable Stop bits: 1 or 2 bits selectable Cable length: 15m max. (RS-232C)/1km max. (RS-485) 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, 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.

Unit:

	Metric system	Inch system
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
External zero adjustment	Set zero available by digital input (option) setting
Damping	0 to 100s (every 1s) 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

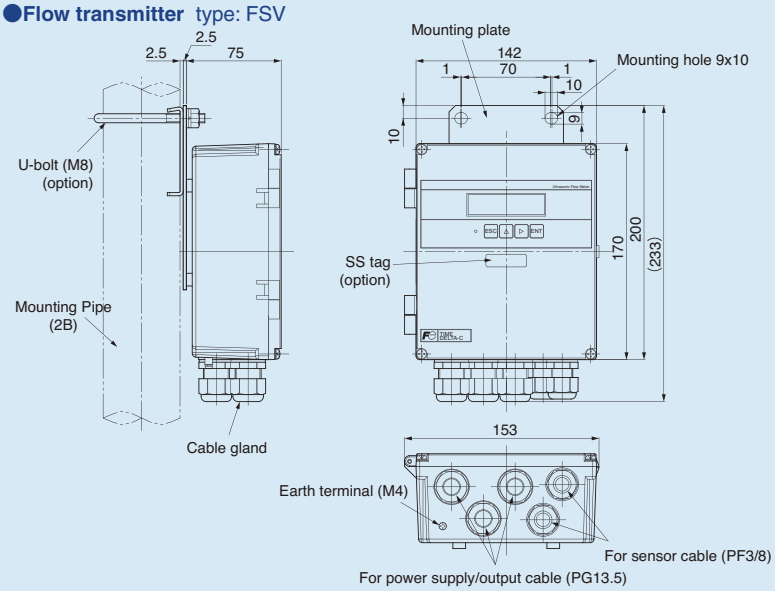
Type of enclosure	Flow transmitter: IP66 / Detector: IP52/IP65/IP67 (Depend on ditector type)				
Mounting method	Mounted on wall or by 2B pipe / Detector: Clamped on existing piping.				
Acoustic couplant	Silicone rubber, silicone grease or silicone-free grease				
Note: The acoustic couplant is a medium 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 +100˚C	-40 to +100˚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)

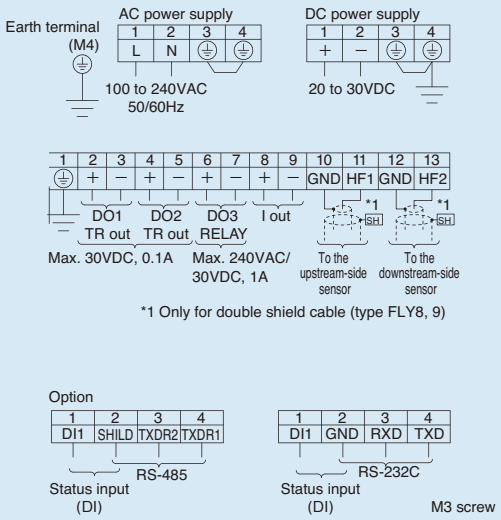
Compatible PC model	PC/AT compatible instrument Operation is undefined for PC98 series (NEC)
Main function	Software for setting/change of the main unit parameters and for collection of the measured data on PC
OS	Windows 2000/XP
Memory requirement	125MB min.
Hard disk capacity	Minimum free space of 52MB or more Note: Loader cable (code symbol ZZP＊FSVTK4J1236) is additionally required.

Outline diagram of the flow transmitter (unit: mm)

●Flow transmitter type: FSV

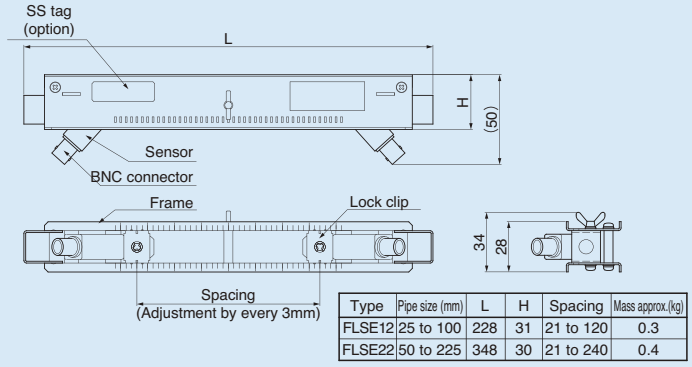


Connection diagram

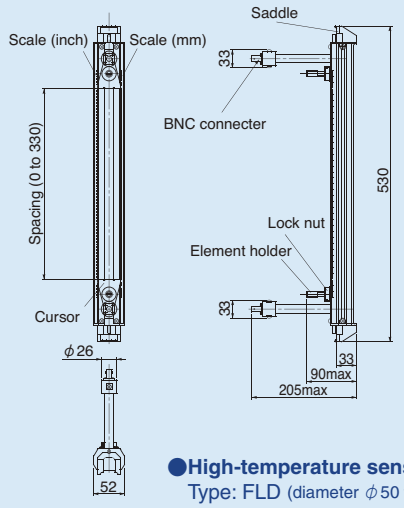


Outline diagram of detector (unit: mm)

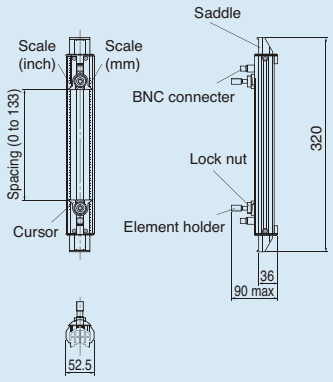
●Compact type detector Type: FLSE1 (diameter ϕ25 to ϕ100)
Type: FLSE2 (diameter ϕ50 to ϕ225)



Type	Pipe size (mm)	L	H	Spacing	Mass approx.(kg)
FLSE12	25 to 100	228	31	21 to 120	0.3
FLSE22	50 to 225	348	30	21 to 240	0.4

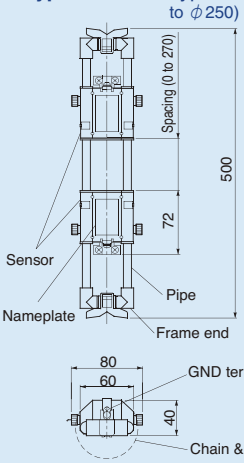


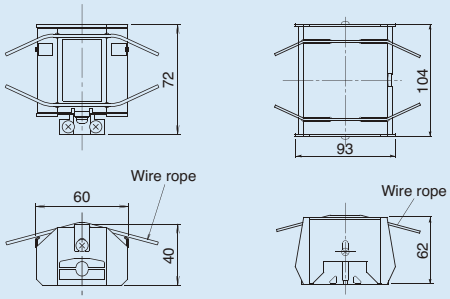
●High-temperature sensor
Type: FLD (diameter ϕ50 to ϕ400)



●Small diameter sensor
Type: FLD2 (diameter ϕ13 to ϕ100)

●Common type detector Type: FLW1 (diameter ϕ50 to ϕ250)





●Large diameter sensor
Type FLW4
(diameter ϕ200 to ϕ1200)

●Large diameter sensor
Type: FLW5
(diameter ϕ200 to ϕ6000)

Fuji Electric

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