

TIME DELTA SERIES

ULTRASONIC FLOWMETER <TIME DELTA-C>

DATA SHEET

FSV, FLS/FLW/FLD

This flowmeter is a clamp-on type ultrasonic flow meter based on transit-time measuring method. Making full use of the latest electronics and digital signal processing technologies, we realized a compact and light-weight design, and improved the accuracy and easiness to use while keeping with anti-bubble performance. The communication function (MODBUS: Option) is also applicable.

FEATURES

1. **Compact and light-weight**
Thanks to the adoption of the latest electronics and digital signal processing technologies, the flow transmitter size and mass are 1/3 of our traditional instrument.
2. **Full variety of sensors**
The flowmeter can be used with various types of sensors applicable for wide range of pipe size (ø13 to ø6000mm) and fluid temperature (-40 to +200°C).
3. **High accuracy**
The flowmeter is designed for high accuracy (better than ±1.0% of rate) by dynamic correction of fully-developed flow profile. Reynolds Number is calculated and a meter factor (K) is automatically applied for best accuracy at all flow velocities. Further, the adoption of new sound velocity measurement system permits measurements of fluids of unknown sound velocity. Moreover, affection from fluid temperature and pressure is negligible (Auto-Temp./Press. compensation).
4. **Excellent resistance against aerated flow**
Fuji's unique ABM feature improves measurement reliability for different flow like slurries, sludge, raw sewage and bubble-contained flow (acceptable up to air bubble of 12% volume at 1m/s velocity).
5. **Quick response**
With the use of high-speed micro-processor suited for digital signal processing, the fast response time is realized.
6. **Multi-lingual**
The following languages are supported for display:
Japanese (Katakana), English, German French, and Spanish.
7. **Excellent performance and easy operation**
LCD and function keys are allowing easy configuration and trouble shooting.
 - LCD with back light
 - Easy mounting of sensor
 - Trouble shooting
 - Easy operation with keypad on the front surface of the flow transmitter (indoor type)



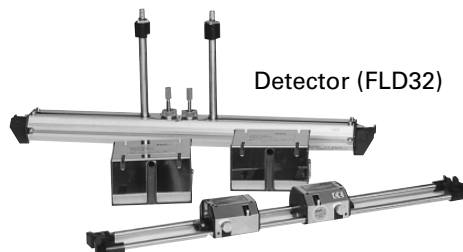
Indoor-type flow transmitter (FSV...S)



Outdoor-type flow transmitter (FSV...H)



Detector (FLSE12, FLSE22)



Detector (FLD32)

Detector (FLW)

SPECIFICATIONS

Operational specifications

- System configuration:** Single-path system of a flow transmitter (Model FSV) and a detector (Model FLS/FLW/FLD)
- Applicable fluid:** Homogenous liquid where the ultrasonic signal can be transmitted
Bubble quantity: 0 to 12vol% (for pipe size 50A, water, velocity 1m/s)
Fluid turbidity: 10000mg/L max.
Type of flow: Fully-developed turbulent or laminar flow in a full-filled pipe
- Flow velocity range:** 0 to ±0.3 ... ±32m/s
- Power supply:** 100 to 240V AC +10%/-15%, 50/60Hz; or 20 to 30V DC
- Signal cable (between detector and converter):** Coaxial cable (5m standard, 300m (60m for popular detector (FLS)) max.)
 Heat resistance: 80°C

Installation environment:

Non-explosive area without direct sunlight, corrosive gas and heat radiation.

Ambient temperature:

Flow transmitter: -20 to +55°C
 Detector: -20 to +60°C
 -20 to +80°C
 (for FLSS□2□2-A only)

Ambient humidity:

95%RH max.

Grounding:

Class D (100 Ω)

Arrester: Provided as standard at output and power supply

Applicable piping and fluid temperature:

Detector	Pipe size (inner diameter)	Applicable pipe material	Mounting method	Fluid temperature range (Note 3)
Popular type	FLSE12	ø25 to ø100 mm	V method	9th digit in code symbol Y... -20 to +100°C A... 0 to +120°C (Note 4) Heat shock resistance 150°C, 30min
		ø50 to ø100 mm		
	FLSE22	ø50 to ø225 mm		
		ø50 to ø225 mm		
Common type	FLD22	ø13 to ø100 mm	V method	-40 to 100°C
	FLW1	ø50 to ø300 mm	V or Z method	-40 to 80°C
	FLW4	ø200 to ø1200 mm		
	FLW5	ø200 to ø6000 mm		
	FLD32	ø50 to ø400 mm		

- Note 1: If the pipe material is PP or PVDF, select FLW11, FLW41 or FLW5.
 Note that the wall thickness is 15mm or less for PP, and 9mm or less for PVDF.
- Note 2: For cast iron pipe, lining pipe, old steel pipe or others through which the ultrasonic signal could not be transmitted easily, select FLW11, FLW41 or FLW50.
 Lining material: Tar epoxy, mortar, rubber, etc.
 * In case the lining is not glued to a pipe, the measurement may be impossible.
 Straight pipe length: Typically 10D for upstream and 5D for downstream.
 (D: Pipe inner diameter)
 Refer to conditions on straight pipe for details
 (Japan Electric Measuring Instruments Manufacturers' Association Standard JEMIS-032).
- Note 3: If silicone-free grease is used as acoustic coupler, the fluid temperature range is 0 to 60°C regardless of the detector.
- Note 4: When the 9th digit in the code symbol is "A", the applicable piping diameter is up to 150mm.

Performance specifications

Rated accuracy:

Detector	Pipe size (diameter)	Applicable pipe material	Flow velocity	Accuracy	
Popular type	FLSE12	ø25 to ø50 mm	Plastic	2 to 32m/s	±2.0% of rate
				0 to 2m/s	±0.04m/s
	ø50 to ø100 mm	Plastic	2 to 32m/s	±1.0% of rate	
			0 to 2m/s	±0.02m/s	
	ø50 to ø100 mm	Metal pipe	2 to 32m/s	±2.0% of rate	
			0 to 2m/s	±0.04m/s	
FLSE22	ø50 to ø225 mm	Plastic	2 to 32m/s	±1.0% of rate	
			0 to 2m/s	±0.02m/s	
	ø50 to ø225 mm	Metal pipe	2 to 32m/s	±2.0% of rate	
			0 to 2m/s	±0.04m/s	
Common type	FLD22	ø13 to ø50 mm	Plastic, metal pipe	2 to 32m/s	±2.5% of rate
				0 to 2m/s	±0.05m/s
	ø50 to ø100 mm	Plastic, metal pipe	2 to 32m/s	±1.5% of rate	
			0 to 2m/s	±0.03m/s	
	FLW12	ø50 to below ø300	Plastic, metal pipe	2 to 32m/s	±1.0% of rate
				0 to 2m/s	±0.02m/s
	FLD32	ø300 to ø6000 mm	Plastic, metal pipe	1 to 32m/s	±1.0% of rate
				0 to 1m/s	±0.01m/s
	FLW51	ø300 to ø6000 mm	Plastic, metal pipe	2 to 32m/s	±1.5% of rate
				0 to 2m/s	±0.03m/s
FLW11	ø50 to below ø300	Plastic, metal pipe	1 to 32m/s	±1.5% of rate	
			0 to 1m/s	±0.015m/s	
FLW41	ø300 to ø6000 mm	Plastic, metal pipe	1 to 32m/s	±1.5% of rate	
			0 to 1m/s	±0.015m/s	
FLW50	ø300 to ø6000 mm	Plastic, metal pipe	1 to 32m/s	±1.5% of rate	
			0 to 1m/s	±0.015m/s	

Response time: 0.5s (standard mode)
 0.2s as selected (quick response mode)

Power consumption:
 15VA max. (AC power supply)
 6W max. (DC power supply)

Functional specifications

- Analog signal:** 4 to 20mA DC (1 point)
 Load resistance: 1 kΩ 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: 240V AC, 30V DC, 1A
 • Output frequency: 1P/s max. (pulse width: 50, 100, 200ms)
 (2) Transistor contact (isolated, open collector, arrester incorporated)
 • Outputs: 2 points
 • Normal: ON/OFF selectable
 • Contact capacity: 30V DC, 0.1A
 • Output frequency: 1000P/s max. (pulse width: 5, 10, 50, 100, 200ms)
- Digital input:** 1 point (no-voltage contact) (option)/
 Set zero, Preset total assignable
- Serial communication (option):**
 RS-232C equivalent or RS-485, isolated, arrester incorporated
 Connectable quantity: 1 unit (RS-232C)/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, Extraordinary: red)
LCD with 2 lines of 16 characters and back light

Indication language: Japanese (Katakana)/English/French/German/Spanish (changeable)

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)
Unit: Metric/Inch system selectable

	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

Note: The "gal" means USgal.

Total indication: Forward or reverse total value indication (negative indication for reverse direction)
Numerals: 8 digits (decimal point is counted as 1 digit)
Unit: Metric/Inch system selectable

	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

Configuration: Fully configurable from the 4-key pad (ESC, △, ▽, ENT) on the surface of flow transmitter's housing case by menu-driven software

Zero adjustment: Set zero/Clear available

External zero adjustment: Set zero available upon digital input setting

Damping: 0 to 100s (every 0.1s) 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/Overscale/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: Forward total switching point configurable
Digital output available when actuated

External total preset: Preset total settable upon contact input setting

Physical specifications

Type of enclosure:

Indoor-type flow transmitter (IP66)
Outdoor-type flow transmitter (IP67)
Detector:
FLS (popular type):
IP65 (When waterproof BNC connector is provided)
FLW (common type):
IP67 (When the terminal block is filled with silicon rubber after wiring)
FLW (submersible type): IP68
FLD (small diameter and high temperature type): IP52

Mounting method:

Flow transmitter: Mounted on wall or by 2B pipe
Detector: Clamped on pipe surface

Acoustic coupler:

Silicone rubber, silicone grease or silicone-free grease
Note: The acoustic coupler is a medium that eliminates a gap between detector and pipe

Type of acoustic coupler:

Type	Silicone rubber (KE-348W)	Silicone grease (G40M)	Silicone-free grease (HIGH Z)	Grease for high temperature (KS62M)
Fluid temperature	-40 to +150°C	-30 to +150°C	0 to +60°C	-30 to +250°C
Teflon piping	×	○	○	○

In case of Teflon piping, use grease.

Procure silicone grease (G40M), if necessary, as an optional accessory.

Material: Flow transmitter: Aluminum alloy
Detector:

Detector	Sensor housing	Sensor cover	Guide rail
FLSE1	PBT	-	SUS304
FLSE2	PBT	-	SUS304
FLD22	PBT	-	Aluminum alloy + plastic
FLW1	PBT	SUS304	SUS304 + plastic
FLW4 FLW5	PBT	SUS304	-
FLD32	SUS304	-	SUS304 + aluminum alloy

- Signal cable:** FLY3 (applicable detector: FLS)
- Structure: Heat-resisting high-frequency coaxial cable (3D2V)
 - Sheath: Flame-resisting PVC
 - Outer diameter: ϕ 5mm
 - Termination: M3 amp terminal (flow transmitter side) and BNC connector (sensor side)
- FLY8, FLY9 (applicable detector: FLW, FLD)
- Structure: High frequency coaxial cable (double shield)
 - Sheath: Black flame-resisting PVC
 - Outer diameter: ϕ 7.5mm
 - Termination: M3 amp terminal (flow transmitter side) and M4 amp terminal. Note, however, that the detector side of FLD22 and FLD32 is provided with BNC connector (FLY9).
 - Mass: Approx. 90g/m
- Dimensions:** Flow transmitter (indoor type):
H170×W142×D70mm
- Flow transmitter (outdoor type):
H277×W244×D95mm
- Detector: H50×W228×D34mm (FLSE1)
H50×W348×D34mm (FLSE2)
H90×W320×D53mm (FLD22)
H40×W500×D80mm (FLW1)
H40×W72×D60mm (FLW4)
H62×W104×D93mm (FLW5)
H205×W530×D52mm (FLD32)
- Mass:** Flow transmitter (indoor type):
1.5kg
- Flow transmitter (outdoor type):
4.5kg
- Detector: 0.3kg (FLSE1)
0.4kg (FLSE2)
0.6kg (FLD22)
1.0kg (FLW1)
0.4kg (FLW4)
1.4kg (FLW5)
1.6kg (FLD32)

■ PC Loader software

Provided as standard

- Compatible model is PC/AT compatible instrument.
- Operation is undefined for PC98 series (NEC).
- Main functions: Software for Main unit parameter setting/change on PC
- OS: Windows 2000/XP
- Memory requirement: 125MB min.
- Disk unit: CD-ROM drive compatible with Windows 2000/XP
- Hard disk capacity: Minimum vacant capacity of 52MB or more

Note: Loader cable (Model ZZP*TK4J1236) is additionally necessary.

Note: USB-RS232C converter

For PC that does not support RS-232C serial interface, a converter is necessary for connecting the PC and main unit.

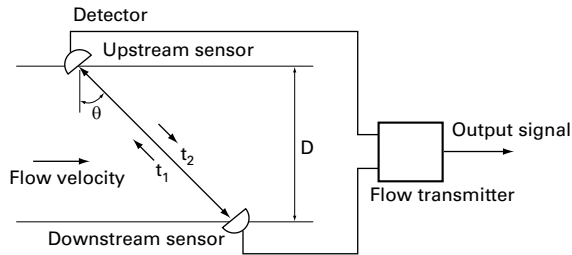
USB-RS232C converter should be combined with the above loader cable.

<Recommendation>

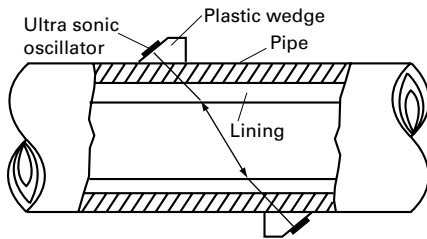
USB-CVRS9 (manufactured by Sanwa Supply)

MEASURING PRINCIPLE

With ultrasonic pulses propagated diagonally between the upstream and downstream sensors, flow rate is measured by detecting the time difference obtained by the flow of fluid.

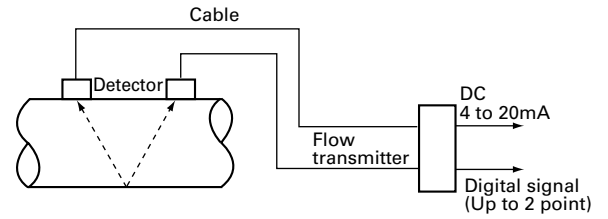


MOUNTING OF DETECTOR

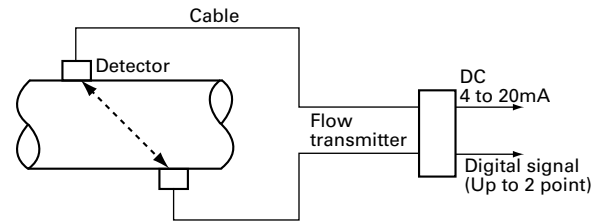


CONFIGURATION DIAGRAM

(1) Single-path system (V method)



(2) Single path system (Z method)



DETECTOR SELECTION GUIDE

Type	Fluid temperature [°C]	Mounting method	Inner diameter of piping ϕ (mm)									
			13	25	50	100	200	250	300	400	1000	3000
FLSE12□2-Y	-20 to 100	V	25 <input type="text" value="P"/> 100									
FLSE12□2-A	0 to 120		50 <input type="text" value="M"/> 100									
FLSE22□2-Y	-20 to 100	V	50 <input type="text" value="P, M"/> 225									
FLSE22□2-A	0 to 120		50 <input type="text" value="P, M"/> 150									
FLW12 ^{Note)} FLW11	-40 to 80	V	50 <input type="text" value="Px, P, M"/> 300									
FLW41		V	200 <input type="text" value="Px, P, M"/> 600									
		Z	200 <input type="text" value="Px, P, M"/> 1200									
FLW51 ^{Note)} FLW50		V	200 <input type="text" value="Px, P, M"/> 3000									
	Z	200 <input type="text" value="Px, P, M"/> 6000										
FLD22	-40 to 100	V	13 <input type="text" value="Px, P, M"/> 100									
FLD32	-40 to 200	V	50 <input type="text" value="Px, P, M"/> 250									
		Z	150 <input type="text" value="Px, P, M"/> 400									

Classification of piping materials {
 Px : PP, PVDF
 P : Plastic (PVC, etc.)
 M : Msetallic piping (steel pipe, copper pipe, aluminum, etc.)

Note: The ultrasonic signal cannot be transmitted easily when the classification of piping material is Px or the turbidity is high. In such a case, a preliminary check by a portable ultrasonic flowmeter is recommended.

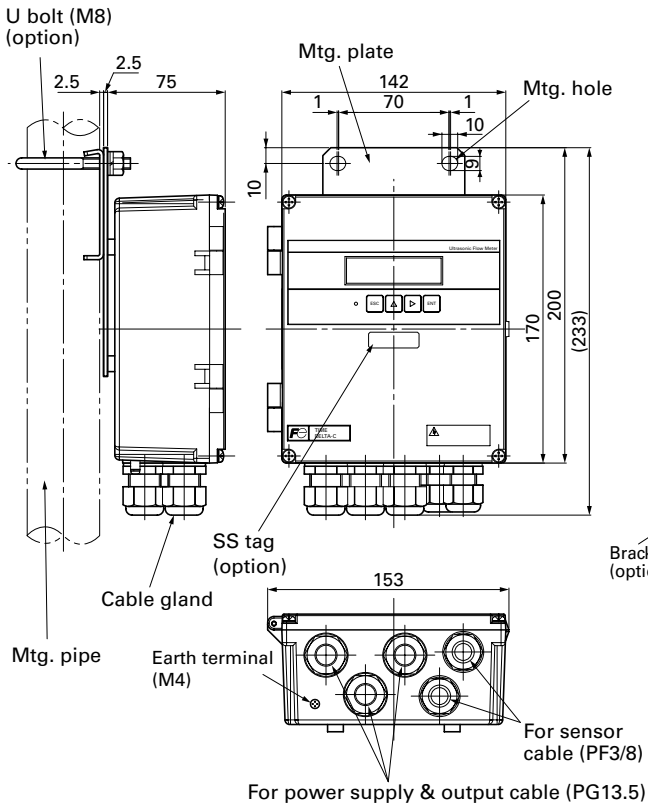
Conditions on straight pipe

(D : Inside diameter of pipe)

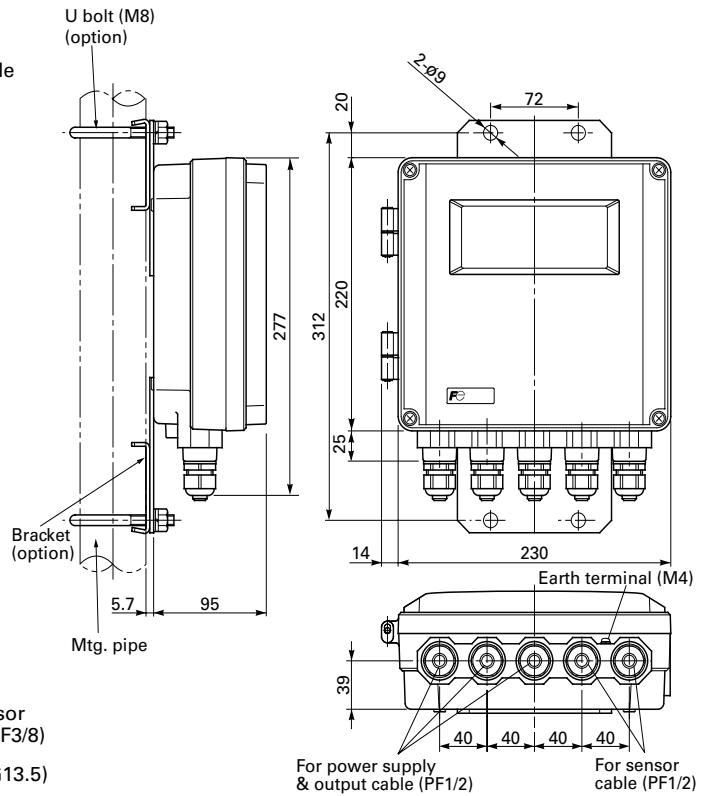
Classification	Upstream side	Downstream side
90 bend		
Tee		
Diffuser		
Reducer		
Various Valve	<p style="font-size: small;">In case that flow control valve exists on upstream side.</p>	<p style="font-size: small;">In case that flow control valve exists on downstream side.</p>
Pump		

(Note) The source : JEMIS-032

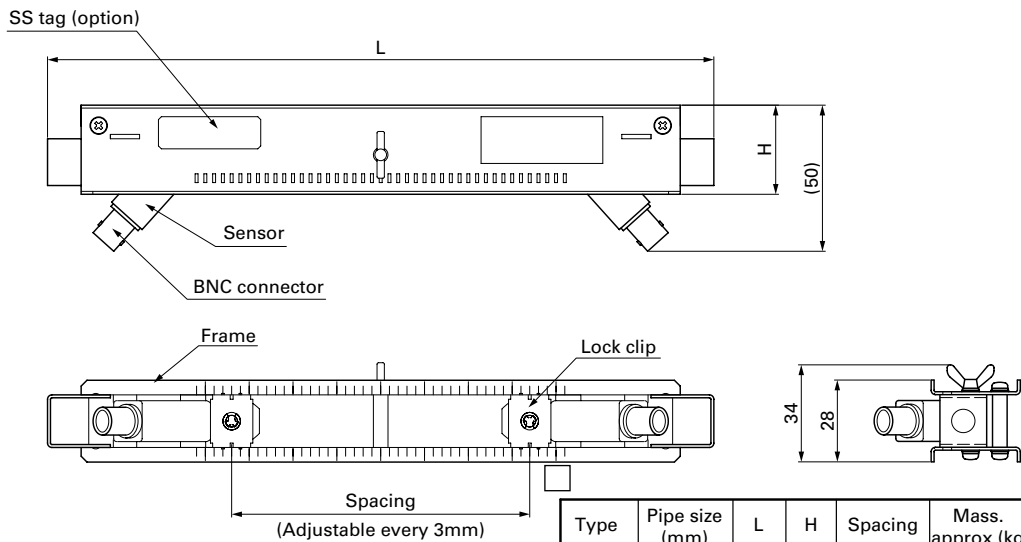
OUTLINE DIAGRAM (Unit:mm)



Indoor-type flow transmitter : FSV...S



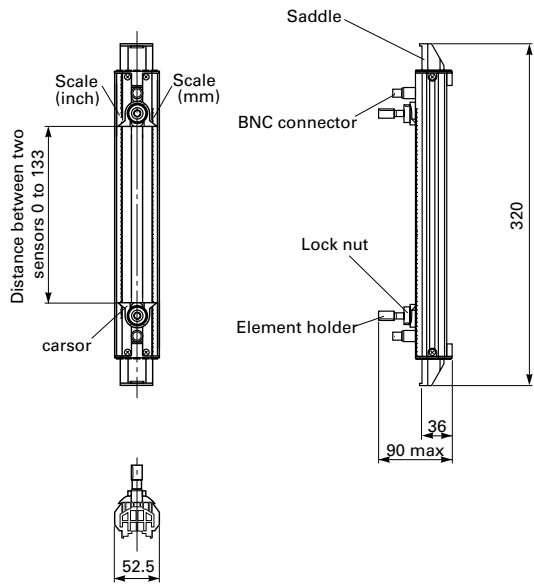
Outdoor-type flow transmitter : FSV...H



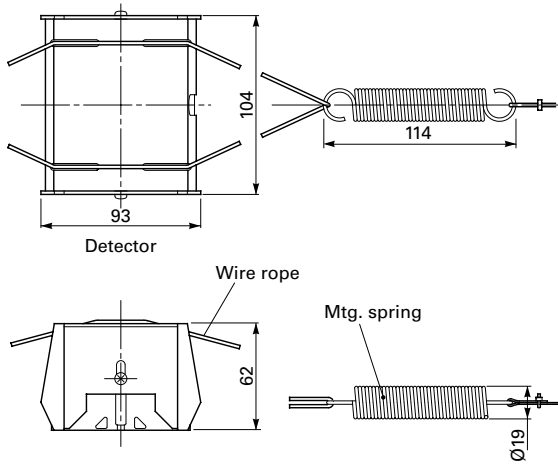
Type	Pipe size (mm)	L	H	Spacing	Mass. approx (kg)
FLSE12	25 to 100	228	31	21 to 120	0.3
FLSE22	50 to 225	348	30	21 to 240	0.4

Detector (type : FLSE 2) (popular type)

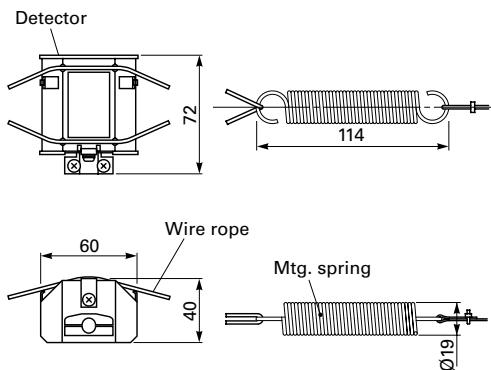
OUTLINE DIAGRAM (Unit:mm)



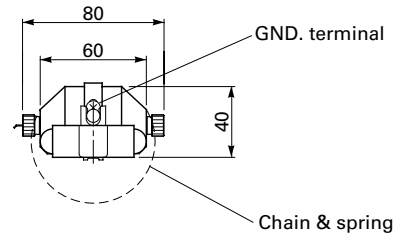
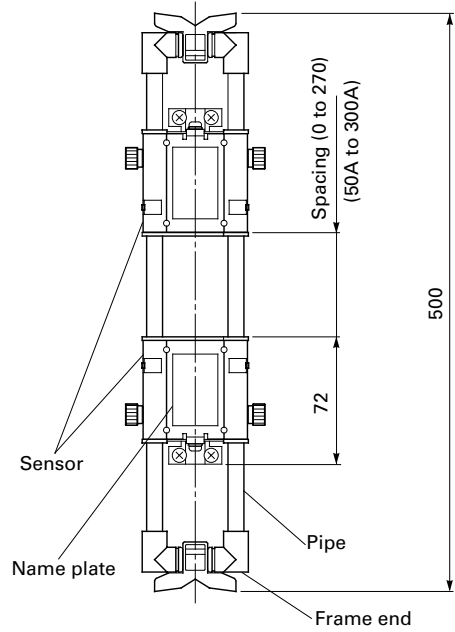
Detector FLD22 (Small diameter sensor)



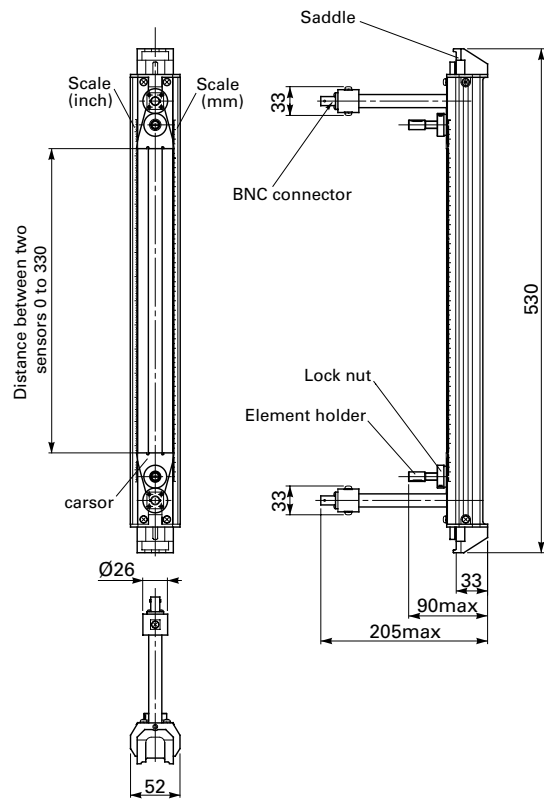
Detector FLW5 (Large sensor)



Detector FLW4 (Middle sensor)



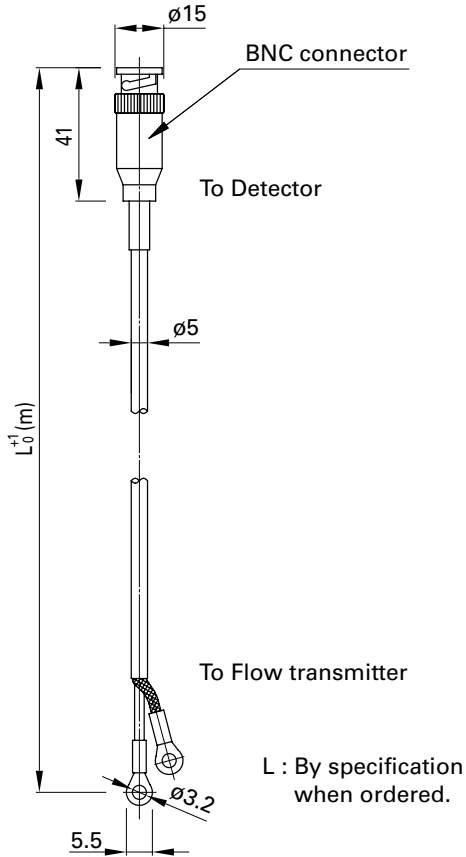
Detector FLW1 (Small sensor)



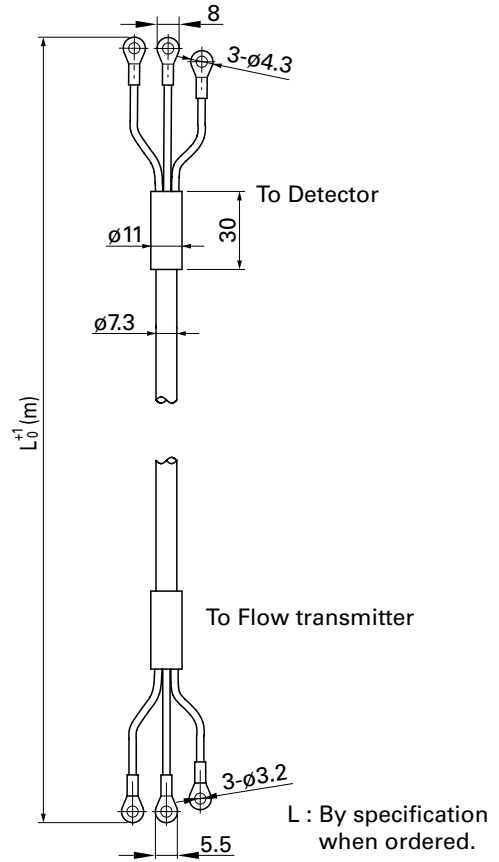
Detector FLD32 (High-temperature sensor)

OUTLINE DIAGRAM (Unit:mm)

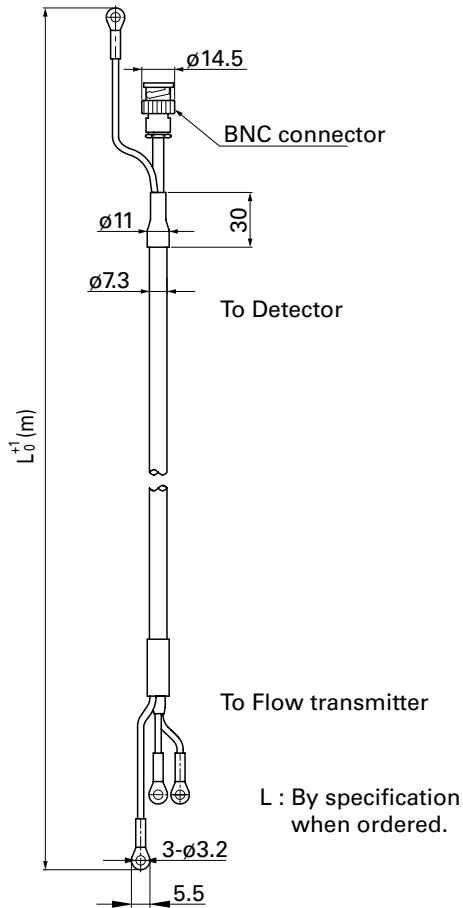
Signal cable : FLY3 (For FLS)



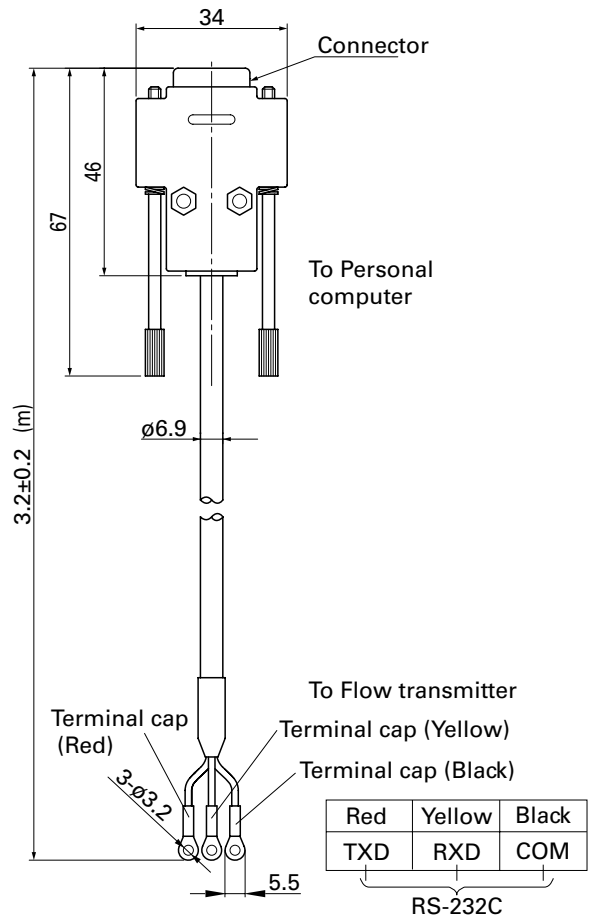
Signal cable : FLY8 (For FLW)



Signal cable : FLY9 (For FLD)

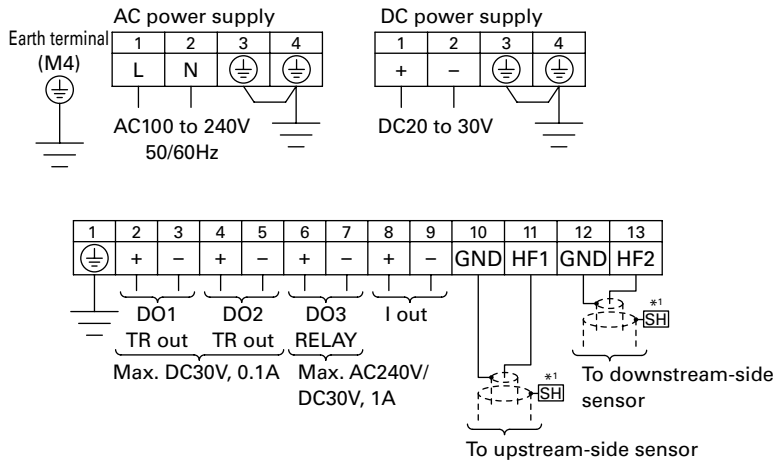


Loader cable : ZP*TK4J1236



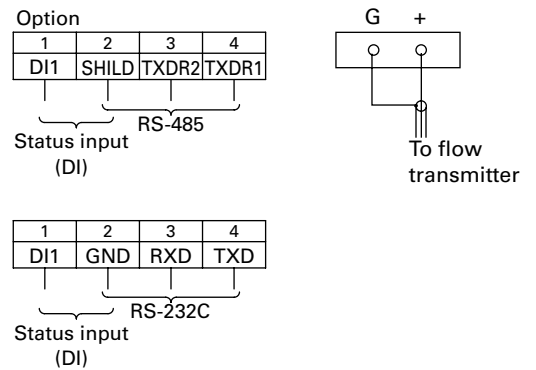
CONNECTION DIAGRAM

<Flow transmitter>



*1) Only for double shield coaxial cable (type FLY8, 9)

<Detector>



SCOPE OF DELIVERY

- Flow transmitter (provided with U-bolt and nuts for pipe mount)
- Detector (provided with mounting fixture and acoustic coupler)
- *The acoustic coupler is option for popular type detectors.
- CD-ROM (contains instruction manual, loader software)

ITEMS DESIGNATED ORDERING

1. Detector code symbols
2. Flow transmitter code symbols
3. Signal cable code symbols
4. For large sensor: Mounting pipe size
5. Tag No. as necessary
6. If parameter setting is specified, send back the attached parameter specification table duly filled.

OPTIONAL ACCESSORIES

	Name	Drawing No.
1	Guide rail for high-temperature sensor	ZZP*TK4C6164C1
2	PC Loader cable	ZZP*TK4J1236
3	Silicon grease	ZZP*FLD1-C100

<Parameter specification table>

Setting item		Initial value	Setting value	Setting item		Initial value	Setting value		
ID No		0000							
Language		English							
Measuring conditions	System unit	Metric		Output conditions	Total mode	Stop			
	Flow unit	m³/h			Total output	Total rate	0m³		
	Total unit	m³			Total preset	0m³			
	Outer diameter	60.00mm			Pulse width	50.0msec			
	Pipe material	PVC pipe			Burnout (total)	Hold			
	Wall thickness	4.00mm			Burnout timer	10sec			
	Lining material	Without lining			DO1 output type (Note 1)	Not used			
	Lining thickness	-			DO1 output actuation	ON when actuated			
	Kind of fluid	Water			DO2 output type	Not used			
	Viscosity	1.0038×10 ⁻⁶ m²/s			DO2 output actuation	ON when actuated			
	Sensor mount	V metod			DO3 output type	Not used			
	Sensor type	FLS_12			DO3 output actuation	ON when actuated			
	Transmission voltage	80Vpp			DI1 input type	Not used			
					DI1 input actuation	ON when actuated			
			Operation mode	Standard					
Output conditions	Damping	5.0sec		Communication	Communication mode	RS-232C			
	Cut off	0.150m³/h			Baud rate	9600bps			
	Display	1st line	Flow velocity (m/s)			Parity	Odd		
		1st line decimal point position	****.***			Stop bit	1 bit		
	Display	2nd line	Flow rate (m³/h)			Station No.	1		
		2nd line decimal point position	****.***						
	Analog output	Range type	Single range						
		Full scale 1	15.000m³/h						
		Full scale 2	0.000m³/h						
		Range HYS.	10.00%						
		Burnout (current)	Hold						
		Burnout timer	10sec						
		Output low limit	-20%						
		Output high limit	120%						
	Rate limit	0.000m³/h							
	Rate limit timer	0sec							

Note1: When total pulse output has been selected for DO1, DO2 or DO3 specify total pulse value and total pulse width so that conditions 1 and 2 shown below are satisfies.

$$\text{Condition 1 : } \frac{\text{Flow span-1} \cdot [\text{m}^3/\text{s}]}{\text{total pulse value} \cdot [\text{m}^3]} \leq \begin{matrix} 1000 \text{ [In the case of DO1 and DO2]} \\ 1 \text{ [In the case of DO3]} \end{matrix}$$

$$\text{Condition 2 : } \frac{\text{Flow span-1} \cdot [\text{m}^3/\text{s}]}{\text{total pulse value} \cdot [\text{m}^3]} \leq \frac{1000}{2 \times \text{total pulse width [ms]}}$$

* In the case of 2 ranges, perform calculations using either flow span-1 or flow span-2, whichever is greater.

⚠ Caution on Safety

*Before using this product, be sure to read its instruction manual in advance.

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