

TIME DELTA SERIES

ULTRASONIC FLOWMETER <TIME DELTA (Standard Type)>

DATA SHEET

FLV...3, FLW...2, FLD...1

This flowmeter is a clamp-on type ultrasonic flowmeter based on transit-time measuring method. Thanks to micro-processor based electronics, the flowmeter can be easily configured from the front keyboard to specific applications. The flowmeter is suitable for liquid flow measurements for pipe size 13mm to 6000mm diameter.

The Flowmeter is a compact and light-weight instrument incorporating the latest electronics and high speed digital signal processing technologies (32bit MPU), realizing high performance and easy operation.

FEATURES

1. Compact and light-weight

The adoption of the latest electronics and digital signal processing technologies has reduced the size and weight of the converter to almost half, in comparison with traditional model.

2. Full variety of sensors including explosion-proof type

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).

Explosion-proof type per CENELEC Std. can be also available.

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 and French

7. Excellent performance and easy operation

Large LCD and function keys are allowing easy configuration and trouble shooting.

- LCD with back light
- Easy mounting of sensor
- Trouble shooting



Flow transmitter (FLV)



Small sensor (FLW12)

SPECIFICATIONS

Operational specifications

System configuration:

The system is composed of a sensor (Model FLW...2 or FLD...1) and a converter (Model FLV...3)

As for explosion-proof type, the converter should be located in safe area.

Application:

Liquid flow through which ultrasonic signal can be transmitted
(Water, sea water, oil and fluid of unknown sound velocity)

Turbidity; 10000deg(mg/L) or less

Fluid temperature;

-40 to +80°C for small (FLW12), middle (FLW41) and large sensor (FLW5)

-40 to +60°C for explosion-proof sensors (FLW1, 4 & 5)

-40 to +100°C for small diameter sensor (FLD22)

-40 to +200°C for high temperature sensor (FLD32)

Type of flow;

Well-developed turbulent or laminar flow in a full-filled pipe

Measurable flow pipe:

Size; 13mm to 100mm dia. with small diameter sensor (FLD22)
 50mm to 400mm dia. with small sensor (FLW12) and high temp. sensor (FLD32)
 200mm to 1200mm dia. with middle sensor (FLW41)
 200mm to 6000mm dia. with large sensor (FLW5)
Material; Carbon steel, SS, cast iron, PVC, FRP, asbestos, copper, aluminum, etc.
Lining; Tar epoxy, mortar, rubber, or others
Straight pipe length (min);
 10 x D upstream and 5 x D downstream required (D: Pipe diameter)
 Refer to JEMIS-032 for details.
 JEMIS: Japan Electric Measuring Instruments Manufacturers' Association's standard.

Velocity: 0 to ±32m/s (bidirectional flow)
Power supply: Two models are available
 100 to 240V AC ±10% 50/60Hz, or 20 to 30V DC
Power consumption: Approx. 20VA
Maximum cable length for sensor: 150m
Ambient Temperature: Converter; -10 to +60°C
 Sensor; -20 to +60°C
Ambient humidity: 90%RH or less.
Hazardous condition: Nemko 00ATEX0054X
 Ex. II2G, EExmIIT6, T_{amb}=60°C per CENELEC Std. EN50014 & EN50028 for explosion-proof sensors FLW1, 4 & 5 combined with the converter FLV specific to them.
Grounding: Class D (less than 100 ohm) in case of need
 As for explosion-proof type, groundings of sensors and converter should be done.

Function/performance specifications

Analog output signal:
 One 4 to 20mA DC current output
 Max. load resistance 1kΩ
Digital status output:
 2 transistor outputs available
 Open collector output; 30V DC, 0.1A
 Configurable to provide following information selected.
 – Total pulse
 – Flow switch
 – Over flow
 – Range change-over
 – Flow direction
 – Range over
 – Memory alarm
 – Receiving signal abnormal

Measuring accuracy:

Pipe size/13mm to under 50mm
 ±0.03m/s for flow rate: under 2m/s
 ±0.75% to ±1.5% of rate for flow rate: 2m/s to 32m/s
 Pipe size/50mm to under 300mm
 ±0.02m/s for flow rate: under 2m/s
 ±0.5% to ±1.0% of rate for flow rate: 2m/s to 32m/s
 Pipe size/300mm up to 6000mm
 ±0.01m/s for flow rate: under 1m/s
 ±0.5% to ±1.0% of rate for flow rate: 1m/s to 32m/s
 (Note) Reference conditions are based on JEMIS-032.

Response time: 0.5s or less
Communication interface:
 RS232-C equivalent
 Baud rate: 2400 to 9600bps
 Distance: 15m max.
 Following information can be sent.
 – Velocity
 – Flow rate
 – Total
 – Alarm output status

Indicator display: LCD with back light, 16 letters 2 lines
Display language: Japanese (Katakana), English, German or French, selectable

Flow rate display function:
 Display of velocity and flow rate (with flow direction) are selectable, Max: 8 digits
 Unit; Metric/Inch system selectable

	Metric system	Inch system
Velocity	m/s	ft/s
Flow rate	L/s, L/min, L/h, ML/d, m ³ /s m ³ /min, m ³ /h, Mm ³ /d, BBL/s, BBL/min, BBL/h, MBBL/d	gal/s, gal/min, gal/h, Mgal/d, ft ³ /s, ft ³ /min, ft ³ /h, Mft ³ /d, BBL/s, BBL/min, BBL/h, MBBL/d

Note : The "gal" means US gal.

Total value display function:
 Display of forward or reverse total, are selectable, Max: 9 digits
 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

Configuration: The flowmeter is fully configurable from front keyboard by menu-driven software
Zero adjustment: Two methods are available
 Set zero/Manual zero adjustment for zero flow
Damping for analog output and indication:
 0 to 100s, configurable
Low flow cut-off: 0 to 5m/s, configurable

Physical specifications

Enclosure protection:

Small, middle and large sensor/IP67
 Small diameter and high temp. sensor/
 IP52
 Flow transmitter/IP65

Mounting:

Sensor/Clamped on pipe wall
 Flow transmitter/Wall or pipe mount

Acoustic coupler: Silicone grease for high temperature
 sensor, silicon rubber for others

Material:

Sensor:

Kind	Sensor case	Guide rail
Small diameter	Plastic	Aluminum+Plastic
Small sensor	Plastic	304SS+Plastic
Middle sensor	Plastic	—
Large sensor	Plastic	—
High-temperature	304SS	Aluminum+304SS

Enclosure of converter : Aluminum alloy

Sensor cable: Radio frequency co-axial cable RG-58A/U

Dimensions and mass of sensors:

Kind	Dimensions(H × W × D)	Mass
Small diameter	320× 53× 90mm	approx. 0.6kg
Small sensor	500 × 80 × 40mm	approx. 1.0kg
Middle sensor	72 × 40 × 60mm	approx. 0.4kg
Large sensor	104 × 93 × 62mm	approx. 1.4kg
High-temperature	530 × 52 × 205mm	approx. 1.6kg

Dimensions of flow transmitter:

H277 × W244 × D95mm

Mass of flow transmitter:

approx, 4.5kg

DESCRIPTION OF OUTPUT FUNCTION

The FLV converter is standard-equipped with the following output functions which can be programmed through key operation.

Total pulse output:

The measured flow rate is integrated, and upon reaching a predetermined unit rate a single pulse is output. In the case of a forward/reverse flowmeter, the flow rate in each direction is independently integrated and transmitted.

Low flow rate cutoff: arbitrarily settable between 0 and 5m/s

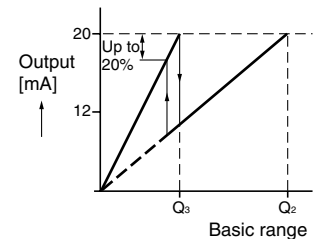
The integration pulse cycle is settable in a range of 5 pulses/second to 1 pulse /day.

Auto multirange output:

When the flow rate largely varies between low and high flow rates, output can be done with large output width for the whole flow range by adding the auto multirange function.

Either two ranges are selectable, and the minimum range is settable within the measurable range. The measuring range signal is transmitted from the DO terminal.

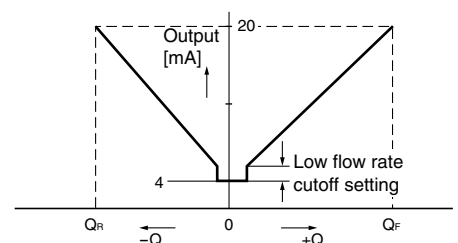
Forward/reverse flow rate output:



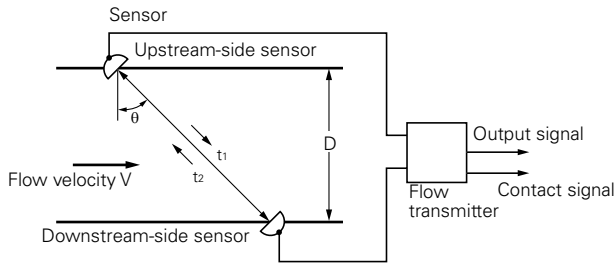
When the flow direction of the fluid changes, then the flow rate can be measured in either direction by adding this function.

When the flow of fluid reverses, measurement is done at an arbitrary range set differently from for the forward direction. The flow direction is discriminated by means of the LCD display and DO terminal signal.

Ultrasonic pulses are propagated in turn between upstream and downstream sides, and the time difference produced according to the flow is detected whereby the flow rate is measured.



MEASURING PRINCIPLE



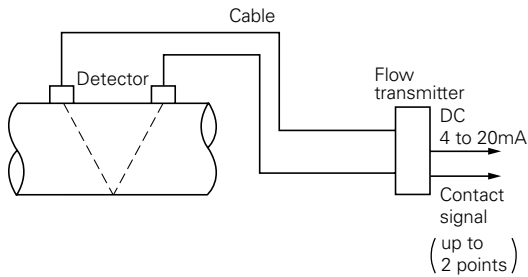
The transit-time technique uses a pair of sensors with each sensor sending and receiving ultrasonic signals through the fluid.

When the fluid is flowing, signal transit-time in the downstream direction is shorter than one in the upstream direction.

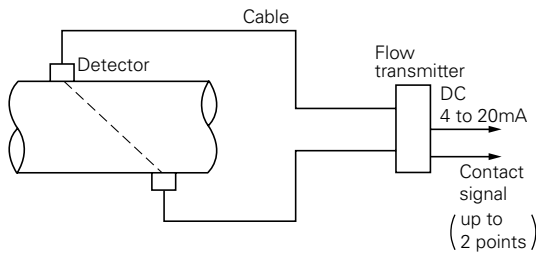
As the difference between these transit-time is proportional to the velocity, the flow rate and direction can be measured properly by detecting such time difference.

CONFIGURATION

(1) Single-path system (V method)



(2) Single-path system (Z method)



SCOPE OF DELIVERY

Flow transmitter FLV:

- Flow transmitter
- Manual

Sensor FLW, FLD:

- Sensor unit
- Signal cable
- Mounting chain/ belt/ wire
- Silicone rubber/ grease (100gr)

Signal cable FLY:

Original cable (2 wires)

OPTIONAL ACCESSORIES

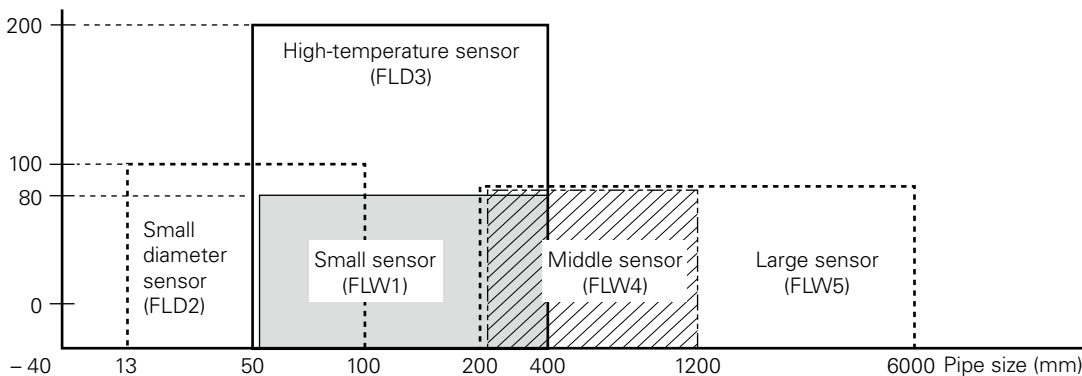
	Name	Drawing No.
1	Guide rail for high-temperature sensor	TK4C6164C1

The product conforms to the requirements of the Electromagnetic compatibility Directive 89/336/EEC as detailed within the technical construction file number TN510423. The applicable standards used to demonstrate compliance are :

EN 55011 : 1991 Conducted and Radiated emissions
 CLASSA
 EN 50082-1 : 1992 Radiated immunity, ESD and FBT

DETECTOR SELECTION GUIDE

Fluid temperature (°C)



CODE SYMBOLS

<Flow transmitter>

1	2	3	4	5	6	7	8	9	10	11	12	13	Description	
F	L	V	S				3	-			Y	Y		
			S											Enclosure (4th digit code) Outdoor immersion-proof case
				1										Power supply (5th digit code) 100 to 240V AC±10%, 50/60Hz
				4										20 to 30V DC
					2									Transistor output (6th digit code) 2 Points
						1								Analog output (7th digit code) 1 system
														Synchronism (9th digit code) None
														Conduit connections (10th digit code) G1/2(Female screw) with water-proof connection
														Option (11th digit code) None
														Tag name plate
														Use for explosion-proof sensors
														Use for explosion-proof sensors with Tag name plate

<Signal cable>

1	2	3	4	5	6	7	8	Description	
F	L	Y					1		
			1						Type of sensor (4th digit code) Small, middle and large sensor (FLW120/410/510)
			2						Small dia. and high temp. sensor (FLD 22/32)
									Cable length (5, 6 and 7th digit)
				0	0	5			5m
				0	1	0			10m
				0	1	5			15m
				0	2	0			20m
				0	2	5			25m
				0	3	0			30m
				0	3	5			35m
				0	4	0			40m
				0	4	5			45m
				0	5	0			50m
				0	5	5			55m
				0	6	0			60m
				0	6	5			65m
				0	7	0			70m
				0	7	5			75m
				0	8	0			80m
				0	8	5			85m
				0	9	0			90m
				0	9	5			95m
				1	0	0			100m
				1	1	0			110m
				1	2	0			120m
				1	3	0			130m
				1	4	0			140m
				1	5	0			150m

Note: No need to order signal cable of FLY when your ordering submergence-proof or explosion-proof type sensor. A pair of cables is provided as one unit.

<DETECTOR>

Standard type

1	2	3	4	5	6	7	8	9	10	11	12	Description	
F	L	W					2	-	Y	Y	0		
			1	2	0								Type
			4	1	0								Small sensor (ø50 to ø400) V method (Standard)
			5	1	0								Middle sensor (ø200 to ø1200) } V method
			5	0	0								Large sensor (ø200 to ø6000) } or Z method
													Option
													None
													Tag name plate
													Mounting method
													Standard
													Z method

(Note) Signal cables are not provided with detector. Signal cable FLY should be ordered separately.

Moulded type

1	2	3	4	5	6	7	8	9	10	11	12	Description	
F	L	W						-	Y	Y	0		
			1	2									Type
			4	1									Small sensor (ø50 to ø400) V method (Standard)
			5	1									Middle sensor (ø200 to ø1200) } V method
			5	0									Large sensor (ø200 to ø6000) } or Z method
													Use
													Submergence-proof type
													Explosion-proof type per EN50028
													Option
													None
													Tag name plate
													Special cable
													10m
													20
													30
													40
													50
													60
													70
													80
													90
													100
													110
													120
													130
													140
													150
													Other
													Mounting method
													Standard
													Z method

(Note)

- High turbid fluid or scales sticking on the internal wall of pipes may interrupt the ultrasonic propagations. Previous check with a portable type ultrasonic flowmeter is recommended.
- In case of cast iron pipes or pipes with lining, the Large sensor is recommended rather than the Middle sensor.
- If the pipe has poor inside surface conditions or highly attenuating fluids, you may not be able to a reliable signal, therefore you should use the "FLW50" sensor.

Small diameter and high-temperature sensor

1	2	3	4	5	6	7	8	9	Description		
F	L	D					S	1	-	Y	
			2	2	0						Type
			3	2	0						Small diameter sensor (ø13 to ø100)
											High-temperature sensor (Note) (ø50 to ø400)
											Belt and Coupler
											Fixed type
											Special cable
											None

(Note)

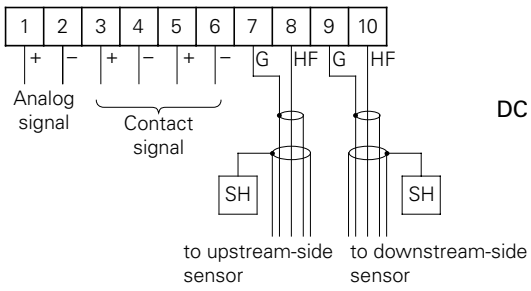
Use the optional guide rail if a pipe that does not allow ultrasonic waves to pass through easily such as an old pipe, cast iron pipe, or a pipe with mortar lining is used, or when the flow of liquid high in turbidity is measured. Employ the Z method for mounting.

Applicable diameter range: V method: ø50 to ø250

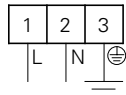
Z method: ø150 to ø400

CONNECTION DIAGRAM

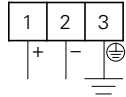
<FLOW TRANSMITTER>



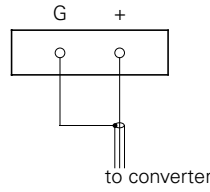
AC power supply



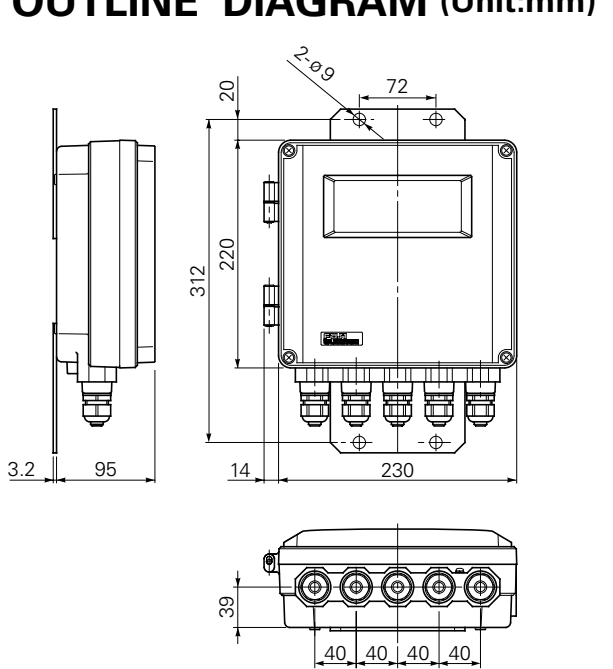
DC power supply



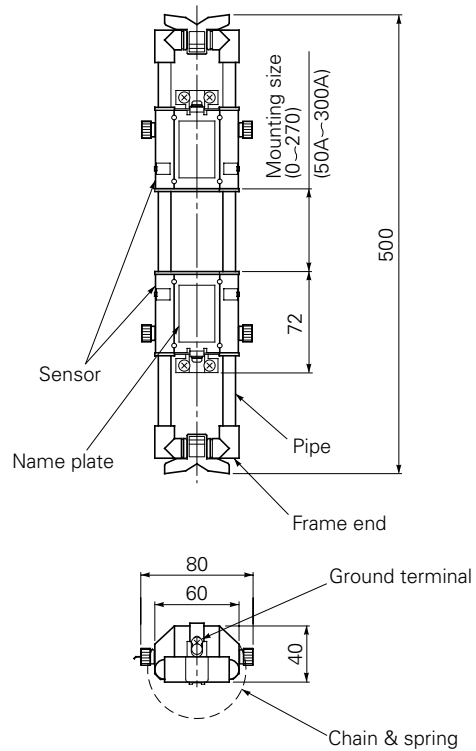
<DETECTOR>



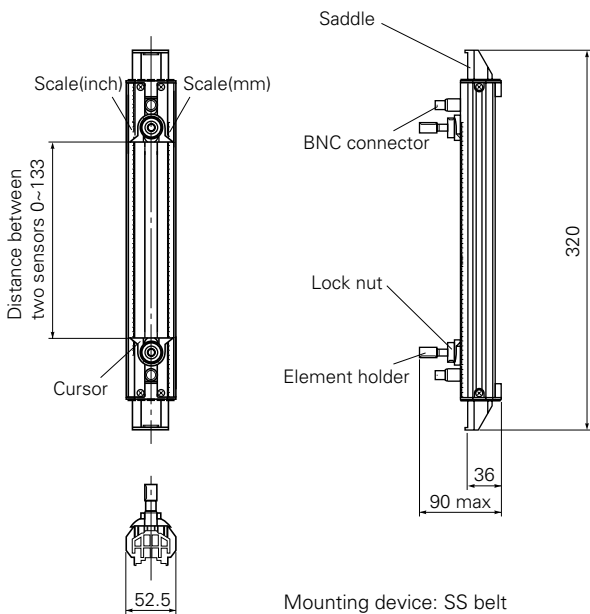
OUTLINE DIAGRAM (Unit:mm)



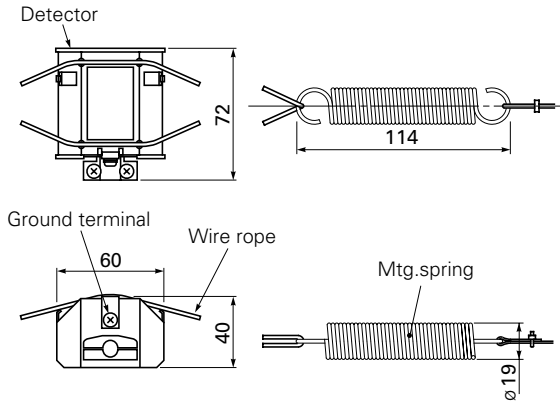
FLOW TRANSMITTER : FLV



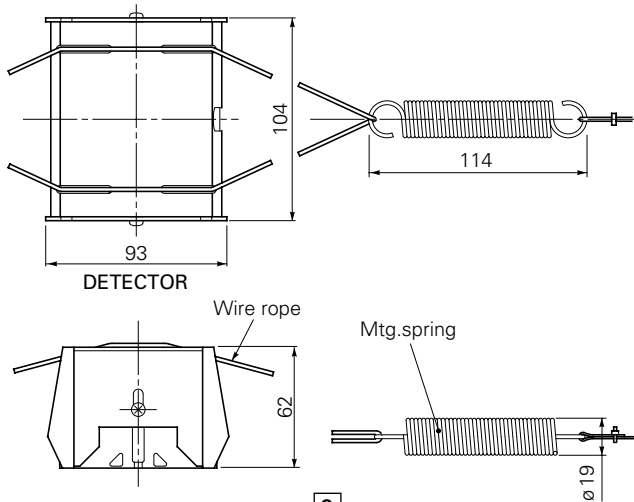
DETECTOR : FLW120 (Small sensor)



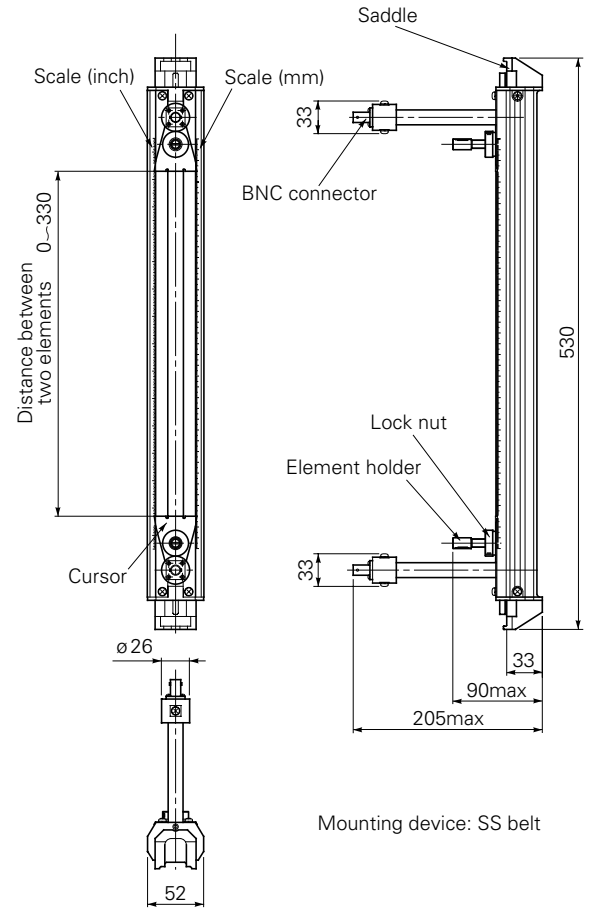
DETECTOR : FLD220 (Small diameter sensor)



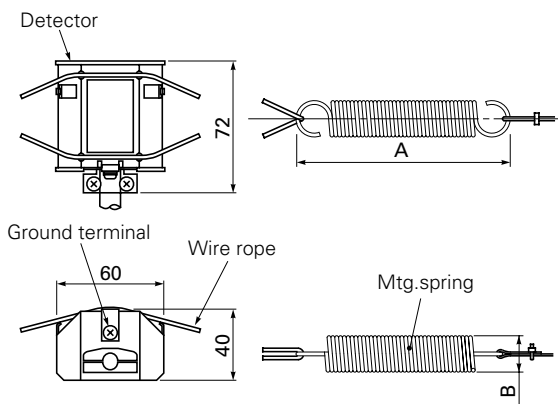
DETECTOR : FLW410 (Middle sensor)



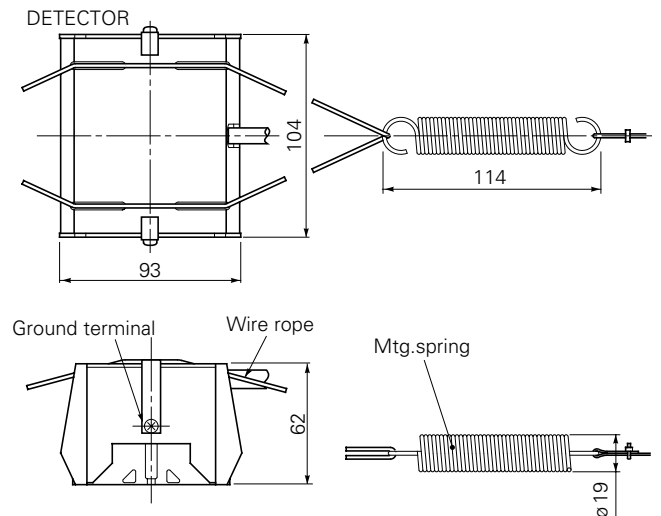
DETECTOR : FLW5 $\begin{matrix} 0 \\ 1 \end{matrix}$ 0 (Large sensor)



DETECTOR : FLD320 (High-temperature sensor)



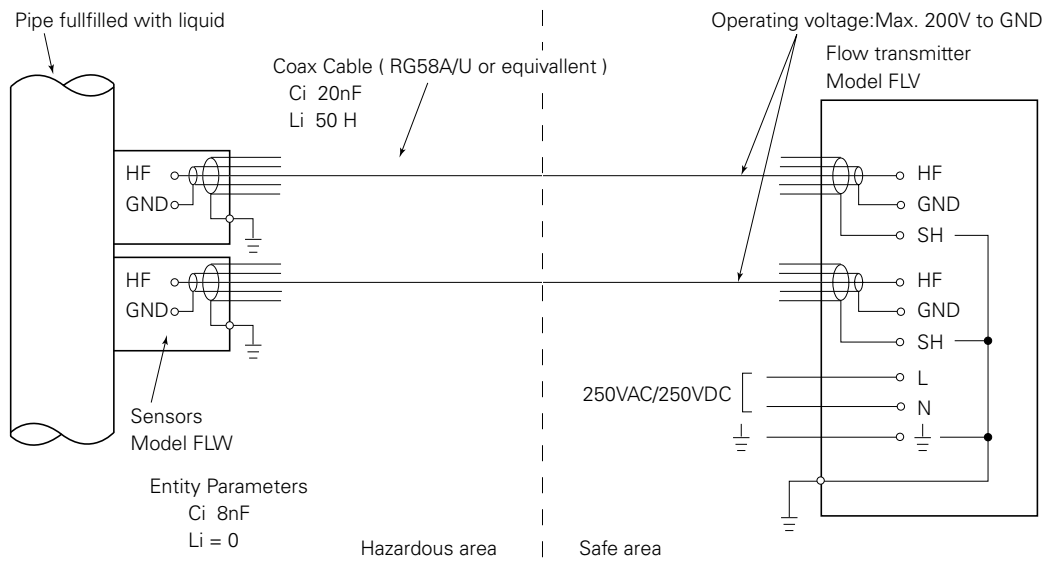
DETECTOR : FLW $\begin{matrix} 12 \\ 41 \end{matrix}$ 2
(Small/Middle explosion-proof sensor)



DETECTOR : FLW5 $\begin{matrix} 1 \\ 0 \end{matrix}$ 2
(Large explosion-proof sensor)

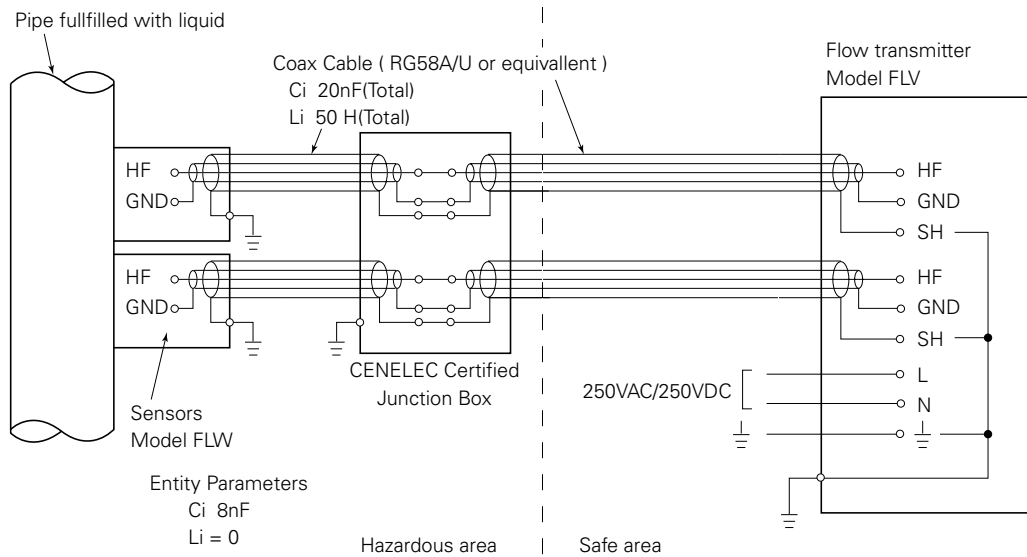
Type	A	B
FLW122	68	10
FLW412	114	19

INSTALLATION INSTRUCTION FOR EXPROSION-PROOF TYPE SENSORS



Note : All groundings are in accordance with class D (less than 100 ohm)

System certification: EEx m II T6
Ambient temperature: -20 to +60°C for all units
Liquid temperature: -40 to +60°C



Note : Any certified junction box conforming to the types of protection listed in EN50014 can be used to relay the co-axial signal cables.

⚠ Caution on Safety

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

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