FUJI ELECTRIC

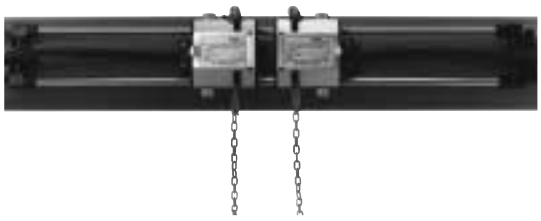
TIME DELTA SERIES

ULTRASONIC FLOWMETER <TIME DELTA S (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 incoporating the latest electronics and high speed digital signal processing technologies (32bit MPU), realizing high performance and easy operation.



Small sensor (FLW12)

Converter (FLV)

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 accurary (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

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 down stream required (D: Pipe diameter)
Refer to JEMIS-032 for details.
JEMIS: Japan Electric Measuring Instruments Manufactures' Associ-ation's standard.

Velocity: 0 to ±32m/s (bidirectional flow)

Power supply: Two models are availble
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, EExm Ⅱ T6, 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
Converter/IP65

Mounting: Sensor/Clamped on pipe wall
Converter/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	420× 53× 90mm	approx. 0.6kg
Small sensor	510 × 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 converter: H277 x W244 x D95mm

Mass of converter: 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.

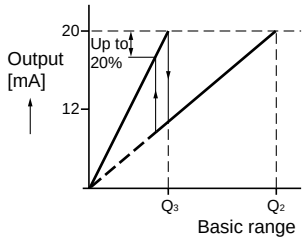
Low flow rate cutoff: arbitrarily settable between 0 and 5m/s

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.

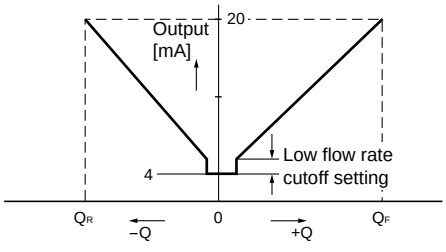


Forward/reverse flow rate output:

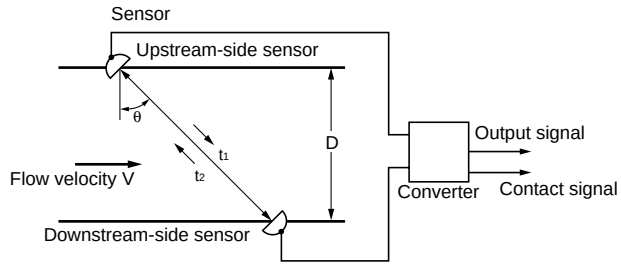
When the flow direction of the fluid changes, then the flow rate can be measured in either direction by adding this function.

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.



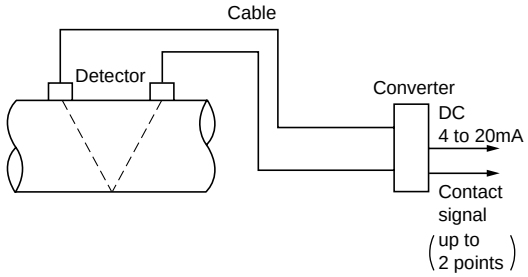
MEASURING PRINCIPLE



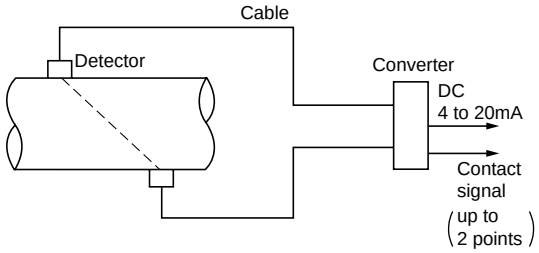
The transit-time technique uses a pair of sensors with each sensor sending and receiving ultrasonic signals through the fluid.
When the fluid is flowing, signal transit-time in the down stream direction is shorter than one in the upstrream direction.
As the difference between these transit-time is proportional 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

Converter FLV:
- Converter
- Manual

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

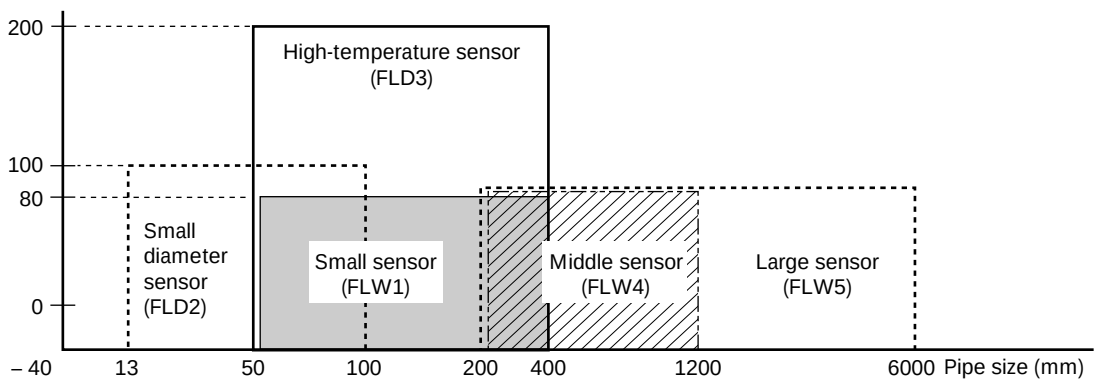
Signal cable FLY:
Orignal cable (2 wires)

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

DETECTER SELECTION GUIDE

Fluid temperature (°C)



CODE SYMBOLS

<Converter>

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

<Signal cable>

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

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

	Description
1 2 0 4 1 0 5 1 0 5 0 0	Type Small sensor (ϕ50 to ϕ400) Middle sensor (ϕ200 to ϕ1200) Large sensor (ϕ200 to ϕ6000) Large sensor (ϕ200 to ϕ6000)
Y A	Option None Tag name plate
Y 2	Mounting method Standard Z method

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

Moulded type

	Description
1 2 4 1 5 1 5 0	Type Small sensor (ϕ50 to ϕ400) Middle sensor (ϕ200 to ϕ1200) Large sensor (ϕ200 to ϕ6000) Large sensor (ϕ200 to ϕ6000)
1 2	Use Submergence-proof type Explosion-proof type per EN50028
Y A	Option None Tag name plate
B Y C Y D Y E Y F Y G Y H Y J Y K Y L Y M Y N Y P Y Q Y R Y	Special cable 10 m 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Y 2	Mounting method Standard Z method

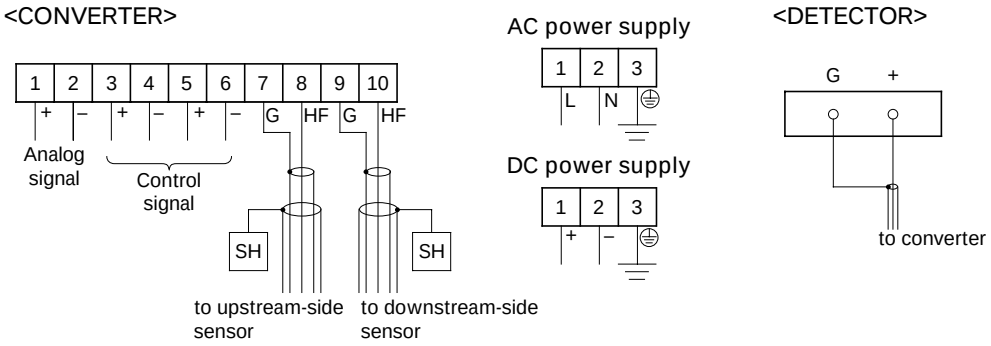
(Note)

1. 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.
2. In case of cast iron pipes or pipes with lining, the Large sensor is recommended rather than the Middle sensor.
3. 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.

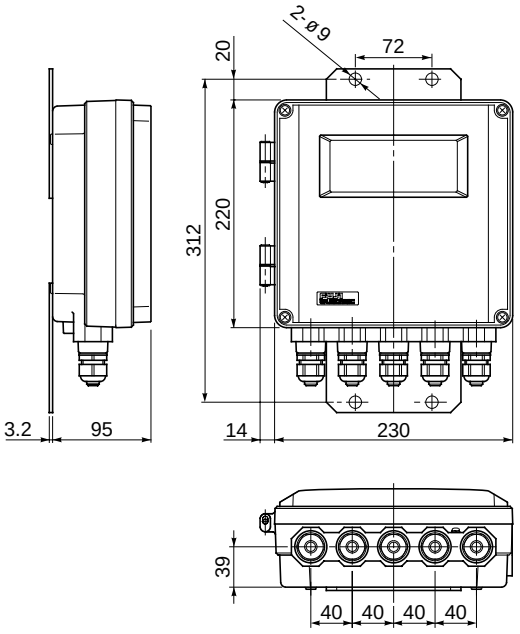
Small diameter and high-temperature sensor

	Description
2 2 0 3 2 0	Type Small diameter sensor (ϕ13 to ϕ100) High-temparature sensor (ϕ50 to ϕ400)
S	Belt and Coupler Fixed type
Y	Special cable None

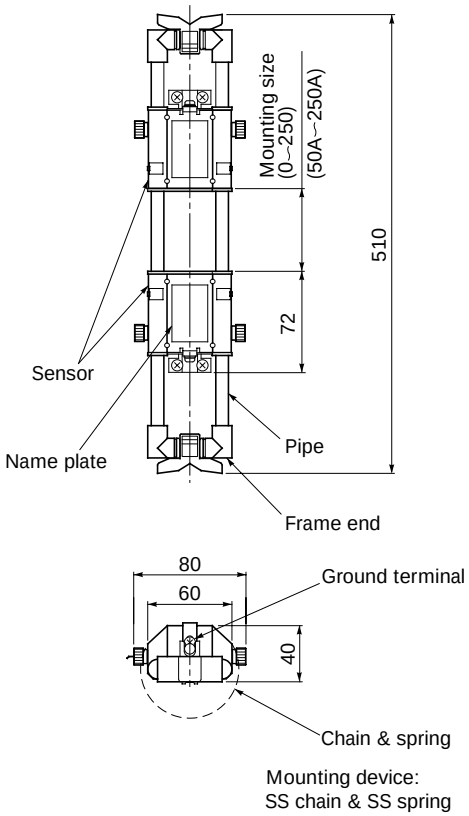
CONNECTION DIAGRAM



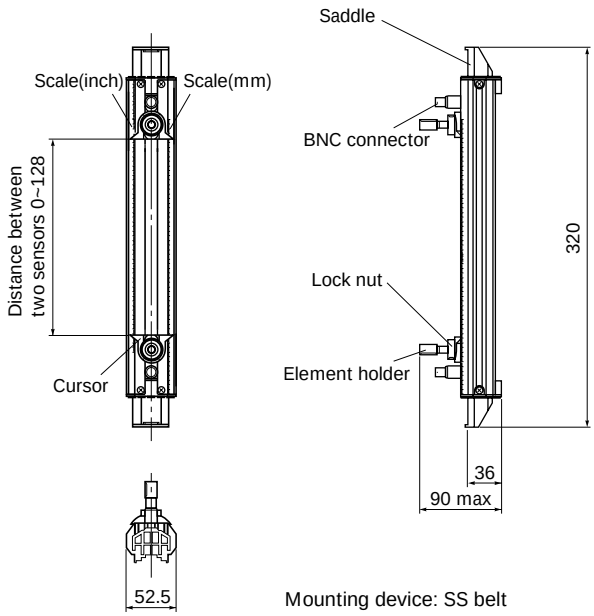
OUTLINE DIAGRAM (Unit:mm)



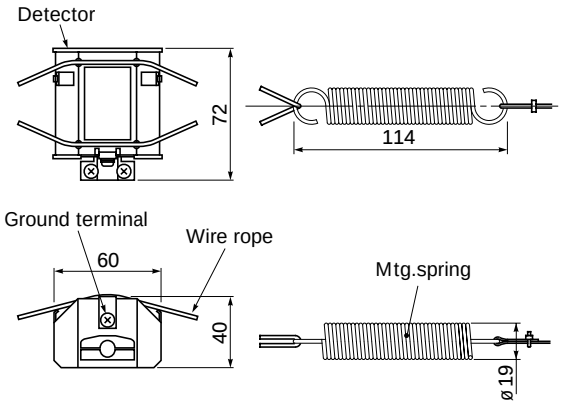
CONVERTER : FLV



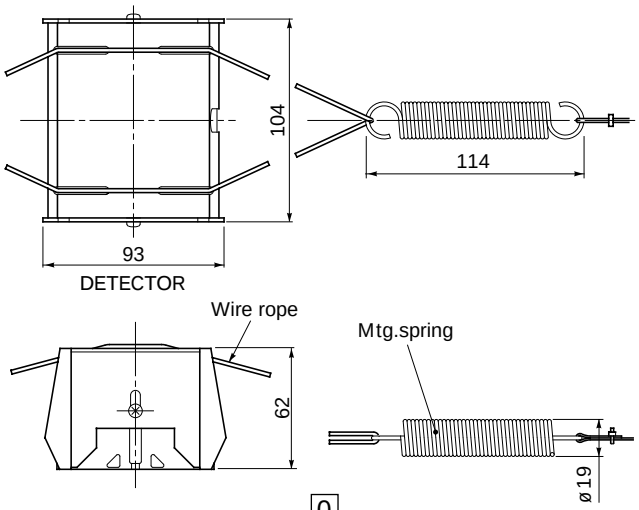
DETECTOR : FLW120 (Small sensor)



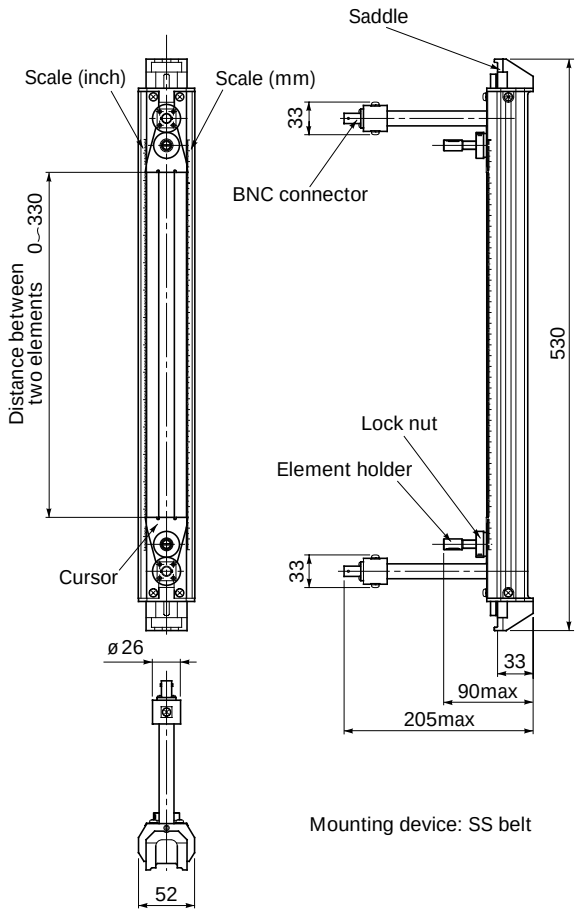
DETECTOR : FLD220 (Small diameter sensor)



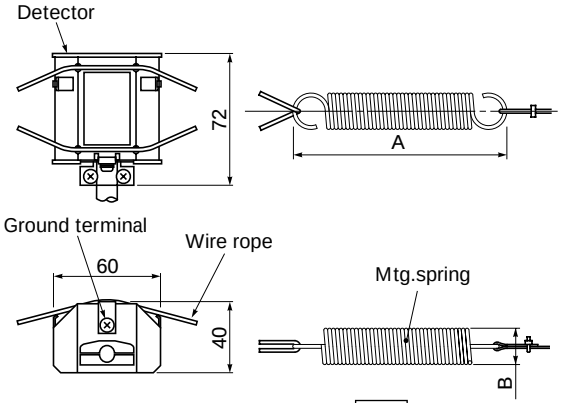
DETECTOR : FLW410 (Middle sensor)



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



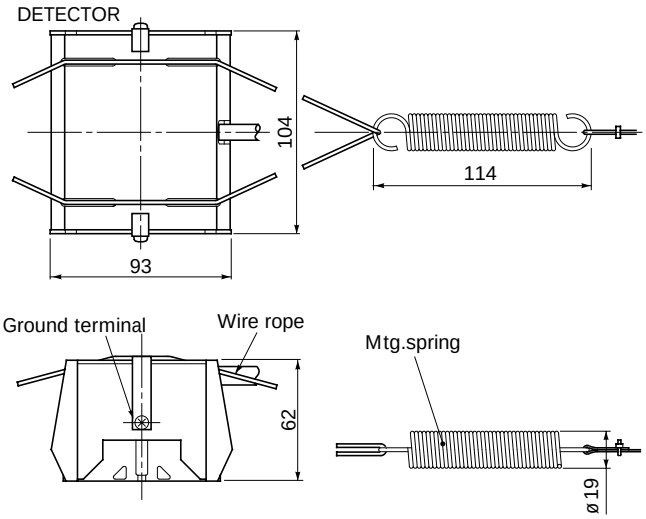
DETECTOR : FLD320 (High-temperature sensor)



DETECTOR : FLW $\boxed{\begin{matrix}1\,2\\4\,1\end{matrix}}$ 2

(Small/Middle explosion-proof sensor)

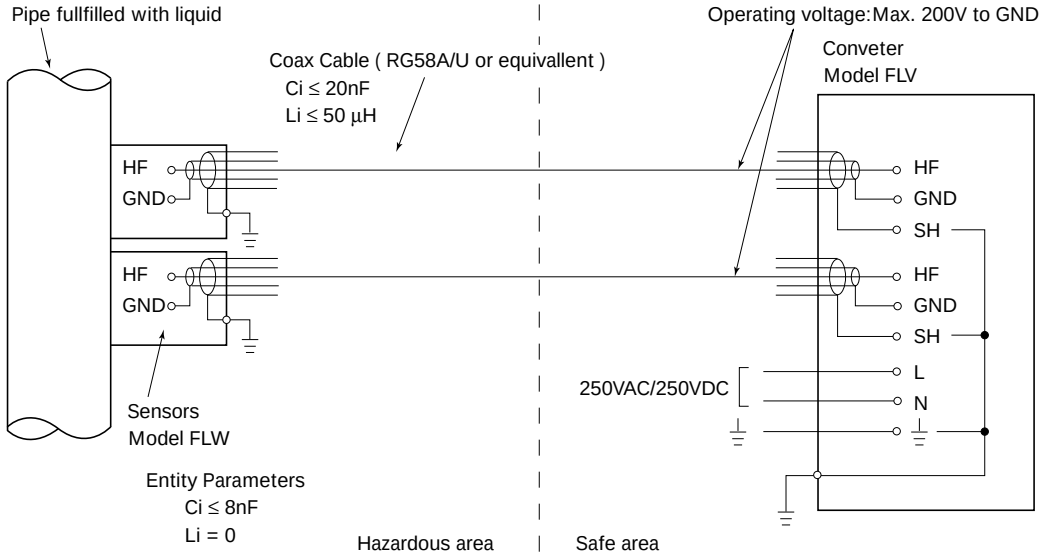
Type	A	B
FLW122	68	10
FLW412	114	19



DETECTOR : FLW5 $\boxed{\begin{matrix}1\\0\end{matrix}}$ 2

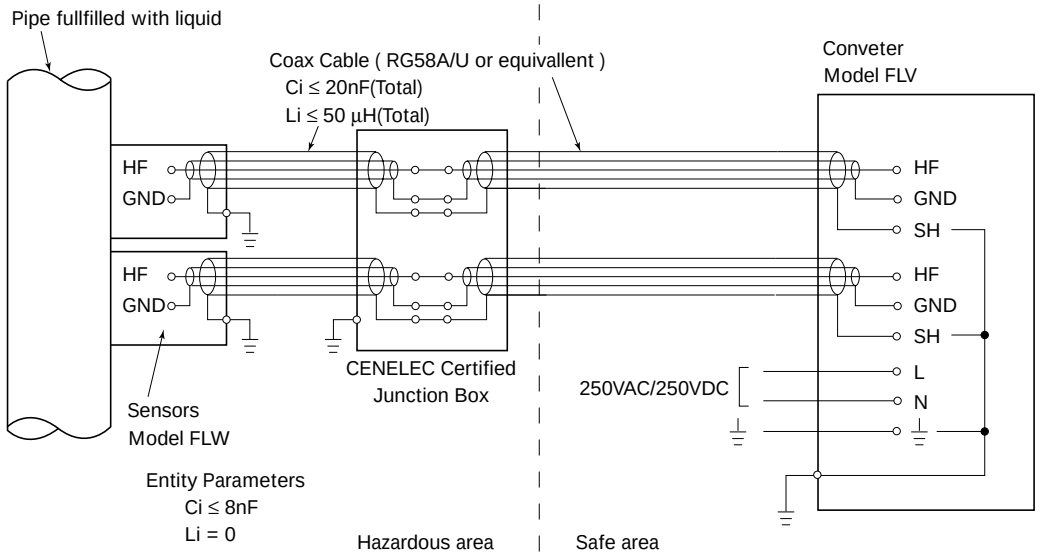
(Large explosion-proof sensor)

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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