

ULTRASONIC FLOWMETER <M-Flow PW>

DATA SHEET

FLR, FLS, FLY

This meter is a clamp-on type ultrasonic flowmeter for permanent use based on transit time measuring method. The M-Flow PW is ideal for clean liquids containing no air bubbles such as pure water. The easy-to-use compact and lightweight design is intended for integration into mechanical devices. The flowmeter applicable to small and medium size pipes of diameter range from 25mm to 600mm provides superior cost performance.

FEATURES

1. Ease of use:

The detector (type: FLSE□2) is mountable quickly and easily.

The parameters necessary for measurement can be configured on the surface of Flow Transmitter's housing case by menu-driven software.

2. Compact and light weight:

The adoption of the latest electronics technology has reduced the size and weight of the flow transmitter to one-fifth of our general use flow transmitter.

3. Superior temperature effect:

The adoption of Sound Velocity Measurement System, which calculates sound velocity from transit time, keeps the flowmeter unaffected by the temperature and the pressure of the fluid to be measured.

4. Quick response:

With the use of fast-speed transit time processor, the system cycle is 0.2 sec that is applicable to short batch process.

5. Multilingual:

The following languages are supported for display: English, Japanese, French, German and Spanish

6. Synchronization (option):

Simultaneous transmission to two or more converters is allowed.

Cross-talk between flowmeters located closely or acoustic interference between flowmeters installed on the same pipe line can be removed by using this synchronization function of transmission timing of ultrasonic waves.

SPECIFICATIONS

Operational specifications

System configuration:

The system is composed of a detector (Model FLS) and a flow transmitter (Model FLR), realizing single-path system.



Flow Transmitter (FLR)



Detector (FLSE12)
(FLSE22)



Detector (FLSE31)



Detector (FLSE41)

Application: Clean liquids that pass ultrasound and do not contain air bubbles (such as pure water and chemical solution)

Turbidity: 10000deg (mg/L) or less

Fluid temperature (Continuous use rating):

-20 to +100deg°C (type: FLSE□2□3-Y)

0 to +120deg°C (type: FLSE□2□3-A)

-20 to +80deg°C (type: FLSE□1)

(With silicon rubber
for acoustic couplant)

0 to +60deg°C

(With silicon-free grease
for acoustic couplant)

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

Applicable flow pipe:

Detector	Internal pipe diameter	Pipe material	Installation method	Fluid temperature range
FLSE12	ø25 to ø100mm	Plastic (PVC, etc.) Note 1	V	9th digit in code symbol Y...-20 to +100°C A...0 to +120°C
	ø50 to ø100mm	Metal (stainless steel, steel, copper, aluminum, etc.)		
FLSE22	ø50 to ø225mm Note 3	Plastic (PVC, etc.) Note 1 Metal (stainless steel, steel, copper, aluminum, etc.) Note 2		
FLSE31	ø50 to ø300mm	Plastic (PVC, PP, PVDF, etc.) Metal (stainless steel, steel, copper, aluminum, etc.) Note 2		
FLSE41	ø300 to ø600mm	Metal (stainless steel, steel, copper, aluminum, etc.) Note 2	Z	

- Note 1: Select FLSE31 or FLSE41 if the pipe is made of PP or PVDF. The wall thickness of PP pipe is 15 mm or less, and that of PVDF pipe is 9 mm or less.
- Note 2: Select FLSE31 or FLSE41 for the pipes that do not transmit ultrasound easily such as those made of cast iron, lining pipes, and old steel pipes.
- Note 3: When the 9th digit in the code symbol is "A", the applicable piping diameter is 50 to 150mm.

Liner: Tar epoxy, mortar, rubber, and others
 Fundamental straight pipe:
 10D for upstream and 5D for downstream (D: internal pipe diameter)
 Refer to "Conditions on straight pipe" for details.

- Velocity: 0 to ±0.3 ... ±10m/s
- Power supply: 100 to 120V AC ±10%, 50/60Hz or 200 to 240V AC ±10%, 50/60Hz or 20 to 30V DC
- Signal cable: Co-axial cable up to 30m and thermal stability of 100 deg.C
- Environment: Non-explosive environment without direct sunlight, corrosive gas and heat radiation
- Ambient temperature:
 -20 to +50deg.C for flow transmitter
 -20 to +60deg.C for detector
- Ambient humidity:
 90%RH or less
- Grounding: Class D (100 Ω or less)
- Synchronization (option):
 Simultaneous transmission eliminates cross talk between multiple flow meters and mutual acoustic interference.
 Number of connectable units: up to 31
 Cable length: up to 15m
 Master/Slave selectable
- Arrester (option):
 Arrester unit for outputs available (while arrester for power supply incorporated as standard)

Performance specifications

Accuracy rating:

Plastic pipe

Internal diameter	Velocity: 2m/s or higher	Velocity: Less than 2m/s
ø25 to ø50mm	±2.5% of rating	±0.05m/s
ø50 to ø600mm	±1.5% of rating	±0.03m/s

Metal pipe

Internal diameter	Velocity: 2m/s or higher	Velocity: Less than 2m/s
ø50 to ø600mm	±2% of rating	±0.04m/s

Response time: System cycle: 0.2s

Dead time: 0.2s or less, Time constant: 0.1s

Power consumption:

15VA or less for AC power supply

5W or less for DC power supply

Permissible air volume rate:

Up to 0.2% at 1 m/s (inversely proportional to velocity)

Short-term thermal stability:

140deg.C, 30min (in case FLSE□2)

Note: Use FLSE31/FLSE41 at the temperature of 80°C or lower.

Functional specifications

- Analog output:** 4 to 20 mA DC (1 point)
Max. load resistance : 600 Ω
- Digital output:** + total, - total, alarm, acting range, flow switch or total switch arbitrarily available
Transistor open collector: 1 point (DO1)
Capacity: 30V DC, 0.1A
Normal off/on selectable
Total pulse: 1pulse/day to 100pps (Pulse width: 5, 10, 50, 100 or 200ms)
- Mechanical relay contact:** 1point (DO2), with socket (exchangeable)
Normal close/open selectable
Capacity: 220V AC /30V DC, 1A (resistive load)
Mechanical expected life: More than 2 x 10⁵ operations (under rated load)
Total pulse: 1pulse/day to 1pps (Pulse width: 50, 100 or 200ms)
- Communication interface (option):**
RS-232C equivalent / RS-485
Number of connectable units: one (RS-232C)/ up to 31 (RS-485)
Baud rate: 2400/4800/9600/19200 bps selectable
Parity: None/Odd/Even selectable
Stop bit: 1 or 2 bits selectable
Cable length: up to 15m (RS-232C)/up to 1km (RS-485)
Data: 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
- Display language:**
English, Japanese, French, German or Spanish selectable
- Velocity/Flow rate display:**
Instantaneous velocity/flow rate display (The flow of opposite direction is displayed by minus numerals.)
Numeral: 7 digits (decimal point be 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, kL/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, kgal/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 USgal.

- Total display:** Display of forward or reverse total
Numeral: 7digits (decimal point be counted as 1digit)
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-in, ACRE-ft

- Configuration:** Fully configurable from the 4-key pad (ESC, Δ , \triangleright , ENT) on the surface of flow transmitter's housing case by menu-driven software
- Zero adjustment:**
Set Zero/Clear available
- Damping:** 0 to 100s (every 1s) configurable for analog output and display
- Low flow cut off :**
0 to 5m/s configurable
- Alarm:** Hardware fault/Process fault applicable to digital output
- Burnout:** Analog output : Hold/Over-scale/Under-scale/Zero selectable
Total: Hold/Count selectable
Working timer: 0 to 100s (every 1s) configurable
- Bi-directional range:**
Forward and reverse ranges configurable independently
Hysteresis: 0 to 10% of acting range configurable
Acting range applicable to digital output
- Auto-2 ranges:** Forward 2 ranges configurable independently
Hysteresis: 0 to 10% of acting range configurable
Acting range applicable to digital output
- Flow switch:** Lower and upper switching points configurable independently
Acting point applicable to digital output
- Total switch:** +total switching point configurable
Acting point applicable to digital output

Physical specifications

- Enclosure protection:**
Jetproof type (IP65) both for converter and detector (FLSE□2: When waterproof BNC connector is provided)
FLSE□1: Immersion-proof type (IP67) (When the terminal block is filled with silicon rubber after wiring)
- Mounting:** Flow transmitter: Wall or 2B pipe mount
Detector: Clamped on pipe surface
- Acoustic coupler:**
Silicon rubber or silicon-free grease
- Material:** Flow transmitter: Plastic ABS
Detector (type: FLSE□2):
Plastic PBT for sensor housing, SUS304 for guide frame
Detector (type: FLSE□1):
Plastic PBT for sensor housing, SUS304 for sensor cover, SUS304 and PBT for guide rail
- Sensor cable:** 3D2V with outside diameter 5mm
- Dimensions:** Flow transmitter: H140 x W137 x D68mm
Detector: H50 x W228 x D34mm (FLSE1)
H50 x W348 x D34mm (FLSE2)
H40 x W500 x D80mm (FLSE3: mounting V method)
H40 x W72 x D60mm (FLSE4: mounting Z method)
- Mass:** Flow transmitter: 0.8kg
Detector: 0.3kg (FLSE1) / 0.4kg (FLSE2)
1kg (FLSE3: mounting V method)
0.4kg (FLSE4: mounting Z method)

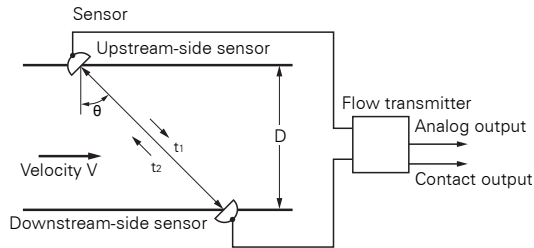
Conditions on straight pipe

(D : Inside diameter of pipe)

Classification	Upstream side	Downstream side
90 bend	<p>10D or more</p> <p>$L \geq 10D$</p> <p>Detector</p>	<p>$L \geq 5D$</p>
Tee	<p>10D or more</p> <p>10D or more</p> <p>$L \geq 50D$</p>	<p>$L \geq 10D$</p>
Diffuser	<p>0.5D or more</p> <p>$L \geq 30D$</p> <p>D</p> <p>$\geq 1.5D$</p>	<p>$L \geq 5D$</p>
Reducer	<p>$L \geq 10D$</p>	<p>$L \geq 5D$</p>
Various Valve	<p>$L \geq 30D$</p> <p>In case that flow control valve exists on upstream side.</p>	<p>$L \geq 10D$</p> <p>In case that flow control valve exists on downstream side.</p>
Pump	<p>Stop valve</p> <p>Check valve</p> <p>P</p> <p>$L \geq 50D$</p>	

(Note) The source : JEMIS-032

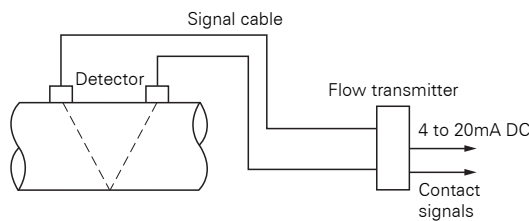
MEASURING PRINCIPLE



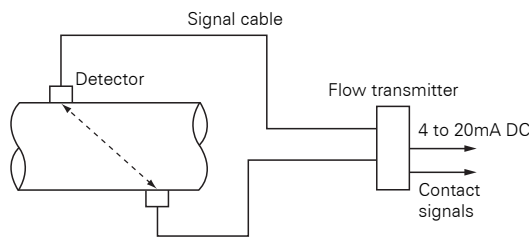
The transit-time technique uses a pair of sensors with each sensor sending and receiving ultrasonic signals obliquely through the fluid.

CONFIGURATION

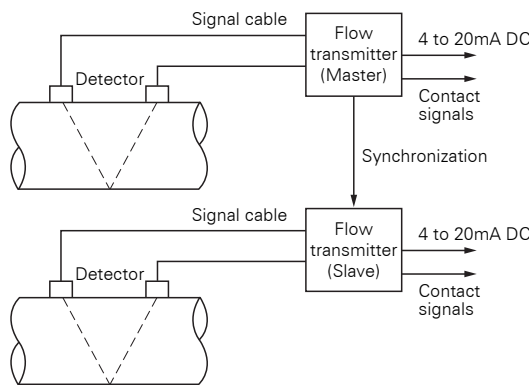
(1) Single-path system (V method)



(2) Single-path system (Z method)



(3) When using synchronization



<Dedicated Signal cable>

1	2	3	4	5	6	7	8	Description
F	L	Y					1	Type (4th digit)
		3						Heat-resistant cable with one-side waterproof BNC connector for FLSE12 and FLSE22
		4						Heat-resistant cable for FLSE31 and FLSE41
			0	0	5			Cable length (5th to 7th digit)
			0	1	0			5m
			0	1	5			10m
			0	2	0			15m
			0	2	0			20m
			0	3	0			30m
							1	Modification No. (8th digit)
								Mark 1

CODE SYMBOLS

<Flow Transmitter>

1	2	3	4	5	6	7	8	9	10	11	12	Description
F	L	R	E				2	-	1			Type (4th digit)
			E									Standard for exports
				2								Power Supply (5th digit)
				3								100 to 120Vac, 50/60Hz
				4								200 to 240Vac, 50/60Hz
					Y							20 to 30Vdc
					A							Communication and Synchronization (6th digit)
					B							None
					C							RS-232C
												RS-485 and Synchronization
												Synchronization
						Y						Arrester (7th digit)
						A						None
												With arresters for outputs
							2					Modification No. (8th digit)
												Mark 2
								1				Case structure (9th digit)
												Jetproof type (IP65)
									A			Mounting bracket (10th digit)
									B			For 2B pipe mount
												For wall mount
										Y		Parameter setting, tag plate (11th digit)
										A		Without
										B		With setting
										C		With setting (Tag plate)
												With Tag plate
											A	Detector (12th digit)
											B	FLSE12, FLSE22
												FLSE31, FLSE41

(Note) This type has not so tough endurance against aeration as Fuji's general use ultrasonic flowmeters TIME DELTA-S/F (Model: FLV/FLH) and PORTAFLOW-X (Model: FLC). For applications containing air bubbles, those general use flowmeters are recommendable to be used.

<Detector>

1	2	3	4	5	6	7	8	9	10	Description	
F	L	S	E					3	-	Y	Type (4th digit)
											Standard
				1	2						Kind of detector (5th to 6th digit)
				2	2						Small-dia. detector (ø25 to ø100 mm)
				3	1						Small detector (ø50 to ø225 mm) *1
				4	1						Small detector (ø50 to ø300 mm) V method
											Small detector (ø300 to ø600 mm) Z method
						Y					Acoustic coupler (7th digit) (Note)
						A					None
						B					Silicon rubber
											(Fluid temperature: -20 to +100 deg.C)
											Silicon-free grease
											(Fluid temperature: 0 to +60 deg.C)
							3				Modification No. (8th digit)
											Mark 2
									Y		Option (10th digit)
									B		Without
											Tag plate

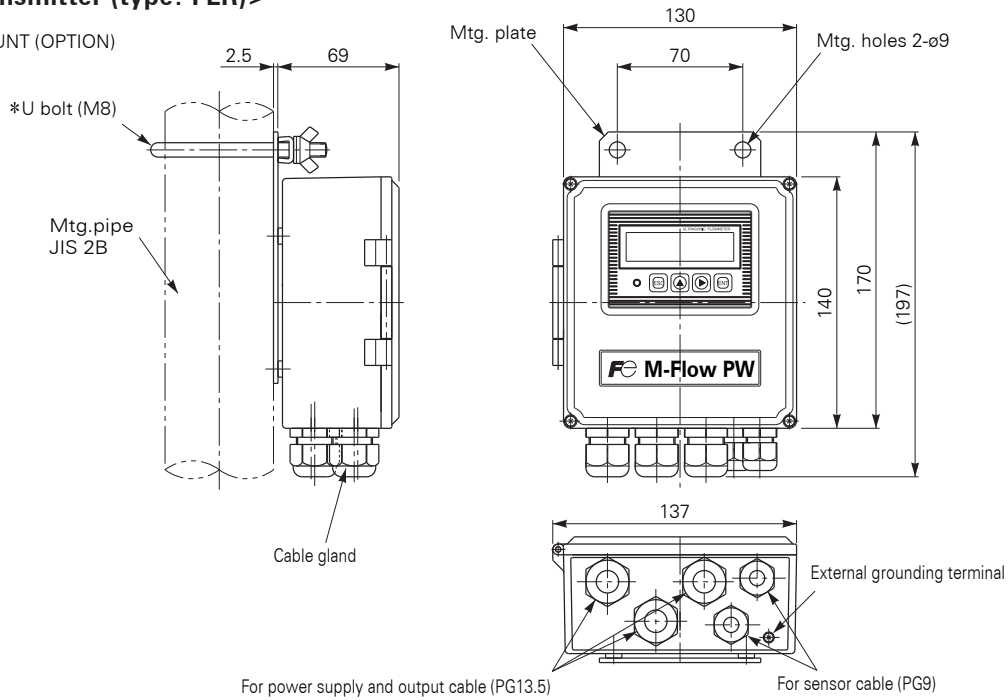
*1) When the 9th digit in the code symbol is "A", the applicable piping diameter is 50 to 150mm.

(Note) In case FLSE□2, select silicon rubber (A) for acoustic coupler in ordinary cases. Silicon rubber is supplied in a tube (100g). If one or more detectors are ordered, silicon rubber may be selected once every 5 orders or so. Select silicon-free grease (B) for the use in an environment where generation of silicon is not desirable such as semiconductor manufacturing facilities. The silicon-free grease is soluble in water. Therefore, do not use it in an environment subject to splash of water or where condensation tends to occur on the surface of the piping. The grease, which does not become hardened, requires periodic maintenance (cleaning and refilling of about once in 6 months at room temperature).

OUTLINE DIAGRAM (Unit:mm)

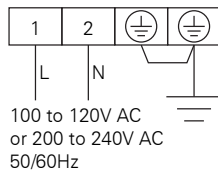
<Flow transmitter (type: FLR)>

* PIPE MOUNT (OPTION)

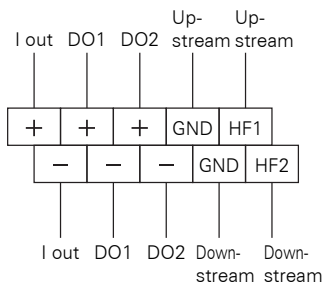
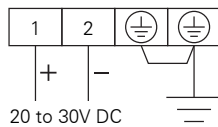


CONNECTION DIAGRAM

AC power supply

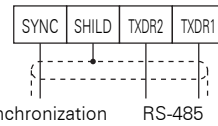


DC power supply

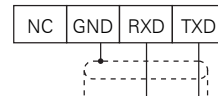


(Note)
DO1 : Transister open collector
DO2 : Mechanical relay contact

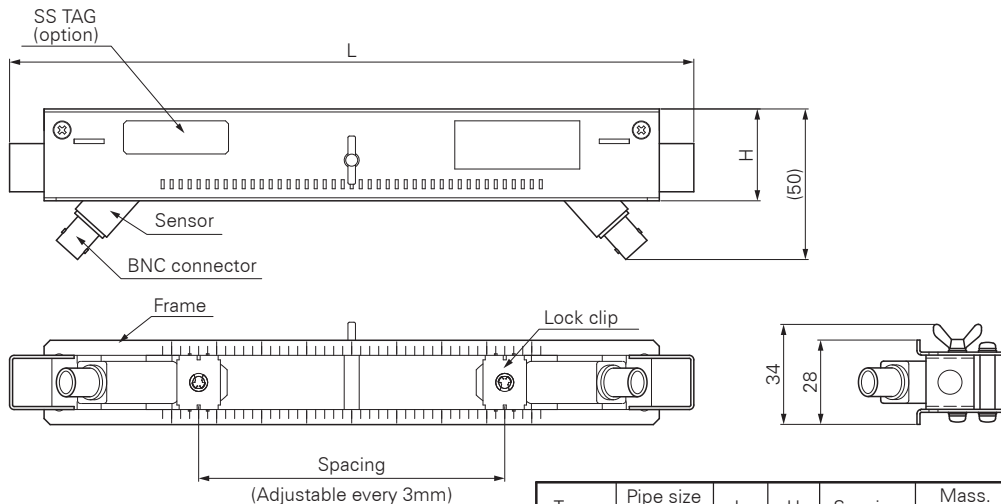
RS-485 and Synchronization



RS-232C

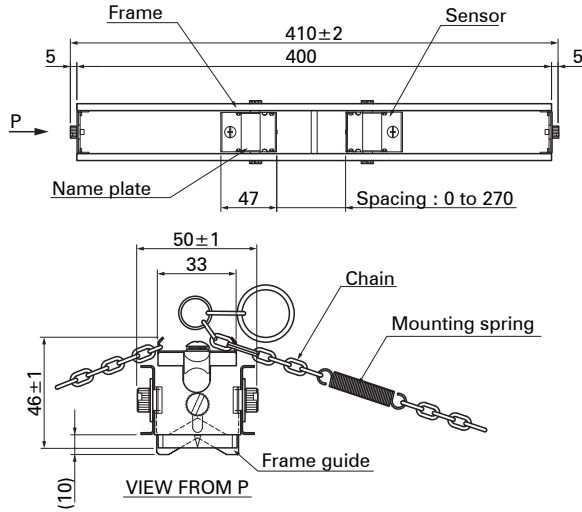


<Detector (type: FLSE□2)>

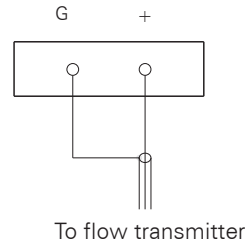


Type	Pipe size (mm)	L	H	Spacing	Mass. approx (kg)
FLSE12	25 to 100	228	31	21 to 120	0.3
FLSE22	50 to 225	348	30	21 to 240	0.4

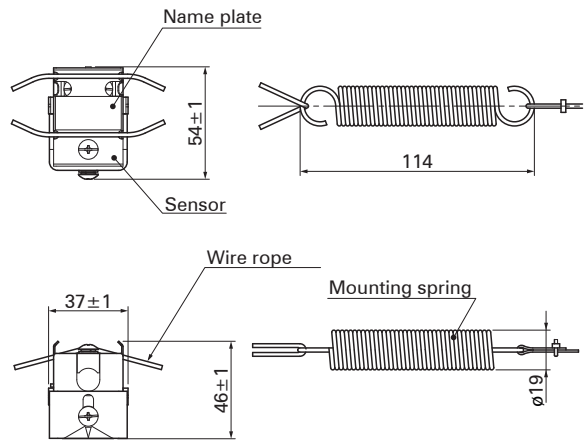
<Detector (type: FLSE31 V METHOD)>



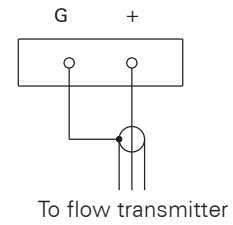
Connection diagram



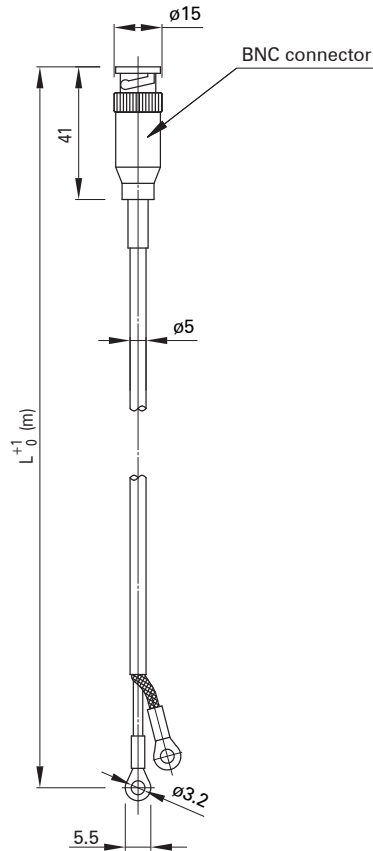
<Detector (type: FLSE41 Z METHOD)>



Connection diagram



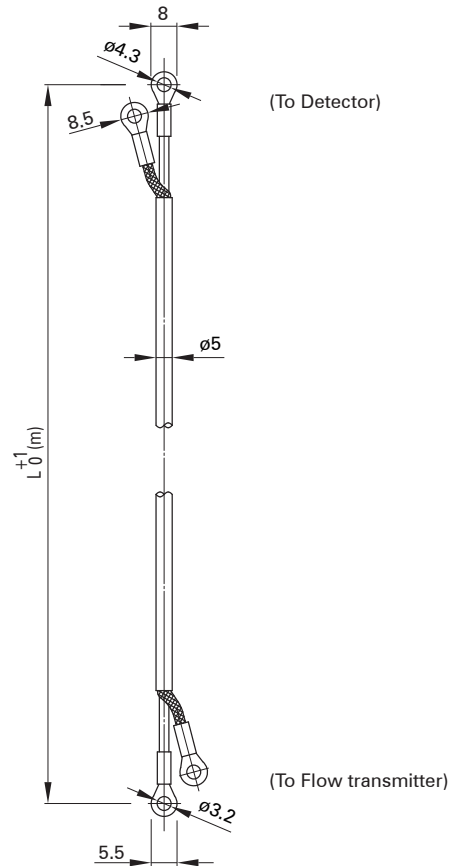
<Signal cable (type: FLY30)>



Type	L (m)	Mass. approx. (kg)	*Note1
FLY3005	5	0.6	
FLY3010	10	1.2	
FLY3015	15	1.8	
FLY3020	20	2.4	
FLY3030	30	3.6	

*Note1: Total of two elements

<Signal cable (type: FLY40)>



Type	L (m)	Mass. approx. (kg)	*Note1
FLY4005	5	0.6	
FLY4010	10	1.2	
FLY4015	15	1.8	
FLY4020	20	2.4	
FLY4030	30	3.6	

*Note1: Total of two elements

SCOPE OF DELIVERY

- Flow transmitter FLR: • Flow transmitter
• Instruction manual
- Detector FLS: • Sensor unit
• Mounting fixtures
• Silicon rubber or Silicon-free grease (option)
- Signal cable FLY : • Cable (one pair)

The product conforms to the requirements of the Electromagnetic compatibility Directive 89/336/EEC as detailed within the technical construction file number TN513321. The applicable standards used to demonstrate compliance are :

EN 61326 : 1998
Electrical equipment for measurement, control and laboratory use —
EMC requirements

⚠ Caution on Safety

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

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