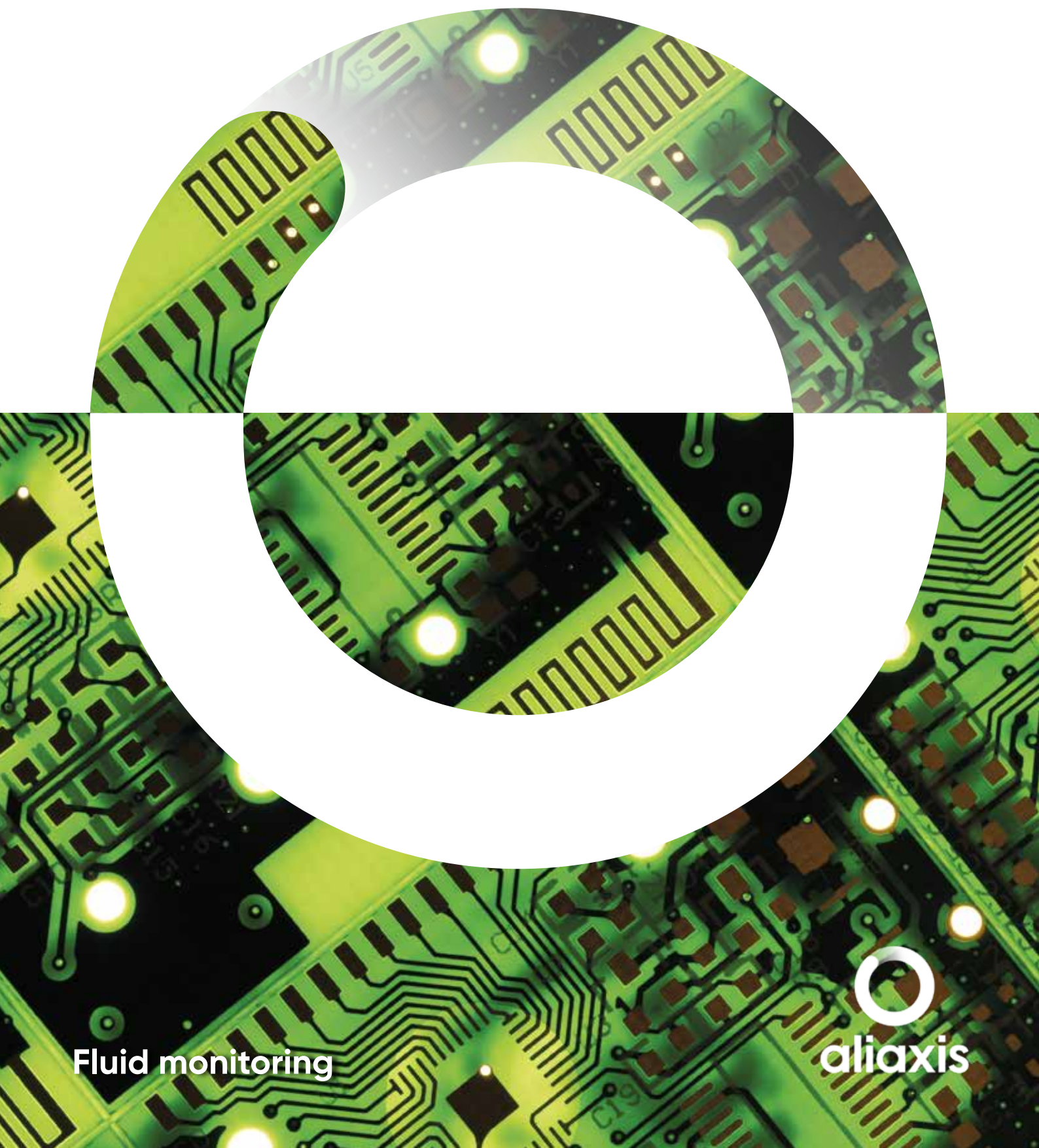


# Technical catalogue

Measuring and control instrumentation



Fluid monitoring





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The data contained in this explanatory note are provided in good faith.  
We accept no responsibility for technical data that is not covered by recognised international standards. FIP reserves the right to make changes to the products illustrated in this explanatory note.

Installation and maintenance operations must be carried out by professionals.

# System selection guide

## Choice of measurement system

This section provides some tips for selecting the right instruments for specific applications and liquids.

## Define the working conditions

Clarifying the following aspects is essential to choose the correct system and achieve maximum performance.

- Measurement range
- Pipe materials, sizes and standards
- Type of liquid (to assess chemical compatibility)
- Temperature and pressure requirements
- Instrumental performance required
- Presence of solids
- Viscosity of the liquid

## Choosing sensor technology

By examining the table of applications it is possible to establish the family of sensors suitable for a specific process. If you need more information, you can also refer to the Technical Information section for further details.

## Choosing the instrumentation

Examine the product compatibility chart to get an overview of all possible combinations of sensors, monitors and transmitters. For a choice appropriate to the process requirements, various input/output, display and installation options are available.

## Define the installation conditions

The last step concerns the process connections: a wide range of adapters and accessories are available for installation on pipes of various diameters and materials, with flush-mounted or immersion installation.

## Pre and after-sales technical support

For measurement and control instrumentation lines you can contact our Sales Technical Support Industry [technical.fip@alixaxis.com](mailto:technical.fip@alixaxis.com)

## Administration and sales

For measurement and control instrumentation lines you can contact our Sales & Customer Care [venditefip@alixaxis.com](mailto:venditefip@alixaxis.com)

# Applications table

## Product selection guide for liquids/operating conditions

Liquids/Operating conditions	Paddlewheel and electromagnetic flow sensors						
	F3.00	F3.20	F6.50	F3.10	F3.05	F6.60	F6.61
Clean liquids	1	1	1	1	1	1	1
Dirty liquids	3	3	3	3	3	1	1
Low viscosity liquids	2	2	2	2	1	2	2
High viscosity liquids	3	3	3	3	2	3	3
Low corrosive liquids	1	1	1	2	1	1	1
Very corrosive liquids	1	2	1	3	1	2	2
Liquids with fibres	3	3	3	3	3	1	1
Abrasive liquids	3	3	3	3	3	1	1
Non-conductive liquids	1	1	1	1	1	3	3
Pulsating flows	3	3	3	3	3	3	3
High temperature	1	1	1	3	1	2	2
High pressure	2	1	2	3	2	3	2
Large pipes	3	3	3	3	3	3	1

Liquids/Operating conditions	Oval gear and in-line flow sensors for low flow rates		Bulb and flat pH/ORP Electrodes				Inductive and potentiometric conductivity sensors		
	ULF	F3.80	pH/ORP 200	pH/ORP 400	pH/ORP 600	pH 800	C150-200	C100-301	C6.30
Clean liquids	1	1	1	1	1	1	1	1	1
Dirty liquids	3	3	2	3	1	1	2	1	1
Low viscosity liquids	2	2	2	2	2	1	2	1	1
High viscosity liquids	3	1	3	3	3	2	3	2	1
Low corrosive liquids	1	1	1	1	1	1	3	2	1
Very corrosive liquids	1	1	2	1	1	1	3	3	1
Liquids with fibres	3	3	2	3	1	1	3	1	1
Abrasive liquids	3	3	2	3	1	1	3	2	1
Non-conductive liquids	1	1	3	1	2	2	3	1	3
Pulsating flows	3	2	1	1	1	1	1	1	1
High temperature	2	3	3	1	2	2	3	2	3
High pressure	3	2	2	1	2	2	2	2	3
Large pipes	3	3	3	2	1	2	3	3	3

## Key

1 = Generally suitable

2 = Usable

3 = Unsuitable



## Guide to choosing products by process or market

Process/Market	Paddlewheel and electromagnetic flow sensors						
	F3.00	F3.20	F6.50	F3.10	F3.05	F6.60-F6.63	F6.61
Fertilization / Agriculture	•			•			
Swimming pools and spas	•		•				
Wastewater treatment						•	
Water treatment and production	•	•	•				
Food and beverage						•	
Water distribution and leak detection							•
Black water						•	•
Mining waste						•	•
Dosing systems							
Pump protection					•		
Heat exchangers and HVAC	•	•	•				
Production and dosing of detergents / disinfectants						•	
Finishing of metals / textile processes						•	

Process/Market	Oval gear and in-line flow sensors for low flow rates		Bulb and flat pH/ORP Electrodes				Inductive and potentiometric conductivity sensors		
	ULF	F3.80	pH/ORP 200	pH/ORP 400	pH/ORP 600	pH 800	C150-200	C100-301	C6.30
Fertilization / Agriculture			•					•	
Swimming pools and spas			•				•		
Wastewater treatment					•	•		•	
Water treatment and production				•				•	
Food and beverage				•			•		
Water distribution and leak detection									
Black water					•	•			•
Mining waste					•	•			•
Dosing systems	•	•				•			
Pump protection									
Heat exchangers and HVAC			•				•		
Production and dosing of detergents / disinfectants	•	•		•			•		
Finishing of metals / textile processes				•				•	

### Key

• = Most convenient option

# Compatibility table

## Compatibility of paddlewheel and electromagnetic flow sensors with measuring instrumentation

	M9.02	M9.00	M9.20	M9.50	M9.05	M9.06	M9.03	M9.07	M9.08	M9.10
<b>F3.00</b> Paddlewheel flow sensor	• (mod. H)	• (mod. H)	• (mod. C)	• (mod. H)			• (mod. H)	• (mod. H)	• (mod. H)	• (mod. H)
<b>F3.20</b> High pressure paddlewheel flow sensor	• (mod. H)	• (mod. H)		• (mod. H)			• (mod. H)	• (mod. H)	• (mod. H)	• (mod. H)
<b>F6.50</b> Paddlewheel flow transmitter										•
<b>F3.10</b> Mini paddlewheel flow sensor	•	•		•			•	•	•	•
<b>F3.05</b> Paddlewheel flow switch										
<b>F6.60 – F6.63</b> Electromagnetic flow sensor	•			•			•	•	•	•
<b>F6.61</b> Hot Tap Electromagnetic flow sensor	•			•			•	•	•	

## Compatibility of oval gear and in-line flow sensors for low flow rates with measuring instrumentation

	M9.02	M9.00	M9.20	M9.50	M9.05	M9.06	M9.03	M9.07	M9.08	M9.10
<b>ULF</b> Ultra Low Flow sensor	• (mod. H)	• (mod. R)	• (mod. R)	• (mod. H)			• (mod. H)	• (mod. H)	• (mod. H)	• (mod. H)
<b>F3.80</b> Oval gear flow sensor	•			•			•	•	•	•



# Compatibility table

## Compatibility of bulb and flat pH/ORP electrodes with measuring instrumentation

	M9.02	M9.00	M9.20	M9.50	M9.05	M9.06	M9.03	M9.07	M9.08	M9.10
<b>pH/ORP 200</b> Epoxy body bulb electrodes						•			•	
<b>pH/ORP 400</b> Glass body bulb electrodes						•			•	
<b>pH/ORP 600</b> Flat-surface C-PVC electrodes						•			•	
<b>pH 800</b> Flat-surface Rytan electrodes						•			•	

## Compatibility of potentiometric and inductive conductivity sensors with measuring instrumentation

	M9.02	M9.00	M9.20	M9.50	M9.05	M9.06	M9.03	M9.07	M9.08	M9.10
<b>C150-200</b> Graphite or platinum conductivity sensors					•			•		
<b>C100-301 C-PVC</b> Stainless steel conductivity sensors					•			•		
<b>C6.30</b> Inductive conductivity transmitter										•

## Technical characteristics of the instruments

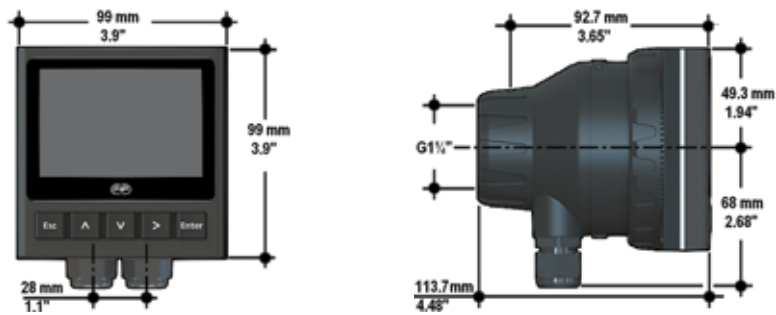
Single parameter	Digital outputs	Analogue outputs	Relay outputs	Power supply	Mounting
<b>M9.02</b> Flow monitor and transmitter	2*solid state relays	1*4-20 mA	1*mechanical relay	24 VDC / 220 VAC	Compact/panel/ wall-mounted
<b>M9.00</b> 2-wire flow monitor and transmitter	1*solid state relay	1*4-20 mA	-	24 VDC / 220 VAC	Compact/panel/ wall-mounted
<b>M9.20</b> Battery powered flow monitor	-	-	-	-	Compact/panel/ wall-mounted
<b>M9.05</b> Conductivity monitor and transmitter	2*solid state relays	2*4-20 mA	2*mechanical relays	24 VDC / 220 VAC	Panel/ wall-mounted
<b>M9.06</b> pH/ORP monitor and transmitter	2*solid state relays	2*4-20 mA	2*mechanical relays	24 VDC / 220 VAC	Panel/ wall-mounted
<b>M9.50</b> Batch Controller	2*solid state relays	2*4-20 mA	2*mechanical relays	24 VDC / 220 VAC	Panel/ wall-mounted
Double parameter	Digital outputs	Analogue outputs	Relay outputs	Power supply	Mounting
<b>M9.03</b> Dual parameter flow monitor and transmitter	2*solid state relays	2*4-20 mA	2*mechanical relays	24 VDC / 220 VAC	Panel/ wall-mounted
<b>M9.07</b> Dual parameter conductivity and flow monitor and transmitter	2*solid state relays	2*4-20 mA	2*mechanical relays	24 VDC / 220 VAC	Panel/ wall-mounted
<b>M9.08</b> Dual parameter flow and pH/ORP monitor and transmitter	2*solid state relays	2*4-20 mA	2*mechanical relays	24 VDC / 220 VAC	Panel/ wall-mounted
<b>M9.10</b> Dual parameter analogue monitor and transmitter	2*solid state relays	2*4-20 mA	2*mechanical relays	24 VDC / 220 VAC	Panel/ wall-mounted

**MONITOR FOR MEASUREMENT AND CONTROL  
OF FLOW, PH/ORP AND CONDUCTIVITY**  
High visibility display and quick calibration system  
for performance optimisation

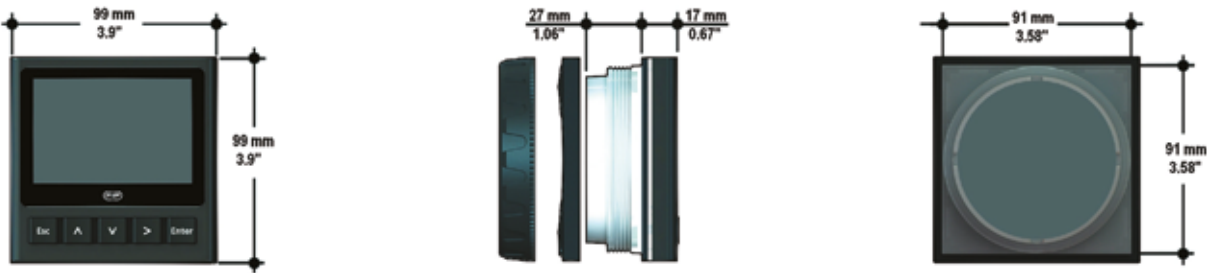


# INSTALLATIONS AND DIMENSIONS

COMPACT MOUNTING (FOR INSTRUMENTS M9.02, M9.00 AND M9.20)



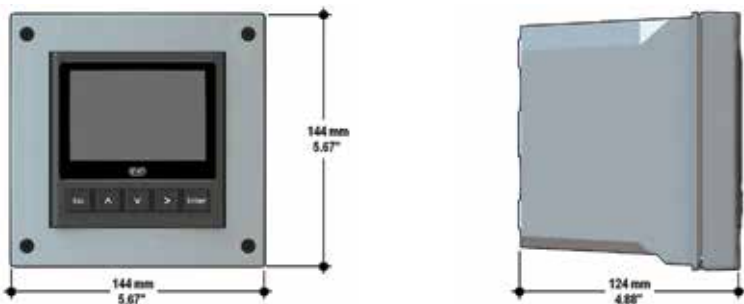
PANEL MOUNTING (FOR INSTRUMENTS M9.02, M9.00 AND M9.20)



PANEL MOUNTING (ALL MONITORS EXCEPT M9.02, M9.00 AND M9.20)



WALL MOUNTING



# M9.02

Flow monitor and transmitter



# M9.02

FLS M9.02 is an extremely efficient flow monitor and is designed to convert the frequency signal of flow sensors into flow rate. The M9.02 monitor is equipped with a large 4" graphic display which shows measured values clearly and a lot of other useful information. Moreover, due to a multicolour display plus a powerful backlight, measurement status can be determined easily from afar too. A tutorial software guarantees a mistake-proof and fast set up of every parameter. Calibration can be performed by indicating the installation features or using a reference value through a new "in-line calibration". A 4-20mA output is available to communicate the flow rate to an external remote device. Appropriate combination of digital outputs allows customised setups for any process to be controlled. The USB port on the back allows you to update the software with a wide range of customisation services as standard and on-demand.

## FLOW MONITOR AND TRANSMITTER

### APPLICATIONS

- Water treatment plants
- Industrial wastewater treatment and recovery
- Water distribution networks
- Filtration systems
- Swimming pools and spas
- Irrigation and fertilization
- Leak detection
- Cooling monitoring
- Processing and manufacturing industry
- Chemical production

### MAIN CHARACTERISTICS

- Large graphic display
- Colour backlighting
- On-line help
- Installation flexibility
- Simple, user-friendly and error-proof calibration software
- Mechanical relay and solid state relay for external alarms and for the control of external devices
- Multilingual menu
- USB port for software upgrade

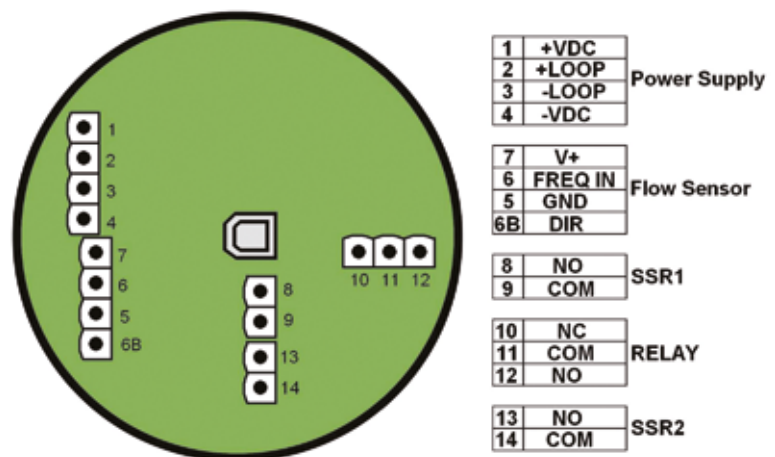
### TECHNICAL DATA

General information	<b>Compatible sensors:</b> Hall - effect flow sensors with frequency output or electromagnetic flow sensors
	<b>Materials:</b> <ul style="list-style-type: none"><li>- Case: ABS</li><li>- Display: PC</li><li>- Panel and wall gasket: silicone rubber</li><li>- 5-button keyboard: silicone rubber</li></ul>
	<b>Display:</b> <ul style="list-style-type: none"><li>- Full graphic LCD</li><li>- Backlight version: 3-colours</li><li>- Backlighting activation: User adjustable with 5 levels of timing</li><li>- Update rate: 1 second</li><li>- Protection class: IP65 front</li></ul>
	<b>Flow input range (frequency):</b> 0÷1500Hz
	<b>Flow input accuracy (frequency):</b> 0.5%

Electrical data	<b>Supply voltage:</b> from 12 to 24 VDC $\pm 10\%$ regulated
	<b>Max electrical consumption:</b> < 200 mA
	<b>Hall effect flow sensor power supply:</b> <ul style="list-style-type: none"> <li>– 5 VDC <math>\alpha</math> &lt; 20 mA</li> <li>– Optically isolated from current loop</li> <li>– Short circuit protected</li> </ul>
	<b>1 current output:</b> <ul style="list-style-type: none"> <li>– 4–20 mA, isolated, fully adjustable and reversible</li> <li>– Max loop impedance: 800 <math>\Omega</math> @ 24 VDC – 250 <math>\Omega</math> @ 12 VDC</li> </ul>
Environmental data	<b>2 solid state relay outputs:</b> <ul style="list-style-type: none"> <li>– User selectable as MIN alarm, MAX alarm, pulse output, window alarm, off</li> <li>– Optically isolated, 50 mA max sink, 24 VDC max pull-up voltage</li> <li>– Max pulse/min: 300</li> <li>– Hysteresis: user selectable</li> </ul>
	<b>1 relay output:</b> <ul style="list-style-type: none"> <li>– User selectable as MIN alarm, MAX alarm, pulse output, window alarm, off</li> <li>– Mechanical Single Pole Double Throw (SPDT) contact</li> <li>– Expected mechanical life (min. operations): <math>10^7</math></li> <li>– Expected electrical life (min. operations): <math>10^5</math> switching N.A./N.C. capacity 5 A/240 VAC</li> <li>– Max pulse/min: 60</li> <li>– Hysteresis: user selectable</li> </ul>
	<b>Operating temperature:</b> from $-10^{\circ}\text{C}$ to $70^{\circ}\text{C}$ (from $14^{\circ}\text{F}$ to $158^{\circ}\text{F}$ )
	<b>Storage temperature:</b> from $-30^{\circ}\text{C}$ to $+80^{\circ}\text{C}$ (from $-22^{\circ}\text{F}$ to $+176^{\circ}\text{F}$ )
Standards & Approvals	<b>Relative humidity:</b> from 0 to 95% not condensing
	Manufactured under ISO 9001 Manufactured under ISO 14001 CE RoHS Compliance EAC

## ELECTRICAL CONNECTIONS

Rear view of electrical connections





# PRODUCT CODES



## M9.02.PX - M9.02.WX

Flow Monitor and Transmitter

Code	Mounting	Power supply	wires power Technology	Sensor Input	Output	Weight (gr.)
M9.02.P1	Panel	12 - 24 VDC	3/4 wires	Flow (Frequency)	1* (4-20 mA) 2* (S.S.R.) 1* (mech. relay)	500
M9.02.W1	Wall	12 - 24 VDC	3/4 wires	Flow (Frequency)	1* (4-20 mA) 2* (S.S.R.) 1* (mech. relay)	550
M9.02.W2	Wall	110 - 230 VAC	3/4 wires	Flow (Frequency)	1* (4-20 mA) 2* (S.S.R.) 1* (mech. relay)	650

S.S.R: solid state relay / mech relay.: mechanical relay

## M9.02.XX

Flow Monitor and Transmitter Field mount

Code	Power supply	wires power Technology	Sensor Input	Output	Length	Main Wetted Materials	Weight (gr.)
M9.02.01	12 - 24 VDC	3/4 wires	Flow (Frequency)	1* (4-20 mA) 2* (S.S.R.) 1* (mech. relay)	L0	C-PVC EPDM	550
M9.02.02	12 - 24 VDC	3/4 wires	Flow (Frequency)	1* (4-20 mA) 2* (S.S.R.) 1* (mech. relay)	L0	C-PVC FKM	550
M9.02.03	12 - 24 VDC	3/4 wires	Flow (Frequency)	1* (4-20 mA) 2* (S.S.R.) 1* (mech. relay)	L1	C-PVC EPDM	550
M9.02.04	12 - 24 VDC	3/4 wires	Flow (Frequency)	1* (4-20 mA) 2* (S.S.R.) 1* (mech. relay)	L1	C-PVC FKM	550
M9.02.05	12 - 24 VDC	3/4 wires	Flow (Frequency)	1* (4-20 mA) 2* (S.S.R.) 1* (mech. relay)	L0	PVDF EPDM	550
M9.02.06	12 - 24 VDC	3/4 wires	Flow (Frequency)	1* (4-20 mA) 2* (S.S.R.) 1* (mech. relay)	L0	PVDF FKM	550
M9.02.07	12 - 24 VDC	3/4 wires	Flow (Frequency)	1* (4-20 mA) 2* (S.S.R.) 1* (mech. relay)	L1	PVDF EPDM	550
M9.02.08	12 - 24 VDC	3/4 wires	Flow (Frequency)	1* (4-20 mA) 2* (S.S.R.) 1* (mech. relay)	L1	PVDF FKM	550
M9.02.09	12 - 24 VDC	3/4 wires	Flow (Frequency)	1* (4-20 mA) 2* (S.S.R.) 1* (mech. relay)	L0	316L SS EPDM	600
M9.02.10	12 - 24 VDC	3/4 wires	Flow (Frequency)	1* (4-20 mA) 2* (S.S.R.) 1* (mech. relay)	L0	316L SS FKM	600
M9.02.11	12 - 24 VDC	3/4 wires	Flow (Frequency)	1* (4-20 mA) 2* (S.S.R.) 1* (mech. relay)	L1	316L SS EPDM	600
M9.02.12	12 - 24 VDC	3/4 wires	Flow (Frequency)	1* (4-20 mA) 2* (S.S.R.) 1* (mech. relay)	L1	316L SS FKM	600

S.S.R: solid state relay / mech relay.: mechanical relay

# M9.00



2-Wires Flow Monitor and Transmitter



# M9.00

FLS M9.00 is a powerful flow monitor and transmitter based on 2-wire technology, designed to convert the frequency signal of flow sensors into flow rate. The M9.00 monitor is equipped with a large 4" display which shows measured values clearly. In addition, the standard backlighting further improves the visibility of the display. The main parameters can be configured with a first wizard. A reference flow rate can be used for recalibration or for an alignment through an intuitive "in-line calibration". A 4-20 mA 2-wire analogue signal combined with a solid-state relay allows you to remotely manage the instantaneous flow rate or an alarm. The M9.00 monitor is equipped with a USB port that facilitates the updating of the instrument software by the customer.

## 2-WIRES FLOW MONITOR AND TRANSMITTER

### APPLICATIONS

- Water treatment plants
- Industrial wastewater treatment and recovery
- Water distribution
- Filtration systems
- Swimming pools and spas
- Irrigation and fertilization
- Leak detection

### MAIN CHARACTERISTICS

- Large display
- Extremely bright backlighting
- Installation flexibility
- Solid-state relays for programmable alarms
- Multilingual menu
- USB port for software upgrade

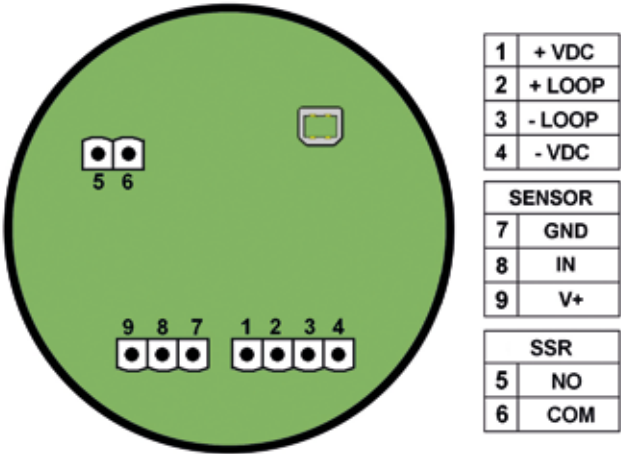
### TECHNICAL DATA

General information	<b>Compatible sensors:</b> Hall - effect flow sensors with frequency output, ULF Reed
	<b>Materials:</b> <ul style="list-style-type: none"><li>– Case: ABS</li><li>– Display: PC</li><li>– Panel and wall gasket: silicone rubber</li><li>– 5-button keyboard: silicone rubber</li></ul>
	<b>Display:</b> <ul style="list-style-type: none"><li>– Transflective technology</li><li>– Backlight version: monochrome</li><li>– Backlighting activation: available without activation of analogue output</li><li>– Update rate: 1 second</li><li>– Protection class: IP65 front</li></ul>
	<b>Flow input range (frequency):</b> from 0.5 to 500 Hz
	<b>Flow input accuracy (frequency):</b> 0.5%
Electrical data	<b>Supply voltage:</b> from 12 to 24 VDC $\pm 10\%$ regulated
	<b>Max electrical consumption:</b> < 20 mA (backlighting off); < 30 mA (backlighting on)
	<b>Hall effect flow sensor power supply:</b> <ul style="list-style-type: none"><li>– 3.8 VDC at &lt; 20 mA</li><li>– Optically isolated from current loop</li><li>– Short circuit protected</li></ul>
	<b>1 current output (not available with active backlighting):</b> <ul style="list-style-type: none"><li>– 4-20 mA, isolated, fully adjustable and reversible</li><li>– Max loop impedance: 800 <math>\Omega</math> @ 24 VDC – 250 <math>\Omega</math> @ 12 VDC</li></ul>
	<b>1 solid state relay outputs:</b> <ul style="list-style-type: none"><li>– User selectable as MIN alarm, MAX alarm, pulse output, window alarm, off</li><li>– Optically isolated, 50 mA max sink, 24 VDC max pull-up voltage</li><li>– Max pulse/min: 300</li><li>– Hysteresis: user selectable</li></ul>

Environmental data	Operating temperature: from -10°C to 70°C (from 14°F to 158°F)
	Storage temperature: from -30°C to +80°C (from -22°F to +176°F)
	Relative humidity: from 0 to 95% not condensing
Standards & Approvals	Manufactured under ISO 9001 Manufactured under ISO 14001 CE RoHS Compliance EAC

ELECTRICAL  
CONNECTIONS

Rear view of electrical connections



# PRODUCT CODES



## M9.00.PX - M9.00.WX

2-wires Flow Monitor and Transmitter

Code	Mounting	Power supply	wires power Technology	Sensor Input	Output	Weight (gr.)
M9.00.P1	Panel	12 - 24 VDC	2 wires	Flow (Frequency)	1*(4-20mA) 1*(S.S.R.)	500
M9.00.W1	Wall	12 - 24 VDC	2 wires	Flow (Frequency)	1*(4-20mA) 1*(S.S.R.)	550
M9.00.W2	Wall	110 - 230 VAC	2 wires	Flow (Frequency)	1*(4-20mA) 1*(S.S.R.)	650

S.S.R: solid state relay

## M9.00.XX

2-wires Flow Monitor and Transmitter Field mounting

Code	Power supply	wires power Technology	Sensor Input	Output	Length	Main Wetted Materials	Weight (gr.)
M9.00.01	12 - 24 VDC	2 wires	Flow (Frequency)	1*(4-20mA) 1*(S.S.R.)	L0	C-PVC EPDM	550
M9.00.02	12 - 24 VDC	2 wires	Flow (Frequency)	1*(4-20mA) 1*(S.S.R.)	L0	C-PVC FKM	550
M9.00.03	12 - 24 VDC	2 wires	Flow (Frequency)	1*(4-20mA) 1*(S.S.R.)	L1	C-PVC EPDM	550
M9.00.04	12 - 24 VDC	2 wires	Flow (Frequency)	1*(4-20mA) 1*(S.S.R.)	L1	C-PVC FKM	550
M9.00.05	12 - 24 VDC	2 wires	Flow (Frequency)	1*(4-20mA) 1*(S.S.R.)	L0	PVDF EPDM	550
M9.00.06	12 - 24 VDC	2 wires	Flow (Frequency)	1*(4-20mA) 1*(S.S.R.)	L0	PVDF FKM	550
M9.00.07	12 - 24 VDC	2 wires	Flow (Frequency)	1*(4-20mA) 1*(S.S.R.)	L1	PVDF EPDM	550
M9.00.08	12 - 24 VDC	2 wires	Flow (Frequency)	1*(4-20mA) 1*(S.S.R.)	L1	PVDF FKM	550
M9.00.09	12 - 24 VDC	2 wires	Flow (Frequency)	1*(4-20mA) 1*(S.S.R.)	L0	316L SS EPDM	600
M9.00.10	12 - 24 VDC	2 wires	Flow (Frequency)	1*(4-20mA) 1*(S.S.R.)	L0	316L SS FKM	600
M9.00.11	12 - 24 VDC	2 wires	Flow (Frequency)	1*(4-20mA) 1*(S.S.R.)	L1	316L SS EPDM	600
M9.00.12	12 - 24 VDC	2 wires	Flow (Frequency)	1*(4-20mA) 1*(S.S.R.)	L1	316L SS FKM	600

S.S.R: solid state relay

# M9.20

Battery powered flow monitor



# M9.20

FLS M9.20 is a smart battery-powered flow monitor designed to convert the frequency signal of FLS sensors into flow rate. The M9.20 monitor is equipped with a high range lithium battery that also powers the sensors. The large 4" display shows the measured values with extreme clarity. The main parameters can be configured with a first wizard. For calibration or alignment using an extremely user-friendly in-line calibration procedure, a reference flow rate can be used. A safety icon notifies you when it is time to replace the battery and the instrument automatically stores all the main parameters. A 10-character string allows you to customise the display of the monitor with ease. The M9.20 monitor is equipped with a USB port that facilitates the updating of the software by the end user.

## BATTERY POWERED FLOW MONITOR

### APPLICATIONS

- Remote distribution systems
- Mobile monitoring systems
- Irrigation and fertilization
- Reclamation of aquifers
- Swimming pools and spas
- Liquid dispensing systems

### MAIN CHARACTERISTICS

- Large display
- Long battery life
- Installation flexibility
- Multilingual menu
- When the battery is replaced the data are not lost
- USB port for software upgrade

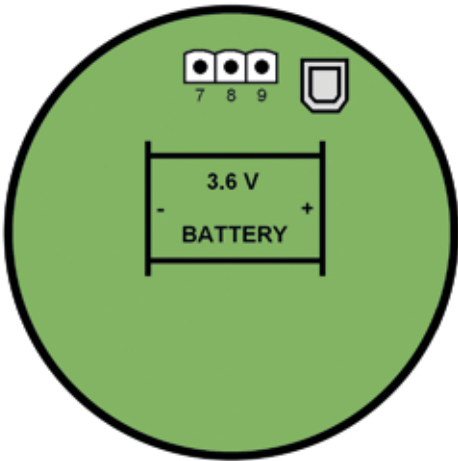
### TECHNICAL DATA

General information	<b>Compatible sensors:</b> FLS Coil effect with frequency output and FLS Reed effect
	<b>Materials:</b> <ul style="list-style-type: none"><li>– Case: ABS</li><li>– Display: PC</li><li>– Panel and wall gasket: silicone rubber</li><li>– 5-button keyboard: silicone rubber</li></ul>
	<b>Display:</b> <ul style="list-style-type: none"><li>– Transflective technology</li><li>– Update rate: 1 second</li><li>– Protection class: IP65 front</li></ul>
	<b>Flow input range (frequency):</b> from 0.5 to 500 Hz
	<b>Flow input accuracy (frequency):</b> 0.5%
Electrical data	<b>Supply voltage:</b> 3.6 Volt Lithium Thionyl Chloride battery, size C, 8.5 Ahr 3
	<b>Max electrical consumption:</b> < 400 mA
	<b>FLS Coil effect flow sensor power supply:</b> <ul style="list-style-type: none"><li>– 3.6 Volts</li></ul>
Environmental data	<b>Operating temperature:</b> from -5°C to 60°C (from 23°F to 140°F)
	<b>Storage temperature:</b> from -10°C to +80°C (from -14°F to +176°F)
	<b>Relative humidity:</b> from 0 to 95% not condensing
Standards & Approvals	Manufactured under ISO 9001 Manufactured under ISO 14001 CE RoHS Compliance EAC



# ELECTRICAL CONNECTIONS

Rear view of electrical connections



9	V+
8	FREQ IN
7	GND

Flow Sensor

# PRODUCT CODES



## M9.20.PX – M9.20.WX

Battery Powered Flow Monitor

Code	Mounting	Power supply	Sensor Input	Weight (gr.)
M9.20.P1	Panel	Battery Powered	Flow (Frequency)	500
M9.20.W1	Wall	Battery Powered	Flow (Frequency)	550

## M9.20.XX

Battery Powered Flow Monitor Field Mounting

Code	Sensor Input	Length	Main Wetted Materials	Weight (gr.)
M9.20.01	Flow (Frequency)	L0	C-PVC EPDM	550
M9.20.02	Flow (Frequency)	L0	C-PVC FKM	550
M9.20.03	Flow (Frequency)	L1	C-PVC EPDM	550
M9.20.04	Flow (Frequency)	L1	C-PVC FKM	550
M9.20.05	Flow (Frequency)	L0	PVDF EPDM	550
M9.20.06	Flow (Frequency)	L0	PVDF FKM	550
M9.20.07	Flow (Frequency)	L1	PVDF EPDM	550
M9.20.08	Flow (Frequency)	L1	PVDF FKM	550
M9.20.09	Flow (Frequency)	L0	316L SS EPDM	600
M9.20.10	Flow (Frequency)	L0	316L SS FKM	600
M9.20.11	Flow (Frequency)	L1	316L SS EPDM	600
M9.20.12	Flow (Frequency)	L1	316L SS FKM	600

# M9.50

Batch Controller



# M9.50

FLS M9.50 is a device dedicated to the accurate batching or mixing operations of liquids. A 4" wide full graphic display shows measured values clearly together with a lot of other useful information. The colour display and its powerful backlight allow an easy control of batching process even from very long distance. The software provides assistance to minimise errors and speed up the configuration of all settings. Advanced options are also available to increase accuracy and reduce transfer times. The possibility of setting various volumes (up to 10 transfers) according to certain calibration factors optimises the flexibility of the system and guarantees maximum precision. The special set of outputs allows remote control and monitoring of the transfer system. The USB port on the back allows you to update the software with a wide range of customisation services as standard and on-demand.

## BATCH CONTROLLER

### APPLICATIONS

- Transfer
- Chemical dosing
- Filling
- Mixing
- Batching
- Bottling

### MAIN CHARACTERISTICS

- Large graphic display
- Colour backlighting
- On-line help
- Remote start, stop and resume
- User-friendly setting
- Two-stage transfer
- Alarm and overrun compensation
- No signal alarm
- USB port for software upgrade

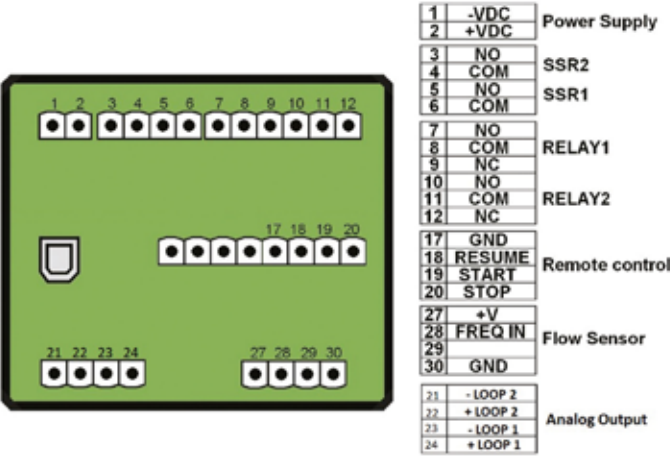
### TECHNICAL DATA

General information	<b>Compatible sensors:</b> FLS Hall effect flow sensors with frequency output or FLS F6.60 electromagnetic flow sensors
	<b>Materials:</b> <ul style="list-style-type: none"><li>– Case: ABS</li><li>– Display: PC</li><li>– Panel and wall gasket: silicone rubber</li><li>– 5-button keyboard: silicone rubber</li></ul>
	<b>Display:</b> <ul style="list-style-type: none"><li>– LCD full graphic</li><li>– Backlight version: 3 - colours</li><li>– Backlighting activation: User adjustable with 5 levels of timing</li><li>– Update rate: 1 second</li><li>– Protection class: IP65 front</li></ul>
	<b>Flow input range (frequency):</b> 0÷1500Hz
	<b>Flow input accuracy :</b> 0.5%

<b>Electrical data</b>	<b>Supply voltage:</b> from 12 to 24 VDC $\pm 10\%$ regulated
	<b>Max electrical consumption:</b> < 300 mA
	<b>FLS Hall effect flow sensor power supply:</b> <ul style="list-style-type: none"> <li>– 5 VDC at &lt; 20 mA</li> <li>– Optically isolated from current loop</li> <li>– Short circuit protected</li> </ul>
	<b>2 solid state relay outputs:</b> <ul style="list-style-type: none"> <li>– Optically isolated, 50 mA max sink, 24 VDC max pull-up voltage</li> <li>– Max pulse/min: 300</li> <li>– Hysteresis: selectable by the user as: two-stage transfer, overrun alarm or no signal</li> </ul>
<b>Environmental data</b>	<b>2 relay outputs:</b> <ul style="list-style-type: none"> <li>– Mechanical Single Pole Double Throw (SPDT) contact</li> <li>– Expected mechanical life (min. operations): <math>10^7</math></li> <li>– Expected electrical life (min. operations): <math>10^5</math> switching N.A./N.C. capacity 5 A/240 VAC</li> <li>– Max pulse/min: 60</li> <li>– Hysteresis: user selectable</li> <li>– User selectable as: <ul style="list-style-type: none"> <li>OUTPUT1 – Option: two-stage transfer, overrun alarm or no signal</li> <li>OUTPUT2 – Transfer: transfer indication in progress</li> </ul> </li> </ul>
	<b>Operating temperature:</b> from $-10^{\circ}\text{C}$ to $70^{\circ}\text{C}$ (from $14^{\circ}\text{F}$ to $158^{\circ}\text{F}$ )
	<b>Storage temperature:</b> from $-30^{\circ}\text{C}$ to $+80^{\circ}\text{C}$ (from $-22^{\circ}\text{F}$ to $+176^{\circ}\text{F}$ )
	<b>Relative humidity:</b> from 0 to 95% not condensing
<b>Standards &amp; Approvals</b>	Manufactured under ISO 9001 Manufactured under ISO 14001 CE RoHS Compliance EAC

# ELECTRICAL CONNECTIONS

Rear view of electrical connections



# PRODUCT CODES



**M9.50.PX – M9.50.WX**  
Batch Controller

Code	Mounting	Power supply	Sensor Input	Output	Weight (gr.)
M9.50.P1	Panel	12 – 24 VDC	Flow (Frequency)	2*(S.S.R.) 2*(mech. relay)	550
M9.50.W1	Wall	12 – 24 VDC	Flow (Frequency)	2*(S.S.R.) 2*(mech. relay)	650
M9.50.W2	Wall	110 – 230 VAC	Flow (Frequency)	2*(S.S.R.) 2*(mech. relay)	750

S.S.R: solid state relay / mech relay.: mechanical relay

# M9.05

Conductivity Monitor and Transmitter





# M9.05

The FLS M9.05 conductivity monitor and transmitter is a powerful device designed for a wide range of applications, including ultrapure water production. A 4" wide full graphic display shows measured values clearly together with a lot of other useful information. Moreover, due to the multicolor bright backlight, measurement status can be determined easily also from very long distance. A tutorial software guarantees a mistake-proof and fast set up of every parameter. The measured values can be displayed as resistivity or TDS, depending on the needs. The freely settable cell constant allows all types of 2-cell conductivity probes to be used. Two 4-20 mA outputs allow conductivity and temperature values to be sent to remote external devices. Appropriate combination of digital outputs allows customised setups for any process to be controlled. The USB port on the back allows you to update the software with a wide range of customisation services as standard and on-demand.

## CONDUCTIVITY MONITOR AND TRANSMITTER

### APPLICATIONS

- Water treatment and regeneration
- Industrial wastewater treatment and recovery
- Softening
- Filtration systems
- Desalination
- Production of demineralised water
- Reverse osmosis/EDI
- cooling monitoring
- Processing and manufacturing industry
- Chemical production

### MAIN CHARACTERISTICS

- Large graphic display
- Colour backlighting
- On-line help
- Temperature compensation dedicated to the production and use of ultrapure water (UPW)
- Freely settable cell constant
- Values in conductivity, resistivity, TDS
- Analogue output for temperature communication to remote devices
- Mechanical relay and solid state relay for external alarms and for the control of external devices
- USB port for software upgrade

### TECHNICAL DATA

#### General information

**Compatible sensors:** conductivity sensors and temperature sensors

**Materials:**

- Case: ABS
- Display: PC
- Panel and wall gasket: silicone rubber
- 5-button keyboard: silicone rubber

**Display:**

- LCD full graphic
- Backlight version: 3 - colours
- Backlighting activation: User adjustable with 5 levels of timing
- Update rate: 1 second
- Protection class: IP65 front

**Conductivity input range:** 0.055÷200000 µS/cm (according to the applied cell constant)

**Conductivity measurement accuracy:** ±2.0% of reading value

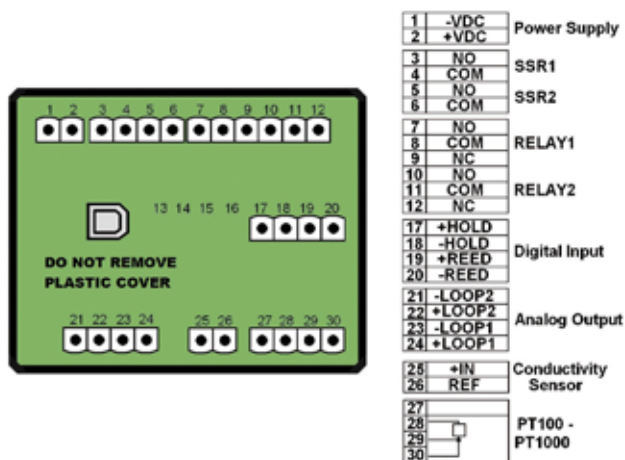
**Temperature input range:** -50÷150°C (-58÷302°F) (with Pt100-Pt1000)

**Temperature measurement resolution:** 0.1°C/°F (Pt1000); 0.5°C/°F (Pt100)

Electrical data	<b>Supply voltage:</b> from 12 to 24 VDC $\pm 10\%$ regulated
	<b>Max electrical consumption:</b> < 300 mA
	<b>2 current output:</b> <ul style="list-style-type: none"> <li>– 4–20 mA, isolated, fully adjustable and reversible</li> <li>– Max loop impedance: 800 <math>\Omega</math> @ 24 VDC – 250 <math>\Omega</math> @ 12 VDC</li> </ul>
Environmental data	<b>2 solid state relay outputs:</b> <ul style="list-style-type: none"> <li>– User selectable as ON-OFF, proportional frequency output, proportional pulses, timed pulses, off</li> <li>– Optically isolated, 50 mA max sink, 24 VDC max pull-up voltage</li> <li>– Max pulse/min: 300</li> <li>– Hysteresis: user selectable</li> </ul>
	<b>2 relay output:</b> <ul style="list-style-type: none"> <li>– User selectable as ON-OFF, proportional frequency output, proportional pulses, timed pulses, off</li> <li>– Mechanical Single Pole Double Throw (SPDT) contact</li> <li>– Expected mechanical life (min. operations): <math>10^7</math></li> <li>– Expected electrical life (min. operations): <math>10^5</math> switching N.A./N.C. capacity 5 A/240 VAC</li> <li>– Max pulse/min: 60</li> <li>– Hysteresis: user selectable</li> </ul>
	<b>Operating temperature:</b> from $-10^{\circ}\text{C}$ to $70^{\circ}\text{C}$ (from $14^{\circ}\text{F}$ to $158^{\circ}\text{F}$ ) <b>Storage temperature:</b> from $-30^{\circ}\text{C}$ to $+80^{\circ}\text{C}$ (from $-22^{\circ}\text{F}$ to $+176^{\circ}\text{F}$ ) <b>Relative humidity:</b> from 0 to 95% not condensing
Standards & Approvals	Manufactured under ISO 9001 Manufactured under ISO 14001 CE RoHS Compliance EAC

## ELECTRICAL CONNECTIONS

Rear view of electrical connections



# PRODUCT CODES



## M9.05.PX – M9.05.WX

Conductivity Monitor and Transmitter

Code	Mounting	Power supply	wires power Technology	Sensor Input	Output	Weight (gr.)
M9.05.P1	Panel	12 – 24 VDC	3/4 wires	Conductivity Temperature	2*(4-20mA) 2*(S.S.R.) 2* (mech. relay)	550
M9.05.W1	Wall	12 – 24 VDC	3/4 wires	Conductivity Temperature	2*(4-20mA) 2*(S.S.R.) 2* (mech. relay)	650
M9.05.W2	Wall	110 – 230 VAC	3/4 wires	Conductivity Temperature	2*(4-20mA) 2*(S.S.R.) 2* (mech. relay)	750

S.S.R: solid state relay / mech relay.: mechanical relay

# M9.06

pH/ORP Monitor and Transmitter



# M9.06

The FLS M9.06 pH/ORP monitor and transmitter is a powerful device designed for a wide range of applications. A 4" wide full graphic display shows measured values clearly together with a lot of other useful information. Moreover, due to the multicolor bright backlight, measurement status can be determined easily also from very long distance. A tutorial software guarantees a mistake-proof and fast set up of every parameter. Calibration based on automatic buffer recognition and in-line adjustment allows accurate and reliable measurements to be obtained in any condition. The M9.06 monitor allows the diagnosis of electrode conditions with practical tips to optimise probe performance. The USB port on the back allows you to update the software with a wide range of customisation services as standard and on-demand.

## PH/ORP MONITOR AND TRANSMITTER

### APPLICATIONS

- Water treatment and regeneration
- Industrial wastewater treatment and recovery
- Scrubber control
- Neutralisation systems
- Heavy metal recovery
- Coating of metal surfaces
- Processing and manufacturing industry
- Chemical production
- Swimming pools and spas

### MAIN CHARACTERISTICS

- Large graphic display
- Colour backlighting
- On-line help
- Automatic recognition of buffers for pH
- In-line adjustment on actual sample
- Analogue output for temperature communication to remote devices
- Mechanical relay and solid state relay for external alarms and for the control of external devices
- USB port for software upgrade

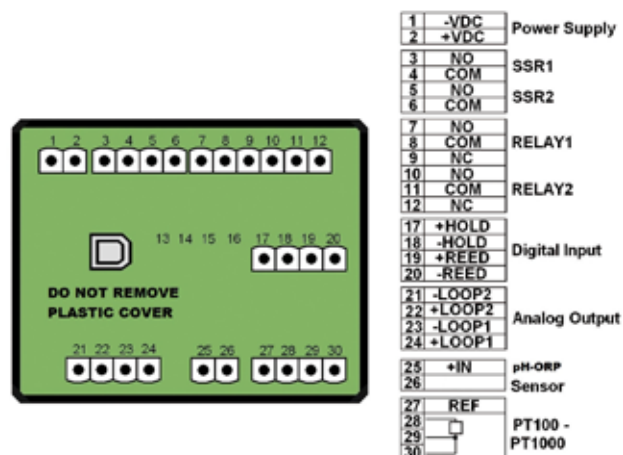
### TECHNICAL DATA

General information	<b>Compatible sensors:</b> pH/ORP electrodes and temperature sensors
	<b>Materials:</b> <ul style="list-style-type: none"><li>– Case: ABS</li><li>– Display: PC</li><li>– Panel and wall gasket: silicone rubber</li><li>– 5-button keyboard: silicone rubber</li></ul>
	<b>Display:</b> <ul style="list-style-type: none"><li>– LCD full graphic</li><li>– Backlight version: 3 - colours</li><li>– Backlighting activation: User adjustable with 5 levels of timing</li><li>– Update rate: 1 second</li><li>– Protection class: IP65 front</li></ul>
	<b>pH input range:</b> -2÷16 pH (depending on the pH electrode applied)
	<b>pH measurement resolution:</b> ±0.01 pH
	<b>ORP input range:</b> -2000÷2000 mV (depending on the ORP probe applied)
	<b>ORP measurement resolution:</b> ±1 mV
	<b>Temperature input range:</b> -50÷150°C (-58÷302°F) (with Pt100-Pt1000)
	<b>Temperature measurement resolution:</b> 0.1°C/°F (Pt1000); 0.5°C/°F (Pt100)

Electrical data	<b>Supply voltage:</b> from 12 to 24 VDC $\pm 10\%$ regulated
	<b>Max electrical consumption:</b> < 300 mA
	<b>2 current output:</b> – 4–20 mA, isolated, fully adjustable and reversible – Max loop impedance: 800 $\Omega$ @ 24 VDC – 250 $\Omega$ @ 12 VDC
	<b>2 solid state relay outputs:</b> – User selectable as ON-OFF, proportional frequency output, proportional pulses, timed pulses, off – Optically isolated, 50 mA max sink, 24 VDC max pull-up voltage – Max pulse/min: 300 – Hysteresis: user selectable
	<b>2 relay output:</b> – User selectable as ON-OFF, proportional frequency output, proportional pulses, timed pulses, off – Mechanical Single Pole Double Throw (SPDT) contact – Expected mechanical life (min. operations): $10^7$ – Expected electrical life (min. operations): $10^5$ switching N.A./N.C. capacity 5 A/240 VAC – Max pulse/min: 60 – Hysteresis: user selectable
Environmental data	<b>Operating temperature:</b> from $-10^{\circ}\text{C}$ to $70^{\circ}\text{C}$ (from $14^{\circ}\text{F}$ to $158^{\circ}\text{F}$ )
	<b>Storage temperature:</b> from $-30^{\circ}\text{C}$ to $+80^{\circ}\text{C}$ (from $-22^{\circ}\text{F}$ to $+176^{\circ}\text{F}$ )
	<b>Relative humidity:</b> from 0 to 95% not condensing
Standards & Approvals	Manufactured under ISO 9001 Manufactured under ISO 14001 CE RoHS Compliance EAC

## ELECTRICAL CONNECTIONS

Rear view of electrical connections



# PRODUCT CODES



## M9.06.P1 – M9.06.WX

pH/ORP Monitor and Transmitter

Code	Mounting	Power supply	wires power Technology	Sensor Input	Output	Weight (gr.)
M9.06.P1	Panel	12 – 24 VDC	3/4 wires	pH/ORP Temperature	2*(4-20mA) 2*(S.S.R.) 2* (mech. relay)	550
M9.06.W1	Wall	12 – 24 VDC	3/4 wires	pH/ORP Temperature	2*(4-20mA) 2*(S.S.R.) 2* (mech. relay)	650
M9.06.W2	Wall	110 – 230 VAC	3/4 wires	pH/ORP Temperature	2*(4-20mA) 2*(S.S.R.) 2* (mech. relay)	750

S.S.R: solid state relay / mech relay.: mechanical relay



# M9.03



Dual Parameter Flow Monitor and Transmitter



# M9.03

The FLS M9.03 dual-parameter flow monitor is a powerful device that converts the frequency signal of the flow sensors into flowrate. The M9.03 monitor is equipped with a large 4" graphic display which shows measured values clearly and a lot of other useful information. Moreover, due to a multicolour display plus a powerful backlight, measurement status can be determined easily from afar too. A tutorial software guarantees a mistake-proof and fast set up of every parameter. Calibration can be performed by indicating the installation features or using a reference value through a new "in-line calibration". Two 4-20 mA outputs are available to communicate the flow rate to an external remote device. Appropriate combination of digital outputs allows customised setups for any process to be controlled. The USB port on the back allows you to update the software with a wide range of customisation services as standard and on-demand.

## DUAL PARAMETER FLOW MONITOR AND TRANSMITTER

### APPLICATIONS

- Water treatment plants
- Industrial wastewater treatment and recovery
- Water distribution
- Filtration systems
- Swimming pools and spas
- Irrigation and fertilization
- Leak detection
- cooling monitoring
- Processing and manufacturing industry
- Chemical production

### MAIN CHARACTERISTICS

- Large graphic display
- Colour backlighting
- On-line help
- Display of the flow rate delta
- Simple, user-friendly and error-proof calibration software
- Mechanical relays for the control of external devices
- Solid-state relays for programmable alarms
- Multilingual menu
- USB port for software upgrade

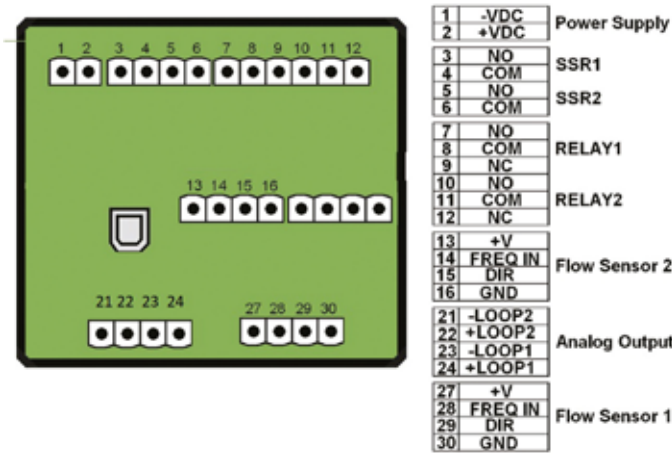
### TECHNICAL DATA

General information	<b>Compatible sensors:</b> 2 FLS Hall effect flow sensors with frequency output or FLS F6.60 electromagnetic flow meters
	<b>Materials:</b> <ul style="list-style-type: none"><li>– Case: ABS</li><li>– Display: PC</li><li>– Panel and wall gasket: silicone rubber</li><li>– 5-button keyboard: silicone rubber</li></ul>
	<b>Display:</b> <ul style="list-style-type: none"><li>– LCD full graphic</li><li>– Backlight version: 3 - colours</li><li>– Backlighting activation: user adjustable with 5 levels of timing</li><li>– Update rate: 1 second</li><li>– Protection class: IP65 front</li></ul>
	<b>Flow input range (frequency):</b> 0÷1500Hz
	<b>Flow input accuracy (frequency):</b> 0.5%

Electrical data	<b>Supply voltage:</b> from 12 to 24 VDC $\pm 10\%$ regulated
	<b>Max electrical consumption:</b> < 300 mA
	<b>FLS Hall effect flow sensor power supply:</b> <ul style="list-style-type: none"> <li>– 5 VDC at &lt; 20 mA</li> <li>– Optically isolated from current loop</li> <li>– Short circuit protected</li> </ul>
	<b>2 current outputs:</b> <ul style="list-style-type: none"> <li>– 4–20 mA, isolated, fully adjustable and reversible</li> <li>– Max loop impedance: 800 <math>\Omega</math> @ 24 VDC – 250 <math>\Omega</math> @ 12 VDC</li> </ul>
Environmental data	<b>2 solid state relay outputs:</b> <ul style="list-style-type: none"> <li>– User selectable as MIN alarm, MAX alarm, pulse output, window alarm, off</li> <li>– Optically isolated, 50 mA max sink, 24 VDC max pull-up voltage</li> <li>– Max pulse/min: 300</li> <li>– Hysteresis: user selectable</li> </ul>
	<b>2 relay outputs:</b> <ul style="list-style-type: none"> <li>– User selectable as MIN alarm, MAX alarm, pulse output, window alarm, off</li> <li>– Mechanical Single Pole Double Throw (SPDT) contact</li> <li>– Expected mechanical life (min. operations): <math>10^7</math></li> <li>– Expected electrical life (min. operations): <math>10^5</math> switching N.A./N.C. capacity 5 A/240 VAC</li> <li>– Max pulse/min: 60</li> <li>– Hysteresis: user selectable</li> </ul>
	<b>Operating temperature:</b> from $-10^{\circ}\text{C}$ to $70^{\circ}\text{C}$ (from $14^{\circ}\text{F}$ to $158^{\circ}\text{F}$ )
	<b>Storage temperature:</b> from $-30^{\circ}\text{C}$ to $+80^{\circ}\text{C}$ (from $-22^{\circ}\text{F}$ to $+176^{\circ}\text{F}$ )
Standards & Approvals	<b>Relative humidity:</b> from 0 to 95% not condensing
	Manufactured under ISO 9001
	Manufactured under ISO 14001
	CE RoHS Compliance EAC

# ELECTRICAL CONNECTIONS

Rear view of electrical connections



# PRODUCT CODES



**M9.03.P1 – M9.03.WX**  
Dual Flow Monitor and Transmitter

Code	Mounting	Power supply	wires power Technology	Sensor Input	Output	Weight (gr.)
M9.03.P1	Panel	12 – 24 VDC	3/4 wires	2* Flow (Frequency)	2*(4-20mA) 2*(S.S.R.) 2* (mech. relay)	550
M9.03.W1	Wall	12 – 24 VDC	3/4 wires	2* Flow (Frequency)	2*(4-20mA) 2*(S.S.R.) 2* (mech. relay)	650
M9.03.W2	Wall	110 – 230 VAC	3/4 wires	2* Flow (Frequency)	2*(4-20mA) 2*(S.S.R.) 2* (mech. relay)	750

S.S.R: solid state relay / mech relay.: mechanical relay

# M9.07



Dual parameter conductivity and flow monitor and transmitter



# M9.07

The FLS M9.07 dual-parameter monitor and transmitter is a device that combines conductivity and flow measurements. A 4" wide full graphic display shows measured values clearly together with a lot of other useful information. Moreover, due to a multicolour display plus a powerful backlight, measurement status can be determined easily from afar too. A tutorial software guarantees a mistake-proof and fast set up of every parameter. Various types of calibration can be performed as needed for both measurements. The 4-20 mA output dedicated to each measurement allows you to send the values to a remote external device. Appropriate combination of digital outputs allows customised setups for any process to be controlled. The USB port on the back allows you to update the software with a wide range of customisation services as standard and on-demand.

## DUAL PARAMETER CONDUCTIVITY AND FLOW MONITOR AND TRANSMITTER

### APPLICATIONS

- Water treatment and regeneration
- Industrial wastewater treatment and recovery
- Softening
- Filtration systems
- Desalination
- Production of demineralised water
- Reverse osmosis
- cooling monitoring
- Processing and manufacturing industry
- Chemical production

### MAIN CHARACTERISTICS

- Large graphic display
- Colour backlighting
- On-line help
- Simultaneous measurement of conductivity, temperature and flow
- Simple, user-friendly and error-proof calibration software
- Mechanical relay and solid state relay for external alarms and for the control of external devices
- Multilingual menu
- USB port for software upgrade

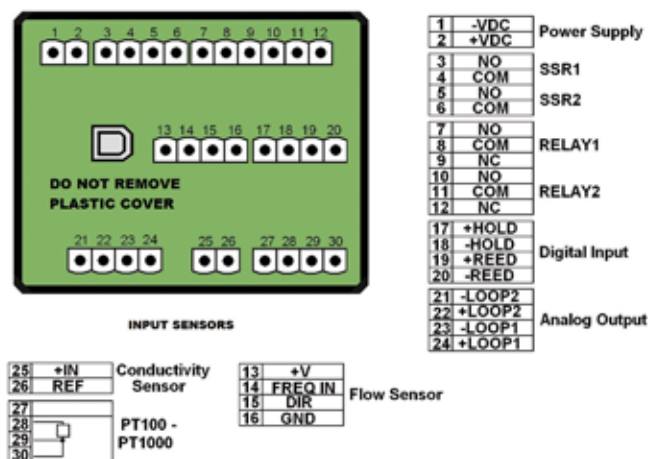
### TECHNICAL DATA

General information	<b>Compatible sensors:</b> F6.60 conductivity/temperature sensors and Hall-effect flow sensors with frequency output or electromagnetic flow sensors
	<b>Materials:</b> <ul style="list-style-type: none"> <li>– Case: ABS</li> <li>– Display: PC</li> <li>– Panel and wall gasket: silicone rubber</li> <li>– 5-button keyboard: silicone rubber</li> </ul>
	<b>Display:</b> <ul style="list-style-type: none"> <li>– LCD full graphic</li> <li>– Backlight version: 3 – colours</li> <li>– Backlighting activation: user adjustable with 5 levels of timing</li> <li>– Update rate: 1 second</li> <li>– Protection class: IP65 front</li> </ul>
	<b>Conductivity input range:</b> 0.055÷200000 µS/cm (according to the applied cell constant)
	<b>Conductivity measurement accuracy:</b> ±2.0% of reading value
	<b>Temperature input range:</b> –50÷150°C (–58÷302°F) (with Pt100–Pt1000)
	<b>Temperature measurement resolution:</b> 0.1°C/°F (Pt1000); 0.5°C/°F (Pt100)
	<b>Flow input range (frequency):</b> 0÷1500Hz
	<b>Flow input accuracy (frequency):</b> 0.5%

Electrical data	<b>Supply voltage:</b> from 12 to 24 VDC $\pm 10\%$ regulated
	<b>Max electrical consumption:</b> < 300 mA
	<b>FLS Hall effect flow sensor power supply:</b> <ul style="list-style-type: none"> <li>– 5 VDC at &lt; 20 mA</li> <li>– Optically isolated from current loop</li> <li>– Short circuit protected</li> </ul>
	<b>2 current output:</b> <ul style="list-style-type: none"> <li>– 4–20 mA, isolated, fully adjustable and reversible</li> <li>– Max loop impedance: 800 <math>\Omega</math> @ 24 VDC – 250 <math>\Omega</math> @ 12 VDC</li> </ul>
Environmental data	<b>2 solid state relay outputs:</b> <ul style="list-style-type: none"> <li>– User selectable as MIN alarm, MAX alarm, pulse output, window alarm, off</li> <li>– (conductivity ) User selectable as ON-OFF, proportional frequency output, timed pulses, off</li> <li>– Optically isolated, 50 mA max sink, 24 VDC max pull-up voltage</li> <li>– Max pulse/min: 300</li> <li>– Hysteresis: user selectable</li> </ul>
	<b>2 relay output:</b> <ul style="list-style-type: none"> <li>– User selectable as MIN alarm, MAX alarm, pulse output, window alarm, off</li> <li>– (conductivity ) User selectable as ON-OFF, proportional frequency output, timed pulses, off</li> <li>– Mechanical Single Pole Double Throw (SPDT) contact</li> <li>– Expected mechanical life (min. operations): <math>10^7</math></li> <li>– Expected electrical life (min. operations): <math>10^5</math> switching N.A./N.C. capacity 5 A/240 VAC</li> <li>– Max pulse/min: 60</li> <li>– Hysteresis: user selectable</li> </ul>
	<b>Operating temperature:</b> from $-10^{\circ}\text{C}$ to $70^{\circ}\text{C}$ (from $14^{\circ}\text{F}$ to $158^{\circ}\text{F}$ )
	<b>Storage temperature:</b> from $-30^{\circ}\text{C}$ to $+80^{\circ}\text{C}$ (from $-22^{\circ}\text{F}$ to $+176^{\circ}\text{F}$ )
Standards & Approvals	<b>Relative humidity:</b> from 0 to 95% not condensing
	Manufactured under ISO 9001
	Manufactured under ISO 14001
	CE RoHS Compliance EAC

## ELECTRICAL CONNECTIONS

Rear view of electrical connections



# PRODUCT CODES



## M9.07.P1 - M9.07.WX

Dual parameter conductivity and Flow Monitor and Transmitter

Code	Mounting	Power supply	wires power Technology	Sensor Input	Output	Weight (gr.)
M9.07.P1	Panel	12 - 24 VDC	3/4 wires	Conductivity temperature Flow (Frequency)	2*(4-20mA) 2*(S.S.R.) 2* (mech. relay)	550
M9.07.W1	Wall	12 - 24 VDC	3/4 wires	Conductivity temperature Flow (Frequency)	2*(4-20mA) 2*(S.S.R.) 2* (mech. relay)	650
M9.07.W2	Wall	110 - 230 VAC	3/4 wires	Conductivity temperature Flow (Frequency)	2*(4-20mA) 2*(S.S.R.) 2* (mech. relay)	750

S.S.R: solid state relay / mech relay.: mechanical relay



# M9.08



Dual parameter pH/ORP & flow monitor and transmitter



# M9.08

The FLS M9.08 dual-parameter monitor is a device that combines pH/ORP and flow measurements. A 4" wide full graphic display shows measured values clearly together with a lot of other useful information. Moreover, due to a multicolour display plus a powerful backlight, measurement status can be determined easily from afar too. The software provides assistance to minimise errors and speed up the configuration of all settings. Various types of calibration can be performed as needed for both measurements. The 4-20 mA output dedicated to each measurement allows you to send the values to a remote external device. Appropriate combination of digital outputs allows customised setups for any process to be controlled. The USB port on the back allows you to update the software with a wide range of customisation services as standard and on-demand.

## DUAL PARAMETER PH/ORP & FLOW MONITOR AND TRANSMITTER

### APPLICATIONS

- Water treatment and regeneration
- Industrial wastewater treatment and recovery
- Scrubber control
- Neutralisation systems
- Heavy metal recovery
- Coating of metal surfaces
- Processing and manufacturing industry
- Chemical production
- Swimming pools and spas

### MAIN CHARACTERISTICS

- Large graphic display
- Colour backlighting
- On-line help
- Simultaneous measurement of pH/ORP and flow
- User-friendly calibration procedures
- Mechanical relay and solid state relay for external alarms and for the control of external devices
- Multilingual menu
- USB port for software upgrade

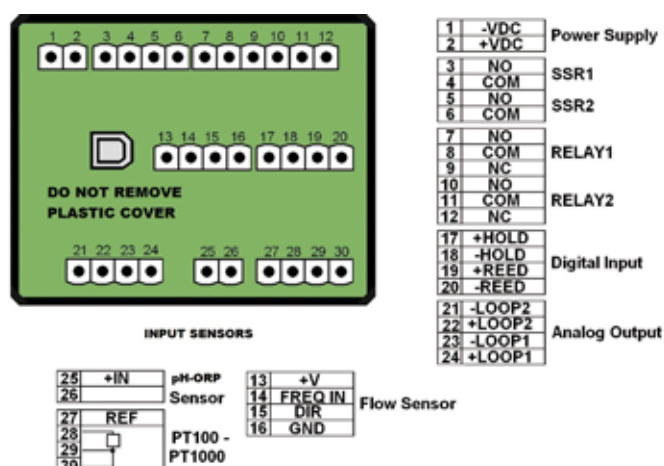
### TECHNICAL DATA

General information	<b>Compatible sensors:</b> F6.60 pH/ORP sensors and Hall-effect flow sensors with frequency output or electromagnetic flow meters
	<b>Materials:</b> – Case: ABS – Display: PC – Panel and wall gasket: silicone rubber – 5-button keyboard: silicone rubber
	<b>Display:</b> – Backlight version: 3 - colours – Backlighting activation: user adjustable with 5 levels of timing – Update rate: 1 second – Protection class: IP65 front
	<b>pH input range:</b> -2÷16 pH (depending on the pH electrode applied)
	<b>pH measurement resolution:</b> ±0.01 pH
	<b>ORP input range:</b> -2000÷2000 mV (depending on the ORP probe applied)
	<b>ORP measurement resolution:</b> ±1 mV
	<b>Temperature input range:</b> -50÷150°C (-58÷302°F) (with Pt100-Pt1000)
	<b>Temperature measurement resolution:</b> 0.1°C/°F (Pt1000); 0.5°C/°F (Pt100)
	<b>Flow input range (frequency):</b> 0÷1500Hz
	<b>Flow input accuracy (frequency):</b> 0.5%

Electrical data	<b>Supply voltage:</b> from 12 to 24 VDC ±10% regulated
	<b>Max electrical consumption:</b> < 300 mA
	<b>FLS Hall effect flow sensor power supply:</b> <ul style="list-style-type: none"> <li>– 5 VDC at &lt; 20 mA</li> <li>– Optically isolated from current loop</li> <li>– Short circuit protected</li> </ul>
	<b>2 current output:</b> <ul style="list-style-type: none"> <li>– 4–20 mA, isolated, fully adjustable and reversible</li> <li>– Max loop impedance: 800 Ω @ 24 VDC – 250 Ω @ 12 VDC</li> </ul>
Environmental data	<b>2 solid state relay outputs:</b> <ul style="list-style-type: none"> <li>– (flow) User selectable as MIN alarm, MAX alarm, pulse output, window alarm, off</li> <li>– (pH/ORP) User selectable as ON-OFF, proportional frequency output, timed pulses, off</li> <li>– Optically isolated, 50 mA max sink, 24 VDC max pull-up voltage</li> <li>– Max pulse/min: 300</li> <li>– Hysteresis: user selectable</li> </ul>
	<b>2 relay outputs:</b> <ul style="list-style-type: none"> <li>– (flow) User selectable as MIN alarm, MAX alarm, pulse output, window alarm, off</li> <li>– (pH/ORP) User selectable as ON-OFF, proportional frequency output, timed pulses, off</li> <li>– Mechanical Single Pole Double Throw (SPDT) contact</li> <li>– Expected mechanical life (min. operations): 10<sup>7</sup></li> <li>– Expected electrical life (min. operations): 10<sup>5</sup> switching N.A./N.C. capacity 5 A/240 VAC</li> <li>– Max pulse/min: 60</li> <li>– Hysteresis: user selectable</li> </ul>
	<b>Operating temperature:</b> from –10°C to 70°C (from 14°F to 158°F)
	<b>Storage temperature:</b> from –30°C to +80°C (from –22°F to +176°F)
Standards & Approvals	<b>Relative humidity:</b> from 0 to 95% not condensing
	Manufactured under ISO 9001 Manufactured under ISO 14001 CE RoHS Compliance EAC

## ELECTRICAL CONNECTIONS

Rear view of electrical connections



# PRODUCT CODES



## M9.08.P1 – M9.08.WX

Dual parameter pH/ORP & Flow Monitor and Transmitter

Code	Mounting	Power supply	wires power Technology	Sensor Input	Output	Weight (gr.)
M9.08.P1	Panel	12 – 24 VDC	3/4 wires	pH/ORP temperature Flow (Frequency)	2*(4-20mA) 2*(S.S.R.) 2* (mech. relay)	550
M9.08.W1	Wall	12 – 24 VDC	3/4 wires	pH/ORP temperature Flow (Frequency)	2*(4-20mA) 2*(S.S.R.) 2* (mech. relay)	650
M9.08.W2	Wall	110 – 230 VAC	3/4 wires	pH/ORP temperature Flow (Frequency)	2*(4-20mA) 2*(S.S.R.) 2* (mech. relay)	750

S.S.R: solid state relay / mech relay.: mechanical relay

# M9.10



Dual parameter analog signal monitor and transmitter



# M9.10

The FLS M9.10 monitor and transmitter is a powerful instrument designed to handle an analogue and a frequency signal (or two analogue signals) emitted by any type of device with a 4-20 mA or frequency output. The M9.10 monitor is equipped with a large 4" graphic display which shows measured values clearly and a lot of other useful information. Moreover, due to a multicolour display plus a powerful backlight, measurement status can be determined easily from afar too. A tutorial software guarantees a mistake-proof and fast set up of every parameter. Calibrations of the 4-20 mA input can be carried out by correcting 2 points and 1 point or by using a reference value with the new "in-line calibration". Frequency input calibration can be performed by fine tuning the installation features or using a reference value through the new "in-line calibration". Two independent 4-20 mA outputs are available to communicate measurements to an external remote device. Appropriate combination of digital outputs (2 solid state relays and 2 relays) allows customised setups for any process to be controlled. The USB port on the back allows you to update the software with a wide range of customisation services as standard and on-demand.

## DUAL PARAMETER ANALOG SIGNAL MONITOR AND TRANSMITTER

### APPLICATIONS

- Industrial wastewater treatment and recovery
- Civil wastewater treatment
- Water treatment processes
- Processing and manufacturing industry
- Transformation of chemicals
- Industrial environment with electromagnetic interference

### MAIN CHARACTERISTICS

- Large graphic display
- Colour backlighting
- On-line help
- Simultaneous display of two parameters
- Free setting of the unit of measurement
- User-friendly calibration procedure
- In-line adjustment on actual sample
- Ability to manage active and passive analogue signals
- USB port for software upgrade
- Mechanical relay and solid state relay for external alarms and for the control of external devices

### TECHNICAL DATA

#### General information

**Compatible sensors:** H Hall-effect flow sensors with frequency output, F6.60 electromagnetic flow sensors and all devices that generate a passive or active 4-20 mA signal

#### Materials:

- Case: ABS
- Display: PC
- Panel and wall gasket: silicone rubber
- 5-button keyboard: silicone rubber

#### Display:

- LCD full graphic
- Backlight version: 3 - colours
- Backlighting activation: user adjustable with 5 levels of timing
- Update rate: 1 second
- Protection class: IP65 front

**Frequency input range (frequency):** 0÷100Hz

**Frequency accuracy (frequency):** 0,5%

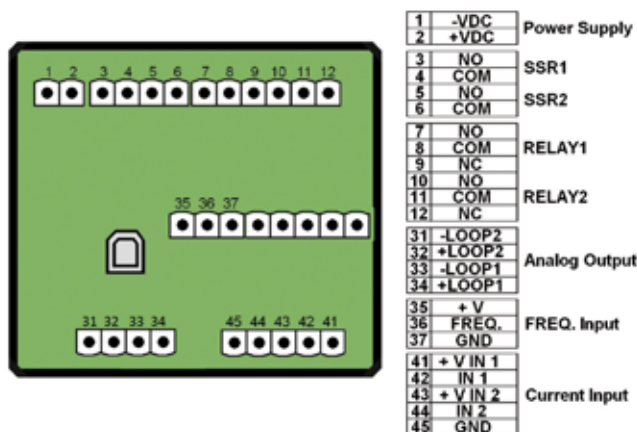
**Analogue input range (current):** 3.8÷21.0 mA

**Analogue input accuracy (current):** 0.01 mA

<b>Electrical data</b>	<b>Supply voltage:</b> from 12 to 24 VDC $\pm 10\%$ regulated
	<b>Max electrical consumption:</b> < 300 mA
	<b>FLS Hall effect flow sensor power supply:</b> <ul style="list-style-type: none"> <li>– 5 VDC at &lt; 20 mA</li> <li>– Optically isolated from current loop</li> <li>– Short circuit protected</li> </ul>
	<b>Power supply 2 current inputs:</b> <ul style="list-style-type: none"> <li>– 18 VDC at <math>\leq 20</math> mA</li> </ul>
	<b>2 current outputs:</b> <ul style="list-style-type: none"> <li>– 4–20 mA, isolated, fully adjustable and reversible</li> <li>– Max loop impedance: 800 <math>\Omega</math> @ 24 VDC – 250 <math>\Omega</math> @ 12 VDC</li> </ul>
<b>Environmental data</b>	<b>2 solid state relay outputs:</b> <ul style="list-style-type: none"> <li>– User selectable as MIN alarm, MAX alarm, pulse output (frequency input only), window alarm, off</li> <li>– Optically isolated, 50 mA max sink, 24 VDC max pull-up voltage</li> <li>– Max pulse/min: 300</li> <li>– Hysteresis: user selectable</li> </ul>
	<b>2 relay outputs:</b> <ul style="list-style-type: none"> <li>– User selectable as MIN alarm, MAX alarm, pulse output (frequency input only), window alarm, off</li> <li>– Mechanical Single Pole Double Throw (SPDT) contact</li> <li>– Expected mechanical life (min. operations): <math>10^7</math></li> <li>– Expected electrical life (min. operations): <math>10^5</math> switching N.A./N.C. capacity 5 A/240 VAC</li> <li>– Max pulse/min: 60</li> <li>– Hysteresis: user selectable</li> </ul>
	<b>Operating temperature:</b> from $-10^{\circ}\text{C}$ to $70^{\circ}\text{C}$ (from $14^{\circ}\text{F}$ to $158^{\circ}\text{F}$ )
	<b>Storage temperature:</b> from $-30^{\circ}\text{C}$ to $+80^{\circ}\text{C}$ (from $-22^{\circ}\text{F}$ to $+176^{\circ}\text{F}$ )
	<b>Relative humidity:</b> from 0 to 95% not condensing
<b>Standards &amp; Approvals</b>	Manufactured under ISO 9001 Manufactured under ISO 14001 CE RoHS Compliance EAC

## ELECTRICAL CONNECTIONS

Rear view of electrical connections



# PRODUCT CODES



## M9.10.P1 – M9.10.WX

Dual Parameter Analog signal Monitor and Transmitter

Code	Mounting	Power supply	wires power Technology	Sensor Input	Output	Weight (gr.)
M9.10.P1	Panel	12 – 24 VDC	3/4 wires	2* (4-20mA)	2*(4-20mA) 2*(S.S.R.) 2* (mech. relay)	550
M9.10.W1	Wall	12 – 24 VDC	3/4 wires	2* (4-20mA)	2*(4-20mA) 2*(S.S.R.) 2* (mech. relay)	650
M9.10.W2	Wall	110 – 230 VAC	3/4 wires	2* (4-20mA)	2*(4-20mA) 2*(S.S.R.) 2* (mech. relay)	750

S.S.R: solid state relay / mech relay.: mechanical relay



# **PADDLEWHEEL AND ELECTROMAGNETIC FLOW SENSORS**

**Versatile installation and application flexibility**





# F3.00

Paddlewheel flow sensor



# F3.00

The FLS F3.00 paddlewheel flow sensor model is a simple and reliable device designed for use with any type of solid-free liquids. The sensor is capable of measuring flows from 0.15 m/s (0.5 ft/s) producing a highly repeatable output frequency signal. Extremely solid construction and consolidated technology ensure exceptional returns, with zero or very little maintenance. Dedicated electronics with push-pull output are available for safe connection to any type of digital instrument/PLC input. The family of specially designed adapters reduces installation times in pipes of all materials and sizes, from DN15 to DN600 (0.5-24").

## PADDLEWHEEL FLOW SENSOR

### APPLICATIONS

- Water treatment and regeneration
- Industrial wastewater treatment and recovery
- Finishing of fabrics
- Water distribution
- Processing and manufacturing industry
- Filtration systems
- Chemical production
- Liquid dispensing systems
- cooling monitoring
- Heat exchangers
- Swimming pools
- Pump protection

### MAIN CHARACTERISTICS

- Sensor body in C-PVC, PVDF or stainless steel
- Two lengths, for pipes from DN15 up to DN600
- Simple insertion system
- IP65 or IP68 protection class
- Measurement range over 50:1
- High chemical resistance
- Battery powered models
- Push-pull output for connection to PLC

TECHNICAL DATA	
General information	<b>Pipe size range:</b> Compatible sensors]:from DN15 to DN600 (0.5-24") For more details, refer to the Installation Adapters section
	<b>Flow range:</b> from 0.15 to 8 m/s (0.5-25 ft/s)
	<b>Linearity:</b> ±0.75% of full scale
	<b>Repeatability:</b> ±0.5% of full scale
	<b>Minimum Reynolds number required:</b> 4,500
	<b>Protection class:</b> IP68 or IP65
	<b>Materials in contact with liquids:</b> <ul style="list-style-type: none"><li>– Sensor body: C-PVC, PVDF or AISI 316L stainless steel</li><li>– O-ring: EPDM or FKM</li><li>– Rotor: ECTFE (Halar®)</li><li>– Shaft: Ceramic (Al2O3) / AISI 316 Stainless Steel (for metal sensors)</li><li>– Bearings: Ceramic (Al2O3) / absent (for metal sensors)</li></ul>
	<b>Supply voltage:</b> from 5 to 24 VDC ±10% regulated
	<b>Supply current:</b> < 30 mA at 24 VDC
	<b>Output signal:</b> <ul style="list-style-type: none"><li>– Square wave</li><li>– Frequency: 45 Hz for nominal m/s (13.7 Hz for nominal ft/s)</li><li>– type: NPN Open collector transistor</li><li>– Output current: max 10 mA</li></ul>
Specific data for F3.00.H	<b>Cable length:</b> 8 m standard, max 300 m

<b>Specific data for F3.00.C</b>	<b>Supply voltage:</b> from 3 to 5 VDC regulated or 3.6 V lithium battery
	<b>Supply current:</b> < 10 mA max
	<b>Output signal:</b> – Square wave – Frequency: 45 Hz for nominal m/s (13.7 Hz for nominal ft/s) – Min input impedance: 100 kΩ
	<b>Cable length:</b> 8 m standard, max 300 m
<b>Specific data for F3.00.P</b>	<b>Supply voltage:</b> from 12 to 24 VDC ±10% regulated
	<b>Supply current:</b> < 30 mA at 24 VDC
	<b>Output signal:</b> – Square wave: – Frequency: 45 Hz for nominal m/s (13.7 Hz for nominal ft/s) – Type: push-pull (for connection to NPN and PNP inputs) – Output current: max 20 mA
	<b>Cable length:</b> standard 8m (26.4ft), max 300m (990ft)
<b>Standards &amp; Approvals</b>	Manufactured under ISO 9001 Manufactured under ISO 14001 CE RoHS Compliance EAC

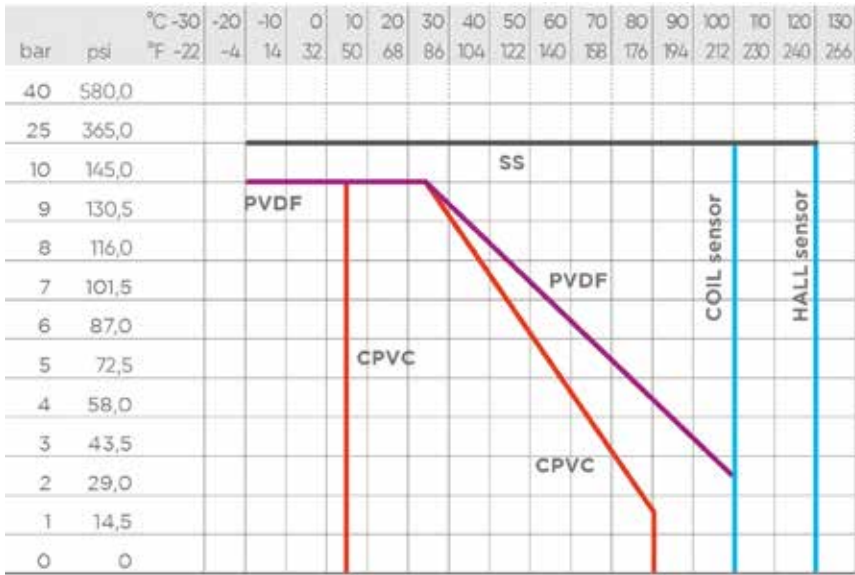
# MAX OPERATING PRESSURE/ TEMPERATURE (25-YEAR DURATION)

## F3.00.H or F3.00.P sensor

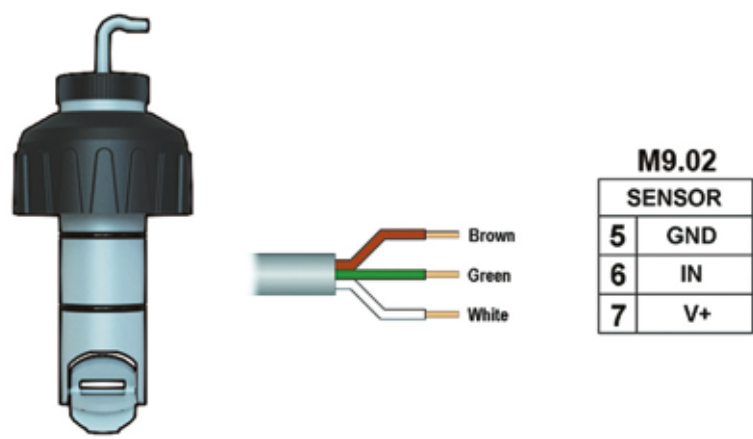
- C-PVC body:
  - 10 bar (145 psi) at 25°C (77°F)
  - 1.5 bar (22 psi) at 80°C (176°F)
- PVDF body:
  - 10 bar (145 psi) at 25°C (77°F)
  - 2.5 bar (36 psi) at 100°C (212°F)
- Stainless steel body:
  - 25 bar (363 psi) at 120°C (248°F)

## F3.00.C sensor

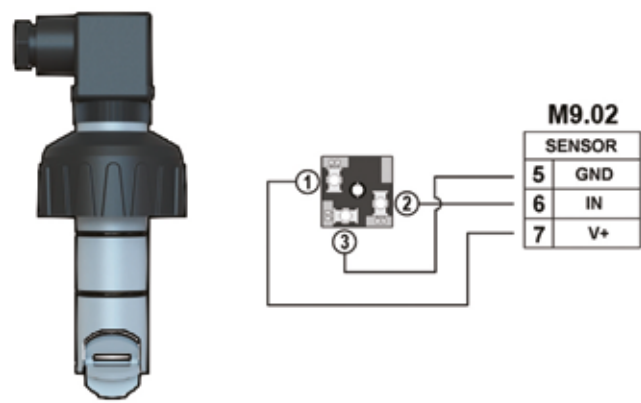
- C-PVC body:
  - 10 bar (145 psi) at 25°C (77°F)
  - 1.5 bar (22 psi) at 80°C (176°F)
- PVDF body:
  - 10 bar (145 psi) at 25°C (77°F)
  - 2.5 bar (36 psi) at 100°C (212°F)
- Stainless steel body:
  - 25 bar (363 psi) at 100°C (212°F)



### F3.00.H IP68 SENSOR ELECTRICAL CONNECTIONS



### F3.00.H IP65 SENSOR ELECTRICAL CONNECTIONS



### ELECTRICAL CONNECTIONS OF F3.00.H TO OTHER INDICATORS

	M9.00	M9.50	M9.03 input 1	M9.03 input 2	M9.07	M9.08	M9.10
GND	7	30	30	16	16	16	37
FREQ	8	28	28	14	14	14	36
V+	9	27	27	13	13	13	35

# PRODUCT CODES



## F3.00.H.XX

Paddlewheel Flow Sensor (Remote version)

Code	Version	Power supply	Length	Main Wetted Materials	Enclosure	Flow Rate Range	Weight (gr.)
F3.00.H.01	Hall	5 - 24 VDC	L0	C-PVC EPDM	IP68	From 0,15 to 8 m/s*	250
F3.00.H.02	Hall	5 - 24 VDC	L0	C-PVC FKM	IP68	From 0,15 to 8 m/s*	250
F3.00.H.03	Hall	5 - 24 VDC	L1	C-PVC EPDM	IP68	From 0,15 to 8 m/s*	300
F3.00.H.04	Hall	5 - 24 VDC	L1	C-PVC FKM	IP68	From 0,15 to 8 m/s*	300
F3.00.H.05	Hall	5 - 24 VDC	L0	PVDF EPDM	IP68	From 0,15 to 8 m/s*	250
F3.00.H.06	Hall	5 - 24 VDC	L0	PVDF FKM	IP68	From 0,15 to 8 m/s*	250
F3.00.H.07	Hall	5 - 24 VDC	L1	PVDF EPDM	IP68	From 0,15 to 8 m/s*	300
F3.00.H.08	Hall	5 - 24 VDC	L1	PVDF FKM	IP68	From 0,15 to 8 m/s*	300
F3.00.H.09	Hall	5 - 24 VDC	L0	316L SS EPDM	IP68	From 0,15 to 8 m/s*	600
F3.00.H.10	Hall	5 - 24 VDC	L0	316L SS FKM	IP68	From 0,15 to 8 m/s*	600
F3.00.H.11	Hall	5 - 24 VDC	L1	316L SS EPDM	IP68	From 0,15 to 8 m/s*	650
F3.00.H.12	Hall	5 - 24 VDC	L1	316L SS FKM	IP68	From 0,15 to 8 m/s*	650
F3.00.H.13	Hall	5 - 24 VDC	L0	C-PVC EPDM	IP65	From 0,15 to 8 m/s*	250
F3.00.H.14	Hall	5 - 24 VDC	L0	C-PVC FKM	IP65	From 0,15 to 8 m/s*	250
F3.00.H.15	Hall	5 - 24 VDC	L1	C-PVC EPDM	IP65	From 0,15 to 8 m/s*	300
F3.00.H.16	Hall	5 - 24 VDC	L1	C-PVC FKM	IP65	From 0,15 to 8 m/s*	300
F3.00.H.17	Hall	5 - 24 VDC	L0	PVDF EPDM	IP65	From 0,15 to 8 m/s*	250
F3.00.H.18	Hall	5 - 24 VDC	L0	PVDF FKM	IP65	From 0,15 to 8 m/s*	250
F3.00.H.19	Hall	5 - 24 VDC	L1	PVDF EPDM	IP65	From 0,15 to 8 m/s*	300
F3.00.H.20	Hall	5 - 24 VDC	L1	PVDF FKM	IP65	From 0,15 to 8 m/s*	300
F3.00.H.21	Hall	5 - 24 VDC	L0	316L SS EPDM	IP65	From 0,15 to 8 m/s*	600
F3.00.H.22	Hall	5 - 24 VDC	L0	316L SS FKM	IP65	From 0,15 to 8 m/s*	600
F3.00.H.23	Hall	5 - 24 VDC	L1	316L SS EPDM	IP65	From 0,15 to 8 m/s*	650
F3.00.H.24	Hall	5 - 24 VDC	L1	316L SS FKM	IP65	From 0,15 to 8 m/s*	650

\* from 0,15 to 8 m/s = (0,5-25 feet/s)



## F3.00.C.XX

Paddlewheel Flow Sensor (Remote version for Battery powered monitor M9.20)

Code	Version	Power supply	Length	Main Wetted Materials	Enclosure	Flow Rate Range	Weight (gr.)
F3.00.C.01	Coil	3 - 5 VDC	L0	C-PVC EPDM	IP68	From 0,15 to 8 m/s*	250
F3.00.C.02	Coil	3 - 5 VDC	L0	C-PVC FKM	IP68	From 0,15 to 8 m/s*	250
F3.00.C.03	Coil	3 - 5 VDC	L1	C-PVC EPDM	IP68	From 0,15 to 8 m/s*	300
F3.00.C.04	Coil	3 - 5 VDC	L1	C-PVC FKM	IP68	From 0,15 to 8 m/s*	300
F3.00.C.05	Coil	3 - 5 VDC	L0	PVDF EPDM	IP68	From 0,15 to 8 m/s*	250
F3.00.C.06	Coil	3 - 5 VDC	L0	PVDF FKM	IP68	From 0,15 to 8 m/s*	250
F3.00.C.07	Coil	3 - 5 VDC	L1	PVDF EPDM	IP68	From 0,15 to 8 m/s*	300
F3.00.C.08	Coil	3 - 5 VDC	L1	PVDF FKM	IP68	From 0,15 to 8 m/s*	300
F3.00.C.09	Coil	3 - 5 VDC	L0	316L SS EPDM	IP68	From 0,15 to 8 m/s*	600
F3.00.C.10	Coil	3 - 5 VDC	L0	316L SS FKM	IP68	From 0,15 to 8 m/s*	600
F3.00.C.11	Coil	3 - 5 VDC	L1	316L SS EPDM	IP68	From 0,15 to 8 m/s*	650
F3.00.C.12	Coil	3 - 5 VDC	L1	316L SS FKM	IP68	From 0,15 to 8 m/s*	650
F3.00.C.13	Coil	3 - 5 VDC	L0	C-PVC EPDM	IP65	From 0,15 to 8 m/s*	250
F3.00.C.14	Coil	3 - 5 VDC	L0	C-PVC FKM	IP65	From 0,15 to 8 m/s*	250
F3.00.C.15	Coil	3 - 5 VDC	L1	C-PVC EPDM	IP65	From 0,15 to 8 m/s*	300
F3.00.C.16	Coil	3 - 5 VDC	L1	C-PVC FKM	IP65	From 0,15 to 8 m/s*	300
F3.00.C.17	Coil	3 - 5 VDC	L0	PVDF EPDM	IP65	From 0,15 to 8 m/s*	250
F3.00.C.18	Coil	3 - 5 VDC	L0	PVDF FKM	IP65	From 0,15 to 8 m/s*	250
F3.00.C.19	Coil	3 - 5 VDC	L1	PVDF EPDM	IP65	From 0,15 to 8 m/s*	300
F3.00.C.20	Coil	3 - 5 VDC	L1	PVDF FKM	IP65	From 0,15 to 8 m/s*	300
F3.00.C.21	Coil	3 - 5 VDC	L0	316L SS EPDM	IP65	From 0,15 to 8 m/s*	600
F3.00.C.22	Coil	3 - 5 VDC	L0	316L SS FKM	IP65	From 0,15 to 8 m/s*	600
F3.00.C.23	Coil	3 - 5 VDC	L1	316L SS EPDM	IP65	From 0,15 to 8 m/s*	650
F3.00.C.24	Coil	3 - 5 VDC	L1	316L SS FKM	IP65	From 0,15 to 8 m/s*	650

\* from 0,15 to 8 m/s = (0,5-25 feet/s)





## F3.00.P.XX

Paddlewheel Flow Sensor (for direct connection to PLC)

Code	Version	Power supply	Length	Main Wetted Materials	Enclosure	Flow Rate Range	Weight (gr.)
F3.00.P.01	Push-Pull	12 - 24 VDC	L0	C-PVC EPDM	IP68	From 0,15 to 8 m/s*	250
F3.00.P.02	Push-Pull	12 - 24 VDC	L0	C-PVC FKM	IP68	From 0,15 to 8 m/s*	250
F3.00.P.03	Push-Pull	12 - 24 VDC	L1	C-PVC EPDM	IP68	From 0,15 to 8 m/s*	300
F3.00.P.04	Push-Pull	12 - 24 VDC	L1	C-PVC FKM	IP68	From 0,15 to 8 m/s*	300
F3.00.P.05	Push-Pull	12 - 24 VDC	L0	PVDF EPDM	IP68	From 0,15 to 8 m/s*	250
F3.00.P.06	Push-Pull	12 - 24 VDC	L0	PVDF FKM	IP68	From 0,15 to 8 m/s*	250
F3.00.P.07	Push-Pull	12 - 24 VDC	L1	PVDF EPDM	IP68	From 0,15 to 8 m/s*	300
F3.00.P.08	Push-Pull	12 - 24 VDC	L1	PVDF FKM	IP68	From 0,15 to 8 m/s*	300
F3.00.P.09	Push-Pull	12 - 24 VDC	L0	316L SS EPDM	IP68	From 0,15 to 8 m/s*	600
F3.00.P.10	Push-Pull	12 - 24 VDC	L0	316L SS FKM	IP68	From 0,15 to 8 m/s*	600
F3.00.P.11	Push-Pull	12 - 24 VDC	L1	316L SS EPDM	IP68	From 0,15 to 8 m/s*	650
F3.00.P.12	Push-Pull	12 - 24 VDC	L1	316L SS FKM	IP68	From 0,15 to 8 m/s*	650
F3.00.P.13	Push-Pull	12 - 24 VDC	L0	C-PVC EPDM	IP65	From 0,15 to 8 m/s*	250
F3.00.P.14	Push-Pull	12 - 24 VDC	L0	C-PVC FKM	IP65	From 0,15 to 8 m/s*	250
F3.00.P.15	Push-Pull	12 - 24 VDC	L1	C-PVC EPDM	IP65	From 0,15 to 8 m/s*	300
F3.00.P.16	Push-Pull	12 - 24 VDC	L1	C-PVC FKM	IP65	From 0,15 to 8 m/s*	300
F3.00.P.17	Push-Pull	12 - 24 VDC	L0	PVDF EPDM	IP65	From 0,15 to 8 m/s*	250
F3.00.P.18	Push-Pull	12 - 24 VDC	L0	PVDF FKM	IP65	From 0,15 to 8 m/s*	250
F3.00.P.19	Push-Pull	12 - 24 VDC	L1	PVDF EPDM	IP65	From 0,15 to 8 m/s*	300
F3.00.P.20	Push-Pull	12 - 24 VDC	L1	PVDF FKM	IP65	From 0,15 to 8 m/s*	300
F3.00.P.21	Push-Pull	12 - 24 VDC	L0	316L SS EPDM	IP65	From 0,15 to 8 m/s*	600
F3.00.P.22	Push-Pull	12 - 24 VDC	L0	316L SS FKM	IP65	From 0,15 to 8 m/s*	600
F3.00.P.23	Push-Pull	12 - 24 VDC	L1	316L SS EPDM	IP65	From 0,15 to 8 m/s*	650
F3.00.P.24	Push-Pull	12 - 24 VDC	L1	316L SS FKM	IP65	From 0,15 to 8 m/s*	650

\* from 0,15 to 8 m/s = (0,5-25 feet/s)



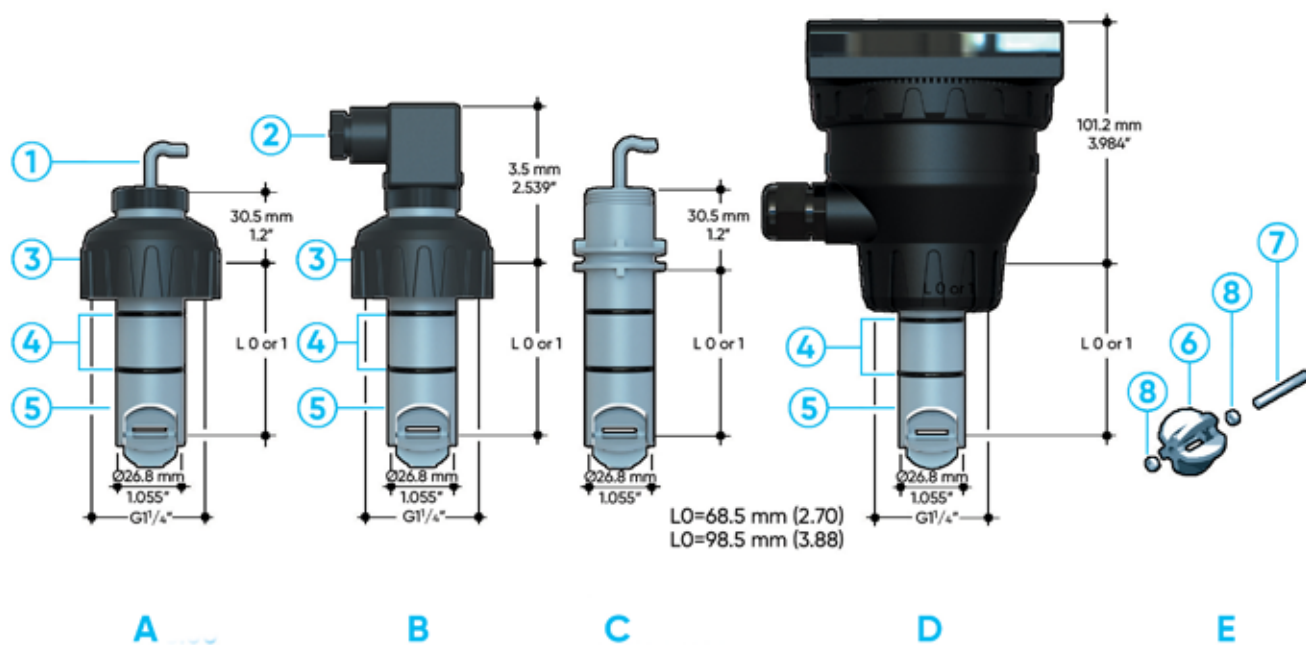
## F3.01.H.XX - F03.01.C.XX

Paddlewheel Flow Sensor (Compact version)

Code	Version	Power supply	Length	Main Wetted Materials	Enclosure	Flow Rate Range	Weight (gr.)
F3.01.H.01	Hall	5 - 24 VDC	L0	C-PVC EPDM	IP68	From 0,15 to 8 m/s*	250
F3.01.H.02	Hall	5 - 24 VDC	L0	C-PVC FKM	IP68	From 0,15 to 8 m/s*	250
F3.01.H.03	Hall	5 - 24 VDC	L1	C-PVC EPDM	IP68	From 0,15 to 8 m/s*	300
F3.01.H.04	Hall	5 - 24 VDC	L1	C-PVC FKM	IP68	From 0,15 to 8 m/s*	300
F3.01.H.05	Hall	5 - 24 VDC	L0	PVDF EPDM	IP68	From 0,15 to 8 m/s*	250
F3.01.H.06	Hall	5 - 24 VDC	L0	PVDF FKM	IP68	From 0,15 to 8 m/s*	250
F3.01.H.07	Hall	5 - 24 VDC	L1	PVDF EPDM	IP68	From 0,15 to 8 m/s*	300
F3.01.H.08	Hall	5 - 24 VDC	L1	PVDF FKM	IP68	From 0,15 to 8 m/s*	300
F3.01.H.09	Hall	5 - 24 VDC	L0	316L SS EPDM	IP68	From 0,15 to 8 m/s*	600
F3.01.H.10	Hall	5 - 24 VDC	L0	316L SS FKM	IP68	From 0,15 to 8 m/s*	600
F3.01.H.11	Hall	5 - 24 VDC	L1	316L SS EPDM	IP68	From 0,15 to 8 m/s*	650
F3.01.H.12	Hall	5 - 24 VDC	L1	316L SS FKM	IP68	From 0,15 to 8 m/s*	650
F3.01.C.01	Coil	3 - 5 VDC	L0	C-PVC EPDM	IP68	From 0,15 to 8 m/s*	250
F3.01.C.02	Coil	3 - 5 VDC	L0	C-PVC FKM	IP68	From 0,15 to 8 m/s*	250
F3.01.C.03	Coil	3 - 5 VDC	L1	C-PVC EPDM	IP68	From 0,15 to 8 m/s*	300
F3.01.C.04	Coil	3 - 5 VDC	L1	C-PVC FKM	IP68	From 0,15 to 8 m/s*	300
F3.01.C.05	Coil	3 - 5 VDC	L0	PVDF EPDM	IP68	From 0,15 to 8 m/s*	250
F3.01.C.06	Coil	3 - 5 VDC	L0	PVDF FKM	IP68	From 0,15 to 8 m/s*	250
F3.01.C.07	Coil	3 - 5 VDC	L1	PVDF EPDM	IP68	From 0,15 to 8 m/s*	300
F3.01.C.08	Coil	3 - 5 VDC	L1	PVDF FKM	IP68	From 0,15 to 8 m/s*	300
F3.01.C.09	Coil	3 - 5 VDC	L0	316L SS EPDM	IP68	From 0,15 to 8 m/s*	600
F3.01.C.10	Coil	3 - 5 VDC	L0	316L SS FKM	IP68	From 0,15 to 8 m/s*	600
F3.01.C.11	Coil	3 - 5 VDC	L1	316L SS EPDM	IP68	From 0,15 to 8 m/s*	650
F3.01.C.12	Coil	3 - 5 VDC	L1	316L SS FKM	IP68	From 0,15 to 8 m/s*	650

\* from 0,15 to 8 m/s = (0,5-25 feet/s)

# TECHNICAL DRAWINGS



- A** F3.00 IP68 Remote Sensor
- B** F3.00 IP65 Remote Sensor
- C** F3.01 Compact Sensor
- D** F3.01 Compact Sensor + Transmitter (sold separately)
- E** Paddlewheel system
- 1** Electrical cable: 8 m. (26.4 ft) standard

- 2** 4 pole cable plug according to DIN 43650-B/ISO 6952
- 3** U-PVC cap for installation into fittings (SS 316L for metal sensor)
- 4** O-Ring seals available in EPDM or FPM
- 5** C-PVC, PVDF or Stainless Steel sensor body
- 6** ECTFE Halar® (registered trademark of Ausimont-Solvay) Open-cell rotor

- 7** Ceramic shaft (SS 316L for metal sensor)
- 8** Ceramic bearings (none for metal sensor)



# F3.00.W



Wireless paddlewheel flow sensor



# F3.00.W

The FLS F3.00.W Wireless paddlewheel flow sensor is an innovative flow monitoring system based on Bluetooth® Low Energy transmission technology. The paddlewheel flow sensor is equipped with a transmitter that communicates with the receiver. The receiver is compatible with monitors or other devices with digital inputs. The F3.00.W system is a reliable solution for any type of solid-free liquid. Easy and quick to install, it is suitable for pipes in various materials and sizes, from DN15 to DN600 (0.5" - 24"). It can cover operating distances of up to 100 metres and work in the presence of electromagnetic interference generated by devices such as pumps or inverters. In addition, thanks to the self-diagnosis system, the user is always informed of any problems related to lack of signal or flat battery.

## WIRELESS PADDLEWHEEL FLOW SENSOR

### APPLICATIONS

- Water and industrial wastewater treatment
- Water cooling systems
- Swimming pools
- Flow control and monitoring
- Water regeneration plants
- Processing and manufacturing industry
- Water distribution
- Irrigation and agriculture

### MAIN CHARACTERISTICS

- High chemical resistance
- Pipe size range: from DN15 (0.5") to DN600 (24")
- Low pressure drop
- Automatic coupling system
- Self-diagnosis control and reporting
- High immunity to electromagnetic interference
- Long operating distance

### TECHNICAL DATA

#### General information

**Pipe size range:** from DN15 to DN600 (0.5-24") For more details, refer to the Installation Adapters section

**Flow range:** from 0.15 to 8 m/s (0.5-25 ft/s)

**Linearity:** ±0.75% of full scale

**Repeatability:** ±0.5% of full scale

**Minimum Reynolds number required:** 4,500

**Protection class:** IP65

#### Materials in contact with liquids:

- Sensor body: C-PVC, PVDF or AISI 316L stainless steel
- O-ring: EPDM or FKM
- Rotor: ECTFE (Halar®)
- Shaft: Ceramic ( $Al_2O_3$ ) / AISI 316 Stainless Steel (for metal sensors)
- Bearings: Ceramic ( $Al_2O_3$ )

#### Electrical data

#### Transmitter:

- Power supply: 3.6V Lithium Thionyl Chloride battery, size C, 8.5 Ahr
- Battery life: nominal 2 years

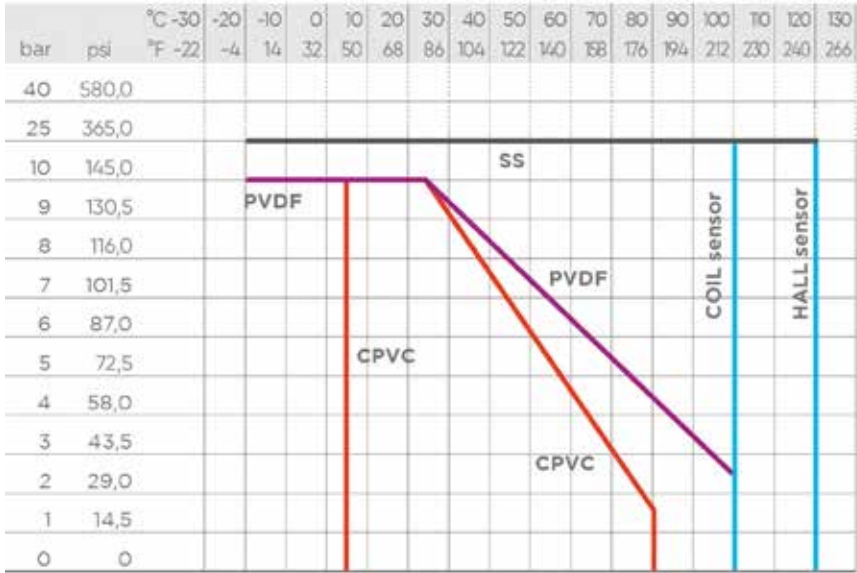
#### Receiver:

- Power supply: 5-24 V CC ±10% a 20 mA
- Output signal for flow measurement and lack of signal:
  - Square wave
  - Frequency: 45 Hz for nominal m/s (13.7 Hz for nominal ft/s)
  - Type: NPN Open collector transistor
- Output signal for flat battery:
  - Type: NPN Open collector
  - Max pull-up voltage 24 VDC
  - Max current: 50 mA
  - Battery level: 0V DC flat battery + V DC fully charged

Environmental data	Operating temperature: from -20 to +70°C (from -4 to 158°F)
	Storage temperature: -30 to +80°C (from -22 to 176°F)
	Relative humidity: from 0 to 95% not condensing
Standards & Approvals	Manufactured under ISO 9001 Manufactured under ISO 14001 CE RoHS Compliance EAC

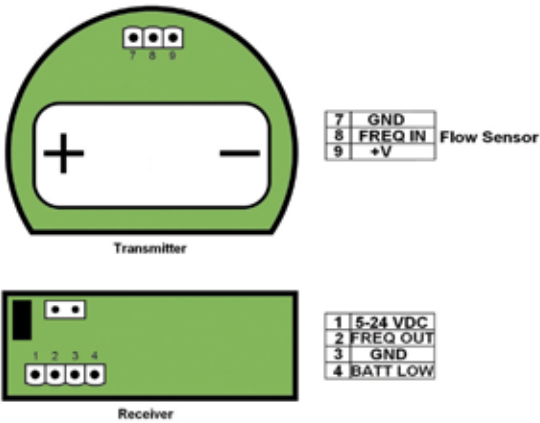
## MAX OPERATING PRESSURE/ TEMPERATURE (25-YEAR DURATION)

- C-PVC body:
  - 10 bar (145 psi) at 25°C (77°F)
  - 1.5 bar (22 psi) at 80°C (176°F)
- PVDF body:
  - 10 bar (145 psi) at 25°C (77°F)
  - 2.5 bar (36 psi) at 100°C (212°F)
- Stainless steel body:
  - 25 bar (363 psi) at 120°C (248°F)



## ELECTRICAL CONNECTIONS

Rear view of electrical connections



# PRODUCT CODES



## F3.00.W.XX

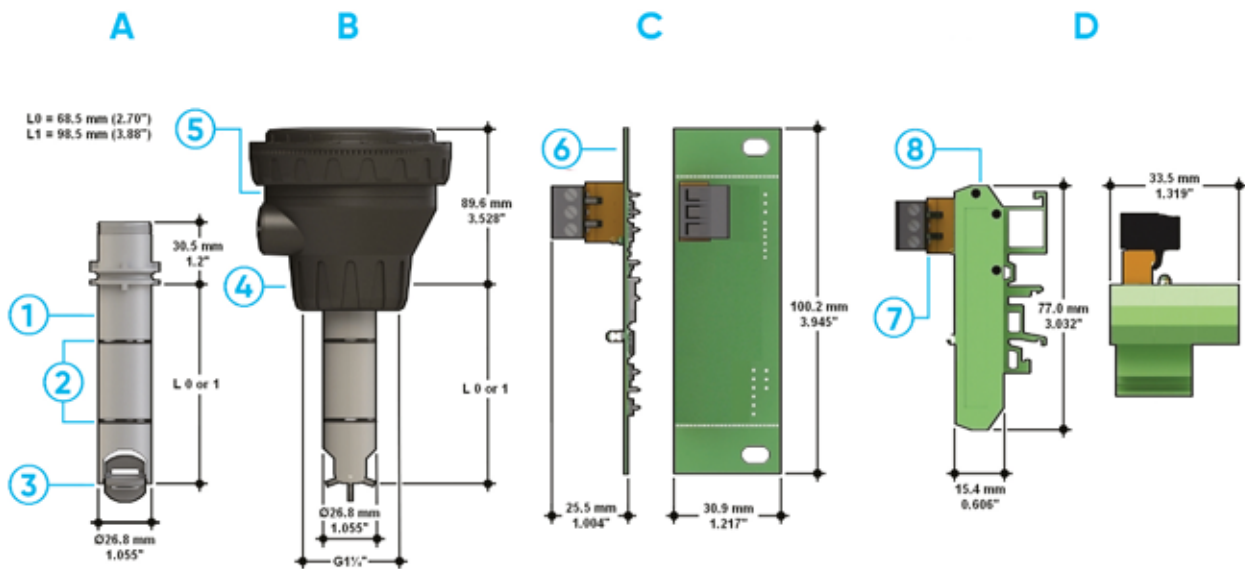
Paddlewheel wireless Flow Sensor (B.L.E.)

Code	Version	Power supply	Length	Main Wetted Materials	Enclosure	Flow Rate Range	Weight (gr.)
F3.00.W.13	wireless	Battery	L0	C-PVC EPDM	IP65	From 0,15 to 8 m/s*	750
F3.00.W.14	wireless	Battery	L0	C-PVC FKM	IP65	From 0,15 to 8 m/s*	750
F3.00.W.15	wireless	Battery	L1	C-PVC EPDM	IP65	From 0,15 to 8 m/s*	800
F3.00.W.16	wireless	Battery	L1	C-PVC FKM	IP65	From 0,15 to 8 m/s*	800
F3.00.W.17	wireless	Battery	L0	PVDF EPDM	IP65	From 0,15 to 8 m/s*	750
F3.00.W.18	wireless	Battery	L0	PVDF FKM	IP65	From 0,15 to 8 m/s*	750
F3.00.W.19	wireless	Battery	L1	PVDF EPDM	IP65	From 0,15 to 8 m/s*	800
F3.00.W.20	wireless	Battery	L1	PVDF FKM	IP65	From 0,15 to 8 m/s*	800
F3.00.W.21	wireless	Battery	L0	316L SS EPDM	IP65	From 0,15 to 8 m/s*	950
F3.00.W.22	wireless	Battery	L0	316L SS FKM	IP65	From 0,15 to 8 m/s*	950
F3.00.W.23	wireless	Battery	L1	316L SS EPDM	IP65	From 0,15 to 8 m/s*	1000
F3.00.W.24	wireless	Battery	L1	316L SS FKM	IP65	From 0,15 to 8 m/s*	1000

\* from 0,15 to 8 m/s = (0,5-25 feet/s)



# TECHNICAL DRAWINGS



- |   |  |   |
|---|--|---|
| <b>A</b> Sensor body                          | <b>1</b> Sensor body C-PVC, PVDF, 316L SS  | <b>4</b> ABS cap for installation into fittings |
| <b>B</b> F3.00.W Paddlewheel Flow transmitter | <b>2</b> O-Ring (EPDM or FPM)  | <b>5</b> Electronic box                         |
| <b>C</b> Receiver PCB                         | <b>3</b> Halar Rotor, Ceramic shaft & bearings for PVDF and C-PVC version and 316 SS Shaft for metal version | <b>6</b> PCB                                    |
| <b>D</b> Receiver + DIN bar adapter           |  | <b>7</b> Connectors                             |
|   |  | <b>8</b> DIN bar case adapter                   |



# F3.20



High pressure paddlewheel flow sensor



# F3.20

The FLS F3.20 paddlewheel flow sensor is a device suitable for high-pressure systems and critical temperatures. The F3.20 flow sensor is designed for use with all types of solid-free liquids in accordance with the chemical compatibilities of the materials in contact with the liquids. Made with top quality materials, such as stainless steel for the body and shaft, and Halar® for the paddlewheel, it guarantees high mechanical performance and proverbial reliability. The sensor requires very limited maintenance, which in any case is easy to perform thanks to the 4-screw system and the flat graphite gasket. The F3.20 sensor can be connected to the monitors and directly to a PLC. Stainless steel welding is available on the adapter to install the sensor on pipes of various sizes, from 1 ½" to 8" (from DN40 to DN200).

## HIGH PRESSURE PADDLEWHEEL FLOW SENSOR

### APPLICATIONS

- Heat exchangers
- Reverse osmosis
- Cooling systems
- HVAC systems (heating, ventilation and air conditioning)
- Water for boiler supply

### MAIN CHARACTERISTICS

- Operating range from 110 bar (1600 psi) and up to 120 °C (248 °F)
- Wide operating range (0.15 to 8 m/s)
- A single sensor and a single adapter for pipes of various sizes (from 1 ½" to 8")
- High linearity and repeatability
- Limited and extremely simple maintenance
- Availability of special models for direct connection to PLC

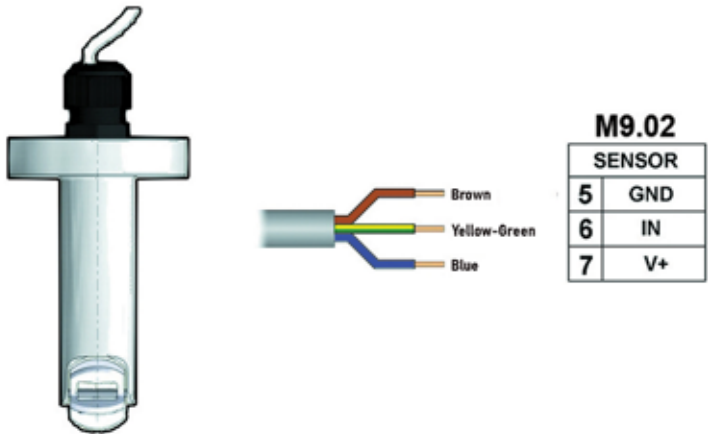
TECHNICAL DATA	
General information	<b>Pipe size range:</b> from DN40 to DN200 (from 0.5 to 8 inches). For more details, refer to the Installation Adapters section
	<b>Flow range:</b> from 0.15 to 8 m/s (0.5-25 ft/s)
	<b>Linearity:</b> ±0.75% of full scale
	<b>Repeatability:</b> ±0.5% of full scale
	<b>Pressure:</b> 110 bar (1600 psi)
	<b>Temperature:</b> 120°C (248°F)
	<b>Minimum Reynolds number required:</b> 4,500
	<b>Protection class:</b> IP68
	<b>Materials in contact with liquids:</b> <ul style="list-style-type: none"><li>– Sensor body: AISI 316L stainless steel</li><li>– Sealing flat graphite gasket</li><li>– Rotor: ECTFE (Halar®)</li><li>– Shaft: AISI 316 Stainless Steel</li></ul>
Specific data for F3.20.H	<b>Supply voltage:</b> from 5 to 24 VDC ±10% regulated
	<b>Supply current:</b> < 30 mA at 24 VDC
	<b>Output signal:</b> <ul style="list-style-type: none"><li>– Square wave:</li><li>– Frequency: 45 Hz for nominal m/s (13.7 Hz for nominal ft/s)</li><li>– Output type: NPN Open collector transistor</li><li>– Output current: max 10 mA</li></ul>
	<b>Cable length:</b> 8 m standard (26,4 ft), max 300 m (990 ft)

Specific data for F3.20.P	<b>Supply voltage:</b> from 12 to 24 VDC $\pm 10\%$ regulated
	<b>Supply current:</b> < 30 mA at 24 VDC
	<b>Output signal:</b> <ul style="list-style-type: none"> <li>– Square wave:</li> <li>– Frequency: 45 Hz for nominal m/s (13.7 Hz for nominal ft/s)</li> <li>– Output type: push-pull (for connection to NPN and PNP inputs)</li> <li>– Output current: <math>I_{max} &lt; 20</math> mA</li> </ul>
Standards & Approvals	<b>Cable length:</b> 8 m standard (26.4 ft), max 300 m (990ft)
	Manufactured under ISO 9001
	Manufactured under ISO 14001
	CE
	RoHS Compliance
	EAC

F3.20.H IP68

SENSOR ELECTRICAL

CONNECTIONS



ELECTRICAL

CONNECTIONS TO

OTHER FLS MONITORS

	M9.00	M9.50	M9.03 input 1	M9.03 input 2	M9.07	M9.08	M9.10
GND	7	30	30	16	16	16	37
FREQ	8	28	28	14	14	14	36
V+	9	27	27	13	13	13	35

# PRODUCT CODES



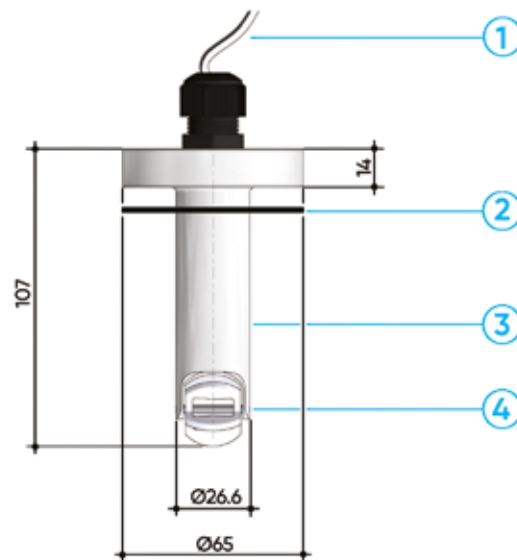
## F3.20.X.01

High Pressure Paddlewheel Flow Sensor

Code	Version	Power supply	Length	Main Wetted Materials	Enclosure	Flow Rate Range	Weight (gr.)
F3.20.H.01	Hall	5- 24 VDC	107 mm	316L SS	IP68	From 0,15 to 8 m/s*	600
F3.20.P.01	Push-Pull	12 - 24 VDC	107 mm	316L SS	IP68	From 0,15 to 8 m/s*	600

\* from 0,15 to 8 m/s = (0,5-25 feet/s)

# TECHNICAL DRAWINGS



F3.20

- |   |  |   |                                       |   |  |
|---|--|---|---------------------------------------|---|--|
| 1 | Electrical cable: standard 8m (26.4ft) | 3 | AISI 316L stainless steel sensor body | 4 | ECTFE Halar® open cell rotor and AISI 316L stainless steel shaft |
| 2 | Flat graphite gasket                   |   |                                       |   |  |





# F6.50

Paddlewheel flow transmitter



# F6.50

The new FLS F6.50 transmitter is a paddlewheel-based device and can be used for measuring any type of solid-free liquid. The F6.50 transmitter provides a 4-20 mA current output and is equipped with a Bluetooth® connection for interaction with the Aliaxis Smart Connect App, which allows the user to set the transmitter configuration and installation parameters and other features. The specific design guarantees accurate flow measurements over a wide range of pipe sizes, from DN15 (0.5") to DN600 (24").

## PADDLEWHEEL FLOW TRANSMITTER

### APPLICATIONS

- Water and industrial wastewater treatment
- Water cooling systems
- Swimming pools
- Flow control and monitoring
- Water treatment
- Water regeneration plants
- Processing and manufacturing industry
- Water distribution

### MAIN CHARACTERISTICS

- High chemical resistance
- Pipe size range: DN15 (0.5") to DN600 (24")
- Low pressure drop
- Setting the functional parameters of the instrument and reading the proximity of the information detected during its use through the Aliaxis Smart Connect application
- 4-20 mA signal transmission via cable connection

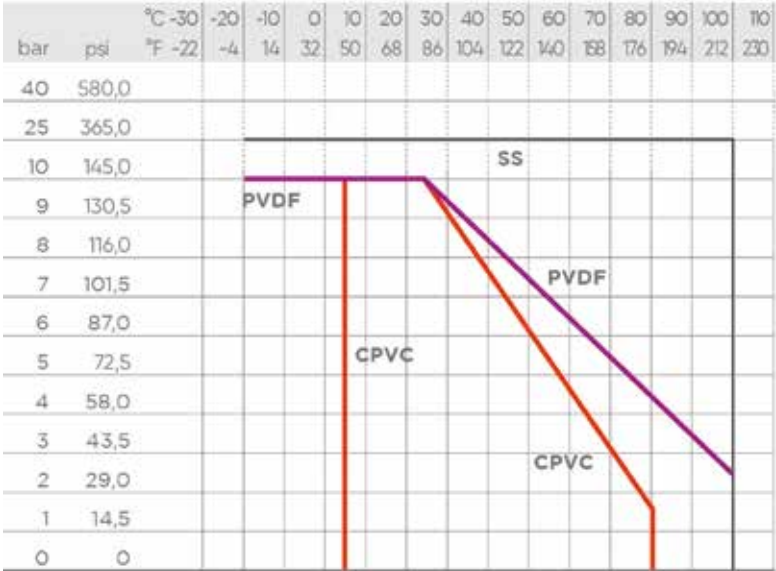
### TECHNICAL DATA

General information	<b>Pipe size range:</b> from DN15 to DN600 (0.5-24") For more details, refer to the Installation Adapters section
	<b>Wireless connection standards:</b> Bluetooth® 5.0 compatible with iOS and Android
	<b>Flow range:</b> from 0.15 to 8 m/s (0.5-25 ft/s)
	<b>Linearity:</b> ±0.75% of full scale
	<b>Repeatability:</b> ±0.5% of full scale
	<b>Minimum Reynolds number required:</b> 4,500
	<b>Protection class:</b> IP65
	<b>Materials in contact with liquids:</b>
	– Sensor body: C-PVC, PVDF or AISI 316L stainless steel
	– O-ring: EPDM or FKM
Electrical data	– Rotor: ECTFE (Halar®)
	– Shaft: Ceramic (Al <sub>2</sub> O <sub>3</sub> ) / AISI 316 Stainless Steel (for metal sensors)
	– Bearings: Ceramic (Al <sub>2</sub> O <sub>3</sub> ) absent for metal sensors
	<b>Power supply:</b> 12 to 24 VDC ±10% regulated (reverse polarity and short circuit protection)
Environmental data	<b>Max electrical consumption:</b> 150 mA
	– Ground connection: < 10 Ω
	<b>Current output:</b>
Standards & Approvals	– 4-20 mA, isolated
	– Max loop impedance: 800 Ω @ 24 VDC - 250 Ω @ 12 VDC
	<b>Storage temperature:</b> -30 to +80°C (from -22 to 176°F)
	<b>Ambient temperature:</b> -20 to +70°C (from -4 to 158°F)
	<b>Relative humidity:</b> from 0 to 95% not condensing
	Manufactured under ISO 9001
	Manufactured under ISO 14001
	CE
	RoHS Compliance
	EAC

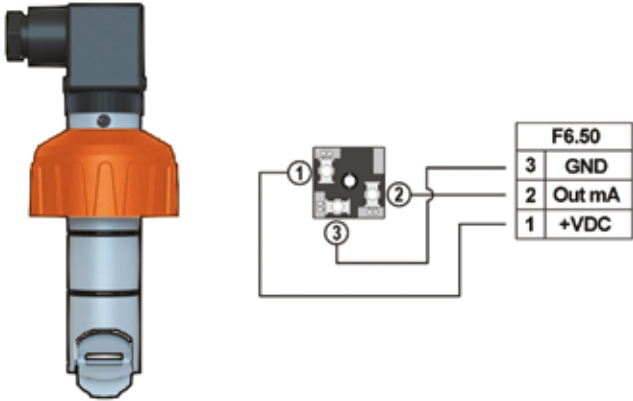
# MAX OPERATING PRESSURE/ TEMPERATURE (25-YEAR DURATION)

## Transmitter F6.50

- C-PVC body:
  - 10 bar (145 psi) at 25°C (77°F)
  - 1.5 bar (22 psi) at 80°C (176°F)
- PVDF body:
  - 10 bar (145 psi) at 25°C (77°F)
  - 2.5 bar (36 psi) at 100°C (212°F)
- Stainless steel body:
  - 25 bar (363 psi) at 100°C (212°F)



# F6.50 TRANSMITTER ELECTRICAL CONNECTIONS



## SMART CONNECT APP



The new F6.50 series rotor flow transmitters are able to communicate with the user via Bluetooth connection<sup>®</sup> and the Smart Connect App.

Smart Connect allows the user to interact with the transmitter in a simple and fast way to access the settings of the instrument or for a proximity reading of the information detected during its use.

Main features of the Smart Connect App:

- Maximum signal range: 10 m, even in the presence of obstacles
- Setting of installation parameters: pipe material and size, K-factor
- Protecting access to transmitter settings via user password
- Multilingual interface
- Reading of the instantaneous and totalised flow rate and related current output value
- Auto Flow Rate Calibration
- Setting the units of measurement, filters and percentage correction of measurement
- Setting of the flow measurement range corresponding to the 4-20mA range
- Simulation of current values for evaluation of calibration and linearity of the output
- Data logger

The Smart Connect App is compatible with Android and IOs, and it is downloadable from Google Play and App Store.



For further information, it is possible to visit the FLS F6.50 dedicated page on our website [aliaxis.it](http://aliaxis.it), accessible via this QR code.

# PRODUCT CODES



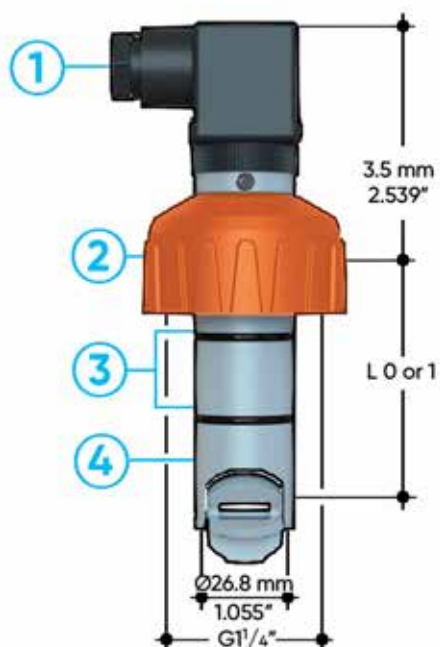
## F6.50.XX

Paddlewheel Flow Transmitter

Code	Power supply	Length	Main Wetted Materials	Enclosure	Flow Rate Range	Weight (gr.)
F6.50.01	12 - 24 VDC	L0	C-PVC EPDM	IP65	From 0,15 to 8 m/s*	250
F6.50.02	12 - 24 VDC	L0	C-PVC FKM	IP65	From 0,15 to 8 m/s*	250
F6.50.03	12 - 24 VDC	L1	C-PVC EPDM	IP65	From 0,15 to 8 m/s*	300
F6.50.04	12 - 24 VDC	L1	C-PVC FKM	IP65	From 0,15 to 8 m/s*	300
F6.50.05	12 - 24 VDC	L0	PVDF EPDM	IP65	From 0,15 to 8 m/s*	250
F6.50.06	12 - 24 VDC	L0	PVDF FKM	IP65	From 0,15 to 8 m/s*	250
F6.50.07	12 - 24 VDC	L1	PVDF EPDM	IP65	From 0,15 to 8 m/s*	300
F6.50.08	12 - 24 VDC	L1	PVDF FKM	IP65	From 0,15 to 8 m/s*	300
F6.50.09	12 - 24 VDC	L0	316L SS EPDM	IP65	From 0,15 to 8 m/s*	450
F6.50.10	12 - 24 VDC	L0	316L SS FKM	IP65	From 0,15 to 8 m/s*	450
F6.50.11	12 - 24 VDC	L1	316L SS EPDM	IP65	From 0,15 to 8 m/s*	500
F6.50.12	12 - 24 VDC	L1	316L SS FKM	IP65	From 0,15 to 8 m/s*	500

\* from 0,15 to 8 m/s = (0,5-25 feet/s)

# TECHNICAL DRAWINGS



**A**



**B**

- |   |   |  |
|---|---|--|
| <b>A</b> Transmitter F6.50  | <b>3</b> O-ring seals available in EPDM or FKM                                  | <b>6</b> Ceramic shaft (AISI 316L stainless steel for metal sensors) |
| <b>B</b> Paddlewheel  | <b>4</b> Sensor body in C-PVC, PVDF or stainless steel                          | <b>7</b> Ceramic bearings (absent for metal sensors)                 |
| <b>1</b> Quadrupole plug in accordance with DIN 43650-B/ISO 6952                              | <b>5</b> ECTFE Halar® (registered trademark of Ausimont-Solvay) open cell rotor |  |
| <b>2</b> U-PVC cap for installation on adapters (AISI 316L stainless steel for metal sensors) |   |  |

# F3.10

Mini paddlewheel flow sensor



# F3.10

The simple and reliable paddlewheel technology was adopted in this type of FLS F3.10 mini flow sensor model, designed for use with any type of solid-free liquids. The sensor is capable of measuring flows from 0.25 m/s (0.8 ft/s) producing a highly repeatable output frequency signal. Extremely solid construction and consolidated technology ensure exceptional returns, with zero or very little maintenance. Due to its highly compact size and particular design, it is suitable for installation on standard FLS T adapters from DN15 to DN40 (0.5-1.5 inches).

## MINI PADDLEWHEEL FLOW SENSOR

### APPLICATIONS

- Water treatment
- Filtration systems
- Production of pure water
- Water monitoring
- Fertilization

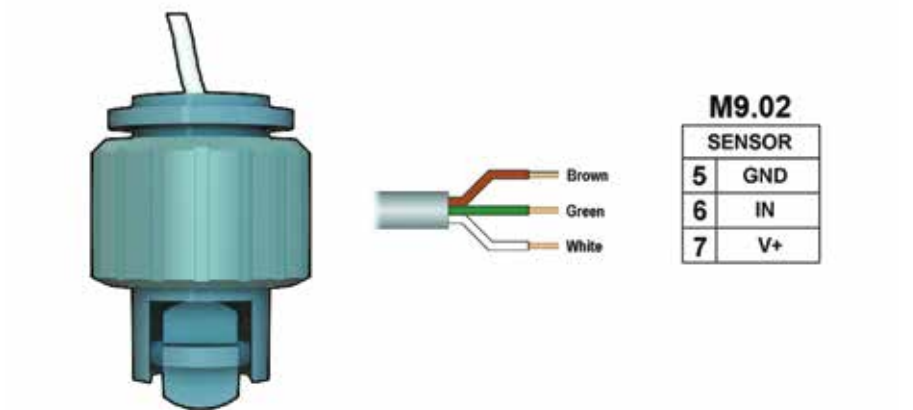
### MAIN CHARACTERISTICS

- IP68 protection class
- ABS body with EPDM or FKM gasket
- 4-blade ABS paddlewheel (without bearings)
- Mono-directional design
- Installation on FLS standard T adapters
- Model with PVDF body on request

TECHNICAL DATA	
General information	<b>Pipe size range:</b> from DN15 to DN40 (from 0.5 to 1 1/2 inches). For more details, refer to the Installation Adapters section
	<b>Flow range:</b> from 0.25 to 4 m/s (0.8-12.5 ft/s)
	<b>Linearity:</b> ±1% of full scale
	<b>Repeatability:</b> ±0.5% of full scale
	<b>Minimum Reynolds number required:</b> 4,500
	<b>Protection class:</b> IP68
	<b>Operating pressure:</b> <ul style="list-style-type: none"><li>– max 10 bar (145 psi) at 20°C (68°F)</li><li>– max 2 bar (30 psi) at 70°C (158°F)</li></ul>
	<b>Operating temperature:</b> from -20 to +70°C (from -4 to 158°F)
	<b>Materials in contact with liquids:</b> <ul style="list-style-type: none"><li>– Sensor body: ABS (PVDF on request)</li><li>– O-ring: EPDM or FKM</li><li>– Rotor: ABS (PVDF on request)</li><li>– Shaft: AISI 316 Stainless Steel</li><li>– Magnets: SmCo<sub>2</sub></li></ul>
Electrical data	<b>Supply current:</b> < 30 mA at 24 VDC
	<b>Output signal:</b> <ul style="list-style-type: none"><li>– Square wave:</li><li>– Output frequency: 15 Hz for nominal m/s (4.6 Hz for nominal ft/s)</li><li>– Output type: NPN Open collector transistor</li><li>– Output current: max 10 mA</li></ul>
Standards & Approvals	<b>Cable length:</b> 2m standard (6,5 ft), max 300 m (990 ft)
	Manufactured under ISO 9001 Manufactured under ISO 14001 CE RoHS Compliance EAC



### F3.10 IP68 SENSOR ELECTRICAL CONNECTIONS



### ELECTRICAL CONNECTIONS TO OTHER FLS MONITORS

	M9.00	M9.50	M9.03 input 1	M9.03 input 2	M9.07	M9.08	M9.10
GND	7	30	30	16	16	16	37
FREQ	8	28	28	14	14	14	36
V+	9	27	27	13	13	13	35

# PRODUCT CODES

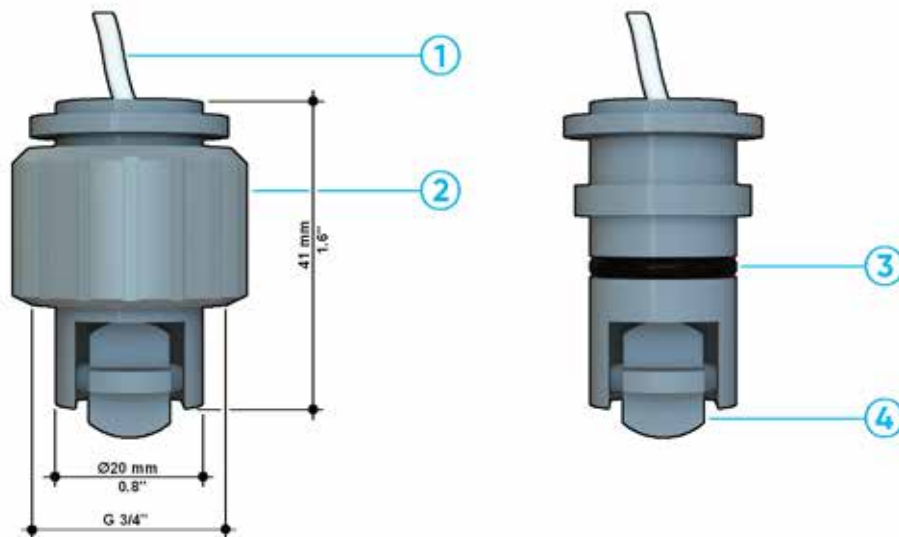


**F3.10.H.XX**  
Mini Paddlewheel Flow Sensor

Code	Version	Power supply	Length	Main Wetted Materials	Enclosure	Flow Rate Range	Weight (gr.)
F3.10.H.01	Hall	5- 24 VDC	41 mm	ABS EPDM	IP68	From 0,25 to 4 m/s*	100
F3.10.H.02	Hall	5- 24 VDC	41 mm	ABS FKM	IP68	From 0,25 to 4 m/s*	100

\*From 0,25 to 4 m/s= (0,8-12,5 feet/s)

# TECHNICAL DRAWINGS



F3.10

- |  |  |
|--|--|
| <b>1</b> Electrical cable: 8 m. (26.4 ft) standard | <b>3</b> O-Ring seals available in EPDM or FKM             |
| <b>2</b> U-PVC cap for installation into fittings  | <b>4</b> ABS rotor with 4 blades and stainless steel shaft |



# F3.05



## Paddlewheel Flow Switch



# F3.05

The FLS F3.05 paddlewheel flow switch is designed to protect pumps from non-lubricating operation or pumping against a closed valve. It is equipped with an electromechanical SPST (Single Pole Single Throw) contact that is activated when the flow speed drops below the factory default value, 0.15 m/s (0.5 ft/s). On the F3.05 model there is an LED indicating the status of the local flow. The family of specially designed adapters reduces installation times in pipes of all materials and sizes, from DN15 to DN600 (0.5-24").

## PADDLEWHEEL FLOW SWITCH

### APPLICATIONS

- Pump protection
- Filtration systems
- Water cooling systems

### MAIN CHARACTERISTICS

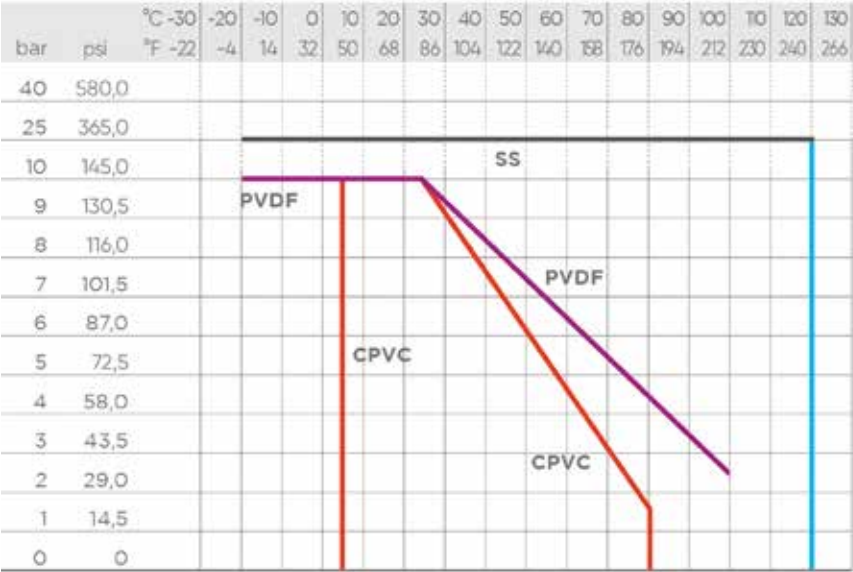
- Sensor body in C-PVC, PVDF or stainless steel
- Simple insertion system
- High chemical resistance
- Flow absence alarm relay output
- Two-tone LED status monitor with high visibility
- Maintenance free
- Very low pressure drop

TECHNICAL DATA	
General information	<b>Pipe size range:</b> from DN15 to DN600 (0.5–24"). For more details, refer to the Installation Adapters section
	<b>Supply voltage:</b> from 12 to 24 VDC ±10% regulated
	<b>Supply current:</b> < 50 mA
	<b>Relay output:</b> Mechanical Single Pole Double Throw (SPDT) contact, 1 A at 24 VDC, 0.1 A at 230 VAC
	<b>Local status indicator:</b> <ul style="list-style-type: none"><li>– GREEN LED = flow present</li><li>– RED LED = no flow</li></ul>
	<b>Point without flow rate:</b> 0.15 m/s (0.5 ft/s)
	<b>Protection class:</b> IP65
	<b>Materials in contact with liquids:</b> <ul style="list-style-type: none"><li>– Sensor body: PVC–C, PVDF or AISI 316L stainless steel</li><li>– O-ring: EPDM or FKM</li><li>– Rotor: ECTFE (Halar®)</li><li>– Shaft: Ceramic (Al2O3)/ AISI 316 Stainless Steel (for metal sensors)</li><li>– Bearings: Ceramic (Al2O3)absent for metal sensors</li></ul>
Standards & Approvals	Manufactured under ISO 9001 Manufactured under ISO 14001 CE RoHS Compliance EAC

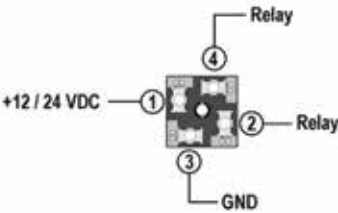
# MAX OPERATING PRESSURE/ TEMPERATURE (25-YEAR DURATION)

## F3.05 sensor

- C-PVC body:
  - 10 bar (145 psi) at 25°C (77°F)
  - 1.5 bar (22 psi) at 80°C (176°F)
- PVDF body:
  - 10 bar (145 psi) at 25°C (77°F)
  - 2.5 bar (36 psi) at 100°C (212°F)
- Stainless steel body:
  - 25 bar (363 psi) at 120°C (248°F)



# F3.05 SENSOR ELECTRICAL CONNECTIONS



# PRODUCT CODES



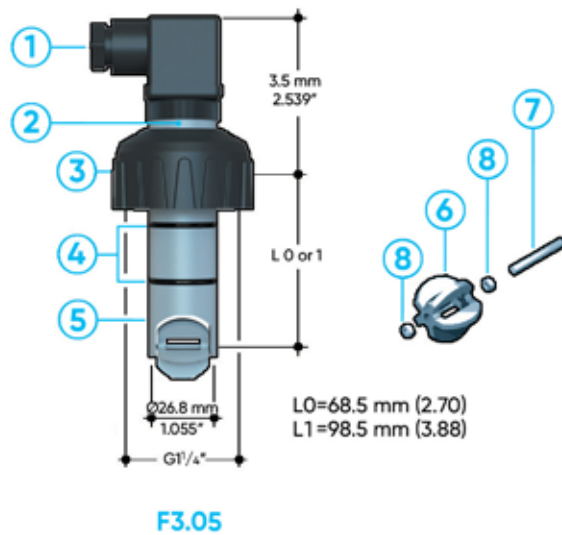
## F3.05.XX

Paddlewheel Flow Switch

Code	Version	Power supply	Length	Main Wetted Materials	Enclosure	Weight (gr.)
F3.05.01	Hall	12 - 24 VDC	L0	C-PVC EPDM	IP65	250
F3.05.02	Hall	12 - 24 VDC	L0	C-PVC FKM	IP65	250
F3.05.03	Hall	12 - 24 VDC	L1	C-PVC EPDM	IP65	300
F3.05.04	Hall	12 - 24 VDC	L1	C-PVC FKM	IP65	300
F3.05.05	Hall	12 - 24 VDC	L0	PVDF EPDM	IP65	250
F3.05.06	Hall	12 - 24 VDC	L0	PVDF FKM	IP65	250
F3.05.07	Hall	12 - 24 VDC	L1	PVDF EPDM	IP65	300
F3.05.08	Hall	12 - 24 VDC	L1	PVDF FKM	IP65	300
F3.05.09	Hall	12 - 24 VDC	L0	316L SS EPDM	IP65	600
F3.05.10	Hall	12 - 24 VDC	L0	316L SS FKM	IP65	600
F3.05.11	Hall	12 - 24 VDC	L1	316L SS EPDM	IP65	650
F3.05.12	Hall	12 - 24 VDC	L1	316L SS FKM	IP65	650



# TECHNICAL DRAWINGS



- |  |  |  |
|--|--|--|
| <b>1</b> Quadrapole plug in accordance with DIN 43650-B/ISO 6952 | <b>4</b> O-ring seals available in EPDM or FKM         | <b>7</b> Shaft in ceramic, AISI 316L stainless steel (for metal sensors) |
| <b>2</b> Two-tone local status LED                               | <b>5</b> Sensor body in C-PVC, PVDF or stainless steel | <b>8</b> Ceramic bearings, absent (for metal sensors)                    |
| <b>3</b> U-PVC cap for installation on adapters                  | <b>6</b> ECTFE (Halar®) open cell rotor                |  |



# F6.60 – F6.63

Electromagnetic Flow Sensor



# F6.60 – F6.63

The FLS F6.60 and F6.63 electromagnetic flow meters, thanks to the absence of mechanical moving parts, can be used for the measurement of dirty liquids as long as they are conductive and homogeneous.

The F6.60 product range offers three different options: frequency output for connection to flow indicators; 4–20 mA output for long-distance transmission and connection to PLC; new freely adjustable volumetric pulse output. The range of electromagnetic insertion meters is equipped with a USB interface and dedicated software (downloadable free of charge from the Aliaxis website) that allows you to easily set, via PC, all the installation parameters and relevant calibration. The specific design guarantees accurate flow measurements over a wide range of pipe sizes, from DN15 (0.5") to DN600 (24").

## ELECTROMAGNETIC FLOW SENSOR

### APPLICATIONS

- Water and wastewater treatment
- Raw water treatment
- Industrial water distribution
- Textile industry
- Swimming pools, spas and aquariums
- HVAC systems (heating, ventilation and air conditioning)
- Processing and manufacturing industry

### MAIN CHARACTERISTICS

- Absence of moving parts, wear and maintenance
- High mechanical strength
- Precise measurement of dirty liquids
- Pipe size range: from DN15 (0.5") to DN600 (24")
- Adjustable flow range
- Low pressure drop
- User-settable operating parameters
- 4–20 mA output, frequency or volumetric pulses
- Bi-directional selectable flow measurement (for F6.60)

## TECHNICAL DATA

### General information

**Pipe size range:** from DN15 to DN600 (0.5–24") For more details, refer to the Installation Adapters section

**Max flow rate range:**

- F6.60: from 0,05 to 8 m/s
- F6.63: from 0,15 to 8 m/s

**Full scale:** 8 m/s (26,24 ft/s)

**Linearity:** ±1% of reading + 1.0 cm/s

**Repeatability:** ±0,5% of reading

**Protection class:** IP65

**Materials:**

- Case: ABS

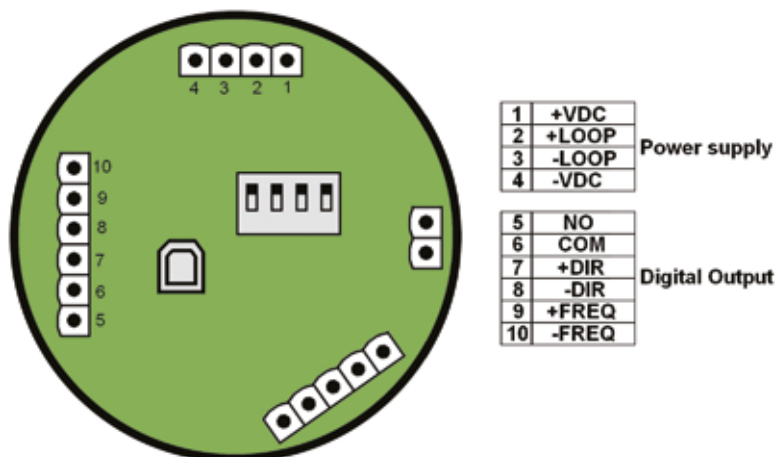
**Materials in contact with liquids:**

- Sensor body: AISI 316L stainless steel and PVDF
- O-ring: EPDM o FKM
- Electrodes: AISI 316L stainless steel

<b>Electrical data</b>	<b>Power supply:</b> 12 to 24 VDC $\pm 10\%$ regulated (reverse polarity and short circuit protection)
	<b>Max electrical consumption:</b> 150 mA] – Ground connection: $< 10 \Omega$
	<b>1 Current output:</b> – 4–20 mA, isolated – Max loop impedance: $800 \Omega$ @ 24 VDC – $250 \Omega$ @ 12 VDC – Positive or negative flow indication
	<b>1 solid state relay outputs:</b> – User selectable as MIN alarm, MAX alarm, volumetric, pulse output, window alarm, off – Optically isolated, 50 mA max sink, 24 VDC max pull-up voltage – Max pulse/min: 300 – Hysteresis: user selectable
	<b>Open collector output frequency:</b> – Type: NPN Open collector – Frequency: 0–800 Hz – Max pull-up voltage: 24 VDC – Max current: 50mA, current limited – Compatible with M9.02, M9.03, M9.50, M9.07, M9.08 and M9.10
	<b>Open collector output direction (not available on model F6.63):</b> – Type: NPN Open collector – Max pull-up voltage: 24 VDC – Max current: 50mA, current limited – Flow direction: – 0 VDC in the direction of the arrow – + VDC in the opposite direction of the arrow
<b>Environmental data</b>	<b>Storage temperature:</b> from $-30^{\circ}\text{C}$ to $+80^{\circ}\text{C}$ (from $-22^{\circ}\text{F}$ to $+176^{\circ}\text{F}$ )
	<b>Ambient temperature:</b> $-20$ to $+70^{\circ}\text{C}$ (from $-4$ to $158^{\circ}\text{F}$ )
	<b>Relative humidity:</b> from 0 to 95% not condensing
	<b>Fluid conditions:</b> – homogeneous liquids, doughs or sludge, even with solid contents – Min electrical conductivity: $20 \mu\text{S}/\text{cm}$ – Temperature: model with PVDF bottom: from $-10^{\circ}\text{C}$ to $+60^{\circ}\text{C}$ (from $14^{\circ}\text{F}$ to $140^{\circ}\text{F}$ )
	<b>Max operating pressure:</b> – 16 bar a $25^{\circ}\text{C}$ (232 psi a $77^{\circ}\text{F}$ ) – 8,6 bar a $60^{\circ}\text{C}$ (124 psi a $140^{\circ}\text{F}$ )
<b>Standards &amp; Approvals</b>	Manufactured under ISO 9001 Manufactured under ISO 14001 CE RoHS Compliance EAC

## ELECTRICAL CONNECTIONS

Rear view of electrical connections



# PRODUCT CODES



## F6.60.XX

Electromagnetic Flow Sensor

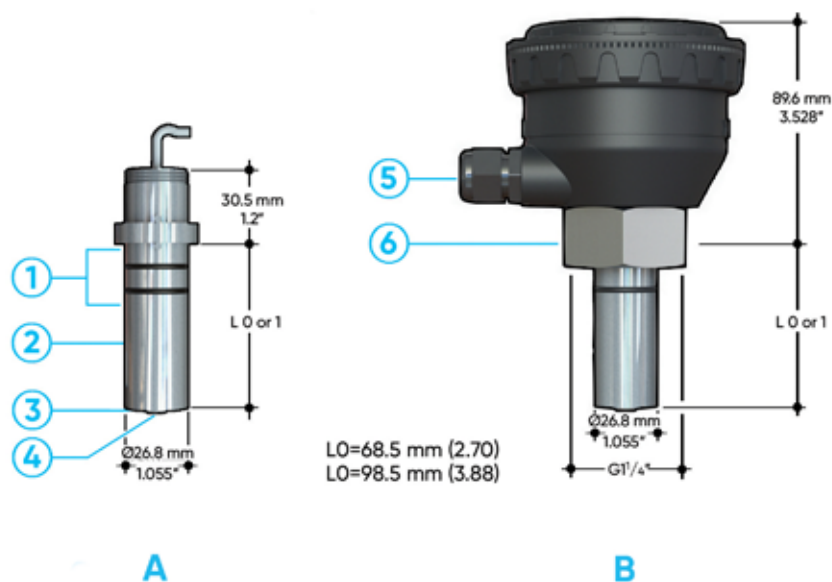
Code	Version	Power supply	Length	Main Wetted Materials	Enclosure	Flow Rate Range	Weight (gr.)
F6.60.09	Blind	12 - 24 VDC	L0	316L SS PVDF EPDM	IP65	From 0,05 to 8 m/s bi-directional	950
F6.60.10	Blind	12 - 24 VDC	L0	316L SS PVDF FKM	IP65	From 0,05 to 8 m/s bi-directional	950
F6.60.11	Blind	12 - 24 VDC	L1	316L SS PVDF EPDM	IP65	From 0,05 to 8 m/s bi-directional	1000
F6.60.12	Blind	12 - 24 VDC	L1	316L SS PVDF FKM	IP65	From 0,05 to 8 m/s bi-directional	1000

## F6.63.XX

Electromagnetic Flow Sensor

Code	Version	Power supply	Length	Main Wetted Materials	Enclosure	Flow Rate Range	Weight (gr.)
F6.63.09	Blind	12 - 24 VDC	L0	316L SS PVDF EPDM	IP65	From 0,15 to 8 m/s mono -directional	950
F6.63.10	Blind	12 - 24 VDC	L0	316L SS PVDF FKM	IP65	From 0,15 to 8 m/s mono -directional	950
F6.63.11	Blind	12 - 24 VDC	L1	316L SS PVDF EPDM	IP65	From 0,15 to 8 m/s mono -directional	1000
F6.63.12	Blind	12 - 24 VDC	L1	316L SS PVDF FKM	IP65	From 0,15 to 8 m/s mono -directional	1000

# TECHNICAL DRAWINGS



- |          |   |          |   |          |  |
|----------|---|----------|---|----------|--|
| <b>A</b> | Sensor body                               | <b>2</b> | Sensor body (AISI 316L stainless steel) | <b>5</b> | Cable Gland  |
| <b>B</b> | F6.60 - F6.63 Electromagnetic Flow Sensor | <b>3</b> | Isolation Plate (PVDF)                  | <b>6</b> | AISI 316L stainless steel cap for installation on adapters |
| <b>1</b> | O-Ring (EPDM or FKM)                      | <b>4</b> | Electrodes (AISI 316L stainless steel)  | <b>7</b> | Electronic box   |





# F6.61



## Hot Tap Electromagnetic Flow Sensor



# F6.61

The FLS F6.61 electromagnetic flow meter is an hot tap sensor that, thanks to the absence of moving parts, can be used for the measurement of dirty liquids provided they are conductive and homogeneous. The sensor offers three different options: frequency output for connection to flow monitors; 4-20 mA output for long-distance transmission and connection to PLC; new freely adjustable volumetric pulse output. The F6.61 electromagnetic insertion meter is equipped with a USB interface and dedicated software (downloadable free of charge from the Aliaxis website) that allows you to easily set, via PC, all the installation parameters and relevant calibration. The sensor can be mounted in pressurised pipes of various sizes, from DN50 (2") to DN900 (36") with a clamp saddle and a standard shut-off ball valve.

## HOT TAP ELECTROMAGNETIC FLOW SENSOR

### APPLICATIONS

- Water distribution
- Leak monitoring and search
- Raw water treatment
- Water and wastewater treatment
- Restoration of aquifers
- Irrigation

### MAIN CHARACTERISTICS

- Adjustable sensor position
- Flush-mounted installation
- PC interface settable operating parameters
- Pressure tap
- 1 ¼" BSP connection to standard process
- Absence of moving parts, wear and maintenance
- Settable flow rate range from 0.05 to 8 m/s (0.15 -25 ft/s)
- Precise measurement of dirty liquids
- 4-20 mA outputs, frequency or volumetric pulses
- Bi-directional selectable flow measurement

### TECHNICAL DATA

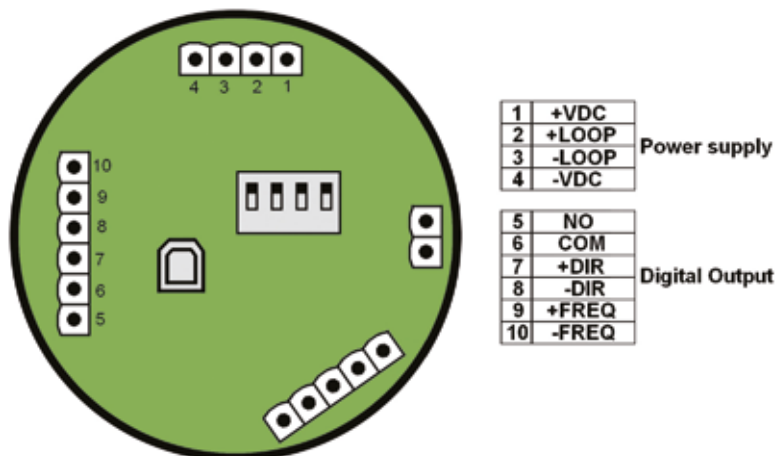
#### General information

<b>Pipe size range:</b> from DN50 to DN900 (from 2" to 36") Special model for other sizes on request. For more details, refer to the Installation Adapters section
<b>Max flow rate range:</b> – from 0.05 at 8 m/s = (0.15-26.24 ft/s)
<b>Full scale:</b> 8 m/s (26,24 ft/s)
<b>Linearity:</b> ±1% of reading + 1.0 cm/s
<b>Repeatability:</b> ±0,5% of reading
<b>Protection class:</b> IP65
<b>Materials:</b> – Case: ABS
<b>Materials in contact with liquids:</b> – Sensor body: AISI 304 stainless steel / PVDF – O-ring: EPDM o FKM – Electrodes: AISI 316L stainless steel

<b>Electrical data</b>	<b>Power supply:</b> 12 to 24 VDC $\pm 10\%$ regulated (reverse polarity and short circuit protection)
	<b>Max electrical consumption:</b> 250 mA] – Ground connection: $< 10 \Omega$
	<b>1 Current output:</b> – 4-20 mA, isolated – Max loop impedance: $800 \Omega$ @ 24 VDC – $250 \Omega$ @ 12 VDC – Positive or negative flow indication
	<b>1 solid state relay output:</b> – User selectable as MIN alarm, MAX alarm, volumetric, pulse output, window alarm, off – Optically isolated, 50 mA max sink, 24 VDC max pull-up voltage – Max pulse/min: 300 – Hysteresis: user selectable
	<b>Open collector output frequency:</b> – Type: NPN Open collector – Frequency: 0-800 Hz – Max pull-up voltage: 24 VDC – Max current: 50mA, current limited – Compatible with M9.02, M9.50, M9.07
<b>Environmental data</b>	<b>Open collector output direction:</b> – Type: NPN Open collector – Max pull-up voltage: 24 VDC – Max current: 50mA, current limited – Flow direction: – 0 VDC in the direction of the arrow – + VDC in the opposite direction of the arrow
	<b>Storage temperature:</b> from $-30^{\circ}\text{C}$ to $+80^{\circ}\text{C}$ (from $-22^{\circ}\text{F}$ to $+176^{\circ}\text{F}$ )
	<b>Ambient temperature:</b> $-20$ to $+70^{\circ}\text{C}$ (from $-4$ to $158^{\circ}\text{F}$ )
	<b>Relative humidity:</b> from 0 to 95% not condensing
	<b>Fluid conditions:</b> – homogeneous liquids, doughs or sludge, even with solid contents – Min electrical conductivity: $20 \mu\text{S}/\text{cm}$ – Temperature: model with PVDF bottom: from $-10^{\circ}\text{C}$ to $+60^{\circ}\text{C}$ (from $14^{\circ}\text{F}$ to $140^{\circ}\text{F}$ )
<b>Standards &amp; Approvals</b>	<b>Max operating pressure:</b> – 16 bar a $25^{\circ}\text{C}$ (232 psi a $77^{\circ}\text{F}$ ) – 8,6 bar a $60^{\circ}\text{C}$ (124 psi a $140^{\circ}\text{F}$ )
	Manufactured under ISO 9001 Manufactured under ISO 14001 CE RoHS Compliance EAC

## ELECTRICAL CONNECTIONS

Rear view of electrical connections



# PRODUCT CODES

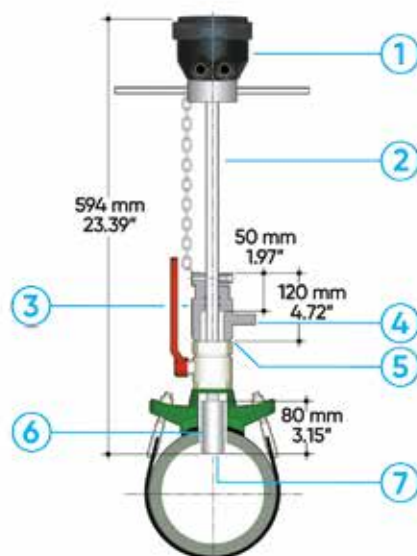


**F6.61.01**  
Hot Tap Electromagnetic Flow Sensor

Code	Version	Power supply	Length	Main Wetted Materials	Enclosure	Flow Rate Range	Weight (gr.)
F6.61.01	HOT TAP INSERTION INSTALLATION	12 - 24 VDC	615 mm	AISI 304 SS PVDF AISI 316L	IP65	Da 0,05 a 8 m/s*	6000

\*from 0,05 to 8 m/s = (0,15-25 feet/s)

# TECHNICAL DRAWINGS



F6.61

- |   |   |  |
|---|---|--|
| <p><b>1</b> Electronic electromagnetic flow meter</p> <p><b>2</b> Sliding stem</p> <p><b>3</b> AISI 304 stainless steel sensor installation joint</p> | <p><b>4</b> Pressure tap</p> <p><b>5</b> Connection to the 1 ¼" threaded gas process</p> <p><b>6</b> Adjustable sensor body in AISI 304 stainless steel</p> | <p><b>7</b> AISI 316L stainless steel electrodes and PVDF bottom</p> |
|---|---|--|



# GUIDELINES FOR THE INSTALLATION AND USE Of insertion flow sensors



# INSTALLATION GUIDELINES

## MAIN CHARACTERISTICS OF INSERTION TECHNOLOGY

- All flow sensors with insertion technology are flow speed based measuring devices
- Typical installation requires only a small hole in the pipe for perpendicular mounting of the sensor;
- The dimensions of the sensor are generally not related to those of the pipe, but are almost independent of the cross-section of the pipe itself.

## FLOW SENSOR INSTALLATION

The positioning of the sensor is essential to obtain an accurate and precise reading. For an appropriate measurement it is necessary to verify that:

- the pipe is always full
- the speed of the fluid in the pipe is uniform

## FULL PIPE CONDITION

If the pipe is not full, the flow meter provides inaccurate readings, although the sensor always remains totally submerged. The meter will calculate the flow rate assuming the pipe is full, resulting in an overestimation of the flow rate itself. A pump delivery or outlet at the bottom of the tank does not necessarily ensure that the pipe is full, as air can be suctioned from the pump or trapped since the pipe was empty. In any case, the flow meter must always be located at the lowest point of the pipe and downstream of the flow meter part of the pipe must be placed lower than the meter for a distance equal to at least the internal diameter of the pipe.

## UNIFORM FLOW RATE

Insertion flow sensors measure the speed of the liquid. It is important that, at the sensor mounting point, the speed is uniform throughout the entire section of the pipe. In a pipe, the liquid near the wall moves more slowly than in the centre, due to friction along the walls. In a straight section of pipe, areas with similar velocities can be represented as concentric rings.

## PIPE POSITION

- The six most common installation configurations shown in Fig. 1 are useful for choosing the best position on the pipe for rotor flow sensors and electromagnetic flow sensors.
- The three configurations shown in Fig. 2 ensure that the pipe is always full: to obtain correct measurements, the sensor must NEVER come into contact with air bubbles.
- The three installations shown in Fig. 3 should be avoided, unless there is absolute certainty that the sensor does not come into contact with air bubbles.
- In gravity systems, the connection to the tank must be designed so that the level does not fall below the intake, to prevent the pipe from suctioning air from the tank, affecting the quality of the sensor measurements (see Fig. 4).
- For more information, refer to EN ISO 5167-1.
- The distance between the flow sensors and the pumps should always be as much as possible.



Fig. 1

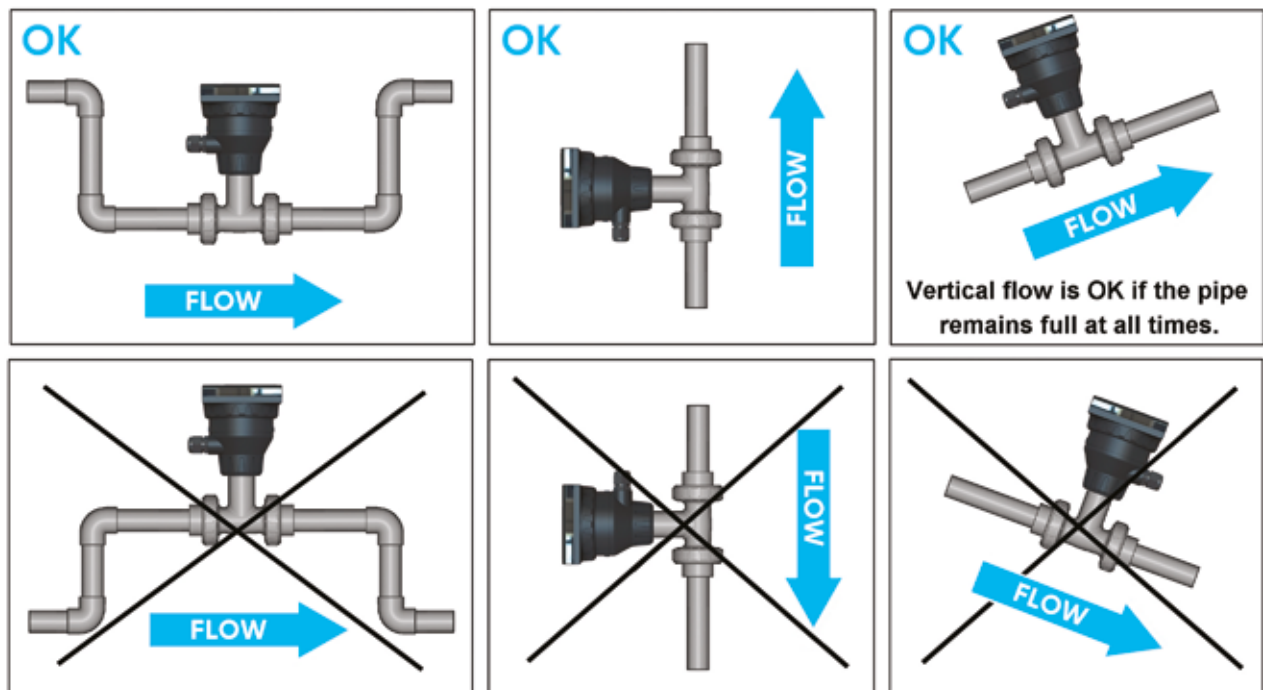


Fig. 2/3

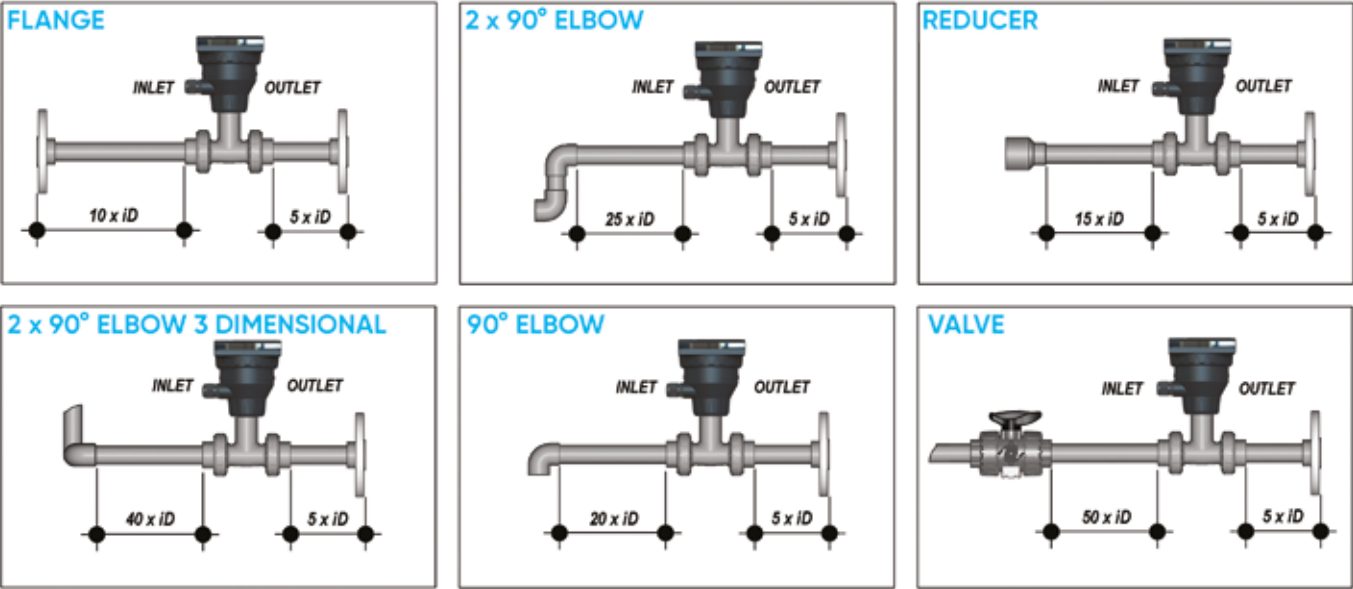
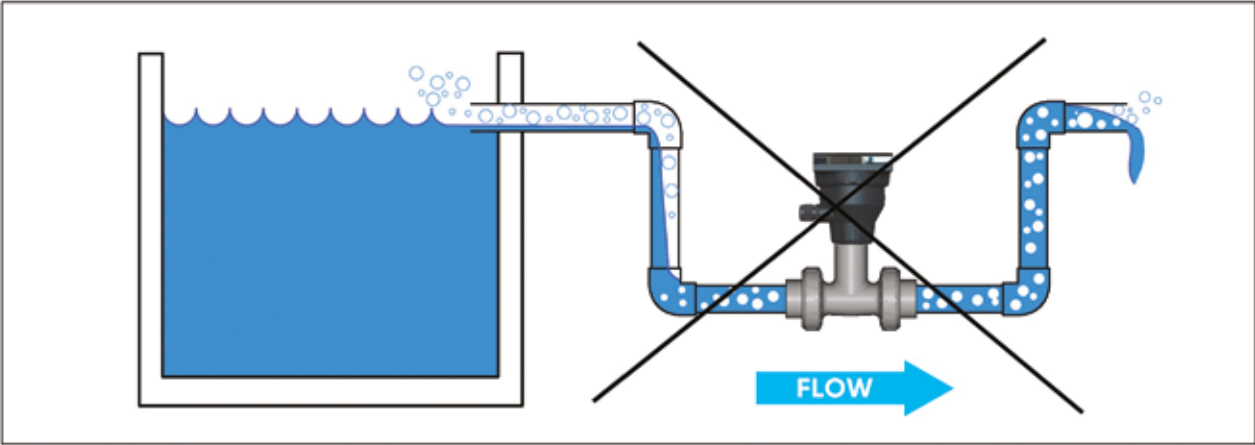


Fig. 4

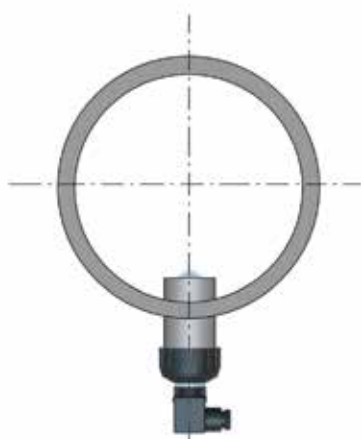


## MOUNTING POSITIONS

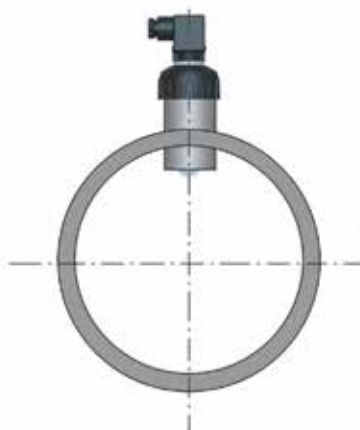
According to the theoretical principles of insertion, the part of the sensor that takes the measurement (the rotor for rotor sensors and the electrodes for electromagnetic meters) must always be placed at 12% of the internal diameter where the average speed can be measured. The accuracy of insertion flow sensor readings can depend on several factors:

- air bubbles;
- sediments;
- friction between shaft and bearings (only for rotor sensors).

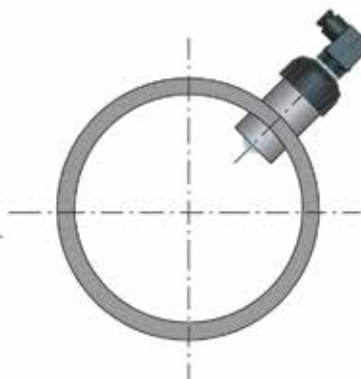
In a pipe running horizontally, the mounting position for optimum performance must be an angle of  $45^\circ$  (Fig. 3) to avoid the formation of air bubbles and sediments. The vertical position (Fig. 2) can be chosen if no air bubbles are present. Do not mount the sensor on the bottom of the pipe (Fig. 1) if there is a likelihood of sediment formation. Do not mount the rotor sensors at  $90^\circ$ , otherwise friction may affect the validity of the measurements. With the exception of the last consideration about  $90^\circ$  installation, all the previous considerations are also valid for sensors with an electromagnetic meter. For optimal orientation, install a vertical section of the pipe. To ensure that the pipe is full, it is preferable that the flow is directed upwards.



**Fig. 1**



**Fig. 2**



**Fig. 3**

## K-FACTOR

The K factor is a conversion value that needs to be set to convert the sensor output (frequency) into flow rate. The K-factor depends on the inner diameter of the pipe in which the sensor is installed. The K-factors provided refer to water, so if the sensors are used to measure other liquids (with different viscosity and/or density), it may be necessary to perform an on-site calibration.

## SENSOR PERFORMANCE OPTIMISATION

To achieve maximum precision, it may be useful to carry out a new calibration with a flow reference value, in order to evaluate the K factor with extreme precision in accordance with the specifications of the installation itself. This procedure is recommended when the sensors are used to measure liquids other than water and in the event that it is not possible to comply with the distances prescribed by EN ISO 5167-1 during installation.

# USAGE GUIDELINES

## ROTOR FLOW SENSORS

The rotor and shaft are in direct contact with the fluid. Since the rotor rotates at a speed directly proportional to that of the flow, these components wear out over time. Rotors operating at high speed are more prone to wear than those operating at low speed. Since each fluid has different characteristics, it is difficult to estimate the expected life of these components. The chemical compatibility of each component in contact with liquids must be appropriately evaluated to choose the most suitable material. The shafts and rotors can easily be replaced to ensure optimum performance at all times. Avoid the use of rotor flow meters for the measurement of very dirty fluids or liquids containing pebbles, as they could break or damage the rotor or shaft.

Solids can negatively affect the response of the sensor by also increasing the friction of the shaft. Do not use rotor sensors with liquids containing fibres. If the maintenance of the rotor sensors is neglected, their accuracy is greatly affected over time. Although in the case where the liquid contains solids it is preferable to apply an electromagnetic flowmeter, it is therefore possible to use a rotor sensor but it is advisable to plan periodic cleaning operations of the parts in contact with the liquids. Use detergents or chemicals compatible with materials in contact with liquids for cleaning.

## ELECTROMAGNETIC FLOW METER

In general, electromagnetic flow sensors do not require special maintenance. If an electromagnetic flowmeter is used to measure very dirty liquids, it is preferable to clean the device periodically with a cloth slightly dampened with water or with a liquid compatible with the material of the device and cloth. Dirty electrodes can affect the accuracy of measurements. Do not use abrasive materials for maintenance.

## FLUSH-MOUNTED INSERTION INSTRUMENTS

It is preferable to use flush-mountable instruments for installation in pressurised pipes and when the flow in the pipe cannot be stopped. The flush-mountable model is only available for electromagnetic sensors. The previous recommendations are also valid for these models. The sensors designed for flush-mounted installation are also suitable for pipes with a diameter greater than the maximum covered by traditional sensors (generally DN600/24"). Flush-mountable sensors can only be used in conjunction with flush-mountable adapters.



**OVAL GEAR AND IN-LINE FLOW  
SENSORS FOR LOW FLOW RATES**  
Lightweight and compact design  
for reliable flow measurement







# ULF

Ultra low flow sensors



# ULF

The FLS ULF, Ultra Low Flow sensor is a device designed for use with any type of aggressive, solid-free liquid. The sensor can be mounted on flexible or rigid pipes through connections with 1/4" GAS male thread. The paddlewheel sensor produces a frequency output proportional to the speed of the flow that can be transmitted and processed without difficulty. The ULF sensor offers two different flow ranges, starting from 1.5 l/h (0.0066 gpm). The construction materials, POM or ECTFE (Halar®), guarantee particularly high strength and chemical resistance.

## ULTRA LOW FLOW SENSORS

### APPLICATIONS

- Water treatment
- Chemical industry
- Pharmaceutical industry
- Batching systems
- Laboratory systems

### MAIN CHARACTERISTICS

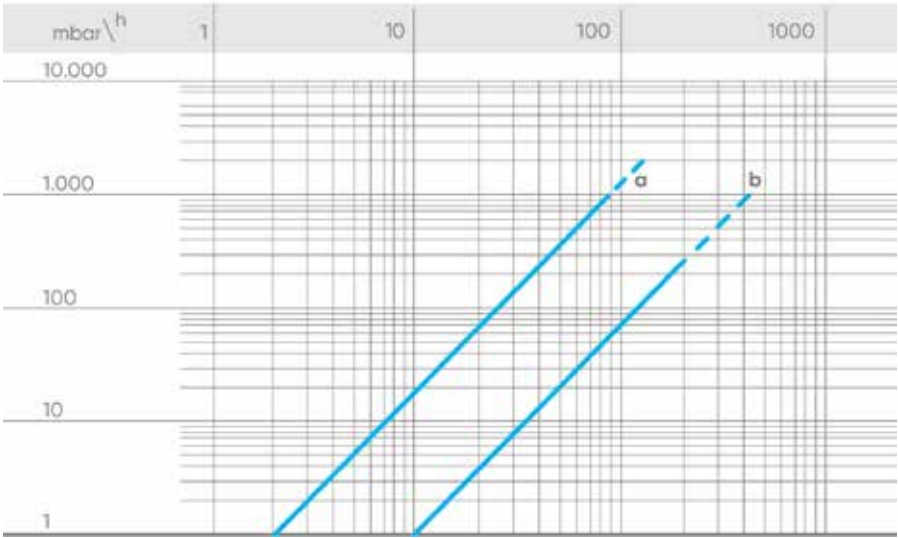
- Parts in contact with liquids in POM or ECTFE (Halar®)
- Two flow rate ranges available:
  - from 1.5 to 100 l/h (0.0066–0.44 gpm)
  - from 6 to 250 l/h (0.0264–1.1 gpm)
- High chemical resistance
- Easy mounting

### TECHNICAL DATA

General information	<b>Flow rate range:</b>
	– Model ULF01: from 1.5 to 100 l/h (0.0066–0.44 gpm)
	– Model ULF03: from 6 to 250 l/h (0.0264–1.1 gpm)
	<b>Linearity:</b> ±1% of full scale
	<b>Repeatability:</b> ±0,5% of full scale
	<b>Operating temperature:</b> from –10°C to 80°C (from 14°F to 176°F)
	<b>Operating pressure:</b> max 5 bar (70 psi) at 22°C (72°F)
	<b>Fluid viscosity:</b> from 1 to 10 cST
	<b>Protection class:</b> IP65
	<b>Materials in contact with liquids (POM model):</b>
	– Sensor body: POM
	– O-ring: FKM
	– Rotor: POM
	– Shaft: corepoint
	– Magnets: SmCo <sub>5</sub>
Specific data for ULF01.H I and ULF03.H	<b>Materials in contact with liquids (ECTEF model):</b>
	– Sensor body: ECTFE (Halar®)
	– O-ring FKM or KALREZ
	– Rotor: ECTFE (Halar®)
	– Shaft: Sapphire
	– Bearings: Sapphire
	<b>Connections:</b> 1/4" GAS male thread
	<b>Cable length:</b> standard 2 m (6.5ft)
	<b>Supply voltage:</b> from 5 to 24 VDC ±10% regulated
	<b>Supply current:</b> < 15 mA at 24 VDC
	<b>Output signal:</b> Square wave
	<b>Signal type:</b> push-pull (for connection to NPN and PNP inputs)
	<b>K-Factor:</b>
	– Model ULF01: 8,431 pulses/litre (31,569 pulses/US gallon), linear range 8 to 100 l/h
	– Model ULF03: 3,394 pulses/litre (12,846 pulses/US gallon), linear range 15 to 250 l/h

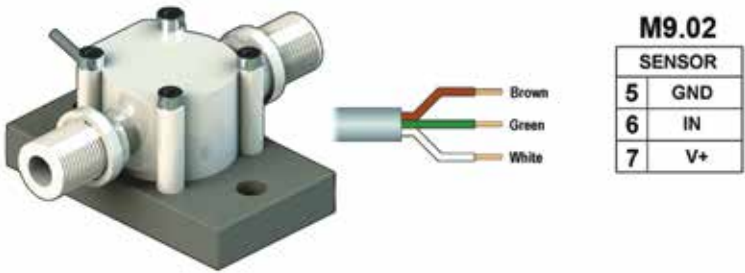
Specific data for ULF01.R I and ULF03.R	Supply voltage: none
	Output signal: Square wave
	Output type: Reed contact
	<b>K-Factor:</b> <ul style="list-style-type: none"> <li>Model ULF01: 2,108 pulses/litre (7,978 pulses/US gallon), linear range 8 to 100 l/h</li> <li>Model ULF03: 848 pulses/litre (3,210 pulses/US gallon), linear range 15 to 250 l/h</li> </ul>
Standards & Approvals	Manufactured under ISO 9001 Manufactured under ISO 14001 CE RoHS Compliance EAC

PRESSURE DROP

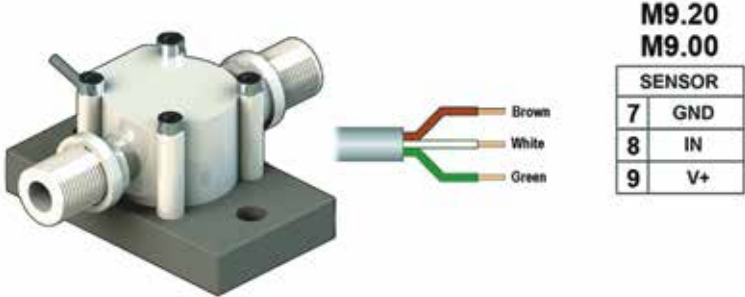


ULFXX.H  
SENSOR ELECTRICAL  
CONNECTIONS

	M9.50	M9.03 iinput 1	M9.03 input 2	M9.07	M9.08	M9.10
GND	30	30	16	16	16	37
FREQ	28	28	14	14	14	36
V+	27	27	13	13	13	35



ULFXX.R  
SENSOR ELECTRICAL  
CONNECTIONS



# PRODUCT CODES



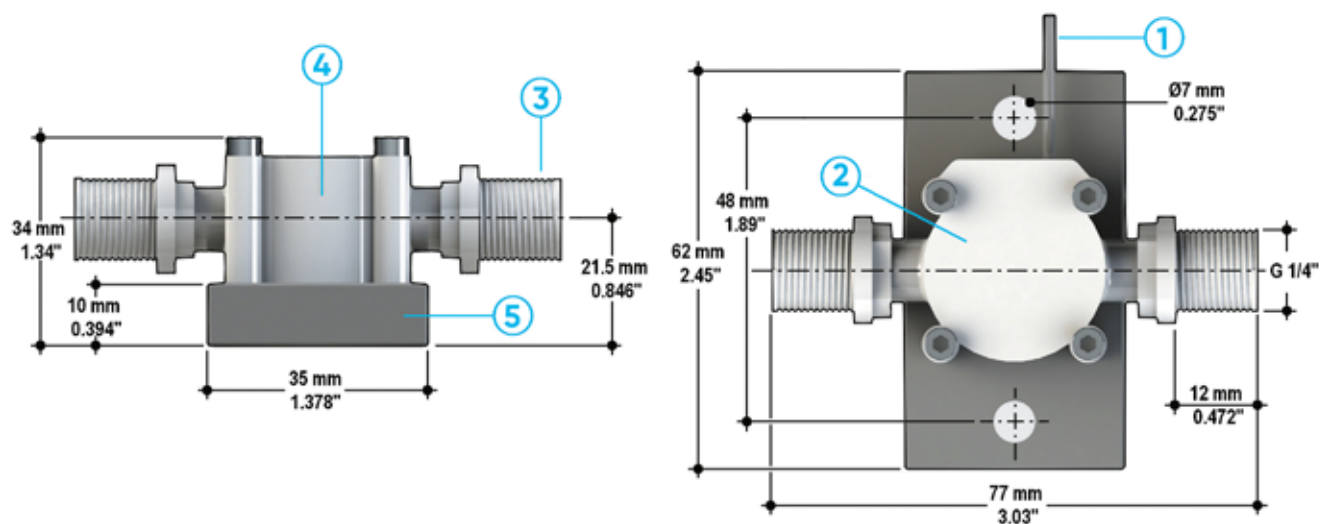
**ULFOX.X.X**  
Ultra Low Flow Sensors

Code	Version	Power supply	Length	Main Wetted Materials	Enclosure	Flow Rate Range	Weight (gr.)
ULF01.H.0	Push-Pull	5 - 24 VDC	77 mm	POM FKM	IP65	From 1,5 to 100 l/h*	170
ULF01.H.2	Push-Pull	5 - 24 VDC	77 mm	ECTFE FKM	IP65	From 1,5 to 100 l/h*	200
ULF01.H.3	Push-Pull	5 - 24 VDC	77 mm	ECTFE KALREZ	IP65	From 1,5 to 100 l/h*	200
ULF01.R.0	Reed	None	77 mm	POM FKM	IP65	From 1,5 to 100 l/h*	170
ULF01.R.2	Reed	None	77 mm	ECTFE FKM	IP65	From 1,5 to 100 l/h*	200
ULF01.R.3	Reed	None	77 mm	ECTFE KALREZ	IP65	From 1,5 to 100 l/h*	200
ULF03.H.0	Push-Pull	5 - 24 VDC	77 mm	POM FKM	IP65	From 6 to 250 l/h**	170
ULF03.H.2	Push-Pull	5 - 24 VDC	77 mm	ECTFE FKM	IP65	From 6 to 250 l/h**	200
ULF03.H.3	Push-Pull	5 - 24 VDC	77 mm	ECTFE KALREZ	IP65	From 6 to 250 l/h**	200
ULF03.R.0	Reed	None	77 mm	POM FKM	IP65	From 6 to 250 l/h**	170
ULF03.R.2	Reed	None	77 mm	ECTFE FKM	IP65	From 6 to 250 l/h**	200
ULF03.R.3	Reed	None	77 mm	ECTFE KALREZ	IP65	From 6 to 250 l/h**	200

\*(0,0066-0,44 gpm)

\*\*\*(0,0264-1,1 gpm)

# TECHNICAL DRAWINGS



## ULF

- |  |  |  |
|--|--|--|
| <p><b>1</b> Electrical cable: standard 2m (6.5ft)</p> <p><b>2</b> Fully encapsulated electronics</p> | <p><b>3</b> Connection to the process (other models are available on request depending on the body material)</p> | <p><b>4</b> Sensor body in POM or ECTFE Halar® (registered trademark of Ausimont-Solvay)</p> <p><b>5</b> PP fixing plate</p> |
|--|--|--|

# F3.80

Oval gear flow sensor



# F3.80

The FLS F3.80 oval gear flow sensors have been designed according to the main industrial requirements, providing particularly high mechanical resistance and performance reliability. These sensors are suitable for measuring a wide range of solid-free liquids of different viscosities with great precision and repeatability. The sensors can be mounted on flexible or rigid pipes using connections with 1/4" GAS female thread. ECTFE (Halar®), PP or stainless steel construction materials guarantee particularly high solidity and chemical resistance.

## OVAL GEAR FLOW SENSOR

### APPLICATIONS

- Chemical industry
- Laboratory systems
- Batching systems
- Pulsating flow measurement
- Measurement of high viscosity and non-conductive fluids
- Measurement of oils

### MAIN CHARACTERISTICS

- Compact size
- Easy installation
- High chemical resistance
- Measurement of high viscosity fluids
- Extremely limited pressure drops

### TECHNICAL DATA

#### General information

#### Flow rate range:

- F3.81.H: 10 to 100 l/h (0.044–0.44 gpm)
- F3.82.H: from 25 to 150 l/h (0.11–0.66 gpm)

**Linearity:** ±1% of full scale

**Repeatability:** ±0,3% of full scale

**Operating temperature:** from –10°C to 60°C (from 14°F to 140°F)

**Max Fluid viscosity:** from 1 to 10 cST

#### Operating pressure (PP-H body):

- 6 bar (87 psi) at 25°C (77°F)
- 3 bar (44 psi) at 60°C (140°F)

#### Operating pressure (ECTFE body):

- 8 bar (116 psi) at 25°C (77°F)
- 5 bar (73 psi) at 60°C (140°F)

#### Operating pressure (STAINLESS steel body):

- 8 bar (116 psi) at 60°C (140°F)

**Protection class:** IP65

#### Materials in contact with liquids (PP-H model):

- Sensor body: PP-H
- O-ring: FKM
- Gear: ECTFE (Halar®)
- Shaft: zircon

#### Materials in contact with liquids (ECTFE model):

- Sensor body: ECTFE (Halar®)
- O-ring: FKM
- Gear: ECTFE (Halar®)
- Shaft: zircon

#### Materials in contact with liquids (STAINLESS STEEL model):

- Sensor body: AISI316L stainless steel
- O-ring: FKM
- Gear: ECTFE (Halar®)
- Stainless steel

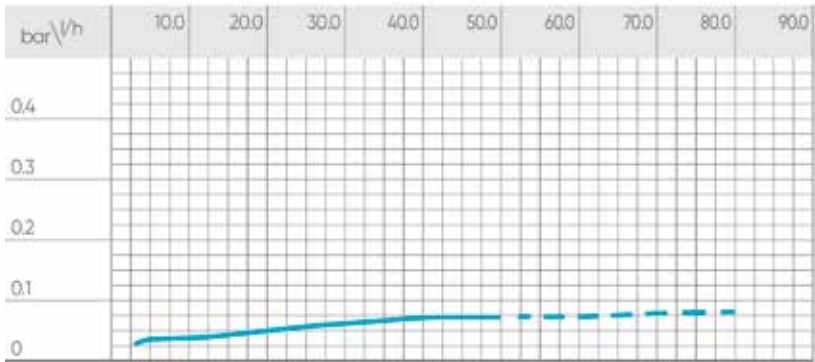
**Connections:** 1/4" GAS female

**Cable length:** standard 2m (6.5ft)

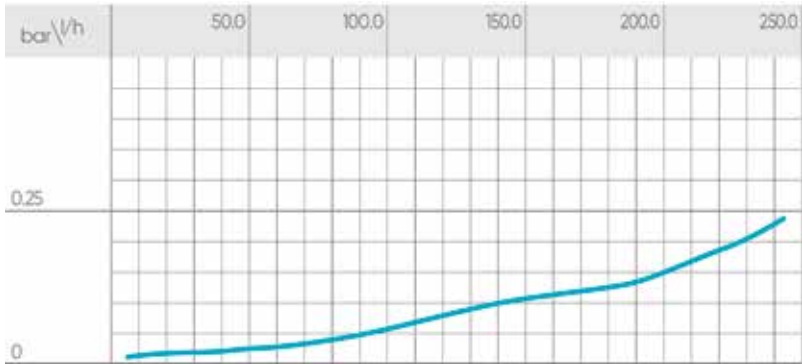


Specific data for F3.81.H	Supply voltage: from 5 to 24 VDC $\pm 10\%$ regulated
	Supply current: < 15 mA at 24 VDC
	Output signal: CMOS square wave (NPN / PNP)
	Signal type: push-pull (for connection to NPN and PNP inputs)
Specific data for F3.82.H	K-Factor:= 5950 pulses/litre (22521 pulses/US gallon)
	Supply voltage: from 5 to 24 VDC $\pm 10\%$ regulated
	Supply current: < 15 mA at 24 VDC
	Output signal: CMOS square wave (NPN / PNP)
Standards and Approvals	Signal type: push-pull (for connection to NPN and PNP inputs)
	K-Factor:= 3400 pulses/litre (12869 pulses/US gallon)
	Manufactured under ISO 9001
	Manufactured under ISO 14001
	CE
	RoHS Compliance
	EAC

### F3.81.H.OX PRESSURE DROPS

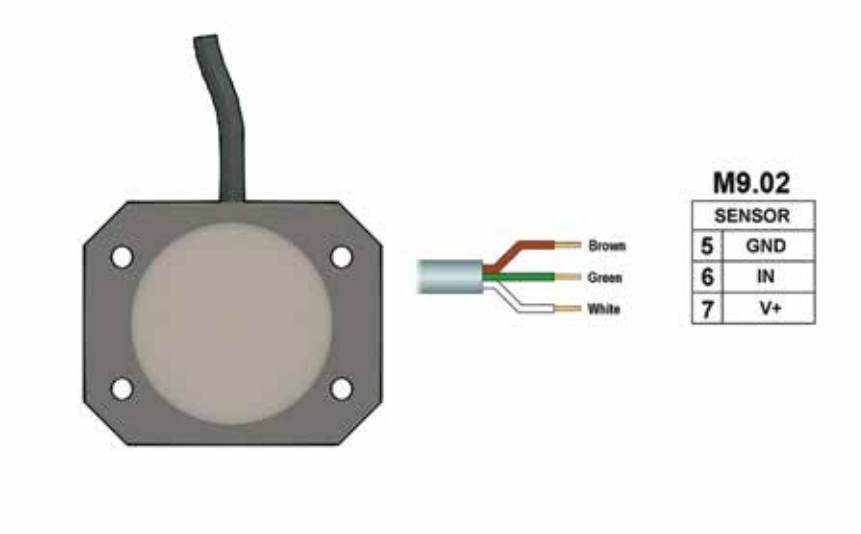


### F3.82.H.OX PRESSURE DROPS

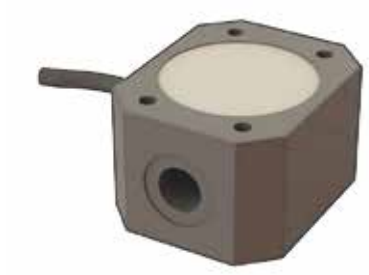


F3.8X.H  
SENSOR CONNECTION

	M9.50	M9.03	M9.03	M9.07	M9.08	M9.10
GND	30	30	16	16	16	37
FREQ	28	28	14	14	14	36
V+	27	27	13	13	13	35



# PRODUCT CODES

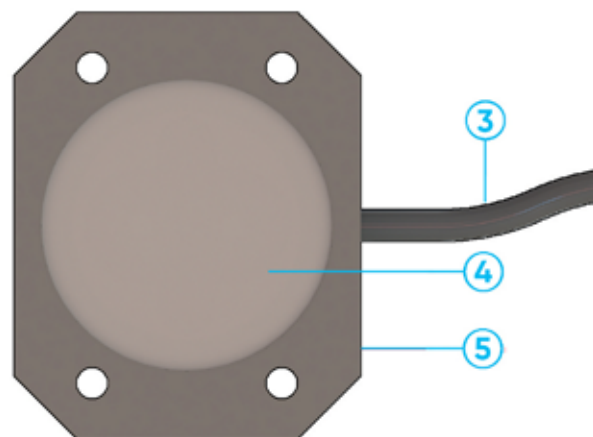
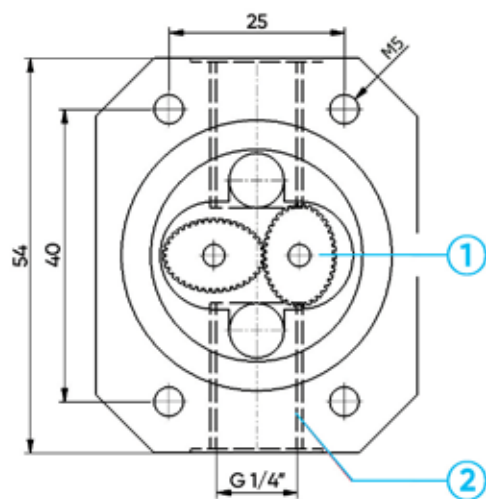


**F3.8X.H.XX**  
Oval Gear Flow Sensors

Code	Version	Power supply	Length	Main Wetted Materials	Enclosure	Flow Rate Range	Weight (gr.)
F3.81.H.01	Push-Pull	5 - 24 VDC	54 mm	PP ECTFE FKM	IP65	From 10 to 100 l/h*	200
F3.81.H.02	Push-Pull	5 - 24 VDC	54 mm	ECTFE FKM	IP65	From 10 to 100 l/h*	300
F3.81.H.03	Push-Pull	5 - 24 VDC	54 mm	316L SS FKM	IP65	From 10 to 100 l/h*	800
F3.82.H.01	Push-Pull	5 - 24 VDC	54 mm	PP ECTFE FKM	IP65	From 25 to 150 l/h**	200
F3.82.H.02	Push-Pull	5 - 24 VDC	54 mm	ECTFE FKM	IP65	From 25 to 150 l/h**	300
F3.82.H.03	Push-Pull	5 - 24 VDC	54 mm	316L SS FKM	IP65	From 25 to 150 l/h**	800

\*(0,044-0,44 gpm)  
 \*\*(0,11-0,66 gpm))

# TECHNICAL DRAWINGS



**F3.80**

- |  |   |  |
|--|---|--|
| <p><b>1</b> ECTFE Halar® oval gears</p> <p><b>2</b> Pipe connection with 1/4" GAS threaded</p> | <p><b>3</b> Electrical cable: 2m. (6.5 ft)</p> <p><b>4</b> Fully encapsulated electronics</p> | <p><b>5</b> Sensor body in PP-H, ECTFE Halar® (registered trademark of Ausimont-Solvay) or stainless steel</p> |
|--|---|--|

# **GUIDELINES FOR THE INSTALLATION AND USE**

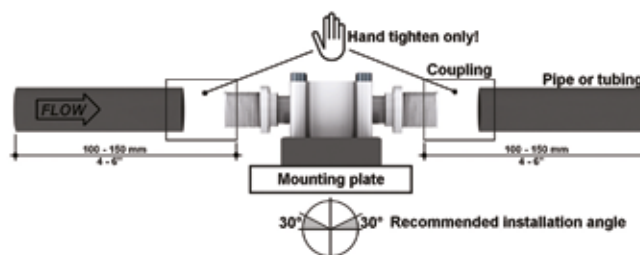
## **Of in-line flow sensors**



# INSTALLATION

## INSTALLATION GUIDELINES

The in-line flow sensor can be installed in any position, horizontally or vertically, although horizontal flow is preferable. A non-horizontal installation may limit the accuracy in the lower part of the measurement range. In any case, it is advisable to position it at a slight angle to avoid the presence of air bubbles. Install the sensor with the arrow pointing in the direction of the flow. The distance between the sensor and the pumps should always be as far as possible. Do not install the sensor immediately downstream of valves, elbows or other types of obstacles: it is preferable that the pipe runs straight for 150 mm before and after the sensor. Evaluate the pressure drops related to in-line sensors, especially if they are used in a pipe line with a diameter other than 1/4" (male for the ULF family, female for the F3.80 family). Significant pressure drops along the line may prematurely wear the sensor and/or damage bearings and/or gaskets.



## USAGE GUIDELINES

Aliaxis offers two different types of in-line sensors for low flow rates, designed for various applications based on the operating range and specific viscosity of the liquid. In general, the ULF flow sensor can be used for measuring liquids with viscosities up to 10 cP, while the F3.80 oval gear flow sensor can be used for measuring liquids with viscosities up to 1000 cP. Both sensors must be used for the measurement of solid-free liquids, as they incorporate moving parts. Dirty or abrasive liquids could damage the gaskets and bearings, and could clog the sensor. A filter may be required to remove dirt. Since these types of instruments are mainly used for dosing, very frequently aggressive chemical solutions are measured. Particular attention should be paid in the following cases:

- Chemicals could crystallise if they remain in the sensor for a long time in the absence of flow, so it is advisable to plan sensor cleaning in case of irregular use. For the cleaning procedure you can use water and other solutions compatible with the materials in contact with the liquids and with the measured chemical.
- Chemicals may release gases, so it is advisable to evaluate this issue carefully, especially during periods of inactivity.

When using in-line sensors, remove the gas bubbles before letting the liquid flow. With regards to the F3.80 family, the flow measurements acquired in the presence of bubbles are overestimated compared to those acquired with the fluid alone, since the volumes of the bubbles are measured as if they were volumes of liquid. With regards to the ULF family sensors, the flow measurements acquired in the presence of gas bubbles are inaccurate as the bubbles produce turbulence in the measuring chamber of the sensor. In the event that the viscosity of the fluid is very different from that of the liquid used for calibration (water), a recalibration may be necessary to properly rectify the K-factor, as variations in the flow of the various liquids may produce incorrect measurements. Note that increasing the viscosity reduces slippage and increases pressure drops in the in-line sensor.





**BULB AND FLAT-SURFACE pH/ORP  
ELECTRODES WITH EPOXY RESIN,  
C-PVC, RYTON OR GLASS BODY**  
One electrode for each application





# pH/ORP 200

Epoxy body bulb electrode



# PH/ORP 200

This line of FLS electrodes has been designed to provide a cost-effective solution for in-line or immersion monitoring with a wide field of application. Single and double coupling models are available, as well as models with or without BNC connection on the electrode. A pH option with built-in temperature sensor is also available for the Automatic Temperature Compensation (ATC) function. These electrodes with an epoxy resin body are suitable for numerous applications, thanks to the high chemical resistance of the material. For a cost-effective in-line installation, a simple reusable electrode holder can be used while the coupling with the 1/2" or 3/4" extension allows immersion installation. A special model is designed for installation on FLS T adapters and for FLS clamp saddles with only the addition of a union nut.

## EPOXY BODY BULB ELECTRODE

### APPLICATIONS

- Water treatment
- Neutralisation systems
- Water quality monitoring
- Swimming pools and spas
- Aquaculture
- Agriculture and fertilizers
- Process control

### MAIN CHARACTERISTICS

- Epoxy resin body
- Single or double coupling technology
- High reference gel volume
- Quick and easy installation system
- BNC or cable connection
- Model with combined temperature sensor
- Special models on request
- Cost-effective adapters

### TECHNICAL DATA

#### General Information

#### Operating range:

- Electrodes for pH: 0–14 pH (0–12.3 pH without Na<sup>+</sup> error)
- Electrodes for ORP: ±2000 mV

#### Temperature compensation device (for TC models): Pt1000

#### Pipe size range: from DN15 to DN100 (da 0,5" a 4")

#### Value at 0 mV of the new electrodes: 7,00 pH ±0,2 pH

#### New electrode efficiency: > 97% at 25°C (77°F)

#### Response time of new electrodes:

- pH: 2 s for 95% signal change
- ORP: depends on the application

#### Reference solution:

- Electrolyte: 3.5 M KCl solidified gel for single coupling models
- KCl-KNO<sub>3</sub> for double coupling models

#### Connection to the process:

- In-line installation with:
- 1/2", 3/4" or PG13.5 threaded adapter
- FLS installation adapters
- Immersion installation

#### Max operating pressure/temperature:

- 7 bar (100 psi) at 25°C (77°F)
- 1 bar (14,5 psi) at 65°C (149°F)

#### Materials in contact with liquids:

- Body: epoxy resin
- O-ring joint: silicone
- Coupling: Pellon®
- Detection surface: glass membrane (pH) or platinum (ORP)

#### O-ring: NBR (PH222 CD, PH223 CD, ORP222 CD, ORP223 CD)

#### Standards & Approvals

Manufactured under ISO 9001  
Manufactured under ISO 14001  
CE  
EAC

# PRODUCT CODES



## PH2XX

Bulb pH Electrodes with epoxy body

Code	Features	Applications/ Operative Range	Reference solution	Cable***	Connection	O-ring	Installation	Weight (gr.)
PH200C	Nylon/Single junction	0-14 pH**	KCl 3,5 M	Not required	5m (16,5 ft.) Cable	-	EG50P EG75P MK150200 MIFV20X05 MIIMC20X05	200
PH222CD	Nylon/Double junction	0-14 pH**	KCl 3,5 M / KNO3 sat.	CN 653 CN 653 TC1	Twist-lock (BNC)	silicone	EG50P EG75P MIFV20X05 MIIMC20X05	90
PH223CD	Nylon/Double junction	0-14 pH**	KCl 3,5 M / KNO3 sat.	CN 653	Twist-lock (BNC)	silicone	With F3.SP2.4 plus FLS adaptors	100
PH222CDTC	Nylon/Double junction	0-14 pH**with Pt100 included	KCl 3,5 M / KNO3 sat	Not required	5m (16,5 ft.) Cable	-	EG50P EG75P MK150200 MIFV20X05 MIIMC20X05	220

\*\* (0-12,3 pH without Na<sup>+</sup> error)

\*\*\* (Sold separately)

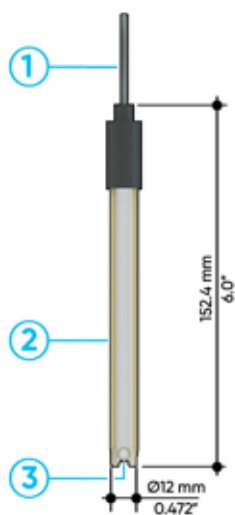
## ORP2XX

Bulb ORP Electrodes with epoxy body

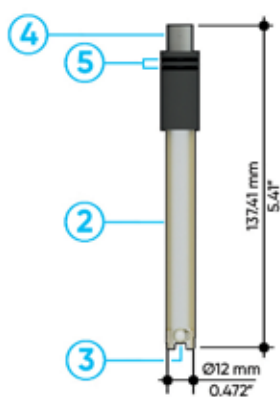
Code	Features	Applications/ Operative Range	Reference solution	Cable**	Connection	O-ring	Installation	Weight (gr.)
ORP200C	Nylon/Single junction	± 2000 mV	KCl 3,5 M	Not required	5m (16,5 ft.) Cable	-	EG50P EG75P MK150200 MIFV20X05 MIIMC20X05	200
ORP222CD	Nylon/Double junction	± 2000 mV	KCl 3,5 M / KNO3 sat.	CN 653	Twist-lock (BNC)	silicone	EG50P EG75P MIFV20X05 MIIMC20X05	90
ORP223CD	Nylon/Double junction	± 2000 mV	KCl 3,5 M / KNO3 sat	CN 653	Twist-lock (BNC)	silicone	With adapter F3.SP2.4 plus FLS adapter	100

\*\* (Sold separately)

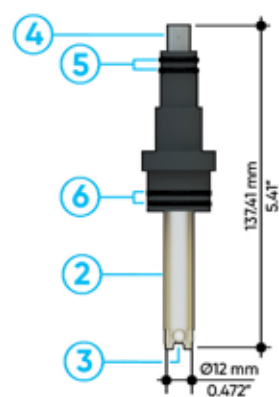
# TECHNICAL DRAWINGS



**A**



**B**



**C**

- A** PH200C PH222CDTC ORP200C
- B** PH222CD ORP222CD
- C** PH223CD ORP223CD

- 1** Cable: 5 mt (6,5 ft.)
- 2** Epoxy resin body
- 3** pH glass bulb

- 4** BNC connector
- 5** Buna-N O-rings
- 6** FKM O-rings

# pH/ORP 400

Glass body bulb electrode



# PH/ORP 400

The FLS 400 glass-bodied pH/ORP electrode line is designed for a wide range of applications. The ceramic coupling guarantees high performance in terms of pressure and temperature. Different types of ceramic couplings are available for various solutions, depending on the application requirements: annular for a faster response time, 3 membranes for a higher pressure. The standard double couplings also prevent contamination of the reference solution and guarantee a long service life. Models with long external cable (9 m) with connection head (S7) are also available.

## GLASS BODY BULB ELECTRODE

### APPLICATIONS

- Water treatment
- Neutralisation systems
- Water quality monitoring
- Process control
- Agriculture and fertilizers
- Cooling towers and scrubbers
- Galvanic processes

### MAIN CHARACTERISTICS

- Glass body
- Sensors suitable for extreme applications
- Simple and cost-effective installation
- Cost-effective installation adapters
- Special models available on request
- High-performance electrodes

### TECHNICAL DATA

#### General information

#### Operating range:

- Electrodes for pH: 0–14 pH (0–12.3 pH without Na<sup>+</sup> error)
- Electrodes for ORP: ±2000 mV

**Temperature compensation device (for TC models):** Pt1000

**Pipe size range:** from DN15 a DN100 (da 0,5" a 4")

**Value at 0 mV of the new electrodes:** 7,00 pH ±0,2 pH

**New electrode efficiency:** > 97% at 25°C (77°F)

#### Response time of new electrodes:

- pH: 2 s for 95% signal change
- ORP: depends on the application

#### Reference solution:

- Electrolyte: 3M KCl polymer gel (different substrates depending on the model)

#### Connection to the process:

- In-line installation with: PG13.5 (PH435CD); ½ threaded adapter (PH431CD; ORP431CD)

#### Max operating pressure/temperature:

- 6 bar (90 psi) at 130°C (266°F); 16 bar (240 psi) at 25°C (77°F) (PH435CD)
- 2 bar (30 psi) at 100°C (212°F); 10 bar (100 psi) at 25°C (PH431CD; ORP431CD)

#### Materials in contact with liquids:

- Body: glass
- Coupling: ceramic annular (PH431CD; ORP431CD); ceramic double annular (PH4354CD)
- Detection surface: glass membrane (pH) or platinum (ORP)

#### Standards & Approvals

Manufactured under ISO 9001  
Manufactured under ISO 14001  
CE  
EAC



# PRODUCT CODES



## PH4XX

Double junction bulb pH Electrodes with glass body

Code	Applications/ Operative Range	Detection surface	Max operating pressure at operating temperature	Cable**	Connection	O-ring	Installation	Weight (gr)
PH431CD	0-13 pH*	Glass type GX2	2 bar at 100°C (30psi at 212°F)	not required	9 m (27 ft)	-	GEG135	200
PH435CD	0-14 pH*	Glass type H	6 bar at 130°C (85 psi at 266°F)	CE5S7	S7	silicone	GEG135 GEG135SE EG135FS EG135FL	200

\*(0-12,3 pH without Na<sup>+</sup> error)

\*\* (Sold separately)

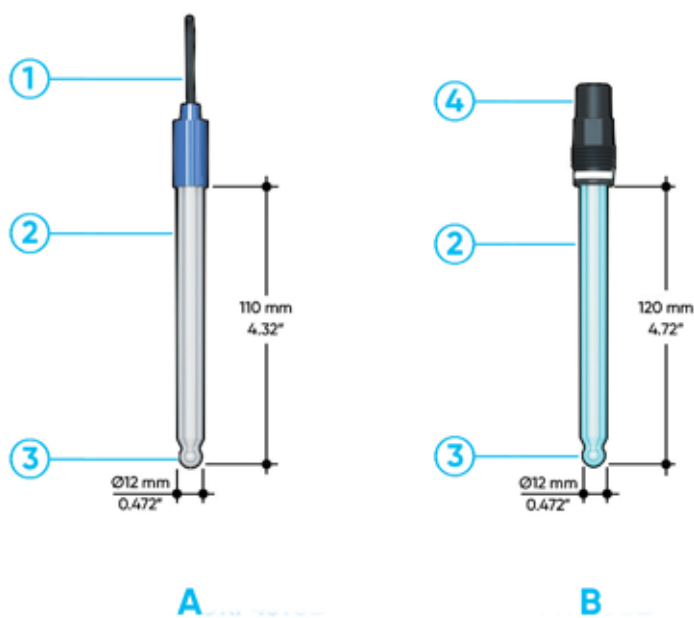
## ORP4XX

Double junction bulb ORP Electrodes with glass body

Code	Applications/ Operative Range	Detection surface	Max operating pressure at operating temperature	Cable*	Connection	O-ring	Installation	Weight (gr)
ORP431CD	± 1000 mV	Platinum	2 bar at 100°C (30 psi at 212°F)	Not required	9 mt (27 ft.)	-	GEG135	200

\* (Sold separately)

# TECHNICAL DRAWINGS



**A** PH431CD, ORP431CD  
**B** PH435CD

**1** Cable: 9m  
**2** Glass body

**3** pH glass bulb  
**4** S7

# pH/ORP 600

C-PVC body flat surface electrode



# PH/ORP 600

This line of FLS sensors constitutes the most robust model of traditional flat surface electrodes with a further enhanced self-cleaning effect. Installation and maintenance are easy thanks to the fast BNC connection. A double-coupling reference with sealed gel has been integrated into the electrode body. This model enables an additional barrier against the contamination of the reference gel and allows the use of such electrodes in critical applications prolonging the duration of the working life. The pH glass is placed centrally in the flat surface and surrounded by a large porous plastic coupling that offers excellent contact between reference and liquid. Model with amplified signal is available for long-distance connection and metal foot in ground liquid. The availability of a wide range of accessories allows for in-line, flush-mounted or immersion installation.

## C-PVC BODY FLAT SURFACE ELECTRODE

### APPLICATIONS

- Water and wastewater treatment
- Prechlorination and dechlorination
- Neutralisation systems
- Water quality monitoring
- Ozone treatment
- Cooling towers
- Boilers
- Production of hypochlorite solutions
- Cellulose pulp bleaching
- Aquaculture
- Fruit and vegetable washing
- Drying of textile products

### MAIN CHARACTERISTICS

- Availability of models for pH and ORP
- Electrodes with flat measuring surface
- Double coupling technology
- High reference gel volume
- High protection from process contamination
- Quick and easy installation system
- BNC connection
- In-line, flush-mounted or immersion installation
- Cost-effective adapters
- HF (pH) option for analysis on liquids containing hydrofluoric acid (max 2%)
- LC (pH) option on request for low conductivity water (<100 µS/cm)
- DA option for the presence of eddy currents or for long distances thanks to signal amplification

## TECHNICAL DATA

### General information

#### Operating range:

- Electrodes for pH: 0–14 pH (0–12.3 pH without Na<sup>+</sup> error)
- Electrodes for ORP: ±2000 mV

**Pipe size range:** from DN15 to DN100 (da 0,5" a 4")

**Value at 0 mV of the new electrodes:** 7,00 pH ±0,2 pH

**New electrode efficiency:** > 97% at 25°C (77 °F)

#### Response time of new electrodes:

- pH: 6 s for 95% signal change
- ORP: depends on the application

#### Reference solution:

- Type: double sealed coupling
- Electrolyte: solidified gel 3.5 M KCl 0.1 M KCl for electrode model LC / solidified gel 3.5 M KCl
- Secondary coupling: nylon filament
- Wiring: Ag/AgCl

#### Connection to the process:

- In-line installation:
- 1/2", 3/4" threaded adapter
- FLS installation adapter
- Immersion installation
- Flush-mounted installation

#### Max operating pressure/temperature:

- 6.7 bar at 75°C (100 psi at 170°F)
- 5.7 bar at 81°C (85 psi at 180°F)

#### Materials in contact with liquids:

- Body: C-PVC (PVDF on request only)
- Reference coupling: Porous HDPE
- Detection surface: glass membrane (pH) or glass sealed platinum (ORP)

**O-ring:** FKM (Viton)

### Standards & Approvals

Manufactured under ISO 9001  
Manufactured under ISO 14001  
CE  
EAC

# PRODUCT CODES



## ORP6XX CD

C-PVC double junction Flat surface electrodes

Code	Characteristics	Applications/ Operative Range	Reference solution	Detection surface	Cable*	Connection	Installation	Weight (gr.)
ORP660CD	-	-	KCl 3.5 M	platinum	CN 653	Twist-lock (BNC)	EG66P MK660	100
ORP650CD	-	-	KCl 3.5 M	platinum	CN 653 CN653 TC1	Twist-lock (BNC)	MIFV20X05 MIMC20X05	100
ORP655CD	With pressurized filling gel	-	KCl 3.5 M	platinum	CN 653	Twist-lock (BNC)	WT675 WT675 TC1	100
ORP660CDDA	Signal amplified	Presence of stray currents	KCl 3.5 M	platinum	CN 653	Twist-lock (BNC)	EG66P MK660	200
ORP650CDDA	Signal amplified	Presence of stray currents	KCl 3.5 M	platinum	CN 653 CN653 TC1	Twist-lock (BNC)	MIFV20X05 MIMC20X05	200

\* (Sold separately)

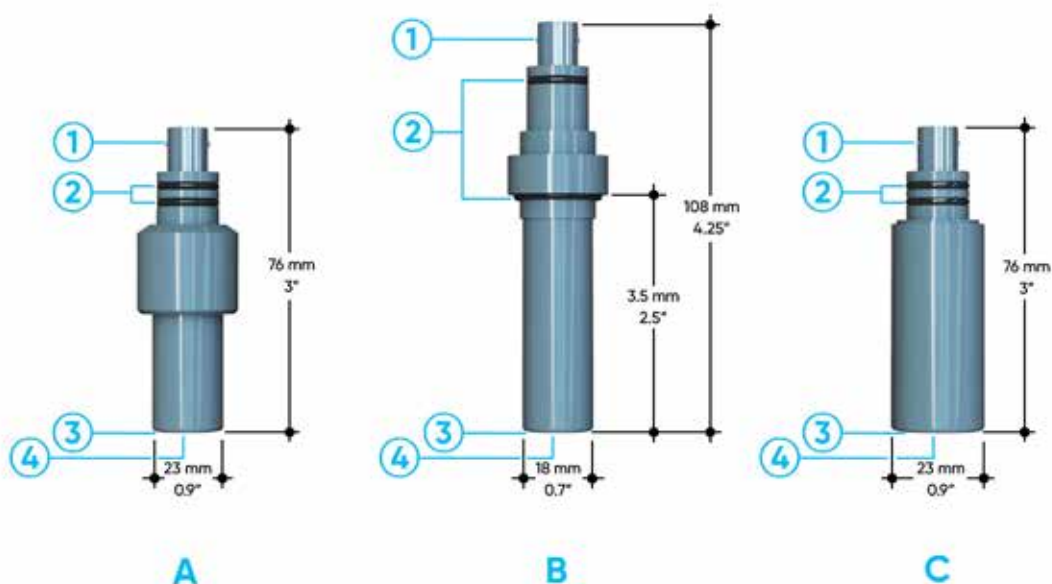
## PH6XX CD

C-PVC double junction Flat surface electrodes

Code	Characteristics	Applications/ Operative Range	Reference solution	Detection surface	Cable*	Connection	Installation	Weight (gr.)
PH660CD	-	-	KCl 3.5 M	flat pH glass membrane	CN 653	Twist-lock (BNC)	EG66P MK660	100
PH650CD	-	-	KCl 3.5 M	flat pH glass membrane	CN 653 CN 653 TC1	Twist-lock (BNC)	MIFV20X05 MIMC20X05	100
PH655CD	With pressurized filling gel	-	KCl 3.5 M	flat pH glass membrane	CN 653	Twist-lock (BNC)	WTF675 WTF675 TC1	100
PH660CDHF	-	Liquids with Hydrofluoric acid (max 2%)	KCl 3.5 M	flat pH glass membrane	CN 653	Twist-lock (BNC)	EG66P MK660	100
PH650CDHF	-	Liquids with Hydrofluoric acid (max 2%)	KCl 3.5 M	flat pH glass membrane	CN 653 CN 653 TC1	Twist-lock (BNC)	MIFV20X05 MIMC20X05	100
PH655CDHF	With pressurized filling gel	Liquids with Hydrofluoric acid (max 2%)	KCl 3.5 M	flat pH glass membrane	CN 653	Twist-lock (BNC)	WTF675 WTF675 TC1	100
PH660CDDA	Signal amplified	Presence of stray currents	KCl 3.5 M	flat pH glass membrane	CN 653	Twist-lock (BNC)	EG66P MK660	200
PH650CDDA	Signal amplified	Presence of stray currents	KCl 3.5 M	flat pH glass membrane	CN 653 CN 653 TC1	Twist-lock (BNC)	MIFV20X05 MIMC20X05	200
PH660CDLC	-	Low conductivity liquids (<100 uS)	KCl 0.1 M	flat pH glass membrane	CN 653	Twist-lock (BNC)	EG66P MK660	100
PH650CDLC	-	Low conductivity liquids (<100 uS)	KCl 0.1 M	flat pH glass membrane	CN 653 CN653 TC1	Twist-lock (BNC)	MIFV20X05 MIMC20X05	100
PH655CDLC	With pressurized filling gel	Low conductivity liquids (<100 uS)	KCl 0.1 M	flat pH glass membrane	CN 653	Twist-lock (BNC)	WTF675 WTF675 TC1	100

\* (Sold separately)

# TECHNICAL DRAWINGS



- A** Submersible PH650, ORP650
- B** In-line PH660, ORP660
- C** Insertion/Hot-tap PH655, ORP655

- 1** BNC coupling
- 2** Viton O-ring
- 3** Porous HDPE coupling

- 4** Platinum or pH glass





# pH 800

Ryton body flat surface electrode



# PH 800

The FLS pH 800 electrodes line feature a robust Ryton body combined with a self-cleaning flat surface and a reliable Pt1000 to ensure accurate measurements of dirty liquids and aggressive solutions. A large coupling improves performance in the presence of suspended solids. The new 870 electrodes allow direct installation by means of the 3/4" thread present in the body, in-line installation by means of the threads in the lower part of the electrode or immersion installation by means of the threads on the electrode end. Models are also available for specific installations: horizontal mounting (-HM), low conductivity samples (-LC), aggressive solutions (HF<2%), low pH values (-HF).

## RYTON BODY FLAT SURFACE ELECTRODE

### APPLICATIONS

- Processing and manufacturing industry
- Transformation of chemicals
- Water treatment processes
- Cooling processes
- Heating processes

### MAIN CHARACTERISTICS

- Combined temperature sensor
- Flat surface electrodes
- Robust Ryton body
- Double-threaded body for in-line and immersion installations
- Double coupling technology
- HM option for horizontal mounting
- HF option for liquids containing hydrofluoric acid (max 2%)
- LC option for liquids with conductivity below 100 µS/cm

### TECHNICAL DATA

#### General information

#### Operating range:

- Electrodes for pH: 0-14 pH (0-12.3 pH without Na+ error)

#### Pipe size range:

- from DN15 a DN100 (da 0,5" a 4")

#### Value at 0 mV of the new electrodes:

- 7.00 pH ±0,2 pH

#### New electrode efficiency:

- > 97% at 25°C (77°F)

#### Response time of new electrodes:

- pH: < 6 s for 95% signal change

#### Reference solution:

- Type: double sealed coupling
- Electrolyte: solidified gel 3.5 M KCl 0.1 M KCl for electrode model LC / solidified gel 3.5 M KCl
- Secondary coupling: nylon filament
- Wiring: Ag/AgCl

#### Connection to the process:

- NPT 3/4" threaded body for immersion or in-line installation

#### Max operating pressure/temperature:

- 6.7 bar at 75°C (100 psi at 170°F)
- 5.7 bar at 81°C (85 psi at 180°F)
- 3.3 bar at 100°C (50 psi at 212°F)

#### Materials in contact with liquids:

- Body: PPS (Ryton®) HDPE, pH glass, leaded glass
- Reference coupling: Porous HDPE
- Detection surface: glass membrane

#### Standards & Approvals

Manufactured under ISO 9001  
Manufactured under ISO 14001  
CE  
EAC

# PRODUCT CODES



## PH870CDTCXX

Ryton double junction flat surface pH electrode with Pt1000

Code	Characteristics	Applications/ Operative Range	Reference solution	Cable**	Connection	Installation	Weight (gr.)
PH870CDTC	Pt100 included	pH 0-14*	KCl 3,5 M	Not required	5 m (16,5 ft.)	3/4" NPT	250
PH870CDTCHM	Pt100 included	0-14 pH / horizontal mounting*	KCl 3,5 M	Not required	5 m (16,5 ft.)	3/4" NPT	250
PH870CDTCLC	Pt100 included	0-14 pH /low conductivity ( $<100 \mu\text{S}$ )*	KCl 3,5 M	Not required	5 m (16,5 ft.)	3/4" NPT	250
PH870CDTCHF	Pt100 included	0-14 pH / presence of hydrofluoric acid (max 2%)*	KCl 3,5 M	Not required	5 m (16,5 ft.)	3/4" NPT	250

\*(0-12,3 pH without Na<sup>+</sup> error)

\*\* (Sold separately)

# TECHNICAL DRAWINGS



**pH 870**

- 1 Cable: 5 m (16.5 ft.)
- 2 Ryton body
- 3 Flat pH glass

- 4 Porous HDPE coupling
- 5 Temperature sensor inside the stem for pH

- 6 NPT 3/4" threads
- 7 Seat for key

# **GUIDELINES FOR THE INSTALLATION AND USE Of pH/ORP electrodes**



# INSTALLATION GUIDELINES

## IN-LINE

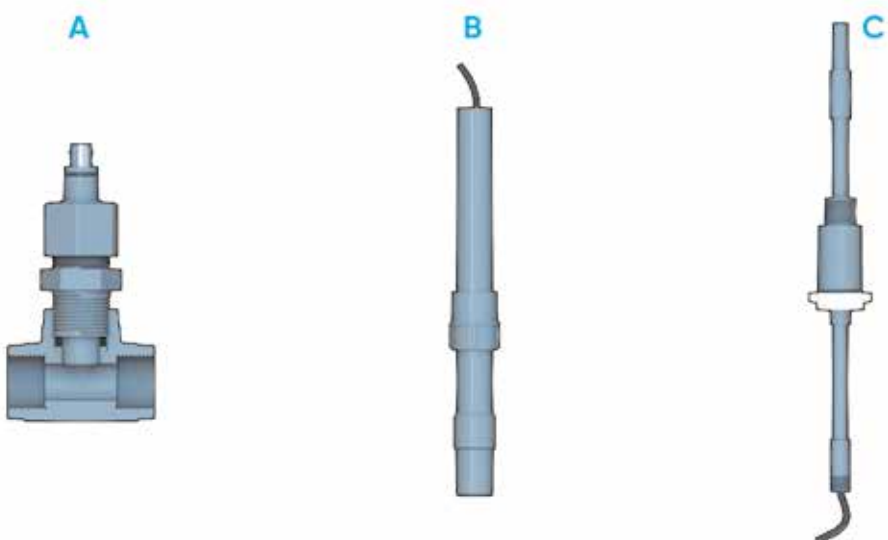
In-line installation is available for all pH/ORP sensor families. In-line installation is suggested for pipes from size DN15 to DN100. For installation in small pipes, keep in mind that the pH glass must not come into contact with the surface of the pipe. The pH/ORP electrodes can be installed at a maximum angle of 30° from the vertical position (except for the 600 model flush-mountable electrode family and the 800 HM model electrode family), ensuring that the sensor is in complete contact with the measured solution. (Fig. A)

## IMMERSION

Immersion installation is available for the electrodes families 200 and 600. To measure a representative solution, the electrode must be installed close to the outlet of the tank, away from the areas where additives are added. The sensor must be below the discharge level to prevent the electrode from running dry (in case of application with CN653TC1, the positioning of the temperature sensor foot requires special attention). (Fig. B)

## FLUSH-MOUNTED INSTALLATION

Flush-mounted installation is only available for a special model of the 600 electrode family (PH655CD, ORP655CD) combined with WT675 or WT675TC1 (in case temperature compensation is required). Flush-mounted installation can be useful if the application does not allow the electrode to be positioned at the standard 30° angle (the sensor works in all positions) and for in-line installation where it cannot be depressurised during maintenance. Flush-mounted insertion can also solve the problems in case of in-line installation on pipes larger than DN100. (Fig. C)



# USAGE GUIDELINES

## STORAGE

When the pH readings are taken occasionally, for example after days or weeks, to store the electrode, simply immerse it again in the bottle or in the protective cap. If the storage solution in the bottle in which it is immersed is missing or has dried, use a pH 4 or KCl 3 M buffer.

## CLEANING AND MAINTENANCE

If the measuring surface of the electrode becomes dirty, it can generate incorrect readings, eliminate short intervals and long response times. The patina of dirt determines the type of cleaning technique. A soft patina can be removed with a vigorous shaking, using a spray bottle or, very carefully, gently rubbing it with a soft, gentle, non-abrasive cloth.

Do not use brushes or abrasive cleaners on the glass for pH. Tough patinas can be chemically removed. The chemical used to remove the patina must be minimally corrosive, so as to dissolve the patina in 1-2 minutes without attacking the material making up the electrode. Under no circumstances should the surface of the pH electrodes be abraded or sandblasted.

ORP/REDOX: the electrode can be gently scraped with a dampened 600 grit silicon carbide paper, jewellery polisher or metal sponge. Before using 600 grit paper, however, try cleaning with chemicals.

## RECONDITIONING FOR PH ELECTRODES ONLY

When the electrode requires reconditioning on the pH glass, you can try one of the chemical treatment indicated below.

NOTE: handling these hazardous chemicals requires appropriate precautions. Ammonium bifluoride and hydrofluoric acid (HF) are extremely hazardous and should be used by qualified personnel only.

1. Soak the tip of the electrode in 0.1 M HCl for 15 seconds, rinse with tap water, then soak in 0.1 M NaOH for 15 seconds then rinse with tap water. Repeat this sequence three times and check the efficiency of the electrode. If the efficiency has not been restored, try step 2.
2. Soak the tip in a 20% solution of ammonium bifluoride ( $\text{NH}_4\text{F}$ -HF) for 2-3 minutes, rinse with tap water and check the efficiency again. If efficiency has not been restored, try step 3.
3. Soak the electrode tip in 5% hydrofluoric acid (HF) for 10-15 seconds, rinse thoroughly with tap water, rinse quickly in 5N HCl, rinse with tap water, and check the efficiency again.

If efficiency has not been restored, the pH electrode must be replaced.

## CALIBRATION

Calibration is critical to the accuracy and reliability of measurements. The calibration frequency depends on the electrode type, the pH meter and the solutions to which the electrode is exposed. The frequency also depends on the application temperature and the level of criticality of the measurements. For general purposes it is possible to use the automatic calibration with buffer with standard value (pH7, pH4, pH10). Keep in mind that the buffer for pH 10 is less stable than the buffer for pH 4, as the CO<sub>2</sub> could dissolve in it. Accordingly, if you wish to use the same buffer bottle for various calibrations, pH 4 buffer is preferred. Do not forget to clean the electrode in water before immersing it in the buffer, to avoid contamination. In the event that greater precision is required with a fixed value, manual calibration may be useful, as it is possible to use buffers that produce values close to those expected.



## INDUCTIVE AND POTENTIOMETRIC CONDUCTIVITY SENSORS

A wide range of measurement options,  
from ultrapure water to dirty liquids





# C150-200



Graphite or platinum conductivity sensor



# C150-200

FLS C150-200 conductivity sensors are equipped with graphite or platinum electrodes for high performance. The body, made of epoxy resin, guarantees high resistance and reliability. These sensors ensure accurate and high-resolution measurement thanks to the temperature sensor included (Pt100) combined with the ATC (Automatic Temperature Compensation) function of the monitor/transmitter. The sensor can be used for laboratory and industrial applications. The sensor electrodes are effectively protected, so the cell constant is unlikely to be modified by the presence of solids. Three cell constants are available, depending on the required operating range. For a cost-effective in-line installation, a simple reusable electrode holder can be used while the coupling with the ½" or ¾" extension allows immersion installation. With a specific kit, these probes can be mounted on FLS T-adaptors and brackets.

## GRAPHITE OR PLATINUM CONDUCTIVITY SENSOR

### APPLICATIONS

- Chemical concentrations
- Food industry
- Steam production
- Metal treatments and extractive industry
- Textile industry
- Paper mills
- Water treatment
- Reverse osmosis
- Regeneration of water softeners
- Deionization
- Distillation
- Aquaculture
- Agriculture and fertilizers

### MAIN CHARACTERISTICS

- Measuring surfaces in graphite or platinum
- Can be used for laboratory, industrial and field applications, provided the liquid is filtered
- In-line and immersion installation
- Temperature sensor included
- Available cell constants: 0.1; 1; 10

### TECHNICAL DATA

#### General information

#### Operating range:

- C150.01 TC, C200.01 TC: from 0,1 a 2000 µS/cm (da 10 MΩ\*cm to 500 Ω\*cm)
- C150.1 TC, C200.1 TC: from 1 a 20000 µS/cm
- C200.10 TC: da 10 to 200000 µS/cm

**Temperature compensation device (for TC models):** Pt100

**Cable length:** 5 m (16 ft)

**Max distance between electrode and controller (without signal conditioning):** 20 m (66 ft.)

#### Connection to the process:

- In-line installation with:
- ½" or ¾" threaded adapter
- FLS Installation adapters
- Immersion installation

**Operating temperature:** from 0°C to 70°C (from 32°F a 158°F)

**Max operating pressure:** 7 bar (100 psi)

#### Materials in contact with liquids:

- Body: epoxy resin
- Measuring surface: graphite (model C150) or platinum (model C200)

#### Standards & Approvals

Manufactured under ISO 9001  
Manufactured under ISO 14001  
CE  
EAC

## OPTIMAL OPERATING RANGES

Cell constant	0.1	1	10
conductivity range	0.5÷200 $\mu\text{S}/\text{cm}$	0.005÷10 $\text{mS}/\text{cm}$	0.5÷200 $\text{mS}/\text{cm}$
resistivity range	2000÷5 $\text{k}\Omega\cdot\text{cm}$	200÷0.1 $\text{k}\Omega\cdot\text{cm}$	2÷0.005 $\text{k}\Omega\cdot\text{cm}$

# PRODUCT CODES



## C150.XX

Epoxy Body Conductivity Sensor with Graphite Electrodes with Temperature Sensor (Pt100) included

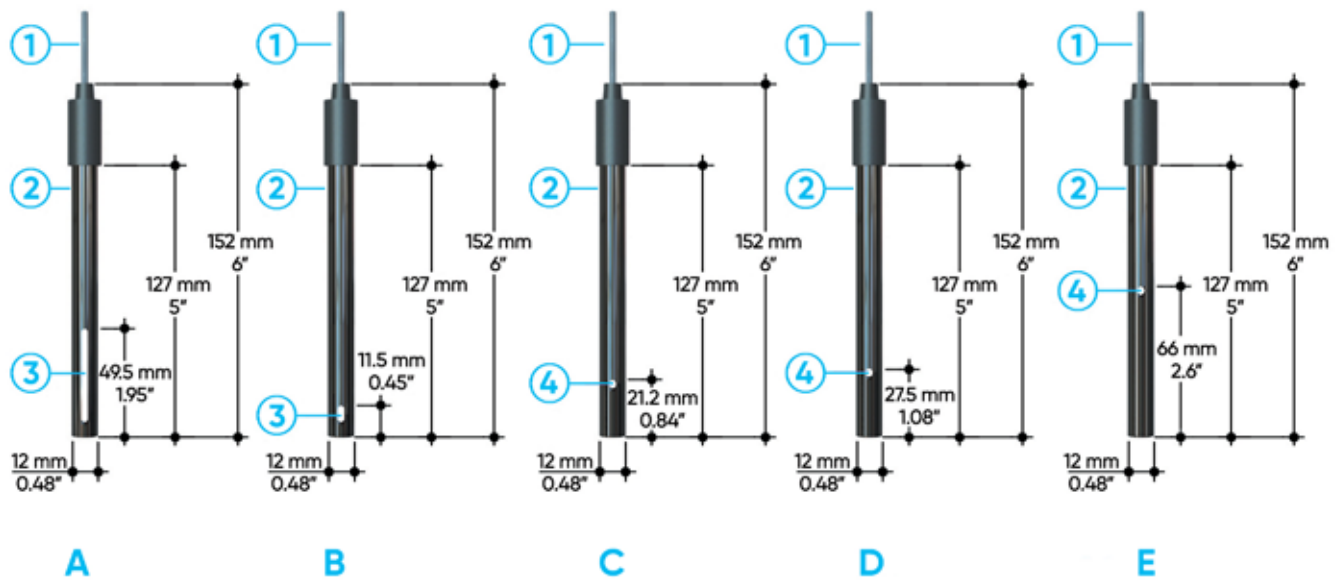
Code	Description	Applications/Flow Rate Range	Cell Constant	Connection	Installation	Weight (gr.)
C150.01TC	Pt100 included	0.1 $\mu\text{S}/\text{cm}$ to 2000 $\mu\text{S}/\text{cm}$ (10M $\Omega$ to 500M $\Omega$ cm)	0,1	5 m (16,5 ft.)	EG50P EG75P MIFV20X05 MIMC20X05	200
C150.1TC	Pt100 included	0.1 $\mu\text{S}/\text{cm}$ to 2000 $\mu\text{S}/\text{cm}$	1,0	5 m (16,5 ft.)	EG50P EG75P MIFV20X05 MIMC20X05 MK150200	200

## C200.XX

Epoxy Body Conductivity Sensor with Platinum Electrodes with Temperature Sensor (Pt100) included

Code	Description	Applications/Flow Rate Range	Cell Constant	Connection	Installation	Weight (gr.)
C200.01TC	Pt100 included	0.1 $\mu\text{S}/\text{cm}$ to 2000 $\mu\text{S}/\text{cm}$ (10M $\Omega$ to 500M $\Omega$ cm)	0,1	5 m (16,5 ft.)	EG50P EG75P MIFV20X05 MIMC20X05	200
C200.1TC	Pt100 included	0.1 $\mu\text{S}/\text{cm}$ to 20000 $\mu\text{S}/\text{cm}$	1,0	5 m (16,5 ft.)	EG50P EG75P MIFV20X05 MIMC20X05	200
C200.10TC	Pt100 included	0.1 $\mu\text{S}/\text{cm}$ to 200000 $\mu\text{S}/\text{cm}$	10	5 m (16,5 ft.)	EG50P EG75P MIFV20X05 MIMC20X05	200

# TECHNICAL DRAWINGS



- A** C150.01 TC
- B** C150.1 TC
- C** C200.01 TC
- D** C200.1 TC
- E** C.200.10 TC

- 1** Cable: 5m (16,5 ft.)
- 2** Epoxy body
- 3** Graphite electrodes
- 4** Platinum electrodes





# C100-301

Stainless steel conductivity sensor



# C100-301

Conductivity FLS sensors with stainless steel electrodes (C100 series) are designed for agriculture and light industrial applications, where the conditions of the samples allow the use of steel (water treatment, food industry and other sectors). This type of sensor is characterised by a particularly convenient cost/performance ratio. The combination of the temperature sensor with the ATC (Automatic Temperature Compensation) function of the monitor/transmitter allows an accurate measurement to be obtained. The wide choice of cell constants also guarantees the availability of the most suitable product for countless specific applications. The C301 series is designed for ultrapure water monitoring (certified cell constant 0.01) and for wastewater (cell constant 10). The C301 sensors are made entirely of stainless steel, so they are suitable for a wide range of applications.

## STAINLESS STEEL CONDUCTIVITY SENSOR

### APPLICATIONS

- Agriculture and fertilizers
- Water treatment
- Food industry
- Aquaculture
- Production and use of ultrapure water

### MAIN CHARACTERISTICS

- Stainless steel measuring surfaces
- Particularly convenient cost/performance ratio
- Temperature sensor included
- Wide choice of cell constants
- Extremely durable PP sensor body (C100)
- Sensor made entirely of stainless steel (C301)
- C301.001TCK with certified cell constant

### TECHNICAL DATA

#### General information

#### Operating range

- C301.001 TC: from 0,055 to 200  $\mu\text{S}/\text{cm}$  (from 18,2  $\text{M}\Omega\cdot\text{cm}$  to 5  $\text{k}\Omega\cdot\text{cm}$ )
- C100.01 TC: from 0,1 to 2000  $\mu\text{S}/\text{cm}$  (from 10  $\text{M}\Omega\cdot\text{cm}$  to 500  $\Omega\cdot\text{cm}$ )
- C100.02 TC: from 0,2 to 4000  $\mu\text{S}/\text{cm}$
- C100.1 TC: from 1 to 20000  $\mu\text{S}/\text{cm}$
- C301.10 TC: from 10 to 200000  $\mu\text{S}/\text{cm}$

**Temperature compensation device (for TC models):** Pt100 (C100TC), Pt1000 (C301 TC)

#### Cable length:

- C100.01 TC, C100.02 TC, C100.1 TC: no cable available
- C301 TC: 3m

#### Connection to the process:

- C100.01 TC, C100.02 TC, C100.1 TC:  $\frac{3}{4}$ " male BSP
- C301 TC:  $\frac{1}{2}$ " male BSP adapter

#### Max operating temperature:

- C100.01 TC, C100.02 TC, C100.1 TC: 80°C (176°F)
- C301 TC: 80°C (PP adapter), 120°C (stainless steel adapter)

#### Max operating pressure:

- C100.01 TC, C100.02 TC, C100.1 TC: 6 bar (85 psi)
- C301 TC: 7 bar (PP adapter), 13 bar (stainless steel adapter)

#### Materials in contact with liquids:

- Body: C100.01 TC, C100.02 TC, C100.1 TC: PP;
- C301 TC: SS 316
- Measuring surface: AISI 316 stainless steel

#### Standards & Approvals

Manufactured under ISO 9001  
Manufactured under ISO 14001  
CE  
EAC

## OPTIMAL OPERATING RANGES

Cell constant	0.01	0.1	0.2
conductivity range	0.055÷20 $\mu\text{S}/\text{cm}$	0.5÷200 $\mu\text{S}/\text{cm}$	1÷400 $\mu\text{S}/\text{cm}$
resistivity range	18.18÷0.05 $\text{M}\Omega\cdot\text{cm}$	2000÷5 $\text{k}\Omega\cdot\text{cm}$	1÷0.0025 $\text{M}\Omega\cdot\text{cm}$

# PRODUCT CODES



## C100.XX

PP Body Conductivity Sensor with SS Electrodes with Temperature Sensor (Pt100) included

Code	Description	Application/Flow Rate Range	Cell Constant	Connection	Installation	Weight (gr.)
C100.01TC	Pt100 included	0.1 $\mu\text{S}/\text{cm}$ to 2000 $\mu\text{S}/\text{cm}$ (10M $\Omega$ to 500M $\Omega$ *cm)	0,1	4 poles connector	$\frac{3}{4}$ " male BSP (parallel threaded)	350
C100.02TC	Pt100 included	0.2 $\mu\text{S}/\text{cm}$ to 4000 $\mu\text{S}/\text{cm}$	0,2	4 poles connector	$\frac{3}{4}$ " male BSP (parallel threaded)	350
C100.1TC	Pt100 included	1 $\mu\text{S}/\text{cm}$ to 20000 $\mu\text{S}/\text{cm}$	1	4 poles connector	$\frac{3}{4}$ " male BSP (parallel threaded)	350

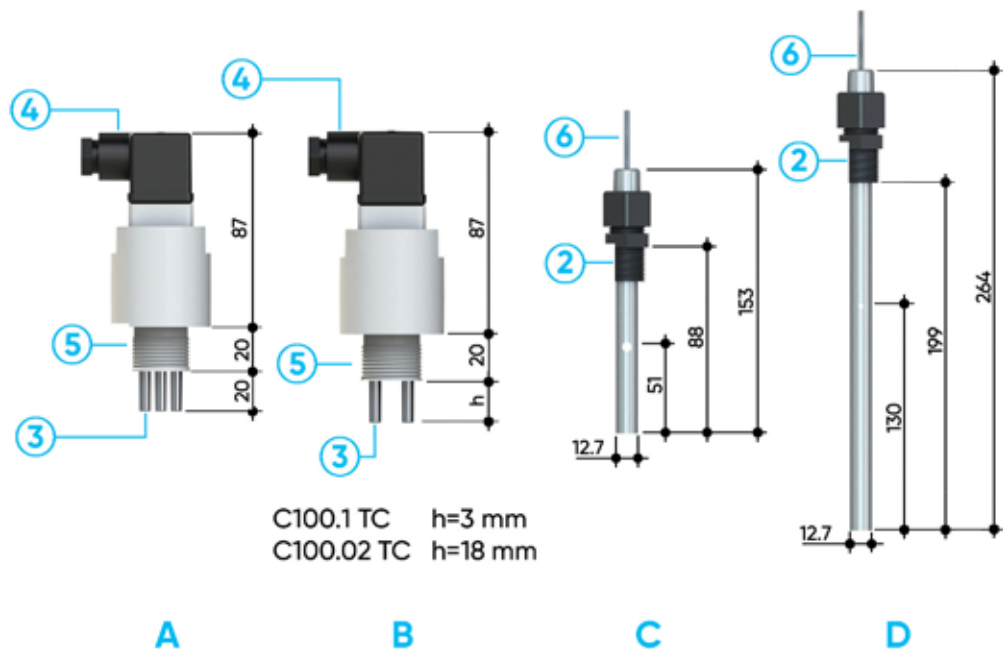


## C301

SS Body and Electrodes Conductivity Sensors with Temperature Sensor (Pt1000) included

Code	Description	Application/Flow Rate Range	Cell Constant	Connection	Installation	Weight (gr.)
C301.001TC	-	0.55 $\mu\text{S}/\text{cm}$ to 200 $\mu\text{S}/\text{cm}$ (18,2M $\Omega$ to 5K $\Omega$ *cm)	0,01	3 m	1/2" male threaded	150
C301.001.TCCK	Certified Cell constant	0.55 $\mu\text{S}/\text{cm}$ to 200 $\mu\text{S}/\text{cm}$ (18,2M $\Omega$ to 5K $\Omega$ *cm)	0,01	3 m	1/2" male threaded	150
C301.10TC	-	10 $\mu\text{S}/\text{cm}$ to 200000 $\mu\text{S}/\text{cm}$	10	3 m	1/2" male threaded	150

# TECHNICAL DRAWINGS



- |          |                       |          |                                |
|----------|-----------------------|----------|--------------------------------|
| <b>A</b> | C100.01 TC            | <b>2</b> | PP body 1/2" male threaded BSP |
| <b>B</b> | C100.1 TC, C100.02 TC | <b>3</b> | Stainless Steel electrodes     |
| <b>C</b> | C301.001 TC           | <b>4</b> | 4-Poles connector              |
| <b>D</b> | C301.10 TC            | <b>5</b> | PP body 3/4" male threaded BSP |
|          |                       | <b>6</b> | Cable: 3m (10 ft.)             |



# C6.30

Inductive conductivity transmitter



# C6.30

The FLS C6.30 product range consists of inductive conductivity transmitters, equipped with a 4-20 mA direct output (two-wire technology). This type of measurement technology allows a wide range of applications, in particular the measurement of high conductivity values (up to 1000 millisiemens) in aggressive fluids (the only material in contact with liquids is PVC-C). Since no electrodes come into direct contact with the liquid, reliable and stable measurements are guaranteed for long periods. The correct automatic temperature compensation (ATC) is guaranteed by the presence of a Pt100 integrated in the sensor body. The 4-20 mA output is ideal for direct connection to the PLC or data logger without the need for an additional interface. Both the transmitter and the temperature sensor are supplied already calibrated.

## INDUCTIVE CONDUCTIVITY TRANSMITTER

### APPLICATIONS

- Water treatment
- Wastewater treatment
- Cooling towers
- Scrubbers and smoke washing
- Surface treatments and measurement of corrosive fluids

### MAIN CHARACTERISTICS

- Resistant to corrosion and the formation of patinas
- Compact transmitter
- Sensors already calibrated
- Easy installation
- Integrated Pt100 sensor
- Suitable for immersion installation

### TECHNICAL DATA

General information	Body material: C-PVC
	Body length: 207 mm
	Protection class: IP68
	Power supply: 10-30 VDC regulated
	Max electrical consumption: < 22 mA
	Max operating pressure/temperature: – 10 bar (145 psi) at 25°C (77°F) – 6 bar (87 psi) at 50°C (122°F)
	Connection to the process: NPT 1 1/2" male
Standards & Approvals	Manufactured under ISO 9001 Manufactured under ISO 14001 CE EAC



# PRODUCT CODES

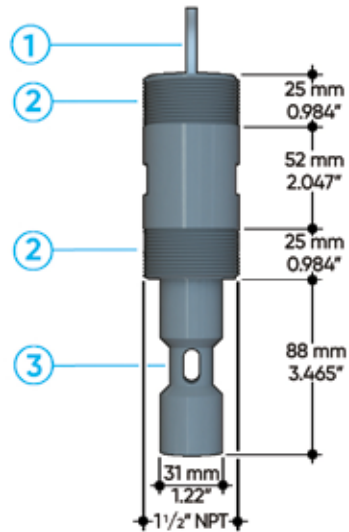


## C6.30.XX

C-PVC Inductive Conductivity Transmitter with Temperature Sensor (Pt100) included

Code	Description	Applications/ Operative Range	Connection	Installation	Weight (gr.)
C6.30.01	Pt100 included	0-10 mS/cm	3 m	1 1/2" NPT male threaded	550
C6.30.02	Pt100 included	0-100 mS/cm	3 m	1 1/2" NPT male threaded	550
C6.30.03	Pt100 included	0-1000 mS/cm	3 m	1 1/2" NPT male threaded	550

# TECHNICAL DRAWINGS



C6.30

1 Cable: 3 m (9 ft)

2 NPT 1 1/2"

3 C-PVC coating

# **GUIDELINES FOR THE INSTALLATION AND USE**

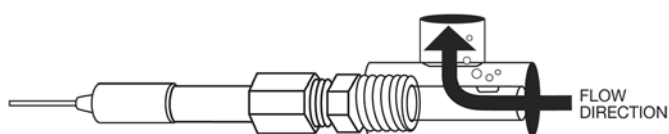
## **Of conductivity sensors**



# INSTALLATION GUIDELINES

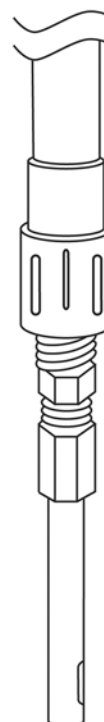
## IN-LINE

In-line installation is available for all families of conductivity sensors. two different types of in-line installation are possible: vertically on straight pipes with T adapter or on the sides of a T fitting. The former installation must be carried out with upside-down mounting (or at least at a 45° angle) to avoid air entrapment. The latter type of installation is preferable, as this configuration reduces the likelihood of trapping air bubbles and ensures optimal continuous sampling of the fluid. Make sure that the sensor electrodes are totally immersed in a representative solution (not in a dead volume). Conductivity sensors work effectively in any direction.



## IMMERSION

Immersion installation is only available for the C150/C200 sensor family. To measure a representative solution, the sensor must be installed close to the outlet of the tank, away from the areas where additives are added.



# USAGE GUIDELINES

## CLEANING AND MAINTENANCE

All conductivity sensors can be cleaned with a non-aggressive detergent. The C150/C200 sensor families can also be cleaned using a 5% HCl solution. Never use abrasion or sandblasting on the surface of the electrodes, as the ensuing change in the surface could result in incorrect readings. In any case, any solution compatible with the material of the electrodes and the sensor body can be used.

## CALIBRATION

Calibration is critical to the accuracy and reliability of measurements. The calibration frequency depends on the operating function of the sensor and the nature of the measured solution. The frequency also depends on the level of criticality of the application. Carefully avoid the presence of air bubbles during calibration, as this may result in incorrect readings. Since temperature greatly affects the measurement of conductivity, particular attention should be paid to:

- the reference temperature (which must be the same for the indicator and the calibration solution);
- temperature compensation: if it is activated, use a conductivity value of the calibration solution at the reference temperature; if it is not activated, refer to the conductivity value of the calibration solution at the temperature of the calibration solution.
- temperature compensation factor: check if it is correct for the calibration and for the measured solution.



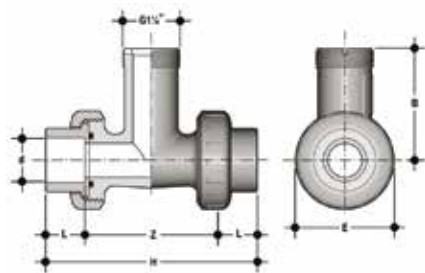
# INSTALLATION ADAPTERS FOR FLOW SENSORS AND ANALYTICAL ELECTRODES



# INSTALLATION ON PVC PIPES

## ADAPTERS

### STANDARD INSERTION INSTALLATION

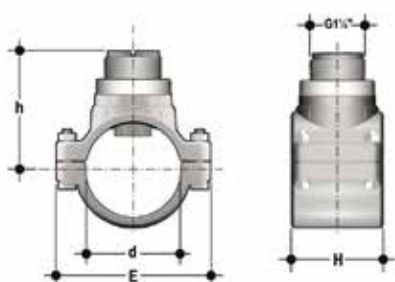


#### TFIV

ISO Metric PVC Tee Fittings (female ends for solvent welding - PN10)

Code	DN	d/R	O-ring	Body	H	Z	L	B	E	Flow Sensor Length	Suitable for (*)
TFIV20B	15	20	EPDM	U-PVC	113	81	16	73	43	L0	F & A
TFIV25B	20	25	EPDM	U-PVC	126	88	19	78	51	L0	F & A
TFIV32B	25	32	EPDM	U-PVC	140	96	22	81	59	L0	F & A
TFIV40B	32	40	EPDM	U-PVC	170	118	26	84	71	L0	F & A
TFIV50B	40	50	EPDM	U-PVC	199	137	31	83	82	L0	F & A
TFIV20D	15	20	FKM	U-PVC	113	81	16	73	43	L0	F & A
TFIV25D	20	25	FKM	U-PVC	126	88	19	78	51	L0	F & A
TFIV32D	25	32	FKM	U-PVC	140	96	22	81	59	L0	F & A
TFIV40D	32	40	FKM	U-PVC	170	118	26	84	71	L0	F & A
TFIV50D	40	50	FKM	U-PVC	199	137	31	83	82	L0	F & A

\*Suitable for: F = flow sensors; A = analytical sensors



#### SVIC

ISO Metric Clamp Saddles PN10 (excluding SMIC serie)

Code	DN	d/R	O-ring	Body	Insert	H	E	h	Drilling Hole mm	Flow Sensor Length	Suitable for (**)
SVIC063BVC	50	63	EPDM	U-PVC	C-PVC	105	116	87	35	L0	F & A
SVIC075BVC	65	75	EPDM	U-PVC	C-PVC	105	135	91	35	L0	F & A
SVIC090BVC	80	90	EPDM	U-PVC	C-PVC	105	152	96	40	L0	F & A
SVIC110BVC	100	110	EPDM	U-PVC	C-PVC	105	176	103	40	L0	F & A
SVIC125BVC	110	125	EPDM	U-PVC	C-PVC	112	190	138	40	L1	F
SVIC140BVC	125	140	EPDM	U-PVC	C-PVC	114	214	143	40	L1	F
SVIC160BVC	150	160	EPDM	U-PVC	C-PVC	120	238	150	40	L1	F
SVIC200BVC	180	200	EPDM	U-PVC	C-PVC	133	300	164	40	L1	F
SVIC225BVC	200	225	EPDM	U-PVC	C-PVC	125	333	172	40	L1	F
SVIC063DVC	50	63	FKM	U-PVC	C-PVC	105	116	87	35	L0	F & A
SVIC075DVC	65	75	FKM	U-PVC	C-PVC	105	135	91	35	L0	F & A
SVIC090DVC	80	90	FKM	U-PVC	C-PVC	105	152	96	40	L0	F & A
SVIC110DVC	100	110	FKM	U-PVC	C-PVC	105	176	103	40	L0	F & A
SMIC250IVC*	225	250	EPDM	PP	C-PVC	79	324	203	40	L0	F
SMIC280IVC*	250	280	EPDM	PP	C-PVC	88	385	212	40	L1	F
SMIC315IVC*	280	315	EPDM	PP	C-PVC	88	385	220	40	L1	F

\* Saddle PN4 only for field mount monitor and IP68 sensors

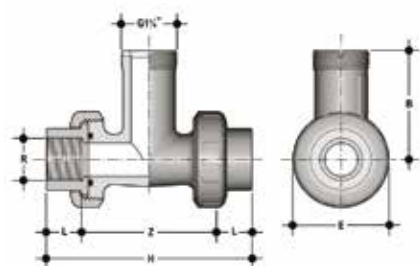
\*\*Suitable for: F = flow sensors; A = analytical sensors



# INSTALLATION ON PVC PIPES

## ADAPTERS

### STANDARD INSERTION INSTALLATION

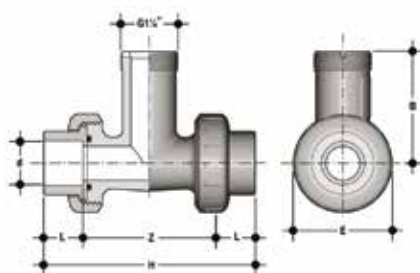


### TFFV

BSP Female Threaded PVC Tee Fittings (parallel threaded female ends - PN10)

Code	DN	d/R	O-ring	Body	H	Z	L	B	E	Flow Sensor Length	Suitable for (*)
TFFV20B	15	1/2"	EPDM	U-PVC	121	81	20	73	43	L0	F & A
TFFV25B	20	3/4"	EPDM	U-PVC	128	88	20	78	51	L0	F & A
TFFV32B	25	1"	EPDM	U-PVC	146	96	25	81	39	L0	F & A
TFFV40B	32	1 1/4"	EPDM	U-PVC	178	122	26	84	71	L0	F & A
TFFV50B	40	1 1/2"	EPDM	U-PVC	191	137	27	83	82	L0	F & A
TFFV20D	15	1/2"	FKM	U-PVC	121	81	20	73	43	L0	F & A
TFFV25D	20	3/4"	FKM	U-PVC	128	88	20	78	51	L0	F & A
TFFV32D	25	1"	FKM	U-PVC	146	96	25	81	59	L0	F & A
TFFV40D	32	1 1/4"	FKM	U-PVC	177	122	28	84	71	L0	F & A
TFFV50D	40	1 1/2"	FKM	U-PVC	191	137	27	83	82	L0	F & A

\*Suitable for: F = flow sensors; A = analytical sensors



### TFLV

BS Solvent Welding PVC Tee Fittings (female ends for solvent welding - PN10)

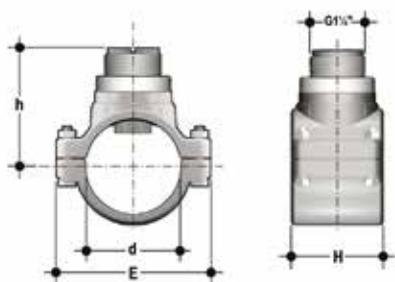
Code	DN	d/R	O-ring	Body	H	Z	L	B	E	Flow Sensor Length	Suitable for (*)
TFLV20B	15	1/2"	EPDM	U-PVC	113	80	17	73	43	L0	F & A
TFLV25B	20	3/4"	EPDM	U-PVC	126	88	19	78	51	L0	F & A
TFLV32B	25	1"	EPDM	U-PVC	140	95	23	81	59	L0	F & A
TFLV40B	32	1 1/4"	EPDM	U-PVC	170	118	26	84	71	L0	F & A
TFLV50B	40	1 1/2"	EPDM	U-PVC	199	139	30	83	82	L0	F & A
TFLV20D	15	1/2"	FKM	U-PVC	113	80	17	73	43	L0	F & A
TFLV25D	20	3/4"	FKM	U-PVC	126	88	19	78	51	L0	F & A
TFLV32D	25	1"	FKM	U-PVC	140	95	23	81	59	L0	F & A
TFLV40D	32	1 1/4"	FKM	U-PVC	170	118	26	84	71	L0	F & A
TFLV50D	40	1 1/2"	FKM	U-PVC	199	139	30	83	82	L0	F & A

\*Suitable for: F = flow sensors; A = analytical sensors

# INSTALLATION ON PVC PIPES

## ADAPTERS

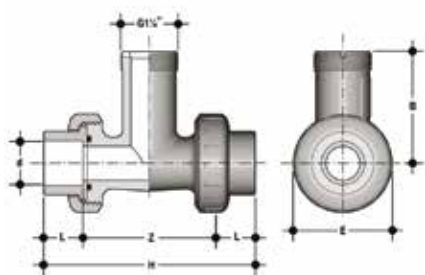
### STANDARD INSERTION INSTALLATION



**SVLC**  
BS Clamp Saddles (PN10)

Code	DN	d/R	O-ring	Body	Insert	H	E	h	Drilling Hole mm	Flow Sensor Length	Suitable for (*)
SVLC2.0BVM	50	2"	EPDM	U-PVC	C-PVC	105	116	85	35	L0	F & A
SVLC3.0BVM	80	3"	EPDM	U-PVC	C-PVC	105	152	95	40	L0	F & A
SVLC4.0BVM	100	4"	EPDM	U-PVC	C-PVC	105	176	104	40	L0	F & A
SVLC6.0BVM	150	6"	EPDM	U-PVC	C-PVC	120	238	152	40	L1	F
SVLC8.0BVM	200	8"	EPDM	U-PVC	C-PVC	125	333	170	40	L1	F
SVLC2.0DVM	50	2"	FKM	U-PVC	C-PVC	105	116	85	35	L0	F & A
SVLC3.0DVM	80	3"	FKM	U-PVC	C-PVC	105	152	95	40	L0	F & A
SVLC4.0DVM	100	4"	FKM	U-PVC	C-PVC	105	176	104	40	L0	F & A

\*Suitable for: F = flow sensors; A = analytical sensors



**TFAV**  
ASTM SCH. 80 PVC Tee Fittings (female ends for solvent welding - PN10)

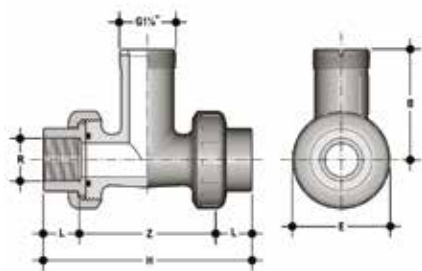
Code	DN	d/R	O-ring	Body	H	Z	L	B	E	Flow Sensor Length	Suitable for (*)
TFAV20B	15	1/2"	EPDM	U-PVC	4,92"	3,19"	0,89"	2,87"	1,69"	L0	F & A
TFAV25B	20	3/4"	EPDM	U-PVC	5,51"	3,50"	1,00"	3,00"	2,00"	L0	F & A
TFAV32B	25	1"	EPDM	U-PVC	6,60"	3,74"	1,14"	3,19"	2,32"	L0	F & A
TFAV40B	32	1 1/4"	EPDM	U-PVC	7,32"	4,80"	1,26"	3,31"	2,77"	L0	F & A
TFAV50B	40	1 1/2"	EPDM	U-PVC	8,17"	5,41"	1,38"	3,25"	3,20"	L0	F & A
TFAV20D	15	1/2"	FKM	U-PVC	4,92"	3,19"	0,89"	2,87"	1,69"	L0	F & A
TFAV25D	20	3/4"	FKM	U-PVC	5,51"	3,50"	1,00"	3,00"	2,00"	L0	F & A
TFAV32D	25	1"	FKM	U-PVC	6,60"	3,74"	1,14"	3,19"	2,32"	L0	F & A
TFAV40D	32	1 1/4"	FKM	U-PVC	7,37"	4,80"	1,26"	3,31"	2,77"	L0	F & A
TFAV50D	40	1 1/2"	FKM	U-PVC	8,17"	5,41"	1,38"	3,25"	3,20"	L0	F & A

\*Suitable for: F = flow sensors; A = analytical sensors

# INSTALLATION ON PVC PIPES

## ADAPTERS

### STANDARD INSERTION INSTALLATION

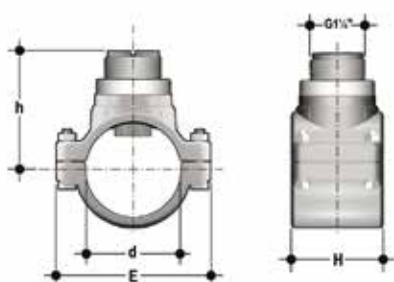


### TFNV

NPT Female Threaded PVC Tee Fittings (NPT threaded female ends - PN10)

Code	DN	d/R	O-ring	Body	H	Z	L	B	E	Flow Sensor Length	Suitable for (*)
TFNV20B	15	1/2"	EPDM	U-PVC	4,81"	3,25"	0,78"	2,87"	1,69"	L0	F & A
TFNV25B	20	3/4"	EPDM	U-PVC	5,04"	3,46"	0,79"	3,00"	2,00"	L0	F & A
TFNV32B	25	1"	EPDM	U-PVC	5,75"	3,77"	0,99"	3,19"	2,32"	L0	F & A
TFNV40B	32	1 1/4"	EPDM	U-PVC	6,76"	4,60"	1,08"	3,31"	2,77"	L0	F & A
TFNV50B	40	1 1/2"	EPDM	U-PVC	7,53"	5,39"	1,07"	3,25"	3,20"	L0	F & A
TFNV20D	15	1/2"	FKM	U-PVC	4,81"	3,25"	0,78"	2,87"	1,69"	L0	F & A
TFNV25D	20	3/4"	FKM	U-PVC	5,04"	3,46"	0,79"	3,00"	2,00"	L0	F & A
TFNV32D	25	1"	FKM	U-PVC	5,75"	3,77"	0,99"	3,19"	2,32"	L0	F & A
TFNV40D	32	1 1/4"	FKM	U-PVC	6,76"	4,60"	1,08"	3,31"	2,77"	L0	F & A
TFNV50D	40	1 1/2"	FKM	U-PVC	7,53"	5,39"	1,07"	3,86"	3,20"	L0	F & A

\*Suitable for: F = flow sensors; A = analytical sensors



### SVAC

ASTM Clamp Saddles PN10

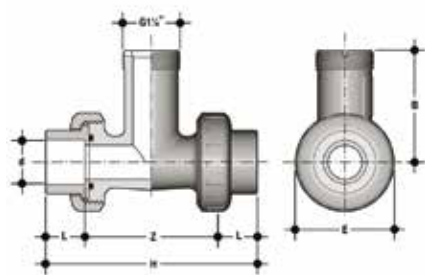
Code	DN	d/R	O-ring	Body	Insert	H	E	h	Drilling Hole (mm)	Flow Sensor Length	Suitable for (*)
SVAC2.0BVM	50	2"	EPDM	U-PVC	C-PVC	4,13"	4,57"	3,3"	1,38"	L0	F & A
SVAC2.5BVM	65	2 1/2"	EPDM	U-PVC	C-PVC	4,13"	5,28"	3,4"	1,38"	L0	F & A
SVAC3.0BVM	80	3"	EPDM	U-PVC	C-PVC	4,13"	5,98"	3,6"	1,57"	L0	F & A
SVAC4.0BVM	100	4"	EPDM	U-PVC	C-PVC	4,13"	6,93"	4,0"	1,57"	L0	F & A
SVAC5.0BVM	125	5"	EPDM	U-PVC	C-PVC	4,49"	8,43"	5,6"	1,57"	L1	F
SVAC6.0BVM	150	6"	EPDM	U-PVC	C-PVC	4,72"	9,37"	5,9"	1,57"	L1	F
SVAC8.0BVM	200	8"	EPDM	U-PVC	C-PVC	4,92"	13,11"	6,6"	1,57"	L1	F
SVAC2.0DVM	50	2"	FKM	U-PVC	C-PVC	4,13"	4,57"	3,3"	1,38"	L0	F & A
SVAC2.5DVM	65	2 1/2"	FKM	U-PVC	C-PVC	4,13"	5,28"	3,4"	1,38"	L0	F & A
SVAC3.0DVM	80	3"	FKM	U-PVC	C-PVC	4,13"	5,98"	3,6"	1,57"	L0	F & A
SVAC4.0DVM	100	4"	FKM	U-PVC	C-PVC	4,13"	6,93"	4,0"	1,57"	L0	F & A

\*Suitable for: F = flow sensors; A = analytical sensors

# INSTALLATION ON C-PVC PIPES

## ADAPTERS

### STANDARD INSERTION INSTALLATION

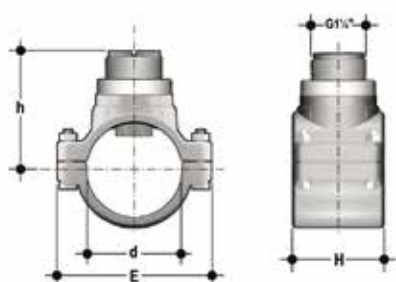


#### TFIF

ISO Metric PVDF Tee Fittings (C-PVC end connectors for solvent welding – PN10)

Code	DN	d/R	O-ring	Body	H	Z	L	B	E	Flow Sensor Length	Suitable for (*)
TFIF20BC	15	20	EPDM	PVDF	112	80	16	75	43	L0	F & A
TFIF25BC	20	25	EPDM	PVDF	125	87	19	80	50	L0	F & A
TFIF32BC	25	32	EPDM	PVDF	140	96	22	83	59	L0	F & A
TFIF40BC	32	40	EPDM	PVDF	167	115	26	86	70	L0	F & A
TFIF50BC	40	50	EPDM	PVDF	196	134	31	84	76	L0	F & A
TFIF20DC	15	20	FKM	PVDF	112	80	16	75	43	L0	F & A
TFIF25DC	20	25	FKM	PVDF	125	87	19	80	50	L0	F & A
TFIF32DC	25	32	FKM	PVDF	140	96	22	83	59	L0	F & A
TFIF40DC	32	40	FKM	PVDF	167	115	26	86	70	L0	F & A
TFIF50DC	40	50	FKM	PVDF	196	134	31	84	80	L0	F & A

\*Suitable for: F = flow sensors; A = analytical sensors



#### SVIC

ISO Metric Clamp Saddles PN10 (excluding SMIC serie)

Code	DN	d/R	O-ring	Body	Insert	H	E	h	Drilling Hole (mm)	Flow Sensor Length	Suitable for (**)
SVIC063BVC	50	63	EPDM	U-PVC	C-PVC	105	116	87	35	L0	F & A
SVIC075BVC	65	75	EPDM	U-PVC	C-PVC	105	135	91	35	L0	F & A
SVIC090BVC	80	90	EPDM	U-PVC	C-PVC	105	152	96	40	L0	F & A
SVIC110BVC	100	110	EPDM	U-PVC	C-PVC	105	176	103	40	L0	F & A
SVIC125BVC	110	125	EPDM	U-PVC	C-PVC	112	190	138	40	L1	F
SVIC140BVC	125	140	EPDM	U-PVC	C-PVC	114	214	143	40	L1	F
SVIC160BVC	150	160	EPDM	U-PVC	C-PVC	120	238	150	40	L1	F
SVIC200BVC	180	200	EPDM	U-PVC	C-PVC	133	300	164	40	L1	F
SVIC225BVC	200	225	EPDM	U-PVC	C-PVC	125	333	172	40	L1	F
SVIC063DVC	50	63	FKM	U-PVC	C-PVC	105	116	87	35	L0	F & A
SVIC075DVC	65	75	FKM	U-PVC	C-PVC	105	135	91	35	L0	F & A
SVIC090DVC	80	90	FKM	U-PVC	C-PVC	105	152	96	40	L0	F & A
SVIC110DVC	100	110	FKM	U-PVC	C-PVC	105	176	103	40	L0	F & A
SMIC250IVC*	225	250	EPDM	PP	U-PVC	79	324	203	40	L0	F
SMIC280IVC*	250	280	EPDM	PP	U-PVC	88	385	212	40	L1	F
SMIC315IVC*	280	315	EPDM	PP	U-PVC	88	385	220	40	L1	F

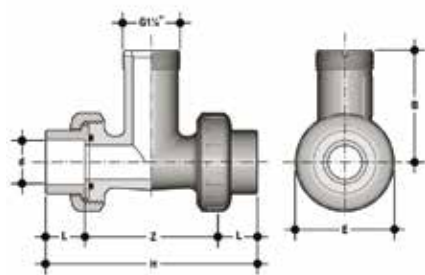
\* Saddle PN4 only for field mount monitor and IP68 sensors

\*\*Suitable for: F = flow sensors; A = analytical sensors

# INSTALLATION ON PP PIPES

## ADAPTERS

### STANDARD INSERTION INSTALLATION

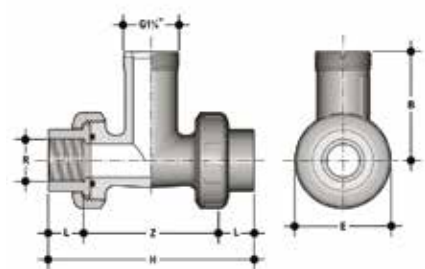


#### TFIM

ISO Metric PP Tee Fittings (female ends for socket welding - PN10)

Code	DN	d/R	O-ring	Body	H	Z	L	B	E	Flow Sensor Length	Suitable for (*)
TFIM20B	15	20	EPDM	PP	114	85	14,5	75	42	L0	F & A
TFIM25B	20	25	EPDM	PP	125	93	16	78	50	L0	F & A
TFIM32B	25	32	EPDM	PP	140	104	18	81	59	L0	F & A
TFIM40B	32	40	EPDM	PP	167	126	20,5	84	70	L0	F & A
TFIM50B	40	50	EPDM	PP	200	153	23,5	84	80	L0	F & A
TFIM20D	15	20	FKM	PP	114	85	14,5	75	42	L0	F & A
TFIM25D	20	25	FKM	PP	125	93	16	78	50	L0	F & A
TFIM32D	25	32	FKM	PP	140	104	18	81	59	L0	F & A
TFIM40D	32	40	FKM	PP	167	127	20,5	84	70	L0	F & A
TFIM50D	40	50	FKM	PP	200	153	23,5	83	80	L0	F & A

\*Suitable for: F = flow sensors; A = analytical sensors



#### TFFM

BSP Female Threaded PP Tee Fittings (parallel threaded female ends - PN10)

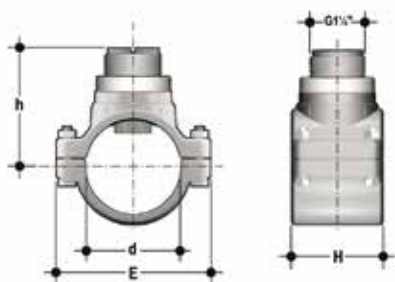
Code	DN	d/R	O-ring	Body	H	Z	L	B	E	Flow Sensor Length	Suitable for (*)
TFFM20B	15	1/2"	EPDM	PP	113	83	15	75	42	L0	F & A
TFFM25B	20	3/4"	EPDM	PP	126	94	16	78	50	L0	F & A
TFFM32B	25	1"	EPDM	PP	140	101	19	81	59	L0	F & A
TFFM40B	32	1 1/4"	EPDM	PP	170	127	21	84	70	L0	F & A
TFFM50B	40	1 1/2"	EPDM	PP	199	156	21	83	80	L0	F & A
TFFM20D	15	1/2"	FKM	PP	113	83	15	74	42	L0	F & A
TFFM25D	20	3/4"	FKM	PP	126	93	16	78	50	L0	F & A
TFFM32D	25	1"	FKM	PP	140	101	19	81	59	L0	F & A
TFFM40D	32	1 1/4"	FKM	PP	170	127	21	84	70	L0	F & A
TFFM50D	40	1 1/2"	FKM	PP	199	156	21	83	80	L0	F & A

\*Suitable for: F = flow sensors; A = analytical sensors

# INSTALLATION ON PP PIPES

## ADAPTERS

### STANDARD INSERTION INSTALLATION



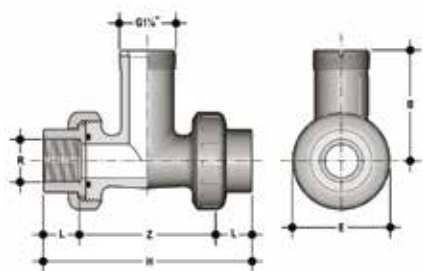
### SVIC

ISO metric Clamp Saddles (PN10 excluding SMIC serie)

Code	DN	d/R	O-ring	Body	Insert	H	E	h	Drilling Hole	Flow Sensor Length	Suitable for (**)
SVIC063BME	50	63	EPDM	U-PVC	C-PVC**	105	116	87	35	L0	F & A
SVIC075BME	65	75	EPDM	U-PVC	C-PVC**	105	135	91	35	L0	F & A
SVIC090BME	80	90	EPDM	U-PVC	C-PVC**	105	152	96	40	L0	F & A
SVIC110BME	100	110	EPDM	U-PVC	C-PVC**	105	176	103	40	L0	F & A
SVIC125BME	110	125	EPDM	U-PVC	C-PVC**	112	190	138	40	L1	F
SVIC140BME	125	140	EPDM	U-PVC	C-PVC**	114	214	143	40	L1	F
SVIC160BME	150	160	EPDM	U-PVC	C-PVC**	120	238	150	40	L1	F
SVIC200BME	182	200	EPDM	U-PVC	C-PVC**	133	300	164	40	L1	F
SVIC225BME	200	225	EPDM	U-PVC	C-PVC**	125	333	172	40	L1	F
SVIC063DME	50	63	FKM	U-PVC	C-PVC**	105	116	87	35	L0	F & A
SVIC075DME	65	75	FKM	U-PVC	C-PVC**	105	135	91	35	L0	F & A
SVIC090DME	80	90	FKM	U-PVC	C-PVC**	105	152	96	40	L0	F & A
SVIC110DME	100	110	FKM	U-PVC	C-PVC**	105	176	103	40	L0	F & A
SMIC250IME*	225	250	EPDM	PP	U-PVC**	79	324	203	40	L0	F
SMIC280IME*	250	280	EPDM	PP	U-PVC**	88	385	212	40	L1	F
SMIC315IME*	300	315	EPDM	PP	U-PVC**	88	385	220	40	L1	F

\* Saddle PN4 only for field mount monitor and IP68 sensors

\*\*Suitable for: F = flow sensors; A = analytical sensors



### TFNM

NPT Female Threaded PP Tee Fittings (NPT threaded female ends - PN10)

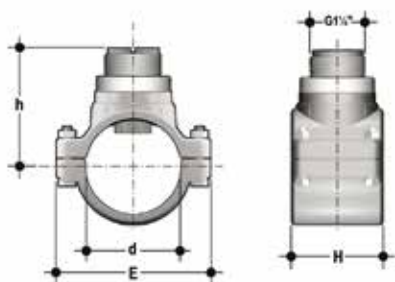
Code	DN	d/R	O-ring	Body	H	Z	L	B	E	Flow Sensor Length	Suitable for (*)
TFNM20B	15	1/2"	EPDM	PP	4,45"	3,19"	0,63"	2,87"	2,09"	L0	F & A
TFNM25B	20	3/4"	EPDM	PP	4,96"	3,48"	0,74"	3,15"	2,44"	L0	F & A
TFNM32B	25	1"	EPDM	PP	5,49"	3,75"	0,97"	3,19"	2,80"	L0	F & A
TFNM40B	32	1 1/4"	EPDM	PP	6,69"	4,69"	1,00"	3,31"	3,31"	L0	F & A
TFNM50B	40	1 1/2"	EPDM	PP	7,83"	5,39"	1,22"	3,25"	3,86"	L0	F & A
TFNM20D	15	1/2"	FKM	PP	4,45"	3,19"	0,63"	2,87"	2,09"	L0	F & A
TFNM25D	20	3/4"	FKM	PP	4,96"	3,48"	0,74"	3,15"	2,44"	L0	F & A
TFNM32D	25	1"	FKM	PP	5,49"	3,75"	0,97"	3,19"	2,80"	L0	F & A
TFNM40D	32	1 1/4"	FKM	PP	6,69"	4,69"	1,00"	3,31"	3,31"	L0	F & A
TFNM50D	40	1 1/2"	FKM	PP	7,83"	5,39"	1,22"	3,86"	3,86"	L0	F & A

\*Suitable for: F = flow sensors; A = analytical sensors

# INSTALLATION ON PP PIPES

## ADAPTERS

### STANDARD INSERTION INSTALLATION

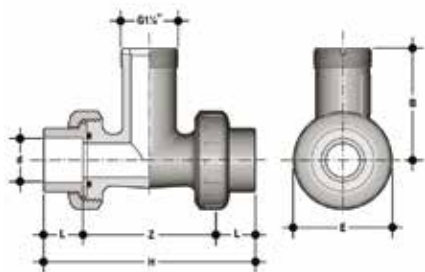


### SVAC

ASTM Clamp Saddles (PN10)

Code	DN	d/R	O-ring	Body	Insert	H	E	h	Drilling Hole(mm)	Flow Sensor Length	Suitable for (*)
SVAC2.0BVM	50	2"	EPDM	U-PVC	C-PVC**	4,13"	4,57"	3,3"	1,38"	L0	F & A
SVAC2.5BVM	65	2 1/2"	EPDM	U-PVC	C-PVC**	4,13"	5,28"	3,4"	1,38"	L0	F & A
SVAC3.0BVM	80	3"	EPDM	U-PVC	C-PVC**	4,13"	5,98"	3,6"	1,57"	L0	F & A
SVAC4.0BVM	100	4"	EPDM	U-PVC	C-PVC**	4,13"	6,93"	4,0"	1,57"	L0	F & A
SVAC5.0BVM	125	5"	EPDM	U-PVC	C-PVC**	4,49"	8,43"	5,6"	1,57"	L1	F
SVAC6.0BVM	150	6"	EPDM	U-PVC	C-PVC**	4,72"	9,37"	5,9"	1,57"	L1	F
SVAC8.0BVM	200	8"	EPDM	U-PVC	C-PVC**	4,92"	13,11"	6,6"	1,57"	L1	F
SVAC2.0DVM	50	2"	FKM	U-PVC	C-PVC**	4,13"	4,57"	3,3"	1,38"	L0	F & A
SVAC2.5DVM	65	2 1/2"	FKM	U-PVC	C-PVC**	4,13"	5,28"	3,4"	1,38"	L0	F & A
SVAC3.0DVM	80	3"	FKM	U-PVC	C-PVC**	4,13"	5,98"	3,6"	1,57"	L0	F & A
SVAC4.0DVM	100	4"	FKM	U-PVC	C-PVC**	4,13"	6,93"	4,0"	1,57"	L0	F & A

\*Suitable for: F = flow sensors; A = analytical sensors



### TFIF

ISO Metric PVDF Tee Fittings PN10 (female ends for socket welding)

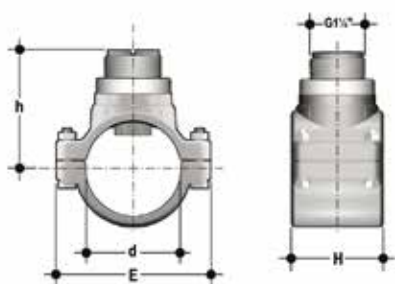
Code	DN	d/R	O-ring	Body	H	Z	L	B	E	Flow Sensor Length	Suitable for (*)
TFIF20B	15	20	EPDM	PVDF	114	85	15	75	42	L0	F & A
TFIF25B	20	25	EPDM	PVDF	125	93	16	78	50	L0	F & A
TFIF32B	25	32	EPDM	PVDF	140	104	18	81	59	L0	F & A
TFIF40B	32	40	EPDM	PVDF	167	126	21	84	70	L0	F & A
TFIF50B	40	50	EPDM	PVDF	200	153	24	83	80	L0	F & A
TFIF20D	15	20	FKM	PVDF	114	85	15	75	42	L0	F & A
TFIF25D	20	25	FKM	PVDF	125	93	16	78	50	L0	F & A
TFIF32D	25	32	FKM	PVDF	140	104	18	81	59	L0	F & A
TFIF40D	32	40	FKM	PVDF	167	127	21	84	70	L0	F & A
TFIF50D	40	50	FKM	PVDF	200	153	24	83	80	L0	F & A

\*Suitable for: F = flow sensors; A = analytical sensors

# INSTALLATION ON PVDF PIPES

## ADAPTERS

### STANDARD INSERTION INSTALLATION

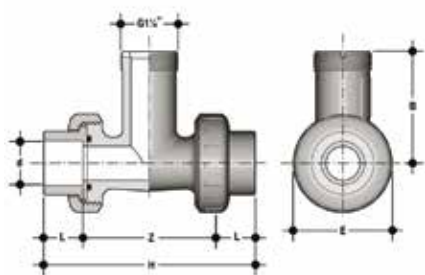


#### SVIF

ISO Metric Clamp Saddles PN10

Code	DN	d/R	O-ring	Body	Insert	H	E	h	Drilling Hole(mm)	Flow Sensor Length	Suitable for (*)
SVIF063BF	50	63	EPDM	U-PVC	PVDF	105	116	87	35	L0	F & A
SVIF075BF	65	75	EPDM	U-PVC	PVDF	105	134	92	35	L0	F & A
SVIF090BF	80	90	EPDM	U-PVC	PVDF	105	152	97	40	L0	F & A
SVIF110BF	100	110	EPDM	U-PVC	PVDF	105	176	104	40	L0	F & A
SVIF063DF	50	63	FKM	U-PVC	PVDF	105	116	87	35	L0	F & A
SVIF075DF	65	75	FKM	U-PVC	PVDF	105	134	92	35	L0	F & A
SVIF090DF	80	90	FKM	U-PVC	PVDF	105	152	97	40	L0	F & A
SVIF110DF	100	110	FKM	U-PVC	PVDF	105	176	101	40	L0	F & A

\*Suitable for: F = flow sensors; A = analytical sensors



#### TFIV

ISO Metric PVC Tee Fittings PN10 (PE end connectors for electrofusion or butt welding)

Code	DN	d/R	O-ring	Body	H	Z	L	B	E	Flow Sensor Length	Suitable for (*)
TFIV20BE	15	20	EPDM	U-PVC	183	73	55	73	43	L0	F & A
TFIV25BE	20	25	EPDM	U-PVC	223	83	70	78	51	L0	F & A
TFIV32BE	25	32	EPDM	U-PVC	237	89	74	81	59	L0	F & A
TFIV40BE	32	40	EPDM	U-PVC	266	110	78	84	71	L0	F & A
TFIV50BE	40	50	EPDM	U-PVC	295	127	84	83	82	L0	F & A
TFIV20DE	15	20	FKM	U-PVC	183	73	55	73	43	L0	F & A
TFIV25DE	20	25	FKM	U-PVC	223	83	70	78	51	L0	F & A
TFIV32DE	25	32	FKM	U-PVC	237	89	74	81	59	L0	F & A
TFIV40DE	32	40	FKM	U-PVC	266	110	78	84	71	L0	F & A
TFIV50DE	40	50	FKM	U-PVC	295	127	84	83	82	L0	F & A

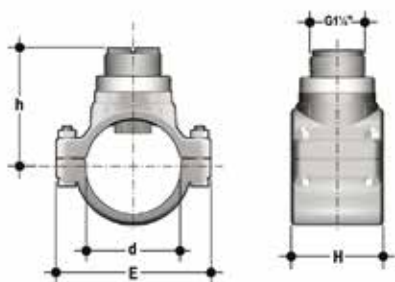
\*Suitable for: F = flow sensors; A = analytical sensors



# INSTALLATION ON PE PIPES

## ADAPTERS

### STANDARD INSERTION INSTALLATION



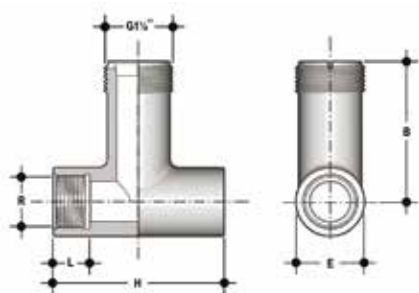
### SVIC

ISO Metric Clamp Saddles PN10 (excluding SMIC serie)

Code	DN	d/R	O-ring	Body	Insert	H	E	h	Drilling Hole(mm)	Flow Sensor Length	Suitable for (**)
SVIC063BME	50	63	EPDM	U-PVC	C-PVC	105	116	87	35	L0	F & A
SVIC075BME	65	75	EPDM	U-PVC	C-PVC	105	135	91	35	L0	F & A
SVIC090BME	80	90	EPDM	U-PVC	C-PVC	105	152	96	40	L0	F & A
SVIC110BME	100	110	EPDM	U-PVC	C-PVC	105	176	103	40	L0	F & A
SVIC125BME	110	125	EPDM	U-PVC	C-PVC	112	190	138	40	L1	F
SVIC140BME	125	140	EPDM	U-PVC	C-PVC	114	214	143	40	L1	F
SVIC160BME	150	160	EPDM	U-PVC	C-PVC	120	238	150	40	L1	F
SVIC200BME	180	200	EPDM	U-PVC	C-PVC	133	300	164	40	L1	F
SVIC225BME	200	225	EPDM	U-PVC	C-PVC	125	333	172	40	L1	F
SVIC063DME	50	63	FKM	U-PVC	C-PVC	105	116	87	35	L0	F & A
SVIC075DME	65	75	FKM	U-PVC	C-PVC	105	135	91	35	L0	F & A
SVIC090DME	80	90	FKM	U-PVC	C-PVC	105	152	96	40	L0	F & A
SVIC110DME	100	110	FKM	U-PVC	C-PVC	105	176	103	40	L0	F & A
SMIC250IME*	225	250	EPDM	PP	U-PVC	79	324	203	40	L0	F
SMIC280IME*	250	280	EPDM	PP	U-PVC	88	385	212	40	L1	F
SMIC315IME*	300	315	EPDM	PP	U-PVC	88	385	220	40	L1	F

\* Saddle PN4 only for field mount monitor and IP68 sensors

\*\*Suitable for: F = flow sensors; A = analytical sensors



### TFFX

BSP Female Threaded 316 SS Tee Fittings (PN25)

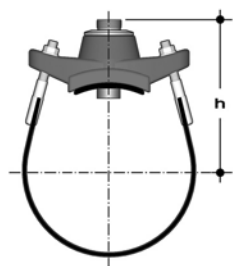
Code	DN	d/R	O-ring	Body	H	Z	L	B	E	Flow Sensor Length	Suitable for (*)
TFFX20	15	1/2"	-	316L SS	85	-	16	73	42	L0	F & A
TFFX25	20	3/4"	-	316L SS	95	-	20	74	42	L0	F & A
TFFX32	25	1"	-	316L SS	105	-	23	81	42	L0	F & A
TFFX40	32	1 1/4"	-	316L SS	120	-	21	84	54	L0	F & A

\*Suitable for: F = flow sensors; A = analytical sensors

# INSTALLATION ON METAL PIPES

## ADAPTERS

### STANDARD INSERTION INSTALLATION

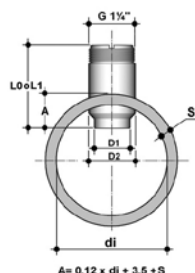
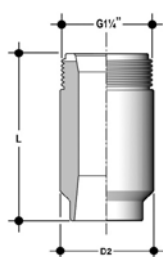


**SZIC**  
Strap-on Saddles (PN16)

Code	DN	O.D. min	O.D. max	Parallel Thread (GAS)	O-ring	Body	Insert	h	Drilling Hole (mm)	Flow Sensor Length	Suitable for (**)
SZIC080I*	80	88	104	1" 1/4	EPDM	Cast iron + 316L SS	C-PVC	153	40	L0	F
SZIC100I*	100	112	126	1" 1/4	EPDM	Cast iron + 316L SS	C-PVC	160	40	L0	F
SZIC125I*	125	140	154	1" 1/4	EPDM	Cast iron + 316L SS	C-PVC	170	40	L0	F
SZIC150I*	150	168	184	1" 1/4	EPDM	Cast iron + 316L SS	C-PVC	180	40	L0	F
SZIC200I*	200	218	234	1" 1/4	EPDM	Cast iron + 316L SS	C-PVC	228	40	L1	F
SZIC250I*	250	272	286	1" 1/4	EPDM	Cast iron + 316L SS	C-PVC	247	40	L1	F
SZIC300I*	300	322	344	1" 1/4	EPDM	Cast iron + 316L SS	C-PVC	266	40	L1	F
SZIC350I*	350	356	384	1" 1/4	EPDM	Cast iron + 316L SS	C-PVC	305	40	L1	F
SZIC400I*	400	425	458	1" 1/4	EPDM	Cast iron + 316L SS	C-PVC	324	40	L1	F
SZIC450I*	450	475	516	1" 1/4	EPDM	Cast iron + 316L SS	C-PVC	343	40	L1	F

\*Only for field mount monitors or IP68 sensors

\*\*Suitable for: F = flow sensors; A = analytical sensors



**WAIX**  
316L SS Weld on Adapters (PN25)

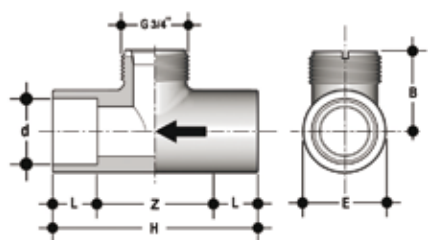
Code	DN	d/R	Parallel Thread (GAS)	Body	L	D1	D2	Drilling Hole	Flow Sensor Length	Suitable for (*)
WAIXL0	40	-	1"1/4	316L SS	69	34	44	44	L0	F & A
WAIXL0	50	-	1"1/4	316L SS	70	35	44	44	L0	F & A
WAIXL0	60	-	1"1/4	316L SS	71	36	44	44	L0	F & A
WAIXL0	65	-	1"1/4	316L SS	72	37	44	44	L0	F & A
WAIXL0	80	-	1"1/4	316L SS	73	38	44	44	L0	F & A
WAIXL0	100	-	1"1/4	316L SS	74	39	44	44	L0	F & A
WAIXL0	110	-	1"1/4	316L SS	75	40	44	44	L0	F & A
WAIXL0	125	-	1"1/4	316L SS	76	41	44	44	L0	F
WAIXL0	150	-	1"1/4	316L SS	77	42	44	44	L0	F
WAIXL0	175	-	1"1/4	316L SS	78	43	44	44	L0	F
WAIXL0	200	-	1"1/4	316L SS	79	44	44	44	L0	F
WAIXL1	225	-	1"1/4	316L SS	80	45	44	44	L1	F
WAIXL1	250	-	1"1/4	316L SS	81	46	44	44	L1	F
WAIXL1	300	-	1"1/4	316L SS	82	47	44	44	L1	F
WAIXL1	350	-	1"1/4	316L SS	83	48	44	44	L1	F
WAIXL1	400	-	1"1/4	316L SS	84	49	44	44	L1	F
WAIXL1	450	-	1"1/4	316L SS	85	50	44	44	L1	F
WAIXL1	500	-	1"1/4	316L SS	86	51	44	44	L1	F
WAIXL1	600	-	1"1/4	316L SS	87	52	44	44	L1	F

\*Suitable for: F = flow sensors; A = analytical sensors

# INSTALLATION FITTINGS FOR FLS F3.10

## ADAPTERS

### STANDARD INSERTION INSTALLATION

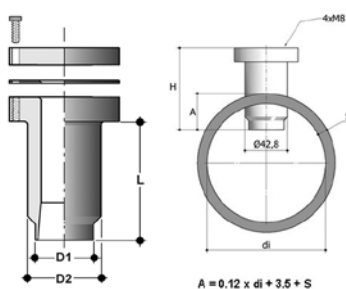


#### TMIV

ISO Metric PVC Tee Fittings (female ends for solvent welding - PN10)

Code	DN	d/R	O-ring	Body	H	Z	L	B	E	Flow Sensor Length	Suitable for (*)
TMIV20MF	15	20	-	U-PVC	43	11	16	27	27	-	F
TMIV25MF	20	25	-	U-PVC	52	14	19	30	33	-	F
TMIV32MF	25	32	-	U-PVC	62	18	22	34	41	-	F
TMIV40MF	32	40	-	U-PVC	74	22	26	38	50	-	F
TMIV50MF	40	50	-	U-PVC	89	27	31	43	61	-	F

\*Suitable for: F = flow sensors; A = analytical sensors



#### WAIX

316L SS Weld-on Adapters

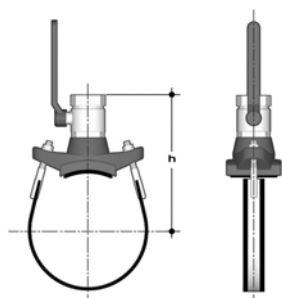
Code	DN	d/R	Parallel Thread (GAS)	Body	L	D1	D2	Drilling Hole (mm)	Flow Sensor Length	Suitable for (*)
WAIXHP	40	-	1"1/4	316L SS	69	34	43	43	-	F
WAIXHP	50	-	1"1/4	316L SS	69	34	43	43	-	F
WAIXHP	60	-	1"1/4	316L SS	69	34	43	43	-	F
WAIXHP	65	-	1"1/4	316L SS	69	34	43	43	-	F
WAIXHP	80	-	1"1/4	316L SS	69	34	43	43	-	F
WAIXHP	100	-	1"1/4	316L SS	69	34	43	43	-	F
WAIXHP	110	-	1"1/4	316L SS	69	34	43	43	-	F
WAIXHP	125	-	1"1/4	316L SS	69	34	43	43	-	F
WAIXHP	150	-	1"1/4	316L SS	69	34	43	43	-	F
WAIXHP	175	-	1"1/4	316L SS	69	34	43	43	-	F
WAIXHP	200	-	1"1/4	316L SS	69	34	43	43	-	F

\*Suitable for: F = flow sensors; A = analytical sensors

# INSTALLATION ON METAL AND PLASTIC PIPES

## ADAPTERS

### HOT TAP INSERTION INSTALLATION

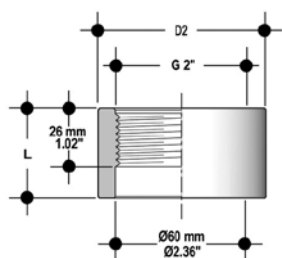


#### SZIC

Strap-on Saddles (PN16) \*\*\*

Code	DN	O.D. min	O.D. max	Parallel Thread (GAS)	O-ring	Body	Insert	h	Drilling Hole(mm)	Flow Sensor Length	Suitable for (*)
SZIC080IHT	80	88	104	2.00"	EPDM	Cast iron + 316L SS	-	160	min 32	-	F
SZIC100IHT	100	112	126	2.00"	EPDM	Cast iron + 316L SS	-	170	min 32	-	F
SZIC125IHT	125	140	154	2.00"	EPDM	Cast iron + 316L SS	-	172	min 32	-	F
SZIC150IHT	150	168	184	2.00"	EPDM	Cast iron + 316L SS	-	172	min 32	-	F
SZIC200IHT	200	218	234	2.00"	EPDM	Cast iron + 316L SS	-	177	min 32	-	F
SZIC250IHT	250	272	286	2.00"	EPDM	Cast iron + 316L SS	-	175	min 32	-	F
SZIC300IHT	300	322	344	2.00"	EPDM	Cast iron + 316L SS	-	178	min 32	-	F
SZIC350IHT	350	356	384	2.00"	EPDM	Cast iron + 316L SS	-	178	min 32	-	F
SZIC400IHT	400	425	458	2.00"	EPDM	Cast iron + 316L SS	-	171	min 32	-	F
SZIC450IHT	450	475	516	2.00"	EPDM	Cast iron + 316L SS	-	180	min 32	-	F

\*Suitable for: F = flow sensors; A = analytical sensors\*\*\* Bigger sizes available on request



#### WAIX

316L SS Weld-on Adapters

Code	DN	d/R	Parallel Thread (GAS)	Body	L	D1	D2	Drilling Hole	Flow Sensor Length	Suitable for (*)
WAIXHT	350	-	2.00"	316L SS	40	-	75	min 32	-	F
WAIXHT	400	-	2.00"	316L SS	40	-	75	min 32	-	F
WAIXHT	450	-	2.00"	316L SS	40	-	75	min 32	-	F
WAIXHT	500	-	2.00"	316L SS	40	-	75	min 32	-	F
WAIXHT	600	-	2.00"	316L SS	40	-	75	min 32	-	F
WAIXHT	700	-	2.00"	316L SS	40	-	75	min 32	-	F
WAIXHT	800	-	2.00"	316L SS	40	-	75	min 32	-	F
WAIXHT	900	-	2.00"	316L SS	40	-	75	min 32	-	F

\*Suitable for: F = flow sensors; A = analytical sensors

# IN-LINE INSTALLATION ADAPTERS

## SPECIFIC ADAPTERS FOR ANALYTICAL SENSORS INSTALLATION



### Adapters for C150-200

T fitting

Code	Main Wetted Materials	d	DN	Suitable for	g
TCONIV32E	U-PVC	32	25	C150-200	500
TCONIV40E	U-PVC	40	32	C150-200	550
TCONIV50E	U-PVC	50	40	C150-200	600
TCONIC32E	C-PVC	32	25	C150-200	500
TCONIC40E	C-PVC	40	32	C150-200	550
TCONIC50E	C-PVC	50	40	C150-200	600



Installation KIT for FLS fittings

Code	Main Wetted Materials	Description	Suitable for	Weight (gr.)
MK150200	C-PVC PP	Installation KIT (EG50P, adapter, yellow cap) for TF,SV,WA	C150.1 C150.1 TC	205



Male Electrode Gland

Code	Main Wetted Materials	Thread	Suitable for	Weight (gr.)
EG50P	PP	1/2"	C150-200	45
EG75P	PP	3/4"	C150-200	45

# IN-LINE INSTALLATION

## ADAPTERS

### SPECIFIC ADAPTERS FOR ANALYTICAL SENSORS INSTALLATION



**Adapters for pH/ORP200**  
T fitting

Code	Main Wetted Materials	d	DN	Suitable for	Weight (gr.)
TPHIV32E	U-PVC-PP	32	25	pH/ORP.200 (except PH223CD, ORP223CD)	500
TPHIV40E	U-PVC-PP	40	32	pH/ORP.200 (except PH223CD, ORP223CD)	550
TPHIV50E	U-PVC-PP	50	40	pH/ORP.200 (except PH223CD, ORP223CD)	600
TPHIC32E	C-PVC-PP	32	25	pH/ORP.200 (except PH223CD, ORP223CD)	500
TPHIC40E	C-PVC-PP	40	32	pH/ORP.200 (except PH223CD, ORP223CD)	550
TPHIC50E	C-PVC-PP	50	40	pH/ORP.200 (except PH223CD, ORP223CD)	600



Installation KIT for FLS fittings

Code	Main Wetted Materials	Description	Suitable for	Weight (gr.)
MK150200	C-PVC PP	Installation KIT (EG50P, adapter, yellow cap) for installation on TF,SV,WA	pH200C ORP200C	205



Yellow Cap

Code	Main Wetted Materials	Description	Suitable for	Weight (gr.)
F3.SP2.4	U-PVC	Yellow cap for installation on TF,SV,WA	pH223CD ORP223CD	60

# IN-LINE INSTALLATION ADAPTERS

## SPECIFIC ADAPTERS FOR ANALYTICAL SENSORS INSTALLATION



Male Electrode Gland

Code	Main Wetted Materials	Thread	Suitable for	Weight (gr.)
EG50P	PP	1/2"	pH/ORP.200	45
EG75P	PP	3/4"	pH/ORP.200	45



### Adapters for pH/ORP400

Gland electrode for PG13.5 electrode with electrode head protection

Code	Main Wetted Materials	Thread	Description	Suitable for	Weight (gr.)
GEG135SE	PP	1 1/4"	gland electrode for PG13.5 electrode with electrode head protection	pH435 CD	500



Male Electrode Gland

Code	Main Wetted Materials	Thread	Description	Suitable for	Weight (gr.)
GEG135	U-PVC	1/2"	gland electrode for PG13.5 or 12mm electrode body male threaded (including FKM o-rings)	pH/ORP.400	70



Short gland electrode for PG13.5

Code	Main Wetted Materials	Thread	Description	Suitable for	Weight (gr.)
EG135FS	PVDF FKM	1/2"	short gland electrode for PG13.5	pH435CD	40

# IN-LINE INSTALLATION

## ADAPTERS

### SPECIFIC ADAPTERS FOR ANALYTICAL SENSORS INSTALLATION



Long gland electrode for PG13.5

Code	Main Wetted Materials	Thread	Description	Suitable for	Weight (gr.)
EG135FL	PVDF FKM	1/2"	long gland electrode for PG13.5 electrode	pH435CD	65



### Adapters for pH/ORP600

Male Electrode Gland

Code	Main Wetted Materials	Thread	Suitable for	Weight (gr.)
EG66P	C-PVC	3/4"	pH660 ORP660	45



T fitting

Code	Main Wetted Materials	d	DN	Suitable for	Weight (gr.)
TPHIC32C	C-PVC	32	25	pH660 ORP660	500
TPHIC40C	C-PVC	40	32	pH660 ORP660	550
TPHIC50C	C-PVC	50	40	pH660 ORP660	600



# IN-LINE INSTALLATION ADAPTERS

## SPECIFIC ADAPTERS FOR ANALYTICAL SENSORS INSTALLATION



Installation KIT for FLS fittings

Code	Main Wetted Materials	Description	Suitable for	Weight (gr.)
MK660	C-PVC	Installation KIT (adapter + yellow cap for TF,SV,WA)	pH660 ORP660	165



### Adapters for Pt100 temperature sensors

Male Electrode Gland

Code	Main Wetted Materials	Thread	Suitable for	Weight (gr.)
EG50P	PP	1/2"	T970278 T970196	45
EG75P	PP	3/4"	T970278 T970196	45



### Adapters for C150-200

Male Electrode Gland

Code	Main Wetted Materials	Thread	Suitable for	Weight (gr.)
EG50P	PP	1/2"	C150-200	45
EG75P	PP	3/4"	C150-200	45

# SUBMERSIBLE INSTALLATION

## ADAPTERS

### SPECIFIC ADAPTERS FOR ANALYTICAL SENSORS INSTALLATION



Double socket 20\*1/2"

Code	Main Wetted Materials	Suitable for	Weight (gr.)
MIFV20X05*	U-PVC	C150-200	30
MIMC20X05*	C-PVC	C150-200	30

\*Pipe supplied by customer



### Adapters for pH/ORP200

Male Electrode Gland

Code	Main Wetted Materials	Thread	Suitable for	Weight (gr.)
EG50P	PP	1/2"	pH/ORP.200	45
EG75P	PP	3/4"	pH/ORP.200	45



\*Double socket 20X1/2"

Code	Main Wetted Materials	Suitable for	Weight (gr.)
MIFV20X05	U-PVC	pH200C ORP200C (with EG50P) pH222CD (with CN653) (GEG135)	30
MIMC20X05	C-PVC	pH200C ORP200C (with EG50P) pH222CD (with CN653) (GEG135)	30

\*Pipe supplied by customer

# SUBMERSIBLE INSTALLATION ADAPTERS

## SPECIFIC ADAPTERS FOR ANALYTICAL SENSORS INSTALLATION



### Adapters for pH/ORP400

Male Electrode Gland

Code	Main Wetted Materials	Thread	Description	Suitable for	Weight (gr.)
GEG135	U-PVC	1/2"	gland electrode for PG13.5 or 12mm electrode body male threaded (including FKM o-rings)	pH-ORP400	70



Short gland electrode for PG13.5 electrode

Code	Main Wetted Materials	Thread	Description	Suitable for	Weight (gr.)
EG135FS	PVDF FKM	1/2"	short gland for PG13.5 electrode	pH435CD	40



Long gland electrode for PG13.5 electrode

Code	Main Wetted Materials	Thread	Description	Suitable for	Weight (gr.)
EG135FL	PVDF FKM	1/2"	long gland for PG13.5 electrode male threaded	pH435CD	65

# SUBMERSIBLE INSTALLATION

## ADAPTERS

### SPECIFIC ADAPTERS FOR ANALYTICAL SENSORS INSTALLATION



#### Adapters for pH/ORP600

Double socket 20\*1/2"

Code	Main Wetted Materials	Suitable for	Weight (gr.)
MIFV20X05*	U-PVC	pH650 ORP650 (with CN653)	30
MIMC20X05*	C-PVC	pH650 ORP650 (with CN653)	30

\*Pipe supplied by customer



#### Adapters for pH/ORP600

Electrode gland for hot tap installation

Code	Main Wetted Materials	Description	Suitable for	Weight (gr.)
WT675	U-PVC	Electrode gland for hot tap installation: max insertion 300mm (12") (including FKM o-ring)	pH655 ORP655	700
WT675TC1	U-PVC SS	Electrode gland for hot tap installation with TC: max insertion 300mm (12") (including FKM o-ring)	pH655 ORP655	880

## ACCESSORIES



# MONITORS AND ANALYTICAL SENSORS

## ACCESSORIES

### ACCESSORIES FOR MONITOR



Compact mounting kit

Code	Description	To be used with:	Weight (gr.)
F6.KC1	Plastic adapter with compact cap and locking nut	M902	137



Wall mounting kit for wall installation of all panel mounting monitors

Code	Description	To be used with:	Weight (gr.)
M9.KW1	144X144mm plastic box	M9XX	600
M9.KW2	144X144mm plastic box and 110/230VAC to 24 VDC power supply included	M9XX	900



USB cable

Code	Description	To be used with:	Weight (gr.)
M9.KUSB	USB cable port type A,B Length1,5m	M9XX	60

# MONITOR AND ANALYTICAL SENSORS

## ACCESSORIES

### ACCESSORIES FOR ANALYTICAL SENSORS



BNC Cable

Code	Length	To be used with:	Weight (gr.)
CN653	5 m	pH222 CD pH223 CD ORP222 CD ORP223 CD pHORP.600	300
CN65310M	10 m	pH222 CD pH223 CD ORP222 CD ORP223 CD pHORP.600	400
CN65315M	15 m	pH222 CD pH223 CD ORP222 CD ORP223 CD pHORP.600	500



Submersible cable assembly with Temperature compensation (PT 100)

Code	Length	To be used with:	Weight (gr.)
CN653TC1*	5 m	pH650CD pH650CD HF pH650CDDA pH650CD LC	350



S7 Cable

Code	Length	To be used with:	Weight (gr.)
CE5S7	5 m	pH435 CD	300
CE10S7	10 m	pH435 CD	400
CE15S7	15 m	pH435 CD	500

# MONITOR AND ANALYTICAL SENSORS

## ACCESSORIES

### ACCESSORIES FOR ANALYTICAL SENSORS



Buffer solutions

Code	Description	To be used with:	Weight (gr.)
B104	Buffer pH 4,01	pH electrodes	450
B107	Buffer pH 7,00	pH electrodes	450
B110	Buffer pH 10,00	pH electrodes	450
B3KCL	3KCL solution	pH electrodes	450
B475	Buffer 475mV	ORP electrodes	450
B0018	Calibration solution for low conductivity (18 microsiemens/cm)	Conductivity sensors	450
B1417	Calibration solution for conductivity (1417 microsiemens/cm)	Conductivity sensors	450



PT100 Temperature Epoxy body Sensor

Code	Features	Weight (gr.)
T970196*	no metal in contact length 5 m	200



**SPARE PARTS**



# MONITORS, SENSORS AND TRANSMITTERS

## SPARE PARTS

### INSTALLATION OF MONITORS, SENSORS AND TRANSMITTERS

#### Spare Parts for monitors

Code	Description	to be used with:	Weight (gr.)
M9.SP4.1	PG 11 complete cable gland (2 o-rings and cap)	M9.XX	12
M9.LN1	Plastic locking nut	M9.02 M9.00 M9.20	24
M9.SN1	2 plastic fixing snails for panel installation	M9.XX except M9.02, M9.00, M9.20	16
M9.SP7	3,6 V Lithium Thionyl Chloride battery	M9.20	60

#### Spare Parts for F3.00

Code	Description	Weight (gr.)
F3.SP1	Cable Plug according to DIN 43650	30
F3.SP2.1	Black Sensor Cap, for Hall version	42
F3.SP2.2	Red Sensor Cap, for Coil version	42
F3.SP2.4	Yellow Sensor Cap, for push-pull version	42
F3.SP2.6	SS 316L Sensor Cap, for SS 316L Hall and Coil versions	20
F3.SP3.1	EPDM Sensor body O-rings	4
F3.SP3.2	FKM Sensor body O-rings	4
F3.SP4.2	ECTFE (Halar®) rotor with Machined Ceramic Shaft and Bearings	8
F3.SP4.3	ECTFE (Halar®) rotor with SS 316L Shaft	8
F3.SP5.1	C-PVC Sensor Plug	140
F3.SP5.2	PVDF Sensor Plug	150
F3.SP5.3	SS 316L Sensor Plug	470
F3.SP6	Cable (per meter), 22AWG, 3 cond.	28

#### Spare Parts for F3.20

Code	Description	Weight (gr.)
F3.SP4.3	ECTFE (Halar) rotor with SS 316L shaft	8
F3.SP8	SS 316L screws + graphite gasket	70

#### Spare Parts for F6.50

Code	Description	Weight (gr.)
F3.SP1	4-pin female connector DIN 4365	30
F3.SP2.6	AISI 316L STAINLESS steel sensor cap	120
F3.SP2.7	Orange PVC cap	42
F3.SP3.1	2 EPDM O-rings for sensor body	4
F3.SP3.2	2 FKM O-rings for sensor body	4
F3.SP4.2	ECTFE (Halar®) rotor kit with shaft without keyway and ceramic bearing	8
F3.SP4.3	ECTFE (Halar®) rotor kit with STAINLESS steel shaft	8

#### Spare Parts for F3.10

Code	Description	Weight (gr.)
F3.SP2.7	Gray Sensor Cap	10
F3.SP3.3	EPDM Sensor body O-rings	2
F3.SP3.4	FKM Sensor body O-rings	2
F3.SP11	PVC rotor with 316L SS Shaft	2

# MONITORS, SENSORS AND TRANSMITTERS

## SPARE PARTS

### INSTALLATION OF MONITORS, SENSORS AND TRANSMITTERS

#### Spare Parts for F3.05

Code	Description	Weight (gr.)
F3.SP1	Cable Plug according to DIN 43650	30
F3.SP2.1	Black Sensor Cap for Hall version	42
F3.SP3.1	EPDM Sensor body O-rings	4
F3.SP3.2	FKM Sensor body O-rings	4
F3.SP4.2	ECTFE (Halar®) rotor with Machined Ceramic Shaft and Bearings	8
F3.SP5.1	C-PVC Sensor Plug	140
F3.SP5.2	PVDF Sensor Plug	150
F3.SP5.3	SS 316L Sensor Plug	470

#### Spare Parts for F6.60 – F6.63

Code	Description	Weight (gr.)
F6.KC1	Plastic adapter with compact cap and locking nut	137
M9.SP4.1	PG 11 complete cable gland (2 o-rings and cap)	12
F3.SP3.1	EPDM Sensor body O-Rings	4
F3.SP3.1	FKM Sensor body O-Rings	4
F6.60.SP1.S	Electronic head 4-20 mA/ Pulse freq. /volumetric for sensor	180
F6.60M.SP09	Sensor body 316L SS/PVDF - EPDM O-rings - L0 Length	330
F3.60M.SP10	Sensor body 316L SS/PVDF - FKM O-rings - L0 Length	330
F3.60M.SP11	Sensor body 316L SS/PVDF - EPDM O-rings - L1 Length	400
F3.60M.SP12	Sensor body 316L SS/PVDF - FKM O-rings - L1 Length	400
M9.KUSB	USB cable dedicated to FLS products, 1,5 meter long	60

#### Spare Parts for F6.61

Code	Description	Weight (gr.)
F6.KC1	Plastic adapter with compact cap and locking nut	137
M9.SP4.1	PG 11 complete cable gland (2 o-rings and cap)	12
F1.SP3	2" Brass Ball Valve	1800
F1.SP5	1"1/4 Isolation brass ball valve	1800
F1.SP6	Zinc Plated Steel 2" BS male to 1"1/4 BS female	405
F1.SP7	Zinc Plated Steel 2" NPT male to 1"1/4" BS female reduction	405
F6.60M.SP1.S	Electronic head 4-20 mA/ Pulse freq. /volumetric for sensor	180
F3.61M.SP01	Sensor body 304 SS/PVDF for hot tap installation	100
M9.KUSB	USB cable dedicated to FLS products, 1,5 meter long	60



# TECHNICAL INFORMATION ABOUT FLOW AND ANALYTICAL MEASUREMENTS





## FLOW MEASUREMENT



## FLOW MEASUREMENT

Insertion technology is based on fluid velocity meters and is used to measure the local flow velocity  $V_m$  to calculate the average velocity  $V_a$  and the volumetric flow rate  $Q_v$ . These flow sensors are supported, from a scientific point of view, by fluid dynamics laws applicable to any circular section of pipe, when certain physical conditions are respected (fully developed turbulent fluid motion). These laws describe the relationship between the measured local velocity and the average flow velocity (UNI 10727; ISO 7145).

The relationship between average speed  $V_a$  and measured speed is generally expressed through the "profile factor":

$$F_p = V_a / V_m$$

Using the above factor:

$$Q_v = V_a * DI^2 / 4 = F_p * V_m * DI^2 / 4$$

$DI$  = internal diameter of the pipe

Two different positions are suitable as a flow velocity measurement point:

1. Critical position: the speed sensor is inserted at a certain point where the local speed corresponds to the average speed (12% of the internal diameter):

$$V_a = V_m \ggg F_p = 1.$$

2. Central position: the speed sensor is placed exactly at the centre of the pipe section. The local speed corresponds to the maximum speed:

$$V_m = V_{\max} \ggg F_p < 1.$$



## FULLY DEVELOPED TURBULENT FLOW

All speed-based flow sensors provide an accurate and reliable indication only when measuring a fully developed turbulent flow. The fully developed turbulent flow is found in any Newtonian fluid when the Reynolds number is greater than 4,500. Fully developed turbulent flow can be difficult to achieve with high viscosity, low flow rate liquids or large pipes. Very often, a reduction in pipe size to increase the local flow velocity is sufficient to produce an adequate Reynolds number:

$$Re = V * ID * Sg / \mu$$

where:

V = flow velocity in m/s

DI = internal diameter of the pipe in metres

Gs = specific gravity in kg/m<sup>3</sup>

$\mu$  = dynamic viscosity in Pa\*s

(1 Pa\*s = 10<sup>3</sup> cP)

or, by converting the flow velocity into flow rate:

$$Re = 1.2732 * Q_v * Sg / \mu * ID$$

where:

Qv = flow rate in l/s

Gs = specific gravity in kg/m<sup>3</sup>

$\mu$  = dynamic viscosity in Pa\*s

(1 Pa\*s = 10<sup>3</sup> cP)

DI = internal diameter of the pipe in metres

$$Re = 3162.76 * Q_v * Sg / \mu * ID$$

where:

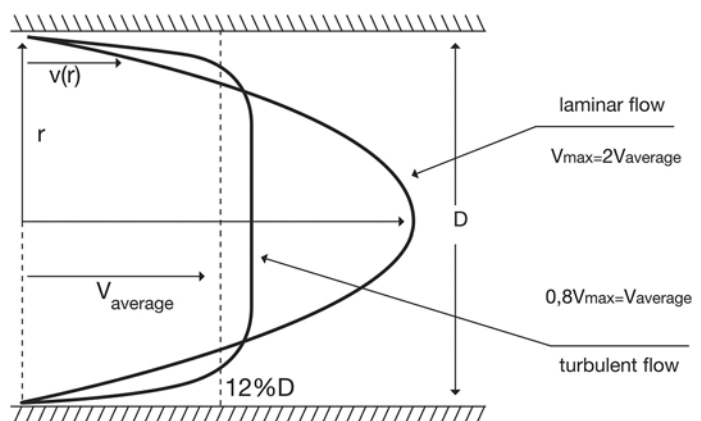
Qv = flow rate in gpm

Gs = specific gravity in kg/m<sup>3</sup>

$\mu$  = dynamic viscosity in centipoise

(1 Pa\*s = 10<sup>3</sup> cP)

DI = internal diameter of the pipe in inches



## INSERTION FLOW SENSOR

### Paddlewheel flow sensor

This flow sensor consists of a transducer (Hall-effect for powered systems and Coil for battery-powered system) and a five-blade open-cell paddlewheel (four blades for model F3.10) fixed on a ceramic shaft (stainless steel in the case of models F3.10 and F3.20, and stainless steel for model F3.00). The shaft is at a right angle to the direction of flow. The rotor is equipped with a permanent magnet embedded in each blade. When the magnet passes near the transducer, a pulse is generated. When the liquid flows into the pipe, the rotor rotates producing a square wave output signal. The frequency is proportional to the speed of the flow. The sensors can be installed in the pipe through a wide range of FLS insertion adapters.

### F3.05 flow switch

From a mechanical point of view, the F3.05 flow switch is based on a rotor sensor. That is to say that there is a transducer and a five-bladed open-cell rotor. In this case too, the rotor is equipped with a permanent magnet embedded in each blade. When the magnet passes near the transducer, an output pulse is generated. This pulse is monitored by a missing signal circuit that activates an internal relay when the pulse frequency is reduced beyond the factory default of 0.15 m/s (0.5 ft/s). The switches can be installed in the pipe through a wide range of FLS insertion adapters.

### Electromagnetic sensor

The electromagnetic sensor is based on Faraday's law, since a voltage is induced by an electrical conductor when it moves in a magnetic field. A coil mounted in the sensor body generates a magnetic field perpendicular to the direction of flow. The magnetic field and the flow velocity induce a voltage between the electrodes. The voltage is directly proportional to the speed of the flow. The voltage is converted to a 4-20 mA output signal proportional to the flow or an output frequency signal.

## IN-LINE FLOW SENSORS

### ULF sensor

It is an in-line flow sensor consisting of a transducer and a five-bladed rotor (four-bladed for ULF0X.X.0). The rotor is equipped with a permanent magnet embedded in each blade. When the magnet passes near the transducer, a pulse is generated. When the liquid flows into the sensor body, the rotor rotates producing a square wave output signal. The frequency generated is proportional to the speed of the flow.

### F3.80 Oval gear sensor

The in-line sensor body contains two oval gears that rotate with the fluid flow. The two gears are placed at 90° to define a fixed flow volume pumped with each rotation. Each gear incorporates two permanent magnets and a Hall-effect sensor detects the magnetic field generating a square wave output signal with frequency proportional to the number of fluid volumes pumped.

## Speed and flow rate conversion charts

Speed [m/s] = (Flow rate [l/s] * 1273.2) / D <sup>2</sup>								Flow rate [l/s] = (Speed [m/s] * D <sup>2</sup> ) / 1273.2							
Speed															
ft/s		0.16	0.33	0.5	0.7	1.6	2.6	3.3	6.6	9.8	13.1	16.4	20	23	26.2
m/s		0.05	0.1	0.15	0.2	0.5	0.8	1	2	3	4	5	6	7	8
D [mm]	DN [mm]	Flow rate l/s													
20	15	0.01	0.02	0.03	0.04	0.09	0.14	0.18	0.35	0.53	0.71	0.88	1.06	1.24	1.41
25	20	0.02	0.03	0.05	0.06	0.16	0.25	0.31	0.63	0.94	1.26	1.57	1.89	2.20	2.51
32	25	0.02	0.05	0.07	0.10	0.25	0.39	0.49	0.98	1.47	1.96	2.45	2.95	3.44	3.93
40	32	0.04	0.08	0.12	0.16	0.40	0.64	0.80	1.61	2.41	3.22	4.02	4.83	5.63	6.43
50	40	0.06	0.13	0.19	0.25	0.63	1.01	1.26	2.51	3.77	5.03	6.28	7.54	8.80	10.05
63	50	0.10	0.20	0.29	0.39	0.98	1.57	1.96	3.93	5.89	7.85	9.82	11.78	13.74	15.71
75	65	0.17	0.33	0.50	0.66	1.66	2.65	3.32	6.64	9.96	13.27	16.59	19.91	23.23	26.55
90	80	0.25	0.50	0.75	1.01	2.51	4.02	5.03	10.05	15.08	20.11	25.13	30.16	35.19	40.21
110	100	0.39	0.79	1.18	1.57	3.93	6.28	7.85	15.71	23.56	31.42	39.27	47.13	54.98	62.83
125	110	0.48	0.95	1.43	1.90	4.75	7.60	9.50	19.01	28.51	38.01	47.52	57.02	66.53	76.03
140	125	0.61	1.23	1.84	2.45	6.14	9.82	12.27	25.54	36.82	49.09	61.36	73.63	85.91	98.18
160	150	0.88	1.77	2.65	3.53	8.84	14.14	17.67	35.34	53.02	70.69	88.36	106.03	123.70	141.38
200	180	1.27	2.54	3.82	5.09	12.72	20.36	25.45	50.90	76.34	101.79	127.24	152.69	178.13	203.58
225	200	1.57	3.14	4.71	6.28	15.71	25.13	31.42	62.83	94.25	125.67	157.08	188.50	219.92	251.34
250	225	1.99	3.98	5.96	7.95	19.88	31.81	39.76	79.52	119.29	159.05	198.81	238.57	278.33	318.10
280	250	2.45	4.91	7.36	9.82	25.54	39.27	49.09	98.18	147.27	196.36	245.44	294.53	343.62	392.71
315	280	3.08	6.16	9.24	12.32	30.79	49.26	61.58	123.15	184.73	246.31	307.89	369.46	431.04	492.62

Speed [m/s] = (Flow rate [l/min] * 21.16) / D <sup>2</sup>								Flow rate [l/min] = (Speed [m/s] * D <sup>2</sup> ) / 21.16							
Speed															
ft/s		0.16	0.33	0.5	0.7	1.6	2.6	3.3	6.6	9.8	13.1	16.4	20	23	26.2
m/s		0.05	0.1	0.15	0.2	0.5	0.8	1	2	3	4	5	6	7	8
D [mm]	DN [mm]	Flow rate l/min													
20	15	0.5	1.1	1.6	2.1	5.3	8.5	10.6	21.3	31.9	42.5	53.2	63.8	74.4	85.1
25	20	0.9	1.9	2.8	3.8	9.5	15.1	18.9	37.8	56.7	75.6	94.5	113.4	132.3	151.2
32	25	1.5	3.0	4.4	5.9	14.8	23.6	29.5	59.1	88.6	118.1	147.7	177.2	206.8	236.3
40	32	2.4	4.8	7.3	9.7	24.2	38.7	48.4	96.8	145.2	193.6	242.0	290.4	338.8	387.1
50	40	3.8	7.6	11.3	15.1	37.8	60.5	75.6	151.2	226.8	302.5	378.1	453.7	529.3	604.9
63	50	5.9	11.8	17.7	23.6	59.1	94.5	118.1	236.3	354.4	472.6	590.7	708.9	827.0	945.2
75	65	10.0	20.0	30.0	39.9	99.8	159.7	199.7	399.3	599.0	798.7	998.3	1198.0	1397.7	1597.4
90	80	15.1	30.2	45.4	60.5	151.2	242.0	302.5	604.9	907.4	1209.8	1512.3	1814.7	2117.2	2419.7
110	100	23.6	47.3	70.9	94.5	236.3	378.1	472.6	945.2	1417.8	1890.4	2362.9	2835.5	3308.1	3780.7
125	110	28.6	57.2	85.8	114.4	285.9	457.5	571.8	1143.7	1715.5	2287.3	2859.2	3431.0	4002.8	4574.7
140	125	36.9	73.8	110.8	147.7	369.2	590.7	738.4	1476.8	2215.3	2953.7	3692.1	4430.5	5169.0	5907.4
160	150	53.2	106.3	159.5	212.7	531.7	850.7	1063.3	2126.7	3190.0	4253.3	5316.6	6380.0	7443.3	8506.6
200	180	76.6	153.1	229.7	306.2	765.6	1225.0	1531.2	3062.4	4593.6	6124.8	7656.0	9187.1	10718.3	12249.5
225	200	94.5	189.0	283.6	378.1	945.2	1512.3	1890.4	3780.7	5671.1	7561.4	9451.8	11342.2	13232.5	15122.9
250	225	119.6	239.2	358.9	478.5	1196.2	1914.0	2392.5	4785.0	7177.5	9569.9	11962.4	14354.9	16747.4	19139.9
280	250	147.7	295.4	443.1	590.7	1476.8	2362.9	2953.7	5907.4	8861.1	11814.7	14768.4	17722.1	20675.8	23629.5
315	280	185.3	370.5	555.8	741.0	1852.6	2964.1	3705.1	7410.2	11115.3	14820.4	18525.5	22230.6	25935.7	29640.8

## Speed and flow rate conversion charts

Speed [m/s] = (Flow rate [l/h] * 0.35344) / D <sup>2</sup>							Flow rate [l/h] = (Speed [m/s] * D <sup>2</sup> ) / 0.35344							
Speed														
ft/s		0.16	0.33	0.5	0.7	1.6	3.3	6.6	9.8	13.1	16.4	20	23	26.2
m/s		0.05	0.1	0.15	0.2	0.5	1	2	3	4	5	6	7	8
D [mm]	DN [mm]	Flow rate l/h												
20	15	32	64	95	127	318	637	1273	1910	2546	3183	3820	4456	5093
25	20	57	113	170	226	566	1132	2263	3395	4527	5659	6790	7922	9054
32	25	88	177	265	354	884	1768	3537	5305	7073	8842	10610	12378	14147
40	32	145	290	435	579	1449	2897	5794	8692	11589	14486	17383	20281	23178
50	40	226	453	679	905	2263	4527	9054	13581	18108	22635	27162	31689	36215
63	50	354	707	1061	1415	3537	7073	14147	21220	28293	35367	42440	49513	56587
75	65	598	1195	1793	2391	5977	11954	23908	35862	47816	59770	71724	83678	95632
90	80	905	1811	2716	3622	9054	18108	36215	54323	72431	90539	108646	126754	144862
110	100	1415	2829	4244	5659	14147	28293	56587	84880	113173	141467	169760	198053	226347
125	110	1712	3423	5135	6847	17117	34235	68470	102705	136940	171175	205410	239645	273880
140	125	2210	4421	6631	8842	22104	44208	88417	132625	176833	221042	265250	309458	353667
160	150	3183	6366	9549	12732	31830	63660	127320	190980	254640	318300	381960	445620	509280
200	180	4584	9167	13751	18334	45835	91670	183341	275011	366682	458352	550023	641693	733364
225	200	2659	5317	7976	10635	26587	53173	106347	159520	212640	265867	319040	372214	425387
250	225	3162	6324	9485	12647	31618	63235	126470	189705	252940	316175	379410	442645	505880
280	250	3842	7683	11525	15367	38417	76833	153667	230500	307334	384167	461000	537834	614667
315	280	4491	8982	13473	17964	44910	89820	179640	269459	358729	447909	537091	626273	715559

Speed [m/s] = (Flow rate [m3/h] * 0.35344) / DI²							Flow rate [m3/h] = (Speed [m/s] * DI²) / 0.35344								
Speed															
ft/s		0.16	0.33	0.5	0.7	1.6	2.6	3.3	6.6	9.8	13.1	16.4	20	23	26.2
m/s		0.05	0.1	0.15	0.2	0.5	0.8	1	2	3	4	5	6	7	8
D [mm]	DN [mm]	Flow rate m³/h													
20	15	0.03	0.06	0.10	0.13	0.32	0.51	0.64	1.27	1.91	2.55	3.18	3.82	4.46	5.09
25	20	0.06	0.11	0.17	0.23	0.57	0.91	1.13	2.26	3.40	4.53	5.66	6.79	7.92	9.05
32	25	0.09	0.18	0.27	0.35	0.88	1.41	1.77	3.54	5.31	7.07	8.84	10.61	12.38	14.15
40	32	0.14	0.29	0.43	0.58	1.45	2.32	2.90	5.79	8.69	11.59	14.49	17.38	20.28	23.18
50	40	0.23	0.45	0.68	0.91	2.26	3.62	4.53	9.05	13.58	18.11	22.63	27.16	31.69	36.22
63	50	0.35	0.71	1.06	1.41	3.54	5.66	7.07	14.15	21.22	28.29	35.37	42.44	49.51	56.59
75	65	0.60	1.20	1.79	2.39	5.98	9.56	11.95	23.91	35.86	47.82	59.77	71.72	83.68	95.63
90	80	0.91	1.81	2.72	3.62	9.05	14.49	18.11	36.22	54.32	72.43	90.54	108.65	126.75	144.86
110	100	1.41	2.83	4.24	5.66	14.15	22.63	28.29	56.59	84.88	113.17	141.47	169.76	198.05	226.35
125	110	1.71	3.42	5.14	6.85	17.12	27.39	34.23	68.47	102.70	136.94	171.17	205.41	239.64	273.88
140	125	2.21	4.42	6.63	8.84	22.10	35.37	44.21	88.42	132.63	176.83	221.04	265.25	309.46	353.67
160	150	3.18	6.37	9.55	12.73	31.83	50.93	63.66	127.32	190.98	254.64	318.30	381.96	445.62	509.28
200	180	4.58	9.17	13.75	18.33	45.84	73.34	91.67	183.34	275.01	366.68	458.35	550.02	641.69	733.36
225	200	5.66	11.32	16.98	22.63	56.59	90.54	113.17	226.35	339.52	452.69	565.87	679.04	792.21	905.39
250	225	7.16	14.32	21.49	28.65	71.62	114.59	143.24	286.47	429.71	572.94	716.18	859.41	1002.65	1145.88
280	250	8.84	17.68	26.53	35.37	88.42	141.47	176.83	353.67	530.50	707.33	884.17	1061.00	1237.83	1414.67
315	280	11.09	22.18	33.27	44.36	110.91	177.46	221.82	443.64	665.46	887.28	1109.10	1330.92	1552.74	1774.56

Speed and flow rate conversion charts

Speed [f/s] = (Flow rate [gpm] * 0.4085) / DI²							Flow rate [gpm] = (Speed [f/s] * DI²) / 0.4085								
Speed															
ft/s		0.16	0.33	0.5	0.7	1.6	2.6	3.3	6.6	98	13.1	16.4	20	23	26.2
m/s		0.05	0.1	0.15	0.2	0.5	0.8	1	2	3	4	5	6	7	8
D [inches]	DN [mm]	Flow rate US gallon/min													
1/2	15	0.14	0.28	0.42	0.56	1.40	2.25	2.81	5.62	8.43	11.24	14.05	16.85	19.66	22.47
3/4	20	0.25	0.50	0.75	1.00	2.50	4.00	4.99	999	14.98	1998	24.97	2996	34.96	3995
1"	25	0.39	0.78	1.17	1.56	3.90	6.24	7.80	15.61	23.41	31.21	39.01	46.82	54.62	62.42
1" 1/4	32	0.64	1.28	1.92	2.56	6.39	10.23	12.78	25.57	38.35	51.14	63.92	76.70	89.49	102.27
1.1	40	1.00	2.00	3.00	4.00	999	15.98	1998	3995	5993	7990	9988	11985	13983	15980
2	50	1.56	3.12	4.68	6.24	15.61	24.97	31.21	64.42	93.63	124.85	156.06	187.27	218.48	249.69
2"1/2	65	2.64	5.27	7.91	10.55	26.37	42.20	52.75	105.49	158.24	210.99	263.74	316.48	369.23	421.98
3	80	4.00	7.99	11.99	15.98	39.95	63.92	79.90	159.80	239.70	319.60	399.50	479.41	559.31	639.21
4	100	6.24	12.48	18.73	24.97	62.42	99.88	124.85	249.69	374.54	499.38	624.23	749.07	873.92	998.76
5	125	9.75	19.51	29.26	39.01	97.54	156.06	195.07	390.14	585.21	780.28	975.35	1170.42	1365.49	1560.56
6	150	14.05	28.09	42.14	56.18	140.45	224.72	280.90	561.80	842.70	1123.61	1404.51	1685.41	1966.31	2247.21
8	200	24.97	49.94	74.91	99.88	249.69	399.50	499.38	998.76	1498.14	1997.52	2496.90	2996.28	3495.66	3995.04
10	225	31.60	63.20	94.80	126.41	316.01	505.62	632.03	1264.06	1896.08	2528.11	3160.14	3792.17	4424.20	5056.23
12	300	48.94	97.88	146.82	195.76	489.39	783.03	978.79	1957.57	2936.36	3915.14	4893.93	5872.71	6851.50	7830.28

To convert		Into	Multiply by
Volume	US Gallons	Liquid ounces (USA)	128
		Cubic inches	231
		Cubic feet	0.134
		Litres	3.785
		Cubic metres	0.004
		Imp. Gallons	0.833
	Imperial gallons	US gallons	1.201
	Cubic feet	US gallons	7.480
		Cubic metres	0.028
	Litres	US gallons	0.264
Length	Cubic metres	Cubic feet	35.315
		US gallons	264.172
	Inches	Centimetres	2.540
	Feet	Metres	0.305
	Yards	Metres	0.914
Weight	Miles	Kilometres	1.609
	Ounce	Gramme	28.349
	Pound	Gramme	453.592
Flow rate	US gallons per minute (gpm)	Litres per second	0.063
	US gallons per minute (gpm)	Cubic metres per hour	0.227
	UK gallons per minute (gpm)	Cubic metres per hour	0.273
Pressure	Atmospheres	Bar	1.013
	Psi [lbs/inch <sup>2</sup> ]	Bar	0.069
	Pascal [Newton/m <sup>2</sup> ]	Bar	1 * 10 <sup>-5</sup>
	MegaPascal	Bar	10
	Kelvin [°K]	Celsius [°C]	°C = °K - 273.15
Temperature	Fahrenheit [°F]	Celsius [°C]	°C = (°F - 32) * 5/9



## ANALYTICAL MEASUREMENTS



# pH MEASUREMENT

## DEFINITION

The pH is defined as the negative logarithm of the activity of hydrogen ions,  $a_{H^+}$ , in a solution.

So:

$$pH = -\log(a_{H^+})$$

## pH MEASUREMENT TECHNOLOGY

The pH is measured using a configuration with two electrodes: the measurement electrode and the reference electrode. These two electrodes are often combined into a single electrode, referred to as a "combined electrode". All pH electrodes in the FLS range are "combined". When the two electrodes are immersed in a solution, a small galvanic cell is created. The potential developed depends on both electrodes. The measured voltage can be expressed by the Nernst equation as follows:

$$E = E_{\text{mis}} - E_{\text{ref}} = E_0 - (2.303 RT/F) pH$$

where:

$E$  = measured voltage

$E_{\text{mis}}$  = measurement electrode voltage

$E_{\text{ref}}$  = reference electrode voltage

$E_0$  = standard electrode potential

$R$  = gas constant

$T$  = absolute temperature

$F$  = Faraday constant

The relationship between pH and  $E$ , therefore, is linearly related to temperature. The slope value at 25°C is 59.18 mV/pH. It is about 54 mV/pH at 5°C and about 62 mV/pH at 40°C. At 100°C the slope increases to about 74 mV/pH.

## TECHNICAL TERMS RELATING TO pH

### Calibration

Determination of the deviation and slope in a pH system. For evaluation of both electrode characteristics, calibration should be performed for two pH points. To consider chemical species that may affect the pH measurement, an adjustment can be made to the actual sample. Calibration solution (buffers) A solution with known pH value is used to calibrate the system for pH.

### Calibration solutions are temperature sensitive.

The temperature dependence of the buffers is known. Below is the dependence of the buffers of the FLS range:

0	32	4.01	7.12	10.31
5	41	4.00	7.09	10.24
10	50	4.00	7.06	10.17
15	59	4.00	7.04	10.11
20	68	4.00	7.02	10.05
25	77	4.01	7.00	10.00
30	86	4.01	6.99	9.95
35	95	4.02	6.98	9.92
40	104	4.03	6.97	9.88
45	113	4.04	6.97	9.85



## TECHNICAL TERMS RELATING TO pH

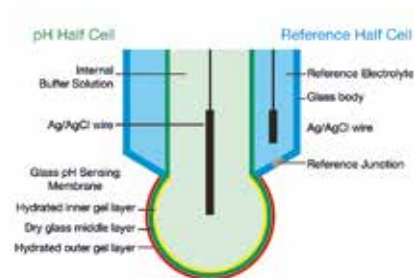
### Reference temperature

pH measurements are often referred to a specific temperature, generally 25°C, for comparison purposes.

### Automatic temperature compensation

Algorithms for the automatic conversion of the sample pH at the reference temperature. This function considers the variation of the pH slope with the temperature.

## OPERATING PRINCIPLE OF ELECTRODES FOR pH



The pH electrode is a high impedance galvanic cell in which the potential developed between the pH half-cell and the reference half-cell is the sum of the various potentials. Figure A shows a typical combined pH electrode in glass wherein the pH half-cell and the reference half-cell are joined in a single body. The ideal situation would be that all potentials are constant, except the one generated on the outer hydrated gel layer, which depends on the pH of the sample according to the Nernst equation. Real electrodes are different from the ideal one due to various factors:

- 1) tolerances during production
- 2) electrode ageing,
- 3) conditioning and cleaning the electrode.

All the pH meters allow calibration or standardisation of the electrode to compensate for the aforementioned effects. Standard calibration requires measuring the electrode response in two pH buffer solutions with known pH values and creating a linear map of the electrode response between these two points. This procedure produces deviation and slope correction factors, where deviation is the result in mV at pH 7 and slope is the change in response in mV per pH unit, generally expressed in mV/pH as a percentage of the ideal electrode slope (59.16 mV/pH at 25°C).

# ORP MEASUREMENT

## DEFINITION

ORP (Oxidation-Reduction Potential) is the measure of the tendency of a solution to oxidise or reduce what comes into contact with it. An oxidising solution is a liquid that tends to gain electrons by reducing and oxidising what comes into contact with it. A reducing solution is a liquid that tends to yield electrons by oxidising and reducing what comes into contact with it.

## ORP MEASUREMENT TECHNOLOGY

The electrode for ORP produces a voltage like the electrode for pH. In this case, the measurement does not depend only on hydrogen ions, but on all chemical species capable of yielding or receiving electrons. Although ORP is temperature-dependent and in principle follows the Nernst equation, it is difficult to compensate the measurement as the number of electrons involved in redox reactions is not known (in case an ORP measurement is used to monitor a reaction, it is only possible to determine the main half-reaction involved, so it might be possible). A configuration with two electrodes is also used for the measurement of the ORP: the measurement electrode and the reference electrode. These two electrodes are often combined into a single electrode, referred to as a "combined electrode". All the ORP electrodes in the FLS range are "combined". When the two electrodes are immersed in a solution, a small galvanic cell is created. The developed potential depends on both electrodes and generally ranges from -1000 mV to +1000 mV.

Although this is a non-specific measurement, it can be very useful for monitoring and controlling the activity of certain compounds. Applications employing ORP for monitoring and controlling redox reactions include cyanide destruction, dechlorination, nitrite and hydrosulfite oxidation, chromate reduction, hypochlorite-based bleach production, and chlorine dioxide neutralisation with bisulfite monitoring. Measuring the concentration with the ORP is not simple, but the ORP can be used in some cases for leak detection, to assess the presence of an oxidant or a reductant. Finally, ORP is measured in some cases for the control of biological growth. The principle behind these applications is that a minimum value of the ORP is capable of destroying microorganisms. This approach has been used in the chlorination of swimming pools and cooling towers. It should be noted that both applications also require pH control.

## TECHNICAL TERMS RELATING TO THE ORP

### Calibration

Determination of the deviation of an ORP system. The slope of the ORP electrode is less variable than that of the pH electrode, since ORP sensors are made of noble metals (non-reactive to various extents), for example platinum (preferred for chlorides contained in strong oxidants and in general for redox titration), gold (preferred for strongly acidic solutions and in the presence of iron and chromium) or rarely silver, and do not vary much with use. The response time of these sensors depends on the area, size and constitution, as well as the degree of cleanliness of the sensor. For most ORP applications, absolute accuracy is less important than the speed and related variations measured in the system. Many procedures and specifications impose target ORP values with tolerances of  $\pm 25$  mV or  $\pm 50$  mV, or specify variations in ORP, for example a 400 mV drop in value with target endpoint value. Since the ORP has various uses with methods involving specialist target measurements or variations of measurements based on experience, it is not possible to describe them all in detail. Suffice it to say that the accuracy needed for pH and other electrochemical measurements generally does not apply for ORP, so calibration for meters and electrodes for ORP is not that common.

## TECHNICAL TERMS RELATING TO THE ORP

### Calibration solution

A solution with known ORP value is used to verify the system for ORP. In principle, as explained above, the absolute value of the ORP is not so important, so the use of an ORP calibration solution can only be applied for verification purposes. Calibration solutions or reference solutions for the ORP, therefore, are mostly used only to simplify the comparison. In other words, deviation evaluation may be necessary in case of electrode replacement when a new probe provides different measurements of the values compared to the old electrode, whereby a calibration may be needed to align the new value to the old one. For example, if a method demands a target value of 410 mV that has been defined with the previous instrumentation and electrode, the new electrode with the same measurement can measure 425 mV in the same liquid. By resorting to calibration or, more precisely, adjustment of the deviation, these 15 mV of difference can be eliminated to avoid confusion. When the other measurements are performed, therefore, these are easily comparable with those produced by the old electrode.

## OPERATING PRINCIPLE OF ORP ELECTRODES

The principle of ORP measurement consists in the use of an inert metal electrode (platinum, sometimes gold, rarely silver) which due to the low resistance gives up electrons in an oxidant or accepts electrons from a reductant. The ORP electrode continues to accept or yield electrons until it develops a potential, due to the accumulated charge, equal to the ORP of the solution. The typical accuracy of an ORP measurement is  $\pm 5$  mV. The ORP electrode also requires a reference electrode, which is typically the same silver-silver chloride electrode used with pH measurement.

# CONDUCTIVITY MEASUREMENT

## DEFINITION

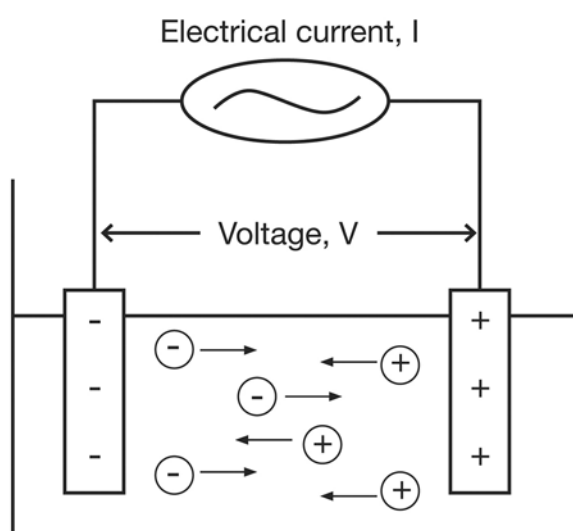
Conductivity is the ability of a solution to carry the flow of an electric current. In solutions, the current is carried by cations and anions. The ability of a solution to conduct electricity depends on several factors:

- Concentration
- Mobility of ions
- Valency of ions
- Temperature

All substances have a different level of conductivity. In aqueous solutions the level of ionic strength varies from the low conductivity of ultrapure water to the high conductivity of concentrated chemical solutions.

## CONDUCTIVITY MEASUREMENT TECHNOLOGY

Conductivity can be measured by applying an alternating electric current ( $I$ ) to two electrodes immersed in a solution and measuring the resulting voltage ( $V$ ). During this process, cations migrate to the negative electrode and anions migrate to the positive electrode, and the solution acts as an electrical conductor.



## TECHNICAL TERMS RELATING TO CONDUCTIVITY

### Resistance

The resistance of the solution (R) can be calculated using Ohm's law ( $V = R \cdot I$ ).

$$R = V/I$$

where:

V = voltage (Volts)

I = current (Amps)

R = resistance of the solution (Ohm)

### Conductance

Conductance (G) is defined as the inverse of the electrical resistance (R) of a solution between two electrodes.

$$G = 1/R$$

The conductivity meter effectively measures the conductance and indicates the measurement converted to conductivity.

### Cell constant

It is the ratio of the distance (d) between the electrodes and the area (a) of the electrodes.

$$K = d/a$$

K = cell constant (cm<sup>-1</sup>)

a = actual area of the electrodes (cm<sup>2</sup>)

d = distance between electrodes (cm)

### Conductivity

Electricity consists of a flow of electrons. This indicates that ions in solution conduct electricity. Conductivity is the ability of a solution to transfer current. The measurement of the conductivity of a sample changes with temperature.

$$C = G \cdot K$$

C = conductivity (S/cm)

G = conductance (S), where  $G = 1/R$

K = cell constant (cm<sup>-1</sup>)

### Resistivity

It is the inverse of the conductivity value and is measured in Ohm·cm. It is generally limited to the measurement of pure water, the conductivity of which is very low.

### Calibration

Determination of the cell constant necessary to convert conductance measurements into conductivity results.

### Standard solution

A known conductivity solution used to calibrate the system for conductivity.

### Reference temperature

Conductivity measurements often refer to a specific temperature, generally 18°C, 20°C or 25°C, for comparison.

### Automatic temperature compensation

Algorithms for the automatic conversion of the sample conductivity at the reference temperature.

### Temperature compensation factor

Factor used for automatic compensation. It is generally considered in % or in °C. For ultrapure water (UPW) applications, on FLS instrumentation, a special correlation based on ASTM D1125-19 is available.

### TDS (Total Dissolved Solids)

It is the measurement of the total concentration of ionic species in a sample. It refers to the standard solution used to calibrate the instrument or to the saline solution chosen as a reference by the operator.

## TECHNICAL TERMS RELATING TO CONDUCTIVITY

### TDS Factor

The conductivity measurements are converted to TDS measurements by multiplying them by a known mathematical factor. The factor depends on the reference compound (generally a salt) used to prepare the standard or the reference material considered. Sea salt, for example, contains several different salts but mainly NaCl, so the operator can only refer to it. Below are some examples of factors:

Reference salts	Conversion factor
NaCl	0.47–0.50
KCl	0.50–0.57
442 (40%NaSO <sub>4</sub> +40%NaHCO <sub>3</sub> +20%NaCl)	0.65–0.85

## OPERATING PRINCIPLE OF CONDUCTIVITY

### 2-electrode conductivity sensor

A 2-electrode conductivity sensor consists of an insulating material with 2 embedded electrodes. The electrodes can be made of platinum, graphite, stainless steel or other metallic materials. These metal contacts act as detection elements and are placed at a fixed distance to create contact with a solution whose conductivity must be determined. The distance between the detection elements and the surface of the metal part determines the cell constant of the electrode, defined as the relationship between distance and area. The cell constant is a critical parameter that affects the value of the conductance produced by the cell and managed by the electronic circuit. A cell constant of 1.0 produces a conductance measurement almost equal to the conductivity of the solution. For solutions with low conductivity, the detection electrodes may be closer, reducing the distance apart and producing cell constants of 0.1 or 0.01. This way, the conductance measurement is increased by a factor of 10 or 100 to compensate for the low conductivity of the solution and provide a better signal to the conductivity meter. On the other hand, the detection electrodes may be positioned further away to create cell constants 10 for the measurement of highly conductive solutions. This way, acceptable conductance for the meter is produced, reducing the measure of conductance by a factor of 10. To produce an acceptable measurement signal for the conductivity meter, it is very important that the operator chooses a conductivity sensor with a cell constant appropriate to the sample. The following table lists the optimal conductivity range for generic probes with various cell constants.

Cell constant	Optimal conductivity range
0.01	0.055–20 µS/cm
0.1	0.5–200 µS/cm
1.0	0.01–2 mS/cm
10.0	1–20 mS/cm

## DEFINITION

Conductivity is the ability of a solution to carry the flow of an electric current. In solutions, the current is carried by cations and anions. The ability of a solution to conduct electricity depends on several factors:

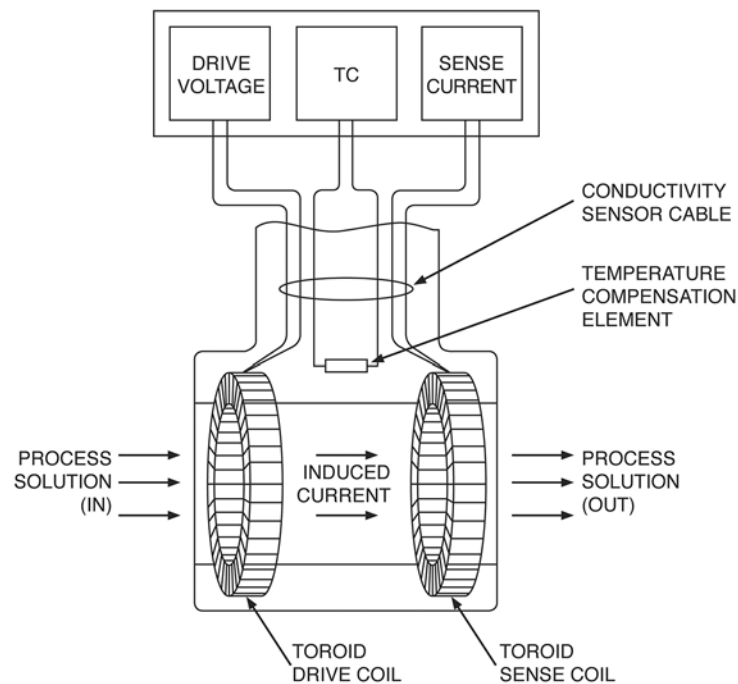
- Concentration
- Mobility of ions
- Valency of ions
- Temperature

All substances have a different level of conductivity. In aqueous solutions the level of ionic strength varies from the low conductivity of ultrapure water to the high conductivity of concentrated chemical solutions.

## TECHNICAL TERMS RELATING TO CONDUCTIVITY

### Inductive toroidal instrument for conductivity

The inductive toroidal conductivity sensor consists of two high quality toroids (Coils) embedded concentrically and adjacent to each other in a non-conductive enclosure. The primary coil is excited with a sinusoidal alternating voltage and creates a variable magnetic field. This variable magnetic field causes the ions in the solution to shift through the centre of the toroid. The movement of the ions is equivalent to an alternating current flowing through the centre of the toroid. The AC current produces in the detection coil an alternating current proportional to the conductivity of the solution. Ideally, the signal in the detection coil is due only to the movement of the ions and not to the variable magnetic field created by the primary coil. For this reason, very effective magnetic shielding is required between the coils.









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