Tecfluid
The art of measuring

Electromagnetic flowmeters
Series FLOMAT

Insertion electromagnetic flowmeter for conductive liquids

- For use in large diameter pipes as an economical solution for flow measurement
- Flow rate measurement is independent of density, temperature, viscosity and pressure
- Pulsed coil excitation to obtain a minimum zero drift
- No moving parts, low maintenance, low pressure drop and allows the pass of solids. Good chemical resistance
- Low power consumption
- Flow rate: 2300 l/h ... 110000 m^3/h
- Accuracy: ±3.5% reading value
- Minimum electric conductivity: 20 µS/cm
- Connections: inserted in pipes of DN40 ... DN2000, by means of:
  - TF Tecfluid standard flange
  - 2 ¼" BSP-F
  - DN40 PN40 EN 1092-1 flange
- Materials:
  - Sensor: EN 1.4404 (AISI 316L), PVDF
  - Sensor head: PVDF
  - Insert pipe adaptor: EN 1.4404 (AISI 316L), PE, PVC Others on request
  - Electrodes: EN 1.4404 (AISI 316L), Hastelloy C, Tantalum, Titanium
- Local indication, volume totalizer, 4-20 mA and pulse outputs
- Alarms, empty pipe detection, etc. depending on converter model
- Full diagnosis for MX4 converter
- HART and MODBUS Communication protocols available on request
- Compact converter, mounted on top of the sensor
- Remote converter for wall or pipe mounting for MX4 and XT5 converters

HART COMMUNICATION PROTOCOL

Modbus

Working principle

The measurement principle is based on Faraday's induction law. A voltage V is induced between a pair of electrodes when a conductive liquid flows in a pipe of diameter D at an average velocity v, through a magnetic field B (which is perpendicular to the flow direction).

This voltage, proportional to the average velocity of the liquid, is acquired by the electronic converter in order to be processed and converted to a flow rate measurement.

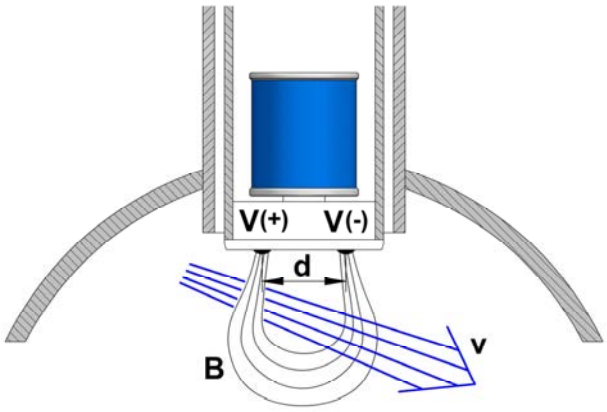
$$V = B \cdot v \cdot D$$

V = Voltage across the electrodes

B = Magnetic field strength

v = Liquid velocity

D = Pipe diameter



Applications

- Water supply & water treatment plants
- Food and beverage industries
- Leak detection in pipelines & chemicals flow monitoring
- HVAC

Models

- Sensor **connector FX** for converters MX4 and XT5:
  - **FLOMAT-FX/1/x**: threaded connection 2 ¼" BSP-F
  - **FLOMAT-FX/2/x**: TF or EN 1092-1 DN40 PN40 flanged connection
  - **FLOMAT-FX/x/1:** DN40 ... DN450 pipe
  - **FLOMAT-FX/x/2:** DN500 ... DN1000 pipe
  - **FLOMAT-FX/x/3:** DN1100 ... DN2000 pipe
- Sensor **connector XL** for converter XL1: same as previous ones, with **FLOMAT-XL** nomenclature.

Technical data

- **Accuracy:** ±3.5% reading value for flow speed ≥ 0.4 m/s
- **Minimum electric conductivity:** 20 µS/cm
- **Liquid temperature:** -20ºC … +120ºC
- **Ambient temperature:** -20ºC ... +60ºC
- **Working pressure:** PN16. Others on request

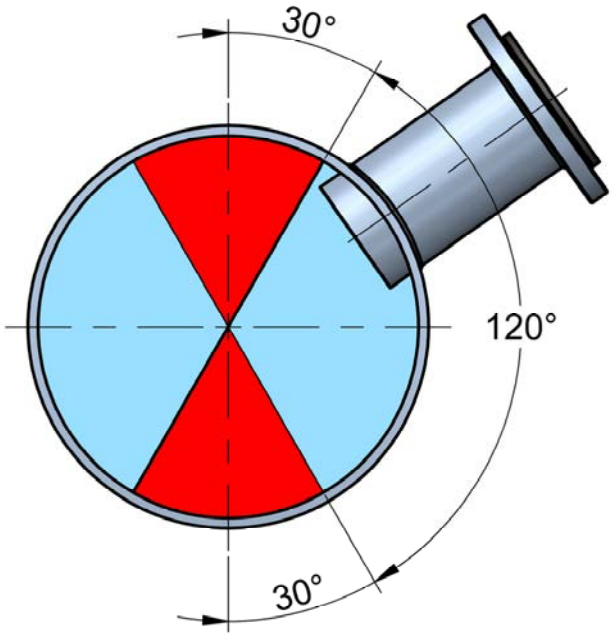
- **Connections:** inserted in pipes of DN40 ... DN2000, by means of:
  - TF Tecfluid standard flange
  - 2 ¼" BSP-F
  - DN40 PN40 EN 1092-1 flange
- **Materials:**
  - Sensor: EN 1.4404 (AISI 316L), PVDF
  - Sensor head: PVDF
  - Insert pipe adaptor: EN 1.4404 (AISI 316L), PVC, PE Others on request
  - Electrodes: EN 1.4404 (AISI 316L), Hastelloy C, Tantalum, Titanium

Electronic converters and options

- **XT5:** Local flow indication, volume totalizer and 4-20 mA and pulse outputs. Compact or remote mounting (model XT5M). HART protocol with model XT5H
- **MX4:** Local flow indication, volume totalizer and 4-20 mA and pulse outputs. 2 relay outputs configurable as an alarm, among others. Full diagnosis. Compact or remote mounting. HART protocol with model MX4H and MODBUS RTU RS485 with model MX4B. Programmable by means of keyboard or Tecfluid S.A. Winsmeter MX4 software and USB cable
- **XL1:** 4-20 mA analog output and digital output, configurable as pulses or alarm. Without indication. Programmable by means of Tecfluid S.A. Winsmeter XL1 software and USB cable

Installation

- Sensor must not be installed in the upper or lower parts of the pipe, in order to avoid air bubbles or solids sedimentation.



- Pipe must always be full of liquid.
- Required straight pipe run depends on the flow profile, which can be affected by the disturbing elements found in the installation before and after the sensor, as shown in the following chart:

Disturbing element before the sensor	Minimum distance between the element and the sensor
90º elbow or T-bend	50 x DN
Several 90º coplanar bends	50 x DN
Several 90º non-coplanar bends	80 x DN
Total angle convergent 18º to 36º	30 x DN
Total angle divergent 14º to 28º	55 x DN
Fully opened butterfly valve	45 x DN
Fully opened plug valve	30 x DN

After the sensor a minimum straight pipe run of 5 x DN is required.

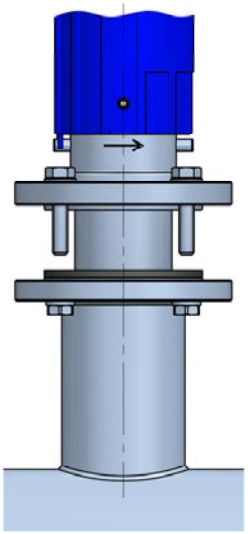
Insert pipe adaptors

Tecfluid shall supply the insert pipe accessory for the correct installation of the FLOMAT sensor.

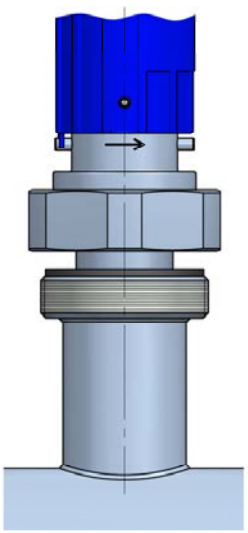
There are two different types of insert pipe adaptors. For a DN40 … DN65 pipe, the adaptor is supplied already welded to a section of pipe that must be mounted inline. In case of a metallic pipe it must be welded and in case of a PVC pipe it shall be glued.

For a DN80 or bigger pipe, the adaptor is welded (or glued) directly to the pipe.

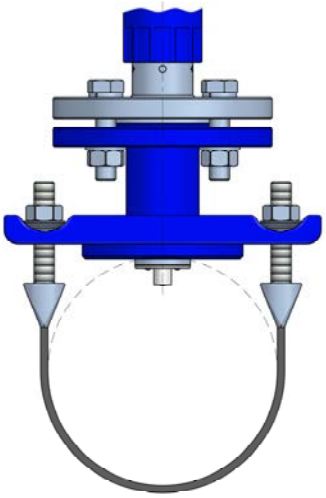
In those cases where Tecfluid insert pipe adaptor cannot be used (FRP or similar pipes), installation should be made by means of a CLAMP-ON saddle (optional).



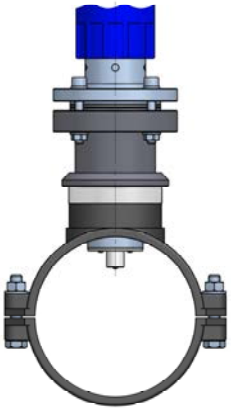
FLOMAT-FX/2/x
flanged connection



FLOMAT-FX/1/x
threaded connection

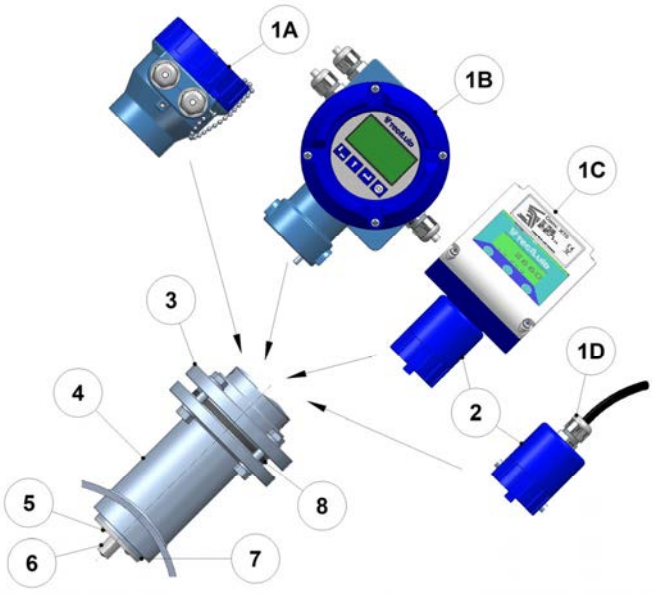


CLAMP-ON saddle for
non-metallic pipes



CLAMP-ON saddle for
plastic pipes

Materials



Nº	Description	Materials
1A	XL1 housing	Painted aluminium
1B	MX4 housing	Painted aluminium
1C	XT5 housing	Polycarbonate
1D	Packing gland	Polyamide
2	Connector	Polycarbonate *
3	Flange / BSP nut	EN 1.4404 (AISI 316L)
4	Insert pipe adaptor	EN 1.4404 (AISI 316L), PVC, PE **
5	Electrodes	EN 1.4404 (AISI 316L), Hastelloy C, Titanium, Tantalum
6	Sensor head	PVDF
7	Sensor body	EN 1.4404 (AISI 316L), PVDF
8	Gasket	NBR, VITON®

* Also available in EN 1.4305 (AISI 303) on request

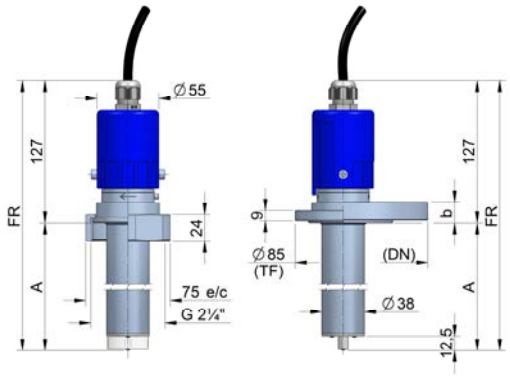
** Others on request

Dimensions

DN	A	FM *	FX *	FR *
40...450	113.5	328	342	241
500...1000	218.5	433	447	346
1100...2000	368.5	583	597	496

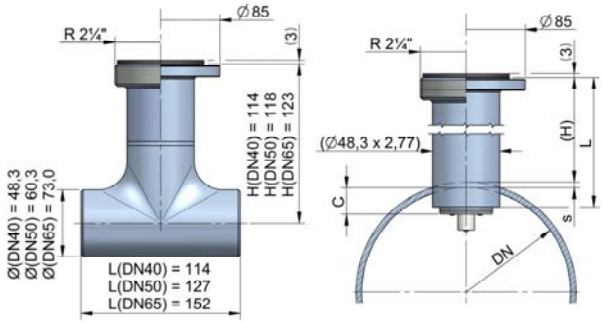
* minimum dimension to remove the sensor from the pipe

Converter remote mounting (IP68 10 m H_2O)



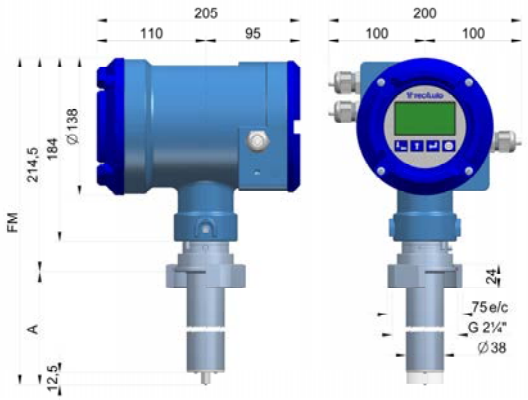
DN	C (mm)	Insert pipe adaptor	
		L (mm)	H (mm)
80	10.0	93	88.0 - s
100	12.5		85.5 - s
125	15.5		82.5 - s
150	19.0		79.0 - s
200	25.0		73.0 - s
250	31.0		67.0 - s
300	37.5		60.5 - s
350	44.0		54.0 - s
400	50.0		48.0 - s
450	56.2		45.0 - s
500	62.5	145	140.5 - s
600	75.0		128.0 - s
700	87.5		115.5 - s
800	100.0		103.0 - s
900	112.5		90.5 - s
1000	125.0		78.0 - s
1100	137.5	205	218.5 - s
1200	150.0		203.0 - s
1400	175.0		178.0 - s
1600	200.0		153.0 - s
1800	225.0		128.0 - s
2000	250.0		103.0 - s

s: pipe thickness (depends on pipe material and pressure rating)

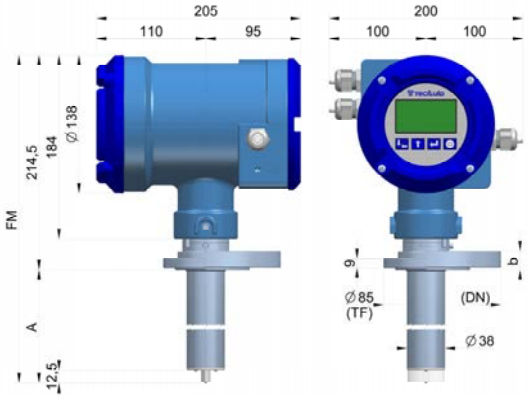


Converter MX4 compact mounting

FLOMAT-FX/1/x threaded connection

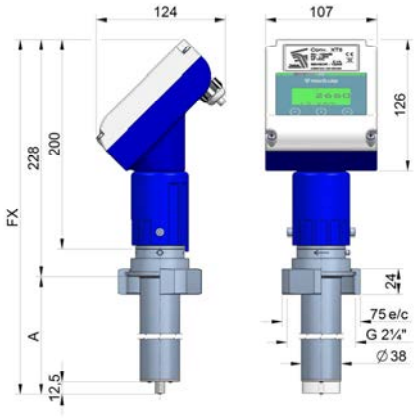


FLOMAT-FX/2/x flanged connection

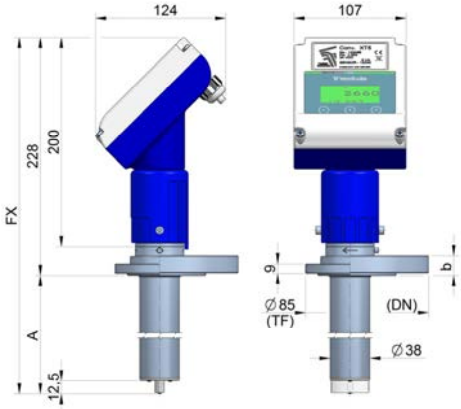


Converter XT5 compact mounting

FLOMAT-FX/1/x threaded connection



FLOMAT-FX/2/x flanged connection



(All dimensions in mm)

Flow ranges

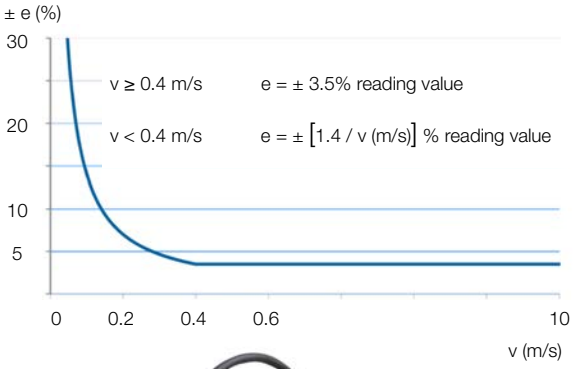
Sensor selection

The diagram shows the correspondence between the liquid velocity and the flow rate for different sensor sizes.

The sensor size should be chosen selecting a liquid velocity of about 3-4 m/s. The minimum liquid velocity should not be below 0.5 m/s.

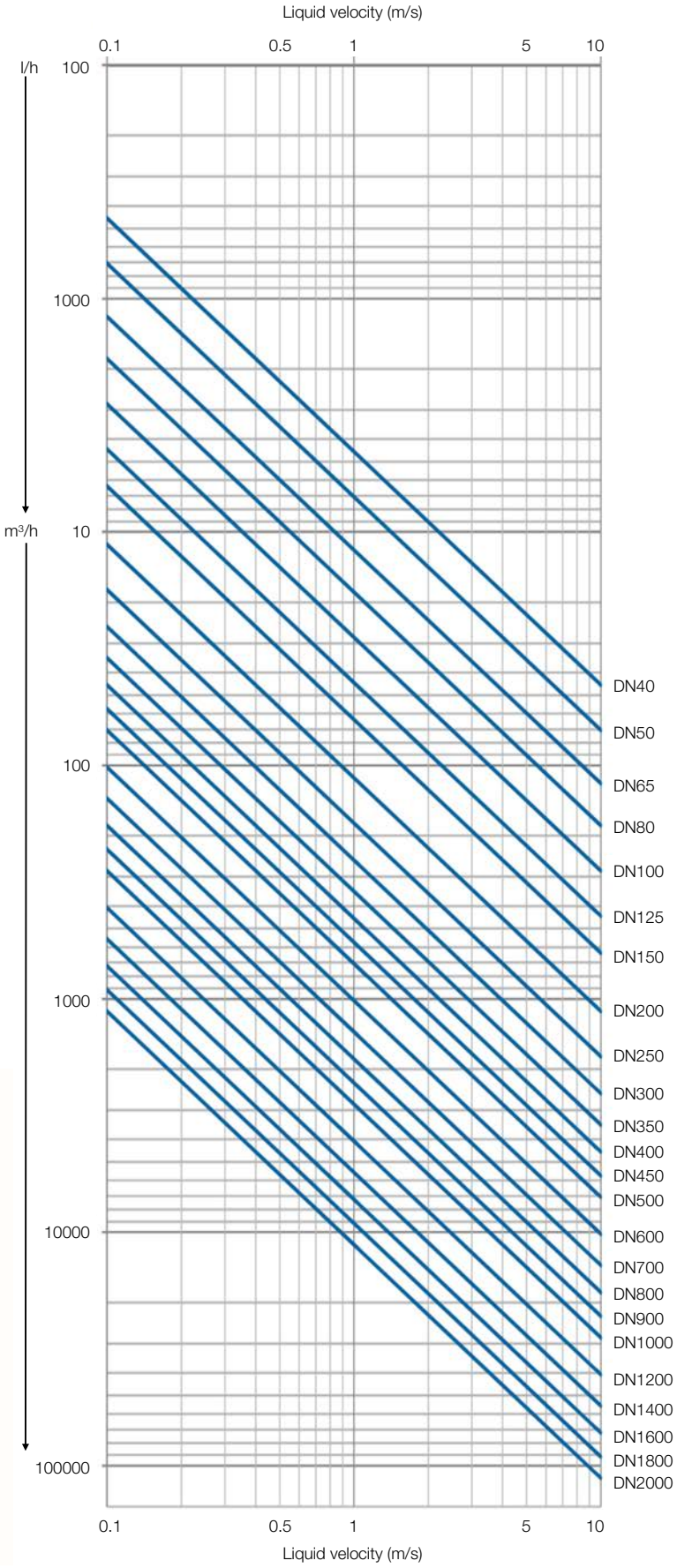
When the liquid contains suspended solids, it is better to work between 3 and 5 m/s in order to avoid sedimentation in the pipe and sensor.

Accuracy curve (error vs velocity)



FLOMAT-FX/1/1 with remote XT5M converter

FLOMAT-FX/2/2 with CLAMP-ON saddle for non-metallic pipes and compact XT5 converter with AISI 303 connector



Electronic converters

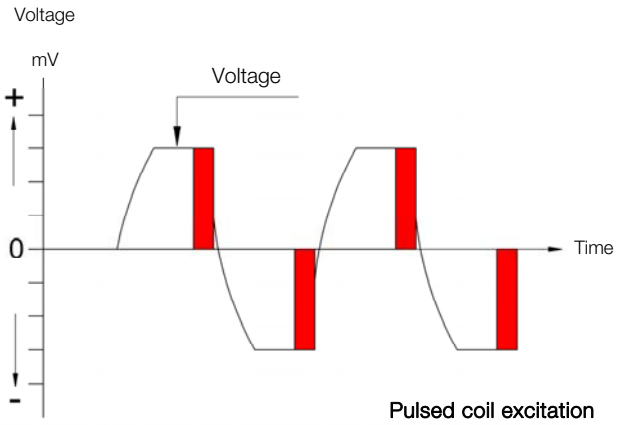
The electronic converters for FLOMAT series provide the different options of flow indication, maximum / minimum flow rate alarms, and analog and pulse outputs.

They are compatible with the different sensors:

- FLOMAT-FX: converters MX4 and XT5 for either compact or remote mounting (cable is supplied).
- FLOMAT-XL: converter XL1 for compact mounting.

HART protocol is available for MX4 and XT5 converters.

MODBUS RTU RS485 protocol is available for MX4 converter.



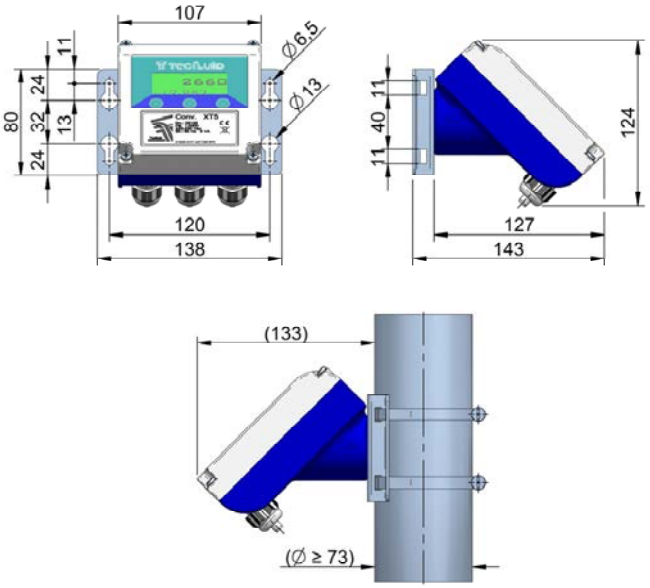
Pulsed coil excitation

XT5 converter

Technical data

- IP67 polycarbonate enclosure
- Compact or remote mounting
- Programming via front tactile push buttons
- Linearity: ±0.2% f.s.
- Repeatability: ±0.1% f.s.
- Ambient temperature range: 0ºC ... +60ºC
- Power supply: 24, 115, 230, 240 VAC 50 / 60 Hz
  24 VDC
- Power consumption: ≤ 5 VA
- Weight: 700 g
- Flow rate indication:
  - No. of digits: 4 (0 to 2 decimal configuration)
  - Digit size: 5 mm
- Volume totalizer:
  - No. of digits: 7 (2 decimal)
  - Digit size: 8 mm
  - Reset button
- Analog output: 4-20 mA, active or passive, programmable measuring units
- Pulse output: optoisolated:
  - V_{max}: 30 VDC ; I_{max}: 30 mA
  - Maximum frequency in “P/U” mode: 6.25 Hz
  - Frequency in “Hz” mode: 0.04 ... 5000 Hz
- Empty pipe detection
- Flow rate cut off, programmable
- Adaptative flow rate filter: programmable integration time between 0.1 ... 20 seconds
- Zero offset adjustment
- HART protocol with model XT5H. All the features regarding HART communication can be found in the corresponding document “Field Device Specification”. Compatible with HART Server Communication software. Also available for remote mounted version XT5HM.

Dimensions remote mounted converter (model XT5M)



XT5 compact converter

XT5M remote converter with wall support

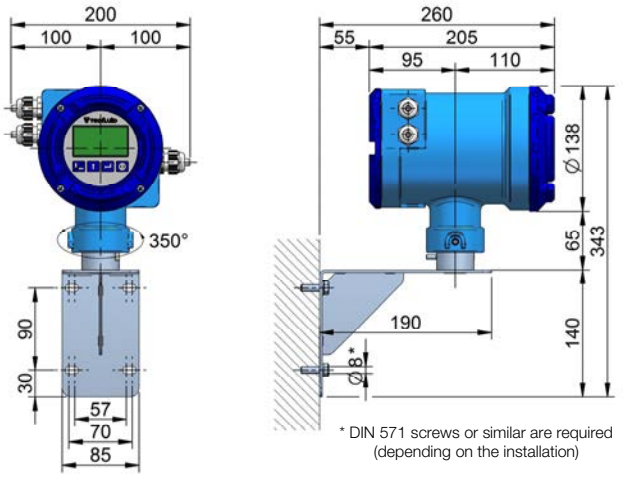
MX4 converter

Technical data

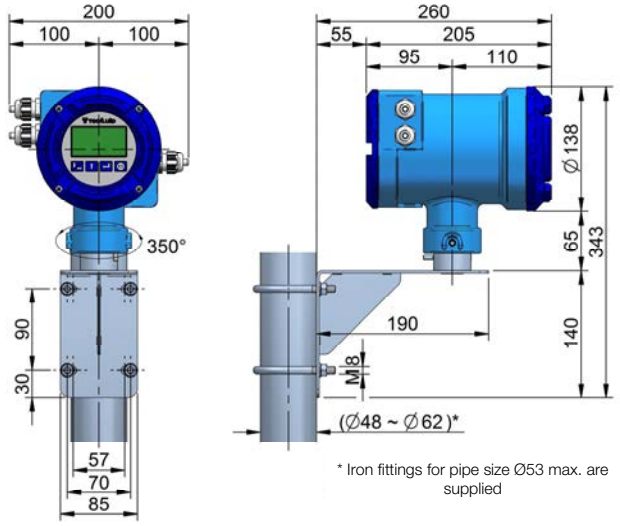
- IP67 coated aluminium enclosure
- Compact or remote mounting
- Programming via front push buttons
- 128 x 64 graphic display
- Linearity: ±0.2% f.s.
- Repeatability: ±0.1% f.s.
- Ambient temperature range: -20ºC ... +60ºC
- Power supply: 90 … 265 VAC 50 / 60 Hz
  12 … 48 VDC
- Power consumption: ≤ 5 VA
- Weight: 3.1 kg
- Flow rate and liquid velocity indication:
  - No. of digits: 5 (0 to 2 decimal configuration)
  - Digit size: 11 mm
- Volume totalizer:
  - No. of digits: 8 (2 decimal)
  - Digit size: 8 mm
  - Reset button
- Analog output: 4-20 mA, active or passive, programmable measuring units
- Pulse output: optoisolated NPN bipolar transistor:
  - V_{max}: 30 VDC ; I_{max}: 30 mA
  - Output frequency: 0.01 ... 5000 Hz
  - Programmable duty cycle
- Relay outputs: 2 relays with potential free contacts.
  - Contact characteristics:
    - Maximum voltage: 250 VAC
    - Maximum current: 8 A
    - Maximum power: 500 VA

  Programmable as flow rate alarms, empty pipe detection or reversed flow indication
- Empty pipe detection
- Flow rate cut off, programmable
- Adaptative flow rate filter: programmable integration time between 0 ... 40 seconds
- Zero offset adjustment
- Full diagnosis of the coil current, the differential voltage on the sensor electrodes and the conductivity of the liquid, as well as detection of an electronic failure in the measuring circuit
- Easy programmable by means of Tecfluid's Winsmeter MX4 software, available for download at www.tecfluid.com
- MODBUS RTU RS485 protocol with model MX4B
- HART protocol with model MX4H. All the features regarding HART communication can be found in the corresponding document "Field Device Specification". Compatible with HART Server Communication software. Also available for remote mounted versions.

Dimensions remote mounted converter



* DIN 571 screws or similar are required (depending on the installation)



* Iron fittings for pipe size Ø53 max. are supplied

MX4 remote converter with wall support

FLOMAT-FX/1/1 with compact MX4 converter

Converter XL1

Technical data

- IP66/IP67 coated aluminium enclosure
- Compact mounting
- Excellent quality/price ratio
- Without display
- Repeatability: ±0.15% measure value ±0.75 mm/s
- Ambient temperature range: -20ºC ... +70ºC
- Power supply: 20 … 30 VDC, 4-wire system
- Consumption: ≤ 5 W
- Weight: 700 g
- Analog output: 4-20 mA, active or passive, programmable measuring units
- Digital output: optoisolated NPN bipolar transistor:
  - V_{max}: 30 VDC ; I_{max}: 30 mA
  - Frequency range: 0.01 ... 5000 Hz
  - Programmable duty cycle
  - Programmable as a pulse or an alarm output (reversed flow direction, empty pipe or flow rate alarm)
- Flow rate cut off, programmable
- Adaptative flow rate filter: programmable integration time between 1 ... 25 seconds
- Zero offset adjustment
- Datalogger, by means of Winsmeter XL1 software in PC
- Easy programmable by means of Tecfluid's Winsmeter XL1 software, available for download at www.tecfluid.com

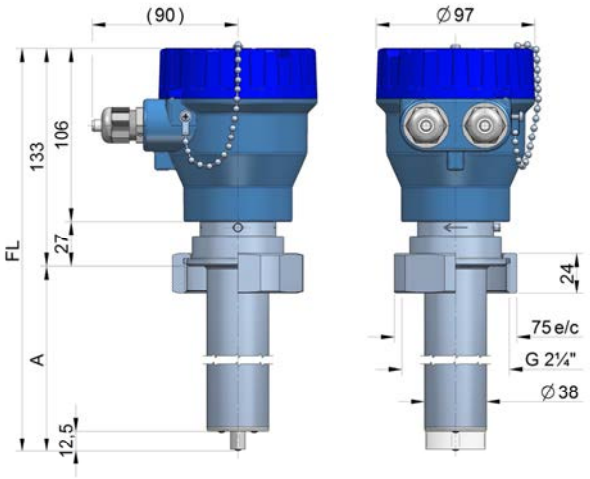
Converter XL1

Dimensions

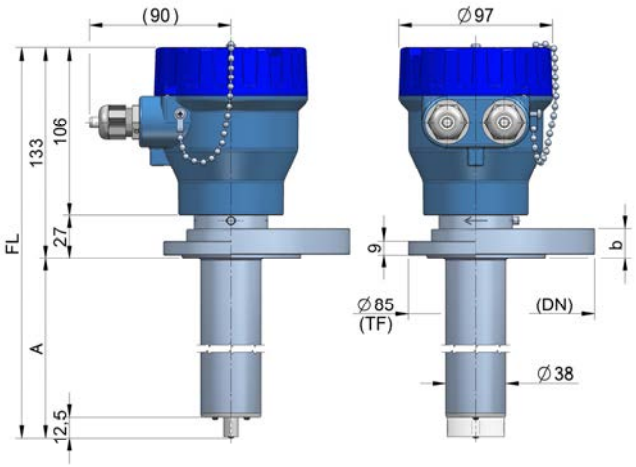
DN	A	FL *
40...450	113.5	247
500...1000	218.5	352
1100...2000	368.5	502

* minimum dimension to remove the sensor from the pipe

FLOMAT-FX/1/x threaded connection



FLOMAT-FX/2/x flanged connection



(All dimensions in mm)

Accessories

FLOMAT-TAP

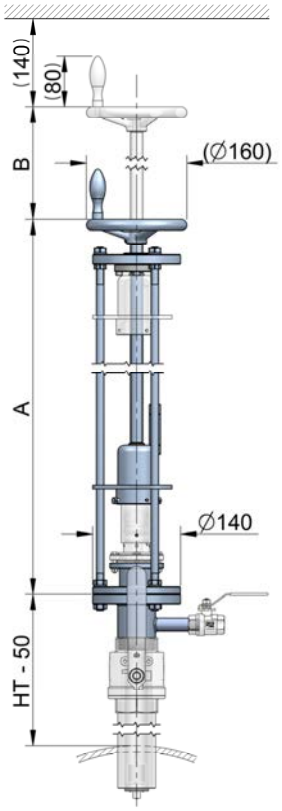
The FLOMAT-TAP accessory is a useful complement for the FLOMAT sensors in some specific installations.

The key features of the product are:

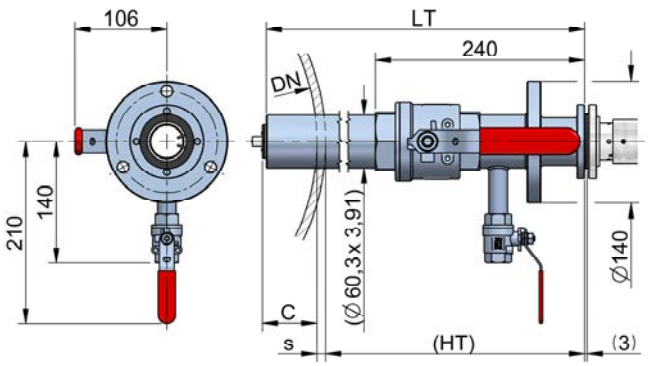
- FLOMAT sensors can be inserted or removed under pressure (pipe full of liquid).
- Designed for obtaining flow measurement in different points of a distribution network with only one FLOMAT sensor.
- Allows the maintenance of FLOMAT sensors without flow interruptions.

The M-TAP accessory must be installed to the main pipe as an insert pipe adaptor and it is a part of the complete system FLOMAT-TAP.

FLOMAT-TAP system



M-TAP insert pipe adaptor



(All dimensions in mm)

Dimensions FLOMAT-TAP

DN	A	B
100 … 600	750	420
700 … 1200	865	535
1300 … 2000	990	660

DN	C (mm)	M-TAP insert pipe adaptor	
		LT (mm)	HT (mm)
100	12.5	365	357.0 - s
125	15.5		354.0 - s
150	19.0		350.5 - s
200	25.0		344.5 - s
250	31.0		338.5 - s
300	37.5		332.0 - s
350	44.0		325.5 - s
400	50.0		319.5 - s
450	56.2		313.0 - s
500	62.5		307.0 - s
600	75.0		2945 - s
700	87.5	450	377.0 - s
800	100.0		364.5 - s
900	112.5		352.0 - s
1000	125.0		339.5 - s
1100	137.5		327.0 - s
1200	150.0		314.5 - s
1400	175.0	575	414.5 - s
1600	200.0		389.5 - s
1800	225.0		364.5 - s
2000	250.0		339.5 - s

PRESENCE IN MORE THAN 50 COUNTRIES ALL OVER THE WORLD

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The art of measuring

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Pressure Equipment Directive certified by Lloyd's Register

ATEX European Directive certified by

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R-CT-FLOMAT Rev. 3 english version