



Instructions manual

Series FLOMID

Sensor FLOMID-FX

Converter XT5



The art of measuring

PREFACE

Thank you for choosing a product from Tecfluid S.A.

This instruction manual allows the installation, configuration, programming and maintenance. It is recommended to read it before using the equipment.

WARNINGS

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- Make sure this manual goes to the end user.
- Keep this manual in a place where you can find it when you need it.
- In case of loss, ask for a new manual or download it directly from our website www.tecfluid.com Downloads section.
- Any deviation from the procedures described in this instruction manual, may cause user safety risks, damage of the unit or cause errors in the equipment performance.
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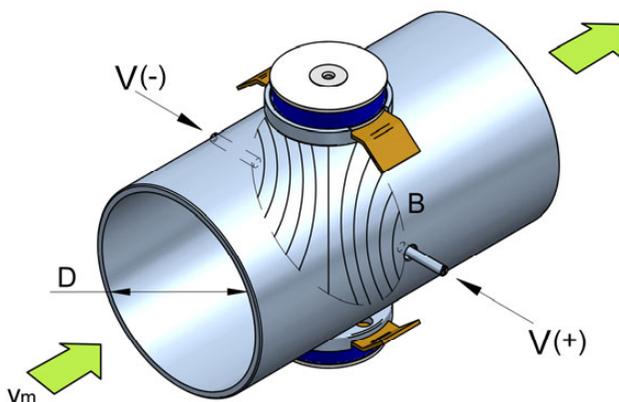
SENSOR FLOMID-FX

1 WORKING PRINCIPLE

The FLOMID electromagnetic flowmeters are based on Faraday's induction law.

When an electrically conductive liquid flows through a magnetic field, perpendicular to the flow direction, it induces a voltage V proportional to the liquid velocity.

Two electrodes in contact with the liquid and positioned perpendicularly to the magnetic field, sense this voltage V .



$$V = B \cdot v_m \cdot D$$

Where:

V = Measured voltage in the electrodes

B = Magnetic field

v_m = Average liquid velocity

D = Pipe diameter

2 RECEPTION

The FLOMID electromagnetic flowmeters are supplied conveniently packaged for their protection during transportation and storage, together with their instructions manual for installation and operation.

All the instruments are supplied tested in our flow rigs, obtaining the gain factor F_c of each sensor.

2.1 Unpacking

Unpack the instrument carefully, removing any remains of the packing from the inside of the sensor. Do not remove the grease from the neck that couples to the electronics housing.

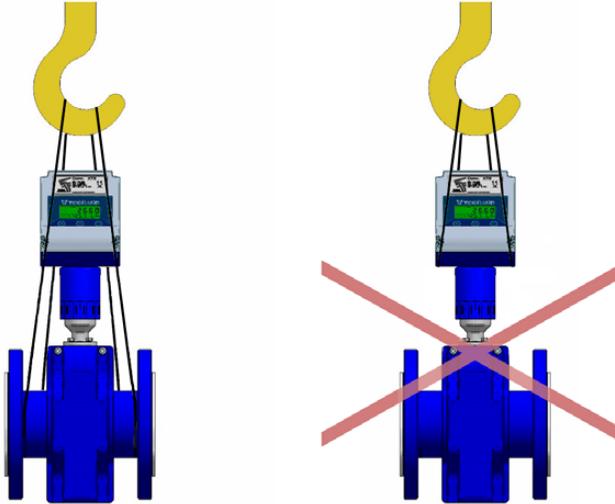
2.2 Storage temperatures

Sensors linings of:	PTFE and PVDF	-20°C +60°C
	PP and EBONITE	-5°C +50°C

3 HANDLING

It should always be done with care and without knocks.

The large diameter sensors have rings for holding the elevation elements. If the flowmeter is held using slings, these should hold on the sensor and not on the electronics housing (see drawing).



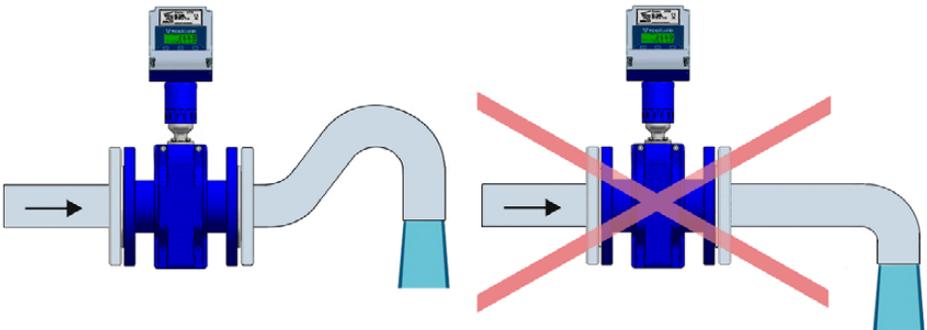
4 INSTALLATION

This should be made in a point that guarantees that the pipe is always completely full.

Avoid high points of the pipes where air pockets usually form, or pipes with falling flow where vacuums can form.

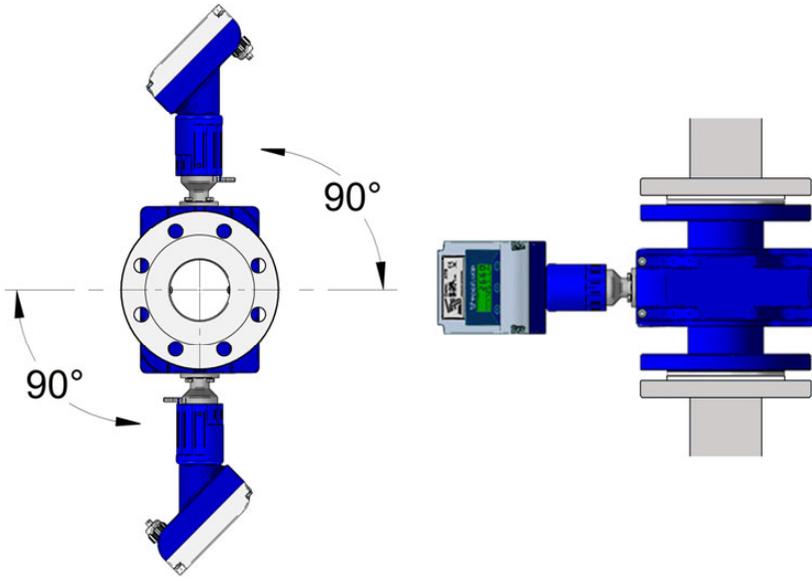
Partially full pipes can produce important reading errors.

Flow rate measurement with open discharge makes it necessary to install the flowmeter in a pipe section with a siphon which avoids stagnation of air in the sensor.



4.1 Sensor position

The most adequate position is with the electrodes in a horizontal plane. In this way, deposits of particles on the electrodes are avoided.

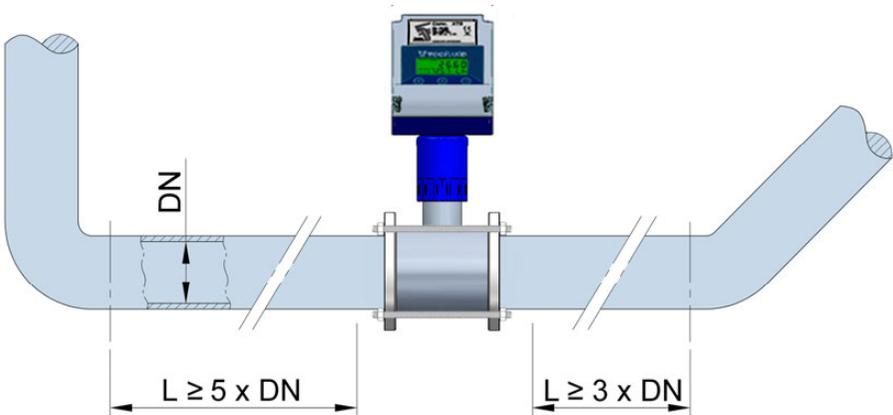


4.2 Straight pipe sections

They are necessary before and after the sensor. The minimum distances are the following:

- Upstream 5 DN
- Downstream 3 DN

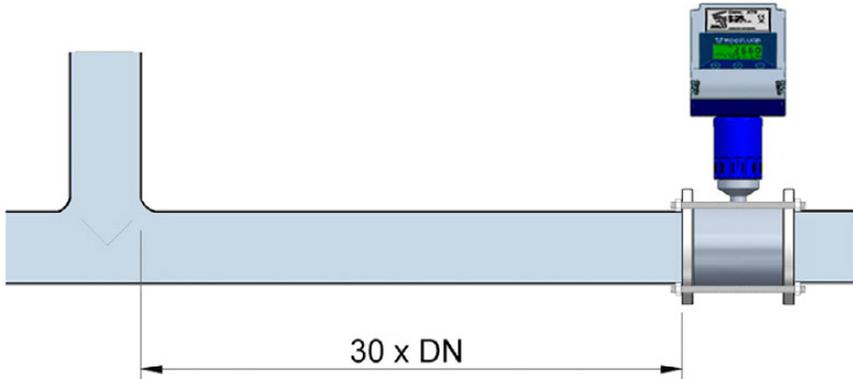
In installations with turbulent flow it may be necessary to increase these distances.



4.2.1 Mixtures

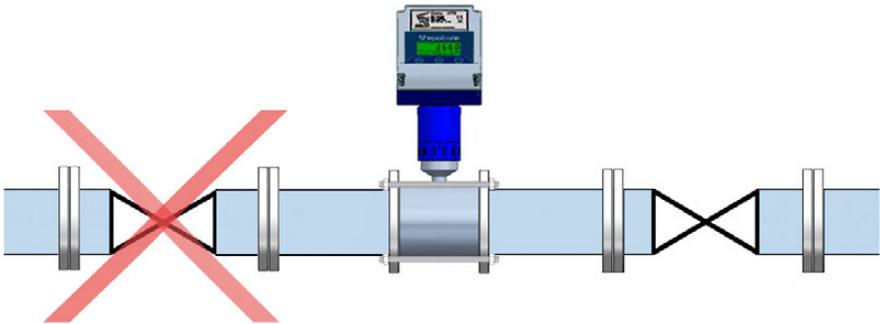
If liquids of different conductivities are mixed it is necessary to install the sensor a minimum of 30 DN from the point of mixture in order to obtain a uniform conductivity of the liquid and stabilize the readings.

If this distance is shorter, readings may be unstable.



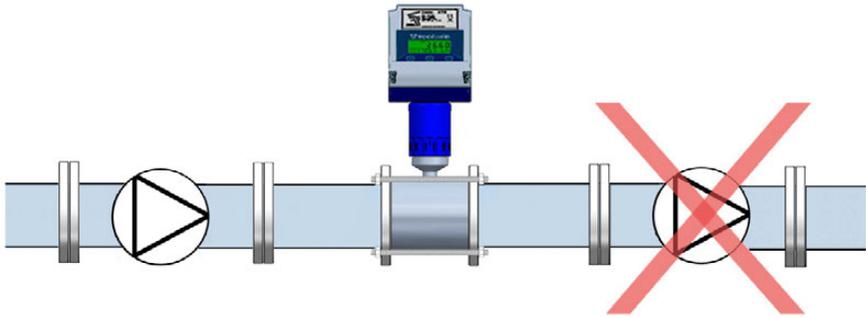
4.3 Valves

Control valves or shut-off valves should always be installed downstream from the sensor to assure that the pipe is always full of liquid.



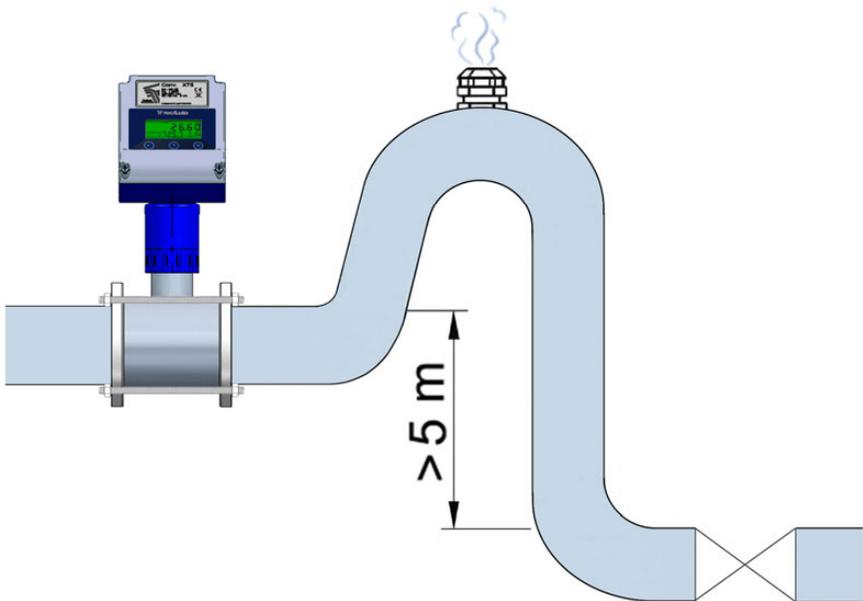
4.4 Pumps

Pumps should be mounted upstream from the sensor to avoid the suction of the pump (vacuum) that could damage the sensor liner.



4.5 Aeration

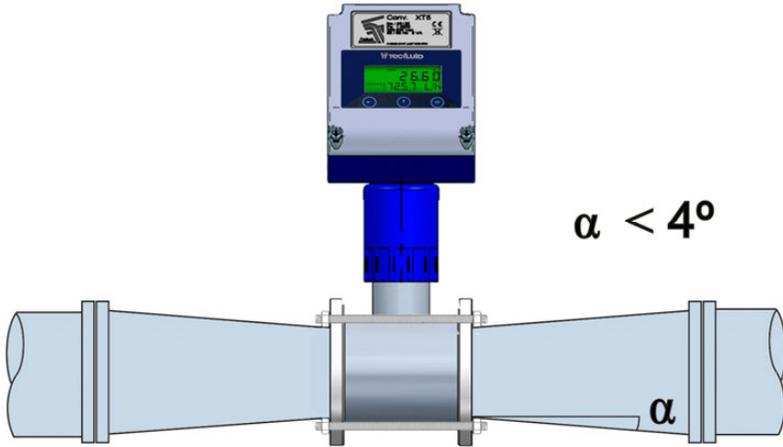
If there is a point where the level difference is higher than 5 m an air inlet valve should be installed after the sensor to avoid a vacuum effect that could damage the sensor liner.



4.6 Reduction of DN

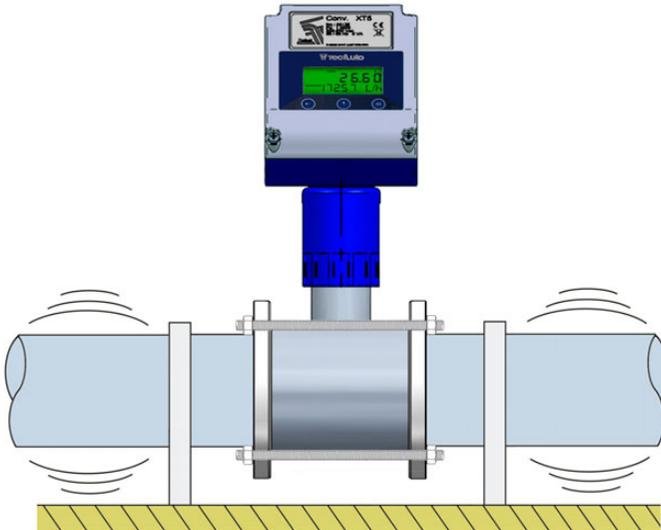
In installations where, due to reasons of the flow rate to be measured, a sensor of a smaller DN than the pipe DN must be mounted, the reduction must be done with an angle smaller than 4° to avoid turbulences that can give false readings.

If the angle cannot be so small, straight pipe sections indicated in 4.2 point must be kept.



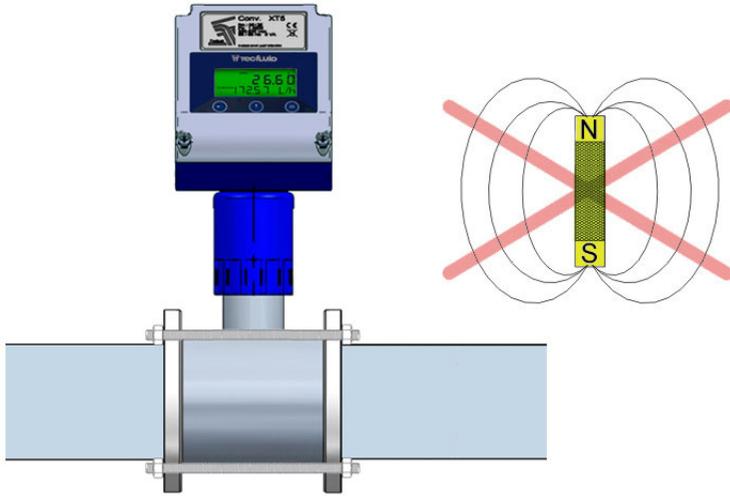
4.7 Vibrations

Vibrations of the pipes should be avoided by anchoring the pipe before and after the sensor. The vibration level should be less than 2.2 g in the range of 20 -150 Hz according to IEC 068 -2-34.



4.8 Magnetic fields

Strong magnetic fields close to the sensor should be avoided.

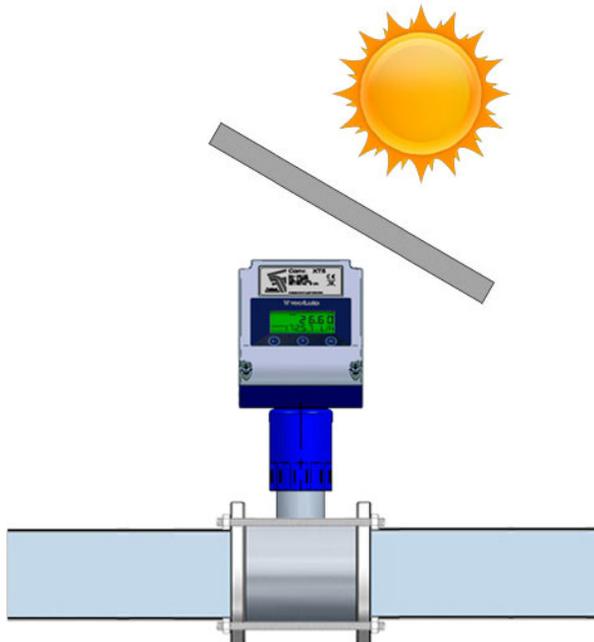


4.9 Temperature

In open air installations it is recommended to install a protection to avoid direct sun light on the flowmeter.

With thermally insulated pipes DO NOT insulate the sensor. High temperatures can damage it.

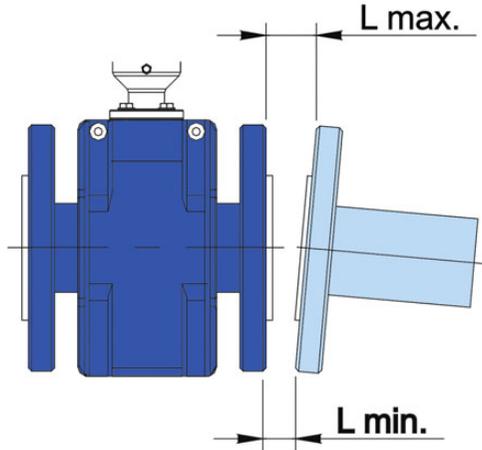
The maximum liquid temperatures are shown on point 14 of page 37.



5 MOUNTING

5.1 Parallelism

The maximum parallelism error must be less than 0.5 mm ($L_{max} - L_{min} \leq 0.5$ mm).

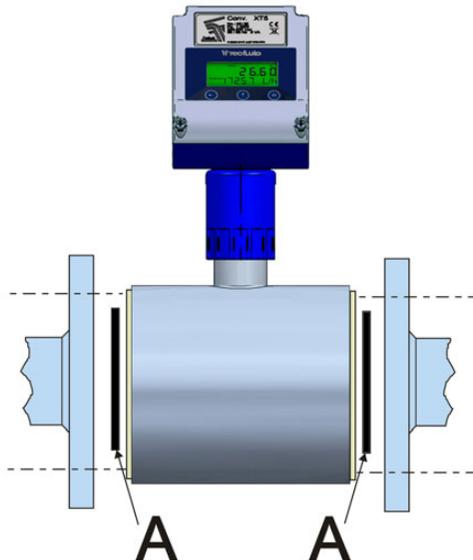


5.2 Gaskets

In the wafer sensors, to avoid leakage of liquid inside the sensor, it must be ensured that the rubber gasket (A) of the figure is well centered, so that it presses directly on the plastic of the sensor.

The standard material of the supplied gasket is NBR. Other materials can be supplied on demand.

The sensors for connection other than wafer, are supplied without gaskets.



5.3 Sensor earth connection



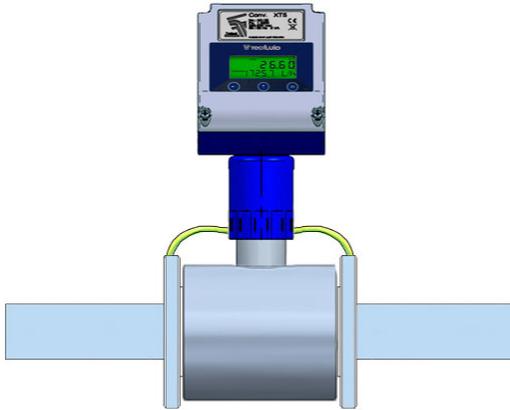
To obtain correct operation the sensor should have its functional earth connected to a point that is in direct contact with the liquid whose flow rate wants to be measured.

The earth cables should assure a good electrical contact. To obtain this, they should be well screwed down and with a good contact on both sides of the sensor. It is important to eliminate paint or coverings that act as insulation of the connection.

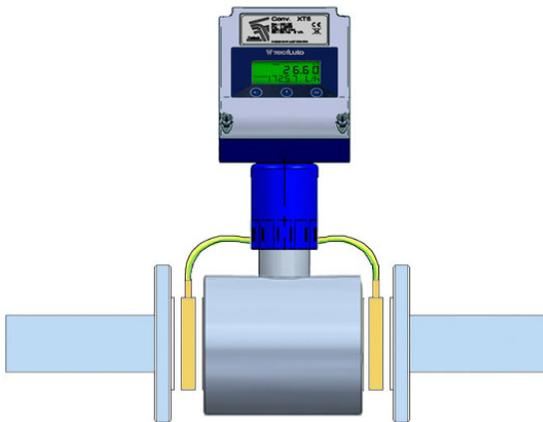
The functional earth connection should be used exclusively for the sensor given that parasitic signals caused by other electrical equipment connected to this earth can cause malfunction of the sensor.

The connection of the functional earth should be made as follows:

- a) In the case of metallic pipes without internal lining connect the earth cables to the counter flanges.

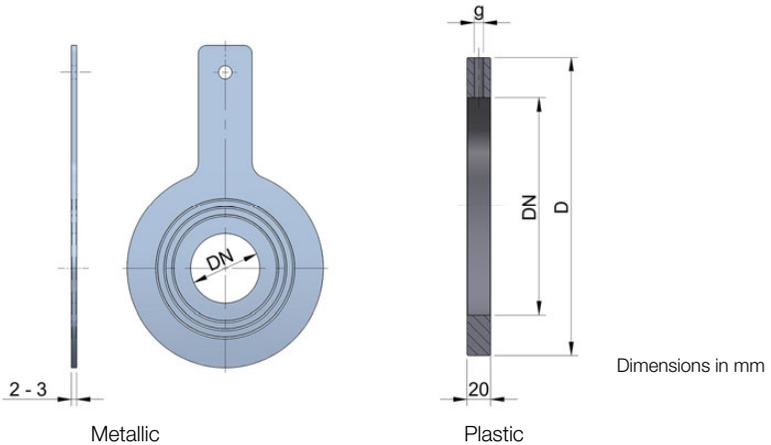


- b) In the case of metallic pipes with internal lining or plastic pipes, connect the earth cables to the earthing rings, supplied on request.



The earthing rings are necessary when installing in non-metallic pipes or in metallic pipes with internal insulating liner (PTFE, PVDF, PP, EBNITE, etc.).

Earthing rings are supplied in two versions:



Metallic, disk in stainless steel EN 1.4404 (SS 316L), for liquids compatible with this material.
 Plastic, with an electrode to make the contact with the liquid. The materials (plastic and metal) depend on the working liquid.

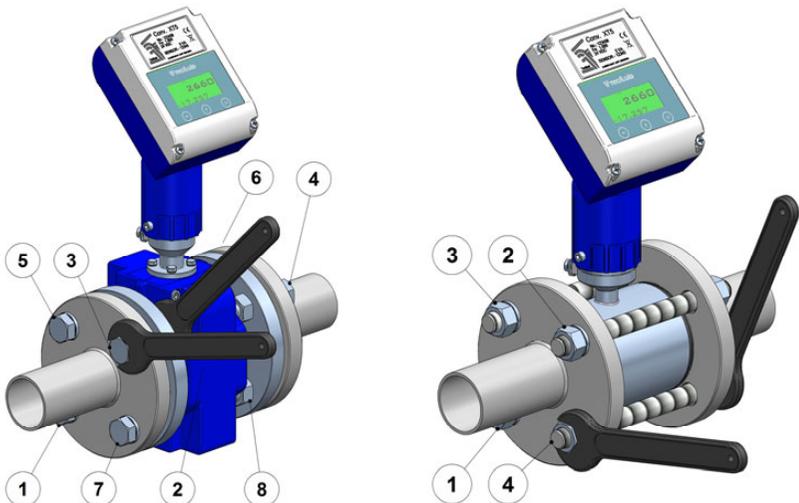
5.4 Tightening

The tightening torque of the fastening screws of the flanges should not exceed 32 Nm for maximum working pressures of 16 bar.

This tightening torque is applicable for wafer sensors (FLOMID-0FX), and with flanges (FLOMID-2FX) for a pressure value of 16 bar.

The maximum value of the torque depends on the sensor nominal pressure (PN).

The tightening of the flange bolts should be done uniformly, following the sequence indicated in the drawings according to the number of flange bolts.



XT5 CONVERTER

1 INTRODUCTION

The XT5 converter unit can be used with the different FLOMID and FLOMAT series of electromagnetic flow sensors. The electronic circuit is based on the most advanced technology, in order to obtain accurate and reliable measurements.

The device provides the following features:

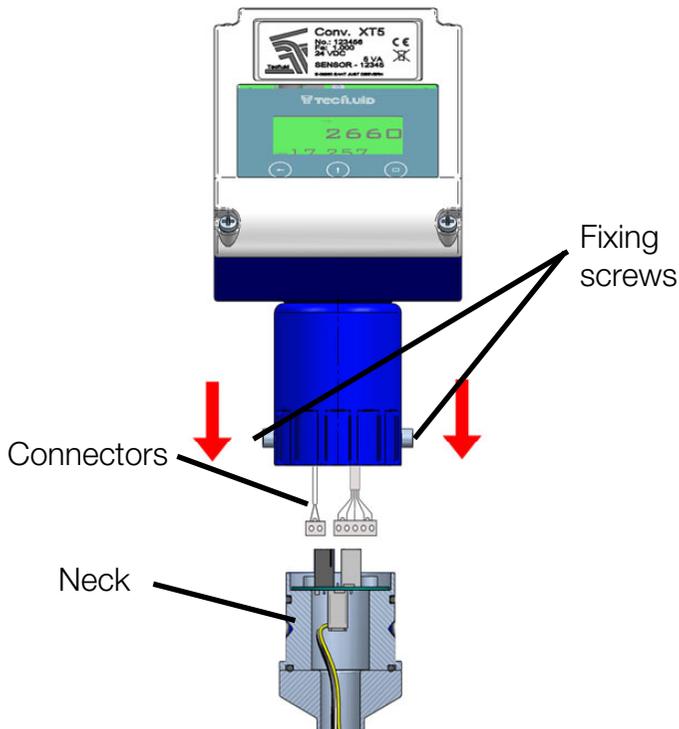
- Coil excitation by means of pulsed signal to obtain a negligible zero offset.
- Pulse and analog current outputs proportional to the flow rate and user configurable.
- Local and separate mounting.
- Easy interchangeability with other sensors.
- Display orientable 180° to adapt to the installation position.
- HART protocol compatibility (XT5H model).

2 INSTALLATION

2.1 Sensor connection

2.1.1 Compact converter

The converter provides two cables to be connected to the sensor. Once connected, slide the converter along the sensor neck until the stop. Tight the two fixing screws.



2.1.2 Remote converter

One of the ends of the cable has a header and two wires, to connect them to the sensor. The connection is as explained in point 2.1.1.

The other end has to be connected to the converter, and has five wires. The cable must be passed through the cable gland and the connection for each wire is explained in chapter 3.

2.2 Electrical connection

For the electrical connection, the XT5 has two screw terminal strip. To help in the connecting of the equipment, the description of the terminals is marked on the printed circuit.

For the electrical installation it is recommended to use multiple conductor cables with individual cable sections in the order of 0.25 to 0.5 mm² in order to make it easier to connect. It is better to maintain the cables with mains voltage (power supply) separated from the cables with low level signals (4-20 mA, etc.).

Before starting the installation, check that the PG11 cable glands are the right size for the cables to be used, in order to guarantee the instrument will stay watertight. The cable glands used are for cables with outside diameters between 3.5 mm and 10 mm.

To connect them, peel the outside insulation to free the inner cables. It is recommended to tin the ends of the wires to avoid loose ends. Pass the cables through the cable glands and screw down in the corresponding positions of the terminal strip. Once the wiring is finished make sure that the cables are well gripped by the cable glands to maintain the degree of protection.



Incorrect installation of the cable gland or inadequate cable placement can cause irreparable damage to the converter.



IMPORTANT NOTE: In order to comply with the electrical safety requirements as per EN-61010-1 (IEC 1010-1), the installation of the equipment must take into account the following:

- A mains switch must be provided to disconnect the equipment. This switch must be marked as the disconnecting device for the equipment and be within easy reach of the operator.
- The mains supply must have an earth line.
- The housing must not be opened when the instrument has mains supply connected.

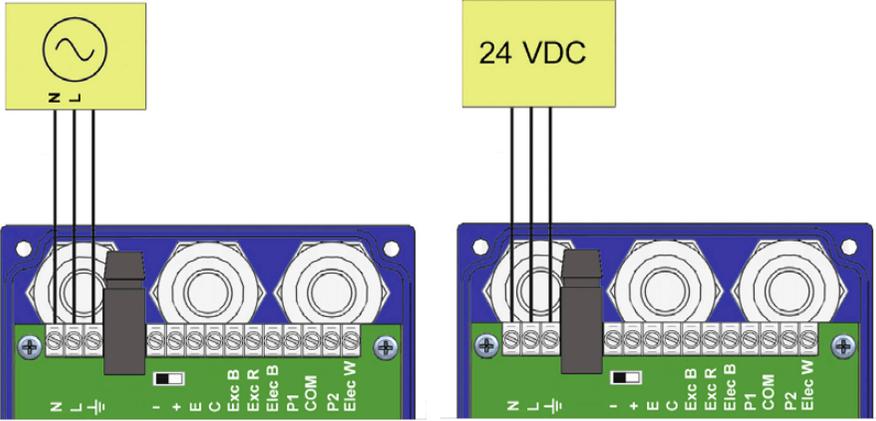


IMPORTANT NOTE: To ensure proper operation of the equipment, it is recommended to make the connection paying attention to the following points:

- For the output signals, use shielded cable when possible.
- Keep the cables away from strong sources of noise.

2.2.1 Power supply wiring

Before connecting the converter, check that the supply voltage available is the same as marked on the label of the instrument.



Terminal



N

L

AC power supply

Earth

Neutral

Phase

DC power supply

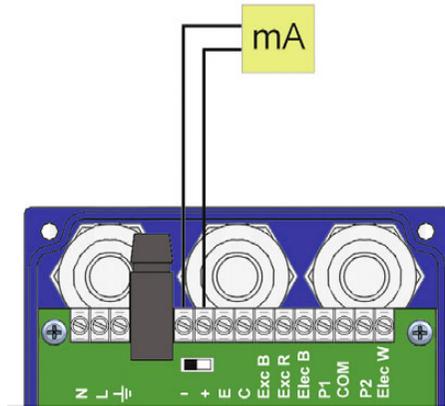
Earth

0 V

24 V (+)

It is important to connect the mains earth to the instruments with AC power supply due to the presence of a mains filter inside that requires this connection.

2.2.2 Analog output wiring



Terminal

- + mA (positive)
- mA (negative)

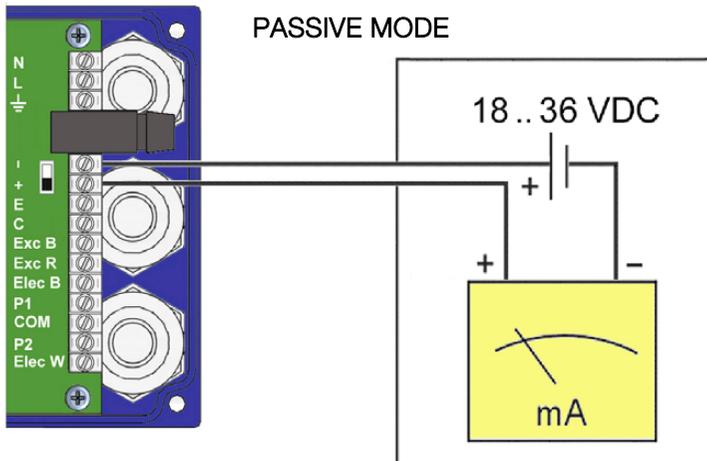
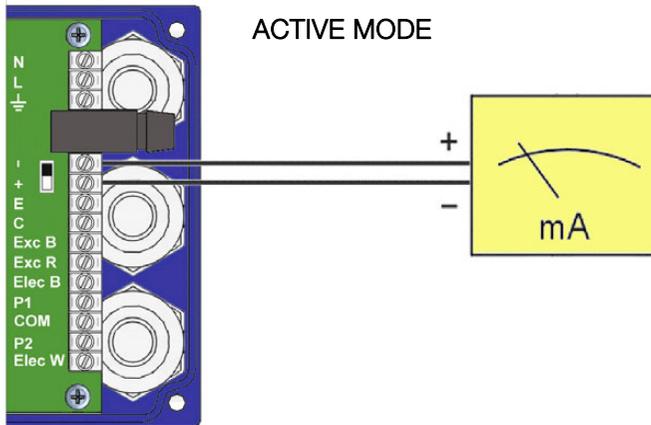
The analog output is galvanically isolated. It can be either active (that means the receptor must be passive) or passive (that means the receptor must supply the power for the current loop). It is recommended to use a receptor with an input resistance of less than $700\ \Omega$ to guarantee correct operation.

To configure the analog output type (active or passive) there is a slide switch situated just behind the terminal strip. For the passive mode the switch must be towards the positive terminal and for active mode the switch must be towards the negative terminal. To move the switch use the point of a small screwdriver.

In the case of using HART communication the output mode should be passive. Normally a HART master is active.



NOTE: The analog output has protection against reversed polarity. Due to another protection against over voltages, if a loop supply voltage of greater than 32 V is connected the equipment may be damaged.



NOTE: Never connect the load between terminals + and -. The analog output could be damaged.

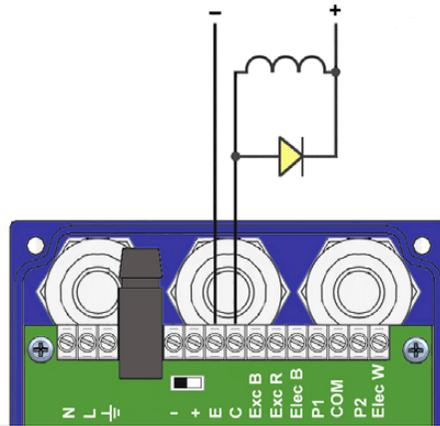
2.2.3 Pulse output wiring

Terminal

E	Emitter
C	Collector

The pulse output is opto-isolated. The terminals are the collector and emitter of an NPN bipolar transistor.

In the case of using inductive loads, in order to protect the output transistor, the use of free wheeling diodes is required.

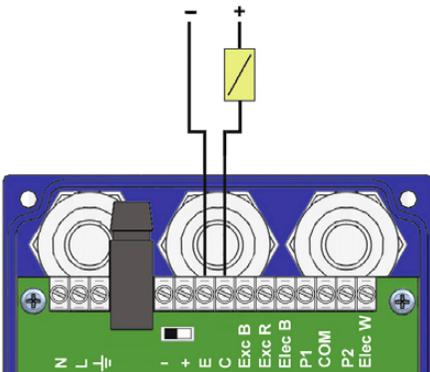


Connection examples

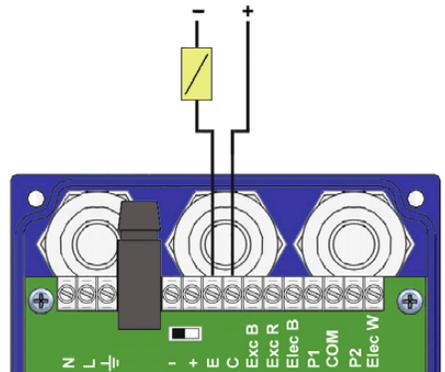
The two usual ways to connect the alarm outputs are NPN or PNP modes, depending on if the load is connected to the positive or negative terminal.

In the following figures, an example of connection for the alarm 2 in NPN and PNP mode can be seen.

NPN connection



PNP connection



3 REMOTE SENSOR

When an installation requires that the electromagnetic sensor is separated from the control unit, the union between these two elements must be made by means of an interconnection cable.

Normally, these cables are supplied by Tecfluid S.A., already prepared for their direct connection to the sensor and the converter.



Important: The interconnection cable between the sensor and the converter must always be a single piece, without any kind of joint.

In the event of having to repair a broken cable at one of its ends, it should be cut at the breakage point and reworked for the connection at that point.

3.1 Preparing the cable

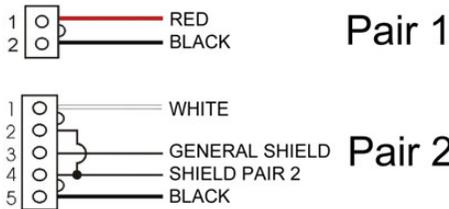
The ends of the cable should be prepared as shown in the drawing on next page. Special care should be taken to avoid possible short circuits between the shields. The point at which the shields are cut refers to the aluminium shields.

Electronics side

At the electronic unit's end, the ends of the cables should be stripped at about 5 mm and then tined. Pair 1 (Red & Black) is for the excitation coils and Pair 2 (White & Black) is for the electrodes.

Sensor side

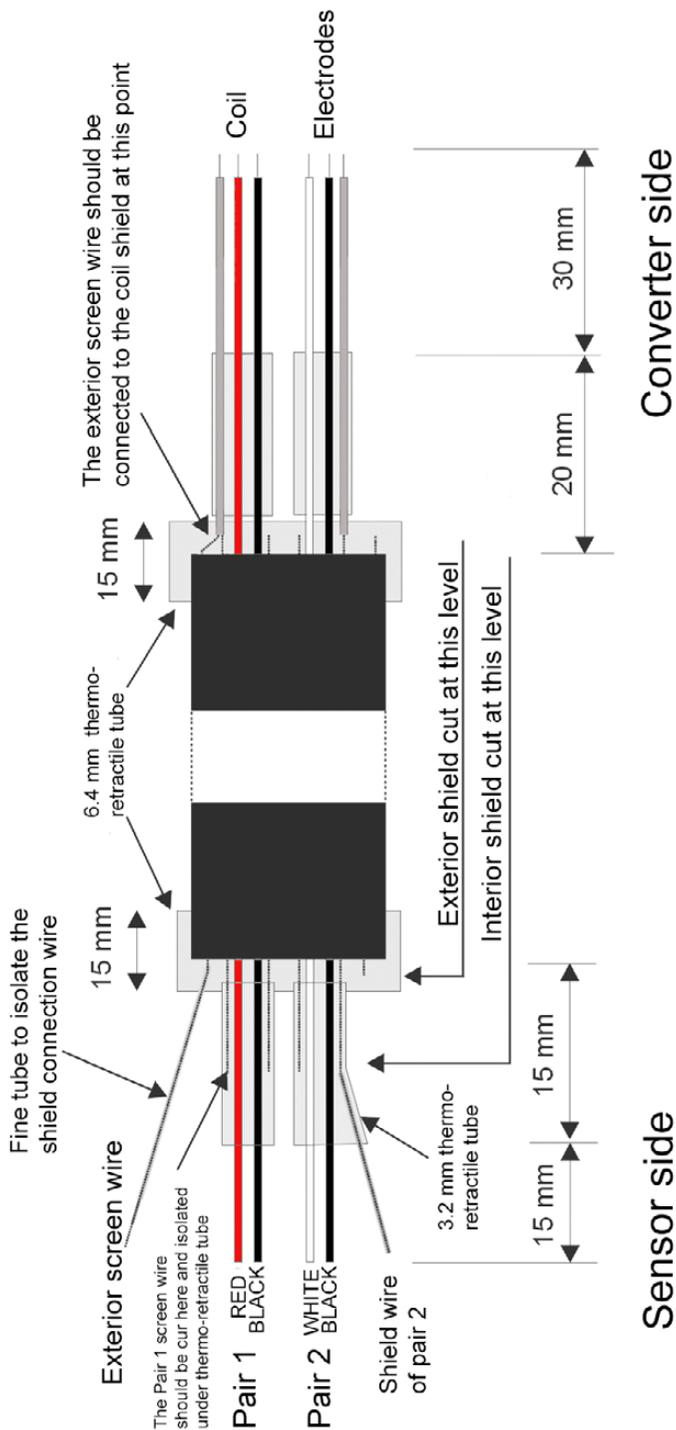
Pass the sensor side end through the cable gland of the sensor connector and then connect the cables of this end to the IDC connectors as shown in the following drawing. (the union between terminals 2 and 4 in Pair 2 must be taken into account).



3.2 Cable installation

The following points must be taken into account:

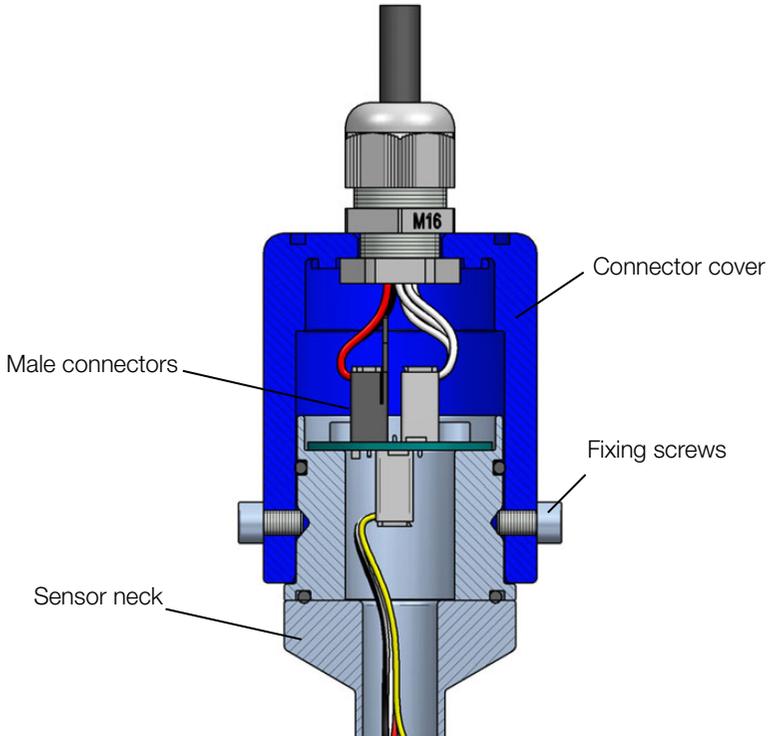
- The cable should be installed in a conduit or should be securely fixed, given that movements of the cable can induce reading errors.
- The cable should be placed as far as possible from sources of electrical noise such as switching gear and electrical machines.
- The maximum length of the connection cable depends on the fluid conductivity. For liquids with a conductivity higher than 500 $\mu\text{S}/\text{cm}$ cable length can be up to 150 m.



3.3 Cable connection to the sensor

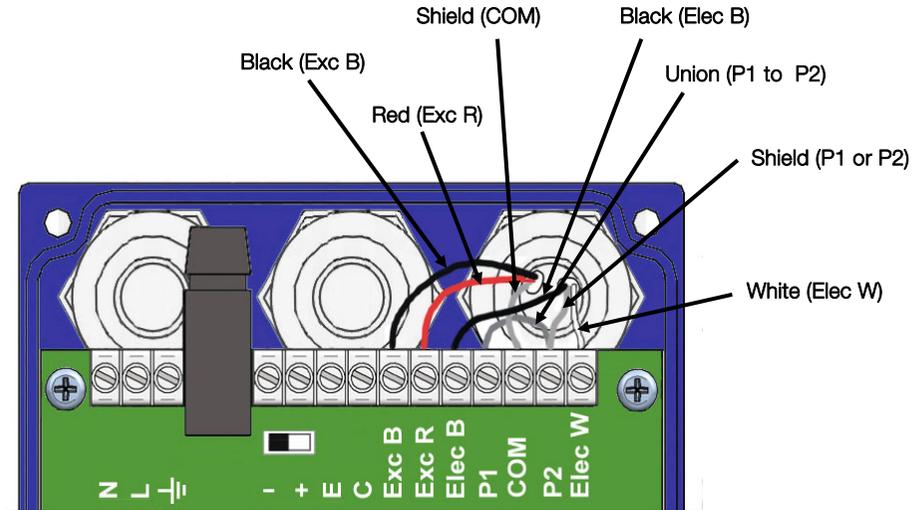
For the sensor connection, first loosen the cable gland to allow the cable to slide in it.

- Make sure that the two fixing screws of the cover do not protrude inside the cover (this avoids damaging the o-ring of the sensor neck).
- Apply a few vaseline on the sensor neck to aid inserting in the cover, specially on the o-rings.



- Connect the two cable connectors in their corresponding male connectors on the sensor, mating the bumps in the guide of the male connectors.
- Slide the cover on the sensor neck until it meets its stop.
- Tighten the two fixing screws to anchor the cover.
- Tighten the cable gland to guarantee water tightness.

3.4 Cable connection to the converter



Terminal

Exc B	Top coil (black cable)
Exc R	Bottom coil (red cable)
Elec W	Rear electrode (white cable)
COM	Process ground (general shield)
Elec B	Front electrode (black cable)

In the case of using a par-pos cable, which has two shielded pairs of cables (one for the electrodes and one for the coils) there is only one shield for the two electrode cables. In this case P1, P2 and COM terminals should be connected together and the electrode shield should be connected to one of these terminals and to the COM terminal.

So that the flow direction shown in the instrument matches the actual direction, please take into account the cables colour scheme according to previous figure.

3.5 Cable specifications

Model: CERVITRONIC PAR-POS Code 04754502

Construction

Conductor: Annealed electrolytic copper, tinned
As Norm: UNE 21064
Isolator: Polyolefin (PE - Solid)
Composition: By pars
Par shield: Tape Al/Pet + Drain Cu Sn
Cover : 100 % Physical
All over shield: Tape Al/Pet + Drain Cu Sn
Cover: 100 % Physical
Exterior cover: PVC
Colour: Black

Electrical characteristics

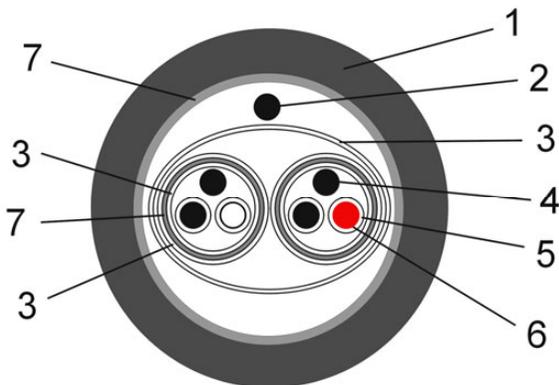
Working Voltage: 250 V
Testing Voltage: 1000 V
Electrical resistance: $\leq 52,2 \Omega/\text{km}$
Capacity: C* / C** 90-170 pF/m
C* capacity between conductors
C** capacity between one conductor and the rest connected to the shields

Physical characteristics

External diameter: 6,6 mm
Bending radius: 66 mm
Working temperature: -5°C ... +70°C
Fire risk: Does not propagate flame as per Norm IEC 60332-1 and EN 50265
Section: 0.34 mm²
Weight: 51 kg/km

Cable section

- 1 PVC cover
- 2 External shield wire
- 3 Insulating film
- 4 Pair 1/2 shield wire
- 5 PVC insulation
- 6 Pair 1/2 conductor
- 7 Aluminium shield



4 CONVERTER INTERFACE

The XT5 converter has an LCD and a keyboard with 3 capacitive buttons to introduce the values of installation and programming. Two of these keys are used also as cursors.



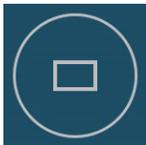
The following figure shows the functionality of the converter keys.



(Left) To change to the digit on the left.
To enter into offset adjustment. With (Up), to enter into installation and to validate the data. With (Escape), to reset the totalizer.



(Up) To increase the digit.
With (Left), to enter into installation and to validate the data. With (Escape), to enter into programming.



(Escape) To exit from a screen without validating data. With (Up), to enter into programming. To exit from an informative text. With (Left), to reset the totalizer.

The equipment is normally delivered calibrated and configured with its sensor so that it indicates the true flow rate and volume. If any configuration parameter is to be changed, this can be done without having to remove the top cover.

If the instrument has not been previously configured or, due to alteration of data in the memory the instrument recovers the default configuration, the word "PRESET" appears on the display. This indication disappears when the sequence of configuration has been completed.



In all the configuration screens the (□) key is used to jump to the next screen without making any changes in the configuration data even if digits have been changed.

5 INSTALLATION PARAMETERS

Power on the electronic converter with the voltage indicated on the label.

Touching the two keys (↑) y (←) at the same time, the first installation screen is accessed for the flow rate measurement calculation.

5.1 Sensor factor

The first screen is to configure the sensor factor (Fc), which is given on the sensor label.



Touching the key (↑) the flashing digit will be increased. When the value of 9 is reached, on the next increment the digit will go to zero. With the key (←) we move to the next digit to the left. If we are on the seventh digit we will go back to the first digit.

When the required factor is on the screen, touching the two keys (↑) & (←) at the same time, the data will be stored in memory and the next screen will appear.

If not specified, the keys for the next screens have the same functions as in this first screen.

5.2 Electronic converter factor

In this screen the electronics factor (Fe), which is indicated on the label on the front cover can be programmed.



5.3 Nominal diameter

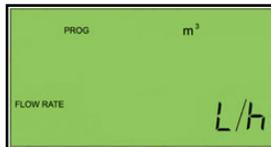
The nominal diameter is always the internal diameter in millimetres of the sensor.



5.4 Measuring units

In the next screen the flow rate and volume totalizer units are selected.

To change the flow rate units, press the key (↑). To change the volume totalizer units, press the key (←).



The possible units for the flow rate and the volume totalizer are the following:

Flow rate:

There are 9 combinations for the 3 units for volume and the 3 units for time.

Volume	/	Time
l (litres)	/	s (second)
m ³ (cubic metres)	/	m (minute)
ga (US gallons)	/	h (hour)

Volume totalizer:

There are 3 possible units for volume, l (litres), m³ (cubic metres), ga (US gallons).

Note: 1ga = 3.785 litres.

If the instrument has a mains power supply connection with the selected working units, touching the two keys (↑) & (←) at the same time, we return to the normal working screen.

5.5 Mains frequency

If the instrument has a DC power supply, user must configure the mains frequency of the country where the instrument is installed. This is done for filtering out line frequency noise found in the electrodes signal.



With the (↑) key the local mains frequency is selected (50 Hz or 60 Hz) and touching the two keys (↑) & (←) at the same time, we return to the normal working screen.

6 CONVERTER PROGRAMMING

By means of the converter programming, the visualization and the outputs of the instrument can be configured.

Power on the electronic converter and touch the two keys (↑) y (□) at the same time. The first programming screen is accessed for the visualization and output parameters.

6.1 Decimals for the flow rate indication

In the first screen the number of decimals for the flow rate indication can be configured.

For this, touching the key (↑) the flashing digit will be increased. When the value of 2 is reached, on the next increment the digit will go to zero. When we have the required factor on the screen, touching the two keys (↑) & (←) at the same time, the data will be stored in memory.



To select the number of decimals it must be taken into account that the instrument has 4 digits for flow rate indication. If two decimals have been selected, these will be seen whilst the flow rate is not greater than 99.99. Above this value the indication will automatically change to one decimal, and when the flow rate is greater than 999.9 the indication will be done without decimals.

If one decimal is selected, the flow rate indication will have a maximum of one decimal.

If indication without decimals is selected, the flow rate will always be shown without decimals.

For the selection of the flow rate units and the number of decimals it must be taken into account that an indication with an excess of decimals may give the false sensation of instability of the reading. As a general rule it can be considered that the reading should not have more than a total of 3 digits (integer + decimals).

6.2 Current output (4-20 mA) configuration

Once the decimals are programmed, the current loop range can be configured. On these screens the measuring units are those selected previously.



In the first screen the flow rate for the 4 mA point (lower range) is configured. In the next screen the flow rate for the 20 mA point (upper range) is configured.

6.3 Pulse output

In this screen, there are two options.

- a) Frequency output (Hz). This is meant for transmitting the instantaneous flow rate to a remote unit. The output pulse frequency for a flow velocity of 5 m/s is programmed here (see limits in point 14).



- b) Pulse output per unit of volume (P/U). This is meant for remote totalizing. The number of pulses per unit of volume totalizer are programmed here. The pulse width is 80 ms. The maximum frequency is 6.25 Hz.



First the pulse output mode (Hz or P/U) is selected using the (↑) key. Once the output mode is selected, touch the (←) key and then enter the corresponding numerical value for the frequency at 5 m/s or pulses/unit according to the output mode selected.

6.4 Cut off

The sensor FLOMID with converter XT5, being an electromagnetic flow meter, has its maximum deviation in the low end of its working range. Due to this, a cut off flow rate can be configured, that means, the flow rate below which the flow rate indication will be zero.



6.5 Damping

The XT5 converter has an adaptive filter (damping) to provide stable flow rate and analog output readings in the presence of continuous flow rate fluctuations.

The configuration of this filter can be very useful in the cases where the flow rate readings have some instability (due to air bubbles, solids in suspension, etc).

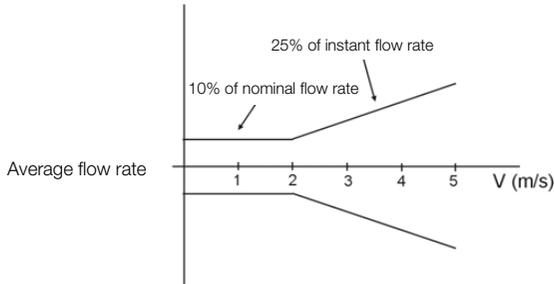


Only the flow rate indication of the display and the analog output are affected by the filter. The pulse output and the totalizer act according to the instant flow rate. By selecting a filter with a longer or shorter integration time, responses to flow rate variations in more or less time can be obtained.

The integration time is selected in seconds, with a minimum value of 0.1 and a maximum value of 20.0 seconds. For example, with an integration time of 15 seconds, the display will indicate the flow rate reading of the average flow rate over the last 15 seconds from the last update of the display. This does not mean that the display is refreshing its data every 15 seconds. The display shows a new value several times per second, indicating an average of the flow rate values of the last 15 seconds.

When there is a sudden variation of the flow rate then the filter should react as fast as possible to give a correct reading of the new value. For this, the filter controls for each reading the deviation of the instant flow rate with respect to a reference. If this deviation exceeds the established limits, the filter will stop acting, indicating the instant value, and will start again the filtering process.

In the following figure we can see the allowed deviation for the filter to continue giving average values.



For example, consider a DN25 flow meter whose average flow rate is 4000 l/h.

4000 l/h corresponds to a liquid velocity of 2.27 m/s, situated in the second zone of the graphic. This means that the filter will continue giving average readings whilst the instant flow rate does not deviate more that 25% (1000 l/h) from the average flow rate.

Since the average flow rate is 4000 l/h, the filter acts whilst the instant flow rate is within 3000 l/h and 5000 l/h.

If the average flow rate is for example 2000 l/h, it corresponds to a liquid velocity of 1.14 m/s, in this case we are in the first zone of the figure. This means that the filter will continue acting whilst the instant flow rate does not deviate from the average flow rate more that 10% from the nominal flow rate, that is 880 l/h (flow rate at 0.5 m/s in a DN25 = 880 l/h).

Since the average flow rate is 2000 l/h, the filter continues to act whilst the instant flow rate is within 1120 l/h and 2880 l/h.

6.6 Flow rate direction

In this screen the flow direction for which the flow rate indication will show a positive value can be programmed.



Using the (↑) key we change the positive flow direction from left to right (R) to right to left (L).

Note: In a FLOMID sensor the left and right of the sensor are when looking at the sensor in a horizontal pipe and with the earth connection stud at the back.

When the flow rate is negative the volume totalizer will not make any action.

6.7 Empty pipe

In the last screen the empty pipe detection (EP) can be enabled or disabled, using the (↑) key to change from ON (enabled) to OFF (disabled).



6.8 Zero drift adjustment

In order to obtain a perfect linearization of the instrument, it is recommended to make an adjustment of the zero drift.



IMPORTANT: The flowmeter is delivered with the zero offset adjusted. Do not make a new adjustment if not necessary. An adjustment not done properly can become in incorrect flow rate values.

In order to make the adjustment, it is necessary that the flow rate through the instrument is zero.

The first step is to deactivate the adjustment. To do this, press the key (←) and the following screen is displayed.



Press the key (↑) until the word OFF appears. Press then the keys (←) & (↑). With this, the adjustment is deactivate.

Before doing the next step, be sure that the pipe is full and that there is not flow rate through the instrument.

Press the key (↑) again and change until the word ON appear. Press the keys (←) & (↑) and the zero offset adjustment is completed.

7 SERIAL NUMBER AND FIRMWARE VERSION

Touching the three keys at the same time we access a screen where the serial number of the converter is shown.



In order to see the software version and return to the normal working screen, touch any key.



8 EMPTY PIPE INDICATION

When the XT5 converter detects that the pipe is empty the flow rate indication will disappear and in its place 4 dashes will be shown.

NOTE: When the XT5 is connected to the power supply the screen shows empty pipe until this state has been checked.



9 RESET

Touching the (←) and (□) keys at the same time the volume totalizer counter will be reset to zero and it will continue counting.

10 KEYBOARD DISABLE AND "WRITE PROTECT"

The instrument has a jumper, placed behind the display on the left side, which can be used to avoid changes in the configuration. When the jumper is connected the instrument can be configured by means of the keyboard and via HART. When the jumper is removed, the keyboard is disabled and "Write Protect" is activated for HART, thus avoiding any changes in the configuration.

11 CHANGING THE POSITION OF THE DISPLAY

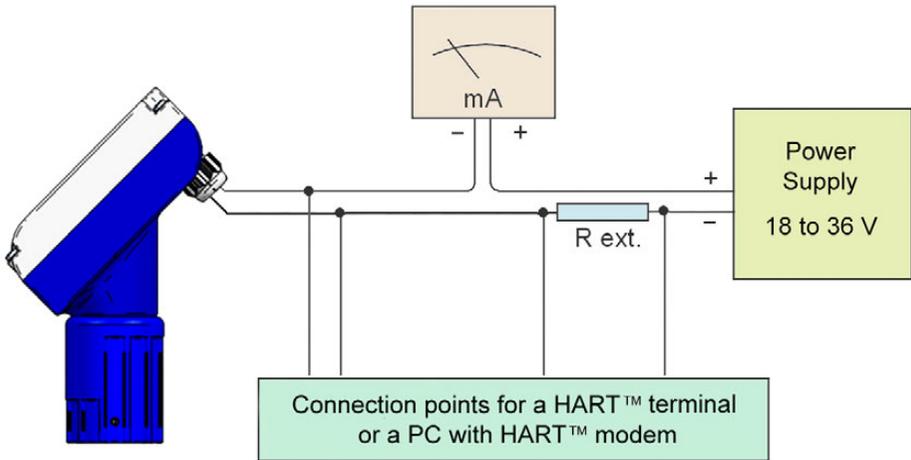
To change the orientation of the display in order to adapt it to the instrument mounting position, first disconnect the equipment from the power supply and remove the front cover. Remove the three screws that hold the display PCB to the base PCB (two screws in the corners opposite to the terminal strip and one central screw next to the terminal strip). Holding the PCB, pull on it to disconnect it. Rotate the display PCB 180° and reconnect it to its connector avoiding the pins to be bent. Reassemble the three screws that hold the display PCB and reassemble the front cover. Reconnect the instrument to its power supply.

12 HART COMMUNICATION

The XT5H converter has a MODEM for HART communication.

The detail of the characteristics with respect to the HART communication are available in the corresponding “Field Device Specification” document.

To be able to use HART communication, a resistance (R ext.), whose value must not be lower than 200 Ohms, should be added to the current loop. The points at which a terminal or a PC with a HART modem can be connected are shown in the following figure.



In a XT5H converter, if during the programming sequence a HART command is received, that must be attended, the local programming will not be valid and all the data previously programmed will be lost. The screen will return to the normal working model and the word PROG will light on the screen, indicating this event. To remove the word PROG from the display, touch any of the two keys (↑) or (←).

Summary of the principal communication characteristics:

Manufacturer, Model and Revision	Tecfluid S.A., converter XT5H, Rev. 1
Device type	Transmitter
Hart Revision	6.0
Device Description available	No
Number and type of sensors	1, exterior
Number and type of actuators	0
Number and type of host side signals	1, 4 – 20 mA analog
Number of Device Variables	2
Number of Dynamic Variables	1
Mappable Dynamic Variables	No
Number of Common Practice Commands	14
Number of Device Specific Commands	8
Bits of Additional Device Status	17
Burst mode?	No
Write Protection?	Yes

13 EXAMPLES OF USEFUL CALCULATIONS

13.1 Measurement error correction

The calibration of flowmeters is made with water at 20°C, obtaining a calibration for a liquid density of 1 kg/l and viscosity of 1 mPa·s. If the flowmeter is used with a liquid of other characteristics than the above specified or for reasons of turbulences in the flow, measurement errors can be induced.

To correct these types of errors we can modify the value of the Fc factor programmed in the instrument.

Example - Shortage of volume

If we have a flowmeter body which specifies $F_c = 0.985$, and when we check the volume of a batch, we find that instead of having 100 litres as programmed, we only have 95 litres (5% less), then the following correction must applied:

F_c = Original sensor factor = 0.985
 V = Expected Volume = 100
 V_r = Real Volume = 95
 F_{cn} = New sensor factor = ? (1.037)

$$F_{cn} = \frac{F_c \cdot V}{V_r}$$

13.2 Configuration of pulses / unit of volume

As indicated in the point 6.3, the maximum frequency of the pulse output in mode pulses / unit is 6.25 Hz. In order to know if the desired number of pulses per unit of volume can reach this frequency, the following formula can be applied:

$$f_{\max} = \text{Flow rate}_{\max} \text{ (u/s)} \times F_{\text{p/u}}$$

Where

f_{\max} = Maximum frequency at the output

Flow rate_{max} (u/s) = Maximum flow rate in units of volume per second

$F_{\text{p/u}}$ = Factor of pulses per unit of volume programmed in the converter

Example - Sensor DN25 and programmed Factor = 100 pulses / litre

Firstly, we need to know what is the maximum flow rate that could pass through the flow meter. For example 9500 litres / hour.

Changing the flow rate to units of volume per second, we obtain:

$$9500 / 3600 = 2.639 \text{ litres / second}$$

Note that the units of volume are litres because in this example the programmed factor is 100 pulses / litre.

In this case, applying the formula, the maximum frequency at the output is:

$$f_{\max} = 2.639 \times 100 = 263.9 \text{ Hz}$$

As the value exceeds 6.25 Hz, this factor can not be applied.

In this case there would be 2 solutions:

1. To change the factor to 1 pulse per litre, becoming the maximum frequency 100 times smaller, $f_{\max} = 2.639 \text{ Hz}$.
2. To change the units of volume to m³. With this, the maximum flow rate is divided by 1000 and therefore the maximum frequency becomes $f_{\max} = 0.2639 \text{ Hz}$.

14 TECHNICAL CHARACTERISTICS

Accuracy

$\pm 0.5\%$ of reading for $v \geq 0.4$ m/s

$\frac{\pm 0.2}{v \text{ (m/s)}}$ % of reading for $v \leq 0.4$ m/s

Repeatability

$\pm 0.15\%$ of reading ± 0.75 mm/s

Velocity range

0.15 ... 10 m/s

Temperature

Process temperature:

PP: -10°C ... $+80^{\circ}\text{C}$

PTFE, PVDF: -20°C ... $+120^{\circ}\text{C}$

Ebonite: -20°C ... $+90^{\circ}\text{C}$

Ambient temperature: -20°C ... $+60^{\circ}\text{C}$

Minimum conductivity

20 $\mu\text{S/cm}$

Power supply

230, 240, 115, 24 VAC 50, 60 Hz Power consumption: ≤ 5 VA

24 VDC Power consumption: ≤ 5 W

Analog output

4-20 mA. Active or passive. Galvanically isolated from the power supply.

Pulse output

Opto-isolated. NPN bipolar transistor. V_{max} : 30 VDC. I_{max} : 30 mA.

Maximum frequency in mode "P/U" : 6.25 Hz

Maximum frequency in mode "Hz" : 10000 Hz

Minimum frequency in mode "Hz" : 0.04 Hz

Totalizer

N° of digits: 7 (2 decimals)**

Digit size: 8 mm

Reset: By means of key

Flow rate indication

N° of digits: 4 (up to 2 decimals configurable)**

Digit size: 5 mm

** When the available digits are full and the integers overflow a decimal is automatically lost.

General characteristics

Sensor materials:

Exterior: FLOMID-0FX: EN 1.4404 (AISI316L)
FLOMID-2FX, 4FX (DN ≤ 80): Aluminium, coated steel and EN 1.4301 (AISI 304)
FLOMID-2FX, 4FX (DN > 80): Coated steel and EN 1.4301 (AISI 304)
FLOMID-1FX, 3FX, 5FX, 7FX, 9FX: EN 1.4404 (AISI316L)

Liner: FLOMID-0FX: PP, PVDF
FLOMID-2FX, 4FX: PTFE, Ebonite
FLOMID-1FX, 3FX, 5FX, 7FX, 9FX:PTFE

Electrodes: Hastelloy C22 (UNS-06022), stainless steel, titanium, zirconium, tantalum

Converter material: Polycarbonate (UV resistant)

Ingress protection:

FLOMID-0FX: IP65
FLOMID-1FX, 2FX, 3FX, 4FX, 5FX, 6FX, 7FX, 9FX: IP68 10 m H₂O
XT5 converter: IP66 / IP67

Maximum cable length (remote version): 150 m

Electrical characteristics referred to the analog loop and communications

Reception impedance:

Rx	>	8,5 MΩ
Cx	<	200 pF

15 MAINTENANCE

Sensor:

It is recommended to clean the electrodes in installations where incrustations or appreciable sedimentations can occur.

Cleaning can be done using liquid detergents and medium hard brushes.

Converter:

No special maintenance is required.

For external cleaning a wet cloth can be used, and if necessary a little soap. Do not use solvents or other aggressive liquids that can damage the enclosure material (polycarbonate).

15.1 Fuse

In the event that the fuse blows, this should be replaced with a slow blow "T" fuse, size Ø5 x 20 mm and of the same rating as indicated on the label inside the equipment.

16 SAFETY INSTRUCTIONS

The series FLOMID flowmeters are in conformity with all essential requirements of all EC directives applicable to them:

2014/68/EU	Pressure equipment directive (PED)
2014/30/EU	Electromagnetic compatibility directive (EMC)
2012/19/EU	Waste electric and electronic equipment (WEEE).
2011/65/EU	Restriction of the use of certain hazardous substances in electrical and electronic equipment (ROHS).



The declarations UE of conformity can be downloaded from the section "Download" of the Tecfluid S.A. website. www.tecfluid.com

16.1 Pressure equipment directive

Tecfluid S.A. have subjected the series FLOMID of flowmeters to a conformity assessment method for the pressure equipment directive, specifically according to module H (full quality assurance).

Conformity with the directive is reflected by the CE marking in each pressure equipment and by the written declaration of conformity. The CE marking is accompanied by the identification number of the notified body involved at the production control phase.

The marking of the equipment takes into account the fluid type, the group of fluid and the category, for example: G1 CATI

G Gases and vapours

1 Group of liquids 1

CATI Category I

Devices that, due to their size, are not subject to conformity assessment, are considered outside the scope of the directive and therefore they have not the CE mark according to pressure directive. These devices are subject to applicable sound engineering practice (SEP).



This equipment is considered as being a pressure accessory and **NOT** a safety accessory as defined in the 2014/68/EU directive, Article 2, paragraph 4.

16.2 Certificate of conformity TR CU (EAC marking)

Tecfluid S.A. have subjected the series FLOMID of flowmeters to a certification procedure according to the technical regulations of the Customs Union of the Eurasian Economic Union (EEU).



This Certificate is an official document confirming the quality of production with the standards on the territory of the Customs Union, particularly regarding safety requirements and electromagnetic compatibility.

17 DIMENSIONS

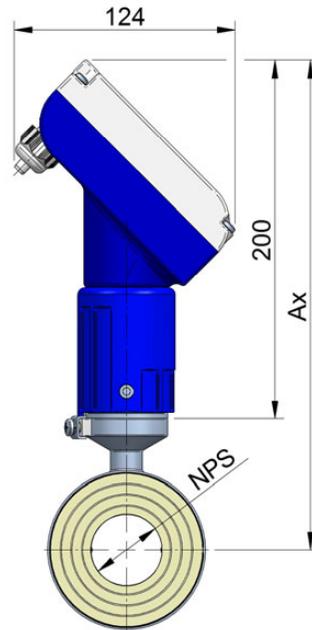
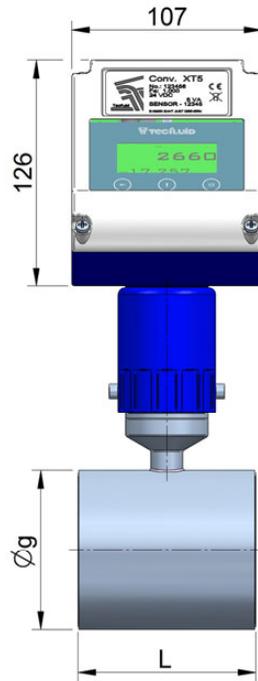
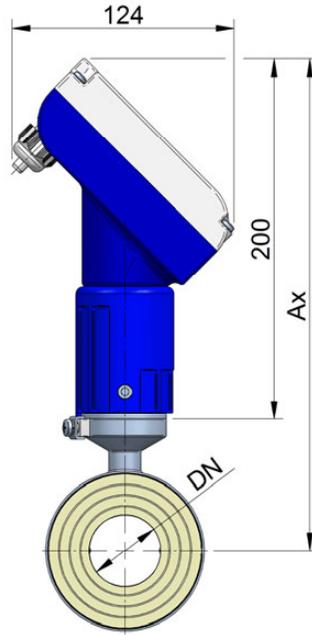
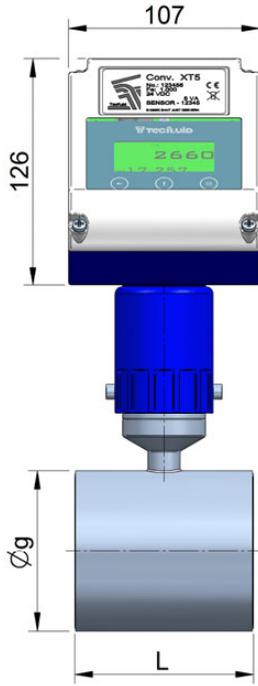
FLOMID-0FX (EN 1092-1 wafer mounted)

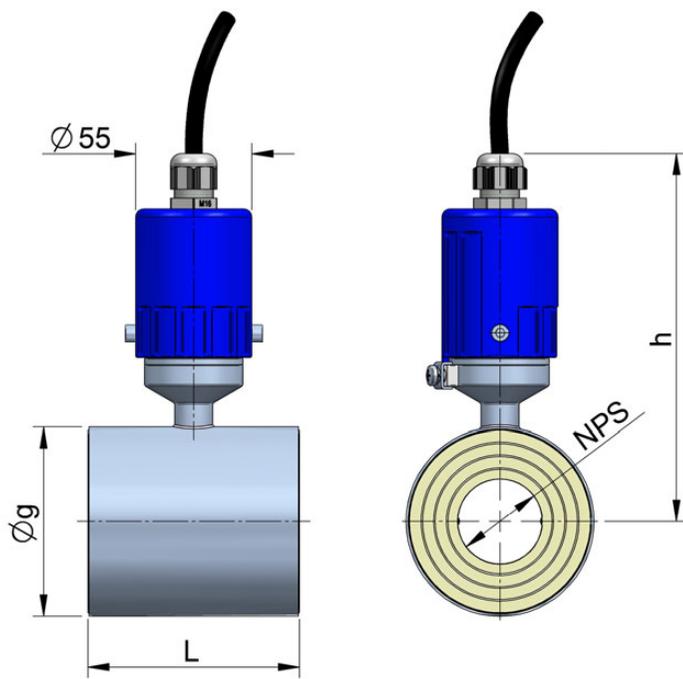
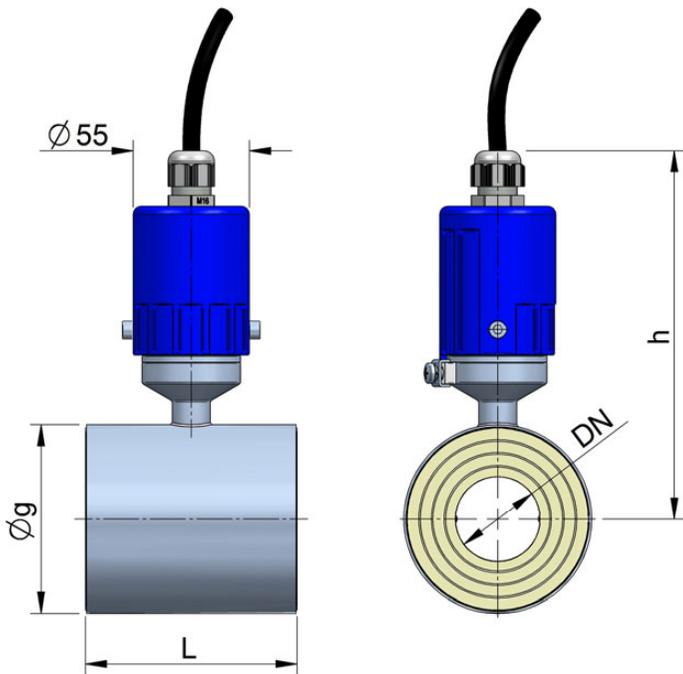
DN	PN	g	L	Ax	h	Weight (kg)
3		48	65	253	152	1.3
6		48	65	253	152	1.3
10		48	65	253	152	1.3
15		54	65	256	155	1.4
20		63	65	261	160	1.5
25	16	73	80	266	165	1.7
32		84	80	272	171	1.8
40		89	100	274	173	2.1
50		108	100	284	183	2.5
65		129	120	294	193	3.1
80		141	120	300	199	3.7
100		154	165	307	206	4.3
125	10	192	165	324	222	8.0
150		218	165	337	235	9.5

FLOMID-0FX (ASME B16.5 150# wafer mounted)

NPS	Class	g	L	Ax	h	Weight (kg)
1/8"		48	65	253	152	1.3
3/8"		48	65	253	152	1.3
1/2"		48	65	253	152	1.3
3/4"		54	65	256	155	1.4
1"		63	65	261	160	1.5
1 1/4"		73	80	266	165	1.7
1 1/2"	150#	84	80	272	171	1.8
2"		89	100	274	173	2.1
2 1/2"		108	100	284	183	2.5
3"		129	120	294	193	3.1
4"		154	165	307	206	4.3
5"		192	165	324	222	8.0
6"		218	165	337	235	9.5

(All dimensions in mm)





FLOMID sensor with flanges, common dimensions

DN	NPS	PN	Class	L	Ax	h	Weight (kg)		
10	3/8"	16		150	307	206	3.5		
15	1/2"			150	307	206	3.5		
20	3/4"			150	307	206	4.0		
25	1"			150	307	206	5.5		
32	1 1/4"			150	314	213	6.0		
40	1 1/2"			150	314	213	6.5		
50	2"			200	341	240	8.0		
65	2 1/2"			200	341	240	10.0		
80	3"			200	341	240	11.0		
100	4"			150#		250	333	232	15.0
125	5"	250	346			245	17.0		
150	6"	300	361			260	20.0		
200	8"	350	390			289	31.0		
250	10"	400	410			317	45.0		
300	12"	500	435			334	53.0		
350	14"	10				500	468	367	62.0
400	16"					600	485	384	76.0
450	18"					600	540	439	85.0
500	20"					600	565	464	98.0

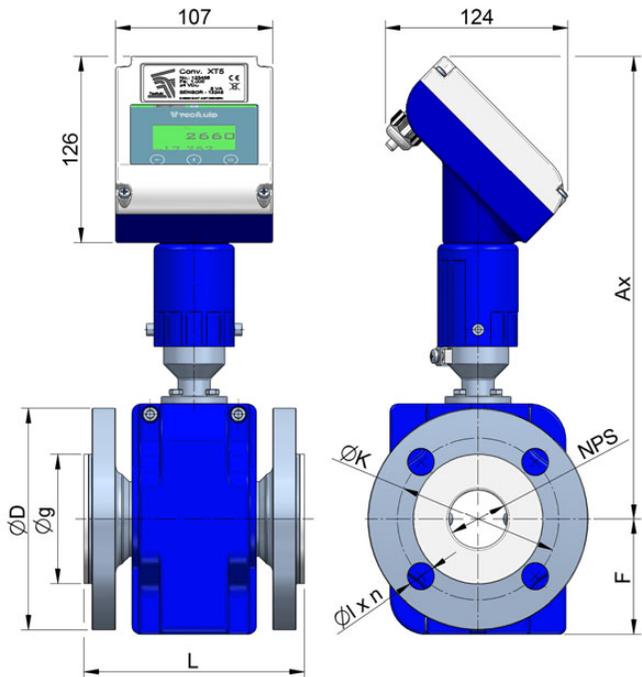
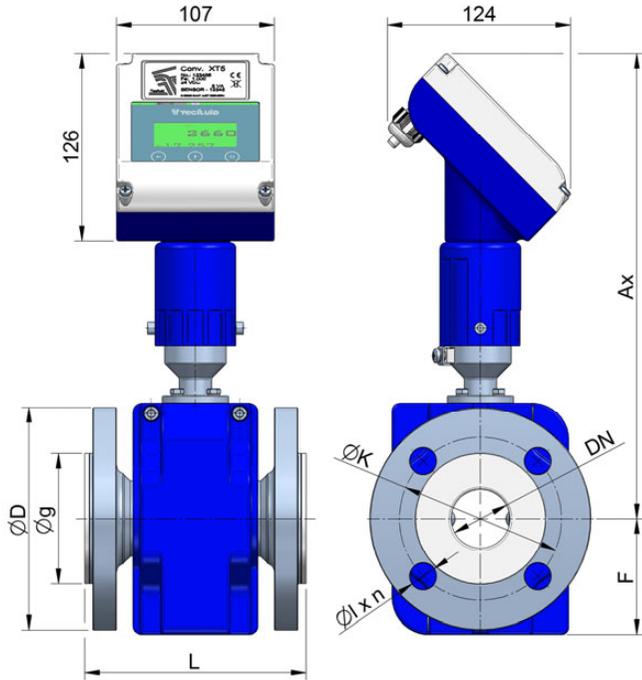
FLOMID-2FX (EN 1092-1 flanges)

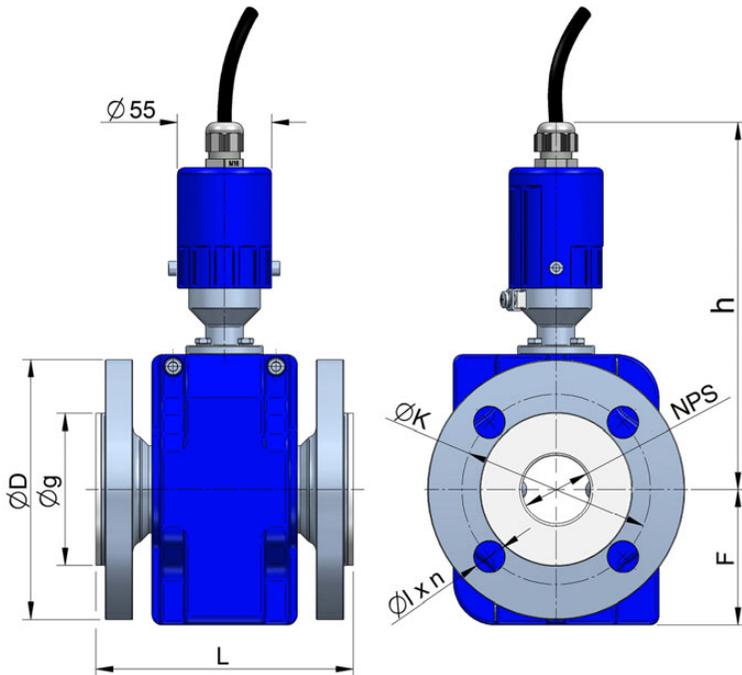
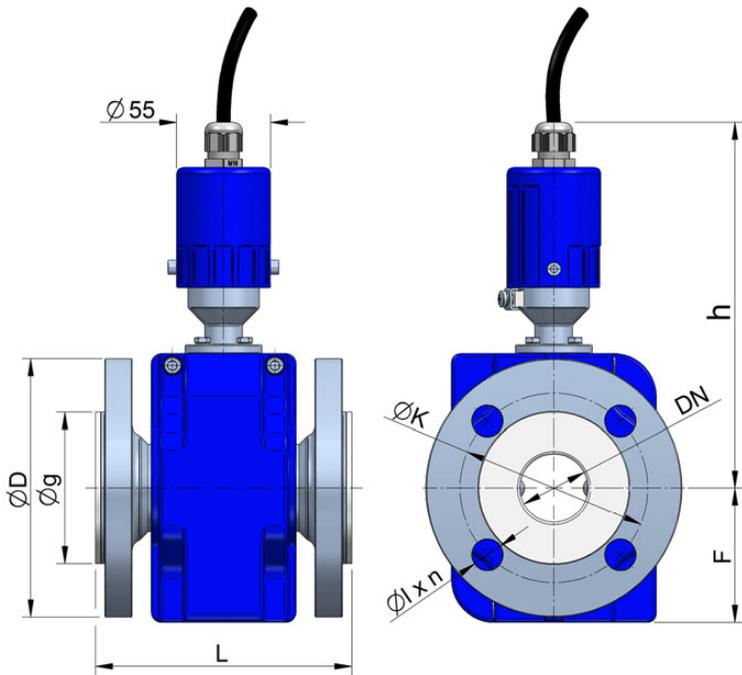
DN	D	K	l x n	g	F
10	90	60	14 x 4	40	71
15	95	65	14 x 4	45	71
20	105	75	14 x 4	58	71
25	115	85	14 x 4	68	71
32	140	100	18 x 4	78	78
40	150	110	18 x 4	88	78
50	165	125	18 x 4	102	105
65	185	145	18 x 8	122	105
80	200	160	18 x 8	138	105
100	220	180	18 x 8	158	110
125	250	210	18 x 8	188	125
150	285	240	22 x 8	212	143
200	340	295	22 x 8	268	170
250	395	350	22 x 12	320	198
300	445	400	22 x 12	370	223
350	505	460	22 x 16	430	253
400	565	515	26 x 16	482	283
450	615	565	26 x 20	532	309
500	670	620	26 x 20	585	335

FLOMID-4FX (ASME B16.5 flanges)

NPS	D	K	l x n	g	F
1/2"	90	60.3	5/8" x 4	34.9	71
3/4"	100	69.9	5/8" x 4	42.9	71
1"	110	79.4	5/8" x 4	50.8	71
1 1/4"	115	88.9	5/8" x 4	63.5	78
1 1/2"	125	98.4	5/8" x 4	73.0	78
2"	150	120.7	3/4" x 4	92.1	105
2 1/2"	180	139.7	3/4" x 4	104.8	105
3"	190	152.4	3/4" x 4	127.0	105
4"	230	190.5	3/4" x 8	157.2	115
5"	255	215.9	7/8" x 8	185.7	128
6"	280	241.3	7/8" x 8	215.9	140
8"	345	298.5	7/8" x 8	269.9	173
10"	405	362.0	1" x 12	323.8	203
12"	485	431.8	1" x 12	381.0	243
14"	535	476.3	1 1/8" x 12	412.7	268
16"	595	539.8	1 1/8" x 16	469.9	298
18"	635	577.9	1 1/8" x 16	533.4	318
20"	700	635.0	1 1/8" x 20	584.2	350

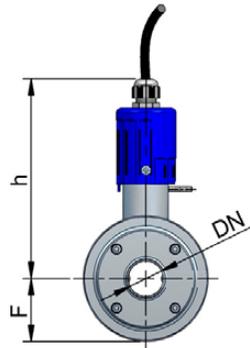
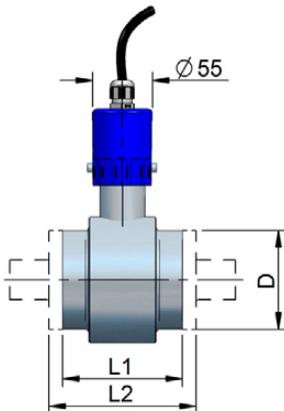
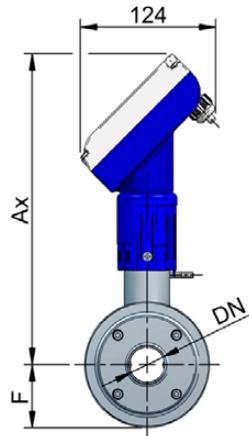
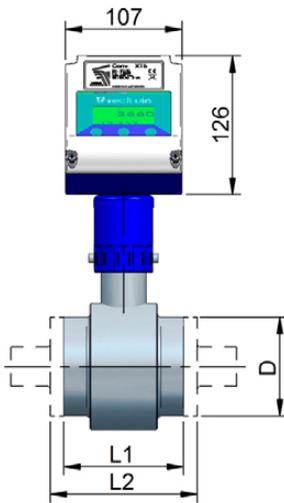
(All dimensions in mm)





Sanitary connection FLOMID sensor, common dimensions

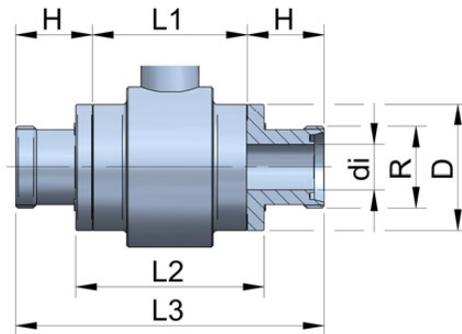
DN	L1	L2	D	Ax	h	F
10	104	120	60	274	172	48
15	104	120	65	274	172	48
20	104	120	70	276	174	50
25	110	134	80	276	174	50
32	110	134	90	284	182	58
40	130	154	100	284	182	58
50	130	154	115	293	191	66
65	160	186	145	306	204	79
80	160	186	160	314	212	86
100	204	234	180	330	228	102



(All dimensions in mm)

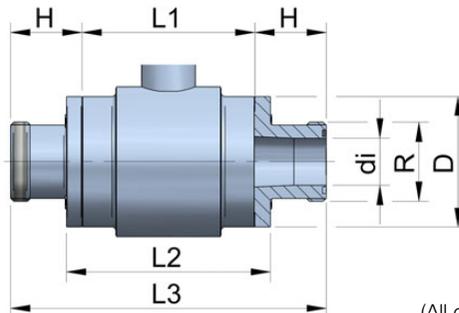
FLOMID-1FX (DIN 11851)

DN	di	R	D	L1	L2	L3	H
10	10	Rd 28 x 1/8"	60	104	120	200	48
15	16	Rd 34 x 1/8"	65	104	120	200	48
20	20	Rd 44 x 1/6"	70	104	120	200	48
25	26	Rd 52 x 1/6"	80	110	134	220	55
32	32	Rd 58 x 1/6"	90	110	134	220	55
40	38	Rd 65 x 1/6"	100	130	154	240	55
50	50	Rd 78 x 1/6"	115	130	154	240	55
65	66	Rd 95 x 1/6"	145	160	186	280	60
80	81	Rd 110 x 1/4"	160	160	186	280	60
100	100	Rd 130 x 1/4"	180	204	234	330	63



FLOMID-3FX (SMS 1145)

DN	di	R	D	L1	L2	L3	H
25	22.5	Rd 40 x 1/6"	80	110	134	220	55
32	29.5	Rd 48 x 1/6"	90	110	134	220	55
40	35.5	Rd 60 x 1/6"	100	130	154	240	55
50	48.5	Rd 70 x 1/6"	115	130	154	240	55
65	60.5	Rd 85 x 1/6"	145	160	186	280	60
80	72.0	Rd 98 x 1/6"	160	160	186	280	60



(All dimensions in mm)

FLOMID-5IFX (CLAMP ISO 2852)

DN	OD*	di	C	D	L1	L2	L3	H
10	12.0	10.0	34.0	60	104	120	200	48
10	12.7	10.7	34.0	60	104	120	200	48
15	17.2	15.2	34.0	65	104	120	200	48
20	21.3	19.3	34.0	70	104	120	200	48
25	25.0	22.6	50.5	80	110	134	220	55
32	33.7	31.3	50.5	90	110	134	220	55
40	38.6	35.6	50.5	100	130	154	240	55
50	51.0	48.6	64.0	115	130	154	240	55
65	63.5	60.3	77.5	145	160	186	280	60
80	76.1	72.9	91.0	160	160	186	280	60
100	101.6	97.6	119.0	180	204	234	330	63

* OD = pipe outside Ø according to ISO 2037

FLOMID-5DFX (CLAMP DIN 32676)

DN	OD*	di	C	D	L1	L2	L3	H
10	13	10	34.0	60	104	120	200	48
15	19	16	34.0	65	104	120	200	48
20	23	20	34.0	70	104	120	200	48
25	29	26	50.5	80	110	134	220	55
32	35	32	50.5	90	110	134	220	55
40	41	38	50.5	100	130	154	240	55
50	53	50	64.0	115	130	154	240	55
65	70	66	91.0	145	160	186	280	60
80	85	81	106.0	160	160	186	280	60
100	104	100	119.0	180	204	234	330	63

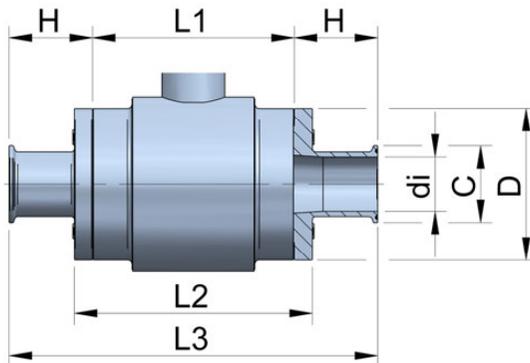
* OD = pipe outside Ø according to DIN 11850 (Series 2)

(All dimensions in mm)

FLOMID-5TFX (TRI-CLAMP®)

DN	Coupling	OD*	di	C	D	L1	L2	L3	H
10	½"	12.7	9.4	25.0	60	104	120	200	48
15	¾"	19.0	15.7	25.0	65	104	120	200	48
25	1"	25.4	22.1	50.4	80	110	134	220	55
40	1½"	38.1	34.8	50.4	100	130	154	240	55
50	2"	50.8	47.5	63.9	115	130	154	240	55
65	2½"	63.5	60.2	77.4	145	160	186	280	60
80	3"	76.2	72.9	90.9	160	160	186	280	60
100	4"	101.6	97.4	118.9	180	204	234	330	63

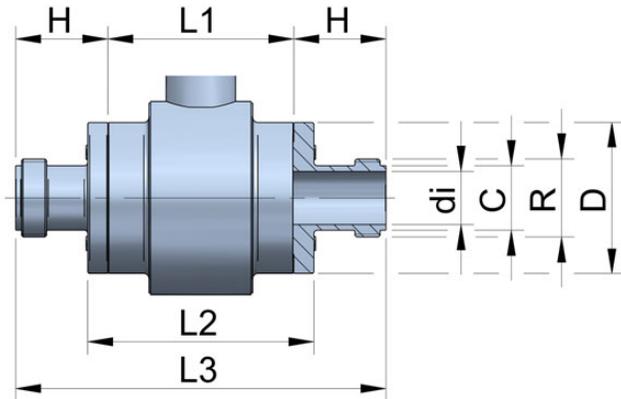
** OD = pipe outside Ø according to ASME BPE DT-1
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(All dimensions in mm)

FLOMID-7FX (ISO 2853)

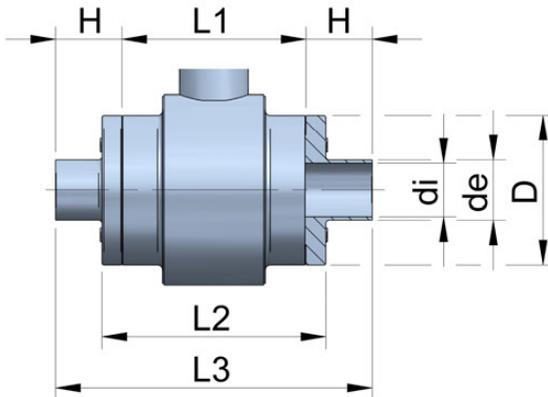
DN	di	R	C	D	L1	L2	L3	H
10	10.0	Tr 22.89 x 1/8"	15.0	60	104	120	200	48
15	15.2	Tr 29.26 x 1/8"	21.2	65	104	120	200	48
20	19.3	Tr 33.53 x 1/8"	25.4	70	104	120	200	48
25	22.6	Tr 37.13 x 1/8"	29.0	80	110	134	220	55
32	31.3	Tr 45.97 x 1/8"	38.0	90	110	134	220	55
40	35.6	Tr 50.65 x 1/8"	42.5	100	130	154	240	55
50	48.6	Tr 64.16 x 1/8"	56.0	115	130	154	240	55
65	60.3	Tr 77.67 x 1/8"	69.7	145	160	186	280	60
80	72.9	Tr 91.19 x 1/8"	82.3	160	160	186	280	60
100	97.6	Tr 118.21 x 1/8"	108.5	180	204	234	330	63



(All dimensions in mm)

FLOMID-9WDFX (DIN 11850 weld-on connections)

DN	de	di	D	L1	L2	L3	H
10	13	10	60	104	120	180	38
15	19	16	65	104	120	180	38
20	23	20	70	104	120	180	38
25	29	26	80	110	134	190	40
32	35	32	90	110	134	190	40
40	41	38	100	130	154	210	40
50	53	50	115	130	154	210	40
65	70	66	145	160	186	250	45
80	85	81	160	160	186	250	45
100	104	100	180	204	234	300	48



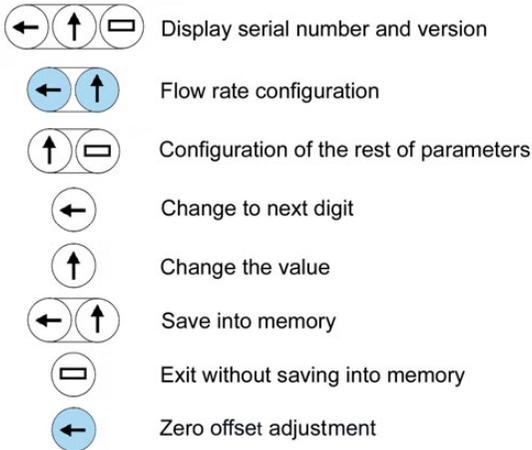
(All dimensions in mm)

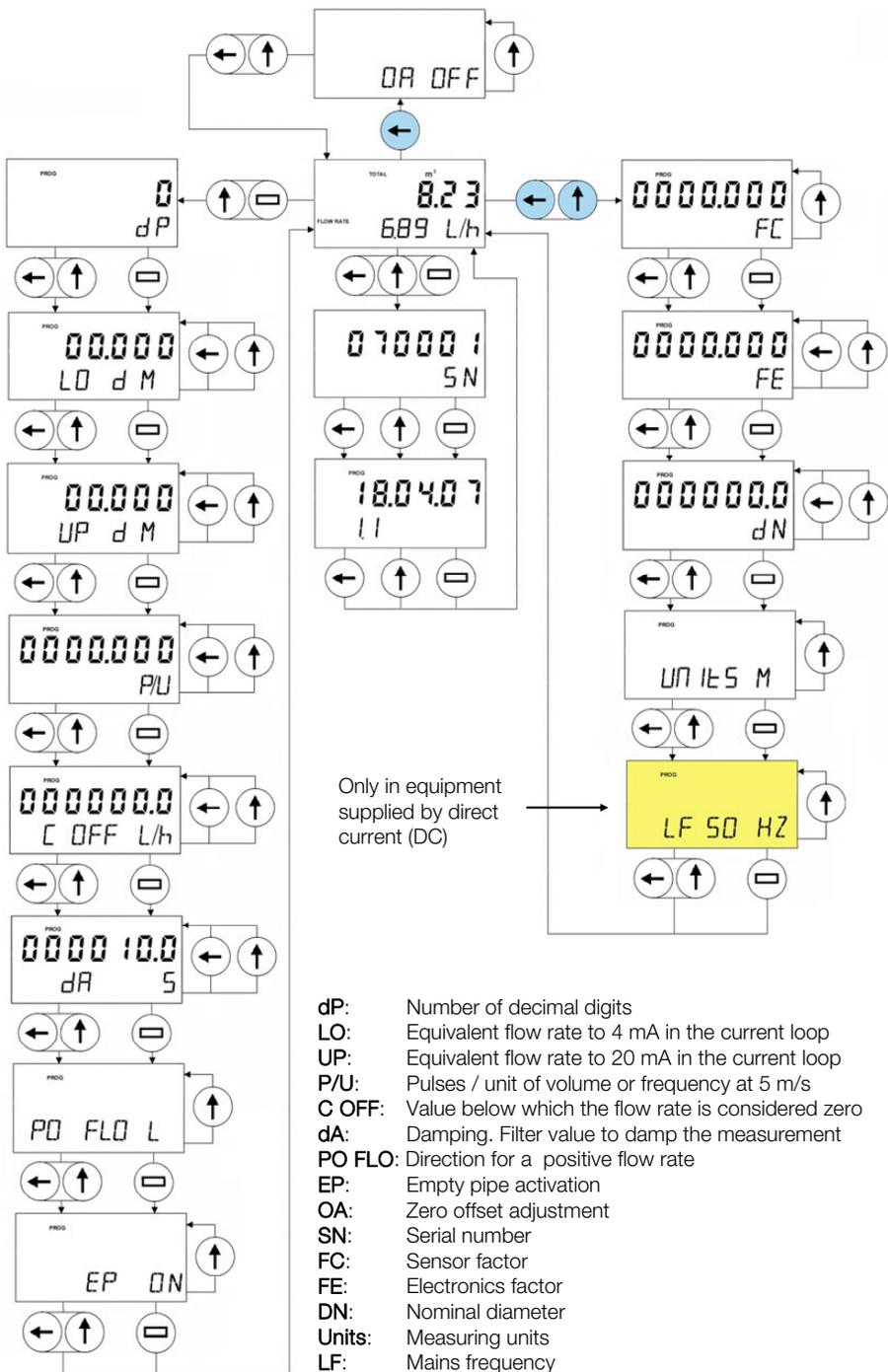
18 TROUBLESHOOTING

Problem	Probable cause	Remedy
The flow rate is not displayed. In its place there are dashes	The pipe is empty	Make sure that the pipe is completely full, installing the flowmeter in a section upstream of the pipe
	The functional earth is not connected.	Connect the functional ground of the flowmeter to a metallic point of the installation in contact with the liquid
	Isolation of the electrodes	Clean the sensor electrodes.
	Electrode cable disconnected	Connect the cable between the sensor and the electronic converter
	Liquid with very low conductivity	The flowmeter is not adequate for the application
The flow rate is unstable	Dirt on the electrodes	Clean the sensor electrodes
	The product contains air or non-conductive particles in suspension	Verify that the flowmeter is adequate for this application
The flow rate displayed is 0	Coil cable disconnected	Connect the cable between the sensor and the electronic converter
	The flow rate is smaller than programmed as CUT OFF	Decrease the value of the cut off (see page 30)
The instrument displays a value when there is not flow	The sensor is damaged due to electrodes corrosion	Electrode material not adequate for the liquid
	The functional earth is not connected and the empty pipe option is OFF	Connect the functional ground of the flow meter to a metallic point of the installation in contact with the liquid
The flow rate displayed is higher than expected	The electrodes are immersed but the pipe is not completely full	Make sure that the pipe is completely full, installing the flow meter in a section upstream of the pipe

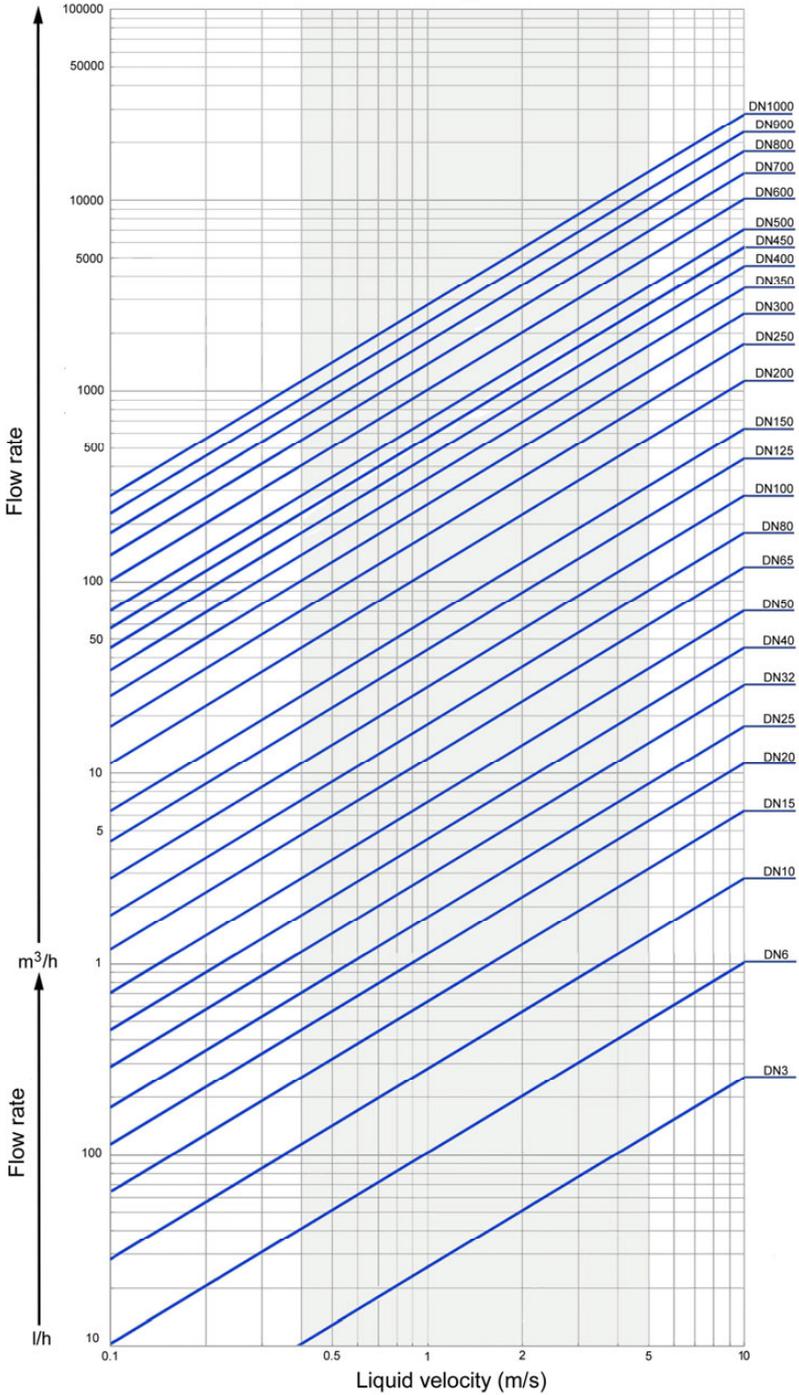
Problem	Probable cause	Remedy
The display is blank	Fused fuse	Change the fuse
The analog output gives always 4 mA or 20 mA	Current output range not properly programmed	Program the range properly (see page 9)
The analog output gives 0 mA	Cable disconnected	Check the cable connection
The pulse output does not work well	In pulse / unit of volume mode, the frequency is higher than 6.25 Hz	Decrease the pulses / unit of volume or change to frequency output mode (see page 30)
The totalizer does not change its value	The flow rate is negative (with respect to the fluid direction)	Program the positive flow rate direction according to the fluid direction (see page 32)
The keys do not act	The keys are locked "write protect"	Unlock the keys by placing the jumper (see page 33)

19 PROGRAMMING DIAGRAM





ANNEX A. FLOW RATE TABLE



WARRANTY

Tecfluid S.A. guarantee all the products for a period of 24 months from their sale, against all faulty materials, manufacturing or performance. This warranty does not cover failures which might be imputed to misuse, use in an application different to that specified in the order, the result of service or modification carried out by personnel not authorized by Tecfluid S.A., wrong handling or accident.

This warranty is limited to cover the replacement or repair of the defective parts which have not damaged due to misuse, being excluded all responsibility due to any other damage or the effects of wear caused by the normal use of the devices.

Any consignment of devices for repair must observe a procedure which can be consulted in the website www.tecfluid.com, "After-Sales" section.

All materials sent to our factory must be correctly packaged, clean and completely exempt of any liquid, grease or toxic substances.

The devices sent for repair must enclose the corresponding form, which can be filled in via website from the same "After-Sales" section.

Warranty for repaired or replaced components applies 6 months from repair or replacement date. Anyway, the warranty period will last at least until the initial supply warranty period is over.

TRANSPORTATION

All consignments from the Buyer to the Seller's installations for their credit, repair or replacement must always be done at freight cost paid unless previous agreement.

The Seller will not accept any responsibility for possible damages caused on the devices during transportation.



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ATEX European Directive certified by



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The technical data described in this manual is subject to modification without notification if the technical innovations in the manufacturing processes so require.