



## Instructions manual



## PREFACE

Thank you for choosing the flowmeter series FLOMAT from Tecfluid S.A.

This instruction manual allows the installation and operation of the electromagnetic sensor FLOMAT-FX as well as the configuration and programming of the electronic converter MX4. It is recommended to read it before using the equipment.

## WARNINGS

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- In case of loss, ask for a new manual or download it directly from our website [www.tecfluid.com](http://www.tecfluid.com) Downloads section.
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**TABLE OF CONTENTS**

**SENSOR FLOMAT-FX**

<b>1</b>	<b>WORKING PRINCIPLE .....</b>	<b>6</b>
<b>2</b>	<b>RECEPTION .....</b>	<b>6</b>
	2.1 Unpacking .....	6
	2.2 Storage temperatures .....	6
<b>3</b>	<b>HANDLING .....</b>	<b>6</b>
<b>4</b>	<b>INSTALLATION .....</b>	<b>7</b>
	4.1 Sensor position .....	7
	4.2 Straight pipe sections .....	7
	4.2.1 Mixtures .....	9
	4.3 Valves .....	9
	4.4 Pumps .....	10
	4.5 Aeration .....	10
	4.6 Vibrations .....	10
	4.7 Magnetic fields .....	11
	4.8 Temperature .....	11
<b>5</b>	<b>MOUNTING .....</b>	<b>12</b>
	5.1 Insert mounting .....	12
	5.2 Sensor mounting .....	14
	5.3 Tightening torque .....	14
	5.4 Connection to the electronic converter .....	14
	5.5 Electronic converter programming .....	14
<b>6</b>	<b>MAINTENANCE .....</b>	<b>14</b>

**MX4 CONVERTER**

<b>1</b>	<b>INTRODUCTION .....</b>	<b>15</b>
<b>2</b>	<b>INSTALLATION .....</b>	<b>15</b>
	2.1 Sensor connection .....	15
	2.1.1 Compact converter .....	15
	2.1.2 Remote converter .....	16
	2.2 Electrical connection .....	16
	2.2.1 Power supply wiring .....	17
	2.2.2 Relay output wiring .....	17
	2.2.3 Remote reset input wiring .....	18
	2.2.4 Analog output wiring .....	19
	2.2.5 Pulse output wiring .....	20

<b>3</b>	<b>REMOTE SENSOR .....</b>	<b>21</b>
3.1	Preparing the cable .....	21
3.2	Cable installation .....	23
3.3	Cable connection to sensor .....	23
3.4	Cable connection to converter .....	24
3.5	Cable specifications .....	25
<b>4</b>	<b>CONVERTER INTERFACE .....</b>	<b>26</b>
<b>5</b>	<b>MAIN MENU .....</b>	<b>27</b>
5.1	Passwords to access the menus .....	27
<b>6</b>	<b>INSTALLATION PARAMETERS .....</b>	<b>29</b>
6.1	Language .....	29
6.2	Sensor factor .....	29
6.3	Converter factor .....	30
6.4	Nominal diameter .....	30
6.5	Diagnosis .....	30
6.5.1	Parameters .....	30
6.5.2	Simulator .....	31
6.5.3	Mains frequency .....	32
6.5.4	Coil current .....	32
<b>7</b>	<b>CONVERTER PROGRAMMING .....</b>	<b>33</b>
7.1	Language .....	33
7.2	Units .....	34
7.3	Flow rate decimals .....	34
7.4	Flow rate .....	35
7.4.1	Empty pipe .....	35
7.4.2	Cut off .....	36
7.4.3	Reversal flow rate .....	36
7.4.4	Damping .....	36
7.4.5	Offset .....	37
7.5	Outputs .....	37
7.5.1	Relay 1 and relay 2 .....	37
7.5.1.1	Alarm .....	38
7.5.1.2	Empty pipe .....	38
7.5.1.3	Negative flow .....	38

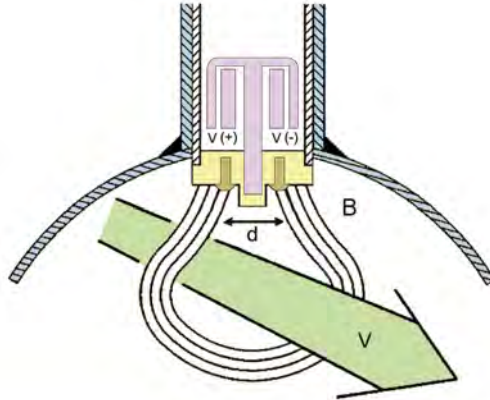
7.5.2	<b>Pulse output</b> .....	38
7.5.2.1	<b>Pulse output configuration</b> .....	39
7.5.2.2	<b>Units</b> .....	39
7.5.2.3	<b>Pulses</b> .....	39
7.5.2.4	<b>Duty cycle</b> .....	39
7.5.3	<b>Analog output</b> .....	40
7.5.3.1	<b>4-20 mA output configuration</b> .....	40
7.5.3.2	<b>Programming of the 4-20 mA output</b> .....	40
7.5.3.3	<b>Current calibration for 4 and 20 mA</b> .....	40
7.6	<b>Working screen</b> .....	41
7.7	<b>Totalizer</b> .....	41
7.8	<b>Modbus</b> .....	42
8	<b>SERIAL NUMBER</b> .....	42
9	<b>SOFTWARE VERSION</b> .....	42
10	<b>DEFAULT SCREEN</b> .....	43
11	<b>MAINTENANCE</b> .....	43
11.1	<b>Fuse</b> .....	43
12	<b>ASSOCIATED SOFTWARE WINSMETER MX4</b> .....	44
12.1	<b>USB cable connection and drivers installation</b> .....	44
12.2	<b>Port connection</b> .....	45
12.3	<b>Access to installation and programming</b> .....	46
12.4	<b>Visualization</b> .....	48
12.5	<b>Firmware update</b> .....	49
13	<b>TECHNICAL CHARACTERISTICS</b> .....	50
14	<b>DIMENSIONS</b> .....	52
15	<b>TROUBLESHOOTING</b> .....	54
ANNEX A	<b>Flow rate diagram</b> .....	55

## 1 WORKING PRINCIPLE

The FLOMAT 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  $V$ .



$$V = B \cdot v \cdot d$$

Where:

$V$  = Measured voltage in the electrodes

$B$  = Magnetic field

$v$  = Liquid velocity

$D$  = Pipe diameter

## 2 RECEPTION

The FLOMAT electromagnetic flowmeters are supplied conveniently packaged for transportation together with their instruction manual for installation and operation.

All the flowmeters have been verified in our calibration rigs to obtain the  $F_c$  factor for 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

-20°C ..... +60°C

## 3 HANDLING

It should always be done with care and without knocks.

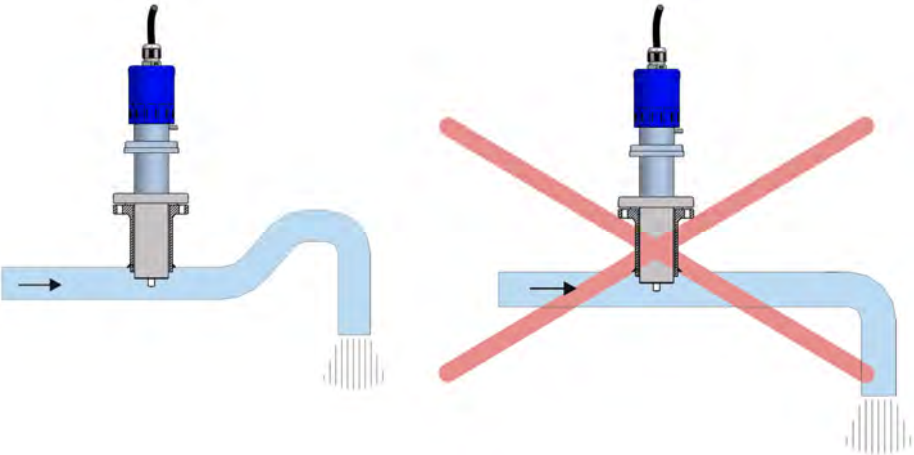
## 4 INSTALLATION

This should be made in a straight pipe run that guarantees that the pipe is always completely full and where there is a fully developed turbulent flow profile (follow indications on point 4.2).

Avoid high points of the pipes where air pockets usually formed, or pipes with downwards flow where vacuums can be formed.

Partially full pipes can produce important reading errors.

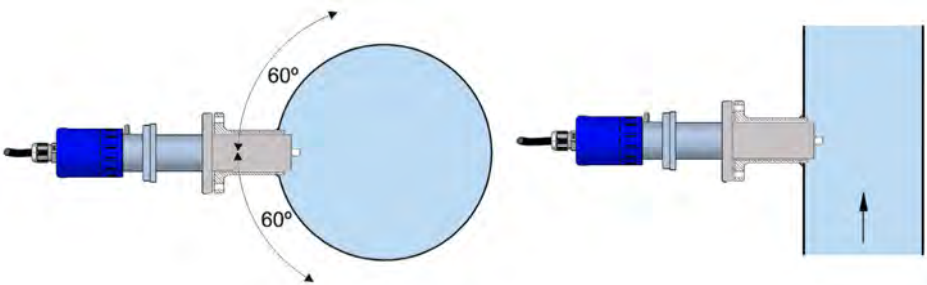
Flow rate measurement with open discharge makes it necessary to install the flowmeter in a pipe section with a siphon which avoids stagnation of air in the sensor.



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### 4.1 Sensor position

The optimum position to install the sensor is with the electrodes in the side of the pipe. This way, air pockets at the top of the pipe are avoided.



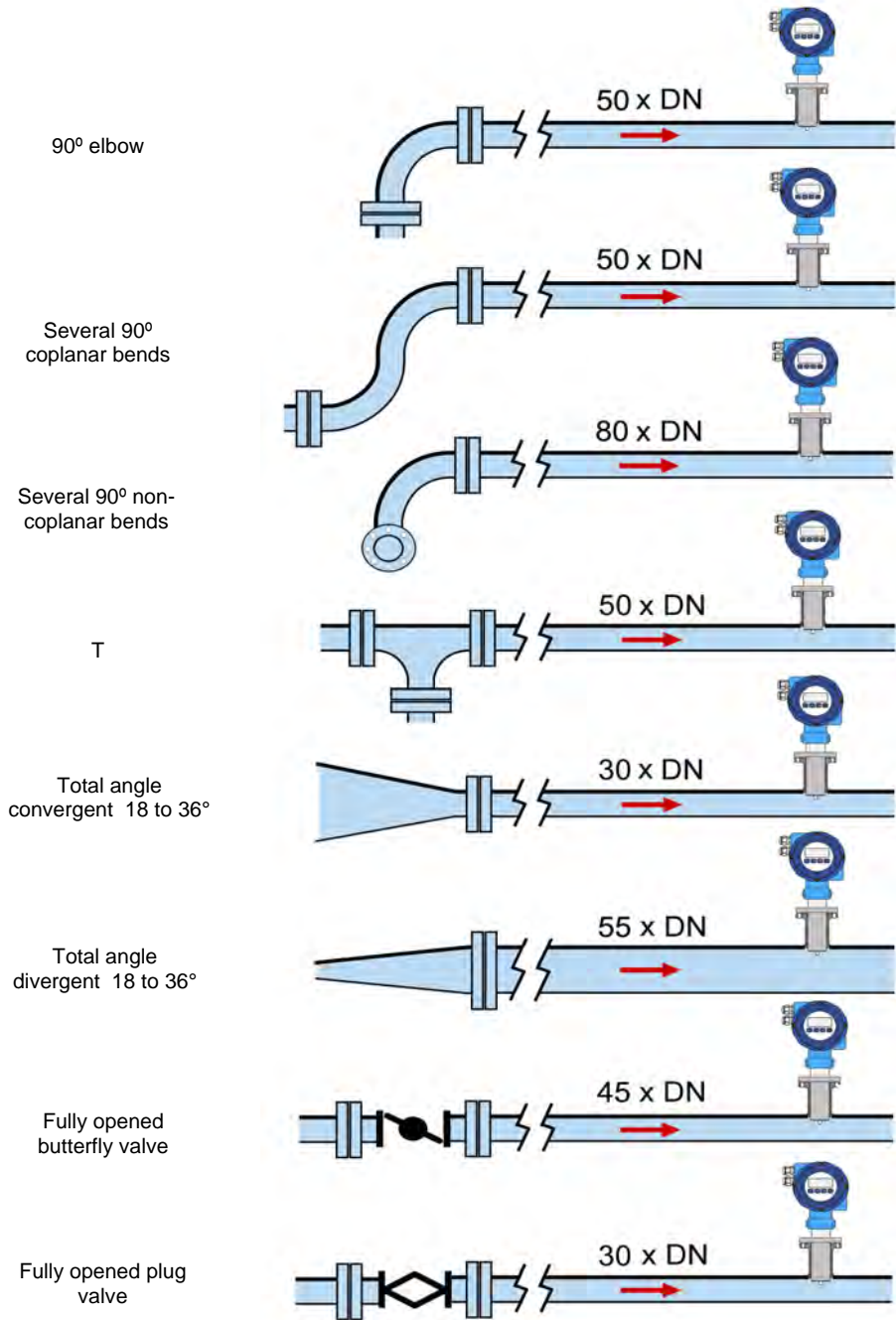
### 4.2 Straight pipe sections

The point where the FLOMAT sensor will be installed must be a straight pipe section, separated from elements that can disturb the flow profile, such as elbows, diameter changes, etc. Depending on the element the minimum necessary distances upstream from the sensor are shown on the next page (BS 1042-2.2:1983 standard):

Disturbing  
element upstream  
the sensor

Minimum distance between  
the sensor and the element

4



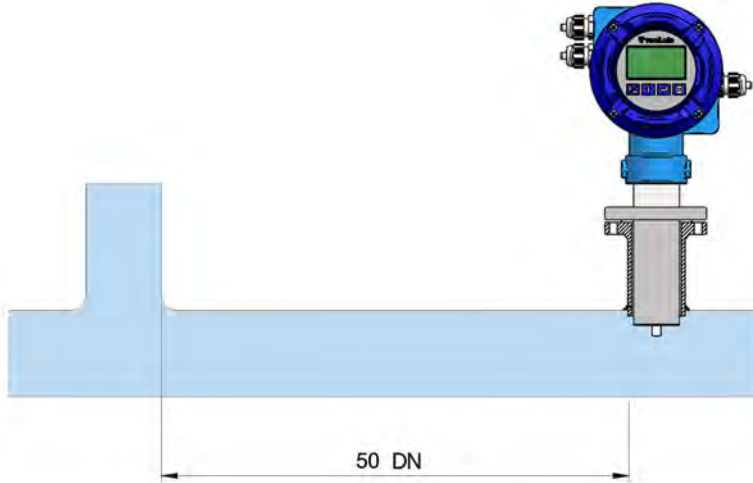


Downstream, the minimum recommended distance to a disturbing element is 5 x DN.

**4.2.1 Mixtures**

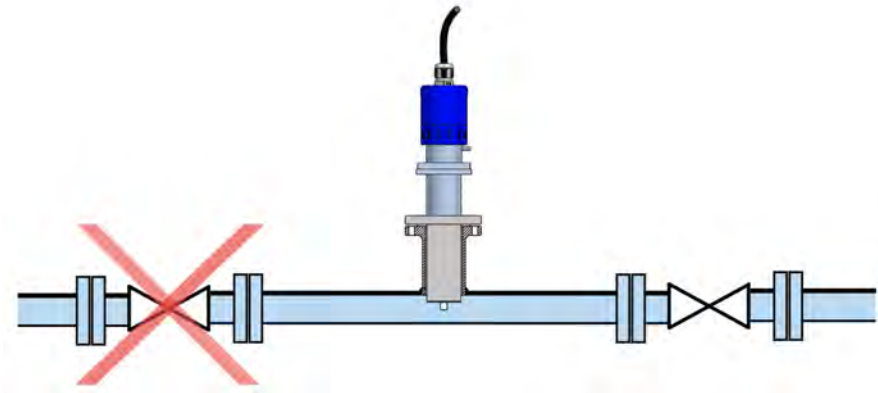
If liquids of different conductivities are mixed it is necessary to install the sensor a minimum of 50 x DN from the point of mixture in order to obtain a uniform conductivity of the liquid and stabilize the readings.

If this distance is shorter, readings may be unstable.



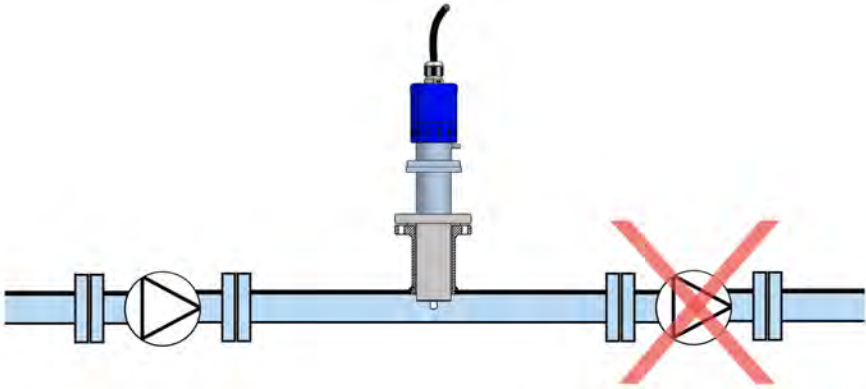
**4.3 Valves**

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



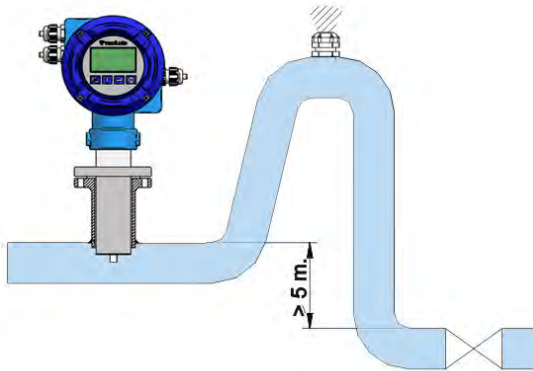
**4.4 Pumps**

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



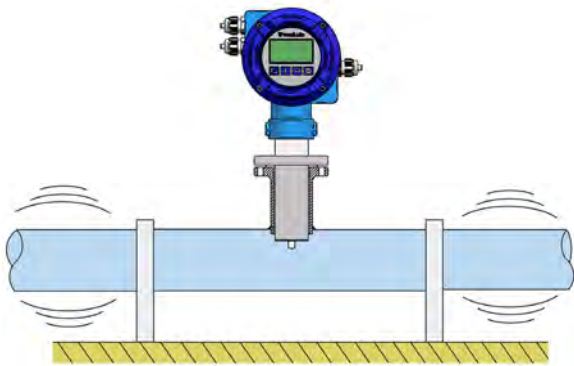
**4.5 Aeration**

If there is a point where the difference in level 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.



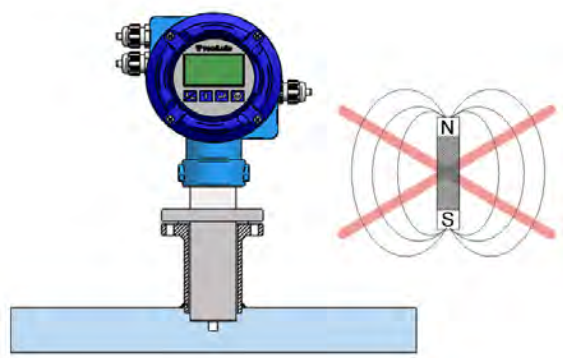
**4.6 Vibrations**

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.



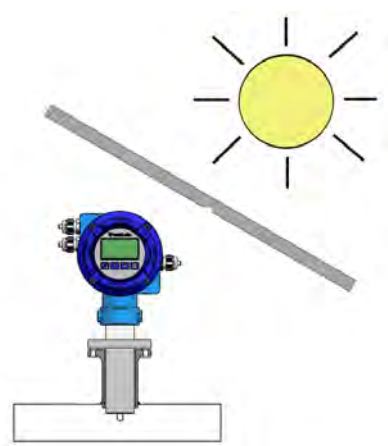
**4.8 Magnetic fields**

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 page 51.

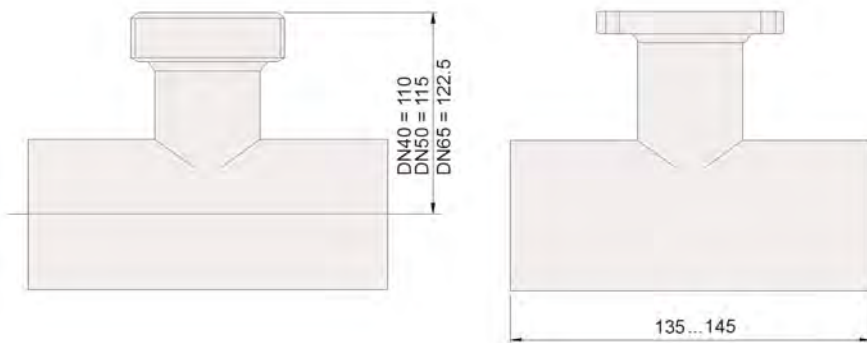
## 5 MOUNTING

### 5.1 Insert mounting

The sensor is normally supplied mounted in its insert pipe adaptor. Before welding the adaptor to the pipe, the sensor must be removed to avoid irreparable damage due to excessive temperatures.

There are two basic types of insert pipe adaptors: with threaded or with flanged connection.

For the smallest pipe diameters (DN40, 50 & 65) the insert pipe adaptor is supplied welded to a short length of pipe with a "T" form. For this type just couple it to the pipe by welding or gluing in the case of PVC.



For DN80 and bigger, there are three lengths for each of the two types of fittings.

The process of putting the insert in should be done accurately. The distance (H) (see drawings on next page) which is what the insert should protrude above the surface of the pipe is important.

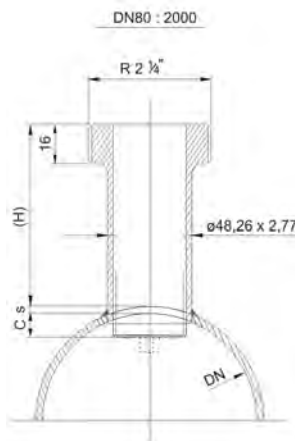
As shown in the table on the next page, to know the distance, the thickness of the pipe (s) must be known.

In order to make the positioning of the insert in the pipe easier, there is a label on one of its sides with markings indicating the position of the internal pipe diameter for each DN. Cut this label above the line corresponding to the DN of the pipe, at a distance equal to the pipe thickness. Peel off the bottom part of the label. Once the insert is placed into its final position, where the label was cut must coincide with the outer diameter of the pipe.

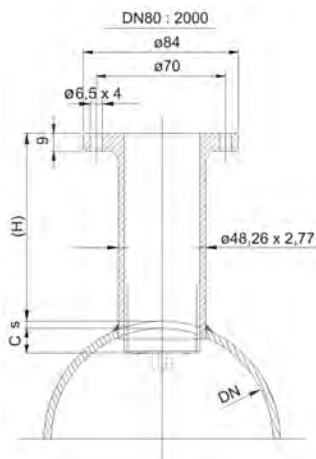
This ensures that the measuring electrodes penetrate far enough in the area of flow profile that will allow an accurate measurement.

DN	Sensor length	Insert length	C	(H)	Qnom m <sup>3</sup> /h
80	101	93	10	88-s	90,5
100			12,5	85,5-s	141,3
125			15,5	82,5-s	220,9
150			19	79-s	318,1
200			25	73-s	565,5
250			31	67-s	883,6
300			37,5	60,5-s	1.272,3
350			44	54-s	1.731,8
400			50	48-s	2.261,9
500	206	145	62,5	140,5-s	3.534,3
600			75	128-s	5.089,4
700			87,5	115,5-s	6.927,2
800			100	103-s	9.047,8
900			112,5	90,5-s	11.451,1
1000			125	78-s	14.137,1
1200	356	190	150	203-s	20.357,5
1400			175	178-s	27.708,8
1600			200	153-s	36.191,1
1800			225	128-s	45.804,4
2000			250	103-s	56.548,7

Threaded insert



Flanged insert



**Example:**

Suppose a pipe of 300 mm inner diameter (DN300) and 5.5 mm thick. In the chart we can see that the distance that the insert pipe adaptor must extend above the external wall is  $H = 60,5 - s = 60,5 - 5,5 = 55$  mm.

The values in the chart are calculated considering the gasket supplied with the instrument, which is 3 mm thick. If the thickness of the gasket is changed, the value of  $H$  will change.

The equation to calculate  $H'$  for a gasket of thickness  $d$  is the following:

$$H' = H + 3 - d$$

In the previous example, if the gasket was 5 mm thick, the distance that the adaptor should extend above the external wall would be  $H' = 55 + 3 - 5 = 53$  mm.

Drill a 48.5 mm diameter hole in the pipe to insert the adaptor and weld the fitting to the pipe.

If the pipe is made of concrete or other material to which the insert pipe adaptor cannot be welded, a clamp-on accessory or saddle should be used. In this case, please contact us to inform about the suitable sensor length.

The axis of the insert pipe adaptor should be perfectly perpendicular to the pipe axis.

5

**5.2 Sensor mounting**

Once the insert pipe adaptor is mounted, place the flat seal in its position and install the sensor with the arrow pointing in the flow direction. The electrodes must be perfectly perpendicular to the pipe axis.

In order to align the sensor, the two bolts or pins situated in each side of the cylinder in the top of the FLOMAT sensor must be aligned with the axis of the pipe and the arrow pointing in the flow direction.

**5.3 Tightening torque**

The tightening torque for the flange screws should not exceed 7.1 Nm.

The tightening torque for the threaded fitting should not exceed 21 Nm.

**5.4 Electronic converter connection**

See point 2.1 MX4 converter on page 15.

**5.5 Electronic converter programming**

FLOMAT sensor is insertion type, so it can be installed in pipes with different diameters.



**NOTE:** It is essential to program the internal diameter of the pipe, in order that the converter can indicate the correct flow rate.

Programming of the pipe diameter is explained in point 6.4 MX4 converter on page 30 of this manual.

**6 MAINTENANCE**

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

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

# MX4 CONVERTER

## 1 INTRODUCTION

The MX4 converter unit adapts to the different FLOMID and FLOMAT series of electromagnetic flow sensors. The electronic circuit is based on the most advanced technology in digital signal processing, in order to obtain accurate and reliable measurements.

The device provides the following features:

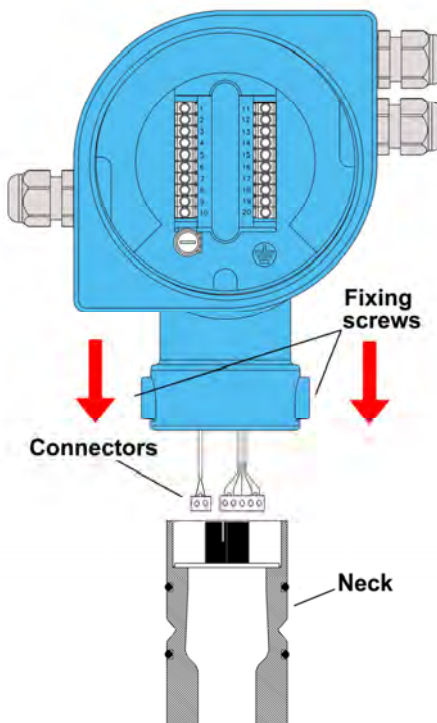
- Coil excitation by means of pulsed signal to obtain a negligible zero offset.
- Pulse and current output proportional to the flow rate and user programmable.
- Relay outputs user programmable as flow rate alarm or status.
- Local and separate mounting.
- Easy exchange with other sensors.
- Graphic display with intuitive menus.
- Adjustable front to make easy the display reading depending on the installation.

## 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 installation, the MX4 converter has two terminal strips. To help in the wiring of the equipment, the description of the terminals is marked on a label in the rear cover of the device.

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 mm<sup>2</sup> 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 cable glands are the right size for the cables to be used. This will 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 the cables, peel the outside insulation to free the inner cables. It is recommended to put a terminal at 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.



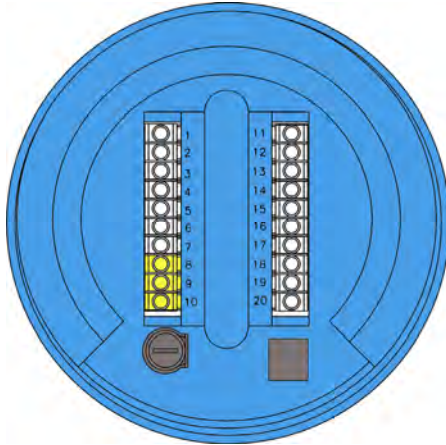
**IMPORTANT NOTE:** To ensure smooth operation of the equipment, it is recommended to make the connection paying attention to the following points:

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



**2.2.1 Power supply wiring**

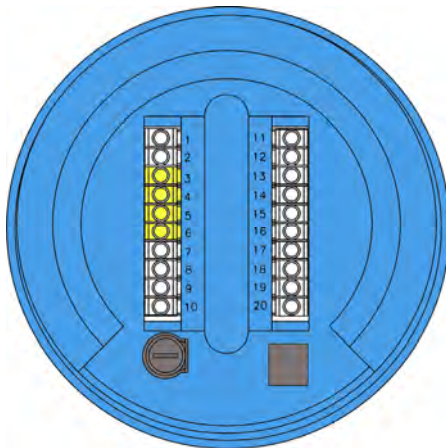
Before starting the installation of the equipment, check that the supply voltage available is the same as marked on the label of the converter.



<u>Terminal</u>	<u>Power supply AC</u>	<u>Power supply DC</u>
<b>8</b>	Earth	NC
<b>9</b>	Neutral	-
<b>10</b>	Phase	+

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

**2.2.2 Relay output wiring**

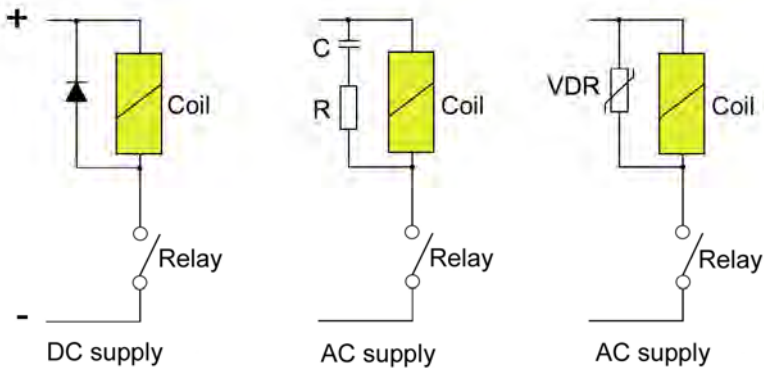


<u>Terminal</u>	<u>Description</u>	<u>Relay</u>
6	Normally Open	Relay 1
5	Common	Relay 1
4	Normally Open	Relay 2
3	Common	Relay 2

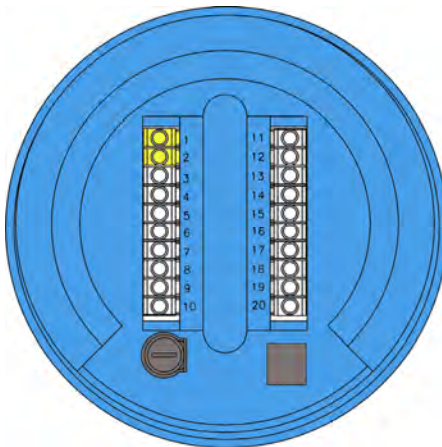
The relay outputs provide relays with potential free contacts (see characteristics in page 50).

The status of the relay contacts corresponds to the relay at rest.

The relay contacts are not protected in any way, and therefore they must be installed externally as required in the application, taking into account the limitations of the characteristics of such contacts. In the case of having inductive loads, and to extend the working life of the relay contacts, it is recommended to use overvoltage protection (VDR for AC and diodes for DC loads). In all cases a fuse or some kind of protection against short circuits, should always be provided according to the needs of the intended load.



2.2.3 Remote reset input wiring

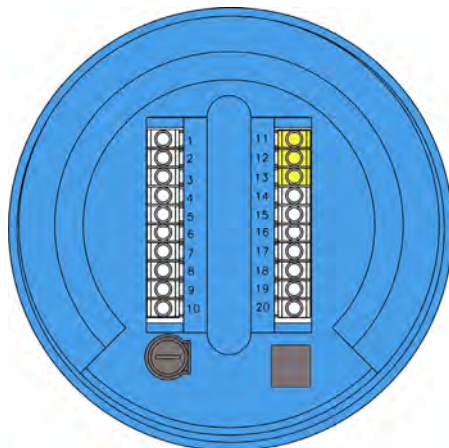


Terminal

- 1 Contact
- 2 Contact

These terminals correspond to an input that resets the value of the totalizer. A potential free normally open push button can be connected. The push button contact must be a good quality snap action switch to guarantee correct working at low voltages and reduce contact bounce effects.

**2.2.4 Analog output wiring**



Terminal

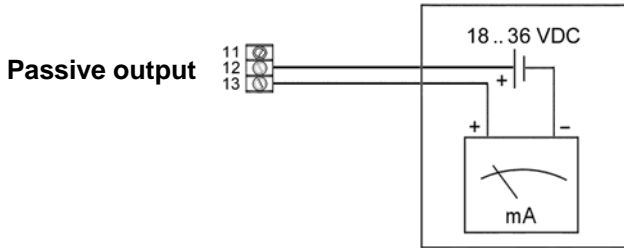
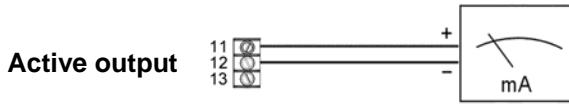
- 11 mA (positive, active output)
- 12 mA
- 13 mA (negative, passive output)

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

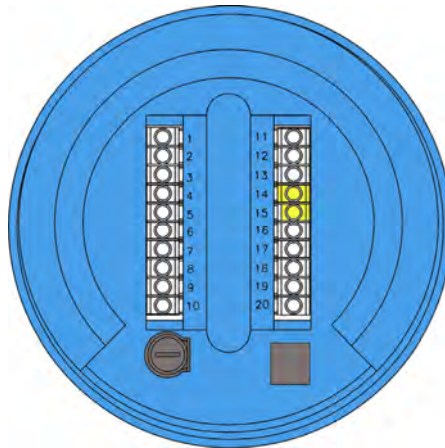
The configuration of the analog output mode (active or passive) is done by means of the connection to the terminal strip. For active mode, terminals 11 and 12 are connected. For passive mode, terminals 12 and 13 are connected.



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



2.2.5 Pulse output connection



Terminal

14

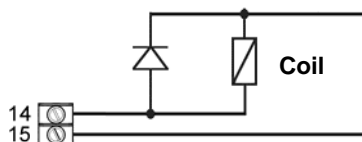
Collector

15

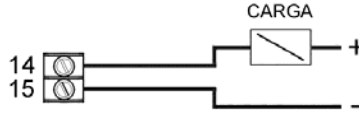
Emitter

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

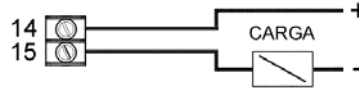
In the case of using inductive loads, in order to protect the output transistor, the use of free wheeling diodes is required.



**Example. Connection with the load at the collector**



**Example. Connection with the load at the emitter**



**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**

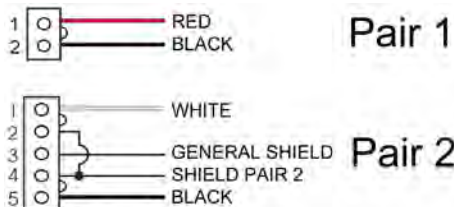
The ends of the cable should be prepared as shown in the drawing on next page. Special care should be taken to avoid possible short circuits between the shields. The point at which the shields are cut refers to the aluminium shields.

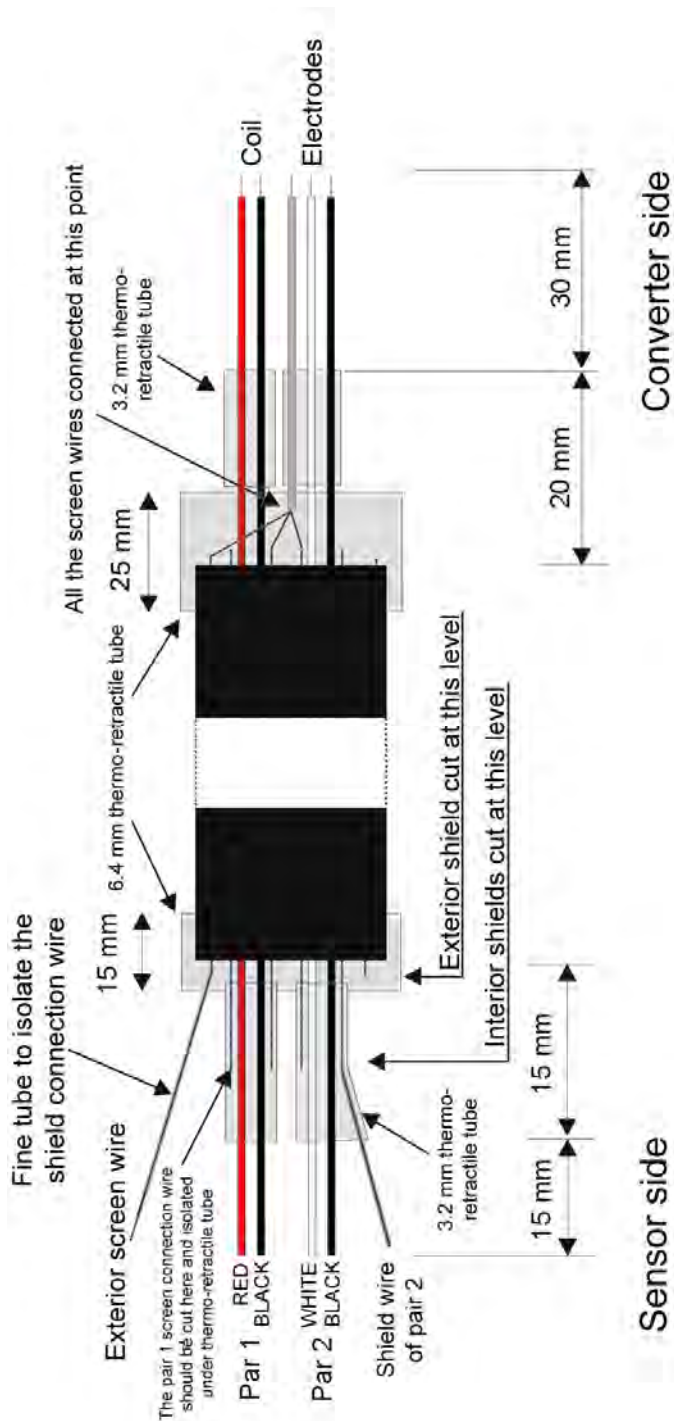
**Electronics side**

At the electronic unit's end, the ends of the cables should be striped 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**

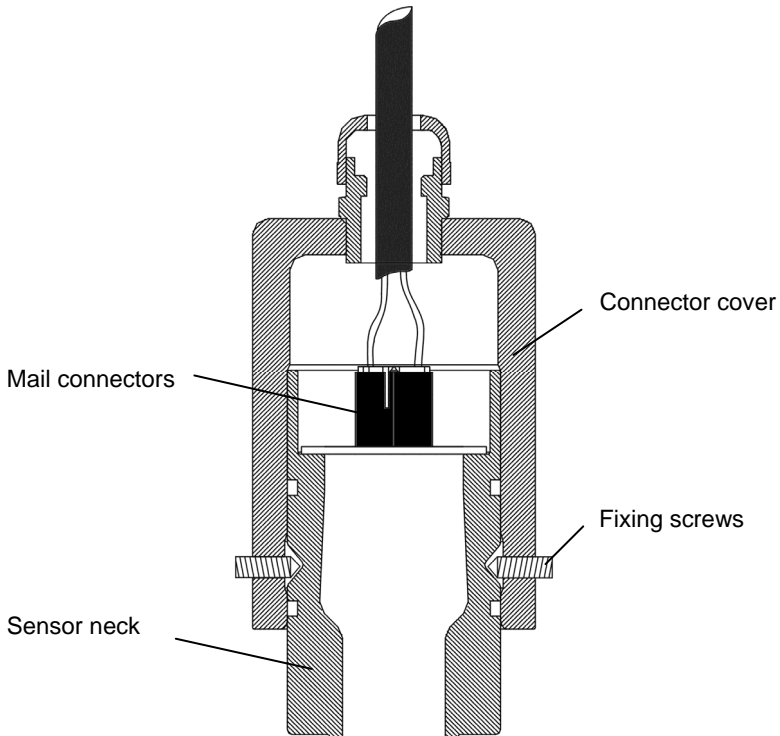
The following points must be taken into account:

- 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 sensor**

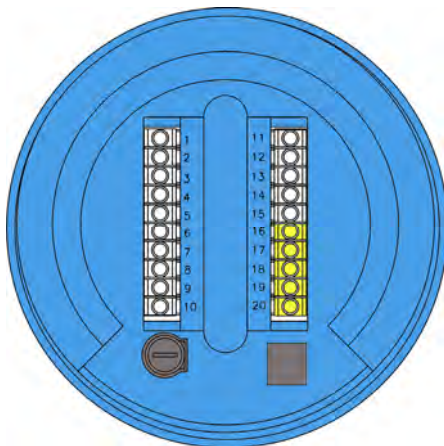
For the sensor connection, first loosen the cable gland to allow the cable to slide in it.

- 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 converter



Terminal

<b>16</b>	Top coil (red cable)
<b>17</b>	Bottom coil (black cable)
<b>18</b>	Rear electrode (white cable)
<b>19</b>	Ground (shield)
<b>20</b>	Front electrode (black cable)

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**

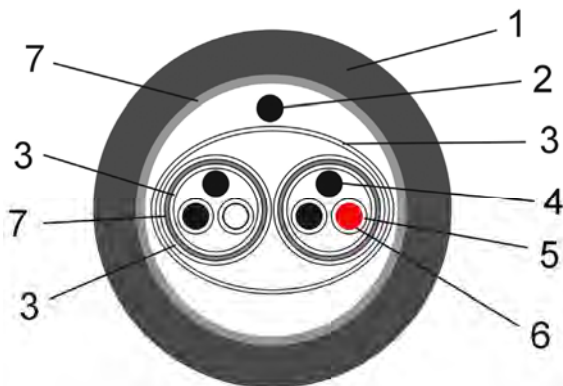
Working Voltage: 250 V  
 Testing Voltage: 1000 V  
 Electrical resistance:  $\leq 52,2 \Omega/\text{km}$   
 Capacity: C\* / C\*\* 90-170 pF/m  
 C\* capacity between conductors  
 C\*\* capacity between one conductor and the rest connected to the shields

**Physical characteristics**

External diameter: 6,6 mm  
 Bending radius: 66 mm  
 Working temperature: -5... +70°C  
 Fire risk: Does not propagate flame as per Norm IEC 60332-1 and EN 50265  
 Section: 0,34 mm<sup>2</sup>  
 Weight: 51 kg/km

**Cable section**

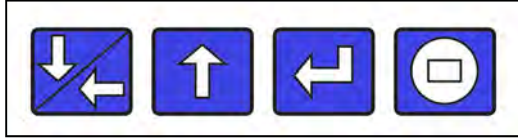
- 1 PVC cover
- 2 External shield wire
- 3 Insulating film
- 4 Pair 1/2 shield wire
- 5 PVC insulation
- 6 Pair 1/2 conductor
- 7 Aluminium shield



## 4 CONVERTER INTERFACE

The MX4 converter has a graphic LCD and a keyboard with 4 push buttons.

The keyboard has four numeric keys to introduce the values of installation and programming. Two of these keys are used also as cursors.



4

The following figure shows the functionality of the converter keys.



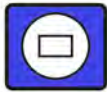
(Down / Left) To switch between flow rate, totalizer and fluid velocity screens. To change to the digit on the left. Into the menu, to scroll down.



(Up) To switch between flow rate, totalizer and fluid velocity screens. To increase the digit. Into the menu, to scroll up.



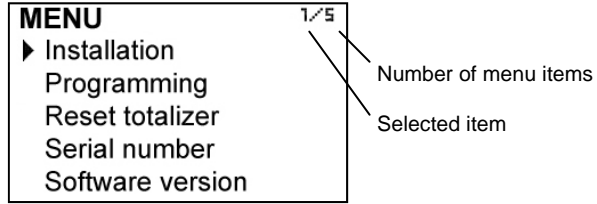
(Enter) To validate the data. To enter into installation and programming modes of the converter. To exit from an informative text.



(Escape) To return to the previous menu. To exit from a screen without validating data.

## 5 MAIN MENU

To access the main menu of the converter, press the key (Enter). The following screen appears:



The "Installation" option allows the basic configuration of the instrument, as explained in Chapter 6 of this manual.

The "Programming" option allows to program all parameters of the converter, as explained in Chapter 7 of this manual.

From the "Reset totalizer" option, the user can return the totalizer to zero. When exiting the menu, the totalizer will begin to accumulate again.

**Note:** The "Reset totalizer" operation requires the program password input (see point 5.1).

The options "Software Version" and "Serial Number" are informative and are discussed in Chapters 8 and 9 of this manual.

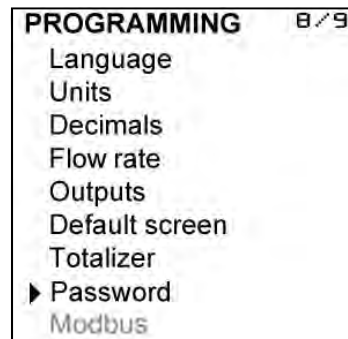
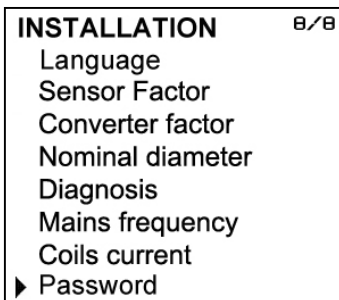
### 5.1 Passwords to access the menus

To access the installation and programming menus, a password must be entered. At first access, the default password is 0123.

The password for the installation menu may be different from the password for the program menu. If you want to change any of these passwords, you must enter the corresponding menu and once inside, access the submenu "Password".

To change the access password of the installation menu, select "Installation" on the main menu and then "Password".

To change the access password of the programming menu, select "Programming" in the main menu and then "Password".



When the "Password" option is selected, a screen to enter the new password appears.

**NEW PASSWORD**

Min: 0                      Max: 9999

**0000**

Once entered, the new password is asked again to avoid possible inadvertent error.

**REP. PASSWORD**

Min: 0                      Max: 9999

**0000**

If the re-entered password does not match the first one, the following error message appears and the process should be carried out again.

**ERROR**

Invalid change  
Password and  
verification do not  
match

If both passwords match, the following information message is displayed:

**INFORMATION**

Password changed

Press any key

## 6 INSTALLATION PARAMETERS

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

Press the (Enter) key in order to enter the main menu.

With the keys (Down / Left) and (Up), select "Installation", and then validate with the key (Enter).

In order to access to the Installation menu, a password must be entered. When accessing the first time, the default password is 0123. For more details about the password, see paragraph 5.1, page 27.

**PASSWORD**

Min: 0                      Max: 9999

0000

Once the password is entered, and after pressing the key (Enter), the first screen allows to choose between the different options of the installation menu.

**INSTALLATION** 1/8

- ▶ Language
- Sensor Factor
- Converter factor
- Nominal diameter
- Diagnosis
- Mains frequency
- Coils current
- Password

### 6.1 Language

You can choose the language in which all the menus will be displayed.

**LANGUAGE** 2/4

- Catalan
- ▶ Spanish
- French
- English

### 6.2 Sensor factor

In this screen the sensor factor is shown. It should coincide with the **Fc** parameter on the sensor label.

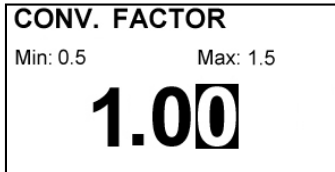
**SENSOR FACTOR**

Min: 0                      Max: 1.5

1.00

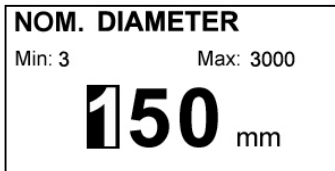
**6.3 Converter factor**

The electronic converter factor is shown. It should coincide with the **Fe** parameter on the converter label.



**6.4 Nominal diameter**

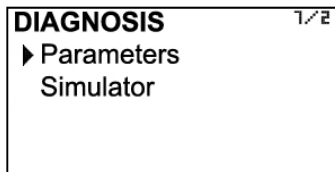
The value of the nominal diameter is always the internal diameter of the pipe.



**6.5 Diagnosis**

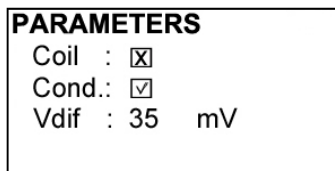
When the flowmeter is not working properly, it can be useful to test some parts of the instrument in order to locate the problem.

In this section a list with two possible options appears.



**6.5.1 Parameters**

This screen allows the diagnosis of the coil current, the differential voltage on the sensor electrodes, and the conductivity of the liquid.



In the first row, a possible damage of the sensor coils can be detected. If there is a symbol 'V' on this row, it means that the coils do not have any damage. If the symbol is 'X' it means that the coils are damaged. In this case, please contact your distributor.

The second row shows if the conductivity of the liquid is high enough for the instrument to perform the measurement process.

The conductivity of the liquid should always be higher than 20 uS / cm .

The third row shows the differential voltage value on the electrodes (Vdif).

This voltage appears in some cases where chemical reactions are created on the surface of the electrodes.

While this value does not exceed 0.5 V the flowmeter can work properly. If the value is higher, there is no guarantee that the flow reading is correct. In this case, please contact your distributor.

### 6.5.2 Simulator

With this diagnosis an electronic fault in the measuring circuit. can be checked.

Before checking, disconnect the electrodes from the converter. To do this, if the converter is compact mounted, remove the electrodes IDC connector shown in the figure on page 15 (5-pin cable). If the converter is remote mounted, remove the electrodes wires (terminals 18, 19 and 20) of the terminal strip on the back (p. 24)

**INFORMATION**  
 Disconnect the cable  
 from the electrodes  
  
 Press Enter

Pressing Enter a screen indicating a simulated speed of the liquid is shown. If the circuit is working properly the displayed value will be between 4 and 6 m/s.

**SIMULATOR**  
 Liquid velocity  
 Min: 4                      Max: 6  
  
**5.23**                      m/s

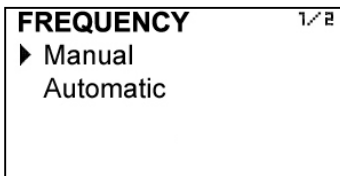
To come back to the main menu, connect the electrodes cable again and press Escape key.

**INFORMATION**  
 Cconnect the cable  
 from the electrodes  
  
 Press Enter

Press again the Escape key until the working screen.

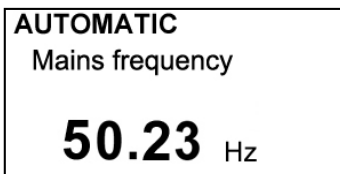
**6.5.3 Mains frequency**

If the power supply of the converter is AC, the following screen will appear:

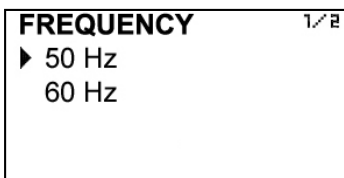


Normally "Automatic" should be selected. In this case, the computer automatically detects the frequency of the mains and thus uses the most appropriate coil excitation to eliminate noise from the mains.

The detected frequency can be shown in the screen that appears when you select the automatic mode.



If manual mode is selected, the mains frequency can be chosen between the two most prevalent in all countries, 50 and 60 Hz



If the power supply of the converter is DC, this screen appears directly.

**6.5.4 Coil current**

In normal situations it is not necessary to change the coil current selected in the equipment by default.



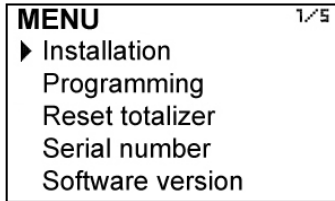
**NOTE:** So that this change is effective, several jumpers inside the instrument need to be changed. In case that a different coil current must be used, please contact your distributor.



## 7 CONVERTER PROGRAMMING

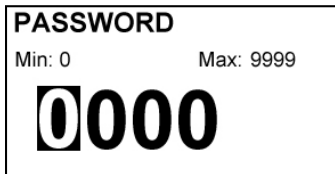
By programming the converter the visualization and the outputs of the instrument can be configured.

Turn on the converter and press (Enter) to enter the main menu. The following screen appears

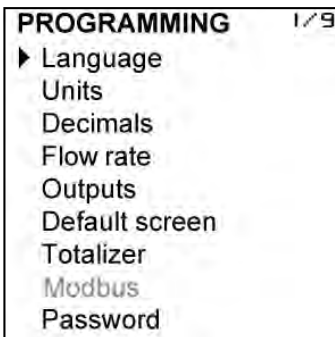


With the keys (Down / Left) and (Up), select Programming, and then validate with the key (Enter).

To access the programming of the converter, you must enter the password. At first access, the default password is 0123. For more details about the password, see paragraph 5.1, page 27.

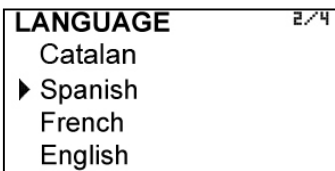


Once the password is entered, the first screen allows to choose between the different programming options.



### 7.1 Language

You can choose the language in which all the menus will be displayed.



7.2 Units

In this screen the units for the liquid velocity, the flow rate and the totalizer can be chosen independently.

<p><b>UNITS</b> <span style="float: right;">E/2</span></p> <p>Velocity</p> <p>▶ Flow rate</p> <p>Totalizer</p>
--

<p><b>FLOW RATE</b> <span style="float: right;">E/12</span></p> <p>US gal/h</p> <p>▶ US gal/min</p> <p>US gal/s</p> <p>UK gal/h</p> <p>UK gal/min</p> <p>UK gal/s</p> <p>l/h</p> <p>l/min</p> <p>l/s</p> <p>m<sup>3</sup>/h</p> <p>m<sup>3</sup>/min</p> <p>m<sup>3</sup>/s</p>
---

<p><b>VELOCITY</b> <span style="float: right;">E/2</span></p> <p>m/s</p> <p>▶ ft/s</p>
--

<p><b>TOTAL</b> <span style="float: right;">E/4</span></p> <p>US gal</p> <p>▶ UK gal</p> <p>l</p> <p>m<sup>3</sup></p>
--

7.3 Flow rate decimals

In this screen the number of decimals for the flow rate indication can be selected.

<p><b>DECIMALS</b> <span style="float: right;">E/2</span></p> <p>0</p> <p>▶ 1</p> <p>2</p>
--

To select the number of decimals it must be taken into account that the instrument has 5 digits for flow rate indication. If two decimals have been selected, these will be seen whilst the flow rate is not higher than 999.99. Above this value the indication will automatically change to one decimal, and when the flow rate is higher than 9999.9 the indication will be done without decimals.

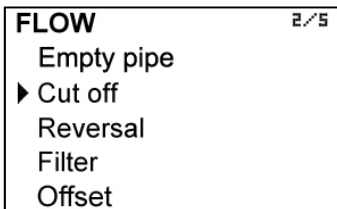
If one decimal is selected, the flow rate indication will have a maximum of one decimal until 9999.9. Above this value the indication will be done without decimals.

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 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 5 digits (integer + decimals).

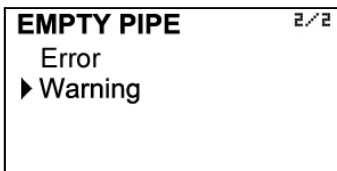
7.4 Flow rate

This screen displays a submenu to modify different aspects related to flow reading, such as empty pipe detection, cut off, reversal flow, filtering and offset.

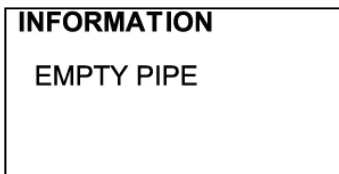


7.4.1 Empty pipe

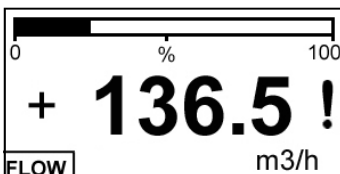
Detection can be programmed in two different ways.



In the event that Error is selected, when the converter detects empty pipe, it will display the following error message instead of readings.

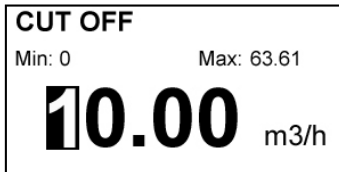


If Warning is selected, in the event of detection of empty pipe, the converter will keep working normally and the symbol "!" will appear next to the measured value, indicating that the reading is not reliable.



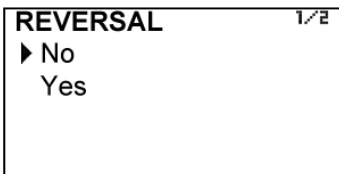
**7.4.2 Cut off**

A cut off flow rate can be programmed, that means, the flow rate below which the flow rate indication will be zero. This can avoid reading errors in the lower zone of the scale. The maximum allowed value for the cut off is the equivalent to a liquid velocity of 1 m/s.



**7.4.3 Reversal flow rate**

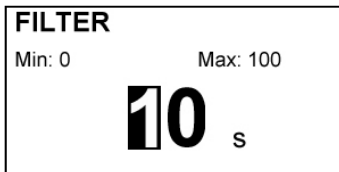
The MX4 is a bi-directional converter. The flow rate changes its sign automatically when the flow is reversed. If after the converter has been installed it is necessary to reverse the flow rate sign, in this screen it can be done by selecting the option "REVERSAL- Yes".



**7.4.4 Damping**

El MX4 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 relay output and the totalizer act according to the instant flow rate. Selecting a filter with a longer or shorter integration time will provide more or less stable readings and will also affect the response time to small variations of flow rate.

The integration time is selected in seconds, with a minimum value of 0 and a maximum value of 40 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 the deviation of the instant flow rate with respect to a reference for each reading. If this deviation exceeds the 10%, the filter will stop acting, indicating the instant value, and will start again the filtering process.

**7.4.5 Offset**



In order to obtain a perfect linearization of the instrument, it is recommended to make an adjustment of the zero offset each time an installation is performed.

The flow rate must be zero, that is, the liquid inside the pipe where the flowmeter is installed should be completely stopped. Furthermore, a completely full pipe is necessary in order to make an effective adjustment.

When the option Offset is selected, the following screen is shown:

**INFORMATION**  
 The flow rate must be zero  
 Press any key

**CAL. OFFSET**  
 When the flow rate is stable press OK  
**0.03** m3/h

When the flow rate is stable, press the key (Enter) and the instrument will save the value.

**INFORMATION**  
 Offset calibrated  
 Press any key

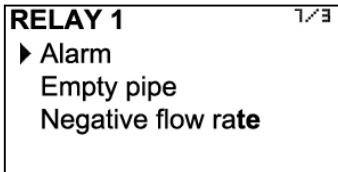
**7.5 Outputs**

This screen allows to program the four outputs of the instrument: Relay 1, Relay 2 pulses and analog output (4-20 mA).

**7.5.1 Relay 1 and relay 2**

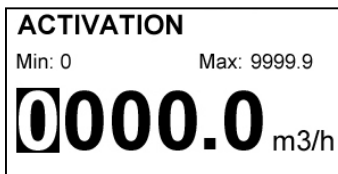
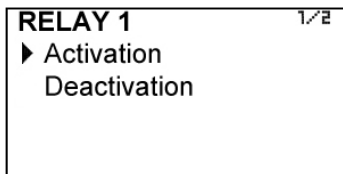
**OUTPUTS** E/1  
 ▶ Relay 1  
 Relay 2  
 Pulses  
 4-20 mA

By selecting one of the two relay outputs, next screen appears with the options which allow to assign the relay to a function.



**7.5.1.1 Alarm**

If Alarm is selected, we have access to program the flow rate at which the relays will change its status and to the level of hysteresis. By level of hysteresis we understand the difference between activation and deactivation of the output. To avoid that an alarm output is continuously moving from activate to deactivate status, we must program the points of connection and disconnection.



**Example**

If the activation point is programmed to 100 m<sup>3</sup>/h and the deactivation point is programmed to 90 m<sup>3</sup>/h, when the flow rate is zero the output will be deactivated. When the flow rate reaches a value of 100 m<sup>3</sup>/h the output will be activated until the level falls below 90 m<sup>3</sup>/h.

If we program an activation point of 90 m<sup>3</sup>/h and a deactivation point of 100 m<sup>3</sup>/h, when the level is zero the output will be activated. When the flow rate reaches a value of 100 m<sup>3</sup>/h the output will be deactivated until the flow rate falls below 90 m<sup>3</sup>/h.

**7.5.1.2 Empty pipe**

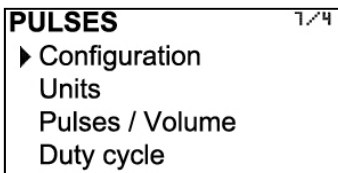
In this case, the relay will change its status when the flowmeter detects empty pipe.

**7.5.1.3 Negative flow**

The relay will change its status when the flow rate changes its sign.

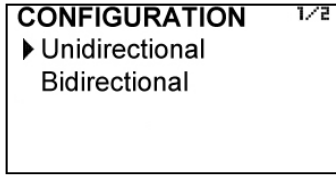
**7.5.2 Pulse output**

This output allows to connect the converter to a PLC or remote totalizer. The number of pulses per unit of volume can be programmed. The following parameters can be selected.



**7.5.2.1 Pulse output configuration**

It allows to choose between unidirectional and bidirectional.

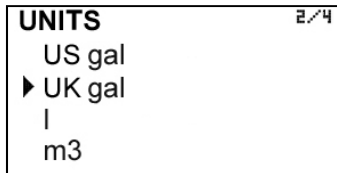


If "Unidirectional" is chosen, the output will give pulses proportional to flow rate when the flow rate is positive, and will not give them when the flow rate is negative.

If "Bidirectional" is chosen, the output will give pulses proportional to flow rate in both flow directions.

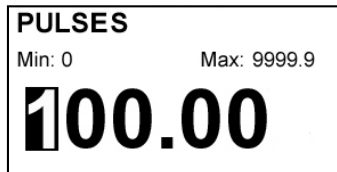
**7.5.2.2 Units**

First volume units for which we want to get a number of pulses are selected.



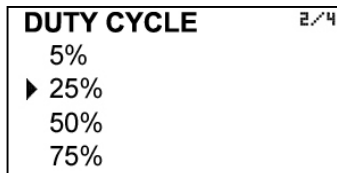
**7.5.2.3 Pulses**

Then the pulses per unit of volume that we will obtain at the output are selected .



**7.5.2.4 Duty Cycle**

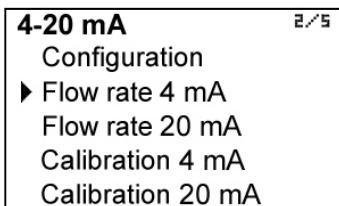
With the duty cycle width or percentage of time the pulse will be active during each cycle can be determined



Active pulse is when the NPN transistor at the output (see 2.2.5) is ON.

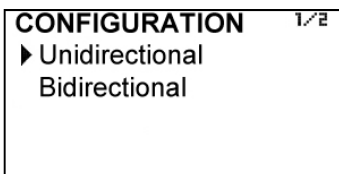
**7.5.3 Analog output**

The flow rate corresponding to 4 mA and 20 mA can be programmed and the calibration for these two values can be made as well.



**7.5.3.1 4-20 mA output configuration**

It allows to choose between unidirectional and bidirectional.

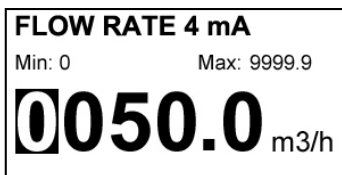


If "Unidirectional" is chosen, the analog output will have a value proportional to the flow rate when positive, and it will provide always 4 mA when negative.

If "Bidirectional" is chosen, the analog output will have a value proportional to the flow rate both for positive and negative values.

**7.5.3.2 Programming of the 4-20 mA output**

Flow rate values equivalent to each current are entered directly.



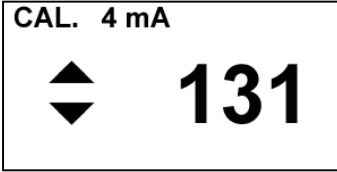
Programming a flow rate value for 20 mA higher than the one for 4 mA, the loop current changes from 4 to 20 mA as the flow increases.

Otherwise, programming a flow rate value for 20 mA lower than the one for 4 mA, the current loop will change from 20 to 4 mA as the flow increases.

**7.5.3.3 Current calibration for 4 and 20 mA**

The MX4 converter is delivered with the current output already calibrated. If you want to correct a derive of the 4 or 20 mA current values because they do not coincide with the ammeter used, it can be done by pressing the keys (Down / Left) and (Up) to increase or decrease the current respectively in each case. The values shown on the screen are reference levels. When one of this data is confirmed, the MX4 will take the current value shown on the ammeter as a reference.

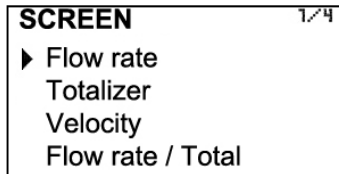




Before making a current calibration, be sure that the ammeter used for that is showing the real measure.

**7.6 Default screen**

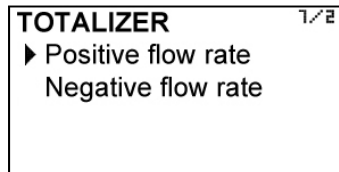
Flow rate, totalizer, liquid velocity or flow rate and totalizer screens can be programmed as a default. Thus, the converter presents this screen when a power failure occurs or when returning from the installation or programming menu.



**7.7 Totalizer**

In this screen you can configure the totalizer operation mode depending on the flow direction. Thus, the value indicated by the totalizer will always be true regardless of the application where the flowmeter is installed.

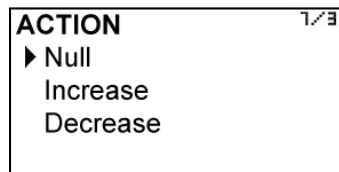
The first screen after selecting "Totalizer" is the following:



In this screen you can choose the flow direction for which you want to configure the action that the totalizer will do.

Positive flow is defined as the one that appears unsigned on the default screen, and negative flow the one that appears with a — sign on the default screen.

Once the flow rate direction is chosen, a screen with the different actions is shown:



If "Null" is selected, the totalizer remains unchanged. If "Increase" is selected, the totalizer will add the amount of fluid passing through the flowmeter, and if you select "Decrease", the totalizer will subtract that amount.

Examples:

- a) Installation in which for a time the product flows through the pipe and after that a cleaning process in reverse direction is performed. The programming will be:  
 Positive flow rate action: Increase  
 Negative flow rate action: Null
- b) Installation in which for a time the product flows through the pipe to a tank, and after that a quantity of the product comes back in the opposite direction. The programming will be:  
 Positive flow rate action: Increase  
 Negative flow rate action: Decrease  
 The totalizer will indicate the volume of product that there is in the tank.
- b) Installation in which for a time a first product flows through the pipe, and after that a second product flows in the opposite direction. The programming will be:  
 Positive flow rate action: Increase  
 Negative flow rate action: Increase  
 The totalizer will indicate the volume corresponding to the sum of both products.

**Note:** To reset the totalizer, go to chapter 5 (page 27).

**7.8 Modbus**

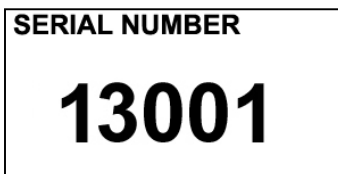
This option is only implemented in some devices.

It allows to configure the needed parameters to establish a Modbus RTU communication with the instrument.

Detailed information on this point could be found in the R-IT-MX4COM instructions manual, that can be downloaded from Tecfluid S.A. website.

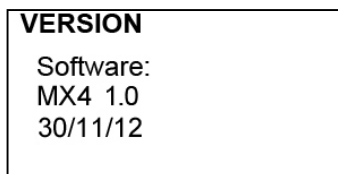
**8 SERIAL NUMBER**

In this section the converter serial number is shown.



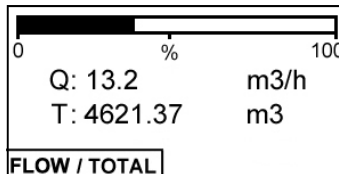
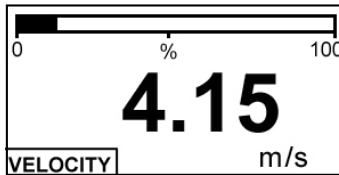
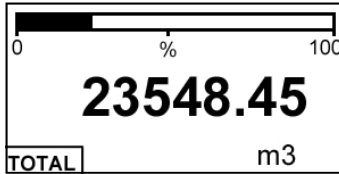
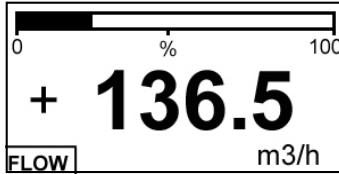
**9 SOFTWARE VERSION**

From the main menu, if "Software version" is selected, the screen will show this data and the corresponding date.



## 10. WORKING SCREEN

When exiting the menu, the display shows the default screen. To scroll between the three operating screens, press the key (Down / Left) or (Up).



## 11. MAINTENANCE

No special maintenance is required .

For cleaning, a humid cloth can be used, and if necessary with a little neutral soap. Solvents or other aggressive liquids which could damage the housing material should not be used.

### 11.1 Fuse

In the event that the fuse blows, this should be replaced with a slow blow "T" fuse, size Ø5 x 20 mm and value 250 mA.

## 12 ASSOCIATED SOFTWARE WINSMETER MX4

Most of the steps in the preceding paragraphs can be done by means of the device associated software Winsmeter MX4, which allows working in a more comfortable and intuitive way.

Such software can be downloaded from the following link of the Tecfluid S.A. website.

[www.tecfluid.com/descargas/winsmeterMX4.zip](http://www.tecfluid.com/descargas/winsmeterMX4.zip)

### 12.1 USB cable connection and drivers installation

Extract the files from the winsmeterMX4.zip to a new system folder.

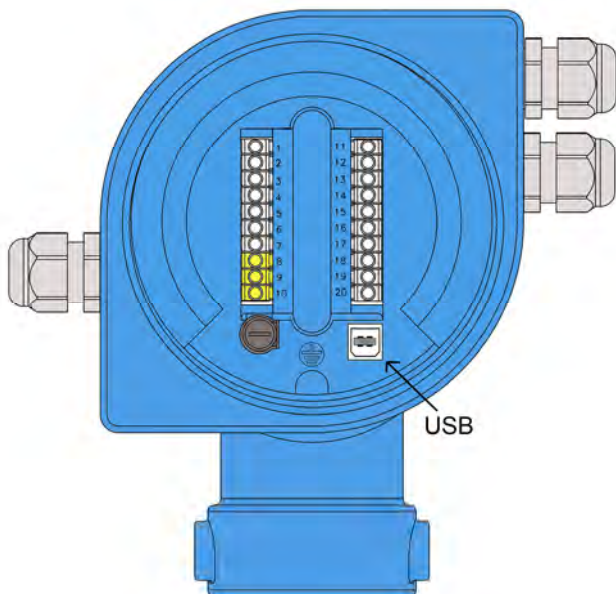
Execute the Setup.exe file and follow the steps for the installation.

In order to connect the converter to a computer an USB cable is required. This cable is type A at one end and type B at the other, and it is readily available on the market.



In the picture you can see the ends of the cables.

The first step to do the connection is to open the rear cover of the electronic converter.

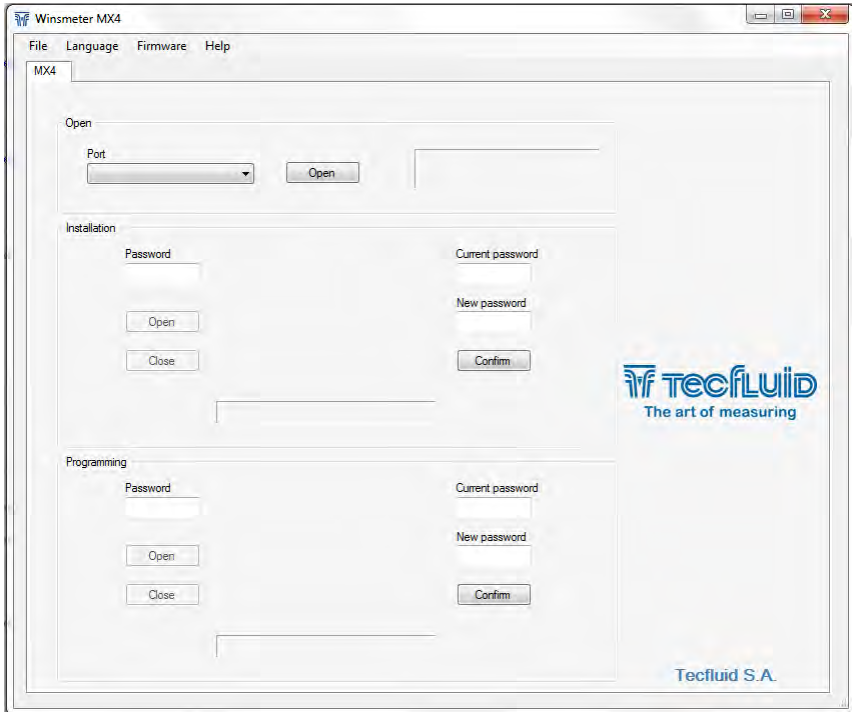


The USB connector is located below the right terminal strip (see figure on the previous page).

Connect the USB cable at one end to the converter and at the other to the computer where the software is installed.

Power on the electronic converter.

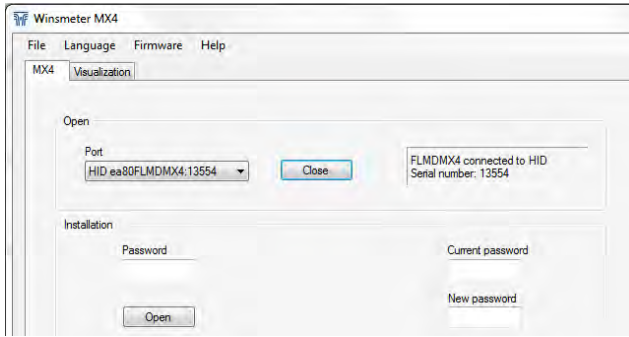
Execute the program WinsmeterMX4 following the sequence Start – Programs – Tecfluid S.A. - WinsmeterMX4.



## 12.2 Port connection

In the "Port" section, choose the appropriate port for the converter. This will appear with the name of the port followed by MX4 and its serial number. Then click "Open".

Once the port is open, the button "Open" in the "Installation" and "Programming" sections activates.

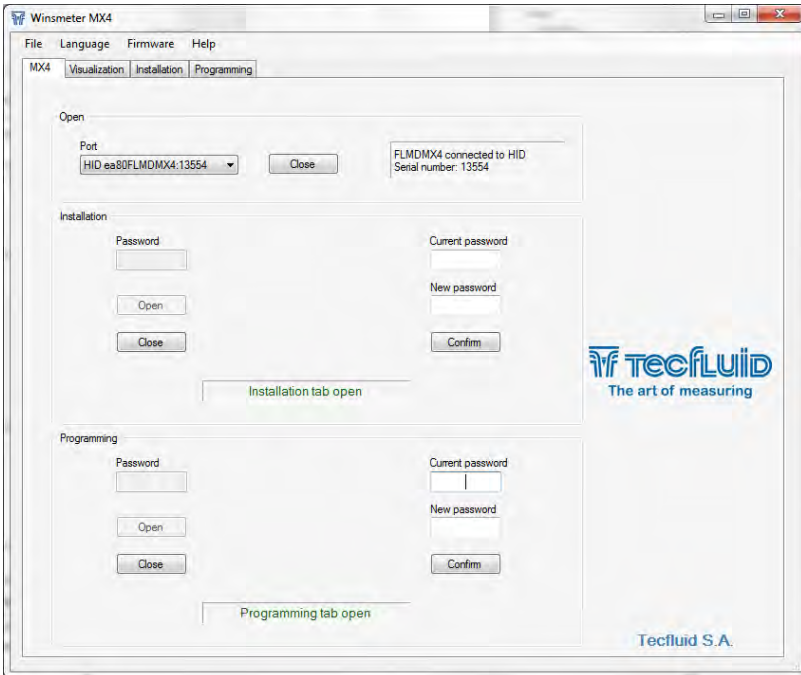


### 12.3 Access to installation and programming

In order to access the tab "Install", you must enter a password.

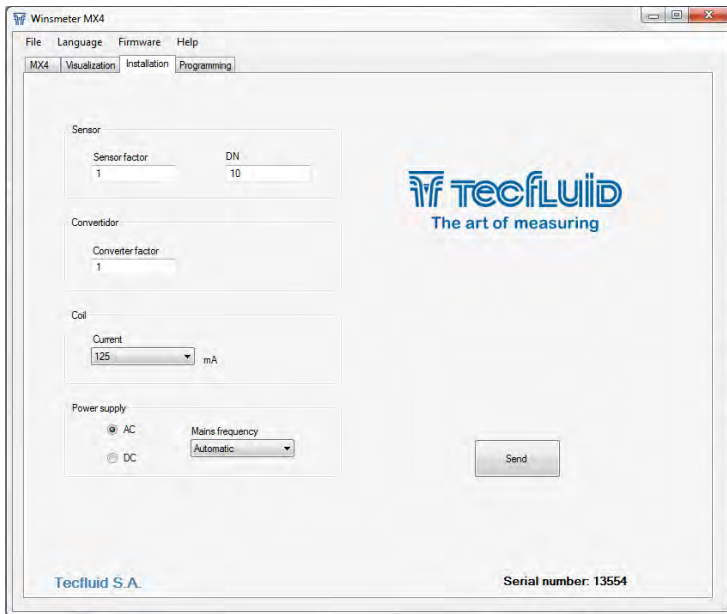
The default password is **install**, and it can be changed using the boxes on the right of the "Installation" section.

Likewise, to access the tab "Programming" it is necessary to enter the password which by default is **program**. This can be changed using the boxes on the right of the "Programming" section.



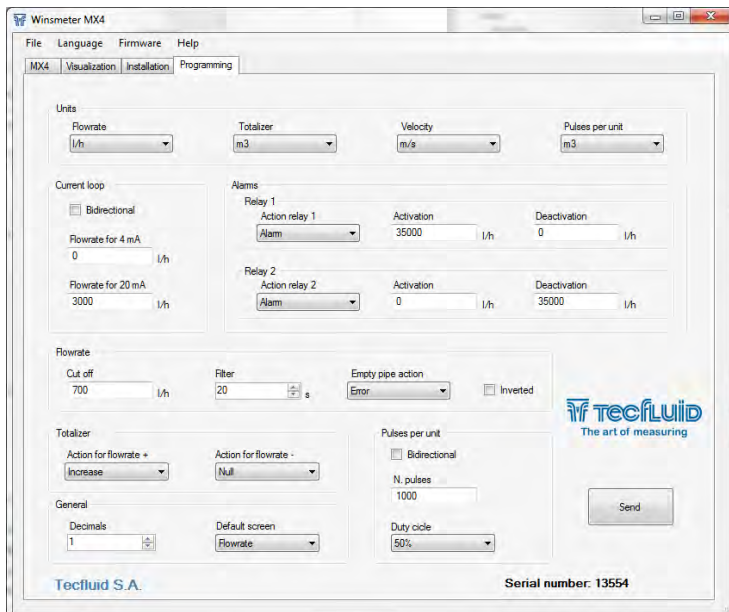
Once the password is written, press "Enter" or "Open", and the installation or programming tab will open. At the bottom of each section the text "Installation tab open" or "Programming tab open" will be displayed.

To enter the Installation window, just click the corresponding tab.



In the installation window the parameters that adapts the converter to a sensor and to a determined installation can be configured.

To transfer data to the MX4 converter, press the "Send" button. The message "Saving program" will appear for two seconds in the converter screen. The installation data will be stored in the memory of the converter.



12

Likewise, to enter into the programming window, just click the corresponding tab.

Changing the parameters of this screen, (see previous page) you can program the different functions of the equipment.

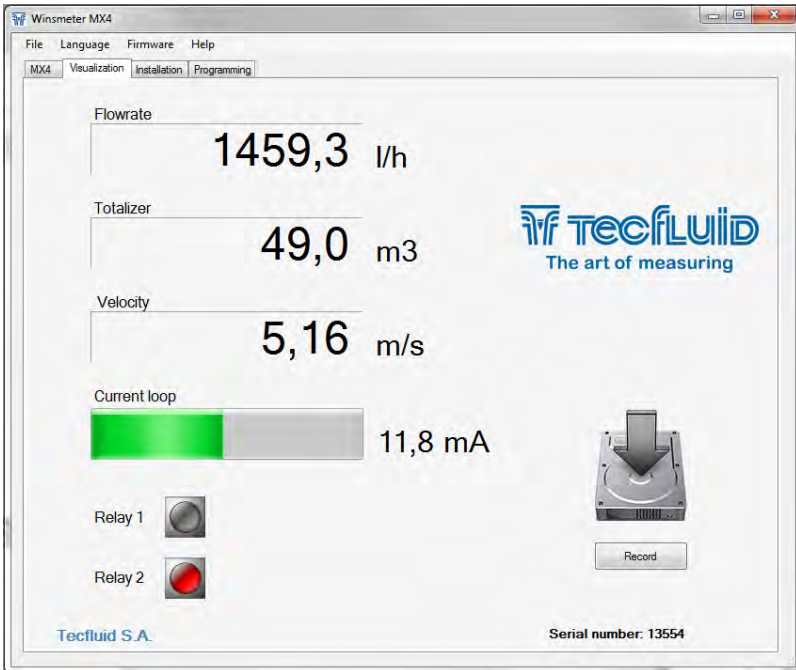
As in the previous paragraph, to program this data in the MX4 converter, press the "Send" button. The message "Saving program" will appear for two seconds in the converter screen. The programming data will be stored in the memory of the converter.

## 12.4 Visualization

When the communication with the computer port is established (see section 12.2), the tab "Visualization" opens. This tab lets you view real-time flow rate, totalizer and velocity values, as well as the current value of the analog output and the status of the relay outputs.

It is an intuitive tool to verify that the instrument has been installed and programmed correctly.

By means of the "Record" button, you can store data in different computer files, which can then be processed by other software.



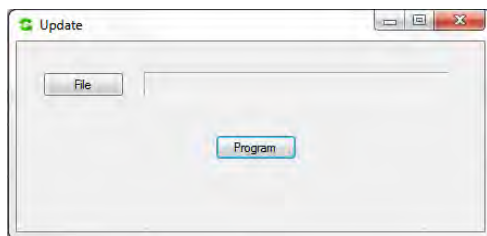


## 12.5 Firmware updates

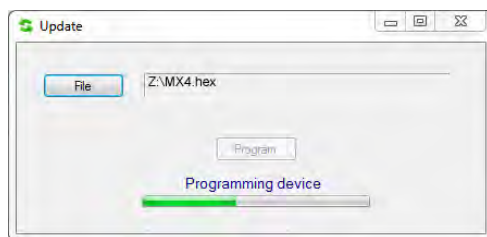
New firmware updates can be published in the website. These updates contain improvements or bug fixes that make the equipment operates at best conditions.

The updates can be downloaded from the following link of Tecfluid S.A. website [www.tecfluid.es/productos/descargas/software/MX4.hex](http://www.tecfluid.es/productos/descargas/software/MX4.hex)

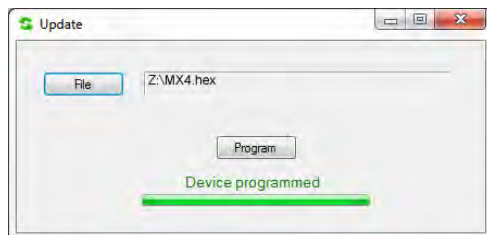
To update the equipment, go to menu “Firmware” - “Update”, and a screen with the button “File” will appear. Pressing this button system can be accessed. The downloaded file has to be searched there.



Once the file is selected, press the “Program” button. A message “Programming device” will appear.



The process takes about 90 seconds, after which the message “Device programmed” will appear.



From this moment, the converter MX4 already has the new version of Firmware.

### 13 TECHNICAL CHARACTERISTICS

**Accuracy**

$\pm 3,5\%$  reading value for  $v > 0,5$  m/s

$\frac{\pm 1,75}{v}$  % reading value for  $v < 0,5$  m/s  
 $v$  (m/s)

**Repeatability**

$\pm 0.1\%$  reading value

**Velocity range**

0.1 ...10 m/s

**Temperature**

Process temperature:  $-20$  °C ...  $120$  °C

Ambient temperature range:  $-20$  ...  $+60$  °C

**Minimum conductivity**

20  $\mu$ S/cm

**Power supply**

90 ... 265 VAC 50, 60 Hz

12 ... 48 VDC

Power consumption:  $\leq 5$  VA

**Analog output**

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

**Pulse output**

Optoisolated. NPN bipolar transistor.  $V_{max}$ : 30 VDC.  $I_{max}$ : 30 mA.

Maximum frequency : 5000 Hz

Minimum frequency : 0.01 Hz

**Relay outputs**

2 relay with potential free contacts.

Contact characteristics:

Maximum voltage : 250 VAC

Maximum current : 8 A

Maximum power : 500 VA

**Totalizer**

N. of digits: 8 (2 decimals)\*\*

Digit size: 8 mm

Reset: by means of keyboard

**Flow rate indication**

N° of digits: 5 (up to 2 decimals configurable)\*\*  
 Digit size: 11 mm

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

**Liquid velocity indication**

N° of digits: 5 (2 decimals)  
 Digit size: 11 mm

**General characteristics**

Sensor materials:

- External: Stainless steel or PVDF
- Head: PVDF
- Electrodes: Hastelloy, stainless steel, titanium, zirconium, tantalum

MX4 converter material: coated Aluminium

Ingress protection:

- Sensor: IP67
- MX4 converter: IP67

Maximum cable length (remote version) : 150 m

**Communication protocols (optional)**

- Modbus RTU
- HART

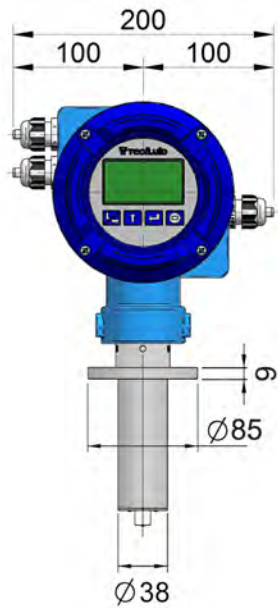
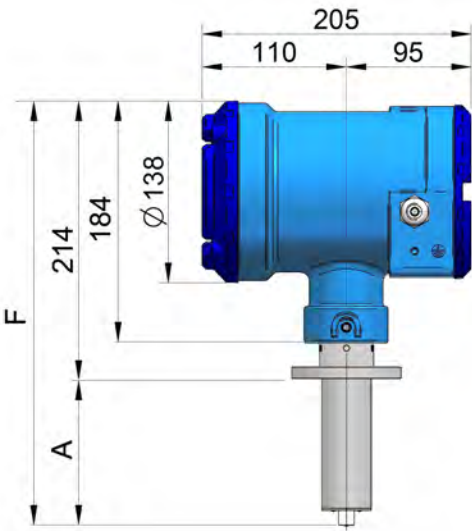
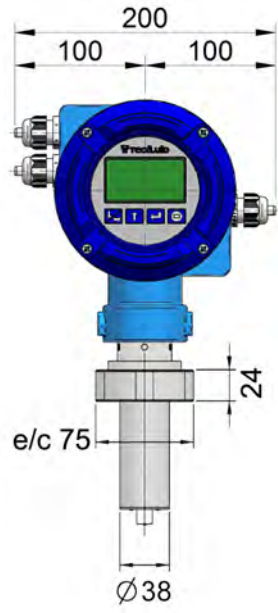
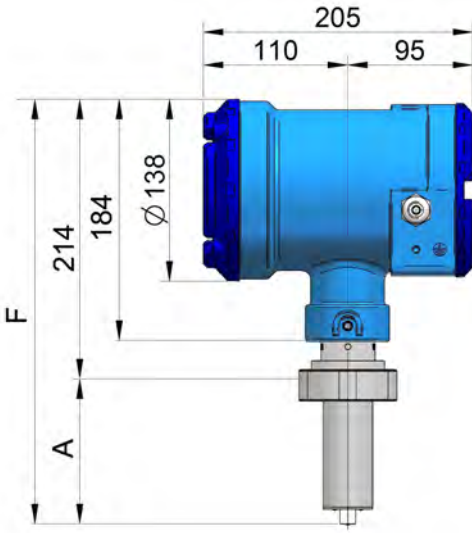
Detailed information on these protocols can be found in the R-IT-MX4COM instructions manual, that can be downloaded from Tecfluid S.A. website.

Conforms to Low voltage Directive 2006/95/CE  
 Conforms to Electromagnetic compatibility Directive 2004/108/CE  
 Conforms to Waste Electrical and Electronic Equipment Directive 2002/96/CE

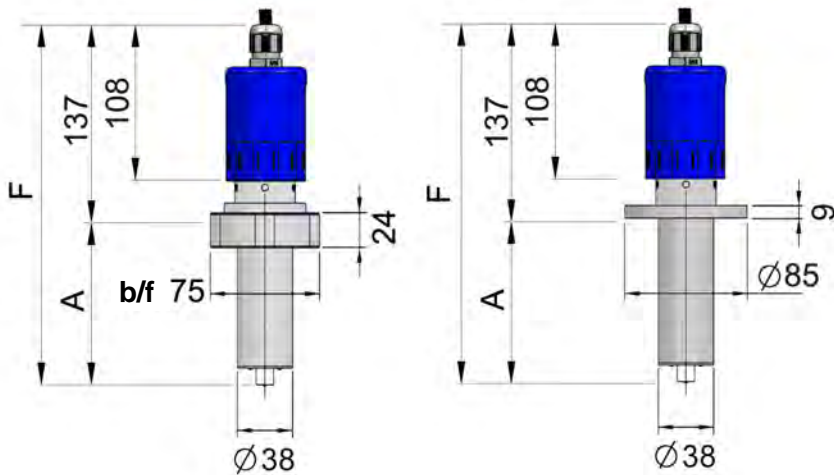


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14 DIMENSIONS



14



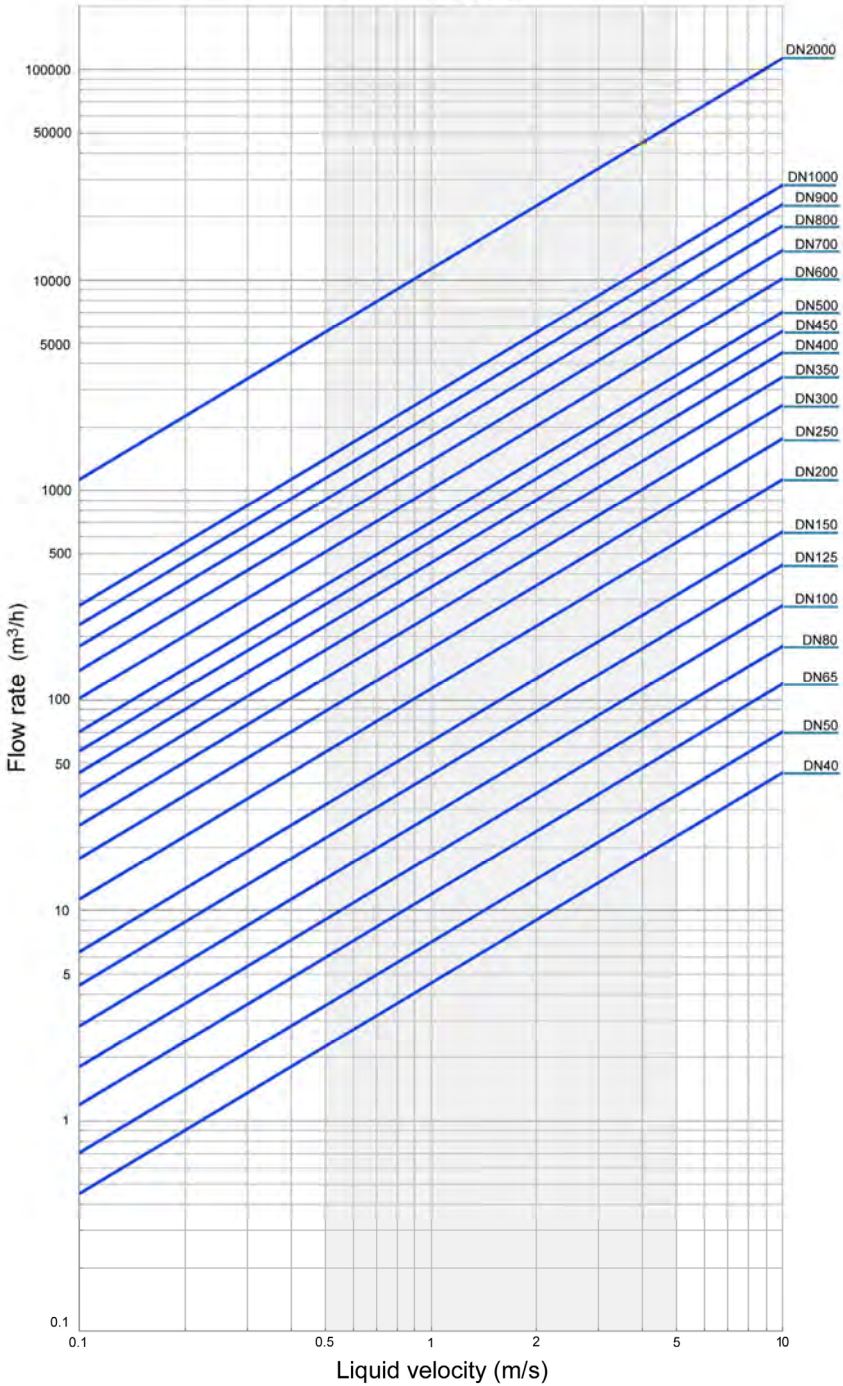
DN	A (sensor length)	F (compact sensor) <sup>1</sup>	F (remote sensor) <sup>1</sup>
40			
50		332 / 151	242
65			
80			
100			
125			
150			
200	105	332 / 289	242
250			
300			
350			
400			
500			
600			
700			
800	210	437 / 124	347
900			
1000			
1200			
1400			
1600	360	587 / 574	497
1800			
2000			

<sup>1</sup> F is the minimum length to remove the converter or the cable

## 15 TROUBLESHOOTING

Problem	Probable cause	Solution
The screen shows empty pipe	Pipe is empty	Make sure that the pipe is completely full, for example, installing the flowmeter in a vertical pipe with upwards flow
	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 36)
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 displayed flow rate is higher than expected	The electrodes are immersed but the pipe is not completely full	Make sure that the pipe is completely full, for example, installing the flowmeter in a vertical pipe with upwards flow
Display is blank	Blown 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 40)
The analog output gives always 0 mA	Cable disconnected	Check the cable connection

Flow rate diagram



## WARRANTY

Tecfluid S.A. guarantees 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](http://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.



TECFLUID, S.A. design and manufacture instrumentation for flow and level measurement using the most advanced techniques.  
May you need more information, please contact us.

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[www.tecfluid.com](http://www.tecfluid.com) - e-mail: [tecfluid@tecfluid.com](mailto:tecfluid@tecfluid.com)

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