Tecfluid s.a.
Instrumentation for fluids

Ultrasonic flowmeter CU100

Instruction manual

PREFACE

Thank you for choosing the flowmeter CU100 of Tecfluid S.A.

This instruction manual allows the installation and operation of the ultrasonic flow meter CU100. It is recommended to read it before using the equipment.

WARNINGS

- This document shall not be copied or disclosed in whole or in any part by any means, without the written permission of Tecfluid S.A.

- Tecfluid S.A. reserves the right to make changes as deemed necessary at any time and without notice, in order to improve the quality and safety, with no obligation to update this manual.

- 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.

- Do not modify the equipment without permission. Tecfluid S.A. is not responsible for any problems caused by a change not allowed. If you need to modify the equipment for any reason, please contact us in advance.

TABLE OF CONTENTS

1   INTRODUCTION

The CU100 flowmeter is an electronic device that is based on ultrasonic signal transmission through a pipe where a liquid is flowing. The working principle is called transit time. It consists of placing two ultrasound transducers on a pipe and sending an ultrasonic signal from the first to the second and then in reverse. The difference between the transmission and the reception time is proportional to the flow velocity in the pipe. An associated electronic circuit based on digital signal processing is responsible for converting the time difference in flow.

The device provides the following features:

- Non-invasive installation. The transducers are placed on the outside of the pipe to measure the flow.
- Current output proportional to the flow rate and user programmable.
- Relay outputs programmable by the user.
- Graphic display with intuitive menus.
- No maintenance required.

2   INSTALLATION OF THE ELECTRONIC CONVERTER

It is recommended to install the electronic converter on a wall near the point where the flow rate needs to be measured, never on pipes .

To do this, remove the lid and use the 5 mm diameter holes indicated in the figure to fix the converter to the wall.

2
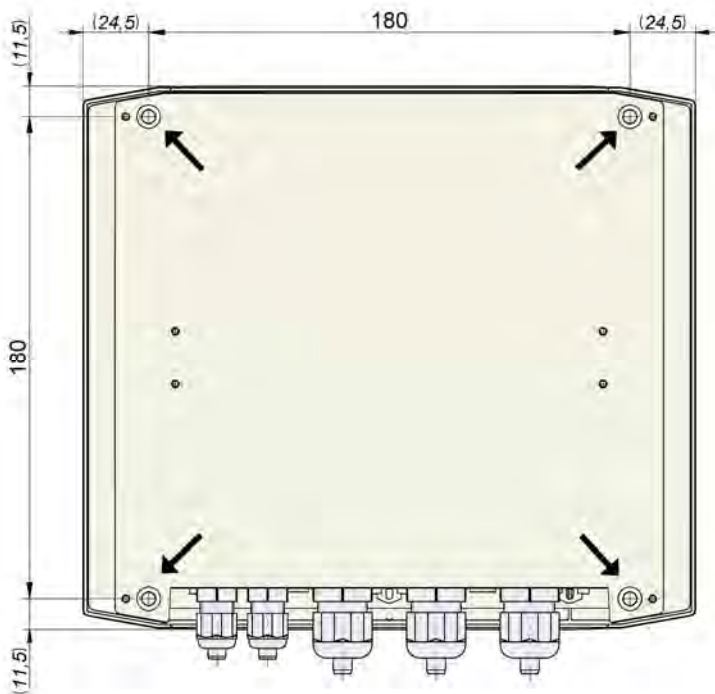
2.1   Electrical connection

For the electrical connection, the CU100 converter has four terminal strips. To help in the wiring of the equipment, the description of the terminals is marked on the printed circuit next to each terminal strip.

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^2 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 (see page 41 for more details).

To connect the cables, 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 smooth operation of the equipment, it is recommended to make the connection paying attention to the following points:

- Do not change or modify the junction cable between the transducers and the converter.
- It is recommended to pass the transducer cables through a metallic conduit. The two cables can go through the same conduit, but never together with other cables.
- For the output signals, use shielded cable when possible.
- Keep the cables away from strong sources of noise.

2.1.1   Power supply wiring

Before starting the installation of the instrument, check that the supply voltage available is the same as marked on the label of the converter.
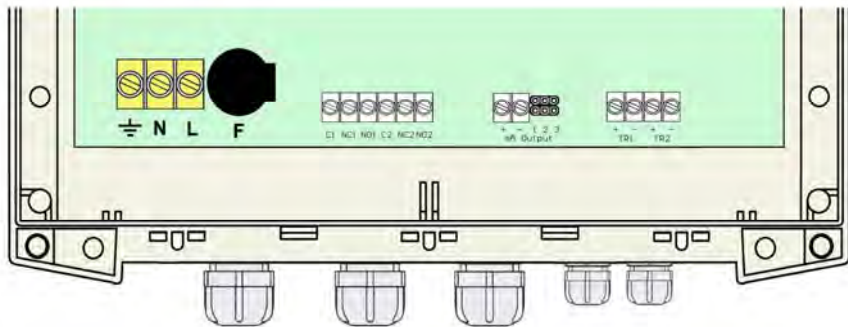
Terminal	Power supply
⏚	Earth
N	Neutral
L	Phase

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.

2.1.2   Relay output wiring
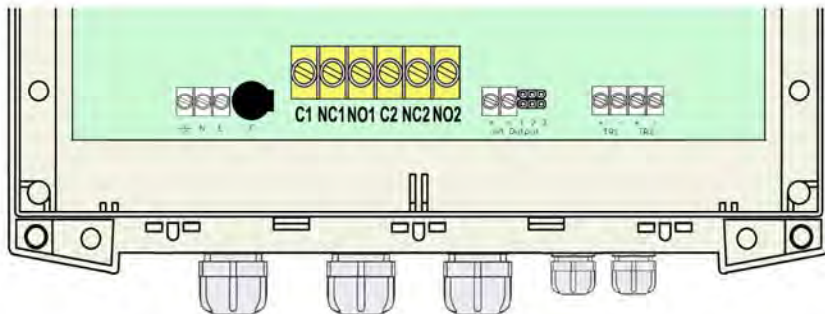
Terminal	Description	Relay
C1	Common	Relay 1
NC1	Normally Closed	Relay 1
NO1	Normally Open	Relay 1
C2	Common	Relay 2
NC2	Normally Closed	Relay 2
NO2	Normally Open	Relay 2

2

The relay outputs are SPDT relays with potential free contacts (see characteristics in page 40).

The state 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 contacts of the relays, it is recommended to use overvoltage protection (VDR for AC and diodes for DC loads). In all cases a fuse or some type of short circuit protection against short circuits, should always be provided according to the needs of the intended load.
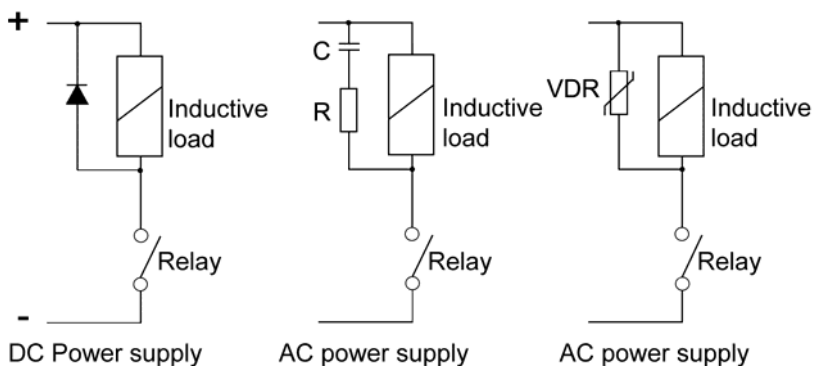
2.1.3 Analog output wiring

Passive mode: pins 2&3
Active mode: pins 1&2
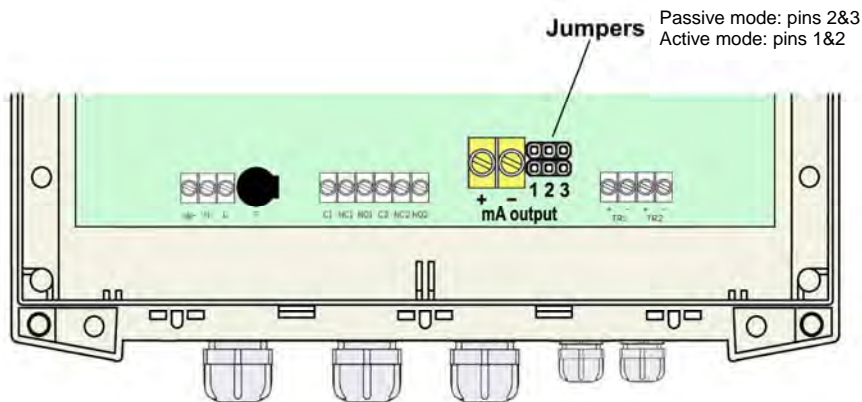
Terminal

+	mA (positive)
-	mA (negative)

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

To configure the analog output type (active or passive) there are two jumpers placed just behind the terminal strip. For the passive mode the jumpers must be situated between pins 2 and 3 and for active mode the jumpers must be between pins 1 and 2.

2

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.

2.1.4   Transducers wiring
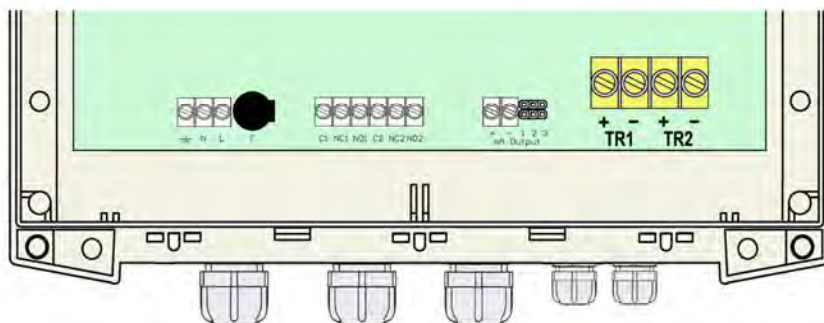
| Terminal	
TR1 +	Live (positive)
TR1 -	Shield (negative)
TR2 +	Live (positive)
TR2 -	Shield (negative)

The transducers are identified as TR1 and TR2. Be sure to connect the cable TR1 in the TR1 terminals in the circuit board and the cable TR2 in the TR2 terminals. The exchange of the transducers can result in a loss of precision of the values measured by the instrument.

Transducer cables are supplied with plastic indicators 1 and 2 to be connected to the transducers TR1 and TR2 respectively.

3 CONVERTER INTERFACE

The CU100 converter has a graphic LCD and a keyboard with 12 push buttons.

The keyboard has ten numeric keys to introduce the values of installation and programming. Two of these keys are used also as cursors, and finally there are two function keys.

3
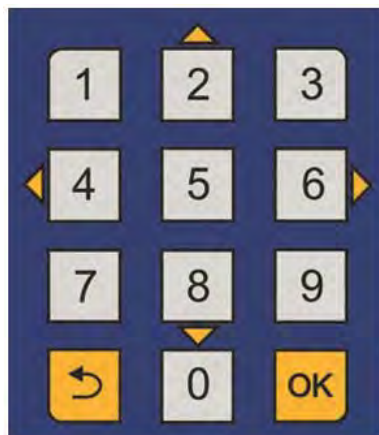
The following figure shows the functionality of the converter keys.

To switch between flow rate, totalizer and fluid velocity screens.
Into the menu, to scroll to the next higher item.

To switch between flow rate, totalizer and fluid velocity screens.
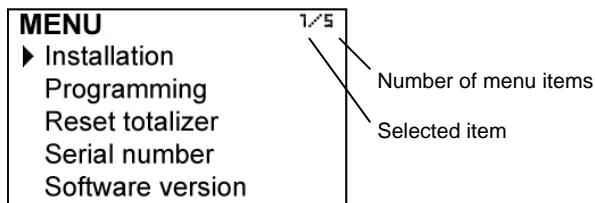Into the menu, to scroll to the next lower item.

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

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

4 MAIN MENU

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

```
MENU                1/5
▶ Installation
  Programming
  Reset totalizer
  Serial number
  Software version
```

Number of menu items

Selected item

4

The "Installation" option allows the installation of the transducers, as explained in Chapter 5 of this manual.

The "Programming" option allows to program all parameters of the converter, as explained in Chapter 6 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.

The options "Software Version" and "Serial Number" are informative and are discussed in Chapters 7 and 8 of this manual.

4.1 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".

```
INSTALLATION      11/11
  Language
  Transducer
  Units
  Pipe
  Liquid
  Paths
  Installation
  Signal power
  Distance
  Programs
▶ Password
```

```
PROGRAMMING       10/10
  Language
  Units
  Decimals
  Flow rate
  Outputs
  Default screen
  Totalizer
  Backlight
  Programs
▶ Password
```
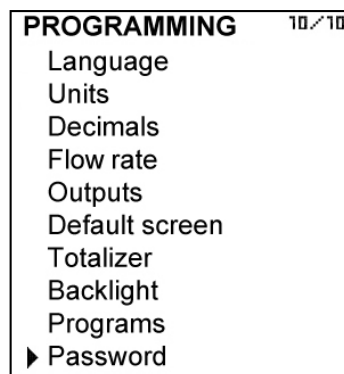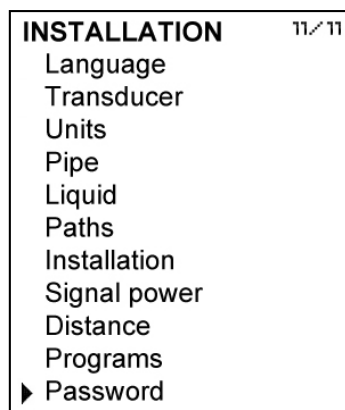
When the "Password" option is selected, a screen to enter the new password appears.

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 message is displayed:

INFORMATION

Password changed

Press any key

4

5   TRANSDUCERS INSTALLATION

Make sure that the surface of the pipe where the transducers will be installed is clean and free of oxides or other dirt.

If possible, always install the transducers on a rising pipe, to ensure that it is always full of liquid.

If the installation of the transducers is in a horizontal section, they should not be placed in the top of the pipe, but in the area indicated in the figure below:

5
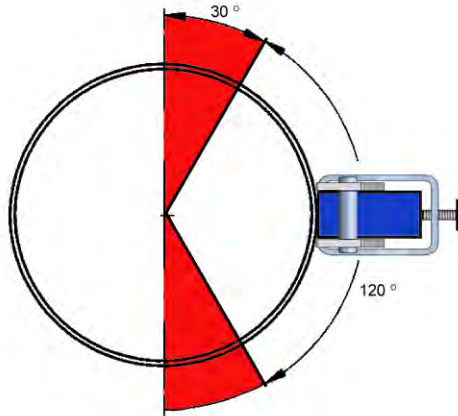
5.1   Straight pipe run requirement

In order to obtain the maximum reading stability and accuracy, the point where the transducers will be installed must meet some requirements regarding the straight pipe sections before and after this point.

If the element that can disturb the flow profile is a fitting such as a flange, the straight pipe section before and after the transducers should be minimum 5 x DN.
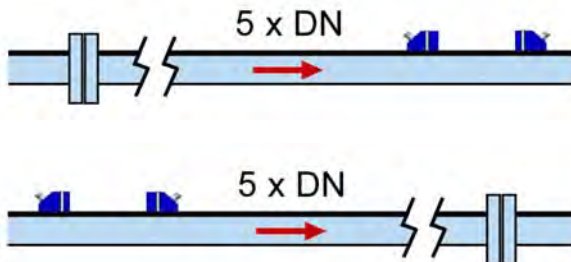
Some plant elements such as pumps, valves, etc., can create turbulences that distort the flow profile resulting in incorrect measurements. In this case, the distances of straight pipe without disturbing elements before and after the transducers can be higher, as shown in the following pages:

13

Disturbing element before the transducers	Minimum distance between the first transducer and the element
90º elbow	10 x DN
90º double elbow in one plane	25 x DN
90º double elbow in different planes	40 x DN
Tee	50 x DN
Reducer	10 x DN
Diffuser	30 x DN
Pump	50 x DN
Valve	40 x DN
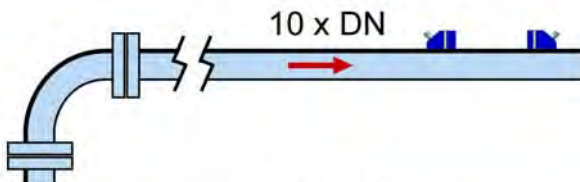
5
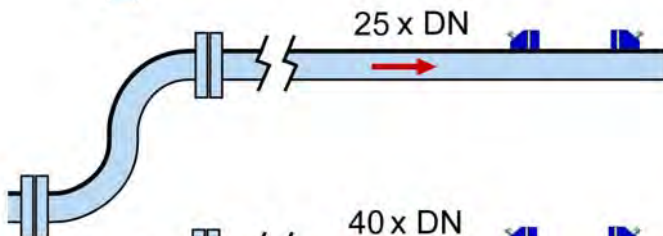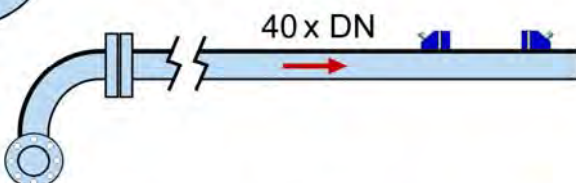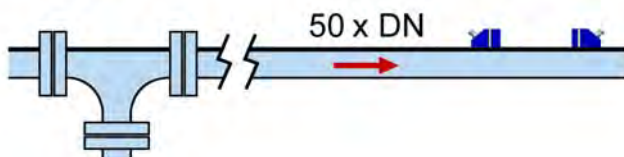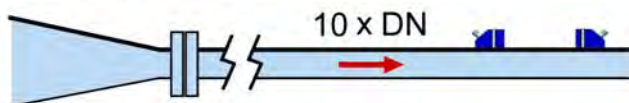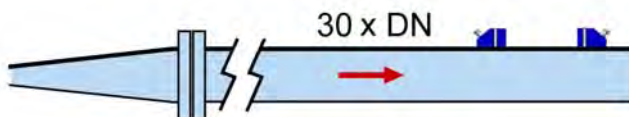
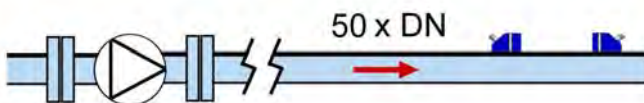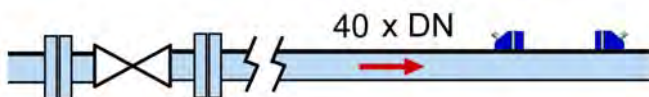| Disturbing element after the transducers	Minimum distance between the second transducer and the ele-
90º Elbow	5 x DN
90º double elbow in one plane	5 x DN
90º double elbow in different planes	5 x DN
Tee	10 x DN
Diffuser	5 x DN
Reducer	5 x DN
Valve	10 x DN

5
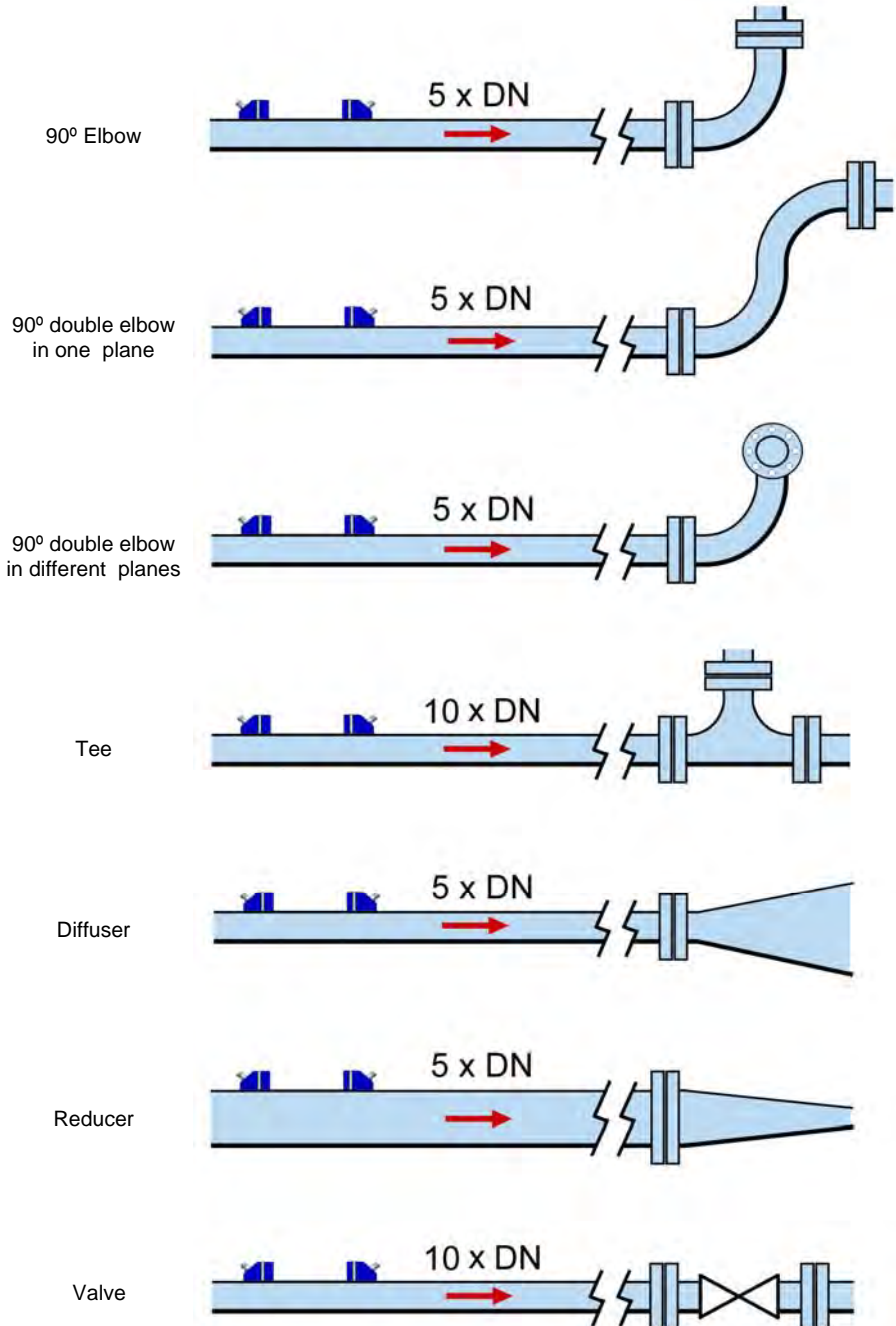
5.2   Installation with the alignment guide

It is convenient to use the alignment guide (normally supplied for pipes from DN80 to DN350), to guarantee that the transducers are perfectly aligned.

In case that the guide is not required or it is not supplied, the transducers can be installed directly with the supplied straps (see paragraph 5.12 page 22).

5.2.1   Straps preparation

Pass the free end of the strap through the two slots of one end of the guide.
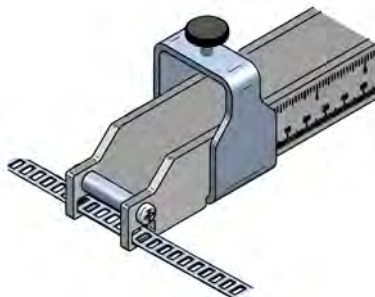
Place the strap encircling the pipe, positioning the free end over the hooks and below the screw. Snap the hooks on the tightest position possible. Tighten the connection with a screwdriver until the guide is fixed rigidly, with no possible movement due to vibrations.

Proceed in the same way for the second strap.

5.3   Fastening of the transducers

In order to fix the transducers it is necessary to calculate de optimum separation distance between them. This distance depends on some parameters of the pipe and the liquid that flows through it. The calculation of the separation between the transducers needs to enter the following parameters.

Turn on the electronic converter. It is not necessary that the transducers are installed.

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

With the keys (2) and (8), select "Installation", and then validate with the key (OK).
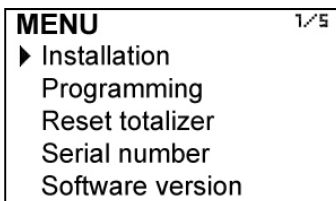
In order to access to the transducers installation menu, a password must be entered. When accessing the first time, the default password is 0123. For more details about the password, see paragraph 4.1, page 11.

PASSWORD

Min: 0   Max: 9999

0000

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

5.4   Entering the installation parameters

INSTALLATION   1/11
▶ Language
   Transducer
   Units
   Pipe
   Liquid
   Paths
   Installation
   Signal power
   Distance
   Programs
   Password

5

5.5   Language

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

LANGUAGE   2/4
   Catalan
▶ Spanish
   French
   English

5.6   Transducer

You can choose the transducer model used in the installation.

TRANSDUCER   1/1
▶ TR1MP

17

5

5.7 Units

User can choose between metric and imperial units.

```
UNITS                    1/2
▶ Metric
  Imperial
```

5.8 Pipe parameters

It is necessary to know some data such as materials, thicknesses, etc., so that the flowmeter can perform the necessary calculations to obtain the flow rate accurately.

```
PIPE                     1/5
▶ Outer diameter
  Pipe material
  Pipe thickness
  Lining material
  Lining thickness
```

First, the outer diameter of the pipe must be entered.

5.8.1 Outer diameter

```
O. DIAMETER
Min: 0           Max: 6000
 0154 mm
```

The outer diameter value must always be entered in millimetres.

If this parameter is not known, it can be calculated by measuring the circumference or perimeter of the pipe.
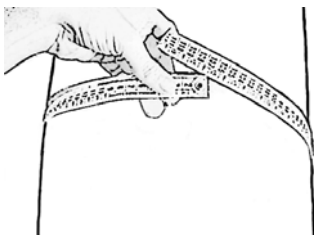
$$\text{Pipe diameter (mm)} = \frac{\text{Pipe perimeter (mm)}}{3,14}$$

5.8.2   Pipe material

For the programming of the CU100 ultrasonic flowmeter, a list with several common pipe materials is available. For each material the flowmeter has the necessary data to perform a good measurement.

```
PIPE MAT.                    1/15
▶ Aluminium
  Brass
  Bronze
  Cast iron
  Copper
  Ductil cast iron
  Glass
       .
       .
       .
       .
  Another material
```

In the event that the pipe material is not on the list, you must select "Another material", in the last position in the list. In this case, the sound propagation velocity of the material must be entered.

```
VELOCITY
Min: 0            Max: 4000.0

3206.0 m/s
```

5.8.3   Pipe thickness

It is usually indicated on the pipe.

```
PIPE THICKNESS
Min: 0            Max: 20.00

02.00  mm
```

5.8.4   Lining material

If the pipe has an internal lining, in this screen the lining material can be selected. In the same way as in paragraph 5.8.2, if the material is not in the list, "Another material" must be selected and the sound propagation velocity of the material must be entered.

In the event that the pipe does not have any internal lining, select "None".

5

```
LINING MAT.        1/12
▶ None
  Bitumen
  Fiber glass
  Glass
  PE
  Plastic
  PTFE
  PVC
  Rubber
  Porcelain
  Titanium
  Another material
```

5.8.5 Lining thickness

If the pipe has an internal lining, its thickness should be entered, in the same way as in the pipe thickness.

```
LINING THICK.
Min: 0          Max: 20.00
  ❪0❫0.00 mm
```

5.9 Liquid

The liquid that flows through the pipe should be selected.

```
LIQUID             1/37
▶ Water 0º
  Water 10º
  Water 20º
       .
       .
  Acetone
  Alcohol
  Ammonia
       .
       .
```

If the liquid is not in the list, "Another liquid" must be selected. In this case, it is necessary to enter the sound propagation velocity of the liquid.

5.10   Paths

The number of paths is given by the transducer installation method.

For pipe diameters up to 350 mm, V mode is recommended. This mode ensures that the propagation path of the ultrasonic wave is long enough so that the instrument can successfully perform the measurement. V mode consists of placing the transducers aligned on the pipe. The propagated signal is reflected in the central point on the opposite side of the pipe.

5
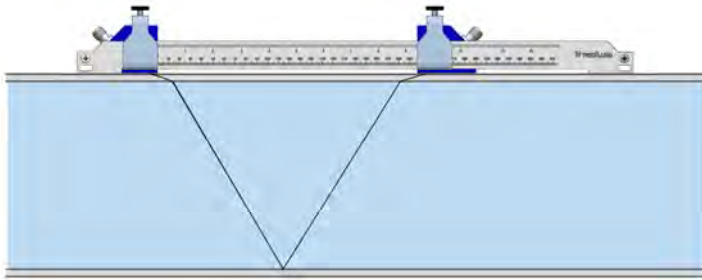
V mode

For pipe diameters bigger than 350 mm, Z mode is recommended, which consists of placing the transducers on opposite sides of the pipe. The signal is propagated directly from one transducer to the other.
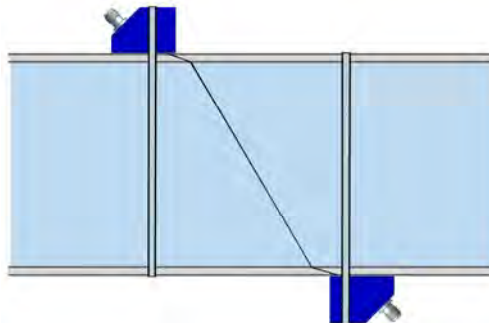
Z mode

Depending on the pipe material and the process fluid, the selection of transducer placement mode (V or Z) according to pipe size may be different than above indicated.

5.11   Installation and distance between the transducers

This screen shows the theoretical distance (Dt) at which the transducers should be placed to work in the best conditions. The practical distance (Dp) is explained in the paragraph 5.14.
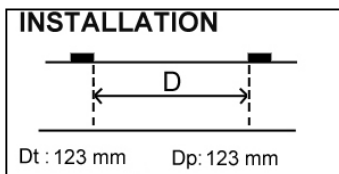
To place the transducers it is essential to apply a layer of ultrasound gel at its base. This gel is supplied with the equipment.

5.12   Fixing the transducers

The transducers should be placed so that the liquid flows from TR1 to TR2, in order that when the liquid flows in the usual direction, the displayed flow rate has a positive sign.
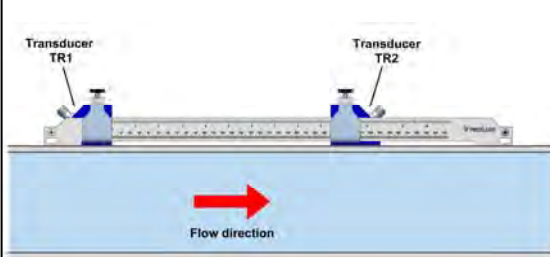
V mode
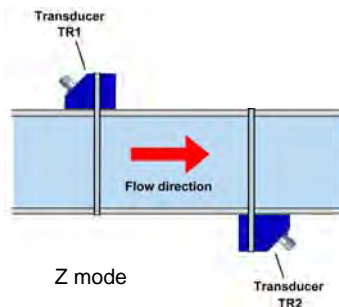
Z mode

It is recommended to fix initially only one of the transducers since in general there are small differences between the theoretical and the optimal distance. The fine adjustment of the position of the second transducer is done by using the option "Signal Strength" of the menu (see paragraph 5.13 page 24).

In case the installation is made by means of the alignment guide, it is recommended to place the transducer TR1 with the gel at the end of the guide so that its inner side matches the zero point of the ruler.

Transducer   Inner side   Fastening "U"

22
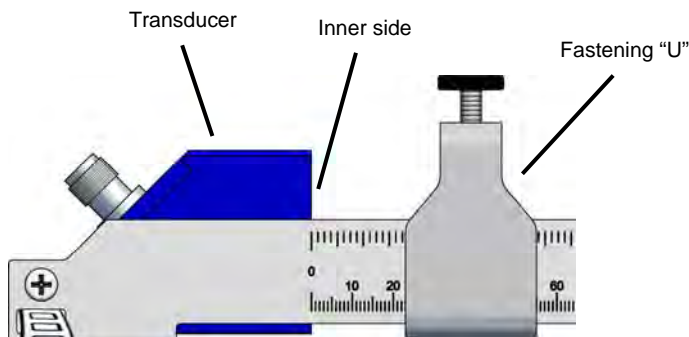
After placing the transducer, move the fastening "U" to it until the knurled screw matches the transducer top notch.
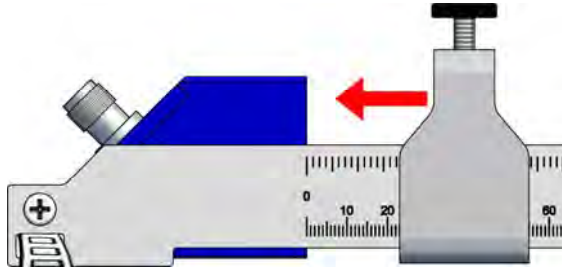
Once in this position, tighten the screw until the transducer is pressed against the pipe.

5
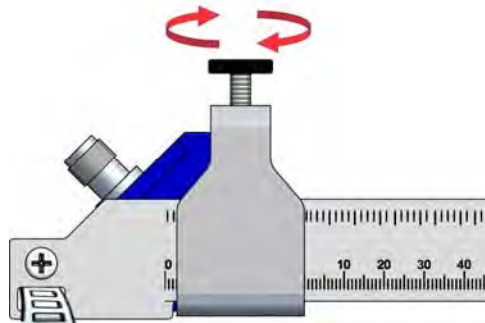
If the alignment guide is not available, place the strap around the pipe and tighten it so that it holds the transducer.

Place the transducer cables by screwing the connectors, and taking into account that the cable TR1 must be connected to transducer TR1 and the cable TR2 to the transducer TR2.

5.13   Signal strength

This screen allows to perform a fine adjustment of the position of the second transducer.

To do so, the second transducer must be moved to find the point where the signal level indicated on the display is maximum.
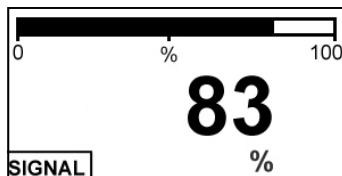
Once this point is found, fix the second transducer in the same way as done with the first one in the paragraph 5.12.

5.14   Distance
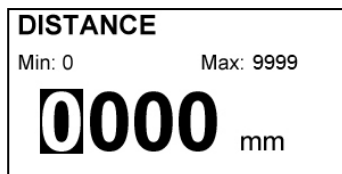
If the transducers have been placed by means of the fine adjustment of signal strength (paragraph 5.13), it is necessary to enter the practical distance at which the transducers have been placed. This distance will be shown on the installation screen (see paragraph 5.11) as Dp.

If the fine adjustment has not been done it is not necessary to go into this screen. Simply fix the second transducer as indicated in paragraph 5.12.

Once this step is done, exit the installation menu by pressing (Return) to go to operation screen.

5.15   Programs

It allows to save a device programming, and retrieve it.
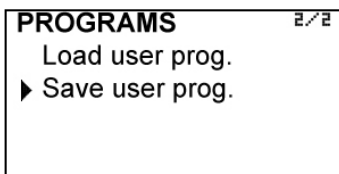
If at any time you want all the transducer installation data to be stored in memory as backup, it can be done by selecting "Save user prog. ".

To restore these data, just select "Load user prog. ".

6   CONVERTER PROGRAMMING

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

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

```
MENU                    1/5
▶ Installation
  Programming
  Reset totalizer
  Serial number
  Software version
```
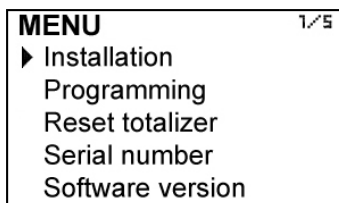
With the keys (2) and (8), select Programming, and then validate with the key (OK). To access the programming of the converter, you must enter the password. At first access, the default password is 0123. For more details about the password, see paragraph 4.1, page 11.

```
PASSWORD
Min: 0            Max: 9999
0000
```

6

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

```
PROGRAMMING        1/10
▶ Language
  Units
  Decimals
  Flow rate
  Outputs
  Default screen
  Totalizer
  Backlight
  Programs
  Password
```
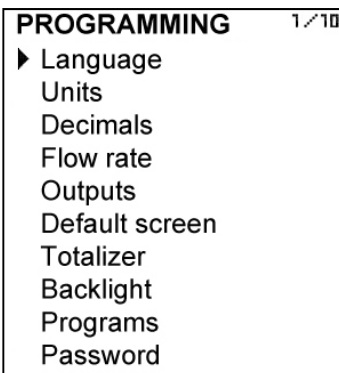
6.1   Language

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

```
LANGUAGE           2/4
  Catalan
▶ Spanish
  French
  English
```
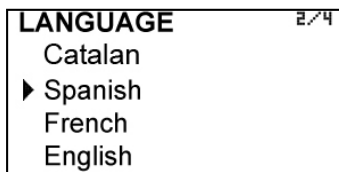
6.2 Units

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

```
UNITS                2/3
   Velocity
 ▶ Flowrate
   Totalizer
```

```
FLOW          2/9
   l/h
 ▶ l/min
   l/s
   m3/h
   m3/min
   m3/s
   gal/h
   gal/min
   gal/s
```

```
VELOCITY         2/2
   m/s
 ▶ ft/s
```

```
TOTAL            2/3
   gal
 ▶ l
   m3
```

Note: Unit gal refers to US gallons.

6.3 Decimals

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

```
DECIMALS         2/3
   0
 ▶ 1
   2
```

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.

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).

6.4 Flow rate

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

```
FLOW                    2/4
   Cut off
 ▸ Reversal
   Filter
   Offset
```
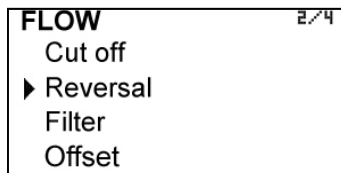
6.4.1 Cut off

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.

```
CUT OFF
Min: 0              Max: 63.61

10.00          m3/h
```

6.4.2 Reverse flow rate

The CU100 is a bi-directional flowmeter. The flow rate changes its sign automatically when the flow is reversed. If after the flowmeter has been installed it is necessary to reverse the flow rate sign, in this screen it can be done selecting the option "REVERSAL–Yes".

```
REVERSAL                1/2
 ▸ No
   Yes
```
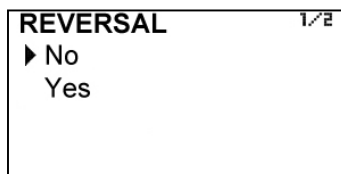
6.4.3 Damping

The CU100 flowmeter 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…).

```
FILTER
Min: 0              Max: 100

10          s
```

27
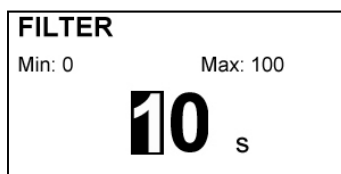
Only the flow rate indication of the display and the analog output are affected by the filter. The relay output and the totalizer act according to the instant flow rate. Selecting a filter with a longer or shorter integration time will provide more or less stable readings and will also affect the response 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 100 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 established limits, the filter will stop acting, indicating the instant value, and will start again the filtering process.

6.4.4 Offset

In order to obtain a perfect linearization of the instrument, in some cases it is recommended to make an adjustment of the zero offset.

To do the adjustment, the flow rate must be zero, that is, the liquid inside the pipe where the transducers are installed should be completely stopped.

6

Once "Yes" is selected, the following informative screen is displayed:

⚠ **IMPORTANT:** The flowmeter is already delivered with a zero offset adjusted. Do not make a new adjustment if not necessary. If the adjustment is not done properly, measurement errors may occur.

6.5 Outputs

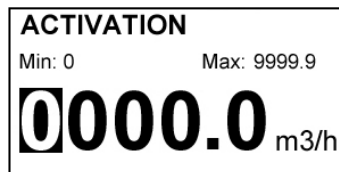This screen allows to program the three outputs of the instrument: Relay 1, Relay 2 and analog output (4-20 mA).

6.5.1 Relay 1 and relay 2

When selecting one of these screens we have access to program the flow rate at which the relays will change its state and to the level of hysteresis. By level of hysteresis we understand the difference between connection and disconnection of the output. To avoid that an alarm output is continuously moving from activate to deactivate state, we must program the points of connection and disconnection.

```
RELAY 1                1/2
▶ Activation
  Deactivation
```

```
ACTIVATION
Min: 0              Max: 9999.9

0000.0 m3/h
```
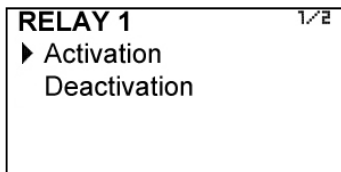
Example

If the activation point is programmed to 100 m3/h and the deactivation point is programmed to 90 m3/h, when the flow rate is zero the output will be off. When the flow rate reaches a value of 100 m3/h the output will go on and it will not go off until the level falls below 90 m3/h.

If we program an activation point of 90 m3/h and a deactivation point of 100 m3/h, when the level is zero the output will be on. When the flow rate reaches a value of 100 m3/h the output will go off and it will not go on until the flow rate falls below 90 m3/h.

6.5.2 Analog output

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

```
4-20 mA               2/5
  Configuration
▶ Flow rate 4 mA
  Flow rate 20 mA
  Calibration 4 mA
  Calibration 20 mA
```
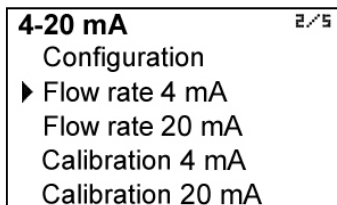
6.5.3 Configuration

It allows to choose between unidirectional and bidirectional.

```
CONFIGURATION         1/2
▶ Unidirectional
  Bidirectional
```
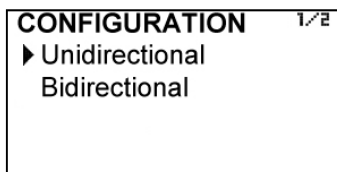
If "Unidirectional" is chosen, the analog output will have a value proportional to the flow rate when positive, and it will provide always 4 mA when negative.

If "Bidirectional" is chosen, the analog output will have a value proportional to the flow rate whether it is positive or negative.

6

6.5.4 Programming of the 4-20 mA output

Flow rate values equivalent to each current are entered directly.

```
┌─────────────────────────┐   ┌─────────────────────────┐
│ 4 mA                    │   │ 20 mA                   │
│ Min: 0      Max: 9999.9 │   │ Min: 0      Max: 9999.9 │
│ [0]050.0 m3/h           │   │ [0]500.0 m3/h           │
└─────────────────────────┘   └─────────────────────────┘
```

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.

6.5.5 Current calibration for 4 and 20 mA

The converter CU100 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 don't coincide with the ammeter used, it can be done by pressing the keys (2) and (8) 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 CU100 will take the current value shown on the ammeter as a reference.

```
┌─────────────────────────┐   ┌─────────────────────────┐
│ CAL.  4 mA              │   │ CAL.  20 mA             │
│   ▲                     │   │   ▲                     │
│   ▼  131                │   │   ▼  3540               │
└─────────────────────────┘   └─────────────────────────┘
```
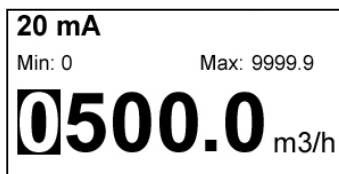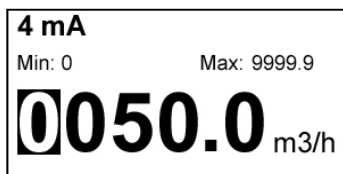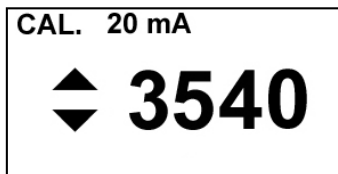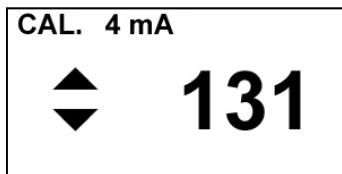
⚠ Before doing a current calibration, be sure that the ammeter used for that is showing the real measure.

6.6 Default screen

Flow rate, totalizer or liquid velocity 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.

```
┌─────────────────────────┐
│ SCREEN             1/3  │
│ ▶ Flow rate            │
│   Totalizer            │
│   Velocity             │
└─────────────────────────┘
```
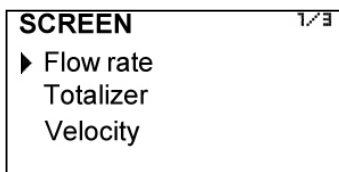
6.7 Totalizer

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 instrument is installed.

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

```
TOTALIZER            1/2
▶ Positive flow rate
  Negative flow rate
```

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:

```
ACTION               1/3
▶ Null
  Increase
  Decrease
```

6

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 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 the two products.

6.8 Backlight

This screen allows to select how long it will takes the backlight to turn off from the moment you release a key.

```
DISCONNECT        2/4
  Never
▸ 5 min
  10 min
  15 min
```
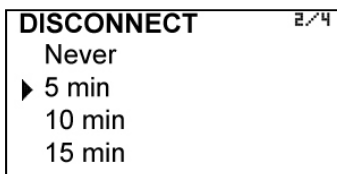
6.9 Programs

It allows to save the device programming, retrieve it or load a default configuration.
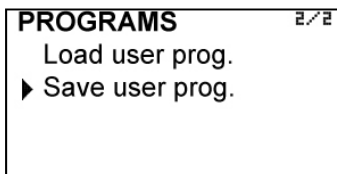
```
PROGRAMS          2/2
  Load user prog.
▸ Save user prog.
```

If at any time you want all the transducer installation data to be stored in memory as backup, it can be done by selecting "Save user prog.".

To restore these data, just select "Load user prog. ".

7 SOFTWARE VERSION

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

```
VERSION

  Software:
  CU100.S00
  20/01/10
```
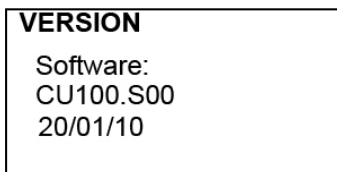
8 SERIAL NUMBER

In this section the converter serial number is shown.

```
SERIAL NUMBER

  11001
```

9   DEFAULT SCREEN

When exiting the menu, the display shows the default screen. To scroll between the three operating screens, press the key (2) or (8).

```
┌──────────────────────────────┐
│ ▓▓▓▓▓░░░░░░░░░░░░░░░░░░░░░     │
│ 0           %           100   │
│                               │
│  +  136.5                     │
│                               │
│ ┌─────────┐                   │
│ │FLOWRATE │         m3/h      │
│ └─────────┘                   │
└──────────────────────────────┘
```

```
┌──────────────────────────────┐
│ ▓▓▓▓▓░░░░░░░░░░░░░░░░░░░░░     │
│ 0           %           100   │
│                               │
│    23548.45                   │
│                               │
│ ┌──────┐                      │
│ │TOTAL │            m3        │
│ └──────┘                      │
└──────────────────────────────┘
```

```
┌──────────────────────────────┐
│ ▓▓▓░░░░░░░░░░░░░░░░░░░░░░░     │
│ 0           %           100   │
│                               │
│      4.15                     │
│                               │
│ ┌─────────┐                   │
│ │VELOCITY │         m/s       │
│ └─────────┘                   │
└──────────────────────────────┘
```
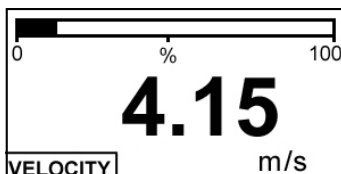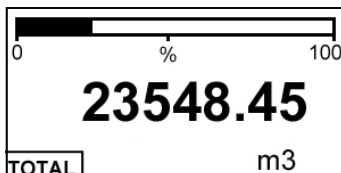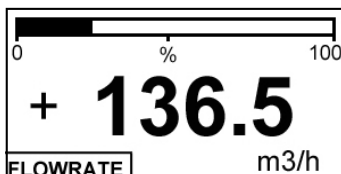
If the device detects no signal at the transducers, because the attenuation is very high, or due to a bad connection or broken cable, the operating display appears as an informative screen indicating this situation.

```
┌──────────────────────────────┐
│ INFORMATION                   │
│   No signal from              │
│   the transducers             │
│   Check the installation      │
│                               │
└──────────────────────────────┘
```

10   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.

10.1   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.

11   ASSOCIATED SOFTWARE WINSMETER CU

Most of the steps in the preceding paragraphs can be done by means of the device associated software Winsmeter CU, 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/downloads/winsmeterCU.zip.

11.1   USB cable connection and drivers installation
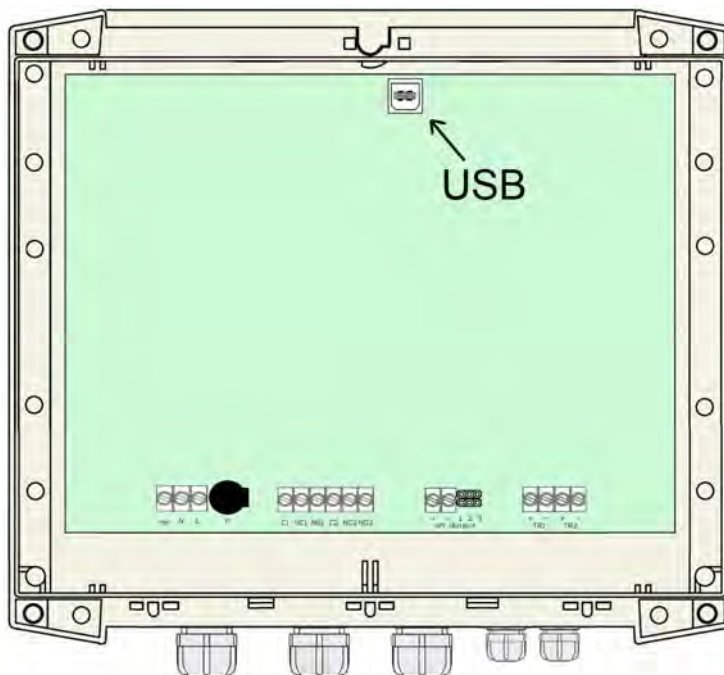
Extract the files from the winsmeterCU.zip to a new system folder.

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 lid of the electronic converter.

34

To open the lid, remove the four screws. The USB connector is located on the opposite side of the cable entry glands.

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

Turn on the electronic converter.

Windows XP:

"Found New Hardware Wizard" appears, with the following question:

Can Windows connect to Windows Update to search for software?

If you have Internet access, answer "Yes, this time only".

If you do not have Internet access, answer "No, not this time".

If you answered "yes", drivers will be installed automatically. Otherwise, finish the wizard and then run the file "Drivers_Winsmeter_Setup.exe". The will guide you until the drivers are installed.

Windows 7

If you have Internet access, a message reporting that the drivers have been installed will appear.

If you do not have Internet access, a message reporting that the drivers can not be installed will appear. In this case, run the file "Drivers_Winsmeter_Setup.exe". The program will guide you through the installation process until the drivers are installed.
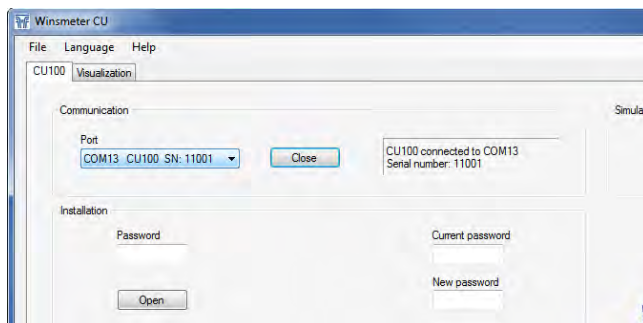
Once the computer has the drivers installed, run the WinsmeterCU.exe. The following screen appears.

11
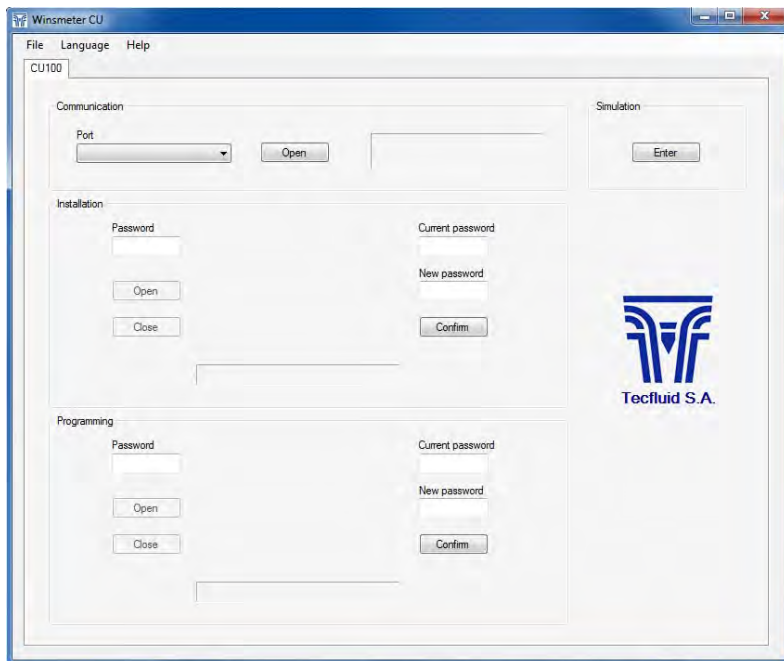
11.2   Port connection

In the "Port" section, choose the appropriate port for the converter. This will appear with the name of the port followed by CU100 and its serial number. Then click "Open".

Once the port is open, the button "Open" in the "Installation" section activates.

11.3   Access to installation and programming
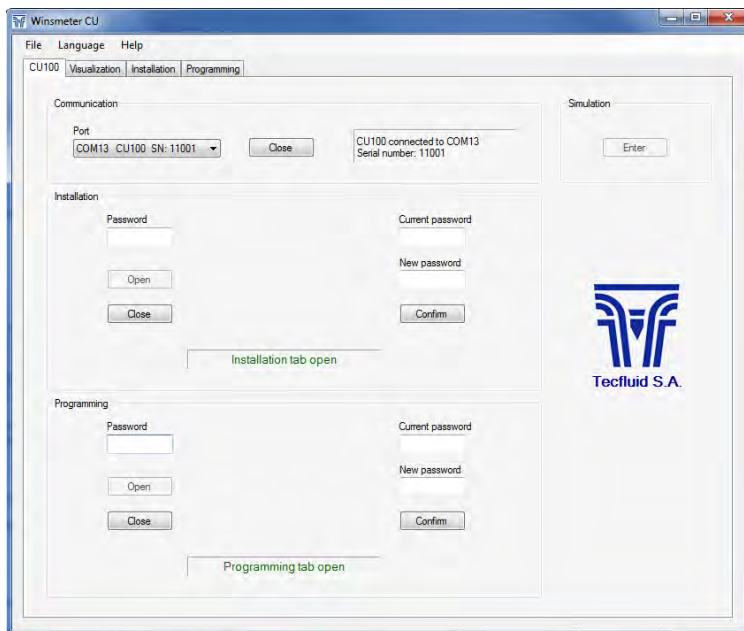
In order to access the tab "Install", you must enter a password.

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 the corresponding "Open", and the installation or programming tab will open as appropriate. At the bottom of each section displays "Installation tab open" or "Programming tab open."

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

11
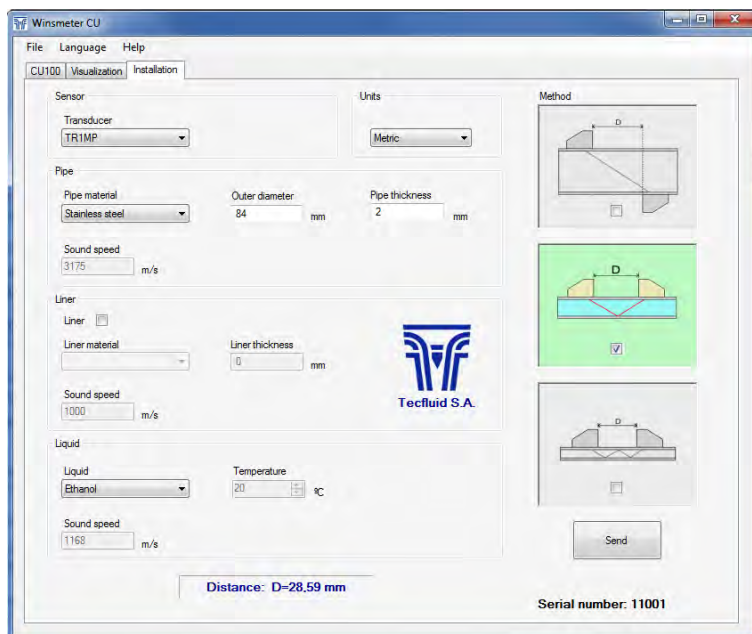
Changing settings on this screen, you get the distance between the transducers on the bottom.

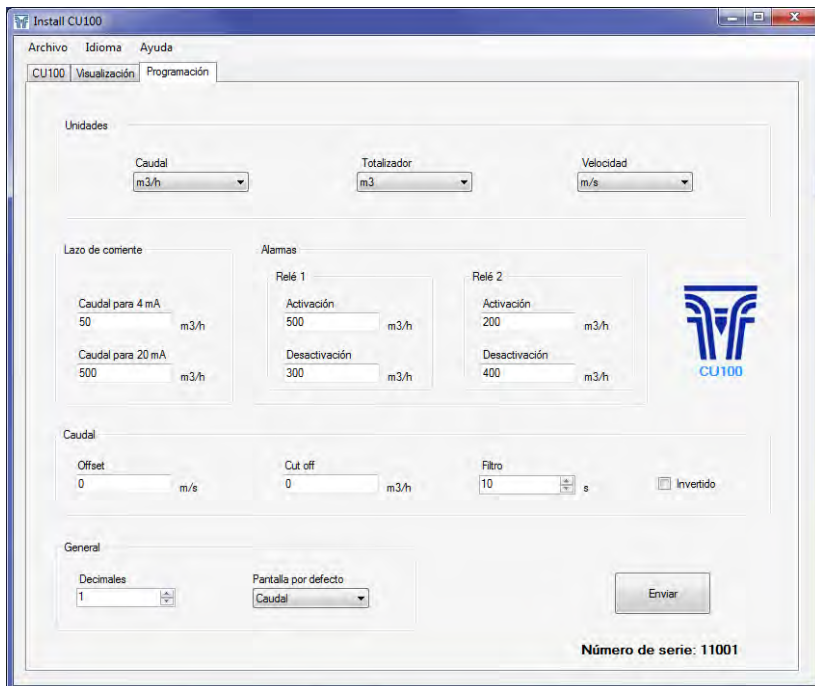To transfer data to the CU100 converter, press the "Send" button. The message "Saving program" will appear for two seconds in the converter screen. The installation data will be stored in the memory of the converter.

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

Changing the parameters of this screen, you can program the different functions of the equipment.

As in the previous paragraph, to pass data to the CU100 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.

11.4 Visualization

When the communication with the computer port is established (see section 11.2), 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 state 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.
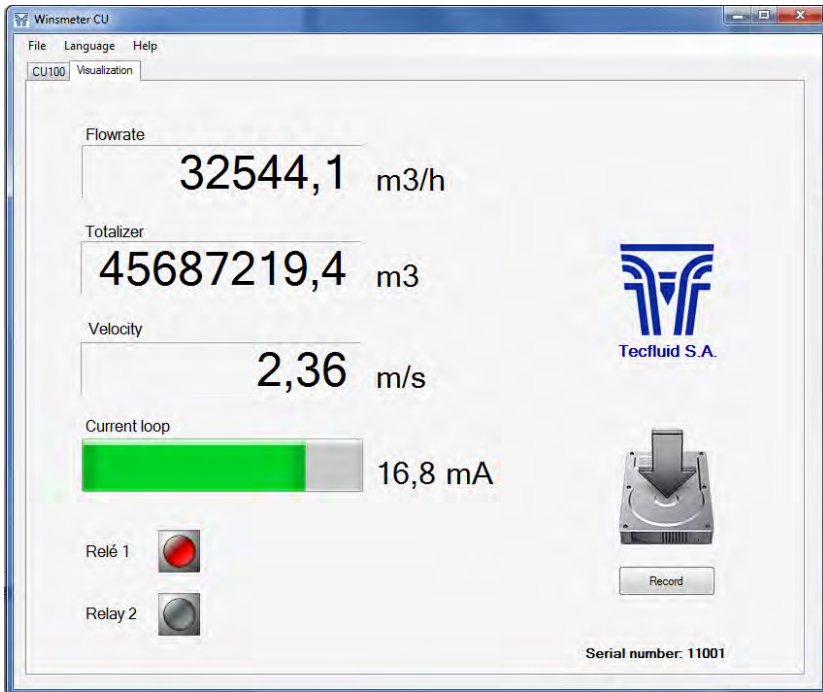
11.5   Simulation

If the converter CU100 is not available, the software can be used in simulation mode.

To do this, press the button "Enter" in the simulation section on the initial screen (see figure on page 36).

Tabs "Installation" and "Programming" will open.

You will be able to calculate the distance between the transducers and change the data, although they may not be sent to the converter.

11

12   TECHNICAL CHARACTERISTICS

Accuracy

± 1,5% of reading ± 0,02 m/s

Repeatability

± 0,25% of reading ± 0,01 m/s

Velocity range

0,2 ...12 m/s

Temperature
Process temperature: -20 ºC … 80 ºC
Ambient temperature range: -20 ... +60 ºC

Power supply
85 ... 265 VAC 50, 60 Hz .
Power consumption: ≤ 5 VA

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

Relay outputs
Two changeover contacts, SPDT, potential free
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 and velocity indication

Nº 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.

General characteristics

Materials:

>   Transducers   : Anodized aluminium and PEEK
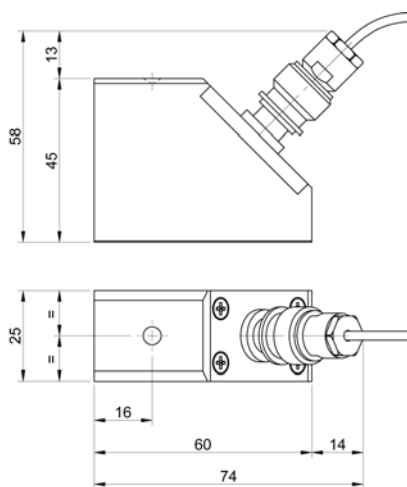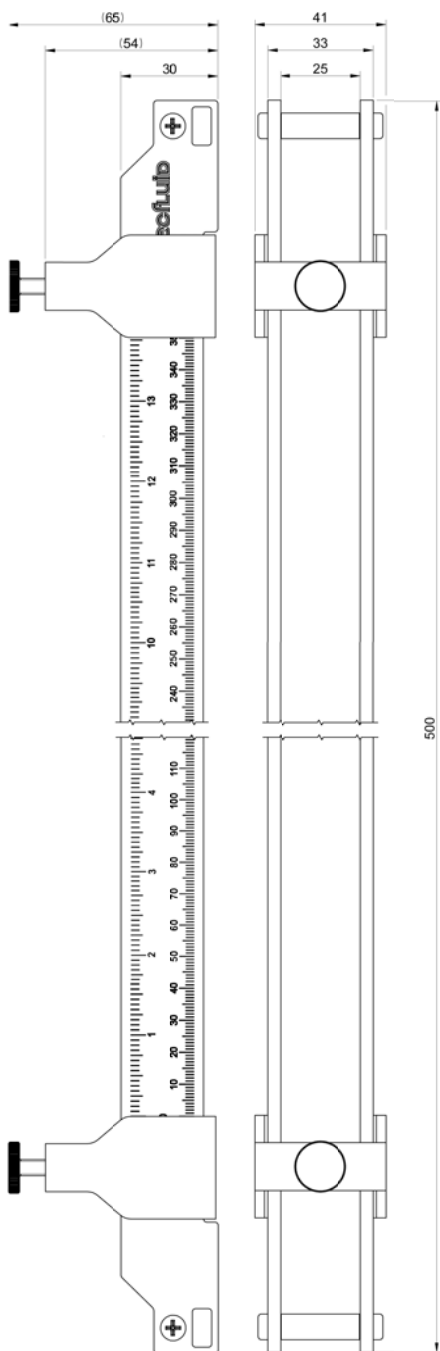>   Housing   : ABS

Ingress protection (transducers and housing): IP65

Maximum transducer cable length: 50 m

Conforms to Low voltage Directive 2006/95/EC

Conforms to Electromagnetic compatibility Directive 2004/108/EC

CE

13 DIMENSIONS

Cable gland M16
(Cable diameter Ø3,5-10)

Cable gland PG7
(Cable diameter Ø1-5)

13

13

42

14   TROUBLESHOOTING

Problem	Probable cause	Solution
The display shows an error informative message instead of the default screen	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.
	The transducers are not at the correct distance.	Enter the installation menu and verify that all parameters are correct. Check that the transducers are at the theoretical distance.
	There is not gel in the transducers.	Put acoustic adaptation gel on the base of each transducer.
	The pipe surface is not adequate.	Dirty or rusty surfaces can difficult the transmission of ultrasonic waves. Clean the pipe.
	Cables are broken or disconnected.	Check the cables between the converter and the transducers.
The flow rate is unstable	The product contains solid particles in suspension.	Verify that the flowmeter is suitable for this application.
	The product contains air.	Verify that the flowmeter is suitable for this application.
	There are excessive turbulences.	Verify that the transducer installation has been made according to the recommended straight pipe requeriments (paragraph 5.1 page13).
The instrument displays a value when there is not flow	The offset is not adjusted.	Perform an offset adjustment (paragraph 6.4.4 page 28).
The displayed flow rate is higher than expected	The pipe is not completely full.	Make sure that the pipe is completely full, installing the flowmeter in a in a vertical pipe with upwards flow.
Display is blank	Blown fuse.	Change the fuse.(paragraph 10.1 page 33).
The analog output provides always 4 mA or	Current output range not properly programmed.	Program the range properly (paragraph 6.5.4 page 30).
The analog output gives always 0 mA	Cable disconnected.	Check the cable connection.
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 flow direction (paragraph 6.4.2 page 27).
	The totalizer action is programmed to do it.	Change the totalizer programming (paragraph 6.7 page 30).

14

43

Annex A. Sound propagation velocity in some liquids (in m/s).

Water	
0 ºC	1403
10 ºC	1447
20 ºC	1482
30 ºC	1507
40 ºC	1526
50 ºC	1541
60 ºC	1552
70 ºC	1555
80 ºC	1555
90 ºC	1550
100 ºC	1543

Liquids	
Acetone	1190
Alcohol	1207
Ammonia	1386
Aniline	1649
Beer	1482
Benzene	1320
Chloroform	950
Diesel	1230
Distilled water	1498
Ethanol	1168
Ether	985
Ethyl acetate	1164
Ethylene glycol	1660
Gasoline	1250
Glycerine	1923
Glycol	1658
Heavy water	1390
Kerosene	1324
Methanol	1119
Milk	1482
Olive oil	1431
Petroleum	1290
Seawater	1521
Toluene	1275
Turpentine	1280

A

Annex B. Sound propagation velocity in some solids (in m/s).

Pipe material	
Aluminium	3080
Brass	2150
Bronze	2270
Cast iron	2550
Copper	2260
Ductile cast iron	2650
Glass	3300
Lead	2170
PE	1950
Plastic	2100
PP	2600
PVC	2395
Stainless steel	3175
Steel	3206

Lining material	
Bitumen	2500
Fiberglass	3430
Glass	3300
PE	1950
Plastic	2100
Porcelain	2540
PTFE	1400
PVC	2395
Rubber	1900
Titanium	3100

B

Flow rate table
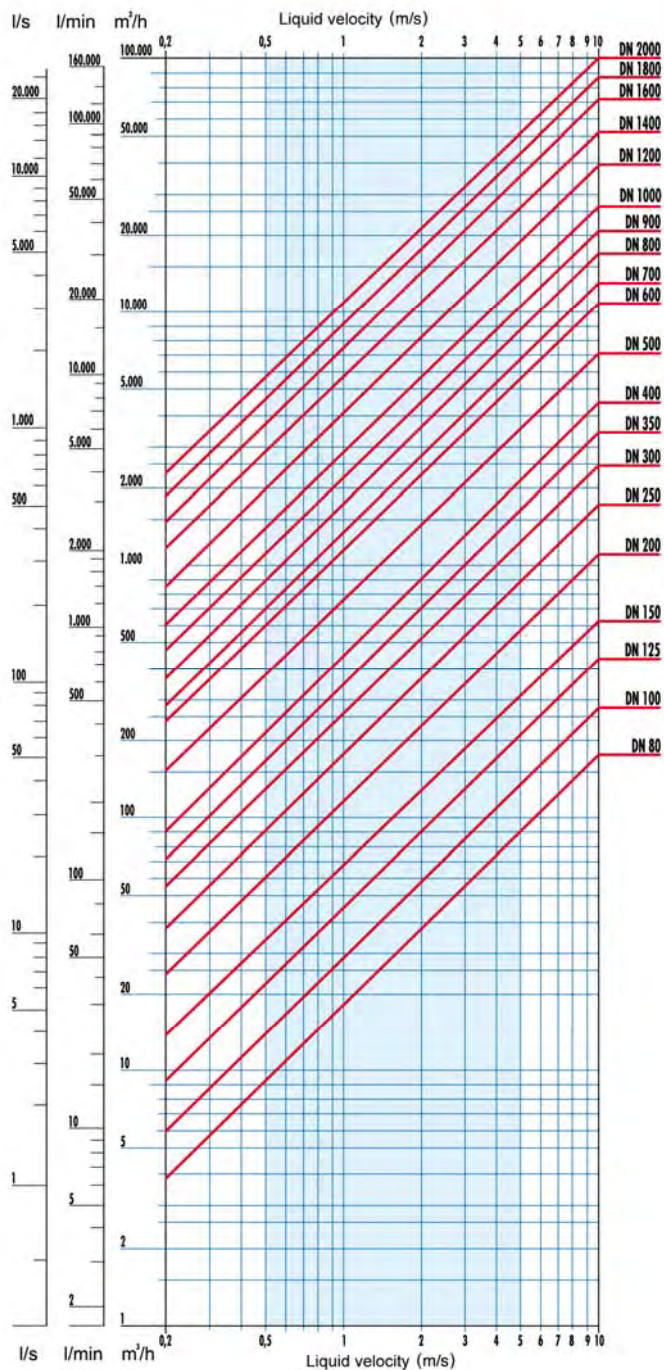
NOTES:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

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, "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.