



User Manual

FM-200E Series Flow Computer

Compatible with: E Series and EI Series Electromagnetic Flowmeters



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CHAPTER 1 BASIC USE

CHAPTER 1-A READING POSITIVE VOLUME, RETURN AND GROSS, FLOW RATE AND VELOCITY OF THE FLUID

The 200E Series flow computer features a very simple operation panel. 6 basic operation screens that will provide you with all the information you need to use the equipment.

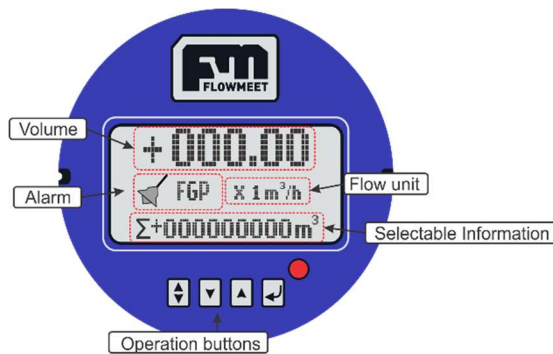



Figure 1.1 Operation panel detail

Just by pressing  the button you can change the information in the lower part of the display to view:

- Direct volume (Volume measured by the flowmeter in the positive direction).
- Return (Volume measured by the flow meter in the negative direction).
- Gross volume (Differential between direct and return volume).
- Percentage of work (Percentage of the maximum work flow of the team).
- Fluid velocity.
- Ratio of empty pipe.

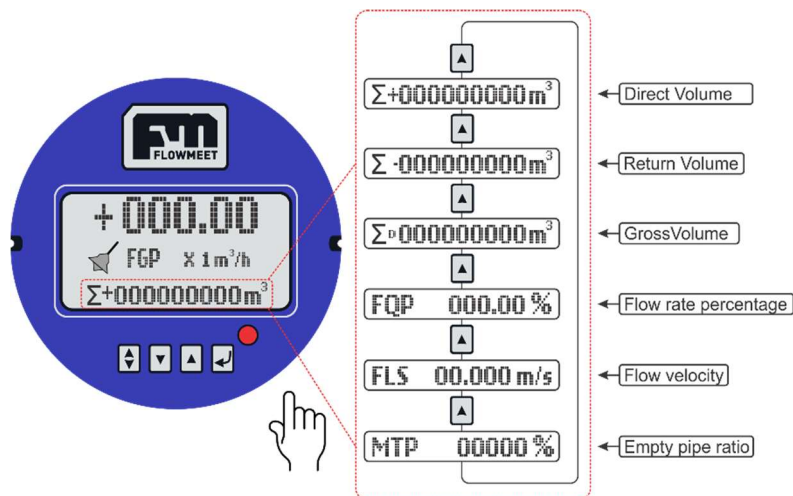


Figure 1.2 Selection of information

CHAPTER 1-B

CUMULATED PARTIAL VOLUME RESET.

To subtract the volume value follow the steps detailed below:

1-Starting from the Operation Screens (Figure 1.1), you must enter the Equipment Configuration Screens by following the steps detailed in Figure 1.3, where you will access the Screen **Parameters Set**.

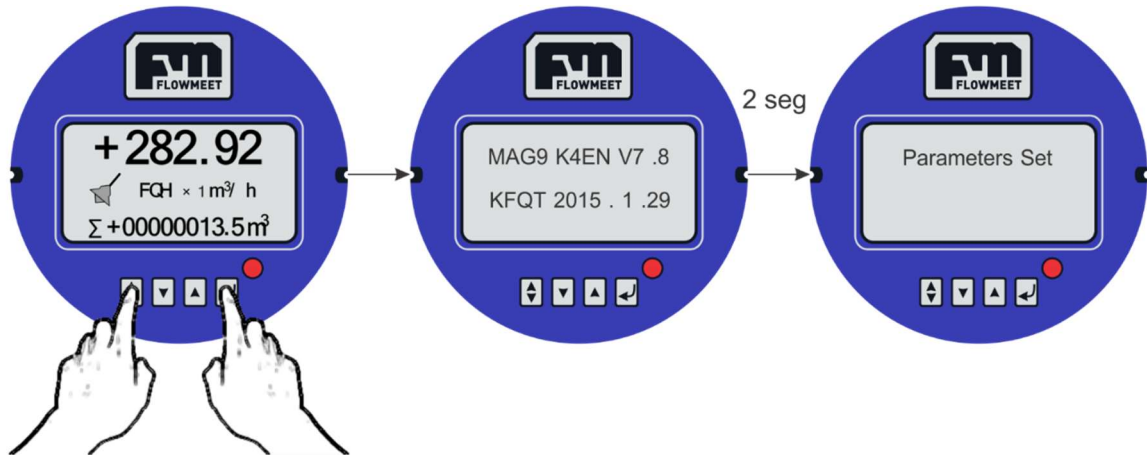


Figure 1.3

2-From this **Parameters Set** screen by pressing you can access the **Clr Total Rec** Screen to reset the volume. In Figure 1.4 you can see the procedure to follow to reset the volume value.

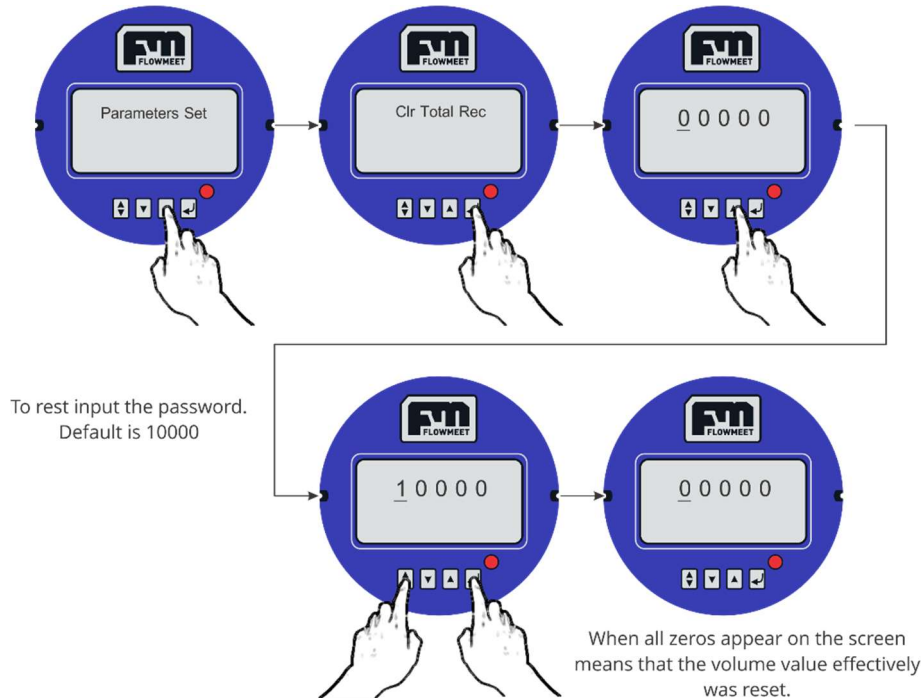


Figure 1.4

CHAPTER 2

ALARM INDICATIONS

In case the flowmeter detects an abnormal operation or outside the correct parameters, it will inform the user through the display an alarm code.

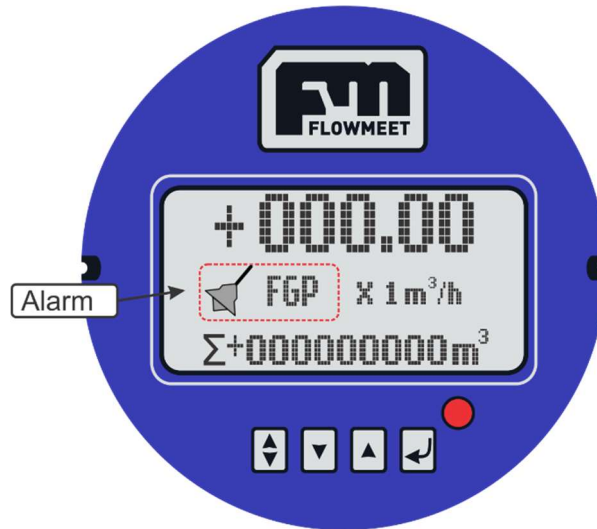






Figure 2.1 Alarm Indications

Below are the alarm codes:

-  FQH: The flow rate is above the working limit.
-  FQL: The flow is below the working limit.
-  FGP: Empty pipe.
-  SYS: Primary sensor coil failure.

CHAPTER 3-A

4-20mA FLOW RATE OUTPUT SIGNAL

Next, Figure 3.1 shows the connection for the use of the current output proportional to the flow rate.

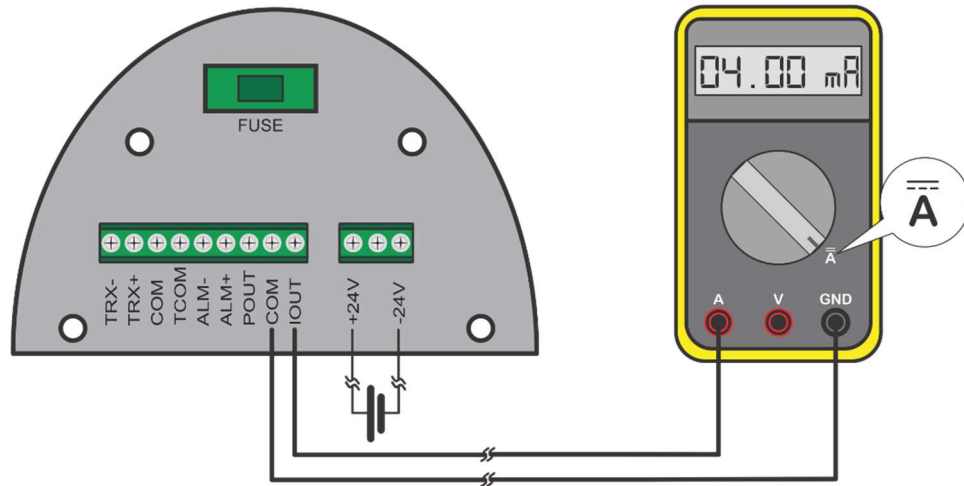


Figure 3.1 Wiring Connection 4-20mA Output

In the case of requiring a voltage output proportional to the flow rate, you will only have to place a resistance of known value as shown in Figure 3.2, and thus be able to measure the voltage drop in said resistance.

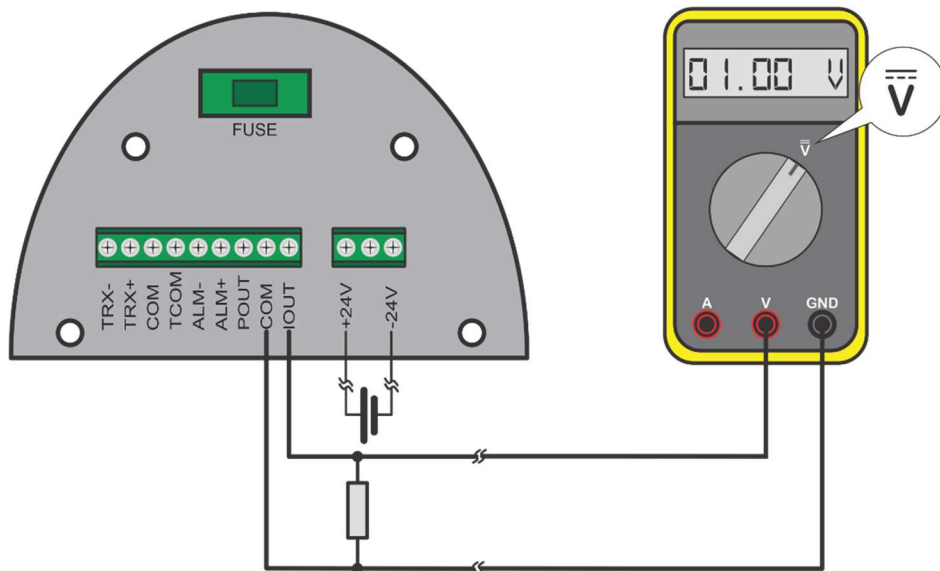


Figure 3.2 Wiring Connection voltage output

4-20MA OUTPUT CONFIGURATION

The logic to configure it is the following:

- 1) Enter Programming mode. See Manual "Series e Configuration Screens".
- 3) Go to the "Flow Range" Menu (MENU 6) to set the Span, that is, the maximum value of flow you want for your system (it must always be below the maximum flow of the equipment).

This value is equivalent to the 20mA of the equipment. Flow 0 will correspond to 4mA.

Example:

If the maximum flow value of your equipment is FLOW RANGE: 350 Lt/min

If the current output obtains 20mA, they will be equivalent to flow values equal to or greater than 350Lt/min

If you get 12 mA, you will be in the middle of the range which equates to flow values of 175 Lt/min.

When you measure 4mA you will find no flow movement, that is to say, flow rate 0 Lt/min.

CHAPTER 3-B

DIGITAL OUTPUT SIGNAL OF VOLUME, PULSES or DIGITAL SIGNAL OF FLOW OUTPUT, FREQUENCY

You can choose between a digital output signal proportional to volume (PULSES) or proportional to flow rate (FREQUENCY)

In Figure 3.3 you can see the connections for the use of the pulse output or frequency of the flowmeter.

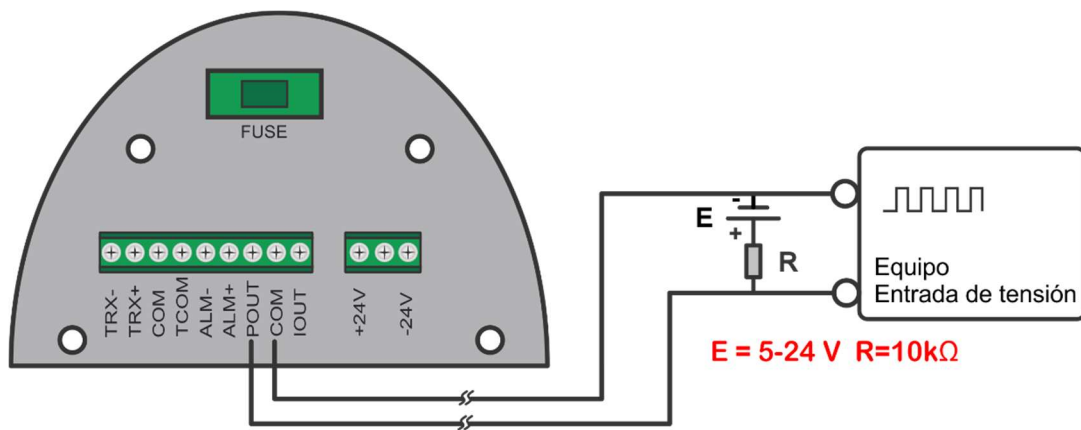


Figure 3.3 Voltage frequency / pulse output connection

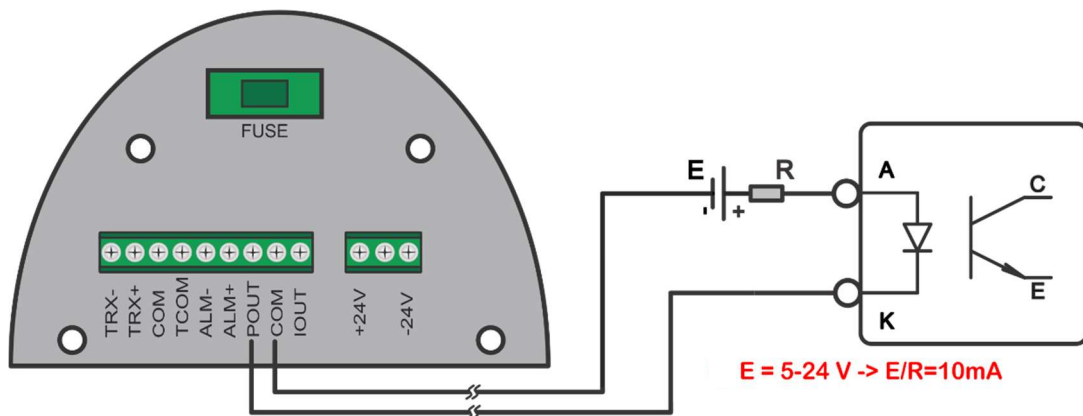


Figure 3.4 Pulse / frequency output connection to optocoupler

PULSE OUTPUT CONFIGURATION

The logic to configure the output proportional to the volume that passes through the flow meter (PULSES) is as follows

- 1) Enter Programming mode. See Manual "Series e Configuration Screens".
- 2) Go to the "Total Unit" Menu to set the FLOW UNIT work units (MENU 12).
- 3) Go to the "Pulse Type" Menu and choose the "Pulse" Option.
- 4) Go to the "Pulse Fact" Menu (MENU 15) to set the volume / pulse ratio you want for your output, which can be: 0.001m³ ~ 1m³ or 0.001L ~ 1L. It is recommended that the value of units chosen in point 2) coincide with that of point 4) for a quick function check at the time of start-up.

Example:

- If you choose 0.001m³, it means that 1000 output pulses from the equipment are equivalent to 1 m³ of volume that passed through the equipment.
 - If you choose 0.01m³, it means that 100 output pulses of the equipment are equivalent to 1 m³
- And so on.

FREQUENCY OUTPUT CONFIGURATION

FREQUENCY OUTPUT CONFIGURATION

The logic to configure the output proportional to the flow through the flowmeter (FREQUENCY) is as follows

- 1) Enter Programming mode. See Manual "Series e Configuration Screens".
- 2) Go to the "Flow Unit" Menu to set the FLOW UNIT work units (MENU 5).
- 3) Go to the "Flow Range" Menu to set the Span, that is, the maximum heat flow you want for your system (it must always be below the maximum flow rate of the equipment) (MENU 6) of the equipment.
- 4) Go to the "Pulse Type" Menu and choose the "Freque" Option.
- 5) Go to the "Freque Max" Menu to set the Maximum Frequency you want to output (MENU 16) which can range from 0-5000Hz. This frequency is equivalent to the Span value set in point 3). The higher the frequency, the higher the resolution you will get at the output. The maximum frequency limit is set by the device when you want to connect the output, the length of the cables, etc.

Example:

If the maximum flow value of your equipment is FLOW RANGE: 350 Lt / min

and choose a maximum output frequency FRQUE MAX = 2000Hz

If at the output you are obtaining a signal of 285.71 Hz, this means that 50Lt / min is passing through the flowmeter, which can be deduced from this simple rule of three:

$$285.71 \text{ [Hz]} * 350 \text{ [Lt / min]} / 2000 \text{ [Hz]} = 50 \text{ Lt / min}$$

CHAPTER 3-C ALARM OUTPUT SIGNAL, RELAY

The E Series flow computer features a number of relay outputs, such as low flow alarm and high flow alarm outputs.

The relay connection diagram for these outputs is shown below:

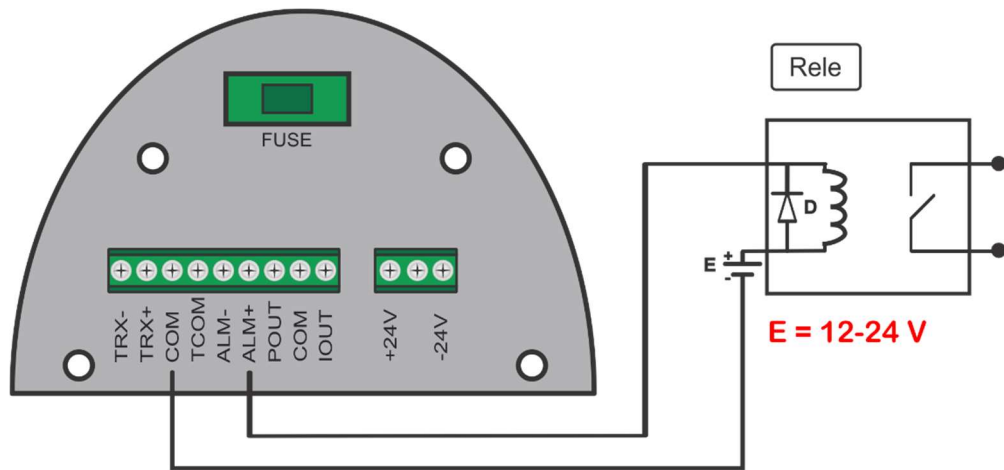


Figure 3.5 Relay output connection

CHAPTER 3-D

RS-485 COMMUNICATION - Modbus RTU

Communication software

To establish communication between the device and the computer, you can use any program of the hyperterminal type. In our case, we recommend TERMITE, which is a free download program. By clicking on the link below you can access the download of the latest version of the program. http://www.compuPhase.com/software_termite.htm.

Procedure to establish communication.

- 1- Feed the equipment
- 2- Connect the equipment to the computer with a RS-485 to USB converter
- 3- Open the Termite

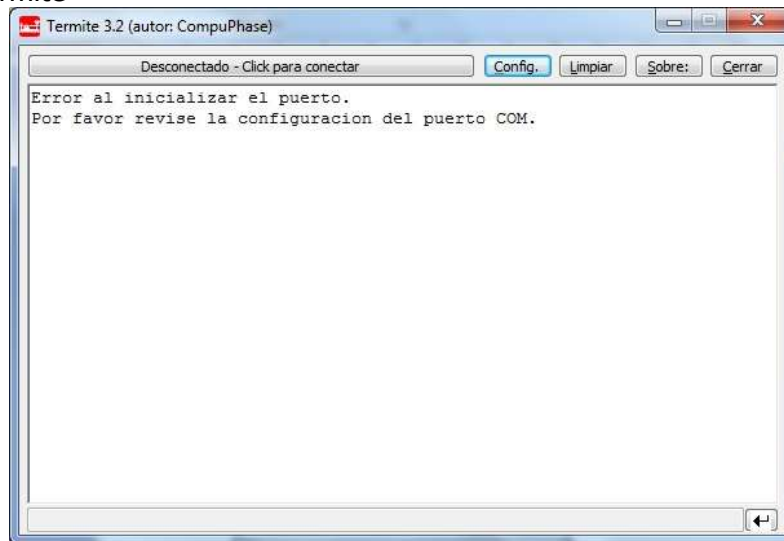


Figure 3.6

- 1- Go to Settings

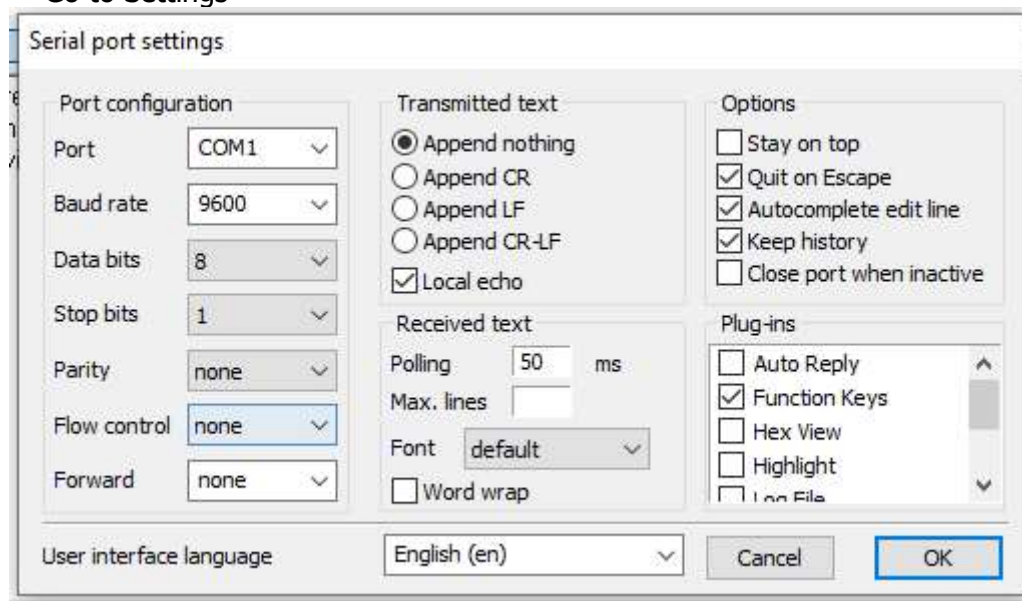


Figure 3.7

- 2- Once in Settings, clicking on Port will open a window with all the equipment available to connect as shown in Figure 2. If you do not know what your equipment is, observe which COM port disappears and appears when you disconnect and reconnect it.
- 3- Once the corresponding COM port is selected, configure the Speed and other characteristics of the communication as shown in Fig 2.
- 4- Go to menu 2 of the unit "Comm Address" and observe that it has a value of 01 and menu 3 "Baud Rate" (Speed) is 9600. Use this configuration. By default you should configure the following in the Termite program:
- 5- Press OK to exit Settings. It will automatically connect and establish communication.

ANALISIS DE DATOS

1 - Instantaneous flow reading.

Command sent from PC: 0x 01 04 10 10 00 02 74 CE
Data I receive (for example): 0x 01 04 04 C4 1C 60 00 2F 72
Where I'm only interested in numbers C4 1C 60 00 whose encoding is in floating point IEEE754¹. Doing the conversion results C4 1C 60 00 = -625.5
The corresponding unit is detailed in section 4.

2 - Instant speed Reading

Command sent from PC: 0x 01 04 10 12 00 02 D5 0E
Data I receive (for example): 0x 01 04 04 C1 B0 80 00 A6 5F
Where I'm only interested in numbers C1 B0 80 00 whose encoding is in floating point IEEE754¹. Doing the conversion results C1 B0 80 00 = -22.0625

3 - Cumulative positive volume reading

To read this data I will need to send two commands to the computer, I will call Command 1 to read the integer part of the accumulated flow and Command 2 to read the fractional part. As a consequence of sending the request, I will receive data 1, a binary integer that corresponds to the integer part of the accumulated flow and data 2, a binary real number in IEEE754 format that corresponds to the fractional part of the accumulated volume.

Command 1 sent from PC: 0x 01 04 10 18 00 02 F5 0C
Data I receive (for example): 0x 01 04 04 00 00 70 71 1E 60
Where I'm only interested in numbers 00 00 70 71 whose encoding is in floating point IEEE754¹. Doing the conversion results 00 00 70 71 = 28785

Command 2 sent from PC: 0x 01 04 10 1A 00 02 54 CC
Data I receive (for example): 0x 01 04 04 3F 00 00 00 3B 90
Where I'm only interested in numbers 3F 00 00 00 whose encoding is in floating point IEEE754¹. Doing the conversion results 3F 00 00 00 = 0.5

In this way I can conclude that the accumulated flow is Data1 + Data2 = 28785.5.
The corresponding unit is detailed in section 6.

4 - Accumulated negative volume reading

Ditto to point 3 but for the flow in the reverse direction.

To read this data I will need to send two commands to the computer, I will call Command 1 to read the integer part of the accumulated flow and Command 2 to read the fractional part. As a consequence of sending the request, I will

receive data 1, a binary integer that corresponds to the integer part of the accumulated flow and data 2, a binary real number in IEEE7541 format that corresponds to the fractional part of the accumulated volume.

Command 1 sent from PC: 0x 01 04 10 1C 00 02 XX XX
Data I receive (for example): 0x 01 04 04 00 00 70 71 1E 60
Where I'm only interested in numbers 00 00 70 71 whose encoding is in floating point IEEE754¹. Doing the conversion results 00 00 70 71 = 28785

Command 2 sent from PC: 0x 01 04 10 1E 00 02 XX XX
Data I receive (for example): 0x 01 04 04 3F 00 00 00 3B 90
Where I'm only interested in numbers 3F 00 00 00 whose encoding is in floating point IEEE754¹. Doing the conversion results 3F 00 00 00 = 0.5
In this way I can conclude that the accumulated negative flow is Data1 + Data2 = - 28785.5. The corresponding unit is detailed in section 6.

5 – Instantaneous flow unit Reading

Command sent from PC: 0x 01 04 10 20 00 01 34 C0
Data I receive (for example): 0x 01 04 02 00 05 79 33
Where I'm only interested in numbers 00 05 whose encoding is in floating point IEEE754¹. Doing the conversion results 00 05 = 5. Looking for the code in the flow table I get that it corresponds to the M3 / H unit

6 – Accumulated volume unit reading

Command sent from PC: 0x 01 04 10 21 00 01 65 00
Data I receive (for example): 0x 01 04 02 00 01 78 F0
Where I'm only interested in numbers 00 01 whose encoding is in floating point IEEE754¹. Doing the conversion results 00 01 = 1. Looking for the code in the flow table I get that it corresponds to the M3 unit

Flow	Unit
0	L/S
1	L/M
2	L/H
3	M3/S
4	M3/M
5	M3/H
6	T/S
7	T/M
8	T/H
9	GPS
10	GPM
11	GPH

Volume	Unit
0	L
1	M3
2	T
3	USG

7 – Reading alarm status

7a – Maximum flow alarm

Command sent from PC: 0x 01 04 10 22 00 01 95 00 ✓

Data I receive (for example): 0x 01 04 02 00 01 78 F0

Where I'm only interested in numbers 00 01 whose encoding is in binary integer. Doing the conversion results in 00 01 = 1.

If the result is 1 the alarm is activated, if it is 0 it is deactivated

7b – Minimum flow alarm

Command sent from PC: 0x 01 04 10 23 00 01 C4 C0 ✓

Data I receive (for example): 0x 01 04 02 00 01 78 F0

Where I'm only interested in numbers 00 01 whose encoding is in binary integer. Doing the conversion results in 00 01 = 1.

If the result is 1 the alarm is activated, if it is 0 it is deactivated

7c – Empty pipe alarm

Command sent from PC: 0x 01 04 10 24 00 01 75 01 ✓

Data I receive (for example): 0x 01 04 02 00 01 78 F0

Where I'm only interested in numbers 00 01 whose encoding is in binary integer. Doing the conversion results in 00 01 = 1.

If the result is 1 the alarm is activated, if it is 0 it is deactivated

7d – System Alarm

Command sent from PC: 0x 01 04 10 25 00 01 24 C1 ✓

Data I receive (for example): 0x 01 04 02 00 01 78 F0

Where I'm only interested in numbers 00 01 whose encoding is in binary integer. Doing the conversion results in 00 01 = 1.

If the result is 1 the alarm is activated, if it is 0 it is deactivated

¹ Calculator to convert from IEEE754 to decimal at: www.binaryconvert.com

¹ More information on IEEE754 at: https://en.wikipedia.org/wiki/IEEE_754

CHAPTER 4-A POWER SUPPLY

The E Series electromagnetic flowmeter requires an industrial quality 24V DC power supply with a capacity greater than 2 AMP.

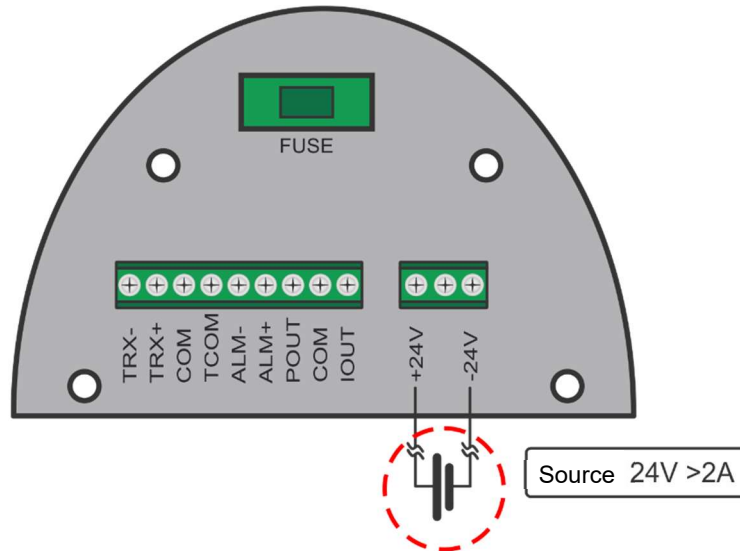


Figure 4.1 Power supply connection

CHAPTER 4-B EARTHING TOTAL PASS FLOWMETER

It is of VITAL IMPORTANCE that the full bore electromagnetic flowmeter has a correct grounding.

The liquid to be measured must have electrical continuity with the earth before, during and after passing through the flowmeter. This can be achieved by placing a javelin for exclusive use of the flowmeter in the vicinity of it.

Figure 4.2 and 4.3 show the connection of the ground connection for both metallic and non-metallic pipes.

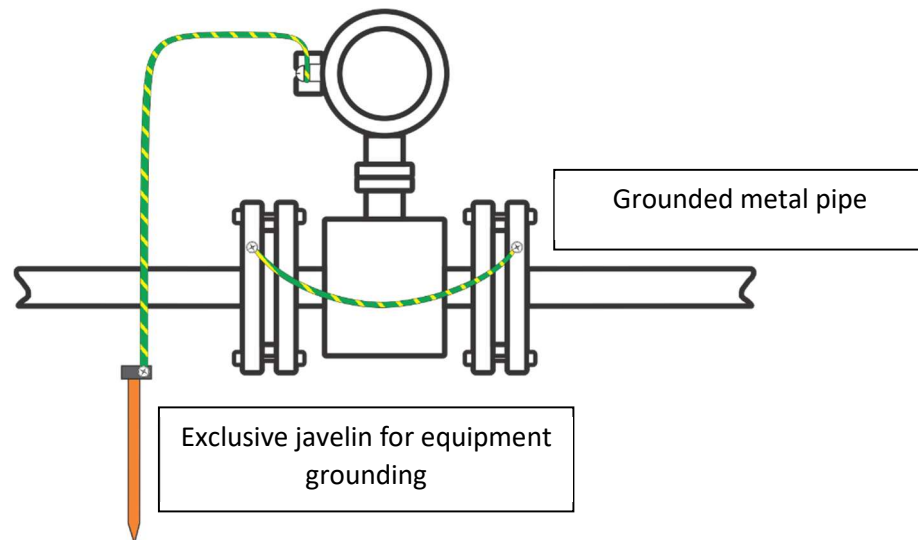


Figure 4.2 Grounding for metal pipes

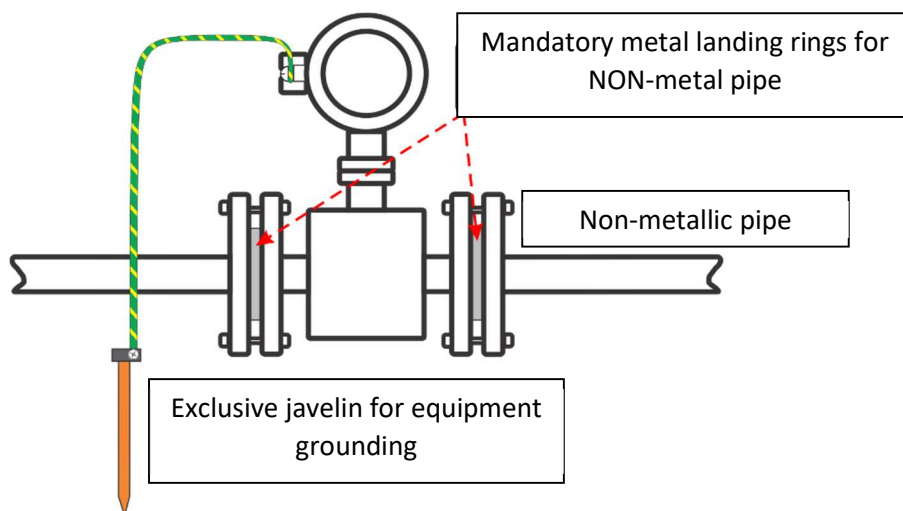


Figure 4.3 Grounding for NON-metallic pipes

CHAPTER 4-C GROUNDING INSERTION FLOWMETER

It is of VITAL IMPORTANCE that the insertion electromagnetic flowmeter has a correct grounding.

The liquid to be measured must have electrical continuity with the earth before, during and after passing through the flowmeter. This can be achieved by placing a javelin for exclusive use of the flowmeter in the vicinity of it.

Figure 4.4 shows the connection of the ground connection.

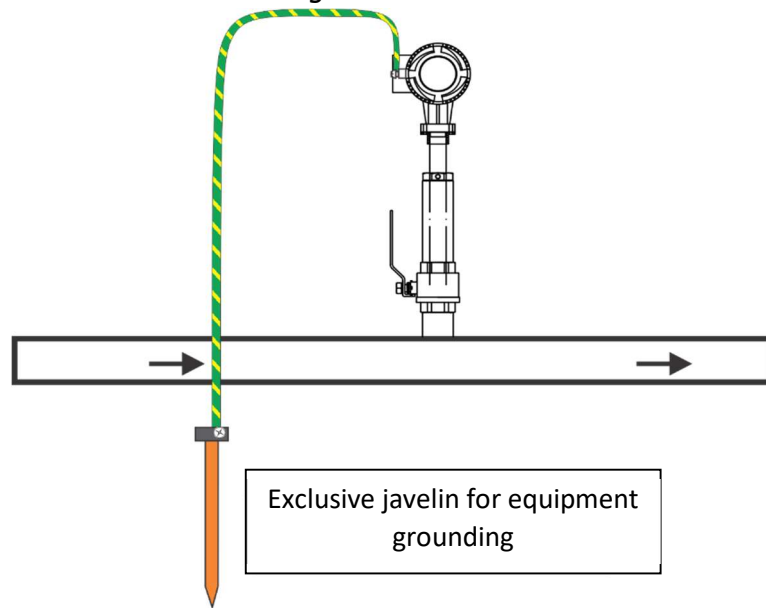


Figure 4.4 Grounding Insertion Flowmeters

CHAPTER 5 HYDRAULIC INSTALLATION FOR FULL PITCH FLOWMETERS

Below are basic guidelines for the hydraulic and mechanical installation of the full bore electromagnetic flowmeter.

Figure 5.1 is of VITAL IMPORTANCE for the correct measurement of the equipment and must be taken as mandatory

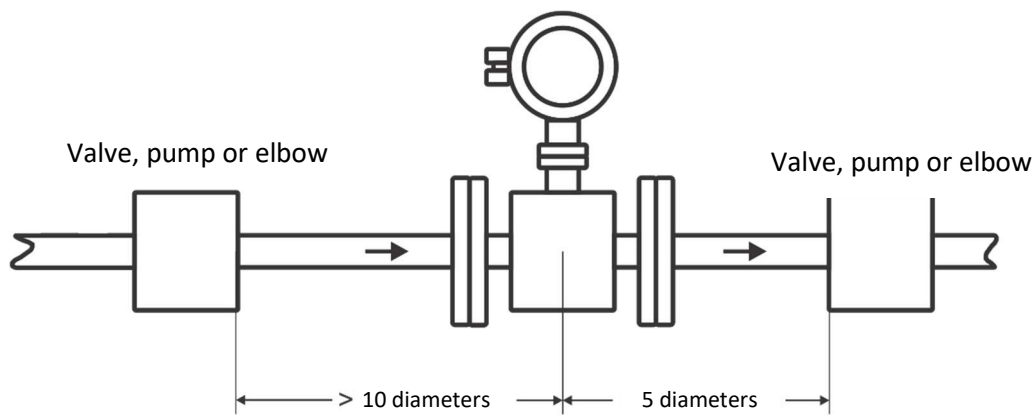


Figure 5.1 Separation distances between any type of obstruction or disturbance and the flow meter

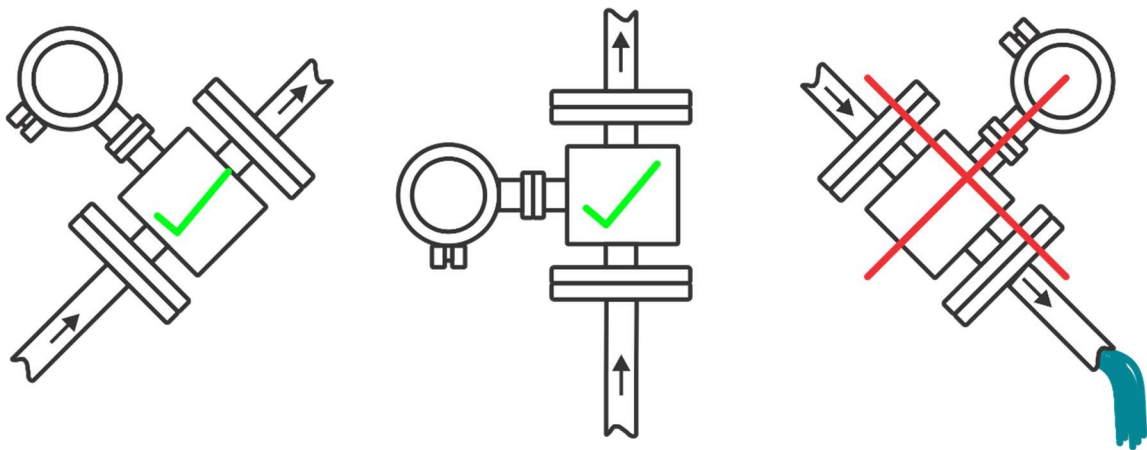


Figure 5.2 Orientation of flowmeter relative to flow. This practice avoids the possibility of a partially empty pipe.

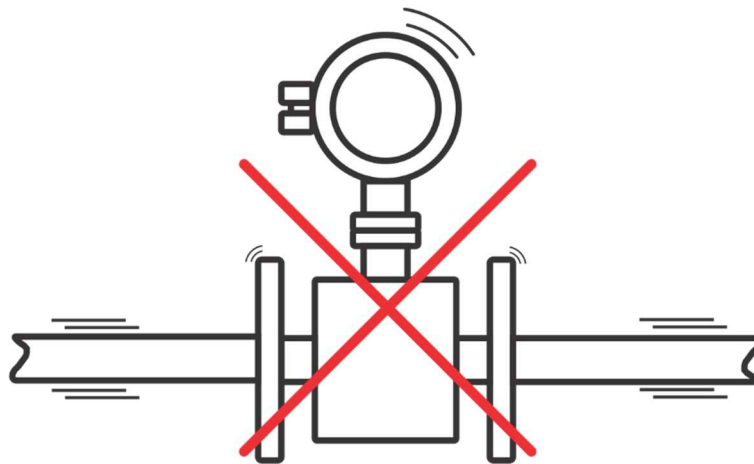


Figure 5.3 Avoid high vibration environments.

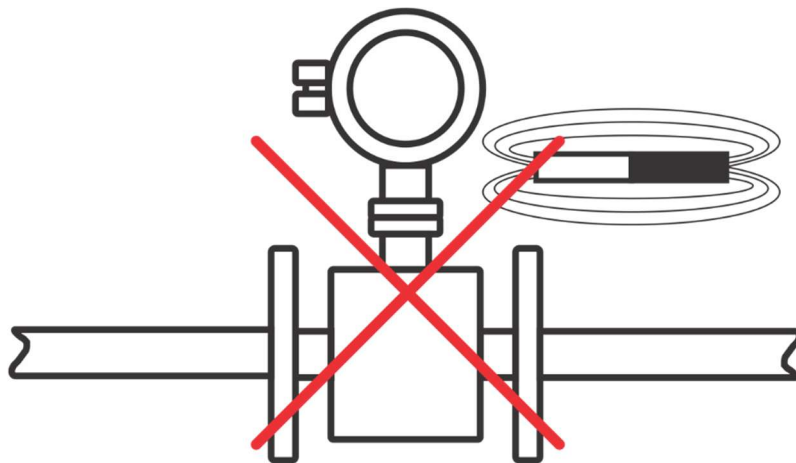


Figure 5.4 Do not install the flowmeter near magnetic fields such as motors or static drives.

CHAPTER 6-A HYDRAULIC INSTALLATION FOR INSERTION FLOWMETERS

The following are basic guidelines for the hydraulic and mechanical installation of the insertion electromagnetic flowmeter.

Figure 6.1 is of VITAL IMPORTANCE for the correct measurement of the equipment and must be taken as mandatory

Figure 6.2 shows how the equipment must be connected to prevent the pipe from being partially full. Remember that the pipe must always be full for a correct measurement.

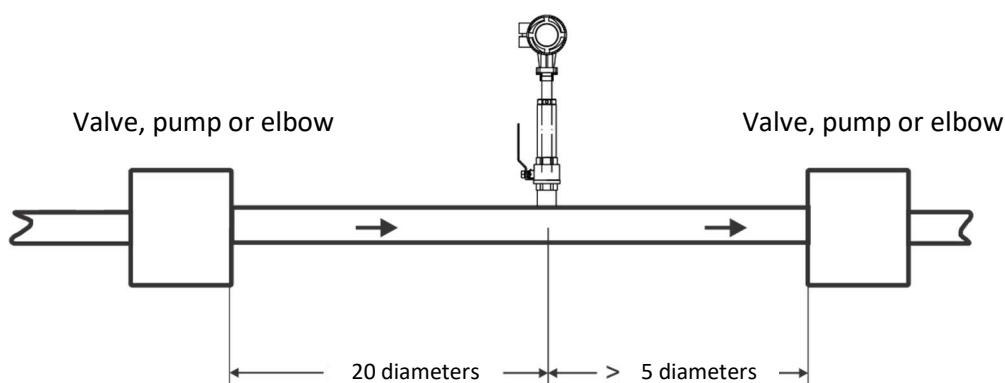


Figure 6.1 Separation distances between any type of obstruction or disturbance and the flowmeter.

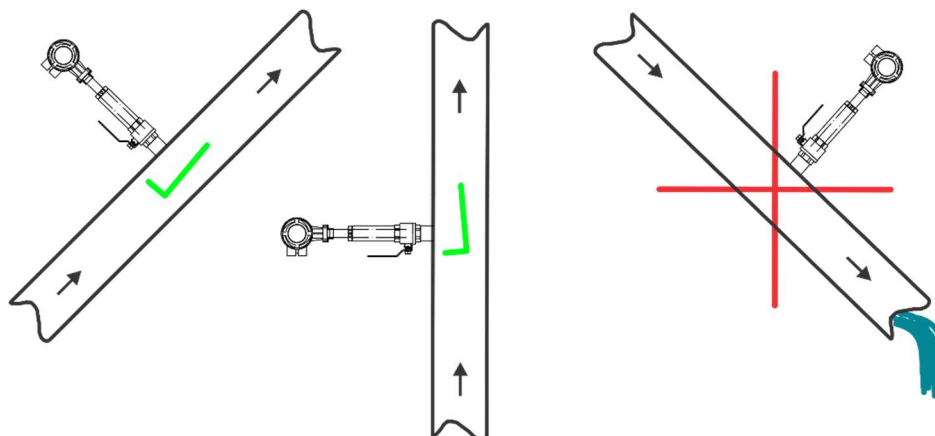


Figure 6.2 Flowmeter orientation relative to flow. This practice avoids the possibility of a partially empty pipe.

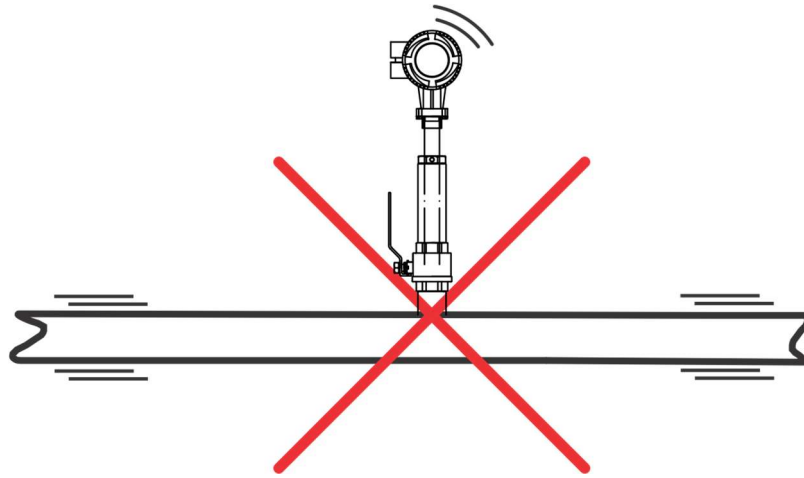


Figure 6.3 Avoid high vibration environments.

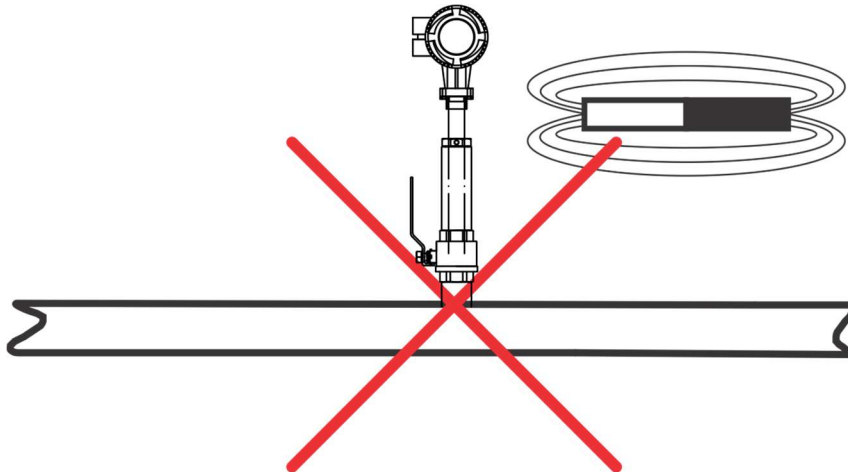


Figure 6.4 Do not install the flowmeter near magnetic fields such as motors or static drives.

CHAPTER 6-B MECHANICAL INSTALLATION INSERTION DEPTH OF THE SENSOR

In Figure 6.5 you can see how to install the sensor inside the pipe and the Insertion Depth (L1) depending on the Internal Diameter of the pipe. You can also see how to orient it correctly based on the flow direction. As you can see, the widest part of the Flow Sensor itself (it is oval in section) must be located following the direction of flow.

IMPORTANT

Please note that the Insertion Depth is not related to the thickness of the pipe, but only to the internal diameter of the pipe.

For example: A pipe with internal diameter DN400, has a thickness of 5mm, and the Insertion Depth must be 1/2 of 400mm, therefore, L1 must be 200mm

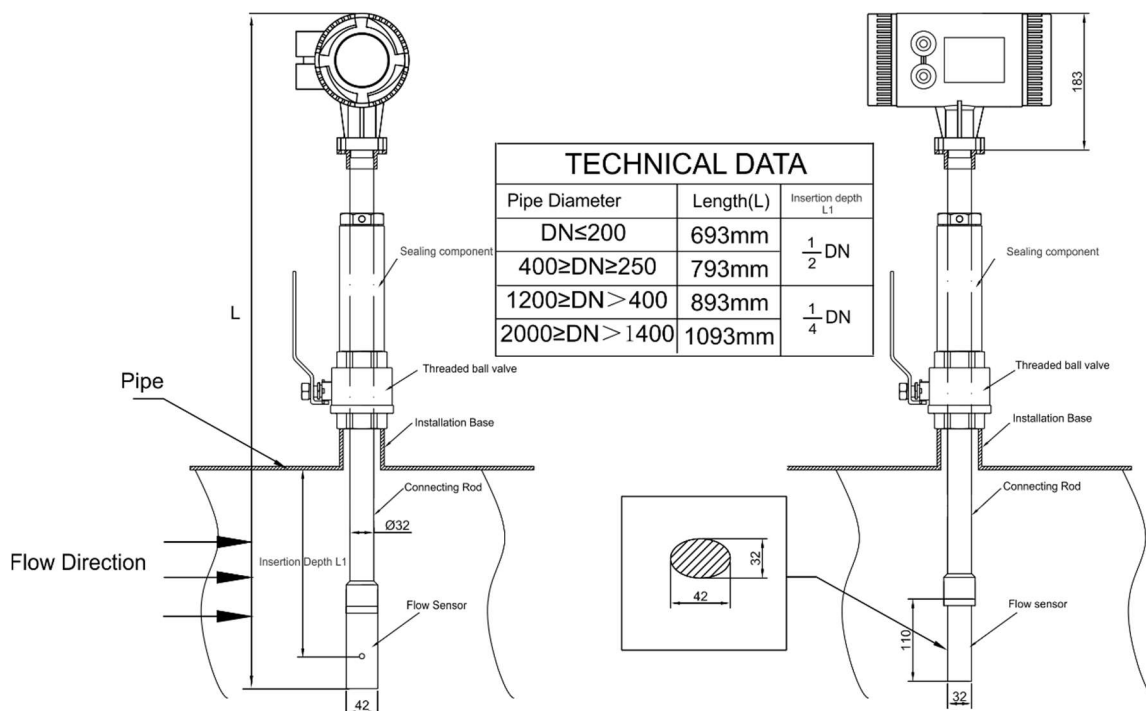


Figure 6.5 Sensor insertion depth in the installation depending on the diameter of the pipe

CHAPTER 7

EQUIPMENT CONFIGURATION ACCORDING TO THE PIPE DIAMETER FOR INSERTION FLOW METERS

It is very important to follow the following steps to configure the equipment and take the following precautions:

The parameters to configure depending on the pipe are two: the diameter of the pipe and the Calibration Factor.

Steps to configure:

- 1) Enter Programming mode. See Manual "Series e Configuration Screens". Enter with the password "07206"
- 2) Go to the "Snr Size" menu and set the diameter of the pipe in question
- 3) Go to the "Sensor Fact" Menu, set the corresponding Calibration Factor according to the diameter of the pipe, following the following logic according to the diameter of the pipe D:
 - If $D < DN500$ mm, the K Factor is the one found on the side plate of the flow computer. It does not have to be modified.
 - If $D > DN600$ mm, the K Factor must be multiplied by 1.12 (For example, if the K Factor (shown on the side plate of the computer) is 2.5; and the pipe is DN600 (or greater), the K factor must be modified to $2.5 \times 1.12 = 2.8$).
- 4) Go to the "Flow Direct" Menu and set the orientation so that the flow direction indicates positive flow in the desired direction. You could also modify this without modifying this parameter, simply by physically reorienting the flow computer head.