Ultrasonic Flow meter quick start guide
Model: D116-HD

We also have an installation demo video on Youtube
Scan the QR code, search for 'D116 HD Overview & Demo'
or use this link: https://youtu.be/Num-K0GLO0g

SCAN ME

Contents

Introduction:

Please note that this guide will go through basic functions of the flow meter only, for advance functions please see the full manual.

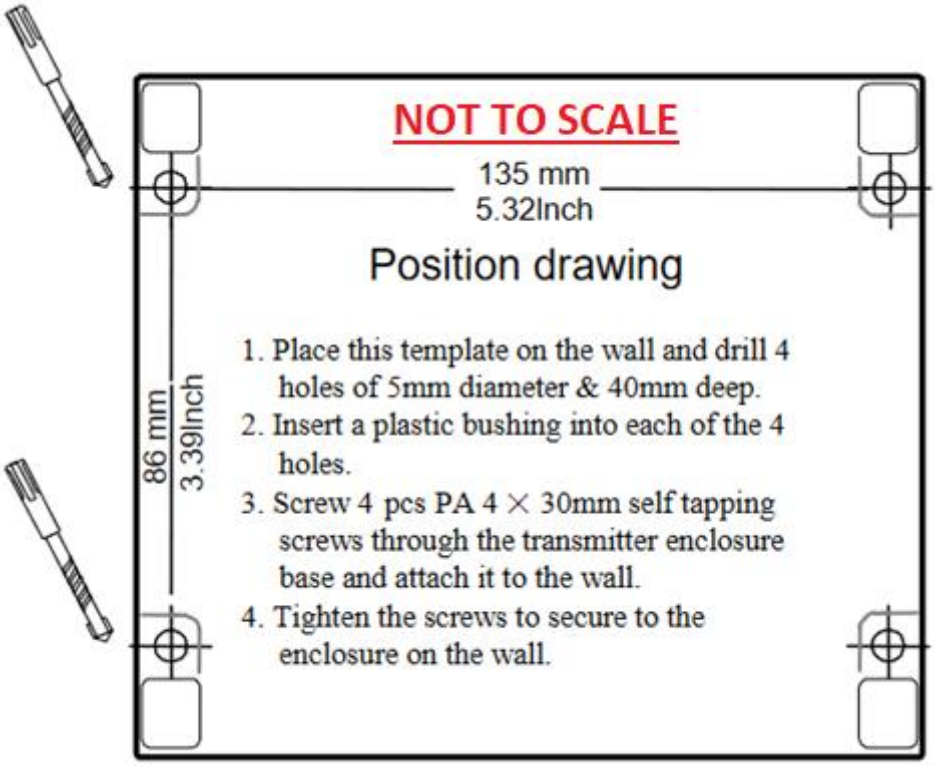
The pFlow D116 HD is a basic wall mount clamp on ultrasonic flow meter, being the most basic in the range it does have some limitations to be aware of, importantly:

- It is only suitable for measurement water; other liquids are not compatible.
- It is only suitable for certain pipe materials; you cannot set a custom pipe sound speed with this model.
    - (Suitable pipe materials include: Carbon steel, Stainless Steel, PVC, Copper)
- This flow meter does not have data logging capabilities (but does have other output options)
- This flow meter is not suitable for pipes with a liner, there is no option to select the liner spec.

Other models are available without limitations, please contact us with your application and measurement requirements and we can offer a suitable system.

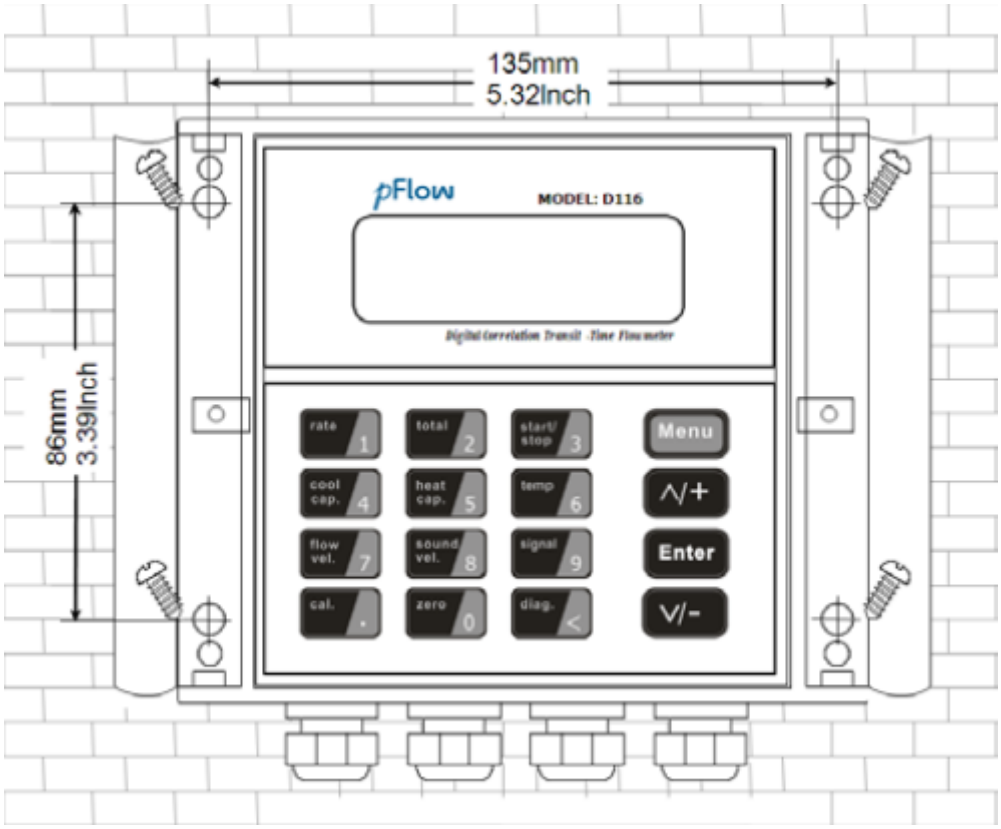
Wall mounting the transmitter:

You will find a "Position Drawing" in the packing. It can be used as a template in the place that you are going to install the Flowmeter. Using a 5.0mm drill bit drill 4 holes at the screws position shown on the drawing.



There are flip open covers on the left and right side which when opened expose the screws to open the enclosure and the holes/mounting points for wall mounting.

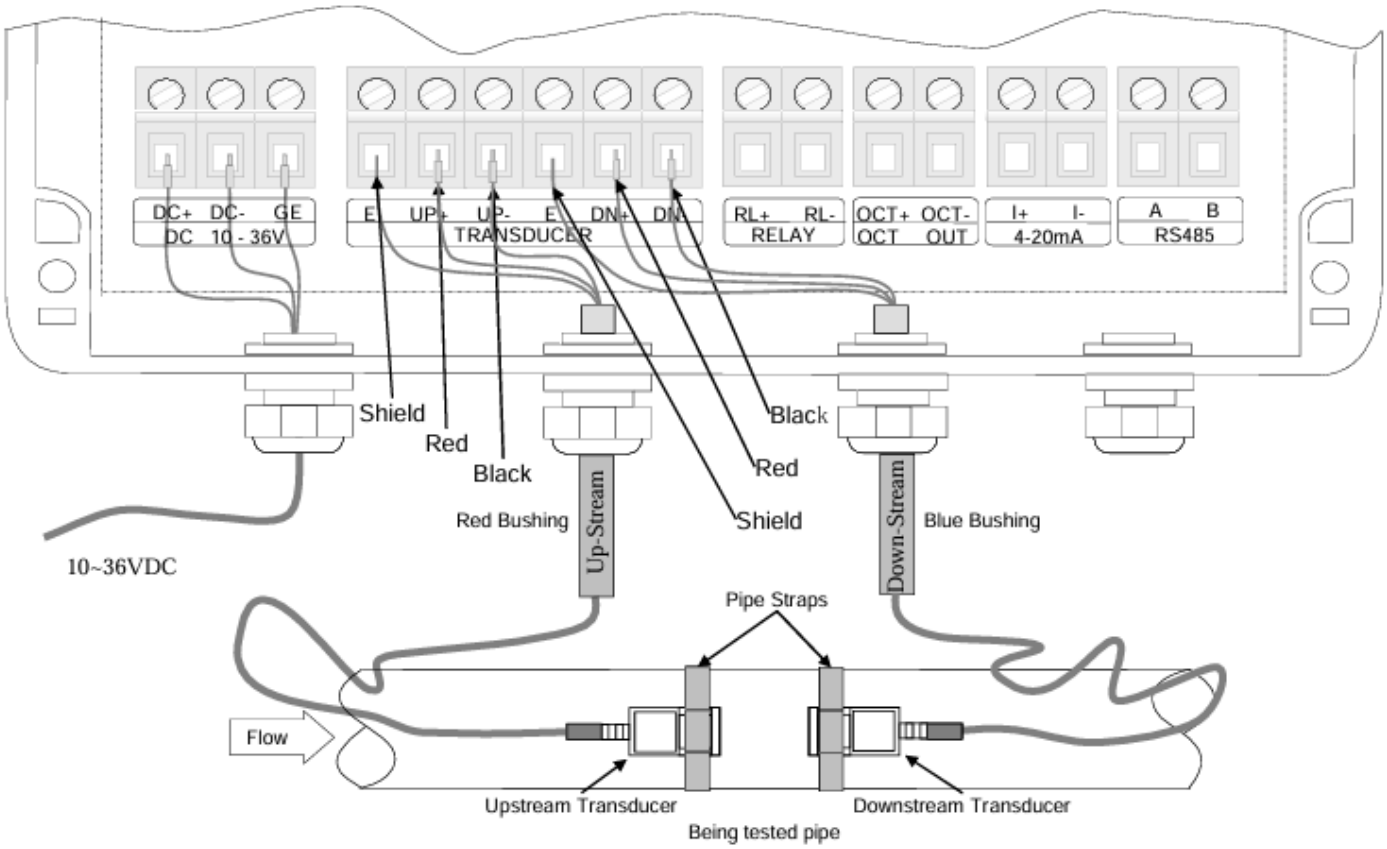
Insert the supplied wall plugs into the drilled holes ensuring they sit flush with the wall. Hold the flowmeter in position and secure firmly with the supplied screws.



Transmitter Wiring:

Warning:
Wire in all connectors with the power off.

Once the electronics enclosure has been installed, the Flowmeter wiring can be connected. Open the case, you will find the transmitter interfaces labels from left to right as follows: Power supply, upstream transducer, downstream transducer, relay, OCT, 4-20mA, RS484. Refer to the below diagram for specific connection: (your model may have different port positions so please refer to the markings on the actual device)



Power supply is 10~36VDC/1A max.
You can just use + and – for DC power supply if there is no 'Ground Earth' shield in the cable

Please note that a power supply is not supplied with the flow meter.
You can source your own power supply if required or contact us we can quote for a power supply.

Please wire in all cables and ensure that all cables are run through the supplied cable glands and tightened up to prevent dust and water ingress.

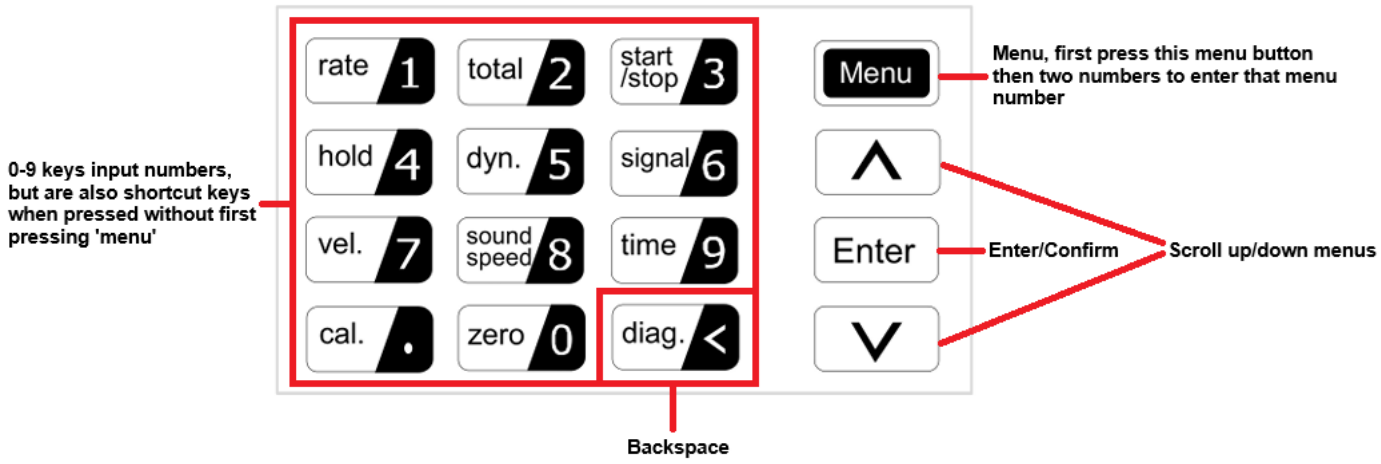
Powering on:

To power on the flow meter, just connect the power source. As soon as the Flowmeter is switched on, the self-diagnosis program will start to run. If any error is detected, an error code will display on the screen (Refer the full manual in 'Error Diagnosis'). The system will default to the last menu at next power on.

As this is the first time use or an install on a new site then you will need to input all installation parameters.

Keypad functions:

The keypad is dual function, the full keypad is pictured below, this will describe basic functionality of the keypad.



0 – 9 keys input numbers, each word printed on the key also is a shortcut to that menu
cal. . is also used as a decimal place button.
diag. < is also used as a backspace.
^ and v scrolls up and down menu numbers
The enter a specifc menu: press the Menu button, then input a two-digit Menu number. for example, by pressing these buttons: Menu rate 1 rate 1 will enter menu 11
Enter is enter/confirm

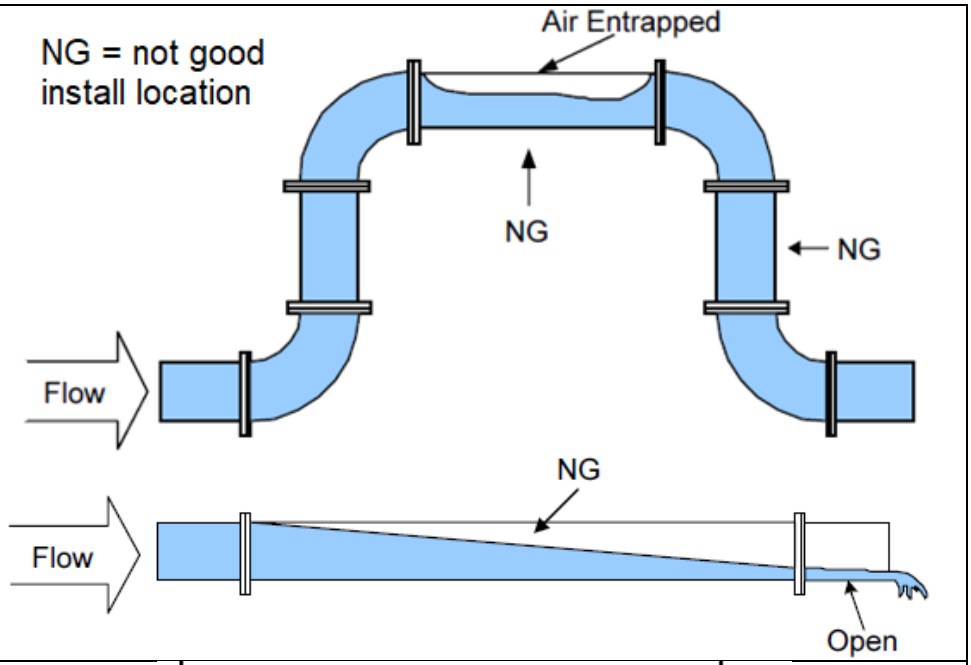
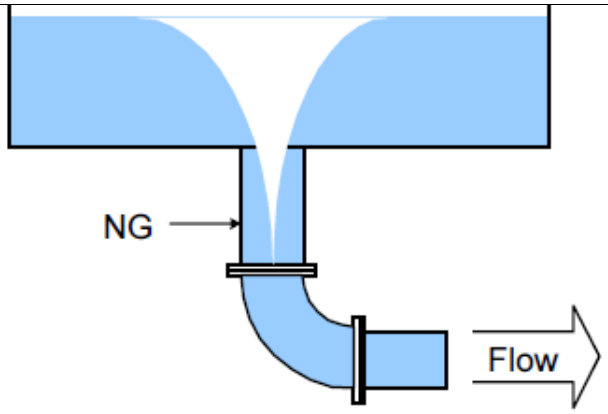
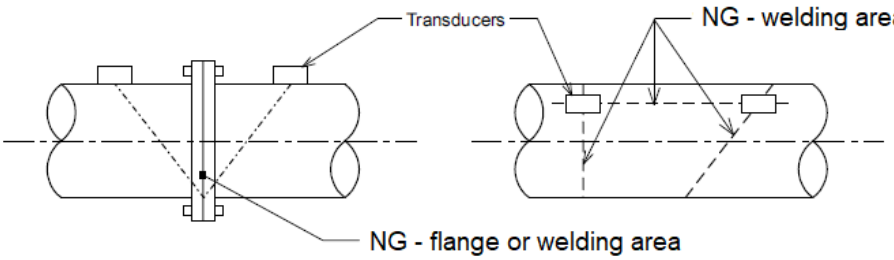
Select installation location:

The installation of ultrasonic flowmeter is the simplest among various types of flowmeters. It can be completed in only three steps: selecting an appropriate measuring point, entering the pipe parameters of the measuring point into the flowmeter, installing the sensor on the pipe, and then starting the measurement.

To ensure measurement accuracy, priority should be given to selecting a pipe section with a uniform fluid flow field distribution as the measuring point. The specific point selection and installation must follow the following principles:

<table>
<tr>
<td>Select a pipe section that is completely filled with fluid such as the vertical part of the pipeline (only with upward fluid flow direction) or a horizontal pipe section filled with fluid. The diagram's show some examples of areas unsuitable for installation.

• Avoid the highest point in a system, there may be entrapped air

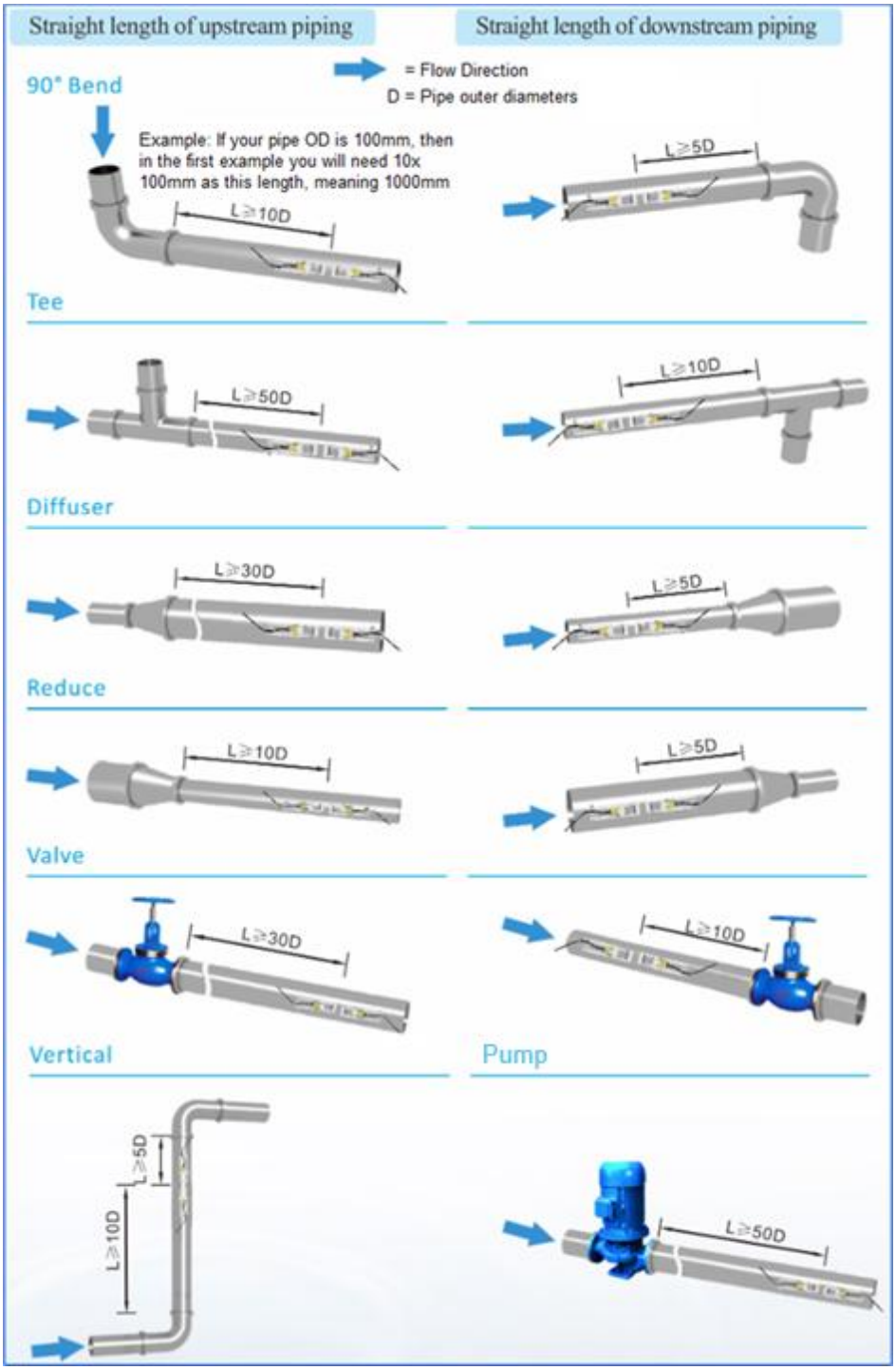
• Avoid a pipe open end.</td>
<td> 
</td>
</tr>
<tr>
<td>Avoid entrained air:
Measurement may not be possible if there is entrained air at the transducer position.
If installing on vertical pipes, it should not be used where flow direction is downward, as the pipe may not be completely full, it would work best on a vertical pipe where the flow direction is from bottom to top.</td>
<td> 
</td>
</tr>
<tr>
<td>Avoid mounting in areas spanning flanges or welded sections of pipe.</td>
<td> 
</td>
</tr>
<tr>
<td>Confirm the temperatures at the measuring point is within the meter's capability</td>
<td>  </td>
</tr>
</table>

- Evaluate condition of the inner pipe wall. Select a pipe section with no scaling or pitting on the inner wall.

- Select a suitable pipe material. A pipe with uniform material and dense structure should be selected to ensure that ultrasonic waves can be stably transmitted in the pipe and reduce signal loss.
  There is a selection of pre-programmed pipe materials, if your pipe material is not one of those you can select 'other', then you can find out the sound speed of that material in m/s, and manually enter it.

- Note that it can only be used with rigid fixed wall pipework, not a flexible hose with a braid for example.

- Ensure that there are sufficient uniform straight pipe sections before and after the measuring point so that the flow is non turbulent inside the pipe. There should be no valves, elbows, reducers, or other devices that may interfere with the flow field within this range. The recommended lengths of straight pipe sections are shown in the diagrams below



Select an area with a straight run of pipe of at least 15x the pipe OD (or more in many cases as shown)

Transducer mounting methods:

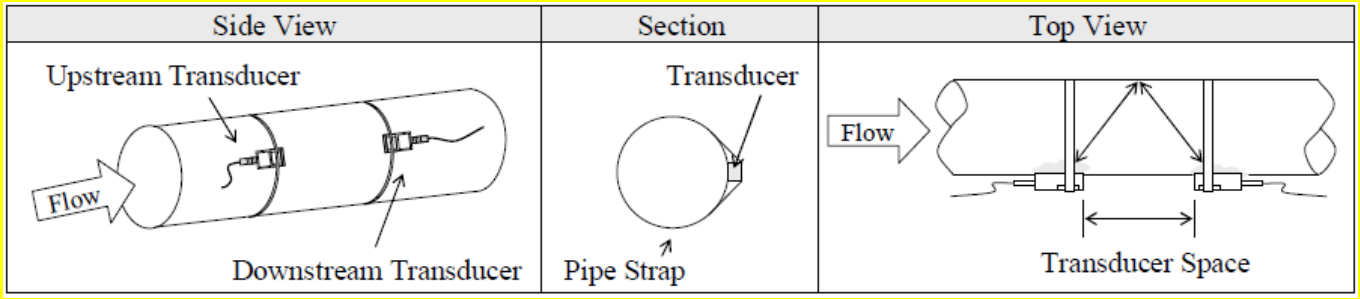
Three transducer mounting methods are available, **V method, Z method** and **N method.**

V method

The V method is considered the standard method. It usually gives a more accurate reading and is used on pipe diameters ranging from 25mm to 400mm. It is also the most convenient to use and setup.

This quick start guide will demonstrate setting up this V method, see the full manual for more info on other methods

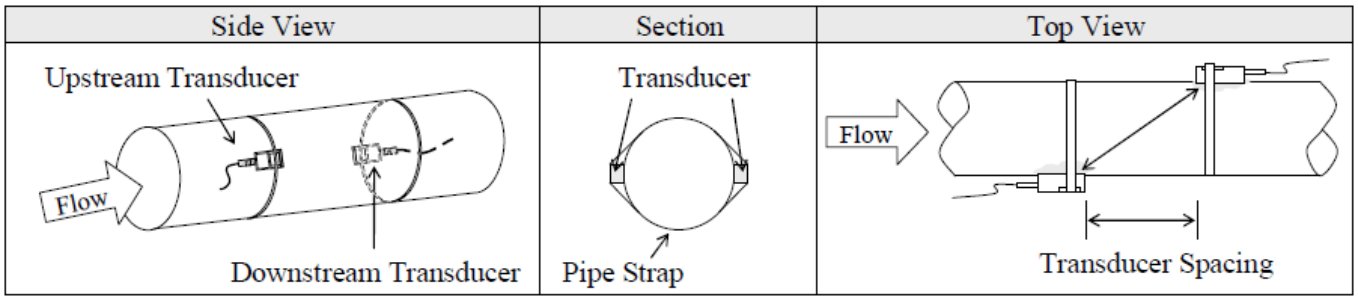
V method – can be used for 25mm to 400mm pipes



Z Method

The signal transmitted in a Z method installation has less attenuation than a signal transmitted with the V method, therefore is good to use when the pipes are large, there are some suspended solid in the fluid, or the scaling and liner are too thick. This is because the Z method utilizes a directly transmitted (rather than reflected) signal which transverses the liquid only once. While the Z method can measure on pipe diameters over 100mm, it is recommended to use this method for pipe diameters over 300mm.

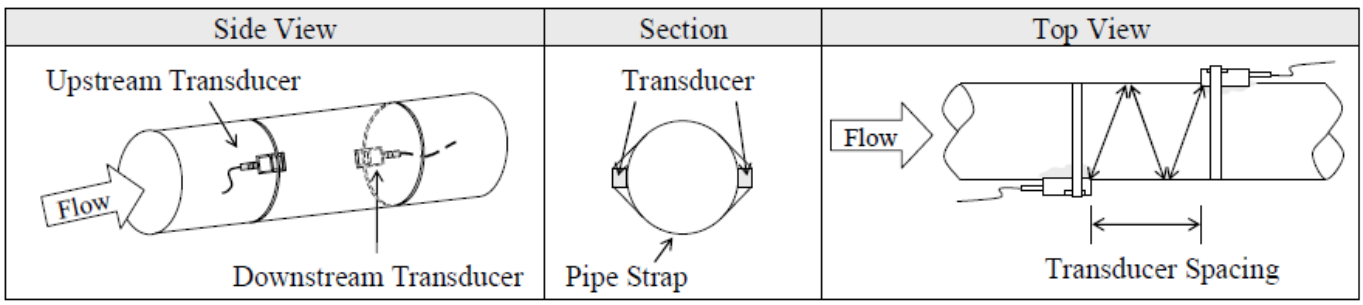
Z method – can be used on pipes over 100mm



N Method (uncommonly used)

With the N method, the sound waves traverse the fluid three times and bounce twice off the pipe walls. It is suitable for small pipe diameter measurement. The measurement accuracy can be improved by extending the transit distance with the N method which this helps to achieve on small pipes

N method – while uncommon – it can be used on small pipes usually under 50mm



Parameters setting:

This guide will only tell you about the most basic menu's – for a full description about each menu's function please see the full manual

Now that a suitable installation location has been decided, and by now you should select the best mounting method for your pipe, we will need to program the pipes parameters into the flow meter, follow the below steps.

Pipe outer diameter (Menu 11)

Press Menu rate 1 rate 1 to enter menu 11, it will appear as below:

You will now need to change the pipe outer diameter to match your pipe, for example if your pipe was 90mm OD then do the following:

Enter first, then type the diamter '90', then enter again to confirm - Enter time 9 zero 0 Enter

Hint: ^ and v scrolls up and down menu numbers, so as the next menu of importance is 12, using this is a quick method to change to that menu

Pipe Wall Thickness (Menu 12)

Press Menu rate 1 total 2 to enter menu 12

You will now need to change the pipe wall thickness to match your pipe, for example if your pipe was 5.2mm then do the following:

Enter first, then type the thickness '5.2', then enter to confirm: Enter dyn. 5 cal. . total 2 Enter

Pipe material (Menu 14)

Press Enter rate 1 hold 4 to enter menu 14

You can select from the preconfigured materials: Carbon steel, Stainless Steel, PVC, Copper

To select your material first press Enter

then c^ or v to scroll up and down selectable options, then Enter again to confirm

Hint: If you have a different pipe material that is not listed as an option this flow meter is unfortunately not suitable, higher spec models can work with more pipe materials and custom sound speed pipes.
Please note this flow meter is also not suitable if the pipe has a liner inside, you will need to user a higher spec model suitable for pipe liners.

Transducer type (Menu 23)

This should generally remain set as '0.CP037' unless you ordered a non standard model or otherwise directed, check the part number you ordered.

Transducer mounting (Menu 24)

Press Menu total 2 hold 4 to enter menu 24

See page 9 (Transducer mounting methods) for more info on selecting the best mounting method, three mounting methods are available.

V – most common, can be used for 25mm to 400mm pipes
Z - can be used if the signal is poor, can be used on pipes over 100mm (but better to be over 300mm)
N - while uncommon to use this, it can be used on small pipes usually under 50mm

To select the mounting method

Press Enter then ∧ or ∨ to scroll up and down selectable options, then Enter again to confirm

Transducer spacing (Menu 25)

Press Menu total 2 dyn. 5 to enter menu 25

After setting all the relevant parameters previously, this menu will display the distance that the transducers should be spaced apart.

Install the transducer according to the displayed transducer mounting spacing and the selected mounting method.

Other Menu numbers are listed below:

01~08	Flow Totalizer Display: to display flow rate, positive total, negative total, net total, velocity, date & time, present operation, and flow results today, etc.
10~29	Initial Parameter Setup: to enter pipe outside diameter, pipe wall thickness, transducer type, transducer mounting method and spacing, etc.
30~38	Flow Units Options: to select the flow unit such as cubic meter, litre, or other units, can turn totalizers on/off and reset totalizers, etc.
40~49	Setup options: Scaling factor, system lock (Window M47), etc.
55~89	Input and output setup: date and time, ESN, communication baud rate setting, etc.
90~98	Diagnoses: Signal strength and signal quality (Window M90), TOM/TOS*100 (Window M91), flow sound velocity (Window M92), total time and delta time (Window M93), Reynolds number and factor (Window M94), etc.
+0~+5	Appendix: power on/off time, total working hours, on/off times, and a single-accuracy function calculator

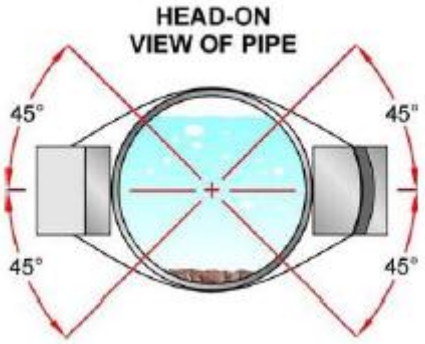
Pipe preparation

So by now you should have already selected the ideal location to install the flow meter transducers.

Remember to consider the possibility of sediment at the bottom of the pipe and the presence of an air pocket at the top of the pipe.

Because of this it is best to install the transducers on the side of the pipe usually within 45° of a horizontal pipe, as shown.

In addition, avoid flanges and welding areas and select a smooth portion of the pipe to install the transducers.



Now that you know the **required sensor spacing** from the previous step, and you have selected a suitable location for the installation with enough distance upstream and downstream away from bends, pumps, valves etc… you can prepare the pipe for mounting the transducers. Using a polisher or sandpaper make the mounting position clean of all rust, mud, scale, painting etc. Ensure the polished area is larger than transducer surface area.	
Polish one mounting area first, measure out the required sensor spacing, and then you can polish the other area accordingly. A clean, polished mounting surface is very important for good signal. For plastic pipe, clean it of painting, sticky oil, adhesives, etc.	

Transducer installation and fixing

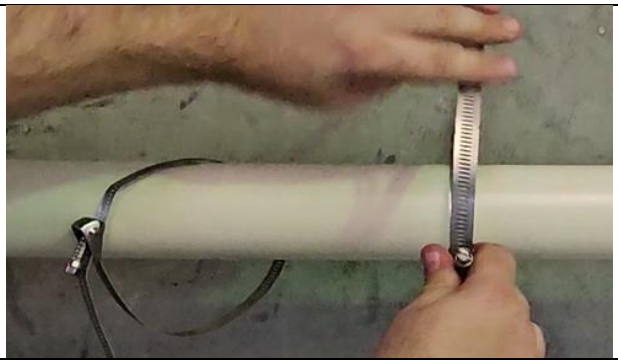
Now the transducers can be installed onto the pipe.
The mounting conditions and positioning directly influences the flow value accuracy and system long-term operation reliability so it is important to mount the transducers correctly and accurately, the transducers should be spaced apart at the distance shown on the meter after parameter setup. (distance shown on menu 25)

Included with the flow meter is some stainless-steel straps and couplant.

Apply a big blob of coupling compound on the face of each transducer, spread it out as required ensuring there are no air gaps between the transducers and the pipe wall.

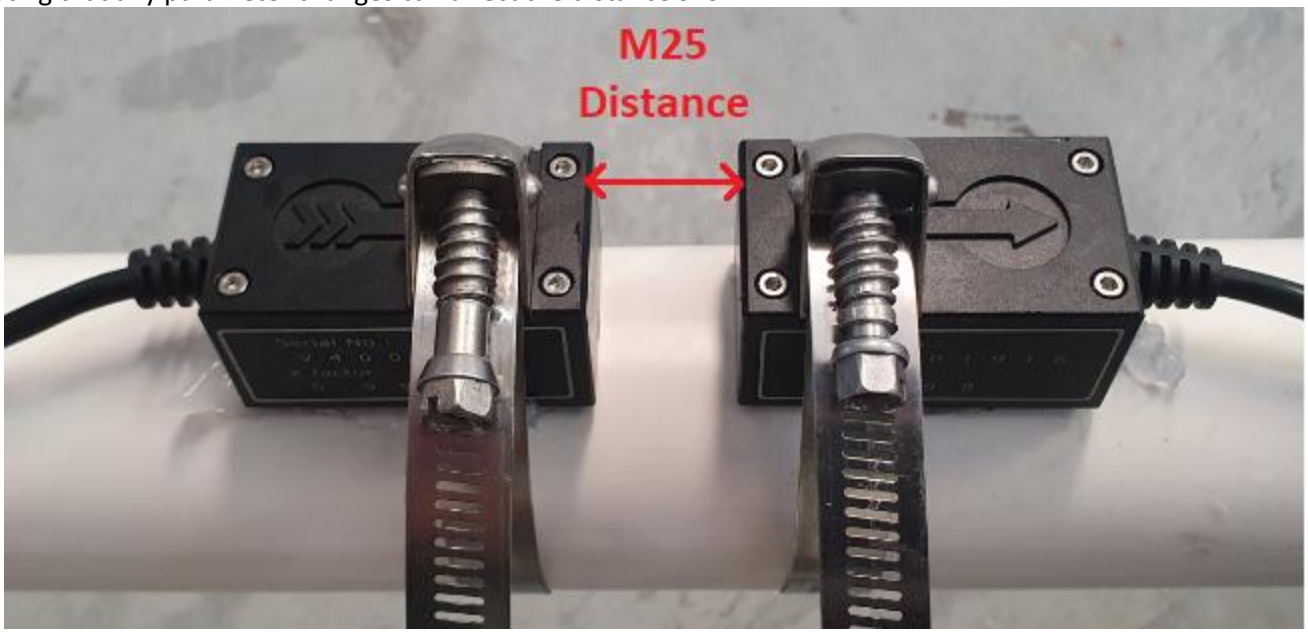
Prepare the stainless-steel straps on the pipe leaving enough slack to slide the transducer into place and tighten up.

Note that the included metal straps obvious can only handle pipe sizes to a certain point, if you have very large pipework then ratchet straps are a handy way to easily mount sensors.



Ensure you place upstream and downstream transducers in accordance with flow direction and check the arrow on the transducer for flow direction. You can also check the labels on the sensor cables which indicate upstream or downstream. Make sure that the transducers are mounted is parallel on the pipe.
Then slide the transducer into position and tighten down the stainless strap.

Double check that the spacing distance matches what your flow meter sensor spacing says on menu 25.
Noting that any parameter changes can affect the distance shown.



Installation Warnings:

1. Pipe parameters entered must be accurate otherwise the flowmeter will not work properly.

2. During the installation, apply enough coupling compounds to stick the transducers onto the pipe wall. While checking the signal strength and Q value, move the transducers slowly around the mounting site until the strongest signal and maximum Q value can be obtained.

3. Check to be sure the mounting spacing is accordance with the display in Window M25 and the transducer is mounted at the pipe's centreline on the same diameter.

4. Pay special attention to those pipes that formed by steel rolls (pipe with seams), since such pipe is always irregular. If the signal strength is always displayed as 0.00, that means there is no signal detected. Thus, it is necessary to check that the parameters (including all the pipe parameters) have been entered accurately. Check to be sure the transducer mounting method has been selected properly, the pipe is not worn-out, rusty, or pitted. Make sure there is indeed fluid in the pipe, or the transducer is not too close to a valve or elbow, and there are not too many air bubbles in the fluid, etc. Apart from these reasons, if there is still no signal detected, the measurement site must be changed to a suitable area.

5. To make sure that the Flowmeter can run properly with high reliability please make sure a strong signal strength is reached. If there is interference from ambient electromagnetic waves or the signal detected is too poor, the flow value displayed will not be reliable; consequently, the capability for reliable operation is reduced.

Checking signal strength, ratio, and Delta time

Once the sensors are properly installed, and flow is going through the pipe, the flow meter should just start measuring, however there are a few key checks you should perform to ensure installation is optimal.

Checking diagnosis information

Press 

shortcut, observe any messages

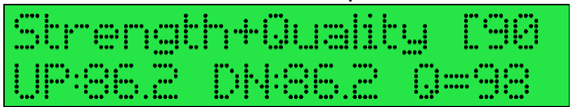
- *R = System normal
- *I = Signal not detected, refer to troubleshooting if it continues
- *G = Adjusting gain, just wait a while and check again

Check Signal strength (Menu 90)

Press 

shortcut or press 

to enter menu 90



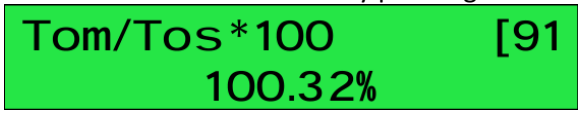
These indicate detected strength and quality of the signal both from upstream and downstream directions
Q=XX is the overall quality

00.0 = no signal
99.9 = maximum signal
65.0+ = all 3 of these values should be over 65 as a minimum requirement for normal operation

Transit time ratio (Menu 91)

Enter the transit time menu by pressing 

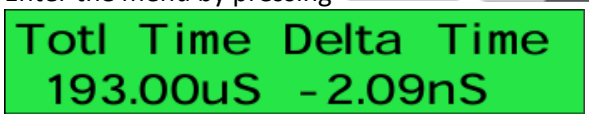
to enter menu 91



Transit time ratio indicates if the transducer mounting spacing is accurate. If the installation and parameters and been completed correctly the **normal transit time ratio should be 100±3** (97% ~ 103%)

Total time and Delta time (Menu 93)

Enter the menu by pressing [Menu] [time 9] [start /stop 3] to enter menu 93



The fluctuation of the time difference should be less than ±20% Under normal circumstances
Essentially just check if the values are jumping around a lot

However, when the pipe diameter is too small or the flow velocity is too low, the fluctuation of the time difference may be slightly larger.

When the "time difference" reading fluctuates too much, the displayed flow rate and flow velocity will also jump sharply. If this occurs, it indicates that the signal quality is too poor, which may be caused by poor pipeline conditions, improper sensor installation, or incorrect parameter input.

If any of these values are out of range:

- Ensure enough couplant has been applied
- Check the transducer installation position and re-check the spacing is correct
- If the parameters are entered correctly (pipe outside diameter, wall thickness, pipe material, liner, etc.)
- If the scale is too thick or the pipe mounting is distorted in shape, etc.
- Check that the cables are well terminated, tight and not shorting to other cables
- If necessary, re-consider the mounting area or method.

You can also check the troubleshooting steps outlined in the troubleshooting section at the back of this guide.

Flow data display after completing setup

View flow rate

To view your flow rate measurement, press the [rate 1] shortcut

Or press [Menu] [zero 0] [rate 1] to enter menu 1. It will display the flow rate.

View totaliser

To view the totaliser, press [total 2] shortcut
you can press continuously to toggle between the day/month/year/latest totalisers

Reset the totaliser:

To reset the totaliser back to 0L, go to Menu 37
It shows: “Totaliser Reset?”
Press [Enter] then [∧] or [∨] to scroll up and down selectable options, then [Enter] to confirm
Note in this menu is also an option ‘RESET’ this is for factory reset, it sets all parameters back to default.

Changing the units

- Flow rate unit can be changed on menu 31
- Totaliser unit can be changed on menu 32

Press [Enter] then [∧] or [∨] to scroll up and down selectable options, then [Enter] to confirm

Basic Troubleshooting

A few key points to consider if you are having measurement problems:

- First, it's suggested to read over this guide in full again or perhaps watch the demonstration video linked on the cover page of this guide, you might pick up a mistake made during initial setup.
- Pipe parameters entered must be accurate; otherwise, the flowmeter will not work properly.
- Ensure transducer wiring has been terminated correctly and tightly, not shorting to other wires.
- Try to clean and/or polish the outer surface of the pipe where the sensors are mounted.
- Apply plenty of coupling compound to the transducer to ensure adequate contact with the pipe wall.
- Check to be sure the mounting spacing is accordance with the displayed value during setup on menu 25
- Ensure transducers are mounted parallel at the pipe's centreline and in the correct flow direction
- While checking the signal strength and Q value, if required you can move the transducers together slowly around the mounting site until the strongest signal can be obtained, eg. Perhaps slightly up/down/left/right. (but maintain correct spacing between sensors)
- Ensure the pipe surface is sanded/polished and free from dirt where the transducers are mounted.
- Keep the flowmeter away from the electromagnetic interference area to ensure its proper operation, In one rare case with another meter we have seen the power supply cause some electronic interference, it may be worth trying a different power supply if required.
- Heavy vibrations on a pipe can also cause issues, you may need to choose an area with less vibrations.
- Ascertain there is not too much air or solids in the fluid, ultrasonic signals cannot get through air and solids in the flow will block signals too.
- Pay special attention to those pipes that formed by steel rolls (pipe with seams), since such pipe is often irregular and so the signal beam may not travel correctly within the pipe.
- Check to be sure the transducer mounting method has been selected properly, the pipe is not worn-out, and the liner is not too thick.
- Make sure there is indeed fluid in the pipe, or the transducer is not too close to a valve, elbow, pipe size change, pump etc…
- You can also try another mounting method instead, V mounting method is most common to use, however it requires the signal to "bounce" off the pipe and therefor can degrade the signal or if the pipe is pitted slightly the signal may bounce unreliably. If you instead use Z method for example the transducers are mounted on opposite sides of the pipe and therefore no "bouncing" is required and should provide a stronger signal when setup correctly, refer to the full manufacturer manual.
- If there is still no signal detected, the measurement site must be changed. Perhaps try another section of pipe, you might be able to find a better location noting the recommendations on pages 6-7
- Might be worth performing a factory reset and re-configuring all parameters from scratch, factory reset option is shown in the totaliser reset menu, shown on page 14 of this guide.

You may need to reference the full manual for further installation instructions, remembering that this guide is just a quick start guide and the full OEM manual has a lot more detailed information.

Frequently asked Questions and Answers

Question: New pipe, high quality material, and all installation requirements met: why still no signal detected?

Answer: Check pipe parameter settings, installation method and wiring connections. Confirm if the coupling compound is applied adequately, the pipe is full of liquid, transducer spacing agrees with the screen readings and the transducers are installed in the right direction.

Question: Old pipe with heavy scale inside, no signal or poor signal detected: how can it be resolved?

Answer: Check if the pipe is full of fluid. Try the Z method for transducer installation (If the pipe is too close to a wall, or it is necessary to install the transducers on a vertical or inclined pipe with flow upwards instead of on a horizontal pipe). Carefully select a good pipe section and fully clean it, apply a wide band of coupling compound on each transducer face (bottom) and install the transducer properly. Slowly and slightly move each transducer with respect to each other around the installation point until the maximum signal is detected. Be careful that the new installation location is free of scale inside the pipe and that the pipe is concentric (not distorted) so that the sound waves do not bounce outside of the proposed area.

For pipe with thick scale inside or outside, try to clean the scale off, if it is accessible from the inside. (Note: Sometimes this method might not work, and sound wave transmission is not possible because of a layer of scale between the transducers and pipe inside wall).

Question: Why is the flow rate still displayed as zero while there is fluid obviously inside the pipe and a symbol of "R" displayed on the screen?

Answer: Check to see if "Set Zero" was carried out with fluid flowing inside the pipe (Refer to Window M42)
If an incorrect “Set Zero” has been carried out, do it again correctly or recover the factory default in Window M43.

Question: The pipe is not full of liquid or there is no flow in the pipe, but still displays an unstable or wrong reading?

Answer: Pipe must be full of liquid, if not, enter the menu 29 to setup an Empty Pipe Q Value less than normal Q value (pipe is full of liquid), cut off abnormal reading, the flow meter will display zero reading.

Question: The pipe is full and flowing, but only at a very low speed, why is the flow meter is displaying 0 flow?

Answer: The data in M41 is Low Flow cut-off Value. If the flow rate falls below the low flow cut-off value, the flow indication is deemed to be ZERO. This can prevent nuisance readings causing the totaliser to accumulate the flow when the actual flow is “0” after a pump was shut down for example. Generally, 0.03m/s is recommended to enter as the flow cut-off point.

The low flow cut-off value has no relation to the measurement results once the velocity is higher than the flow cut-off value.

Question: Why is the flow reading on the display not the same as a trusted known flow rate?

Answer: If you have a known flow rate on a pipe and this flow meter is not reading as expected then the flow meter may need to be “tared” or “zeroed”. Just like scales for example, the zero point sometimes needs to be reset. First, the zero may have accidently been set to an incorrect point, in which case you can re-set the zero point to the factory point using Menu 43.

Alternatively, if you install the flow meter on a full pipe with no flow you can use Menu 42 to set a new zero point. See the full manual for more information on this.

If the zero point is fine, your flow meter may need re-calibration, it is recommended to have the flow meter calibrated regularly to maintain best accuracy.