

# INSTRUCTIONS and OPERATION MANUAL

FOR MODEL

**UA108P**

Portable Ultrasonic Flow meter



Update Record	Revision:	
	Date:	

## Notice

Thank you for choosing the UA108P Ultrasonic Flowmeter with ARM CMOS and low-voltage wide-pulse transmission technology.

This instruction manual contains important information. Please read carefully before the operation of the flowmeter.

## WARNINGS IN THIS MANUAL

Caution and warning statements are used throughout this book to draw your attention to important information.



### **WARNING**

"Warning" statement appears with information that is important to protect people from injury and protect equipment from damage. Please pay very close attention to all warnings that are used to your application. Failure to comply with these instructions may damage the meter.



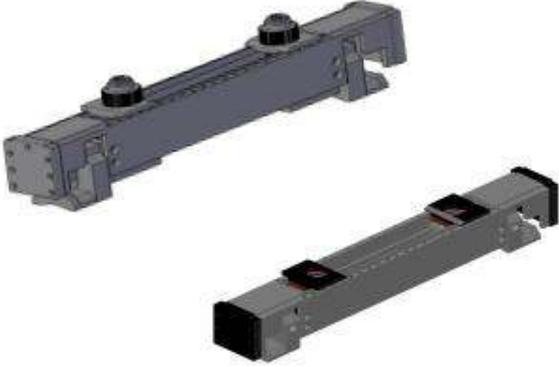
### **NOTE**

"Note" indicates that ignoring the relevant requirements or precautions may result in the meter's damage or malfunction.

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# Product Components

Inspection should be made of the desired location before installing the flowmeter. Check to see if the spare parts are present in accordance with the packing list. Make sure that there is no shipping damage to the enclosure due to a loose screw or loose wire. If you have any questions, please contact your representative as soon as possible.

Transmitter	Transducer
	
Accessories	Documents
<div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;">  <p>Pipe Strips</p> </div> <div style="width: 50%;">  <p>Coupling Compound</p> </div> <div style="width: 50%;">  <p>Transducer Cable</p> </div> <div style="width: 50%;">  <p>4-20mA Connection Cable</p> </div> <div style="width: 50%;">  <p>Recharger</p> </div> <div style="width: 50%;">  <p>Carrying Case</p> </div> </div>	<div style="display: flex; justify-content: space-around;"> <div data-bbox="901 1041 1066 1265">  </div> <div data-bbox="1177 1041 1332 1243">  </div> </div> <ol style="list-style-type: none"> <li>1. Instruction manual;</li> <li>2. Factory certificate;</li> <li>3. Packing list.</li> </ol>

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Update Information:

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# 1. Electronics Installation and Connection

## 1.1. Power Supply Connections

### 1.1.1 Type of Power Supply

The factory offers matching battery charger.

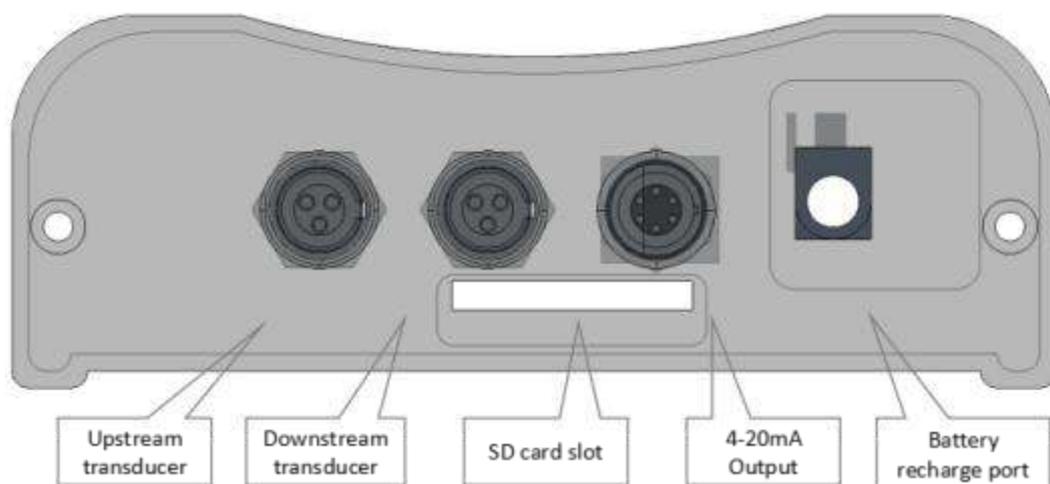
**ATTENTION:**

Please turn off the transmitter when you recharge it, usually it needs around 6 hours to refill the battery.

### 1.1.2 Wiring

Open the hinged top cover of the electronics. The wiring ports of the UA108P, from left to right, are as follows:

The downstream transducer connector, upstream transducer connector, the battery recharge port ( charge the transmitter or connect to a standby power supply ), and the 4~20mA output connector.

**WARNING**

Wiring connections should be made when power is off.

## 1.2. Powering on

After the power is on, the version 1.01.00 will display at the bottom of the right corner as the picture below:



All the parameters that were set by the user will be saved permanently until they are changed by the user.

When the user modifies the parameters and removes the transducers, the meter will recalculate automatically and operate normally with the new parameters.

### 1.3. Keypad Functions

Follow these guidelines when using the flowmeter keypad:

**0** ~ **9** and **.**: Input numbers.

**#**: Backspace or delete characters to the left.

**↶** and **↷**: Return to the last Menu or open the next Menu. Acts as "+" and "-" are used to enter numbers.

**Menu**: Select a Menu. Press this key first, input a two-digit Menu number and the selected Menu data will be displayed. For example, in order to input a pipe outside diameter, press **Menu 11** where "11" is the window ID to display the pipe outside diameter.

**Enter**: Enter / Confirm.

**Data**: Enter / Exit SD card storage interface.

**Graph** window for flow velocity and flow rate curve;

**Flow** , **Total** are shortcuts to the windows for Flow Rate , POS Totalizer,



### 1.4. Keypad Operation

The instrument setup and measurement displays are subdivided into more than 100 independent Menus. The operator can input parameters, modify settings or display measurement results by "visiting" a specific Menu. These Menus are arranged by 2-digit serial numbers from 00~99, then using +0, +1, etc. Each Menu ID code has a defined meaning. For example, Menu 11 indicates the pipe outside diameter, while Menu 25 indicates the mounting spacing between the transducers. Each Menu will be discussed later in this manual.

1.To visit a specific Menu, press the **Menu** key at any time except the SD Card Storage Interface, then input the 2-digit Menu ID code and that Menu will be displayed. For example, to input or check the pipe outside diameter, press the **Menu 11** keys for window ID code 11.

Another method to visit a particular Menu is to press the **↶**, **↷** and **Enter** keys to scroll through the Menus. For example, if the current Menu is 30, press **↷** key to enter Menu 31, press the **↶** button again to enter Menu 30.

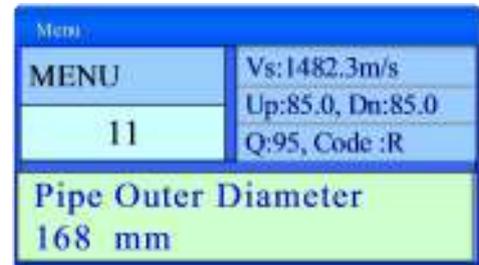
The Menus are divided into three types: 1) Data Type, such as M11, M12; 2) Selection Type, such as M14; 3) Display Type, such as M00, M01.

Visit Data Type Menus to check specific parameters. If parameter change is needed, just press **Enter** first, then input the values and press **Enter** to confirm.

Example 1: To enter a pipe outer diameter of 200mm, the procedure is as follows:

Press **Menu** **1** **1** to enter Menu11 (the numerical value displayed currently is the previous pipe outer diameter). Now press the **Enter** key. The symbol ">" and a flashing cursor is displayed on the screen. The

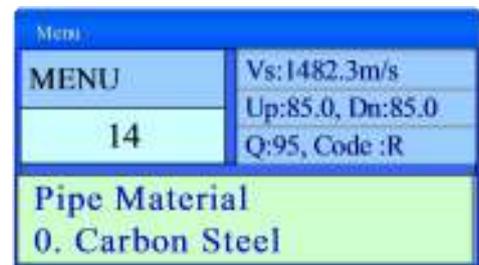
new value can now be entered.



Visit Selection Type Menus to check the related options. If need to modify it, press **Enter** first to enter the revised selection when the symbol ">" is displayed on the screen; or input numbers directly to select the option when the symbol ">" and a flashing cursor are displayed.

Example 2: If the pipe material is "Carbon Steel", press **Menu** **1** **4** to enter Menu 14, then press **Enter** to modify the option. Then, select "0. Carbon Steel" from the drop-down Menu ( you may cycle through

the choices by pressing the **N/+** and **V/-** keys ) and then press **Enter** to confirm the selection.



### 1.5. Flowmeter Menu Descriptions

- 00~09 Display Menus: Used to display flow rate, positive total, negative total, net total, velocity, date & time etc.
- 10~29 Setup Menus: Used to enter pipe outer diameter, pipe wall thickness, fluid type, transducer type, transducer mounting and spacing, etc.
- 30~38 Flow units selection and totalizer operating Menus: Used to select units of measurement. Other Menus set / reset the various totalizer modes.
- 40~45 Setup Menus: Zero Set Calibration menu, Scale Factor menu, etc.
- 46~81 Input and output setup Menus: current loop mode select, 4mA or 20mA output value, etc.
- 90~96 Diagnostics: signal strength quality (Menu 90), TOM/TOS\*100 (Menu 91), sound velocity (Menu 92), total time and delta time of the measured signal (Menu 93), Reynolds number and K factor (Menu 94).
- 0 4~20mA correction Menu.



#### ATTENTION

"Hidden" Menus are for hardware adjustment (retained by the manufacturer).

## 2. Pipe Parameter Entry Shortcuts

### 2.1. Double function keys

Press  to display Flow Rate with large font.

Press  again to return to the main interface



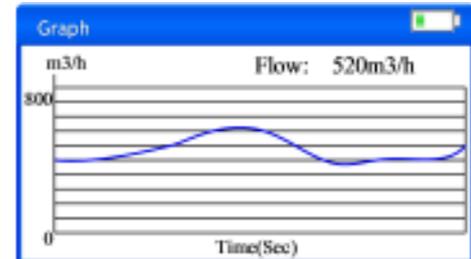
Press  to display Net Total with large font.

Press  again to return to the main interface



Press  to display Flow Rate waveform.

Press  again to return to the main interface



## 2.2. Illustrations

For Example: Let us assume you have a DN150 (6") pipe, measuring medium is water, Material is carbon steel with no liner. These parameters should be operated as follows:

### Step 1. Pipe Outer Diameter

Press **Menu** **1** **1** keys to enter Menu 11, enter the Pipe Outside Diameter, then press the **Enter** key.

Menu:	
MENU	Vs:1482.3m/s
11	Up:85.0, Dn:85.0
Q:95, Code :R	
Pipe Outer Diameter	
168 mm	

### Step 2. Pipe Wall Thickness

Press the **Menu** **1** **2** key to enter Menu 12 enter the Pipe Wall Thickness ( wall thickness for various pipe schedules can be found in the appendix ), then press the **Enter** key.

Menu:	
MENU	Vs:1482.3m/s
12	Up:85.0, Dn:85.0
Q:95, Code :R	
Pipe Wall Thickness	
2.5mm	

### Step 3. Pipe Material

Press the **Menu** **1** **4** key to enter Menu 14, press the **Enter** key, use the **▲/+** or **▼/-** key to select the pipe material from the drop-down Menu, then press the **Enter** key.

Menu:	
MENU	Vs:1482.3m/s
14	Up:85.0, Dn:85.0
Q:95, Code :R	
Pipe Material	
0. Carbon Steel	

### Step 4. Liner Material Parameters

(including thickness and sound velocity, if needed ):

Press the **Menu** **1** **6** key to enter Menu 16, press the **Enter** key, use the **▲/+** or **▼/-** key to select liner material from the drop-down Menu, and then press the **Enter** key.

Menu:	
MENU	Vs:1482.3m/s
16	Up:85.0, Dn:85.0
Q:95, Code :R	
Liner Material	
0.None,liner	

### Step 5. Fluid Type

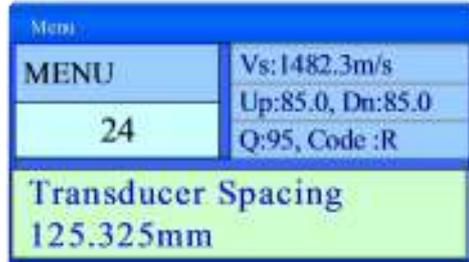
Press the **Menu** **2** **0** key to enter Menu 20, press the **Enter** key, use the **▲/+** or **▼/-** key to select fluid type from the drop-down Menu, then press the **Enter** key.

Menu:	
MENU	Vs:1482.3m/s
20	Up:85.0, Dn:85.0
Q:95, Code :R	
Fluid Type	
0. water	

**Step 6. Transducer Mounting**

Press the **Menu** **2** **4** key to enter Menu 24, press the **Enter** key, use the **▲/■** or **▼/■** key to select transducer-mounting from the drop-down Menu, then press the **Enter** key.

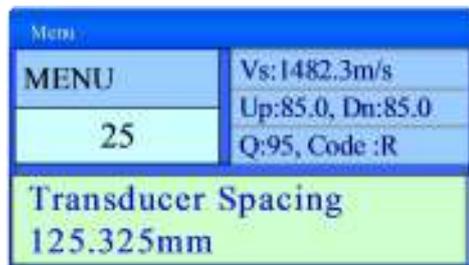
( Details on Chapter 3.1.1 ).



**Step 7. Transducer Spacing**

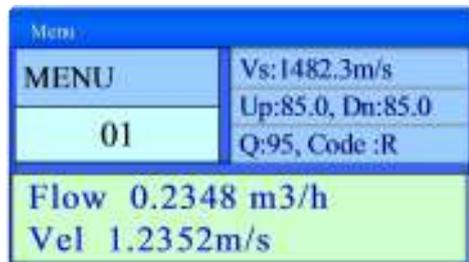
Press the **Menu** **2** **5** key to enter Menu 25, accurately install the transducer according to the displayed transducer mounting spacing and the selected mounting method.

( Details on Chapter 2.3 ).



**Step 8. Display Measurement Results**

Press **Menu** **0** **1** to enter Menu 01 to display flow rate. ( Subject to the real measurement. )

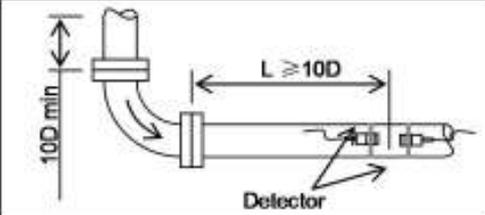
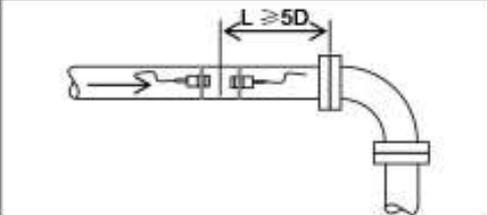
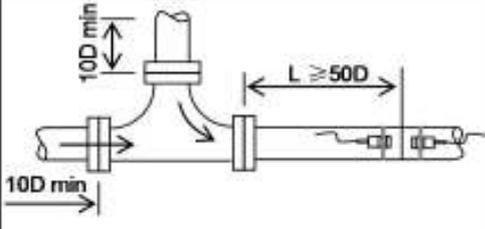
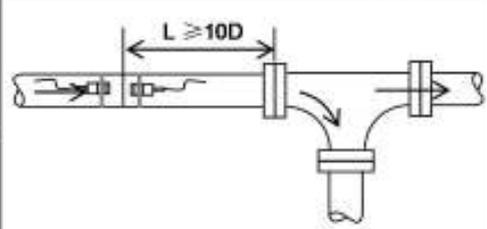
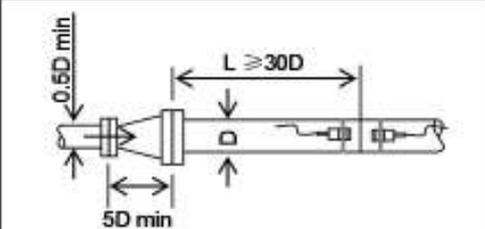
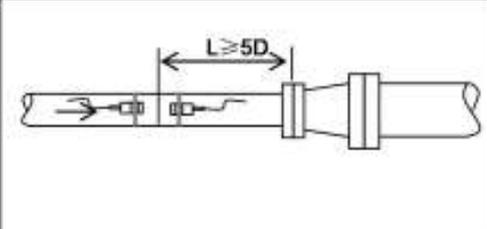
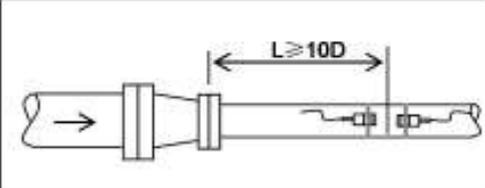
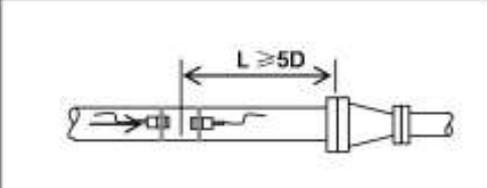
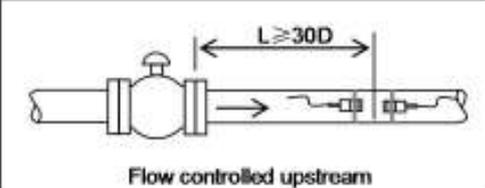
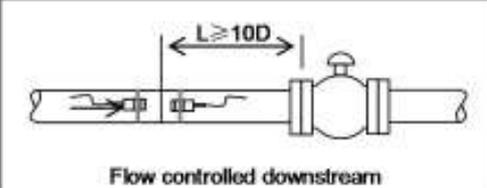
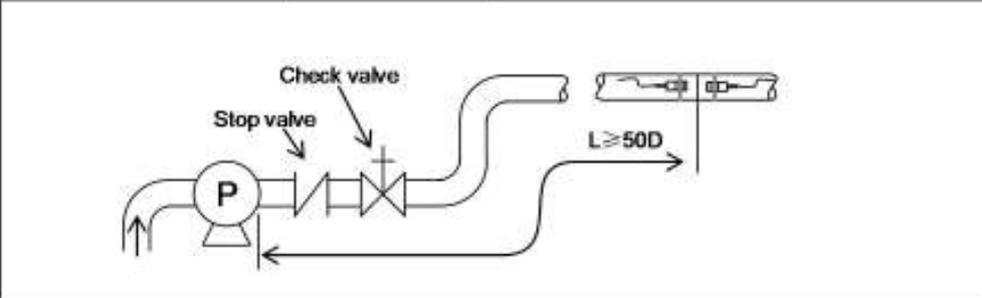


**2.3. Measurement Site Selection**

The installation of this ultrasonic flow meter is the simplest one of all kinds of flowmeters. Only one suitable measuring site needed, plug the transducers on the pipe and then start the measurement.

When selecting a measurement site, it is important to select an area where the fluid flow profile is fully developed to guarantee a highly accurate measurement. Use the following guidelines to select a proper installation site:

- Choose a section of pipe that is always full of liquid, such as a vertical pipe with flow in the upward direction or a full horizontal pipe.
- Ensure enough straight pipe length at least equal to the figure shown below for the upstream and downstream transducers installation. Try to avoid Ensure enough straight pipe length at least equal to the figure shown below for the upstream and downstream transducers installation.
- On the horizontal pipe, the transducer should be mounted on the 9 and 3 of the pipe, avoiding the position of 6 and 12, in case of the signal attenuation caused by pipe at the bottom sediment or bubble、cavitation on the pipe.
- Ensure that the measuring site temperature is under the transducer temperature limits.
- Consider the inside condition of the pipe carefully. If possible, select a section of pipe where the inside is free of excessive corrosion or scaling.
- Choose a section of sound conducting pipe.

Name	Straight length of upstream piping	Straight length of downstream piping
90° bend		
Tee		
Diffuser		
Reduce		
Valve	 <p style="text-align: center;">Flow controlled upstream</p>	 <p style="text-align: center;">Flow controlled downstream</p>
Pump		

## 3. Transducer Installation

### 3.1. Installing the Transducers

Before installing the transducers, clean the pipe surface where the transducers are to be mounted. Remove any rust or loose paint and make a smooth surface. Apply a wide band of sonic coupling compound down the center of the face of each transducer as well as on the pipe surface, and then attach the transducers to the pipe with the straps provided and tighten them securely.

Note:

1. The two transducers should be mounted at the pipe's centerline on horizontal pipes. Make sure that the transducer mounting direction is parallel with the flow.
2. During the installation, there should be no air bubbles or particles between the transducer and the pipe wall. On horizontal pipes, the transducers should be mounted in the 3 o'clock and 9 o'clock positions of the pipe section in order to avoid any air bubbles inside the top portion of the pipe.
3. Refer to Transducer Mounting in Menu 25.
4. If the transducers cannot be mounted horizontally symmetrically due to limitation of the local installation conditions, it may be necessary to mount the transducers at a location where there is a guaranteed full pipe condition (the pipe is always full of liquid).

#### 3.1.1 Transducer Mounting Methods

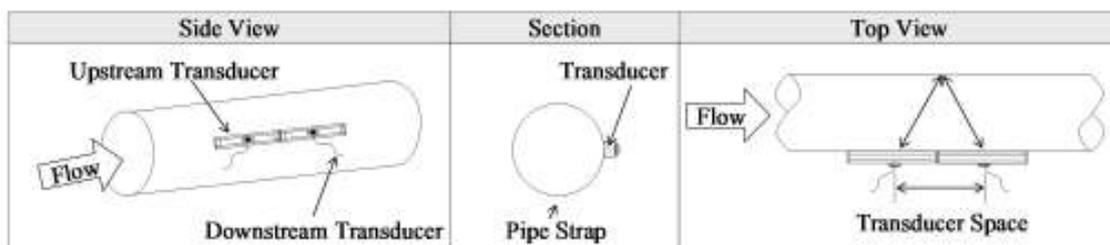
Three transducer mounting methods are available. They are respectively: V method, Z method and N method.

The V method is primarily used on small diameter pipes (DN100~300mm, 4"~12"). The Z method is used in applications where the V method cannot work due to poor signal or no signal detected. In addition, the Z method generally works better on larger diameter pipes (over DN300mm, 12") or cast iron pipes.

The N method is an uncommonly used method. It is used on smaller diameter pipes (below DN50mm, 2").

#### 3.1.2 V Method

The V method is considered as the standard method. It usually gives a more accurate reading and is used on pipe diameters ranging from 25mm to 400mm (1"~16") approximately. Also, it is convenient to use, but still requires proper installation of the transducer, contact on the pipe at the pipe's centerline and equal spacing on either side of the centerline.

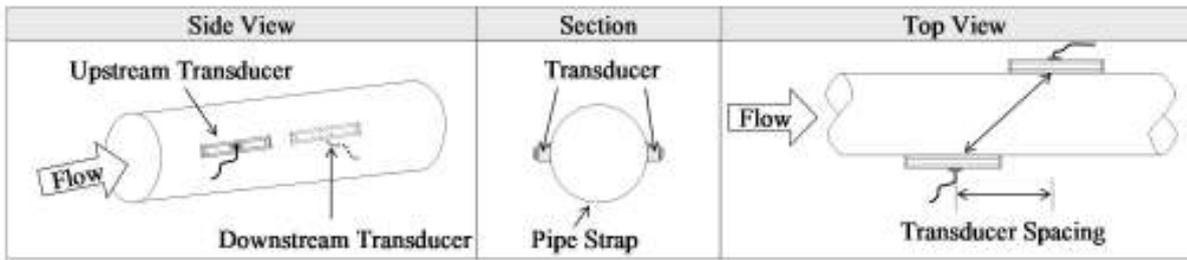


#### 3.1.3 Z Method

The signal transmitted in a Z method installation has less attenuation than a signal transmitted with the V method. This is because the Z method utilizes a directly transmitted (rather than reflected) signal which transverses the liquid only once.

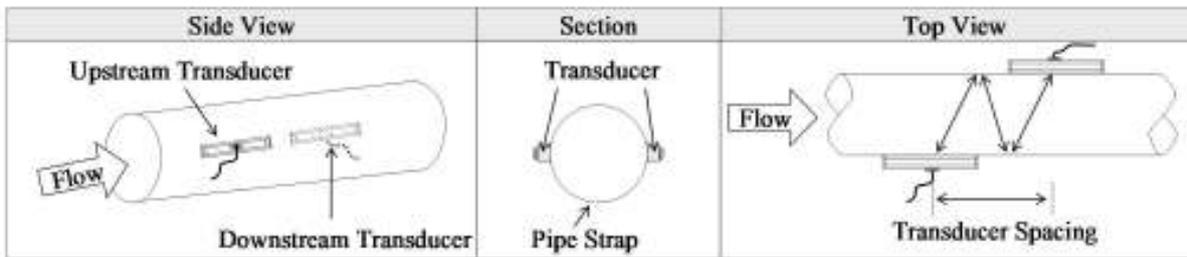
The Z method is able to measure on pipe diameters ranging from 100mm to 5000mm (4"~200")

approximately. Therefore, we recommend the Z method for pipe diameters over 300mm (12" ).



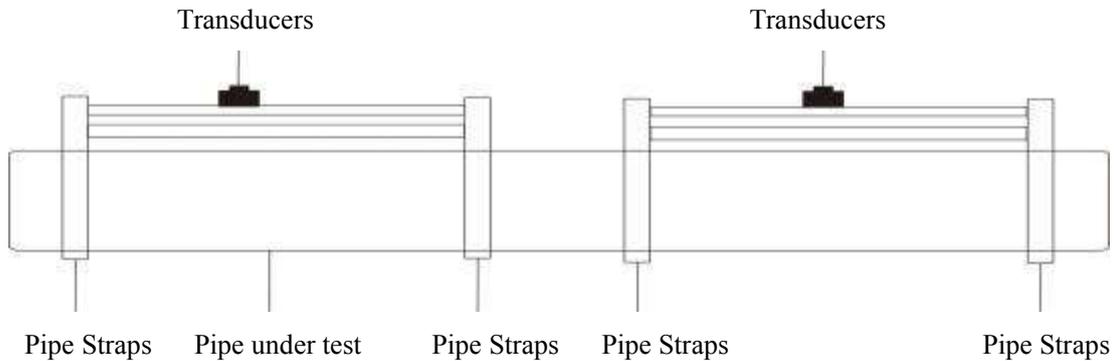
### 3.1.4 N Method (not commonly used)

With the N method, the sound waves traverse the fluid twice and bounce three times 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 (uncommonly used).



### 3.2. Transducers Fixing

Transducers can be installed onto the pipe with its magnetic racks. If you need to fasten them, then you can use the chains to make it firm. Show as below:



### 3.3. Transducer Mounting Inspection

Check to see if the transducer is installed properly and if there is an accurate and strong enough ultrasonic signal to ensure proper operation and high reliability of the transducer. It can be confirmed by checking the detected signal strength, total transit time, delta time as well as transit time ratio. These checks are explained below.

The "mounting" condition directly influences the flow value accuracy and system reliability. In most instances, apply a wide bead of sonic coupling compound lengthwise on the face of the transducer and stick it to the outside pipe wall to get good measurement results. However, the following inspections still need to be carried out in order to ensure a high reliability of the measurement and long-term operation of the instrument.

#### 3.3.1 Signal Strength

Signal strength (displayed in Menu 90) indicates a detected strength of the signal both from upstream and downstream directions. The relevant signal strength is indicated by numbers from 00.0~99.9. 00.0 represents no signal detected while 99.9 represent maximum signal strength.

Normally, the stronger the signal strength detected, the better the measurement.

Adjust the transducer spacing to the best position and check to ensure that enough sonic coupling compound is applied during installation in order to obtain the maximum signal strength.

System normal operation requires signal strength over 60.0, which is detected from both upstream and downstream directions. If the signal strength detected is too low, the transducer installation position and the transducer mounting spacing should be re-adjusted and the pipe should be re-inspected. If necessary, change the mounting to the Z method (Z has the highest signal strength).

#### 3.3.2 Signal Quality (Q value)

Q value is short for Signal Quality (displayed in Menu 90). It indicates the level of the signal detected. Q value is indicated by numbers from 00~99. 00 represents the minimum signal detected while 99 represent the maximum.

The transducer position may be adjusted and enough coupling used to get the signal quality detected as strong as possible.

#### 3.3.3 Total Time and Delta Time

"Total Time and Delta Time" are displayed in Menu 93. The measurement calculations in the flowmeter are based upon these two parameters. Therefore, when "Delta Time" fluctuates strongly, the flow and velocities fluctuate accordingly strongly. This means that the signal quality detected is poor. It may be the result of poor pipe installation conditions, inadequate transducer installation or incorrect parameter input.

Generally, "Delta Time" fluctuation should be less than  $\pm 20\%$ . Only when the pipe diameter is too small or velocity is too low can the fluctuation be more strongly.

#### 3.3.4 Transit Time Ratio

Transit Time Ratio indicates if the transducer mounting spacing is accurate. The normal transit time ratio should be  $100 \pm 3$  if the installation is proper. Check it in Menu 91.

---

#### ATTENTION



If the transit time ratio is over  $100 \pm 3$ , it is necessary to check:

- (1) If the parameters (pipe outside diameter, wall thickness, pipe material, liner, etc.) have been entered correctly;
  - (2) If the transducer mounting spacing is accordance with the display in Menu 25;
  - (3) If the transducer is mounted at the pipe's centerline on the same diameter;
-

- (4) If the fouling layer is too thick or the pipe mounting is distorted in shape, etc.
- 

### 3.3.5 Warnings

1. Pipe parameters entered must be accurate; otherwise the flowmeter will not work properly.
2. During the installation, apply enough coupling compound to bond the transducer onto the pipe wall. While checking the signal strength and Q value, move the transducer slowly around the mounting site until the strongest signal and maximum Q value are obtained.
3. Check to be sure the mounting spacing is as calculated in Menu 25 and the transducer is mounted at the pipe's centerline on the same diameter. Note that you can adjust the spacing slightly as described above to fine tune the device.
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 whether 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, and the liner is not too thick. Make sure there is no fluid in the pipe or the transducer is not very close to a valve or elbow, and/or there are not too many air bubbles in the fluid, etc. Once you have ruled out all these possible reasons, if there is still no signal detected, the measurement site has to be changed.

## 4. Operating Instructions

### 4.1. System Normal Identification

Press the    keys. If the letter "\*R" displays on the screen, it indicates system normal.

If the letter "E" is displayed, it indicates that the current loop output is over ranged by 120%. This refers to the settings in Menu 57. Enter a larger value in Menu 57, and the letter "E" will disappear. It can be ignored if no current loop output is used.

If the letter "G" is displayed, it indicates that system is adjusting the signal gain prior to the measurement. Also, it means system normal. Only in such a condition for a long time, can the instrument be proved to be abnormal.

Letter "I" indicates no signal is being detected. Check to see if the transducer wiring connections are correct, the transducers are securely installed, etc.

For further information, please refer to "Error Diagnosis".

### 4.2. Low Flow Cutoff Value

The data in M41 is Low Flow Cutoff Value. If the flow rate falls below the low flow cutoff value, the flow indication is driven to zero. This function can prevent the flow meter from displaying flow as "0" after a pump was shut down, but there is still liquid movement in the pipe, which will result in cumulative error.

Generally, 0.01m/s is recommended to enter as the low flow cutoff point. The low flow cutoff value has no relation to the measurement results once the velocity increases over the low flow cutoff value.

### 4.3. Zero Setting

Once zero flow occurs, a zero point is established, i.e., that the measurement value reaches zero flow, it indicates as zero. It is necessary to establish the true zero flow condition and program that set point into the instrument.

If the zero set point is not at true zero flow, an offset will occur. For an ultrasonic flowmeter, the measurement error from zero point cannot be ignored under low flow conditions. It is necessary to perform a zero set calibration to improve low flow measurement accuracy.

Set Zero in Menu42, press , wait for the processing indication at the bottom right corner of the screen to reach "0". Performing Set Zero in flowing conditions may cause the flow to be displayed as "0". If so, it can be recovered via Menu 43.

### 4.4. Scale Factor

Scale factor refers to the ratio between "actual value" and "reading value". For example, when the measurement is 2.00, and it is indicated as 1.98 on the instrument, the scale factor reading is 2/1.98. This means that the best scale factor constant is 1. However, it is difficult to keep the scale factor as "1" on the instrument especially in batch control operations. The difference is called "consistency".

During operation, if there still exists possible difference in pipe parameters, etc., the "scale factor" may be necessary to be changed when used on different pipes. Thus, scale factor calibration is specially designed for calibrating the differences that result from application on different pipes. The scale factor entered must be one that results from actual flow calibration. The scale factor can be entered via M45.

### 4.5. 4~20mA Current Loop Output

With a current loop output exceeding an accuracy of 0.1%, the flowmeter is programmable and configurable with outputs such as 4 ~ 20mA selected in Menu 55. For details, please refer to Menu55 in "Window Display

Explanations".

In Window M56, enter a 4mA flow value. Enter the 20mA flow value in Window M57. For example, if the flow range in a specific pipe is 0~1000m<sup>3</sup>/h, enter 0 in Window M56 and 1000 in Window M57. If the flow ranges from -1000~0~2000m<sup>3</sup>/h, configure the 20~4~20mA output by selecting in Window M55 when flow direction is not an issue. Enter -1000 in Window M56 and 2000 in Window M57.

Calibrating and testing the current loop is performed in Window M58. Complete the steps as follows:

Press **Menu** **5** **0** **Enter**, move **A/+** or **W/-** to display "4mA", "20mA" readings, connect an ammeter to test the current loop output and calculate the difference. Calibrate it if the difference is not within tolerance. Refer to Section 5.6 for Current Loop Verification.

Check the present current loop output in Window M59 as it changes with change in flow.

## 4.6. 4-20mA Analog Input Verification



### NOTE

Do not perform this operation unless the actual output current value is different from the value indicated in Menu 58 CL Check Verification. Every meter has been calibrated before leaving the factory.

Calibrate the analog input required to expand the hardware debugging Menu as below procedures:

Press **Menu** **W/-** **0** **Enter** to enter the password "115800" then press **Enter**. This action will be inoperative after powering off.

Then press **Enter** to enter the Current Loop Verification Mode, press **Enter** to enter the 4mA verification status, use an accurate ammeter to measure the output current of the current loop, and move **A/+** or **W/-** to adjust the displayed values, wait for the ammeter current value to reach "4.00mA", then the 4mA verification is finished.

Press **Enter** to do the 20mA verification using the same procedure as for the 4mA verification.

The verification results will be automatically saved in the EEPROM and will not be affected when the instrument is powered off.

## 4.7. SD Card Operation

### 4.7.1 Specifications

Memory: 2 GB (Standard).

Note: The SD card is a consumable item and its models updates quickly. Thus the configuration is on the basis of the physical matter received.

Data collection interval: any interval settings from 1 to 60 seconds are OK according to the requirement. If the rate is set longer than 60 seconds the default will be 60 seconds; when it is set to be less than 1 second, it will default to 1 second.

Data content: date and time, flow rate, flow velocity, total flow, positive totalizer and negative totalizer.

Data collection time: user selectable from 1~9999 mins. If it is set longer than 9999 mins, it will default to 9999 mins.

Data storage format: 1=07-04-10,14:16:33

2=+3.845778E+01 m<sup>3</sup>/h

3=+1.451074E+00 m/s

4=-0000010E+0 m<sup>3</sup>

5=+0000002E+0 m<sup>3</sup>

6=-0000012E+0 m<sup>3</sup>

File system format: FAT16

File type: plain text file(.TXT)

File capacity: maximum 512 pcs

File name format: mmddhhmm (yy - year, mm - month, dd - date)

Turn to Chapter 5.7.4 for details if want to change a file name.

When the capacity of the SD card is full, the new data will override the earliest files automatically (it will rollover).

## 4.7.2 Install or Remove the SD card while the meter is powered on

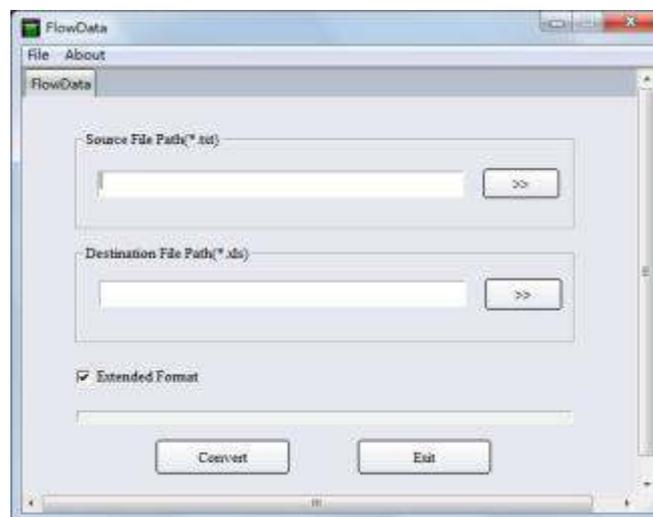


### ATTENTION

Do not remove the SD card from the reader while actively collecting data. Processing the data directly from the SD card file location on the PC could result in lost or corrupt data if the SD card is removed while data is still being processed.

## 4.7.3 Reading the SD Data Externally

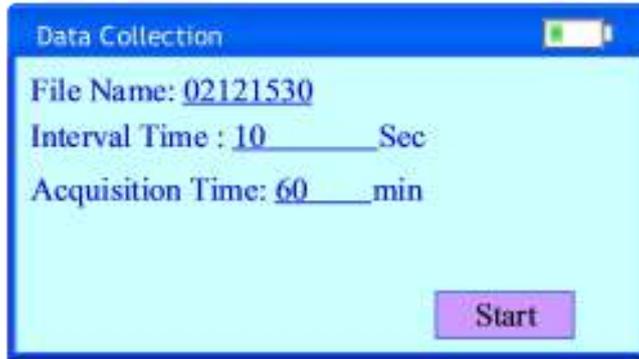
The operator can read and work with the data in the SD card with the “FlowData” software provided with the flowmeter:



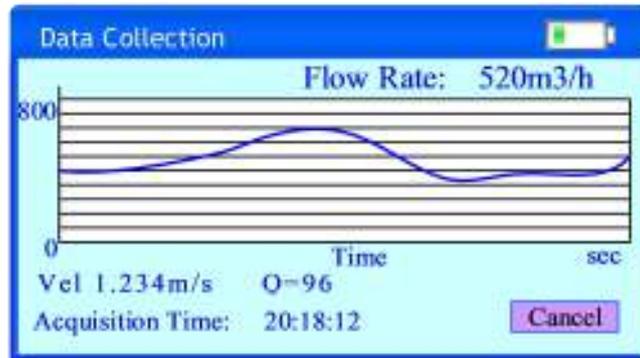
Select the file to be converted in "Source File (\*.txt)", enter the directory path and the file name in "Destination File (\*.xls)", then press "Convert". When "OK" is displayed means the conversion is completed.

## 4.7.4 SD Card Storage Operation

1. Insert the SD card, then press  button to enter the SD card storage setting interface.



2. If you need to modify the file name, acquisition time or acquisition interval, enter the number to modify it directly, press **▲/+** or **▼/-** button for line feed.



3. After modification or to use the default value, press **Enter** to store the data. The above picture shows the normal operation interface.
4. If need to stop store the data, choose "Stop", "Start" and press **Enter** to stop or start data storage. Then choose "OK" and press **Enter** to exit the SD Card storage.

#### 4.8. ESN

We provide the flowmeter with a unique electronic serial number to identify each flowmeter for the convenience of the manufacturer and customers. The ESN, instrument types and versions are able to view in Window M61.



#### ATTENTION

Other Operating Refer to "6.2 Window Display Explanations".

## 5. Window Display Explanations

### 5.1. Window Display Codes

Flow Totalizer Display	
00	Flow Rate/Net Totalizer
01	Flow Rate/Velocity

02	Flow Rate/POS Totalizer
03	Flow Rate/NEG Totalizer

04	Date Time/Flow Rate
08	System Error Codes

09	Net Flow Today
<b>Initial Parameter setup</b>	
10	Pipe Outer Perimeter
11	Pipe Outer Diameter
12	Pipe Wall Thickness
13	Pipe Inner Diameter
14	Pipe Material
15	Pipe Sound Velocity
16	Liner Material
17	Liner Sound Velocity
18	Liner Thickness
20	Fluid Type
21	Fluid Sound Velocity
22	Fluid Viscosity
24	Transducer Mounting
25	Transducer Spacing
26	Parameter Setups
27	Cross-sectional Area
28	Holding with Poor Sig
29	Empty Pipe Setup
<b>Flow Units Options</b>	
30	Measurement Units

31	Flow Rate Units
32	Totalizer Units
33	Totalizer Multiplier
35	POS Totalizer
36	NEG Totalizer
37	Totalizer Reset
38	Manual Totalizer
<b>Setup Options</b>	
40	Damping
41	Low Flow Cutoff Value
42	Set Zero
43	Reset Zero
44	Manual Zero Point
45	Scale Factor
<b>Input and output setup</b>	
46	Network identifying address code
47	System Lock
49	Segmented Correction
55	CL Mode Select
56	CL 4mA Output Value
57	CL 20mA Output Value

58	CL Check
59	CL Current Output
60	Date and Time
61	ESN
62	Serial Port Parameter
67	FO Frequency Range
68	Low FO Flow Rate
69	High FO Flow Rate
72	Working Timer
73	Alarm #1 Low Value
74	Alarm #1 High Value
77	Beeper Setup
80	Flow Batch CTRL
81	Flow Batch Controller
<b>Diagnoses</b>	
90	Signal Strength and Quality
91	TOM/TOS*100
92	Fluid Sound Velocity
93	Total Time and Delta
94	Reynolds Number and Factor
96	Time Fixed Delay
<b>Appendix</b>	
-0	Hardware Parameter Modification

NOTE: The factory maintains the final explanation for other menu features.

## 5.2. Display Explanation

MENU 0 0

### Flow Rate / Net Totalizer

Display flow rate and net totalizer.

MENU		Vs:1482.3m/s
00		Up:85.0, Dn:85.0
		Q:95, Code :R
Flow	0.2348 m3/h	
Net	+125×1m3	

MENU 0 1

### Flow Rate / Velocity

Display flow rate and velocity.

MENU		Vs:1482.3m/s
01		Up:85.0, Dn:85.0
		Q:95, Code :R
Flow	0.2348 m3/h	
Vel	1.2352m/s	

MENU 0 2

### Flow Rate / Positive Totalizer

Display flow rate and positive totalizer.

Select the positive Totalizer units in Window M31.

If the positive totalizer has been turned off, the positive totalizer value displayed is the total the total that existed prior to turning it off.

MENU		Vs:1482.3m/s
02		Up:85.0, Dn:85.0
		Q:95, Code :R
Flow	0.2348 m3/h	
POS	0×1m3	

MENU 0 3

### Flow Rate / Negative Totalizer

Display flow rate and negative totalizer.

Select the negative totalizer value in Window M32.

If the negative totalizer has been turned off (refer to M36), the value displayed is total the total that existed prior to turning it off.

MENU		Vs:1482.3m/s
03		Up:85.0, Dn:85.0
		Q:95, Code :R
Flow	0.2348 m3/h	
NEG	0×1m3	

MENU 0 4

**Current Time / Flow Rate**

Display the current time and flow rate.

The time setting method is found in window M60.

Menu	
MENU	Vs:1482.3m/s Up:85.0, Dn:85.0
04	Q:95, Code :R
16-12-11 13:45:32	
Flow 0.2345m3/h	

MENU 0 8

**System Error Codes**

Display the operating condition and the system error codes. More than one error code can occur at the same time.

The explanations of error codes and detailed resolution methods can be found in "Error Diagnosis".

Menu	
MENU	Vs:1482.3m/s Up:85.0, Dn:85.0
08	Q:95, Code :R
*R----- System Normal	

MENU 0 9

**Net Flow Today**

Display net total flow today.

Menu	
MENU	Vs:1482.3m/s Up:85.0, Dn:85.0
09	Q:95, Code :R
Net Flow Today 289.76 m3	

MENU 1 0

**Pipe Outer Perimeter**

Enter the pipe outer perimeter (circumference). If the pipe outer diameter is known, enter it in window M11.

Menu	
MENU	Vs:1482.3m/s Up:85.0, Dn:85.0
10	Q:95, Code :R
Pipe Outer Perimeter 412.96 mm	

MENU 1 1

**Pipe Outside Diameter**

Enter the pipe outside diameter; the pipe outside diameter must range from 15mm to 6000mm.

Note:

Enter either the pipe outside diameter or pipe outer

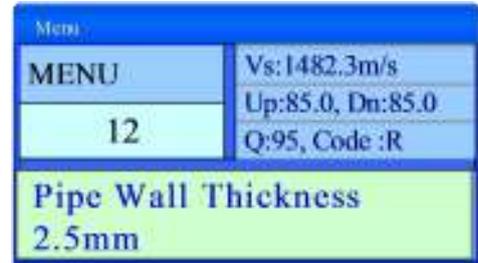
perimeter.

Menu	
MENU	Vs:1482.3m/s Up:85.0, Dn:85.0
11	Q:95, Code :R
Pipe Outer Diameter 168mm	

Menu 1 2

**Pipe Wall Thickness**

Enter the pipe wall thickness. If the pipe inside diameter is already known, skip this window and enter it in window M13.



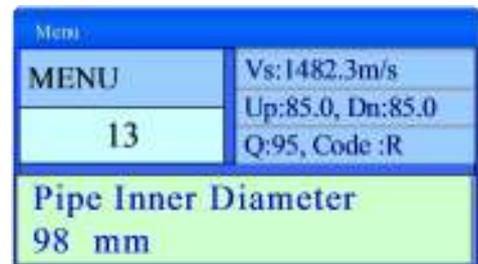
Menu 1 3

**Pipe Inner Diameter**

Enter the pipe inside diameter. If the pipe outside diameter and pipe wall thickness has been entered, press to skip this window.

Note:

Enter either pipe wall thickness or pipe inside diameter.



Menu 1 4

**Pipe Material**

Enter pipe material. The following options are available (by , , buttons or numerical keys):

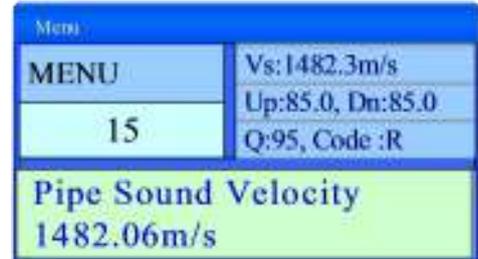
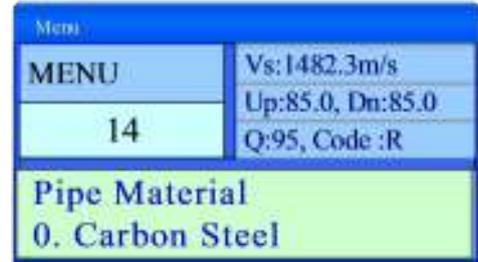
- 0. Carbon Steel
- 1. Stainless Steel
- 2. Cast Iron
- 3. Ductile Iron
- 4. Copper
- 5. PVC
- 6. Aluminum
- 7. Asbestos
- 8. Fiber Glass-Epoxy
- 9. Other

Refer to item 9 "Other"; it is possible to enter other materials, which are not included in previous eight items. Once item 9 is selected, the relevant pipe sound velocity must be entered in Window M15. If sound velocity is not known, there are other ways to determine it on site.

Menu 1 5

**Pipe Sound Velocity**

Enter pipe sound velocity. This function is only used when item 9 "Other" is selected in Window M14. At the same time, this window cannot be visited. It will be calculated automatically according to the existing parameters.



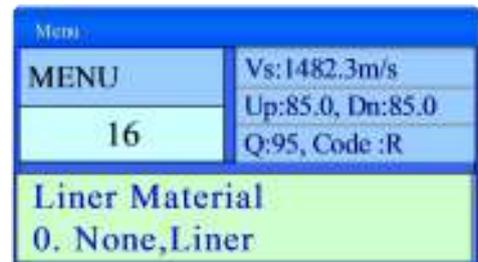
Menu 1 6

**Select the Liner Material**

The following options are available:

0. None, No Liner	6. Polystyrene
1. Tar Epoxy	7. Polyester
2. Rubber	8. Polyethylene
3. Mortar	9. Ebonite
4. Polypropylene	10. Teflon
5. Polystyrol	11. Other

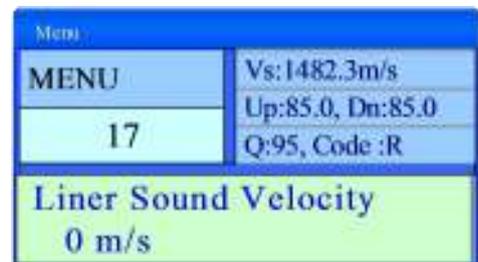
Item 11 "Other" is available to enter other materials that are not included in previous ten items. Once the "Other" is selected, the relevant liner sound velocity must be entered in Window M17.



Menu 1 7

**Liner Sound Velocity**

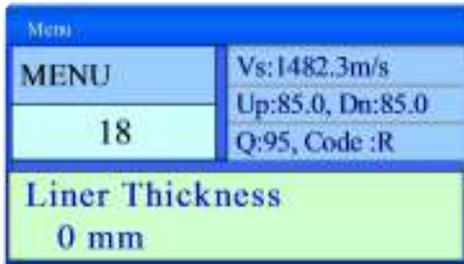
Enter liner sound velocity. It only can be visited when item " Other" in Window M16 is selected.



Menu 1 8

**Liner Thickness**

Enter liner thickness. It only can be visited when a definite liner is selected in Window M16.



Menu 2 0

**Select Fluid Type**

The following options are available:

0. Water	8. Other
1. Sea Water	9. Diesel Oil
2. Kerosene	10. Castor Oil
3. Gasoline	11. Peanut Oil
4. Fuel Oil	12. Gasoline #90
5. Crude Oil	13. Gasoline #93
6. Propane (-45°C)	14. Alcohol
7. Butane (0°C)	15. Water (125°C)

Menu 2 1

**Fluid Sound Velocity**

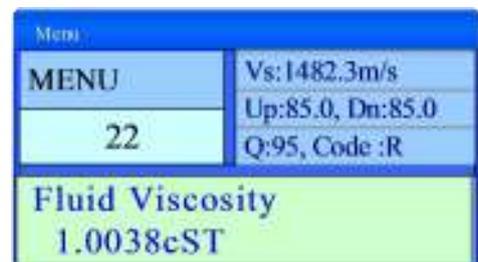
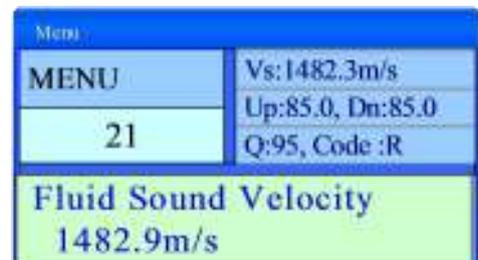
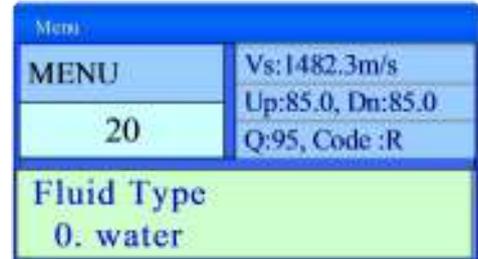
Enter the fluid sound velocity. It only can be used when item "Other" is selected in window M20, i.e. it is unnecessary to enter all the fluids listed in Window M20.

Menu 2 2

**Fluid Viscosity**

Enter fluid's kinematics viscosity. It only can be used when item "Other" is selected in Window M20, i.e. it is unnecessary to enter all the fluids that listed in Window M20.

"other" refer to any fluid. The relevant sound velocity must be entered in window M21.

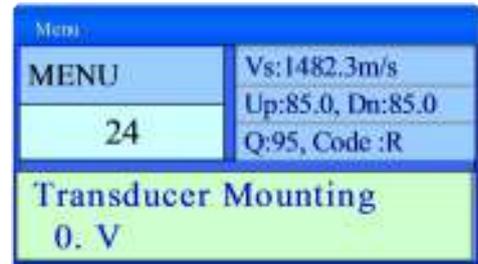


Menu 2 4

**Transducer Mounting**

Three mounting methods are available:

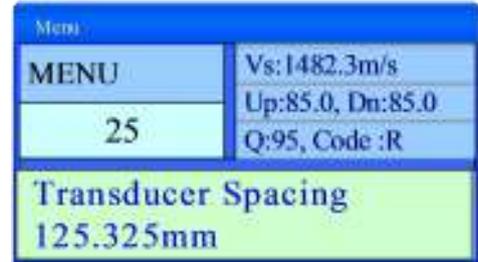
- 0. V (sound wave bounces 2 times)
- 1. Z (sound wave bounces once)
- 2. N (small pipe, sound wave bounces 3 times)



Menu 2 5

**Transducer Spacing**

The operator must mount the transducer according to the transducer spacing displayed (be sure that the transducer spacing is measured precisely during installation). The system will display the data automatically after the pipe parameter has been entered.



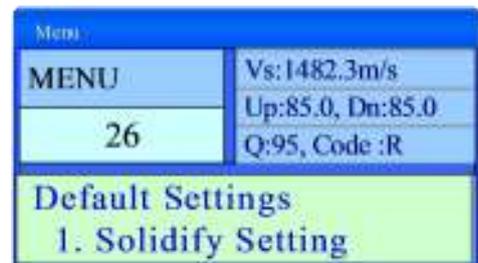
Menu 2 6

**Default Settings**

Solidify setting parameters.

- 0. Use RAM Settings (not common use) ;
- 1. Solidify Settings.

Select "1. Solidify Settings", press **Enter** to save the parameters you have already entered.



Menu 2 7

**Save/Load Parameters.**

Load and save the parameters. 8 different sets of setup conditions/groups are available to load and save (i.e. you can load and save 8 different application parameters):

- 1. Entry to Save
- 2. Entry to Load

Select "Entry to Save", press **Enter**. An ID code and the original parameters are displayed in the window. Press UP or DOWN ARROW to move the ID code, then press the **Enter** key again to save the current parameter

Menu 2 8

**Holding With Poor Sig**

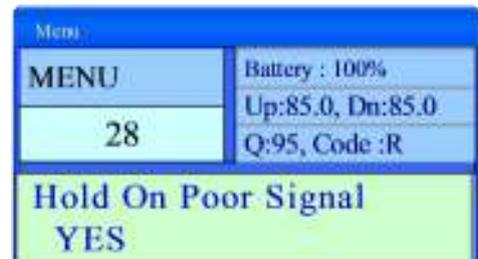
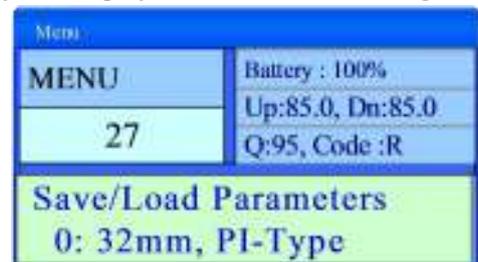
Select "Yes" to hold last good flow signal displayed if the flowmeter experiences a poor temporary signal condition. This function will allow continued data calculation without interruption.

Menu 2 9

**Empty Pipe Setup**

in the current ID room.

When selecting "Entry to Load", press ENT, and the system will read and calculate the parameters automatically and display the transducer mounting



This parameter is used to overcome the possible problems that usually show up when the pipe being

measured is empty. Since signals can be transmitted through the pipe wall, the flow meter may still read a flow while measuring an empty pipe. To prevent this from happening, you can specify a value. When the signal quality falls below this value, the measurement stops automatically. If the flow meter is already able to stop measuring when the pipe is empty, a value in the range of 30 to 40 should also be entered in this window to ensure no measurement when the pipe is empty.

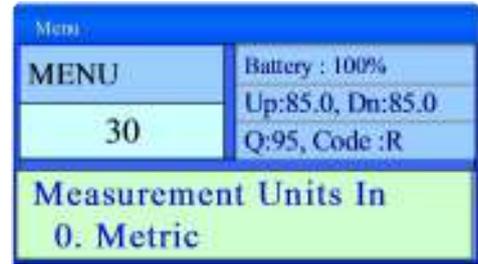
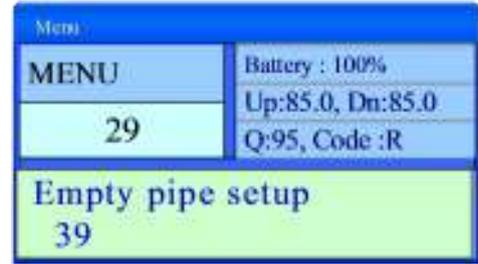
MENU 3 0

**Measurement Units**

Select the measurement unit as follows:

- 0. Metric
- 1. English

Factory default is metric.



MENU 3 1

**Flow Rate Units Options**

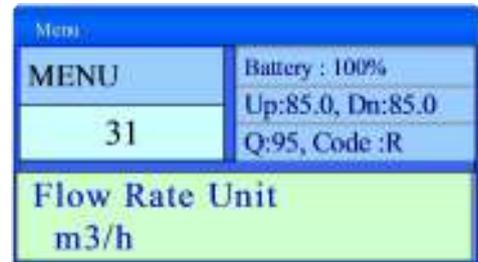
The following flow rate units are available:

- 0. Cubic Meters (m3)
- 1. Liters (l)
- 2. USA Gallon (GAL)
- 3. UK Gallons (Imp gal)
- 4. Million US Gallon (mg)
- 5. Cubic Feet (cf)
- 6. US Oil Barrel (OB)
- 7. UK Oil Barrel (IB)

The following time units are available:

- /Day /Hour
- /Min /Sec

Factory default is Cubic Meters/hour.

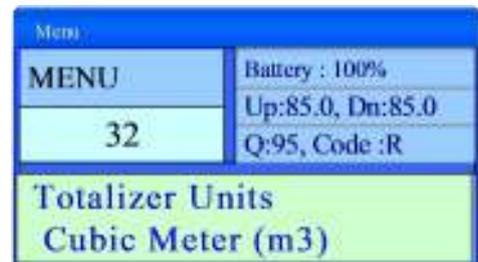


MENU 3 2

**Totalizer Units Options**

Select Totalizer units. The available unit options are as same as those found in Window M31. The user can select units as their required.

Factory default is Cubic Meters.



MENU 3 3

**Totalizer Multiplier Options**

The totalizer multiplier acts as the function to increase

the totalizer indicating range. Meanwhile, the totalizer multiplier can be applied to the positive totalizer, negative totalizer and net totalizer at the same time. The following options are available:

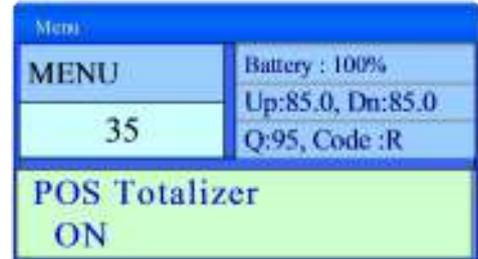
0. x 0.001 (1E-3)	4. x 10
1. x 0.01	5. x 100
2. x 0.1	6. x 1000
3. x 1	7. x 1000

Factory default factor is x1



**ON/OFF POS Totalizer**

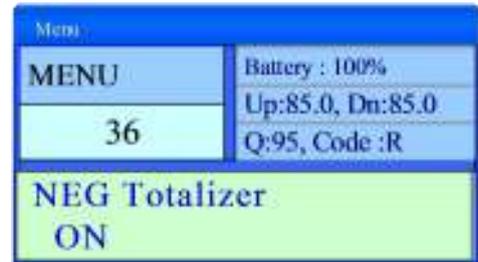
On/Off net totalizer. "ON" indicates the totalizer is turned on, while "OFF" indicates it is turned off. When it is turned off, the net totalizer displays in Window M02 will not change. Factory default is "ON".



**ON/OFF NEG Totalizer**

ON/OFF negative totalizer. "ON" indicates the totalizer is turned on. When it is turned off, the negative totalizer displays in Window M03.

Factory default is "ON".



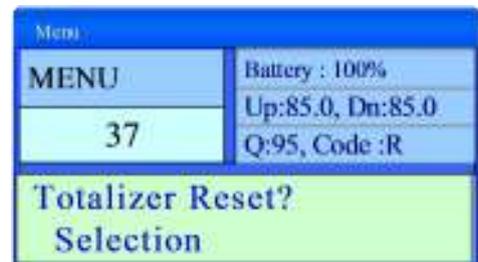
**Totalizer Reset**

Totalizer reset; all parameters are reset. Press ; move or arrow to select "YES" or "NO". After "YES" is selected, the following options are available:

None, All, NET, POS, NEG

If it is necessary to recover the factory default, press keys after the above-mentioned characters are displayed on the screen.

Generally, it is unnecessary to activate this function except during the initial installation.



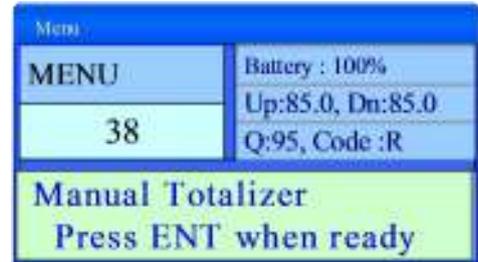
**ATTENTION:**

This operation will cancel all the data and revert back to factory default. Be careful with this operation.

Menu 3 8

**Manual Totalizer**

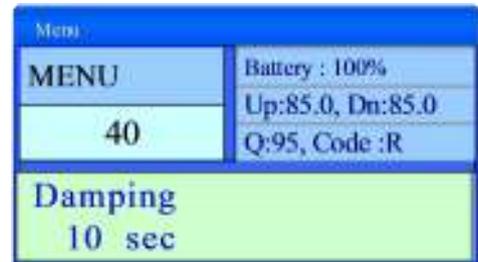
The manual totalizer is a separate totalizer. Press **Enter** to start, and press **Enter** to stop it. It is used for flow measurement and calculation.



Menu 4 0

**Damping**

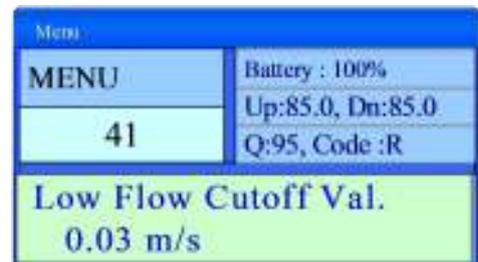
The damping factor ranges from 0~999 seconds. 0 indicates no damping; 999 indicate the maximum damping. The damping function will stabilize the flow display. Usually a damping factor of 3 to 10 is recommended in most applications.



Menu 4 1

**Low Flow Cutoff Value**

If the flow rate falls below the low flow cutoff value, the flow indication is driven to zero. This function can prevent the flowmeter from reading flow after pump shut down but there is still liquid movement in the pipe, which will result in accumulative error. Generally, 0.03m/s is recommended to enter as the low flow cutoff point. The low flow cutoff value has no relation to the measurement results once the velocity increases over the low flow cutoff value.



Menu 4 2

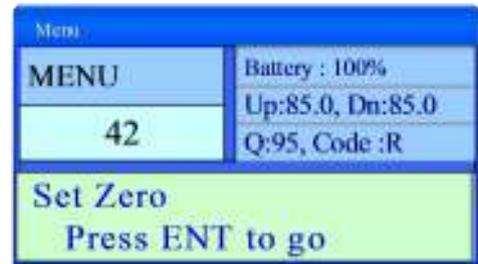
**Set Zero**

When fluid is in the static state (no movement), the displayed value is called "Zero Point". When "Zero Point" is not at true zero in the flowmeter, the difference is going to be added into the actual flow values and measurement differences will occur in the flowmeter.

Set zero must be carried out after the transducers are installed and the flow inside the pipe is in the absolute static state (no liquid movement in the pipe). Thus, the "Zero Point" resulting from different pipe mounting location and parameters can be eliminated. The measuring accuracy at low flow is enhanced by doing this function and flow offset is eliminated.

Press **Enter**, wait for the processing instructions at the bottom right corner of the display to reach 0.

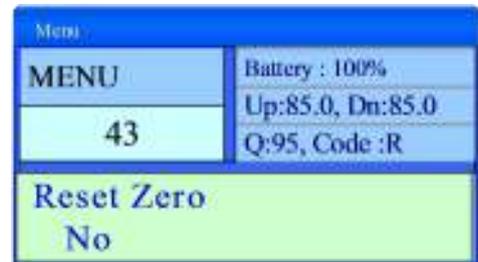
Performing Set zero with existing flow may cause the flow to be displayed as "0". If so, it can be recovered via window M43.



Menu 4 3

**Reset Zero**

Select "YES"; reset "Zero Point" which was set by the user.



Menu 4 4

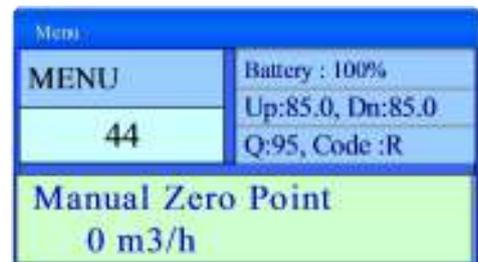
**Manual Zero Point**

This method is not commonly used. It is only suitable for experienced operators to set zero under conditions when it is not preferable to use other methods.

Enter the value manually to add to the measured value to obtain the actual value. For example:

- Actual measured value = 250 m3/H;
- Value Deviation = 10 m3/H;
- Flowmeter Display = 240 m3/H.

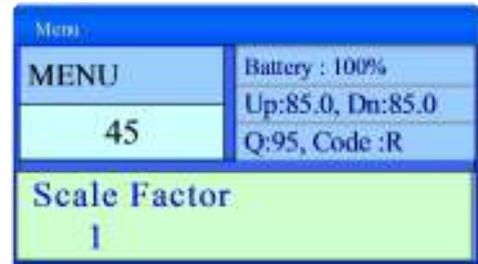
Normally, set the value as "0".



Menu 4 5

**Scale Factor**

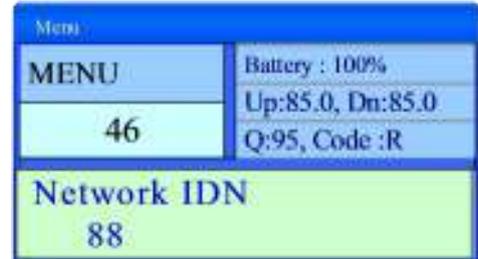
The scale factor is used to modify the measurement results. The user can enter a numerical value other than "1" according to calibration results.



Menu 4 6

**Network IDN**

Input system identifying code, these numbers can be selected from 1~247 except that 13 (0DH ENTER), 10 (0AH Newline), 42 (2AH \* ) and 38 (26H&) are reserved. System IDN is used to identify the flowmeter to a network.



Menu 4 7

**System Lock**

Lock the instrument.

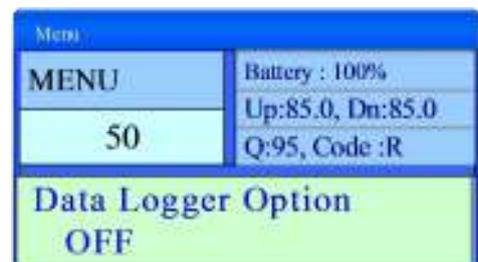
Once the system is locked, any modification to the system is prohibited, but the parameter is readable. "Unlock" using your designated password. The password is composed of 4 numbers.



Menu 5 0

**Data Logger Option**

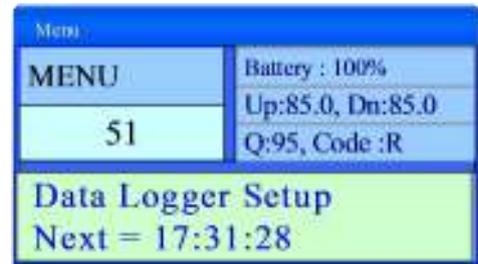
- 1. On
- 2. Off



Menu 5 1

**Data Logger Time Setup**

Enter to setup logger time, which include start time, time interval. Minimum time unit is second. Maximum time interval is 24 hours.



Menu 5 2

**Send Log-Data to**

Press **Enter** and move **^** or **v** arrow to select

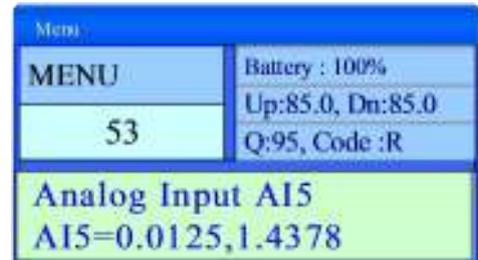
1. Internal SerBus
2. RS485



Menu 5 3

**Analog Input AI5**

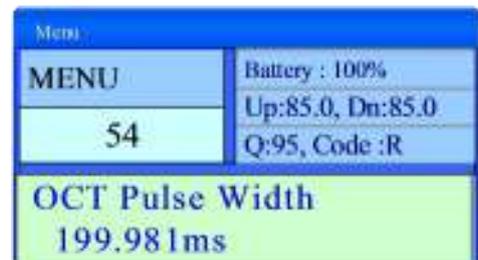
Enter into this menu to check AI5 value.



Menu 5 4

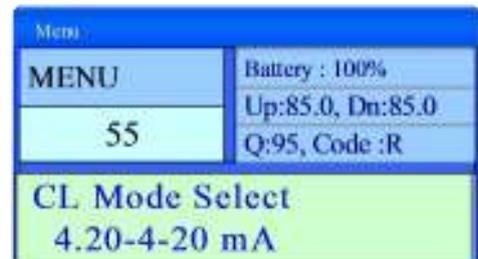
**OCT Pulse Width**

Press **Enter** and input the right parameter, then press **Enter** to confirm



Menu 5 5

**Current Loop Mode Select**



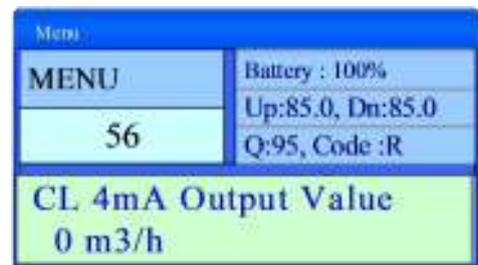
Select the current loop mode. The following options are available:

- |    |                   |  |
|----|-------------------|--|
| 0. | 4-20mA            | set up the output range from 4-20mA                                |
| 1. | 0-20mA            | set up the output range from 0-20mA                                |
| 2. | 0-20mA via RS232  | set up to be controlled by Serial Port                             |
| 3. | 4-20mA VS.Fluid   | set up the CL output 4-20mA corresponding sound velocity           |
| 4. | 20-4-20mA         | set up the CL output range from 20-4-20mA                          |
| 5. | 0-4-20mA          | set up the CL output range from 0-4-20mA                           |
| 6. | 20-0-20mA         | set up the CL output range from 20-0-20mA                          |
| 7. | 4-20mA vs. Vel    | set up the CL output range from 4-20mA corresponding flow velocity |
| 8. | 4-20mA vs. Energy | set up the CL output range from 4-20mA corresponding heat flow     |

Menu 5 6

**CL 4mA Output Value**

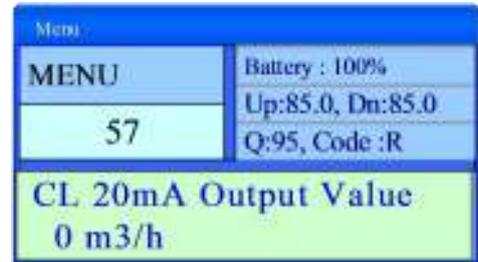
Set the CL output value according to the flow value at 4mA. The flow unit's options are as same as those in Window M31. Once "velocity 4-20mA" is selected in Window M55, the unit should be set as m/s if it is the velocity unit selected.



Menu 5 7

**20mA Output Value**

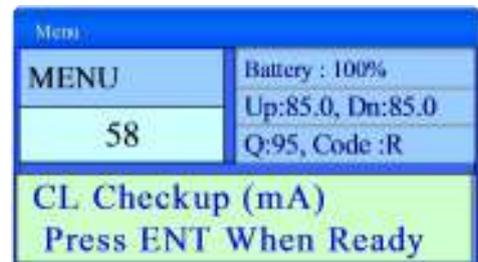
Set the CL output value according to the flow value at 20mA. The flow unit is the as same as that found in Window M31. Once "velocity 4-20mA" is selected in Window M55, the unit should be set as m/s, if m/s is the velocity selection.



Menu 5 8

**CL Check Verification**

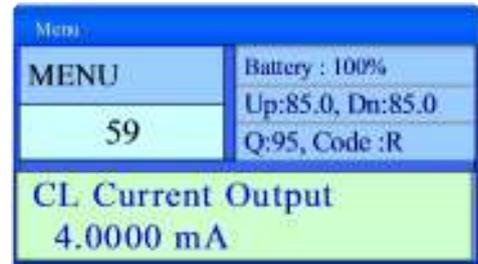
Check if the current loop has been calibrated before leaving the factory. Press **Enter** move **▲/+** or **▼/-** separately to display 4mA, 20mA, and at the same time, check with an ammeter to verify that CL output terminals M31 and 32 agree with the displayed values. It is necessary to re-calibrate the CL if it is over the permitted tolerance. For more information, refer to "Analog Output Calibration".



Menu 5 9

**CL Current Output**

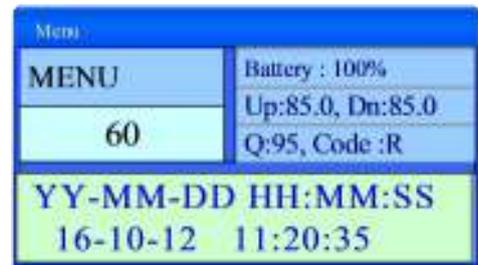
Display CL current output. The display of 10.0000mA indicates that CL current output value is 10.0000mA. If the difference between displaying value and CL output value is too large, the current loop then needs to be re-calibrated accordingly.



Menu 6 0

**Date and Time Settings**

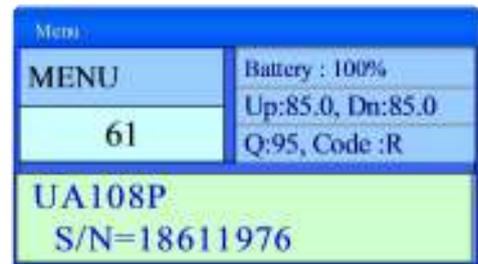
The format for setting time setting is 24 hours. Press **Enter**, wait until ">" appears, the modification can be made.



Menu 6 1

**ESN**

Display electronic serial number (ESN) of the instrument. This ESN is the only one assigned to each flowmeter ready to leave the factory. The factory uses it for file setup and for management by the user.



Menu 6 2

**Serial Port Settings**

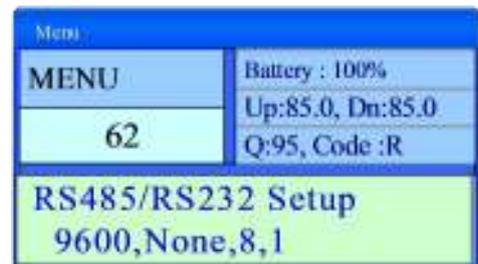
This window is used for serial port setting. Serial port is used to communicate with other instruments. The serial port parameters setting of the instrument that applies the serial port connection must be consistency. The first selected data indicates baud rate, 9600, 19200, 38400, 57600, 115200 are available.

The second option indicates parity bit, None (No verification).

Data length fixed to 8;

Stop bit length for a fixed length.

The factory default serial port parameter is "9600, None, 8,1".



Menu 6 7

**Set FO Frequency Range**

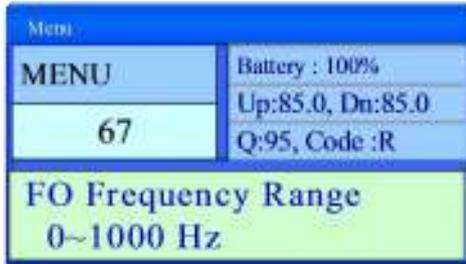
Set up high FO frequency range. It must be higher

than the low FO frequency. Ranges from 1-9999Hz.

Factory default is 1~100 Hz.

Note: The frequency output is transmitted through

OCT Serial Port; therefore the OCT must be set to the frequency output mode.

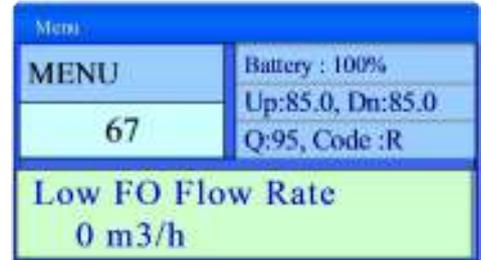


Menu 6 8

**Low FO Flow Rate**

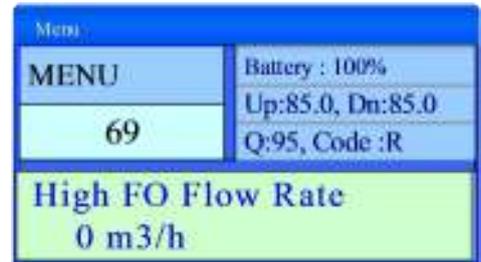
Set up low FO flow rate, i.e. the corresponding flow value when output signal frequency is at the lowest FO frequency. For example, when the low FO frequency is 1000Hz, low FO flow rate is 100m3/h then when the frequency output is 1000Hz, the low flow at this moment measured by the Flowmeter is 100m3/h.

Menu 6 9



**High FO Flow Rate**

Enter the high FO flow rate, i.e. the corresponding flow value when frequency output signal is at highest FO frequency. For example, when the low FO frequency is 3000Hz, low FO flow rate is 1000m3/h then when the frequency output is 3000Hz, the low flow at this moment measured by the Flowmeter is 1000m3/h.



Menu 7 2

**Working Timer**

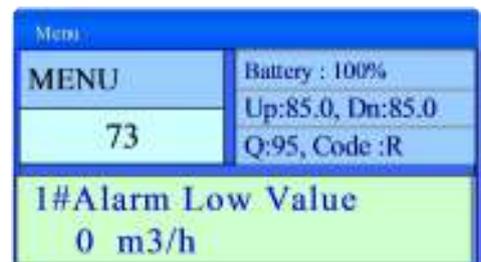
Display the total working hours of the Flowmeter since last reset. It is displayed by HH:MM:SS. If it is necessary to reset it, press , and select "YES".



Menu 7 3

**Alarm #1 Low Value**

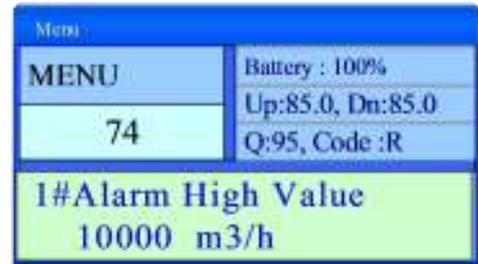
Enter the low alarm value. Relevant alarm is turned on in Windows M78 and M79; any of the measured flow, which is lower than the low value, will activate the alarm in the OCT hardware or Relay output signal.



Menu 7 4

**Alarm #1 High Value**

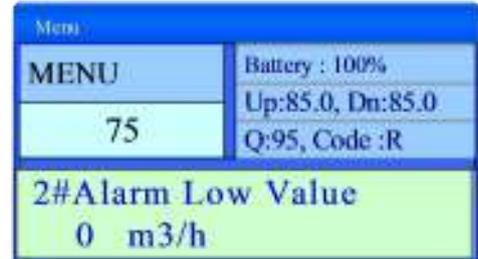
Enter the high alarm value. Relevant alarm is turned on in Windows M78 and M79; any of the measured flow, which is higher than the high value, will activate the alarm in the OCT hardware or Relay output signal.



Menu 7 5

**Alarm #2 Low Value**

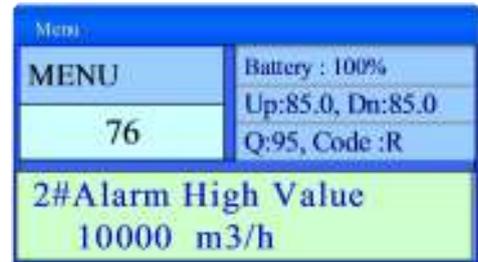
Enter the alarm low value. Both relevant alarms are turned on in Windows M78 and M79; any measured flow, which is lower than the low value, will activate the alarm in the OCT hardware or relay output signal.



Menu 7 6

**Alarm #2 High Value**

Enter the alarm high value.



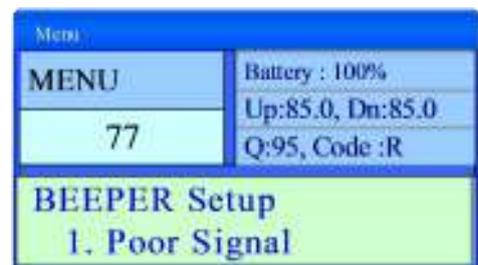
Menu 7 7

**Beeper Setup**

If a proper input source is selected, the buzzer will beep when the trigger event occurs. The available trigger sources are as follow:

- 0.No signal
- 1.Poor signal
- 2.Not ready
- 3.Reverse flow
- 4.AO Over 100%
- 5.FO Over 120%
- 6.Alarm #1
- 7.Negative Alarm #2
- 8.Batch Controller
- 9.POS Int Pulse
- 10.NEG Int Pulse
- 11. NET Int Pulse
- 12. Energy POS Pulse
- 13.Energy NEG Pulse
- 14.Energy NET Pulse
- 15.MediaVel=>Thresh
- 16.MediaVelo<Thresh
- 17.ON/OFF via RS485
- 18.Timer(M51 Daily)
- 19.Timed Alarm #1
- 20.Timed Alarm #2
- 21.Batch Total Full
- 22.Timer by M51
- 23.Batch 90% Full

24.Key Stroking on      25.Disable BEEPER



Menu 7 8

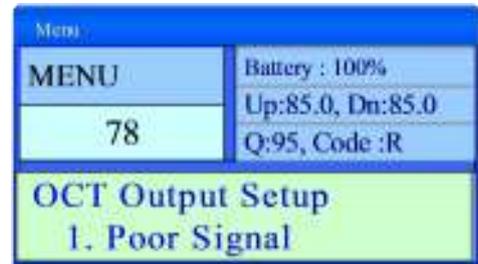
**OCT Output Setup**

The OCT output in the flowmeter is a kind of isolated collector open circuit output with programmable open and close qualifications. The user can program the open and close functions under the following conditions: the system alarm signals are being activated or the totalizer pulse is being transmitted.

The frequency output signal is also transmitted from the OCT. When it functions as the frequency output, other functions are unavailable. The following signal options are available:

The following signal options are available:

- |                      |                        |
|----------------------|------------------------|
| 0. No Signal         | 1. Poor Signal         |
| 2. Not Ready (No*R)  | 3. Negative Flow Alarm |
| 4. AO Over 100%      | 5. FO Over 120%        |
| 6. Alarm #1          | 7. Alarm #2            |
| 8. Batch Control     | 9. POS Int Pulse       |
| 10. NEG Int Pulse    | 11. NET Int Pulse      |
| 12. Energy Pulse     | 13. FO                 |
| 14. FO via RS-232C   | 15. ON/OFF viaRS232    |
| 16. Fluid changed    | 17. Not Using          |
| 18. Timer(M51 Daily) | 19. Time Alarm#1       |
| 20. Time Alarm#2     | 21. Batch Total Full   |
| 22. Timer by M51     | 23. Batch 90% Full     |
| 24. Flow Rate Pulse  | 25. Disable OCT        |

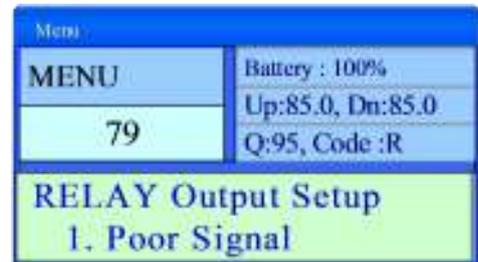


Menu 7 9

**Relay Output Setup**

The relay output in the flowmeter is programmable. The user can program the open and close functions under the following conditions: the system alarm signals are activated or the totalizer pulse is transmitting. The relay is single-pole and constant-on for external instrument controls. The following options are available:

- |                       |                        |
|-----------------------|------------------------|
| 0. No Signal          | 1. Poor Signal         |
| 2. Not Ready (No*R)   | 3. Reverse Flow        |
| 4. AO Over 100%       | 5. FO Over 120%        |
| 6. Alarm #1           | 7. Alarm #2            |
| 8. Batch control      | 9. POS Int Pulse       |
| 10. NEG Int Pulse     | 11. NET Int Pulse      |
| 12. Energy Pulse      | 13. ON/OFF via RS232   |
| 14. Fluid changed     | 15. Fluid Vel.=>Thresh |
| 16. Fluid Vel.<Thresh | 17. On/OFF via RS485   |
| 18. Timer(M51 Daily)  | 19. Timed Alarm #1     |
| 20. Timed Alarm #2    | 21. Batch Total Full   |
| 22. Timer by M51      | 23. Batch 90% Full     |
| 24. Disable Relay     |                        |



Menu 8 0

**Batch Trigger Select**

Set the input trigger for the batch control function on the flow meter. The following options are available:

- 0.Key Pressing
- 1.Serial Port
- 2.AI3 Rising Edge
- 3.AI3 Falling Edge
- 4.AI4 Rising Edge
- 5.AI4 Falling Edge
- 6.AI5 Rising Edge
- 7.AI5 Falling Edge
- 8.Timer-Periodical
- 9.Timer-daily



Menu 8 1

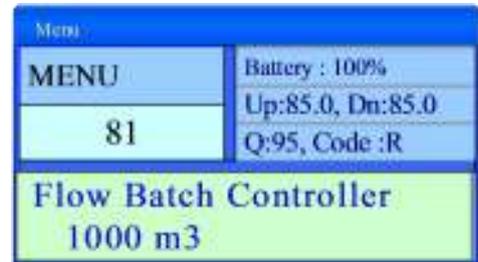
**Flow Batch Controller**

The internal batch controller in the flowmeter is able to control the input signals through keypad or analog input Serial Port. Output signals can be transmitted through OCT or relay.

The flow batch value can be modified in this window.

The output state of the flow batch controller can be

displayed in Menu 80.



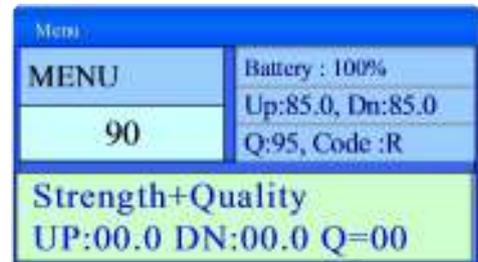
Menu 9 0

**Signal Strength and Signal Quality**

Display the measured signal strength and signal quality Q value upstream and downstream.

Signal strength is indicated from 00.0~99.9. A reading of 00.0 indicates no signal detected, while 99.9 indicates maximum signal strength. Normally the signal strength should be  $\geq 60.0$ .

Signal quality Q is indicated by 00~99. Therefore, 00 indicates the poorest signal while 99 indicates the best signal. Normally, signal quality Q value should be better than 50.

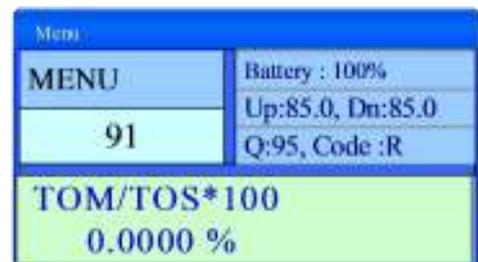


Menu 9 1

**TOM/TOS\*100**

Display the ratio between the actual measured transmit time and the calculated transmit time according to customer's requirement. Normally the ratio should be  $100 \pm 3\%$ . If the difference is too large, the user should check that the parameters are entered correctly, especially the sound velocity of the fluid and the installation of the transducers. This data is of

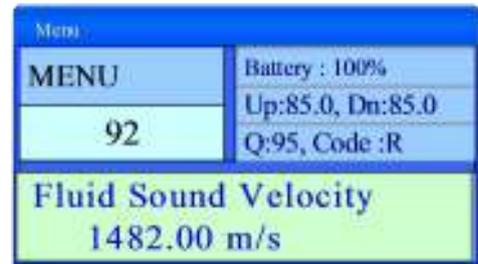
no use before the system is ready.



Menu 9 2

**Fluid Sound Velocity**

Display the measured fluid sound velocity. Normally this value should be approximately equal to the entered value in Window M21. If the difference is too large, it probably results from an incorrect value entered in Window M21 or improper installation of the transducers.

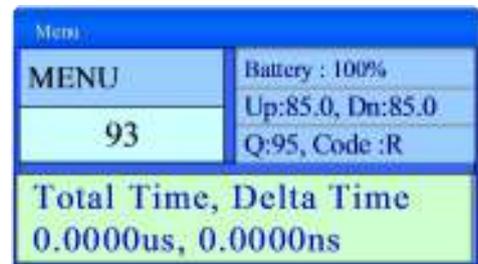


Menu 9

**Total Time and Delta Time**

Display the measured ultrasonic average time (unit: nS) and delta time of the upstream and downstream (unit: nS) time. The velocity calculation in the flowmeter is based on the two readings. The delta time is the best indication that the instrument is running steadily. Normally the fluctuation in the ratio of the delta time should be lower than 20%. If it is not, it is necessary to check if the transducers are installed properly or if the parameters have been entered

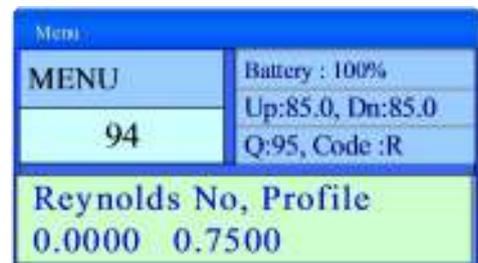
correctly.



Menu 9 4

**Reynolds Number and Factor**

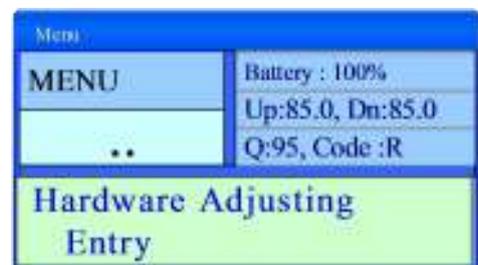
Display the reynolds number that is calculated by the flowmeter and the factor that is set currently by the flowmeter. Normally this scaling factor is the average of the line and surface velocity factor inside the pipe.



Menu w/ 0

**Hardware Adjusting**

Enter to do hardware adjusting. The password is 4213068



## 6. Error Diagnoses

The ultrasonic flowmeter has advanced self-diagnostics functions and displays any errors in the upper right corner of the LCD via definite codes in a date/time order. Some errors can be detected during normal operation. Undetectable errors caused by unskilled operation, incorrect settings and unsuitable measurement conditions can be displayed accordingly during work. This function helps the user detect the errors and find causes quickly; thus, problems can be solved in a timely manner according to the solutions listed in the following tables. The error codes caused by incorrect settings and the detected signal can be displayed in Window M08.

### 6.1. Table 1. Error Codes and Solutions (during operation)

Codes	M08 Display	Causes	Solutions
*R	System Normal.	* System normal.	
*I	Signal Not Detected.	<ul style="list-style-type: none"> <li>* Signal not detected.</li> <li>* Spacing is not correct between the transducers or not enough coupling compound applied to face of transducers.</li> <li>* Transducers installed improperly.</li> <li>* Scale is too thick.</li> <li>* New pipe liner.</li> </ul>	<ul style="list-style-type: none"> <li>* Attach transducer to the pipe and tighten it securely. Apply a plenty of coupling compound on transducer and pipe wall.</li> <li>* Remove any rust, scale, or loose paint from the pipe surface. Clean it with a file.</li> <li>* Check the initial parameter settings.</li> <li>* Remove the scale or change the scaled pipe section. Normally, it is possible to change a measurement location. The instrument may run properly at a new site with less scale.</li> <li>* Wait until liners solidified and saturated</li> </ul>
*G	Adjusting Gain (Display in Windows M01).	* Adjusting gain for normal measurement.	

## 6.2. 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 the a layer of scale between the transducers and pipe inside wall).

Question: Why is the CL output abnormal?

Answer: Check to see if the desired current output mode is set in Window M55.

Check to see if the maximum and minimum current values are set properly in Windows M56 and M57.

Re-calibrate CL and verify it in Window M49.

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 it is confirmed, recover the factory default in Window M43.

## 7. Product Overview

### 7.1. Introduction

The Model UA108P Ultrasonic Flowmeter is a state-of-the-art universal transit-time flowmeter designed using ARM technology and low-voltage broadband pulse transmission. While principally designed for clean liquid applications, the instrument is tolerant of liquids with the small amounts of air bubbles or suspended solids found in most industrial environments.

### 7.2. Features of Flowmeter

With distinctive features such as high precision, high reliability, high capability and low cost, the flowmeter features other advantages:

1. With ARM COMA chip, low power consumption, high reliability, anti-jamming and outstanding benefits.
2. Clear, user-friendly Menu selections make flowmeter simple and convenient to use. U.S., British and Metric measurement units are available. Meanwhile, almost all-universal measurement units worldwide may be selected to meet customer's requirements.
3. With the SD Card, 512 files can be stored; the time interval can be within 1 second.
4. Parallel operation of positive, negative and net flow totalizer with scale factor and 7 digit display.

The flow meter ensures the higher resolution and wider measuring range by the 0.04nS high resolution, high linearity and high stability time measuring circuit and 32 bits digits processing program.

### 7.3. Theory of Operation

When the ultrasonic signal is transmitted through the flowing liquid, there will be a difference between the upstream and downstream transit time (travel time or time of flight), which is proportional to flow velocity, according to the formula below.

$$V = \frac{MD}{\sin 2\theta} \times \frac{\Delta T}{T_{up} \cdot T_{down}}$$

Remarks:

$V$  Medium Velocity

$M$  Ultrasonic frequency of reflection

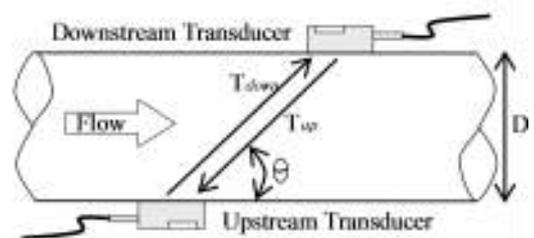
$D$  Pipe Diameter

$\theta$  The angle between the ultrasonic signal and the flow

$T_{up}$  Transit time in the forward direction

$T_{down}$  Transit time in the reverse direction

$\Delta T = T_{up} - T_{down}$



## 7.4. Applications

- Water, sewage (with low particle content) and seawater
- Water supply and drainage water
- Power plants (nuclear power plant, thermal and hydropower plants), heat energy, boiler feed water and energy management system
- Metallurgy and mining applications (cooling water and acid recovery, for example)
- Petroleum and chemicals
- Food, beverage and pharmaceutical
- Marine operation and maintenance
- Energy economy supervision and water conservation management
- Pulp and paper (clean liquid applications)
- Pipeline leak detection
- Regular inspection, tracking and collection
- Energy measuring and balance
- Network monitoring systems and energy/flow computer management

## 7.5. Specifications

<b>Performance Specifications</b>	
Flow range	$\pm 0.01$ to $\pm 12$ m/s ( for 0.03 ~ 40 ft/s or - 40 ~ -0.03 ft/s).
Accuracy	$\pm 0.5\%$ .
Repeatability	0.15%.
Linearity	$\pm 0.5\%$ .
Pipe Size	1in to 200in ( 25 mm to 5000 mm ).
<b>Function Specifications</b>	
Output	Analog output: 4~20mA, Max 750 $\Omega$ .
SD card	Storage: 2GB; Max: 512 files; Interval: 1 ~ 3600 seconds.
Power Supply	rechargeable Lithium Battery Power ( continuous operation of main battery 8 hours ).
Display	4.3 inch color screen( 910 $\times$ 500 ), backlit LCD.
Temperature	Transmitter: $-10^{\circ}\text{C} \sim 50^{\circ}\text{C}$ ( $-40^{\circ}\text{F}$ to $176^{\circ}\text{F}$ ); Measuring medium: $-40^{\circ}\text{C} \sim 120^{\circ}\text{C}$ (Standard).
Humidity	0 ~ 99% RH, non-condensing.
<b>Physical Specifications</b>	
Transmitter	NEMA13 ( IP54 ).
Transducer	Encapsulated design, IP68; Standard cable length: 5m.
Weight	Transmitter: 10kg.

# 8. Appendix 1 - Flow Application Data

## 8.1. Sound Velocity and Viscosity for Fluids Commonly Used

Fluid	Sound Velocity (m/s)	Viscosity
water 20°C	1482	1.0
water 50°C	1543	0.55
water 75°C	1554	0.39
water 100°C	1543	0.29
water 125°C	1511	0.25
water 150°C	1466	0.21
water 175°C	1401	0.18
water 200°C	1333	0.15
water 225°C	1249	0.14
water 250°C	1156	0.12
Acetone	1190	
Carbine	1121	

Ethanol	1168	
Alcohol	1440	1.5
Glycol	1620	
Glycerin	1923	1180
Gasoline	1250	0.80
Benzene	1330	
Toluene	1170	0.69
Kerosene	1420	2.3
Petroleum	1290	
Retinal	1280	
Aviation kerosene	1298	
Peanut oil	1472	
Castor oil	1502	

## 8.2. Sound Velocity for Various Materials Commonly Used

Pipe Material	Sound Velocity (m/s)
Steel	3206
ABS	2286
Aluminum	3048
Brass	2270
Cast iron	2460
Bronze	2270
Fiber glass-epoxy	3430
Glass	3276
Polyethylene	1950
PVC	2540

Liner Material	Sound Velocity (m/s)
PTFE	1225
Titanium	3150
Cement	4190
Bitumen	2540
Porcelain enamel	2540
Glass	5970
Plastic	2280
Polyethylene	1600
PTFE	1450
Rubber	1600

### 8.3. Sound Velocity In Water (1 atm) At Different Temperatures

t(°C)	v(m/s)
0	1402.3
1	1407.3
2	1412.2
3	1416.9
4	1421.6
5	1426.1
6	1430.5
7	1434.8
8	1439.1
9	1443.2
10	1447.2
11	1451.1
12	1454.9
13	1458.7
14	1462.3
15	1465.8
16	1469.3
17	1472.7
18	1476.0
19	1479.1
20	1482.3
21	1485.3
22	1488.2
23	1491.1
24	1493.9
25	1496.6
26	1499.2
27	1501.8
28	1504.3
29	1506.7
30	1509.0
31	1511.3
32	1513.5

33	1515.7
34	1517.7
35	1519.7
36	1521.7
37	1523.5
38	1525.3
39	1527.1
40	1528.8
41	1530.4
42	1532.0
43	1533.5
44	1534.9
45	1536.3
46	1537.7
47	1538.9
48	1540.2
49	1541.3
50	1542.5
51	1543.5
52	1544.6
53	1545.5
54	1546.4
55	1547.3
56	1548.1
57	1548.9
58	1549.6
59	1550.3
60	1550.9
61	1551.5
62	1552.0
63	1552.5
64	1553.0
65	1553.4

66	1553.7
67	1554.0
68	1554.3
69	1554.5
70	1554.7
71	1554.9
72	1555.0
73	1555.0
74	1555.1
75	1555.1
76	1555.0
77	1554.9
78	1554.8
79	1554.6
80	1554.4
81	1554.2
82	1553.9
83	1553.6
84	1553.2
85	1552.8
86	1552.4
87	1552.0
88	1551.5
89	1551.0
90	1550.4
91	1549.8
92	1549.2
93	1548.5
94	1547.5
95	1547.1
96	1546.3
97	1545.6
98	1544.7
99	1543.9

Please contact the factory for other sound of the velocity of fluids and materials.