1100V-E Series

Transit Time Ultrasonic Flow Meter
Clamp-on & Insertion

Operation & Maintenance

Manual

REV 1/2023

CONTENTS

PART-1 INTRODUCTION 2

1.1 GENERAL 2
1.2 PRINCIPLE OF MEASUREMENT 2
1.3 APPLICATIONS 3
1.4 FEATURES 4
1.5 SPECIFICATIONS 5
1.6 PARTS IDENTIFICATION 6

PART-2 TRANSDUCER INSTALLATION 7

2.1 GENERAL 7
2.2 MOUNTING LOCATION 7
2.3 TRANSDUCER SPACING 8
2.4 TRANSDUCER MOUNTING 10
2.5 TRANSDUCER MOUNTING INSPECTION AND COUPLANT APPLICATION 14

PART-3 TRANSMITTER INSTALLATION CONNECTION AND OPERATION INSTRUCTIONS 15

3.1 TRANSMITTER INSTALLATION 15
3.2 TRANSDUCER CONNECTIONS 16
3.3 TRANSMITTER POWER AND OUTPUT CONNECTIONS 17
3.4 KEYPAD CONFIGURATION 18

PART-4 WINDOWS DISPLAY EXPLANATIONS 19

PART-5 ENERGY FUNCTION 31

5.1 INTRODUCTION 31
5.2 WIRING CONNECTION 32
5.3 ENERGY CALCULATION 32
5.4 TEMPERATURE RANGE 32

PART-6 TEMPERATURE SENSOR INSTALLATION 33

6.1 PT1000 TEMPERATURE SENSOR 33
6.2 TEMPERATURE SENSOR INSTALATION 33
(a) 6.2.1 CLAMP-ON TEMPERATURE SENSOR 33
(b) 6.2.2 INSERTION TEMPERATURE SENSOR 33

PART-7 HOW TO USE MENU FUNCTIONS 35

7.1 HOW TO JUDGE THE LIQUID FLOWING DIRECTION 35
7.2 HOW TO RESET THE DEFAULT SETUPS 35
7.3 HOW TO STABILIZE THE FLOW 35
7.4 HOW TO USE THE LOW FLOW-CUTOFF FUNCTION 35
7.5 HOW TO SETUP A ZERO POINT CALIBRATION 35
7.7 HOW TO USE SCALE FACTOR 36
7.8 HOW TO USE THE 4~20M A OUTPUT 36
7.9 HOW TO USE THE RELAY OUTPUT 36

7.10 HOW TO USE PULSE OUTPUT 37
7.11 HOW TO SET THE DATE AND TIMER 37
7.12 ON/OFF NET TOTALIZER 37
7.13 UNITS OPTIONS 37
7.14 LCD BACKLIT OPT IONS 37
7.15 USE MENU WINDOWS FOR TRANSDUCER MOUNTING INSPECTION 37

PART-8 FREQUENTLY ASKED QUESTIONS AND ANSWERS 39

PART-9 WARRANTY AND SERVICE 40

9.1 WARRANTY 40
9.2 SERVICE 40

APPENDIX 1 INSERTION TRANSDUCER INSTALLATION 41

A, MENU CONFIGURATION 41
B, INSTALLATION LOCATING 41
C, DRILLING HOLES 43
D, MOUNTING THE TRANSDUCERS 44
E, TRANSDUCER WIRING 45
F, HOW TO OBTAIN GOOD SIGNAL STRENGTH AND SIGNAL QUALITY 45

APPENDIX 2 MODBUS-RTU COMMUNICATIONS PROTOCOL 46

APPENDIX 3 DATA LOGGER 51

APPENDIX 4 FUILD CHARACTERISTIC (SOUND SPEED) 53

1. FLUID PROPERTIES 53
2. WATER SOUND SPEED 55
3. PIPE MATERIAL SOUND SPEED TABLE 55

PART-1 INTRODUCTION

1.1 GENERAL

1100V-E series wall-mounted transit-time ultrasonic heat meters works on transit-time principle. It includes clamp-on type and insertion type. They are used for liquid flow measurement in fully filled pipe. Two types of transducers are sufficient to cover the most common pipe diameter ranges and materials. In addition, its optional thermal energy measurement capability makes it possible to carry out a complete analysis of thermal energy usage in any facility.

This flexible and easy to use flow meter is the ideal tool for the support of service and maintenance activities. It can also be used for the control or even for the temporary replacement of permanently installed meters.

1.2 PRINCIPLE OF MEASUREMENT

The 1100V-E ultrasonic flow meter is designed to measure the fluid velocity of liquid within a closed pipe. The transducers are a non-invasive, clamp-on type, which will provide benefits of non-fouling operation and easy installation.

The 1100V-E transit time flow meter utilizes two transducers that function as both ultrasonic transmitters and receivers. The transducers are clamped on the outside of a closed pipe at a specific distance from each other. The transducers can be mounted in V-method where the sound transverses the pipe twice, or W-method where the sound transverses the pipe four times, or in Z-method where the transducers are mounted on opposite sides of the pipe and the sound crosses the pipe once. This selection of the mounting method depends on pipe and liquid characteristics. The flow meter operates by alternately transmitting and receiving a frequency modulated burst of sound energy between the two transducers and measuring the transit time that it takes for sound to travel between the two transducers. The difference between the transit-time is directly and exactly related to the velocity of the liquid in the pipe, as shown in Figure 1.

Figure 1

$$V_f = Kdt / TL$$

Where: V_f Liquid velocity

K Constant

dt Difference in time of flight

TL Average Transit Time

When measuring temperature, the two temperature sensors of Pt1000 clamp on the pipeline or insert in the pipe, and get two temperature values.

The value of energy is indicated / measured based on the following mathematical model:

$$Q = \int_{V1}^{V2} k(t1 - t2)dV$$

Where: Q – Quantity of heat given up

V – Volume of liquid passed

k – Heat coefficient, is a function of the properties of the heat-conveying liquid at the relevant temperatures and pressure

t1 – Inlet temperature of liquid

t2 – Outlet temperature of liquid

1.3 APPLICATIONS

1. Water, sewage (with low particle content) and sea water

2. Water supply and drainage water

3. Process liquids; Liquors

4. Milk, yoghourt milk

5. Gasoline kerosene diesel oil

6. Power plant

7. The flow patrolling and examining

8. Metallurgy, Laboratory

9. Energy-conservation, economize on water

10. Food and medicine

11 Heat measures, Heat balance

12 On-the-spot check-up, standard, the data are judged, Pipeline leak detection

1.4 FEATURES

- Advanced Digital Signal Processor technology and the MultiPulse™ transducer technology.
- 1100V-E Clamp-on type, non-invasive system allows solids to pass through the pipe within effect on meter. Y-strainers or filtering devices are not needed. 1100V-E insertion type is hot-tapped.
- Digital cross-correlation technology.
- Since the sensors do not contact the liquid, fouling and maintenance are eliminated.
- Provides easy and low cost installation by clamping on the outside of existing piping systems.
- Clear, user-friendly menu selections make 1100V-E simple and convenient to use.
- Two pairs of transducers can satisfy different materials , wide different pipe diameters.
- Multiline display, can display total flow, flow rate, velocity and meter run status. Parallel operation of positive, negative and net flow totalizes with scale factor and 7 digit display, while the output of totalize pulse and frequency output are transmitted via open collector.
- U.S., British and Metric measurement units are available. Meanwhile, almost all-universal measurement units worldwide may be selected to meet customer’s requirements.

1.5 SPECIFICATIONS

Transmitter:

Principle	Ultrasonic transit-time difference correlation principle
Channel	One
Velocity range	0.01 to 12 m/s, bi-directional
Resolution	0.25mm/s
Repeatability	0.2% of reading
Accuracy	±1% of reading at rates >0.3 m/s);±0.003 m/s of reading at rates<0.3 m/s
Response time	0.5s
Sensitivity	0.003m/s
Damping	0-99s(selectable by user)
Liquid Types Supported	Both clean and somewhat dirty liquids with turbidity <10000 ppm
Power Supply	AC: 85-265V DC: 24V/500mA
Enclosure type	Wall-mounted
IP class	IP66 according to EN60529
Operating temp.	-20℃ to +60℃
Material	Fiberglass
Display	4.3“ color LCD 5 lines display, 16keys
Units	User Configured (English and Metric)
Rate	Rate and Velocity Display
Totalized	gallons, ft³, barrels, lbs, liters, m³,kg
Communication	4~20mA,OCT, Relay, RS485 (Modbus),Logged data,GPRS/GSM, NB-IOT
Size	244*196*144mm
Weight	2.4kg

Transducer

IP class	IP67 or IP68 according to EN60529
Liquid Temp.	Clamp on:-35℃~200℃; Insertion: -35℃~150℃
Pipe range	Clamp on B: 20mm-50mm; Clamp-on A: 40mm-5000mm; Insertion: 65-5000mm
Size	Clamp-on B type: 40*24*22mm; Clamp-on A type 46*31*28mm; Insertion： Φ58*199mm
Material	Clamp-on: Aluminum +peek; Insertion: SUS304+peek
Temp. Sensor	Pt1000 Clamp-on or Insertion type
Weight (2 pairs):	Clamp-on：3.2kg ; Insertion：7kg
Cable Length	Std: 10m

1.6 PARTS IDENTIFICATION

Transmitter

Clamp-on transducer

Insertion transducer

S-S Belt

PT1000 clamp-on

PT1000 insertion

Couplant

Drill tools

Ball valve base

PART-2 TRANSDUCER INSTALLATION

2.1 GENERAL

The transducers that are utilized by the Series 1100V-E contain piezoelectric crystals for transmitting and receiving ultrasound signals through walls of liquid piping systems. The transducers are relatively simple and straight-forward to install, but spacing and alignment of the transducers is critical to the system's accuracy and performance. Extra care should be taken to ensure that these instructions are carefully executed.

Mounting of the clamp-on ultrasonic transit time transducers is comprised of three steps:

Selection of the optimum location on a piping system.

Entering the necessary parameters into the 1100V-E keypad.

(1100V-E will calculate proper transducer spacing based on these entries.)

Pipe preparation and transducer mounting.

2.2 MOUNTING LOCATION

The first step in the installation process is the selection of an optimum location for the flow measurement to be made. For this to be done effectively, a basic knowledge of the piping system and its plumbing is required.

An optimum location is defined as:

A piping system that is completely full of liquid when measurements are being taken. The pipe may become completely empty during a process cycle - which will result in an error code being displayed on the flow meter while the pipe is empty. Error codes will clear automatically once the pipe refills with liquid. It is not recommended to mount the transducers in an area where the pipe may become partially filled. Partially filled pipes will cause erroneous and unpredictable operation of the meter.

A piping system that contains lengths of straight pipe such as those described in Table 2.1. The optimum straight pipe diameter recommendations apply to pipes in both horizontal and vertical orientation. The straight runs in Table 2.1 apply to liquid velocities that are nominally 7 FPS [2.2 MPS]. As liquid velocity increases above this nominal rate, the requirement for straight pipe increases proportionally.

Mount the transducers in an area where they will not be inadvertently bumped or disturbed during normal operation.

Avoid installations on downward flowing pipes unless adequate downstream head pressure is present to overcome cavitations in the pipe.

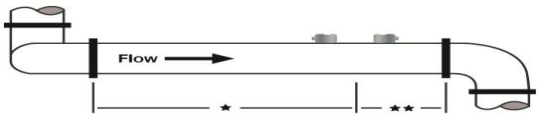
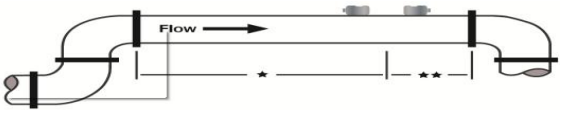
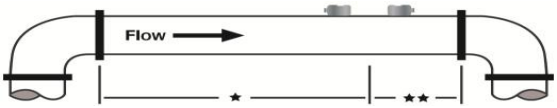
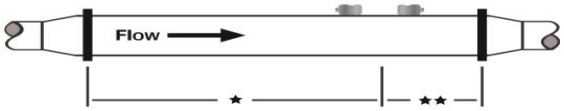
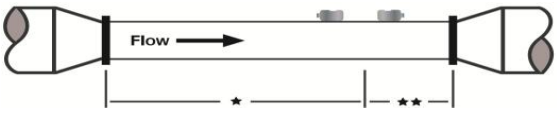
Piping configuration And transducer position	Upstream Dimension	Downstream Dimension
	Pipe Diameters(*)	Pipe Diameters (**)
	10	5
	14	5
	24	5
	30	5
	10	5
	24	10

Table 2.1 Straight Pipe Requirement

2.3 TRANSDUCER SPACING

1100V-E transducers are clamped on the outside of a closed pipe **at a specific distance from each other**. The transducers can be mounted in V-mode where the sound transverses the pipe two times, W-mode where the sound transverses the pipe four times, or in Z-mode where the transducers are mounted on opposite sides of the pipe and the sound crosses the pipe once. For further details, reference pictures located under **Table 2.2**. The appropriate mounting configuration is based on pipe and liquid characteristics. Selection of the proper transducer mounting method is not entirely predictable and many times is an iterative process. **Table 2.2** contains recommended mounting configurations for common applications. These recommended configurations may need to be modified for specific applications if such things as aeration, suspended solids or poor piping conditions are present. W-mode provides the longest sound path length between the transducers - but the weakest signal strength. Z-mode provides the strongest signal strength - but has the shortest sound path length.

Table 2.2
Transducer Mounting Modes

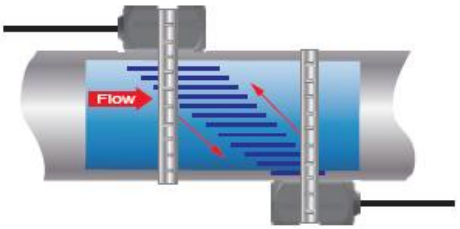
Transducer Mount Mode	Pipe Material	Pipe Size	Liquid Composition
V-Mode	Plastic Metal	1-30 in. (20-750 mm) 2-24 in. (50-600 mm)	Low TSS; non-aerated
Z-Mode	Plastic Metal	＞ 12 in. (＞ 300 mm) ＞ 8 in. (＞ 200 mm) or < 4 in. (< 100 mm)	Low TSS; non-aerated
W-Mode not recommend	Plastic Metal	1-4 in. (20-100mm) 1-4 in. (20-100mm)	Low TSS; non-aerated

TSS= Total Suspended Solids

Plastic includes all pipe material such as PVC, PP, PTFE, PVDF, etc.

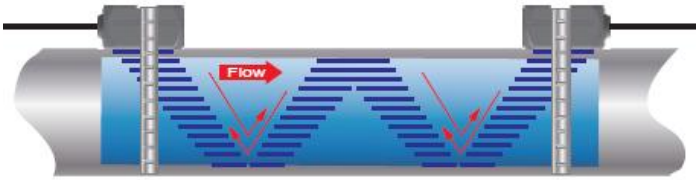
Metal includes all pipe material such as SS, steel, copper, aluminium, etc, etc.

Transducer Mounting Modes



Z method

V method



W method

The 1100V-E system calculates proper transducer spacing by utilizing piping and liquid information entered by the user.
The following information is required before programming the instrument. Note that much of the data relating to material sound speed, viscosity and specific gravity are preprogramed

into the 1100V-E flow meter. This data only needs to be modified if it is known that a particular liquid data varies from the reference value. Refer to Part 3 of this manual for instructions on entering configuration data into the 1100V-E flow meter via the meter keypad. Transducer mounting configuration. See Table 2.2

1. Pipe Outer Diameter)
2. Pipe wall thickness
3. Pipe material
4. Pipe sound speed
5. Pipe relative roughness
6. Pipe line thickness
7. Pipe line material
8. Pipe line sound speed
9. Fluid type
10. Fluid sound speed

Nominal values for these parameters are included within the 1100V-E operating system. The nominal values may be used as they appear or may be modified if exact system values are known.

After entering the data listed above, the 1100V-E will calculate proper transducer spacing for the particular data set. This distance will be in inches if the 1100V-E is configured in English units, or millimeters if configured in metric units.

2.4 TRANSDUCER MOUNTING

After selecting an optimum mounting location and successfully determining the proper transducer spacing, the transducers may now be mounted onto the pipe.

The transducers must be properly oriented on the pipe to provide optimum reliability and performance. On horizontal pipes, one pair transducers should be mounted 180 radial degrees from one another and at least 45 degrees from the top-dead-center and bottom-dead-center of the pipe. See Figure 2.1. Figure 2.1 does not apply to vertically oriented pipes. Another pair transducers are installed in the same way.

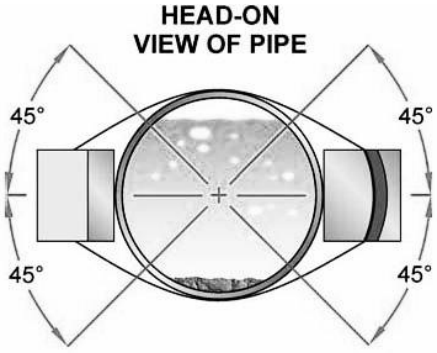


Figure 2.1
Transducer Orientation—Horizontal Pipes

On vertical pipes the orientation does not apply.

Pipe Preparation

Before the transducers are mounted onto the pipe surface, two areas slightly larger than the flat surface of the transducer heads must be cleaned of all rust, scale and moisture. For pipes with rough surfaces, such as ductile iron pipe, it is recommended that the pipe surface be ground flat. Paint and other coatings, if not flaked or bubbled, need not be removed. Plastic pipes typically do not require surface preparation other than soap and water cleaning.

Observe Signal Strength while placing the transducers into position. Signal Strength can be displayed on Menu RSSI.

V-Mode and W-Mode Installation

1. For 1100V-E transducers, place a single bead of couplant, approximately 1.2 mm thick, on the flat face of the transducer. Generally, silicone-based grease is used as an acoustic couplant, but any grease-like substance that is rated not to “flow” at the temperature that the pipe may operate will be acceptable.

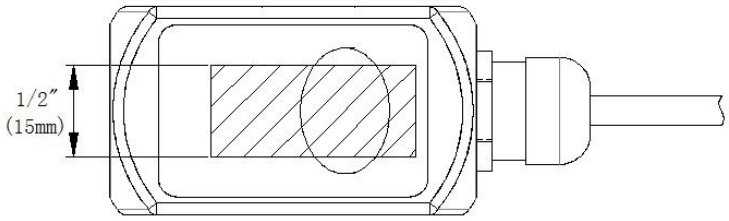


Figure 2.2

2. Place the upstream transducer in position and secure with a mounting strap. Straps should be placed in the arched groove on the end of the transducer. A screw is provided to help hold the transducer onto the strap. Verify that the transducer is stick to the pipe - adjust as necessary. Tighten the transducer strap securely.

3. Place the downstream transducer on the pipe at the calculated transducer spacing. See **Figure 2.3**. Using firm hand pressure, slowly move the transducer both towards and away from the upstream transducer while observing Signal Strength. Clamp the transducer at the position where the highest Signal Strength is observed. A Signal Strength (RSSI) between 60 and 95 is acceptable.

4. If after adjustment of the transducers the Signal Strength（RSSI） does not rise to above 60, then an alternate transducer mounting method should be selected. If the mounting method was W-mode, then reconfigure the 1100V-E for V-mode, reset the 1100V-E, move the downstream transducer to the new location and repeat step 3.

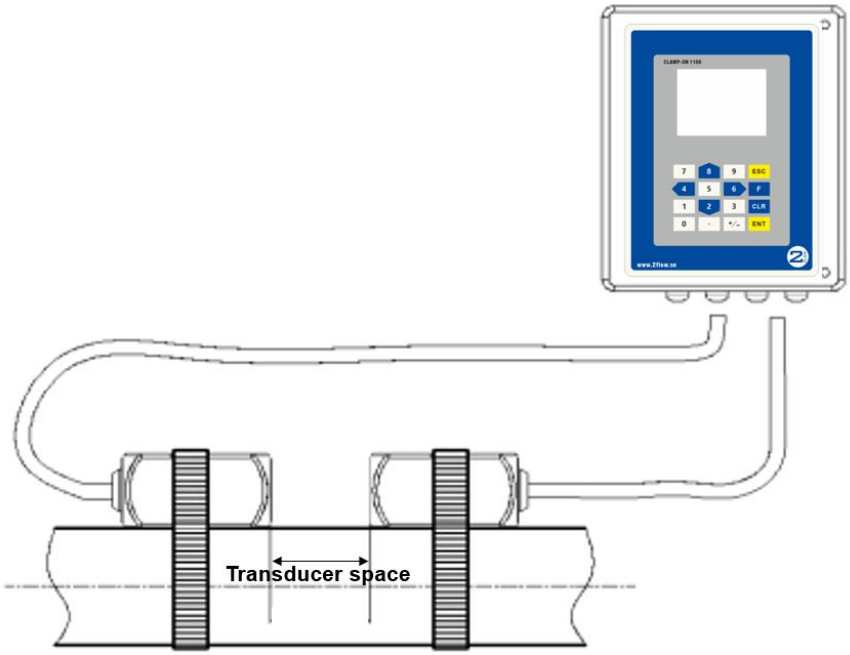


Figure 2.3 Transducer position

V-Mount is the STD installation method, it is convenient and accurate, Reflective type (transducers mouthed on one side of the pipe) of installation used primarily on pipe size in the (50mm~400mm) internal diameter range attention transducer designed parallel on the centre line of installing the pipeline.

The spacing value shown on menu refers to the distance of inner spacing between the two transducers. The actual transducers spacing should be as close as possible to the spacing value. The transducer spacing is from the end of one transducer to another sensor.

The transducer mounting spacing is very important for Transit-time meters, and users need mount transducers exactly according to the spacing distance value displays after users input proper parameter settings. Pls note the distance is only for reference, and just keep it within 97--103% value range.

As the above figure shows, the normal transducer spacing refers to the distance between the ends of the two transducers (one pair). And this spacing should be according to the value Menu tells you. Note that this method suits for normal Small, Std. M transducer.

Mounting Transducers in Z-Mount Configuration

Installation on larger pipes requires careful measurements to the linear and radial placement of the L1 transducers. Failure to properly orient and place the transducers on the pipe may lead to weak signal strength and/or inaccurate readings. The section below details a method for properly locating the transducers on larger pipes. This method requires a roll of paper such as freezer paper or wrapping paper, masking tape and a marking device.

1. Wrap the paper around the pipe in the manner shown in **Figure 2.4**. Align the paper ends to within 6 mm.
2. Mark the intersection of the two ends of the paper to indicate the circumference.

Remove the template and spread it out on a flat surface. Fold the template in half, bisecting the circumference. See **Figure 2.5**.

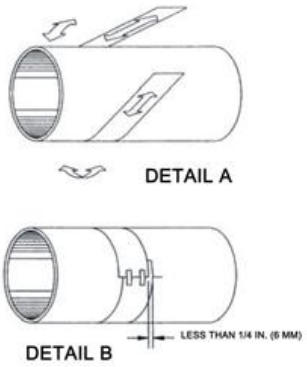


Figure 2.4
Paper Template Alignment

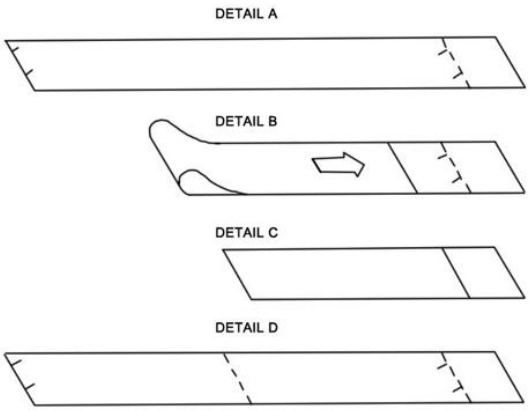


Figure 2.5
Bisecting the pipe cirumference

3. Crease the paper at the fold line. Mark the crease. Place a mark on the pipe where one of the transducers will be located. See **Figure 2.1** for acceptable radial orientations. Wrap the template back around the pipe, placing the beginning of the paper and one corner in the location of the mark. Move to the other side of the pipe and mark the pipe at the ends of the crease. Measure from the end of the crease directly across the pipe from the first transducer location) the dimension derived in Step 2, Transducer Spacing. Mark this location on the pipe.

4. The two marks on the pipe are now properly aligned and measured.

If access to the bottom of the pipe prohibits the wrapping of the paper around the circumference, cut a piece of paper to these dimensions and lay it over the top of the pipe.

Length = Pipe O.D. x 1.57; width = Spacing determined on page 2.6

Mark opposite corners of the paper on the pipe. Apply transducers to these two marks.

5. Place a single bead of couplant, approximately 1.2 mm thick, on the flat face of the transducer. See **Figure 2.2**. Generally, a silicone-based grease is used as an acoustic couplant, but any grease-like substance that is rated to not “flow” at the temperature that the pipe may operate at, will be acceptable.

a) Place the upstream transducer in position and secure with a stainless steel strap or other. Straps should be placed in the arched groove on the end of the transducer. A screw is provided.

b) Try to help hold the transducer onto the strap. Verify that the transducer is true to the pipe - adjust as necessary. Tighten transducer strap securely. Larger pipes may require more than one strap to reach the circumference of the pipe.

6. Place the downstream transducer on the pipe at the calculated transducer spacing. The installation of a pair of sensors is used as an example. The method of the other pair is the same. See **Figure 2.6**. Using firm hand pressure, slowly move the transducer both towards and away from the upstream transducer while observing Signal Strength. Clamp the transducer at the position where the highest Signal Strength is observed. Signal Strength RSSI of between 60 and 95 percent is acceptable. On certain pipes, a slight twist to the

transducer may cause signal strength to rise to acceptable levels.

7. Secure the transducer with a stainless steel strap or other.

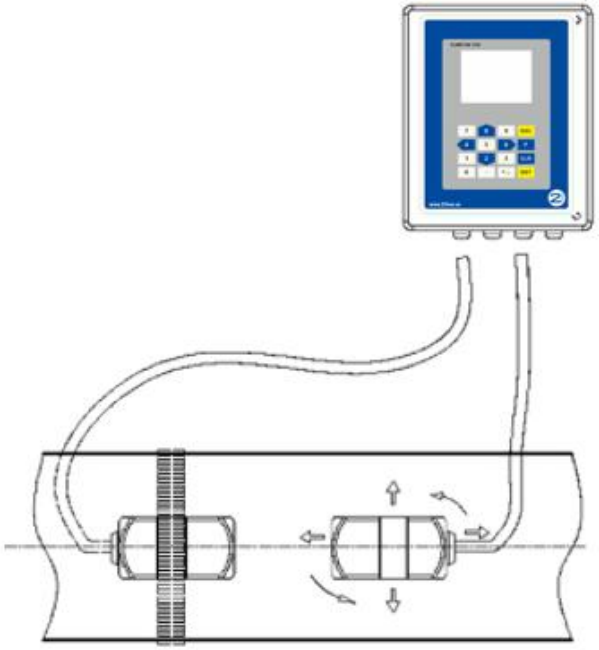


Figure 2.6
Z-Mode transducer placements

2.5 TRANSDUCER MOUNTING INSPECTION AND COUPLANT APPLICATION

2.5.1 Transducer Mounting Inspection

It is very important to use menu operations for TRANSDUCER MOUNTING INSPECTION and Estimation, Use menu windows for Transducer Mounting Inspection.

2.5.2 Couplant Application

A, It is also very important for couplant application.

When mounting the transducers, apply just enough pressure so that the couplant fills the gap between the pipe and transducer. Commonly, the Dow 732 for permanent and Dow 111 for temporary installations, but Dow 111 has a better coupling effect. If Dow 732 was used, ensure that no relative movement between the transducer and the pipe takes place during the setting time and do not apply instrument power for at least 24 hours, Dow 111 also be used for permanent installations(avoid rain or water etc.), setting time is not necessary. We recommend using Dow 111 for permanent installing, and then use Dow732 around the transducer in order to fix the transducer, waterproof cloth is recommended if the Transducers are installed outdoor. Dow 112 for high temperature application.

B, Transducers for High Temperature

Mounting of high temperature transducers is similar to 1100V-E standard transducers; High temperature installations require acoustic couplant Dow Corning 112 that is rated not to flow at the temperature that will be present on the pipe surface.

PART-3 TRANSMITTER INSTALLATION CONNECTION AND OPERATION INSTRUCTIONS

3.1 TRANSMITTER INSTALLATION

After unpacking, it is recommended to save the shipping carton and packing materials in case the instrument is stored or re-shipped. Inspect the equipment and carton for damage. If there is evidence of shipping damage, notify the carrier immediately.

The enclosure should be mounted in an area that is convenient for servicing, calibration or for observation of the LCD readout (if so equipped).

1. Locate the transmitter within the length of transducer cable that was supplied with the 1100V-E system. If this is not possible, it is recommended that the cable be exchanged for one that is of proper length. Transducer cables that are up to 300 meters may be accommodated.
2. Mount the 1100V-E transmitter in a location that is:
   - ♦ Where little vibration exists.
   - ♦ Protected from falling corrosive fluids.
   - ♦ Within ambient temperature limits -20 to 60°C
   - ♦ Out of direct sunlight. Direct sunlight may increase transmitter temperature to above the maximum limit.
3. Mounting: Refer to **Figure 3.1** for enclosure and mounting dimension details. Ensure that enough room is available to allow for door swing, maintenance and conduit entrances. Secure the enclosure to a flat surface with four appropriate fasteners.
4. Conduit holes. Conduit hubs should be used where cables enter the enclosure. Holes not used for cable entry should be sealed with plugs.

NOTE: Use NEMA 4 [IP65] rated fittings/plugs to maintain the water tight integrity of the enclosure. Generally, the left conduit hole (viewed from front) is used for line power; the center conduit hole for transducer connections and the right hole are utilized for OUTPUT wiring.

5 If additional holes are required, drill the appropriate size hole in the enclosure's bottom. Use extreme care not to run the drill bit into the wiring or circuit cards.

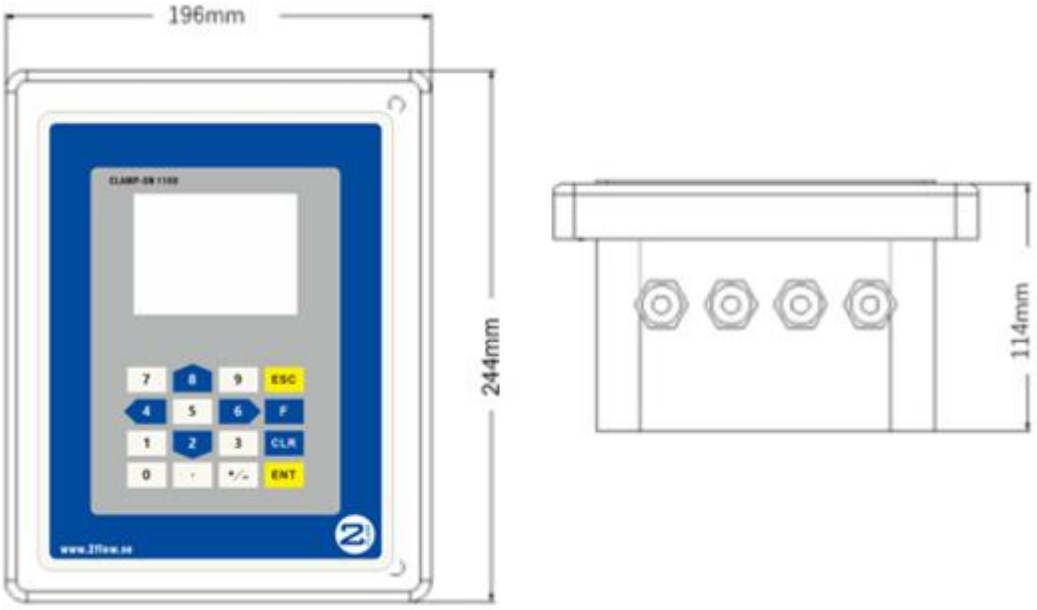


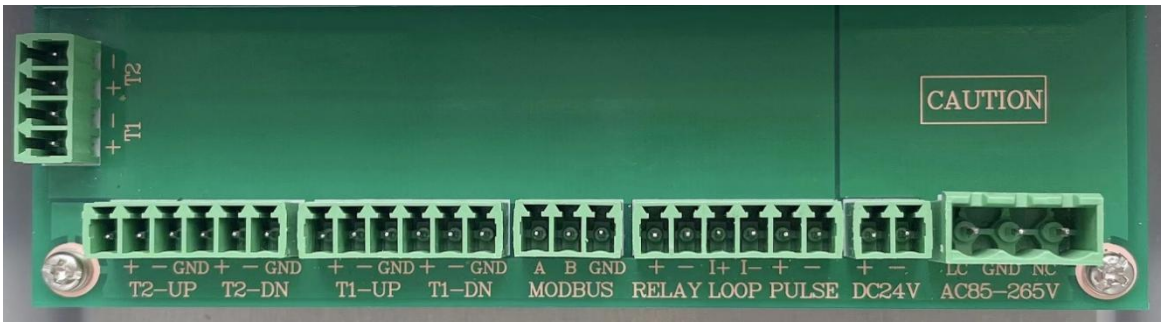
Figure 3.1 Mechanical Dimensions

3.2 TRANSDUCER CONNECTIONS

To access terminal strips for electronic connectors, loosen the two screws in the enclosure door and open the door.

Guide the transducer terminations through the transmitter conduit hole located in the bottom-center of the enclosure.

The terminals within 1100V-E are a pluggable type - they can be removed wired and then plugged back in. Connect the appropriate wires to the corresponding screw terminals in the transmitter. Observe UP/DN transducers orientation, the status of the two pairs of transducers are equal. There is no need to specify the transmitting and receiving transducers. (if flow rate display negative, exchange the UP/ DN wiring).



For 1100V-E single channel flowmeter, pls just connect the two transducers with T1- UP/T1-DN. T2-UP/T2-DN is only for dual-channel ultrasonic flowmeter.

─ T1 (+, -) and T2 (+, -) are used for PT1000 temperature sensor wires. T1 is for inlet pipe and T2 is for outlet pipe.

Figure 3.2

NOTE: The transducer cable carries low level high frequency signals. In general, it is not recommended to add additional cable to the cable supplied with the transducers. If additional cable is required, contact the factory to arrange an exchange for a transducer with the appropriate length of cable.
Cables to 300 meters are available.

3.3 TRANSMITTER POWER AND OUTPUT CONNECTIONS

1, Connect line power to the screw terminals AC, GND or DC in the transmitter. See the Figure 3.2, the ground terminal grounds the instrument, which is mandatory for safe operation.
DC Power connection: The 1100V-E can be operated from a 9-28 VDC source, as long as the source is capable of supplying a minimum of 3 Watts.

NOTE: This instrument requires clean electrical line power. Do not operate this unit on circuits with noisy components (i.e., fluorescent lights, relays, compressors, or variable frequency drives). It is recommended not to run line power with other signal wires within the same wiring tray or conduit.

2, Connect the 4~20mA wires to the appropriate (LOOP/I+ I-) (The 4-20 mA output do not requires power from an external DC power supply)

3, Pulse output

The pulse output can only be output by hardware OCT or relay. It requires a 10 k Ω pull-up resistor and an external 24V power supply. The wiring diagram is as below.

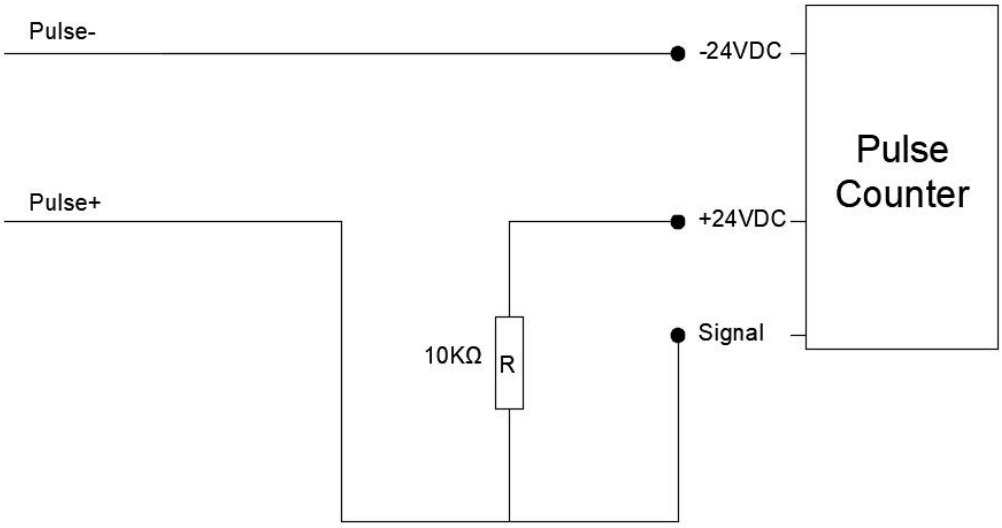


Figure 3.3 Pulse wires connection

3.4 KEYPAD CONFIGURATION

3.4.1, Keypad functions

After transducer and connection of appropriate power supply to 1100V-E, keypad configuration of the instrument can be undertaken. Generally, there should be no display of error messages, and the flow meter will go to the most commonly used Menu to display the Velocity, Flow Rate, Positive Totalizer, Signal Strength and Signal Quality, based on the pipe parameters entering by the user or by the initial program.

The 1100V-E contains a 16-key tactile keypad, allows the user to view and change configuration parameters as shown below.

Follow these guidelines when using 1100V-E keypad:

0~9 and . to input numbers and decimal.

CLR to backspace or delete characters to the left.

The ARROW keys 8∧ and 2 ∨ To return to the last menu or to open the next menu, are used to scroll through menu configuration parameters; also acts as "+" and "-" functions when entering numbers.

The ESC key is used to exit the current screen;

The ENT key is also confirm key, it is used to "confirm" that a number or selection has been entered. Another function is to enter the "Modify" state before entering parameters.

The FUC key is used to view the heat value, temperature, TOM/TOS.

3.4.2 KEYPAD OPERATION

1100V-E series ultrasonic flowmeter adopts window software design, all input parameters, instrument Settings and display measurement results are uniformly subdivided into independent Windows, users can achieve the purpose of input parameters, modify Settings or display measurement results by "access" to a specific window. The window is entered by pressing a button. Window number, or window address code, indicates a specific meaning, such as pipe parameter setting window indicates pipe outside diameter parameter input in this system, pls check the window details chapter description.

A quick way to access a window is to press the ESC key, then press the ENT key. For example, user want to input or check the pipe diameter parameters, press ECS first to enter the initial setting, and then press ENT key to enter the pipe parameter setting and select the pipe diameter.

Windows address arrangement is a certain rule (please see the next section description and "window details" chapter), users do not need to remember one by one, just remember the common window address code and the general location of the less common window. When using, temporarily enter roughly adjacent windows, and then press ▲ and ▼ keys to find the window to visit.

Using a combination of shortcut and mobile methods, users can find window access simple and convenient.

PART-4 WINDOWS DISPLAY EXPLANATIONS

1100V-E Window Descriptions

When reading this section, please refer to the meter menu one by one for easy understanding

The quick way to check display window is to press the ESC key and then press ENT key to check initial Settings.

Windows Display Explanations

Main menu window

Window Display	Flow / Total Flow Display	CH
		RSSI
		Positive, negative, net total flow
		Time/ Flow
		Velocity
Site Set up	Pipe Parameter	Outer Diameter
		Wall Thickness
		Lining Thickness
		Inner Diameter
		Pipe MAT./Liner MAT.
		Kind Of Fluid/Sensor Type/Sensor Mounting
		Zero Adjust/Damping Set
		Empty Pipe Set
		Measure CHAN Set
		Static Zero Reset
		Liquid Temperature
		Sensor Distance
	Flow Unit Set	Flow Unit Set
		Totalizer Set
		Totalizer Factor
	Totalizer Set	Positive Totalizar
		Negtive Totalizer
		Totalizer Reset
	Flow Cut-off m/s	
	Flow Scale Factor	
	Energy Measuring Set	Energy Measuring
		Energy Unit SET
		Net totalizer
		Positive Totalizar/Negtive Totalizer
		Totalizer Factor
		Input Temp Calib
		Output Temp Calib
		Temp Cut-off
		SHC
Output Set up	Modbus Output	Modbus Address Set
		Baudrate Set
		Parity Set
		Stop Bit
	Relay Output	Relay Output
		Relay Type
		Relay Flow Unit
		Relay Energy Unit
	Pulse Output	Pulse Output
		Pulse Type
		Pulse Flow Unit
		Pulse Energy Unit

Output Setup	Current Loop Output	CL Output
		CL Calibration / CL Output Checkup
		Current Loop Output
		CL Mode
		Min Output/Max Output
		Current Output
	SD Card Output	Logger Output
		Logger Interval
	NB Output	NB Output
		NB Report Type
		Period Start Time
		Period Interval
		Regular Report 1/2/3/4
System Setup	Date	
	Time	
	Backlight	
	Language Set	
F button Energy Measuring	Net Energy	
	Pos Energy	
	Neg Energy	
	Curr NRG	
	T1/T2	
	Transit-Time	
	Reynolds	
	CH1 TX-Time Rate	
	CH2 TX-Time Rate (for dual-channel flowmeter	
	Device SN	
	Version	
	Work Time	

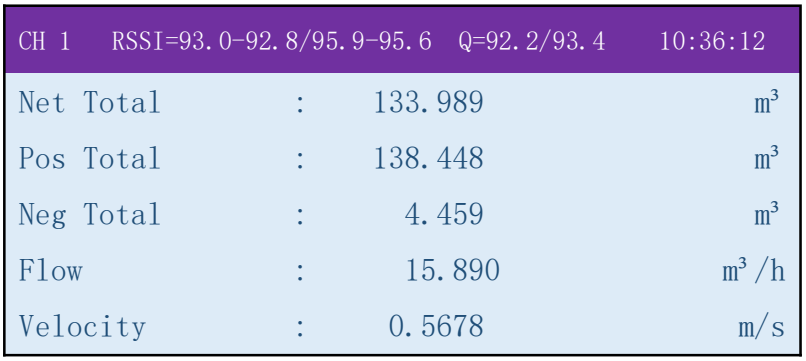
Positive total / negative total / net total / flow / Velocity / channel number*(only for dual-channel flow meter)* / S, Q value / time

Display positive total flow, negative total flow, net total flow, instantaneous flow and velocity, upstream and downstream signal strength S, signal quality Q value and time.

Signal strength is expressed in numbers from 0 to 99.9. 00.0 indicates that no signal is received and 99.9 indicates that the maximum signal is received. Under normal working conditions, the signal strength RSSI should be ≥60.0.

The signal quality Q value is represented by numbers from 00 to 99, 00 is the worst and 99 is the best. The normal working condition is the signal quality Q value > 40.

When installing and using the flowmeter, the signal strength and quality value need to be as high as possible. Good signal strength and Q value, can ensure the flow meter long-term stable operation and good measurement accuracy.

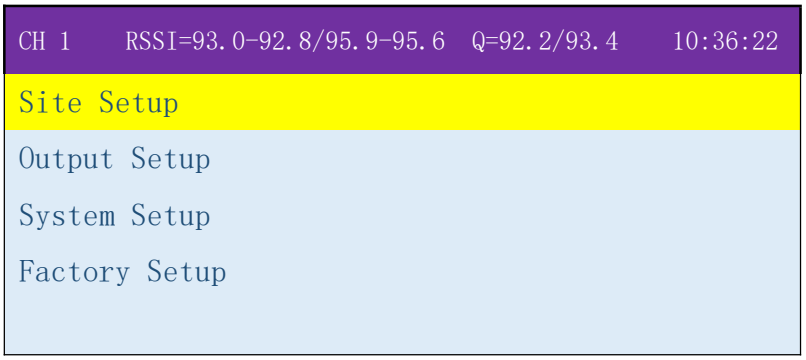


If the user turns off the net total flow, the value of the net total flow displayed is the value before it is turned off. The net total flow= positive total flow- negative total flow.

Host Menu Window

Site setup/Output Setup/system Setup/factory Setup

This window is only used to set the parameters of the flowmeter. To access the host menu window, first type ESC and then ENT from the screen.

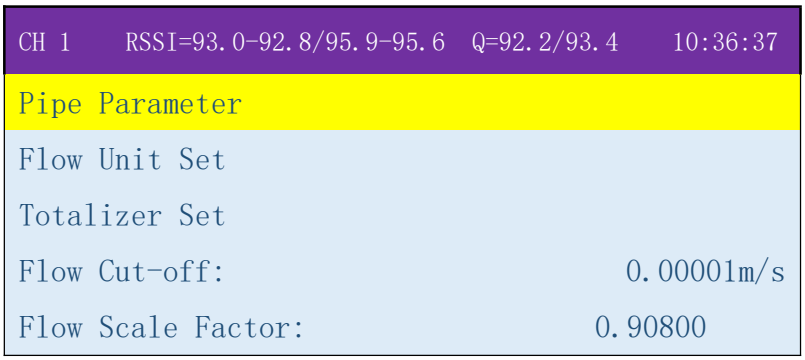


Site Setup Window

Pipe parameter/ Flow unit set/ Totalize set/ Flow cut-off/ Flow scale factor/ Energy

Measuring Set

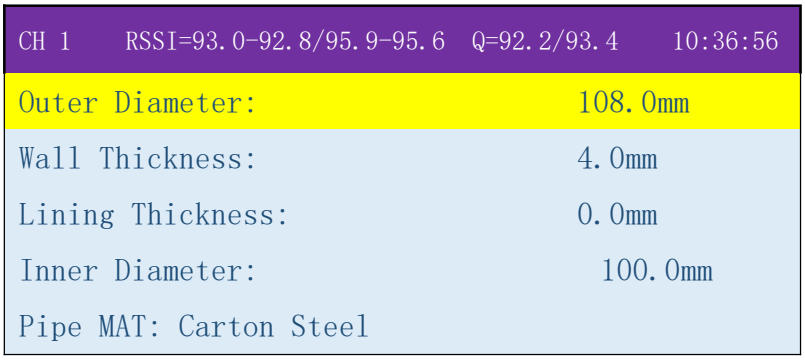
This window is used for setup pipe, flow, totalize, energy and other related parameters. By using ↑ and ↓ keys, you can select the corresponding function and enter ENT for selection or modification.

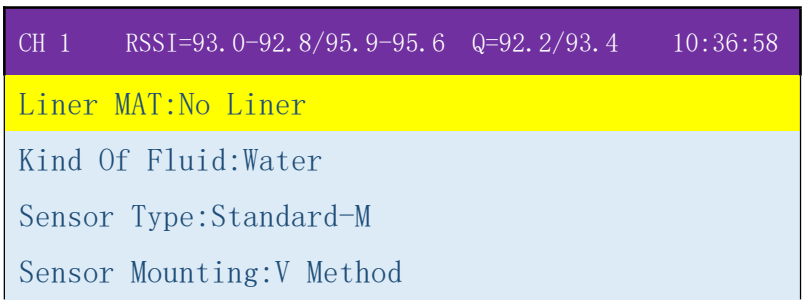


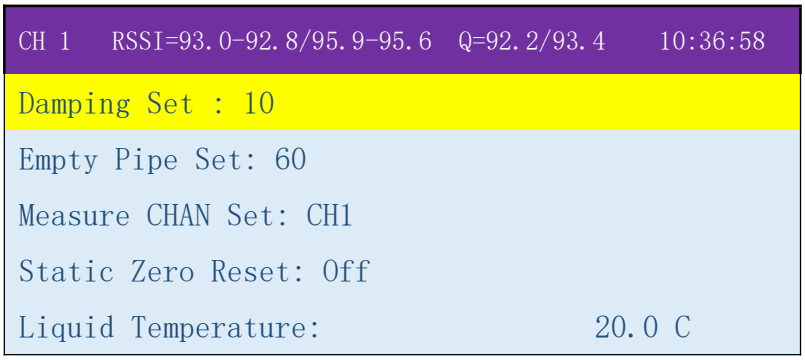
Pipe Parameter Menu

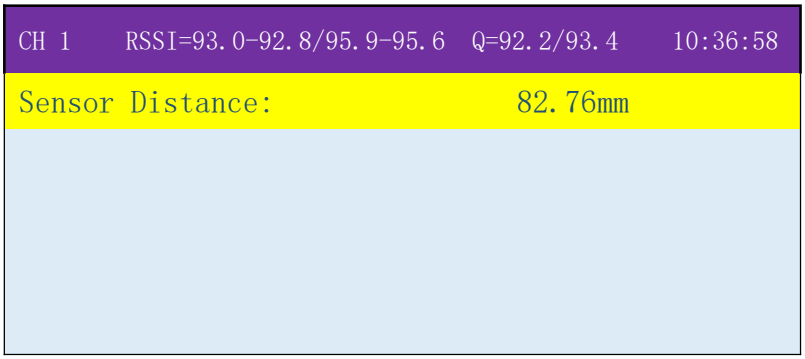
Outer Diameter/ Wall Thickness /Lining Thickness/ Inner Diameter/ Pipe MAT/Liner MAT./ Kind Of Fluid/ Sensor Type/ Sensor Mounting/ Zero Adjust/ Damping Set/ Empty Pipe Set/ Measure CHAN Set/ Static Zero Reset/ Liquid Temperature/ Sensor Distance

This window is used for parameter setting, installation and debugging on site. Use ↑ and ↓ to select the corresponding function and type ENT for modification. And then type ENT again for saving.









Outer Diameter

This menu for entering/changing the outside (outer) diameter of the pipe line. 0 to 6000 mm is the allowed range of the value. Enter the outside diameter size, type ENT for save.

Note: The outer diameter of the insertion sensor must be more than 65mm.

Wall Thickness

The menu for entering pipe wall thickness.

Lining Thickness

The menu for selecting the liner thickness.

Inner Diameter

This menu for inside(inner) diameter of the pipe. It is not necessary to enter, automatically calculate and display from outer diameter and pipe wall thickness, it can't be changed.

Pipe MAT

Menu for selecting pipe material, familiar pipe materials include: (The materials must be equable, compact and can transmit ultrasound)

0. Carbon steel 1. Stainless steel 2. Cast iron 3. Ductile iron 4. Copper

5. PVC 6. Aluminum 7. Asbestos 8. Fiberglass 9. Others

Item 9 Other is used to enter other materials not included in the 1- 8 items. If the

user selects this option, the corresponding sound speed for the pipe must be entered in the window.

Liner MAT

The menu for selecting the liner material, select 0. No liner if pipe without any liner. familiar liner materials include:

0. No liner 1. Tar Epoxy 2. Rubber 3. Mortar 4. Polypropylene 5. Polystryol 6. Polystyrene 7. Polyester. 8. Polyethylene 9. Ebonite 10. Teflon 11. Others

Item 11 Others is used to enter other materials not included in the 1- 10 items. If the user selects this option, the corresponding sound speed for the liner material must be entered in the window.

Kind Of Fluid

Menu for selecting fluid type

familiar liquids types include:

0. Water 1. Sea Water 2. Kerosene 3. Gasoline 4. Fuel oil 5. Crude Oil 6. Propane at -45℃ 7. Butane at 0℃ 8. Diesel Oil 9. Caster Oil 10 . Peanut Oil 11. #90 Gasoline 12. #93 Gasoline 13. Alcohol 14. Hot water at 125 ℃ 15. Others

Item 15 Others is used to enter other fluid not included in the 0- 14 items. If the user selects this option, the corresponding sound speed for the liquid must be entered in the window.

Sensor Type

This menu is for selecting the proper sensor type. There are different types of sensors for. For 1100V-E series

0. Standard-S
1. Standard-M
2. Standard-L（delete）
3. A-HT
4. B-HT
5. Plug-in Type B
6. Plug-in Type C
7. User’s

If the user selects 7 user’s, sensor parameters including: Angle of acoustic wedge, acoustic wedge speed, ultrasonic delay time, distance between the center of the acoustic beam and the edge of the sensor must be entered. Please contact 2Flow AB for specific usage method. Plug-in Type B is for standard Insertion sensor 65-6000mm.

Sensor Mounting

Menu for selecting the sensor mounting method. Four methods can be selected:

0. V-method 1. Z-method 2. N-method 3. W-method

Zero Adjust

Automatic zero/ manual zero/ static zero/ factory zero

Automatic zero is usually chosen.

Damping Set

Flow rate Damping for displaying a stable read. The input range is 0 to 99.

0 means no damping and 99 means maximum damping. Damping acts as a smooth display of data. The principle is just like a single RC low-pass filter, the damping coefficient value is equivalent to the time constant of the circuit. Default value is 10 seconds; common setup value is 10-30 seconds.

Empty Pipe Set

Empty Pipe Setup, this is very useful for user, Empty pipe line or pipe shaking etc., meter may display error or undesired read, user can setup a Q value less than normal Q value, for example, normal Q value is 60-70, user can enter Empty Pipe Setup value 50, so the meter will display 0 flow rate when Q value is less than 50. In good pipe status, please do not setup this value too small, enter a value of 30~40 in this menu is recommended.

Measure CHAN Set

This menu is based on the application to select the corresponding channel and channel number, type ENT for save.

Channel 1 is working for channel 1, channel 2 is working for channel 2, channel 1+ channel 2 means two channels are working at the same time.

Note: For single ultrasonic flowmeter, channel 2 is can NOT be optional.

For dual channel ultrasonic flowmeter, channel 2 is can be optional.

Static Zero Reset

Set Zero, when the fluid is in the static state, the displayed value is called “static zero point”. When the “Zero Point” is not really at zero, the incorrect read value is going to be added into the actual flow values.

Set static zero must be carried out after the sensors are right installed and the flow inside is in the absolute static state (no liquid moved in the pipe line). Set static zero also is very important step when re-calibrating the meter in lab. Doing this step enhances the measuring accuracy and flow offset can be eliminated.

Liquid Temperature

Display the current pipe temperature, it can be setup according to the site conditions, and

then enter ENT to save the data.

If no temperature sensor is installed, no need to set this parameter.

Sensor Distance

This menu display the sensors mounting spacing.

Users need mount sensors exactly according to the spacing distance value after users input correct parameter setting. This data is automatically calculate by the flow meter after the user enters the all pipeline parameters.

Flow Unit Set

This window displays Settings for flow unit, for flow rate unit, totalizer flow unit and tolalizer factor.

Flow Rate Unit

Press scroll key ∧ or ∨ to select desired time unit, then press “ENTER for save .

Flow rate unit can be in

0. Cubic Meters	short for	(m3)
1. Liter		(l)
2. American Gallon		(gal)
3. Imperial Gallon		(igl)
4. Million Gallon (American)		(mgl)
5. Cubic Feet		(cf)
6. American Liquid Barrel		(bal)
7. Imperial Liquid Barrel		(ib)
8. Oil Barrel		(ob)

The flow unit in terms of time can be per day, per hour, per minute or per second. So there are 36 different flow rate units in total for selection.

Totalizer flow unit

Window for selecting Totaliziers Unit, working unit default is cubic meters, if change it, press ENTER, then press scroll key ∧ or ∨, to select desired unit.

Tolalizer factor

Select Totalizer Factor (Multiplier)

The multiplier ranges from 0.001 to 10000, default value is ×1, addition, if select total flow pulse output, this value represent one pulse corresponding value.

0. x 0.001 (1E-3)
1. x 0.01
2. x 0.1
3. x 1
4. x 10

5. x 100

6. x 1000

x 10000(1E+4)

Totalizer Set

Turn on or turn off the NET Totalizer, Positive Totalizer, Negative Totalizer.

Positive Totalizer

This menu is used to turn on or turn off the positive totalizer, the flowmeter positive totalizer accumulates when it is "ON". When it is “Off”, the positive totalizer will not change. The factory default is "ON".

Negative Totalizer

This menu is used to turn on or turn off the negative totalizer, the flowmeter negative totalizer accumulates when it is "ON". When it is “Off”, the negative totalizer will not change. The factory default is "ON".

Totalizer Reset

This window is used to clear the Totalizer and all set parameters. the following options are available after type ENT:

None

All

Positive

Negative

Take care or make note on the parameters before doing restoration.

Flow Cut-off

Low Flow Cutoff, may be used in order to force a zero display at lower flows and avoid incorrect totalizer.

For instance, this value is 0.02m/s, the meter will display zero when flow rate is less than ±0.02m/s.

Flow Scale Factor

The Scale Factor is used to modify the measurement results, factory default is 1.0 or other value depend on calibration, please see the calibration data sheet and save this sheet. If really necessary, the user can enter a numerical value other than factory default value according to re-calibration results.

Energy Measure Set

This window is mainly used for parameter setting of energy measurement.

Energy Measuring

This menu is used to turn on or turn off the energy measure. After it is turn on, the energy measurement function is started.

Energy Unit Set

Energy Flow Unit can be choose as KCAL, KWh and GJ.

Factory default is KWh.

Positive Totalizer (Energy)

This menu is used to turn on or turn off the energy positive totalizer, the flowmeter energy positive totalizer accumulates when it is "ON". When it is “Off”, the energy positive totalizer will not change. The factory default is "ON".

Negative Totalizer (Energy)

This menu is used to turn on or turn off the energy negative totalizer, the flowmeter energy negative totalizer accumulates when it is "ON". When it is “Off”, the energy negative totalizer will not change. The factory default is "ON".

Totalizer Reset (Energy)

This window is used to clear the energy Totalizer and all set parameters. the following options are available after type ENT:

None

All

Positive

Negative

Take care or make note on the parameters before doing restoration.

Tolalizer factor (Energy)

Select Energy Totalizer Factor (Multiplier)

The multiplier ranges from 0.001 to 10000, default value is ×1, addition, if select total flow pulse output, this value represent one pulse corresponding value.

0. x 0.001 (1E-3)

1. x 0.01

2. x 0.1

3. x 1

4. x 10

5. x 100

6. x 1000

x 10000(1E+4)

Input Temp Calib

Calibrate the input temperature, we have already done the calibration in our laboratory, so customers do not need to calibrate. When the value has been changed or need to re-calibrate, customers can calibrate the value yourselves.

Output Temp Calib

Calibrate the output temperature.

Temp Cut-off

Low temperature difference cutoff.

SHC

SHC is short of specific heat capacity.

The meter default calculate the thermal enthalpy as the water of a certain temperature automatically. If the measure fluid is not water, user need to manually enter the fluid specific heat capacity in the menu SHC.

Output Setup

This window is used for the flowmeter output Setup, the output can be set Modbus output / Relay output / Pulse output / Current loop output / SD card output/ NB output. Select the corresponding output according to the application.

Modbus Output

This menu is used for Modbus Settings as Address/ Baud Rate/ Parity Set/ Stop Bit.

The default address is 1, baud rate is 9600, Parity is None and stop bit is 1.

It can be set according to the site conditions.

Relay Output

This menu is used to set the relay output.

Once the transmitter is powered on, relay output is normally Open state.

Pulse Output

This menu is used for pulse output settings, such as Pulse output, Pulse type, pulse flow unit and pulse energy unit.

Current Loop Output

This window is used to set current loop output turn on or off and related parameters settings.

CL Calibration

This menu is for 4-20mA output calibration,Use a Ammeter to verify 4mA output, use key ∧ or ∨, let the output is 4.0mA. Use the same way, let the Output is 20.0mA. This

function mainly used by 1100V-E manufacturer.

CL Output Checkup

This menu is used to check whether the current loop of flow meter has been calibrated well. Enter ENT key and use ↑ or ↑ to check value of 4mA, 8mA, 12mA, 16mA and 20mA . At the same time, use a precision ammeter to check if the output data correct. If the allowable error is exceeded, the current loop needs to be re-calibrated.

Current Loop Output and CL mode

4-20mA is the most common output mode.

Min Output/Max Output

Min Output is used to set the minimum flow value of 4mA or 0mA. Max Output is used to set the maximum flow value of 20mA.

Current Output

It is for current output display.

If 4.0000mA is displayed, it means that the output value of the current loop is 4.0000mA. If there is a large deviation between the output value and flow meter display, the user should calibrate the current loop.

Logger Output/Logger Interval

This menu is for data logger output to store measurement data. And the logger time interval can be set up.

System Setup

This window is used for date, time, backlight, language settings.

Date and time

Setup the date and time of the meter.
YY-MM-DD (For example, it is Aug 14, 2022 today, the setting should be 22/08/14)
HH-MM-SS (Hour-minute-second, in 24 hour format)
Type ENT and the prompt ">" appears then the date and time can be modify.

Backlight

LCD contrast control. The LCD will become darker when a small value is entered.

Language Set

Used to select the display language.

F button

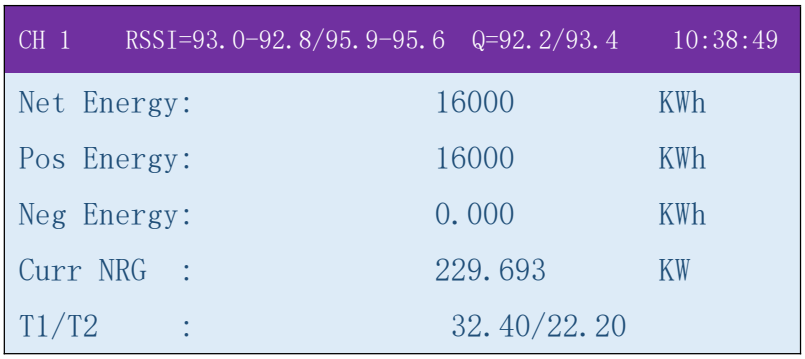
Enter FUNC function key, press ENT key.

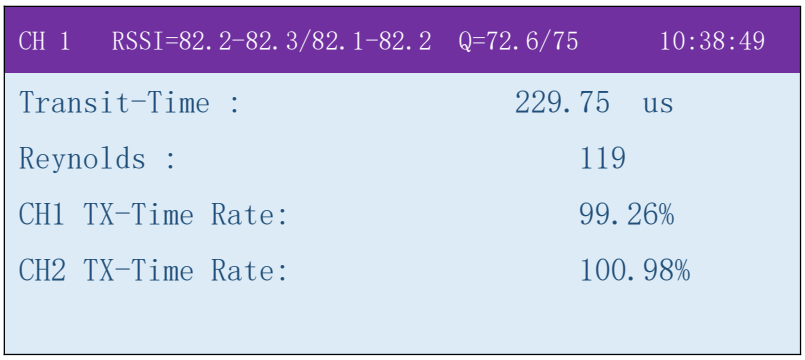
This window for net total, positive total / negative total / flow / velocity;

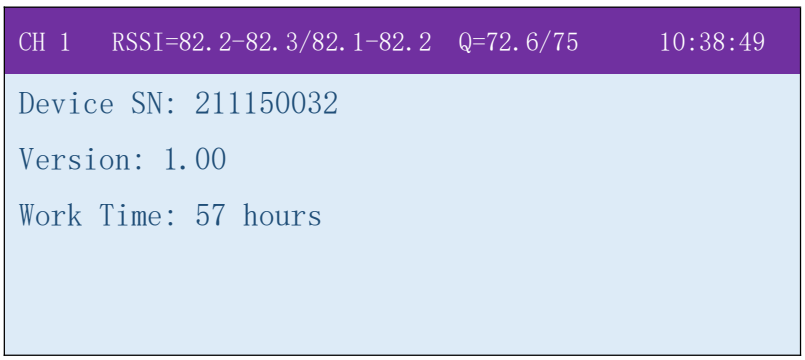
Net Energy / Pos Energy / Neg Energy/ Current energy / T1 and T2;

Transit-Time / Reynolds / CH1 TX-Time Rate / CH2 TX-Time Rate;

Device SN / Version / work time. As shown in the window below.







PART-5 ENERGY FUNCTION

5.1 INTRODUCTION

Series 1100V-E heat meter owns an in-built module for energy calculation. It can calculate the thermal enthalpy of the water of a certain temperature automatically. Accordingly we can calculate the heat flow and totalizer.

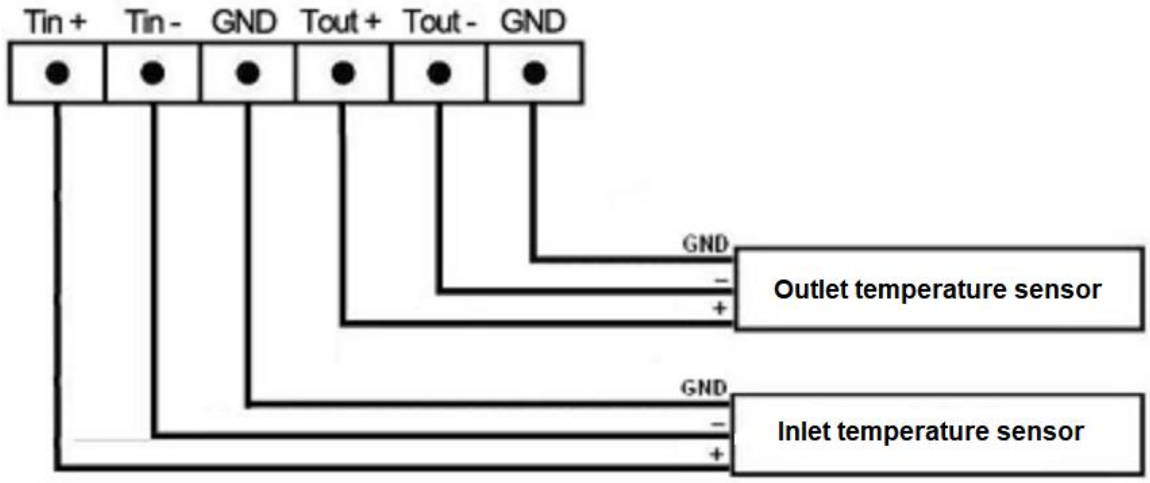
If the measure fluid is not water, user need to manually enter the fluid specific heat capacity in the menu SHC.

All above results can be transferred to host computer through a communication protocol of the flowmeter. In this case, 1100V-E heat meter works as data monitoring network RTU, greatly decrease the complexity, cost and enhancing the reliability of the hardware of devices.

5.2 WIRING CONNECTION

The fluid temperature is obtained by an external input Pt1000 platinum resistance temperature sensor signal from outside. When calculating energy, T1 connects to inlet sensor and T2 to outlet sensor.

PT1000 temperature sensor wiring diagram



5.3 ENERGY CALCULATION

There are two methods to calculate energy：

Method 1)： Energy=Flow×Temp. Difference×heat capacity （Where： Temp. Difference refers to the temperature difference between Tin and Tout.）

Method 2): Energy = Flow×(thermal enthalpy at T1 temp.- thermal enthalpy at T2 temp.) This thermal enthalpy is automatically calculated by heat meter according to international standard.

5.4 TEMPERATURE RANGE

Temperature range is defined in Menu.

For example, at the condition that when temperature sensor resistance value is 1000Ω, temperature is 0℃, and temperature sensor resistance value is 1758.56Ω, temperature is 200℃. The temperature values have been calibrated before delivery, so users do not need to set this parameter. If the output value of the platinum resistance temperature sensor is 1000Ω, the temperature displayed by the flowmeter is 0°C; If the platinum resistance value is 1758.56Ω, the displayed temperature is 200 ° C. Users can check the menu to view the current temperature.

PART-6 TEMPERATURE SENSOR INSTALLATION

6.1 PT1000 TEMPERATURE SENSOR

1100V-E heat meter utilizes two PT1000 temperature sensors, and the temperature sensors are matching. Temperature sensor cable is provided by manufacturer, and the standard length is 10m.

For measurement accuracy, test security, convenient maintenance, and not affect equipment operation and production operation, we should pay attention to the following before installation:
1. Should be rationally choose installation position, avoid the valve, elbow and equipment installed with thermal resistance.

2. For measuring the fluid temperature of pipe center, generally the measurement terminal is inserted into the pipe in the center.

3. Water supply temperature sensor (high temperature point) must be installed in flow transducer downstream side, and is apart from the downstream flow transducer 5DN.
The return water temperature sensor (low temperature point) should choose the position where is in recent from water supply temperature sensor.

6.2 TEMPERATURE SENSOR INSTALATION

(a) 6.2.1 CLAMP-ON TEMPERATURE SENSOR

When determining the installation position of temperature sensor, we should pay attention to the pipeline surface. Pipeline surface must be clean before installing temperature sensor, then use belts to fix temperature sensor.

(b) 6.2.2 INSERTION TEMPERATURE SENSOR

The insertion temperature sensor is directly contact with measured fluid, so its accuracy is higher. We have two methods to install insertion temperature sensor.

1. Installing by ball valve

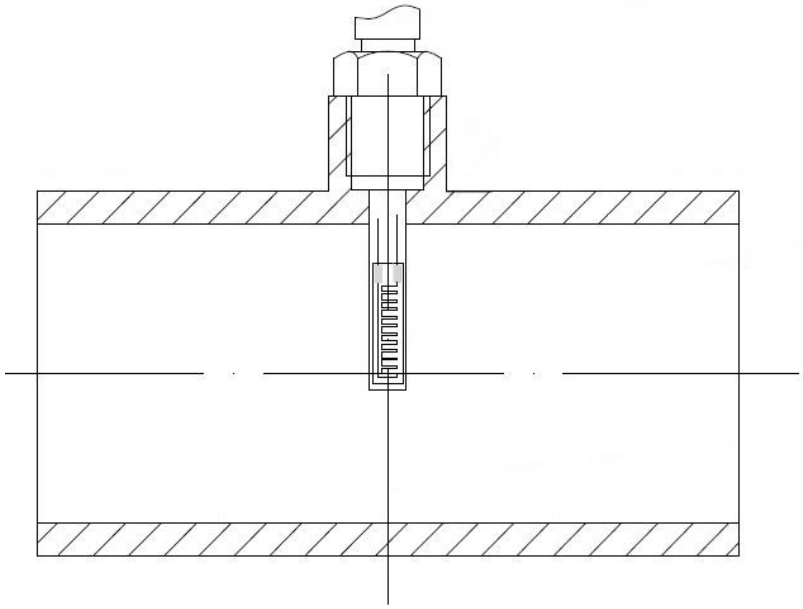
For weldable pipe material, weld ball valve on pipe directly. For unweldable pipe material, first welding a hoop (Usually material is carbon steel) on pipe, then welding ball valve on hoop.

After welding ball valve, drill a suitable hole. Drill into the pipe wall in accordance with the instructions supplied with the drilling machine, at first, please select the slow tap position to drill hole, then select fast tap position.

After drilling a hole, plug in the insertion temperature sensor, adjust the insertion depth, then fix it.

2. Installing on pipe directly

Drill a suitable hole on pipe directly, plug in the insertion temperature sensor, adjust the insertion depth, and then fix it.



Note: The cables of two temperature sensor must be the same length.

PART-7 HOW TO USE MENU FUNCTIONS

7.1 HOW TO JUDGE THE LIQUID FLOWING DIRECTION

Make sure that the instrument works properly
Check the flow rate for the indication. If the displayed value is positive, the direction of the flow will be from the UP transducer to the Down transducer; if the displayed value is negative, the direction will be from the Down transducer to the UP transducers;
Check the flow rate, if the display value is "+", will it is positive. If the display value is "-" , It is negative.

7.2 HOW TO RESET THE DEFAULT SETUPS

Press the key ESC and then press ENT to enter, meter will erase all the parameters entered by the user and setup the meter with default values.

7.3 HOW TO STABILIZE THE FLOW

The damping acts as a filter for a stable reading. If '0' is entered in menu, that means there is no damping. A bigger number brings a more stable effect. But bigger damping numbers will prevent the instrument from acting quickly. Numbers 0 to 10 are commonly used for the damping value.

7.4 HOW TO USE THE LOW FLOW-CUTOFF FUNCTION

The number displayed in menu Flow Cut-off is called the low flow cutoff value or zero cutoff value. The flow meter will replace these flow rate values that are absolutely less than the low-cutoff value with '0'. This means the flow meter will avoid any invalid accumulation when the actual flow is below the zero-cutoff value.
The low-cutoff value does not affect the flow measurement when the actual flow is absolutely greater than the low-cutoff value.

7.5 HOW TO SETUP A ZERO POINT CALIBRATION

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, a measurement difference may occur. Because every flow meter installation is slightly different and sound waves can travel in slightly different ways through these various installations, a provision is made in this entry to establish "True Zero" flow – SETUP ZERO.
There exists a 'Zero Point' with certain installation which means the flow meter will display a non-zero value when the flow is absolutely stopped. In this case, setting a zero point with the function in menu will bring a more accurate measurement result. When do a calibration test, it is also very important.
Make sure that the pipe is full of liquid and the flow is absolutely stopped - securely close

any valves and allow time for any settling to occur. Then run the function in window Static Zero Reset by press ENT key and wait until the counter readings displayed in the lower right corner of the screen goes to “00”; thus, the zero set is completed and the instrument indicates the results automatically. Repeat zero set calibration if it still needs to be minimized, i.e. the velocity reading is still high.

7.7 HOW TO USE SCALE FACTOR

Scale factor refers to the ratio between “actual value” and “reading value”. For instance, 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”. High quality products always require high consistency.

The scale factor default is “1”or a factory calibration value (see the calibration data sheet for every meter) for each instrument prior to shipment from the factory. The scale factor entered must be one that results from actual calibration. Re-calibration or change the Scale factor may be necessary on different pipe lines or different applications in order to obtain better accuracy.

7.8 HOW TO USE THE 4~20M A OUTPUT

Possessing a current loop output exceeding an accuracy of 0.1%, the 1100V-E is programmable and configurable with multiple output modules. Select in Window Current Loop Output.

Calibrating and testing the current loop 4mA,8mA,12mA,16mA, and 20mA are performed in the Window. Complete the steps as follows: Press Menu, move ∧or ∨ to display “0mA”, “4mA”, “8mA”, “16mA”, “20mA” readings, connect an ammeter to test the current loop output and calculate the difference. Calibrate it if the difference is within tolerance. Check the present current loop output as it changes along with change in flow.

Enter the flow value represented by 4mA and the flow value represented by 20mA in the current loop menu. For example, if the flow rate range is from 0 to 1000m3/h, input 0 for the 4mA and input 1000 for the 20mA.

7.9 HOW TO USE THE RELAY OUTPUT

To use the relay to output forward cumulative pulses.

For example, to set the pulse equivalent to 1m3, the following settings can be made:

Select "Relay output" in the output setting, select "On" for relay output, select "Positive flow" for relay type, and select "1m³" for relay flow unit. At this time, the relay will work once for every 1m³ increase in positive flow.

The appropriate relay data should be set, if it is too large, the output cycle is too long; If it is too small, the relay will operate too frequently, affecting its service life.

7.10 HOW TO USE PULSE OUTPUT

Each unit flow detected by the ultrasonic flowmeter generates a cumulative pulse and outputs it to an external pulse counter device. Pulse output is only for Totalizer Output, and it can only be output through OCT or relays. So it is necessary to set the OCT or relay accordingly in the flow meter menu.

For example, to set the positive totalizer to output a pulse for every 10mL increase in water, the setting is as follows:

Select "Pulse output" in the output setting, select "On" for pulse output, select "Positive flow" for pulse type, and select "10mL" for pulse flow unit. At this time, the pulse will work once for every 10mL increase in positive flow.

7.11 HOW TO SET THE DATE AND TIMER

The ultrasonic flowmeter adopts the perpetual calendar clock chip produced by RAMTRON, which has high reliability. In general, the date and time need not be modified.
In case of modification, enter the system setting of date and time window and type ENT. When a symbol is displayed on the left side of the downward line of the screen, it indicates the state of modification. Users can modify the time and date.

7.12 ON/OFF NET TOTALIZER

Window Totalizer Set is available to turn totalizer on and off.

7.13 UNITS OPTIONS

Measurement units options, Metric or English, select Flow Unit Set, Press ESC and then ENTER, and scroll the ∧or ∨ to select units;

7.14 LCD BACKLIT OPT IONS

Adjustment the backlighting in window , press ENTER, then use ∧or ∨ to scroll the menu, to select backlit options.

7.15 USE MENU WINDOWS FOR TRANSDUCER MOUNTING INSPECTION

7.15.1 Signal Strength

Signal strength (displayed in Window RSSI) 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 in the 1100V-E. 00.0 represents no signal detected while 99.9 represent maximum signal strength.
Normally, the stronger the signal strength detected, the instrument will work more reliably, as well as the more stable the measurement value obtained.
Adjust the transducer to the best position and check to ensure that enough sonic coupling compounds is applied adequately during installation in order to obtain the maximum signal strength. System normally 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.

7.15.2 Signal Quality (Q value)

Q value is short for Signal Quality (displayed in Window). It indicates the level of the signal detected. In the 1100V-E, Q value is indicated by numbers from 00~99. 00 represents the minimum signal detected while 99 represent the maximum. Normally, the transducer position should be adjusted repeatedly and coupling compound application should be checked frequently until the signal quality detected is as strong as possible.

7.15.3 Total Time and Delta Time

“Total Time and Delta Time”, which displays in Window, indicates the condition of the installation. The measurement calculations in the flow meter are based upon these two parameters. Therefore, when “Delta Time” fluctuates widely, the flow and velocities fluctuate accordingly. This means that the signal quality detected is too poor. It may be the resulted of poor pipe-installation conditions, inadequate transducer installation or incorrect parameter input. Generally, “Delta Time” fluctuation should be less than ±20％. Only when the pipe diameter is too small or velocity is too low can the fluctuation be wider.

7.15.4 Transit Time Ratio

Transit Time Ratio indicates if the transducer mounting spacing is accurate. The normal transit time ratio should be 100±3% if the installation is proper. Check it in Window TOM/TOS.If the transit time ratio is over 100±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 Window, (3) if the transducer is mounted at the pipe’s centerline on the same diameter, or (4) if the scale is too thick or the pipe mounting is distorted in shape, etc.

7.15.5 Warnings

1. Pipe parameters entered must be RIGHT; otherwise the flow meter will not work properly.
2. During the installation, apply enough coupling compounds in order to stick 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 can be obtained. Make sure that the larger the pipe diameter, the more the transducer should be moved. Check to be sure the mounting spacing is accordance with the display in meter and the transducer is mounted at the pipe’s centerline on the same diameter. 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, and the liner is not too thick. Make sure there is there is indeed fluid in the pipe or the transducer is not very close to a valve or elbow, and there are not too many air bubbles in the fluid, etc. With the exception of these reasons, if there is still no signal detected, the measurement site has to be changed.

3 Make sure that the flow meter is able to run properly with high reliability. The stronger the signal strength displayed, the higher the Q value reached. The longer the flow meter runs accurately, the higher the reliability of the flow rates displayed. If there is interference from ambient electromagnetic waves or the signal detected is too poor, the flow value displayed is not reliable; consequently, the capability for reliable operation is reduced.

4 After the installation is complete, power on the instrument and check the result accordingly.

PART-8 FREQUENTLY ASKED QUESTIONS AND ANSWERS

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

A: 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.

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

A: 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 surface (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）.

Q: Why is the CL output abnormal?

A: Check to see if the desired current output mode is set in the flow meter. Check to see if

the maximum and minimum current values are set properly in meter.

Q: Why is the flow rate still displayed as zero while there is fluid obviously inside the pipe ?
A: Check to see if “Set Zero” was carried out with fluid flowing inside the pipe. If it is confirmed, recover the factory default.

Q: With a poor measurement site environment in the plant and the voltage and power supplies fluctuating widely, is the instrument really able to keep running 24 hours a day repeatedly without stopping and last for several years under such conditions?
A: 1100V-E is designed to work with high reliability under such conditions. It is provided with an intelligent signal conditioning circuit and internal correction circuitry. It will work under strong interference conditions and is able to adjust itself with strong or weak sound waves. It will work in a wide band of voltage: 90-260VAC or 8V~28V DC voltage.

PART-9 WARRANTY AND SERVICE

9.1 WARRANTY

The manufacturer provides one year warranty on all products, free of charge, but the users should be responsible for the one-way transportation fee from the customer to the factory.

9.2 SERVICE

The manufacturer provides instrument installation for our customers, and the charges will be made according the cost.

(1) For any hardware failure of the instrument, we recommend that our customers send back the instrument to our factory for service, due to the fact that the instrument is made of microprocessors and it will be difficult to perform field maintenance. Before sending back the instrument, please try to contact the factory first to make sure what the problem is.
(2) For other operational problems, please contact our local distributor by telephone, fax or email. In most cases, the problem could be solved immediately.

APPENDIX 1 INSERTION TRANSDUCER INSTALLATION

Overview

Insertion transducers can be installed into metal pipelines via an isolation ball valve (installation into pipelines of plastic or other materials may require an optional coupling; If the pipe material is cement, please consult factory to use special lengthen insertion transducer, furthermore, use special cement borer). The maximum pipe diameter in which insertion transducers can be installed is DN5000mm. Sensor cable length (10m standard) normally can be extended to as long as 300m. Follow the procedure below to install insertion transducers, the pipe size should not be smaller than DN65mm).

A, MENU CONFIGURATION

Refer to Part 2 and Part3, the transmitter is the same as Clamp-on Ultrasonic Flow meter, entering configuration parameters (pipe O.D., Wall Thickness, liquids type, etc.), then calculate the Transducer Spacing (Transducer type is:**Plug-in Type B45**;Transducer Mounting is: **Z**, for the Insertion transducer, **Mounting type is Z mode.**

B, INSTALLATION LOCATING

After entering the setup parameters, the 1100V-E will calculate the transducer spacing , commonly, this distance= I.D.
(Inside Diameter) – 9.113mm). The transducer spacing is distance between the centre points of two transducers.

Z method is the most commonly used mounting method for insertion-type ultrasonic flow meters, suitable for pipe diameters ranging from 100mm to 5000mm. Due to strong signal strength and high measurement accuracy, the Z method is preferable for pipe sections severely rusted or with too much scale formation on the inside wall. When installing the transducer using the Z method, be sure that the two transducers and the pipeline center axis are in the same plane, but never in the 6 or 12 o'clock positions.

Perform the following steps to install transducers using the Z mounting method:
Locate the reference mounting positions of 3 and 9 o'clock as shown in Fig. 1.

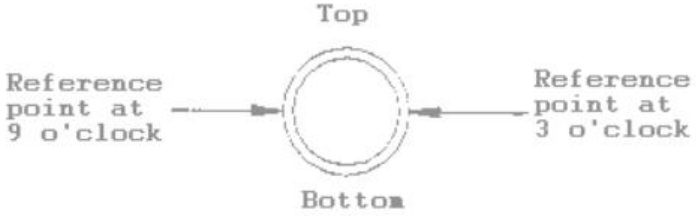


Fig.1 Reference Mounting Positions of 3 and 9 o'clock (Z Method)

1, Locating

By positioning paper, or positioning ropes, first identified point A and then confirmed C points
(A and C into 180° symmetric), extended C level again, determined to point B, L = BC
Step by step shown as below Fig.2 – 6

Fig.2 Prepare a rectangular paper or substitutes.

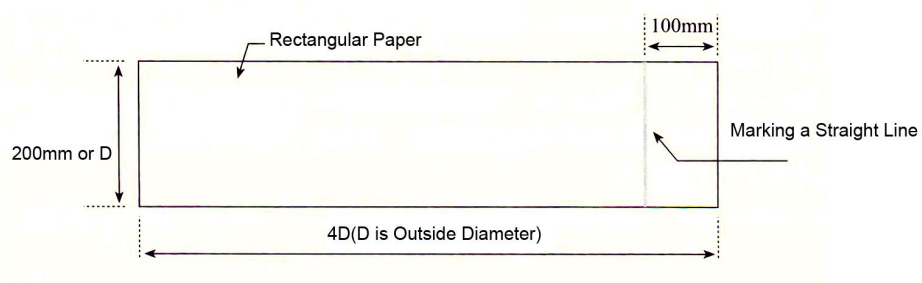


Fig. 2

Fig. 3 Wrap the paper around the pipeline with the folded end perpendicular to the length of the paper (Z Method).

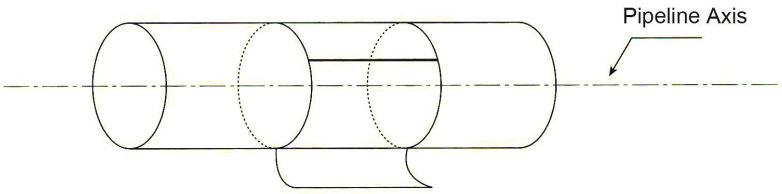


Fig. 3

Fig.4 Mark the overlapping line between the folded end and the other end of the paper, mark A point as shown.

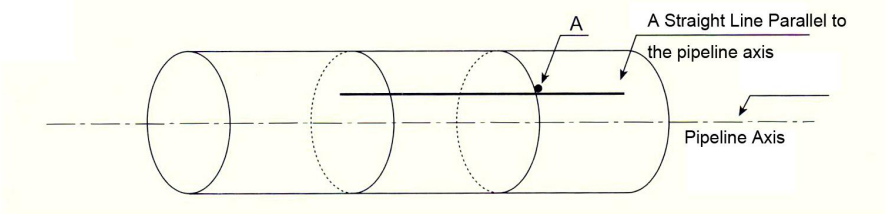


Fig. 4

Fig.5 Mark C point (A and C into 180° symmetric), extended C level again, determined to point B, L = BC, L is transducer spacing in Menu 25.

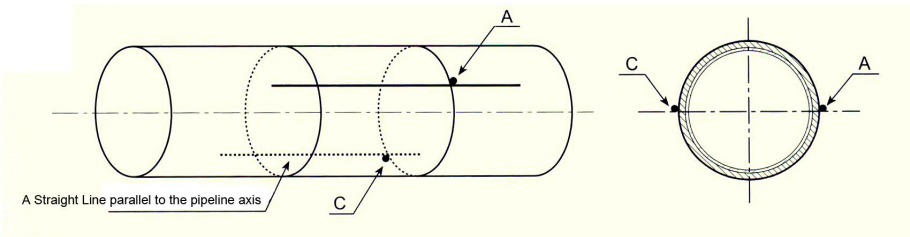


Fig. 5

Fig.6 Remove the positioning paper, prepare weld the ball valve bases on A and B point, **note that the center point of Ball Valve Base coincidences with the A, B points.**

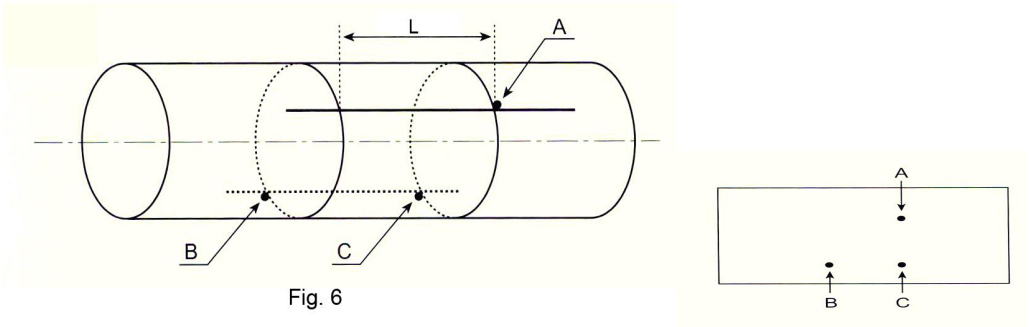


Fig. 6

C, DRILLING HOLES

After removing the auxiliary paper, draw a locating point and use it as the center to drill a hole of 19mm. Then, weld the transducer-mounting base vertically and install the transducer (Figure 7). Note that the inside central point of the transducer (on the other side of the cable connector) must coincide with the position point marked in Fig. 6.
After Welding the Ball Valve Base, mount the Ball Valve on base.

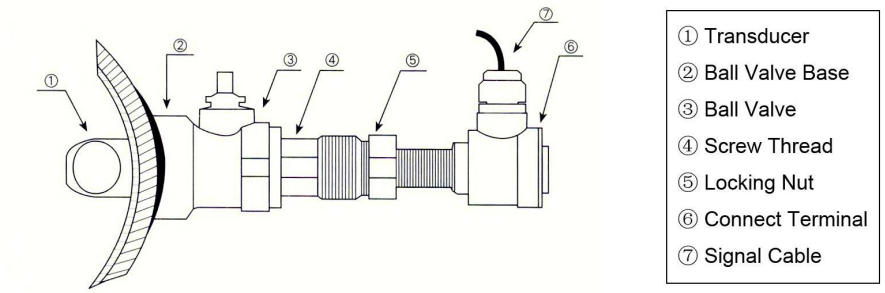


Fig.7 Construction Drawing of Insertion Transducer

Fig. 7 shows a diagram of the Insertion Transducer. The insertion transducer is attached to its mounting base (which is welded to the pipe section at the measurement point) via a ball valve. When the transducer is removed, pipe fluids can be contained by shutting off the ball valve. Therefore, installation and extraction of the transducer can be performed without relieving pipeline pressure. An O-ring seal and locking nut guarantee user safety while installing or operating the transducer.

If the pipe line is not weldable, please use special Pipe Hoop, shown as Figure 8, below

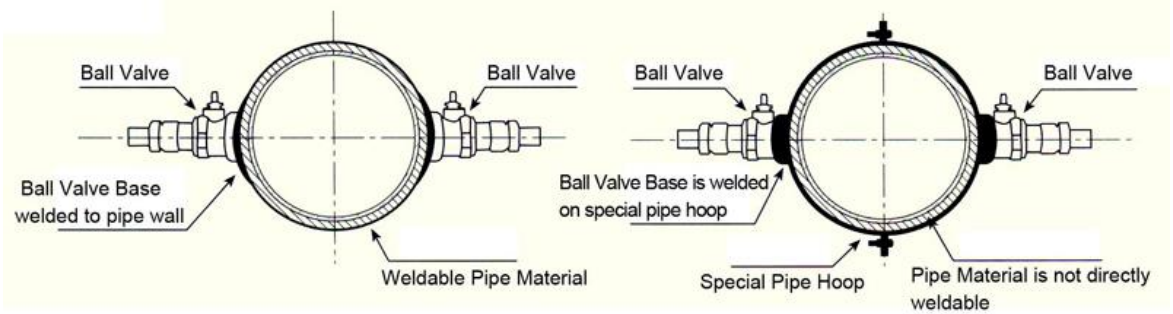


Figure 8

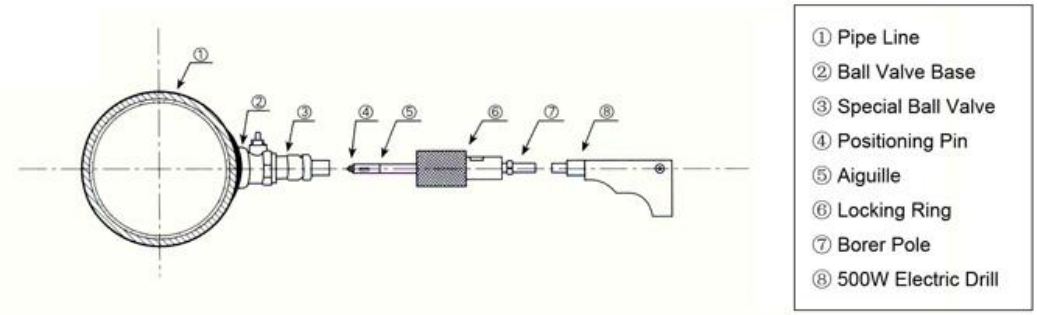


Figure 9 Drilling hole Diagram

After Welding the Ball Valve Base, mount the Ball Valve on base, note use PTFE belt for sealing.

Connecting the locking ring of borer to the thread of Ball Valve, tightening, open the Ball Valve, pushing the Borer Pole to outside of pipeline, connecting the 500W Electric Drill to the Borer Pole, tightening, power on, begin to drill hole. While drilling hole, keep the 500W Electric Drill relatively slow speed, do not too fast. After drilling hole finished, pull-out the Borer Pole, shut off the Ball Valve.

D, MOUNTING THE TRANSDUCERS

Procedures for installing insertion transducers follow：Fig.10 is mounting diagram

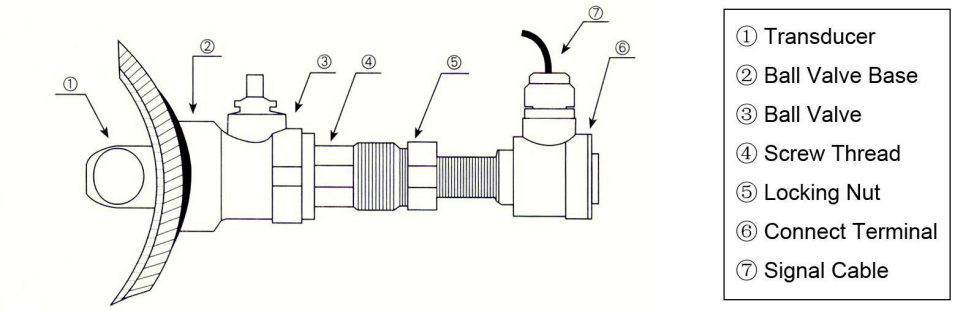


Fig. 10

Screwing the locking nut to bottom of transducer pole, insert the transducer into the Ball Valve, screw and then tighten the locking nut onto the ball valve.

Open the ball valve and insert the transducer into the pipe. At the same time, measure the Length L (See Fig.11) and make sure it complies with the following formula:

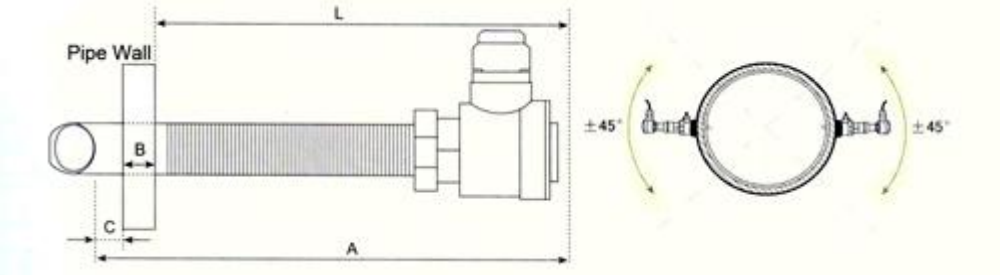


Fig. 11

L＝A-B　(Let C=0)
In this formula:　L---Mounting height (mm)
A--Transducer length (mm)
B---Pipe wall thickness (mm)
As shown Fig.11 right, the cable holes of two transducers must be in same direction.

Important: For horizontal pipelines, transducers must be fixed on the sides of the pipe (i.e. at the 3 and 9 o'clock position of the pipe) to prevent signal attenuation caused by sediment on the bottom of the pipe or air bubbles and air pockets in the top of the pipe.

E, TRANSDUCER WIRING

SEE FIGURE12 Connect the transducer cables to the corresponding upstream/downstream terminal ends.

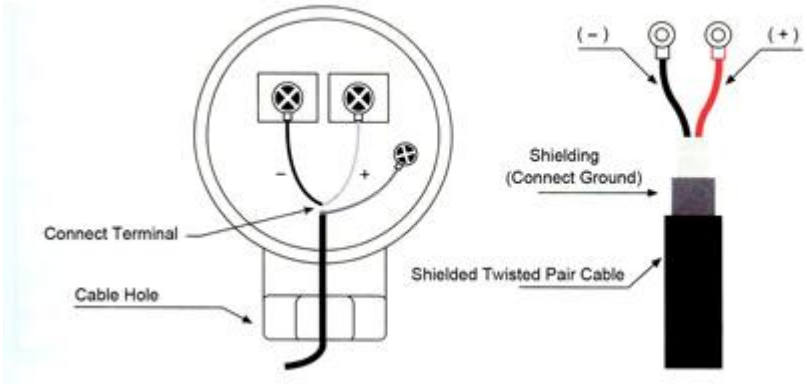


Fig. 12

In Fig. 12, if the colors of wirings are blue and brown, the blue wiring is connected to "+", and the brown wiring is connected to "-". If the colors of wirings are red and blue, the red wiring is connected to "+", and the blue wiring is connected to "-".

In order to keep the transducer waterproof, please screw tight the cable hole and wiring cover.

F, HOW TO OBTAIN GOOD SIGNAL STRENGTH AND SIGNAL QUALITY

After installing two transducers, please check the signal strength and signal quality, time ratio within the range of 97%-103%.
Screw one transducer or another transducer, let the value of signal strength at least ＞60.

The scale factor is used to modify the measurement results, factory default is 1.0 or other value depends on calibration. The user can enter a numerical value other than 1.0 according to re-calibration results.

APPENDIX 2 MODBUS-RTU COMMUNICATIONS PROTOCOL

1100V-E series ultrasonic flowmeter default Modbus output as Modbus-RTU protocol. The "D+" terminal is connected to RS485 "A", and "D-" terminal is connected to RS485 "B".

When use Modbus-RTU protocol, please refer to the following steps:

a. To enter Output Setup in the menu.

b. Select the Modbus Output.

c. Enter the meter address, and this address must be the same with modbus address. If users modify the meter address after power on meter, please restart meter.

d. Set the baud rate, Parity and stop bit

The default setting as address is 1, baud rate is 9600, none, and stop bit is 1.

A. Communications Protocol

The flow meter supports the Modbus RTU protocol as slave device and communicate with other device by RS485 in usual. It will adhere to the standard read/write message structures and its implementations, note that Modbus does not provide a suitable structure for file transfers.

The general message structure will consist of device address, function code, data payload and the checksum. Data transmission follows big-endian byte order rules.

Master Format

Device Address	Function Code	Data Payload	CRC

Device address – 1 byte field ranging from 1 to 255. Broadcast address 0.
Function code – 1 byte field with 3 read operations, 16 write operations.
Data payload – 0-N bytes with response data from the device.
CRC – 2 bytes computed mathematically.

Slave Response Format

Device Address	Function Code	Data Payload	CRC

Device Address – Echo of device address sent in master message to the device
Function code – Echo of function code sent in master message to the device
Data payload – 0-N bytes with response from device.
CRC – 2 bytes with a value computed mathematically

B. Standard Message Format

Read Holding Registers is used to retrieve measurements.

Message	
Address	1 byte
Function Code	1 byte
Data Address	2 bytes
Register Count	2 bytes
CRC	2 bytes

Response	
Address	1 byte
Function Code	1 byte
Byte Count	1 byte
Data Payload	N bytes
CRC	2 bytes

*Byte count = 2*Register Count

Write Single Register is used to configure instrument settings.

Message	
Address	1 byte
Function Code	1 byte
Data Address	2 bytes
Register Count	2 bytes
Data Payload	N byte
CRC	2 bytes

Response	
Address	1 byte
Function Code	1 byte
Byte Count	1 byte
Data Payload	N bytes
CRC	2 bytes

C. RS485 Settings

Baud rates – Support Baud rates from 4800 to 19200
Data Bits – 8 data bits (7 data bits is not valid setting for Modbus RTU)
Parity Bits – Even, Odd and None
Stop Bits – 1

Default settings will be 9600,8,N,1.

D. Modbus Registers

The below list of parameters will all be located in the holding registers.

Note: All the parameters for CH2 (channel 2) is only for 1100V-E series dual-channel flowmeter.

Register Address	Size (byte)	Mode	Data Type	Description
00	4	RO	float	Velocity
02	4	RO	float	Flow
04	8	RO	double	Net Total
08	8	RO	double	Pos Total
12	8	RO	double	Neg Total
16	4	RO	float	T1 Input Value
18	4	RO	float	T2 Input Value
20	4	RO	float	Instant Energy
22	8	RO	double	Net Energy
26	8	RO	double	Pos Energy
30	8	RO	double	Neg Energy
34	4	RO	int	Sensor Distance（mm）
36	4	RO	float	CH1 TX-Time Rate
38	4	RO	float	Channel 1 signal quality (Q)
40	4	RO		Reserve
42	4	RO	float	Channel 1 up signal strength
44	4	RO	float	Channel 1 down signal strength
46	4	RO	float	CH2 TX-Time Rate
48	4	RO	uint	Channel 2 signal quality (Q)
50	4	RO		Reserve
52	4	RO	float	Channel 2 up signal strength
54	4	RO	float	Channel 2 down signal strength

Register Address	Size (byte)	Mode	Data Type	Description
100	4	RO	float	Outer Diameter（mm）
102	4	RO	float	Wall Thickness（mm）
104	4	RO	float	Lining Thickness（mm）
106	4	RO	Int	Pipe MAT
108	4	RO	float	User-defined pipe sound speed（m/s）
110	4	RO	Int	Liner MAT
112	4	RO	float	User-defined liner sound speed（m/s）
114	4	RO	Int	Kind of Fluid
116	4	RO	float	User-defined liquid sound speed（m/s）
118	4	RO	Int	Sensor Type
120	4	RO	Int	User-defined sensor angle
122	4	RO	float	User-defined sensor wedge sound speed（m/s）
124	4	RO	float	User-defined sensor wedge surface center point to sensor edge distance（mm）
126	4	RO	float	User-defined sound wave delay time in a single sensor（us）
128	4	RO	Int	Sensor Mounting
130	4	RO	Int	Measure the minimum signal strength
132	4	RO	Int	Zero calibrate type
134	4	RO	float	User-defined zero offset
136	4	RO	uint	Damping Set
138	4	RW	Int	Volume set in flow unit
140	4	RW	Int	Time set in flow unit
142	4	RW	Int	Totalizer Unit
144	4	RW	Int	Totalizer Factor
146		RW	Int	Postive Totalizer
148		RW	Int	Negtive Totalizer
150		RW	float	Flow Cut-off
152		RW	float	Flow Scale Factor
154		RW	Int	Energy Measuring
156		RW	Int	Energy Unit Set
158		RW	Int	Positive Totalizer
160		RW	Int	Negtive Totalizer
162		RW	Int	Totalizer Factor
164		RW	float	Input Temp Calib
166		RW	float	Output Temp Calib
168		RW	float	Temp Cut-off
170		WO	Int	Totalizer Reset-Flow
172		WO	Int	Totalizer Reset-Energy
174		RO	Int	Measure CHAN Set

Register Address	Size (byte)	Mode/ Access	Data Type	Description
200	4	RW	Int	Modbus address
202	4	RW	Int	Baudrate Set
204	4	RW	Int	Parity Set
206	4	RW	Int	Relay output
208	4	RW	Int	Relay Type
210	4	RW	Int	Relay Flow Unit
212	4	RW	Int	Relay Energy Unit
214	4	RW	Int	Pulse Output
216	4	RW	Int	Pulse Type
218	4	RW	Int	Pulse Flow Unit
220	4	RW	Int	Pulse Energy Unit
222	4	RW	Int	Current Loop Output
224	4	RW	Int	CL Calibration
226	4	RW	Int	4ma Checkup
228	4	RW	Int	20maCheckup
230	4	RW	Int	CL Mode
232	4			Reserve
234	4	RW	float	Min. Output
236	4	RW	float	Max. Output
238	4	RO	float	Current Output
240	4	RW	Int	Logger Output
242	4	RW	hhmmss	Logger Interval BCD Code
244	4	RW	Int	NB Output
246	4	RW	Int	NB Report Type
248	4	RW	hhmmss	NB Period Start Time BCD Code
250	4	RW	hhmmss	NB Period Interval BCD Code
252	4	RW	hhmmss	NB Regular Report 1，BCD Code
254	4	RW	hhmmss	NNB Regular Report 2，BCD Code
256	4	RW	hhmmss	NB Regular Report 3，BCD Code
258	4	RW	hhmmss	NB Regular Report 4，BCD Code

Register Address	Size (byte)	Mode	Data Type	Description
300	4	RW	yymmdd	Data Set BCD Code
302	4	RW	hhmmss	Time Set BCD Code
304	4	RW	Int	Backlight
306	4	RW	Int	Language Set
308	4	RO	Int	Relay output

310	4	RO	Int	Working Time (hours)

Register Address	Size (byte)	Mode	Data Type	Description
400	4	RW	Int	ESN (Electronic Serial Number)

APPENDIX 3 DATA LOGGER

Meter Setting Before Using Data Logger

Before using the data logger, please check the following items of meter settings (otherwise, the data logger will not work normally):

I. Time setting
it is time setup for meter, the format should be:
YY-MM-DD (For example, it is Aug 14, 2022 today, the setting should be 22/08/14)
HH-MM-SS (Hour-minute-second, in 24 hour format)

II. SD card output setting
SD card output
To choose "On" for Logger output

II. Logger Interval
To set the time interval as your application
The format is as hh:mm:ss (Hour: Minute: Second)
Recommend to set the time interval longer than 5 seconds.
Then insert the SD card in the meter. The meter will restart, which means the data logger works well.

IMPORTANT: Restart the meter is a must before data logger working. Only insert the SD card the meter will not restart, and the data logger will **stop recording data.**

III. 5.6.3 Read Data
When downloading data, it will create a new .csv file named for date,, the naming rules of the file is the data storage date. For example,
Naming rules of "csv" file
xx(year)-xx(month)-xx(date).csv
22-08-25.CSV
Save another file by naming rules when the "csv" file has recorded 2000 data.
(Default data number: without limit, according to requirement, the number can change, please consult factory)

When opening the “csv” file, the data are shown as below:

DateTime	Flow	unit	Vel	unit	NET	unit	POS	unit	NEG	unit	EFR	unit	E.T.	unit	Tin	Tout	T.D.
2022/8/25 11:55	4.54976	l/s	0.491178	m/s	4	m3	4	m3	0	m3	223.397	KW	13000	KWh	32.2345	20.3649	11.8696
2022/8/25 11:55	4.55328	l/s	0.491558	m/s	4	m3	4	m3	0	m3	224.73	KW	13000	KWh	32.2996	20.3649	11.934698
2022/8/25 11:55	4.56521	l/s	0.492846	m/s	4	m3	4	m3	0	m3	225.011	KW	13000	KWh	32.2909	20.3649	11.926001
2022/8/25 11:55	4.5783	l/s	0.494259	m/s	4	m3	4	m3	0	m3	226.186	KW	14000	KWh	32.2996	20.3432	11.956398
2022/8/25 11:55	4.57987	l/s	0.494428	m/s	4	m3	4	m3	0	m3	226.621	KW	14000	KWh	32.317	20.3693	11.947701
2022/8/25 11:55	4.5675	l/s	0.493094	m/s	4	m3	4	m3	0	m3	227.538	KW	14000	KWh	32.3474	20.3083	12.039101
2022/8/25 11:55	4.58037	l/s	0.494483	m/s	4	m3	4	m3	0	m3	227.607	KW	14000	KWh	32.33	20.304	12.026001
2022/8/25 11:55	4.574	l/s	0.493795	m/s	4	m3	4	m3	0	m3	228.147	KW	15000	KWh	32.3561	20.2996	12.056498
2022/8/25 11:55	4.57332	l/s	0.493721	m/s	4	m3	4	m3	0	m3	228.762	KW	15000	KWh	32.3691	20.2953	12.073799
2022/8/25 11:55	4.54864	l/s	0.491057	m/s	4	m3	4	m3	0	m3	227.918	KW	15000	KWh	32.3822	20.2865	12.095697
2022/8/25 11:55	4.59105	l/s	0.495189	m/s	5	m3	5	m3	0	m3	228.944	KW	15000	KWh	32.3691	20.2996	12.069498
2022/8/25 11:56	4.56672	l/s	0.493009	m/s	5	m3	5	m3	0	m3	229.693	KW	16000	KWh	32.3822	20.2343	12.147898
2022/8/25 11:56	4.55305	l/s	0.491533	m/s	5	m3	5	m3	0	m3	229.352	KW	16000	KWh	32.4082	20.2343	12.173899
2022/8/25 11:56	4.55373	l/s	0.491851	m/s	5	m3	5	m3	0	m3	229.535	KW	16000	KWh	32.4082	20.2256	12.1826
2022/8/25 11:56	4.57246	l/s	0.493629	m/s	5	m3	5	m3	0	m3	229.567	KW	17000	KWh	32.3778	20.2299	12.1479
2022/8/25 11:56	4.5706	l/s	0.493428	m/s	5	m3	5	m3	0	m3	230.087	KW	17000	KWh	32.3822	20.2169	12.165298
2022/8/25 11:56	4.57454	l/s	0.492803	m/s	5	m3	5	m3	0	m3	229.41	KW	17000	KWh	32.3691	20.2169	12.152199
2022/8/25 11:56	4.56386	l/s	0.492701	m/s	5	m3	5	m3	0	m3	229.339	KW	17000	KWh	32.3865	20.2256	12.160902
2022/8/25 11:56	4.55195	l/s	0.491414	m/s	5	m3	5	m3	0	m3	229.255	KW	18000	KWh	32.3822	20.2038	12.178398
2022/8/25 11:56	4.55141	l/s	0.491356	m/s	5	m3	5	m3	0	m3	230.606	KW	18000	KWh	32.3908	20.1602	12.2306
2022/8/25 11:56	4.56454	l/s	0.492773	m/s	5	m3	5	m3	0	m3	230.489	KW	18000	KWh	32.3691	20.1602	12.208899
2022/8/25 11:56	4.55548	l/s	0.491795	m/s	5	m3	5	m3	0	m3	229.229	KW	18000	KWh	32.3517	20.1602	12.1915
2022/8/25 11:56	4.55682	l/s	0.491941	m/s	5	m3	5	m3	0	m3	229.7	KW	19000	KWh	32.3387	20.1602	12.178499
2022/8/25 11:57	4.56909	l/s	0.493265	m/s	5	m3	5	m3	0	m3	230.694	KW	19000	KWh	32.3257	20.1559	12.1698
2022/8/25 11:57	4.59885	l/s	0.496478	m/s	5	m3	5	m3	0	m3	230.498	KW	19000	KWh	32.2909	20.1515	12.1394
2022/8/25 11:57	4.59512	l/s	0.496373	m/s	5	m3	5	m3	0	m3	210.692	KW	20000	KWh	31.1876	20.1123	11.075298
2022/8/25 11:57	4.57622	l/s	0.494035	m/s	5	m3	5	m3	0	m3	188.603	KW	20000	KWh	30.0626	20.1036	9.959
2022/8/25 11:57	4.58291	l/s	0.494757	m/s	5	m3	5	m3	0	m3	174.672	KW	20000	KWh	29.2982	20.0862	9.212
2022/8/25 11:57	4.5731	l/s	0.492588	m/s	5	m3	5	m3	0	m3	160.979	KW	20000	KWh	28.6162	20.0993	8.516899

1100V-E series ultrasonic flowmeter can storage: data, time, flow, velocity, net totalizer, positive totalizer, negative totalizer, EFR, E.T, Tin, Tout and T.D.

APPENDIX 4 FUILD CHARACTERISTIC (SOUND SPEED)

1. FLUID PROPERTIES

Fluid	Specific Gravity	Sound Speed		delta-v/degree C	Kinematic Viscosity	Absolute viscosity
	20 degrees C	m/s	ft/s	m/s/degree C	Centistokes	Centipoise
Acetate, Butyl		1270	4163.9			
Acetate, Ethyl	0.901	1085	3559.7	4.4	0.489	0.441
Acetate, Methyl	0.934	1211	3973.1		0.407	0.380
Acetate, Propyl		1280	4196.7			
Acetone	0.79	1174	3851.7	4.5	0.399	0.316
Alcohol	0.79	1207	3960.0	4.0	1.396	1.101
Alcohol, Butyl	0.83	1270	4163.9	3.3	3.239	2.688
Alcohol, Ethyl	0.83	1180	3868.9	4	1.396	1.159
Alcohol, Methyl	0.791	1120	3672.1	2.92	0.695	0.550
Alcohol, Propyl		1170	3836.1			
Alcohol, Propyl	0.78	1222	4009.2		2.549	1.988
Ammonia	0.77	1729	5672.6	6.7	0.292	0.225
Aniline	1.02	1639	5377.3	4.0	3.630	3.710
Benzene	0.88	1306	4284.8	4.7	0.711	0.625
Benzol, Ethyl	0.867	1338	4389.8		0.797	0.691
Bromine	2.93	889	2916.7	3.0	0.323	0.946
n-Butane	0.60	1085	3559.7	5.8		
Butyrate, Ethyl		1170	3836.1			
Carbon dioxide	1.10	839	2752.6	7.7	0.137	0.151
Carbon tetrachloride	1.60	926	3038.1	2.5	0.607	0.968
Chloro-benzene	1.11	1273	4176.5	3.6	0.722	0.799
Chloroform	1.49	979	3211.9	3.4	0.550	0.819
Diethyl ether	0.71	985	3231.6	4.9	0.311	0.222
Diethyl Ketone		1310	4295.1			
Diethylene glycol	1.12	1586	5203.4	2.4		
Ethanol	0.79	1207	3960.0	4.0	1.390	1.097
Ethyl alcohol	0.79	1207	3960.0	4.0	1.396	1.101
Ether	0.71	985	3231.6	4.9	0.311	0.222
Ethyl ether	0.71	985	3231.6	4.9	0.311	0.222
Ethylene glycol	1.11	1658	5439.6	2.1	17.208	19.153
Freon R12		774.2	2540			
Gasoline	0.7	1250	4098.4			
Glycerin	1.26	1904	6246.7	2.2	757.100	953.946
Glycol	1.11	1658	5439.6	2.1		
Isobutanol	0.81	1212	3976.4			
Iso-Butane		1219.8	4002			
Isopentane	0.62	980	3215.2	4.8	0.340	0.211
Isopropanol	0.79	1170	3838.6		2.718	2.134
Isopropyl alcohol	0.79	1170	3838.6		2.718	2.134
Kerosene	0.81	1324	4343.8	3.6		

Linalool		1400 4590.2			
Linseed Oil	.925-.939	1770 5803.3			
Methanol	0.79	1076 3530.2	2.92	0.695	0.550
Methyl alcohol	0.79	1076 3530.2	2.92	0.695	0.550
Methylene chloride	1.33	1070 3510.5	3.94	0.310	0.411
Methylethyl Ketone		1210 3967.2			
Motor Oil (SAE 20/30)	.88-.935	1487 4875.4			
Octane	0.70	1172 3845.1	4.14	0.730	0.513

Oil, Castor	0.97	1477	4845.8	3.6	0.670	0.649
Oil, Diesel	0.80	1250	4101			
Oil (Lubricating X200)		1530	5019.9			
Oil (Olive)	0.91	1431	4694.9	2.75	100.000	91.200
Oil (Peanut)	0.94	1458	4783.5			
Paraffin Oil		1420	4655.7			
Pentane	0.626	1020	3346.5		0.363	0.227
Petroleum	0.876	1290	4229.5			
1-Propanol	0.78	1222	4009.2			
Refrigerant 11	1.49	828.3	2717.5	3.56		
Refrigerant 12	1.52	774.1	2539.7	4.24		
Refrigerant 14	1.75	875.24	2871.5	6.61		
Refrigerant 21	1.43	891	2923.2	3.97		
Refrigerant 22	1.49	893.9	2932.7	4.79		
Refrigerant 113	1.56	783.7	2571.2	3.44		
Refrigerant 114	1.46	665.3	2182.7	3.73		
Refrigerant 115		656.4	2153.5	4.42		
Refrigerant C318	1.62	574	1883.2	3.88		
Silicone (30 cp)	0.99	990	3248		30.000	29.790
Toluene	0.87	1328	4357	4.27	0.644	0.558
Transformer Oil		1390	4557.4			
Trichlorethylene		1050	3442.6			
1,1,1-Trichloro-ethane	1.33	985	3231.6		0.902	1.200
Turpentine	0.88	1255	4117.5		1.400	1.232
Water, distilled	0.996	1498	4914.7	-2.4	1.000	0.996
Water, heavy	1	1400	4593			
Water, sea	1.025	1531	5023	-2.4	1.000	1.025
Wood Alcohol	0.791	1076	3530.2	2.92	0.695	0.550
m-Xylene	0.868	1343	4406.2		0.749	0.650
o-Xylene	0.897	1331.5	4368.4	4.1	0.903	0.810
p-Xylene		1334	4376.8		0.662	

2. WATER SOUND SPEED

Water Sound Speed table (pressure: 1 bar） Units: Sound Speed: m/s

Temperature ℃	Sound Speed	Temperature ℃	Sound Speed	Temperature ℃	Sound Speed	Temperature ℃	Sound Speed
0	1402.3	25	1496.6	50	1542.5	75	1555.1
1	1407.3	26	1499.2	51	1543.5	76	1555.0
2	1412.2	27	1501.8	52	1544.6	77	1554.9
3	1416.9	28	1504.3	53	1545.5	78	1554.8
4	1421.6	29	1506.7	54	1546.4	79	1554.6
5	1426.1	30	1509.0	55	1547.3	80	1554.4
6	1430.5	31	1511.3	56	1548.1	81	1554.2
7	1434.8	32	1513.5	57	1548.9	82	1553.9
8	1439.1	33	1515.7	58	1549.6	83	1553.6
9	1443.2	34	1517.7	59	1550.3	84	1553.2
10	1447.2	35	1519.7	60	1550.9	85	1552.8
11	1451.1	36	1521.7	61	1551.5	86	1552.4
12	1454.9	37	1523.5	62	1552.0	87	1552.0
13	1458.7	38	1525.3	63	1552.5	88	1551.5
14	1462.3	39	1527.1	64	1553.0	89	1551.0
15	1465.8	40	1528.8	65	1553.4	90	1550.4
16	1469.3	41	1530.4	66	1553.7	91	1549.8
17	1472.7	42	1532.0	67	1554.0	92	1549.2
18	1476.0	43	1533.5	68	1554.3	93	1548.5
19	1479.1	44	1534.9	69	1554.5	94	1547.5
20	1482.3	45	1536.3	70	1554.7	95	1547 .1
21	1485.3	46	1537.7	71	1554.9	96	1546.3
22	1488.2	47	1538.9	72	1555.0	97	1545.6
23	1491.1	48	1540.2	73	1555.0	98	1544.7
24	1493.9	49	1541.3	74	1555.1	99	1543.9

3. PIPE MATERIAL SOUND SPEED TABLE

Pipe Material Sound Speed Table	Sound Speed(m/s)
Steel	3206
ABS	2286
Aluminum	3048
Brass	2270
Cast Iron	2460
Bronze	2270
Fiber Glass	3430
Glass	3276
Polyethylene	1950
PVC	2540

Liner Material	Sound Speed (m/s)
Teflon	1225
Titanium	3150
Cement	4190
Tar Epoxy	2540
Porcelain Enamel	2540
Glass	5970
Plastic	2280
Polyethylene	1600
PTFE	1450
Rubber	1600

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