1. Introduction

§1.1 Preface

Welcome to the MT101FU series Fixed ultrasonic flow meter that has been manufactured with patent technologies and is equipped with more functions and advanced performance than our previous versions.

The MT101FU series ultrasonic flow meter has been upgraded based on the Version 6 series ultrasonic flow meter, which is still the main product line of the company. The new Version 7.50 retains most of the excellent features and functions of the previous versions: the pulse measurement technology, the ultrasonic igniting and the small signal receiving circuits etc. The main improvements are made on the battery supply circuit and on the transmitting circuits. All other circuits are simply integrated into this new version without major modifications, due to the fact that we have already applied the most advanced measurement technologies and attained a more reliable model of ultrasonic flow meter.

The MT101FU Series flow meter incorporates the latest ICs manufactured from the famous semiconductor manufacturers like Philips, Maxim, TI, Winbond, and Xilinx. The hardware features the ease of operation, high accuracy and outstanding reliability, while the software provides a very user friendly interface and much more functions. It employs a patent balanced lower voltage multi-pulse igniting circuit which increases the anti-interference ability magnificently so that the flow meter will work properly even in demanding industrial environments such as those with power frequency transverter working nearby.

The advanced circuit design, the integration of the latest semiconductors, the user-friendly software interface both in English and Chinese languages and small-sized PCB board, all these features combine to make the MT101FU series ultrasonic flow meter the best and the biggest seller on the Chinese market. Moreover, it is gaining more and more recognition on the international flow meter market

§1.2 Features

With distinctive features such as high precision, high reliability, high function and its low cost, compared with other flow meters, MT101FU flow meter is based on micro-processing technology.

* 0.5% of linearity , 0.2% of repeatability
* bilingual interface in Chinese and English
* low voltage, multi-pulse balanced transmission and receiving
* anti-jamming design, suitable for converter working environment
* internal thermometer
* 5-port 12-digits 4~20mA analog inputs
* 2-port programmable switching value output
* non-conductive/special media measurement
* Parallel operation of positive, negative and net flow totalizers

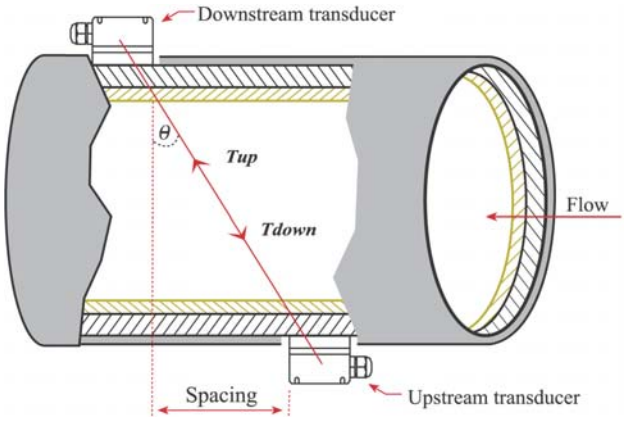
* die casting aluminum case (for fixedd standard instrument)
* RS-232 terminal, perfect communication Protocol
* Internally configured batch controller
* 1-port programmable 4-20mA analog outputs
* perfect flow /heat RTU long range terminal
* built-in daily, monthly and yearly date totalizers
* built-in data-logger
* common measurement unit
* 0.5 second basic totalizing period
* frequency-signal output
* built-in last power-off recorder
* optional AC220 AC/DC current supply
* media identification function
* built-in 32 digits floating-point data processing
* 40 Pico-second resolution of time measurement

In designing, MT100FU has adopted the most advanced integrated circuit and micro-processing in intelligent control, which has realized the non-adjustment parameter of hardware. The production process is simple and reliable, and the integrity of products is good, which makes sure that every machine can reach the best function and the best working state.

§1.3 Principle of Measurement

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

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



Remarks:

θ The angle between the ultrasonic signal and the flow

M Transit time of the ultrasonic signal

D The internal diameter of the pipe

Tup Transit time in the forward direction

Tdown Transit time in the reverse direction

ΔT=Tup –Tdown

1.4 Applications

1. Water, sewage (with low particle content) and seawater
2. Water supply and drainage water
3. Power plants (nuclear power plant, thermal and hydropower plants)
4. Heat energy, heating system, heat supply
5. Metallurgy and mines
6. Petroleum and chemicals
7. Food and pharmaceutical
8. Marine operation and maintenance
9. Energy economy supervision and water conservation management
10. Pulp and paper industry
11. Pipeline leak detection
12. Regular inspection, tracking and collection
13. Energy measuring and balance
14. Network monitoring systems and energy/flow computer management

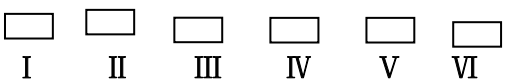
1.5 Packing List (standard)

1. Transmitter	1 set
2. Standard M1 type transducer	1 pair
3. Transducer strap	1 set
4. Instruction manual (this manual)	1 copy
5. Transducer cable	2 set
6. Coupling agent	2tubes
7. Product certificate	1 sheet

1.6 Optional Parts

1. Standard Large,Small transducer,insertion transducer,pipe-section-mounted transducer
2. Specialized shield cable SEYV75-2
3. UPS-72 Non-incessant power (72 hours) for MT101FU ultraseonic flow meter
4. RS485 interface plate
5. Ultrasonic thickness gauge
6. GSM /GPRS inquiry mode for message flow data

1.7 Coding Rules for Product Model Number



Ⅰ：1→wall mounted(standard),2→wall mounted(explosion-proof)，3→integrative type S
→panel mounted
N→wall mounted(net)

Ⅱ：power supply：**A→AC220V , B→**3.6V lithium battery , **D→**DC, **L→**Current Loop

Ⅲ：trancducer type：**B→**clamp on { **1 standard S** / **2 standard M** / **3 standard L**

C→insertion { **1 for welded pipe** / **2 for cast iron pipe** / **3 for cement pipe**

G→pipe-section

Ⅳ：pipe diameter：

Ⅴ：length of cable :

Ⅵ: measurement range：**0~± m/s**

§1.8 Specification

fluids	types	any homogeneous and sonically conductive liquid
	temperature range	－40℃～160℃
	turbidity	Less than 10000ppm(10g/l)
pipe	types	Carbon steel,stainless steel,cast iron,copper,etc.
	diameter	DN15～DN6000
	lining	Tax expory,rubber,mortar,polypropylene,etc.
	minimum straight pipe	Upstream side = 10 X Pipe diameter
		Downstream side = 5 X Pipe diameter
accuracy	±1%	
linearity	0.5%	
repeatability	0.2%	
response time	1-999seconds,user-configurable	
velocity	0～32m/s	
measure principle	transit time	
output	analog output	instantaneous flow rate,4-20mA,0-4-20mA,0-20 Ma (selectable)
	digital output	OCT output
		Relay output
		RS232,RS485(selectable) interface
input	5channel analog	4-20mA
display	2×10 backlight Chinese characters OR 2×20 English letters LCD display	
Logging function	Built-in data logger can store over 2000lines of data	
Power supply	AC220V,DC8～36V，AC7～30V	
power	Less than 2W	

consumption		
Transducer	Clamp on type	Standard S1,for pipe diameter DN15～DN100mm
		Standard M1,for pipe diameter DN50～DN700mm
		Standard L1,for pipe diameter DN300～DN6000mm
	Insertion type	For pipe diameter above DN80
	Pipe-section type	Standard Π model, for pipe diameter DN15～DN40mm
		Standard model, for pipe diameter DN50～DN1000mm
temperature	transmitter	-30℃～80℃
	transducer	-40℃～160℃(clamped-on type less than 110℃)
humidity	RH85% or less than (no condensation)	
Protection class	transmitter	IP65
	transducer	IP68
dimension	F1/FN: 251×192×80mm;F2: 290×270×110mm;FS:80×250×160mm	
weight	F1:2.5kg F2:7kg FN:2.5kg FS:1.5kg	

2. Starting Measurement

§2.1 Examine after you get the instrument

Inspection should be made before installing the meter. Check to see if the spare parts are inaccordance with the packing list. Make sure that there is no potential damage to the enclosure due to a loose screw or loose wire, which occurred during transportation. Any questions, please contact your representative as soon as possible.

2.2 Power Supply

Customers should pay special attention to specify the desired power supply when placing an order. Factory standard power supply is AC 220V.. Observe the following precautions for installation procedures outlined in this chapter: Ensure that power connections are made in accordance with the indications shown on the connection terminals.

Note: If the transmitter with DC8-36V or AC7-30V is connected to power supply AC220V, the flow meter will be damaged.

As for the DC power supply, positive and negative poles do not need to be distinguished because polar reversal circuit has been installed inside

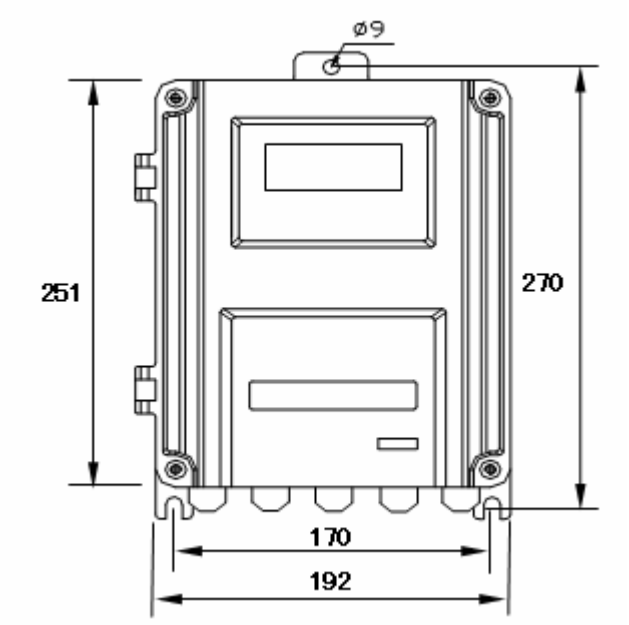
Transmitters can be powered by two different power supplies:

1. AC220V power supply（AC supply）
2. DC10-36Vor AC7-30V（DC supply）

.

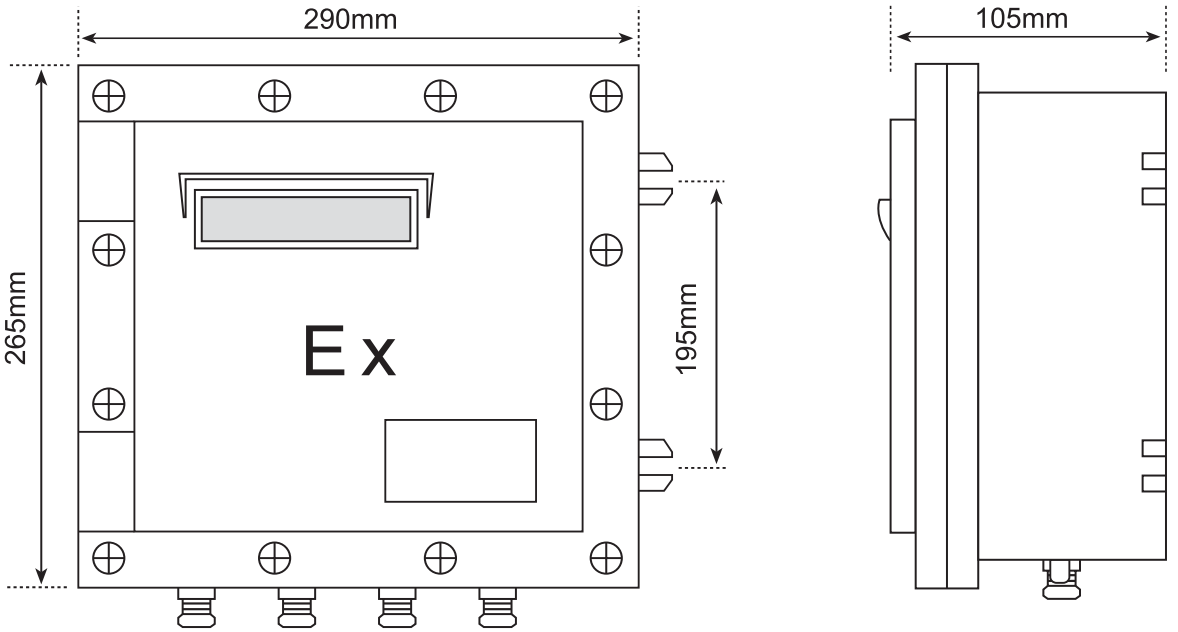
2.3 Outside View

1. Standard



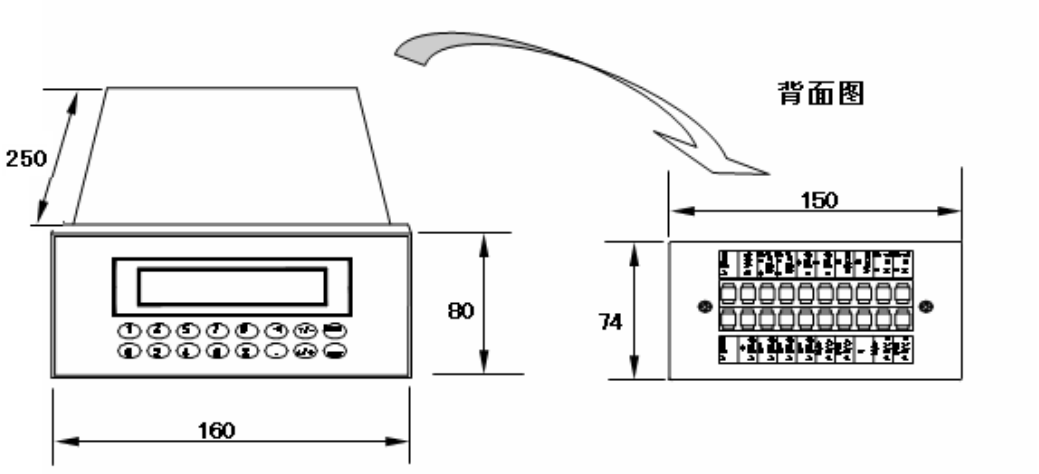
Thickness:96mm

2. Explosion-proof outside view



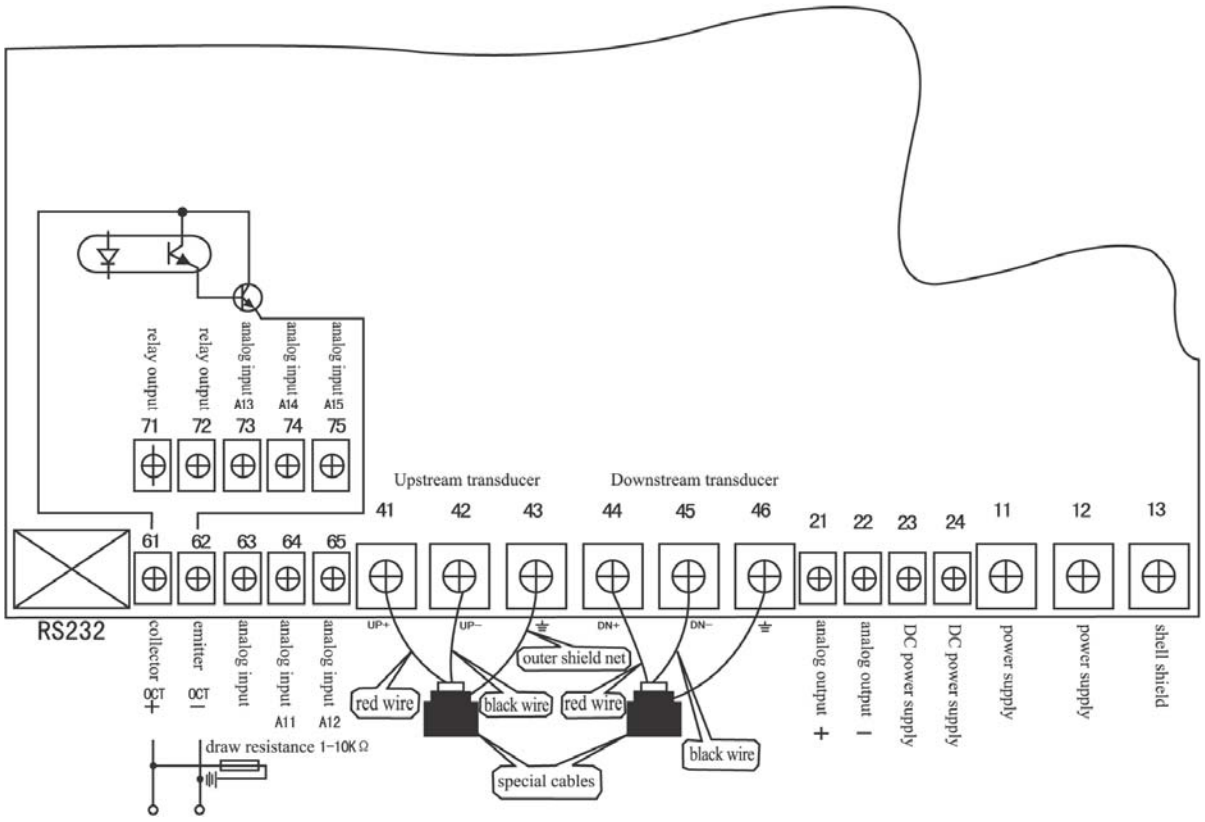
3. Panel mounted type outside view

MT101FU has a 160×80×250mm case,and the open size is 152×76mm.The wiring diagram is as follows.



2.4Transmitter Wiring Diagram

2.4.1 Wall Mounted Type Main Board Wiring Diagram



Open the case, terminals 11, 12, 13 can be found at the left lower side. Terminal 13is grounded (earth) while connecting, Terminals 11, 12are the main power supply terminals. As for the DC power supply, positive and negative poles do not need to be distinguished. They can be connected to terminals 23 and 24 because polar reversal circuit has been installed inside.

2.4.2 Panel Mounted Type Main Board Wiring Diagram

RS232 wiring diagram

Power input	RS232 interface			Analog input +	Analog output -	OCT collector +	OCT Transmitter -	Relay output	Relay output
	2	3	5						

Power input	Analog input earth	Analog input AI1	Analog input AI2	Analog input AI3	Upstream transducer (+) Red	Upstream transducer (-) Black	earth	Downstream transducer (+) Red	Downstream transducer (-) Black

RS485 wiring diagram:

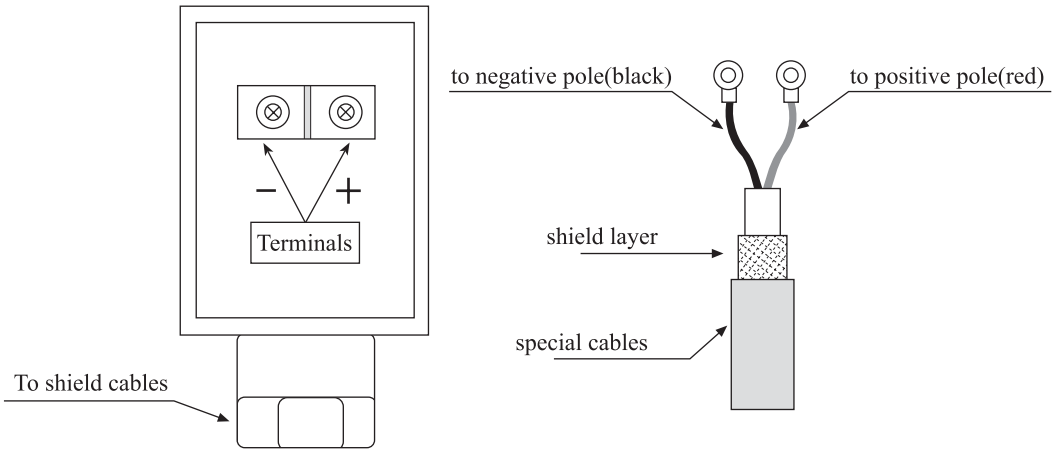
Power input	Out shield	485 Input output	485 Input output	Analog input +	Analog output -	OCT collector +	OCT Transmitter -	Relay output	Relay output

Power input	Analog input earth	Analog input AI1	Analog input AI2	Analog input AI3	Upstream transducer (+) Red	Upstream transducer (-) Black	earth	Downstream transducer (+) Red	Downstream transducer (-) Black

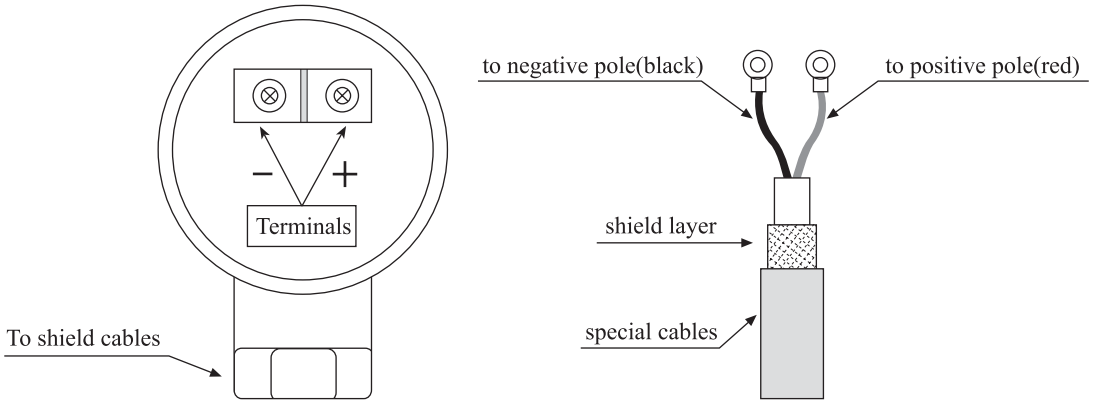
2.5 Transducer Wiring Diagram

The connection wire for Version 7.5 flow meter is high frequency twisted pair. This is determined by balanced transmission and receiving in the circuit. The advantage of using high frequency twisted pair is that it can improve the anti-jamming function. If the single shield common high frequency cable is used, the function of the instrument will be decreased. If the disturbance signal is strong, the instrument cannot work smoothly. It is recommended that specialized cables should be used under most circumstances. The loss of the specialized cables is small, and the anti-jamming function works well to make sure that the instrument can work smoothly.

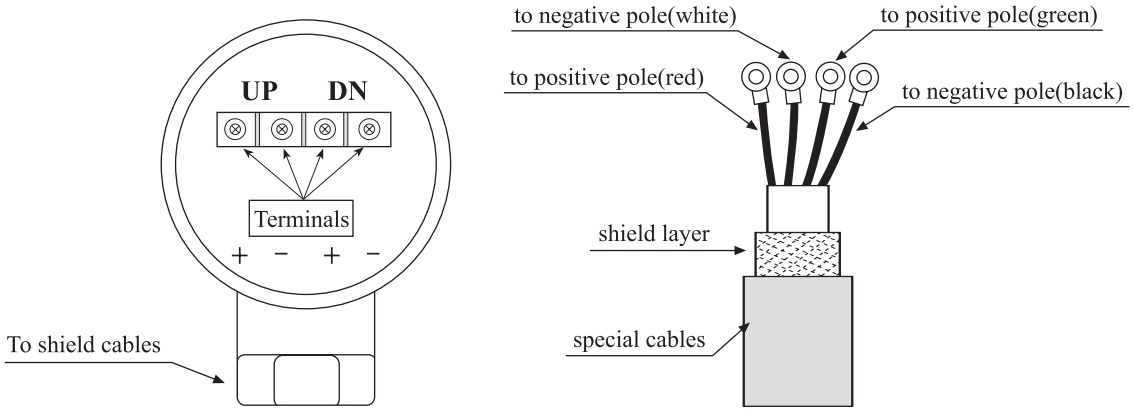
2.5.1 Clamp On Transducer



2.5.2 Insertion Transducer



2.5.3 Pipe-section Transducer



§2.6 Power On

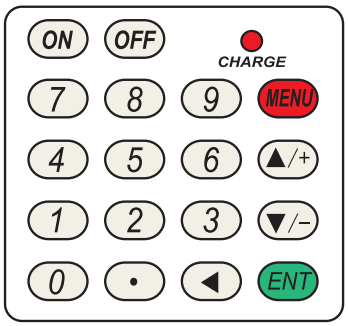
Once the MT101Fu flow meter is switched on, the self-diagnosis program will start to run. If any error is detected, a corresponding error code will display on the screen (Refer to Chapter 5 –Error Diagnoses). After that, the system will run automatically according to the last input parameters. If the installation is accomplished when system is switched on, gain adjustment can be monitored in Window M01. After S1, S2, S3, S4 are displayed on the upper left corner of the screen, the system will activate the normal measurement condition automatically. It is indicated by code "*R" on the upper left corner of the screen. The system will default to the last window settings and automatically display then at every next power on

The operation of keypad does not interfere with the measurement because there is simultaneous processing technology in MT101FU. Measurement, calculation, keying in, display, printing, serial operation, input and output are called "events", and these are independent of each other. For example, if users make changes to dates and time, it will not affect other tasks irrelevant of dates and time.

If the instrument is running for the first time or it is being installed in a new position, users need to enter new pipe parameters. Any parameters entered by users will be recorded in the NVRAM of the MT101FU flow meter permanently until they are modified next time by users.

When new pipe parameters have been entered or the search unit has been moved, the flow meter will re-adjust and work according to the parameters re-entered by users.
MT101FU can simultaneously accomplish all tasks, like measurement or outputting, no matter which window it is displayed on.

§2.7Keypad Function



The keypad for MT101FU flow meter is shown by the right diagram.
Keys 0~ 9 and . To enter numbers or menu number;
Key ◄ To backspace or delete characters to the left.
Key ▲/+ and ▼/- To return to the last menu or to open the next menu. Also acts as "+" and "-" functions when entering numbers.
Key MENU To select a menu. Press this key first, input two menu numbers and then enter the selected menu. For instance, to input a pipe outside diameter, press MENU 1 1 keys, where "11" is the window ID to display the parameter for pipe outside diameter.
Key ENT is the ENTER key for any inputting or selections, which is used for confirming the numbers input or the contents selected. Another function is to go into "Change" mode before inputting the parameters.
The key for the buzzer can be selected from NO. 15 in window 77.

§2.8 Keyboard Operation

MT101FU flow meter has adopted the user interface comprised of about 100 different menu windows which can display the parameters, instrument setting and displaying the measurement result. The user can enter parameters, revise configurations, or display the measurement results by going to certain windows. Windows are labeled with two digits (including +) from 00-99, and then +0, +1. Window number or window address code has specific reference, like window 11 refers to the pipe outer diameter, window 25 displays the installation distance of the search unit. Details of the windows are listed in the section about briefs of windows.
The fast way to enter certain menu window is that the user can press the MENU key followed by two-digit number keys under any circumstances. For example, the menu window M11 is for the entering of pipe outer diameter. The display will go to the M11 menu window after the user presses MENU 1 1.
Another way to enter menu window is to press ▲/+ and ▼/- keys. For example, if the current window is 66, the display will go to the number 65 window after pressing the ▲/+ key, and then 64 after pressing the ▲/+ key again; pressing ▼/- keys will make window return to 65, and then 66 by pressing the ▼/- keys again
The window address code is arranged in certain order (please refer to the next section and explanation of windows for details). The user does not have to remember them all. The user need to remember the

common window address window and the approximate position of the uncommon windows. The user can go to the adjacent window temporarily, and then go to the target window by pressing ▲/+ and ▼/- keys. All in all, the combination of fast way and ▲/+ and ▼/- keys makes it easy and convenient to go to the window.

There are three different types of menu windows:

(1) Menu windows for number entering, like M11 for the entering of pipe outer diameter.

(2) Menu windows for option selection/selecting options, like M14 for the selection of pipe materials.

(3) Displaying windows only, like M01, M00.

For number entering windows, the user can check the relevant parameters. The user can press the digit keys first and then the ENT key when the user is going to modify the value. The user can also press ENT key and then the digit keys and then the ENT key for confirmation.

For example, the user wants to enter 219.2345 as the pipe outer diameter, the user can go into window 11 by pressing MENU 1 1. The value displayed is the valued entered last time, and the user may use ENT key, on the left of the second line, there is a ">" and a flashing cursor, and the user can enter value parameter; then the user can enter ENT key by pressing the following serial keys: 2 1 9 . 2 3 4 5 ENT.

For the option selection windows, the user should check the relevant options. If the user wants to make changes, the ENT key must be pressed. The user can see ">" and a flashing cursor on the left screen, which signifies a selection modification mode. The user can select the relevant options by pressing the ▲/+ and ▼/- keys and then press the ENT key; the user can also press the digit keys and then the ENT key to make the selection. For example, if the pipe material is stainless steel, the MENU 1 4 should be pressed first to enter this menu window, and then the user should first press the ENT key to enter into a selection modification mode. The user should make the selection by pressing the ▲/+ and ▼/- keys to go to the display "1. Stainless Steel", and then press the ENT key for confirmation or make the selection by pressing the 1 key directly. "1. Stainless Steel" will be displayed on the second line and the user can press the ENT key for confirmation.

Generally, the ENT key must be pressed to enter a modification mode (which can be omitted for digit window). If the modification mode cannot be entered after pressing the ENT key, it means the instrument is locked out. In such cases, the user should go to M47 to select "Unlock", and then enter the original password before any further modification can be made.

§2.9 Briefs of Menu Windows

The special feature of MT101FU flow meter is the operation in windows.

These windows are assigned as follows:

00~09 Flow Totalizer Display: to display flow rate, positive total, negative total, net total, velocity, date & time, analog inputs for present flow, present operation and flow results today, etc.

10~29 Initial Parameter Setup: to enter pipe outside diameter, pipe wall thickness, fluid type, transducer type, transducer mounting and spacing, etc.

30~38 Flow Units Options: to select the flow unit, totalizer unit, measurement unit, turn totalizers on/off and reset totalizes, etc.

40~49 Setup options: Scaling factor, network IDN (Window No.46), system lock (Window No.47) and keypad lock code (Window No.48), etc.

50~89 Input and output setup: relay output setup, 4-20mA outputs, flow batch controller, LCD backlit option, date and time, low/high output frequency, alarm output, date totalizer, etc.
90~94 Diagnoses: Signal strength and signal quality (Window No.90), TOM/TOS*100 (Window No.91), flow sound velocity (Window No.92), total time and delta time (Window No.93), Reynolds number and factor (Window No.94), etc.
+0~+8 Appendix: power on/off time, total working hours, on/off times and a single-accuracy function calculator.
The other windows are for hardware adjustment, used by the manufacturer only. For further information, please refer to ***Chapter 3 – Operating Instructions*** and ***Chapter 4 – Windows Display Explanations.***

§2.10 Pipe Parameter Entry Shortcuts

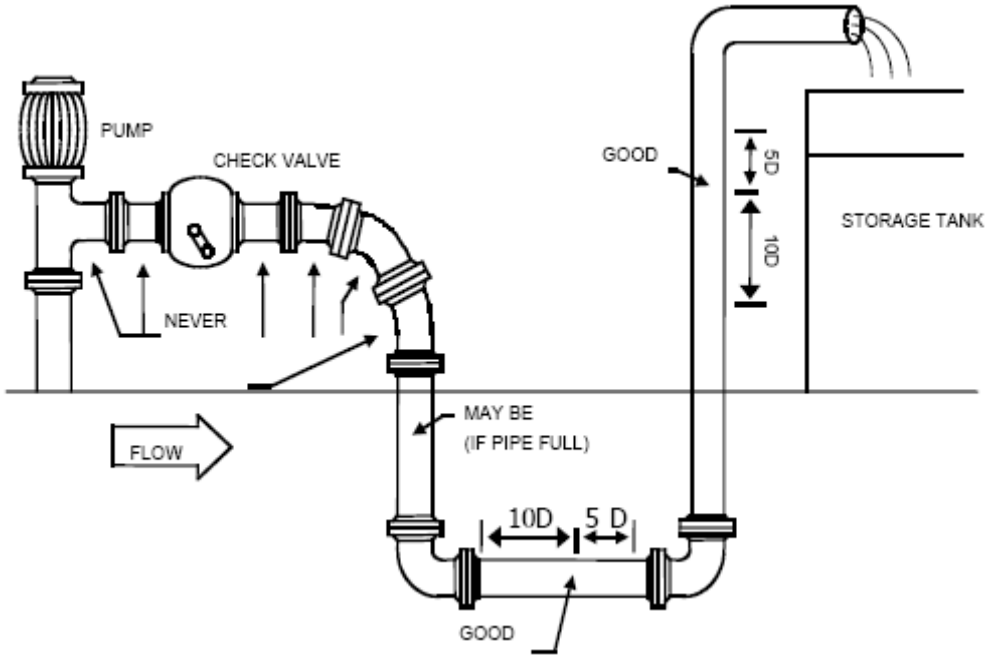
The following parameters should be entered for normal measurement:
1. Pipe outside diameter
2. Pipe wall thickness
3. Pipe material
4. Liner material parameters (including thickness and sound velocity, if needed)
5. Fluid type
6. Transducer type (The transmitter is available for various transducer types)
7. Transducer mounting methods

In the order stated above, enter the above-mentioned parameters by the following keypad shortcuts:
1. Press MENU 1 1 keys to enter Window No.11, and enter the pipe outside diameter, and then press the ENT key.
2. Press the ▼/- key to enter Window No.12, pipe wall thickness, and press the ENT key.
3. Press the ▼/- key to enter Window No.14, press the ENT key, move the ▲/+ or ▼/- key to select pipe material, and press the ENT key.
4. Press the ▼/- key to enter Window No.16, press the ENT key, move the ▲/+ or ▼/- key to select liner material, and press the ENT key.
5. Press the ▼/- key to enter Window No.20, press the ENT key, move the ▲/+ or ▼/- key to select fluid type, press the ENT key.
6. Press the ▼/- key to enter Window No. 23, press the ENT key, move the ▲/+ or ▼/- key to select transducer type, and press the ENT key.
7. Press the ▼/- key to enter Window No.24, press the ENT key, move the ▲/+ or ▼/- key to select transducer-mounting method, and press the ENT key.
8. Press the ▼/- key to enter Window No.25, accurately install the transducer according to the displayed transducer mounting spacing and the selected mounting method
9. Press the MENU 0 1 keys to enter Window No.01 to display measurement result.

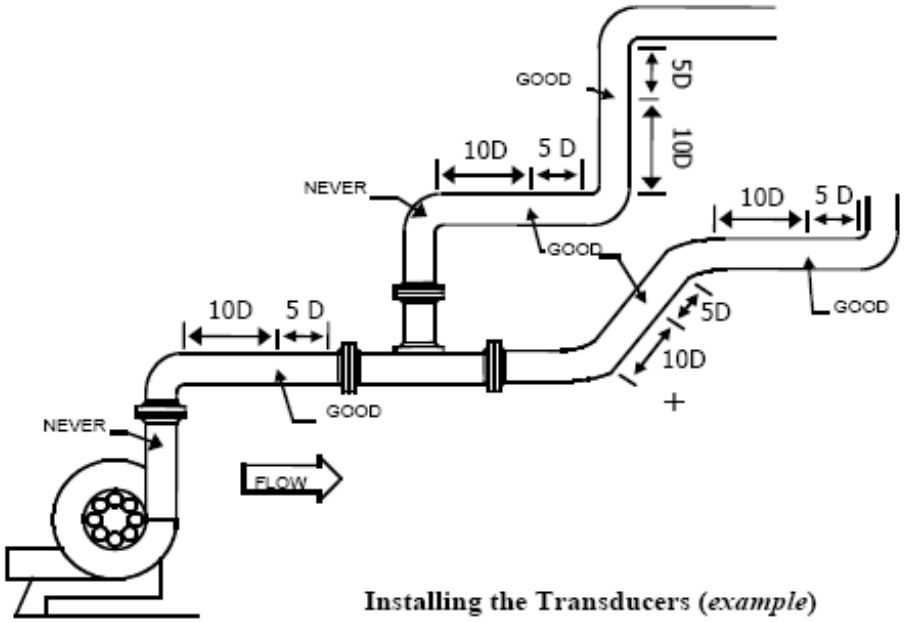
2.11 Measurement Location Selection

When selecting a measurement location, it is important to select an area where the fluid flow profile is fully

developed to guarantee a highly accurate measurement. Use the following guidelines when to select a proper
measurement installation location: Choose a section of pipe, which is always full of liquid, such as a vertical pipe with flow in the upward direction or a full horizontal pipe.



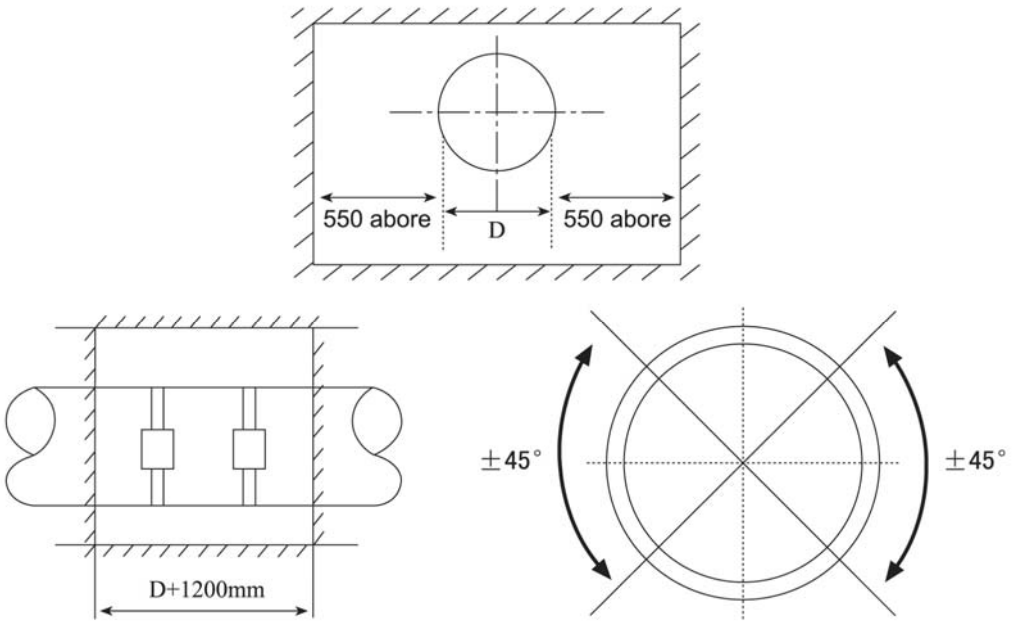
The location should have a straight pipe run length equal to at least 10 pipe diameters upstream and 5 pipe
diameters downstream from any throttling valves or other flow disturbance producing elements, such as pipe
reducers, elbows, tees, etc.
Ensure that the pipe surface temperature at the measuring point is within the transducer temperature limits.
Consider the inside condition of the pipe carefully. If possible, select a section of pipe where the inside is free
excessive corrosion or scaling.Choose a section of sound conducting pipe.
Examples acceptable measurement location selection are illustrated on the figure below.



Installing the Transducers (*example*)

§2.12 Instrument Well Dimension

Space is needed for installing transducer, and the distance should be at least 540mm between the pipe wall and the wall in the instrument well. That is, width W>(D+540╳2)mm, for the cement pipe, W>(D+700╳2)mm. Vertical length of pipe L>(D+1200)mm and in the horizontal axis within ±45 degrees(see Figure 1).



§2.13 Transducers Installation

Before installing the transducer,pay attention to the following ;

1. The two transducers should be mounted at the pipe's centerline on horizontal pipes.
2. Make sure that the transducer mounting direction is parallel with the flow.

2.13.1Clamp On Transducer

Before the installation, clean the pipe surface where the transducers are to be mounted. Removeany rust, scale or loose paint and make a smooth surface. Choose a section of sound conducting pipe forinstalling the transducers. Apply a wide band of sonic coupling agent down the center of the face ofeach transducer as well as on the pipe surface, and then attach the transducers to the pipe with the straps provided and tighten them securely.
During the installation, there should be no air bubbles or particles between the transducer and the pipe wall.
On horizontal pipes, the transducers should be mounted in the 3 o'clock and 9 o'clock positions of the pipe
section in order to avoid any air bubbles inside the top portion of the pipe. If the transducers cannot be mounted horizontally symmetrically due to limitation of the localinstallation conditions, it may be necessary to mount the transducers at a location where there is a guarantee full pipe condition (the pipe is always full of liquid).

2.13.1.1 Transducer Spacing

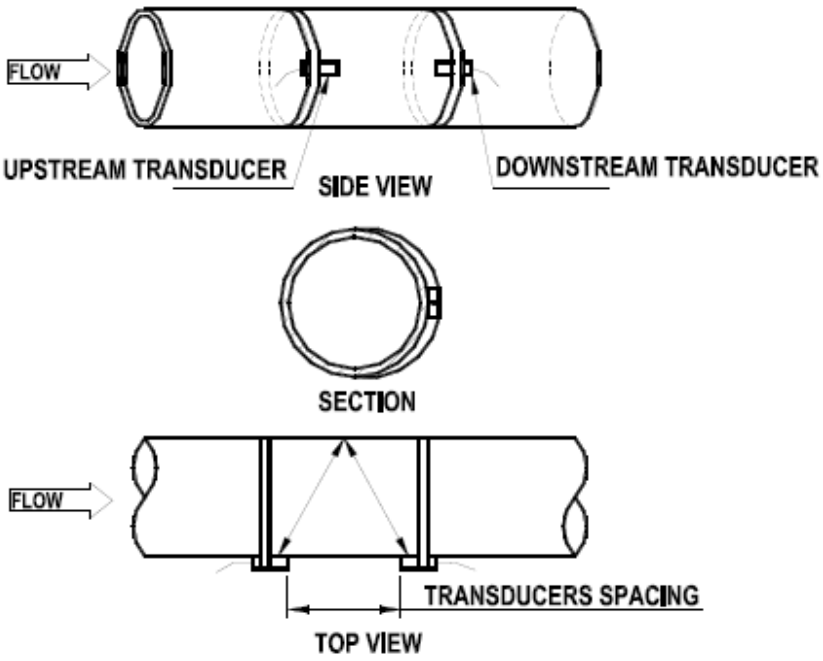
After entering the required parameters, the spacing between the *ENDS* of the two transducers is considered
as the standard transducer spacing. Check the data displayed in
Window No.25 and space the transducers accordingly.

2.13.1.2 Transducer Mounted Methods

Four transducer-mounting methods are available. They are respectively: V method, Z method, N method and W method. The V method is primarily used on small diameter pipes (DN15~200mm). The Z method is used in applications where the V method cannot work due to poor signal or no signal detected. In addition, the Z method generally works better on larger diameter pipes (over DN200mm,) or cast iron pipes. The N method is an uncommonly used method as well as is the W method. They are used on smaller diameter pipes (below DN50mm,).

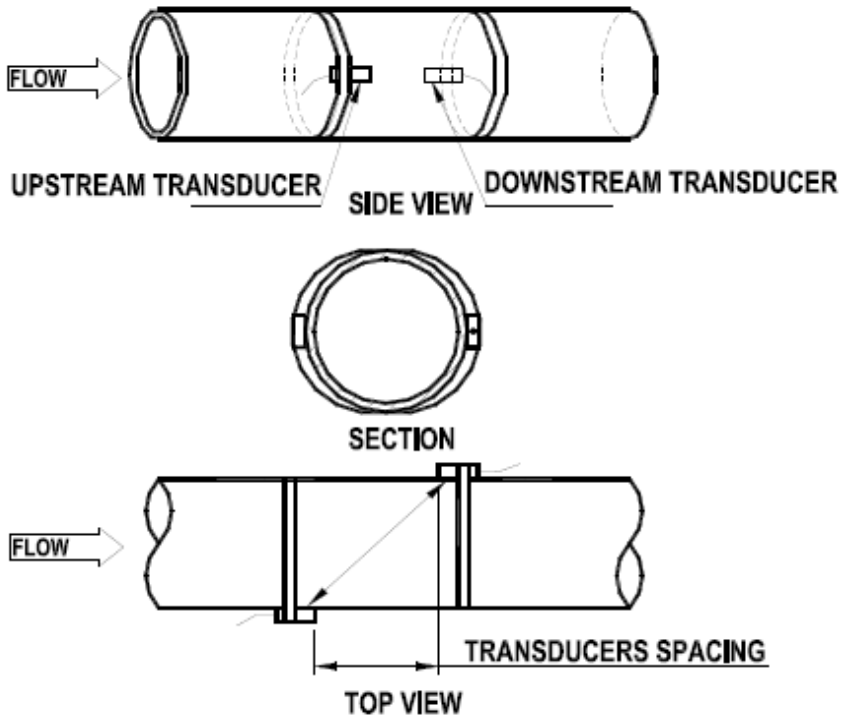
2.13.1.2.1 V Method

The V method is considered as the standard method. It usually gives a more accurate reading and is used on pipe diameters ranging from 15mm to 400mm approximately. Also, it is convenient to use, but still requires proper installation of the transducer, contact on the pipe at the pipe's centerline and equal spacing on either side of the centerline.



2.13.1.2.2 Z Method

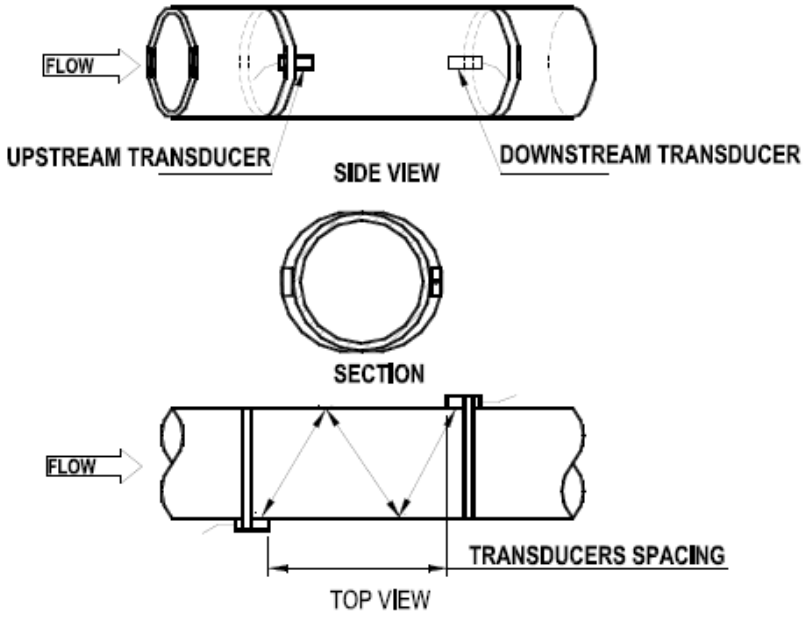
The signal transmitted in a Z method installation has less attenuation than a signal transmitted with the V method. This is because the Z method utilizes a directly transmitted (rather than reflected) signal which transverses the liquid only once. The Z method is able to measure on pipe diameters ranging from 100 to 6000mm. Therefore, we recommend the Z method for pipe diameters over 200mm.



2.13.1.2.3 N Method(not commonly used)

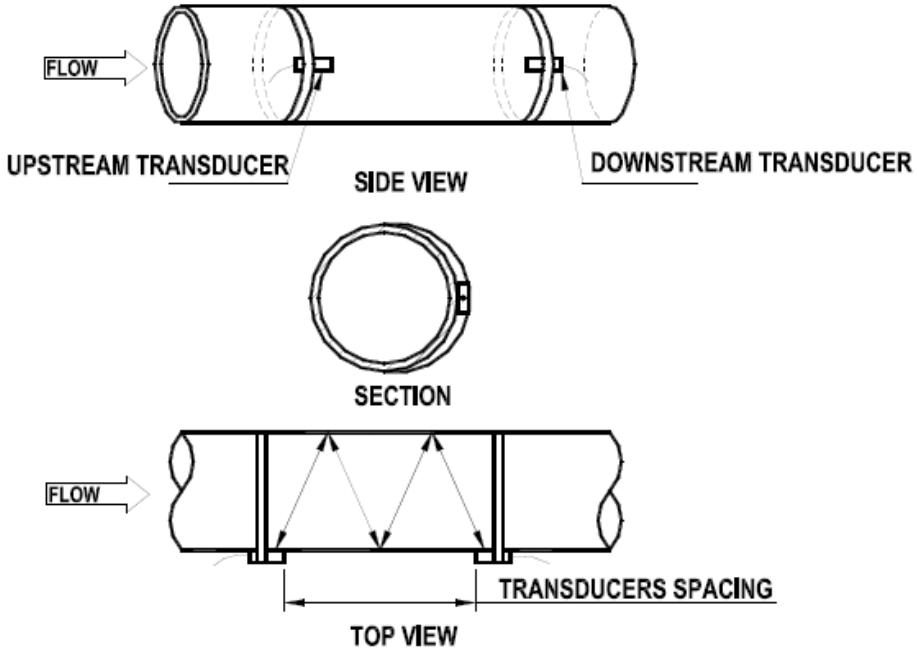
With the N method, the sound waves traverse the fluid twice and bounces three times off the pipe walls. It issuitable for small pipe diameter measurement.The measurement accuracy can be improved by extending

the transit distance with the N method



2.13.1.2.4 W Method(very rarely used)

As with the N method, the measurement accuracy can also be improved by extending the transit distance with the W method. The sound wave traverses the fluid four times and bounces three times off the pipe walls. It is suitable for very small pipe (diameters less than 50mm).



2.13.2 Insertion Transducer

The insertion transducer combines the advantage of clamp on transducer and pipe-section transducer.
Its features are:

1. It solves the problems of weak signal or abnormal measurement of the transducer when there is thick

stain or rust in the pipe. It can also be installed on the cement pipes (the user should measure the actual outer diameter of the pipe and order the pliers from the manufacturers).

2. Specialized drilling tool can be used, and the transducer can be installed without stopping the water flow. It guarantees the normal operation of production and water does not have to be stopped in maintenance.
3. The ultrasonic launching crystal of the transducer can contact the liquid measured, which improves the precision of measurement and the stability of the instrument.
4. It is more economical and precise in pipes with large diameters compared with electromagnetic flow meter.

2.13.2.1 Tools

Tools needed for the installation of insertion transducer include: specialized drilling tool, 400w manual electric drill (preferably the one with high-speed adjustment), wrench and so on.

2.13.2.2 Configure the Parameters

The initial parameter setup is the same as the clamp on transducer flow meter except：

M23: choose Item 5, i.e., "5. insert transducer B"

M24: choose Item 1, i.e., "1. Z-method installation"

M25: show the installation space, which refers to the distance between the centers of the two insertion transducers along with the axis of the pipe.

2.13.2.3 Installtion Steps

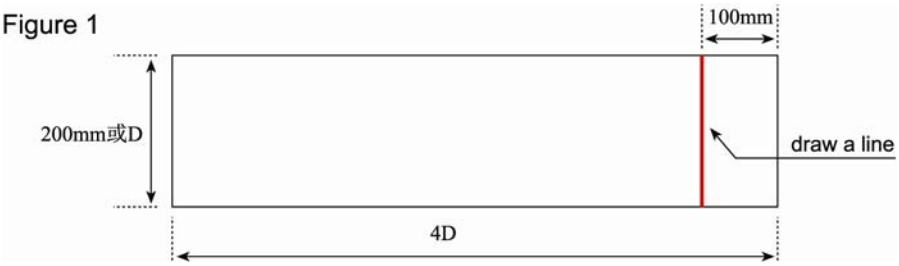
2.13.2.3.1 Locating Mounting Position

Enter the pipe parameters into the transmitter, calculate the installation spacing L in Menu25, the installation spacing is the center-to-center distance of the two transducers.

Note: Be sure that the two transducers and the pipeline center axis are in the same plane.

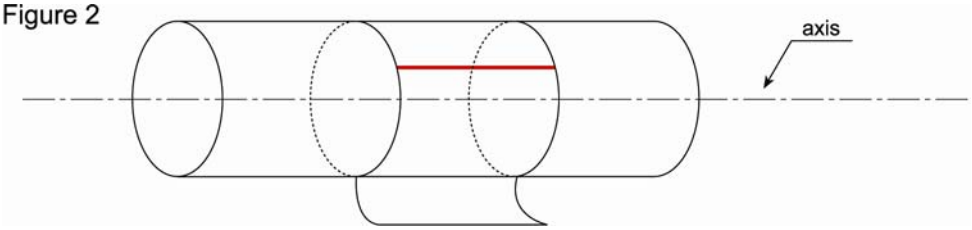
Use a continuous sheet of paper whose length is 4D(D- diameter)and width is 200mm(or D). and draw a line which is 100mm from the edge of the paper (see Figure 1)

Figure 1



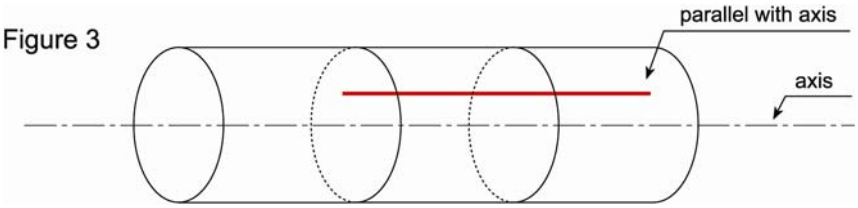
Wrap the pipe surface tightly with the paper and make sure that the two sides of the paper is aligned, which makes the drawn line paralleled with the axis of the pipe. (see Figure 2).

Figure 2



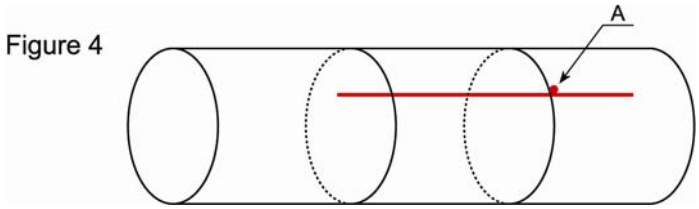
Extend the drawn line and draw a line on the pipe (see Figure 3).

Figure 3



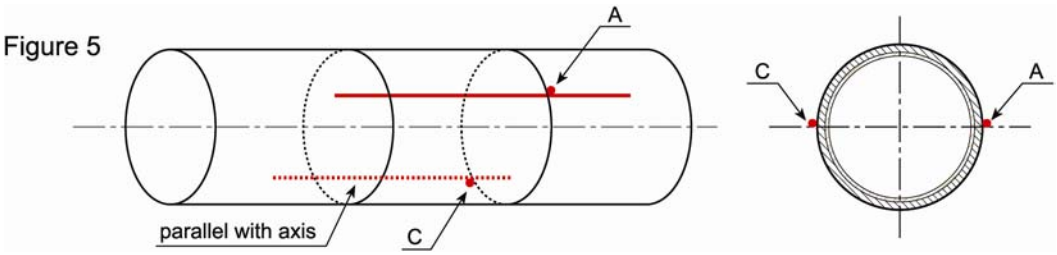
The intersection of the line and the paper is A(see Figure 4).

Figure 4



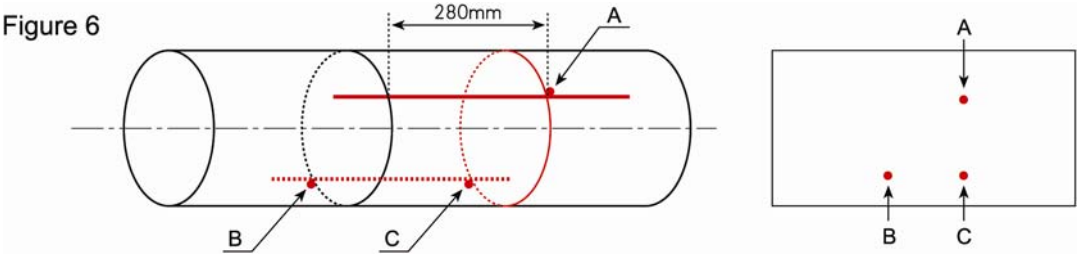
From Point A, measure 1/2 circumference along the edge of the paper, which is Point C.
From point C ,draw a line which is vertical to the edge of the paper (see Figure 5).

Figure 5



Take down the paper,form point C,measure the installation spacing to determine the point . A and point B are the mounting position.For exmple:L=280mm (see Figure 6).

Figure 6



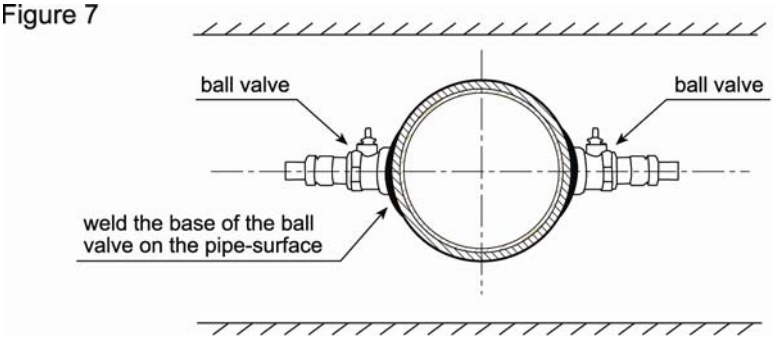
Weld the base of the ball valve to Point A and B.

2.13.2.3.2 Welding The Base Of Ball Value

Base of the ball valve can be welded to the out wall of the pipe directly if the pipe material can be welded (like steel or PVC). (The surface of the pipe should be cleaned before welding.) No air hole should be there before welding in case it leaks or breaks.

To those materials which cannot be welded like cast iron or cement pipe, special pipe clamp (with rubber mat for sealing) should be used. The base of ball valve has been welded on the clamp, and it can be fastened to the pipe. The center of the ball valve should be attached to Point A and B. The base of the ball valve should be fastened to the outer wall of the pipe, and sealed well in case it leaks. The next step is to wrap polytetrafluoroethylene belts around the base and screw the ball valve(see Figure 7).

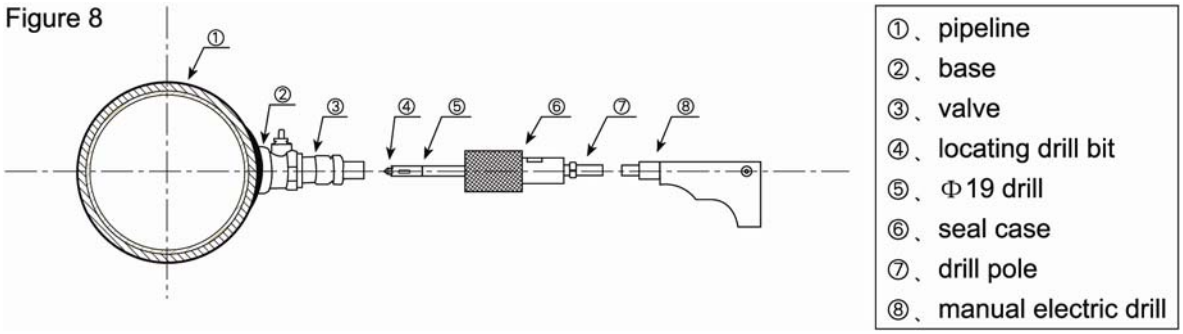
Figure 7



2.13.2.3.3 Drilling

Fasten the seal case with the specialized screw thread of the ball valve, and then open the ball valve. Push the drill pole until it is connected with the outer wall of the pipe. Connect the manual electric drill with the drilling pole and then switch on the power to start drilling. Make sure that the drill will not spin too fast in case it gets stuck or breaks the drill. After it finishes drilling, pull the drill pole out of the ball valve. Shut off the ball valve. (seeFigure 8)

Figure 8

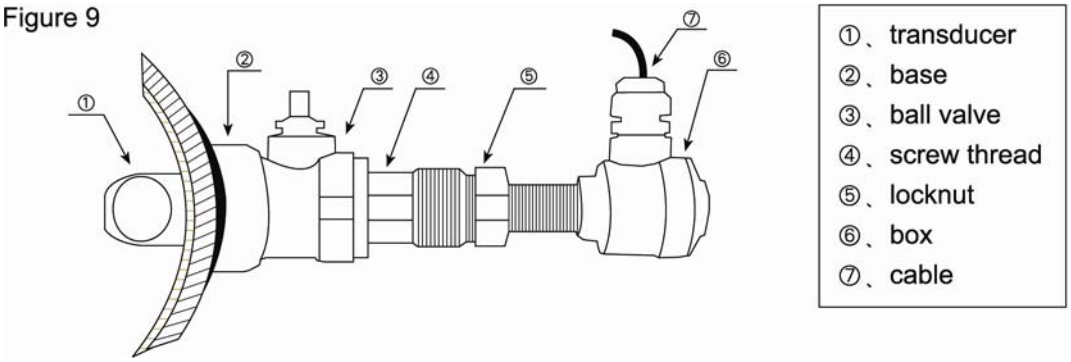


2.13.2.3.4 Inserting The Tranducer

Loosen the lock ring, retract the transducer into the joint nut, and then tighten the joint nut onto the ball valve.

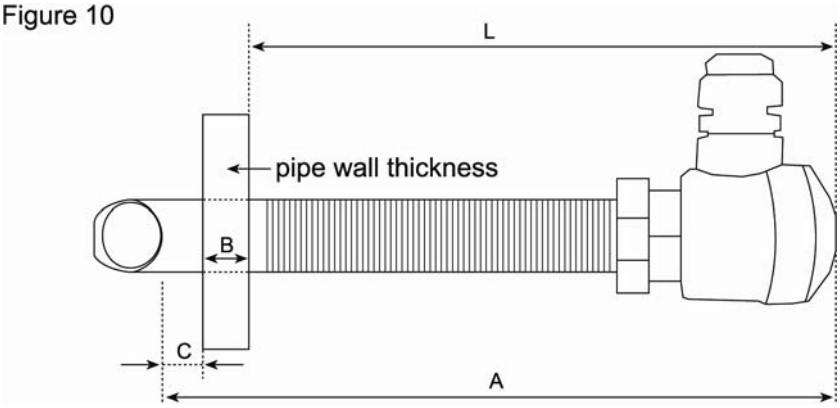
Open the ball valve and insert the transducer into the pipe(see Figure9).

Figure 9



At the same time, measure the dimension between the outside pipe and the end of the transducer and make sure it complies with the following formula:
L＝A-B C=0(see Figure10)
A---Transducer length (mm)
B---Pipe wall thickness (mm)

Figure 10



Connect the transducer cables to the corresponding upstream/downstream terminal ends.Then lock the nut and fasten the case.

2.13.2.3.5 Maintenance

It is easy to repair the transducer. The user can follow the reverse installation procedure ---unfasten the transducer and then insert the new one.

2.13.3 Pipe-Section Transducer

For the mounting of the meter on site, the pipe needs to be cut apart and the transducers are flange connected (The initial parameters have been setuped in factory).

§2.14 Installation Checkup

Check to see if the transducer is installed properly and if there is an accurate and strong enough ultrasonic signal to ensure proper operation and high reliability of the transducer. It can be confirmed by checking the

detected signal strength, total transit time, delta time as well as transit time ratio.The “mounting” condition directly influences the flow value accuracy and system long-time running reliability. In most instances, only apply a wide bead of sonic coupling compound lengthwise on the face of the transducer and stick it to the outside pipe wall to get good measurement results. However, the following inspections still need to be carried out in order to ensure the high reliability of the measurement and long-term operation of the instrument.

§2.14.1 Signal Strength

Signal strength (displayed in Window M90) 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 MT101FU 00.0 represents no signal detected while 99.9 represents maximum signal strength.
Normally, the stronger the signal strength detected, the longer the operation of the instrument 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 compound 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.

§2.14.2 Signal Quality (Q value)

Signal quality is indicated as the Q value (in M90) in the instrument. 00-99 is adopted in MT101FU to indicate the signal quality. 00 refers to the lowest quality, while 99 is the best quality. 60.0 is required in most cases.
Causes for a lower Q value could be: interference, bad installation of the transducer, using bad-quality unspecialized signal cables. The user can adjust the transducer or check the coupler to get better quality.

§2.14.3 Total Transit Time and Delta Time

The numbers displayed on menu window M93 are called total transit time and delta time respectively. They are the primitive data for the instrument to calculate the flow rate inside the pipe. If delta time fluctuates too much, the displayed flow volume and flow rate will fluctuate, which means the signal quality is bad. It may be caused by the pipe, the bad installation of the transducer or the wrong parameters input.
Generally, the delta time should fluctuate within $\pm$ 20%. If the pipe diameter is too small or flow rate is too low, the delta time will fluctuate.

§2.14.4 Time Ratio between the Measured Total Transit Time and the Calculated Time

This ratio would be used to check the transducer installation. If the pipe parameters are entered correctly and the transducers are installed properly, the value for this ratio should be in the range of 100±3. It can be seen in M91.

If this range is exceeded, the user should check:

(1) If the pipe parameters (outer diameter of the pipe, thickness of the wall, pipe materials etc) are correctly entered.
(2) If the actual spacing of the transducers is right and the same as what the window M25 shows.
(3) If the transducers are installed properly in the right directions.
(4) If the mounting location is good and if the pipe has changed shape or if there is too much fouling inside the pipes.

§2.14.5 Problems to be Noted in Installation

1. Pipe parameters entered must be accurate; otherwise the flowmeter 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 Window M25 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 flowmeter is able to run properly with high reliability. The stronger the signal strength displayed, the higher the Q value reached. The longer the flowmeter 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.

3. OPERATING INSTRUCTIONS

§3.1 How to judge if the instrument works properly

Press the MENU 0 8 keys. If the letter "*R"displays on the screen, it indicates system normal.
If the letter "E" is read, it indicates that the current loop output is over ranged by 120%. This refers to the settings in Window No.57. Enter a larger value in Window No.57, and the letter "E" will disappear. It can be ignored if no current loop output is used.
If the letter "Q" is read, it indicates that the frequency output is over ranged by 120%, and this refers to the settings in Window No.69.Incease the input value in Window No.69, and the letter "Q" will disappear. It can be ignored if no frequency output is used.
If the letter "H" is read, it indicates that the ultrasonic signal detected is poor. For more information, please refer to *Chapter 5 – Error Diagnoses*.
If the letter "G" is read, it indicates that system is adjusting the signal gain prior to the measurement. Also, it means system normal. Only when the adjustment takes too long without stopping, can system be identified as abnormal.
Letter "I" indicates no signal is being detected. Check the transducer wiring connections are correct, the transducers are installed firmly, etc.
Letter "J" indicates a hardware defect exists. Normally, such defect is temporary; it could be eliminated by system reboot (power off and restart).
For further information, please refer to *Chapter 5 – Error Diagnoses*.

§3.2 How to judge the liquid flowing direction

(1) Make sure that the instrument works properly.
(2) If the transducer connected to the upper side of the flow meter plate is A, and the one connected to the lower side is B.
(3) Check the flow rate for the indication. If the displayed value is POSITIVE, the direction of the flow will be from A to B; if the displayed value is NEGATIVE, the direction will be from B to A.

§3.3 How to change between units systems

Window No.30 is available for British or Metric system options. Select 0 for Metric units, 1 for British units. Press the MENU 3 0 ENT keys, and the symbol of ">" will be displayed on the bottom left line of the screen. It indicates that the screen is ready for unit's options selection. Press the ▼/- or ▲/+ key to select the desired flow units, and then press the ENT key again to confirm.

§3.4 How to select a required flow rate unit

Use menu window M31 to select the flow unit first and then the timing unit. Press the MENU 3 1 keys to enter M31. Press the ENT key. The symbol ">" is displayed on the left bottom line of the screen; it

indicates that the screen is ready for selection. Press the ▲/+ or ▼/- key to select the desired flow rate units. Press the ENT key to enter the screen for time unit options. Move ▲/+ or ▼/- key to select the desired time unit; then press the ENT key again to confirm.

M32 is available for totalizer unit options. The operation is the same as the previous procedures. The selected unit applies in positive, negative and net totalizer**.**

§3.5 How to use the totalizer multiplier

Totalizer multiplier is used to expand the indication range of the totalizer. Use window M33 to select a proper totalizer. The selected mulitiplier applies in positive, negative and net totalizer.

§3.6 How to open or shut the totalizers

M34 is available to turn net totalizer on and off net. M35 is available to turn the positive totalizer on and off, while M36 is for the negative totalizer. Select "YES" to activate the totalizer and "NO" to de-activate the totalizer.

The user can select the positive, negative and net totalizer according to their requirements of flow data.

§3.7 How to reset the totalizers

Window No.37 is available to select and reset the desired totalizer. Generally, it is unnecessary to activate this function except during the initial installation.

§3.8 How to restore the flow meter with factory default

Press the MENU 3 7 keys to enter Window No.37, press the . ◄ keys, and the factory default values are recovered.

§3.9 How to use the damper

The damping function will stabilize the flow display. Essentially, it is a part of the signal filter. Enter a coefficient in Window No.40. Increasing the coefficient increases the stability. However, the measurement displayed may be slightly delayed due to over damping. Logging too long may result in no response to real-time fluctuation, especially when flow rate fluctuates wildly. Therefore, damping should be kept at a minimum and increased just enough to reduce the fluctuation to an acceptable degree by 3 to 10 seconds.

This window is for data input. After entering the window, input the coefficient, then press the ENT key to confirm.

§3.10 How to use the zero-cutoff function

The data displayed in M40 is called the low flow cutoff value. If the flow rate falls below the low flow cutoff value, the flow indication is driven to zero. This function can prevent the flowmeter from reading flow after a pump as shut down but there is still liquid movement in the pipe, which will result in

totalization error. Generally, 0.03m/s is recommended to enter as the low flow cutoff point.
The low flow cutoff value has no relation to the measurement results once the velocity increases over the low flow cutoff value.

§3.11 How to setup a zero point

Once zero flow occurs, a zero point may indicated on each measuring instrument, i.e. as the measurement value reaches zero flow, it is indicated as zero. It is necessary to establish the true zero flow condition and program that set point into the instrument. If the zero set point is not at true zero flow, a measurement difference may occur.
The smaller the physical measurement capacity is, the larger the measurement difference from the zero point will exist. Only when zero point reduced to a definite degree, as compared with the physical measurement capacity, can the measuring difference from zero point be ignored.
For an ultrasonic flowmeter, the measurement difference from zero point cannot be ignored at low flow. It is necessary to perform a zero set calibration to improve low flow measurement accuracy.
Press the MENU 4 2 key to ensure that the fluid is definitely at a static state (true zero) and the flowmeter is working properly. Press the 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 through Window No.01. Repeat zero set calibration if it still needs to be minimized, i.e. the velocity reading is still high.

§3.12 How to get a scale factor for calibration

A scale factor is the ratio between the ‘actual flow rate’ and the indicated value by the flow meter.
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” for each instrument prior to shipment from the factory. The reason is that the scale factors in SL1188 flowmeter are only limited by two parameters, i.e. the crystal oscillation frequency and the transducer. It has no relation to any circuit parameters.
During operation, there still exists possible difference in pipe parameters, etc. The “scale factor” may be necessary when used on different pipes. Thus, scale factor calibration is specially designed for calibrating the differences that result from application on different pipes. The scale factor entered must be one that results from actual calibration.

§3.13 How to use the operation locker

System lock is readable but uneditable to prevent operation error due to unauthorized tampering by unauthorized personnel.
Press the MENU 4 7 ENT keys, move ▲/+ or ▼/- key to select “Lock”, press the ENT key, enter a 1~4 numerically long password, and then press the ENT key to confirm.
Unlock using the selected password only. Press MENU 4 7 ENT, move ▲/+ or ▼/- to select “Unlock”, press ENT, enter the correct password, then press ENT to confirm.

Keep the password in mind or recorded in a safe place or the instrument cannot be used.

§3.14 Keypad lock

The keypad is locked up. Unlock it using the correct password only.
To lock it, first enter desired window, then press MENU 4 8 press ENT to enter a 1~8 numerically long password, and then it will return to the locked window automatically.
For example, if Window No.01 is required to display in the locked condition, enter Window No.01 first (if already in this window, skip this step), press MENU 4 8 , press ENT to enter a password such as "12345678", press ENT again to return to the locked Window No.01 automatically. The keypad is "invalidated" now. Unlock it by entering the password "12345678" again.

§3.15 How to use data set-time output function

The MT101FU flow meter can output data to RS-232C and set the data set-time output.
The functions include: output content, starting time, intermittent time and duration.
Output content can be selected in M50. First select "ON", and then choose the output contents in order (15 items). The content to be output is selected and then press ENT key, and then press "ON". The contents to be left out can be chosen with "OFF".
The output time is entered in M51. For further information, refer to Windows Display Explanations M50, M51.

§3.16 4~20mA Current Loop Verification

Possessing a current loop output exceeding an accuracy of 0.1%, the MT101FU is programmable and configurable with multiple output modules such as 4 ~20mA or 0~20mA. Select in M55. For details, please refer to Windows Display Explanations.
In M56, enter a 4mA flow value. Enter the 20mA flow value in M57. For instance, if the flow range in a specific pipe is 0~1000m3/h, enter 0 in M56 and 1000 in M57. If the flow ranges from -1000~0~2000m3/h, configure the 20~4~20mA (module by selecting M55) when flow direction is not an issue. Enter 1000 in M56 and 2000 in M57. When flow direction is an issue, module 0~4~20mA is available. When the flow direction displays as negative, the current output is in range of 0~4mA, whereas the 4~20mA is for the positive direction. The output module options are displayed in M55. Enter "-1000" in M56 and 2000 in M57.
Calibrating and testing the current loop is performed in Window M58. Complete the steps as follows:
Press MENU 5 8 ENT, 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. If not, calibrating the current loop is to be found in Section §3.36 in this chapter.
Check the present current loop output in M59 as it changes along with change in flow.

§3.17 How to output simulative voltage signal

Parallel a 250Ω electric resistance on terminal 21 and 22 of the current loop, which can alternate 4~20mA to 1~5V and then output them.

§3.18 How to use the Frequency Output

The MT101FU flow meter is provided with a frequency output transmitter function. The high or low frequency output displayed indicates the high or low flow rate readings. The user can reset the frequency output as well as flow rate per his requirements

For instance: if a pipe flow range is 0~3000m^3/h, the relative frequency output required is 123~1000Hz, and the configuration is as follows:

In M68 (low limit frequency output flow value), input 0;

In M69 (high limit frequency output flow value), input 3000;

In M67 (low limit frequency), input 123; (high limit frequency), input 1000.

There is no output circuit specially assigned to frequency output. It only can be transmitted through OCT, i.e. select item 13 in M78 (item "***13. FO***"). The connecting method should be referred to in §2.4 fixed Standard MT101FU.

§3.19 How to use the Totalizer Pulse Output

Each time the MT101FU ultrasonic flowmeter reaches a uniflow, it may generate a totalizer pulse output to an remote counter.

To configure the unit flow, please refer to §3.4 and 3.5.

The totalizer pulse output can be transmitted through OCT or a relay. So, it is necessary to configure OCT and the relay accordingly. Please refer to M78 and M79.

For instance, if it is necessary to transmit the positive totalizer pulse through a relay, and each pulse represents a flow of 0.1m3, the configuration is as follows:

1 In M33, select totalizer the flow unit "Cubic Meters m3";

2 In M34, select the scale factor "2. x0.1";

3 In M79, select "9. Positive totalizer pulse output";

Note: Make sure to select a suitable totalizer pulse, since the output may be extended if it is too large. If it is too small, the relay may activate too frequently and may probably shorten its life. Furthermore, if it operates too fast, it may generate a pulse loss error. Therefore, a rate of 1~60/minute is recommended.

§3.20 How to produce an alarm signal

The MT101FU ultrasonic flowmeter has two programmable alarms: audible alarm and on off output alarm.

The audible alarm generates an internal beeper. Select the buzzer trigger in M77.

The on-off output alarm is generated through OCT or transmission to an external circuit by opening or closing a relay. The on-off output signal is activated under the following conditions:

1 Signal not detected;

2 Poor signal detected;

3 The flow meter is not ready for normal measurement;
4 The flow is in the reverse direction (back flow).
5 The analog outputs exceed span by 120%.
6 The frequency output exceeds span by 120%.
7 The flow rate exceeds the ranges configured (Configure the flow ranges using the software alarm system. There are two software alarms: Alarm#1 and Alarm #2. The lower limit value for Alarm#1 is configured in Window M73, and the upper limit value is configured in M74. As for Alarm#2, the lower limit value is in M75 and the upper one is in Window M76).

Example 1: To program audible alarm, activated when the flow meter is not ready for normal measurement: Select item 2 in M77: "2. Abnormal Measurement State".

Example 2: To program the relay output alarm, activated when flow rate exceeds 300~1000m3/h:
1. In M73, input 300;
2. In M74, input 1000;
3. In M79, select item 6: "6. Alarm #1 limit exceed".

Example 3: To program OCT output alarm signal, activated when flow rate exceeds 100~500m3/h; relay output alarm signal activated when flow rate exceeds 600~1000m3/h:
1. In M73, input 100;
2. In M74, input 500;
3. In M75, input 600;
4. In M76, input 1000;
5. In M78, select item 6: "6. Alarm #1 limit exceed".
6. In M79, select item 6: "6. Alarm #1 limit exceed".

§3.21 How to use Buzzer

The internal buzzer in the MT101FU ultrasonic flow meter is programmable. Besides the keys, the user can also program those items audibly in the following conditions: system alarm signals are being activated or totalizer pulse is being transmitted.
Further information, please refer to Window M77.
The built-in buzzer is user-configurable. It can be used as an alarm. Use M77 for setups.

§3.22 How to use the OCT output

The OCT output in MT101FU ultrasonic flow meter is a kind of isolated collector open circuit output with programmable open and close qualifications. The user can program the open and close functions under the following conditions: the system alarm signals are being activated or the totalizer pulse is being transmitted.
The frequency output signal is also transmitted from the OCT. When it functions as the frequency output, other functions are unavailable.
The frequency output signal is transmitted from terminals 61 and 62. Terminal 61is the collector while 62 is the emitter-collector circuit. Be careful of the polarity during connection. The connecting method can be

referred to in MT101FU.
For details, please refer to M78.

§3.23 Relay Output

The relay output in the MT101FU ultrasonic flow meter is programmable. The user can program the open and close functions under the following conditions: the system alarm signals are activated or the totalizer pulse is transmitting. For details, please refer to M79.
The relay output is transmitted from terminals 71 and 72; it can be remotely connected to a counter or alarm system.

§3.24 How to modify the calendar

No modification on the built-in calendar will be needed in most cases. The calendar runs on insignificant amount of power supply. Modification will be required only in such cases as when the battery is totally consumed, or when the changing of the battery takes a long time.

Press the ENT key under M61 for Modification. Use the dot key to skip over these digits that need no modification.
Generally, it is unnecessary to modify date time as the system is provided with a highly reliable perpetual calendar chip, manufactured by RAMTRON. If necessary, key in the MENU 6 0 buttons to enter the window, then press ENT to see '>' displayed on the bottom left line of the screen. It indicates that the screen is ready for the modification. Press . to skip the numbers that do not need to be changed, and then press ENT again to confirm the modification.

§3.25 How to adjust the LCD contrast

The backlit and contrast in the LCD display of the MT101FU can be adjusted through specific windows.
Adjust the backlighting in Window M70. Press MENU 7 0 , press ENT, and look for the '>' displayed on the bottom left line of the screen. It indicates that the screen is ready for modification. Press ▲/+ or ▼/- to select "Always On"; it indicates that the backlighting will remain on always. If you select "Always Off", it indicates that the backlighting will remain off always. Select "Time=", then enter the desired backlighting time for "n" seconds; it indicates that after pressing the button, the backlighting will keep on for "n" seconds then turn off automatically.
Adjust the contrast in M71. It is necessary to adjust the contrast when the characters displayed are unclear and the viewing angle is offset. Press MENU 7 0 , press ENT, and '>' will display on the bottom left line of the screen. It indicates that the screen is ready for modification. Press ▲/+ or ▼/- to increase or reduce the contrast, and then check the screen.

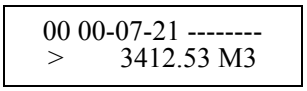
§3.26 How to use the RS232/RS485 serial interface

MT101FU ultrasonic flow meter has DB9 serial interface in accordance with RS-232C and the data rate is between 75-115200 baud.
Use M62 to enter parameters for serial interface. The user can set baud rate and checking unit.

The user can use Rs-232C to RS-485 switching device, which enables the user to connect the flow meter to 485. The device is electricity air isolated, which makes it suitable in industry.
As to more information, please refer to “6 Internet/communications Protocol”.

§3.27 How to view the Date Totalizers

In M82, the history file storage of flow data and working state in last 64 days can be reviewed.
Press MENU 8 2 , select item 0 for “Day” and it will display on the screen as shown on the right:



Left upper corner: “00-63” indicates the serial numbers;
In the middle: “00-07-21” indicates the date;
Upper right corner: “-------” indicates the working condition.
If there is only “--------” displayed, it indicates the system was normal during that time period. If other characters displayed, please refer to the “Error Code and Resolutions”. The following numerical value 3412.53 indicates the net totalized flow for a specific day.
To review the flow for a month, press MENU 8 2 , and select item 1 for “Month”.
To review the flow for a year, press MENU 8 2 , and select item 2 for “Year”.

§3.28 How to Connect Pressure Signal and Temperature Signal (Simulative Input)

Simulative input can be connected with 5-port 4-20mA pressure and temperature signals. The signals can be connected to PC through the serial interface. The method can be referred to in “Internet/Communication Protocol”. When the user measures heat, the user can enter simulative A11 to water supply temperature transducer and A12 to inlet temperature transducer.
M60 displays the current circuit and pressure temperature which is simulative entered.
Simulative enter A11 to terminals 63 and 64. 63 is GND。
Simulative enter A12 to terminals 63 and 65.
Simulative enter A13 to terminals 63 and 73.
Simulative enter A14 to terminals 63 and 74.
Simulative enter A15 to terminals 63 and 75.
A 13，A14，A15 has not got column。The user can contact the manufacturer to solve the problem.

§3.29 How to Use Automatic Flow Correction During Offline Session

In M83, select “ON”, the lost flow during an offline session will be automatically recovered into the flow totalizer as soon as the next power on. Select “OFF” to neglect this function.

§3.30 How to use the Working Timer

Window M72 displays the total running hours since last reset.
Press ENT, select “Yes” to reset the working timer.

§3.31 How to use the manual totalizer

Press MENU 3 8 ENT to start the totalizer. Press ENT key to stop it.

§3.32 How to use the batch controller

The batch controller is able to perform flow quantity control, or the batching of specific volumes to control events in product production or chemical dosing, etc. The internal batch controller in the MT101FU flow meter is able to take the high or low end of analog input signals as an input, or through the keypad, to perform control functions. The output can be transmitted through OCT or a relay.

When taking analog inputs as control signals, input an analog output which is over 2mA through the analog input terminal to indicate the condition of "1"; current "0" indicates the condition of "0".

In M80, select the control signal input. In M78 OCT output or M79 relay output, select Item 8 " output as batch controller" and the OCT or relay output will generate output signals.

Enter the batch value in M81. Start the batch controller after that. For details, please refer to ***Windows Display Explanations in M80 and M81.***

§3.33How to use the analog output calibration

Each flowmeter has been calibrated strictly before leaving factory. It is unnecessary to carry through this step except when the current value (detected while calibrating the current loop) displayed in M58 is not identical with the actual output current value.

The hardware detect window must be activated prior to calibration. The procedure is as follows:

Press MENU – 0 ENT enter password "4213068", then press ENT to activate the detect menu. With no effect to next power on, this window will close automatically as soon as the power turned off.

Press MENU - 5 ENT to calibrate the current loop 4mA output. Use an ammeter to measure the current loop output current. At the same time, move ▲/+ or ▼/- to adjust the displayed numbers. Watch the ammeter until it reads 4.00. Stop at this point, the 4mA has been calibrated. Then, press ENT to calibrate the current loop 20mA output. The method is as same as in 4mA calibration. The results must be saved in EEPROM to make it permanent.

§3.34 How to Check Electrical Serial Number and Other Details

We provide MT101FU with a unique electronic serial number to identify each flow meter for the convenience of the manufacturer and customers. The ESN for ultrasonic flow meter is 0307 XXXXF . 03 indicates that it was produced in 2003. 07 means it is Version 7. XXXX means the serial number. F indicates the type (Note: A fake flow meter does not have this serial number.) The ESN, instrument types and versions are able to view in M61.

In M+1, view the total working hours since the flowmeter left the factory.

In M+4, view the total power on and off times since the flowmeter left the factory.

4. Window Display Explantions

4.1 windows display codes

Flow Totalizer Display	00	Flow Rate/Net Totalizer
	01	Flow Rate/Velocity
	02	Flow Rate/POS Totalizer
	03	Flow Rate/NEG Totalizer
	04	Date Time/Flow Rate
	05	Instantaneous Caloric/Totalized Caloric
	06	Analog Input AI1, AI2
	08	System Error Codes
	09	Flow Today
Initial Parameter setup	11	Pipe Outside Diameter
	12	Pipe Wall Thickness
	13	Pipe Inside Diameter
	14	Pipe Material
	15	Pipe Sound Velocity
	16	Liner Material
	17	Liner Sound Velocity
	18	Liner Thickness
	20	Fluid Type
	21	Fluid Sound Velocity
	22	Fluid Viscosity
	23	Transducer Type
	24	Transducer Mounting
	25	Transducer Spacing
	26	Parameter Setup
	27	Cross-sectional Area
	28	Hold Previous Data
Flow Units Options	30	Measurement Unit
	31	Flow Rate Units
	32	Totalizer Units
	33	Totalizer Multiplier
	34	Net Totalizer
	35	Positive Totalizer
	36	Negative Totalizer
	37	Totalizer Reset
	38	Manual Totalizer
Setup Options	40	Damping
	41	Low Flow Cutoff Value
	42	Set Zero
	43	Reset Zero
	44	Manual Zero Point
	45	Scale Factor
	46	Network identifying address code
	47	System Lock
	48	Keypad Lock Code

Input and output setup	55	CL Mode Select
	56	CL 4mA Output Value
	57	CL 20mA Output Value
	58	CL Check
	59	CL Current Output
	60	Date and Time
	61	Software Version and ESN
	63	AI1 Value Range
	64	AI2 Value Range
	66	Low FO Frequency
	67	High FO Frequency
	68	Low FO Flow Rate
	69	High FO Flow Rate
	70	LCD Backlit Option
	71	LCD Contrast
	72	Working Timer
	73	Alarm #1 Low Value
	74	Alarm #1 High Value
	75	Alarm #2 Low Value
	76	Alarm #2 High Value
	77	Beeper Setup
	78	OCT Output Setup
	79	Relay Output Setup
	81	Flow Batch Controller
	82	Date Totalizer
	83	Automatic Correction
Calorimetry	84	Energy Units Select
	85	Temperature Select
	86	Specific Heat Select
	87	Energy Totalizer ON/OFF
	88	Energy Multiplier
	89	Reset Energy Totalizer
Diagnoses	90	Signal Strength and Quality
	91	TOM/TOS*100
	92	Fluid Sound Velocity
	93	Total Time and Delta
	94	Reynolds Number and Factor
Appendix	+0	Power ON/OFF time
	+1	Total Working Hours
	+2	Last Power Off Time
	+3	Last Flow Rate
	+4	ON/OFF Times
	+5	Calculator

4.2 Display explanation

While reading this section, please compare it with the instrument in order to improve your understanding.

MENU 0 0

Flow 0.1154 m3/h *R
NET 0X1m3

Flow Rate/Net Totalizer

Display flow rate and net totalizer.

If the net totalizer has been turned off (refer to M34), the net totalizer value displayed is the total prior to its turn off.

MENU 0 1 Flow 0.1129 m3/h *R
Vel 1.0415 m/s

Flow RateVelocity

Display flow rate and velocity.

MENU 0 2 Flow 0.1129 m3/h *R
POS 0X1m3

Flow Rate Positive Totalizer

Display flow rate and positive totalizer.

Select the positive totalizer units in Window M31.

If the positive totalizer has been turned off, the positive totalizer value displayed is the total prior to its turn off.

MENU 0 3 Flow 0.1120 m3/h *R
NEG 0X1m3

Flow RateNegative Totalizer

Display flow rate and negative totalizer.

Select the negative totalizer value in Window M31.

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

MENU 0 4 03-04-03 15:49:40 *R
Flow 0.1116m3/h

Date TimeFlow Rate

Display the current date time and flow rate.

The time setting method is found in Window M60.

MENU 0 5 03-04-03 15:49:48 *R
Vel 1.0350 m/s

Date TimeVelocity