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MADE IN CHINA

FDT-21W
Wall Mounted Ultrasonic Flowmeter

OMEGA®

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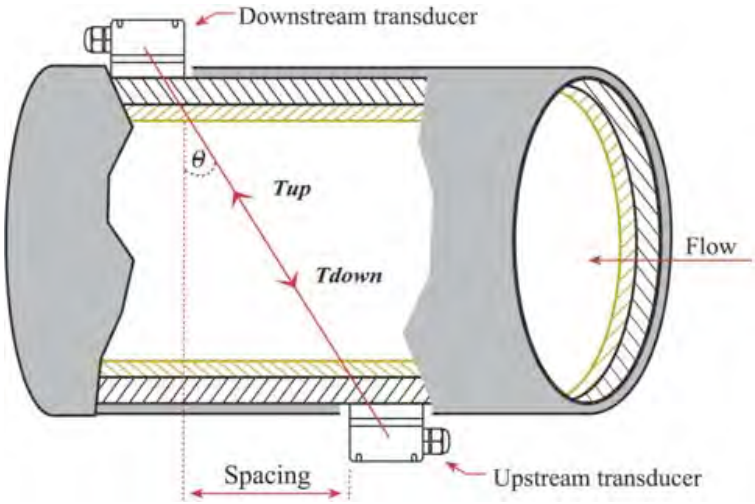
1. Outline

§1.1 Principle of Measurement

When an ultrasonic beam is transmitted through 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. When the fluid is flowing, counter flow transit time is more than direct flow transit time. Please see formula below:

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

.



Remarks:

Θ = The angle between the ultrasonic and the flow

M = Transit times of the ultrasonic beam

D = The internal diameter of the pipe

Tup = Transit time in forward direction

Tdown = Transit time in reverse direction

ΔT = Tup – down

F=900×π×D2×V

F = Instant flow rate (unit: m³/hour)

D = Inside pipe diameter (unit: m)

V = Flow velocity (unit: m/s)

2. Starting Measurement

The instruments are comprised of a measuring main board, function extending module and a display operation terminal. Users can choose the right configuration according to their requirements.
The easiest configuration only needs a measuring main board and a pair of transducers to complete the function of flow measurement.

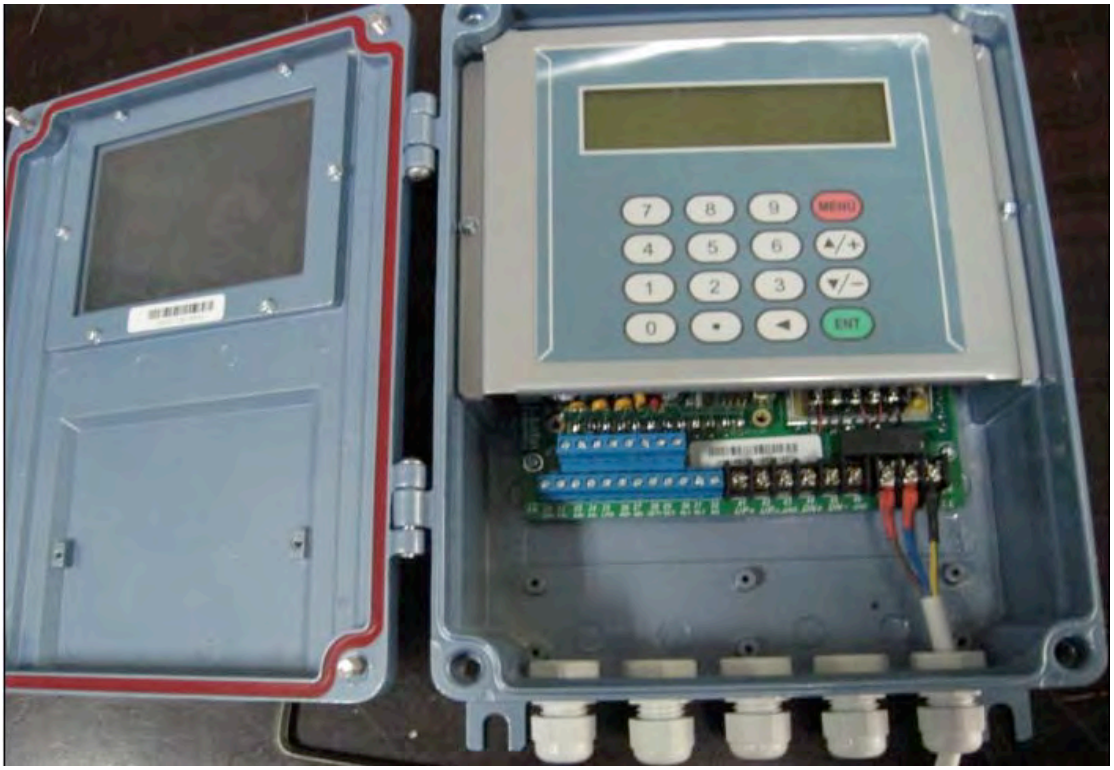
§2.1 Wall Mounted, Fixed-style, Ultrasonic Flow Meter

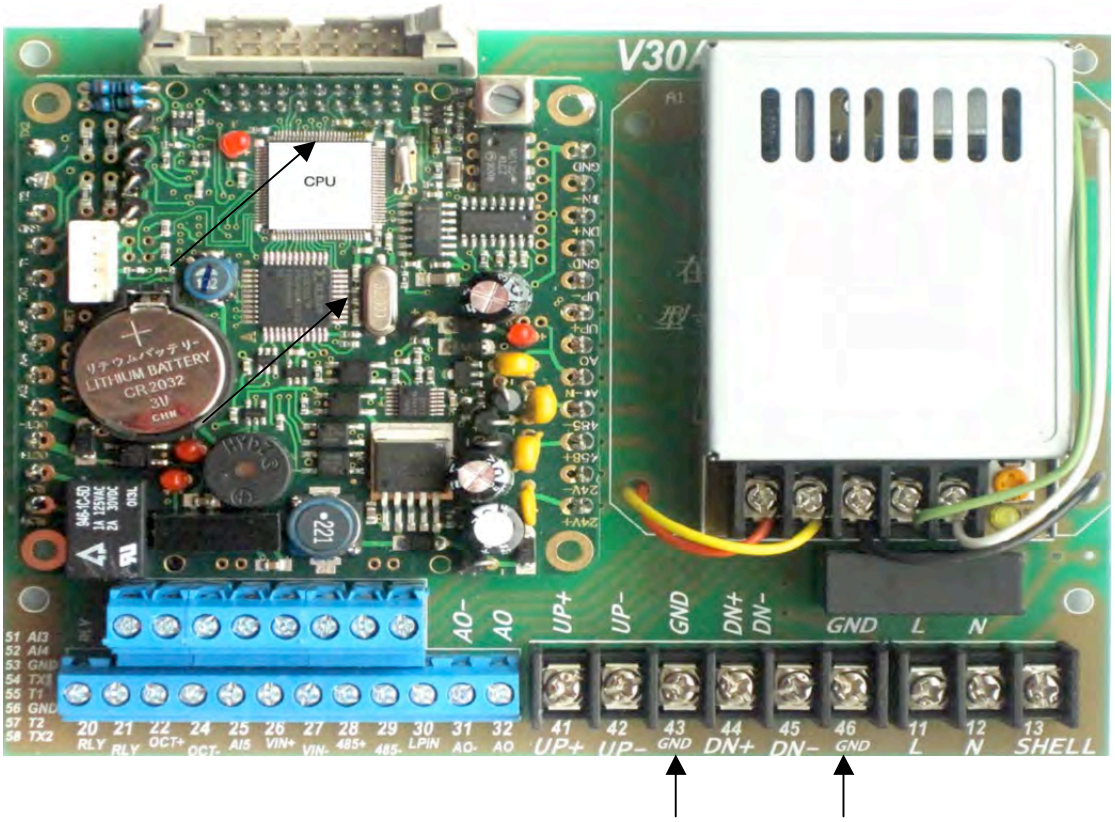
Available transducers include the following types: clamp-on, insertion and in-line.

Technology features:

1. Operating Power: AC 85—264V.
2. Repeatability: Better than 0.2%.accuracy: better than 1%.
3. Signal Output:
    - ▲ One channel standard isolation RS485 output
    - ▲ One channel isolation 4-20mA or 0-20mA active output
    - ▲ Dual channel OCT output (programmed between the OCT pulse width (6-1000ms), default (200ms)
    - ▲ One channel isolation relay output, with positive, negative, net accumulation pulses and different alarm signals.
4. Signal Input:
    - ▲ Two channel three wire system (for pressure, level, or temperature)
    - ▲ PT100 platinum resistor input loop, accuracy: 0.1%.
5. Display: 2*10 backlit LCD (Chinese and English optional).
6. Operating: 4*4 tactile keypad.
7. Other functions:
    - ▲ Automatic memory of the positive, negative and net totalized flow rate of the last 512 days, 128 months, 10years;
    - ▲ Automatic memory of the on/off power time and the flow rate of the last 30 times;
    - ▲ Reset automatically or by hand;
    - ▲ Read data through Modbus communication protocol.
8. Protection level: mainframe: IP65, transducer: IP68
9. Transducer: M2: clamp-on.

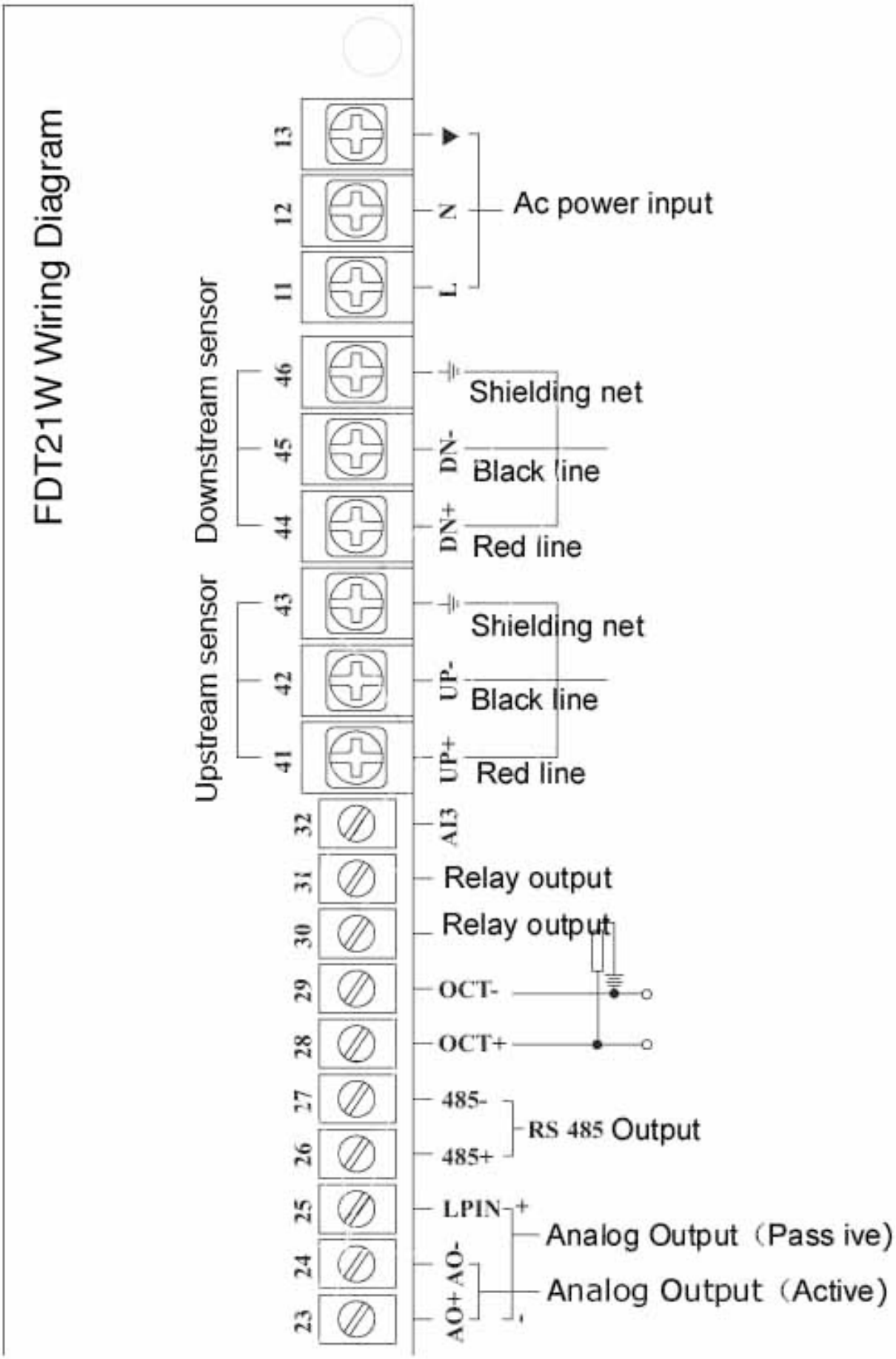
■ Main board wiring map and outline size:





Grounded Wires: Includes both upstream and downstream ground wires.

18 Version Main Board


FDT21W Wiring Diagram
13
12
11
N
L
Ac power input
Downstream sensor
46
45
44
DN-
DN+
Shielding net
Black line
Red line
Upstream sensor
43
42
41
UP-
UP+
Shielding net
Black line
Red line
32
AI3
31
Relay output
30
Relay output
29
OCT-
28
OCT+
27
26
485-
485+
RS 485 Output
25
LPIN
+
24
AO-
AO+
23
Analog Output（Pass ive）
Analog Output（Active）

3. Display and Operation

3.1 Key Functions

3.1 .1 Overview

The FDT-21W Ultrasonic Flow Meter can use the 16 keys keyboard monitor, the 16 keys parallel and serial port keyboard which includes: 10 digit keys, 2 up/down arrow keys, 1 menu key (M), 1 enter key, 1 decimal point key and 1 backspace key. The keyboard allows users to program quickly and easily.

Delete the usage of 4 keys keyboard

Here are some usages of 16 keys keyboard:

- ▲ **"0 – 9"** and "·"are used to input numerical value and menu number.
- ▲ "◄ " key is used to left backspace or delete left character.
- ▲ "<▲/+>" and "<▼/- >" are used to shift to upper and lower menu. When inputting digits, these are equal to the "plus" or "minus" keys.
- ▲ The **"Menu"** key brings up the main menu.

  First, press the **"Menu"** key and then your topic.

  A related menu is pulled up listing all subtopics available.

  Select the related number for your specific subtopic.

(ex: to get the outside pipe diameter, press "Menu" and "11". "M11" is the address code of outside pipe diameter parameter setting)

- ▲ The "**<ENT>"** key is mainly used to ensure the input digit and chosen content. The other function is to press it to enter "modify" status before setting parameters.
- ▲ The keypad buzzer can be shut down at the 25th Item of M77.
- ▲ See section 4.4 for Quick Pipe Parameter Settings..

3.1.2 Detailed information of Menu

Flow Rate & Flow Totalizer Display	M00	Display instant flow rate/net totalizer (adjust the units in M30-M32)
	M01	Display instant flow rate/instant flow velocity (adjust the units in M30-M32)
	M02	Display instant flow rate/positive totalizer (adjust the units in M30-M32)
	M03	Display instant flow rate/negative totalizer (adjust the units in M30-M32)
	M04	Display instant flow rate/date & time
	M05	Not Used
	M06	Display temperature input T1,T2
	M07	Display analog input A13, A14
	M08	Display system error code
	M09	Display the net accumulative total flow
Initial Set-Up	M10	Input outside perimeter of pipe
	M11	Input pipe outer diameter, data range: 0-18000mm
	M12	Input pipe wall thickness
	M13	Input pipe inner diameter
	M14	Choose pipe materials
	M15	Input sound velocity of pipe material

Initial Set-Up (cont…)	M16	Choose liner
	M17	Input the sound velocity of liner
	M18	Input the thickness of liner
	M19	Input inner pipe wall & absolute degree of roughness
	M20	Choose fluids
	M21	Input fluid velocity
	M22	Input fluid viscosity
	M23	Choose the types of transducers, selection includes more than 20 types
	M24	Choose transducer installation method
	M25	Display transducer installation space
	M26	Enter set-up parameters
	M27	Fast access to history installation parameters setting at points measured before.
	M28	When setting with a poor signal, keep the last data entered by choosing “yes”; this will keep the last measurement entered.
	M29	Setting a signal strength when the pipe flow is about to be emptied. Ex: If a signal strength level of “65” is entered when it is actually lower than 65, the flow meter will not recognize the signal. The flow meter interprets this as the pipe does not have any liquid in it and therefore is empty. The flow value end result displayed will be a zero value.
Flow Unit Setup	M30	Choose metric or imperial unit
	M31	Choose instant flow rate unit
	M32	Choose totalizer
	M33	Choosing the totalizer multiplying factor which function is to multiply totalizer data range, normally set it as X1
	M34	Net totalizer switch
	M35	Positive totalize switch
	M36	Negative totalize switch
	M37	Restore parameters setup before leaving factory and reset totalize
	M38	Manual totalize (the key to control on/off)
	M39	Choose operating language, 8 different languages
	M3	Not Used
Choosing Setup	M40	Damper Coefficient
	M41	Input low flow velocity cutoff value
	M42	Setup static zero point
	M43	Clear zero point setup and manually setup zero point. Restore default before leaving factory.
	M44	Set up zero point deviant by hand
	M45	Meter coefficient, rectification coefficient
	M46	Input network address identification number (IDN)
	M47	Password protecting operation. After the meter is setup with a password, only browse menus available without any modification.
	M48	Input degree of linearity, broken line rectification data. At most, there are

		12 broken line segments that are used to rectify meter but with no linearity.
	M49	Network communication tester. Check data transferred from the computer to judge the problems during communication.
Scheduled Time Output	M50	Optional setup of data. Output at scheduled time. Choose output content at scheduled time to print, more than 20 to select.
	M51	Setup output time at scheduled time.
	M52	Printing data flow direction control by default. Printing data will flow directly to the printer hung. Setup printing data output to outside serial port (RS485).
AI5 Setup	M53	Display analogue input AI5 (reserved for the battery powered main board).
Input and Output Setup	M54	Setup of OCT totalizer pulse output, pulse width, range: 6 Ms-1000Ms.
	M55	Choose current loop mode.
	M56	Corresponding data to output of current loop 4mA or 0mA.
	M57	Corresponding data to output of current loop 20mA.
	M58	Verification of current loop output. Applied to check whether current loop is normal or not.
	M59	Present output of current loop.
	M60	Date/Time set up. The date/time of the new flow meter is set by CPU. When upgrading software, adjust the date and time to display correctly.
	M61	Software version information and Electronic Serial Number (ESN).
	M62	Setup serial port parameter.
	M63	Communication protocol selection. Two options: a) MODBUS-RTU uses the binary system MODUS-RTU protocol and b) MODBUS-ASCII+ uses ASCII protocol. At this time, it can support several protocols simultaneously, including MOSBUS-ASCII, FUJI protocol, Meter-BUSx protocol etc.
	M64	Analogue input AI3.
	M65	Analogue input AI4.
	M66	Analogue input AI5. *64–65: By entering measuring range, the flow meter will turn current signal into data range users need, so the display related analogue input that corresponds to physical parameter data.*
	M67	Setup frequency range of frequency output signal. Frequency signal output represents instant flow rate value by signal frequency value default: 0-1000, max-range: 0-999Hz.output frequency signal by special frequency output unit.
	M68	Setup lower limit flow of frequency signal output.
	M69	Setup upper limit flow of frequency signal output.
	M70	LCD backlit control.
	M71	LCD contrast ratio control.
	M72	Work timer. Logs work time of meter by unit of second; time can be reset
	M73	Setup lower limit flow of frequency signal output
	M74	Setup upper limit flow of frequency signal output

	M75	LCD backlit control.
	M76	LCD contrast ratio control *73-75: By establishing the lower and upper limit of alarm, confirm range. When actual flow is over the set range in this window, an output alarm signal can be created. Alarm signal can be transferred to the outside by setting up OCT or relay.*
	M77	Beeper setup options
	M78	Setup Open Collector Transistor output (OCT) options
	M79	Setup relay (OCT2) output options
	M80	Choose input signal of batch controller
	M81	Batch controller
	M82 M-89	Not Used
Design Diagnosis	*M90	Displays signal strength and quality
	*M91	Displays transit time ratio
	M92	Displays calculated fluid sound velocity
	M93	Displays total transit and delta times
	M94	Displays Reynolds number and pipe coefficient
	M95	Displays positive and negative heat quantity totalizer. Also start cycle display function.
Added Menu Window	+0	Displays time when powered on/off and flow rate
	+1	Displays total working time of flow meter
	+2	Displays last time when powered off.
	+3	Displays flow rate of last power off
	+4	Displays total times meter was powered on
	+5	Scientific calculator
Hardware Adjustment Menu Window	.2	Stores static zero point
	.5	Threshold value of Q value setup
	.8	Max instant flow rate of this day and this month
	.9	Serial port testing window with CMM direct output
	-0	Circuitry hardware parameter adjusting entrance (enter password to enter following windows)
	-1	4-20mA current loop calibration.
	-2	AI3 entering calibration of analogue input 4 mA.
	-3	AI3 entering calibration of analogue input 20mA.
	-4	AI4 entering calibration of analogue input 4mA.
	-5	AI4 entering calibration of analogue input 20mA.
	-6	AI5 entering calibration of analogue input 4mA.
	-7	AI5 entering calibration of analogue input 20mA.

3.1.3 Work parameter solidification of the flow meter and option introduction

The FDT-21W has 3 working parameter areas respectively called: present parameter data block, solidification parameter data block and user pipe parameter data block.

Present Parameter Data Block is built in the internal RAM. If the outside power supply and the spare battery are off together, the parameter will be lost.

Solidification Parameter Data Block is built in the internal FLASH; this data usually would not be lost. Either check one point frequently or measure the solidification parameter data block for a long period. Use the solidification parameter function in M26 to store the parameter data block in RAM to FLASH. Setup by recalling the stored work parameters in FLASH to the present parameter data block. Each time unit is powered on, any stored parameters are immediately available.

When frequently modifying parameters, like the portable flow meter, select “0” and use the parameter in RAM M26. When powered on, this would use the parameters in RAM. If the data block in RAM fails to verify, the meter will recall the work parameter in FLASH. Parameter data block is able to store nine sets of commonly **Used Pipe Parameters** allowing quick operation access in M27.

3.1.4 Zero Point Setup and Zero Point Solidification

The new transducers have a “zero point”, meaning when the fluid flow velocity is zero, the flow meter will display a non-zero flow value. This value will be added to every indicating flow velocity value. For example, if the zero point is 1 m^3/h, present flow velocity is 10m^3/h, then the indicating value of the flow meter is 11 m^3/h. So if newly installing or changing transducers, we should better setup the zero point and log zero point value, deduct this zero point value from indicating value when calculating later.
This setup can be done in M42, but the zero point value is only stored in RAM parameter block temporarily, not solidified in FLASH. If the spare battery inside is out of power or if recalling the solidification parameters in FLASH as working parameters directly when powered on, the zero point value will be lost. In order to keep the zero point value forever, users must use M.2 to store the zero point after adjusting zero point for each time.

3.1.5 Factory: Solidifying Scaling Factor

Prior to shipping, the factory solidifies the scaling factor after the calibration. This solidification is stored in M.1. and are dual factory password protected.

3.1.6 Applying the Analogue Function

When setting pipe diameter is zero, it will display the instant flow velocity: 1.2345678m/s (4.0504ft/s), instant flow =0 and display “R” status. Entering a value in M44 can get a totalized output. Using this function, we can test of the flow meter and the software (connecting the meter to the computer) without connecting transducers.

3.1.7 Introduction: Analogue Interface

The new FDT-21W series' analogue input interface can be used as digit input interface but please notice the loop input current should not be beyond 20 mA. When the outer digital voltage is 5V, a 1k resistor should be put in series. If the digital quantity voltage is 12V, then a 2k resistor should be put in series.

3.1.8 Introduction: Serial Peripheral Extension Interface

Serial peripheral extension interface has 4 wires for input, output, power supply +, power supply. It can output instant flow, positive total, 4-20mA value, frequency value and printing data (etc). Different function models can use the data according to requirements. The serial bus uses 4800 baud rate.

3.2 Restoring Factory Defaults

To restore the factory setting, use either the serial or parallel port keyboard and enter M37. Then press <•><◀>.

Attention! Do not use this function except when installing for the first time.

3. Installing Transducers

4.1 Unpacking

Cross check spare parts against the enclosed packing list and ensure they comply. Please contact OMEGA Engineering if the box is broken during transportation, any screws are lost, the connecting line is loose or if you have any other questions or concerns.

4.2 Power Supply and Cables

The meter can be power by two types of suppliers:

1) AC85~264V
2) DC24V or DC8~36V

WARNING! Do NOT connect the mainframe power supply to direct current or connect low voltage AC (DC8-36V) with AC220V; the flow meter will be destroyed.

The FDT-21W Flow Meter transducers signal cables accept high frequency, shielded and twisted cable pairs, which are designed to be anti-interference and low signal loss.

If a coaxial shielded radio frequency cable or a substandard twisted pair of cables is used, the data will not be accurate and the meter will not function correctly. Strong interference signal from outside would also negatively affect the operation.

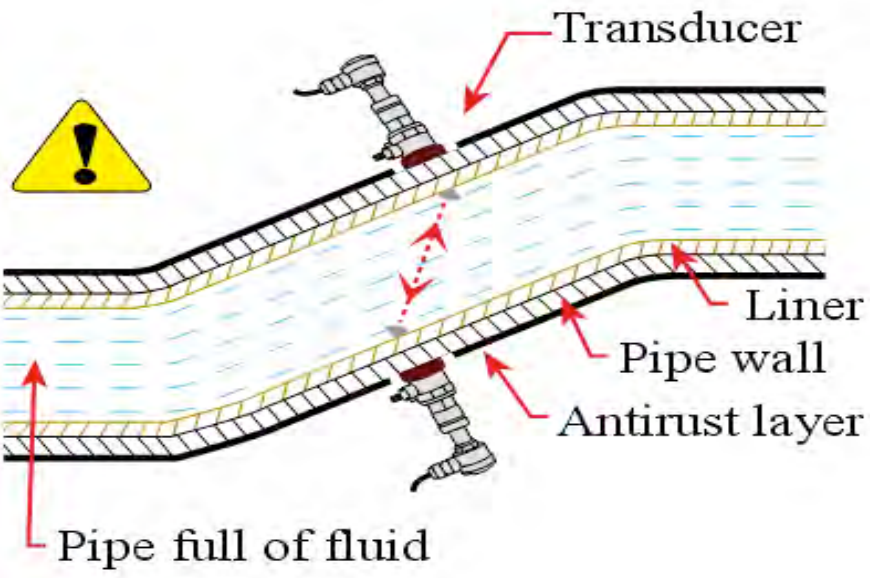
4.3 Required Installation Condition

The new FDT-21W series is very easy to use. Select a suitable measurement point, input the pipe parameters, select the installation point, put grease on the transducers and then fix the transducers on the pipe with strap.

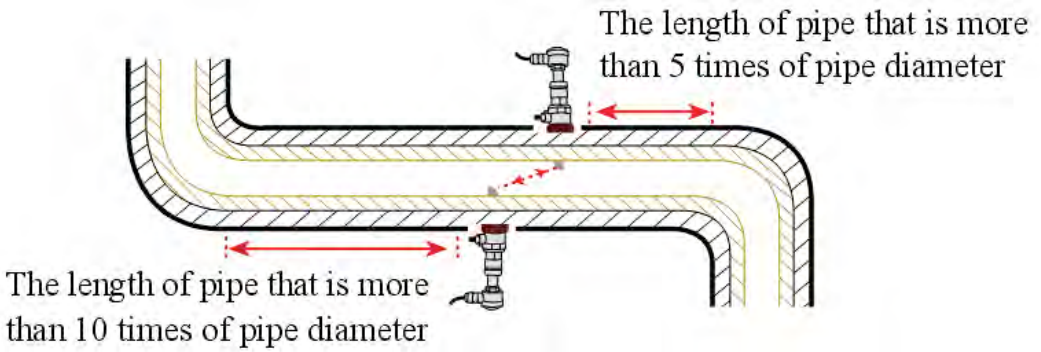
4.3.1 Choosing a Measurement Point

To ensure accuracy and stability of the measurement, the installation point of the transducers should be on a straight, uniform pipe and is full of liquid. To select the installation point, follow these principles:

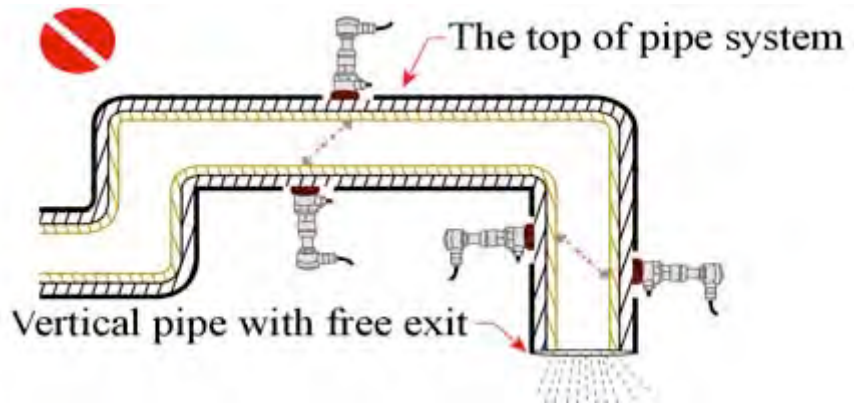
1. Pipe is uniform, full with a liquid and able to transmit the ultrasonic beam without interference (e.g. a vertical (up-flow) or horizontal pipe – illustration below).



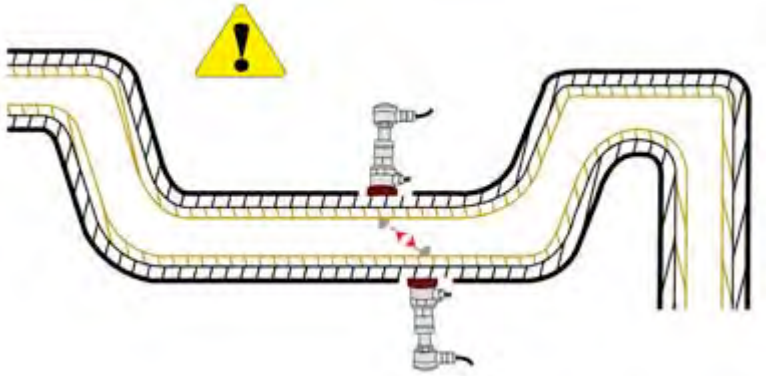
2. The upstream transducer should be installed at the place where the upstream length of the straight pipe is at least 10D and the downstream length is at least 5D. To install the downstream transducer, the pipe should be straight without any valve, pump, angle head or pipe size changing within 15D length (D = pipe outside diameter) . The installation point should be far from valves, pump or interference source, such as high-voltage electricity, frequency transformers .



3. Avoid installing on the highest point of pipe or vertical pipe with free exit (flow down).

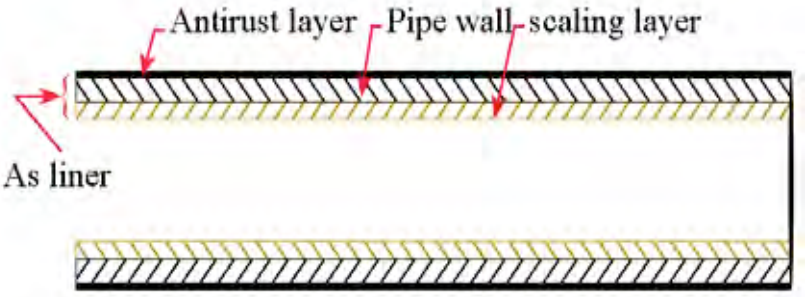


4. For the opened pipe or half full pipe, the transducers should be installed on bottom of U pipe.

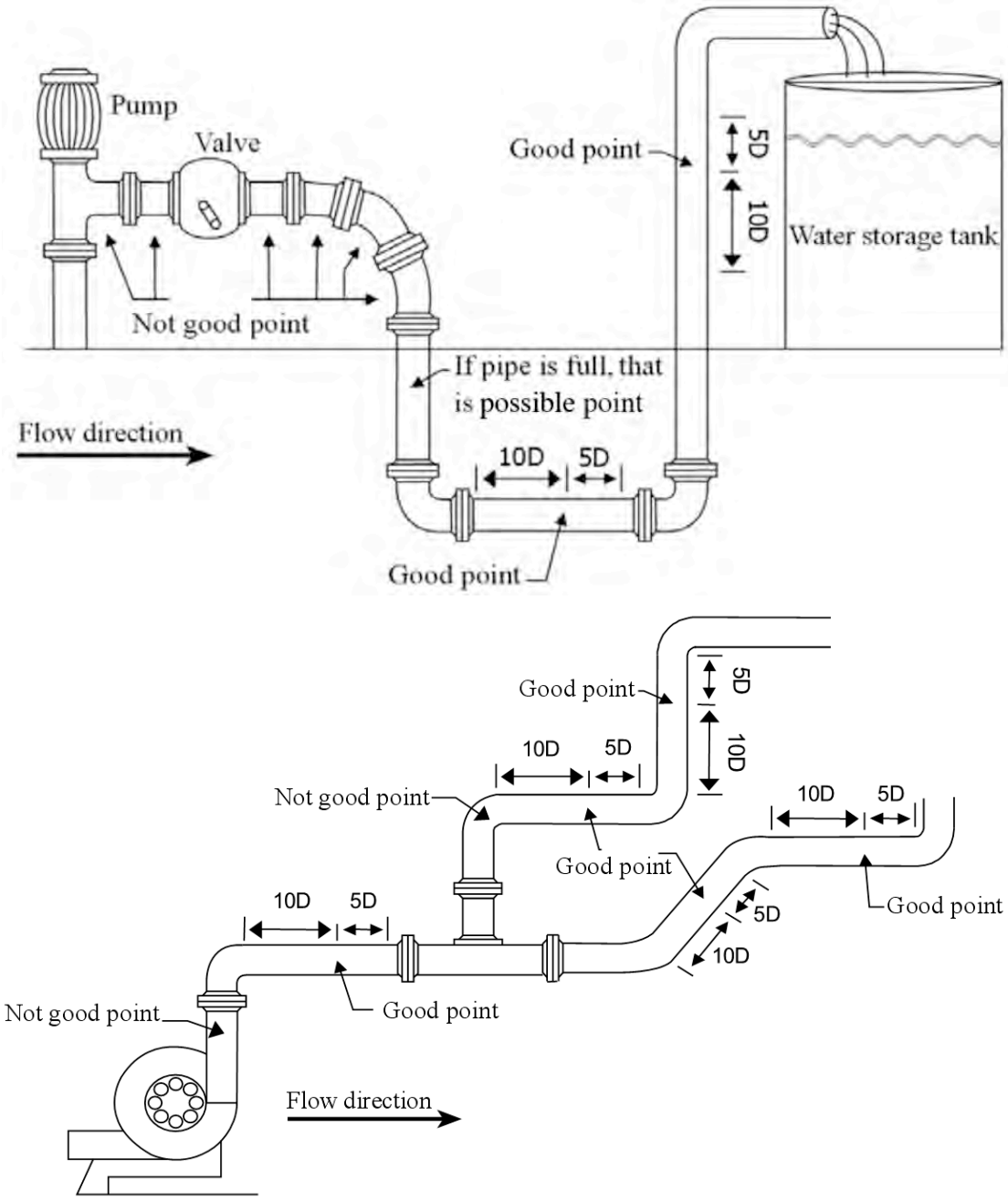


5. The temperature and pressure at the installation point should be in the work range of the transducers.

6. Pay attention to the pipes inner wall and check for pollution build-up. Select a pipe without any or very little buildup of sediment because it may interfere with the signal.

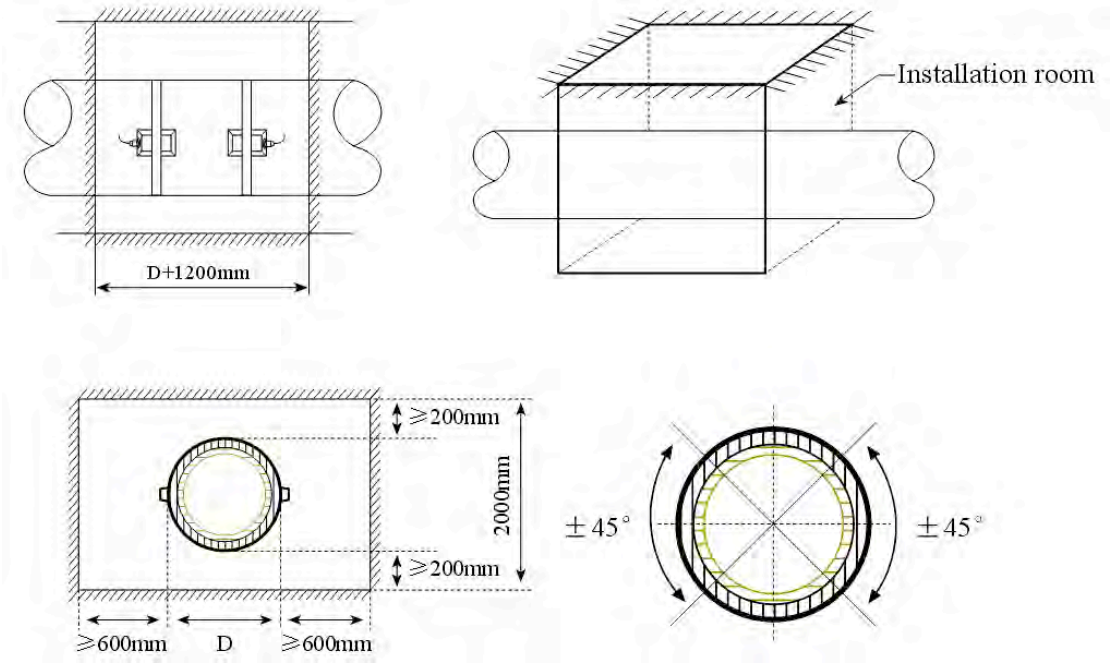


7. The two transducers must be installed in horizontal direction, within ±45°of horizontal plane to prevent bubbles in pipe. The pipe should not be full or contain any sediment, which would affect the precision of the measurement. If space is limited when installing, do not install the sensors horizontally and symmetrically. Instead, install the transducers vertically or with dip angle. Then the user must check and ensure no bubbles are found in the inner top of pipe.



4.3.2 Installation Requirements for a Well

To install transducers in a well, there must be enough installation space so the engineer can install it conveniently. The distance between pipe wall and well wall should be more than 550mm, the width is more than (D+550*2) mm, the cement pipe width is more than (D+700*2) mm and the instrument well axial width L is more than D+1200mm. When installing transducers, avoid the following places: flange, welding line and changing diameters. It is best to install transducers in the range of +/-45° of horizontal position of pipe axis.



Attention!

1. Install transducers in the range of +/-45° of horizontal position of pipe axis.
2. Connect the mainframe shell with ground.
3. Avoid the installation places of flange, welding line, changing diameter.
4. Have enough installation room, convenient for people to stand up to work

4.4 Quick Pipe Parameter Setting

The user must set the parameters when measuring the following:

1. Pipe outer diameter
2. Pipe wall thickness
3. Pipe material
4. Liner parameter (if having liner, then the liner thickness and sound velocity)
5. Fluid types
6. Transducers type
7. Transducers installation method
8. Solidification parameter

4.5 Installing a Clamp Type Transducer

Before installing, start by cleaning the installation area; removing any rust, paint and anti-rust layers. Then polish the area using a clean cloth with either alcohol or acetone. Apply a sufficient amount of grease at the installation area and clamp the transducers tightly on the pipe. The grease is used to eliminate any gaps between the transducer and the pipe wall. **NOTE**: If not enough grease is applied or the transducers are not clamped to the wall tightly, the precision of measurement may be effected.

High temperature S1H type

High temperature M2H type

Standard S1 type

Standard M2 type

Standard L1 type

Transducer	S1 type	M2 type	L1 type	S1H type	M2H type
Compliant pipe size	DN15~100	DN50~700	DN300~6000	DN15~100	DN50~700
Fluid temperature	0℃~70℃	0℃~70℃	0℃~70℃	0℃~160℃	0℃~160℃
size	45×30×30mm	60×45×45	80×70×55	90×85×24	90×82×29
weight	75g	250g	650g	94g	150g

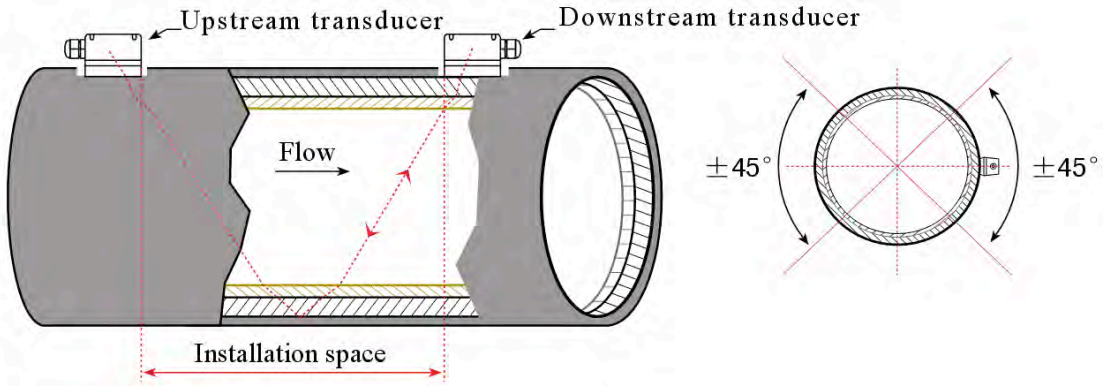
4.5.1 Installation Space

The installation space for the clamping transducer is the nearest distance of the two transducers (please refer to the sketch in **4.5.2**). After setting the required parameters in the menu, go to the space figure at M25.

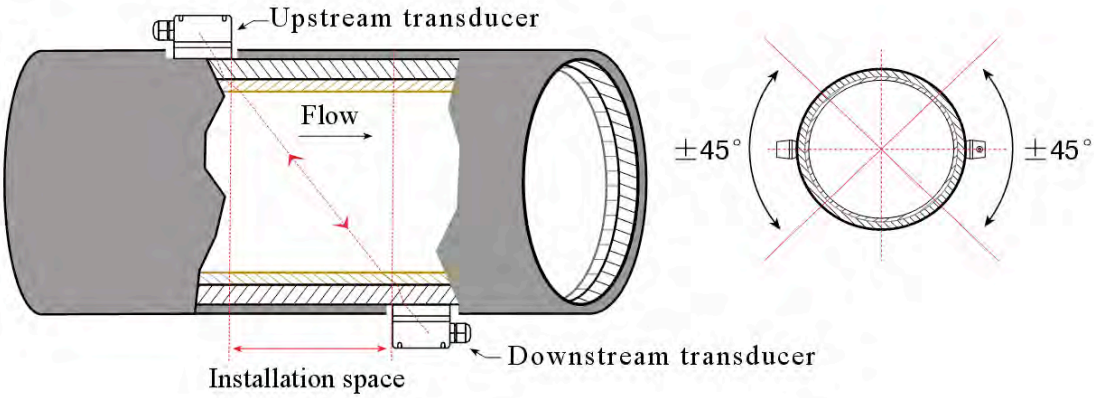
4.5.2 Installation Methods: "V & Z Methods"

There are two types of installation methods to choose from: the "V Method" and the "Z Method".

1. The "V Method" is the first choice when measuring a pipe with a diameter range of DN15-DN200mm. If no signal is received or the signal is weak with V method, then use the "Z Method". The "V Method" is a standard installation method because it is convenient to install and easy to ensure the installation precision of relative position between two transducers. The horizontal median should be parallel with pipe axis line. The V method can be used on pipe with DN15mm-DN400mm. *(Illustration below)*



3. The “Z Method” is the most commonly used method. When a pipe diameter is wide, there are suspended matters in the fluid or are too thick or may have produced incrustation (or a liner) causing the flow meter to not function properly or give a weak signal using the “V Method”. The “Z Method” is then applied. The pulse reaches the other transducer with single sound path and less signal attenuation.



PLEASE NOTE/IMPORTANT!

1. Before installing, the surface of the pipe being measured MUST be cleaned using either alcohol or acetone and a clean cloth.
2. When connecting the transducer cable, it is acceptable that the shielded cable is not connected. But do not connect them to the red or black line; this will cause the shielded cable to short circuit.
3. After transducers are connected with cables, the user must seal the connecting point with grease or a sealant to prevent water getting into the sensors.
4. After covering the transducers with grease, the user must screw and tightly lock the shield line hole to prevent water getting in.
5. Fix the transducer with the strap (stainless steel band) at the middle of the transducer to ensure it is tightly bound to the pipe.
6. Apply an ample amount of grease between the grease and the pipe to prevent bubbles, sand or rust getting in

4.6 Turning On the FDT-21W

A self-diagnosis function runs every time the FDT-21W is powered on. If there are any issues/problems, the errors are displayed on the upper right corner of the LCD (Please refer to Chapter 5 detailed). After the diagnosis, the meter will work according to last parameter setting.

It does not affect the measurement when programming the unit because the meter is designed with Time-Division techniques. Measurement, calculation, keypad operation, display, typing, inputting and output are treated as “affair” and all affairs are independent.

For example, if we change the date and time, this operation would not affect the “affairs” which have no relationship with date and time. After finishing the steps S1, S2, S3, S4 deployed on the left upper corner, the meter will start the measurement and “R” will be displayed on the left upper corner.
If it is the first usage of the meter or a new installation point, you need to set the pipe parameters. The meter will adjust and calculate automatically if you change the parameter setting. The meter will go to the menu page when it is shut down.

4.7 Checking Transducer Installation

After the transducers have been completely installed, check the following: signal strength S, the signal quality Q value, total time ratio, delta time and the transit time ratio to confirm the installation is completed. Usually, a signal is available after putting grease on the transducer and securing it to the pipe, but absolute confirmation all the checks listed above are essential in order to get reliable and accurate measure results.

4.7.1 Signal Strength

The signal strength “**S**” (display on M90) indicates the strength of the sending and receiving signals from the upstream transducer and the downstream transducer. “**[00.0]**” indicates no signal detected and “**[99.9]**” indicates the maximum and best signal strength that can be detected. While installing, if a signal is not received or is weak, the positions of the transducers can be adjusted Along with adjusting the transducers, adequately greasing them will enable the user to get the strongest signal.

The meter works well when the signal strength ranges from 60 to 99. When the signal strength is too weak, recheck the installation position, transducer distance, if the pipe is suitable for installation or change installation method.

4.7.2 Signal Quality (Q Value) 

Signal quality is indicated as the **“Q”** value (display on M90) which indicates either a good or poor/weak signal. The FDT-21W series uses the “00-99” digits to represent signal quality. “00” represents the worst signal and “99” represents the best signal. Ideally, the signal quality should be above “60”. When the Q value is not meeting the ideal benchmark of “60”, there are a few reasons for this: interference, shoddy installation of the transducers, the quality of the signal cables are inferior, not enough grease was applied between the transducers and pipe or the position of the transducers needs adjusting.

4.7.3 Total Transit Time (Delta Time)

The total transit time (delta time) is displayed on the menu window M93, which indicates if the installation is correct. The flow meter's internal measurement and calculation are based on these two parameters. When the indicating delta time data fluctuates too much, the showed flow rate and velocity will change quickly, too. In this case, it means the signal quality is not good; perhaps the pipe is not good enough for measurement, is not suitable for the installation of the transducers or the wrong parameters were set. Usually the fluctuation of delta time should be less than ±20□, but when the pipe diameter is too small or flow velocity is slow, the fluctuation of delta time may be higher.

4.7.4 Transit Time Ratio 

The transit time ratio (displayed on M91) is usually used to check whether the transducer installation space is sufficient. If the pipe parameters are correctly set and the transducers are installed properly, the transit time ratio should be in the range of 100±3 %. When the ratio is beyond this range, check the following:

1. The pipe's parameter was set correctly. This includes the pipes outer diameter, the thickness of the pipe, the material of pipe and the liner.
2. The actual installation space of the transducers is the same as or close to what shown in M25.
3. If the transducers were installed properly on the same axis plane of pipe.
4. The mounting location is in the best possible place. Also check: if the pipe I. D. is changing the age of the pipe (too old?), if there is excessive incrustation, if the liner inside the pipe is exceedingly thick, if the flow rate is very slow or if any bubbles, paint or rust got inside the pipe.
5. Interference from other sources around the flow meter.

4.7.5 Note the following points when installing

1. The pipe parameters must be correctly entered; otherwise the flow meter will not work accurately.
2. When fixing the clamp to the transducers, enough grease must be applied between the transducers and the pipe, the signal strength and quality are verified on the display screen while moving one transducer around the installation point to get the best signal and signal quality; the bigger the pipe size, the larger moving range. Then check the installation distance, ensure it is the same with what displayed on M25. If the signal strength is "0.00", it means no ultrasonic beam. Then check whether the input parameters and the installation method are correct. Also check the age of the pipe, the liner thickness, inside the pipe for bubbles, rust or paint. Confirm there is fluid inside the pipe (must have full fluid). Other quality control checks: is the space is too near to the valves, angle head? If any of these check points are not the reasons for a poor or absence of a signal, try another measuring point.
3. After installation has finished, go to M26 to solidify the parameters, shut it down and power it on again to check if the results are correct.

5. Troubleshooting

The FDT-21W was designed with and accurate self-diagnosis function. The errors are displayed on the upper right corner of the LCD display via identification code in a timely order. All the existing errors can be checked at M08. Hardware self-diagnosis is executed every time the meter is powered on and some errors can even be detected when operating. For those errors undetectable due to incorrect settings or improper testing conditions, the flow meter will display information to help the user to quickly debug the

error and solve the problems according to following listed methods.

Displayed errors of FDT-21W are distinguished to two types:

1. Circuit hardware errors. Please refer to Table 1 of potential problems and solution methods. Example: If “F” is displayed upon power on, restart the unit, check the solution table and follow the instructions listed in the box. If the problem still exists, please contact OMEGA Engineering.
2. Measurement errors: please refer to Table 2.

Table 1. Hardware Diagnosis: Errors and Solutions

LCD Display Information	Causes	Solution
ROM verification Error	ROM operation illegal / error	Contact OMEGA.
Save data logger reading error	Stored parameters are wrong	Power on again/contact OMEGA.
System data logger error	System stored data area has error	Power on again/contact OMEGA.
Measuring circuit hardware error	Sub-CPU circuit vital error	Power on again/contact the OMEGA.
Cpu clock speed error	System timer has errors	Power on again/contact the OMEGA.
Date and time error	System date and time are wrong	Reset date and time
No Display (Erratic or Abnormal) Operation	Wires not well connect with the display	Check wiring connections. No influence on measuring
No response to key pressing Keypad is locked	Bad plug connection	Input pw to unlock keyboard or check wiring connections. No influence on measuring.

Table 2 Working Status Errors Code Causes and Solutions

Code	M08 displaying	causes	solutions
R	system work normally	System is normal	
J	Circuit Hardware Error	Hardware problem	Contact the OMEGA
I	No Signal	Unable to receive signal	Ensure the transducers and pipes are tightly fixed and with enough grease between them
		Not well contact or not enough couplant between transducer and pipe surface	Polish the pipe surface and clean the pipe surface (to remove the paint and rust).
		Transducers installed improperly	Check original installation parameter settings
		Incrustation in pipe wall is too thick	Clear the incrustation or replace it with new pipe, or move to another proper measure point to find a point with less incrustation.
		New changed liner	Wait until the liner is solidified enough
H	low signal strength	1. Low signal 2. Causes are the same as with code “I”	Solutions are the same as code “I”
H	poor signal quality	1. Poor signal quality 2. Include above all causes	Include above all solutions
E	The current of current loop is over 20mA (does not affect the measurement if don’t using current output, we can	1. 4-20mA current loop output is over 100% 2. Improper settings for current loop output	Check current loop settings on M56. or check if the actual flow rate is too high.

	don't handle it)		
Q	Frequency Output is higher than the set value (does not affect the measurement if don't using current output, we can don't handle it)	1. Frequency output is over 120% 2. Improper settings of frequency output or flow rate in pipe is too high.	Check frequency output settings (refer to M66-M69) or check if the actual flow rate is too high.
F	Listed in table 1	Find problems when powered on and self-diagnosis	Power on again, check the information shown on the screen and handle according to table 1. If not resolved, contact the seller
		Permanent hardware problems	Contact the OMEGA.
G	Adjusting Gain >S1 Adjusting Gain >S2 Adjusting Gain >S3 Adjusting Gain>S4 (displayed on M00, M01, M02, M03)	These four steps mean that the meter is preparing to make the gain adjusting. If it stops at S1 or S2 or switching between S1 and S2, it means the signal is low or bad wave	
K	Empty Pipe, setup on M29.	No liquid in pipe or wrong setup.	If actually there is liquid in pipe, please set 0 on M29

Attention: The codes of Q, & E displayed do not affect measurement. This only means the current loop and frequency output have problems.

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OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

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Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

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1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

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