Spectra Technologies

Model TTM-550-P

Digital Transit Time Flow Monitor

Installation and Programming Guide

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1.0: Introduction

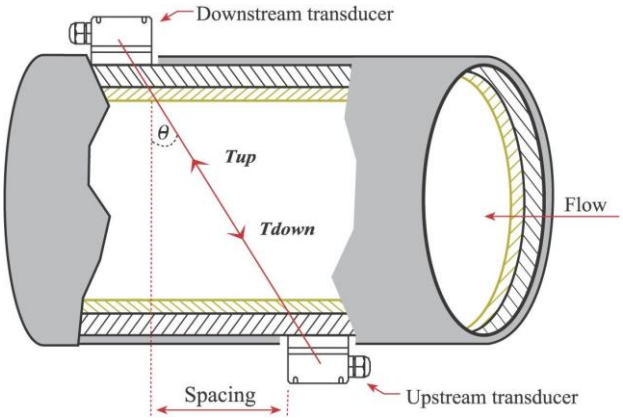
The TTM-550-P ultrasonic digital transit time flow monitor by Spectra Technologies Inc. is a cutting-edge flow monitoring device that utilizes the latest in digital and microprocessor-based design. The TTM-550-P offers a flexible, easy to use meter with outstanding accuracy and reliability.

The TTM-550-P transmitter can be used with any of Spectra Technologies clamp-on type sensors that allow the unit to accommodate a large range of pipe sizes as well as sensors from other popular suppliers. This type of flexibility makes the TTM-550-P the ideal instrument for off the shelf use under the most demanding situations.
The TTM-550-P can address applications for various liquids and has been used for industrial and municipal water and wastewater,petro chemical, metallurgy, electric power generation and energy management.

1.1 Principle of Measurement

When the ultrasonic beam 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, when fluid is flowing, counterflow transit time is more than direct flow transit time. The formula is as below.

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



θ

Notes: The angle between the ultrasonic beam and the flow

M Transit times of the ultrasonic beam

D The internal diameter of the pipe
Tup Transit time in the forward direction
Tdown Transit time in the reverse direction
ΔT=Tup –Tdown $F=900\times\pi\times D^2\times V$
F is instant flow rate(unit:m^3/hour)
D is inside pipe diameter(unit:m)
V is flow velocity(unit:m/s)

2.0 Specifications

The instrument is comprised of a main processing board and display board and keypad. The transmitter and set of sensors are all that is required to generate the required application setup and flow data.

The TTM-550-P wall mounted transit time flow monitor includes the transmitter and a one set of clamp-on type sensors that meet the desired requirements.
1: Operating power: Universal, AC 85—264V or isolation DC 8-36VDC
2: Accuracy: 0.5 to 1% (application dependent)
3: Repeatability: Better than 0.2%.
4: Signal output: One channel standard isolated RS485 output.
One channel isolated -20mA or 0-20mA active output.
One channel OCT output (programmable, 6-1000ms.
One channel isolated relay output, with positive, negative, net accumulation pulses and different alarm signals.

5: Display: 2x20 backlit LCD

6: 5x3+1 tactile keypad

7: Additional functions: automatic memory the positive, negative, net totalizer flow rate and heat quantity of the last 512 days, 128 months, 10 years. Automatic memory the time of power on/off and flow rate of the last 30 times, resettable by hand or automatically, data access via Modbus communication protocol.

8: Protection level: Transmitter IP65
Transducer: IP:68
9: Transducer: non-invasive, clamp-on type.
M2 Sensors supplied standard
Optional Sensors:
S2 type for small pipe application
L2 type for large pipe applications

10: Cable: Two wire shielded audio type. 15 feet standard, supplied

2.1 Unpacking the Unit

Verify that the equipment supplied agrees with the packing list. Check for any enclosure damage that may have occurred during transportation. Check for any lose hardware that may have come lose. Inspect all inter-connecting cables for proper set. If there are any questions or doubts, please contact the factory.

2.2 Power supply and cable

Power supply is a universal type: AC85~264VAC, 50-60 Hz. DC,
Be aware! Connecting the transmitter power incorrectly will damage the transmitter.

2.3 Main Unit

3.0 Display and Operation

The programming of the TTM-550-P is accomplished via an integral keypad and back lit alpha/numeric LCD display. The program is menu based and intuitive. However, because of the number of options and features that are available on the unit, it is best to use the manual until you become familiar with the various functions of the unit.

3.1 Key function

The TTM-550-P ultrasonic transit time flow monitor allows input via a 5x3+1 keypad. 0-9 numeric keys, Arrow keys, Menu key (M), Enter key, Arithmetic point key and Backspace key. The keypad makes data input convenient and fast.

For example: to use the keypad.
0-9 and <•> are used to input digits or Menu number.
◄ key is used to left backspace or delete left character.
<▲/+> and <▼/- > are used to enter upper and lower Menu when programming digits, it equals to plus or minus key.

The Menu key (M) is used to access the Menu, by pressing this key and then selecting two digits menu level code (see tables below) to enter related menu item.

For example: To enter the outside pipe diameter menu item; Press Menu <1><1>. “11” the menu code for outside pipe diameter parameter.

Press the <ENT>key to modify the data. Make the desired changes and then press the <ENT> once more to save the data.

The “Beep” sound for audio response of key presses can be modified by selecting M77 and selecting the parameter that fits your need.

3.2 Detailed Menu Codes

Display Options

00	Displays instant flow rate/net totalizer, adjust the units in M30-M32
01	Displays instant flow rate/instant flow velocity, adjust the units in M30-M32
02	Displays instant flow rate/positive totalizer, adjust the units in M30-M32
03	Displays instant flow rate/negative totalizer, adjust the units in M30-M32
04	Displays instant flow rate/date time
05	Displays date, time, velocity, signal strength, signal quality and working status
06	Display the wave form of the received signal
07	Displays present battery voltage.
08	Displays system error code
09	Displays current day net totalizer

Application Setup

10	Input inside perimeter of pipe
11	Input outer diameter of pipe
13	Input wall thickness
*14	Choose the kinds of pipe materials
15	Input sound velocity of pipe material
16	Select type of pipe liner
17	Input the speed of sound for only non-standard liners
18	Input the thickness of liner
19	Input the sound velocity for ABS liners
20	Select type of fluids
21	Input fluid velocity of non-standard liquids
22	Input fluid viscosity
23	Select transducer type, 14 types available
24	Select transducer installation method
25	Display transducer spacing
26	Store specific application parameters and setup
27	Store and load saved installation parameters
28	Set what occurs on poor signal, hold last data, selecting” yes” means when there is a poor signal, the meter will display the last correct measured data.
29	Input signal strength when the pipe flow is set to be empty. For example: if 65 is set, when the signal strength is lower than 65, the flow meter displays the flow value as zero.
30	Selects English or Metric Units
31	Selects the instantaneous flow rate units
32	Selects the Totalizer(s) units
33	Selects the totalizer multiplying factor. The default is set it as x1
34	Net totalizer switch (On or Off)
35	Positive totalizer switch (On or Off)
36	Negative totalizer switch (On or Off)
37	Totalizer rest and factory defaults reset Note: all totalizers will be reset to zero if factor default is selected.
38	manual totalizer (the key to control on/off)
39	Select operating language
*40	Damping Level
*41	Programs a low flow velocity cutoff value
42	Setup static zero point
43	Clears zero-point setup and manually setup zero point, restore default before leaving factory.
44	Set up zero-point deviant by hand
45	Meter coefficient (k factor)

Communications Setup

46	Input Network address identification number (IDN)
47	Set up password protection
48	Not used

49	Network communication test, use this window to review the data transferred from upper computer to evaluate problems that arise during communication.
50	Optional setup of data output at scheduled time, choose output content at scheduled time to print
51	Setup time for the data logger
52	Printing data flow direction control.by default printing data will flow directly to the thermal printer when installed... Setup printing data output to outside serial port (RS485 port)
53	Data logger buffer viewer.
54	Not used
55	Not used
56	Not used
57	Not used
58	Not used
59	Not used
60	Date time and setup. The date time of the new flow meter is set by the CPU, when upgrading software, time will be slow, so after upgrading, adjust the date and time to display correctly
61	Software version information and Electronic Serial Number (ESN)
62	setup RS-232 serial port parameters
63	Not used
64	Not used
65	Not used
66	Not used
67	Setup frequency range of frequency output signal. Frequency signal output represent instant flow rate value by signal frequency value.default:0-1000Hz. Max-range:0-999Hz.output frequency signal by special frequency output unit
68	setup lower limit flow of frequency signal output
69	setup upper limit flow of frequency signal output

LCD Display Options

70	LCD back light control
71	LCD contrast ratio control

Misc. Setup Options

72	Working timer, logs up time of the meter
73	Setup lower limit flow that will trigger Alarm #1
74	Setup upper limit flow that will trigger Alarm #1
75	Setup lower limit flow that will trigger Alarm #2
76	Setup upper limit flow that will trigger Alarm #2
77	Keypad beep setup options
78	Setup Open Collector Transistor output (OCT1) output options (Used with M73 and M74)
79	setup relay (OCT2) output options. (Used with M75 and M76)
80	Used to communicate with a second portable unit with RS-232
81	Not used
82	View day/month/year totalizer values
83	Not Used
84	Not Used
85	Not Used
86	Not Used
87	Not Used
88	Not Used
89	Not Used
90	Displays signal strength, signal quality and time ratio
91	Displays the time ratio between the measured transit time and the calculated transit time. Normal value is 100 +/- 3. If reading is not in the is range, check programed pipe parameters
92	Displays the estimated fluid sound velocity
93	Displays total transit time and delta time (transit time difference)
94	Displays estimated Reynolds number
95	Not Used
96	Not Used
97	Saves pipe parameters to data logger or RS-232
98	Records diagnostic information to the data logger or RS-232
99	Records the current display to data logger or RS-232

Other Functions

M+0	Browse the past 64 power on and off cycles with time/date and flow rate at time of power down
M+1	Displays total working time of the unit
M+2	Displays the last power off date and time
M+3	Displays the last power off flow rate
M+4	Displays the last power on time and date
M+5	Calculator
M+6	Not Used
M+7	Not Used
M+8	Not Used
M+9	Not Used
M-0	Factory Only access

: * means common required menus, red color indicates new added or changed functions, blue color indicates the menus related with heat quantity measurement.

3.3 Program Solidification

The TTM-550-P has 3 work parameter areas. Respectively called: present parameter data block, solidification parameter data block, user pipe parameter data block.

The present parameter data block is built into the internal RAM, if power interrupted, the present work parameter will be lost.

The solidification parameter data block is built into the internal FLASH memory of the TTM-550-P, even if all power is lost, this data will remain.

For long term security of application data once all parameters are programmed, the Solidification function parameter M26 is used to save the programmed data from RAM to FLASH. Once this is done, all setup data can be recalled.

The User parameter data block can store up to 9 sets of commonly use pipe data programs. Access to saved data is found in menu item M27.

3.4 Zero-point setup and zero-point saving

When installing transducers for the first time, set the zero-flow point when the fluid flow velocity is zero, and the display is indication a non-zero flow value. This non- zero value will add to the actual flow value of the flow meter under any flow velocity and result in inaccurate instantaneous and total flow data. Adjust the zero point under menu item, M42. The initial zero-point value after adjusting is only stored in RAM parameter area temporarily, is not saved to FLASH memory. If power fails, the zero point will be lost. In order to keep the zero-point value, use the menu item, M02 to store the zero point anytime the zero point is adjusted.

3.5 Analog output calibration function

When programming pipe diameter to zero, display the instant flow velocity: 1.2345678m/s (4.0504 fps), instant flow rate=0, and display “R” status. Programming a set value in menu item M44 can obtain totalizer output changes. Use this function testing of the flow meter and adjustment of network software without connecting transducers.

3.6 Analog input interface as digit input interface function.

The TTM-550-P analog input interface can work as a digital input interface. Note that the loop input current should not be over 20 MA. When the maximum digital voltage is 5V, a 1k resistor should be connected in the return circuit. If the digital voltage is 12V, then series connect a 2k resistor.

3.7 Serial peripheral extension interface function

Serial peripheral extension interface operates like a USB interface, it has input, output, power supply+, power supply-, totally 4 lines. For each measuring, it can output instant flow, instant heat flow, positive total,4-20mA value, frequency value and printing data etc. Different function model can take down data according to requirements. The serial bus use 4800 baud rate.

3.8 Medium identification function

For example: An application is a mixture fluid of oil and water, to dete3rmine the medium in pipe is water or oil, you can input a lower limit for water flow in M+6, it is 1400 m/s for this example. When the fluid flow velocity measured by the flow meter is lower than 1400m/sea an internal signal is created, this information is used to indicate that the fluid is another medium. This signal can then be relayed by OCT or read by MODBUS protocol. You now have an indication of media change so that the two-fluid flow velocities will not overlap.

3.9 Restoring Factory Default

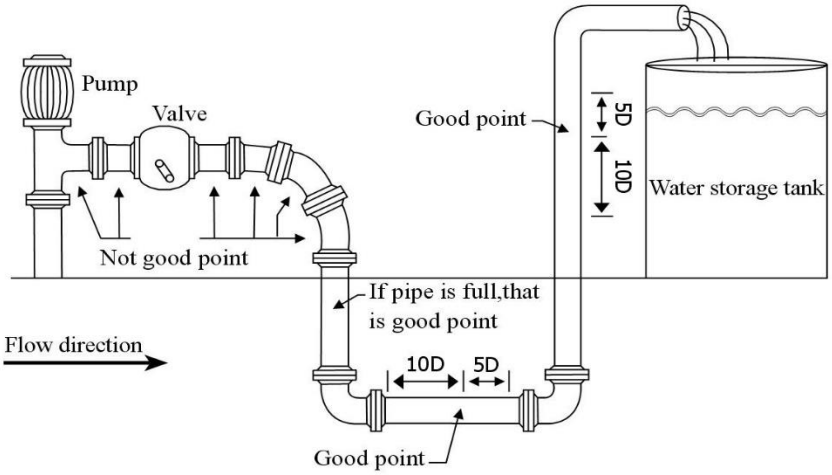
If like to clear all set parameters to restore original factory default, only use serial port or parallel port keyboard to enter M37 to click <•><◀>, so can restore default set parameters before leaving factory. Note: Other than before the first installation, do not use this function. All programmed data will be lost.

4.0 Transducer Installation

The following graphics represent acceptable and undesirable transducer location areas. Keep this in mind when selecting a mounting location. While every situation will not present an ideal situation, select a location where the longest straight runs of pipe are available.

Attention:

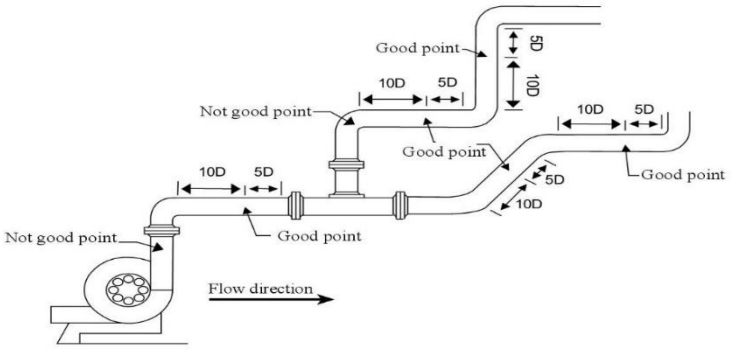
1. Locate transducer in a range of +/-45° of horizontal position of pipe axis.



2. Ensure the enclosure is properly grounded.
3. Avoid installation near flanges, welding beads or reducing couplers
4. Allow enough installation room for ease of work in the installation area.

4.1 Quick Start parameter steps:

The following information will be needed prior to installing the transducers. This information must be programmed into to the transmitter so that the unit can calculate the sensor spacing that is used for transducer placement.



1. pipe outer diameter
2. pipe wall thickness
3. pipe material
4. liner parameter (if has liner, then include liner thickness and sound velocity)
5. fluid types
6. transducers type (The TTM-550-P can support multiple type sensors as well as those from other manufacturers)
7. transducers installation method
8. solidification parameter

4.2 Clamp on Type Transducer Installation

Before installation, determine the transducer installation location and clean the installation area. Remove any rust, lose paint or other anti-corrosion coatings. If the pipe is older, use an angle grinder or wire brush to clear surface occlusions, use a cloth with appropriate solvents or cleaner to remove oil and dust. Once the area is clean apply a tooth-paste size bead of couplant around the center of line of the transducers. Place the transducers on the pipe in the general area of the transducer spacing distance determined by the transmitter. Secure the sensors with the provided pipe bands. Do not initially tighten the band so that the sensors can be moved to get the proper spacing between the transducers. Once the spacing is correct, tighten the bands to provide mechanical support of the sensors. DO NOT over tighten the bands in such a way that the acoustic couplant is lost from in between the face of the transducer and the outside pipe wall.

S2 Small Pipe

M2 Medium pipe

L1 Large Pipe

Transducer	S2	M2	L2
Suitable pipe diameter	0.5”- 4” DN15-DN100mm	2”-48” DN50-DN925mm	48”-236” DN965-DN6000mm
Fluid temperature	-30F~320F -30℃～160℃	-30F~320 F -30℃～160℃	-30F~320F -30℃～160℃
Outer size	1.77”x 1.18” x 1.18” 45×30×30mm	2.36” x 1.77” x 1.77” 60×45×45mm	3.15” x 2.75” x 2.17” 80×70×55mm
Weight	2.6 ounces 75g	8.8 ounces 250g	22.9 ounces 650g

4.3 Installation spacing

Installation spacing of clamp on type transducers is the inner edge distance of the two transducers (face to face), as determined by programming the required parameters in the Quick Start Section. Menu Item M25 will display the sensor spacing.

4.4 Installation method

There are two (2) methods for installing sensors: V method and Z method

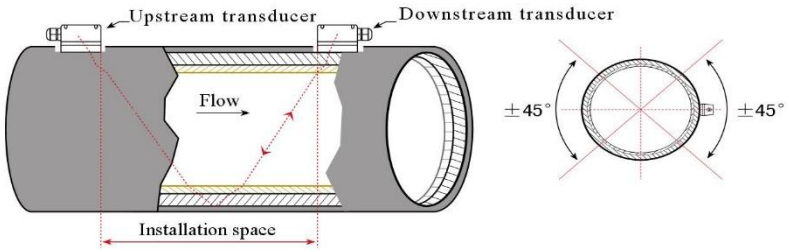
Normally the “V” method is suitable for pipe diameters within the range: 0.75” (DN15)- 8” (DN200mm). When using the “V” method and reading cannot be achieved or the signal is or the signal is low or of poor quality, switch to the Z method. The “Z” should always be used for pipe diameters that are more than 8” (DN200mm) or when measuring Ductile or cast-iron pipes.

4.5 V Method

When appropriate, the “V”method should be used. This method allows for a more precise measurement and alignment of the sensors leading to higher accuracies.

4.6 Z Method

When measuring large pipe diameters or if there are suspended solids in the liquid, suspected scaling or liners inside pipe inner wall, the Z method the recommended installation method.

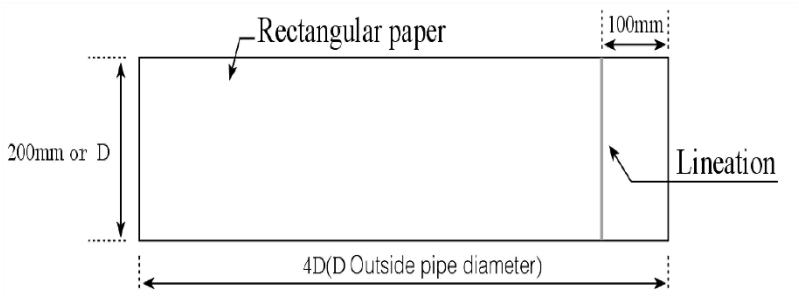


4.7 Pipe Surface Preparation

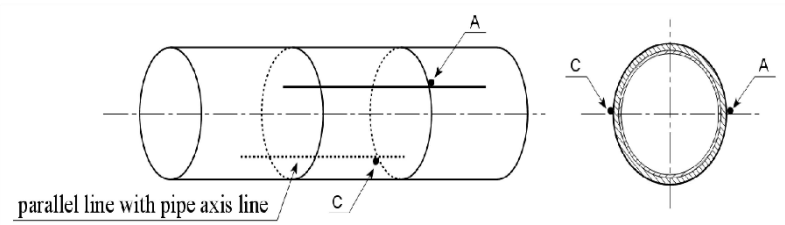
1. When possible, clean the pipe surface down clean metal.
2. After connecting the sensor cable to the sensor, insert the cover cap in the access hole. Tighten properly to prevent moisture and water from entering the body of the sensor.
3. Use the stainless-steel band to mechanically fix the sensors along the center portion of transducers. The band prevents the transducers from moving and provides a solid contact for the face of the sensor and pipe interface.
4. Apply enough acoustic couplant to the face of each sensor and on the area of the pipe where the transducers are to be placed. The couplant should eliminate voids and fill in pitting on the pipe surface that can influence the efficient transmission of signal into the liquid.

4.8 Installation Template

The following is a suggested measuring template that can be used to help align the transducers.

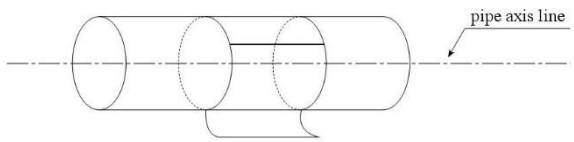


A. Wrap the fixed position paper on the cleaned surface of the pipe, making sure that the two paper sides making sure the two ends are overlapping and aligned. In this way, any reference lines drawn will be parallel with the pipe axis;

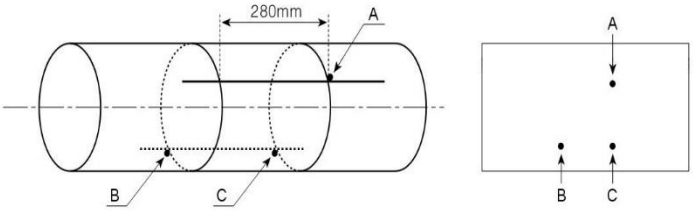


B. Extend a line on the fixed position paper to the pipeline and the cross-point between the vertical side of the fixed position paper and the extended line as shown by A.

C. Starting from A and along the edge of the position paper, the length of half of the pipe perimeter is measured and the cross point is C; then draw a line at C to be parallel to the axis (that is, to be parallel with the line on the position paper);



Removing the fixed position paper and starting from C, the installation space L should be measured along the line, draw on the pipe, the point is B. Thus, A and B are the points where the transducers are to be installed. For example, L=280mm. Then two bases of ball valves should be welded respectively on A and B, making sure the centers of bases overlap A and B respectively.



4.9 Transducer Wiring Diagram The sensors cables are pre-wired and should be connected as shown by color.

4.10 Maintenance

Typically, no maintenance is required for the sensors. The acoustic couplant should be checked periodically to ensure that signal transmission is maintained.

4.11 Checking Transducer Installation

After the transducer installation is complete, the user should check the following items to see whether the installation is suitable.

4.12 Signal Strength

Signal strength S (M90) indicates strength of sending and receiving signals from upstream transducer and downstream transducer indicated by a 3-digit number. [00.0] means there is no signal detected, and [99.9] refers to the maximum signal strength that can be detected. The sensor position can be adjusted both horizontally and vertically to achieve the strongest signal possible. This adjustment allows for slight variances in wall thickness, pipe wall buildup and other similar factors. A signal strength range from 35 to 99 indicates a good installation. If signal strength is observed that is below 35 recheck the programming parameter for the pipe, transducer spacing and acoustic couplant. If a “V” mounting method was used a switch to the “Z” method may be required.

The strongest signal strength should be pursued. The stronger the signal will provide a more accurate and stable measurement result.

4.13 Signal quality (Q value)

Signal quality is indicated as the Q value (M90) this represents the how good the received signal is. TTM-550-P series uses 00-99 range to represent signal quality. 00 represent the worst signal, 99 represent the best signal. Typically, the signal quality should be above 60. Sources of poor signal quality could be EMI or RFI interference, poor installation of transducers. If user supplied cable is used for the sensors, the wrong type of cable can cause this problem also. Poor transducer installation, insufficient couplant or pipe straps that are tightened enough or that have been tightened too much will also cause poor signal quality.

4.14 Total transit time, delta time

The total transit times (up and down stream transmission/receive time) and delta time are displayed on menu window M93. This data can indicate whether the installation is suitable or not, these two parameters are based on the flow meters internal measurement and calculations, When the delta time fluctuates too much, this indicates that the flow velocity is changing very quickly. Under this type of condition, a poor signal quality is typically indicated as well. For applications where liquid velocities vary quickly, transit time technology may not be suitable. If care was not taken to ensure proper preparation of pipe surface was not done, improper transducer installation of the transducers, or wrong parameters were programmed for the application can lead to fluctuating transit time data. Fluctuation of delta time less than ±20％ is normal. Note: For small pipe diameters or very low flow velocity, the fluctuation of delta time may be higher but are still acceptable.

4.15 Transit time ratio

Transit-time ratio (M91) is usually used to check whether the transducer installation space is good. If the pipe parameters are correct and the transducers are installed properly, the transit time ratio should be in the range of 100±3 %. when the ratio is over this range, the following should be checked:

a) Programmed pipe parameters are correct.
b) Actual transducer spacing of the transducers is the same as or close to what shown in M25.
c) If the transducers are installed properly in the same axis plane of pipe.
d) If the mounting location is good, if the pipe has changed shape, or if the pipe is too old (i.e., too much corrosion or liner inside the pipe)?
e) If there is any source of interference near the flow meter?

4.0 Troubleshooting

TTM-550-P incorporates a self-diagnosis function. The errors are displayed on the upper right corner of the menu window via identification code in a timely order. Display any existing errors on M08

Hardware self-diagnosis is conducted every time when power is on. Some errors can even be detected during normal operation. For those errors undetectable due to incorrect settings or improper testing conditions, the flow meter will also display useful information to help the user to quickly debug the error and solve the problems according to following listed methods.

Displayed errors of TTM-550-P have two kinds: one is circuit hardware errors information, arising possible problems and solve method can refer to table 1. if finding problems when power is on, and in the state of measuring, it will display “* Fond the upper left corner of screen. Power on again, check the displayed information, adopts measures according to following table. If the problems still exist, contact manufacture. The other is error information about measurement. Refer to table 2.

5.1 Table 1. Hardware self-diagnosis errors and solutions after power up

LCD display information	Causes	Solution
ROM verification Error	* ROM operation illegal / error	* Contact factory
Logger reading error	* Stored parameters are wrong	*Cycle power Contact the factory
System logger error	* System stored data area has error	*Cycle power Contact the factory

Measuring circuit hardware error	* Sub-CPU circuit errors	*Cycle power Contact the factory
CPU clock speed error	* System timer has errors	* Cycle power Contact the factory
Date time error	* System date and time are wrong	* reset date and time
No Display. Erratic or Abnormal Operation	* Problem with wiring	* check wiring connections.no influence of measuring normally
No response to key pressing	* Keypad is locked * Bad plug connection	* input password to unlock keyboard, or check wiring connections, no influence of measuring normally

5.2 Table2. Working status errors code causes and solutions

code	M08 displaying	Causes	Solutions
*R	System Normal	* normal system	
*J	Circuit Hardware Error	* Hardware problem	* Contact the manufacturer
*I	No Signal	* Unable to receive signal * Loosen contact or not enough couplant between transducer and pipe surface. * Transducers installed improperly * scaling on inner pipe wall is too thick. * new changed liner	*Make sure the transducer is in good contact with pipe surface, the couplant is enough. *Polish the pipe surface and clean the pipe surface. Clear paint, rust. *Check original installation parameter settings *Clear the scaling or change the pipe with thick scaling, normally change to another measurement point that has little scaling, the meter can work normally. * Wait until the liner has been solidified and then test.
*H	lower signal strength received	* lower signal * causes are the same as code “I”	* solutions are the same as code “I” 。
*H	Poor signal quality received	* poor signal quality * include above all caused	* include above all solutions

*E	The current of Current Loop is Over 20mA (not influence the measurement if not using current output)	* 4-20mA current loop output overflow 100% * Improper settings for current loop output 。	* Check current loop settings on M56. or Confirm if the actual flow rate is too high.
*Q	Frequency Output is Over the set value (not influence the measurement if not using frequency output)	* 4-20mA current loop output overflow 120% * Improper settings for current loop output 。	* Check frequency output settings (refer to M66-M69). or Confirm if the actual flow rate is too high. Check the values for 4 ma and 20 ma Engineering Units.
*F	Listed in table 1	*find problems when power on and self-diagnosis *permanent hardware errors	*power on again, check the information showed on screen, handled according to table 1, if not solved, contact manufacturer. *contact manufacturer.
*G	Adjusting Gain >S1 Adjusting Gain >S2 Adjusting Gain >S3 Adjusting Gain >S4 （ displayed on M00, M01, M02, M03 ）	Instrument is in the progress of adjusting the gain to prepare the measurement. If stopped at S1or S2 or switched between S1 and S2, that means the too lower receiving signal or not good wave.	
*K	Empty pipe , setup in M29	No liquid in pipe or incorrect setup.	if there is liquid, input 0 value in M29

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

6.0 Warranty and Service

6.1 Warranty

The products manufactured by Spectra Technologies are warranted to be free from defects in materials and workmanship for a period of one year from the date of shipment to the original purchaser. Spectra Technologies obligation will be limited to restoring the meter to normal operation or replacing the meter, at Spectra Technologies discretion, and shall be conditioned upon receiving written notice of any alleged defect within 10 days after its discovery. Spectra Technologies will determine if the return of the meter is necessary. If it is, the user shall be responsible for shipping costs from the customer to the manufacturer and return.

6.2 Maintenance Service

For operational problems, please contact the technical support department by phone, fax, or email. In most cases, problems can be solved immediately.

For any hardware failure, we recommend our customers return the product for evaluation and service. Please contact the technical support department with the model number and serial number of the unit before sending the unit back to the factory. Both numbers can be found on the product label. For service issues, a Return Materials Authorization (RMA) number will be issued.

Be aware that the cost of repairs can only be determined after receipt and inspection of the instrument. A quotation will be sent to the customer before proceeding with the service. The customer is responsible for the transportation of meters and freight

6.3 Important Notice for Product Return

Before returning the instrument for warranty repair or service, please read the following carefully:

1. If the return item has been exposed to nuclear or other radioactive environment or has been in contact with hazardous material, which could pose any danger to our personnel, the unit cannot be serviced.

2. If the return item has been exposed to or in contact with dangerous materials but has been certified as a hazard-free device by a recognized organization, you are required to supply the certification in-order for service to be performed.

3. If the returned item does not have an RMA# associated with it, the equipment will be returned, and no service will have been performed.