Innova-Sonic®
In-Line Model 206

Liquid Ultrasonic Flow Meter

Instruction Manual

Part Number: IM-206, Rev. B.2, February 2010

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EXPERIENCE OUR PASSION FOR FLOW!

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IMPORTANT CUSTOMER NOTICE

Before installing and operating the flow meter, please read this manual carefully and follow its instructions.

- Sierra has verified the conformity between the contents in this manual and the hardware and software described. However, errors may still exist. We regularly review the materials covered in this manual and correct errors with revisions. Any suggestions for improvement will be appreciated.
- Go to www.sierrainstruments.com/products/downloads.html for a most current electronic version of this manual.
- We reserve the right to change the content of this manual without prior notification.

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WARNINGS IN THIS MANUAL

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

Warnings

"Warning" indicates that ignoring the relevant requirements or precautions may result in personal injury or flow meter damage.

Notes

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

Table of Contents

1 General Description

1.1 Meter &Applications

The Innova-Sonic® In-Line Model 206 consists of a pair of wetted transducers (integrated into a spool piece) and a flow transmitter.（Fig 1.1-1）

The Innova-Sonic® In-Line Model 206 is a state-of-the-art universal transit-time flow meter designed using SLSI (single large scale integration) technology. While principally designed for clean liquid applications, the instrument is tolerant of liquids with the small amount of air bubbles or suspended solids found in most industrial environments. It offers high accuracy, high performance and fast response at a low cost. Product features include:

• Accuracy better than +/-0.5% of reading, Repeatability +/- 0.2% of reading

• Ultrasonic Flow Meter for the detection of the volumetric flow rate of most liquids

• Ultra-precise patented time measurement technology (PicoFly™) measures the transit-time accurately between the upstream and downstream transducers.

• Ideal for any liquid flow measurement application

• Clear, user-friendly menu-driven selections make the flow meter simple and convenient to use and include full diagnostic support to help in troubleshooting and setup

• Excellent zero tracking with no damping. Will measure down to zero flow

• Powder Coated Carbon Steel (150# ANSI or DN PN 10)

• NEMA 4X / IP65 die cast PC/ABS enclosure.

• IP 68 transducer area classification

• Power: 85-265 VAC, 48-63 Hz or 12 to 36 VDC

• Outputs: pulse (1 Hz to 1 Khz), 0/4 to 20mA DC (500 Ohm max), Relay (on/off time <2 msec, max current load 1.2 amps)

• Wide operating temperature range for measured fluid -40F to +176F (-40C to 80C)

• Wide bi-directional Flow range of 0 to 23 fps liquids (0 to 7 mps).

• In-line body sizes from 2.5" to 10" (65mm- 250mm).

1.2 **Dimensions**

The Innova-Sonic® In-Line Model 206 transmitter consists of a transparent polycarbonate lid and a flame resistant ABS (Acrylonitrile Butadiene Styrenede) case. The dimensions are shown in figure 1.2-1:

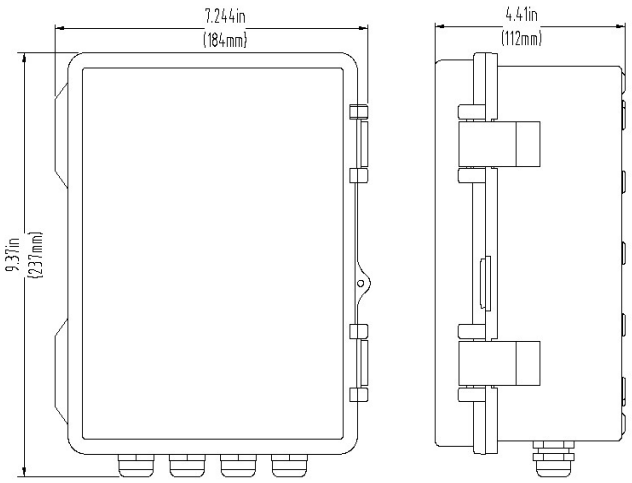


Fig 1.2-1

1.3 Principle of Measurement

When an ultrasonic signal is transmitted through a flowing liquid, there is a difference between the upstream and downstream transit time (travel time or time of flight). This difference is proportional to flow velocity as described by *Equation (1).*

$$\textit{Equation (1)} \quad V = \frac{MD}{\sin 2\theta} \times \frac{\Delta T}{T_{up} \bullet T_{down}}$$

Where:

M	Transit time of the ultrasonic signal
θ	The angle between the ultrasonic signal and the flow
T_{up}	Transit time in the forward direction
T_{down}	Transit time in the reverse direction

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

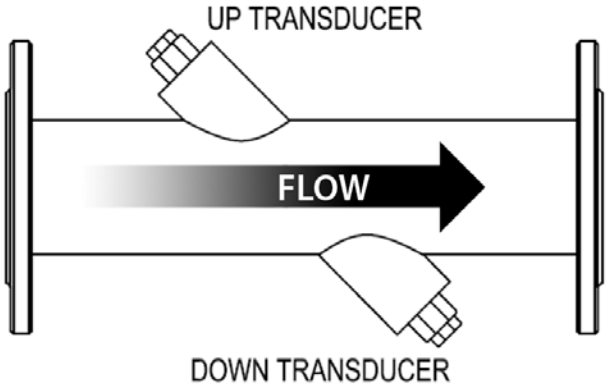


Fig.1.3-1

2 Technical Specifications

Capability	
Flow range	0～±7m/s (0～±23ft/s)
Accuracy	+/- 0.5% of measured value
Repeatability	+/- 0.2% of measured value
Pipe size	Spool piece：2.5”, 3”, 4” 6”, 8”, 10” (DN 65-DN 250)
Function	
Outputs	Current output: 4～20mA DC，maximum load 750Ω Pulse output: 1～10KHz, OCT output Relay output: maximum frequency 1Hz (1A@125VAC or 2A@30VDC)
Power supply	85～265VAC, 48～63Hz or 12～36VDC, 12～24VAC
Keypad	16（4X4）key with tactile action
Display	20×2 liquid crystal bitmap character
Temperature	Transmitter: -14F-140F(-10C-60C) Transducer: -40F to +176F (-40C-80C)
Humidity	Relative humidity 0～99%, non- condensing
Physical features	
Transmitter	Top lid PC material，Die-cast ABS enclosure
Transducer	Encapsulated design Standard cable length: 30ft (9m) standard
Weight	Transmitter: 1.2kg (2.64 pounds) Spool piece transducer: 15kg～67.2kg（DN65～DN250); 33lbs-150 lbs (2.5” – 10”)

3 Installation

3.1 Installing the Transmitter

The transmitter must be installed perpendicularly. There are four mounting holes in the back of the transmitter (Figure 2.1-1)

Install as follows：

1. Select the installation site for the transmitter
2. Install the four (15mm) bolts provided into the rear of the enclosure
3. Drill four bore holes(10×50mm) into the area where you will mount the transmitter (according to the provided template)
4. Install the transmitter to the wall

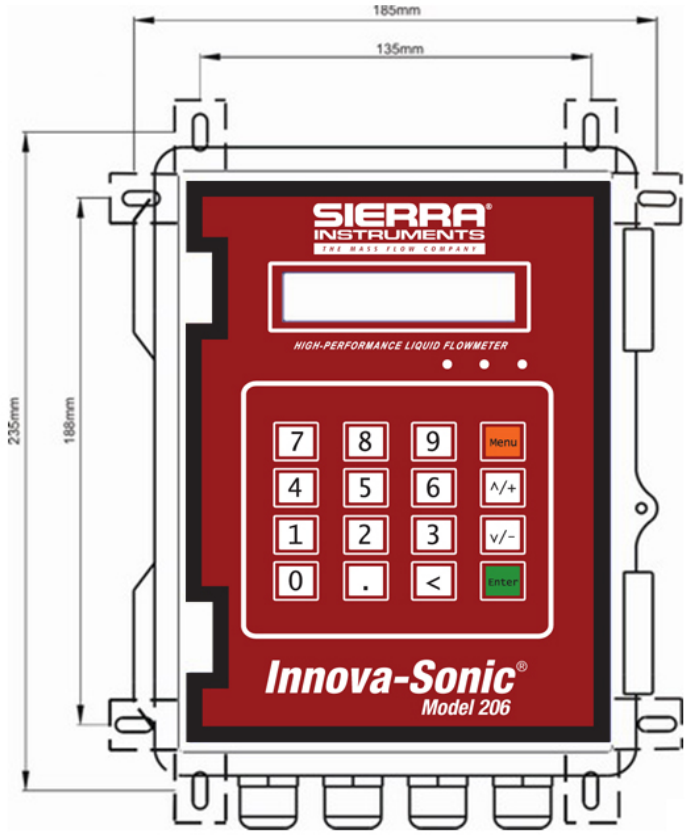


Fig. 2.1-1

3.2 Connecting the Transmitter

The 206 electronics are connected to the spool piece transducer with a coaxial-cable, the core being positive and the outer screen wiring being negative （Fig.2.2-1). The screen wiring material is made of copper with an impedance of 50 ohms; this provides low impedence with high anti-jamming capability.

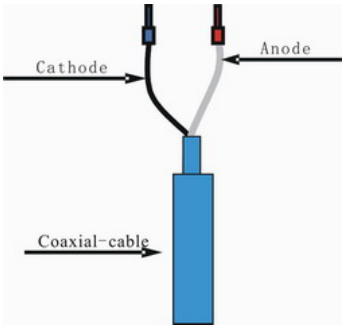


Fig.2.2-1

Connecting the transmitters is divided into two steps:

1) Connecting The Main Board & 2) Connecting Power Supply

Step 1: Connecting The Main Board（Fig.2.2-2）

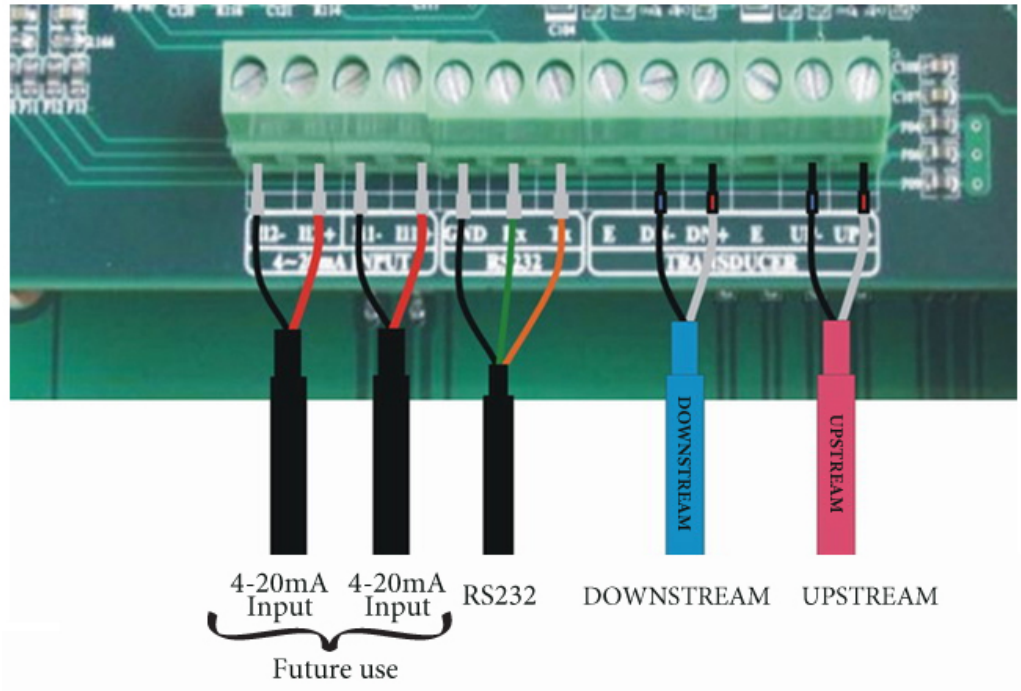


Fig.2.2-2

Note: 4-20 MA INPUTS are reserved for future use

Step 2: Connecting the Power Supply （Fig.2.2-3）

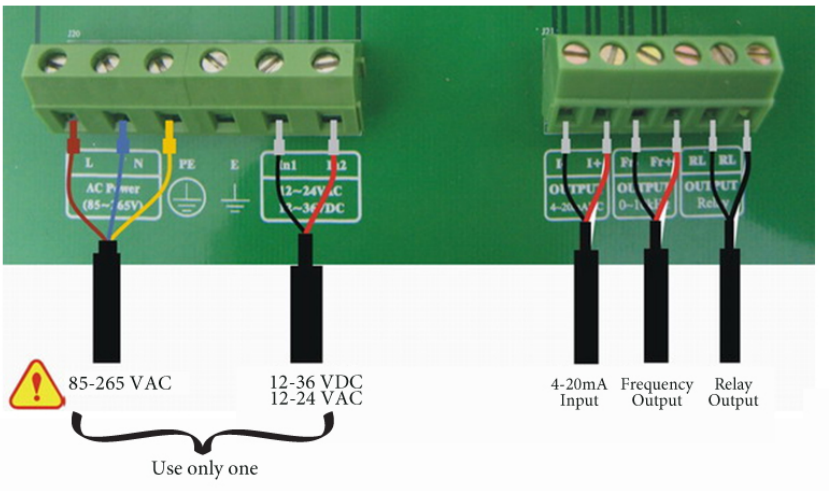


Fig.2.2-3

Warning Disconnect the power supply before making connections.

Warning Be sure to use either AC or DC power supply. Do not connect AC or DC power supply at the same time.

3.3 Measurement Site Selection

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

2. 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.

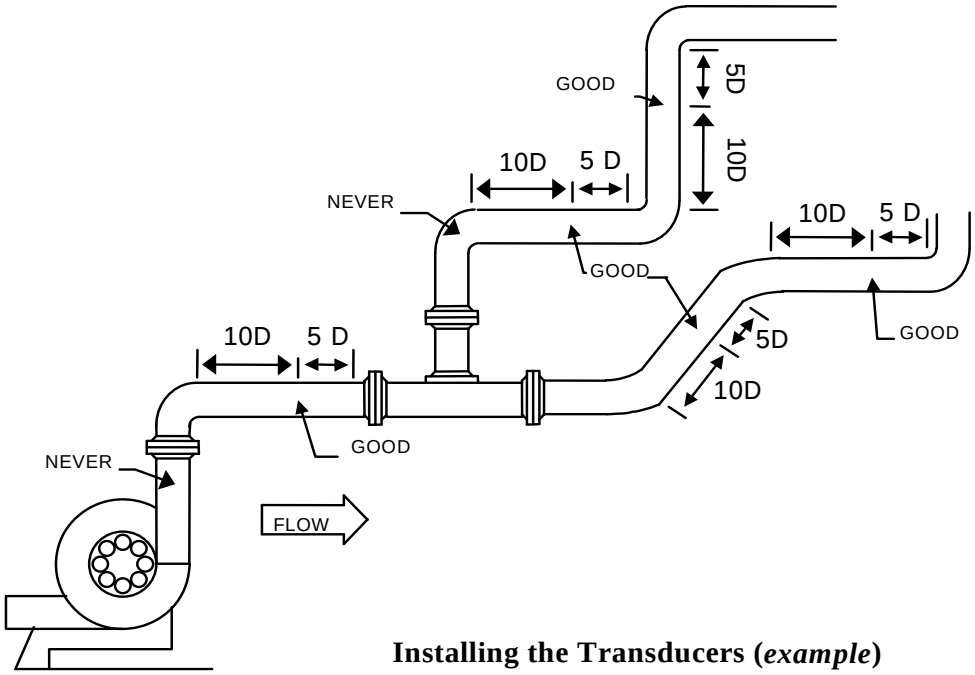
3. The site should have a straight pipe run length equal to at least 10 pipe diameters upstream and 5 pipe diameters downstream from any throttling valves or other flow disturbances, such as pipe reducers, elbows, tees, etc.

4. Ensure that the pipe surface temperature at the measuring point is within the transducer temperature limits.

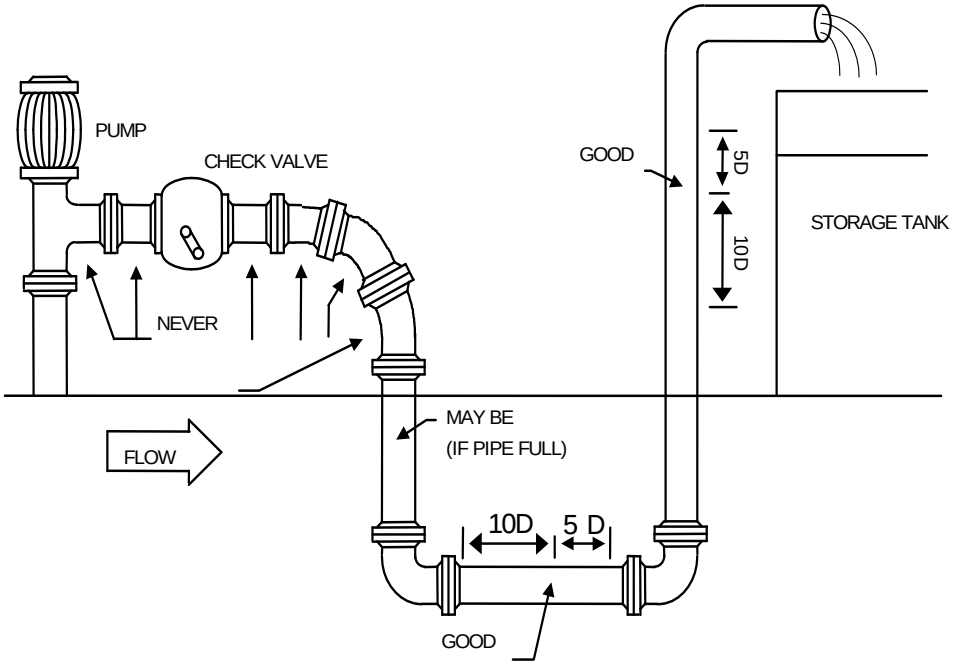
5. Consider the inside condition of the pipe carefully. If possible, select a section of pipe where the inside is free of excessive corrosion or scaling.

6. Install the Model 206 flanged spool into the pipe section to be measured. The transducers have been installed into the spool by the factory.

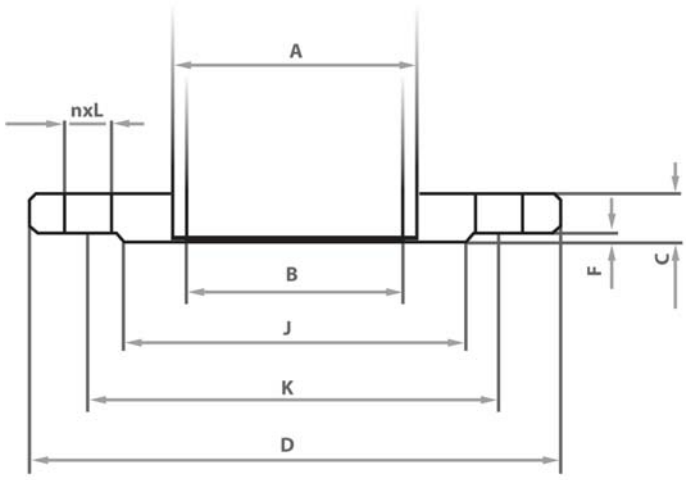
Examples of acceptable measurement site selections are illustrated below.



Installing the Transducers (*example*)

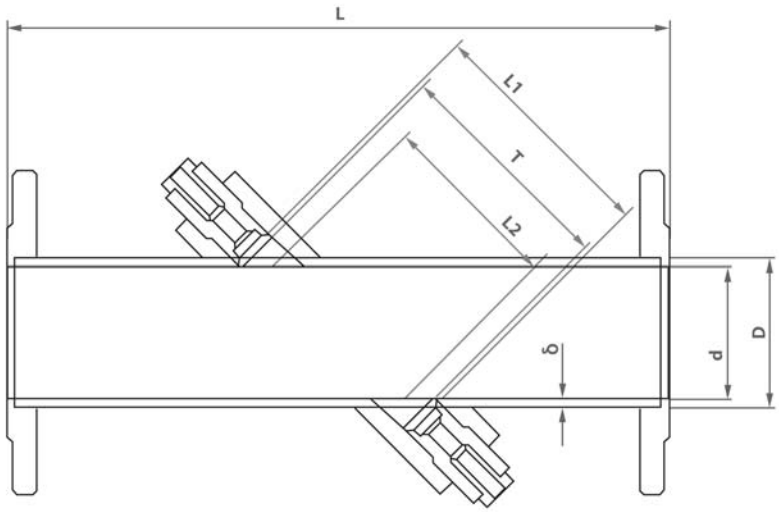


Warning Follow the principles of measurement site selection, or it may cause low signal strength and low signal quality, which will make the measurement inaccurate.



PN1.6MPa(16bar) RF Flange Dimensions (mm)

Current Diameter DN	Steel Tube Outer Diameter A	Connecting Dimension					Raised Face		Flange Thickness C	Flange Inner Diameter B
		Flange Outer Diameter D	Bolt bore's Central Circularity's Diameter K	Bolt Bore's Diameter L	Bolt		J	F		
					Quantity n	Whorl Specification				
65	76	185	145	18	4	M16	118	2	20	78
80	89	200	160	18	8	M16	132	2	20	91
100	108	230	180	18	8	M16	156	2	22	110
150	159	285	240	22	8	M20	211	2	24	161
200	219	340	295	22	12	M20	266	2	26	222
250	273	405	385	26	12	M24	319	2	28	276



Spool Piece Dimensions (in mm)							
Specification	Inner Diameter d	Outer Diameter D	Wall Thickness δ	Installation Length L	Wafer Distance L1	Measurement Length L2	PEI Space Between T
DN65 (2.5”)	65	73	4	400	148.3	91.9	141.1
DN80 (3”)	80	88	4	400	148.3	113.1	141.1
DN100 (4”)	100	108	4	400	176.6	141.4	169.4
DN150 (6”)	150	159	4.5	450	247.3	212.1	240.1
DN200 (8”)	207	219	6	550	327.9	292.7	320.7
DN250 (10”)	259	273	7	600	401.5	366.3	394.3

4 Operating Instructions

4.1 Panel Functions

As shown in Figure 3-1, the Model 206 panel consists of an LCD Display, operational status LCD's and a keyboard. The LCD display is 2 rows by 20 characters with a backlight. The status LCD's show the meter's working status. **SS** indicates **S**ignal **S**trength, **SQ** indicates **S**ignal **Q**uality and **Run** indicates the meter's running status. When operating and working normally, SQ, SS, and Run should all be green.

The Keyboard is used to enter information into the menu windows for setting and display.

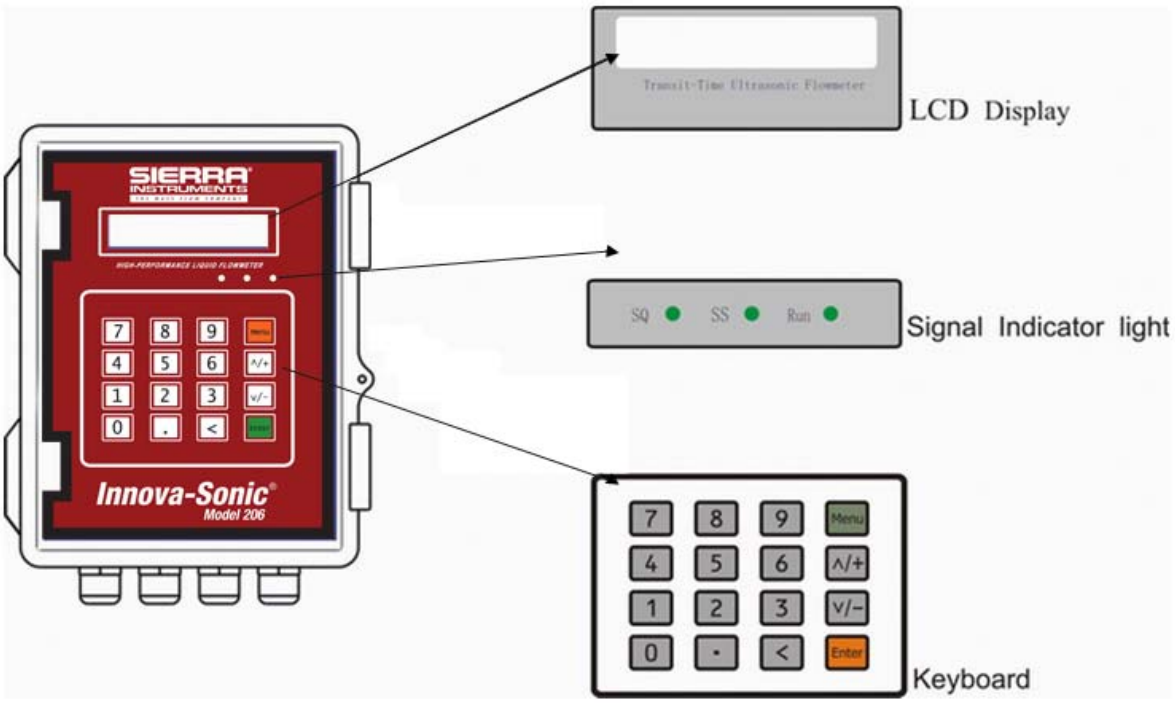


Fig.3-1 Panel Drawing

4.2 Keyboard Operation

The instrument's setup and measurement displays are subdivided into more than 100 independent windows. The operator can input parameters, modify settings or display measurement results by "visiting" a specific window. These windows are arranged by 2-digit serial numbers (including the "+" sign) from 00~99, then to +0, +1, etc. Each window menu number, or so-called window ID code, has a defined meaning. For instance, Window No.21 indicates the parameter input for flow rate / flow velocity, etc.

The keypad shortcut to visit a specific window is to press the Menu key at any time, then input the 2-digit

window ID code. For example, to input or check the pipe outside diameter, just press the Menu 2 1 keys for window ID code 21.

Another way to visit a particular window is to press ^/+, v/- and Enter keys to scroll the screen. For instance, if the current window ID code is NO.68, press ^/+ key to enter Window No.69, press the ^/+ button again to enter Window No.70; then, press the v/- key to back Window No.69, and press the v/- key again to enter Window No.68.

There are three types of windows:

（1）Display，such as Menu 0 0;

（2）Data，such as Menu 2 1;

（3）Setup，such as Menu 2 3。

DISPLAY: For display windows, you will see the corresponding measured values. These values can't be changed. For example, to view the instantaneous flow rate and net totalizer, just press Menu 0 0 and you will see the screen shown below.

DATA: For data windows, you will see the selected parameter. This data may be changed by entering the desired number. Enter the number ,then press the Enter key，then press the Enter key again to confirm. For example, to input the fluid velocity of sound 1485, Press Menu 2 1 to enter menu No. 21 (the numerical value displayed currently is a previous value). Now press Enter key. The symbol ">" and the flashing cursor is displayed at the left end of the second line on the Screen. The new value can be entered then… 4 8 6 2 • 2 0 5, Enter to confirm.

SETUP: For setup windows, you will see the selected pull down menu. To reset it，press key Enter first，then the symbol ">". A flashing cursor will be displayed at the left on the Screen. Then press ^/+ and v/- keys to move the selection, and then press the Enter key to confirm the selection. For example, if the pipe is "DN150"，press key Menu 2 3 to enter Window No.23. and next press Enter key to modify the option. By pressing ^/+ and v/- move to "7. DN150（6"）and press Enter to confirm the selection.

4.3 Menus

The windows for the Model 206 fall into the following categories:

00～09 Flow and Totalizer Displays: displays flow rate, positive total, negative total, net total, velocity, date & time, etc.

10～29 Initial Parameter Setup: allows setup of fluid, velocity of sound, transducer type.

30～39 Flow Unit Options: allows setup of flow units, totalizer units, measurement units, turn totalizer on/off, reset totalizer, etc.

40～49 Setup options: Scale factor, LFCO, Set zero, set damping

50～89 Input and output setup: Current Loop (CL) Mode Select, CL 4mA Output Value, RS-232C Setup, Low FO Flow Rate, etc.

90～99 Diagnosis: Signal strength (Menu 90) Signal quality (Menu 91), RTP Parameter (Menu 92), TOM/TOS*100 (Menu 93), flow sound velocity (Menu 94), total time and delta time (Menu 95), Reynolds number and factor (Menu 96), etc.

Item	Serial number	Menus
Flow Totalizer Display	00	Flow Rate/Net Totalizer
	01	Flow Rate/Velocity
	02	Flow Rate/POS Totalizer
	03	Flow Rate/NEG Totalizer
	04	Time/Flow Rate
Initial Parameter setup		
	20	Fluid Type
	21	Fluid Sound Velocity
	22	Fluid Viscosity
	23	Transducer Type
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	Eliminate set zero & resume
Setup Options	44	Manual Zero Point
	45	Meter modulus and Factor
	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
	62	RS-232C Setup
	67	FO Frequency Range
	68	Low FO Flow Rate
	69	High FO Flow Rate
	70	LCD Backlit Option
	73	Alarm #1 Low Value
	74	Alarm #1 High Value
	75	Relay Output Setup
Diagnoses	90	Signal Strength
	91	Signal Quality
	92	RTP Parameter
	93	TOM/TOS*100
	94	Fluid Sound Velocity
	95	Total Time and Delta
	96	Reynolds Number and Factor

5 Meter Application

5.1 Display Totalizer

Display flow rate and net total

Menu 0 0

Flow Rate / Net Total
Display flow rate and net total.
If the net totalizer has been turned off (refer to Menu 3 4); the net total value displayed is the total prior to its turn off.

Display flow rate and velocity

Menu 0 1

Flow Rate / Velocity
Display flow rate and velocity.

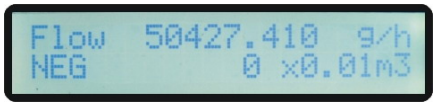
Display flow rate and positive total

Menu 0 2

Flow Rate / Positive Total
Display flow rate and positive total.
Select the positive total units in Window Menu 3 2.
If the positive totalizer has been turned off（refer to Menu 3 5）, the positive total value displayed is the total prior to its turn off.

Display flow rate and negative total

Menu 0 3



Flow Rate / Negative Total
Display flow rate and negative total.
Select the negative total units in Window Menu 3 2.
If the negative totalizer has been turned off（refer to Menu 3 6)，the negative total value displayed is the total prior to its turn off.

Display time and flow rate

Menu 0 4

Time / Flow rate
Display current time and flow rate

5.2 Display Initial Setup

Fluid Type

Menu 2 0

Fluid Type
Select fluid type. The following options are available:

0. Water
1. Sea Water
2. Kerosene
3. Gasoline
4. Fuel Oil
5. Crude Oil
6. Propane、-45C
7. Butane、0C
8. Other
9. Diesel Oil
10. Castor Oil
11. Peanut Oil
12. Alcohol
13. Water 125C

"Other" refers to any fluid. The relevant sound velocity must be entered in Menu 2 1.

Fluid Sound Velocity

Menu 2 1

Enter the fluid sound velocity. It only can be used when item "Other" is selected in Menu 2 0 i.e. it is unnecessary to enter this if the fluid is listed in Menu 2 0.

Fluid Viscosity

Menu 2 2

Fluid Viscosity
Enter fluid's kinematic viscosity. It only can be used when item "Other" is selected in Menu 2 0 i.e. it is unnecessary to enter this ifl the fluid is that listed in Menu 2 0.

Transducer Type

Menu 2 3

Select transducer type. The following transducer types are available.

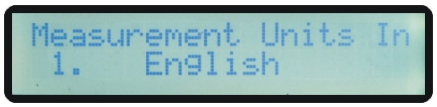
0. DN8 （ 1/4″ ）
1. DN25 (1″)
2. DN40 (1-1/2″)
3. DN50 (2″)
4. DN65 (2-1/2″)
5. DN80 (3″)
6. DN100 (4″)
7. DN150 (6″)
8. DN200 (8″)
9. DN250 (10″)

Note: 0.25" – 2" spool pieces will be a future addition

5.3 Flow Units Option

Measurement Units

Menu 3 0



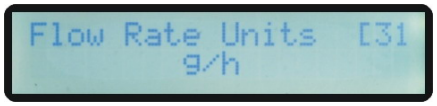
Measurement Units：

0. Metric
1. English

Measurement Units Options
Factory default is metric.

Flow Rate Units

Menu 3 1



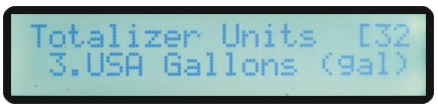
Flow Rate Units Options
Select flow rate units and time units:

0. Cubic Meters(m3)
1. Milliliters(ml)
2. Liters(l)
3. USA Gallons(gal)
4. Million Gallons(mg)
5. USA Barrels(bal)
6. Cubic Feet(cf)
7. Imperial Gallons(gal)

The following time units are available:
/Day
/Hour
/Min
/Sec
Factory default is Cubic Meters/hour.

Totalizer Units

Menu 3 2



Totalizer Units Options

Select totalizer units. The available unit options are as same as those found in Menu 3 1 .The user can select units as required. Factory default is Cubic Meters.

Totalizer Multiplier

Menu 3 3

Totalizer Multiplier Options
The totalizer multiplier multiplies the totalized value. It can be applied to the positive totalizer, negative totalizer and net totalizer at the same time. The following options are available:

0. x 0.001 (1E-3)
1. x 0.01
2. x0.1
3. x1
4. x10
5. x100
6. x1000
7. x10000 (1E+4)

Factory default factor is x1

Net Totalizer

Menu 3 4

ON/OFF Net Totalizer

On/off net totalizer. "ON" indicates the totalizer is turned on, while "OFF" indicates it is turned off. When it is turned off, the net totalizer displayed in Window Menu 0 0 will not change. Factory default is "ON".

Positive Totalizer

Menu 3 5

ON/OFF Positive Totalizer

On/off positive totalizer. "ON" indicates the flow meter is totalizing. When it is turned off, the positive totalizer is displayed in Window Menu 0 2. Factory default is "ON".

Negative Totalizer

Menu 3 6

ON/OFF Negative Totalizer

On/off negative totalizer. "On" indicates the totalizer is turned on. When it is turned off, the negative totalizer is displayed in Menu 0 3.

Factory default is "ON".

Totalizer Reset

Menu 3 7

Totalizer Reset

Totalizer reset: all parameters are reset. Press Enter; move UP or DOWN arrow to select “YES” or “NO”. The following options are available:

None

All

NET Totalizer

POS Totalizer

NEG Totalizer

Manual Totalizer

Menu 3 8

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

5.4 Setup Options

Damping

Menu 4 0

The damping factor ranges from 0.0001～100 seconds.

Damping smooths the display. Its principle is the same as that in a single-section RC filter. The damping factor value corresponds to the circuit time constant. Usually a damping factor of 3 to 10 is recommended.

Low Flow Cutoff Value

Menu 4 1

The Low flow cutoff may be used in order to force a zero display at lower flows in order to avoid incorrect totalization. For instance, if the cutoff value is set at 0.03, the system will force all the measured flow values of ±0.03 to "0". The value of 0.03 is recommending in most applications.

Set Zero

Menu 4 2

When the fluid is in the static state, the displayed value is called the "Zero Point". When the "Zero Point' is not at zero, the difference is going to be added into the actual flow values and measurement differences will occur in the flow meter.

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

Press Enter; wait for the processing instructions at the bottom right corner to reach 0. Performing Set zero with existing flow may cause the flow to be displayed as "0". If so, it can be recovered via Window Menu 4 3.

Reset Zero

Menu 4 3

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

Manual Zero Point

Menu 4 4

This method is not commonly used. It is only suitable for experienced operators to set zero under conditions when it is not preferable to use other methods. Enter the value manually to off set the measured value to obtain the actual value. For instance：

Actual measured value＝250 m^3/H

Value Deviation＝10 m^3/H

206 Display＝240 m^3/H

Normally, set the value as “0”.

Scale Factor

Menu 4 5

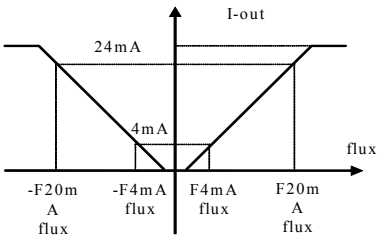
The scale factor is used to modify the measurement results. Factory default is 1. The user can enter a numerical value other than “1” according to calibration results.

Current Loop Mode Select

Menu 5 5

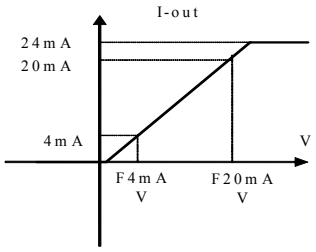
Select the current loop mode. The following options are available:

0	4-20mA vs. Flow	set up the output range from 4-20mA
1	20-4-20mA vs. Flow	set up the output range from 20-4-20mA
2	4-20mA vs.Vel	set up the output range from 4-20mA
3	20-4-20mA vs.Vel	set up the output range from 20-4-20mA

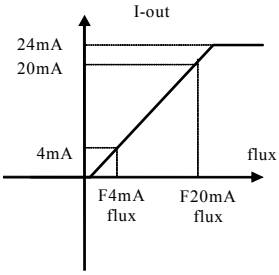


20-4-20mA Export characteristic

Other different current output characteristics are displayed in the above figure 4.1.1. The user can select one of them according to his actual requirements. In the six graphs shown right, flow F_{0mA} or F_{4mA} indicates the value that the user entered in Window Menu 5 7; and flow F_{20mA} indicates the value that the customer entered in Window Menu 5 8. In the 4-20mA and 20-4-20mA modes, F_{0mA}（or F_{4mA}）and F_{20mA} can be selected as a positive or negative flow value as long as the two values are not the same.



4-20mA Export characteristic



4-20mA Export characteristic

Fig.4.4-1CLoutput Characteristic

CL 4mA or 0mA Output Value

Menu 5 6

The flow unit's options are the same as those in Window Menu 3 1.

CL 20mA Output Value

Menu 5 7

Set the CL output value according to the flow value at 20mA. The flow unit is the same as that found in Window Menu 3 1.

CL Check

Menu 5 8

Check the current loop calibration. Press Enter, move ^/+ or v/- separately to display 0mA, 4mA and 24mA, checking with an ammeter to verify that CL output terminals No. 16 and 17 agree with the displayed values. It is necessary to re-calibrate the CL if over the permitted tolerance.

CL Current Output

Menu 5 9

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

Time & Data Setting

Menu 6 0

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

Software Version and ESN

Menu 6 1

Display software version and **E**lectronic **S**erial **N**umber (ESN) of the instrument. **This ESN is unique to each Model 206 flow meter.** The ESN is for Factory setup and for end-user management.

RS232C Setup

Menu 6 2

Setup the RS232 to communicate with other equipment. The first data in the window indicates the baud rate which can be chosen 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 115200.

Factory default is "9600"

Set FO Frequency Range

Menu 6 7

Ranges from 1-9999Hz. Factory default is0~10 KHz.

Low FO Flow Rate

Menu 6 8

Set up low FO flow rate, i.e. the corresponding flow value when output signal frequency is at the lowest FO frequency.

High FO Flow Rate

Menu 6 9

Enter the high FO flow rate, i.e. the corresponding flow value when frequency output signal is at highest FO frequency.

LCD Backlit Option

Menu 7 0

Select LCD backlit controls.

"Always On" indicates that the backlight remains lit constantly; "Always Off" indicates that the backlit remains off constantly. Select "Lighting For" "n" seconds; it indicates that the backlight will automatically turn off after pressing the buttons for "n" seconds. This function is recommended as it saves energy (keeping the backlight off will prolong battery life).

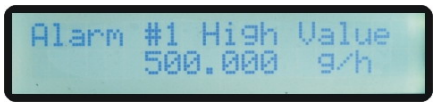
Alarm #1 Low Value

Menu 7 3

Enter the low alarm value. Low flow will activate the alarm in the OCT hardware or relay output signal.

Alarm #1 High Value

Menu 7 4



Enter the high alarm value. High flow will activate the alarm in the OCT hardware or relay output signal.

Relay Output Setup

Menu 7 5

Set up the relay output signal options. The relay is single-pole and RELAY constant-on for external instrument controls.

The following options are available:

0. No signal
1. Poor signal
2. Reverse Flow
3. AO Over 100%
4. FO Over 100%
5. Alarm #1
6. Batch Control
7. POS Int Pulse
8. NEG Int Pulse
9. NET Int Pulse
10. ON/OFF via RS-232
11. NOT Used

5.5 Diagnostics

Signal Strength

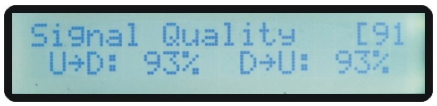
Menu 9 0

Display the measured signal strength for upstream and downstream transducers.

Signal strength is indicated from 00.0～99.9. A reading of 00.0 indicates no signal detected, while 99.9 indicates maximum signal strength.

Signal Quality

Menu 9 1



Display the measured signal quality for upstream and downstream transducers.
Signal quality Q is indicated by 00～99. Therefore, 00 is the poorest signal while 99 indicates the best signal.

RTP Parameter

Menu 9 2

Signal quality Upstream & Downstream transducers is indicated by -100～+100. The smaller the D value the better.

TOM/TOS*100

Menu 9 3

Displays the ratio between the actual measured transit-time and the calculated transit-time according to the user requirement. Normally the ratio should be 100±3%. If the difference is too large, the user should check that the parameters are entered correctly, especially the sound velocity of the fluid and the installation of the transducers. **This data is of no use before the system is ready.**

Fluid Sound Velocity

Menu 9 4

Display the measured fluid sound velocity. Normally this value should be approximately equal to the entered value in Window Menu 2 1. If the difference is too large, it probably results from an incorrect value entered in window Menu 2 1 or improper installation of the transducers.

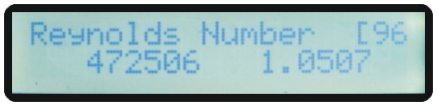
Total Time and Delta Time

Menu 9 5

Display the measured ultrasonic average time (unit: us) and delta time of the upstream and downstream (unit: ns) time. The velocity calculation in the Model 206 is based on the two readings. The delta time is the best indication that the instrument is running steadily. Normally the fluctuation of the ratio of the delta time should be lower than 20%. If it is not, it is necessary to check if the transducers are installed properly or if the parameters have been entered correctly.

Reynolds Number and Factor

Menu 9 6



Display the Reynolds number that is calculated by the Model 206 and the factor that is set currently by the flow meter. Normally this scaling factor is the average of the line and surface velocity factor inside the pipe.

6 Serial Interface Network Use and Communications Protocol

6.1 Overview

The Model 206 has a digital communications protocol. Its hardware directly supports a modem. It can also be connected through an RS232 port.

Two basic schemes can be chosen for networking, the analog current output method using only the 4-20 output from the Model 206 or the RS232 communication method via the serial port of the Model 206. The former is suitable to replace dated instruments in old monitoring networks. The later is used in new monitoring network systems. It has advantages such as low hardware investment and reliable system operation.

When the serial port communication method is directly used to implement a monitoring network system, the address identification code of the flow meter is used as network address code. In this case, the analog current loop and OCT output of the Model 206 can be used to control the opening of a control valve. The relay output can be used to power-on/off other equipment. The analog input of the system can be used to input signals such as pressure and temperature. The system provides an RTU function for flow measurement.

RS-232C（0~15m）can be directly used for data transmission for a short distance. MODEM can be used in medium or long distance transmission.

When the Model 206 is used in a network environment, various operations can be performed at the host device, except for programming of the address identification code, which needs to be done at the Model 206 keyboard.

The command answer mode is used in data transmission, i.e. the host device issues commands and the flow meter answers correspondingly.

6.2 Serial Port Definitions

PIN 1	empty
PIN 2	RXD receive
PIN 3	TXD send
PIN 4	empty
PIN 5	ground
PIN 6	empty
PIN 7	empty
PIN 8	empty
PIN 9	empty

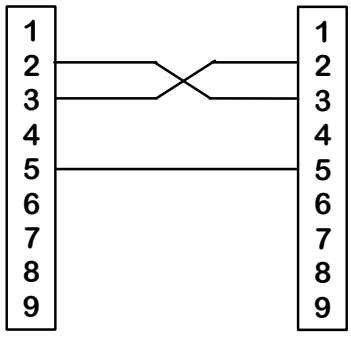


Fig.5-1 Serial Port Definitions

6.3 Direct Connection via RS232 to the Host Device

See the above Fig.5-1

6.4 Communication Protocol Use

The host device requests the flow meter to answer by sending a “command”. A data character string is used to express basic commands and a carriage return character (cr) is used to express the end of the command. The characteristic is that the length of data is flexible. Frequently used commands are as follows:

Table 5-1 Communication commands

Command	Description	Data format	
EQ(cr)	Return instantaneous flow	±d.dddddd E±dd(cr)	
EV(cr)	Return instantaneous velocity	±d.dddddd E±dd(cr)	
EF(cr)	Return frequency output	±ddddddd E±d(cr)	
EU(cr)	Return totalizer flow	ddddddddd(cr)	
ES(cr)	Return signal strength	Sud=ddd% Sdu=ddd%(cr)	
EC(cr)	Return signal quality	Qud=ddd% Qdu=ddd% (cr)	
ET(cr)	Return current date &time	yy-mm-dd,hh:mm:ss(cr)	
EN(cr)	Return electronic serial number	dddddddd(cr)	
MBS d(cr)	(bps)Baud Rate	d=0:1200 d=1:2400 d=2:4800 d=3:9600 d=4:14400	d=5:19200 d=6:28800 d=7:38400 d=8:57600 d=9:115200
MDP dd(cr)	Damp	Dd=0-99(cr)	
MKC d.ddddd(cr)	Kc	d.ddddd=0.70000-1.30000	
MQM ddd.ddd(cr)	Flowmax	ddd.ddd(7bits in length)decimal figure	
MQC ddd.ddd(cr)	Flowcut	ddd.ddd(7bits in length)decimal figure	
MTZ ddd.ddd(cr)	t0	ddd.ddd(7bits in length)decimal figure	
MDZ ddd.ddd(cr)	td0	ddd.ddd(7bits in length)decimal figure	
MAZ ddd(cr)	Val_4mA	dddd=1-1999	
MAF ddd(cr)	Val_20mA	dddd=2000-4095	
MRZ ddd(cr)	Rxbeg-min	ddd=0-800	
MRF ddd(cr)	Rxbeg-max	ddd=0-900	
MFU d(cr)	Flow unit	d=0:m d=1:mL(ml) d=2:L（l） d=3:gal（gal） d=4:Mgal	d=5:bal(bal) d=6:cf d=7:igal d=8:ib（ib） d=9:ob（ob）
MTU d(cr)	Time unit	d=0:hr(hour) d=1:sec(sec)	d=2:min(min) d=3:day(day)
MDD yy-mm-dd(cr)	Date	yy-mm-dd(cr)	
MTT hh:mm:ss(cr)	Time	hh:mm:ss(cr)	
MFZ(cr)	Automation Flow Zero（td0）		
SDB(cr)	(reset)Debugging sign		
STD(cr)	Totalizer reset		
SSN ddddddddd(cr)	Electronic serial number input	dddddddd(8bits in length)integers without expression	
SFX(cr)	Electronic serial number solidiy		

Notes：

0. (cr) expresses carriage return.
1. “d” expresses 0-9 number. 0 value is expressed as +0.000000E+00.
2. “d” expresses 0-9 numbers. There is no decimal point in integral part before “E”.
3. Eight “dddddddd” expresses the electronic serial number of the machine.
4. If there are multiple Model 206 flow meters in a data network then the basic commands cannot be used alone. Otherwise, multiple flow meters will answer simultaneously, which will causes chaos in the system.

7 Troubleshooting

The Model 206 has advanced self-diagnostics functions and displays any errors in the upper right corner of the LCD via codes in a date/time order. Hardware error diagnostics are usually performed upon each power on. Some errors can be detected during normal operation. Undetectable errors caused by incorrect settings and unsuitable measurement conditions can be displayed accordingly. This function helps to detect the errors and determine causes quickly; thus, problems can be solved in a timely manner according to the solutions listed in the following table.

Table 5-1. Self-diagnoses and error solutions (upon power on)

LCD Display	Cause	Solution
Rom Parity Error	* System ROM illegal or error	* Contact the factory
Stored Data Error	* System stored data block error	* Power on again or contact the factory
SCPU Fatal Error!	* SCPU circuit fatal error	* Power on again or contact the factory
Timer Slow Error Timer Fast Error	* System clock error	* Contact the factory
CPU or IRQ Error	* CPU or IRQ problem	* Power on again
System RAM Error	* System RAM questionable	* Power on again or contact the factory
Time or Bat Error	* System date time chip error	* Power on again or contact the factory
No Display, Erratic or Abnormal Operation	* Bad wiring connection	* Check wiring connections