

SITELAB INSTRUMENTS

SL3488

In-Line Ultrasonic Flowmeter with Wall Mount Electronics Instruction Manual

SITELAB

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The Model SL3488 Wall Mount Ultrasonic Flowmeter (hereinafter referred to as SL3488) is a state-of-the-art universal transit-time flowmeter designed using PICOFLY technology and with differentiate rate is 0.01 ns; the flux sampling speed has achieved 1000 each seconds, which designed for industry or business. It compared with the general flowmeter and other ultrasonic flowmeter, has prominent characteristics such as high accuracy, high credibility, high performance, high response speed and low cost.

Ultrasonic flowmeter's flux measuring accuracy nearly can't be affected by the flux temperature, pressure, viscosity, density and other parameters, and it also be designed un-touch and portable flowmeter, so it can solve the problems which other flowmeter can't measure such as high causticity , can't electric, radioactivity and flammability and burst medium fluids. On the base of on-touch catachrestic and compound with logical electron circuitry, the flowmeter could apply in multi-pipe diameter and multi-range of measuring. Other flowmeter's capability application can't achieve the ultrasonic flowmeter's and the ultrasonic has more and more attached importance to the domain and it come into being series, currency developing trends. We have made different track meters with standard, high temperature, prevent burst, humid type which are applied in the different mediums, different situations and different pipelines for measuring flux.

Thank you for choosing SIERRA ultrasonic flowmeter.

Before your operation, please read carefully the reference manual. If you make a mistake there will be affected the meter's working and reduce the meter's life or cause some malfunctions.

The following is the contents of SL3488; please consult with your needs.

The information will be continued renovated.

n Security Notice Proceeding

Before your installation, wiring (connecting), circulate maintain and inspect the meter, you must needs to read the celerity reference manual which can help you accurately operate the meter. At one time please know well the correlation information about equipment, the security and all notices.

The security notices are divided two by its grade, which as following:

 **Warning** Mistake will cause un-safety happening, such as death or GBH accident.

 **Notice** Mistake will cause un-safety happening, such as middling tension hurt , boo-boo or property losing etc.

Even if under the “notices”, there will come out grievous accidents because of the different conditions. So all the notice and warning are important, you must needs to stand by them.

Correlative information of installation

 **Notice** Avoid the smash fabric, sheet, wood bits , dust, metal and other eyewinker intrude into transducer.

Correlative information of wiring

 **Warning** Please confirm the parameters of power supply and rating voltage are or not consistent with the connected power supply, rating voltage and other specifications.

About operation

 **Warning** Don't maintain and checkup, in other words don't replace fittings without assigner's permission .Please use insulated tool.

About disuse



Notice

Avoid the smash fabric, sheet, wood bits; dust, metal and other eyewinker intrude into transducer. Please don't install and operate the outer or inside of scathing transducer.

Other



Warning

Strictly prohibit refit.

General Notice

- Ø Some illustrations of manual that the illustrations are on the condition of backout lid or safety screen, just illustrate for the details. Some available functions may not be included in this manual. In the service or installation of new devices, however, we nor our distributors assume no liability for the consequences of providing such functions.

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1.1 General Description

1.2 Composing & Application

The SL3488 consists of a wetted transducer integral with its own pipe section, and a flow transmitter.

(Fig 1.1-1)



Fig 1.1-1

The Model SL3488 Ultrasonic Flowmeter (hereinafter referred to as SL3488) is a state-of-the-art universal transit-time flowmeter designed using SLSI technology. While principally designed for clean liquid applications, the instrument is tolerant of liquids with small amounts of air bubbles or suspended solids found in most industrial environments. It compared with the general flowmeter and other ultrasonic flowmeter, has prominent characteristics which are not only with high accuracy, high credibility, high performance, high response speed, low cost but also with the following characteristics.

1. It is designed using SLSI technology which with few hardware, low voltage, low power loss, high reliability, anti-jamming and good applicability. User dispense with any modulating circuit, you can use the meter which with optimized aptitude signal as the same as using multimeter conveniently and easily.
2. Windows software design. Users can easily set up the pipe size, pipe materiel, fluid type, output signal and other parameters through windows operating. Metric and English units are both available.
3. The seven digit full-bottomed positive direction, negative direction and net tantalizer flux of multi-factorial work in double harness. I t could achieve control fix quantity by its fix quantity control.
4. The SL3488 designed with 0.01ns high differentiate, high linearity, high steady-going capability measurement circuit and 32 members figure processing procedure , which can ensure the meter with much high differentiate and high range of measurement. While principally designed for clean liquid applications, the instrument is tolerant of liquids with small amounts of air bubbles or suspended solids found in most industrial environments, such as water industry, chemical industry, pharmaceuticals,

district heating supply, mine, power plant ,oil and chemical etc.

1.3 Dimension

The SL3488 transducer's crust consists of transparent lid (made by PC material) and shell (made by ABS material). PC with the characteristics as, high strike intension, steady dimension, achromaticity transparent, good bepaint, good isolation and is able to bear causticity and attrition. ABS with the characteristics as, good rigidity, high strike intension, good mechanism intension, good wiring and is able to bear heat, microtherm and chemical medicine. The dimensions for it are shown in figer1.2-1:

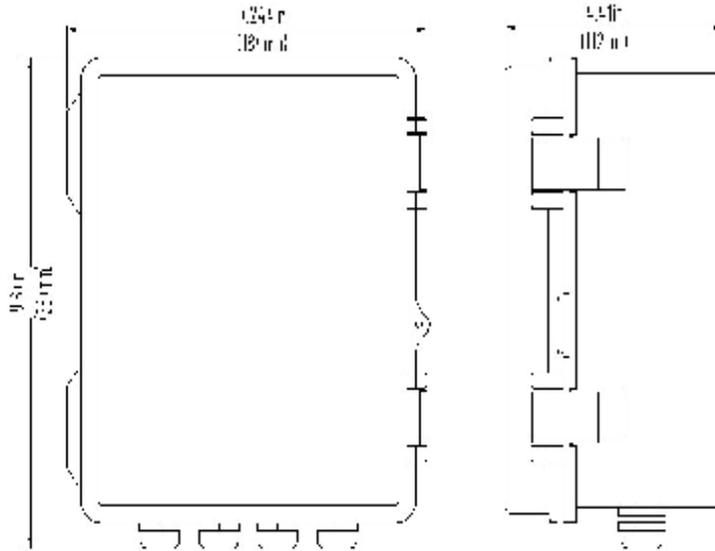


Fig.1.2-1

1.4 Principle of Measurement

Ultrasonic flowmeter adopts the time difference principle of measurement. When the ultrasonic signal is transmitted through the flowing liquid, there will be a difference between the upstream and downstream transit time (travel time or time of flight), which is proportional to flow velocity, according to this to measure the fluid's velocity of flow. (Fig.1.4-1)

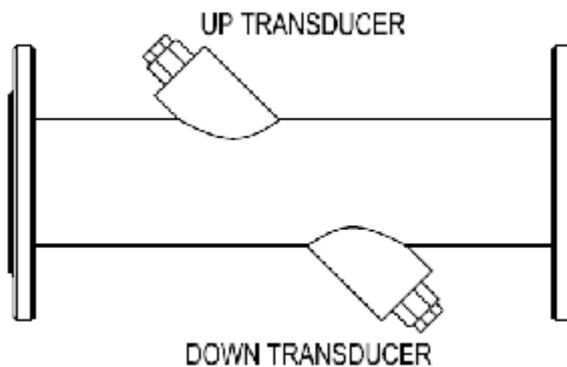


Fig.1.4-1

The different site of the pipe, the different velocity of flow and the middle of the pipe's velocity is much faster than the close with pipe mural velocity. The velocity of flow's section distributing illustration shows the distributing of the fluid in the pipe's velocity of flow. Thinking over the influence of the velocity of flow's section distributing, you can figure out the average velocity of flow. Then you can accord the pipe's section area figure out the fluid's cubage flux.

2 Technical Specification

Capability	
Flow range	0~±7m/s (0~±23ft/s) Pressure ≥0.1MPa
Accuracy	±0.5% of measured value
Repeatability	0.2% of measured value
Pipe size	Spool piece: DN25~DN250
Function	
Outputs	Simulate output: 4~20mADC, 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: -10℃~60℃ Transducer: -40℃~80℃ (Standard)
Humidity	Relative humidity 0~99%, non- condensing
Physical features	
Transmitter	Top lid with PC material, Die-cast ABS enclosure
Transducer	Encapsulated design Standard cable length: 30ft (9m) standard
Weight	Transmitter: 1.2kg Spool piece transducer: 5.8kg~67.2kg (DN25~DN250)

3 Installation

The chapter introduces the installation steps of SL3488.

Customers should check –up the meter and spare parts are whether or not consistent with packing list, the meter’s shell whether or not attains, any screws brush off, and the wiring became flexible. If you found it, please restitute. When the meter can’t be used normally, please contact with us or the dealer.

3.1 Installing the Transmitter

The transducer must be riveted in a perpendicularity objects, such as metope.

There are four bores in the transducer’s DOS shell sole, please be riveted one aspect of the matter of the installing auris in the four bores, and the other aspect of the matter of the installing auris riveted in the perpendicularity objects. (Figure2.1-1)

The steps of installation as following:

1. Selecting the installing site of transmitter
2. Riveted the four installing aurises in the bores of the meter’s rear shell by (15mm) bolt.
3. According to the site of installing auris, drill four bores ($\phi 10 \times 50\text{mm}$) in the fixing-face.
4. Strike the gluey stopper into the bores ($\phi 10 \times 50\text{mm}$).
5. Riveted the box with installing auris in the solidity surface by four (50mm) screws.

Notes: The installing auris must be horizontal or perpendicularity.

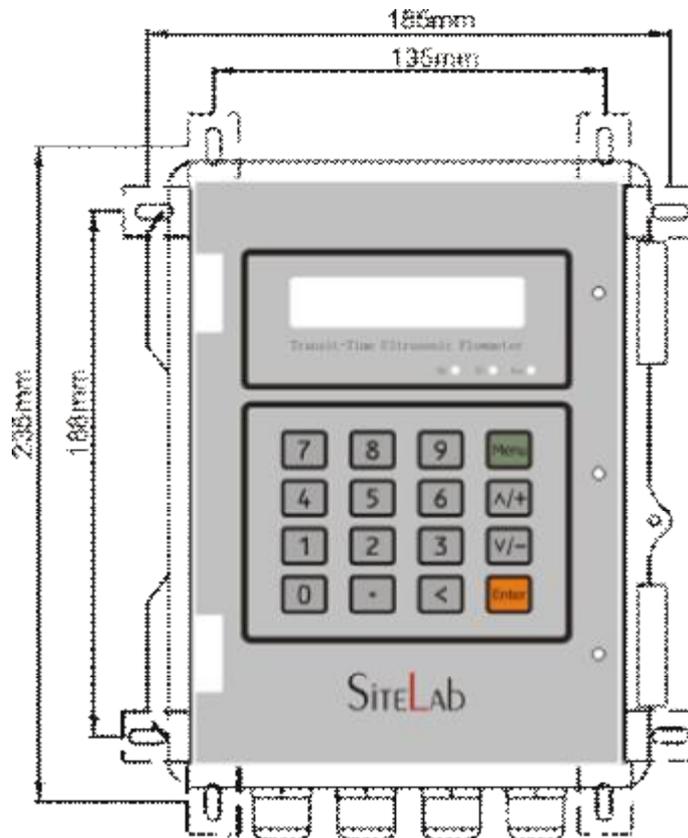


Fig.2.1-1

3.2 Connecting the Transmitter

Cable explain of SL3488

SL3488 Transmitter and spool piece transmitter both connecting with the coaxial-cable, the core wiring connect with positive pole and the outer screen wiring connect with negative pole (Fig.2.2-1). The screen wiring's material is made by the multi-copper and its character is impedance 50(such as, RG-8、RG-58etc.); This wiring is with high velocity of transfer and high anti-jamming capability.

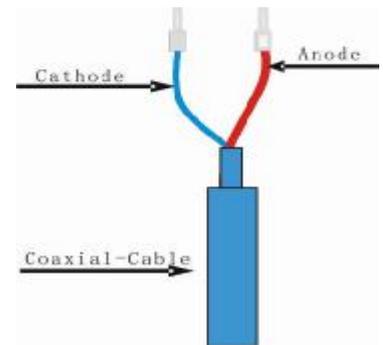


Fig.2.2-1

Connecting transmitter is divided into two parts as following:

Connecting mainboard (Fig.2.2-2)

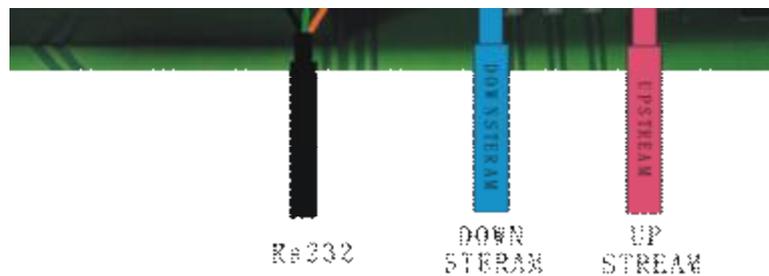


Fig.2.2-2

Connecting power supply (Fig.2.2-3)

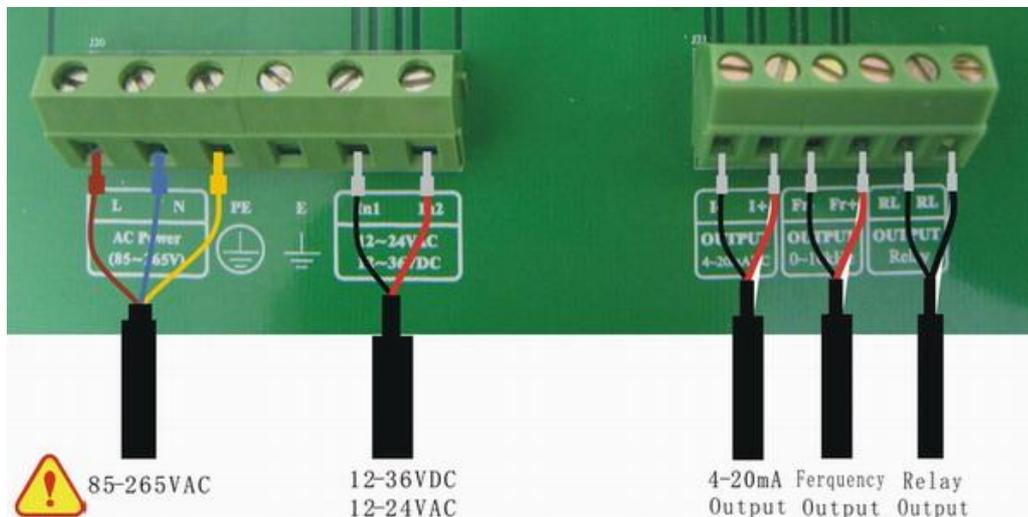


Fig.2.2-3

**Warning**

Disconnect the power supply before making connections. Before operating it, you must make the meter be grounding credible.

**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

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 when to select a proper measurement installation site:

Choose a section of pipe, which is always full of liquid, such as a vertical pipe with flow in the upward direction or a full horizontal pipe.

The 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 disturbance producing elements, such as pipe reducers, elbows, tees, etc.

Ensure that the pipe surface temperature at the measuring point is within the transducer temperature limits. Consider the inside condition of the pipe carefully. If possible, select a section of pipe where the inside is free of excessive corrosion or scaling.

Choose a section of sound conductive pipe.

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

Examples acceptable measurement site selections are illustrated on the figure below.

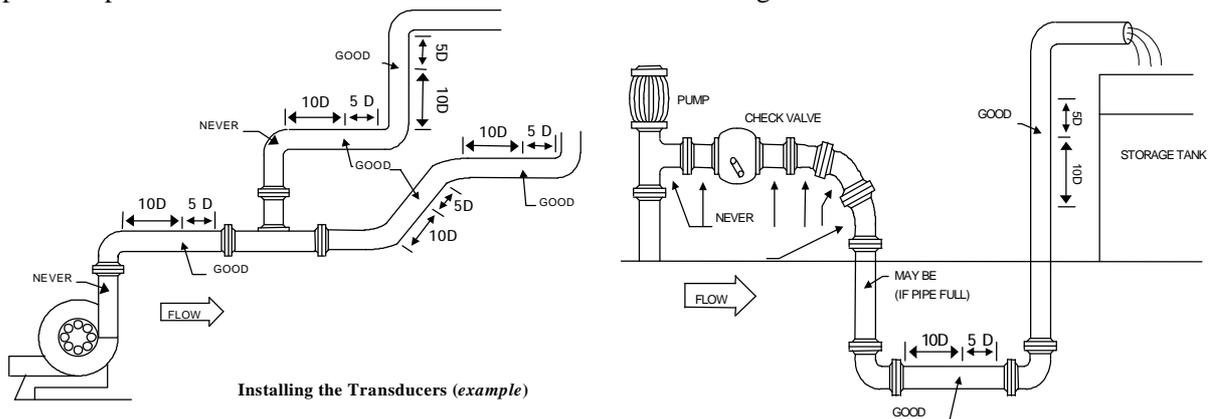


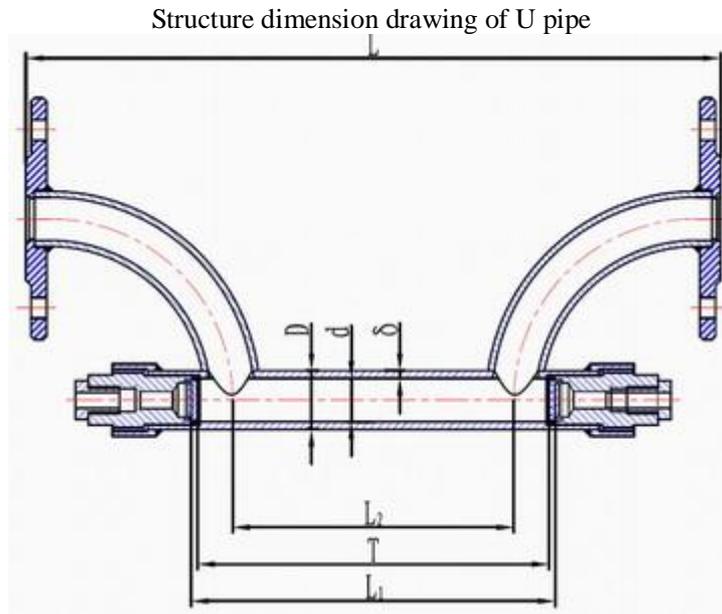
Fig. 2.3-1 Examples acceptable measurement points

**Warning**

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

3.4 Installation spool piece transducer

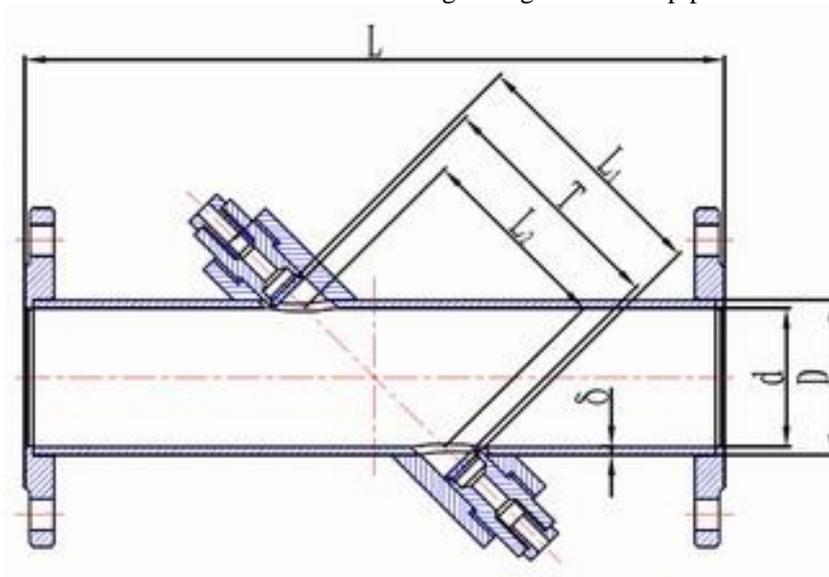
The pipe is made of carbon steel material, when you installing the transducer, make the transducer fixup in the installing bores. Structure dimension drawing of pipe and flange as following:



Main dimension confirmed form of U pipe

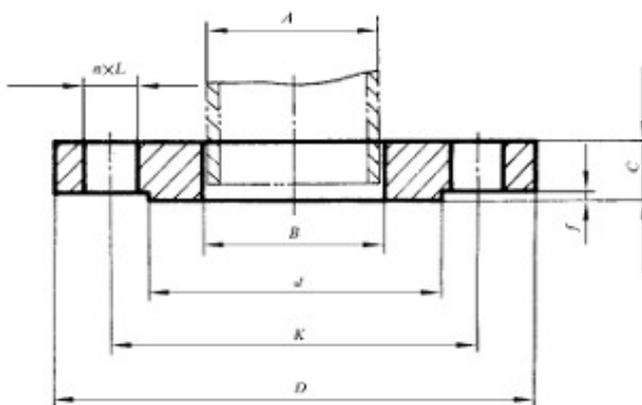
Specification	Inner diameter d	Outer diameter D	wall thickness δ	Installation length L	wafer distance L1	Measurement length L2	PEI space between T
DN25	25	34	4.5	400	207.2	175	200
DN40	40	48	4	450	246	198.8	238.8
DN50	50	60	5	500	259.2	202	252

Structure dimension drawing of angle insertion pipe



Structure dimension drawing of angle insertion pipe							
Specification	Inner diameter d	Outer diameter D	Wall thickness δ	Installation length L	wafer distance L1	Measurement length L2	PEI space between T
DN65	65	73	4	400	148.3	91.9	141.1
DN80	80	88	4	400	148.3	113.1	141.1
DN100	100	108	4	400	176.6	141.4	169.4
DN150	150	159	4.5	450	247.3	212.1	240.1
DN200	207	219	6	550	327.9	292.7	320.7
DN250	259	273	7	600	401.5	366.3	394.3

RF steelness flange



PN1.6MPa(16bar) RF steelness flange's form

Recognized current diameter DN	Steel tube outer diameter A		Connecting dimension					Airproof cover		Flange thickness C	Flange inner diameter B	
	Series I	Series II	Flange outer diameter D	Bolt bore's central circularity's diameter K	Bolt bore's diameter L	Bolt		d	f		Series I	Series II
						Quantity Z	Whorl specification					
25	33.7	32	115	85	14	4	M12	65	2	16	34.5	33
40	48.3	45	150	110	18	4	M16	84	2	18	49.5	46
50	60.3	57	165	125	18	4	M16	99	2	20	61.5	59
65	76.1	76	185	145	18	4	M16	118	2	20	77.5	78
80	88.9	89	200	160	18	8	M16	132	2	20	90.5	91
100	114.3	108	230	180	18	8	M16	156	2	22	116	110
150	168.3	159	285	240	22	8	M20	211	2	24	170.5	161
200	219.1	219	340	295	22	12	M20	266	2	26	221.5	222
250	273	273	405	385	26	12	M24	319	2	28	276.5	276

4 Operating Instructions

4.1 Panel Function

Shown in Figure 3-1, the SL3488 panel consists of an LCD Display, operational LCDs and keyboard. LCD is 2 row 20 characters with backlight, which can show the values of measurement, totalizer and setting, etc. The LCDs show the meter's working status. SS indicates signal strength, SQ indicates signal quality, Run indicates meter's running status. When operating and working normally, SQ, SS, Run show green light. Keyboard is used to enter into the windows for seeing and setting.

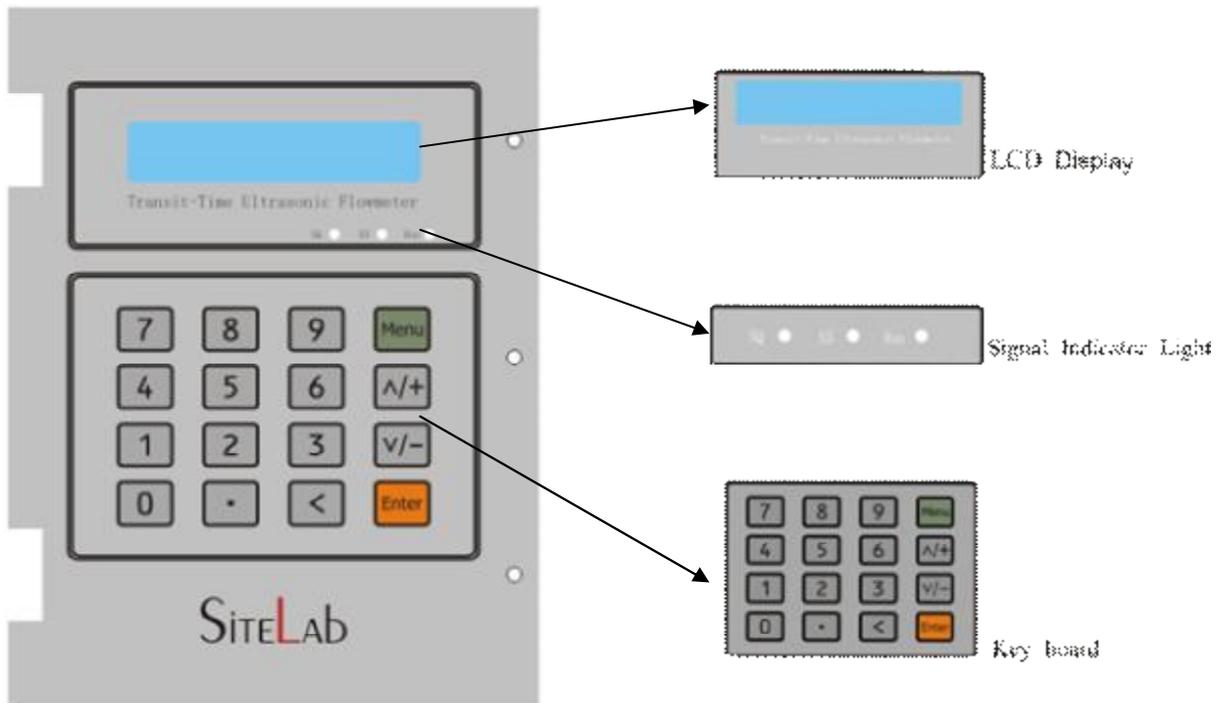


Fig.3-1 panel drawing

4.2 Keyboard operation

With all of the parameters entered, the instrument setup and measurement displays are subdivided or consolidated 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 “+” sign) from 00~99, then to +0, +1, etc. Each window serial 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 instance, to input or check the pipe outside diameter, just press the **Menu** **2** **1** keys for window ID code 21.

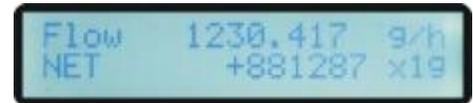
Another way to visit a particular window is to press **^/+**, **v/-** and **Enter** keys to scroll the screen. For instance, if the current window ID code is NO.69, press **^/+** key to enter Window No.68, press the **^/+** button again to enter Window No.67; then, press the **v/-** key to back Window No.68, and press the **v/-** key again to enter Window No.69.

There are three types of window, as following:

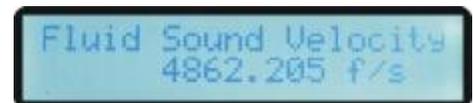
- (1) Display, such as **Menu** **0** **0** ;
- (2) Data, such as **Menu** **2** **1** ;

(3) Selecting, such as   .

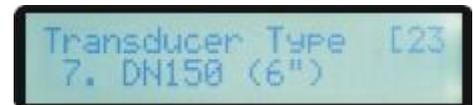
Visiting the display window, first of all should see the corresponding menus. Such as looking over the instantaneous flow rate and net totalizer, just press    key directly.



Visiting the data window, first of all should see the corresponding menus. If reset the data, just press the data key directly, then press  key, or press  key, then press data key, and press  key to confirm. Such as input the fluid velocity of sound 1485, the procedure is as follows: Press    keys to enter into No. 21 (the numerical value displayed currently is a previous value). Now press  key. The symbol “>” and the flashing cursor are displayed at the left end of the second line on the Screen. The new value can be entered then        ,  to confirm.



Visiting the selecting window, first of all should see the corresponding menus. If reset it, press key  first, then the symbol “>” and the flashing cursor are displayed at the left on the Screen. Then press  and  keys to move the selection, and then press  key to confirm the selection. Such as, the pipe is “DN150”, press key    to enter Window No.23. Then press  key to modify the option. By pressing  and  move to “7. DN150 (6 ”) and press  to confirm the selection.



4.3 Menus

The SL3488 has the unique feature of windows processing for all operations. These windows are assigned as follows:

- 00~09 Flow Totalizer Display: To display flow rate, positive total, negative total, net total, velocity, date & time, etc.
- 10~29 Initial Parameter Setup: To input into fluid velocity of sound, transducer type.
- 30~39 Flow Units Options: To select the flow units, totalizer units, measurement units, turn totalizer on/off, reset totalizes, etc.
- 40~49 Setup options: Scale factor, etc.
- 50~89 Input and output setup: 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	9.	Resume initial 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
	39	Sensor Adjust
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
	46	Network IDN
	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
	Diagnoses	70
73		Alarm #1 Low Value
74		Alarm #1 High Value
75		Relay Output Setup
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

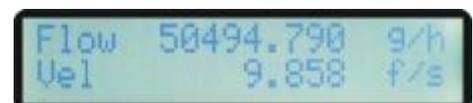


Flow Rate / Net Total

Display flow rate and net total.

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

Display flow rate and velocity



Flow Rate / Velocity

Display flow rate and velocity.

Display flow rate and positive total

Menu 0 2

Flow 50465.430 g/h
POS 7799 x0.01m3

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 50427.410 g/h
NEG 0 x0.01m3

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

00-02-23 23:16:56
Flow 50357.300 g/h

Time / Flow rate

Display current time and flow rate

5.2 Display initial setup

Fluid Type

Menu 2 0

Fluid Type [20
0 . Water

Fluid Type

Select fluid type. The following options are available:

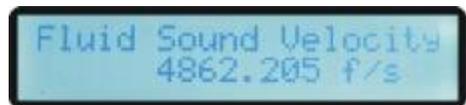
0. Water
1. Sea Water
2. Kerosene
3. Gasoline
4. Fuel Oil
5. Crude Oil
6. Propane、-45°C

7. Butane, 0°C
8. Other
9. Diesel Oil
10. Castor Oil
11. Peanut Oil
12. Alcohol
13. Water 125°C

“Other” refers to any fluid. The relevant sound velocity must be entered in   .

Fluid Sound Velocity

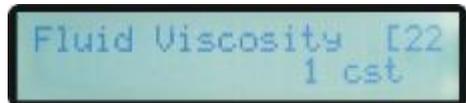


Fluid Sound Velocity
4862.205 f/s

Enter the fluid sound velocity. It only can be used when item “Other” is selected in    i.e. it is unnecessary to enter all the fluids listed in   .

Fluid Viscosity



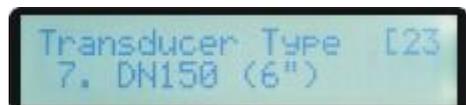
Fluid Viscosity [22]
1 cst

Fluid Viscosity

Enter fluid’s kinematics viscosity. It only can be used when item “Other” is selected in    i.e. it is unnecessary to enter all the fluids that listed in   .

Transducer Type



Transducer Type [23]
7. DN150 (6")

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")

5.3 Flow Units Option

Measurement Units

Menu 3 0

Measurement Units In
1. English

Measurement Units:

0. Metric
1. English

Measurement Units Options
Factory default is metric.

Flow Rate Units

Menu 3 1

Flow Rate Units [3]
g/h

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 [32]
3.USA Gallons (gal)

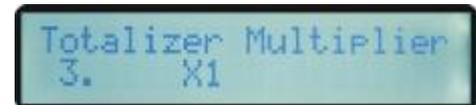
Totalizer Units Options

Select totalizer units. The available unit options are as same as those found in .The user

can select units as their required. Factory default is Cubic Meters.

Totalizer Multiplier

Menu 3 3



Totalizer Multiplier
3. X1

Totalizer Multiplier Options

The totalizer multiplier acts as the function to increase the totalizer indicating range. Meanwhile, the totalizer multiplier 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



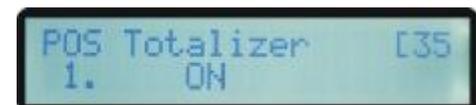
NET Totalizer [34]
1. ON

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 displays in Window Menu 0 0 will not change. Factory default is “ON”.

Positive Totalizer

Menu 3 5



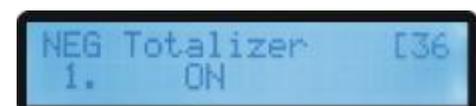
POS Totalizer [35]
1. ON

ON/OFF Positive Totalizer

On/off positive totalizer. “ON” indicates the flowmeter starts to totalize the value. When it is turned off, the positive totalizer displays in Window Menu 0 2. Factory default is “ON”.

Negative Totalizer

Menu 3 6



NEG Totalizer [36]
1. ON

ON/OFF Negative Totalizer

On/off negative totalizer. “On” indicates the totalizer is turned on.

When it is turned off, the negative totalizer displays in Menu 0 3.

Factory default is “ON”.

Totalizer Reset

Menu 3 7



Totalizer Reset? [37
Selection

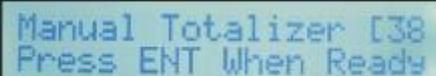
Totalizer Reset

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

0. None
1. All
2. NET Totalizer
3. POS Totalizer
4. NEG Totalizer

Manual Totalizer

Menu 3 8

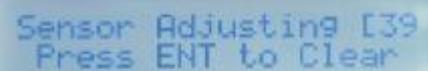


Manual Totalizer [38
Press ENT When Ready

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

Sensor Adjusting

Menu 3 9



Sensor Adjusting [39
Press ENT to Clear

This window uses in the sensor signal compensation adjustment. When  window demonstrated the sensor pairs when the value is lower than 20, may adjust  to carry on compensates.

5.4 Setup Options

Damping

Menu 4 0



DAMPING [40
1 sec

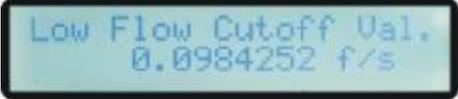
The damping factor ranges from 0.0001~100 seconds.

Damping functions to display the data smoothly. Its principle is as 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 in applications.

Low Flow Cutoff Value

Menu 4 1

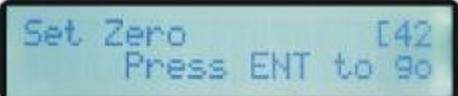


Low Flow Cutoff Val.
0.0984252 f/s

The Low flow cutoff may be used in order to make the system display a “0” value at lower and smaller flows to avoid incorrect totalization. For instance, if the cutoff value is set as 0.03, system will take all the measured flow values of ± 0.03 as “0”. Usually 0.03 is recommending in most applications.

Set Zero

Menu 4 2



Set Zero [42]
Press ENT to go

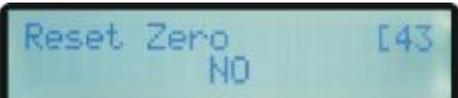
When fluid is in the static state, the displayed value is called “Zero Point”. When “Zero Point” is not at zero in the flowmeter, the difference is going to be added into the actual flow values and measurement differences will occur in the flowmeter.

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 ; 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  4 3.

Reset Zero

Menu 4 3

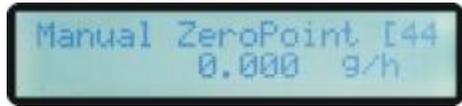


Reset Zero [43]
NO

Select “YES”; reset “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 add to the measured value to obtain the actual value. For instance:

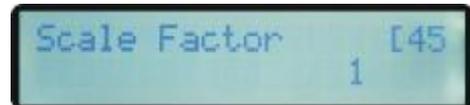
Actual measured value = 250 m³/H

Value Deviation = 10 m³/H

SIERRASL3488 Display = 240 m³/H

Normally, set the value as “0”.

Scale Factor



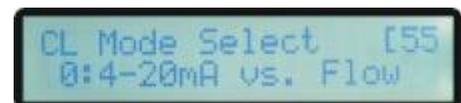
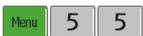
The scale factor is used to modify the measurement results. Factory default is 1. The user can enter a numerical value other than “1” according to calibration results.

Network IDN

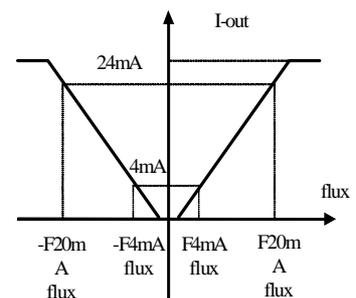


Input system identifying code, these numbers can be selected from 0~65535 except that 13 (0DH ENTER), 10 (0AH Newline), 42 (2AH *) and 38 (26H&) are reserved. System IDN is used to identify the flowmeter to a network.

CL Mode Select

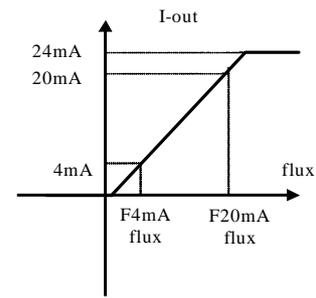


Select the current loop mode. The following options are available:
 0 4-20mA vs.Flow set up the output range from 4-20mA

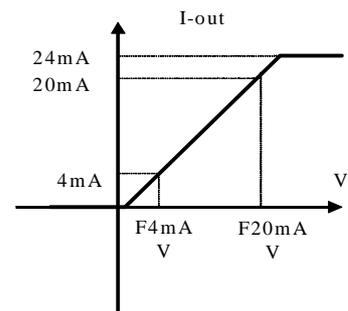


20-4-20mA Export characteristic

- 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



4-20mA Export characteristic



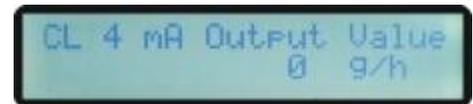
4-20mA Export characteristic

Other different current output characteristics are displayed in above figures. The user can select one of them according to his actual requirements. In six graphs shown right, flow F_{0mA} or F_{4mA} indicates the value that user entered in Window Menu 5 7; and flow F_{20mA} indicates the value that 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.

Fig.4.4-1 CL output Characteristic

CL 4mA or 0mA Output Value

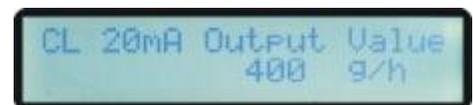
Menu 5 6



The flow unit's options are as same as those in Window Menu 3 1. Once "velocity 4-20mA" is selected in Window Menu 5 5, the unit should be set as m/s.

CL 20mA Output Value

Menu 5 7



Set the CL output value according to the flow value at 20mA. The flow unit is the as same as that found in Window Menu 3 1. Once "velocity 4-20mA" is selected in Window Menu 5 5, the unit should be set as m/s.

CL Check

Menu 5 8

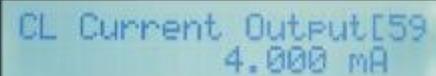


CL Verification
Press ENT When Ready

Check if the current loop has been calibrated before leaving the factory. Press , move  or  separately to display 0mA, 4mA till 24mA, and at the same time, check 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

 5 9

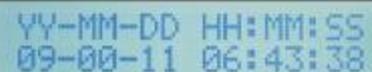


CL Current Output[59]
4.000 mA

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

Time & Data Setting

 6 0

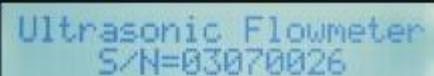


YY-MM-DD HH:MM:SS
09-00-11 06:43:38

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

Software Version and ESN

 6 1



Ultrasonic Flowmeter
S/N=03070026

Display software version and electronic serial number (ESN) of the instrument. This ESN is the only one assigned to each SL3488 flowmeter ready to leave the factory. The factory uses it for files setup and for management by the user.

RS232C Setup

 6 2

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

Factory default is “9600”

Set FO Frequency Range

Menu 6 7



It must be higher than the low FO frequency.

The following options are available:

0. 0→1000Hz
1. 0→2000Hz
2. 0→5000Hz
3. 0→10000Hz

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

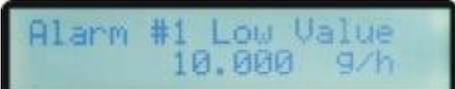
Menu 7 0

Select LCD backlit controls.

“Always On” indicates that the backlight remains lit constantly; “Always Off” indicates that the backlight remains off constantly. Select “Lighting For” for “n” seconds; it indicates that the backlight will automatically turn off after pressing the buttons for “n” seconds. This function saves energy (for an instrument, keeping the backlight off will prolong battery life).

Alarm #1 Low Value

Menu 7 3

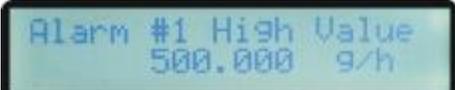


Alarm #1 Low Value
10.000 g/h

Enter the low alarm value. Any of the measured flow, which is lower than the low value, will activate the alarm in the OCT hardware or relay output signal.

Alarm #1 High Value

Menu 7 4

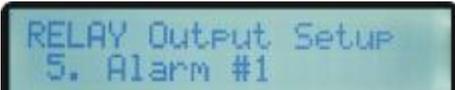


Alarm #1 High Value
500.000 g/h

Enter the high alarm value. Any of the measured flow, which is higher than the high value, will activate the alarm in the OCT hardware or relay output signal.

Relay Output Setup

Menu 7 5



RELAY Output Setup
5. Alarm #1

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 Using

5.5 Diagnoses

Signal Strength

Menu 9 0

Signal Strength [90]
U→D: 86% D→U: 86% T: 0

Display the measured signal strength for upstream and downstream.

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

Signal Quality [91]
U→D: 93% D→U: 93%

Display the measured signal quality for upstream and downstream.

Signal quality Q is indicated by 00~99. Therefore, 00 indicates the poorest signal while 99 indicates the best signal.

RTP Parameter

Menu 9 2

RTP Parameter [92]
UD: -63 DU: +91 D: 46

Signal quality UD and DU is indicated by -100 ~ +100. The smaller the D value is the better.

TOM/TOS*100

Menu 9 3

TOM/TOS*100 [93]
97.157 %

Display the ratio between the actual measured transmits time and the calculated transmit time according to customer's requirement. Normally the ratio should be $100 \pm 3\%$. 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

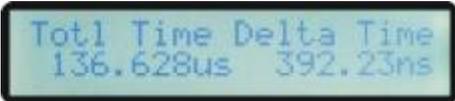
Menu 9 4



Fluid Sound Velocity
4862.205 f/s

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

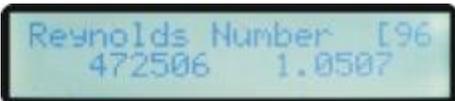
Total Time and Delta Time



Total Time Delta Time
136.628us 392.23ns

Display the measured ultrasonic average time (unit: nS) and delta time of the upstream and downstream (unit: nS) time. The velocity calculation in the SIERRASL3488 is based on the two readings. The delta time is the best indication that the instrument is running steadily. Normally the fluctuation in 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



Reynolds Number [96
472506 1.0507

Display the Reynolds number that is calculated by the SL3488 and the factor that is set currently by the flowmeter. 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 SIERRASL3488 has communication protocol. Its hardware directly supports a modem, a composition of flow data monitoring system that is economical, reliable and based on telephone line transmission. It can also be connected through a RS232 change-over panel.

Two basic schemes can be chosen for networking, i.e. the analog current output method only using the SL3488 or the RS232 communication method via serial port directly using the SL3488. 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 flowmeter is used as network address code. Thus analog current loop and OCT output of SL3488 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 link for a short distance. MODEM can be used in medium or long distance transmission.

When the SL3488 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 SL3488 keyboard.

The command answer mode is used in data transmission, i.e. the host device issues commands and the flowmeter 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

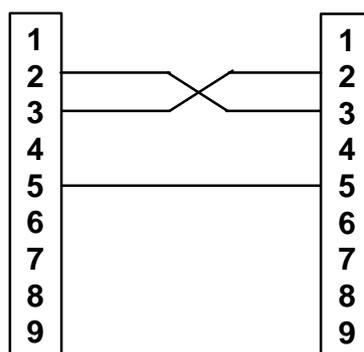


Fig.5-1 serial port definitions

6.3 Direct Connection via RS232 to the Host Device

See the above Fig.5-1

6.4 Communication Protocol and the Use

The communication protocol format used by the SL3488 ultrasonic flowmeter is an expanded set of the Fuji FLV series flowmeter protocol. The host device requests the flowmeter to answer by sending a “command”. A data character string is used to express basic commands and a carriage return character 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
DQD(cr) *0	Return daily instantaneous flow	±d.dddddE±dd(cr) *1
DQH(cr)	Return hourly instantaneous flow	±d.dddddE±dd(cr)
DQM(cr)	Return instantaneous flow per minute	±d.dddddE±dd(cr)
DQS(cr)	Return instantaneous flow per second	±d.dddddE±dd(cr)
DV(cr)	Return instantaneous velocity	±d.dddddE±dd(cr)
DI+(cr)	Return positive accumulative flow	±d.dddddE±d(cr) *2
DI-(cr)	Return negative accumulative flow	±d.dddddE±d(cr)

DIN(cr)	Return net increment	±d(5)E±d(cr)
DID(cr)	Return identification code of instrument (address code)	ddd(5)(cr) 5 bits in length
DL(cr)	Return signal intensity	UP:dd.d, DN:dd.d, Q=dd(cr)
DS(cr)	Return percentage of analogous output (AO)	±d(5)E±dd(cr)
DA(cr)	Alarm signal of OCT or RELAY	TR:s, RL:s(cr)
DT(cr)	Current date and time	yy-mm-dd, hh:mm:ss(cr)
M@(cr)	Analogous key value @ sent to SL3488	M@(cr)
LCD(cr)	Return currently displayed content on current LCD display	
ESN(cr)	Return electronic serial number	ddd(5)dt(cr)(lf) *3
W	Networking command prefix of numeric string address	

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 “ddd(5)dt” express electronic serial number of the machine.
4. If there are multiple SL3488 flowmeters in a data network then the basic commands cannot be used alone. Otherwise, multiple flowmeters will answer simultaneously, which will causes chaos in the system.

7 Troubleshooting

The SL3488 ultrasonic flowmeter has advanced self-diagnostics functions and displays any errors in the upper right corner of the LCD via definite 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 tables.

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