

## ULTRASONIC INLINE FLOW METER USER MANUAL



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## 1. PREFACE

### 1.1 FEATURES:

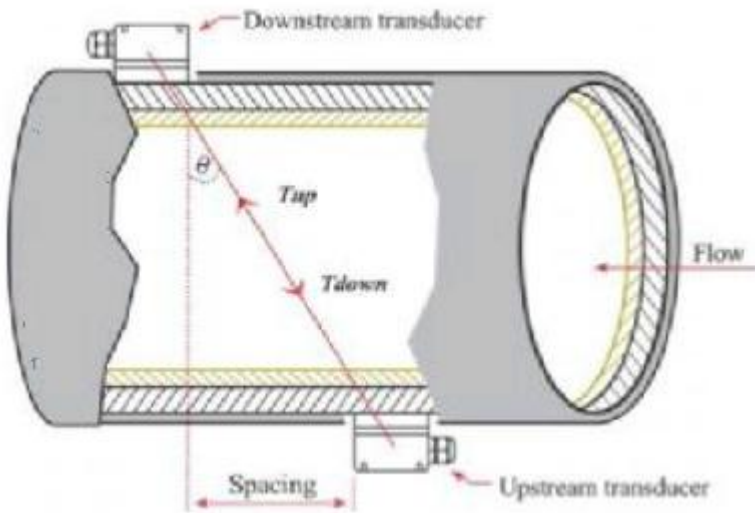
1. Operating power: 36 V/19AH Lithium battery or AC or DC
2. Measuring cycles: 500ms-49 seconds (default before leaving factory: 10 seconds)
3. Sampling times: optional sampling times for one cycle (32—128) (default before leaving Factory: 64)
4. Battery consumption: the battery can work continually up to 5 years under the condition of default.
5. Optional output: one channel USART (TTL) output.  
One channel non-isolation RS485 output (the built-in 3.6V battery supply power,

At the state of sending data, there is power consumption. But the interface is not electrical isolation, it is easy to be disturbed to make the flow meter work abnormally. So that is a suggestion for users to use TTL to output when networking, RS485 is used to set up parameters).

6. Input Optional: Two channel two wire system PT1000 platinum resistor input loop, to make Heat meter has the function of displaying heat quantity.
7. Display: 96 segments LCD, display 44 different quantities.
8. Operating: Magnetic two keypad, browse prior 40 windows data, but can not setup parameters, in order to setup parameters, you have to connect with another meter or PC setup parameter software through RS 485.
9. Other functions: Automatic memory the positive, negative, net totaliser or flow rate and heat quantity of the last 512 days, 128 months, 10 years. Automatic memory the time of power turning on and off and flow rate of the last 30 times, realize to replenish by hand or automatically, read the data through Modbus communication protocol.
10. Protection Level: IP 68
11. Replacing directly.
12. Transducer: Clamp on type, insertion type, in line type.

### 1.2 PRINCIPLE OF MEASUREMENT

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



**Remarks:-**

The angle between the ultrasonic signal and the flow

M Transit time of the ultrasonic signal

D The internal diameter of the pipe

Tup Transit time in the forward direction

Tdown Transit time in the reverse direction

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

**1.3 DIMENSION DETAILS**

**FIGURE : 1**

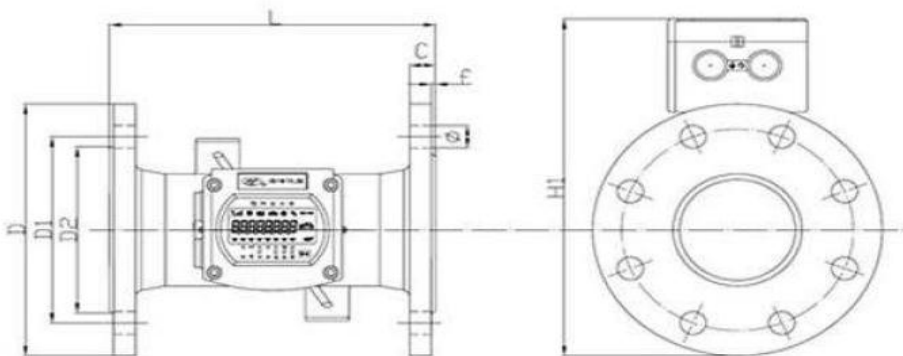
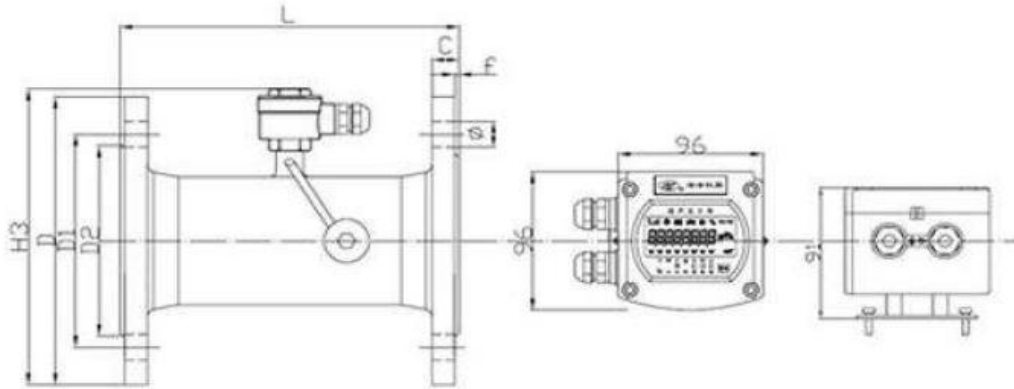


FIGURE : 2



Size DN	Lengt h L	OD D	PCD D1	Q*n	Seal Surface		C	Height			M <sub>R</sub>
					D2	f		H1	H2	H3	
50	200	165	125	18×4	99	3	20	234	255	172	7.5
65	200	185	145	18×4	118	3	20	254	275	192	10.2
80	225	200	160	18×4	132	3	20	268	289	206	11
100	250	220	180	18×8	156	3	22	287	308	225	13.5
125	250	250	210	18×8	184	3	22	315	336	253	17.5
150	300	285	240	22×8	211	3	24	345	366	285	22.8
200	350	340	295	22×12	266	3	24	403	424	341	34.2
250	450	405	355	26×12	319	3	26	462	483	405	65.8
300	500	460	410	26×12	370	4	28	516	537	460	76.6
350	550	520	470	26×12	429	4	30	572	593	520	86.4
400	600	580	525	26×16	480	4	32	626	647	580	121
450	700	640	585	30×20	548	4	34	682	703	640	168
500	800	715	650	33×20	609	4	36	745	766	715	256
600	1000	840	770	36×20	720	5	38	858	879	840	295
700	1100	910	840	36×24	794	5	40	938	959	910	323
800	1200	1025	950	39×24	901	5	42	1046	1067	1025	386
900	1300	1125	1050	39×28	1001	5	44	1146	1167	1125	465
1000	1400	1255	1170	42×28	1112	5	46	1261	1282	1255	510

DN –	Flow Meter Size	–	mm
L -	Length of the Meter	-	mm
D -	Outer Diameter of flange	-	mm
D1 -	Pitch Circle Diameter (PCD)	-	mm
	Q*n-	Diameter of Bolt * No. of Holes -	mm
C -	Flange Thickness	-	mm
M <sub>R</sub> -	Reference Mass	-	Kg
P -	Pressure	-	Bar

#### 1.4 INTRODUCTION

Low power ultrasonic water meter is designed according to Europe alliance EN1434 standard and ultrasonic time-difference principle. It can instead of other water meter and it has other characters: High accuracy, better reliable, no moving part, no need to set data. Install in any angle. Ultrasonic time-difference principle Measuring water or other liquid.

#### 1.5 SPECIFICATION

Accuracy:  $\pm 0.5\%$ ,  $\pm 1\%$

Repeatability:  $\pm 0.5\%$

Measurement cycle: Default for 3Sec, 1~31Sec should be optional by the user

Battery Life 6-10years, or two line power

Lowest measuring velocity of liquid 0.01m/s

No pressure lost and moving parts

Pipe length designing according to the normal water meter

IP68, can work under water lower than 2 meters

No leakage.

Line Size: DN15-1000mm

Temperature: -40degC ~160degC as Ceramic sensor

Over look type, normal type, separate type

### 1.6 STANDARD FUNCTION PARAMETER

<b>Measurement Principle</b>	Ultrasonic time difference principle. Double balance to handle Signals receiving and sending
<b>Precision</b>	±0.5%, ±1% should be optional
<b>Repeatability</b>	More than ±0.5%
<b>Measurement Cycle</b>	Default for 3 Seconds: 1-31 Seconds should be optional by the user
<b>Display</b>	Local 96. LCD with low power consumption
<b>Display Parameters</b>	Cumulative Flow Rate, Instant Flow Rate, Flow Speed, Accumulative working time, Date, working status error code, Battery Consumption, The signal intension and quality of Ultrasonic, Velocity of sound for liquid and etc.,
<b>Operation</b>	Magnetic operational stick, inside double keyboard.
<b>Interface Output</b>	RS232, RS485, 4-20mA Standard Scheme M-Bus, GPRS, CDMA can be optional
<b>Communication Agreement</b>	Compatible with the Communication Agreement of other domestic products Standard Communication of M-BUS Communication Agreement of GPRS、CDMA Communication Agreement can be made per the requirement of users
<b>Application(Medium)</b>	Water or other liquid
<b>Temperature Adaptable</b>	-40°C~80°C (LCD for -25°C~60°C)
<b>Other performances</b>	Can display the measure results Anto circularly ,can be programmed Failure self-diagnostic , Failure indicator 1、 0.1、 0.01、 0.001、 0.0001 Cubic meter of accumulative unit are optional Communication of baud rate: 300, 1200, 2400, 4800, can be with parity bit Over look type, normal type, separate type are optional During the previous 24 months, flow rate and velocity of flow can be accumulative monthly 8 digits of positive and negative integrator ,and counter with 64 digits Patent double balance 20dB Dynamic range ultrasonic self-adjusting receiving circuit to assure the meter can still work when the condition get worse
<b>Pipe size</b>	Casting according to the mould casting procedure, without leakage The length of pipe are designed per the diameters of normal water meter DN15-1000mm of diameters are optional by the users
<b>Transducers</b>	High temperature ceramic sensor:-40°C~160°C



<b>Power supply</b>	Can operate for six years with a single Ni-H battery of 3.6V,, Battery chosen can operate for over ten years, can work normally when the voltage should be 2.6V 4-20mA supply (two lines), can work normally without battery RS232 output, The meter can work by using outside power supply, It can work as normal without battery 5V power supply is needed for RS485 output, It can work as normal without battery
<b>Power consumption</b>	Measuring cycle 3 seconds, The average power consumption of DN00mm should be 0.55mW Measuring cycle 1 second, The average power consumption of DN00mm should be 1.65mW When there is no liquid in the pipe, the meter works under the electricity saving and the power consumption reduce to 30%, so that the battery will have a longer working life
<b>Protection Grade</b>	IP68, can work under water lower than 2 meters

## 1.7 FLOW RATE DETAILS

Pipe ID (mm)	Lowest Flow Rate Detectable	Min. Flow Rate (Q Min)	Operational Flow Rate (Qt)	Max. Flow Rate (Qmax)	Cumulative Flow Rate (M3/hr)		
					Max. Reading	Min. Reading	
					(M3/hr)		
15	0.0019	0.0238	0.072	1.5	99999.999	0.001	
20	0.0019	0.0238	0.072	2.5			
25	0.0045	0.056	0.169	3.0			
32	0.0073	0.092	0.275	12			
40	0.0114	0.144	0.429	20			
50	0.0353	0.35	2.1	150	9999999.9	0.1	
65	0.06	0.60	3.58	180			
80	<i>Single-Path</i>	0.09	0.9	5.43			230
	<i>Double-Path</i>	0.063	0.9	5.43			230
100	<i>Single-Path</i>	0.141	1.41	8.48.			300
	<i>Double-Path</i>	0.099	1.41	8.48			300
125	<i>Single-Path</i>	0.221	2.21	13.25	360		

	<i>Double-Path</i>	0.155	2.21	13.25	360		
150	<i>Single-Path</i>	0.318	3.18	19.08	460		
	<i>Double-Path</i>	0.223	3.18	19.08	460		
200	<i>Single-Path</i>	0.565	5.6	33.93	660		
	<i>Double-Path</i>	0.396	5.6	33.93	660		
	<i>4-Path</i>	0.226	5.6	33.93	660		
250	<i>Single-Path</i>	0.883	8.83	53.0	740		
	<i>Double-Path</i>	0.618	8.83	53.0	740		
	<i>4-Path</i>	0.353	8.83	53.0	740		

**1.8 APPLICATION FIELD:**

Applied to on-line measure and system monitor for nearly all liquids from petrol chemical, Metallurgy , Electric power plant, irrigation, city water company, energy monitor fields, realize The functions of measuring and checking of flow velocity, flow rate, accumulation and heat Quantity of different liquids , and flow rate on/off, liquids distinguish.

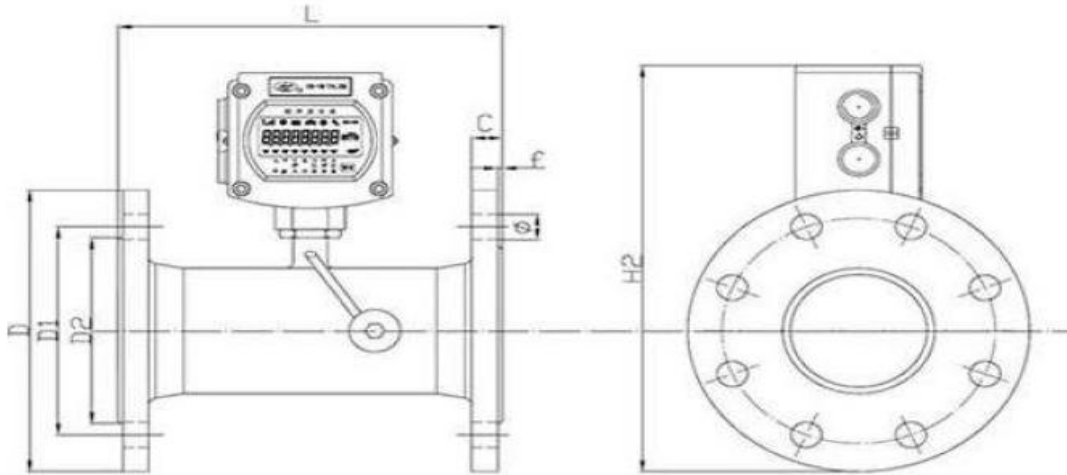
Ultrasonic flow meter has the advantages of high accuracy. Wide measurement range, no pressure Lost, easy installation, no need to set parameter, etc.

DN (mm)	Ratedpressure (Mpa)	Outer size				Material
		L	H	D	C	
25	4.0	300	282	51	19	Stainless Steel
40		300	300	74	23	
50		300	31	84	24	
65		350	330	100	28	
80		400	345	114	30	
100		450	365	128	31	



## 1.9 HYGIENIC STYLE PIPE PARAMETER:

### 1.9.1 FLANGE MECHANISM SIZE:



DN(mm)	Rated pressure (Mpa)	II in line style outer size		Standard in line outer size		Flange size (mm)				
		L1	H1	L2	H2	D	D1	D2	Φ-N	
15	1.6	320	136			95	65	46	14×4	
20		360	142			105	75	56	14×4	
25		390	151			115	85	65	14×4	
32		450	157			140	100	76	18×4	
40		500	169			150	110	84	18×4	
50					200	260	165	125	000	18×4
65					210	280	180	145	120	18×4
80					225	295	195	160	135	18×8
100					250	314	215	180	155	18×8
125					270	347	245	210	185	18×8
150					300	372	280	240	210	23×8
200					370	430	335	295	265	23×12
250					450	489	405	355	320	25×12
300					500	543	460	410	375	25×12
350					550	599	520	470	435	25×16
400					600	653	580	525	485	30×16
400	1.0			600	653	565	515	482	25×16	
450				700	708	615	565	532	25×20	
500				800	771	670	620	585	30×20	
600				1000	884	780	725	685	24×25	
700				1100	964	860	810	775	24×30	
800				1200	1072	975	920	880	24×30	

900			1300	1172	1075	1020	980	24×30
1000			1400	1287	1175	1120	1080	28×30

### 1.9.2 DIMENSION DETAILS

FIGURE : 1

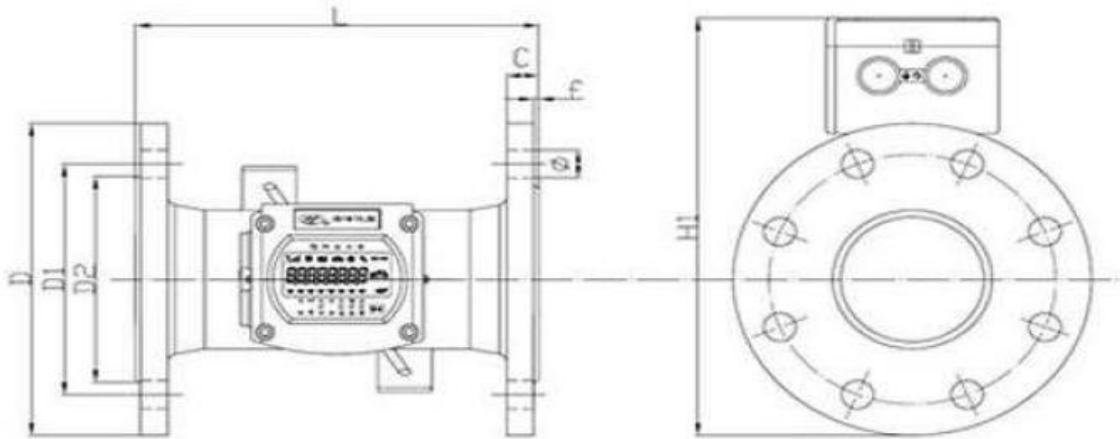
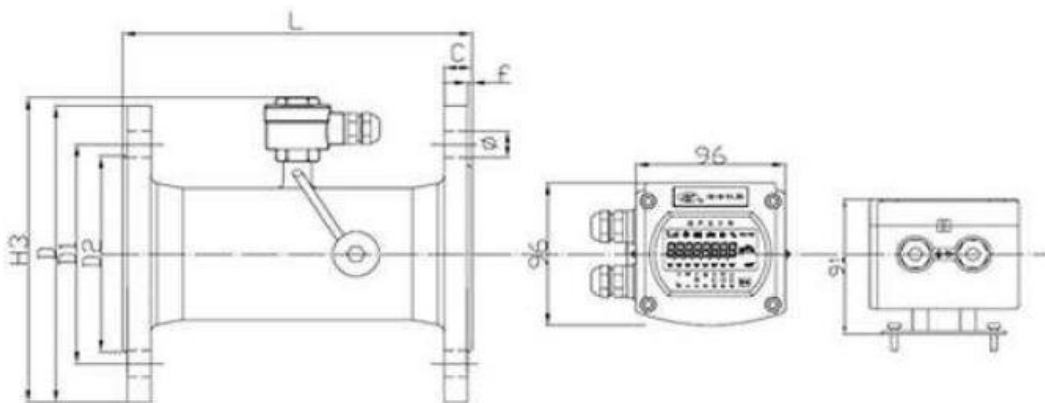


FIGURE : 2



Size	Length	OD	PCD	Q*n	Seal Surface		C	Height			M <sub>R</sub>	P
					D2	F		H1	H2	H3		
50	200	165	125	18×4	99	3	20	234	255	172	7.5	16
65	200	185	145	18×4	118	3	20	254	275	192	10.2	
80	225	200	160	18×4	132	3	20	268	289	206	11	
100	250	220	180	18×8	156	3	22	287	308	225	13.5	
125	250	250	210	18×8	184	3	22	315	336	253	17.5	
150	300	285	240	22×8	211	3	24	345	366	285	22.8	
200	350	340	295	22×12	266	3	24	403	424	341	34.2	
250	450	405	355	26×12	319	3	26	462	483	405	65.8	
300	500	460	410	26×12	370	4	28	516	537	460	76.6	
350	550	520	470	26×12	429	4	30	572	593	520	86.4	
400	600	580	525	26×16	480	4	32	626	647	580	121	
450	700	640	585	30×20	548	4	34	682	703	640	168	
500	800	715	650	33×20	609	4	36	745	766	715	256	
600	1000	840	770	36×20	720	5	38	858	879	840	295	
700	1100	910	840	36×24	794	5	40	938	959	910	323	
800	1200	1025	950	39×24	901	5	42	1046	1067	1025	386	
900	1300	1125	1050	39×28	1001	5	44	1146	1167	1125	465	
1000	1400	1255	1170	42×28	1112	5	46	1261	1282	1255	510	

- DN – Flow Meter Size – mm
- L - Length of the Meter - mm
- D - Outer Diameter of flange - mm
- D1 - Pitch Circle Diameter (PCD) - mm
- Q\*n- Diameter of Bolt \* No. of Holes- mm
- C - Flange Thickness - mm
- M<sub>R</sub>- Reference Mass - Kg
- P - Pressure - Bar



## 2.1 BATTERY POWERED STYLE ULTRASONIC WATER METER:

New version RLU 100 battery powered style ultrasonic water meter/calorimeter achieved to Display online on spot, RLU 100 mainboard is encapsulated in the sealed body (the size is the same as In-line style meter), solved the problem of drifting with little flow rate, the measuring mainframe can Be welded on the measured pipe or range up on the wall. It features with lower starting flow, wide Measuring range ratio, higher accuracy, long lifetime.

Used preposition receiving amplifier that has 50 decibel dynamic range in RLU 100 mainboard, the Meter can measure the pipe diameter from 3mm to 10 m through clamp on type and other transducers. It can connect any type transducers.

## 2.2 .DISPLAY AND OPERATION:

### 96 SEGMENTS LCD DISPLAY AND OPERATION (SUITABLE TO RLU 100 )

There is a 96 LCD monitor in RLU 100 ultrasonic water meter (RLU 100 mainboard), totally 44 menu windows, commonly used 8 menu windows is listed in forefront, triangle indicator indicate explaining characters on the menu, displaying automatic cycle, the interval time is fixed at 8 seconds, also using keys to visit and page turning, but could not setup parameters, if need to setup parameters, you have to connect another device through RS485 serial port or computer software to set.

## 2.3 DISPLAY

### Sample displaying as follows:

- Display datas.
- Represent ultrasonic signal strength
- Represent Ultrasonic signal quality
- Rolling means the flow rate is not zero
- Fault existing, need to repair
- ←→Represent flow direction.
- Represent the flow is zero or not reach rated sensitivity.
- m<sup>3</sup>/hr Represent instant flow rate (m<sup>3</sup>/hr)
- GJ/h Represent instant heat quantity (Gj/hour)
- KWh Represent totalizer heat quantity (Kwh)

- $\Delta C$  Temperature difference of supply and return water.

The LCD can display 44 menu windows, respectively from M00 to M43, it can be set to two displaying way, one is regular display method, the other is automatic cycle method. Inputting the digits from 2-43 on M3 • (M3A) to setup automatic cycle method, inputting 0,1 to setup regular display method.

When power on, default is to enter M00, using keys to move to other menu windows. At the state of automatic cycle method, stopping operation for over 60 seconds. LCD will display automatically cycle from M00 to the menu windows defined in M3 • at the time interval of 8 seconds. When users can not operate the keys, such design make users read the value on the windows if to wait for enough time. Users press keys firstly, the LCD will display the menu window that users

visited last time, press the key again, enter upper window or down to the above window for example, users move the upper or down arrow key to window L5, stop pressing key for over 60 seconds, it starts.

The state of displaying automatically cycle, press the key again at this time, displaying turns back to Window L5. Press the down arrow key for more than 3 seconds, the LCD will display M00 window.

## 2.4 DISPLAY CONTENTS OF LCD

Sequence	Displaying model	Displaying contents	Description
00	006789.45	Represent positive totaliser value	Position of arithmetic point is set in M33
01	8.3215 m <sup>3</sup> /hr	Represent present instant flow rate	If "U" appeared, that means flow rate can not reach the set sensitivity, low flow cutoff, it is set in M41
02	007658.34 GJ	Display positive totaliser heat quantity	Position of arithmetic point and unit are set in M88.
03	2.3214 KW	Display instant heat flow	Unit is set in M84, if "U" appears, that means the flow rate can not reach the set sensitivity, or temperature difference is lower than set value, Min temperature difference is set in M89.
04	91.4	Rate	Reach the set sensitivity, or temperature difference is lower than set value, Min temperature difference is set in M89
05	34.2345	Display present temperature difference	
06	000012.14	Display fault running time	Unit: hour
07	F-80 9	Display present working status	Respectively is error code, signal strength, signal quality etc.
08	23.15.49	Display time	
09	07-12-31	Display date	
10	E0 0.1234	Display present flow velocity	

**RLT Instrumentation Pvt Ltd**  
**(Unit of RLT Group)**

11	E1 99.876	Display present ultrasonic signal transit time ratio	%
12	E2 1480.3	Display estimated sound velocity of fluid	Unit: m/s
13	E3 4.0000	Display present 4-20mA output value	Unit: mA
14	E4 130.24	Display equal resistor value of T1	Unit: Ohm
15	E5 130.56	Display equal resistor value of T2	Unit: Ohm
16	E6 3.5673	Battery voltage	Unit: V (RLU 100)
	E6 15	Display outside pipe diameter	Unit: mm (RLU 100)
17	E7 12.05	Display used software version	
18	1280001	Display ESN	
19	E9 1	Display communication address code (meter address)	Set in M46
20	002345.23 h	Display total work time	Unit: hour
21	071219.08	Display the date of leaving factory	Respectively year, month, date, hour
22	88888888	Display all fields to check LCD	
23	23 A5 F7 89	Display the value input through serial port	Used to check serial port communication
24	L4	Display used communication protocol	To choose MODBUS RTU/ASCII on M63
25	L5	Display the meter's coefficient	
26	23658933 m <sup>3</sup>	Display this year's total flow	
27	236.58933 m <sup>3</sup>	Display this month's total flow	
28	L8	Display present ultrasonic total transmitting time	Unit: Microsecond
29	L9	Display present time difference of the wave	Unit: nanosecond
30	C0	Display time difference voltage 1	Range: 3500~5000
31	C1	Display time difference voltage 2	Range: 7000~9600
32	C2	Display frequency coefficient	Lower than 0.1
33	C3	Display current value of analogue input A13	Unit: mA(reserved in RLU100 mainboard)
34	C4	Display current value of analogue input A14	Unit: mA(reserved in RLU100 mainboard)
35	C5	Display current value of analogue input A15	Unit: mA (reserve in RLU 100 mainboard)
36	0000234.5	Display negative totaliser heat quantity	Set unit in M84, arithmetic point in M88
37	000045.67	Display net totaliser flow	Unit: m <sup>3</sup> , set arithmetic point





			M33
38	000012.34	Display negative totaliser flow	Unit: m <sup>3</sup> , set arithmetic point M33
39	000012.34	Display today's totaliser flow	Unit: m <sup>3</sup> , set arithmetic point M33
40	HO 1.2345	Start manual totaliser	Stop operating when exit this menu
41	H1 2.3456	Stop and display manual totaliser flow rate	Unit is present chosen totaliser unit (determined in M32)
42	H2 34.567	Display manual totaliser timer	Unit: second
43	H3 9600	Display present used band rate	

Attention: M40-M42 are used to calibration display.

## 2.5 DISPLAY STATUS CODE AND FAULT JUDGING

To judge the work status of flowmeter on M07 of LCD. The sample showing on M07:FxG SS Q SS means data from 00-99, represent present signal strength. Normal range: 50-99, more higher, more higher, more better. Data range of Q: 0-9, represent present signal quality, normal range: 5-9, more higher, more better. G means signal adjusting process. Normally working, it is blank, display 3,2 1 during adjustment. X means present system work status code, meaning is as follow:

- “\_” represent work normally, corresponding to “R” status
- “1” represent lower signal error
- “2” poor signal error
- “3” pipe empty error
- “4” circuitry hardware error
- “5” adjusting circuitry gain
- “6” frequency output over measurement range error
- “7” the current of current loop output over measurement range error
- “8” inner data register checking error
- “9” main quake frequency or timer frequency existing error
- “A” parameter area existing checking error
- “b” Program memorizer data checking error
- “C” temperature measurement circuitry probably existing error
- “d” reserve for use
- “E” inner timer overflow error
- “F” analogue input circuitry existing error

## 2.6 KEYS

Ultrasonic water meter (RLU100 mainboard) use two magnetic keys (Up arrow key and down arrow Key) located in the left upper and right down side of LCD monitor to operate page tuning, no need To open enclosure, use special magnetical bar to browse windows.

## 2.7 SERIAL PORT OPERATION SETUP PARAMETER:

RLU-100W ultrasonic water meter (RLU 10016 mainboard), has ability to view menu window, can not set parameter. If to set, users need to use the another device that we supplied to setup parameter by RS485 serial port, and also to set parameter by RS485 connecting computer serial port software. The another device that we supplied is in fact a serial port keyboard operator, the operating method is the same with parallel port keyboard monitor, also can supply 24 V DC power for mainboard. In environment of the one meter, not applied to use for data collecting network of more than two RLU-100. When users need to connect RLU 100 with network for RS 485, and at same time need RS485 serial keyboard monitor to display measurement results, thus you have to use network style keyboard monitor (in research process)

Software serial port keyboard monitor connect the setup parameter software in computer by RS485. Its function and operating method is the same with parallel keyboard monitor, but can not supply power for mainboard.

## **2.8 ABOUT SPECIAL INTRODUCTION OF THE CALIBRATION OF WATER METER**

Water meter's min-readings is fixed when leaving factory, when calibrating, it could possibly create results deviation owing to resolution insufficient. So when calibrating, using manual totalizer menu H0,H1,H2,H3 (40,41,42,43) to ensure accuracy.

Attention: when leaving factory, the set min-reading is 0.001 cubic meter, the menu unit of the manual totalizer is litre; when the set min-reading is 1 cubic meter, the menu unit of the manual totalizer is cubic meter.

Parallel keyboard monitor is a simple keyboard monitor that has 20 wires interface, the function is to display the measured results of flow meter and setup parameters of flow meter, in order to operate online and measure conveniently on spot, each set of separate fixed style, in-line style, cost effective style and RLU 100 M1 style ultrasonic flow meter is equipped with a parallel keyboard (4 keys or 16 keys ) before leaving factory.

### **2.9.1 KEY FUNCTION**

The new RLU-100 series ultrasonic flow meter/heat meter can respectively or at same time use 4 key or 16 key keyboard monitor.

16 key parallel or serial port key board, including 10 digit keys, 2 up/down arrow key, 1 menu key(M), 1 enter key, 1 arithmetic point key, 1 backspace key. The keyboard can make users operate quickly and conveniently. 4 key keyboard has 2 up/down arrow key, 1 menu key (M), 1 enter key (ENT), inputting

Digits, characters and arithmetic point is by using up arrow key to input many times, the use of down Arrow key is to move to next digit position.

For example : to use 16 keys keyboard.

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 inputting digits, it equals to plus or minus

Key. Menu key is used to visit menu, firstly press this key and then press two digits keys to enter Related menu. For example, if to input outside pipe diameter, press menu <1><1>, “11” is the address

Code of outside pipe diameter parameter, <ENT> key is used to ensure the input digit or chosen content, the other function is to press this key to enter “modify” status before inputting parameters. “bibi” sound of pressing keys of buzzer can be shut down by using M77 to choose 25 item.

### **3. MENU OPERATION**

The new ultrasonic flow meter/heat meter adopt menu window software design,

The flow meter use windows comprised about more than 100 independent menu windows to input parameters, Setup the device, display measurement result, menu windows adopt two digits (including +, -) that are numbered by M00, M01, M02, .....M99, M+0, M+1, M-0, M-1, M.0, M.1, etc.

There are two methods to visit a menu window:

- 1) Direct jump in. simply press the MENU key under any status, followed by a 2 digit numbers that have different special meanings. For example , if you want to visit menu window M11 for pipe outside diameter, press the following three keys consecutively. MENU 11
- 2) Press the ▲/+ or ▼/- and <ENT> key. For example, if the present window is on M66, the Display will go to window M65 after the ▲/+ key is pressed, click the key again to enter M64; after press ▼/- key , return to M65, press ▼/- key again to enter M66.

You do not need to remember all the menu windows. Just remember the most commonly used Window numbers and the approximate window number of some uncommonly used windows Would be sufficient. You can always use ▲/+ and ▼/- keys to find the right window. In a word, Combining the shortcut keys and moving method, you will find it easy and convenient to visit Menu windows.

There are three different types of menu windows:

- 1) Data style: For example : M11 represents to setup pipe outside diameter.
- 2) Choosing style: For example : M14 represents to choose pipe material



3) Results display window: M100 represent to display flow rate.

For data style windows, the user can directly press the digit keys and press <ENT> key or firstly Press <ENT> key and press digits keys and then press <ENT> key again, if the user wants to modify The parameters. For example, if the present window is on M11, and the user wants to enter 219.2345 as the outside pipe diameter, ut displayed datas are the set datas last time, at this time press <ENT> key, there is “>” and flash cursor on the left second line on th screen, input the wanted parameter; it is available

not to press <ENT> firstly, the flowing keys should be directly pressed: 219.2345 ENT.

For choosing style windows, users can check chosen optionals. If want to modify, the user should first Press the ENT key, there is “>” and flash cursor on the left screen, means to enter modify and choosing Status. Then, move ▲/+ , ▼/- to the wanted optionals , press ENT key to confirm, or input digit that Correspond to the right optionals., press the ENT to make the selection done. For example , assume your pipe material is stainless steel and you are currently on menu window M14 which is for the selection of pipe

Materials (if you are on a different window, you need to press MENU 1 4 first in order to ensure into the M14

Windows.) You need to press the <ENT> key to enter modification model. Then, move the ▲/+ ,and ▼/-

Keys to make the cursor on the line that display “1”Stainless steel” , or press the 1 key directly. At the end , press ENT again to make the selection done.

### **3.1 MENU CLASSIFICATION**

The features of the RLU-100 flow meter is using Menu window operation totally, menu is arranged

As following rules:

00-09 menu windows are display window, display of the instatnt flow rate, net totaliser, positive totaliser, negative totaliser, instant flow velocity, date time, ananlogue input present flow rate, prepsent workding status, today’s total flow rate.



10~29 menu windows for entering system parameters, such as pipe outside diameter, pipe wall thickness. Liquids type, transducer type, transducer installation method, etc. display installation space, parameter Solidifying etc.,

30-38 menu windows are the windows to choose flow rate unit and totalizer, in these windows, users can Select flow rate unit, such as cubic meter or liter, as well as turn on/off each totaliser, or to reset.

Windows (M40-49) including flow rate modification operation, network ID (M46), password protection (M47), degree of linearity broken line rectification (M48) and so on.

Windows (M50-89) including output at scheduled time, RS232 output, relay output, current loop output, Batch controller, LCD, frequency signal output, alarm output, analogue inputs. Day/month/year totaliser, Heat quantity, heat quality measurement etc.,

Windows (M90-94) for flow meter checking, display signal strength and signal quality Q value in M90. Display signal transit time ratio in M91, display estimated velocity of sound by measurement in M92. Display Total measured signal transmitting time and difference in time in M93. Display Reynolds number and Self rectification coefficient of the device in M94.

Upon entering M95 window, the cycling display function is stated automatically the order is M95→M00

→M01→M02→M03→M04→M05→M06→M07→M08→M09→M90→M95, the interval time is 8 seconds +0~+9 windows for additional functions, including power on/off time logging, total work Times, total power on/off times and a single precision function calculator etc.,

Other windows are about hardware adjustment operation, used by factory to adjust, detailed information Is as follows.

<b>Flow rate/</b>	<b>00</b>	Display instant flow rate/ net totalizer, adjust the units in M30-M32
	<b>01</b>	Display instant flow rate/ instant flow velocity, adjust the units in M30-M32
	<b>02</b>	Display instant flow rate/ positive totalizer, adjust the units in M30-M32
	<b>03</b>	Display instant flow rate/ negative totalizer, adjust the units in M30-M32



<b>flow totalizer display</b>	<b>04</b>	Display instant flow rate/ date time
	<b>05</b>	Display instant flow rate/ total heat quantity, adjust the units in M84-M88
	<b>06</b>	Display Temperature input T1, T2
	<b>07</b>	Display present battery voltage
	<b>08</b>	Display analogue input A13, A14
	<b>09</b>	Display system error code
	<b>10</b>	Display today net totalizer
<b>Initial Setup</b>	<b>11</b>	Input outside perimeter of pipe
	<b>12</b>	Input pipe outer diameter, data range: 0-18000mm
	<b>13</b>	Input pipe wall Thickness
	<b>14</b>	Input pipe inner diameter
	<b>15</b>	Choose the kinds of pipe materials
	<b>16</b>	Input sound velocity of pipe material
	<b>17</b>	Choose kinds of liner
	<b>18</b>	Input the sound velocity of liner
	<b>19</b>	Input thickness of liner
	<b>20</b>	Input inner pipe wall absolute degree of roughness
	<b>21</b>	Choose kinds of fluids
	<b>22</b>	Input fluid velocity
	<b>23</b>	Input fluid viscosity
	<b>24</b>	Choose the types of transducers, including more than 20 types to use
<b>25</b>	Choose transducer installation method	
<b>26</b>	Display transducer installation space	
<b>27</b>	Parameter solidifying and setup	
<b>28</b>	Store and read installation parameters on installation point	
<b>29</b>	When signal set turning poor, keep last datas, choosing “ yes” means when the signal turning poor, the flow meter display last correct measured datas	
<b>30</b>	Input signal strength when the pipe flow is set to be empty. For example: inputting 65 means when the signal strength is lower than 65, the flow meter will think that there is no liquid in the pipe and display the flow values as zero	
<b>Flow Unit setup</b>	<b>31</b>	Choose metric or imperial unit
	<b>32</b>	Choose instant flow rate unit
	<b>33</b>	Choose totalizer unit
	<b>34</b>	Choosing the totalizer multiplying factor which function is to multiply totalizer data rang, normally set it is X1
	<b>35</b>	Net totalizer switch
	<b>36</b>	Positive totalizer switch
	<b>37</b>	Negative totalizer switch
	<b>38</b>	Restore parameters setup before leaving factory and reset totalizer
	<b>39</b>	Manual totalizer ( the key to control on/off)
	<b>40</b>	Choose operating language, including 8 kinds of different languages for international users to use
	<b>41</b>	Setup the LCD display method, inputting 0 or 1 means regular displaying content. Inputting 2-39 means automatically cycle displaying method, displaying the previous menu of 2-39, time internal is 8 seconds. when inputting accures displaying according to the inputting operation, when there is no inputting operation, it will automatically enter cycle displaying status



		(detailed information 3.1)	
<b>Choosing</b>	<b>42</b>	Damper coefficient	
	<b>43</b>	Input low flow velocity cutoff value	
	<b>44</b>	Setup static zero point	
	<b>45</b>	Clear zero point setup and manually setup zero point, restore default before leaving factory	
	<b>46</b>	Setup zero point deviant by hand	
	<b>47</b>	Meter coefficient, rectification coefficient	
	<b>48</b>	Input network address identification no (IDN)	
	<b>49</b>	Password protecting operation, after the meter was setup with password, only browse menus without any modification	
	<b>50</b>	Input degree of linearity broken line rectification data at most there is 12 segments broken line, used of users to rectify meter nonlinear	
	<b>51</b>	Network communication tester, on this window to visit the datas transferred from upper computer to judge the problems raised during communication	
<b>Scheduled time output</b>	<b>52</b>	Optional setup of datas output at scheduled time, choose output content at scheduled time to print, more than 20 to select	
	<b>53</b>	Setup output time at scheduled time	
	<b>54</b>	Printing data flow direction control, by default printing data will flow directly to the thermal printer hanged inside bus. Setup printing data output to outside serial port (RS485 port)	
<b>A15 Setup</b>	<b>55</b>	Display analogue input A15 (reserved for the main board)	
<b>Input and Output setup</b>	<b>56</b>	Setup of OCT totalizer pulse output, pulse width range : 6Ms- 1000Ms	
	<b>57</b>	Choose current loop mode	
	<b>58</b>	Corresponding data to output of current loop 4mA or 0mA	
	<b>59</b>	Corresponding data to output of current loop 20 mA	
	<b>60</b>	Verification of current loop output. Applied to check weather current loop is normal or not	
	<b>61</b>	Present output of current loop	
	<b>62</b>	Date time and setup the date time of the new flow meter is realized by CPU, when upgrading software, time will be slow, so after upgrading, recommend to adjust the date and time to display correctly	
	<b>63</b>	Software version information and electronics serial no (ESN)	
	<b>64</b>	Setup serial port parameter	
	<b>65</b>	Communication protocol choosing (including compatible protocol choosing), two options, choosing MODBUS-RTU means using binary system MODBUS-RTU protocol. Choosing MODBUS-ASCII + previous protocol means using ASCII protocol , at this time can support several protocols simultaneously , including MOSBUS-ASCII, previous 7 version protocol, FUJI protocol, meter –BUS x protocol etc	
	<b>65</b>	Analogue input A13	By inputting measuring range the flow meter will turn current signal into data range users need, so display related analogue input that corresponding to physical parameter data
	<b>66</b>	Analogue input A14	
	<b>67</b>	Analogue input A15	
	<b>68</b>	Setup frequency range of frequency output signal. Frequency output signal. Frequency signal output represents instant flow rate value by signal frequency value. Default: 0-1000Hz, max-range: 0-999Hz. Output frequency signal by special frequency output unit	
	<b>69</b>	Setup lower limit flow of frequency signal output	



	<b>70</b>	Setup upper limit flow of frequency signal output	
	<b>71</b>	LCD backlit control	
	<b>72</b>	LCD contrast ratio control	
	<b>73</b>	Work timer, logging work time of the meter by unit of second. It can reset	
	<b>74</b>	Setup lower limit flow of frequency signal output	By setup the lower and upper limit of alarm, confirm a range, when actual flow is over the range set in this window, then create a alarm signal output alarm signal can be transferred to outside by setup OCT or relay
	<b>75</b>	Setup Upper limit flow of frequency signal output	
	<b>76</b>	LCD backlit control	
	<b>77</b>	LCD contrast ratio control	
	<b>78</b>	Beeper setup options	
	<b>79</b>	Setup open collector transistor output (OCT) output options	
	<b>80</b>	Setup relay (OCT2) output options	
	<b>81</b>	Choose input signal of batch controller	
	<b>82</b>	Batch controller	
<b>Heat quantity measuring</b>	<b>83</b>	Day/ month/ year totalizer, check the flow rate and heat quantity of the totalizers	
	<b>84</b>	Automatically replenish flow switch during the period of power off, default status: off. This function is not available under special conditions	
	<b>85</b>	Choosing heat quantity unit, 0. GJ (default), 2. Kcal, 3. Kw, 4. BTU (imperial Unit)	
	<b>86</b>	Choose temperature signal origin. If choosing inputting temperature signal by A13. A14 then need temperature transmitter that can output 4-20 mA current signal	
	<b>87</b>	Heat capacity, default GB-CJ128 enthalpy potential method. Temperature difference method is available also	
	<b>88</b>	Heat quantity totalizer switch	
	<b>89</b>	Heat quantity multiplier factor	
	<b>90</b>	Display present temperature difference and setup temperature difference sensitivity	
	<b>90</b>	Options of installation of heat meter on supply water pipe or return water pipe	
<b>Diagnosis</b>	<b>91</b>	Display the signal strength and signal quality	
	<b>92</b>	Display the transit time ratio	
	<b>93</b>	Display the calculated fluid sound velocity	
	<b>94</b>	Display the total transit time and the delta time	
	<b>95</b>	Display the Reynolds no and the pipe coefficient	
	<b>96</b>	Display positive, negative heat quantity totalizer, start cycle display function	
<b>Added menu Window</b>	<b>+0</b>	Display the time of power On/Off and flow rate	
	<b>+1</b>	Display the total working time of the flow meter	
	<b>+2</b>	Display the last time of power off	
	<b>+3</b>	Display the flow rate of last power off	
	<b>+4</b>	Display total times of power On	
	<b>+5</b>	Specific calculator	
	<b>+6</b>	Setup threshold value of fluid sound velocity	
	<b>+7</b>	Net totalizer of this month	
	<b>+8</b>	Net totalizer of this year	
<b>+9</b>	Operating time with trouble (including power Off time)		



<b>Hardware adjustment</b>	<b>.2</b>	Store static zero point
	<b>.5</b>	Setup threshold value of Q value
	<b>.8</b>	Max instant flow rate of this day and this month
	<b>.9</b>	Serial port testing window with CMM direct output
<b>Menu Windows</b>	<b>-0</b>	Circuitry hardware parameter adjusting entrance (only inputting password to enter following windows)
	<b>-1</b>	4-20 mA current loop calibration
	<b>-2</b>	A13 inputting calibration of analogue input 4 mA
	<b>-3</b>	A13 inputting calibration of analogue input 20 mA
	<b>-4</b>	A14 inputting calibration of analogue input 4 mA
	<b>-5</b>	A14 inputting calibration of analogue input 20 mA
	<b>-6</b>	A15 inputting calibration of analogue input 4 mA
	<b>-7</b>	A15 inputting calibration of analogue input 20 mA
	<b>-8</b>	Zero point setup of PT100 at lower temperature (<40°C)
	<b>-9</b>	PT100 setup zero point at higher temperature (>55°C)
	<b>-A</b>	PT100 standard calibration at 50°C
	<b>-B</b>	PT100 standard calibration at 84.5°C

### **3.2 DETAILED EXPLANATION OF MENU WINDOW**

#### **M00: INSTANT FLOW/NET TOTALISER**

Display instant flow and net totaliser. If the net totaliser turn off (visit M34). The displayed net totaliser is the totaliser value before turning off. Net totliser equals positive totaliser plus negative totaliser.

M01: Instant flow /instant flow velocity

Only display instant flow rate and instant flow velocity on this menu.

#### **M02: INSTANT FLOW RATE/POSITIVE TOTLISER**

Only display instant flow rate and positive totliser flow.

Choosing the unit of positive totaliser in M32 , if positive totaliser turns off, the displaying is positive totaliser value before turning off.

#### **M03: INSTANT FLOW RATE/NEGATIVE TOTALISER.**

Only display instant flow rate and negative totaliser value.

Choosing the unit of negative totaliser in M32.

If negative totaliser turns off (visit M36), the displayig is negative totaliser value before turning off.

#### **M04: DATA TIME/INSTANT FLOW RATE**

Only display present date time and instant flow rate on this menu.

Inputing time method refer to M60.

**M05: HEAT QUANTITY/NET HEAT TOTALISER**

Only display instant heat quantity and net heat totaliser on this menu. Detailed method of heat measurement is in the section of heat quantity measurement.

**M06: DISPLAY TEMPERATURE INPUTING T1, T2**

Display PT100 platinum resistor value and corresponding temperature value.

**M07: ANALOGUE INPUT AI3, AI4**

Display analogue input AI3, AI4 current value and corresponding temperature value, pressure value or liquids level value.

**M08: SYSTEM ERROR CODE**

Display work status and error code of the instrument. Perhaps have many error codes at the same time , the meaning of error code and trouble shooting is in section of “seven troubleshooting”.

**M09: TODAY’S TOTAL FLOW**

Today’s net total flow.

**M10: OUTSIDE PIPE DIAMETER**

Inputing outside pipe permieter in this menu, also input outside pipe perimeter in M10. The range of outside diameter is more than 10mm and less thant 6000mm.

Attention: Inputing one of outside pipe diameter or outside pipe permieter is available.

**M12: PIPE THICKNESS**

Inputing pipe thickness in this menu. If inner pipe diameter is known, skip this menu to enter M13 to input inner pipe diameter.

**M13: INNER PIPE DIAMETER**

Inputing inner pipe diameter in this menu. If having outside pipe diameter (or outside pipe perimeter)

And pipe thickness, then use <▼-> key to skip this menu.

Attention: Inputing one of pipe thickness or inner pipe diameter is ok.

**M14: INPUT KINDS OF PIPE MATERIAL**

Inputing pipe material in this menu, following options(using <+>, <-> or numeric keys to choose)

0. carbon steel

1. stainless steel

2. cast iron
3. nodular cast iron
4. copper
5. PVC, plastics
6. Aluminum
7. Asbestos
8. FRP
9. Others

Inputting other materials not including in previous 8 items in “9”(others), if so, you must input corresponding

Sound velocity of the material in M15.

#### **M15: SOUND VELOCITY OF PIPE**

Input the sound velocity in this menu, only used when choosing options in M14 is (others), when choosing previous 8 items, You can not visit this menu, system automatically calculate according to internal parameters.

#### **M16: CHOOSING KINDS OF LINERS**

Following options:

0. No liner
1. 1. Epoxy asphalt
2. Rubber
3. Grout
4. Polypropylene
5. Polystyrene
6. Polyester
7. Polytene
8. Hard Rubber
9. PTFE
10. Others

Inputting other materials not including in previous 10 items in “11” items. If so, you need input the sound velocity of the liner M17.

#### **M17:SOUND VELOCITY OF THE LINER**

Input sound velocity of the liner, only used when choosing”others”item in M16.

### **M18: LINER THICKNESS**

Inputting liner thickness in this menu, only used when choosing “others” item in M16.

### **M19: INPUT INNER PIPE WALL ABSOLUTE DEGREE OF ROUGHNESS**

Input inner pipe wall absolute degree of roughness in this menu. The New version flow meters do not have this parameter, reserved for use.

### **M20: CHOOSING KINDS OF FLUIDS.**

Following liquids to choose.

- |                     |                                    |
|---------------------|------------------------------------|
| 0. Water            | 8. Others                          |
| 1. Sea water        | 9. Diesel oil                      |
| 2. Coal oil         | 10. Castor oil                     |
| 3. Gasoline         | 11. Arachis oil                    |
| 4. Fuel oil         | 12. 90 # gasoline                  |
| 5. Crude oil        | 13. 93# gasoline                   |
| 6. Propane (-45° C) | 14. Alcohol                        |
| 7. 0 ° C butane     | 15. 125 ° C high temperature water |

“Others” indicate any kinds of liquid, but need to input the corresponding sound velocity in M21.

### **M21: SOUND VELOCITY OF FLUID**

Only inputting sound velocity of measured fluid in this menu. Visit this menu when choosing “others” item in M20, when choosing listed liquid in M20, these items don’t need to input, the instrument will take it as default.

### **M22: FLUID VISCOSITY**

Inputting viscosity coefficient of measured fluid in this menu. Visit this menu when choosing “others” item in M20, choosing listed liquid in M20, these items don’t need to input, the instrument will take it as default.

### **M23: CHOOSING TYPE OF TRANSDUCERS**

Following options to choose

0. Standard medium transducer-M (stop production)
1. Insertion transducer-C (not commonly used)
2. Standard samms transducer-S (stop production)
3. User’s self equipped transducer
4. Standard B transducer (stop production)

5. Insertion B transducer (now used: Insertion transducer standard fitting)
6. Standard large transducer-L (stop production)
7. Baolisheng standard transducer (from other manufacturer)
8. Standar HS small rack transducer (now used: special for hand-held flow meter)
9. Standard HM medium rack transducer (now used: special for had-held flow meter)
10. Standard M1 medium transducer (now used: suitable to normal/high temperature, standard fitting when leaving factory is equipped with normal temperature M1.
11. Standard S1 samm transducer (now used: suitable to normal/high temperature)
12. Standard L1 large transducer (now used)
13. PI style pipe water meter transducer
14. FS410 (medium) transducer
15. FS510 (large) transducer
16. Clamp on medium transducer TM-1
17. Insertion transducer TC-1
18. Clamp on small transducer TS-1.
19. Reserved item for transducer.
20. Clamp on large transducer TL-1
21. Insertion transducer TLC-2

If users choosing the item of “user’s self equipped transducer” and “PI style pipe water meter transducer” , you must input a set of transducer parameter including: acoustic wedge angle, acoustic Wedge velocity, ultrasonic wave delayed time and space between beam center and dege of Transducer.

#### **M24: TRANSDUCER INSTALLATION METHOD**

Choosing transducer installation method, following 4 options:

0. V (V method install, 2 sound path, commonly used method)
1. Z (Z method install, 1 sound path, the most used method)
2. N method small pipe install (N method install, 3 sound path, not commonly used method)
3. W method small pipe install (W method install, 4 sound path, the less used method)

#### **M25: TRANSDUCER INSTALLATION SPACE**

Display transducer installation space in this menu, users should install transducers according

To this space (when installation, precise installation space is a must), the space is automaticaly

Calculated after inputing pipe parameters.

M26: Setup default parameter when power on

Options: 0. Save parameter by battery

1. Solidify parameter and start to use generally.

1. Solidify parameter and start to use generally means the flow meter automatically callout the Work parameters saved in internal FLASH parameter area to work according to these parameters When power on. The work parameters include pipe parameter, flow unit setup, output equipment Definition etc., the data of the parameter data block can be downloaded by PC, and also solidify the Work parameter of the flow meter into it. Method of solidifying present work parameter is to choose Item of “1. Solidify parameter and start to use generally” in M26, and then press <ENT> key. If The flow meter restarts automatically, that means saved completely. If the flow meter enters the Status of “no option”, that means the work parameters used presently are the same with the parameters Saved in FLASH. If changing the pipe parameters frequently, above methods are not convenient, so Users should choose item of “0. save parameter by battery” and the flow meter will use the work Parameters in Ram instead of calculating the work parameter in FLASH.

#### **M27: SAVE OR READ PIPE PARAMETERS**

This menu is used to save and read pipe and installation parameters, totally 9 sets parameters. The digit Before the sign “.” in the menu means the pipe parameter save address. Press <ENT> key to browse, Move <+> or <-> key to visit the pipe parameters from 0 to 8, saved in 9 pieces parameter saved address. If save the present pipe parameters in the address, then press <ENT> key to choose “1. Save parameter on this position” and press <ENT> key again. If read the parameters on this address as present pipe parameters, then press <ENT> key to choose “0 read the parameter on this position and press <ENT> key again. system will callout the parameter And calculate, automatically turn to M25 window to display installation space after that the flow meter Will work according to this parameter. If after pressing <ENT> key, do not like to save or read, then press <MENU> key to exit.

#### **M28: KEEP LAST DATA WHEN SIGNAL IS POOR**

Choosing “yes” means the flow meter will keep to display normally measured data last time when Signal is poor, so to measure flow continually for the data of totaliser. Otherwise to choose “no”.

#### **M29: SETUP EMPTY PIPE**

The data used to solve the problem of empty pipe. When pipe is empty, perhaps the flow meter



Display “work normally” because signal transfer through pipe wall, in order to prevent it happens,  
Setting the data to make the flow meter not to measure when signal is less than the data. In the condition  
Of empty pipe, the flow meter can automatically not to measure. Pls input 30-40 numeric data.  
To ensure the flow meter not to measure.

## **M2●: INTERVAL OF MEASURING FLOW**

This menu is suitable to RLU 100 version, default sampling period is 0.5 second, you can set reasonable  
Data according to actual needs, enter the menu, press <ENT> key to input.

## **M2-: SAMPLING DATA SET**

This menu is suitable to RLU 100 version, press <ENT> key to input data, then press the key again.

## **M30: CHOOSING METRIC OR IMPERIAL UNIT**

following options:

0. Metric
1. Imperial
2. Default: metric

## **M31: CHOOSING THE UNIT OF INSTANT FLOW RATE**

**Following options:**

Cubic meter	(m <sup>3</sup> )
Litre	(L)
America Gal	(GAL)
Imperial GAL	(IGL)
Americ MGL	(MGL)
Cubic feet	(CF)
America barrel [42]	(OB)
Imperial Barrel	(IB)

## **TIME UNIT OPTIONS:**

Day (d)/ hour(H)/minute(m)/second(S)  
Default unit: (m<sup>3</sup>/hr)

## **M32: CHOOSING TOTALISER FLOW UNIT**

Choosing totaliser flow unit on this menu. The units are the same with those in M31. Users can choose  
According to actual needs. Default unit: m<sup>3</sup>.

### **M33: TOTALISER MULTIPLIER FACTOR**

The function of multiplier factor is to extend totaliser range. It act on the positive , negative, net Totaliser at same time. Choosing following factors according to actual flow size.

0.×0.001 (1E-3)

1. ×0.01

2. ×0.1

3. ×1

4. ×10

5. ×100

6. ×1000

7. ×10000(1E+4)

Default factor: ×1

### **M34: NET TOTALISER SWITCH**

This menu is used to open or close net totaliser switch, when closing the net totaliser value will not Change on M00. Default value.”open”

### **M35: POSITIVE TOTALISER SWITCH**

This menu is used to open or close positive totaliser switch, the flow meter accumulate when opening, when closing, positive totaliser value will not change on M02. Default value: open.

### **M36: NEGATIVE TOTALISER SWITCH**

This menu is used to open or close negative totaliser switch, the flow meter accumulate when Opening. When closing ,negative totaliser value will not change on M03. Default value: open.

### **M3●: DISPLAY CYCLE CONTROL**

Totally displaying 40differnt menu contents, from M00-M39. When power on the default is to Display M00 two methods to setup the LCD display, one is regular display method, the other one Is automaticaly cycle display method. Inputing 0 or 1 means regular displaying content. At the Condition of cycle displaying, after stoping operation fo r60 seconds. Such design make users read More menu contents if waiting for enough tiem when users can not operate the keyboard.

### **M40: DAMPING COEFFICIENT**

Damping coefficient range: 0-999 second. Damping acts as the function of smoothin displaying Datas. Its principle is like a RC low pass filter, damping coefficient value equals to circuitry time Constant, bigger damping coefficient , larger measurement resulrs delayed. Commonly inputing 15-30 for application.

Attention: When clairbrating the flow meter, you must set damping coefficient as zero.

### **M41: LOW FLOW VELOCITY CUTOFF VALUE**

To cutoff flow of low flow velocity in this mnu. So to make the system display “0” value when flow velocity is low, to prevent unvalid accumulation. For example set cutoff value as 0.03, then the instrument take the measured flow data that within  $\pm 0.03$  as “0”, commonly input 0.03 for



Application.

#### **M42: SETUP STATIC ZERO POINT**

When fluid is not running and static, the measuring instruments will have a zero point, but the Displayed data do not equal to “0” , this data is called “zero point” for any instrument, the Existing zero poing is better to be more and more little, otherwise, the zero point is little bigger, that means there is inner quality problem. When the “zero point” of the flow meter os notzero , any time the “zero Point” will be pulsed to the actual flow data, so make the measuring result have to setup static zero point to increase measuremnet accuracy of small flow.

#### **M43: CLEAR STATIC ZERO POINT**

Choosing “yes” to claer the “zero poit” set by users.

#### **M44: MANUAL SETUP ZERO POINT**

Not often used calibration method, suitab;e for experienced operators to us when other methods are not available, the deviant input by people is plused to measuring datas any time , so to obtain true value . for example

Actual measuring value	=250 m <sup>3</sup> /H
deviant	=10 m <sup>3</sup> /H
RLU 100 display	=240 m <sup>3</sup> /H

Normaly the value should be set as “0”.

#### **M45: SCALE FACTOR**

This parameter is called meter coefficient also, used to rectify measuring results, the meter Coefficient is the ratio of “actual value” and “reading Value”. For example , the measured physics value is 2.00, the meter display 1.98, the the coefficient is 2/1.98. so the best coefficient is fixed at 1. But when the meters were batch produced , it is difficult to ensure the coefficient is “1”. The extent of unconformity

Or difference is called “conformity” of the meter. The conformity of higher quality of meter must be better. The coefficient is fixed at “1” before leaving factory. Owing to the design, make the coefficient is determined only by frequency of crystal oscillator and transducers. Unrelated with other circuitry parameters.

The meter coefficient must be input by actual calibrated results.

#### **M46: NETWORD ADDRES IDENTIFICATION NUMBER (IDN)**

Input sustum identification bumber on this menu, th ecode range: 0-65535 except of 13 (ODH <ENT>, 10(OAH changing line), 42 (2AH\*), 33 (26H&), 65535. The identification number is used to identify equipments in network environment. Detailed information is in section of ( 7 seial port and communication protocol).

**M47: PASSWORD PROTECTION**

Lock the instrument in this menu, after locking , system prohibit any modification operation, only can visit parameter to protect the meter work normaly. Enter this menu, press <ENT> to input 4 digits password, press <ENT> again to confirm , so can complete locking , unlocking is the same. Pls remember the password , avoid missing the password that could be unable to operate the meter.

**M48: FLOW RATE RECTIFICAITON BROKEN LINE ARRAY**

The ultrasonic flow meter /heat meter can achieve up to 12 segments flow no linear multi point line segments rectificaiton. This function is off before leaving factory.

Users can choose any digit between 2-12 to rectify the meter according to actual occation.

In order to explain in the method, we can assume the following listed test datas obtained by on line calibrating the meter.

Refer to standard instrument flow rate (m <sup>3</sup> /h)	Displaying flow rate (m <sup>3</sup> /h)	Rectificaion coefficient (standard/displaying) value
1.02	0.998	1.02
5.11	5.505	0.93
10.34	10.85	0.95
20.45	19.78	1.03
50.56	51.23	0.99

In order to rectify the flow that exceeds the above flow range and do not creat sudden change of Rectification coefficient, we plus two point based on above 5 rectification point, ( 0 m<sup>3</sup>/hr , 1.0), (100000 m<sup>3</sup>/hr , 1.0) and (0 m<sup>3</sup>/hr , 1.0) is called minimum flow rectification point, this data set creates suitable rectification coefficient as the indicating flow value of the instrument is less that 1.02 m<sup>3</sup>/hr ; (100000 m<sup>3</sup>/hr , 1.0) is called maximum flow rectification point, its function is to creat suitable Rectification coefficient as the indicating flow value of the instrument is more that 50.56m<sup>3</sup>/hr, so We can conclude following data set from minimum to maximum.

- ( 0 , 1 )
- ( 0.998 , 1.02 )
- ( 5.505 , 0.93 )
- ( 10.85 , 0.95 )
- ( 19.78 , 1.03 )
- ( 51.23 , 0.99 )
- ( 10000 , 1 )

Totally have 7 data set, next to input the 7 data set into the instrument in proper order from minimum to maximum, enter this menu, input data set number “7” , then input above 7 data set in order, so to Complete , the setup of the function of multi-line segments broken line rectificaiton . if need to delete the function , then “0” in menu 48. Restart the function , need to input data point in menu 48 (this example is “7”)

**Attention:** before calibration of the meter, users must shutoff broken line rectification function! Without shutoffing broken line rectification function and to calibrate, thus creat rectification data set that must be



handled by anti-certification according to previous rectification curve data, after that, input the rectification data to the meter, you should avoid anti-rectification that is complex.

Broken line rectification needs users to add two minimum and maximum flow rectification point datas Over the calibration range, the benefit is to achieve special rectification function by inputting different Minimum and maximum flow rectification coefficient. For example , input following data point (0,0) (0.1, 1), (100000, 1) to make the meter introduce “ non linear between 0-0.1 to avoid ultrasonic meters “self running “ occurring near little flow-actual flow rate is zero, but the meter still has indicators. (the self –running phenomenon near zero “zero point”, its nature is the side effect created by the advantage of the flow meter linear keep straight line near zero point, most meters compell To indicate zero by using low flow cutoff, in order to reduce the side effect , by adjusted inputting Different minimum flow point rectification coefficient , choosing suitable rectification curve , to reduce the disadvantage of side effect to the lowest.

#### **M49: CHECK SERIAL PORT INPUT CONTENT**

Using this menu to check the datas transfereed from serial port. If unconnecting with communication, pls check this menu to see whether there are datas transferred from upper monitor. If no diaplaying. Pls check hardware circuitry. If there is data displaying , but unvaluable, pls check whether the setup of baud rate is right or not.

#### **M50: DATA PRINTING AT SCHEDULED TIME OPTIONS**

To setup opening or closing the function of printing on scheduled time and setup the pirnting content in this menu. Press <ENT> key, move upper or down arrow key to choose “open” or “close” means Closing the printing function, “Open” means : the system indicate users to choose following printing contents.

0. Output date time
1. Output system work status
2. Copy present displaying menu.
3. Output signal stength quality
4. Output instant flow rate
5. Output instant flow velocity
6. Output net totaliser
7. Output positive totaliser
8. Output negative totaliser
9. Output instant heat flow rate
10. Output net heat totaliser
11. Output positive heat totaliser
12. Output negative heat totaliser
13. Output present medium flow velocity
14. T1 output temperature input T1
15. Output temperature input T2
16. Output analogue input AI3
17. Output analogue input AI4



18. Output analogue input AI5
19. Work time timer
20. Output today total
21. Output (ESN)

“Open” above options means printing at scheduled time . “close” means no printing.

#### **M51: SETUP PRINTING TIME AT SCHEDULED TIME.**

This menu is used to input starting time, interval and continually printing times of printing at scheduled time, minimum unit is second.

Input “\*\*.\*.\*.” at printing item, that means starting printing at this time. Example : 23:10:10, then start printing at this time, interval time is the interval of two printing time is over 8000, that means the printing at scheduled time can last for the longest time. After input starting time <ENT> to enter interval menu, the biggest printing Interval is 24 years.

#### **M52: CONTROL OUTPUTING DATA FLOW DIRECTION**

To setup opening or closing the function of printing on scheduled time, and setup the printing content on this menu. Press ,ENT> key, move upper or down arrow key to choose “Open” or “close”, “close” means closing the printing function, “open” means : the system indicate users to choose following printing contents. Two options:

0. Output to internal serial bus (output to internal serial printer)
1. Output to serial port (RS -232C/RS-485)

#### **M53: DISPLAY ANALOGUE INPUT AI5**

Display analogue input AI5 current value and corresponding temperature value , pressure value or liquid level valud, flow meter version function is to display battery voltage.

#### **M54: OCT PULSE WIDTH SETUP**

Setup range: 6ms-1S

#### **M55: CURRENT LOOP OUTPUT MODEL CHOOSING**

The menu is to choose current loop output model, following options:

- |                                                            |                                                               |
|------------------------------------------------------------|---------------------------------------------------------------|
| 0. 4-20 mA output model                                    | setup current loop 4-20 mA corresponding to instant flow rate |
| 1. 0-20 mA output modle                                    | Setup current loop 0-20mA corresponding to instat flow rate’  |
| 2. RS485 control 0-20mA                                    | setup to be controlled by serial port method.                 |
| 3. 4-20 mA correspondig to flow velocity<br>sound velocity | setup curretn loop 4-20 mA corresponding to flow              |
| 4. 20-4-20mA output model                                  | setup output range of current loop: 20-4-20 mA                |
| 5. 0-4-20 mA model                                         | setup current loop output range: 0-4-20mA                     |
| 6. 20-0-20mA model                                         |                                                               |

- |                                        |                                                                   |
|----------------------------------------|-------------------------------------------------------------------|
| 7. 4-20mA corresponding flow velocity  | setup current loop 4-20mA corresponding to instant Flow velocity. |
| 8. 4-20mA corresponding heat flow rate | setup current loop 4-20 mA corresponding to heat Flow rate.       |

Output is controlled by serial port method, current loop output current value according to input command and parameters on RS 485 port, command format refer to serial port control command introduction. For example : if to make current loop to output 6 mA current , then to setup “RS485 control 0-20 mA” method in M55 and execute command “A06 (CR)” on serial port, that is ok. This function make flow meter control conveniently valve aperture.

#### **M56: 4MA OR 0MA OUTPUT VALUE**

This menu is used to setup correspondign flow value of current loop output value 4 mA or 0mA (4 mA or 0mA is setup in M5), choose flow unit inM31. When choosing “flow velocity 4-20mA” method in M56 , th unit is m/s.

#### **M57: 20 MA OUTPUT VALUE**

This menu is used to setup corresponding flow value of current loop output value 20 mA, the flow unit is the same with that in M31.

#### **M58: CURRENT LOOP OUTPUT CALIBRATION**

This menu is used to check whether the current loop has been calibrated or not. When checking , press <ENT> key, move <+>, <-> to 0mA, 4 mA, 20mA, using ammeter to measure the output current of current loop, and see whether it is the same with the value diaplaying on Menu. If over the tolerant error, then need to calibrate the current loop again. Detailed information refer to “input and output return circuit and use”.

#### **M59: PRESENT CURRENT LOOP OUTPUT VALUE**

This menu display current loop output actual current value. If displaying 10.0000mA, that means the current loop output value is 10.0000mA. if the output value has bigger deviation with the value displaying on this menu, users should calibrate the current loop again.

#### **M60: SETUP DATE AND TIME**

This menu is used to modify system date and tim. Time is 24 hous format commonly no use to modify. When outer power off, it can use spare battery , permanent calender can continue to run for 5 years. Many ways to modify time. Using keyboard to modify , using software protocol to modify also. Using keyboard to modify, press ,ENT> key, “>” sign appears on the left down line of screen, it is modify status , using <> key to skip the digits that need not modify , press <ENT> key to confirm.



**M61: SOFTWARE VERSION AND ESN**

Displaying the meter's software version and ESN, the version represents the development of the software, normally bigger digit represent better developed software, the ESN is sole for the manufacture to establish meter files, users to manage the flow meter.

**M62: SERIAL PORT SETUP**

This menu is used to setup serial port that is connected with other equipments, so the serial port parameters of both must be compatible. The datas of first choice in this menu is baud rate, there are several choices: 300,600,1200,2400,4800,9600,19200 . Second choice represents check bit, choose "none", "Even", "odd".

Fixed length of data bit : 8

Fixed length of stop bit: 1

Default parameter of serial port: "9600, 8. None, 1"

**M63: CHOOSING COMMUNICATION PROTOCOL**

This menu is used to choose communication protocol. If users use FUJI extension protocol or water meter simplicity protocol, pls choose "MODBUS ASCII+ previous protocol" item.

If choosing "MODBUS~RTU", though it can support MODBUS~ ASCII and FUJI extension protocol or water meter simplicity protocol, but the setup is convenient to adjust data transfer. So the suggestion for users to choose ASCII item.

**M64: AI3 ANALOGUE INPUT VALUE RANGE**

This menu is used to input analogue input temperature or pressure value that 4 mA and 20 mA represents.

**M65: AI4 ANALOGUE INPUT VALUE RANGE**

This menu is used to input analogue input temperature or pressure value that 4 mA and 20 mA represents

**M66: AI5 ANALOGUE INPUT VALUE RANGE**

This menu is used to input analogue input temperature or pressure value that 4 mA and 20 mA represents

**M67: FREQUENCY RANGE OF FREQUENCY OUTPUT SIGNAL**

This menu is used to setup upper limit frequency value of frequency output signal. The upper limit value must be more than lower limit value , value range : 0~6666HZ. Default range: 0~100HZ.detailed information refer to " input output return and its use".

**M68: LOWER LIMIT FLOW VALUE OF FREQUENCY OUTPUT**

This menu is used to setup flow value of lower limit frequency point of corresponding frequency signal, when frequency output signal is lower limit frequency value of frequency output, its corresponding flow value.



**M69: UPPER LIMIT FLOW VALUE OF FREQUENCY OUTPUT**

This menu is used to input flow value of upper limit frequency point of corresponding frequency signal.

**M70: LCD BACKLIT LIGHTING TIME**

This menu is used to choose LCD backlit lighting time.

Press <ENT> key, input the lighting time of the LCD.

**M71: LCD CONTRAST CONTROL**

Control LCD contrast ratio, press <ENT> key, more,<+> or <-> key to increase or decrease data value to reach the ratio, press <ENT> again to ensure.

**M72: WORK TIMER**

Display total work time since last clear zero, listed hour: minute : second . if to clear zero, press <ENT> key, choose “yes”.

**M73: #1 SETUP LOWER LIMIT VALUE OF BEEPER**

Input lower limit value of alarm. Under the condition of opening alarm in M78 or M79 , any measured flow value lower this limit will cause alarm output of hardware OCT or relay.

**M74: #1 SETUP UPPER LIMIT VALUE OF BEEPER**

Input upper limit value of alarm . Under the condition of opening alarm in M78 or M79 , any measured flow value higher this limit will cause alarm output of hardware OCT or relay.

**M75: SETUP LOWER LIMIT VALUE OF BEEPER**

Input lower limit value of alarm . Under the condition of opening alarm in M78 or M79 , any measured flow value lower this limit will cause alarm output of hardware OCT or relay.

**M76: SETUP UPPER LIMIT VALUE OF BEEPER**

Input upper limit value of alarm . Under the condition of opening alarm in M78 or M79 , any measured flow value higher this limit will cause alarm output of hardware OCT or relay.

**M77: BEEPER SETUP**

Trigger source signal of beeper , choose one of the following.

0. alarm when there is no signal
1. Alarm when the signal is poor
2. Alarm when the measured status is not normal
3. Alarm when flow reversely
4. Analogue output over range by 100%
5. Frequency output over range by 120%
6. # 1 beeper over upper and lower limit



7. #2 beeper over upper and lower limit
8. Act as batchmeter output
9. Positive totaliser pulse output
10. Negative totaliser pulse output
11. Net totaliser pulse output
12. Positive heat quantity totaliser pulse output
13. Negative heat quantity totaliser pulse output
14. Net heat quantity totaliser pulse output
15. Fluid sound velocity changing bigger>
16. Fluid sound velocity changing smaller<
17. Serial port control on/off
18. M51 output at scheduled time once a day.
19. Scheduled time's #1 beeper
20. Scheduled time's #2 beeper
21. Scheduled time controller is fully occupied
22. M51 cycle output at scheduled time
23. 90% of batchmeter is occupied
24. Ringing when pressing keys
25. Close beeper

Default : "ringing when pressig keys".

#### **M78: OPEN COLLECTOR TRANSISTOR OUTPUT( OCT) SELECTION**

This menu is used to setup trigger source of output part of OCT. OCT is normally closed , optional trigger source is following:

0. Alarm when there is no signal
1. Alarm when the signal is poor
2. Alarm when the measured status is not normal
3. Alarm when flow reversely
4. Analogue output over range by 100%
5. Frequency output over range by 120%
6. #1 beeper over upper and lower limit
7. #2 beeper within limit
8. Act as batchmeter output
9. Positive totaliser pulse output
10. Negative totaliser pulse output
11. Net totaliser pulse output
12. Positive heat quantity totaliser pulse output
13. Negative heat quantity totaliser pulse output
14. Net heat quantity totaliser pulse output
15. Fluid sound velocity changing bigger>
16. Fluid sound velocity changing smaller<
17. Serial port control on/off



18. M51 output at scheduled time once a day
19. Scheduled time's #1 beeper
20. Scheduled time's #2 beeper
21. Batching controller is fully occupied
22. M51 cycle output at scheduled time
23. 90% of batchmeter is occupied
24. Frequency signal output
25. Close OCT output

When choosing totaliser pulse output , width is between 6mS-1S to setup : 200 mS, setup pulse width in M54.

Increaded function of outputting frequency signal by OCT. frequency output signal represents the size of instant flow by output pulse numbers per second.for example: assumed 0 flow correspond to 0 pulse, 3600 m<sup>3</sup>/S correspond to 1000 pulsed, then if tested 432 pulsed per second, instant flow rate of present flow meter is  $432 * (3600/1000) = 1555.2 \text{ m}^3/\text{S}$ . in this example pulse equivalency =  $3600/1000 = 3.6 \text{ m}^3/\text{pulse}$ , the pulse equivalency number can be freely setup in flow meter. In the OCT output selection, choose "24 frequency signal Output " to lead the frequency signal to OCT output.

### **M79: RELAY OUTPUT SELECTION**

This menu correspond to OCT2( normally closed) output, optioal trigger source is as following.

0. Alarm when ther is no signal
1. Alrarm when the signal is poor
2. Alram when the measured status is no normal
3. Alarm when the flow reversely
4. Analogue output over range by 100%
5. Frequency output over range by 120%
6. #1 beeper over upper and lower limit
7. #2 beeper within limit
8. Act as batchmeter output
9. Positive totaliser pulse output
10. Negative totaliser pulse output
11. Net totaliser pulse output
12. Positive heat quantity totaliser pulse output
13. Negative heat quantity totaliser pulse output
14. Net heat quantity totaliser pulse output
15. Fluid sound velocity changing bigger>
16. Fluid sound velocity changing smaller<
17. Serial port control on/off
18. M51 output at scheduled time once a day
19. Scheduled time's #1 beeper
20. Scheduled time's #2 beeper

21. Batching controller is fully occupied
22. M51 cycle output at scheduled time
23. 90% of batchmeter is occupied
24. Frequency signal output
25. Close relay output

### **M80: CHOOSE INPUT SIGNAL OF BATCHING CONTORLLER**

This menu is used to choose start control signal of batching controller, following options:

0. Press <ENT> key to start
1. Serial port input control
2. Analogue input AI3 upper limit start
3. Analogue input AI3 lower limit start
4. Analogue input AI4 upper limit start
5. Analogue input AI4 lower limit start
6. Analogue input AI5 upper limit start
7. Analogue input AI5 lower limit start
8. Time cycle start
9. Start at scheduled time one time per day.

Current signal imposed on analogue input, “0” signal represents 0mA, “1” signal represent more than 2 mA, this signal can be obtained by series connecting a suitable resistor to analogue input interface. Impedance of analogue input return is 220 ohm. If the output high level voltage of digit signal is 5V, then choose the resistor in series connection is 1K ohm, creat about 4mA current.

### **M81: BATCHING CONTROLLER**

Flow meter has built in batching controller , keyboard can control input signal , and control by analogue input port also, or by MODBUS to setup and control ; output signal can be output by relay or OCT , and read by MODBUC. Modify the batching value in this menu, after that it enter batching controller display status.

Accumulating intercal time fo the built in batch controller is reduced form 500ms to 5 ms , accuracy is quality improved . It can meet requirements of most industrial application.

### **M82: DAY/MONTH/YEAR TOTALISER**

Using this menu to check totaliser of any one day, one month, one year of last 64 days , 32 months , 2 years. 0. Check by day 1. Check by month 2. Check by year.

Using <ENT> , <+> or <-> keys to browse the totaliser contents of day, month, year, moving <+> or <-> key to browse totaliser of some one day , some one month, some one year.

### **M83: AUTOMATICALLY REPLENISH FLOW SWITCH DURING THE PERIOD OF POWER OFF**

The function of automatically replenish flow switch during the period of power off can estimate the uncalculated flow during the period of power off and replenish . The estimated base is average of instant flow before power off and instant flow after power on multiply the time of power off. Choosing “on” to use this function.

**Attention:** Ultrasonic flow meter mainboard do not have built-in spare battery , when power off , clock Stops work, the function unavailable.

### **M84: CHOOSING HEAT QUANTITY UNIT**

Optional unit: “GJ”, “Kcal”, “BTU” default: GJ.

### **M85: TEMPERATURE SIGNAL SOURCE CHOOSING**

This menu is used to choose temperature signal source while measuring heat quantity.

Two sources.

0. Input from temperature T1, T2
1. Input from AI3, AI4
2. “0” input from temperature T1, T2” means inputting temperature signal by temperature transmitter T1,T2.

Input signal form AI3, AI4 must be the current signal between 4-20 mA or 0-20mA, the signal is normally created by temperature transmitter.

### **M86: CHOOSING HEAT CAPACITY**

Optional following two specific heat. International specific heat is calculated according to temperature value by national standard.

1, international CJ-128 enthalpy

2, using fixed specific heat

Water heat capacity is normally  $0.0041868 \text{ GJ/m}^3/\text{°C}$  (=1000kcal/m<sup>3</sup>/°C)

### **M87: HEAT QUANTITY TOTALISER SWITCH**

This menu is used to open or close the totaliser , choose “on” to open, choose “off” to close.

### **M88: HEAT QUANTITY TOTALISER MULTIPLY FACTOR**

This menu is used to choose the multiply factor , the factor is  $\times 0.0001$ - $\times 1.000000$

### **M89: PRESENT TEMPERATURE DIFFERENCE AND SENSITIVITY**

### **M80: CHOOSING INSTALLATION LOCATION OF HEAT METER**

This menu is used to choose the heat meter is installed on supply pipe or return pipe. Default : install on supply pipe, calculate heat energy by enthalphy potential method.

0, install on return pipe

1, install on supply

### **M90: SIGNAL STRENGTH AND SIGNAL QUALITY**

This menu is used to display the upstream and downstream signal strength and signal quality measured by the flow meter. Signal strength is expressed by digits range 00.0-99.9. “00.0” indicates no signal received, “99.9” indicates maximum signal. Normaly work environment, the signal strength should more than 60.0 .

Signal quality is expressed by digits range 00-99. “00” means the worst , “99” means the best. Normaly work environment, the signal quality should be more than 50 (>50), if lower than 50 , the flow meter can not measure normaly.

When installing,adjust the signal strength and quality more bigger, more better, higher data can assure the flow meter work stably for longer time, get more accuracty results.

### **M91: TRANSIT TIME RATIO**

This menu display the ratio of calculated transit time according to users condition and actualy measured transit time. Normaly the value should be  $100\pm 3\%$ . If the difference is too big. Users should check whether the input parameters are correct or not, (outside diameter, wall thickness, material etc), especialy the sound velocity of fluid is correct or no, installation location of transducers are suitable or not. And also check if the pipe is in good shape , the kinds of fluids ,etc.

If the signal transit time is over the range of  $100\pm 20\%$ , that means serious wrong parameters, or the pipe exists serious problem of wall directly transfer.

### **M92: FLUID SOUND VELOCITY**

This menu displays measured fluid sound velocity by the flow meter, normaly the value nearly equal to the input value by users in M21, if the difference of two values is too bigger, then the installation location of transducers is wrong or the datas in M21 are not correct.

### **M93: TRANSIT TIME AND TRANSIT DELTA TIME**

This menu display measured ultrasonic average transit time (unit uS) and transit delta time of upstream and downstream the value is the main base of calcuating flow velocity by ultrasonic flow meter. Especialy the transit delta time can reflect whether the meter work stably or not. Normaly the fluctuation ratio of the transit delta time should be less than 20%. If more than this value, that means the system do not work stably, so you should check the transducers installation location, and the set parameter.

When measuring pipes that the diameter is little , pls note the stable transit time, if it change a lot often, pls move the transducers to keep it stabe to obtain more accuracy measurement results.

#### **M94: REYNOLDS NUMBER AND RECTIFICATION COEFFICIENT**

This menu display the reynolds number calculated by the flow meter and present adopted speed rectification coefficient value (or pipe factor) , this rectification coefficient is the coefficient of pipe inner line average flow velocity and average flow velocity.

#### **M95: POSITIVE, NEGATIVE HEAT QUNATITY TOTALISER , START CYCLE DISPLAY FUNCTION**

The menu feature: enter this mnu to start cycle display status , the order is M95→M00→M01→M02→M03→M04→M05→M06→M07→M08→M09→M95,time interval is 8S, this function can make users visit main measurement value and work status without operating on the meter. If to stop this function , input any menu number except M95. For example: M02.

#### **M+1: TOTAL WORK TIME OF THE FLOW METER**

Using this function to know the total work time of the RLU 100100 after leaving factory.

#### **M+2: LAST TIME OF POWER OFF**

Display last time of power off

#### **M+3: LAST INSTANT FLOW RATE WHEN POWER OFF**

Display last instant flow rate when power off.

#### **M+4: TOTAL TIMES OF POWER ON/OFF**

Display total times of power on/off of the RLU-100 after leaving factory.

#### **M+5: CALCULATOR**

This menu is a calculator including function calculation , the using method. Firstly input first parameter  $\times$ , then choose operator , if there is second parameter, then input it, the result exist in  $\times$  . for example : 1+2, firstly input <MENU> <+><5><1><ENT> , move <+> or <-> to choose “+” operator <ENT><2><ENT>

The calculator has the function of register , choosing the function by the way of choosing operator.

**Attention:** when the meter is in work , there is no influence to use the calculator

#### **M+6: SETUP THRESHOLD VALUE OF FLUID SOUND VELOCITY**

Input the threshold value, after estimated fluid sound velocity on M92 reach this value , it create reversion signal internally , the signal will be output through OCT, BUZZER , using this function to identify fluid simply.

#### **M+7: THIS MONTH NET TOTAL FLOW**

Display this month net total flow



**M+8: THIS YEAR NET TOTAL FLOW**

**M+9: TOTAL RUNNING TIME OF FAULT**

Display unavailable measuring time including power off, no signal, signal adjusting etc, Press ENT key to clear zero.

**M•2: STORE PRESENT ZERO POINT DELAY**

Display the size zero point created by using M42, press<ENT> key to store the zero point to hardware as default zero value later.

**M•5: SETUP THRESHOLD VALUE OF Q VALUE**

The signal quality(Q value) of the flow meter is more than the threshold value set in this menu (default: 50), so that the flow meter could be in normal work status(display\*R).

**M•8: MAXIMUM INSTANT FLOW RATE OF THIS DAY AND THIS MONTH**

Display maximum instant flow rate of this day and this month.

## **4. SPECIAL PORT TEST WINDOW WITH CMM COMMAND OUTPUT**

### **4.1 SPECIAL INTRODUCTION OF MENU SETUP**

#### **4.1.1 WORK PARAMETER SOLIDIFICATION OF THE FLOW METER AND OPTION INTRODUCTION**

The new Ultrasonic Flow meter has 3 work parameter areas. Respectively called present parameter data block, solidification parameter data block, user pipe parameter data block.

Present parameter data block is built in internal RAM, if outside power supply and spare battery are off together, then lost the present work parameter

Solidification parameter data block is built in internal FLASH, normally it will not lose for long time stable work application, after setup all the work parameter data block when power on for each time. For the application of modifying the parameters frequently (Like portable flow meter), please choose "0". Use parameter in RAM area option in M26. When power On, then keep the parameters in RAM to use directly. If the data block in RAM exists verification errors, then it will go on to recall the work parameter in flash

User parameter data block is able to store 9 sets commonly used pipe parameters the access operation is in M27.

#### **4.1.2 ZERO POINT SETUP AND ZERO POINT SOLIDIFICATION**

The new transducers have a "zero point", its meaning is when fluid flow velocity is zero, the flow meter will display a non-zero flow value. This value will repeatedly add to indicating value of the flow meter under any flow velocity, for example assume that the zero point is 1m<sup>3</sup>/h, present flow velocity is 10m<sup>3</sup>/h, and then the indicating value of the flow meter is 11m<sup>3</sup>/h. so newly install or change transducers, normally

need to adjust zero point and log zero point value, minus this zero point value from indicating value for calculating later.

To adjust zero point in M42. But the zero point value after adjusting is only stored in RAM parameter area temporarily, is not solidified in FLASH. If the spare battery is off or choosing the solidification parameters in FLASH as work parameters when power on, the zero point value will loose. In order to keep the zero point value forever, users must use M.2 to store the zero point after adjusting zero point for each time

#### **4.1.3 FACTORY USE THE SCALING FACTOR SOLIDIFICATION**

Same as the principle of storing zero point value, factory scaling factor need be solidified after calibration before leaving factory is M.1, use two grade passwords to visit

#### **4.1.4 ANALOGUE CALCULATING FUNCTION APPLICATION**

When setuping pipe diameter is zero, display the instant flow velocity: 1.2245678 m/s (4.0504 ft/s), instant flow rate=0, and display “R” status inputting a set value in M44 can obtain changeable totalizer output. Using this function to achieve the function of test of the flow meter and adjust of network software without connecting transducers.

#### **4.1.5 ANALOGUE INPUT INTERFACE AS DIGIT INPUT INTERFACE METHOD AND INTRODUCTION**

The ultrasonic flow meter series analogue input interface can work as digit input interface can work as digit input interface, but note that the loop input current should not be over 20mA. When outer digital quantity voltage is 5V, you should series connect at 1k resistor in return circuit. If the quantity voltage is 12V, then series connect a 2K resistor.

#### **4.1.6 INTRODUCTION OF SERIAL PERIPHERAL EXTENSION INTERFACE**

Serial peripheral extension interface is like 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, 4-20 mA value , frequency value and printing data etc. different function model can take down datas according to requirements. The serial bus use 4800 baud rate

#### **4.1.7 REALIZE MEDIUM IDENTIFYING FUNCTION**

For example: application in mixture fluid of oil and water, to judge the medium in pipe is water or oil, you could input lower limit of the 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 1400 m/s, a internal signal created, used to indicate that the fluid is another medium this signal can be output by OCT or ready by MODBUS protocol but you assure that the two fluid flow velocity cannot exist overlap



#### 4.1.8 THE FLOW METER RESTORE TO 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

Attention: Expect of first installation, normally not use this function.

### 5. SWITCH ON (POWER ON)

When switched on, the Ultrasonic Flow meter series will run self-diagnostic procedures, I there are problems; they will be displayed on the window. After troubleshooting the device will work according to the parameters set by user last time

Keyboard operation does not affect the measurement process, because ultrasonic Flow Meter series have adopted time-sharing technology for parallel processing. Operations like measurement, calculation, press the key, displaying, print, serial port operation, input and output etc. are known as “incidents” and they are independent. For example, modification of time and date will not affect other tasks unrelated to time and date.

When the transducer is switched on, if the flow meter have been installed, the adjustment of amplifier gain by the flow meter can be seen on M01. After showing the four steps of S1, S2, S3 and S4 at the upper left corner of the window, the flow meter will automatically enter the normal measuring status with “\*R” displayed on the upper left corner

The pipeline parameters should be input when the transducer is used for the first time or is located at a new position. When users change the parameters or move the transducer, the mainframe will automatically re-calculate add adjust, operate according to the new parameters entered by users.

Ultrasonic Flow Meter series is able to complete all the tasks at the same time, and whatever on

Which menu window, tasks like measuring and output go on without delay..

After power on for each time, display the last menu before power off.

### 5.1 CHECK INSTALLATION OF TRANSDUCERS

After the completion of transducer installation, the user should check the following items to see whether the installation is suitable, whether they received ultrasonic signal is correct, enough strong, that could make the meter. Work normally and long time running. By checking the receiving signal strength S, the signal quality Q value the delta time, the transit time ratio R to assure whether the installation point is good or not. Normally couplant on the transducers and attach them on the pipe, so can obtain measurement results, but it normally couplant on the transducers and attach them on the pipe, so can obtain measurement results, but it is better to check followings to ensure the flow meter is working properly and the results are reliable and accurate



### **5.1.1 SIGNAL STRENGTH**

Signal strength S (Display on M90) indicates strength of sending and receiving signals from upstream transducer and downstream transducer by a 3-digit no.[00.0] means there is no signal detected and [99.9] refers to the maximum signal strength that can be detected. When installation do best to adjust the position of transducers and check whether the couplant is sufficient, to make sure to gain the strongest signal. Although the instrument works well when the signal strength ranges from 60 to 99, when the signal strength is too low, you should check the installation position, installation space, whether the pipe is suitable to install or change to install by Z method. Stronger signal strength should be pursued, because a stronger signal means a stable measurement results, long and reliable running.

### **5.1.2 SIGNAL QUALITY (Q VALUE)**

Signal quality is indicated as the Q value (display on M90) that represents the receiving signal is good or not, Ultrasonic Flow Meter series use 00-99 digits to represent signal quality. 00 represent the worst signal, 99 represent the best signal and normally the signal quality should be above 60. The reason of poor signal quality could be big interference or worse installation of transducers or using bad quality not professional signal cable. Normally to adjust transducers repeatedly, check the couplant that is enough or not, until the signal is better.

### **5.1.3 TOTAL TRANSIT TIME, DELTA TIME**

The total transit times (or travelling time) and delta time are displayed on menu window M93, they can display whether the installation is suitable or not, they are

The basic two parameters for the flow meter's internal measurement and calculation, when the data of delta time fluctuates too much, they showed flow rate and velocity will change quickly, under such condition, it means the signal quality is not good, perhaps the conditions of pipe is not good, not suitable installation of the transducers, or wrong parameters input. Normally the fluctuation of delta time is less than  $\pm 20\%$ . But when the pipe diameter is too small or lower flow velocity, the fluctuation of delta time may be higher

### **5.1.4 TRANSIT TIME RATIO**

Transit –time ratio 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  $100\pm 3\%$ . When the ratio is over the range you should check

- a) If the entered pipe parameter are correct?
- b) If the actual space of the transducers is the same as or close to what shown on window 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 interference source around the flow meter?

## 6. TROUBLE SHOOTING

Ultrasonic Flow meter series designed perfect self- diagnosis function. The errors are displayed on the upper right corner of the menu window via identification code in a timely order.; display orderly all the 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

Display errors of ultrasonic flow meter series 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 “\*F” on 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 manufacturer. The other is error information about measurement refer to tables

### 6.1 : HARD WARE SELF-DIAGNOSIS ERRORS AND SOLUTIONS AFTER POWER ON

<b>LCD Display Information</b>	<b>Causes</b>	<b>Solution</b>
ROM verification Error	*ROM operation illegal/ Error	* contact the manufacturer
Logger reading error	*Stored parameters are wrong	*Power On again/ contact the manufacturer
System Logger error	*System stored data area has error	*Power On again/ contact the manufacturer
Measuring circuit hardware error	*Sub-CPU circuit errors	*Power On again/ contact the manufacturer
CPU Clock speed error	*system timer has errors	*Power On again/ contact the manufacturer
Date time error	*System timer has errors	*Power On again/ contact the manufacturer
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

**6.2: WORKING STATUS ERRORS CODE CAUSES AND SOLUTIONS**

Code	M08 Displaying	Causes	Solutions
*R	System work normally	*normal system	
*J	No Signal	*Unable to receive signal *Loosen contact or not enough couplant between transducer and pipe surfaces *Transducers installed improperly *Scaling on inner pipe wall is too thick *new changed liner	*Make Sure the transducer is in tight 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 with code "I"	* Solutions are the same with code "T"
*H	Poor Signal quality received	*poor signal quality * include above all caused	* Include above all solutions
*E	The current of loop is over 20mA (not influence the measurement if not using current output)	*4-20 mA 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 freq output)	*4-20 mA current loop output overflow 120% * Improper settings for current loop output	* Check Freq output settings or confirm if the actual flow rate is too high
*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 M00, M01, M02, M03)	Instrument is in the progress of adjusting the gain to prepare the measurement. If stopped at S1 or S2 or switched between S1 and S2 that means the too lower receiving signal or not good wave	
*K	Empty pipe setup	No liquid in pipe or wrong	If there is liquid actually input 0



in M29	setup	Value in M29
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**Attention:** the codes of \*Q, \*E displayed do not affect measurement, only means current loop and frequency output have problems.

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