Process Center AB

Manual Elektromagnetisk Flödesmätare RBEF-E Mini

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Manual

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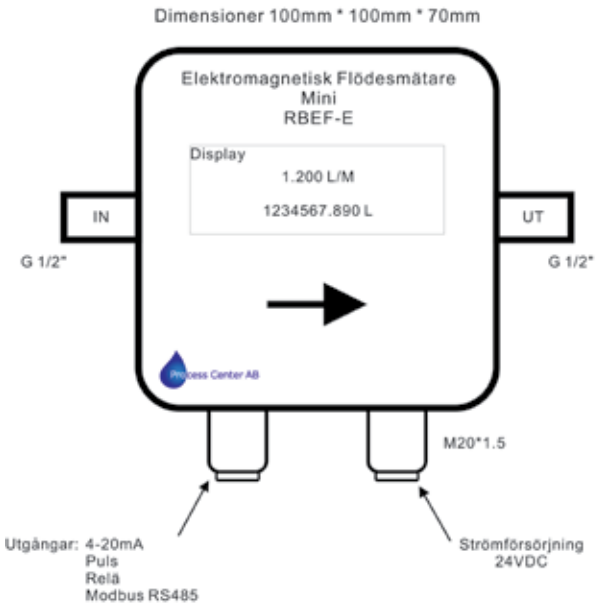
Contents

1. Structure

There are two versions of RBEF-E-Mini: Display and Blind as shown in Fig. 1.

Fig. 1 Photograph of RBEF-E-Mini

The basic structure of the compact Magmeter is given in Fig. 2



Anslutningar:

Spänningsmatning:	+24VDC COM	Grå Blå
Pulsutgång:	P+ COM	Vit Blå
Analog utgång:	I+ COM	Brun Blå
Reläutgång	N01 N02	Grön Svart
Modbus RS485	A B	Röd Gul

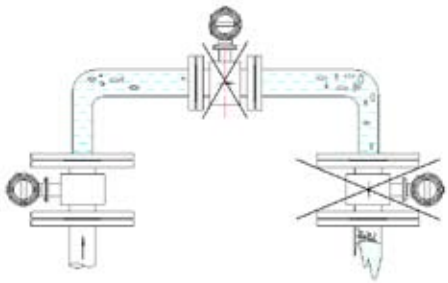
2. Technical Specification

- Size: DN1.5, 3, 6, 8, 10, 15, 20mm
- Velocity range: 0.01m/s – 10 m/s
- Accuracy: ±0.5% of RS (Velocity>0.6m/s) or ±3mm/s(Velocity≤0.6m/s)
- Repeatability: 1/3 of accuracy
- Temperature: PT1000, 0.1℃ resolution
- Media Conductivity: 20 ms/cm
- Measuring Direction: Bi-directional measurement
- Max Working Pressure: 1.0MPa
- Max Working Temperature: 60℃ for PE liner, 90℃ for PEEK or Ceramic liner
- Liner: PE, PEEK, Ceramic
- Electrodes: SS316L or HC
- Enclosure: Aluminum, IP65 for Blind version
- Connection: G1/2 or NPT 1/2
- Power supply: 24VDC, ≤100mA
- LCD display: flow rate and total flow
- Analog output: 4 – 20mA
- Pulse output: 0 – 5K Hz
- Relay Output: optional, 1 Relay 2A/30VDC
- RS485 MODBUS: Optional for Display version, Standard for Blind version

3. Installation

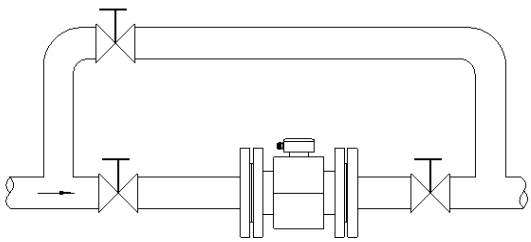
RBEF-E-Mini can be installed horizontally or vertically. It is recommended that the meter is installed with the electrodes in or close to the horizontal plane to ensure that any passing air or bubbles do not interfere with the measurement. If installing in a vertical pipe, it is highly recommended that flow direction is upwards to guarantee that the pipe remains full at all times. Ensure upstream and downstream straight pipe run requirements are met.

There are some general precautions for installation:



Avoid Areas Where Air Accumulates and Open Pipe Outlets

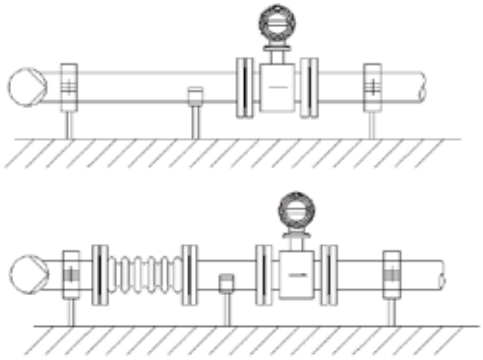
The meter must remain full of liquid in order to operate correctly. Avoid high points in



Bypass Line for Easier Maintenance

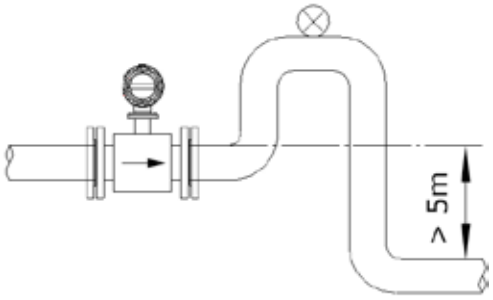
It is good practice to install a bypass around a meter to allow maintenance access without the need to shut down the line. Ensure upstream

pipes where air may tend to accumulate and vertical outlet legs.



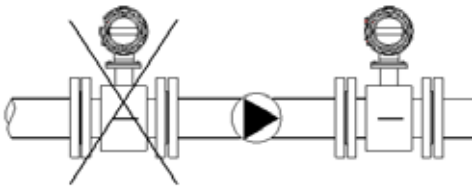
Avoid Strong Vibration

Piping should be securely fixed where there are vibrations present. It is recommended that the transmitter be mounted remotely in these installations. For installations with severe vibration, a flexible coupling is recommended to prevent the transmission of vibration through the pipe to the flow tube. In all cases, the flow meter should be properly supported upstream and downstream to prevent undue stress being placed upon the meter and flanges. NEVER support a meter on it's casing as this can cause internal dRBEF-Ee to the meter coils.



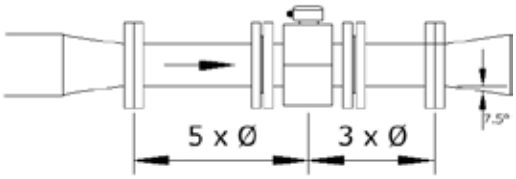
Avoid Negative Pressure Situations

Where the pipe system has a fall of over 5m after a meter installation, it is advisable to install a vent or vacuum breaker above the meter to prevent damage to the meter liner.



Avoid Installing Upstream of a Pump

Avoid installing a mag flow meter on the suction side of a pump as this may create negative pressure in the line and damage the meter lining. Wherever possible, always install downstream of a pump.



Ensure Straight Pipe Run Requirements are met when Reducing Pipe Diameter

When the pipe diameter is reduced to accommodate a flow meter, it is recommended that straight run pipe length requirements both upstream and downstream are built into the installation. It is further recommended that reducers with a center cone angle no greater than 15° be used to ensure the consistency of the liquid flow profile.

4. Wiring

There are 8 cables for wiring, which are depicted in Table 1 below.

Fig. 3 Cable Connection Identifier

Table 1 Cable Description

Connector Label	Cable Color	Cable Definition	Cable Descriptions
7	Gray	+24V DC	The external 24V DC Power +
8	Blue	COM	Common Ground
6	White	P+	Pulse +
5	Brown	I+	4-20mA Current Output +
3	Green	NO1	Relay NO Contact 1
4	Black	NO2	Relay NO Contact 2
1	Red	A	RS485 A
2	Yellow	B	RS485 B

5. Operation

5.1 The Operation of Display version

The keypad and display are shown in Fig. 4.

Notes: Hold ALT key and press ENTER key, the converter will display a login page and password is required. Input proper password and press ENTER again. The system enters into the setup mode. To exit from setup mode and return to measurement mode, hole ENTER key for a couple of seconds. The system can automatically return to measurement mode if no key is pressed for 3 minutes.

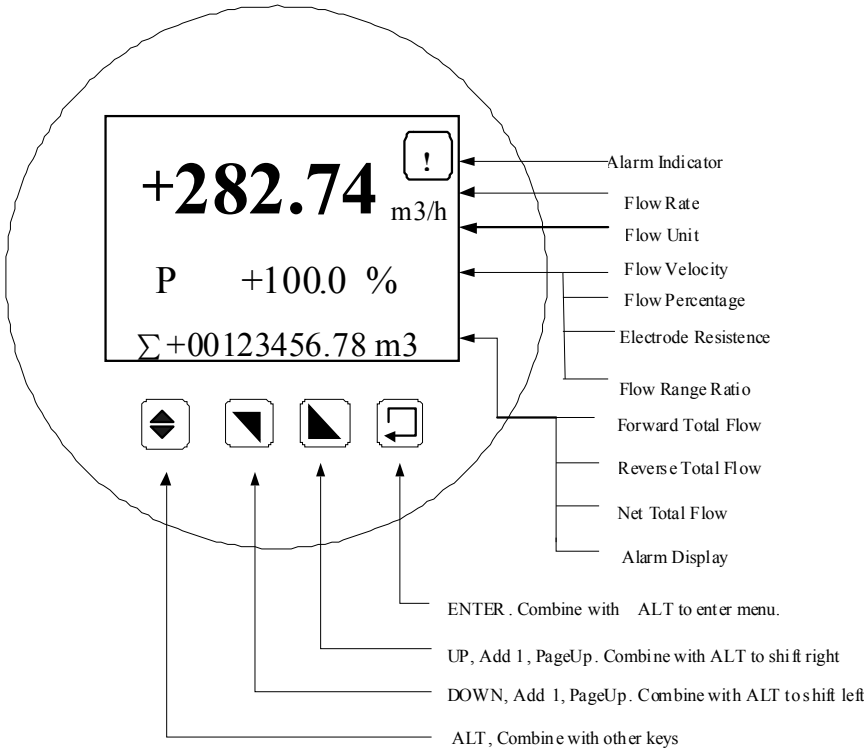


Fig. 4 Keypad and LCD for Display version

5.1.1 Running Modes

The meter has two running modes: Automatic Measurement Mode and Parameter Setting Mode.

After power-on, the meter enters measurement mode automatically. Under this mode, the meter fulfills all measurement functions, displays data and outputs signals.

There are four keys on the keypad. They can be used to enter the parameter setting mode and change the meter's configuration. The key operation does not affect the measurement and the output.

5.1.2 Key Function

5.1.2.1 Automatic Measurement Mode

DOWN:	Scroll bottom line display;
UP:	Scroll top line display;
ALT + ENTER:	Enter into setting mode;
ENTER:	Return to measurement mode.

5.1.2.2 Parameter Setting Mode

DOWN:	Subtract one form the digit at the cursor;
UP:	Add one on the digit at the cursor
ALT + DOWN:	Cursor shifts left
ALT + UP:	Cursor shifts right
ENTER:	Enter/exit submenu;
ENTER:	Return to measurement mode if held for 2 seconds at any location

Notes:

(1) When using ALT key, hold ALT first and then press UP or DOWN.

(2) Under setting mode, the meter returns to measurement mode automatically if no key is pressed for 3 minutes.

(3) When adjusting flow zero, UP or DOWN key can be used to change the sign (+/-).

(4) When setting flow range, UP or DOWN key can be used to change flow unit.

5.1.3 Parameter Setting Operation

To setup the meter, changing to setting mode from measurement mode is the first step. Enter ALT + ENTER key in measurement mode to pop a login page and password is required to enter. Input authorized password and press ENTER again to confirm. The converter enters into setting mode if the password is approved, otherwise it returns to measurement display.

5.1.3.1 Menu Items

RBEF-E converter setting menu consists of 45 items. Many of them are set up by manufacturer before shipping. It is not necessary to change them when applying. There are only a few of them to be set by user according to the application. The menu items are listed in Table 2.

Table 2 Operation Menu

Item No.	Menu Display	Setting Method	Password Level	Value Range
1	Language	Option	1	English
2	Sensor Size	Option	1	3 - 3000mm
3	Flow Range	Modify	1	0 - 99999
4	Decimal Point	Option	1	0,1,2,3
5	Damping	Option	1	0 - 100 s
6	Flow Dir.	Option	1	Fwd/ Res
7	Flow Zero	Modify	1	+/-0.000
8	L.F. Cutoff	Modify	1	0.0 – 99.9%
9	Cutoff Enble	Option	1	ON / OFF
10	Rate-Of-Chng	Modify	1	0 - 30%
11	Limit Time	Modify	1	0 - 20 s
12	Total Unit	Option	1	0.001L - 1 m3
13	Flow Density	Modify	1	0.0000 - 3.9999
14	Current Output	Option	1	4-20mA/0-10mA
15	Pulse Output	Option	1	Frq/ Pulse
16	Pulse Factor	Option	1	0.001L - 1 m3
17	Freq Max	Modify	1	1 - 5999 Hz
18	Comm Address	Modify	1	0 - 99
19	Baudrate	Option	1	600 - 14400
20	EmpPipe Det.	Option	1	ON / OFF

21	EmpPipe Alm	Modify	1	150.0 KΩ
22	DO1 Output	Option	1	Disabled/High Flow Alarm/EmpPipe Alarm/Flow Direction/Pulse Output
23	Hi Alm Limit	Modify	1	000.0 - 199.9%
24	DO2 Output	Option	1	Disabled/Low Flow Alarm/
25	Lo Alm Limit	Modify	1	000.0 - 199.9%
26	RevMeas.Enbl	Option	1	ON/OFF
27	Sensor S/N	Modify	2	000000000000-999999999999
28	Sensor Fact.	Modify	2	0.0000 - 3.9999
29	Field Mode	Option	2	Mode 1,2,3
30	Multiplying	Modify	2	0.0000 - 3.9999
31	F. Total Set	Modify	3	0000000000 - 9999999999
32	R.Total Set	Modify	3	0000000000 - 9999999999
33	Input Contrl	Option	3	Disable/Stop Tot/Reset Tot
34	Clr Totalizr	Password	3	00000 - 59999
35	Clr Tot. Key	Modify	3	00000 - 59999
36	Date –y/m/d *	Modify	3	99/12/31
37	Time-h/m/s *	Modify	3	23/59/59
38	Password L1	Modify	3	0000 - 9999
39	Password L2	Modify	3	0000 - 9999
40	Password L3	Modify	3	0000 - 9999
41	Current Zero	Modify	4	0.0000 - 1.9999
42	Current Max	Modify	4	0.0000 - 3.9999
43	Meter Factor	Modify	4	0.0000 - 3.9999
44	Convtr S/N	Modify	4	0000000000-9999999999
45	Sys Reset	Password	4	

* Item No. 36 and 37 are optional and only effective for the converter with real clock and power failure recording function. The default key to clear the totalizer is 36666.

5.1.3.2 Meter Parameter Description

The setting parameters determine the operation status, calculation method and output mode of the flow meter. Properly setting meter parameter can make the meter work in best condition and higher accuracy of display and output can be obtained.

There are five levels of password, where level 0 - 3 are open for user and level 4 reserved for manufacturer. Level 1 to 2 passwords are changeable by higher level password-holder, e.g. Level-3 password.

Meter setting can be browsed by entering any level of password. However, higher level password is needed to change settings.

- Password Level-0 (default value 0521): fixed and browsing only;
- Password Level-1 (default value 7206): changeable and authorized to modify menu

item 1 to 25;

- Password Level-2 (default value 3110): changeable and authorized to modify menu item 1 to 29;
- Password Level-3 (default value 2901): fixed and authorized to modify menu item 1 to 38;
- Password Level-4 (reserved): fixed and authorized to modify any menu item including resetting system.
- Totalizer Reset Password (default value 36666): changeable in menu item 'Clr Tot. Key 'and authorized to clear the three internal counter.

It is suggested that Level-3 password be held by manager or supervisor while Level-0 to 2 passwords be kept by operator. The Level-3 password can also be used to change the password for totalizer resetting.

5.1.3.2.1 Sensor Size

RBEF-E converter supports sensor diameter ranging from 3 to 3000mm, which can be chosen by pressing UP or DOWN key.

5.1.3.2.2 Flow Range

Flow range refers to the upper range value (URV) of flow rate. The URV is relative to flow percentage and output signal. At the analog output the amount of the measured values in the range 0 up to URV is displayed linear to the current range 4 to 20mA, at the frequency output to the frequency range 0 to the end frequency. The low flow cutoff and flow limit alarm relates to flow range as well. The maximum measurable flow rate, however, is not limited to the flow range as long as the flow speed does not exceed 15m/s.

In this menu item, user can also choose unit of flow rate. For volume flow, L/s, L/min, L/h, m^3/s, m^3/min, m^3/h, gpm, gph, igpm and igph are available; while for mass flow, kg/s、kg/m、kg/h、t/s、t/m、t/h can be selected from. It is up to the application requirements to choose a proper unit.

5.1.3.2.3 Decimal Point

The decimal point shown on the display can be chosen in this menu from 0 to 3 depending on the requirement.

5.1.3.2.4 Damping

Long damping constant can improve the stability of display and output and is suitable to flow control application; while short damping constant has short response time and is suitable to the totalization of pulse flow. Damping time is selectable from 0.2s to 100s.

5.1.3.2.5 Flow Dir.

If the displayed direction sign is not agreed to the actual flow direction, change this item to the opposite option.

5.1.3.2.6 Flow Zero

To conduct zero adjustment, the fluid in the sensor pipe must be held still. The flow zero is displayed by flow speed and the unit is m/s. The display of flow zero is shown below:

FS=○○.○○○m/s ±○○○○○

On the LCD, the top line displays the measured zero point while the bottom line shows the adjustment value. If the FS is not equal to 00.000m/s, adjust the sign and value on bottom line until FS back to nil. Remind again: to adjust the flow zero, the sensor pipe must be filled and the fluid must be kept still. The flow zero adjustment value is an important constant of the meter and should be printed on the calibration sheet and label. The value should include the sign and amount by unit of m/s.

5.1.3.2.7 L.F. Cutoff and Cutoff Enble

Low flow cutoff is set in percentage relative to flow range. If Cutoff is enabled and flow is lower than the set value, the display of flow rate, speed and percentage and signal outputs are forced to nil. If the item is disabled, no action is taken.

5.1.3.2.8 Rate-Of-Chng and Limit Time

'Rate-of-change' limit technique is used to eliminate application-related high electrical noise contained in the process flow signal.

To check electrical noise, two parameters are defined: 'Rate-of-change' limit and 'Control limit time'. If the sampled flow value exceeds the set rate-of-change limit value based on the averaged flow rate value up until the sampled time, the system will reject that sampled value and instead the averaged value including the rate-of-change limit value in place of the rejected sampled value will be output. However, if the limit-exceeding sampled value continues for the same flow direction for more than the preset control limit time, that data will be used as output signal. Fig. 5 illustrates the effect of noise-suppressing by rate-of-change limit.

The value of rate-of-change limit can be set from 0 to 30% of flow range and limit time ranges from 0 to 20 seconds. If either of the two parameters is set to nil, the function is disabled.

The rate-of-change limit function is not suitable for short period measurement and flow meter calibration.

5.1.3.2.9 Total Unit

The converter has three 10-digit counters and the maximum counts are 9999999999. The total flow unit can be L, m^3, US gallon, Imperial gallon, kg or t (metric ton) with a multiplying factor of 0.001, 0.01, 0.1, 1, 10, 100 or 1000.

5.1.3.2.10 Flow Density

The converter is capable of measuring mass flow if fluid density is set. The density can be set from 0.0001 to 3.9999 and the mass unit is determined automatically by flow unit. The density should be set to 1.0000 (default value) if not used. Otherwise, measurement data will be forced to nil.

5.1.3.2.11 Current Type

Current output type is selectable from 4-20mA to 0-10mA.

5.1.3.2.12 Pulse Output

Two types of pulse output are available to choose from: frequency output mode and pulse output mode. The meter outputs continuous square wave pulse under frequency mode, while pulse series under pulse mode. Frequency output is usually used for flow rate measurement and short period of time totalization. Pulse output can be connected to an external counter directly and is often used for long period of time totalization.

As mentioned hereinbefore, transistor open collector circuit is used for frequency and pulse output. Therefore, the external DC power supply and load are necessary.

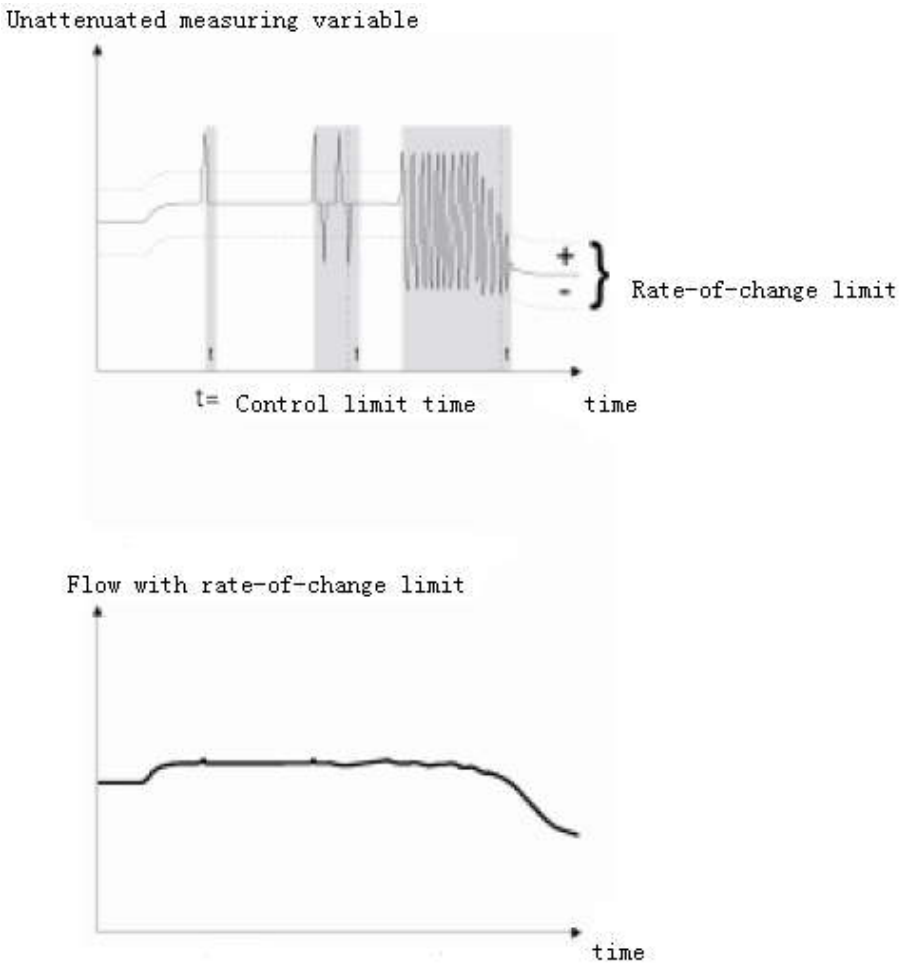


Fig.5 Example for the effect of rate-of-change limit

5.1.3.2.13 Pulse Factor

Pulse factor is defined as volume or mass per pulse. It can be set to 0.001L/p, 0.01L/p, 0.1L/p, 1L/p, 2L/p, 5L/p, 10L/p, 100L/p, 1m^3/p, 10 m^3/p, 100 m^3/p or 1000 m^3/p. Pulse width is

selectable from auto, 10ms, 20ms, 50ms, 100ms, 150ms, 200ms, 250ms, 300ms, 350ms and 400ms.

5.1.3.2.14 Freq Max

Frequency range corresponds to the upper range value of flow rate, or 100% of flow percentage in other word. Maximum frequency is selectable from 1 to 5999Hz.

5.1.3.2.15 Comm Address and Baud rate

Substation address is needed when using RS485 communication. The address can be set from 001 to 255. Baud rate is the transmission speed between main and sub stations. It is selectable from 600, 1200, 2400, 4800, 9600, 14400, 19200 and 38400bps. Remind: the baud rate must be the same as that of the main computer.

5.1.3.2.16 EmpPipe Det.

This item is used to enable or disable the empty-pipe detector. If enabled, the meter will force the display value, analog output and digital output to nil when the sensor pipe is not full.

5.1.3.2.17 EmpPipe Alm.

This item is to set the electrode alarm trip value. Constant current source method is employed to measure the resistance between two electrodes. The variation of the resistance is checked by CPU and CPU recognizes if the pipe is empty or the electrodes are contaminated. The resistance is calculated as following:

$$R \approx 1/d\sigma$$

where, d = electrode radius

σ = Fluid conductivity

The electrodes resistance is usually between 5 to 50kΩ。The variation of the resistance relates to the surface status of electrodes and variation of fluid characteristic. If the sensor is filled with fluid, abnormal resistance signal is detected and empty pipe alarm is output.

The electrode alarm trip value is determined based on the first-time measured electrode resistance. After the installation of the flowmeter, measure the resistance between the electrodes when the sensor pipe is filled. Record the resistance value and take it as a basis. Usually, set the trip value as 3 times of the original resistance recorded.

5.1.3.2.18 DO1 Output

User can program the DO1 output by selecting the following options:

(1) Disabled: to disable the DO1 output;
(2) High Flow Alarm: DO1 outputs as a high flow alarm when the flow percentage exceeds the Hi Alm Limit;
(3) EmpPipe Alarm: When the pipe is detected as empty, an alarm signal is output from DO1;
(4) Flow Direction: the DO1 outputs as a flow direction indicator;
(5) Pulse Output: the DO1 outputs pulse signal.

5.1.3.2.19 Hi Alm Limit

High alarm limit value is set in percentage of the upper range of flow rate. The parameter ranges from 0% to 199.9%. The meter outputs alarm signal when the flow percentage is higher than this value.

5.1.3.2.20 DO2 Output

User can program the DO2 output by selecting the following options:

(1) Disabled: to disable the DO2 output;

(2) Low Flow Alarm: DO2 outputs as a low flow alarm when the flow percentage is lower than the Lo Alm Limit;

5.1.3.2.21 Lo Alm Limit

Low alarm limit value is set in percentage of the upper range of flow rate. The parameter ranges from 0% to 199.9%. The meter outputs alarm signal when the flow percentage is lower than this value.

5.1.3.2.22 Sensor S/N

Sensor serial number records the information of the sensor equipped with the converter and ensure them match up when installing.

5.1.3.2.23 Sensor Fact.

The sensor factor is set according to the calibration sheet supplied by the manufacturer. Usually this factor has been set up by the manufacturer before shipping. It is an important value that determines the accuracy of measurement. Do not change it without calibration.

5.1.3.2.24 Field Mode

The converter offers three field exciting modes based on the exciting frequency. Mode 1 is the most-commonly used one and suitable for most cases. Mode 2 and 3 are low-frequency exciting modes and are better for large size meter to measure water. The calibration should be taken under the same exciting mode as that used for measurement.

5.1.3.2.25 RevMeas.Enbl: Reverse Measurement Enable

If RevMeas.Enbl is set to ON, the converter displays flow and outputs signals when flow direction is reversed. If OFF, the converter displays no flow and does not output signals when reversing.

5.1.3.2.26 Multiplying

This item is a multiplying factor selectable from 0.0000 to 3.9999. When calculating the flow rate and total, this factor is taken into account. It is often used to measure the flow in the open channel. If not applied, set the value to 1.0000.

5.1.3.2.27 F. Total Set and R. Total Set

Presetting of forward and reverse total counter is designed to start counting from the existing reading when replacing a converter or flowmeter. It provides a continuous total flow read which is convenient for management.

5.1.3.2.28 Input Contrl

Not available.

5.1.3.2.29 Clr Totalizr

Enter the 'Totalizer Reset Password' in this menu item and press ENTER to confirm. The converter clears the three internal counter and restart counting if password matched.

5.1.3.2.30 Clr Tot. Key

The 'Totalizer Reset Password' is changeable in this menu item if Level-3 password is entered. Remind: keep the new password in a safe place.

5.1.3.2.31 Date –y/m/d and Time-h/m/s

These items are used to change the internal real time clock if equipped.

5.1.3.2.32 Password L1 ,Password L2 and Password L3

To change the Level-1 to Level-3 passwords, use Level-4 or higher level password to enter and change these two items.

5.1.3.2.33 Current Zero and Current Max

Adjust the current output zero point and upper range value as detailed in Sec. 2.7. It is not suggested that user make any adjustment since it has been setup to the best condition by the manufacturer.

5.1.3.2.34 Meter Factor

This factor is used by the manufacturer to normalize the excitation current and amplifier signal of the converter. DO NOT change it.

5.1.3.2.35 Convtr S/N

This serial number records the manufacturing date and code of converter. DO NOT change it.

5.1.3.2.36 Sys Reset

This item is reserved for the manufacturer to re-initialize the converter. After system resetting, all settings are set to default values automatically.

5.2 The Operation of Blind version

The blind version can be operated by a handheld controller or a laptop through RS485 port. The MODBUS RTU protocol version V1.8.3 is given in Appendix 1.

5.2.1 The Operation by a Handheld Controller

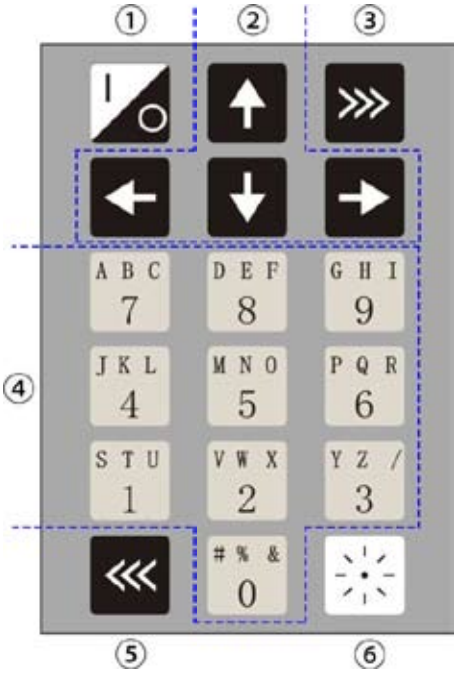
The handheld controller is illustrated in Fig. 6. The red and black clips are connected to the red (A) and yellow (B) cable of RBEF-E-Mini respectively for communication.

Fig.6 Photo of Handheld Controller

5.2.1.1 The Keypad

The keypad function is depicted as below:

①.	【On/Off】	Turn on/off the controller
②.	【Up】	Scroll up, last option or add 1
	【Down】	Scroll down, next option or minus 1
	【Left】	Scroll left or shift left
	【Right】	Scroll right or shift right
③.	【Enter】	Enter/Save
④.	【Number】	Input number at the cursor
⑤.	【Back】	Return to previous level menu
⑥.	【Pause】	Pause when multiple communication



5.2.1.2 The Operation Flowchart

The operation flowchart is given in Fig. 7 below.

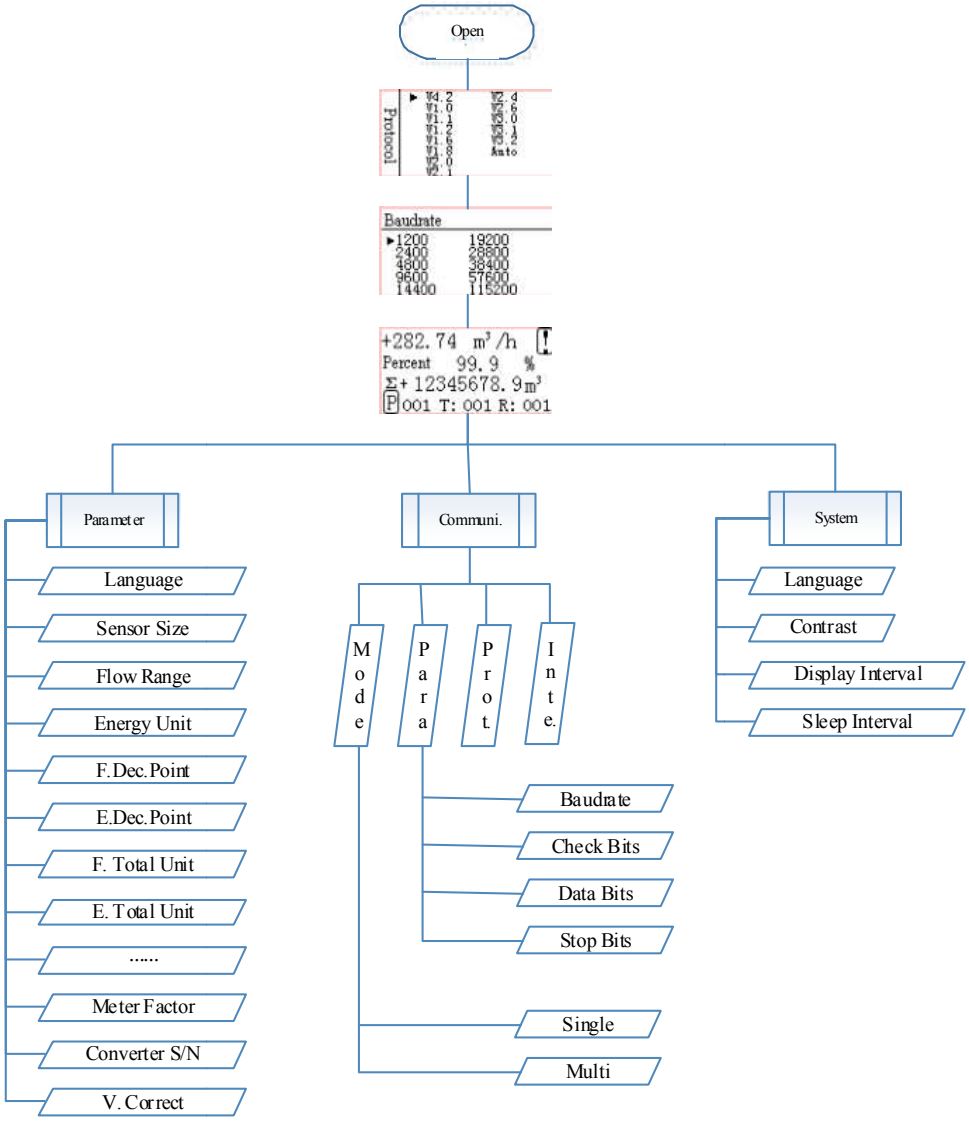
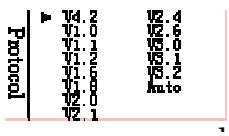


Fig. 7 Handheld operation flowchart

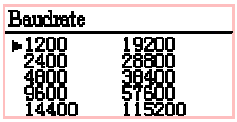
5.2.1.3 Startup of the Handheld Controller

1) Press 【On/Off】:

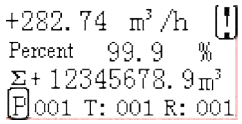
2) Initializing, after 6 seconds:



3) Using 【Up】,【Down】,【Left】or 【Right】key to move the cursor to choose Protocol V1.8, then press【Enter】key to confirm and save:

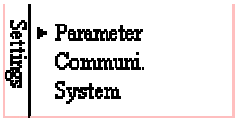


4) Using 【Up】,【Down】,【Left】or 【Right】key to move the cursor to choose 9600 bps, then press【Enter】key to confirm and save. The controller enter measurement data mode.

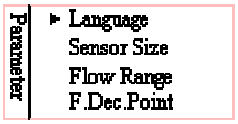


Here, "T" is "Try counter"; "R" is "Response counter".

5) To setup the parameter, press 【Enter】key now:



6) Using 【Up】,【Down】,【Left】or 【Right】key to move the cursor to the menu, then press【Enter】>>> key to enter and modify or press 【Back】<<< back to previous level.



7) Parameter List: the definition of the parameters is given in Section 5.1.3.2. For RBEF-E-Mini, Potocol V1.8 is available.

No.	V4.2	V1.1	V1.8	V3.0	V3.2
1	Sensor Size	Language	Language	Language	Clear Totalizer
2	Flow Range	Sensor Size	Sensor Size	Sensor Size	
3	Damping	Flow Range	Flow Range	Flow Range	
4	Flow Direction	Damping	F.Dec.Point	Energy Unit	
5	L.F. CutOff	Flow Direction	Damping	F.Dec.Point	
6	Flow Total Unit	Flow Zero	Flow Direction	E.Dec.Point	
7	Signal Output	L.F. CutOff	Flow Zero	Flow Total Unit	
8	Frequency Max	CutOff Enable	L.F. CutOff	E. Total Unit	
9	Flow Pulse Factor	Flow Total Unit	CutOff Enable	Damping	
10	DO1. Output	Signal Output	Flow Total Unit	Flow Direction	
11	Hi Alarm Limit	Flow Pulse Factor	Density	Flow Zero	
12	DO2. Output	Pulse Width	Signal Output	L.F. CutOff	
13	Lo Alarm Limit	Frequency Max	Frequency Max	Pressure	
14	Flow Zero	EmpPipe	Flow Pulse	Current Output	

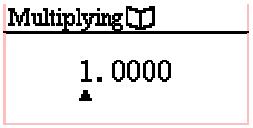
		Enable	Factor		
15	Sensor Factor	EmpPipe Alarm	Pulse Width	E. Current Factor	
16	Multiplying	DO1. Output	EmpPipe Enable	Signal Output	
17		Hi Alarm Limit	EmpPipe Alarm	Frequency Max	
18		DO2. Output	DO1. Output	Flow Pulse Factor	
19		Lo Alarm Limit	Hi Alarm Limit	E. Pulse Factor	
20		Reverse Enable	DO2. Output	Pulse Width	
21		Sensor Factor	Lo Alarm Limit	EmpPipe Enable	
22		Field Mode	Reverse Enable	EmpPipe Alarm	
23		Multiplying	Sensor S/N	Hi Alarm Limit	
24		Current Zero	Sensor Factor	Lo Alarm Limit	
25		Current Max	Field Mode	DO1. Output	
26		Meter Factor	Multiplying	Inlet T. Zero	
27			F.F. Total	Inlet T. Max	
28			F.R. Total	Outlet T. Zero	
29			Clear Totalizer	Outlet T. Max	
30			Clear Total Key	Low T. Set	
31			Date (Y-M-D)	Density Select	
32			Time (H:M:S)	Density Setting	
33			Current Zero	PT Select	
34			Current Max	Algorithm	
35			Meter Factor	Specific Heat	
36			Converter S/N	Sensor S/N	
37			V. Correct	Sensor Factor	
38			Point 1#	Field Mode	
39			Value 1#	Multiplying	
40			Point 2#	Clear Totalizer	
41			Value 2#	Clear Total Key	
42			Point 3#	Date (Y-M-D)	
43			Value 3#	Time (H:M:S)	
44			Point 4#	Current Zero	
45			Value 4#	Current Max	
46			PT Select	Meter Factor	
47			Inlet T. Zero	Converter S/N	
48			Inlet T. Max	Record Reset	

5.2.1.4 Example of Setup Parameters

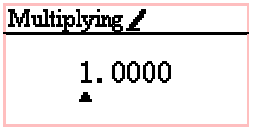
Taking setup of "Multiplying" as example, follow the steps below:

1) When entering parameter item "Multiplying", the handheld will read the current value from the meter automatically.

2) If verified correct, a “read confirmed” icon will appear on the top right corner:



3) Using “Number” ,”Shift” Keys to change the value, and then press 【Enter】>>> to confirm and save the new setting. A “write confirmed” icon will appear on the top right corner:



4) Using 【Back】key <<< , cancel the setting at any time.

5.2.1.5 Communication setup for RBEF-E-Mini

The communication parameters for RBEF-E-Mini are as:

9600bps, 8 bit data, 1 bit stop, None Parity check

5.2.2 The Operation by a Laptop

RBEF-E-Mini can be operated by a laptop through RS485 MODBUS RTU protocol V1.8.3 version. The protocol is given in Appendix 1.

Electromagnetic Flowmeter MODBUS RTU Protocol

V1.8.3

1. Introduction

This communication protocol is used for the real-time acquisition of instantaneous flow rate, flow velocity, flow percentage, fluid resistance, total forward and reverse flow, alarm status and temperature or pressure. The converter parameters can also be read and written through this protocol.

2. The protocol

2.1 Electrical Interface: RS485 or RS232

2.2 Data Transfer Mode: RTU mode

2.3 Data Format:

- 1 start bit
- 8 bits data, the least significant bit first
- Non parity check
- 1 stop bit

2.4 Error Check: CRC checksum

2.5 MODBUS function code:

0X03: data read

0X04: parameter read

0X06: parameter write

2.6 Flow Data Register Address：(0X03 function code)

Register Address		Data Description	Data Format	Register Length
Dec	Hex			
4112	1010	Flow rate	float	2
4114	1012	Forward total(integer part)	long	2
4116	1014	Forward total(fractional part)	float	2
4118	1016	Flow velocity(m/s)	float	2
4120	1018	Flow percentage(%)	float	2
4122	101A	Fluid resistance(KΩ)	float	2
4124	101C	Reverse total(integer part)	long	2
4126	101E	Reverse total(fractional part)	float	2
4128	1020	Flow rate unit	uchar	1
4129	1021	Total unit	uchar	1
4130	1022	Alarm status	uchar	1
4131	1023	Temperature	float	2

Float format: IEEE754 Float Inverse

2.7 Parameter Register Address: (Read:0X04 function code, Write: 0X06 function code)

Register Address		Parameter	format	bytes	Register Address		parameter	format	bytes
Dec	Hex				Dec	Hex			
32	20	language	uchar	01	55	37	EmpPipe Alm (KΩ)	uint	01
33	21	Pipe size(mm)	uchar	01	56	38	Input control	uchar	01
34	22	Flow range	float	02	57	39	1# Output	uchar	01
36	24	Flow unit	uchar	01	58	3A	Hi Alm Limit (%)	uint	01
37	25	Flow range auto change	uchar	01	59	3B	2# Output	uchar	01
38	26	Damping	uchar	01	60	3C	Lo Alm Limit (%)	uint	01
39	27	Flow direction	uchar	01	61	3D	Clr Tot. Key	uint	01
40	28	Flow zero sign(+/-)	uchar	01	62	3E	Sensor S/N	char[]	06
41	29	Flow zero	uint	01	68	44	Sensor Factor	uint	01
42	2A	Low flow cutoff (%)	uint	01	69	45	Field Mode	uchar	01
43	2B	Cutoff enable	uchar	01	70	46	Flow density(t/m³)	uint	01
44	2C	Rate-Of-Chng (%)	uchar	01	71	47	Multiplying	uint	01
45	2D	Limit Time (s)	uchar	01	72	48	Current Zero	uint	01
46	2E	Total Unit	uchar	01	73	49	Current Max	uint	01
47	2F	Flow decimal point	uchar	01	74	4A	Meter Factor	uint	01
48	30	Pulse type	uchar	01	75	4B	Converter S/N	char[]	05
49	31	Pulse factor	uchar	01	80	50	F. Total Set	char[]	05
50	32	Pulse width	uchar	01	85	55	R.Total Set	char[]	05
51	33	Frequency max	uint	01	90	5A	Date	char[]	03
52	34	Comm address	uchar	01	93	5D	Time	char[]	03
53	35	Baud rate	uchar	01	96	60	RevMeas.Enbl	uchar	01
54	36	EmpPipe Det.	uchar	01	97	61	Remote resetting total	uint	01
					121	79	PT Select	uchar	01
					122	7A	T. Zero	float	02
					124	7c	T.Max	uint	01

3. Communication Instruction Format and Examples

3.1 Flow Data Read Instructions and Examples

Master computer sends:

Slave address	0X03	Register high byte	Register low byte	Register length high byte	Register length low byte	CRC checksum low byte	CRC checksum high byte

Slave flowmeter responds:

Slave address	0X03	Data length N	Data 01	... ...	Data N	CRC checksum low byte	CRC checksum high byte

Take slave addres 0X01 flowmeter as an example:

1) Flow rate

Read data: 01 03 10 10 00 02 C1 0E

Flowmeter responses: 01 03 04 **43 0D 6B 85** 90 E7

43 0D 6B 85 is as IEEE754 float inverse format, which is 141.420

Example:
```
UCHAR charTempi[0X04];
*(FLOAT*)charTempi =fTempi;
float fTempi=*((float*)charTempi);
```

2) forward total

read data: 01 03 10 12 00 04 E0 CC

flwometer responses: 01 03 08 **B1 68 DE 3A 80 D6 FC 3D** 34 FB

B1 68 DE 3A is as longformat: 987654321

80 D6 FC 3D is as float format: 0.123456

Forward total: 987654321.123456

3) Flow velocity(m/s)

Read data: 01 03 10 16 00 02 21 0F

responses: 01 03 04 **F6 28 B1 42** BD D2

F6 28 B1 42 = 88.58

4) Flow percentage (%)

Read data: 01 03 10 18 00 02 40 CC

responses: 01 03 04 **00 00 A4 41** 40 C3

00 00 A4 41 = 20.50

5) Fluid resistance (KΩ)

Read data: 01 03 10 1A 00 02 E1 0C

responses: 01 03 04 **00 00 C8 42** 2D C2

00 00 C8 42 = 100.00

6) Reverse total

Read data: 01 03 10 1C 00 04 81 0F

responses: 01 03 08 **B1 68 DE 3A 80 D6 FC 3D** 34 FB

B1 68 DE 3A = 987654321

80 D6 FC 3D = 0.123456

Reverse total =987654321.123456

7) Flow rate unit

Read data: 01 03 10 20 00 01 81 00

responses: 01 03 02 **00 02** 39 85

Definition:

00	01	**02**	03	04	05	06	07
m /s	m /min	**m /h**	L/s	L/min	L/h	USg/m	USg/h
08	09	0A	0B	0C	0D	0E	0F
ig/m	ig/h	t/s	t/m	t/h	kg/s	kg/min	kg/h

8) Total unit

Read data: 01 03 10 21 00 01 D0 C0

responses: 01 03 02 **00 07** F9 86

definition:

00	01	02	03	04	05
L	m	USgal	igal	kg	t

9) Alarm status

Read data: 01 03 10 22 00 01 20 C0

responses: 01 03 02 **00 00** B8 44

definition:

02	04	08	10	20
Excitation alarm	Electrode alarm	Empty pipe alarm	High alarm	Low alarm

10) Temperature

Read data: 01 03 10 23 00 02 31 01

response: 01 03 04 **41 E6 66 66** A4 72

41 E6 66 66 transferred into float: 28.8

11) Read all flow data

Read data: 01 03 10 10 00 **16** C1 01

response: 01 03 2C 43 0D 5E 80 00 09 FC 03 3E 63 51 16 40 9F FF 44 42 47 FF B1 40 51 B3 DB 00 00 BD 8F 3F 4A 13 A1 00 02 00 01 00 00 41 E6 66 66 00 0A AA 96

3.2 Read/Write Parameter Instructions and Examples

3.2.1 Read instructions:

Slave address	0X04	Register high byte	Register low byte	Register length high byte	Register length low byte	CRC checksum low byte	CRC checksum high byte

Slave flowmeter responds:

Slave address	0X04	Data byte number	D0	... ...	Dn	CRC checksum low byte	CRC checksum high byte

3.2.2 Write instructions:

Slave address	0X06	Register high byte	Register low byte	D0	... ...	Dn	CRC checksum low byte	CRC checksum high byte

Slave flowmeter responds:

Slave	0X06	Register high	Register low	D0	... ...	Dn	CRC checksum	CRC checksum

addres		byte	byte				low byte	high byte

The response data is consistent with the write instruction if written successfully.

Take slave address 0X01flowmeter as an example for parameter read and write:

1) Language 0X20

Read 01 04 00 20 00 01 30 00 return 01 04 02 **00 00** B9 30

Write 01 06 00 20 00 00 88 00 (simplified Chinese) 01 06 00 20 00 01 49 C0 (English)

Parameter value

00	01
simplified Chinese	English

2) Pipe Size(mm) 0X21

Read 01 04 00 21 00 01 61 C0 return 01 04 02 **00 0C** B9 35

Write 01 06 00 21 00 0C D9 C5 (100) 01 06 00 21 00 0F 99 C4 (200)

Parameter value

00	3	0D	125	1A	1000
01	6	0E	150	1B	1100
02	8	0F	200	1C	1200
03	10	10	250	1D	1300
04	15	11	300	1E	1400
05	20	12	350	1F	1600
06	25	13	400	20	1800
07	32	14	450	21	2000
08	40	15	500	22	2200
09	50	16	600	23	2400
0A	65	17	700	24	2600
0B	80	18	800	25	2800
0C	**100**	19	900	26	3000

3) Flow range 0X22

Read 01 04 00 22 00 02 D1 C1 return 01 04 04 **43 8D 5E B8** 46 39

write 01 06 00 22 00 0C D9 C5 (282.74)

43 8D 5E B8 = 282.74

4) Flow unit 0X24

Read 01 04 00 24 00 01 71 C1 return 01 04 02 **00 02** 38 F1

write 01 06 00 24 00 02 48 00 (m /h) 01 06 00 24 00 09 09 C7 (ig/h)

Parameter value

00	01	**02**	03	04	05	06	07
m /s	m /min	**m /h**	L/s	L/min	L/h	USg/m	USg/h
08	09	0A	0B	0C	0D	0E	0F
ig/m	ig/h	t/s	t/m	t/h	kg/s	kg/min	kg/h

5) Flow range auto change 0X25

Read 01 04 00 25 00 01 20 01 return 01 04 02 00 00 B9 30

Write 01 06 00 25 00 00 98 01

Parameter value

00	01	02	03
disabled	1:2	1:4	1:8

6) Damping 0X26

Read 01 04 00 26 00 01 71 C1 return 01 04 02 **00 08** B8 F6

Write 01 06 00 26 00 08 69 C7 (6.0s) 01 06 00 26 00 05 A8 02 (3.0s)

Parameter value

00	01	02	03	04	05	06	07
0.2s	0.5s	0.8s	1.0s	2.0s	3.0s	4.0s	5.0s
08	09	0A	0B	0C	0D	0E	
6.0s	8.0s	10.0s	20.0s	30.0s	50.0s	100.0s	

7) Flow direction 0X27

Read 01 04 00 27 00 01 81 C1 return 01 04 02 **00 00** B9 30

Write 01 06 00 27 00 00 39 C1 (forward) 01 06 00 27 00 01 F8 01 (reverse)

Parameter value

00	01
forward	reverse

8) Flow zero sign(+/-) 0X28

Read 01 04 00 28 00 01 B1 C2 return 01 04 02 **00 00** B9 30

Write 01 06 00 28 00 00 09 C2 (+) 01 06 00 28 00 01 C8 02 (-)

Parameter value

00	01
+	-

9) Flow zero 0X29

Read 01 04 00 29 00 01 E0 02 return 01 04 02 **04 56** 3B CE

Write 01 06 00 29 00 00 58 02 01 06 00 29 04 56 DA FC

04 56 = 1110，divided by 1000, then flow zero = 1.110

10) Low flow cutoff (%) 0X2A

Read 01 04 00 2A 00 01 10 02 return 01 04 02 **00 05** 79 33

write 01 06 00 2A 00 00 A8 02 (0.0) 01 06 00 2A 00 05 68 01 (0.5)

00 05 = 5, divided by 10, then low flow cutoff = 0.5%

11) Cutoff enable 0X2B

Read 01 04 00 2B 00 01 41 C2 return 01 04 02 **00 01** 78 F0

Write 01 06 00 2B 00 00 F9 C2 (enable) 01 06 00 2B 00 01 38 02 (disable)

Parameter value

00	**01**
enable	**disable**

12) Rate-Of-Change (%) 0X2C

Read 01 04 00 2C 00 01 F0 03 return 01 04 02 **00 00** B9 30

Write 01 06 00 2C 00 00 48 03 (00%) 01 06 00 2C 00 05 88 00 (05%)

00 00 = 0, range: 0～99%，rate-of-change = 00%

13) Limit time (s) 0X2D

Read 01 04 00 2D 00 01 A1 C3 return 01 04 02 **00 00** B9 30

Write 01 06 00 2D 00 00 48 03 (00s) 01 06 00 2D 00 05 88 00 (05s)

00 00 = 0, range:0～99s， limit time = 00s

14) Total unit 0X2E

Read 01 04 00 2E 00 01 51 C3 return 01 04 02 **00 07** F8 F2

Write 01 06 00 2E 00 07 A8 01 (1m) 01 06 00 2E 00 04 E8 00 (0.001m)

Parameter value

00	01	02	03	04	05	06	**07**
0.001L	0.01L	0.1L	1L	0.001m	0.01m	0.1m	**1m**
08	09	0A	0B	0C	0D	0E	0F
0.001USgal	0.01USgal	0.1USgal	1USgal	0.001igal	0.01igal	0.1igal	1igal
10	11	12	13	14	15	16	17
0.001kg	0.01kg	0.1kg	1kg	0.001t	0.01t	0.1t	1t

15) Flow decimal point 0X2F

Read 01 04 00 2F 00 01 00 03 return 01 04 02 **00 02** 38 F1

Write 01 06 00 2F 00 02 39 C2 (2) 01 06 00 2F 00 01 79 C3 (1)

Parameter value

00	01	**02**	03
0	1	**2**	3

16) Pulse type 0X30

Read 01 04 00 30 00 01 31 C5 return 01 04 02 **00 00** B9 30

Write 01 06 00 30 00 00 89 C5 (frequency) 01 06 00 30 00 01 48 05 (pulse)

Parameter value

00	01
frequency	pulse

17) Pulse factor 0X31

Read 01 04 00 31 00 01 60 05 return 01 04 02 **00 04** B8 F3

Write 01 06 00 31 00 04 D9 C6 (1.0L/P) 01 06 00 31 00 01 19 C5 (0.001L/P)

Parameter value

00	01	02	03	**04**	05	06	07	08	09	0A	0B	0C
0.0001L/P	0.001L/P	0.01L/P	0.1L/P	**1.0L/P**	2.0L/P	5.0L/P	10.0L/P	100.0L/P	1.0m/P	10.0m/P	100.0m/P	1000.0m/P

18) Pulse width 0X32

Read 01 04 00 32 00 01 90 05 return 01 04 02 **00 00** B9 30

write 01 06 00 32 00 00 28 05 (自动) 01 06 00 32 00 01 E9 C5 (100ms)

Parameter value

00	01	02	03	04	05	06	07	08	09	0A
auto	10ms	20ms	50ms	100ms	150ms	200ms	250ms	300ms	350ms	400ms

19) Frequency max 0X33

Read 01 04 00 33 00 01 C1 C5 return 01 04 02 **07 D0** BA 9C

Write 01 06 00 33 07 D0 7A 69 (2000)

07 D0 = 2000, range = 1～5999Hz， frequency max = 2000Hz

20) Comm address 0X34

Read 01 04 00 34 00 01 70 04 return 01 04 02 **00 01** 78 f0

Write 01 06 00 34 00 01 09 C4 (01)

00 01 = 01, range 1～255， comm address = 01

21) Baud rate 0X35

Read 01 04 00 35 00 01 21 C4 return 01 04 02 **00 03** F9 31

Write 01 06 00 35 00 07 D8 06 (38400) 01 06 00 35 00 03 D9 C5 (9600)

Parameter value

value	00	01	02	**03**	04	05	06	07
Dec	1200	2400	4800	**9600**	14400	19200	28800	38400
Hex	0X4B0	0X960	0X12C0	**0X2580**	0X3840	0X4B00	0X7080	0X9600

22) Empty pipe detection 0X36

Read 01 04 00 36 00 01 D1 C4 return 01 04 02 **00 01** 78 F0

Write 01 06 00 36 00 00 69 C4 (enable) 01 06 00 36 00 01 A8 04 (disable)

Parameter value

00	**01**
enable	**Disable**

23) EmpPipe Alarm (KΩ) 0X37

Read 01 04 00 37 00 01 80 04 return 01 04 02 **05 DC** BB F9

Write 01 06 00 37 05 DC 3A CD (150.0)

05 DC= 1500, divided by 10, EmpPipe Alarm=150.0KΩ, range 0～999.9KΩ

24) Input Control 0X38

Read 01 04 00 38 00 01 B0 07 return 01 04 02 **00 00** B9 30

Write 01 06 00 38 00 00 08 07 (disable) 01 06 00 38 00 01 C9 C7 (stopping totalizing)

Parameter value

00	01	02
disable	Stopping totalizing	Resetting totalizing

25) 1# Output0X39

Read 01 04 00 39 00 01 E1 C7 return 01 04 02 **00 01** 78 F0

Write 01 06 00 39 00 01 98 07 (High alarm) 01 06 00 39 00 00 59 C7 (output disable)

Parameter value

00	**01**	02	03	04	05
Output disable	**High alarm**	Low alarm	Empty pipe alarm	Flow direction alarm	Pulse alarm

26) Hi Alm Limit (%) 0X3A

Read 01 04 00 3A 00 01 11 C7 return 01 04 02 **03 20** B8 18

Write 01 06 00 3A 03 20 A8 EF (80.0%)

03 20=800, divided by 10, Hi Alm Limit=80.0%, range 0～199.9%

27) 2# output 0X3B

Read 01 04 00 3B 00 01 40 07 return 01 04 02 **00 01** 78 F0

Write 01 06 00 3B 00 00 F8 07 (output disable) 01 06 00 3B 00 01 39 C7 (**Low alarm**)

Parameter value

00	**01**	02

Output disable	**Low alarm**	Range auto change

28) Lo Alm Limit (%) 0X3C

Read 01 04 00 3C 00 01 F1 C6 return 01 04 02 **00 96** 39 5E

Write 01 06 00 3C 00 96 C9 A8 (15.0%)

00 96=150, divided by 10, Lo Alm Limit=15.0%, range 0～199.9%

29) Clr Tot. Key 0X3D

Read 01 04 00 3D 00 01 A0 06 return 01 04 02 **8F 3A** 5D 13

Write 01 06 00 3D 8F 3A FC 25 (36666)

8F 3A=36666, range 00000～59999

30) Sensor S/N 0X3E (BCD code)

Read 01 04 00 3E 00 06 11 C4

return 01 04 0C **01 04 00 03 00 00 00 00 00 00 00 00** 69 B4

Write 01 06 00 3E 01 04 00 03 00 00 00 00 00 00 00 00 52 1F

Sensor S/N 140300000000, range 000000000000～999999999999

31) Sensor factor 0X44

Read 01 04 00 44 00 01 71 DF return 01 04 02 **27 10** A3 0C

Write 01 06 00 44 27 10 A8 EF (1.0000)

27 10=10000，divided by 10000, sensor factor=1.0000, range 0.0000～3.9999

32) Field mode 0X45

Read 01 04 00 45 00 01 20 1F return 01 04 02 **00 00** B9 30

Write 01 06 00 45 00 00 98 1F (Mode 1) 01 06 00 45 00 01 59 DF (Mode 2)

Parameter value

00	01	02
Mode 1	Mode 2	Mode 3

33) Flow density (t/m)0X46

Read 01 04 00 46 00 01 D0 1F return 01 04 02 **03 E8** B9 8E

Write 01 06 00 46 03 E8 68 A1 (1.000 t/m)

03 E8=1000, divided by 1000, flow density=1.000 t/m , range 0.000～9.999 t/ m

34) Multiplying 0X47

Read 01 04 00 47 00 01 81 DF return 01 04 02 **27 10** A3 0C

Write 01 06 00 47 27 10 23 E3 (1.0000)

27 10=10000, divided by 10000, multiplying=1.0000, range 0.0000～3.9999

35) Current zero 0X48

Read 01 04 00 48 00 01 B1 DC return 01 04 02 **0C 83** FD 91

Write 01 06 00 48 0C 83 4D 7D (0.3203)

0C 83=3203, divided by 10000, current zero=0.3203, range 0.0000～1.9999

36) Current max 0X49

Read 01 04 00 49 00 01 E0 1C return 01 04 02 **3E 89** 68 F6

Write 01 06 00 49 3E 89 89 DA (1.6009)

3E 89=16009，divided by 10000, current max=1.6009, range 0.0000～4.9999

37) Meter factor 0X4A

Read 01 04 00 4A 00 01 10 1C return 01 04 02 **27 10** A3 0C

Write 01 06 00 4A 27 10 B2 20 (1.0000)

27 10=10000，divided by 10000, meter factor=1.0000, range 0.0000～3.9999

38) Converter S/N 0X4B (BCD code)

Read 01 04 00 4B 00 05 40 1F

Return 01 04 0A **01 04 00 03 00 00 00 00 00 00** 81 78

Write 01 06 00 4B 01 04 00 03 00 00 00 00 00 00 82 E6

Converter S//N 1403000000，range 0000000000～9999999999

39) F. Total Set 0X50 (BCD code)

Read 01 04 00 50 00 05 30 18

Return 01 04 0A **00 00 00 00 00 00 00 00 00 00** D1 7D

Write 01 06 00 50 00 00 00 00 00 00 00 00 00 00 A3 07

F.Total Set 000000000, range 0000000000～2000000000

40) R. Total Set 0X55 (BCD code)

Read 01 04 00 55 00 05 20 19

Return 01 04 0A **00 00 00 00 00 00 00 00 00 00** D1 7D

Write 01 06 00 55 00 00 00 00 00 00 00 00 00 00 B2 CB

R.Total Set 000000000, range 0000000000～2000000000

41) Date 0X5A (BCD code)

Read 01 04 00 5A 00 03 90 18

Return 01 04 06 **07 00 00 01 00 01** F1 24

Write 01 06 00 5A 07 00 00 01 00 01 61 D0

Date 70-01-01, range 00/01/01~99/12/31

42) Time 0X5D (BCD code)

Read 01 04 00 5D 00 03 21 D9

Return 01 04 06 **00 00 00 00 00 00** 60 93

Write 01 06 00 5D 00 00 00 00 00 00 86 A7

Time 00:00:00, range 00/00/00~23/59/59

43) RevMeas.Enbl 0X60

Read 01 04 00 60 00 01 31 D4 return 01 04 02 00 00 B9 30

Write 01 06 00 60 00 00 89 D4 (enable) 01 06 00 60 00 01 48 14 (disable)

Parameter value

00	**01**	02
enable	**disable**	Single direction

44) Remote resetting total 0X61

Write 01 06 00 61 8F 3A 3C 37

45) RT Select 0X79

Read 01 04 00 79 00 01 E0 13 Return 01 04 02 **00 00** B9 30

Write 01 06 00 79 00 00 58 13 (PT100)

01 06 00 79 00 01 99 D3 (PT500)

01 06 00 79 00 02 D9 D2 (PT1000)

Parameter Value

00	01	02
PT100	PT500	PT1000

46) T.Zero 0X7A (PT1000 temperature zero adjustment)

Read 01 04 00 7A 00 02 50 12 Return 01 04 04 **00 00 00 00** FB 84

Write 01 06 00 7A 00 00 00 00 3E 0D
00 00 00 00 float value: 0.000

47) T. Max 0X7C (PT1000 temperature max adjustment)

Read 01 04 00 7C 00 01 F0 12 Return 01 04 02 **3E 89** 68 F6

Write 01 06 00 7C 3E 89 99 D4 (1.6009)

3E 89 is transferred into integer as 16009, divided by 10000 and converted to float value 1.6009, ranged from 0.0000 to 4.9999.