

# HBYB-FM

## Non-full-tube Electromagnetic Flowmeter Manual

KAIFENG AFT INSTRUMENT CO.,LTD  
MADE IN CHINA

# Contents

Product description.....	3
Product Features .....	3
Main technical performance indicators.....	4
Flow meter size.....	5
Instrument parameter introduction.....	6
Instrument display and operation.....	6
1.Key Function.....	7
2.Instrument terminal wiring.....	7
3.Line connection.....	8
4.Flow parameter setting.....	8
4.2Alarm parameter setting.....	12
5. Output parameter setting.....	14
6. Communication parameter setting.....	126
7. Instrument factory parameters.....	16
8. Level parameter.....	17

## Product description

AFTLD-NF non-full-tube electromagnetic flowmeter is a new type of flowmeter developed by our company that can measure liquid flow under non-full-tube conditions. Non-full pipe flowmeter is an automatic flow measuring instrument that continuously measures fluid flow in open pipelines (such as semi-pipe flow sewage pipes and large flow pipes without overflow weirs) using the flow-area method. It can measure and display data such as instantaneous flow rate, flow rate, and accumulated flow rate. It is especially suitable for the measurement of municipal rainwater, wastewater, sewage discharge and irrigation water pipes.

The non-full-tube flowmeter is composed of an electromagnetic flow rate sensor, a liquid level sensor and a flow indicator, which continuously measures the flow velocity and level of the fluid in the pipe. The user only needs to enter the inner diameter of a round pipe or the width of a square pipe. AFTLD-NF The non-full-pipe flowmeter will automatically calculate the flow in the pipeline and automatically display the measurement parameters such as instantaneous flow, flow rate, and accumulated flow in the pipeline.

## Product Features

- Can be used for flow measurement of open non-full pipe (round pipe, rectangular pipe or other special-shaped pipe);
- Can be used for continuous measurement of municipal rainwater, wastewater, sewage discharge and irrigation water pipelines;
- Can realize forward and reverse two-way flow measurement;
- The sensor can work reliably for a long time under the harsh scene and sewage water quality;
- Flow velocity measurement range 0.05-10m / s;
- The flow measurement accuracy is high, and it is not affected by factors such as downstream, direct current, blockage, etc.
- The large-screen backlight LCD display can clearly read the measurement data

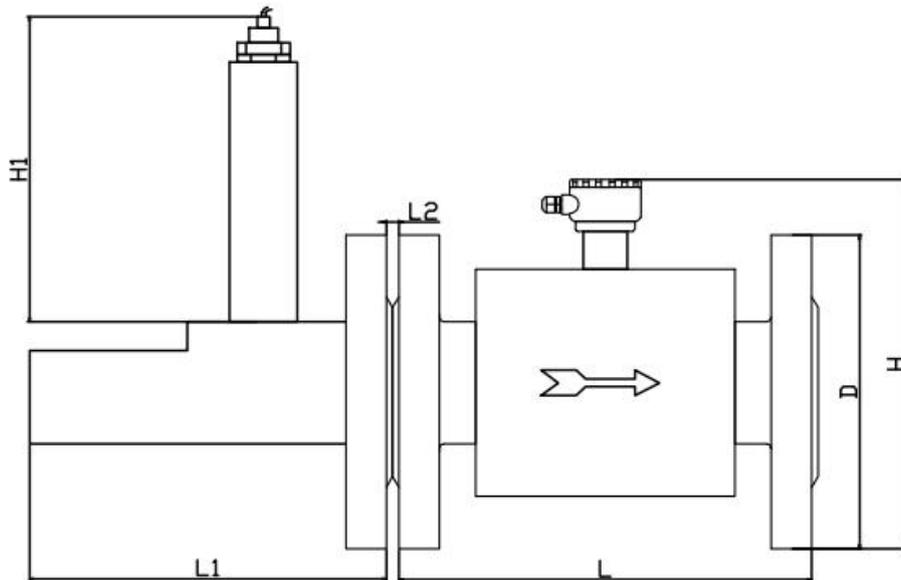
under strong light or at night;

- Instrument display and output functions are complete, it can display instantaneous flow, flow rate, cumulative flow and other data, and has RS485 interface (optional);
- With GSM and GPRS wireless data remote transmission function (optional);
- It has the functions of timing, counting and clocking out of power.

## Main technical performance indicators

- Nominal diameter: round pipe DN200-DN6000mm rectangular pipe: width  $\leq 6m \leq 6m$
- Measurement accuracy: water level  $\pm 2mm$ ; flow rate  $\pm 1.0\%$ ; flow rate  $\pm 1.5\%$
- Measurement range: flow rate 0.05-10m / s
- Conductivity of measured medium:  $\geq 20s / cm$
- Measured medium temperature:  $\leq 60\text{ }^{\circ}C$
- Large screen, backlight LCD display, can display instantaneous flow rate, flow rate, cumulative flow rate, liquid level and other measurement data at the same time
- Current output signal: 4-20mA / DC (load resistance  $\leq 500\Omega$ )
- Pulse output signal: 1-2000HZ
- Digital communication interface: Rs232RS485 optional
- Wireless data transmission: GSM and GPRS optional
- Power supply: 220VAC or 12VDC, 24VDC

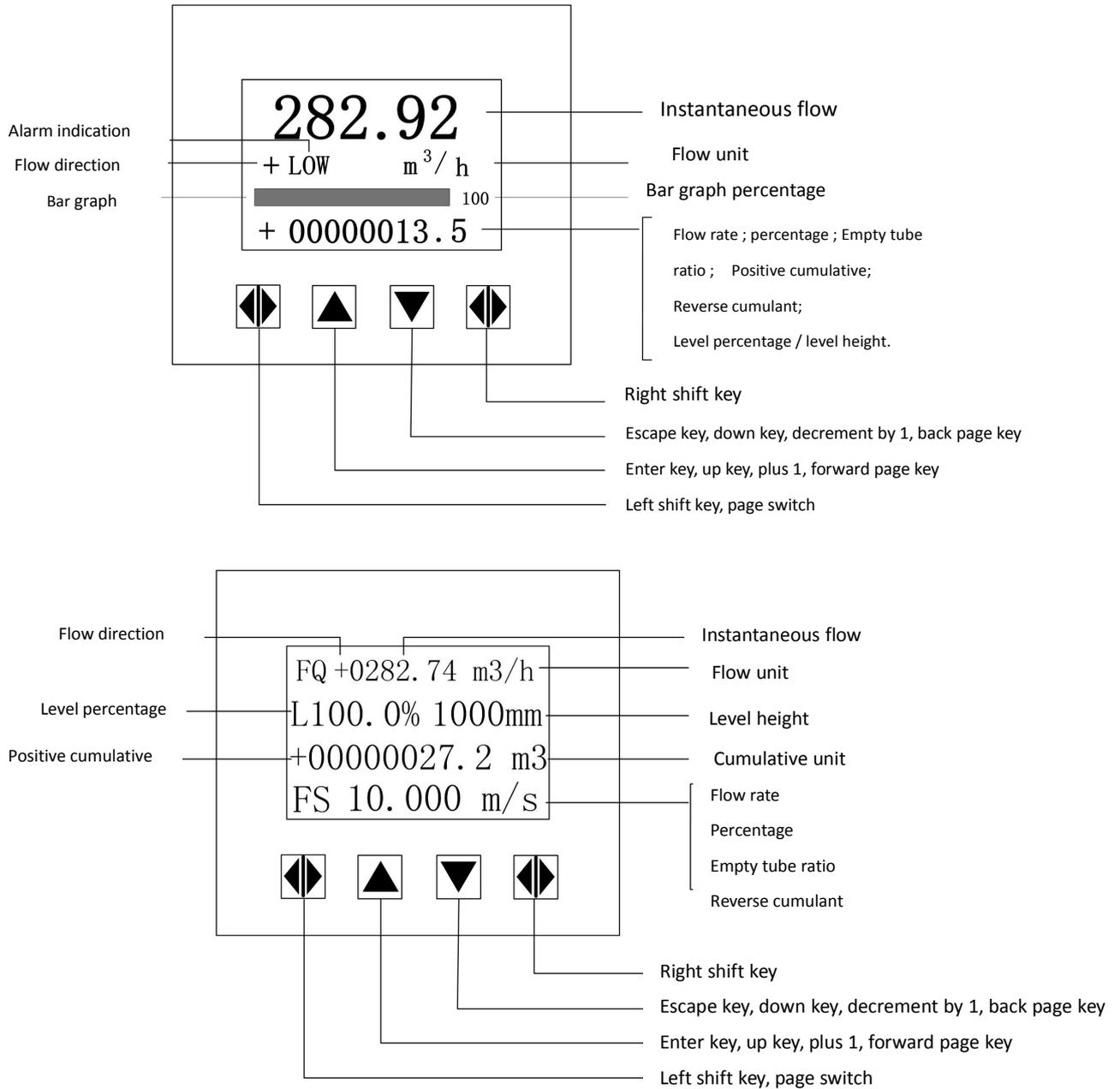
## Flow meter size



Size (mm)	L (mm)	H (mm)	D (mm)	L1 (mm)	H1 (mm)	L2 (mm)	
						PTFE	F46/PFA/ Rubber
200	340	405	335	500	500	8	10
250	440	460	390	500	500	8	10
300	490	510	440	500	500	8	10
350	490	570	500	500	500	8	10
400	490	635	565	500	500	8	10
450	540	685	615	500	500	8	10
500	540	740	670	500	500	8	10
600	590	850	780	500	500	8	10
700	690	965	895	500	500	8	10
800	790	1085	1015	500	500	8	10
900	890	1185	1115	500	500	8	10
1000	990	1300	1230	500	500	8	10

## Instrument parameter introduction

### Instrument display and operation



When the meter is powered on, it automatically enters the measurement state. In the automatic measurement state, the meter automatically completes each measurement function and displays the corresponding measurement data. To set or modify the instrument parameters, the instrument must be switched from the measurement state to the parameter setting state. In the parameter setting state, the user uses the panel key to complete the instrument parameter setting.

# 1.Key Function

## 1.1Key functions in automatic measurement

Down key: Cycle through the content displayed on the bottom line of the screen;

Right shift key: Press the right shift key once to enter the meter function selection screen;

Left shift key: Press the left shift key once to switch the page of the main interface;

## 1.2 Function of each key in parameter setting state

Down key: Decrease the number at the cursor by 1 to move forward.

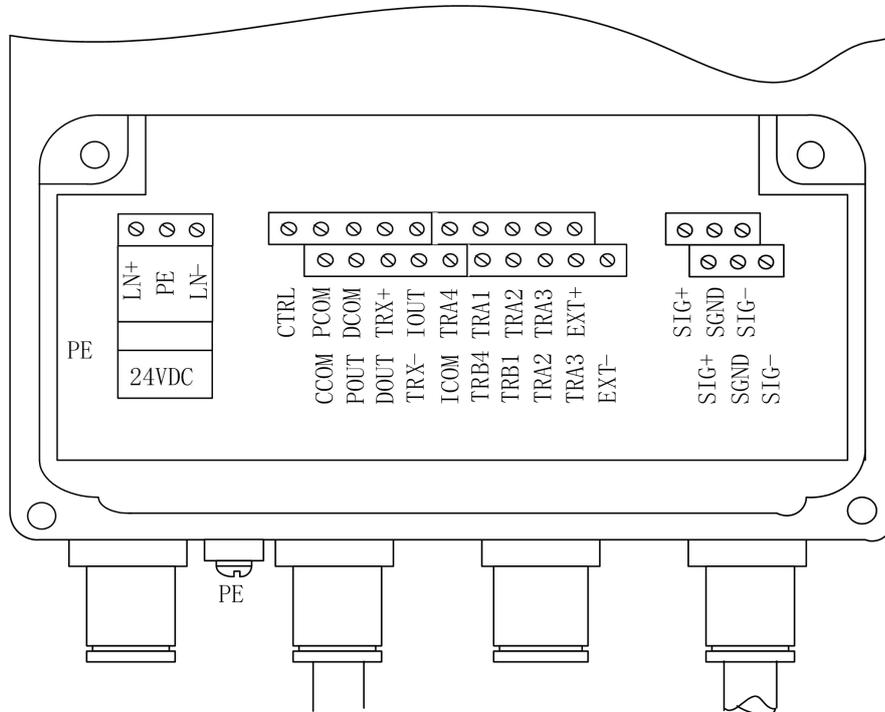
Up key: add 1 to the number at the cursor, then turn the page;

Press the right shift key to move the cursor clockwise, and press the left shift key to move the cursor counterclockwise;

When the cursor moves below the up key, press the up key to enter the submenu.

When the cursor moves below the down key, press the key to return to the previous menu.

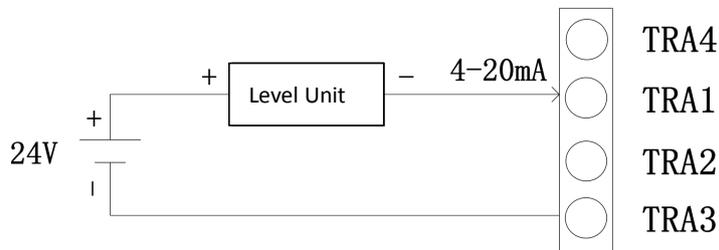
# 2. Instrument terminal wiring



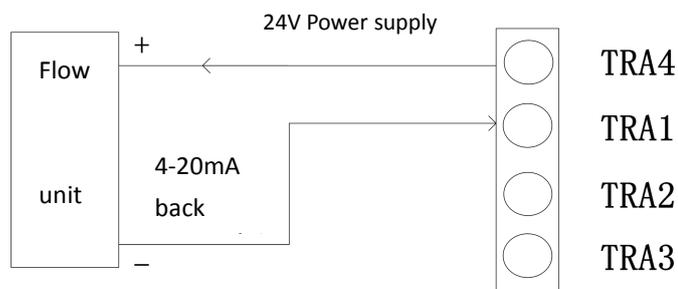
### 3.Line connection

The liquid level measuring unit of the non-full-tube electromagnetic flowmeter outputs 4-20mA current, corresponding to the level of the liquid level. The liquid level measurement unit can be powered by 24VDC power supply from the outside or by 24VDC power supply inside the electromagnetic flowmeter.

#### 3.1External power supply wiring diagram



#### 3.2Internal power supply wiring diagram



### 4.Flow parameter setting

#### 4.1Flow unit

Select the flow display unit in the parameters. The flow display units of the meter are: L / s, L / m, L / h, m<sup>3</sup> / s, m<sup>3</sup> / m, m<sup>3</sup> / h. The user can choose a suitable one according to the process requirements and usage habits Flow display unit.

## 4.2 Flow accumulation unit

The converter display is a 9-digit counter with a maximum allowable count value of 999999999.

The accumulative unit used is L, m<sup>3</sup> (liters, cubic meters).

Flow accumulation equivalent is : 0.001L、 0.010L、 0.100L、 1.000L

0.001m<sup>3</sup>、 0.010m<sup>3</sup>、 0.100m<sup>3</sup>、 1.000m<sup>3</sup>

## 4.3 Reverse output allowed

When the reverse output enable parameter is set to the "prohibited" state, as long as the fluid flows, the converter outputs pulses and current according to the flow value.

When the reverse output permission parameter is set to "allow", if the fluid flows in reverse, the converter flow rate is displayed normally, the output pulse is "0", the current output is signal "0" (4mA), and the instantaneous flow rate is displayed as 0.

## 4.4 Meter range setting

The meter range setting refers to the determination of the upper limit flow value, and the lower limit flow value of the meter is automatically set to "0".

Therefore, the meter range setting determines the meter range, which also determines the corresponding relationship between the meter percentage display, meter frequency output, meter current output, and flow:

Meter percentage display value = (flow value measurement value / meter range range) \* 100%;

Meter frequency output value = (flow value measurement value / meter range range) \* frequency full range value;

Instrument current output value = (flow value measurement value / instrument range range) \* current full range value + base point;

The meter pulse output value is not affected by the meter range setting;

## 4.5 Measuring damping time

That is, the filtering time and long measurement damping time can improve the stability of the meter flow display and the stability of the output signal, which is suitable for the measurement of the total accumulated pulsating flow. The short measurement damping time is expressed as fast measurement response speed, which is suitable for production process control. Measurement damping time is divided into 1S, 2S, 3S, 4S, 6S, 8S, 10S, 15S, 30S, 60S, and can be selected and set.

## 4.6 Analog output damping

That is, the current filtering time and long analog output damping can improve the stability of the 4-20mA output signal. Short analog output damping appears as a fast measurement of 4-20mA response speed.

Analog output damping: 5S, 10S, 20S, 50S, 80S, 150S, 250S, which can be selected and set.

## 4.7 Spike suppression selection

For the measurement of slurry flow rate of pulp, mud, etc., the solid particles in the fluid rubbing or impacting

the measuring electrode will cause "spike false signals". To overcome such false signals, the converter is designed with a spike suppression function. Fluctuation of the flow value and peak width time, the converter will suppress the spike false signal that meets the set value to minimize the flow fluctuation.

This parameter has two functions: "spike suppression enable" : 1) This parameter is set to "allow" to start the spike suppression function. 2) Set this parameter to "Disable", turn off the spike suppression function and turn on the noise sensitivity test.

#### 4.8 Spike suppression range

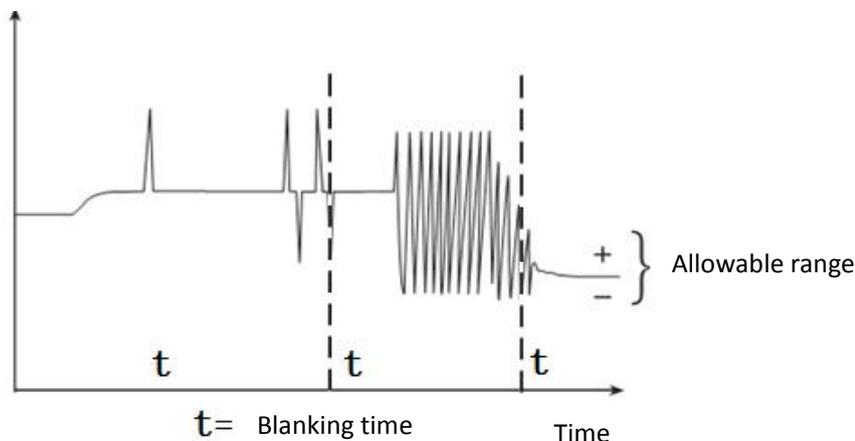
This parameter has two functions:

- 1) When the "Spike Suppression Allowed" parameter is set to Allow, this value confirms the start value of the spike suppression, which is used to set the flow velocity fluctuation value of the spike false signal to be suppressed. If the current velocity fluctuates higher than this starting value, the change is considered to be caused by a spurious spurious signal, and the system will cut it and display a PSM alarm. When the flow velocity fluctuates below this starting value, it is considered that the change is caused by a true flow velocity change, and the system recognizes that it is measuring the flow velocity change.
- 2) When the "Spike Suppression Enable" parameter is set to Disable, this value determines the sensitivity test for noise. ※ If the "FST" display frequently appears, it is recommended to increase the "Spike Suppression Range" value.

#### 4.9 Spike suppression time

This parameter selects the peak width time of the spurious pseudo signal to be suppressed, in seconds.

Measured variable not attenuated



Flow rate with filter time constant as a percentage

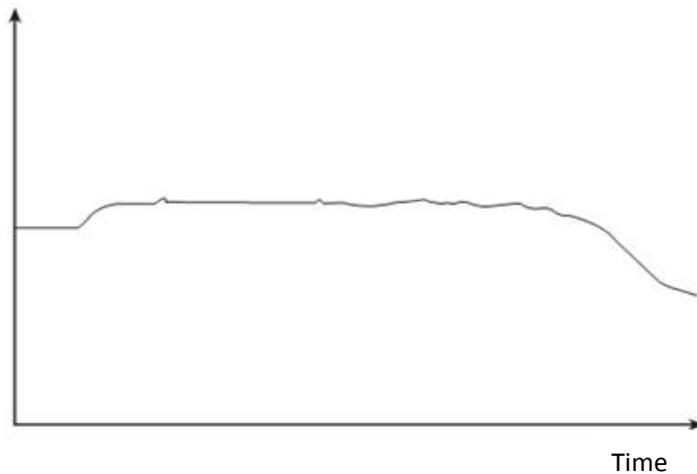


Figure 2.1.6 Elimination of coarse error noise with spike suppression technology

#### 4.10 Abnormal suppression time

For abnormal conditions such as air bubbles in the water, in order to prevent the flow from returning to "zero", the converter has designed an abnormal suppression function on the software and hardware. When the converter finds an abnormal condition, the converter will display an "ABN" abnormal alarm for an abnormal time. The flow is suppressed to prevent the flow from returning to "zero" and to minimize flow fluctuations.

This parameter is used for abnormal suppression time, and can be selected within 0 ~ 99s. When 0s is selected, this function is turned off.

#### 4.11 Flow direction options

If the user thinks that the fluid direction during the debugging is inconsistent with the design, the user does not have to change the connection method of the excitation line or signal line, but can use the flow direction setting parameters to change.

#### 4.12 Signal removal allowed

When the signal cut-off allowance parameter is set to "prohibited", as long as the fluid flows, the converter outputs pulses and current according to the flow value.

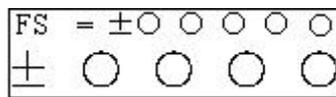
When the signal cut-off allowance parameter is set to "allow", if the fluid flow rate is lower than the flow rate set by the small signal cut-off point, the converter flow rate is displayed normally, the converter displays small signal cut-off (CUT), the output pulse is "0", and the current The output signal is "0" (4mA), and the instantaneous flow rate is displayed as "0".

### 4.13 Small signal cut-off point

The small signal cut-off point setting is expressed in terms of flow. This parameter is allowed in conjunction with signal cut.

### 4.14 Zero flow correction

Make sure that the sensor tube is filled with fluid when the zero point is corrected, and the fluid is at a standstill. The zero point of the flow is expressed by the flow rate, and the unit is mm / s. The converter flow zero correction is displayed as follows :



Small characters on the upper display: FS stands for the zero measurement value of the meter; large characters on the lower display: the zero correction value for the flow velocity;

When the FS display is not "0", adjust the correction value so that FS = 0. Note: If the downward correction value is changed and the FS value increases, the positive and negative signs of the downward value need to be changed so that the FS can be corrected to zero.

The correction value of the flow zero point is the matching constant value of the sensor, which should be recorded in the sensor's record sheet and sensor label. The zero value of the sensor at the time of entry is the velocity value in mm / s, and its sign is opposite to that of the correction value.

### 4.15 Factory calibration factor

This coefficient is a coefficient specific to the converter manufacturer. The converter manufacturer uses this coefficient to normalize the measurement circuit system of the L-magBP electromagnetic converter to ensure that the interchangeability between all L-magBP electromagnetic converters reaches 0.1%.

### 4.16 Total clear password

The user can set the password by using a password above the third level, and then set the password within the total amount cleared.

## 4.2 Alarm parameter setting

### 4.2.1 Alarm output selection

There are 9 options for converter alarm output: prohibited alarm output, flow upper limit alarm, flow lower limit alarm, flow empty pipe alarm, flow reverse alarm, flow cut off alarm, excitation system alarm, liquid level upper limit alarm, and liquid level lower limit alarm.

Example "Upper Limit Alarm": The upper limit alarm allows the parameter to be set to "Allow" and the alarm output option is set to "flow upper limit alarm". At this time, if the fluid flow reaches the upper limit alarm value, the converter displays the upper limit alarm (HIG), and the terminals DO + and DO- output Low.

### 4.2.2 Upper limit alarm allowed

When the upper limit alarm enable parameter is set to "disable", the upper limit alarm function is canceled. When the upper limit alarm allowable parameter is set to "Allow", if the fluid flow reaches the upper limit alarm value, the converter displays the high limit alarm (HIG).

### 4.2.3 Upper alarm value

The upper limit alarm value is calculated based on the flow rate. This parameter is set in numerical mode. The user sets an appropriate flow value in this parameter. After the instantaneous flow is higher than this value during the operation of the instrument, it will output and display according to the upper limit alarm allowable parameter and alarm output parameter.

### 4.2.4 Lower limit alarm

Same upper limit alarm

### 4.2.5 Excitation alarm

When the excitation alarm parameter is set to "disabled", the excitation alarm function is cancelled. When the excitation alarm parameter is set to "Enable", if the excitation coil fails, the converter displays SYS.

### 4.2.6 Air flow alarm allowed

L-magBP has an empty tube detection function and does not require additional electrodes. If the user selects the Air Traffic Control Alarm Allowed parameter as "Prohibited", the Air Traffic Control Alarm function will be cancelled.

If the user selects the allowable parameter of the empty pipe alarm as "allowed", the empty pipe alarm function is provided. When the fluid in the pipeline is lower than the measuring electrode, the meter can detect an empty pipe state, the converter displays MTP and the output pulse is "0", The current output is signal "0"(4mA), and the instantaneous flow rate and flow rate are displayed as 0.

### 4.2.7 ATC alarm threshold

When the fluid is full (either with or without flow rate), the measured value of the conductivity of the empty pipe alarm threshold parameter is displayed on the upper line, and the measured value of the empty pipe alarm threshold is set on the lower line. It can be set to 3 to 5 times of the measured conductivity.

### 4.2.8 Empty pipe zero point correction

When the full pipe value on site is large, the user can perform zero pipe zero point correction. Make sure that the sensor tube is filled with fluid during zero tube zero point correction. The zero tube zero point correction is shown below :

$$\begin{array}{r} MZ = 0\ 0\ 0\ 1\ 5 \\ +\ 0\ 0\ 0\ 0 \end{array}$$

Upward display: MZ represents the zero measurement value of the empty pipe of the instrument;

Downward display: zero correction value of air traffic control;

First, adjust the correction value based on the measured conductivity MT to make MZ = 5-10 (note: if the downward correction value is increased, the MZ value will decrease).

#### 4.2.9 Empty tube span correction

When the MT value of the empty pipe conductivity measured by the meter is too small, the user can correct the empty pipe range. The empty tube range correction should ensure that there is no fluid in the sensor tube. The empty tube range correction display is as follows :

$$\begin{array}{r} \text{MR} = 0\ 0\ 1\ 0\ 7 \\ 1\ .\ 0\ 0\ 0\ 0 \end{array}$$

Upper display: MR stands for the measurement value of the empty tube range of the instrument;

Downward display: Empty tube range correction value;

Increasing the downward correction value increases the MR value, decreases the downward correction value and decreases the MR value. The user can adjust the MR to an appropriate value according to the actual needs (recommended to adjust to MR = 500), then the measured conductivity of the air pipe is basically the actual corrected MR value

#### 4.2.10 Tube damping time

Long air pipe damping time is slower in response to air pipe alarms. Short measurement damping time.

The response time of the air pipe alarm is fast. the way.

## 5.Output parameter setting

### 5.1Pulse output mode

There are two types of pulse output modes: frequency output and pulse output:

PO frequency output mode: The frequency output is a continuous square wave, and the frequency value corresponds to the flow percentage.

Frequency output value = (flow value measurement value / meter range range) \* frequency range + frequency lower limit;

PO pulse output mode: The pulse output is a rectangular wave pulse train. Each pulse represents a flow equivalent flowing through the pipeline. The pulse equivalent is set by the following two parameters: "pulse equivalent unit" and "pulse equivalent" . The pulse output mode is mostly used for totalizing the total, which is generally connected with the totalizing meter.

The frequency and pulse output are generally in the form of OC gates. Therefore, an external DC power supply and load should be connected. See Section 5.14 for details.

## 5.2 Pulse unit

L-magBP electromagnetic converter has four pulse equivalents: m<sup>3</sup>, L.

## 5.3 Pulse equivalent

Pulse equivalent refers to the flow value represented by a pulse. The pulse equivalent of the instrument must be composed of "pulse equivalent unit" and "pulse equivalent".

"Pulse equivalent" is set in conjunction with the two parameters, ranging from 0.001 to 59.999m<sup>3</sup> and 0.001 to 59.999L.

At the same flow rate, if the pulse equivalent is small, the frequency of the output pulse is high, and the cumulative flow error is small.

## 5.4 Pulse Width

Pulse output is active low, pulse width: 0.5 --- 1999ms

**Pulse width—the maximum output pulse number correspondence table (Table 2)**

No.	Pulse Width ( ms )	Maximum output pulses per hour ( p/h )
1	0.5	3600000
2	1	1800000
3	5	360000
4	10	180000
5	50	36000
6	100	18000
7	500	3600
8	999	1800
9	1999	900

## 5.5 Frequency output lower limit

Meter frequency output range corresponds to flow measurement zero

## 5.6 Frequency output range

The frequency output range of the meter corresponds to the upper limit of flow measurement.

### 5.7 Current output mode

At present, users can only choose 4 ~ 20 mA current output.

### 5.8 Current zero point correction

The current output zero adjustment of the converter makes the current output accurate to 4mA.

### 5.9 Full current correction

The full-scale current output of the converter is adjusted so that the current output is exactly 20mA.

### 5.10 Output current test

After adjusting the current output zero and full scale, users can use this parameter to test the linearity of the output current of the converter. Users can set 0, 20.00, 50.00, 70.00, 99.99 to check the linearity characteristics of output current.

## 6. Communication parameter setting

### 6.1 Instrument communication mode

This table provides three communication modes: MODBUS, current loop communication, PROFIBUS, and the corresponding communication mode should be set when the instrument is equipped with different communication methods.

### 6.2 Instrument communication address

When referring to data communication, the communication address of this table, optional range: 01 to 250 address, address 0 is reserved.

### 6.3 Meter communication speed

Instrument communication baud rate selection range: 300,600,1200,2400,4800,9600,19200,38400

### 6.4 Instrument calibration mode

The converter is equipped as standard with standard MODBUS communication. One stop bit 8-bit non-check mode, the user can choose one stop bit 8-bit odd check, one stop bit 8-bit even check mode, two stop bits 8-bit non-check Test mode, two stop bits with 8-bit odd parity, two stop bits with 8-bit odd parity.

## 7. Instrument factory parameters

### 7.1 User password 1 ~ 4

The user enters with a level 5 password, which can be modified;

## 7.2 Instrument codes 1 and 2

The converter code records the delivery time and number of the converter.

## 7.3 Positive total high and low

The total high and low setting can change the value of the forward cumulative total and reverse cumulative total. It is mainly used for meter maintenance and meter replacement.

The user can use the 5-level password to enter, and can modify the positive cumulative value ( $\Sigma +$ ). Generally, the cumulative value cannot exceed the maximum value counted by the counter (999999999).

## 7.4 Reverse total high and low

The user can use the 5-level password to enter and modify the reverse cumulative quantity ( $\Sigma -$ ). Generally, the cumulative quantity cannot exceed the maximum value (999999999) counted by the counter.

# 8. Level parameter

The liquid level measurement unit outputs a 4-20mA current signal, corresponding to the level of the liquid level, 4mA corresponds to the zero level, and 20mA corresponds to the full level.

## 8.1 Zero level correction

Input the 4mA liquid level signal, adjust the zero correction parameter of the liquid level, and make the meter display 0% liquid level.

## 8.2 Level correction

Input the 20mA liquid level signal and adjust the liquid level fullness to make the meter display 100.0% liquid level.

## 8.3 Level alarm allowed

When the level alarm allowable parameter is set to "prohibited", the upper and lower level alarm functions are cancelled. When the liquid level alarm allowable parameter is set to "Allow", if the liquid level height reaches the upper limit value or the liquid level height is lower than the lower limit value, the converter displays the upper limit alarm (LIH) or the lower limit alarm (LIL).

## 8.4 High level alarm

The liquid level upper limit alarm is calculated based on the liquid level height. This parameter is set by numerical values. The user sets an appropriate liquid level height value in this parameter. After the liquid level height is higher than this value during the operation of the instrument, the corresponding liquid level alarm allows the parameters to be output and displayed accordingly.

### **8.5 Lower limit level alarm**

Same with Upper limit alarm

### **8.6 Level mode selection**

If this parameter is set to "allow", the liquid level is measured normally, 4mA corresponds to the zero level, and 20mA corresponds to the full level;

If this parameter is set to "Prohibited", the liquid level does not participate in the calculation of instantaneous flow, that is, the liquid level measurement function does not work, and the liquid level percentage and liquid level height are both 0

### **8.7 Level height**

This parameter is used to set the height of the liquid level at full scale in the pipeline, in mm.