Electromagnetic flowmeter converter

User 's Manual

L-mag U series

(With non-full pipeline measurement function)

V1.0.1

2025-09-15

Catalogue

1 Converter wiring ---------- 1

1.1 Signal line marking ---------- 1
1.2 Characteristics of connecting wires and cables ---------- 2
1.3 Output and power cable ---------- 4
1.4 Connection mode of liquid level unit ---------- 5

2 Introduction to instrument parameters ---------- 6

2.1 Flow Set Up ---------- 6
2.2 Alarm Set Up ---------- 11
2.3 Output Set Up ---------- 14
2.4 Sensor Set Up ---------- 16
2.5 Communication ---------- 17
2.6 Meter Parameters ---------- 18
2.7 Level Parameters ---------- 19

3 Instrument display and operation ---------- 21

3.1 Key function and remote control function ---------- 22
3.2 Function selection screen and parameter setting operation ---------- 24

4 Instrument picture ---------- 25

5 Product performance and index ---------- 25

5.1 Basic function ---------- 25
5.2 Special functions ---------- 26
5.3 Normal operating conditions ---------- 26
5.4 Type of connection to sensor ---------- 26
5.5 Request of relative sensor ---------- 26
5.6 Dimension drawing for installation ---------- 27
5.7 Measuring accuracy of the whole machine ---------- 28
5.8 Analog current output ---------- 28
5.9 Digital frequency output ---------- 28
5.10 Digital pulse output ---------- 28
5.11 Alarm output ---------- 29
5.12 Digital communication port and protocol ---------- 29
5.13 Electrical isolation ---------- 29
5.14 Digital output and Calculate ---------- 30
5.15 Analog output and calculation ---------- 32

6 Alarm Information ---------- 34

7 Troubleshooting ---------- 35

7.1 No display ---------- 35
7.2 System alarm ---------- 35
7.3 Empty pipe alarm ---------- 35
7.4 The measured flow is not accurate ---------- 36

8 Packing and storage ---------- 36

8.1 Packing ---------- 36
8.2 Shipping and storage ---------- 36

Appendix1 Description of nonlinear correction function ---------- 37

Appendix 2 Setting Parameters in Menu ---------- 39

L-magU Electromagnetic Flowmeter Converter User Manual

(Non-full pipeline measurement function)

1 Converter wiring

1.1 Signal line marking

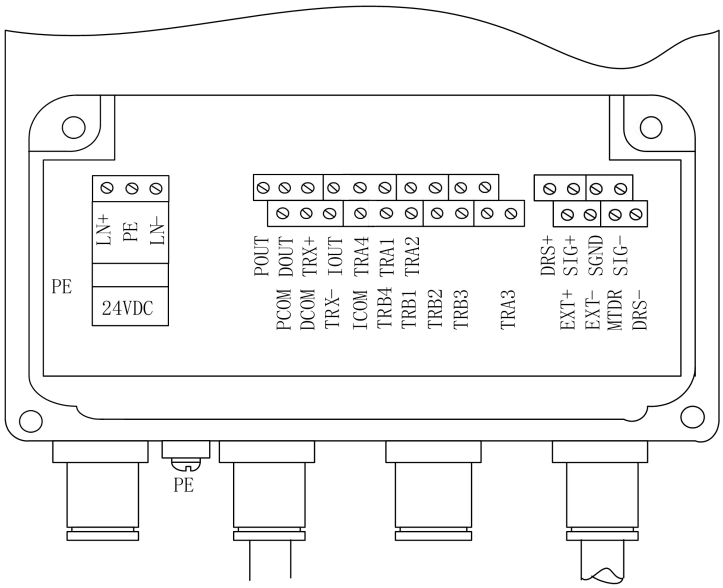


Fig1.1 Processing and marking of signal lines

The meanings of the markings of each terminal are as follows.

CTRL：	Reserved
CCOM：	Reserved
PCOM：	Pulse/Frequency output ground
POUT：	Pulse/Frequency output +
DCOM：	Alarm output ground
DOUT：	Alarm output+
TRX+：	Communication input(RS485- A)
TRX-：	Communication input(RS485- B)
IOUT：	Current output +
ICOM：	Current output ground

TRA4	24VDC signal output
TRB4	Reserved
TRA1	4-20mA input
TRB1	Reserved
TRA2	Reserved
TRB2	Reserved
TRB3	Reserved
TRA3	COM
EXT+：	Excitation current +
EXT-：	Excitation current -
SIG+：	Signal 1
SGND：	Signal ground
SIG-：	Signal 2
DRS+：	Excitation shielding +
MTDR	Excitation shielding ground
DRS+：	Excitation shielding -
LN+	220VAC/24VDC power input
LN-	220VAC/24VDC power input

1.2 Characteristics of connecting wires and cables

1.2.1 Flow signal line

The converter provides equipotential excitation shield signal output voltage to reduce the influence of distributed capacitance transmitted by cable on flow signal measurement. When the measured conductivity is less than 50 μS/cm or long-distance transmission, double-core double-shielded signal cable with equipotential shielding can be used. For example, STT3200 special cable or BTS triple shielded signal cable.

1.2.2 Excitation current line

Two-core insulated rubber flexible cable can be used for excitation current line, and the recommended model is RVVP2 * 0.3mm^2. The length of excitation

current line is consistent with the length of signal cable. When STT3200 special cable is used, excitation cable and signal cable are combined into one.

1.2.3 Grounding requirements for converter installation

The grounding terminal of the converter housing shall be grounded with a grounding copper wire not less than 1.6mm^2. The grounding resistance from the converter housing to the ground should be less than 10 Ω.

First Φ 20 copper pipe, cut into 1700 mm long (can be lengthened as needed) to make a ground nail buried 1500 mm (note: when embedding the ground nail, sprinkle a layer of wood charcoal on the tip of the ground nail, and then pour salt water);

Next, weld 4mm^2 copper wire on the ground stud, and finally connect the ground wire to the sensor flange, grounding ring, and pipe flange, as shown in Figure 1.3.

Note: stainless steel is required for fixing ground wire screw, spring washer and flat washer.

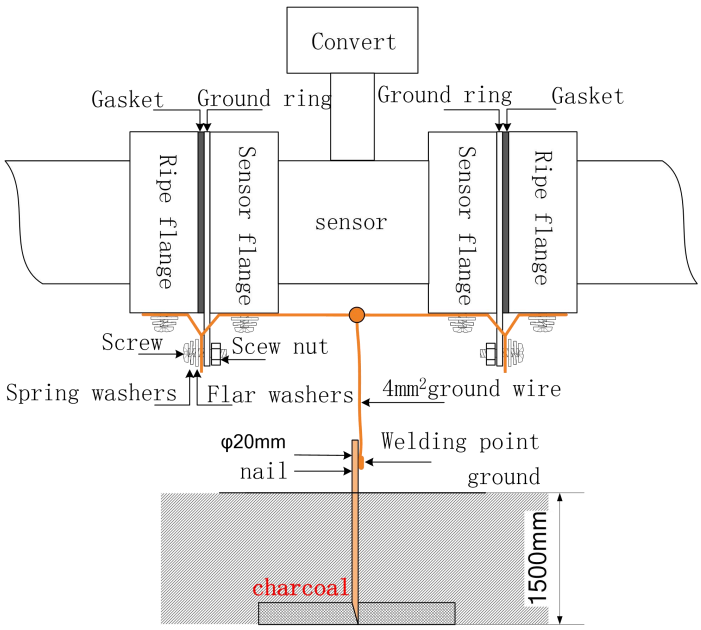


Fig.1.2 Grounding

1.3 Output and power cable

All output and power cables shall be prepared by the user according to the actual situation. However, please pay attention to meet the requirements of load current.

Pulse, current, alarm output external power supply and load are shown in Figure 1.3.1, ---- Figure 1.3.4. When using inductive load, the freewheeling diode should be added as shown in the figure.

1.3.1 Current output wiring

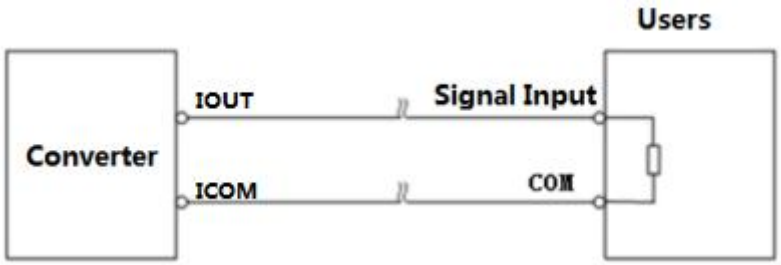


Fig1.3.1 4-20mA Internal power supply connection

1.3.2 Pulse output wiring

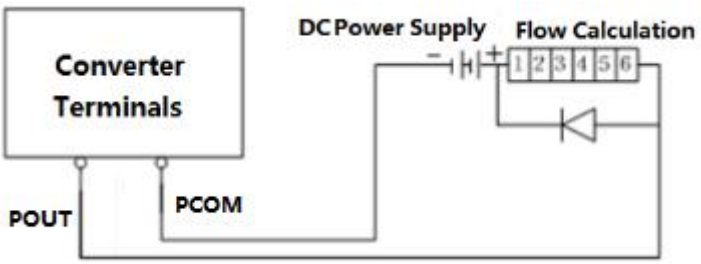


Fig1.3.2 External power supply connected electronic counter

1.3.3 Alarm output wiring

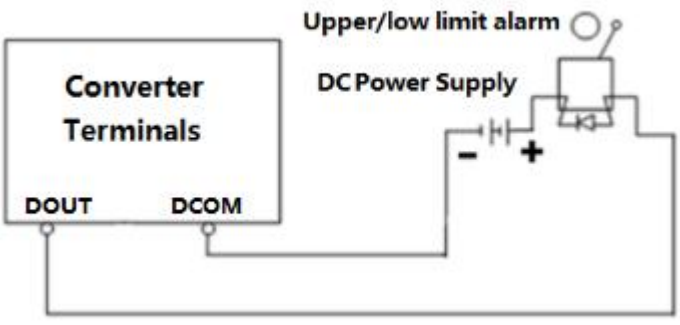


Fig1.3.3 Alarm output connection

1.3.4 Connection mode of OC door in the table

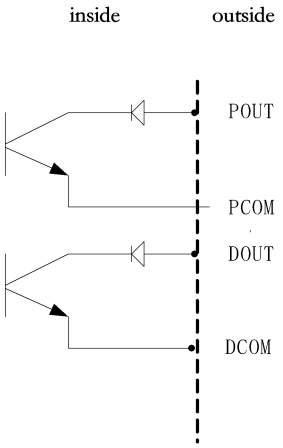
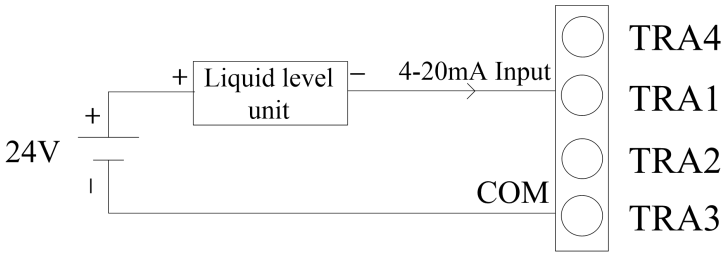


Fig1.3.4 Connection mode of OC door in the table

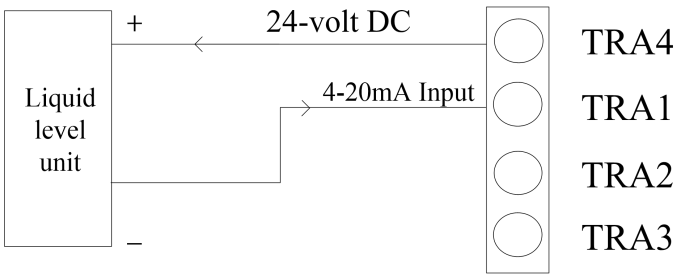
1.4 Connection mode of liquid level unit

The liquid level measurement unit of the non-full pipe electromagnetic flowmeter outputs a current of 4 to 20 milliamperes, which corresponds to the value of the liquid level.The liquid level measurement unit can be supplied with a 24-volt DC power source externally, or it can be powered by a 24-volt DC power source inside the electromagnetic flowmeter.

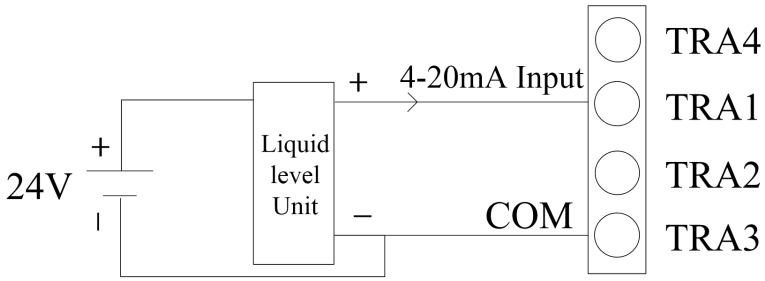
1.4.1 Wiring diagram of two-wire external power supply



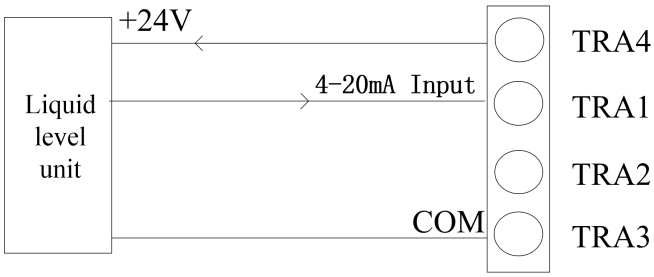
1.4.2 Wiring diagram of two-wire internal power supply



1.4.3 Wiring diagram of three-wire external power supply



1.4.4 Wiring diagram of three-wire internal power supply



2 Introduction to instrument parameters

2.1 Flow Set Up

2.1.1 Flow unit

Select the flow display unit in the parameters. The flow display units of the instrument include: L/s, L/m, L/h, m^3/s, m^3/m, m^3/h, km^3/s, km^3/m,km^3/h.

Users can select an appropriate flow display unit according to the process

requirements and usage habits.

2.1.2 Flow total unit

The converter display is a 9-bit counter, and the maximum allowable count value is 999999999.

The unit of use is L, m^3,km^3(liter, cubic meter,cubic kilometer).

The flow accumulation equivalent is:

0.001L,	0.010L,	0.100L,	1.000L
0.001m^3,	0.010m^3,	0.100m^3,	1.000m^3
0.001km^3,	0.010km^3,	0.100km^3,	1.000km^3

2.1.3 Reverse flow En.

When “Reverse flow En.” is set to the “Disable” state, as long as the fluid flows, the converter will output pulse and current according to the flow value.

When “Reverse flow En.” is set to “Enable” , if the fluid flows in reverse direction, the converter flow rate is normal, the output pulse is “0”, the current output is signal “0” (4mA), the instantaneous flow is displayed as 0.

2.1.4 Flow range

The instrument range setting refers to determining the upper limit flow value, and the lower limit flow value of the instrument is automatically set to “0”.

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

percent display = (flow measure / measure range) * 100 %;

frequency output = (flow measure / measure range) * frequency full;

current output = (flow measure / measure range) * current full + base point;

pulse output will not affect.

2.1.5 Flow filter time

That is, filtering time, long measurement damping time can improve the stability of instrument flow display and output signal, and is suitable for the

measurement of total cumulative pulsating flow. Short measurement damping time is characterized by fast measurement response speed, which is suitable for production process control. The measurement damping time is divided into 1S, 2S, 4S, 6S, 8S, 10S, 15S, 30S and 60S, and can be set by selection.

2.1.6 Analog Damp time

This parameter means current filtering time.Long simulated output damping can promote stability of 4-20mA output signal.Short simulated output damping can fleetly measure respond speed of 4-20mA.

This parameter has seven mode to choice:5S,10S,20S,50S,80S,150S,250S.

2.1.7 Peak Limit Ena.

For pulp, slurry and other slurry flow measurement, the solid particles in the fluid friction or impact the measuring electrode, which will cause “spike false signal”. To overcome this kind of false signal, the converter is designed with a spike suppression function. The user sets the peak fluctuation flow value and peak width time, and the converter will suppress the peak false signal that meets the set value to minimize the flow fluctuation.

The parameter “Peak Limit Ena.” has two functions: 1) Set the parameter to “Enable” to start the spike suppression function. 2) This parameter is set to “Disable”, the peak suppression function is turned off and the noise sensitivity test is turned on.

2.1.8 Peak Limit Valu.

This parameter has two functions：

1) When “Peak Limit Ena.” parameter is set to “Enable”, this value confirms the initial value of spike suppression, and is used to set the flow rate fluctuation value of the spurious signal to be suppressed. If the current flow rate fluctuation is higher than this initial value, it is considered that this change is caused by the spike false signal, and the system will switch it off and display the PSM alarm. When the flow rate fluctuation is lower than this initial value, it is considered that this change is caused by the real flow rate change, and the system recognizes that it is to measure the flow rate change.

2) This value determines the sensitivity test of noise when the “Peak Limit

Ena.” parameter is set to “Disable”.

※ If the “FST” display appears frequently, it is recommended to increase the “Peak Limit Valu.” value.

2.1.9 Peak limit Time

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

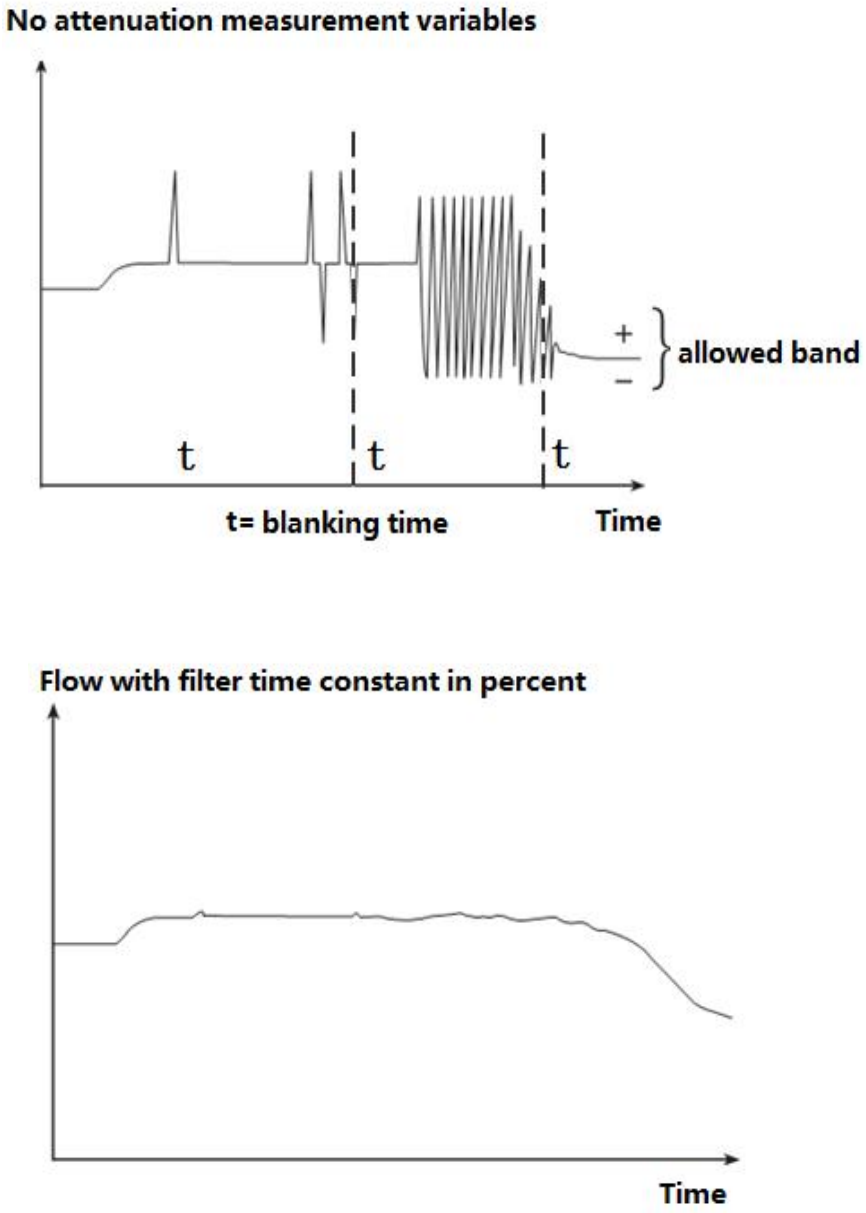


Fig2.1.9 Eliminating big noise error with Peak Limit Value

2.1.10 Abnormal Contorl

For abnormal conditions such as 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 abnormal conditions, the converter will display “ABN” abnormal alarm

Inhibit the abnormal flow for a period of time, prevent the flow from returning to “zero” and minimize the flow fluctuation.

This parameter is used for the length of abnormal suppression time, which can be selected from 0 to 99 s. When 0 s is selected, this function will be turned off.

2.1.11 Flow direction

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

2.1.12 Cutoff alarm en.

When “Cutoff alarm en.” is set to “Enable”:

If the fluid flow rate is lower than the flow rate set by the Low Signal Cutoff Point, the converter will display the instantaneous flow rate and flow velocity normally, show the Low Signal Cutoff (CUT) indicator, output a pulse of “0”, and output a current signal of “0” (4mA).

When “Cutoff alarm en.” is set to “Disable”:

If the fluid flow rate is lower than the flow rate set by the Low Signal Cutoff Point, the converter will display the flow velocity normally, show the Low Signal Cutoff (CUT) indicator, output a pulse of “0”, output a current signal of “0” (4mA), and display the instantaneous flow rate as “0”.

2.1.13 Low flow cutoff

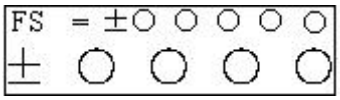
“Low flow cutoff” is expressed in flow. This parameter is allowed to be used in conjunction with “Cutoff alarm en.”.

2.1.14 Zero correction

During point correction, ensure that the sensor tube is filled with fluid and

that the fluid is still. The flow zero point is expressed by the flow rate, and the unit is mm/s.

The converter flow zero correction is shown as follows:



Upward small word display: FS represents the zero measurement value of the instrument; Downward large word display: correction value of flow rate zero point;

When FS is not displayed as “0”, the correction value should be adjusted to make FS=0. Note: If the downstream correction value is changed and FS value increases, the positive and negative signs of the downstream value need to be changed so that FS can be corrected to zero.

The corrected value of flow zero is the matching constant value of the sensor, which should be recorded in the sensor record sheet and the sensor label. When recording, the zero point value of the sensor is the flow rate value in mm/s, and its sign is opposite to the sign of the corrected value.

2.1.15 Meter Factor

This coefficient is the special coefficient of the converter manufacturer, which is used by the converter manufacturer to normalize the measuring circuit system of L-magU electromagnetic converter to ensure that the interchangeability of all L-magU electromagnetic converters reaches 0.1%.

2.1.16 Clear total key

The user can set this password with a password above the third level, and then set the password within the total amount of zero.

2.2 Alarm Set Up

2.2.1 Alarm Output Set

“Alarm Output Set” include nine choices: “No Output”, “Flow High Alarm”, “Flow Low Alarm”, “Pipe Empty Alarm”, “REV Flow Alarm”,“Cutoff Alarm”, “System Alarm”, “Level High Alarm”, “Level Low Alarm”.

For example: “High alarm Enab.” is set to “Enable” and “Alarm Output

Set" is set to "Flow High Alarm". If the fluid flow reaches the upper limit alarm value, the converter displays the upper limit alarm (HIG), and the terminal DO+and DO - output low level.

2.2.2 High alarm Enab.

When "High alarm Enab. "is set to "Disable", the upper limit alarm function is cancelled.

"High alarm Enab. " is set to "Enable". If the fluid flow reaches the upper limit alarm value, the converter displays the upper limit alarm (HIG).

2.2.3 High alarm value

"High alarm value" is calculated by flow value. This parameter is set by numerical value. The user sets an appropriate flow value in this parameter. When the instantaneous flow rate of the instrument is higher than this value during operation, corresponding output and display will be made in combination with the upper limit alarm allowable parameters.

2.2.4 Low alarm enable & Low alarm value

Same to "High alarm Enab." and "High alarm value".

2.2.5 System Alarm Ena.

When "System Alarm Ena." is set to "Disable", the excitation alarm function is canceled.

"System Alarm Ena." is set to "Enable" . If the excitation coil fails, the converter displays SYS.

2.2.6 Snsr measure Ena.

L-magU has empty tube detection function without additional electrode. If the user selects "Snsr measure Ena." as "Disable", the alarm function will be canceled.

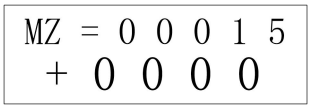
If "Snsr measure Ena." is set to "Enable", the empty pipe alarm function is provided. When the fluid in the pipeline is lower than the measuring electrode, the instrument can detect an empty pipe status, the converter displays MTP, the output pulse is "0", the current output is signal "0" (4mA), the instantaneous flow and flow rate are displayed as 0.

2.2.7 Snsr MT Alarm

When the fluid is full (with or without flow rate), the measured conductivity is displayed on the upper side of the empty pipe alarm threshold parameter, and the empty pipe alarm threshold is set on the lower side. When setting the empty pipe alarm threshold, it can be set according to the measured conductivity, which is 3-5 times of the measured conductivity.

2.2.8 Snsr MT zero

When the field full pipe value is large, the user can correct the empty pipe zero point. When correcting the null point of the empty tube, ensure that the sensor tube is filled with fluid. The null point correction of the empty tube is shown as follows:



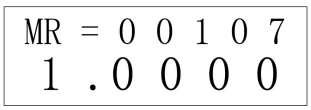
Up line display: MZ represents the measured value of zero point of instrument air pipe;

Down line display: ATC zero correction value;

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

2.2.9 Snsr MT range

When the MT value of empty tube conductivity measured by the instrument is small, the user can correct the empty tube range. During empty tube range correction, ensure that there is no fluid in the sensor tube, and the empty tube range correction display is as follows:



Upstream display: MR represents the measured value of instrument air pipe range;

Downward display: ATC range correction value;

Increase the downlink correction value, and the MR value will increase; decrease the downlink correction value, and the MR value will decrease. The user can adjust the MR to the appropriate value according to the actual needs (it is recommended to adjust it to about MR=500), so the measured conductivity value of empty pipe is basically the actual corrected MR value.

2.2.10 MT filter time

The response speed of ATC alarm is slow for long ATC damping time. Short measurement damping time, ATC alarm response speed is fast, ATC damping time: 10SEC, 15 SEC, 20 SEC, 25 SEC, 30 SEC, 35 SEC, 40 SEC, 45 SEC, 50 SEC, 60 SEC can be set by selection.

2.3 Output Set Up

2.3.1 Pulse output mode

Pulse output mode includes frequency output and pulse output:

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

  Frequency output value=(flow value measurement value/instrument range) * output range+output lower limit;

- PO Pulse output：The pulse output is a rectangular wave pulse string. Each pulse represents a flow equivalent that the pipeline flows through. The pulse equivalent is set by the following two parameters "Pulse unit" and "Pulse Factor". Pulse output mode is mostly used for total accumulation, and is generally connected with the totalizer.

  Frequency and pulse output are generally in the form of OC gate.

Therefore, DC power supply and load should be connected externally. See Section 5.13 for details.

2.3.2 Pulse unit

L-magU electromagnetic converter has four pulse equivalents: km^3,m^3, L.

2.3.3 Pulse Factor

Pulse equivalent refers to the flow value represented by a pulse. The instrument pulse equivalent shall be composed of “pulse unit” and “pulse Factor”.The two parameters are set together, and the range is 0.001-59.999m^3, 0.001-59.999L, 0.001-59.999km^3.

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

2.3.4 Pulse Width

Pulse output is effective at low level, pulse width: 0.5-1999ms.

Corresponding table of pulse width - maximum output pulse number

No.	**Pulse Width(ms)**	Maximum number of 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

2.3.5 Frequency lower

The frequency output range of the instrument corresponds to the zero point of flow measurement.

2.3.6 Frequency range

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

2.3.7 Analog output

At present, users can only select 4-20 mA.

2.3.8 Analog Zero CRC

The zero-point adjustment of the current output from the factory of the converter makes the current output accurate to 4mA.

2.3.9 Analog Range CRC

The current output of the converter is fully adjusted to make the current output accurate to 20mA.

2.3.10 Analog Out. Test

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

2.4 Sensor Set Up

2.4.1 Sensor size

The diameter range of the supporting sensor of the L-magU electromagnetic flowmeter converter:32 - 4000 mm.

32,40,45,50,55,65,70,75,80,85,90,95,100,125,150,200,250,300,320,350,400,450,500,550,600,650,700,750,800,850,900,950,1000,1100,1200,1300,1400,1500,1600,1700,1800,1900,2000,2100,2200,2300,2400,2500,2600,2700,2800,2900,3000,...4000.

2.4.2 Excit. Frequency

L-magU electromagnetic converter offers eight selectable excitation frequencies (the instrument is factory-set to the 50Hz power supply mode with an excitation frequency of 6.25Hz), and users can adjust the settings according to actual operating conditions.

50Hz power supply mode:

6.250Hz(default mode),5.555Hz,5.000Hz,4.545Hz;

60Hz power supply mode :

6.250Hz,5.555Hz,5.000Hz,4.545Hz;

The excitation system inductance of small caliber sensor is small, so high excitation frequency should be selected. The excitation system of large-diameter sensor has large inductance, so only low excitation frequency can be selected. In use, select low excitation frequency first, and then select low excitation frequency in turn if the zero point of the instrument flow rate is too high.

Note: The calibration must be carried out at the excitation frequency.

Note: If high-frequency excitation is used, please order high-frequency excitation converter and select appropriate excitation frequency value according to this principle.

2.4.3 Sensor Factor

Sensor Factor: the calibration coefficient of the whole electromagnetic flowmeter. The coefficient is obtained from the real label and stamped on the sensor label. The user must put this coefficient in the L-magU converter parameter table.

2.4.4 Lineary correct. & Velocity Point 1-5 & Velocity Vzale 1-5

See Appendix 1 for details.

2.4.5 Sensor Code 1-2

Sensor Code can be used to mark the factory time and number of the matched sensor to set the sensor coefficient.

2.5 Communication

2.5.1 Communicat.mode

This table provides one communication modes: MODBUS.

2.5.2 Communic.addres

Refers to the communication address of this table during data communication. The optional range: address 01-250, address 0 reserved.

2.5.3 Baud rate

Selection range of instrument communication baud rate:

300,600,1200,2400,4800,9600,19200,38400.

2.5.4 Check Mode

The converter is standard MODBUS communication one stop bit 8 bit no check mode, the user can choose one stop bit 8 bit odd check mode, one stop bit 8 bit even check mode, two stop bit 8 bit no check mode, two stop bit 8 bit odd check mode, one stop bit 8 bit even check mode.

2.6 Meter Parameters

2.6.1 User Password 1-4

The user can modify this password after entering with a level 5 password;

2.6.2 Meter Code 1 and 2

Meter Code record the factory time and number of the converter.

2.6.3 Fwd.Total High&Fwd.Total low

The total high-low setting can change the value of the total forward and reverse cumulative amounts, mainly used for instrument maintenance and instrument replacement.

The user can modify the forward cumulative value by entering with a level 5 password(Σ+).Generally, the cumulative amount set cannot exceed the maximum value (999999999) counted by the counter.

2.6.4 Rev.Total High&Rev.Total low

The user can modify the reverse cumulative amount by entering with a level 5 password(Σ-). Generally, the cumulative amount set cannot exceed the maximum value (999999999) counted by the counter.

2.7 Level Parameters

The liquid level measurement unit outputs a current signal of 4 to 20mA, which corresponds to the high and low levels of the liquid level range. 4 mA corresponds to the zero liquid level, and 20mA corresponds to the full liquid level.

2.7.1 Level Zero CRC

Input a 4mA liquid level signal, adjust the liquid level zero point and correct the parameters to make the flowmeter display 0% of the liquid level.

2.7.2 Level Range CRC

Input a 20mA liquid level signal, adjust the liquid level full-scale point and correct the parameters to make the flowmeter display 100% of the liquid level

2.7.3 Level Alarm Ena.

When “Level Alarm Ena.” is set to “disable”, the upper and lower liquid level limit alarm functions will be cancelled. When this parameter is set to “enable”, if the liquid level reaches the upper limit value of the liquid level or is lower than the lower limit value of the liquid level, the converter will display an alarm for the upper limit(LIH) or an alarm for the lower limit(LIL).

2.7.4 Level High Alarm

“Level High Alarm” is calculated based on the liquid level height and is set in a numerical way. Users can set an appropriate liquid level height in this parameter. During the operation of the converter, when the liquid level height is higher than this value ,corresponding output will be made in conjunction with “Level High Alarm”.

2.7.5 Level Low Alarm

The function of this parameter refers to “Level High Alarm”.

2.7.6 Pipeline Type

The converter has two types of pipeline types: full tube, non-full tube, canal mode 1, canal mode 2.

Full tube: it is used for circular full-flow pipelines. At this time, the liquid

level measurement function does not participate in the calculation , so it is an ordinary converter.

Non full tube: it is used for the measurement of circular non-full-flow pipelines. 4mA corresponds to the zero liquid level, and 20mA corresponds to the full liquid level.

2.7.7 Level Height

"Level Height" is set to the height of the liquid level in the pipeline at full scale. The unit of this parameter is mm.

2.7.8 Test Mode En

"Test Mode En" can be used to check whether the converter hardware is working properly under special circumstances.This parameter allows for the setting of different flow rates and liquid levels, and simultaneously enables the verification of the displayed flow rate.

When this parameter is set to "enable", both the flow velocity value and the liquid level value are calculated according to the test values.When it is set to "disable",it will not have any effect.

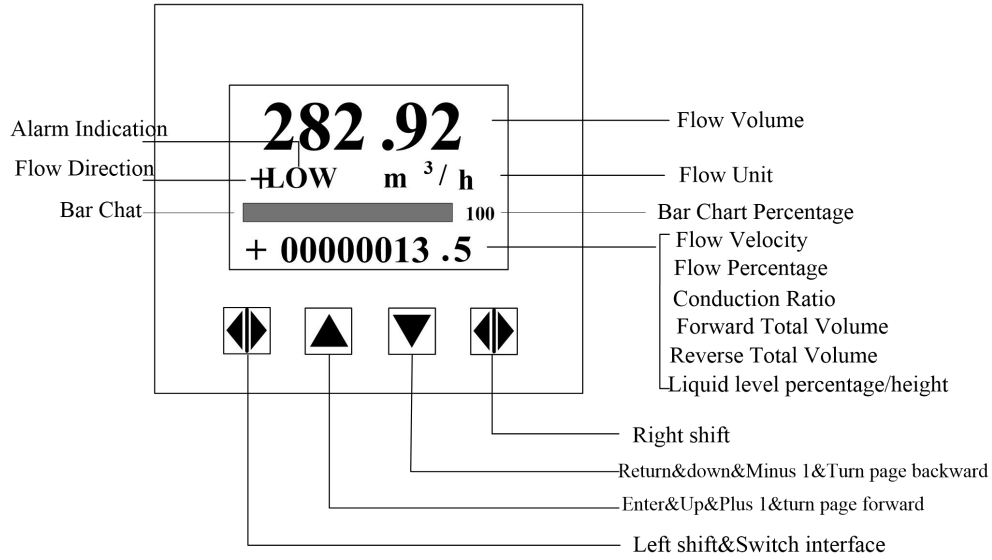
2.7.9 Test Flow Speed

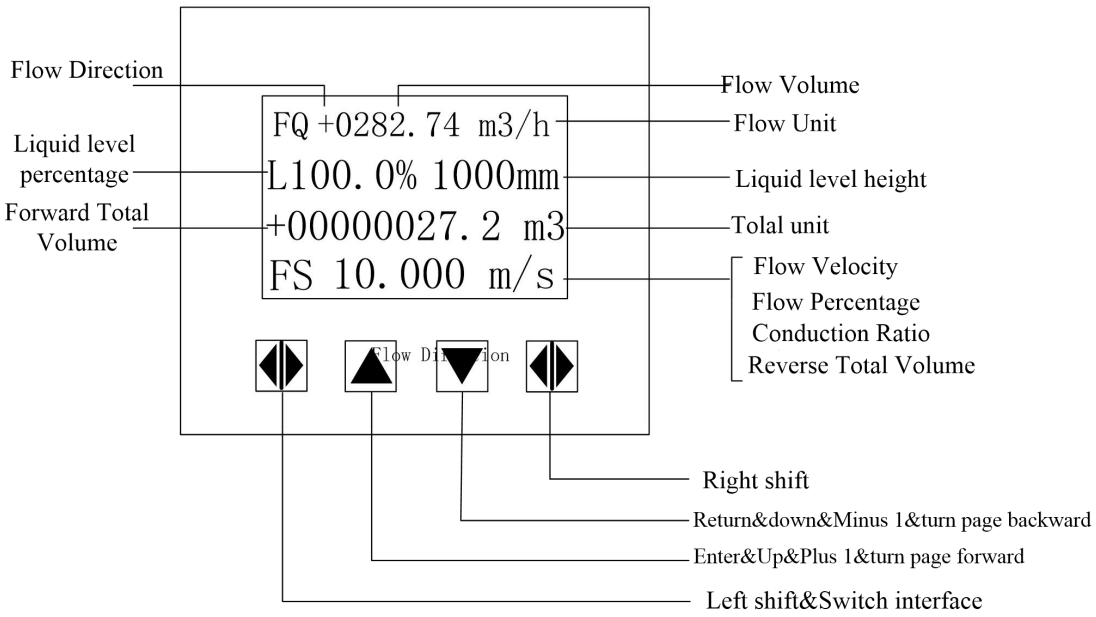
"Test Flow Speed" only takes effect when "Test Mode En" is set to "enable".The range of flow velocity that the user can set is from 0.000 to 10.000 m/s.

2.7.10 Test Level Value

"Test Level Speed" only takes effect when "Test Mode En" is set to "enable".The range of liquid levels that the user can set is from 000.0 to 100.0%.

3 Instrument display and operation





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

3.1 Key function and remote control function

3.1.1Key function in automatic measurement state

- Down key: Cycle to select the content displayed in the lower line of the screen;
- Left key: Press the left shift key once, and the instrument's main interface will switch other interface.
- Right key: Press the right shift key once, and the instrument will enter the password screen. Enter the password to enter the parameter setting Status;
- Left key+up key：The contrast of measurement state is getting dark;
- Left key+down key:The contrast of the measurement status is getting brighter;

3.1.2 Functions of keys in parameter setting state

- Down key: Subtract 1 from the number at the cursor and turn the page forward;
- Up key: Subtract 1 from the number at the cursor and turn the page forward;
- 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 sub menu.
- When the cursor moves below the next key, press the key to return to the previous menu.

3.1.3 Remote control operation

Fig3.1.3Infrared remote control key definition and operation

- Entry: Measurement status Press this key to enter the password screen of the instrument. Enter the password to enter the parameter setting status;
- Press this key to enter menus at all levels during parameter setting;
- Return: Return to the upper menu during parameter setting;
- Left shift: The contrast of the measurement status is getting dark, and the cursor moves left under the parameter setting status;
- Right shift: The contrast of measurement status is gradually lightened, and the cursor moves right under the parameter setting status;
- Plus:In the measurement status, the downward content of the screen will be displayed in a cycle. In the parameter setting status, the number at the cursor will be added by 1, and then Turn the page;
- Minus:Under the parameter setting status, the number at the cursor is minus 1, and the page is turned forward;
- Number:Digital input at cursor;

3.2 Function selection screen and parameter setting operation

No.	function	explain
1	Parameters Setup	Enter the parameter setting screen
2	Reset Flow Total	Clear the total amount of the instrument

3.2.1 Parameter Setup

Press the “Right shift”, and the instrument will enter the state of entering the password “00000”. After entering the corresponding password, move the cursor under the “Entry”, press the “Entry”, and the function selection screen “Parameters Setup” will appear. Then press the shift key to move the cursor under the “Entry”, press the “Entry”, and enter the main menu for parameter setting.

3.2.2 Reset Flow Total

Press “Right shift”, and the instrument will enter the state of entering the password “00000”. After entering the corresponding password, move the cursor to the “Entry”, and press the “Entry”, and the function selection screen “Parameters Setup” will appear,

Then press the “Up” or “Down” key to turn to the “Reset Flow Total” page, enter the total amount reset password (this password needs to be set by the user in the parameter menu “Clear total key”), press the “Right shift” to move the cursor under the “Entry”, and press the “Entry” once. When the total amount reset password automatically changes to “00000”, the instrument reset function is completed, and the total amount inside the instrument is 0.

4 Instrument picture

Fig.4.1a The integrated shell of 211E converter

Fig.4.1b The split shell of 211E converter

5 Product performance and index

5.1 Basic function

- Frequency excitation :
  50Hz power supply mode:6.250Hz(Default),5.555Hz,5.000Hz,4.545Hz;
  60Hz power supply mode:6.250Hz,5.555Hz,5.000Hz,4.545Hz;
- The excitation current is 125 mA (must be selected for high-frequency excitation), 187 mA, and 250 mA;
- Empty tube measurement function without additional electrode, continuous measurement, constant value alarm;
- Flow rate measurement range: 0.1 - 10 m/s, flow rate resolution: 0.5 mm/s;
- AC high-frequency switching power supply, voltage range: 85VAC - 250VAC;
- DC 24V switching power supply, voltage application range: 18VDC - 36VDC;
- DC 12V switching power supply, voltage application range: 12VDC - 18VDC;

- Network function (optional): MODBUS;
- English display mode (other languages can be customized);
- There are two internal totalizer totals, which can be recorded separately: forward total, reverse total.

5.2 Special functions

- The infrared remote control operates the keyboard and operates all functions of the converter remotely and non-contact.

5.3 Normal operating conditions

Ambient Temperature Ranges：Split type –10-+50℃;
Relative Humidity：5%-90%;
Power Supply: single-phase AC85-250V,50Hz/60Hz.
DC 18-36V or DC 12-18V.
Dissipation Power: <20W（ After connecting sensor）

5.4 Type of connection to sensor

- Split square-shaped shell:the housing can be hung on the wall,and converter can connect the transducer to the sensor cable.
- Integrated square-shaped shell: square housing, which is directly connected to the sensor flange.

5.5 Request of relative sensor

The sensitivity of the sensor signal: at a flow rate of 1 meter per second, the sensor outputs a signal ranging from 150 microvolt to 200 microvolt.

Resistance of sensor exciting coil:

250mA exciting current：50 - 60Ω;
187mA exciting current：60 - 80Ω;
125mA exciting current：100 - 120Ω;

5.6 Dimension drawing for installation

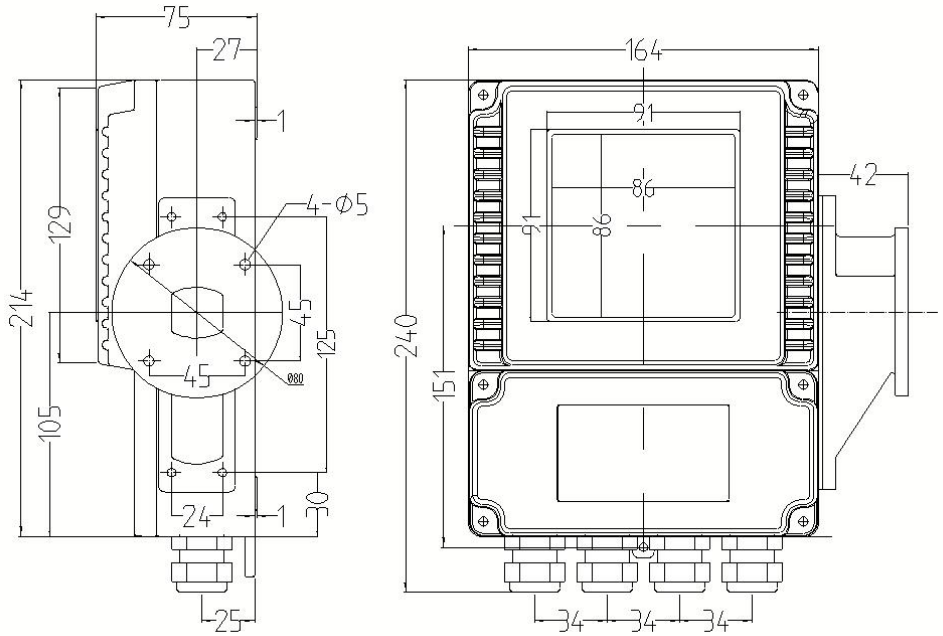


Fig5.6a Dimension drawing of integrated shell

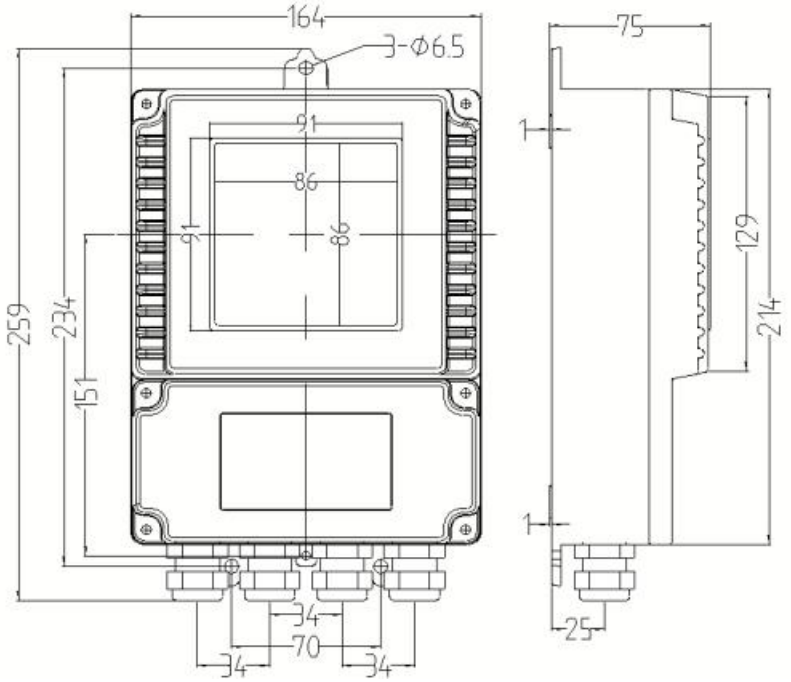


Fig5.6b Dimension drawing of split shell

5.7 Measuring accuracy of the whole machine

VS：setting measurement range（m/s）（m/s）

Diameter mm	Range m/s	Accuracy
3-20	≤0.3	±0.25%FS
	0.3-1	±1.0%R
	1-15	±0.5%R
25-600	0.1-0.3	±0.2 5 %FS
	0.3-1	±0.5%R
	1-15	±0.3%R
700-3000	≤0.3	±0.25%FS
	0.3-1	±1.0%R
	1-15	±0.5%R
%FS：for relative ranges; %R：for relative value of measurement.		

5.8 Analog current output

Load resistance： 0-750Ω.

Basic error：0.1%±10μA.

5.9 Digital frequency output

Frequency output range：1-5000Hz；

Output electrical isolation： Photoelectric isolation.. Isolation voltage：＞1000VDC；

Frequency output drive：FET output，Maximum withstand voltage36VDC，Maximum load current250mA.

5.10 Digital pulse output

Pulse output value: 0.001-59.999 m^3/cp, 0.001-59.999 Ltr /cp,
0.001-59.999 km^3/cp.

Pulse output width: 1-1999ms adjustable,

Pulse output isolate: photo electricity isolate. Isolate voltage: > 1000VDC;

Pulse output drive: output by field-effect transistors, the highest subjected voltage is 36VDC，maximum of output current is 250 mA.

5.11 Alarm output

Alarm output junction:DOUT---alarm public output points +,DCOM---alarm public output points ground;if alarm and output enable,a low level is output between DO+ and DO-, else,output high level.

Output isolate: photo electricity isolate. Isolate voltage: > 1000VDC;

Alarm output drive: output by Darlington tube, the highest subjected voltage is 36VDC, maximum of output current is 250 mA.

5.12 Digital communication port and protocol

MODBUS interface: format of RTU, physical interface RS-485,electrical isolation 1000V.

5.13 Electrical isolation

Insulated voltage between simulated input and simulated output should be higher than 500V;

Insulated voltage between simulated input and alarm power supply should be higher than 500V;

Insulated voltage between simulated input and AC power supply should be higher than 500V;

Insulated voltage between simulated output and AC power supply should be higher than 500V;

Insulated voltage between simulated output and earth should be higher than 500V;

Insulated voltage between pulse output and AC power supply should be higher than 500V;

Insulated voltage between pulse output and earth should be higher than 500V;

Insulated voltage between alarm output and AC power supply should be

higher than 500V;

Insulated voltage between alarm output and earth should be higher than 500V;

5.14 Digital output and Calculate

Digital output means frequency output and pulse output, and both of them use the same output point, so user can choose only one type of them but not both.

5.14.1 Freq.Output

Frequency output range is 0-5000HZ, and corresponding the percent of flux.

$$F = \frac{\text{Measure value}}{\text{Full scale value}} \times \text{frequency range}$$

The up limit of frequency output can be adjusted. It can be chosen from 0 - 5000HZ, and also can be chosen low frequency: such as 0 - 1000HZ or 0 -5000HZ.

Frequency output mode general can be used in control application, because it responses the percent flux. Users can choose pulse output when the equipment is applied to count.

5.14.2 Pulse output mode

Pulse output mainly applies in count mode. A pulse output delegates a unit flux, such as 1L or $1M^3$ etc.

Pulse factor can be set from0.001 to 59.999.When users choose the pulse factor, they should notice the match of the flux range of flow meter and pulse factor. For volume flux, count formula as follows:

$QL=0.0007854\times D^2\times V$ (L/S)

$QM=0.0007854\times D^2\times V\times 10^{-3}$ (M^3/S)

Note: D-caliber (mm) V-velocity of flow (m/s)

If the pipe flow is too large and the pulse equivalent is too small, the pulse output will exceed the upper limit. Therefore, the pulse output frequency should be limited below 500Hz (when the pulse width is 1ms). If the pipe flow is small and the pulse equivalent is too large, it will cause the instrument to output a

pulse for a long time. For specific settings, please refer to Pulse Width - Maximum Output Pulse

Data Correspondence Table.

In addition, it must be noted that the pulse output is different from the frequency output. The pulse output is cumulative enough to output a pulse, so the pulse output is not very uniform. Generally, the counter instrument shall be used for measuring pulse output instead of frequency meter instrument.

5.14.3 The connection of digital output

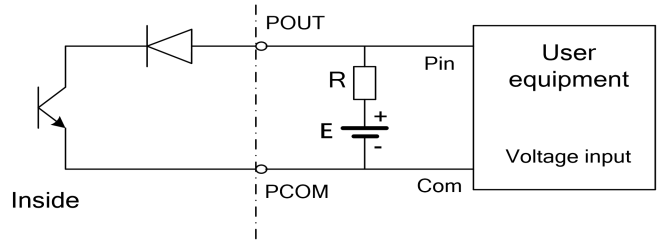
Digital output and alarm output have two connected points: digital output connected point, digital ground point, and symbol as follows:

POUT ----- digital output point;

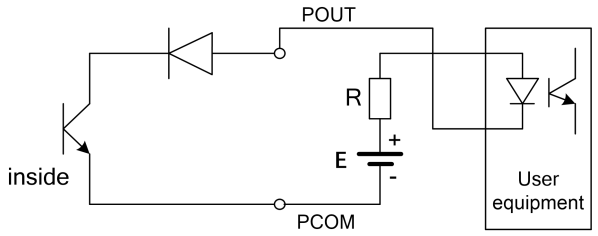
PCOM ----- digital ground point;

POUT is collector plough output, user may refer to next circuit to connect.

5.14.4 The connection of digital voltage output

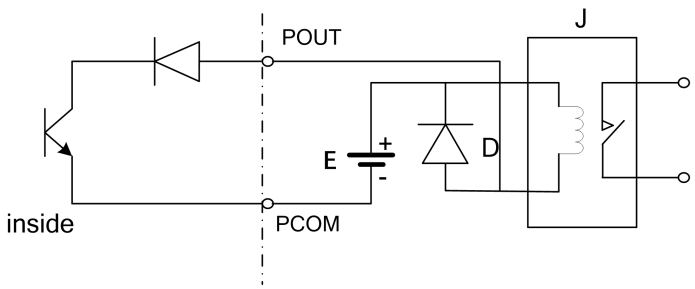


5.14.5 Digital output is connected to optocoupler (such as PLC)



Generally, the user optocoupler needs about 10mA current, so E/R=about 10mA. E=5～24V.

5.14.6 Digital output connect relay



Generally, the required E of intermediate relay is 12V or 24V. D is a freewheeling diode, which is currently used in most intermediate relays. If the intermediate relay itself does not contain this diode, the user should connect it externally.

Table of digital output parameter:

POUT

Parameter	Test condition	Mini	Typical	Max	Unit
working voltage	IC=100 mA	5	24	36	V
Working current	Vol≤1.4V	0	300	350	mA
working frequency	IC=100mA Vcc=24V	0	5000	7500	HZ
High level	IC=100mA	Vcc	Vcc	Vcc	V
Low level	IC=100mA	0.9	1.0	1.4	V

5.15 Analog output and calculation

5.15.1 Analog output

Analog output refers to 4-20mA signal system.

The analog current output is internally powered by 24V, which can drive 750 Ω load resistance.

Analog current output corresponds to the percentage flow of flow, namely:

$$I0 = \frac{\text{Measure value}}{\text{Full scale value}} \times \text{ scale of current} + \text{zero point of current}$$

For 4-20mA signal system, the current zero point is 4mA.

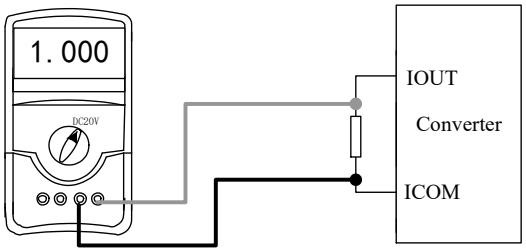
Therefore, in order to improve the resolution of the output analog current, users should properly select the range of the flowmeter.

When the flowmeter leaves the factory, the manufacturer has calibrated the parameters of analog output. Generally, no user adjustment is required. If the user needs to calibrate the analog output under abnormal conditions, the following operation procedures can be followed.

5.15.2 Analog output adjustment

(1)Instrument calibration preparation

The instrument shall be started and operated for 15 minutes to achieve thermal stability inside the instrument. Prepare 0.1% level ammeter, or 250 Ω resistance and 0.1% voltmeter, and connect them according to the following figure.



(2)Analog Zero CRC

Set the converter to the parameter setting state, select the “Analog Zero CRC” item, enter, set the standard signal source to the “0” position, adjust the correction factor value, so that the ammeter just indicates 4mA (± 0.004mA).

(3)Analog Range CRC

Select “Analog Range CRC”, enter, set the standard signal source to the full range, adjust the converter correction factor, and make the ammeter exactly indicate 20mA (± 0.004mA).

After adjusting the “0” point and the full range value of the current, the current function of the converter can ensure the accuracy. The current output linearity of the converter is within 0.1%.

(4)Current linearity check：

Set the standard signal source to 75%, 50% and 25%, and check the linearity of the output current.

※Note: After L-magU electromagnetic flowmeter converter and sensor are connected to the fluid pipeline (whether it is calibrated or used), the following work should be carried out first:

- The pipes in front of and behind the sensor shall be securely connected with copper wire.
- Ground the sensor well.
- When adjusting the zero point of the instrument, ensure that the fluid in the pipeline is still.
- Ensure that the oxide film of the sensor electrode is stable (the electrode can be contacted with the fluid continuously for 48 hours).

6 Alarm Information

The printed circuit board of electromagnetic flow converter adopts surface welding technology, which is not repairable to users. Therefore, the user cannot open the converter housing.

L-magU intelligent converter has self-diagnosis function. In addition to power supply and hardware circuit faults, faults in general applications can give correct alarm information. These messages are displayed on the left side of the display as follows:

SYS ---- System exciting alarm; MTP --- Flow empty pipe alarm;
CUT --- Flow cutoff alarm; REV --- Flow reverse Alarm;
HIG ---- Flow high limit alarm; LOW ---- Flow low limit alarm;
LIH ----Level high alarm； LIL ---- Level low alarm；
ABN ---- Abnormal limit alarm; PSM ---- Peak limit alarm;

FST ---- Noise sensitivity alarm;

7 Troubleshooting

7.1 No display

- Check the power supply connection;
- Check the power fuse to see for OK;
- Check the contrast of LCD and regulate it to working state;

7.2 System alarm

- Check if the exciting cables EX1 and EX2 did not connected;
- Check if the total resistance of sensor's exciting coil resistances less than 150Ω;
- If the first two checks are normal, the converter is faulty.

7.3 Empty pipe alarm

- Measure whether the fluid is filled with the sensor measuring tube;
- Short-circuit the converter signal wire (white core wire, red core wire, shield wire). At this time, if the "empty tube" prompt is canceled, it means that the converter is normal. It may be due to the low conductivity of the measured fluid or the wrong setting of the empty tube threshold and the empty tube range;
- Check whether the signal wiring is correct;
- Check whether the sensor electrode is normal:

Set the flow to zero, and observe that the conductivity ratio should be less than 100%;

In the case of flow, the resistance of the white core wire and the red core wire of the terminal to the shield wire shall be less than 50k Ω (the measured value for the medium is water. It is better to measure with a pointer multimeter, and it can be seen that there is charging and discharging phenomenon in the measurement process).

7.4 The measured flow is not accurate

- Measure whether the fluid is filled with the sensor measuring tube;
- Whether the signal line is connected normally;
- Check whether the sensor coefficient and sensor zero point are set according to the sensor label or factory calibration sheet;

8 Packing and storage

8.1 Packing

The electromagnetic converter is packaged in plastic bags and has a certain moisture-proof capability.

The accompanying documents include: one product certificate and one packing list.

8.2 Shipping and storage

In order to prevent the instrument from being damaged during operation, please keep the packaging state of the manufacturer before arriving at the installation site. During storage, the storage place shall be indoor with the following conditions, rain-proof, moisture-proof, low mechanical vibration and avoid impact; Temperature range: - 20-+60 ℃; The humidity shall not be greater than 80%.

Solemnly declare that this manual is suitable for our company's general software. In case of any difference between some contents and the actual converter, please refer to the physical object.

Appendix1 Description of nonlinear correction function

The electromagnetic converter has updated the nonlinear correction calculation method. The new calculation method is easy to set, has clear meaning and accurate correction results.

Basic concept of nonlinear correction algorithm: within a velocity range, the measured velocity value (correction point) is corrected to the desired velocity value (target value).

Qpn -- Selecting the Real Velocity value of the Correction Point(correction point Qp1--Qp5)

Qcn -- Hoping the revised velocity at this point(correction value Qc1--Qc5)

L-magU electromagnetic converter design five velocity correction points and four velocity correction values.The fifth velocity correction point is the fifth correction value,their correspondence is:

Velocity correct point 1------Velocity correct value 1

Velocity correct point 2------Velocity correct value 2

Velocity correct point 3------Velocity correct value 3

Velocity correct point 4------Velocity correct value 4

Velocity correct point 5------Velocity correct value 5

Users must follow the principle of setting correction points from small velocity to large velocity

Correct point 5 > Correct point 4 > Correct point 3 > Correct point 2 > Correct point 1 > 0

Velocity correction formula:

$$K = \frac{Q_{c1}}{Q_{p1}} + \frac{Q_X - Q_{P1}}{Q_{p2} - Q_{P1}} \times \left(\frac{Q_{c2}}{Q_{p2}} - \frac{Q_{c1}}{Q_{p1}} \right)$$

$$Qcx = K \times Qx$$

Qcx ---revised flow Qx ---revised before discharge K---intermediate

variable

Example 1：Use all correction point parameter settings

NO.	fact(fix)point	Target point	Correction value range
1	0.100 m/s	0.110 m/s	0--- 0.100 m/s
2	0.150 m/s	0.160 m/s	0.100 m/s -- 0.150 m/s
3	0.200 m/s	0.220 m/s	0.150 m/s -- 0.200 m/s
4	0.250 m/s	0.270 m/s	0.200 m/s -- 0.250 m/s
end	0.300 m/s		0.250 m/s -- 0.300 m/s

Example 2:Use partial correction point parameter setting

NO.	fact(fix)point	Target point	Correction value range
1	0.100 m/s	0.110 m/s	0--- 0.100 m/s
2	0.150 m/s	0.160 m/s	0.100 m/s -- 0.150 m/s
3	0.161 m/s	0.161 m/s	No correct
4	0.162 m/s	0.162 m/s	No correct
end	0.163 m/s		No correct

Attention： **Users should set all the correcting points,if you set not enough,the screen will “bug”,than the correcting won’t be work.**

Appendix 2 Setting Parameters in Menu

Menu List

Code	Parameters	Set	Content	Password Level
1	**Flow Set Up**			
1	Flow Unit	Select	L/h, L/m, L/s, m^3/h, m^3/m, m^3/s, km^3/h,km^3/m,km^3/s,	2
2	Flow Total Unit	Select	$0.001m^3$-$1m^3$,0.001L-1L, $0.001km^3$-$1km^3$	2
3	Reverse flow En	Select	Disable,Enable	2
4	Flow range	Set Count	0-99999	2
5	Flow filter time	Selected	1-60S	2
6	Analog Damp time	Selected	0-250S	2
7	Peak Limit Ena.	Select	Disable,Enable	2
8	Peak limit Valu.	Set Count	According to rate	3
9	Peak limit Time	Set Count	2s-30s	3
10	Abnormal Control	Set Count	0s-99s	3
11	Flow direction	Select	Forward,Reverse	2
12	Cutoff alarm en.	Set Count	Disable,Enable	2
13	Low flow cutoff	Set Count	According to flow	2
14	Zero Correction	Set Count	0-±9999	2
15	Meter Factor	Set Count	0.0000-5.9999	5
16	Clear total key	User Set	0-99999	2
2	**Alarm Set up**			
1	Alarm Output Set	Select	Nine choice: No Output,Flow High Alarm, Flow Low Alarm, Pipe Empty Alarm, REV Flow Alarm, Cutoff Alarm,System Alarm, Level High Alarm, Level Low Alarm.	2
2	High alarm Enab.	Select	Disable,Enable	2
3	High alarm value	Set Count	According to flow	2
4	Low alarm enable	Select	Disable,Enable	2
5	Low alarm value	Set Count	According to flow	2

6	System Alarm Ena	Select	Disable,Enable	2
7	Snsr measure Ena	Select	Disable,Enable	2
8	Snsr MT Alarm	Set Count	0-59999	2
9	Snsr MT zero	Set Count	0-±9999	5
10	Snsr MT range	Set Count	0-5.9999	5
11	MT filter time	Selected	10-60SEC	2
3	**Output Set up**			
1	Digital output	Select	PO:Freq.output /PO:Pulse output	2
2	Pulse unit	Select	m^3,Ltr, km^3	2
3	Pulse Factor	Set Count	00.001-59.999	2
4	Pulse Width	Select	0.5-1999.9ms	2
5	Frequency lower	Set Count	0-5000 Hz	2
6	Frequency range	Set Count	1-5000 Hz	2
7	Analog output	Select	4-20mA	2
8	AnalogZero CRC	Set Count	0.0000-0.9999	5
9	Analog Range CRC	Set Count	0.0000-0.9999	5
10	Analog Out.Test	Set Count	00.00-99.99	2
4	**Sensor Set up**			
1	Sensor size	Select	32-4000	2
2	Excit.Frequency	Select	For 50 Hz: 6.250Hz(Default),5.555Hz,5.000 Hz,4.545Hz; For 60 Hz: 6.250Hz,5.555Hz,5.000Hz,4.545 Hz;	4
3	Sensor Factor	Set Count	0.0000-5.9999	4
4	Lineary correct	Select	Disable,Enable	2
5	Velocity Point 1	User Set	According to speed	4
6	Velocity Vzale 1	User Set	According to speed	4
7	Velocity Point 2	User Set	According to speed	4
8	Velocity Vzale2	User Set	According to speed	4
9	Velocity Point 3	User Set	According to speed	4
10	Velocity Vzale3	User Set	According to speed	4
11	Velocity Point 4	User Set	According to speed	4
12	Velocity Vzale4	User Set	According to speed	4
13	Velocity Point 5	User Set	According to speed	4
14	Sensor Code1	User Set	Factory year,month（0-99999）	4

15	Sensor Code2	User Set	Product number（0-99999）	4
5	**Communication**			
1	Communicat. mode	Select	MODBUS-A	2
2	Communic. addres	Set Count	0-250	2
3	Baud rate	Select	300-38400	2
4	Check Mode	Select	No Parity,1 stop Odd Parity,1 St Even Parity,1 S. No Parity,2 stop Odd Parity,2 St Even Parity,2 stop	2
6	**Meter parameters**			
1	Password 1	User Set	0-99999	5
2	Password 2	User Set	0-99999	5
3	Password 3	User Set	0-99999	5
4	Password 4	User Set	0-99999	5
5	Meter Code 1	Factory Set	Finish Y,M（0-59999）	5
6	Meter Code 2	Factory Set	Finish Y,M（0-59999）	5
7	Fwd. Total Low	User Set	0-99999	5
8	Fwd. Total High	User Set	0-9999	5
9	Rev. Total Low	User Set	0-99999	5
10	Rev. Total High	User Set	0-9999	5
7	**Level Parameters**			
1	Level Zero CRC	User Set	0-59999	5
2	Level Range CRC	User Set	0-59999	5
3	Level Alarm Ena.	Select	Disable,Enable	5
4	Level High Alarm	Select	0-39999	5
5	Level Low Alarm	Select	0-39999	5
6	Pipeline Type	User Set	Full tube, None full tube	2
7	Level Height	User Set	0-59999	5
8	Test Mode En	Select	Disable,Enable	5
9	Test Flow Speed	User Set	0-19.999	5
10	Test Level Value	User Set	0-99.99	5

The instrument parameter setting function is equipped with 5-level password. Among them,

level 1-4 is the user password, and level 5 is the manufacturer password. The user can use the 5th level password to reset the 1st to 4th level passwords.

No matter which level of password is used, the user can view the instrument parameters. However, if users want to change the instrument parameters, they need to use different levels of passwords.

Level 1 password (ex-factory value 00522): can only be viewed. Level 2 password (ex-factory value 03210), level 3 password (ex-factory value 06108), level 4 password (ex-factory value 07206), level 5 password (fixed value): password level can be seen. See the above table for the parameter range.