Electromagnetic Flow Meter

User's Manual

(Version 9.0)

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I. Introduction

1.1 Magnetic Flowmeter Introduction

Electromagnetic flow meter is a velocity flow measurement device which measures volume flow of conductive liquids. It not only has on site display, but also can output standard current signals for recording, adjustment and control, to realize automatic detection and long-distance signal transmission. It can measure the flow of liquids, pastes, and slurries in water, wastewater, chemical, fertilizer, dairy, food, beverage, pharmaceutical, medical, petrochemical, iron, steel, paper, mining, and agricultural industries etc. The structure of the instrument has integral type and remote type.

1.2. Features:

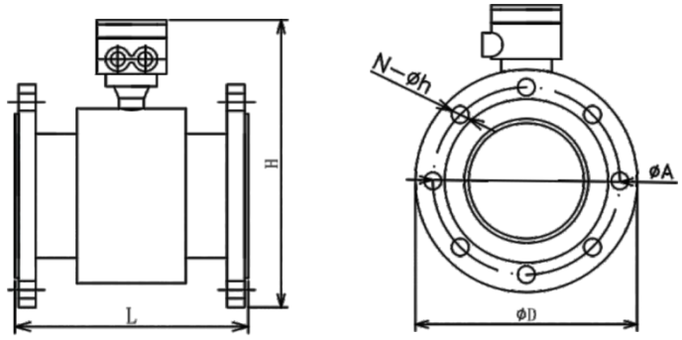
- There are no moving parts in measuring tube, so it is convenient for maintenance. No flow-blocking parts, so it has quite low pressure loss.
- The lowest conductivity of the tested liquid is ≥20μs/cm, with various lining materials, it can be used to measure the flow of various acids, alkali, salt solutions, slurry, mineral pulp and paper pulp etc.
- The performance of the instrument is not affected by the properties of the material such as corrosiveness, viscosity, pressure, density, acidity, and alkalinity. The induction voltage signal of sensor has a linear relationship with the average flow rate, which ensure high accuracy.
- With Low-frequency rectangular wave excitation, it is not affected by the power frequency and various interferences on site, so that to ensure stable and reliable measuring.
- Not affected by the direction of the fluid, both positive and negative flow can be accurately measured.
- With LCD backlit display, parameters can be modified on site conveniently.

With empty pipe detection/alarm function, the unit can detect if the pipe is full or drained /empty.

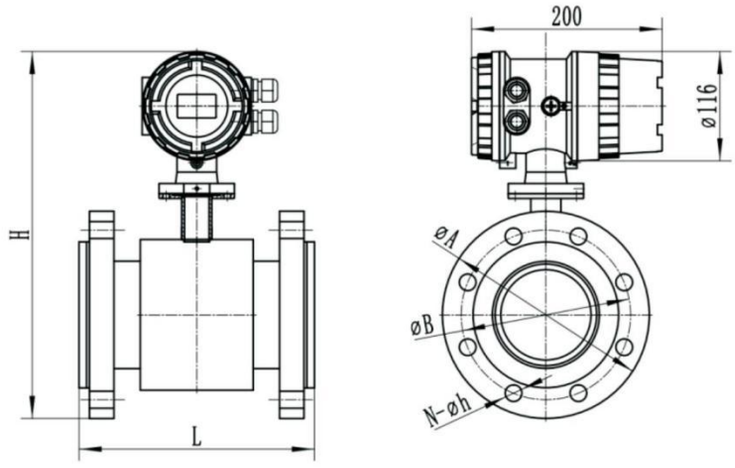
1.3. Technical Data:

Diameter Range	DN3～DN3000
Medium conductivity	≥ 20 μs/cm or ≥5 μs/cm
Liner material	Polyurethane, Neoprene Rubber, Hard Rubber, PTFE, FEP, PFA,Ceramic
Electrode material	SUS316L, HastelloyB, Hastelloy C, Titanium, Tantalum, Platinum-iridium alloy
Ambient temperature	-20℃~60℃
Converter Working Environment Humidity	≤95%
Protection Grade	IP65, IP67, IP68 (Optional)
Measurement Range of Velocity	0~15 m/s
Accuracy	±0.5%; ± 0.2%
Measurement Parameters	Instantaneous flow, velocity, positive and negative accumulative flow
Detection & Alarm Function	Fluid empty pipe detection, excitation alarm, upper and lower limit alarm, system alarm
Network Function	HART, MODBUS, GPRS, PROFIBUS (optional)
Power Supply	AC power supply, voltage applicable range: 85VAC-250VAC
	DC power supply, voltage applicable range: 20VDC-36VDC
Special Function	Bluetooth, SD card, OLED

1.4. Overall Dimension:



Remote Mag Flow Meter Size						
Size	Nominal Pressure	L	ϕD	ϕA	H	N- ϕ h
15	PN16	200	95	65	220	4- ϕ 14
20		200	105	75	220	4- ϕ 14
25		200	115	85	223	4- ϕ 14
32		200	140	100	240	4- ϕ 18
40		200	150	110.	250	4- ϕ 18
50		200	165	125	263	4- ϕ 18
65		200	185	145	283	4- ϕ 18
80		200	200	1 60	290	8- ϕ 18
100		250	220	180	310	8- ϕ 18
125		250	250	210	340	8- ϕ 18
150		300	285	240	373	8- ϕ 22
200		350	340	295	430	12- ϕ 22
250		450	405	355	495	12- ϕ 26
300	PN10	500	445	400	540	12- ϕ 22
350		550	505	460	595	16- ϕ 22
400		600	565	515	658	16- ϕ 26
450		600	615	565	708	20- ϕ 26
500		600	670	620	760	20- ϕ 26
600		600	780	725	882	20- ϕ 30
700		700	895	840	982	24- ϕ 30
800		800	1015	950	1092	24- ϕ 33
900		900	1115	1050	1192	28- ϕ 33
1000		1000	1230	1160	1299	28- ϕ 36
1200	PN6	1200	1405	1340	1488	32- ϕ 33



Nominal Diameter	Flange Standard	Rated Pressure	H	L	ϕA	ϕB	ϕh	N
DN15	DIN	PN16	296	200	95	65	14	4
DN20	DIN	PN16	301	200	105	75	14	4
DN25	DIN	PN16	306	200	115	85	14	4
DN32	DIN	PN16	318	200	140	100	18	4
DN40	DIN	PN16	328	200	150	110	18	4
DN50	DIN	PN16	344	200	165	125	18	4
DN65	DIN	PN16	361	200	185	145	18	4
DN80	DIN	PN16	377	200	200	160	18	8
DN100	DIN	PN16	396	250	220	180	18	8
DN125	DIN	PN16	421	250	250	210	18	8
DN150	DIN	PN16	454	300	285	240	22	8
DN200	DIN	PN16	511	350	340	295	22	12
DN250	DIN	PN16	587	450	405	355	26	12
DN300	DIN	PN16	640	500	460	410	26	12
DN350	DIN	PN16	696	550	520	470	26	16
DN400	DIN	PN16	751	600	580	525	30	16
DN450	DIN	PN16	781	600	640	585	30	20
DN500	DIN	PN16	818	600	715	650	33	20
DN600	DIN	PN16	881	600	840	770	36	20

(Note:The dimensions in above table is based on DIN standard flange; For other standards, please check with us.).

II. Installation Note

2.1 Choose the Installation Place

To ensure the stable and reliable performance of the sensor, please pay attention to the following requirements when choosing the installation location:

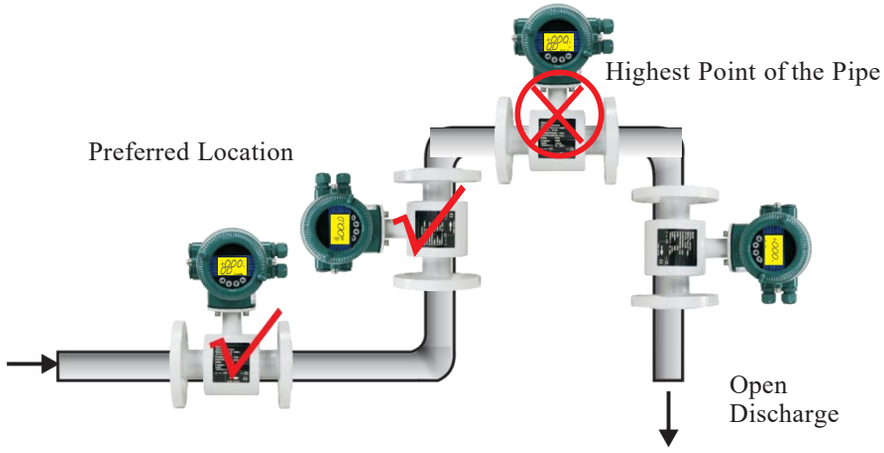
(1) Keep away from equipment with a strong magnetic field as far as possible, such as large motors, large transformers, frequency conversion equipment etc.

(2) Please better install in a dry and ventilated place, not a humid place.

(3) Direct sun exposure or direct raining is better to be avoided. The environment temperature should be not more than 60 °C and relative humidity not more than 95%.

(4) Choose a place where is convenient for operation and maintenance.

(5) To avoid negative pressure, the flow sensor should not be installed at the pump inlet, but at the pump outlet. Valves should always be mounted on the downstream side of the flow sensor.



2.2. Installation Requirements

In order to ensure correct measuring, please pay attention to the following requirements when choosing the line position:

(1) The flow sensor can be mounted vertically or horizontally. If the flow sensor is mounted vertically, the flow direction should always be upwards.

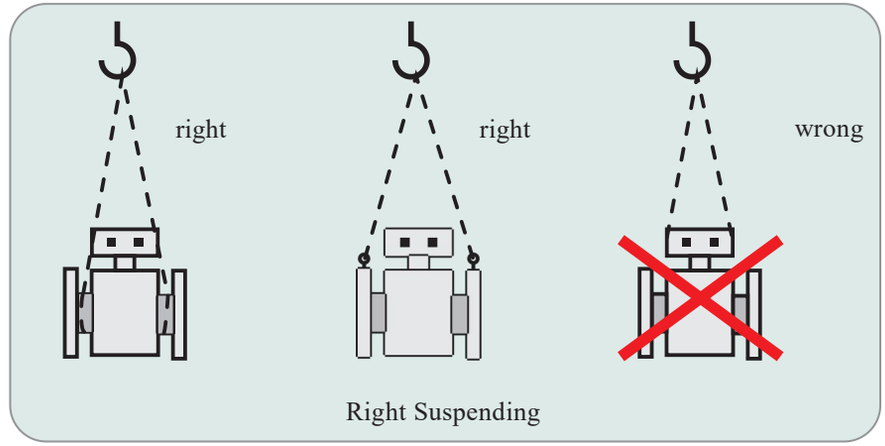
(2) The medium should always be full-filled in pipe at the installation location to avoid not full filled pipes and gas adhering to the electrode.

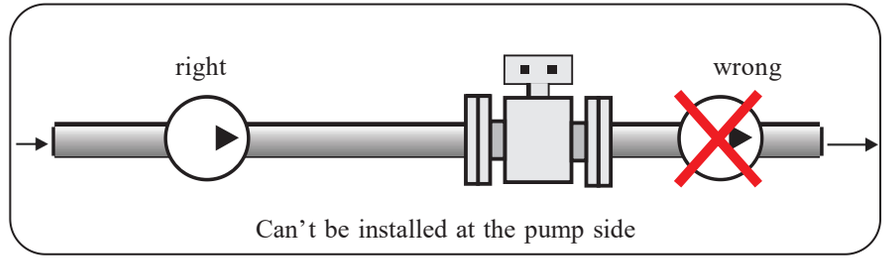
(3) For liquid-solid two-phase flow, it's better to choose perpendicular installation to make liner of sensor attrition uniform and prolong working life.

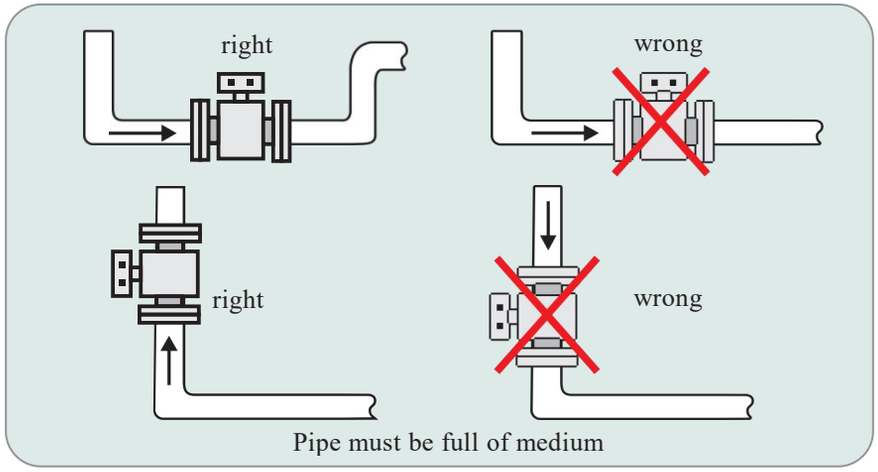
(4) When sensor is not fully filled, it can raise end pipeline of flow meter and makes its full tube.

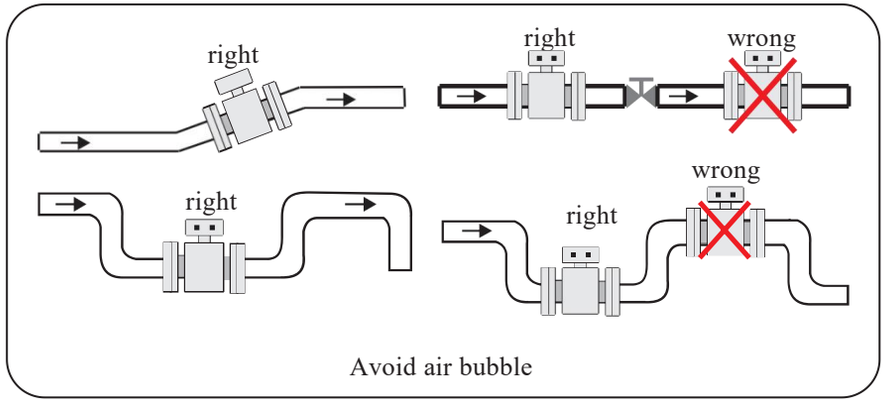
(5) Diameter-Varing: When flow rate is too large or too small, we should use this installation method change diameter to meet flow rate requirements. Straight pipe upstream ⩾ 10DN, straight pipe downstream ⩾5DN(DN means pipe diameter)

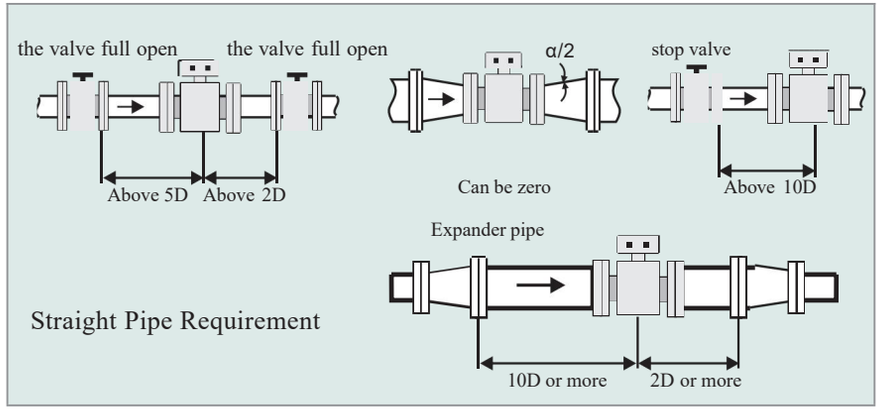
(6) The front and rear straight pipes are ⩾ 10DN at the front of the flowmeter and ⩾5DN at the back.











2.3 Instrument Wiring

● The remote type signal cable should use a customized dedicated cable, the shorter the cable, the better.

● A Yz medium-sized rubber sheathed cable is optional for the excitation cable, and its length is the same as that of the signal cable.

● Signal cables must be strictly separated from other power sources and cannot be laid in the same pipe.

● The signal cable and excitation cable should be as short as possible, and the excess cables should not be rolled together. The excess cables should be cut off and the joints should be re-welded.

● When the cable is connected to the electrical interface of the sensor, insert a U-shape at the port to prevent rainwater from penetrating into the sensor.

2.4 Sensor Grounding

Attention!

Electric potential difference is not allowed between measuring sensor and shells or converter protection grounding.Electromagnetic flow meter must be ground connection separately before using， if grounding together with other instruments or electrical devices, the leakage current in ground wire may will produce series mode interference to the measurement signal , it could cause electromagnetic flow meter can not work.

① Measurement sensors must be properly grounded;

② Earthing wire should not transmit any interference voltage;

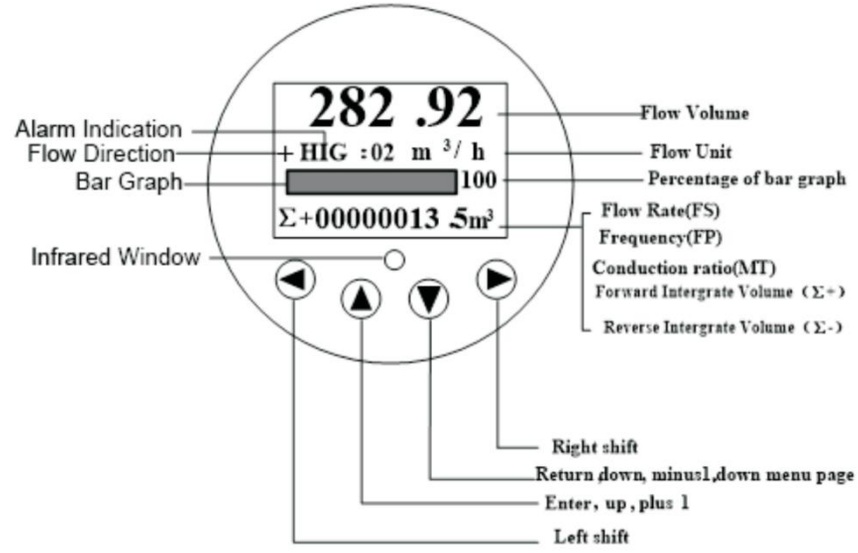
③ Grounding wires are not allowed to connect to other electrical equipments at the same time .

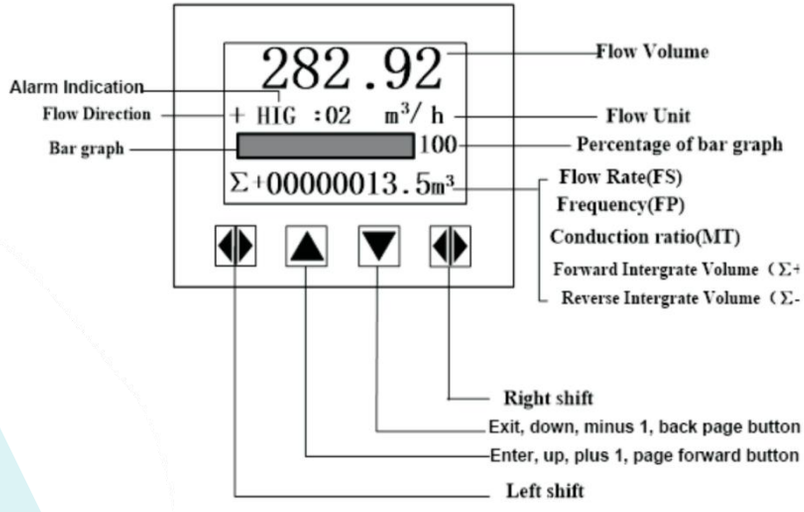
Note:The details,please refer to chapter 3.3.4

Electromagnetic Flowmeter Converter Instruction Manual

1.Display and Operation

1.1 The Definition of Remote Square Converter Keyboard and LCD Display





When the instrument is electrified, it automatically enters the measurement state. In the state of automatic measurement, the instrument automatically completes the measuring functions and displays the corresponding measurement data.To set or modify the instrument parameters, we must make the instrument enter the parameter setting state from the measurement state. Under the parameter setting condition, the user uses the panel key to complete the instrument parameter setting.

1.2 Function of Keys and Remote Control

1.2.1 Key Function in State of Automatic Measurement

Down key: loop select downlink content on screen;

Right key: press right key, the instrument enter password screen,enter the parameter setting after import password.

1.2.2 Key Function in State of Parameter Setting

Down key:Cursor number minus 1,page up;

Up key：cursor number plus 1,page down;

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

When the cursor moves below the top key, press the button to enter the submenu. When the cursor moves below the next key, press the key to return to the previous menu.

1.2.3 Remote Controller Operation

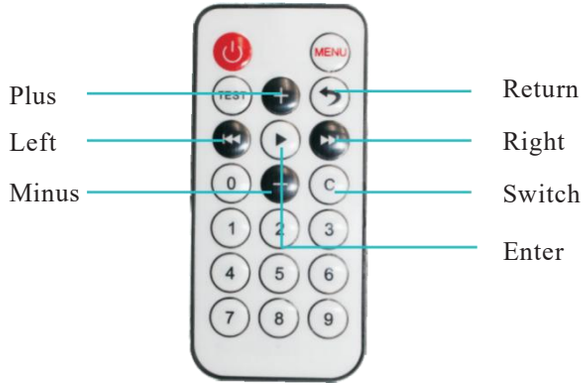


Fig3.1.3 Definition and Operation of Infrared Remote Control Keys

Enter:	enter the measurement state by pressing this key, enter the parameter setting by import password; press this key to enter the menu at all levels when setting parameters;
Return:	parameter settings back to the next higher level menu;
Left:	measurement state contrast fading,cursor moves left;
Right:	measurement state contrast brightening,cursor moves right;
Plus:	measure status, loop display screen downlink,cursor number plus 1, page reverse ;
Minus:	cursor number minus 1, page forward;
Number:	cursor digital input;

Parameter number	Function	Comment
1	Parameters set	Select the function to enter parameters setting
2	Clr Total Re	Select the function to clear total record

2.Converter Structure Size

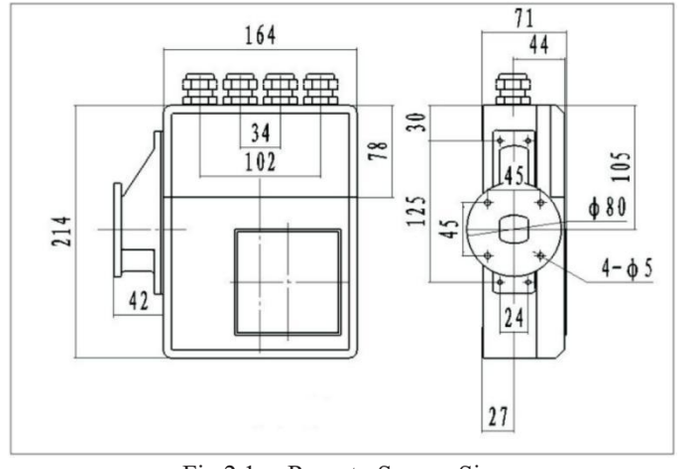


Fig 2.1 a Remote Square Size

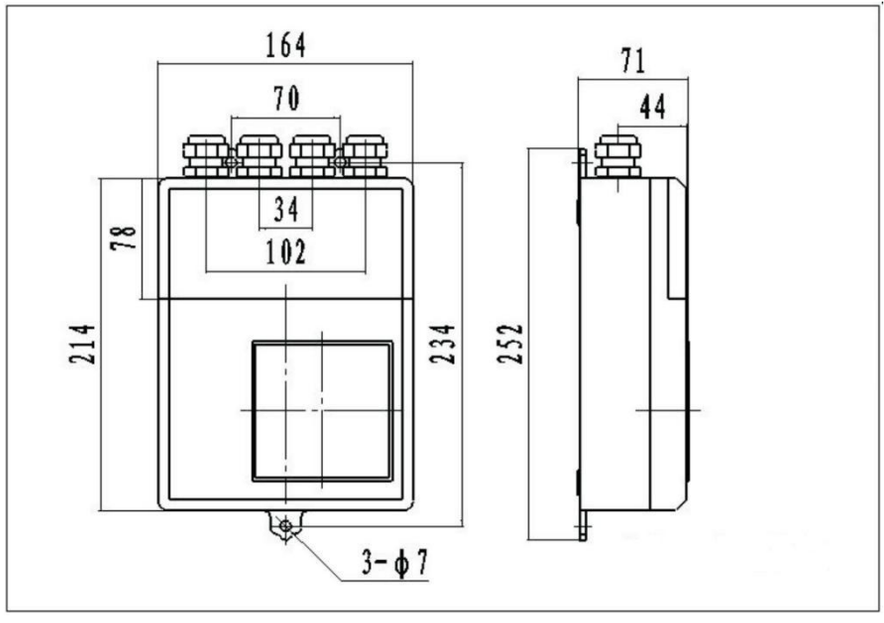


Fig 2.1 b Remote Square

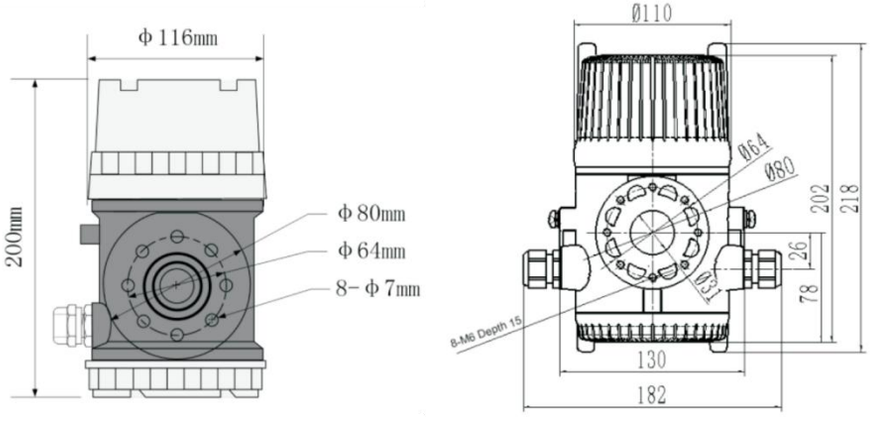


Fig 2.1 c Compact Round

3. Converter Picture

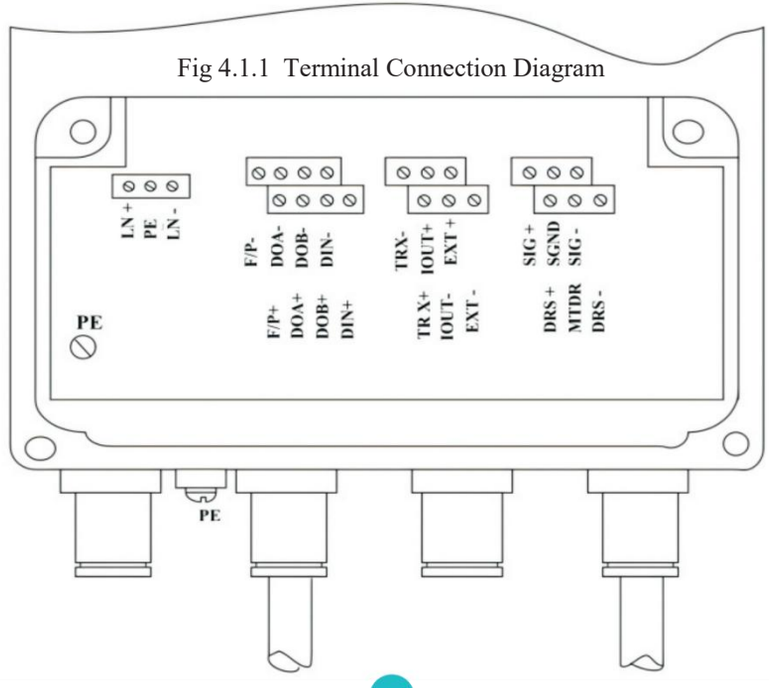
Fig 3.1a Remote Square converter

Fig 3.1b Compact converter

4. Converter Wiring

4.1 Remote Type Wiring Instruction

Fig 4.1.1 Terminal Connection Diagram



The terminals are marked as follows:

LN+:	220VAC Power supply
LN-:	220VAC Power supply
F/P- :	Pulse/Frequency Output Ground
F/P+ :	Pulse/Frequency Output +
DOA+:	Alarm Output +
DOA-:	Alarm Output Ground
DOB+:	Reserve
DOB-:	Reserve
DIN + :	Reserve
DIN - :	Reserve
TRX+:	Communication Input (RS485- A)
TRX-:	Communication Input (RS485- B)
IOUT+:	Current Output +
IOUT-:	Current Output Ground
EXT+:	Exciting Current +
EXT-:	Exciting Current -
SIG+:	Signal +
SGND:	Signal Ground
SIG-:	Signal -
DRS+:	Shielded Exciting +
MTDR:	Shielded Exciting Ground
DRS-:	Shielded Exciting -

4.2 Compact Type Wiring Instruction

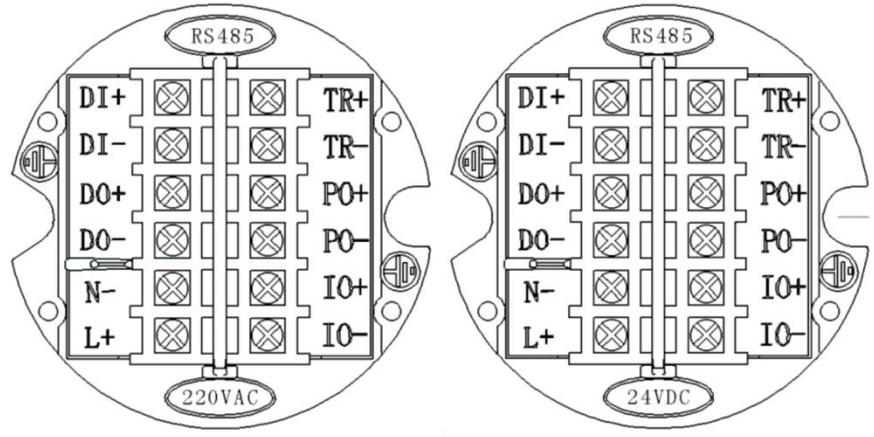


Fig 4.2.1 Terminal Connection Diagram

The terminals are marked as follows:

TR+:	Communication Input (RS485- A)
TR-:	Communication Input (RS485- B)
PO+:	Pulse/Frequency Output +
PO-:	Pulse/Frequency Output Ground
IO+:	Current Output +
IO-:	Current Output Ground
DI+:	Reserve
DI-:	Reserve
DO+:	Alarm Output +
DO-:	Alarm Output Ground
N-:	220V（24V）Power Supply
L+:	220V（24V）Power Supply

4.3 Characteristic and Connection of Cable

4.3.1 Flux Signal Line

The converter can output equivalent level of shielded exciting signal voltage so that interference to flow measurement signals can reduced by means of lowering the distributed capacitance of communication cable. When measured conductivity is less than 50μS/cm or signals are transferred in remote distances, double-conductor and double-shielded signal cable at equivalent level of voltage can be used. For example, special STT3200 cable or BTS model signal cable (triple-shielded) can be used for signal communication.

4.3.2 Exciting Current Cable

Two conductor and insulating rubber- covered cables can be used as exciting current cables. Suggested model is RVVP2*0.3mm^2 . Length of exciting current cable should be equal to that of signal cable. When the model STT3200 cables are used for exciting current and signals, two cables can be put together as one cable.

5. Meter Parameters

5.1 Flow Parameter Setting

5.1.2 Flow Unit

Flow units are L/s, L/m，L/h，m^3/s, m^3/m, m^3/h, uk/s, uk/m, uk/h, us/s, us/m, us/h, kg/s, kg/m, kg/h, t/s, t/m, t/h. User can select the unit according to actual status.

5.1.3 Flow Total Unit

9 bit calculator is applied and the upper limit is 999999999.

Flow Integrating Units are: L、m3、kg, t. This unit is consistent with the unit of flow unit. For example :when the flow unit is L/h、L/m、L/s，the total unit is L; the flow unit is m3/h、m3/m、m3/s，the total unit is m3; the flow unit is uk/h、uk/m、uk/s，the total unit is ukg; the flow unit is us/h、us/m、us/s，the total unit is usg; the flow unit is kg/h、kg/m、kg/s，the total unit is kg; the flow unit is t/h、t/m、t/s，the total unit is t.

Flow Integrating Units are：

0.001L,	0.010L,	0.100L,	1.000L
0.001m^3,	0.010m^3,	0.100m^3,	1.000m^3
0.001ukg,	0.010ukg,	0.100ukg,	1.000ukg
0.001usg,	0.010usg,	0.100usg,	1.000usg
0.001kg,	0.010kg,	0.100kg,	1.000kg
0.001t,	0.010t,	0.100t,	1.000t

5.1.4 Reverse Flow Enable

When “Reverse Flow En” is “disable”, if the fluid flows, the sensor will export pulse and current,and the terminal “DO+ and DO-” output high level。

When it is “enable”, the sensor will export pulse as “0” and current as “0”(4mA or 0mA) for the fluid flows reversals and the terminal “DO+ and DO-” output high level.

When it is “output enable ”, the sensor will export pulse as “0” and current as “0”(4mA or 0mA) for the fluid flows reversals and the terminal “DO+ and DO-” output low level.

5.1.5 Flow Range

Flow range setting means upper limit flow value setting, and lower limit flow value is set to “0” automatically.

So, it makes the range, and makes the relation of percent display, frequency output and current output with 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.

5.1.6 Flow Rspns

Flow Rspns is filter Time. Large damping time can improve the stability of instrument flow display and output signal, which is suitable for the measurement of total accumulative pulsating flow. Small damping time can be used to improve the response speed and is suitable for production process control. The Flow Rspns is: 5S、 10S、20S、50S、80S、 150S、250S, which can be set by choice.

5.1.7 Analog Output Rspns

Analog Output Rspns is current filter time. The long analog damping time can improve the stability of 4-20mA output. And the short damping time can be used to measure the response speed of 4-20mA quickly. The output damping of the analog output is: 5S、 10S、20S、50S、80S、 150S、250S, which can be set by choice.

5.1.8 Peak Limit Ena.

5.1.9 Peak Limit Value

This parameter has two effects:

1. When “Peak Limit Value”is set as “Enable”,the parameter is the initial value and used to set the flow velocity fluctuating value. When the flow velocity is higher than the value , this change is caused by peak limit fake single. The instrument cut off this value and display “PSM” alarm. When the value is lower than the range, the change is caused by the real flow velocity and the instrument accept this change.

2. When “Peak Limit Value”is set as “Disable”,the value is used to test the noise sensitivity. If the screen is displaying “FST”, the users can turn up the value.

5.1.10 Peak Limit Time

“Peak Limit Time” is used to set the width of peak limit fake single. The value’s unit is second.

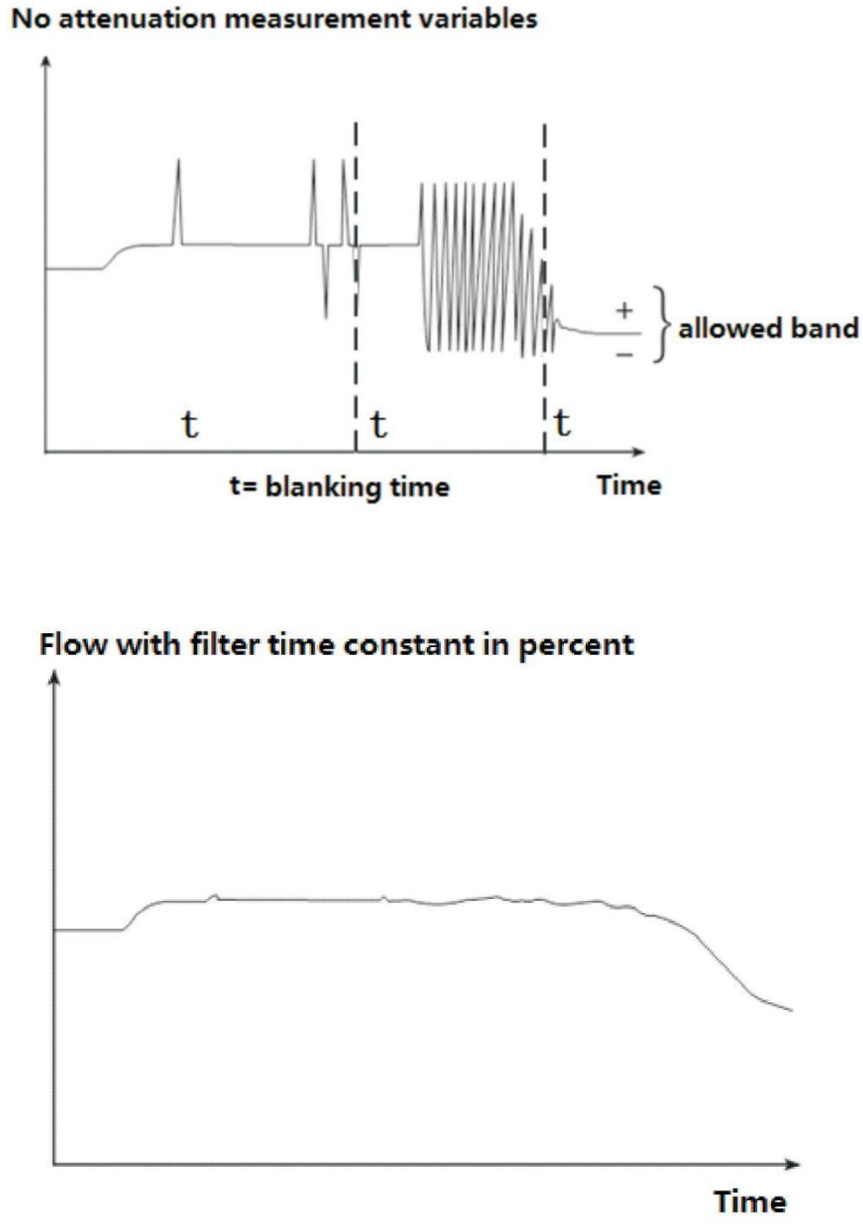


Fig 5. 1. 10. 1 Eliminating big noise error with Peak Limit Value

5.1.11 Abnormal Control

When water contain the bubble, the flow will make zero.The instrument include the function “abnormal control time ”for fear of this condition. The screen will display “ABN” abnormal alarm. This parameter prevent the flow to be made zero and restrain the flow fluctuate for a while.

This parameter can be set from zero to ninety-nine seconds.When is set zero second, the function will be closed.

5.1.12 Flow Direction

When doing debugging, if the flow direction is not consistent, users do not have to change the excitation line or signal line connection, and just reset the flow direction parameters.

5.1.13 Cutoff Enable

When “Cutoff Enable” is “disable”: if the fluid flows, the sensor will export pulse and current,and the terminal “DO+ and DO-” output high level。

When it is “enable”: if the flow is lower than the flow cutoff, the velocity display normal and the converter display “CUT”,the sensor will export pulse as“0” and current as “0”(4mA or 0mA) , and the terminal “DO+ and DO-” output high level.

When it is “output enable”: if the flow is lower than the flow cutoff, the velocity display normal and the converter display “CUT”,the sensor will export pulse as“0” and current as “0”(4mA or 0mA) , and the terminal “DO+ and DO-” output low level.

5.1.14 Low Flow Cutoff

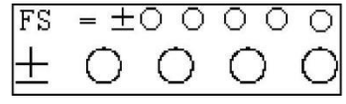
The flow cutoff is set by flow. This parameter is allowed in conjunction with “Cutoff Enable”.

5.1.15 Flow Density

This parameter is automatically selected in units. When the flow unit is set to the quality unit kg/h, kg/m, kg/s, t/h, t/m and t/s, this parameter is worked, the maximum setting can be 1.999, no unit display, when unit setting is kg, the unit of density is kg/L, and the T unit density is t/ m3.

5.1.16 Flow Zero CRC

Make sure the senior is full and the fluid is in stationary state when doing the flow zero-point correction. Flow zero-point is shown as velocity of flow, mm/s. Zero-point correction displayed as below:



Upper small characters: FS means measured zero-point,

Lower large characters: corrected flow zero-point.

When FS display is not “0”, do correction to make FS display to “0”. Note: if correct lower line character and FS increases, change the “+, -” in lower line to make sure FS display to be zero.

The corrected flow zero-point is the compound value of sensor, and shall be recorded in sensor list and label. The unit is mm/s, and the sign is in opposite with corrected value.

5.1.17 Meter Factor

Factory calibration factor the special factor of sensor-made-factory and the factory use this factor to unite mag converters to make sure all the meters can interchange by 0. 1%.

5.1.18 Clr Total Key

The password can be set by the user with more than third levels of password, and then the password is set in the total key.

5.2 Alarm Set Up

5.2.1 High Alarm Enab.

When “High Alarm Enable ” is set “disable”, high alarm function canceled. When “High Alarm Enable ” is set “enable”, if the flow is upper than the high limit value,the converter display “HIG”,the terminal “DO+”and “DO-” output high level. When “High Alarm Enable ” is set “output enable”, if the flow is upper than the high limit value,the converter display “HIG”,the terminal “DO+”and “DO-” output low level.

5.2.2 High Alarm Value

High alarm value based on flow, and the parameter is set by numerical method, in which the user sets an appropriate flow value. When the instantaneous flow rate is higher than that of this value, the upper limit alarm is used to allow the corresponding output and display.

5.2.3 Low Alarm

The same as the high alarm.

5.2.4 System Alarm Ena.

When the “System Alarm Enable” is set “disable”, cancel the system alarm function.

When the “System Alarm Enable” is set “enable”, if the excitation coil fails, the converter display “ SYS”,and the terminal “DO+”and “DO-”output high level.

When the “System Alarm Enable” is set “output enable”, if the excitation coil fails, the converter display “ SYS”,and the terminal “DO+”and “DO-”output low level.

5.2.5 Snsr Measure Ena.

This converter has the function of empty pipe detection without additional electrodes. If the “Snsr measure Ena.” is set “disable”,cancel the empty pipe alarm function.

When the “Snsr measure Ena.” is set “Enable”, if the fluid is lower than electrodes,the converter display “MTP”, the pulse output is “0”, the current

output is “0”(4mA), the flow and the velocity is0, the terminal of DO+ between DO- is high level.

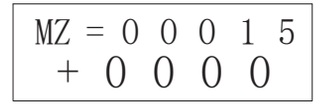
When the “ Snsr measure Ena.” is set “Enable & Output”, if the fluid is lower than electrodes,the converter display “MTP”, the pulse output is “0”, the current output is “0”(4mA), the flow and the velocity is0, the terminal of DO+ between DO- is low level.

5.2.6 Snsr MT Alarm

When the pipe is full of liquid (whether flowing or not), the parameter could be modified more easily. The parameter displayed upper line is real MTP, and the parameter displayed bellow is the “Empty Pipe Value” that should be set. When setting “Empty Pipe Value”, you could be according to the real MTP, the value that should be set is usually three to five times of real MTP.

5.2.7 Snsr MT Zero

User can do empty pipe zero-point correction. When doing the calibration, make sure the senior is full. Empty pipe zero-point correction displayed as below:



Upper large characters:MZ means measured zero-point;

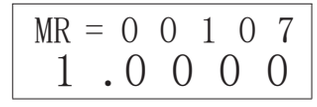
Lower small characters: calibrated empty pipe zero-point.

According to the actual measured conductivity R%, do correction to make MZ=5 – 10.

Note: if increase lower line character and MZ decreases.

5.2.8 Snsr MT Range

User can do full pipe zero-point correction when the conductivity R% is small. When doing the calibration, make sure the senior is empty. Full pipe zero-point correction displayed as below:



Upper large characters: MR means measured zero-point.

Lower small characters:calibrated full pipe zero-point ;

Increase lower line character and MR decreases. Decrease lower line character and MR increases. User can correct MR to proper value based on actual needs (it is suggested that MR is around 500), the conductivity obtained in empty pipe is actual corrected MR.

5.2.9 MT Filter Time

That is to say, the reaction time of empty pipe alarm and the long damping time of empty pipe show that the MT value of conductivity measured by the instrument is slow.The short damping time of air pipe is the response speed of measuring the MT value of instrument conductivity quickly.

MT filter time is 1: 2 S0 3 S0 4 S0 6 S0 8 S10 S10 S10 15 S30 S0 45 S0 60S can be selected and set.

5.3 Output Set Up

5.3.1 Digital Output

Pulse output mode includes frequency output and pulse output:PO:Fred. output :The frequency output is continuous square wave, and the frequencyvalue corresponds to the flow percentage.Frequency output value=(low value measurement value/instrument range)* outputrange+output lower limit;PO:Pulse output :The pulse output is a rectangular wave pulse string. Each pulserepresents a flow equivalent that the pipeline flows through. The pulse equivalent is set bythe following two parameters "Pulse unit" and "Pulse Factor". Pulse output mode is mostlyused for total accumulation, and is generally connected with the totalizer.Frequency and pulse output are generally in the form of OC gate. Therefore, DC powersupply and load should be connected extermally. See Section 5.13 for details.

5.3.2 Pulse Unit

This converter has six units: m3、L、ukg、usg、kg、t.

5.3.3 Pulse Factor

Pulse factor refers to the flow value by a pulse. The instrument pulse factor should be set by two parameters: "pulse unit" and "pulse factor". The range of pulse factor is :

0.001～ 59.999m3 、 0.001～ 59～.999L、 0.001～ 59.999ukg、 0.001～ 59.999usg、0.001～59.999kg、0.001 59.999t.

Under the same flow, the smaller pulse, the higher frequency output, and the smaller error will be.

5.3.4 Pulse Width

The pulse output is low level effective,the pulse width is: 0.5---1999ms

Pulse Width—Max number pulse diagram（table 2）

No.	Pulse-width(ms)	Num of the maximum pulse(p/h)
1	0.5	3600000
1	1	1800000
2	5	360000
3	10	180000
4	50	36000
5	100	18000
6	500	3600
7	999	1800
8	1999	900

5.3.5 Frequency Lower

The frequency lower output corresponds to the flow zero-point of the flow measurement under the measurement mode.

5.3.6 Frequency Range

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

5.3.7 Analog Output

4~20mA practically.

5.3.8 Analog Zero CRC

When the converters are made in the factory, output current has been calibrated to zero scale, that is, accurate 0mA or 4mA output.

5.3.9 Analog Range CRC

When the converters is made in the factory, output current have been calibrated to full scale, that is, accurate 10mA or 20mA output.

5.3.10 Current Out. Test

After adjusting the zero and full current output, the user can test the output current linearity of the converter.Users can check the linearity of the output current by setting 0 0. 00 0. 00 0. 00 0. 00 0. 00 0. 00 0. 00 and 99. 99 respectively.

5.4 Sensor Set Up

5.4.1 Sensor Size

The sensor size scope of this converter is 3～3000mm.

3, 4, 5, 6, 8, 10, 15, 20, 25, 32, 40, 50, 65, 80, 100, 125, 150, 200, 250, 300, 320, 350, 400, 450, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000;

5.4.2 Excit. Frequency

This converter has six kinds of excitation frequency(the instrument is set to 50Hz power supply mode by default when it leaves factory, excitation frequency is 6.25Hz). Users can set as scene:

50Hz power supply:3.125Hz，4.167 Hz，6.250 Hz;
60Hz power supply:1.667Hz, 2.500Hz, 5.000Hz;

Small size sensor excitation system inductance small, high excitation frequency. Large size sensor excitation system inductance is large, users can only choose low excitation frequency. In use, select the low excitation frequency first, if the zero point of the meter velocity is too high, then select the low excitation frequency in turn.

Note: It must work at which excitation frequency is calibrated. If you use high frequency excitation, order a high frequency excitation converter and select the

appropriate excitation frequency value according to this principle.

5.4.3 Sensor Factor

Sensor factor is electromagnetic flow meter calibration factor. The factor obtained from the actual calibration, and stenciled onto the sensor plate. Users shall input the factor into this converter parameter table.

5.4.4 Lineary Correct

Details refer to Annex 1.

5.4.5 Sensor Code 1/2

Sensor code is used by the factory to record the sensor.

5.5 Communication Set Up

5.5.1 Communicat. Mode

The converter has three kinds of communication modes: Modbus, current loop communication and PROFIBUS.The instrument should set the corresponding communication mode when selecting different communication modes.

5.5.2 Communic. Address

Communication address means address range when doing data communication. The address range is from 01 to 250 and address 0 is reserved.

5.5.3 Baud Rate

The scale of communication rate is:300、600、1200、2400、4800、9600、19200、38400

5.5.4 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;
two stop bit 8 bit even check mode.

5.6 Meter Parameters

5.6.1 Fwd. Total High / Low

The total high and low digits can change the values of the forward total and the reverse total, which is mainly used for instrument maintenance and instrument replacement.

Users can use the 5-level password to enter and modify the forward cumulative amount (Σ+). Generally, the cumulative amount set cannot exceed the maximum value counted by the counter (999999999).

5.6.2 Rev. Total High / Low

Users can use the 5-level password to enter and modify the reverse cumulative amount (Σ-). Generally, the cumulative amount set cannot exceed the maximum value counted by the counter (999999999).

5.7 Output and Power Line

All output and power lines are prepared by the user according to the actual situation. But please pay attention to meet the load current requirements.

Pulse, current, alarm output external power supply and load are shown in Figure 5.8.1 & Figure 5.8.2; When using inductive load, a freewheeling diode should be added as shown in the figure.

5.7.1 Current Output Connection

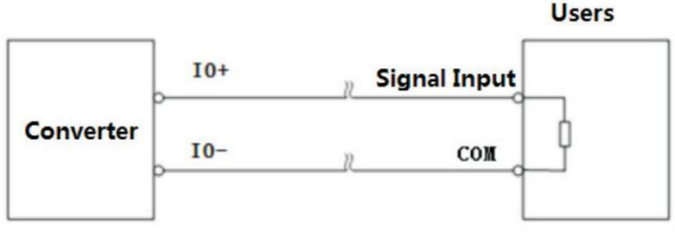


Fig 5.8.1.1 4～20mA Internal power supply connection
（current and pulse is not isolated）

5.7.2 Pulse Output Connection：

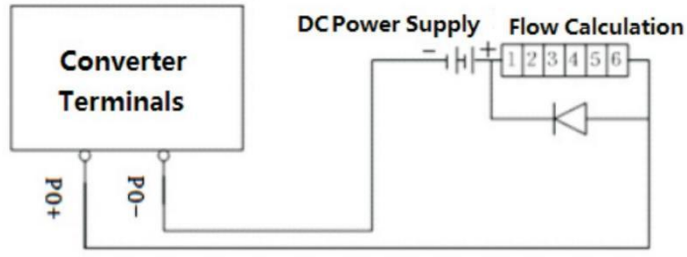


Fig 5.8.2.1 a External power supply connected electronic counter

Fig 5.8.2. 1 b Internal power supply connected electronic counter

5.7.3 Alarm Output Connection

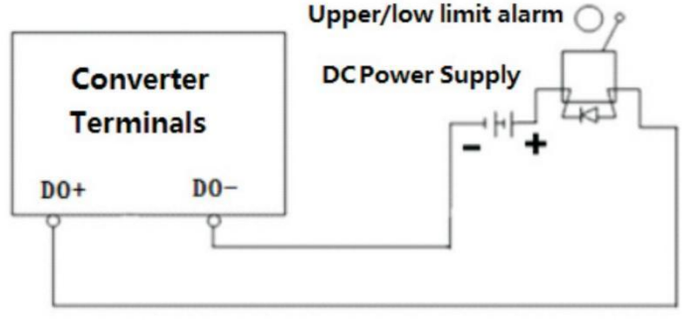


Fig 5.8.2. 1 b Internal power supply connected electronic counter

5.8 Alarm Information

The PCB of the electromagnetic flow converter uses surface welding technology and is not repairable by the user. Therefore, the user cannot open the converter housing.

This intelligent converter has a self-diagnosis function. Except for power supply and hardware circuit failures, faults in general applications can correctly give alarm information. These information are prompted 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;
PAH	A Pressure high limit alarm;
PAL	A Pressure low limit alarm;
PBH	B Pressure high limit alarm;
PBL	B Pressure low limit alarm;
TAH	Inlet temperature high limit alarm;
TAL	Inlet temperature low limit alarm;
TBH	Outlet temperature high limit alarm;
TBL	Outlet temperature low limit alarm;
ABN	Abnormal limit alarm;
PSM	Plsntlmt Alarm;
FST	Noise Sensitivity Alarm

6. Troubleshooting

6.1 No display on the instrument

* Check whether the power is on;

* Check whether the power fuse is intact;

* Check whether the power supply voltage meets the requirements;

6.2 Exciting Alarm

a) Check if the exciting cables EX1 and EX2 did not connected;

b) Check if the total resistance of sensor's exciting coil resistances less than 150Ω;

c) If a) and b) are OK, the converter is failed.

6.3 Empty Pipe Alarm

* Check whether the measured fluid fully fills the pipe

* Short-circuit the converter signal wires (white core wire, red core wire, and shielding wire). If the "empty pipe" alarm is canceled after short circuit, it indicates that the converter is functioning normally. The issue may be due to low conductivity of the measured fluid or incorrect settings of the menu "Snsr MT Alarm" and "Snsr MT range"

* Check whether the signal wiring is correct

* Check if the sensor electrodes are functioning properly:

* When the flow is zero, observe that the displayed conductivity ratio should be less than 100%.

* When there's liquid flow, measure the resistance between the terminal's white core wire and shielding wire, and between the red core wire and shielding wire. The resistance should be less than 50kΩ (measured with water as the medium). It's best to use an analog multimeter, and you could observe a charging and discharging phenomenon during the measurement process.

6.4 Measure Flow Disallow

Measured flow is inaccurate

Check if the measured fluid fully fills the sensor measuring tube;Ensure signal line connections are correct;Verify if the sensor factor and sensor zero point are set correctly;

7.Packing and Storage

To prevent damage to the instrument during operation, please maintain the original packaging as provided by the manufacturer until the instrument reaches the installation site. During storage, the location should meet the following indoor conditions: protected from rain and moisture, minimal mechanical vibration, and free from impacts. The temperature range should be -20 to +60°C, and the humidity should not exceed 80%.

Annex 1 : Function of Nonlinear Correction

Noted: this is an advanced menu, do not suggest normal user to change. Suggest engineer check when necessary only.

The basic concept of a non-linear correction algorithm is that, within a given velocity range, to adjust the actual measured flow velocity (correction point) to the desired flow velocity (target value).

Qpn -- Select the actual flow velocity value at the correction point (correction point Qp1--Qp5)

Qcn -- The desired flow velocity after correction at the specified point ((correction value Qc1--Qc5)

Electromagnetic flow meter is with five velocity correction points and four velocity correction values. The fifth velocity correction point is the fifth correction value, their correspondence is:

Velocity point 1------Velocity value 1
Velocity point 2------Velocity value 2
Velocity point 3------Velocity value 3
Velocity point 4------Velocity value 4
Velocity point 5------Velocity value 5

Please be noted that when setting up, users must follow the principle of setting correction points from low flow velocity to high flow velocity. If set correctly, the screen will display "ok" at the top of the menu, indicating that the non-linear correction function is active. Conversely, if the settings are incorrect, a "bug" message will appear, and the non-linear correction function will not be operational.

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

Velocity value 5 (point 5) > Velocity value 4 > Velocity value 3 > Velocity value2 > Velocity value 1 > 0

Velocity correction formula:

$$Q_{cx} = Q_{c1} + \left(\frac{Q_{C2} - Q_{C1}}{Q_{P2} - Q_{P1}}\right) \times \left(Q_x - Q_{p1}\right)$$

Qcx---revised flow velocity Qx--original flow velocity

Example 1: Using All Correction Points

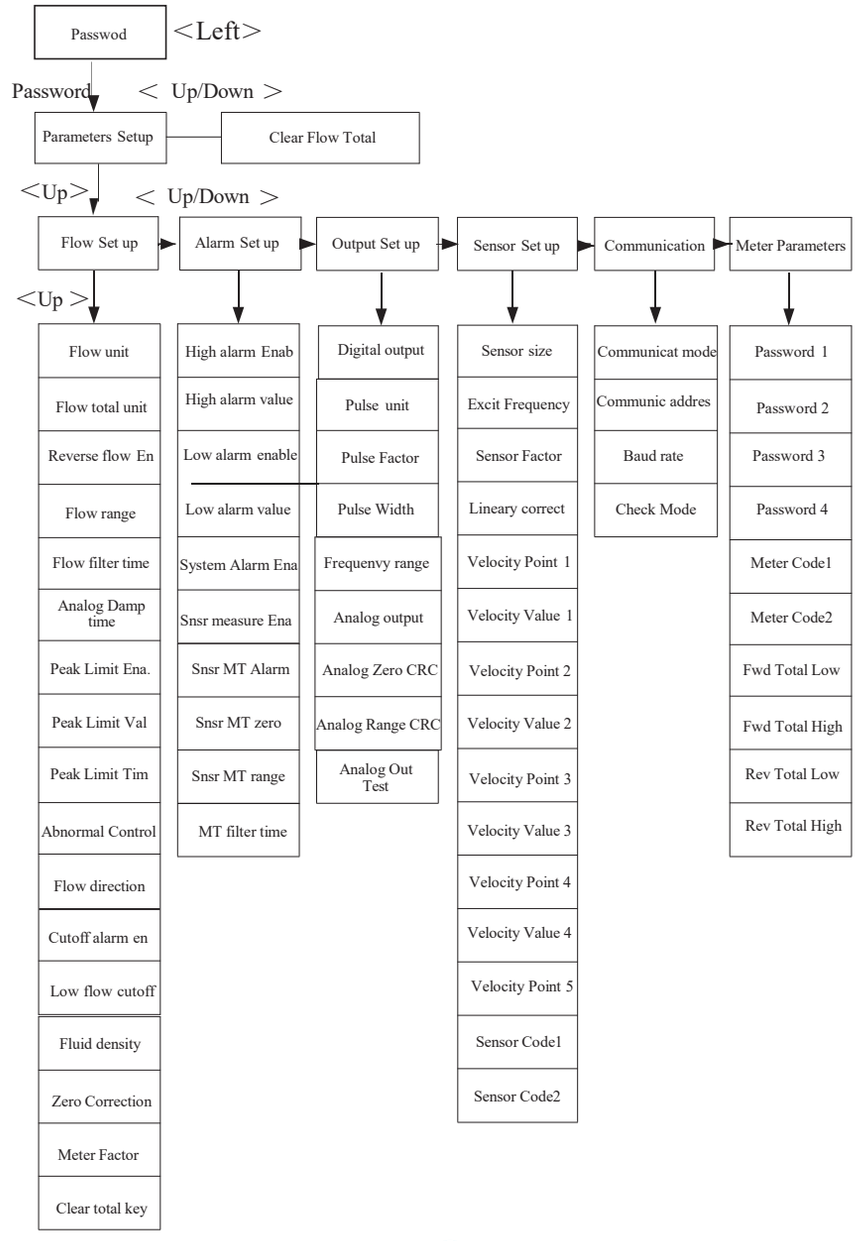
Point	Actual Velocity Point	Desired velocity value	Correction Value Effect Range
1	0.100m/s	0.110m/s	0m/s--0.100m/s
2	0.150m/s	0.160m/s	0.100m/s--0.150m/s
3	0.200m/s	0.220m/s	0.150m/s--0.200m/s
4	0.250m/s	0.270m/s	0.200m/s--0.250m/s
End	0.300m/s		0.250m/s--0.300m/s

Example 2: Using Partial Correction Points

Point	Actual Velocity Point	Desired velocity value	Correction Value Effect Range
1	0.100m/s	0.110m/s	0m/s--0.100m/s
2	0.150m/s	0.160m/s	0.100m/s--0.150m/s
3	0.161m/s	0.161m/s	No correction
4	0.162m/s	0.162m/s	No correction
End	0.163m/s		No correction

Note: When using non-linear correction, users must ensure that all correction points and correction values are set according to the established principles. If any correction point or correction value is not set, the screen will display a "bug" message, and the non-linear correction function will not be operational.

Annex 2: Setting Parameters in Menu



Menu List

Code	Parameters	Set	Content	Password Level
I	Flow Set Up	Select		
1	Flow Unit	Select	L/h, L/m, L/s, m^3/h, m^3/m, m^3/s, UK/h, UK/m, UK/s, US/h, US/m, US/s, kg/h, kg/m, kg/s, t/h, t/m, t/s	2
2	Flow Total Unit	Select	0.001m^3~1m^3, 0.001L~1L 0.001UKG~1UKG, 0.001USG~1USG 0.001kg~1kg, 0.001t~1t	2
3	Reverse Flow En.	Select	Enable, Disable, Enable & Output	2
4	Flow Range	Set Count	0~99999	2
5	Flow filter time	Selected	1~60S	2
6	Analog Damp time	Selected	0~150S	2
7	Peak Limit Ena.	Select	Enable, Disable	2
8	Peak limit Valu.	Set Count	0%~30%	3
9	Peak limit time	Set Count	0s~20s	3
10	Abnormal Control	Select	0~99s	
11	Flow direction	Select	Foward, Reverse	2
12	Cutoff alarm en.	Set Count	Enable, Disable	2
13	Low flow cutoff	Set Count	According to flow	2
14	Fluid density	Set Count	0~1.999	2
15	Zero Correction	Set Count	0~±9999	2
16	Meter Factor	Set Count	0.0000~5.9999	5
17	Reset Flow Total	User Set	0~99999	2

II	Alarm Set up	Select		
1	High alarm Enab.	Select	Enable, Disable, Enable & Output	2
2	High alarm value	Set Count	According to flow	2
3	Low alarm enable	Select	Enable, Disable, Enable & Output	2
4	Low alarm value	Set Count	According to flow	2
5	System Alarm Ena	Select	Enable, Disable, Enable & Output	2
6	Snsr measure Ena	Select	Enable, Disable, Enable & Output	2
7	Snsr MT Alarm	Set Count	0~59999	2
8	Snsr MT zero	Set Count	0~59999	5
9	Snsr MT range	Set Count	0~5.9999	5
10	MT filter time	Selected	2~60SEC	
III	Output Set up			
1	Digital output	Select	PO: Freq.output / PO: Pulse output / DO: Pulse output	2
2	Pulse unit	Select	m^3,Ltr,UKG,USG,kg,t	2
3	Pulse Factor	Set Count	00.001~59.999	2
4	Pulse Width	Select	1~9999ms	2
5	Frequency lower		0~5000 Hz	2
6	Frequency range	Set Count	1~5000 Hz	2
7	Analog output	Select	4-20mA/4mA	2
8	Analog Zero CRC	Set Count	0 .0000~1.9999	5

9	Analog Range CRC	Set Count	0.0000~3.9999	5
10	Analog Out.Test	Set Count	00.00~99.99	2
IV	Sensor Set up			
1	Sensor size	Select	3~33000	2
2	Excit.Frequency	Select	For 50 Hz: 6.25Hz, 4.167Hz, 3.125Hz For 60 Hz: 5.000Hz, 2.500 Hz, 1.667 Hz	4
3	Sensor Factor	Set Count	0.0000~35.9999	4
4	Lineary correct	Select	Enable, Disable	2
5	Velocity point 1	User Set	According to flow	4
6	Velocity value1	User Set	According to flow	4
7	Velocity point 2	User Set	According to flow	4
8	Velocity value2	User Set	According to flow	4
9	Velocity point 3	User Set	According to flow	4
10	Velocity value3	User Set	According to flow	4
11	Velocity point 4	User Set	According to flow	4
12	Velocity value4	User Set	According to flow	4
13	Velocity point 5	User Set	According to flow	4
14	Sensor code1	User Set	Factory year, month (0-99999)	4
15	Sensor code2	User Set	Product number (0-99999)	4

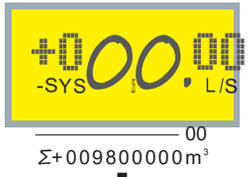
V	Communication			
1	Communicat. mode	Select	MODBUS, HART, PROFIBUS	2
2	Communic. address	Set Count	0~250	2
3	Baud rate	Select	300~38400	2
4	Check Mode	Select	No Parity,1 stop,Odd Parity, 1 St,Even Parity,1 S.,No Parity, 2 stop,Odd Parity,2 St, Even Parity,1 S.	2
VI	Meter parameters			
1	Password 1	User Set	0~59999	5
2	Password 2	User Set	0~59999	5
3	Password 3	User Set	0~59999	5
4	Password 4	User Set	0~59999	5
5	Meter Code 1	Factory Set	Finish Y,M (0-99999)	5
6	Meter Code 2	Factory Set	Finish Y,M (0-99999)	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

The instrument parameter setting function has 5 levels. The 1~4 level is the user password, and the fifth is the manufacturer's password.Users can use the fifth level password to reset 1~4 level password.

No matter which level the password is used, users can check the flow meter parameters. But if the user wants to change the flow meter parameters, a different level of password is used.

The fist level (Default Value is 00522): Only for checking, the second level (default value is 03210), the third level (default value is 06108),the forth level (default value is 07206),the fifth level (fixed value).The scope of the password level is detailed in the above table.

Reset Flow Total



Press key (remote) / key (compact) and input password 19818, enter Parameters Setup,

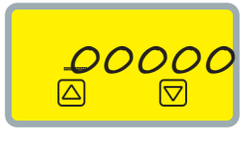
!

Press key (remote) / key (compact) enter, then press key and find the menu “Reset Flow Total”.

!

Press key (remote) / key (compact) and move the cursor under , then press key and move cursor to input password.

!



Press and change password into 10000 (default, can be changed), then press key (remote) / key (compact) move cursor under , then press and display below.

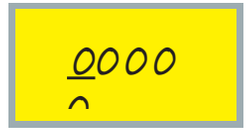
!

Press key (remote) / key (compact), then press key and realize total clear.

Parameter Set

Press the " key (remote) / key (compact)" , flow meter will enter the password input state of "00000".

!



After entering the corresponding password, 19818 move the cursor to the " " and press the " " key. The function selection screen "Parameters Setup" will appear.

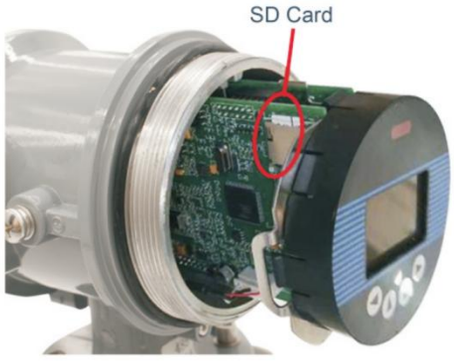
!

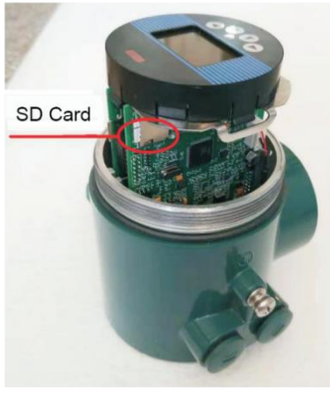
Then press the shift key to move the cursor to the " ". Press the " " to enter the main menu and set the parameters.

41

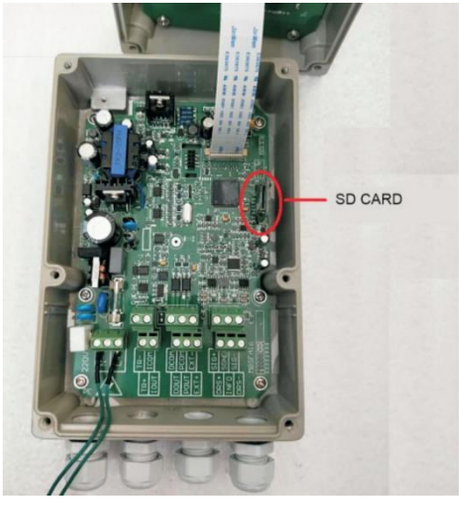
42

Annex 3 : Flow Meter Data Logger





Compact Converter SD CARD Location



Remote Converter
SD CARD Location

Remote Converter
SD CARD Reader

Instrument data logger, is installed inside the electromagnetic flowmeter to record the instrument operation status in real time and various measurement data, including instantaneous flow rate (FLOW), instantaneous flow velocity (FS), total forward flow rate ($\Sigma+$), total reverse flow rate ($\Sigma-$), etc.

The instrument data recording features are as follows:

I.High Reliability of Data Record

The general data record, while the part of the recorded data was interferenced, will have big part of recorded data, but the flow meter are easy interferenced in the working site. Our unique data record method, could make the data loss negligible.

II.Big Data Record Capacity

Flow meter could record 32G memory with 15 years above data.

III.Can Support many Data Recorder Analysis Software

We adopt the international data format, can support many analysis software, such as the “Microsoft Excel”, the data like below:

A1 时间

	A	B	C	D	E	F	G	H
1	Time	Instant Flow	FLS	FQP	Flow Conductive Ratio	Σ+	Σ-	Alarm
2	2018/09/08 00:00:03	081.37M3/02.878m/s		28.77%	15%	00003080E	00000309M3	
3	2018/09/08 00:00:13	081.33M3/02.877m/s		28.76%	15%	00003080E	00000309M3	
4	2018/09/08 00:00:18	081.37M3/02.878m/s		28.77%	15%	00003080E	00000309M3	
5	2018/09/08 00:00:23	081.37M3/02.878m/s		28.77%	15%	00003080E	00000309M3	
6	2018/09/08 00:00:28	081.37M3/02.878m/s		28.77%	15%	00003080E	00000309M3	
7	2018/09/08 00:00:33	081.37M3/02.878m/s		28.77%	15%	00003080E	00000309M3	
8	2018/09/08 00:00:38	081.37M3/02.878m/s		28.77%	14%	00003080E	00000309M3	
9	2018/09/08 00:00:43	081.37M3/02.878m/s		28.77%	15%	00003080E	00000309M3	
10	2018/09/08 00:00:48	081.33M3/02.877m/s		28.77%	15%	00003080E	00000309M3	
11	2018/09/08 00:00:53	081.33M3/02.877m/s		28.76%	15%	00003080E	00000309M3	
12	2018/09/08 00:00:58	081.33M3/02.878m/s		28.77%	15%	00003080E	00000309M3	
13	2018/09/08 00:01:03	081.37M3/02.878m/s		28.77%	15%	00003080E	00000309M3	
14	2018/09/08 00:01:13	081.37M3/02.878m/s		28.77%	15%	00003080E	00000309M3	
15	2018/09/08 00:01:18	081.37M3/02.878m/s		28.77%	15%	00003080E	00000309M3	
16	2018/09/08 00:01:23	081.37M3/02.878m/s		28.77%	14%	00003080E	00000309M3	
17	2018/09/08 00:01:28	081.33M3/02.877m/s		28.76%	14%	00003080F	00000309M3	
18	2018/09/08 00:01:33	081.33M3/02.877m/s		28.77%	14%	00003080F	00000309M3	
19	2018/09/08 00:01:38	081.37M3/02.878m/s		28.77%	14%	00003080F	00000309M3	
20	2018/09/08 00:01:43	081.37M3/02.878m/s		28.77%	14%	00003080F	00000309M3	
21	2018/09/08 00:01:48	081.37M3/02.878m/s		28.77%	14%	00003080F	00000309M3	
22	2018/09/08 00:01:53	081.33M3/02.877m/s		28.76%	14%	00003080F	00000309M3	
23	2018/09/08 00:01:58	081.33M3/02.877m/s		28.76%	14%	00003080F	00000309M3	
24	2018/09/08 00:02:03	081.33M3/02.877m/s		28.76%	14%	00003080F	00000309M3	

Annex 4:Blue Tooth Communication Illustration

First install the Bluetooth APP (Android system) in the phone. After the installation is complete, the icon is . Then set the "Instrument Communication Address" of the circular converter with Bluetooth function to a value other than 0.

Open the Bluetooth APP software of the mobile phone and click the "Login" button, as shown in Figure 1 below. Then click "Search Device" to search for Bluetooth devices. As shown in Figure 2 below.

Figure 1

Figure 2

Select the converter that needs Bluetooth communication from the searched devices, as shown in Figure 3. After entering the setting password 19818, click the "Enter" button, as shown in Figure 4.

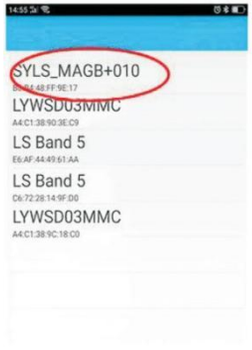


Figure 3

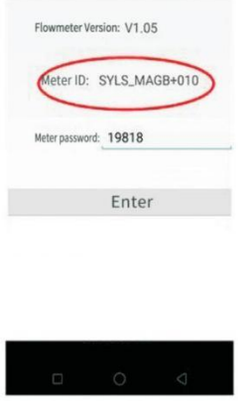


Figure 4

Click the "real-time flow" button on this interface to view the relevant data information of the paired converter, and click "parameter settings" to modify some parameters of the paired converter.

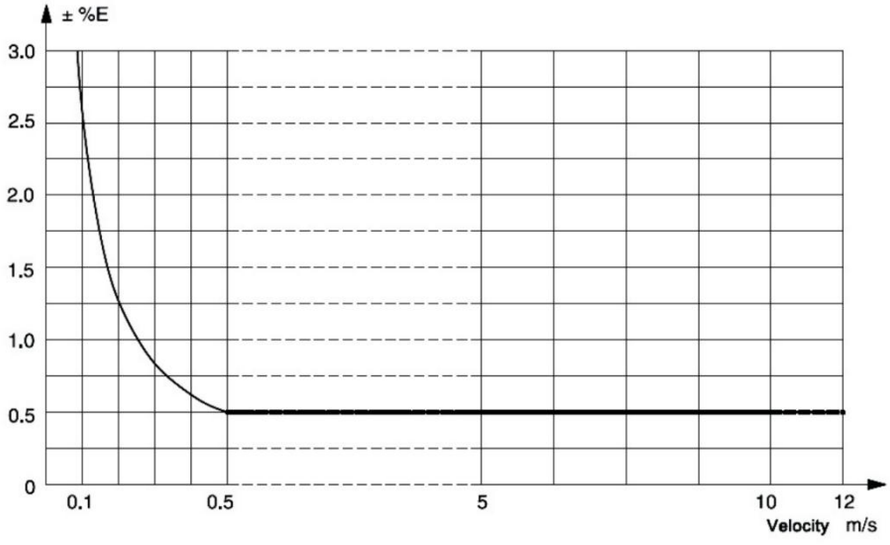
Appendix Five

Electromagnetic flowmeter flow rate table

m/s / m³/h / mm	0.1	0.5	1	3	5	10	15
DN10	0.02	0.14	0.28	0.84	1.41	2.82	4.24
DN15	0.06	0.31	0.63	1.90	3.18	6.36	9.54
DN20	0.11	0.56	1.13	3.39	5.65	11.31	16.96
DN25	0.17	0.88	1.76	5.30	8.83	17.67	26.50
DN32	0.28	1.44	2.89	8.68	14.47	28.95	43.42
DN40	0.45	2.26	4.52	13.57	22.62	45.23	67.85
DN50	0.70	3.53	7.06	21.20	35.34	70.68	106.02
DN65	1.19	5.97	11.94	35.83	59.73	119.46	179.19
DN80	1.80	9.04	18.09	54.28	90.47	180.95	271.44
DN100	2.82	14.13	28.27	84.82	141.37	282.74	424.11
DN125	4.41	22.08	44.17	132.53	220.89	441.78	662.68
DN150	6.36	31.80	63.61	190.85	318.08	636.17	954.27
DN200	11.31	56.54	113.09	339.29	565.48	1130.97	1696.47
DN250	17.67	88.35	176.71	530.14	833.57	1767.15	2650.72
DN300	25.44	127.23	254.46	763.40	1272.35	2544.68	3817.03
DN350	34.63	173.18	346.36	1039.08	1731.80	3463.61	5195.41
DN400	45.23	226.19	452.38	1357.17	2261.95	4523.89	6785.83
DN450	57.25	286.27	572.55	1717.67	2862.78	5725.55	8588.32
DN500	70.68	353.42	706.85	2120.58	3534.29	7068.58	10602.87
DN600	101.78	508.93	1017.88	3053.63	5089.38	10178.80	15268.20
DN700	138.54	692.72	1385.44	4156.33	6927.21	13854.40	20781.60
DN800	180.95	904.77	1809.56	5428.67	9047.80	18095.60	27143.40
DN900	229.02	1145.11	2290.22	6870.66	11451.10	22902.20	34353.30
DN1000	282.74	1413.72	2827.43	8482.30	14137.20	28274.30	42411.45
DN1200	407.15	2035.75	4071.50	12214.50	20357.50	40715.00	61072.50
DN1400	554.17	2770.88	5541.77	16625.30	27708.80	55417.70	83126.55

DN1600	723.82	3619.11	7238.23	21714.70	36191.10	72382.30	108573.45
DN1800	916.08	4580.44	9160.88	27482.70	45804.40	91608.80	137413.20
DN2000	1131.97	5654.87	11309.70	33929.20	56548.70	113097.00	169645.50
DN2200	1368.48	6842.39	13684.80	41054.30	68423.90	136848.00	205272.00
DN2400	1628.60	8143.01	16286.00	48858.10	81430.10	162860.00	244290.00
DN2600	1911.35	9556.72	19113.40	57340.30	95567.20	191134.00	286701.00
DN2800	2216.71	11083.50	22167.10	66501.20	110835.00	220671.00	332506.50
DN3000	2544.70	12723.50	25446.90	76340.70	127235.00	254469.00	381703.50

Accuracy curve



Reference condition:

- Liquid: Water /20℃
- Stability time: 30min
- Pressure: 1 bar
- Inlet straight pipe: ≥5D
- Fluid condition: with good flow regime