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S-MAG-HTLD2

ELECTROMAGNETIC FLOWMETER

Instruction manual

(Version 9.0)

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ELECTROMAGNETIC FLOWMETER CONTENTS

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I. Introduction

1.1 Magnetic Flowmeter Introduction

It is 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.

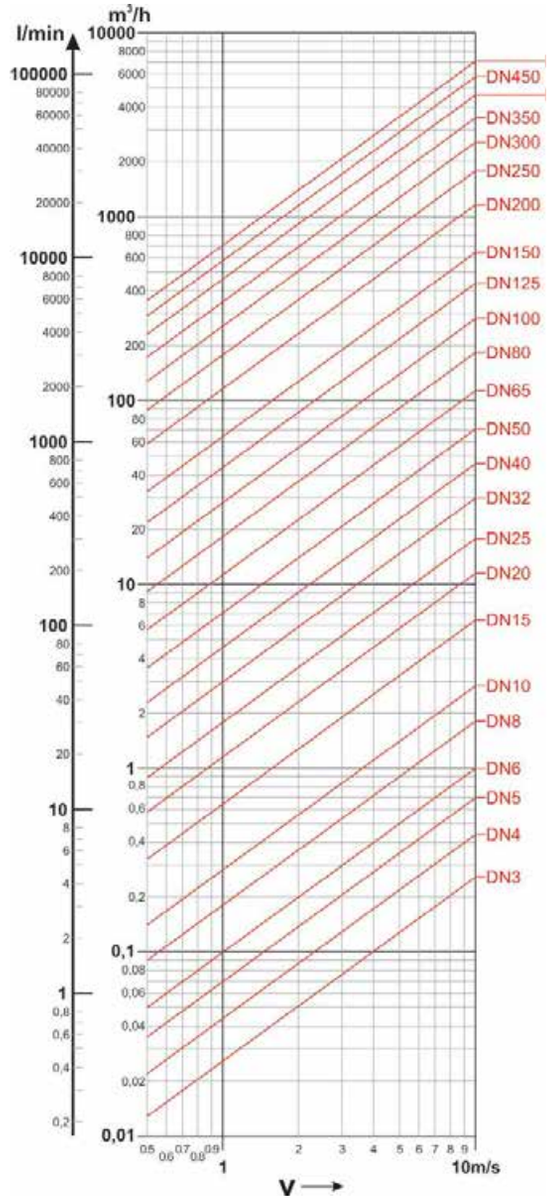
1.2. Technical Data

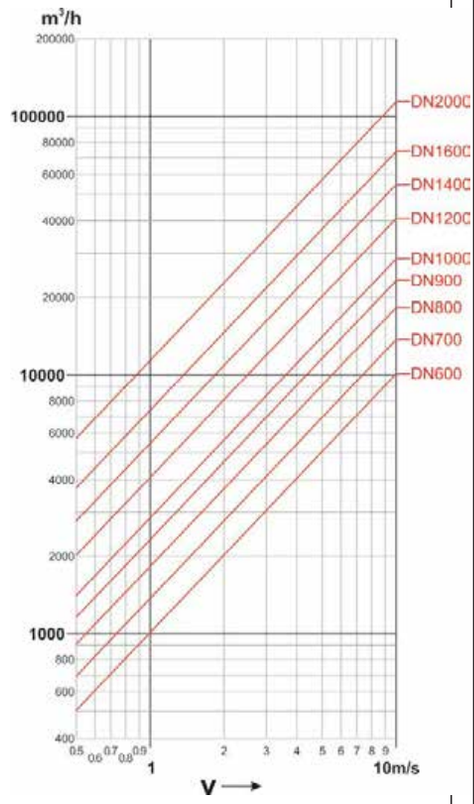
● The technical data depend on the S-MAG model ordered. For more information, see the brochure on the SMERI website (-->).

1.3. Overall Dimension

● The dimensions depend on the S-MAG model ordered. For more information, see the brochure on the SMERI website (-->).

1.4 Flow/diameter/velocity





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:

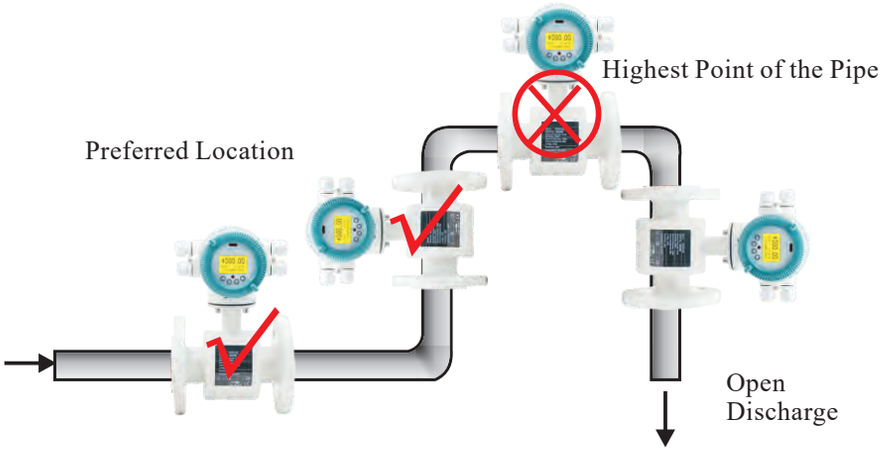
(1) Keep away from equipment with a strong magnetic field as far as possible, such as large motors, large transformers, frequency conversion equipment etc.

(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.

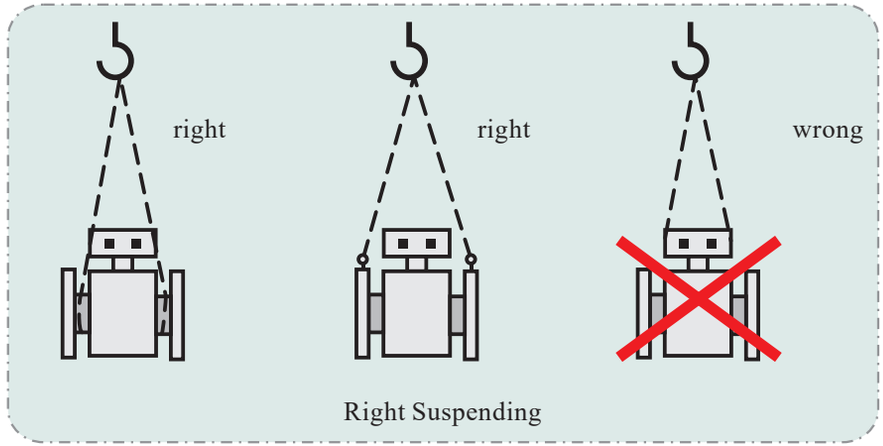
(2) The medium should always be full-filled in pipe at the installation location to avoid not full filled pipes and gas adhering to the electrode.

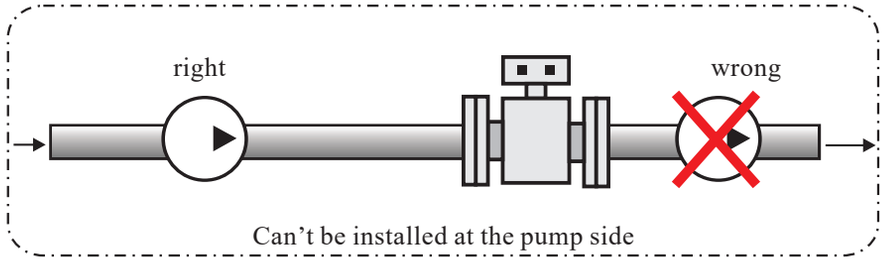
(3) For liquid-solid two-phase flow, it's better to choose perpendicular installation to make liner of sensor attrition uniform and prolong working life.

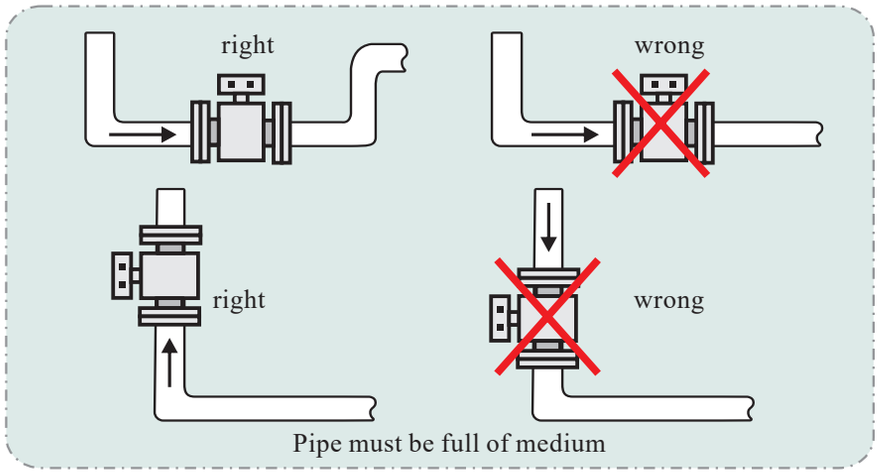
(4) When sensor is not fully filled, it can raise end pipeline of flow meter and makes its full tube.

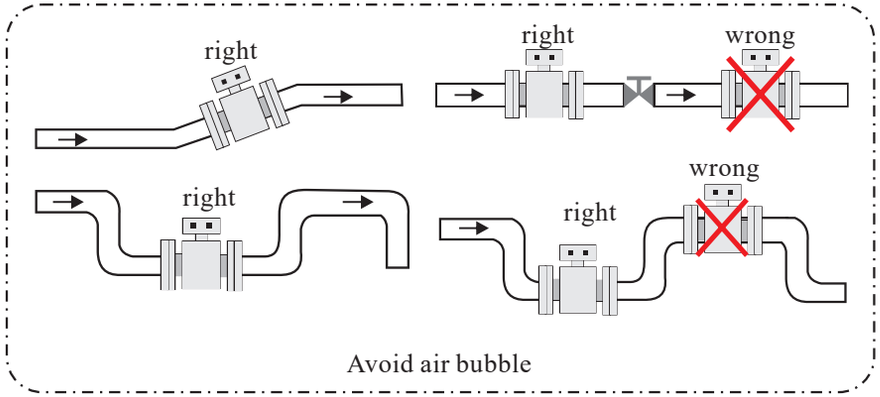
(5) Diameter-Varing: When flow rate is too large or too small, we should use this installation method change diameter to meet flow rate requirements. Straight pipe upstream ⩾10DN, straight pipe downstream ⩾5DN(DN means pipe diameter)

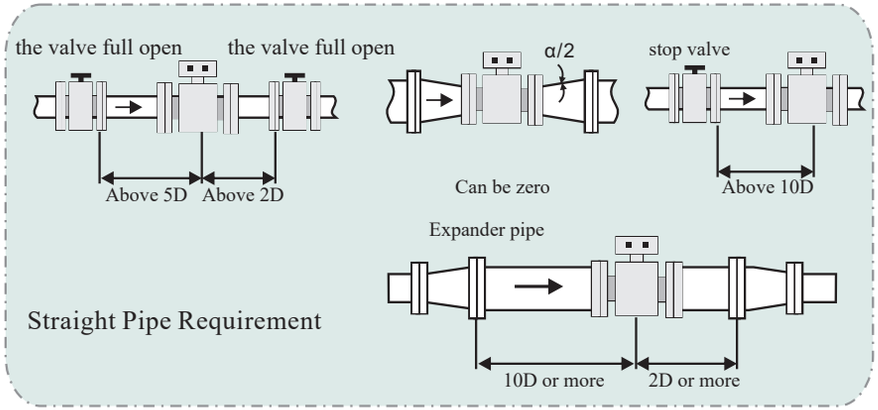
(6) The front and rear straight pipes are ⩾10DN at the front of the flowmeter and ⩾5DN at the back.











2.3 Instrument Wiring

- The remote type signal cable should use a customized dedicated cable, the shorter the cable, the better.
- A 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 will cause electromagnetic flow meter have trouble.

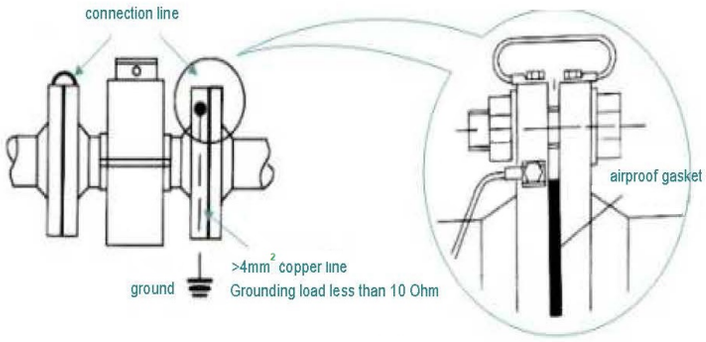
① Measurement sensors must be properly grounded;

② Earthing wire should not transmit any interference voltage;

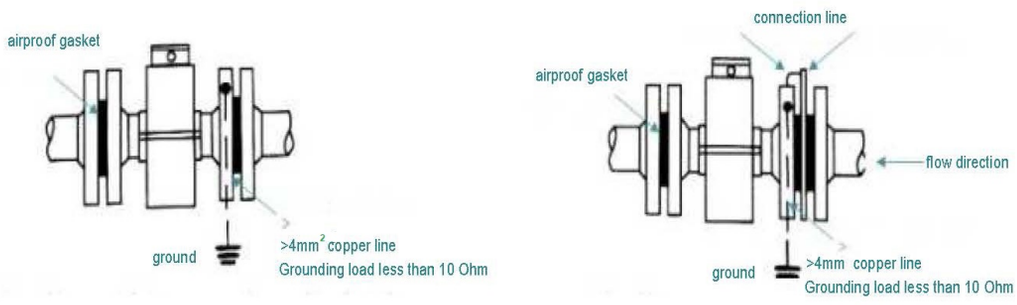
③ Grounding wires are not allowed to connect to other electrical equipments at the same time.

GROUNDING

Metallic and non-metallic tube



METALLIC TUBE

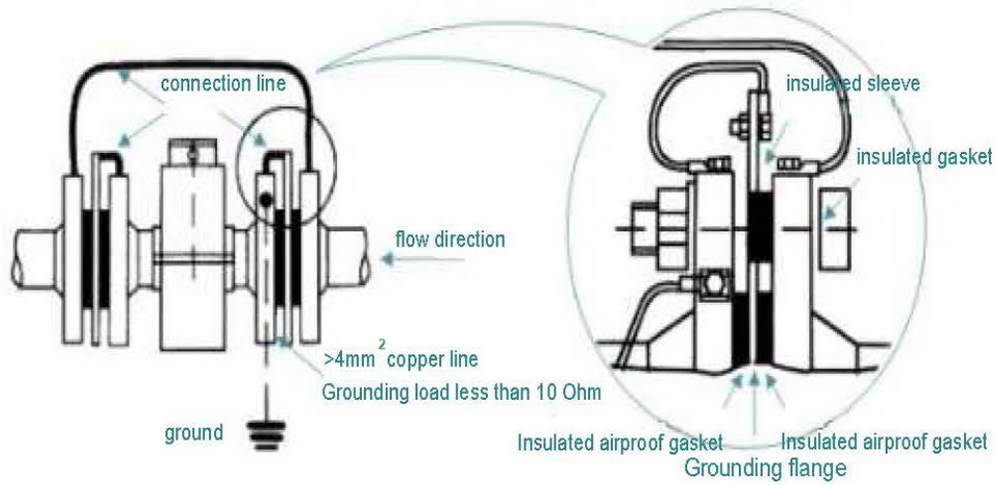


NON-METALLIC TUBE, SENSOR WITH GROUNDING ELECTODE

S-MAG Electromagnetic Flowmeter

ATTENTION!

With a non-metallic tube, it is necessary to insert 2 grounding discs to ensure electrical continuity between the product and the meter ground.

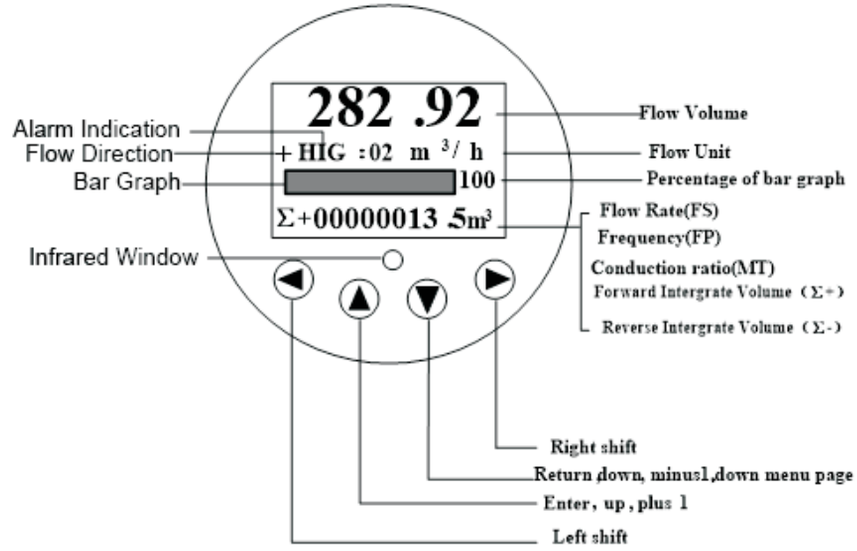


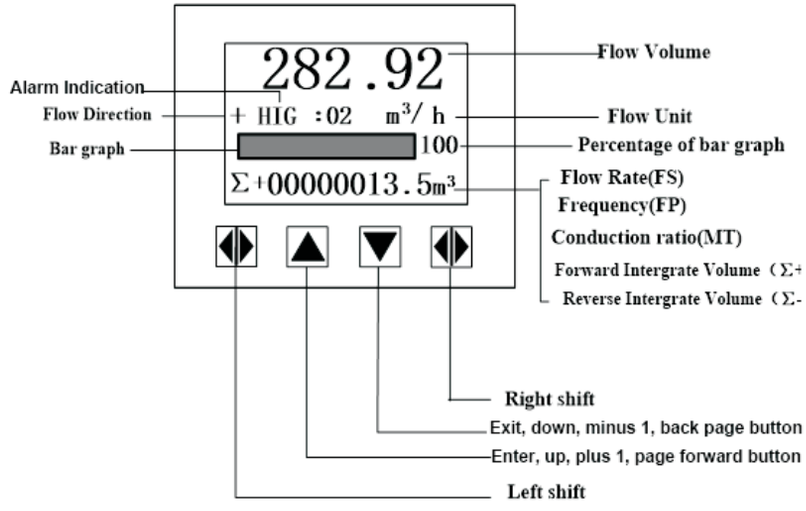
TUBE WITH CATHODIC PROTECTION

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

1.2 Function of Keys and Remote Control

1.2.1 Key Function in State of Automatic Measurement

Down key (The 3rd Key): Cycle select the next line content on screen;
Right Shift key (The 4th Key): Press the right Shift key, input the password to access the parameter settings.

1.2.2 Key Function in State of Parameter Setting

Down key: Cursor number minus 1, turn to the previous page;
Up key: Cursor number plus 1, turn to the next page;
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 Up key, press the button to enter the submenu.
When the cursor moves below the Down key, press the key to return to the previous menu.

1.2.3 Remote Controller Operation (Only Available When Request it Specially)

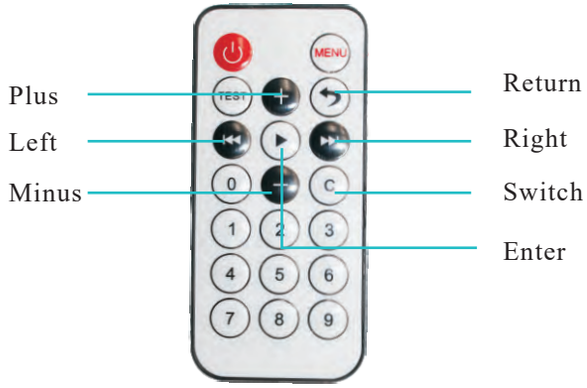


Fig3.1.3 Definition and Operation of Infrared Remote Control Keys

Enter:	Enter the measurement state by pressing this key, enter the parameter setting by inputing 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,loopingdownward display on the screen,cursor number plus 1, page backward ;
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

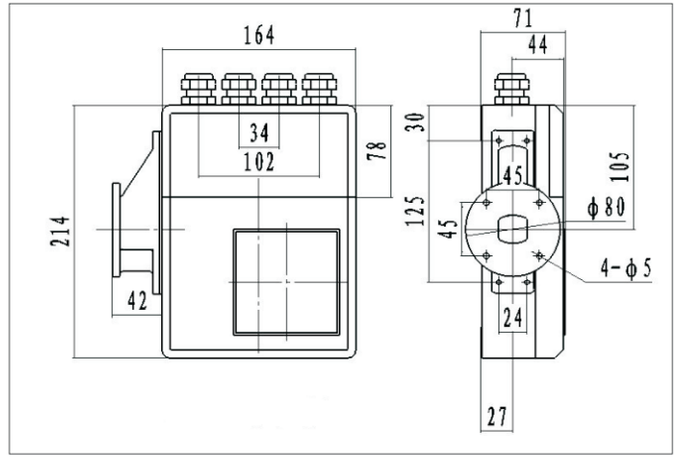


Fig 2.1 a Remote Square Size

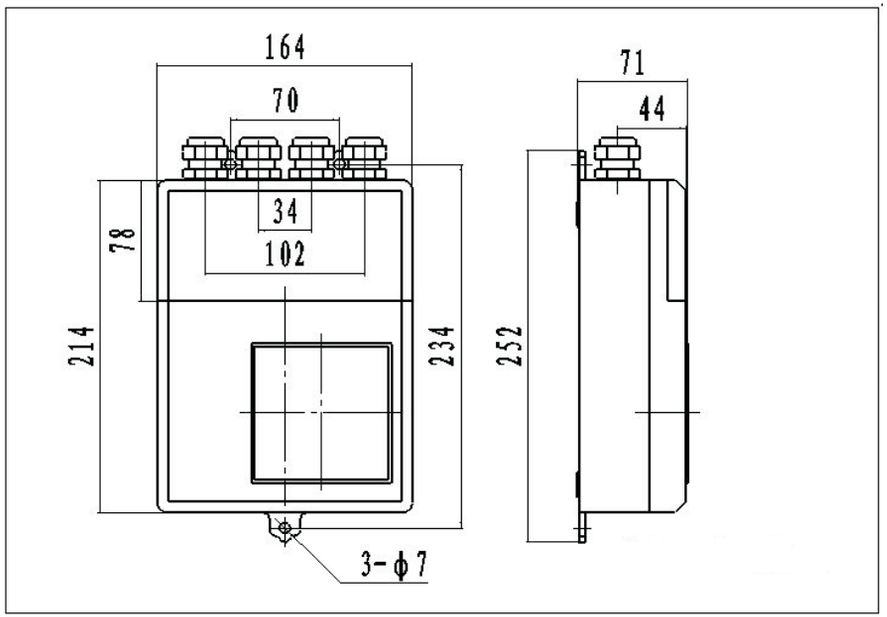


Fig 2.1 b Remote Square

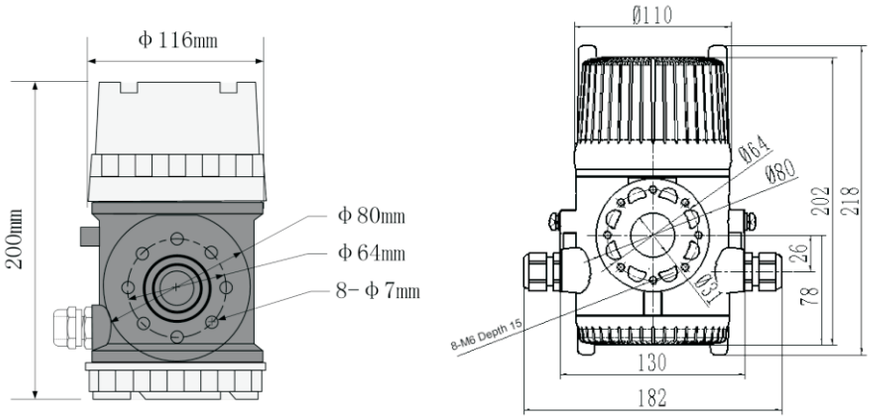


Fig 2.1 c Compact Round

3. Converter Picture

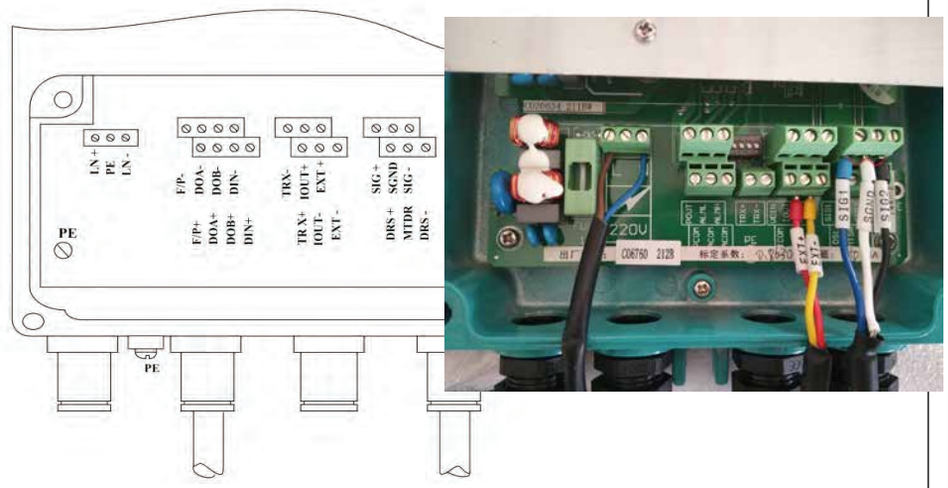
Fig 3.1a Remote Square Converter

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

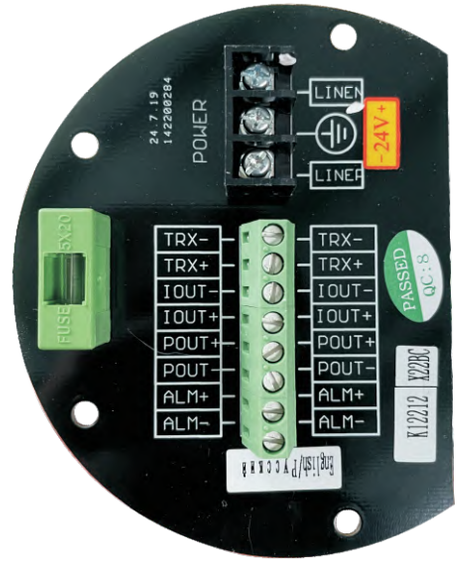


Fig 4.2.1 Terminal Connection Diagram

The terminals are marked as follows:

TRX+:	Communication Input (RS485- A)
TRX-:	Communication Input (RS485- B)
POUT+:	Pulse/Frequency Output +
POUT-:	Pulse/Frequency Output Ground
IOUT+:	Current Output +
IOUT-:	Current Output Ground
ALM+:	Alarm Output +
ALM-:	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

MASTER PASSWORD 19818 - QUICK START see Appendix

NOTE: RESET TO FACTORY DEFAULT
Please contact SMERI

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 total units are: L, m^3, kg, ukg, usg, 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 m^3/h, m^3/m, m^3/s, the total unit is m^3;
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 total 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 converter outputs pulse and current signal according to the flow value, and the terminals DO+ and DO− output high level.

When it is “enable”, if the fluid flows in the reverse direction, the converter flow rate display is normal, the output pulse is “0”, the current output is signal “0” (4mA), the instantaneous flow display is 0, and the terminals “DO+” and “DO−” output high level.

When it is “output enable”, if the fluid flows in the reverse direction, the converter flow rate display is normal, the output pulse is “0”, the current output is signal “0” (4mA), the instantaneous flow display is 0, and the terminals “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. Big 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:1S, 2S, 3S, 4S, 6S, 8S, 10S, 15S, 30S, 60S, which can be set at will.

5.1.7 Analog Output Rspns

Analog Output Rspns is current filter time. Big analog damping time can improve the stability of 4-20mA output.And the small 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 at will.

5.1.8 Peak Limit Ena.

This parameter allows you to enable the peak threshold.

5.1.9 Peak Limit Value

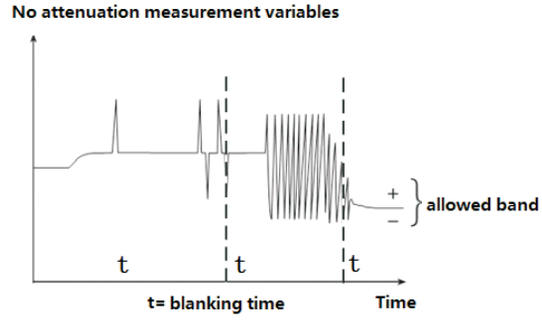
This parameter has two effects:

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.



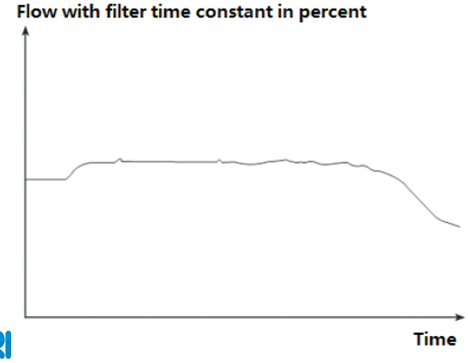


Fig 5.1.10.1 Eliminating big noise error with Peak Limit Value

5.1.11 Abnormal Control

For abnormal conditions such as bubbles in the water, in order to prevent the flow from returning to "zero", the converter is designed with an abnormal suppression function in both software and hardware.

When the converter finds an abnormal situation, the converter will display an "ABN" abnormal alarm to suppress the abnormal flow for a period of time, prevent the flow from returning to "zero" and suppress the flow fluctuation to the minimum.

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

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

If “Cutoff Enable” is enabled, the meter indicates the measurement even at low flow rates. The cutting percentage at low flow rates must be set = 0 to confirm this enabling.

When the signal cut-off permission parameter is set to "Enable", the fluid flow rate is lower than the flow rate set at the small signal cut-off point, the converter instantaneous flow rate and flow rate display are normal, the converter displays small signal cut-off (CUT), the output pulse is "0", the current output signal is "0" (4mA), and the terminals “DO+” and “DO- “ output high level.

When the signal cut-off permission parameter is set to " Disable", the fluid flow rate is lower than the flow rate set at the small signal cut-off point, the converter flow rate display is normal, the converter displays small signal cut-off (CUT), the output pulse is "0", the current output signal is "0" (4mA), the instantaneous flow rate display is "0", and the terminals “DO+” and “DO- ” output high level.

When the signal cut-off permission parameter is set to "output enable", the fluid flow rate is lower than the flow rate set at the small signal cut-off point, the converter instantaneous flow rate and flow rate display are normal, the converter displays small signal cut-off (CUT), the output pulse is "0", the current output signal is "0" (4mA), and the terminals “DO+” and “DO- ” output low level.

5.1.14 Low Flow Cutoff

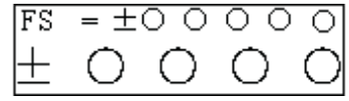
The flow cutoff is set by flow. This parameter is allowed in conjunction with “Cutoff Enable”. The device has a pulse output and does not count if a low-flow cutoff percentage has previously been entered (regardless of whether the function is enabled or disabled). In this case, set the Flow Cutoff percentage back to zero so that the device resumes counting pulses.

5.1.15 Flow Density

The unit of this parameter is automatically selected. This parameter takes effect when the mass unit kg/s, kg/m, kg/h, t/s, t/m, t/h is selected in "Flow Unit". When the flow unit is set to kg/s, kg/m, kg/h, the density unit is automatically kg/L. When the flow unit is set to t/s, t/m, t/h, the density unit is automatically t/m^3.

5.1.16 Flow Zero CRC

Make sure the sensor 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

“Meter Factor” is converter’s factor, The factor is used to normalize the electromagnetic converter measurement circuit system to ensure that the interchangeability between all electromagnetic converters reaches 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 as “disable”, high alarm function cancelled. When “High Alarm Enable ” is set as “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 as “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 as “disable”, cancel the system alarm function.

When the “System Alarm Enable” is set as “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 as “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 as “disable”,cancel the empty pipe alarm function.

When the “Snsr measure Ena.” is set as “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 is 0, the terminal of DO+ between DO- is high level.

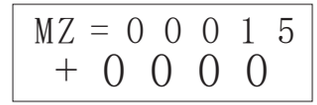
When the “Snsr measure Ena.” is set as “Enable & Output”, if the fluid is lower than electrodes, the converter display “MTP”, the pulse output is “0”, the current output is “0” (4mA), the flow and the velocity is 0, the terminal of DO+ between DO- is low level.

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”, It can be set according to the actual measured conductivityand can be set to 3 to 5 times the actual measured conductivity. The value of MT Alarm is suitable also for measure liquids with low conductivity; the higher the value is, the lower is the conductivity that the meter can read. The maximum level is 10.000: with this value, the minimum conductivity of the meter is around 8 microSiemens per second.

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;

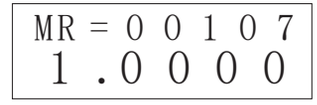
Lower small characters: Calibrated empty pipe zero-point.

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 sensor 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

The longer the empty pipe damping time, the slower the empty pipe alarm response speed. The shorter the measurement damping time, the faster the empty pipe alarm response speed.

The empty pipe damping time: 10SEC, 15 SEC, 20 SEC, 25 SEC, 30 SEC, 35 SEC, 40 SEC, 45 SEC, 50 SEC, 60 SEC can be set selectively.

5.3 Output Set Up

5.3.1 Digital Output

Pulse output mode includes frequency output and pulse output:

PO:Freq. output :The frequency output is continuous square wave, and the frequency value 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 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 most lyused 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.

5.3.2 Pulse Unit

This converter has six units: m^3, 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 is made in the factory, the 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, the output current has been calibrated to full scale, that is, accurate 10mA or 20mA output.

5.3.10 Current 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, 99.99 respectively to check the output current linearity characteristics.

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 provides six excitation frequency options (the default setting of the instrument is 50Hz power mode and 6.25 Hz excitation frequency when it leaves the factory). Users can set it according to actual conditions:

50Hz power mode: 6.250Hz, 5.555Hz, 5.000Hz, 4.545Hz;

60Hz power mode: 6.250Hz, 5.555Hz, 5.000Hz, 4.545Hz;

Small-diameter sensor excitation system has small inductance and high excitation frequency. Large-diameter sensor excitation system has large inductance, and users can only choose low excitation frequency. In use, first select low excitation frequency. If the zero point of the flow velocity of the instrument is too high, then select low excitation frequency in turn. Note: It must work at the excitation frequency at which it is calibrated.

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

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5.4.3 Sensor Factor

The sensor factor is the calibration coefficient of the electromagnetic flowmeter. This coefficient is obtained after actual calibration and is engraved on the sensor nameplate. The sensor factor has been entered into the parameter table of this converter before leaving the factory.

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 Forward Total and Reverse Total

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

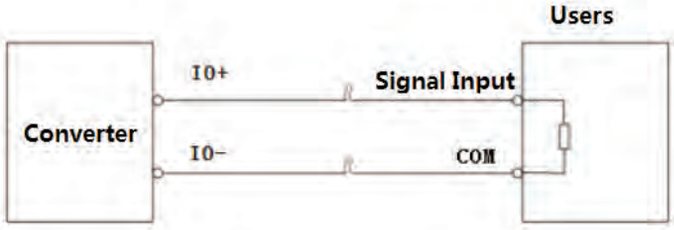

Fig 5.8.1.1 4～20mA Internal power supply connection
(current and pulse is not isolated)

5.7.2 Pulse Output Connection:

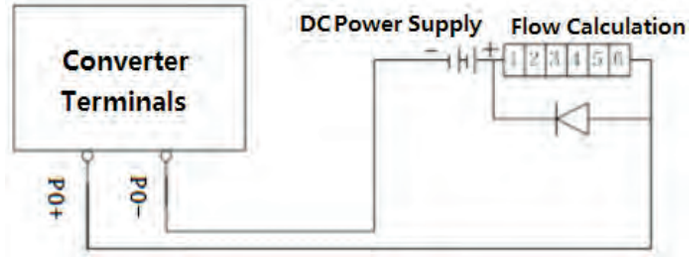

Fig 5.8.2.1 a External power supply connected electronic counter

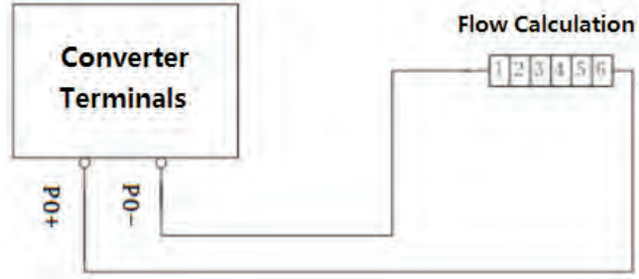

Fig 5.8.2.1 b Internal power supply connected electronic counter

5.7.3 Alarm Output Connection

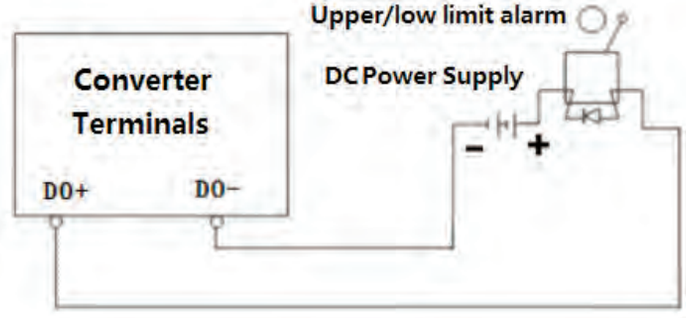

Fig 5.8.2.1 b Internal power supply connected electronic counter

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

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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 cancelled 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.

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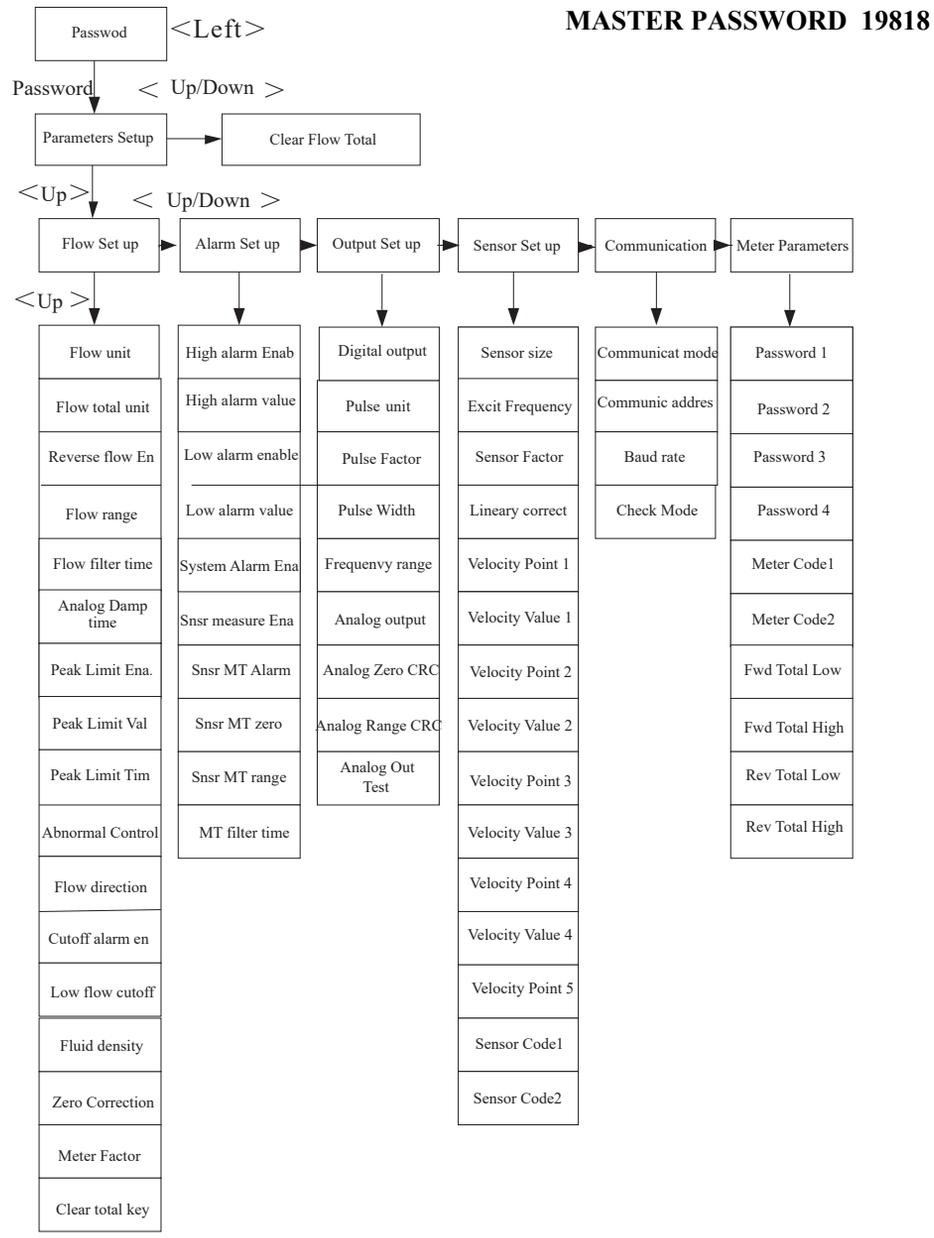
Annex 2: Setting Parameters in Menu



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	1~60S	2
7	Peak Limit Ena.	Select	Enable, Disable	2
8	Peak limit value.	Set Count	According to velocity	3
9	Peak limit time	Set Count	2s~30s	3
10	Abnormal Control	Select	0~99s	
11	Flow direction	Select	Foward, Reverse	2
12	Cutoff alarm en.	Set Count	Enable, Disable, Enable | Output	2
13	Low flow cutoff	Set Count	According to flow	2
14	Fluid density	Set Count	0~1.9999	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

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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~±9999	5
9	Snsr MT range	Set Count	0~5.9999	5
10	MT filter time	Selected	2~60SEC	2
III	Output Set up			
1	Digital output	Select	PO: Freq.output / PO: 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	0.5~1999ms	2
5	Frequency lower		0~5000 Hz	2
6	Frequency range	Set Count	1~5000 Hz	2
7	Analog output	Select	4-20mA	2
8	Analog Zero 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
IV	Sensor Set up			
1	Sensor size	Select	3~3000	2
2	Excit.Frequency	Select	50Hz: 6.250Hz, 5.555Hz, 5.000Hz, 4.545Hz 60Hz: 6.250Hz, 5.555Hz, 5.000Hz, 4.545Hz	4
3	Sensor Factor	Set Count	0.0000~5.9999	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 Stop; Even Parity, 1 Stop; No Parity, 2 Stop; Odd Parity, 2 Stop; Even Parity, 2 Stop.	2
VI	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 (0-99999)	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 of passwords. Among them, levels 1 to 4 are user passwords, and level 5 is the manufacturer password. Users can use the 5th level password to reset the 1st to 4th level passwords.

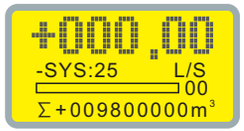
Regardless of which level of password is used, users can view the instrument parameters. However, if users want to change the instrument parameters, they must use different levels of passwords.

Level 1 password (factory value 00522): can only view; Level 2 password (factory value 03210); Level 3 password (factory value 06108); Level 4 password (factory value 07206); Level 5 password (fixed value).

Please refer to the table above for the applicable parameters of the password level.

Reset To Factory Default **Please, contact SMERI**

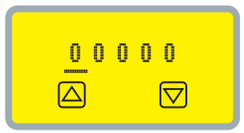
Reset Flow Total



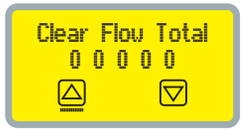
Press key (remote) / key (compact) and input password 19818, enter Parameters Setup,

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.

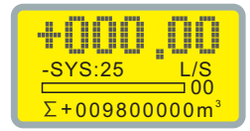


Press and change password into 10000 (default, can be changed), then press key (remote) / key (compact) move cursor under , then press and display below.

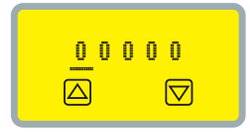


Press key (remote) / key (compact), then press key and realize total clear.

Parameter Set



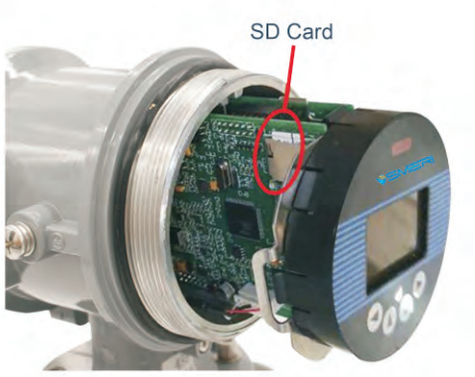
Press the " key (remote) / key (compact)" , flow meter will enter the password input state of "00000".

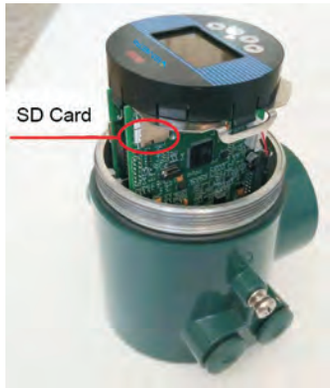


After entering the corresponding password, 19818 move the cursor to the " " and press the " " key. The function selection screen "Parameters Setup" will appear.

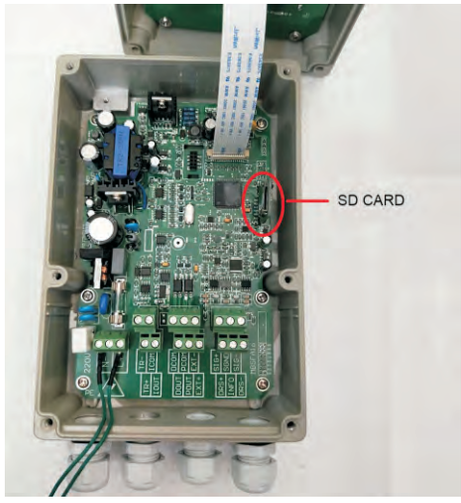
Then press the shift key to move the cursor to the " ". Press the " " to enter the main menu and set the parameters.

Annex 3: Flow Meter Data Logger





Compact Converter SD CARD Location



Remote Converter
SD CARD Location

Remote Converter
SD CARD Reader

S-MAG Electromagnetic Flowmeter

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 (Σ +), total reverse flow rate (Σ -), 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:

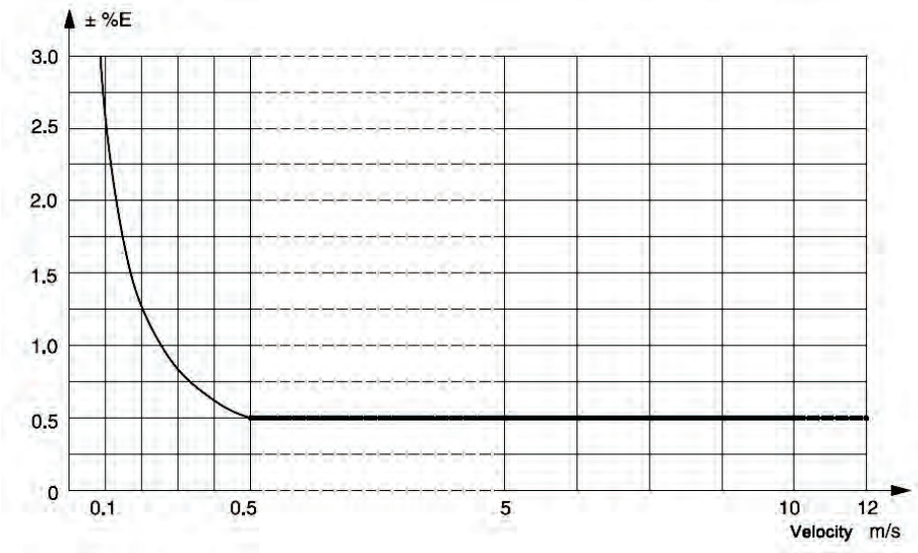
A1 时间

	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	000003093M3	
3	2018/09/08 00:00:13	081.33M3/02.877m/s		28.76%	15%	00003080E	000003093M3	
4	2018/09/08 00:00:18	081.37M3/02.878m/s		28.77%	15%	00003080E	000003093M3	
5	2018/09/08 00:00:23	081.37M3/02.878m/s		28.77%	15%	00003080E	000003093M3	
6	2018/09/08 00:00:28	081.37M3/02.878m/s		28.77%	15%	00003080E	000003093M3	
7	2018/09/08 00:00:33	081.37M3/02.878m/s		28.77%	15%	00003080E	000003093M3	
8	2018/09/08 00:00:38	081.37M3/02.878m/s		28.77%	14%	00003080E	000003093M3	
9	2018/09/08 00:00:43	081.37M3/02.878m/s		28.77%	15%	00003080E	000003093M3	
10	2018/09/08 00:00:48	081.33M3/02.877m/s		28.77%	15%	00003080E	000003093M3	
11	2018/09/08 00:00:53	081.33M3/02.877m/s		28.76%	15%	00003080E	000003093M3	
12	2018/09/08 00:00:58	081.33M3/02.878m/s		28.77%	15%	00003080E	000003093M3	
13	2018/09/08 00:01:03	081.37M3/02.878m/s		28.77%	15%	00003080E	000003093M3	
14	2018/09/08 00:01:13	081.37M3/02.878m/s		28.77%	15%	00003080E	000003093M3	
15	2018/09/08 00:01:18	081.37M3/02.878m/s		28.77%	15%	00003080E	000003093M3	
16	2018/09/08 00:01:23	081.37M3/02.878m/s		28.77%	14%	00003080E	000003093M3	
17	2018/09/08 00:01:28	081.33M3/02.877m/s		28.76%	14%	000030807	000003093M3	
18	2018/09/08 00:01:33	081.33M3/02.877m/s		28.77%	14%	000030807	000003093M3	
19	2018/09/08 00:01:38	081.37M3/02.878m/s		28.77%	14%	000030807	000003093M3	
20	2018/09/08 00:01:43	081.37M3/02.878m/s		28.77%	14%	000030807	000003093M3	
21	2018/09/08 00:01:48	081.37M3/02.878m/s		28.77%	14%	000030807	000003093M3	
22	2018/09/08 00:01:53	081.33M3/02.877m/s		28.76%	14%	000030807	000003093M3	
23	2018/09/08 00:01:58	081.33M3/02.877m/s		28.76%	14%	000030807	000003093M3	
24	2018/09/08 00:02:03	081.33M3/02.877m/s		28.76%	14%	000030807	000003093M3	

Annex 4: 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

Annex 5: Modbus Communication

1. Introduction..... - 2 -

2. S-MAG network structure and wiring..... - 2 -

3. RTU frame format of modbus protocol..... - 3 -

1) Master order frame structure..... - 3 -

2) Slave response frame structure..... - 3 -

4. Code definition of MODBUS protocol order..... - 4 -

5. MODBUS register definition of electromagnetic flowmeter..... - 5 -

1) MODBUS register definition of electromagnetic flowmeter..... - 5 -

2) PLC address set illustration..... - 5 -

6. Communication data analysis..... - 7 -

1) Read instantaneous flow..... - 7 -

2) Read instantaneous velocity..... - 8 -

3) Read cumulative flow..... - 9 -

4) Read instantaneous flow unit..... - 10 -

5) Read the unit of the total amount of flow..... - 10 -

6) Read alarm status..... - 10 -

Remark: The routine of this protocol's application example only provide reference. Some parameters in the routine are different from the address definition of MODBUS register. Please subject to the address definition of MODBUS register.

1. Introduction

S-MAG electromagnetic flowmeter has the standard MODBUS communication interface supporting baud rate 1200, 2400, 4800, 9600, 19200. Through MODBUS communication network, host can collect instantaneous flow, instantaneous velocity and accumulative flow.

S-MAG electromagnetic flowmeter uses serial port parameters: 1 start bit, 8 data bits, 1 stop bit, none parity bit.

S-MAG electromagnetic flowmeter MODBUS communication port uses electric isolation mode in physical structure. The isolation voltage is 1500V and it owns ESD protection. Thus it can overcome various interferences from industrial scene to ensure the reliability service of communication network.

2. S-MAG network structure and wiring

S-MAG electromagnetic flowmeter's standard MODBUS communication network is bus network. It can support 1-99 electromagnetic flowmeters to network organization. As the farthest electromagnetic flowmeter in the network, it usually needs a 120 Ω matched termination resistor to connect the two ports of communication wire in parallel. The standard communication connection media is shielded twisted pair.

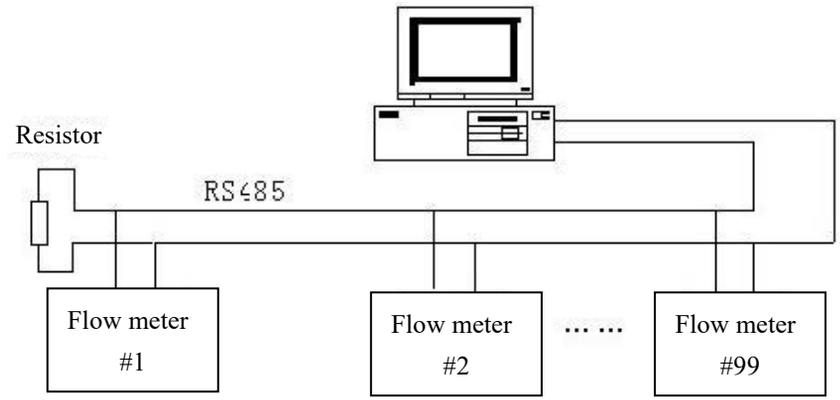


Figure-1 Electromagnetic flowmeter network structure

3. RTU frame format of modbus protocol

MODBUS protocol is a kind of master-slave communication. Every communication is started from master and slave responds master' order through passing back data.

S-MAG electromagnetic flowmeter uses the MODBUS RTU frame format (hexadecimal format). Its frame format is shown in figure2.

1) Master order frame structure

Start	Device address	Function code	Register address	Register length	CRC	Stop
T1-T2-T3-T4	8Bits	8Bits	16Bits	16Bits	16Bits	T1-T2-T3-T4

Figure-2 Master RTU message frame

2) Slave response frame structure

Start	Device address	Function code	Data	CRC	Stop
T1-T2-T3-T4	8Bits	8Bits	n 8Bits	16Bits	T1-T2-T3-T4

Figure-3 Slave RTU message frame

Remark: T1-T2-T3-T4 is start or stop frame. MODBUS protocol sets that every two frames must have 3.5 char delay at least. It is shown in figure-4.

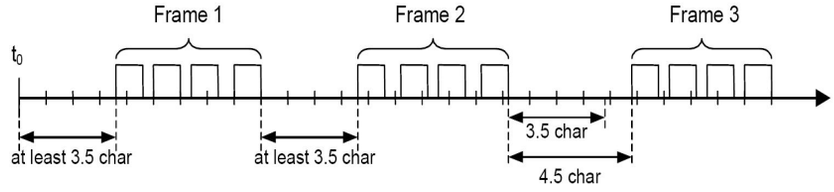


Figure-4 MODBUS frame interval

- Device address: It is the flowmeter's communication address. It couldn't have two same address in a network.
- Function code: It is set by MODBUS protocol. The flowmeter uses the function code 4 which realize the collecting function through reading input register.
- Register address and register number: The start address of register which restore data. Register number is the number that is used to store data.
- Slave response data: Byte number and n-bytes data.

4. Code definition of MODBUS protocol order Table-1

Function	name	function
01	Read coil status	reservation
02	Read input status	reservation
03	Read holding registers	reservation
04	Read input register	read Electromagnetic Flowmeter real-time info
05	Strong set single coil	reservation
06	Preset single register	reservation
07	read abnormal status	reservation
08	Loopback diagnostic check	reservation
09	Program（only used for 484）	reservation
10	Control exercise（only used for 484）	reservation
11	Read events count	reservation
12	Read communication events record	reservation
13	Program（184/384 484 584）	reservation
14	Inquire（184/384 484 584）	reservation
15	Strong multi-coil set	reservation

S-MAG Electromagnetic Flowmeter

5. MODBUS register definition of electromagnetic flowmeter

Table-2

Protocol addresses（Decimal）	Protocol addresses（HEX）	Data format	Resister definition
4112	00x10100	Float Inverse	Instantaneous flow float representation
4114	0x1012	Float Inverse	Instantaneous velocity float representation
4116	0x1014	Float Inverse	Float representation of the flow percentage (reservation for battery-powered
4118	0x1016	Float Inverse	Floating representation of fluid conductivity ratio
41200	0x1018	Long Inverse	Integer part of the cumulative positive value
4122	00x101AA	Float Inverse	Decimal part of the cumulative positive value
4124	00x101C	Long Inverse	Integer part of the cumulative negative value
4126	00x101E	Float Inverse	Decimal part of the cumulative negative value
4128	00x10200	Unsigned short	Instantaneous flow unit (table-3)
41299	00x1021	Unsigned short	Cumulative total units (table-4 or table-5)
41300	00x1022	Unsigned short	Upper limit alarm
4131	00x1023	Unsigned short	Lower limit alarm
4132	00x1024	Unsigned short	Empty pipe alarm
4133	00x1025	Unsigned short	System alarm

2) PLC address set illustration

If there isn't function code setting options when we configure PLC, you should add 3 in front of register address when you use function code 004. If PPLC register address's basic address is from 1, you should add 1 to original address when configuring register address. Example: S-MAG flowmeter MODBUS register address is 4112(0x1010) and MODBUS function code is 4. So PLC register address is 34113. The detailed configuration is seen in example chapter 2.

3) Address configuration illustration of KingView software

There isn't option of configuring function code. Different drivers have different configuration methods.

Take PLC- Modicon-MODBUS (RTU) driver for a example. You should add 8 in front of register address when using function code004. KingView register basic address is 1, so to the original address should be added 1 when configuring KingView register address. S-MAG MODBUS register address is 4112(0x1010) and MODBUS function code is 4. SoPPLC register address is 84113.

The detailed configuration is seen in example chapter 4.

4) Illustration of data's meaning

- Float format:

S-MAG MODBUS uses IEEE754 which is 32 bits float format. Its structure is shown as follows: (take Instantaneous flow for a example)

0X1010（34113）		0x1011（34114）	
BYTE1	BYTE2	BYTE3	BYTE4
S EEEEEEE	E MMMMMMM	MMMMMMMM	MMMMMMMM

S- Mantissa symbol; 1=negative, 0=positive. E- Exponent; expressed by the difference with decimal number 127. M- Mantissa; low 23 bits and the decimal part.

When not all of the E is "0" and "1", the conversion formula between float and tehe decimal number is:

$$V = (-1)^S 2^{(E-127)}(1+M)$$

address Device	code Function	address high Register	address high Register	length high Register	length low Register	high CRC	low CRC
001	004	100	100	0000	002	774	CE

Master sends command (hexadecimal number)

1) Read instantaneous flow

Instantaneous flow, instantaneous velocity, flow percentage, fluid conductivity ratio, decimal part of the cumulative positive and negative value, format conversion of float, integer part of the cumulative positive and negative value, transmission of long.

5. Communication Data Analysis

Upper/lower limit alarm,, empty pipe alarm,, system alarm: 0 -- No alarm; 1-- Alarm

- Alarm

Cumulative unit	T	T	T	USG	USG	USG
Code	6	7	8	99	100	11
Cumulative unit	L	L	L	M3	M3	M3
Code	0	1	2	3	4	5

Table 5 (It is suit for C type electromagnetic flowmeter converter)

Cumulative unit	L	M3	T	USG
Code	00	1	2	3

Table 4 (It is suit for B type and 511 type electromagnetic flowmeter converter)

- Cumulative flow unit

2	L/H/H	5	M3/H	8	T/HH	11	GPH
1	L/M	4	M3/M	7	T/M	10	GPM
0	L/S	3	M3/S	6	T/S	9	GPS
Code	Unit	Code	Unit	Code	Unit	Code	Unit

- Instantaneous flow unit

Data that master receives

01	04	04	C4	1C	60	00	2F	72
Device address	Function code	Data length	4 bytes float (instantaneous flow)				CRC high	CRC low

Float: C4 1C 60 00

1100 0100 0001 1100 0110 0000 0000 0000

float byte 1 float byte 2 float byte 3 float byte 4

S=1: if mantissa symbol is 1, it is a negative.

E=10001000: Exponent is 136

M=001 1100 0110 0000 0000 0000, The mantissa is :

$$V = (-1)^1 2^{(136-127)}(1+\frac{1}{8}+\frac{1}{16}+\frac{1}{32}+\frac{1}{512}+\frac{1}{1024}) \quad = -625.5$$

2) Read instantaneous velocity

Master sends command (hexadecimal number)

01	04	10	12	00	02	D5	0E
Device address	Function code	Register high address	Register high address	Register high length	Register low length	CRC high	CRC low

01	04	04	C1	B0	80	00	A6	5F
Device address	Function code	Data length	4 bytes float (instantaneous velocity)				CRC high	CRC low

Float : C1 B0 80 00

1100 0001 S=1 1011 0000 1111 1000 0000 0000

E=10000011

M= 011 0000 1111 1000 0000 0000

$$V = (-1)^1 2^{(131-127)}(1+\frac{1}{4}+\frac{1}{8}+\frac{1}{256}) \quad = -22.0625$$

3) Read cumulative flow

To express the 9 bits cumulative value of electromagnetic flowmeter totally, integer part and decimal part of cumulative flow are expressed respectively. The integer part uses long variable and the decimal uses float variable.

Cumulative flow is 1578 m^3

Master sends command to collect the integer value of cumulative flow

01	04	10	18	00	02	F5	0C
Device addrese	Function code	Register high address	Register high address	Register high lenght	Register low lenght	CRC high	CRC low

Data that master receives

01	04	04	00	00	70	71	1E	60
Device addrese	Function code	Data lenght	4 bytes float (integer value of cumulative flow				CRC high	CRC low

Integer value of cumulative flow is 28785

Master sends command to collect the decimal value of cumulative flow

01	04	10	1A	00	02	54	CC
Device addrese	Function code	Register high address	Register high address	Register high lenght	Register low lenght	CRC high	CRC low

Data that master receives

01	04	04	3F	00	00	00	3B	90
Device addrese	Function code	Data lenght	4 bytes float (integer value of cumulative flow				CRC high	CRC low

Float: 3F 00 00 00

0011 1111 0000 0000 0000 0000 0000 0000

S=0

E= 0111111 126

M= 000 0000 0000 0000 0000 0000

$$V = (-1)^1 2^{(126-127)} = 0.5$$

4) Read instantaneous flow unit

Master sends 8 bytes command to read instantaneous flow unit

01	04	10	20	00	01	34	C0
Device address	Function code	Register high address	Register high address	Register high length	Register low length	CRC high	CRC low

7 bytes data that master receives from slave

01	04	02	00	05	79	33
Device address	Function code	Data length	2 bytes float (instantaneous flow unit)		CRC high	CRC low

Flow unit is m3/h from table-3.

5) Read unit of the total amount of flow

Master sends 8 bytes command to read instantaneous flow unit

01	04	10	21	00	01	65	00
Device address	Function code	Register high address	Register high address	Register high length	Register low length	CRC high	CRC low

7 bytes data that master receives from slave

01	04	02	00	01	78	F0
Device address	Function code	Data length	2 bytes integer (cumulative flow unit)		CRC high	CRC low

Flow unit of B type and 511 type is m^3 from table-4. Flow unit of C type is L from table-5.

6) Read alarm status

Master sends 8 bytes command to read instantaneous flow unit

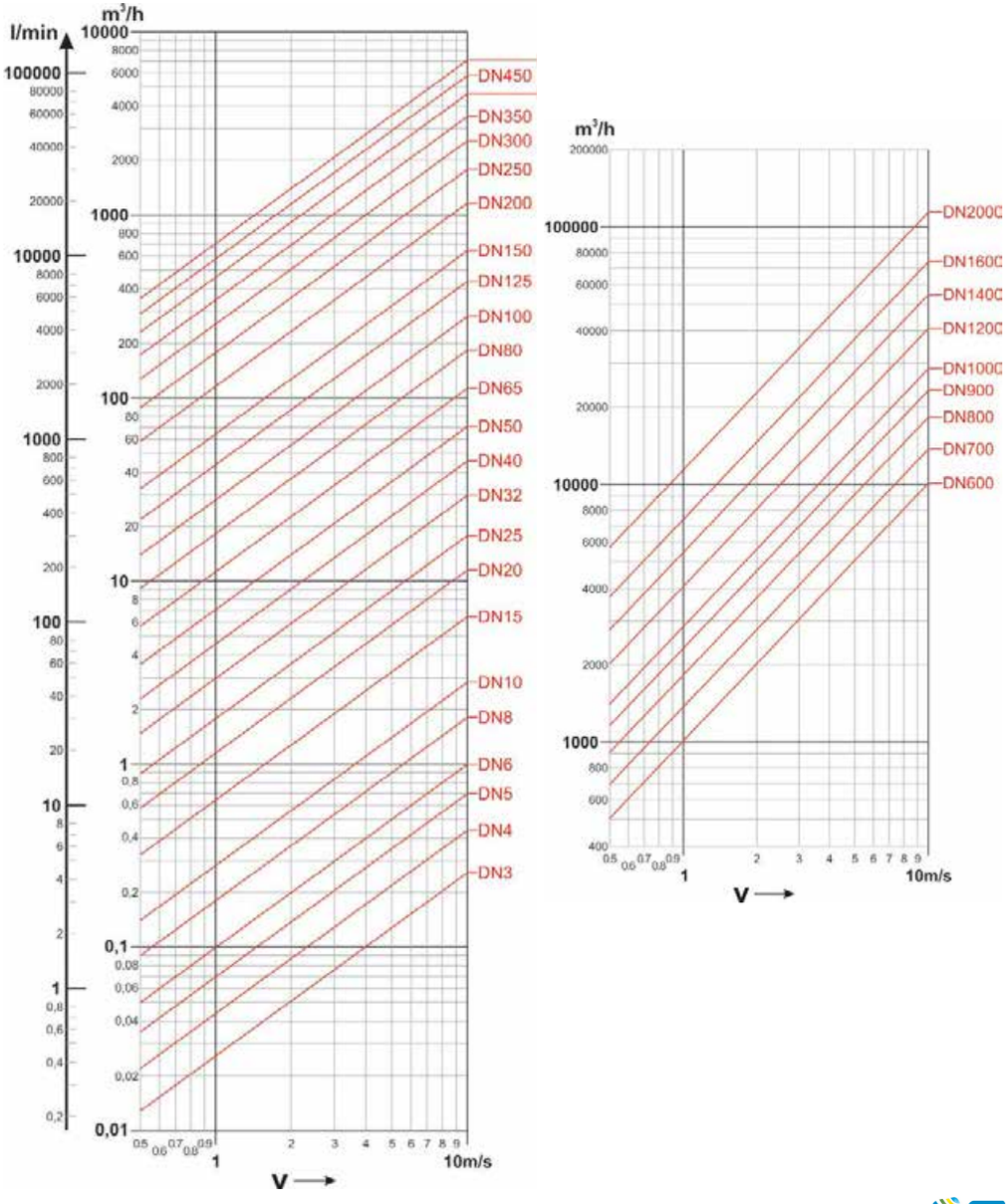
01	04	10	24	00	01	75	01
Device address	Function code	Register high address	Register high address	Register high length	Register low length	CRC high	CRC low

7 bytes data that master receives from slave

01	04	02	00	01	78	F0
Device address	Function code	Data length	2 bytes integer (alarm)		CRC high	CRC low

Appendix

Flow/DN/Flow rate



Appendix

S-MAG HTLD2 - QUICK START

PARAMETRI OBBLIGATORI

1. Inserire MAIN PASSWORD 19818
2. Accedere a PARAMETER SETUP
3. Accedere a FLOW SETUP
4. Parametro FLOW UNIT, selezionare l'unità di misura
5. Parametro FLOW TOTAL UNIT, selezionare l'unità di misura del totalizzatore
6. Parametro FLOW RANGE, inserire la portata massima

PARAMETRI FACOLTATIVI

CUTOFF ALARM EN	Abilitare/disabilitare l'allarme per taglio di bassa portata
LOW FLOW CUTOFF	% sotto la quale il dispositivo non misura
DIGITAL OUTPUT	Selezionare uscita impulsi o frequenza
PULSE UNIT	Unità di misura dell'impulso
PULSE FACTOR	Valore che determina ogni quanto è emesso un impulso (in base all'unità di misura per "Pulse unit")
PULSE WIDTH	Ampiezza dell'impulso

S-MAG Electromagnetic Flowmeter

Appendix

CONNESSIONE IMPULSI