

S-MAG Electromagnetic Flowmeter

Operating manual



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S-MAG Electromagnetic Flowmeter Converter Operation

1. The product function introduction

1.1 Basic function

- Low-frequency square-wave exciting, exciting frequency: 1/16 power frequency、1/20 power frequency、1/25 power frequency;
- High-frequency square-wave exciting, exciting frequency: 1/2 power frequency (for grouting liquid measure) ;
- Exciting current can be selected for 125mA、187.5mA、250mA、500 mA;
- No need to add empty pipeline measurement, and can measure continuously, alarm by fixed value;
- Current speed range: 0.1 --- 15m/s, current speed resolution: 0.5mm/s;
- AC high-frequency switching power, range of voltage: 85VAC --- 250VAC;
- DC 24V switching power, range of voltage: 20VDC --- 36VDC;
- Network function: MODBUS、GPRS、PROFIBUS 、HART communication interface (choose) ;
- Chinese or English displaying mode, (other languages can be set);
- Three integrator gross inside, respective register: Forward gross, reverse gross and minus value gross.

1.2 Especial function

- Recording time when power turn-off, to record power broken time of instrument system automatically and recruit to count the missing flux;
- Recording function of hour gross, to record the flux gross by hour, fit for timed measure;
- Infrared handing telecontrol keyboard, all the functions of far-untouched controlling converter.

1.3 Normal operating conditions

Ambient Temperature Ranges: fission $-10\sim+60^{\circ}\text{C}$;

Relative Humidity: 5%~90%;

Power Supply: 85~250V, 45~63Hz (single-phase AC).

Dissipation Power: <20W (After connecting sensor) .

1.4 Connecting with sensors

- The integrated round shells: round shells, shells connect with the flange directly, explosion-proof;

2. Basic circuit of converter

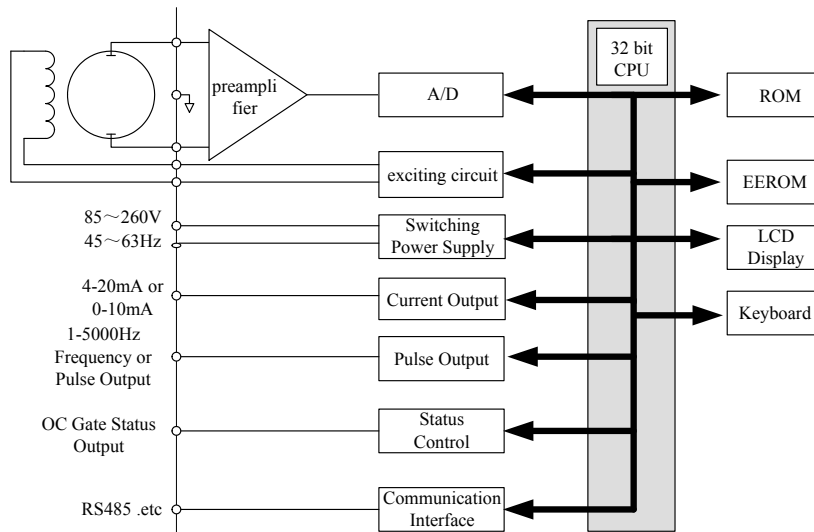


Fig.2. 1 Structure Of Converter's Circuit

The converter can supply exciting current to the coil in the sensor of electromagnetic flowmeters, the head amplifier amplifies the electromotive force from the sensor and converts it into standard signals of current or frequency so that the signals can be used for displaying, controlling and processing. See structure of converter circuit shown in Fig.2.1.

3. Index of technical performance

3.1 Standard of implement

The design, production and instrument of **S-MAG** Electromagnetic Flowmeter Converter implement

《JJG-1033-2007 Electromagnetic Flowmeters》。

3.2 Basic parameters and performance index

3.2.1 Pipe's inside diameter of relative sensor (mm):

3、6、10、15、20、25、32、40、50、65、80、100、125、150、200、250、300、350、400、450、500、600、700、800、900、1000、1200、1400、1600、1800、2000、2200、2400、2500、2600、2800、3000;

3.2.2 Request of relative sensor

Sensitivity of sensor signal: under 1m/s, output 150 μ V ~200 μ V;

For S-MAG electromagnetic flowmeter signal converters, there are two currents of 125mA in exciting loop, which make up of 250mA, and every 125mA is controlled by one 10 Ω exact resistance. So user can choose different exciting current by changing the number of exact resistance.

The current will be 250mA when the signal converters leave factory, as such, if there are three 20 Ω exact resistance or one 20 Ω and one 10 Ω exact resistance, the current will be 187.5 mA; if two 20 Ω , 125mA.

Resistance of sensor exciting coil:

500mA exciting current: 20 ~ 30 Ω ;

250mA exciting current: 50 ~ 60 Ω ;

187mA exciting current: 60 ~ 80 Ω ;

125mA exciting current: 100 ~ 120 Ω ;

3.2.3 Measure precision for assembly

Table 3.1 V_S : Setting measurement range (m/s)

| Diameter(mm) | Range(m/s) | Accuracy |
|--------------|------------|----------------|
| 3 ~ 20 | ≤ 0.3 | $\pm 0.25\%FS$ |
| | 0.3~1 | $\pm 1.0R$ |
| | 1~15 | $\pm 0.5\%R$ |
| 25 ~ 600 | 0.1~0.3 | $\pm 0.25\%FS$ |
| | 0.3~1 | $\pm 0.5\%R$ |
| | 1~15 | $\pm 0.3\%R$ |
| 700~3000 | ≤ 0.3 | $\pm 0.25\%FS$ |
| | 0.3~1 | $\pm 1.0\%R$ |
| | 1~15 | $\pm 0.5\%R$ |

| |
|--|
| <p>%FS: for relative ranges; %R: for relative value of measurement</p> |
|--|

3.2.4 Simulated current output

Load resistor: 0~1.5k Ω (0~10mA); 0~750 Ω (4~20mA).

Basic Errors: 0.1% \pm 10 μ A.

3.2.5 Digital frequency output

Frequency output range: 1~5000Hz;

Output electric isolate: Photoelectric isolate. Isolate voltage: > 1000VDC;

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

3.2.6 Digital pulse output (Active for compact units, passive for the separate one)

Pulse output range: 0 ~100 pulse/s. (When higher than upper limit, pulse will lose);

Pulse output value: 0.001~1.000 m³/ cp 0.001~1.000 Ltr / cp

Pulse output width: 50ms,

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

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

3.2.7 Alarm output

Alarm output junction: ALMH--- upper limit; ALML--- lower limit;

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

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

3.2.8 Digital communication port and protocol

MODBUS interface: format of RTU.

HART interface: designed by standard of HART , if you choose our hand held unit , you can display the measure value on line,and setting the parameters.

3.2.9 Electric isolate

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

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

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

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

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

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

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

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

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

4. Operation converter

4.1 Key and display

4.1.2 S-MAG_4Keys and display

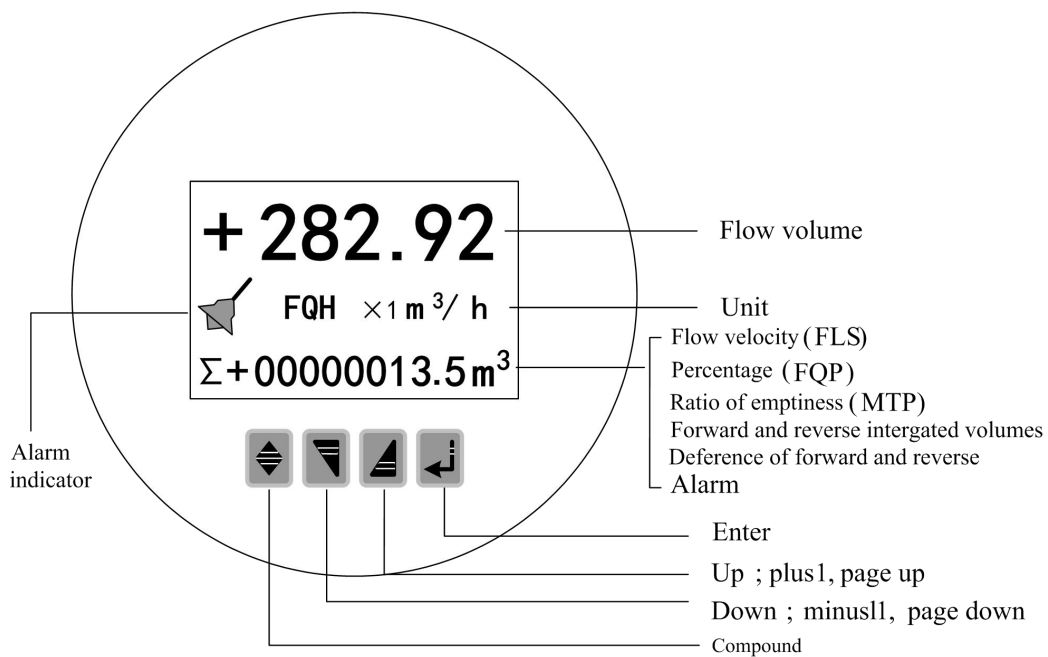


Fig. 4.1(d) Keys on round panel and big LCD display

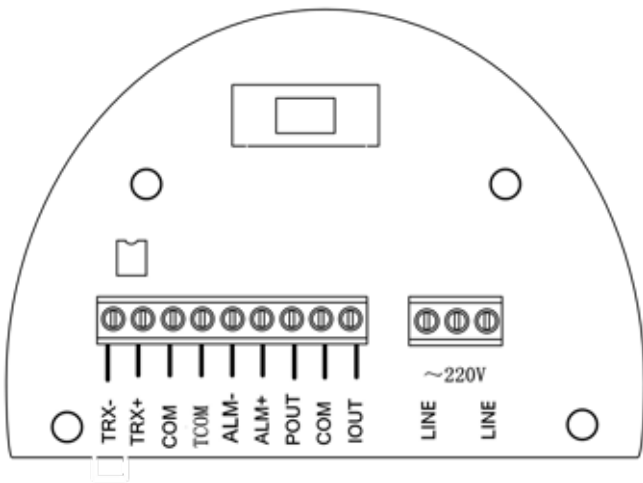
Note: When powered, pushing “Compound Key + Enter” will appear password of changing and with the up and down keys increasing and decreasing the number.

To change the other numbers then moove the sursore right or left, push Coupound + UP or Down key state, base on distinction of secrecy, and change the password as we provide. Then pushing “Compound Key + Enter” again, and you can inter the state of setting parameter. If want to return to the running state, push “Enter” for several seconds.press “Enter” for save dates.

4.3 Connections of sensor

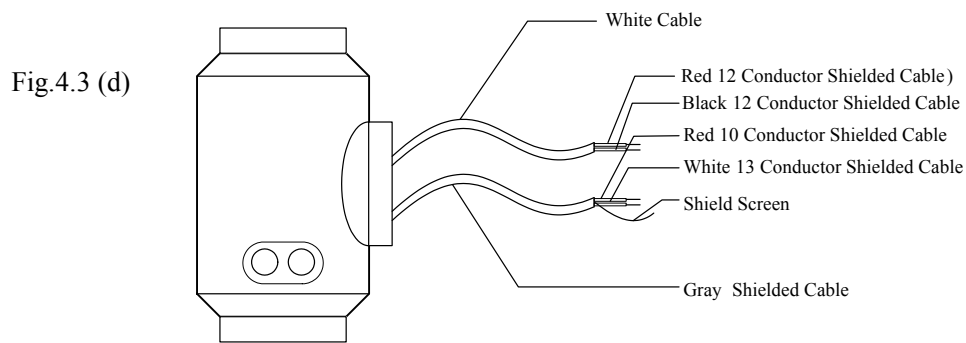
4.3.1 Links and labels of connectors in Round Model

Fig.4.3(c) Connectors in round model



Symbols and Description of Connectors in Round Panel

| | |
|--------|---|
| IOUT: | Output Current for Flow Measurement |
| COM: | Output Current (Ground) for Flow Measurement |
| POUT: | Frequency(Pulse) Output for Bi-directional Flow |
| COM: | Frequency (Pulse) Output (Ground) |
| ALM-: | Alarm Output for Low Limit |
| ALM+: | Alarm Output for Upper Limit |
| COM: | Alarm Output (Ground) |
| TRX +: | +Communication Input Signal(RS485-A) |
| TRX -: | -Communication Input Signal(RS485-B) |
| TCOM | 232 Communication ground |
| LINE: | 220V (24V) Power Supply |
| LINE: | 220V (24V) Power Supply |



Labels and connection of signal lines in round model

Signal lines labels in round model:

White twisted-pair cable (for exciting current): 12 Conductors (Red)

12 Conductors (Black)

Gray shielded twisted-pair cable: 10 Conductors (Red) connected to “Signals 1”

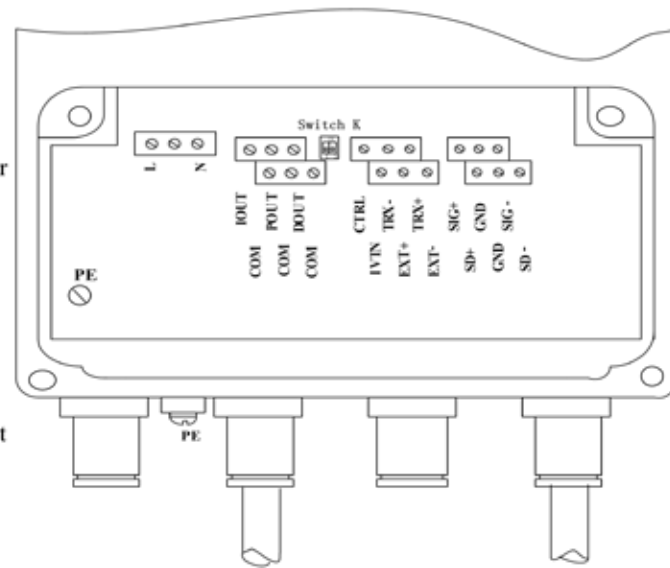
13 Conductors (White) connected to “Signals 2”

Shielded Conductor connected to “Signal Ground”

Connectors and labels for the squared

Labels of connectors in squared model :

| | | |
|-------|--------------------------------|--------------------------------|
| SIG 1 | Signal 1 | } ——— To Separate Model Sensor |
| SGND | Signal Ground | |
| SIG 2 | Signal 2 | |
| DS1 | Shielded Exciting 1 | |
| GND | Shielded Exciting Ground | |
| DS2 | Shielded Exciting 2 | |
| EXT + | Exciting Current + | |
| EXT - | Exciting Current - | |
| IOUT | Analog Current Output | } ——— Analog Current Output |
| COM | Analog Current Output Ground | |
| POUT | Flow Frequency (Pulse)Output | } ——— Frequency (Pulse) Output |
| COM | Frequency (Pulse)Output Ground | |
| CTRL | Control Output | ——— Alarm Output(Reserve) |
| DOUT | Alarm Output | ——— Alarm Output |
| TRX + | Communication Input(RS485-A) | } ——— Communication Input |
| TRX - | Communication Input(RS485-B) | |



NOTE: 1 Switch k is the terminal resistance for RS485 (standard configuration resistance is :120 Ω).

4.4 Characteristic and connection of cable

4.4.1 Flux signal line

Connections of signal cables are shown Fig.4.3(d) for circle-shaped models.

4.4.2 Exciting current cable

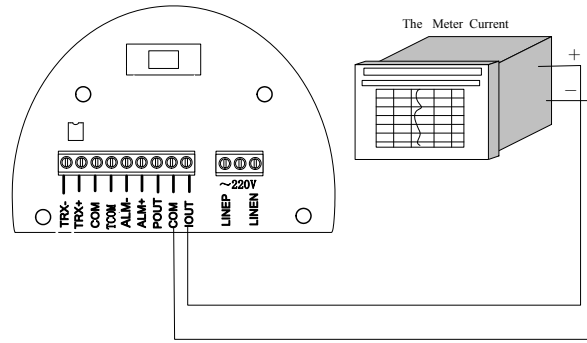
Two conductor and insulating rubber- covered cables can be used as exciting current cables. Suggested model is RVVP2*0.3mm². Length of exciting current cable should be equal to that of signal cable. When the model STT3200 cables are used for exciting current and signals, two cables can be put together as one cable.

4.4.3 Output and power line

All cables for signals transferring and power supply have to be prepared by users. However, it should be careful to choose the cables that meet the upper limit load of consuming current.

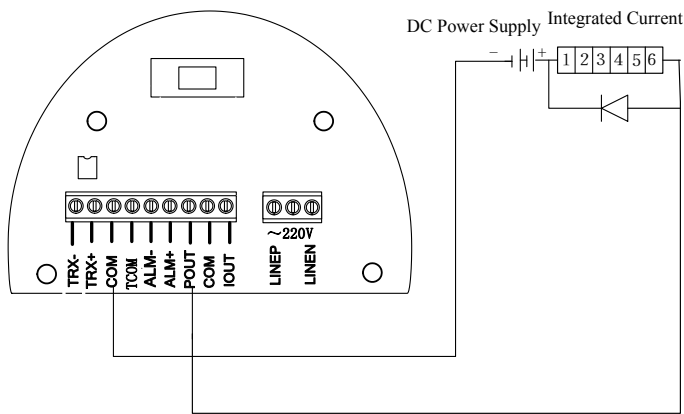
Note: When DIP switch next to terminal is set to ON places, the converter from its inside can provide +28V power supply and up-pull 10kΩ resistance to output Frequencies (PUL) to isolated OC gate, Alarm Output (ALMH.ALML), and Status Control (INSW). Therefore, when converter has frequency output and works with sensor together, DIP switch can be set as ON getting frequency signals from POUT and PCOM terminals.

inductive load is
should be used as in



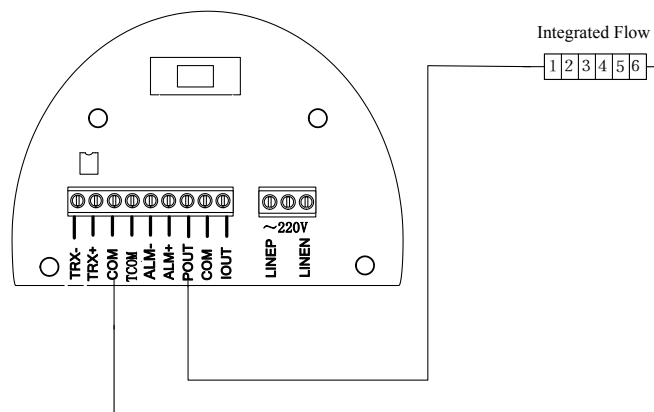
connected to converter, diode
Fig.4.4(b).

Fig.4.4 (a)



Output current circuit

Fig.4.4 (b)
electro-magnet



Connection of
counter

Fig.4.4 (c) Connection of electronic counter

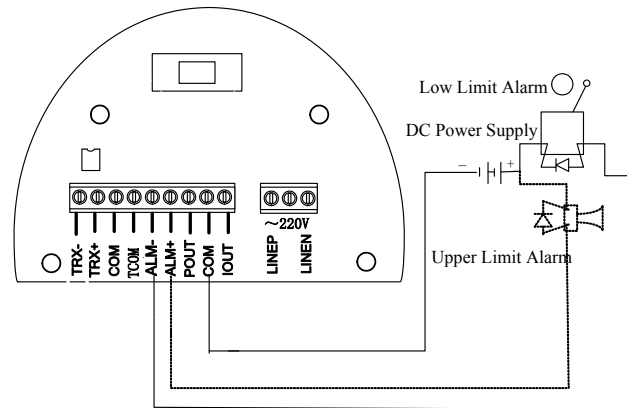


Fig.4.4 (d) Connection of alarm output

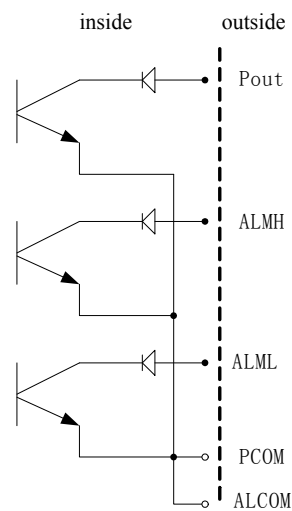


Fig.4.4 (e) Connection of OC gate

4.5 Digital output and calculate

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

4.5.1 Frequency output

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

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

The up limit of frequency output can be adjusted. It can be chosen from 0 ~ 5000HZ, and also can be

chosen low frequency: such as 0 ~ 1000HZ or 0 ~ 5000HZ.

Frequency output mode general can be used in control application, because it responses the percent flux.

Users can choose pulse output when the equipment is applied to count.

4.5.2 Pulse output mode:

Pulse output mainly applies in count mode. A pulse output delegates a unit flux, such as 1L or 1M³ etc. Pulse output unit divide into 0.001L, 0.01L, 0.1L, 1L, 0.001M³, 0.01M³, 0.1M³, 1 M³ .When users choose the pulse unit, they should notice the match of the flux range of flowmeter and pulse unit. For volume flux, count formula as follows:

$$Q_L = 0.0007854 \times D^2 \times V \text{ (L/S)}$$

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

Note: D-nozzle (mm)

V-velocity of flow (m/s)

The oversize flux and too small pulse unit will be made the pulse output over the up limit. Generally, pulse output should be controlled below 3000P/S. However, the too small flux and too large pulse unit will be made the instrument exports a pulse long time.

Otherwise, pulse output is different from frequency output. When pulse output cumulates a pulse unit, it exports a pulse. Therefore, pulse output is not equality. Generally, measure pulse output should chooseto count instrument, but not frequent instrument.

4.5.3 The connection of digital output

Digital output has tow connected points: digital output connected point, digital ground point, and symbol as follows:

POUT ----- digital output point;

PCOM ----- digital ground point;

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

4.5.4 The connection of digital voltage output

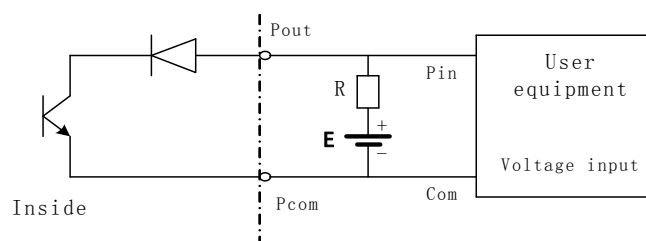


Fig.4.5(a) The connection of digital voltage output

4.5.5 Digital output connect photoelectricity coupling (PLC etc.)

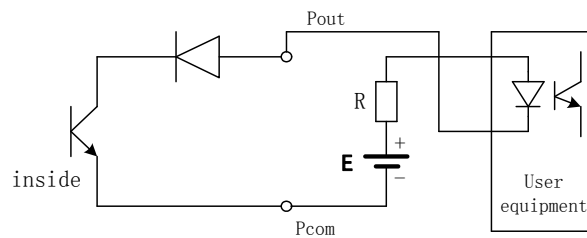


Fig.4.5(b) Digital output connect photoelectricity coupling

Commonly user's photoelectricity coupling current is about 10mA, so about $E/R=10\text{mA}$, $E=5\sim 24\text{V}$.

4.5.6 Digital output connect relay

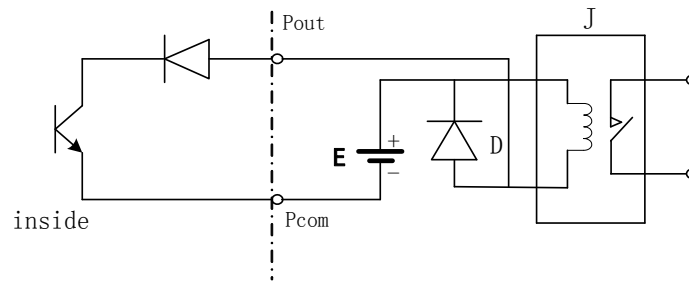


Fig.4.5 (c) Digital output connect relay

Commonly relay needs E as 12V or 24V. D is extend diode, now most middle relays has this diode inside.

If not have, user can connect one outside.

Table of digital output parameter:

POUT

| Parameter | Test condition | Mini | Typical | Max | Unit |
|--------------|---|----------|----------|----------|------|
| Voltage | $I_C=100\text{ mA}$ | 3 | 24 | 36 | V |
| Current | $V_{ol}\leq 1.4\text{V}$ | 0 | 300 | 350 | mA |
| Frequency | $I_C=100\text{mA}$ $V_{CC}=24\text{V}$ | 0 | 5000 | 7500 | HZ |
| High voltage | $I_C=100\text{mA}$ | V_{CC} | V_{CC} | V_{CC} | V |
| Low voltage | $I_C=100\text{mA}$ | 0.9 | 1.0 | 1.4 | V |

4.6 Simulation signal output and calculate

4.6.1 Simulation signal output

There are two signal system: 0~10mA and 4~20mA, user can select from parameter setting.

Simulation signal output inner is 24V under 0~20mA, it can drive 750Ω resistance.

The percent flux of simulation signal output:

$$I_0 = \frac{\text{Measure value}}{\text{Full scale value}} \bullet \text{the scale of current} + \text{the zero point of current}$$

The current zero is 0 when 0~10mA, and the current zero is 4mA when 4~20mA.

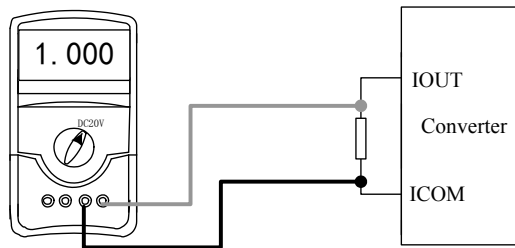
It can be advanced simulation signal output distinguish. User can select the range of measure.

The manufacture's parameter have been adjusted, it can't need adjust. If have abnormality, it can consult 4.6.2.

4.6.2 Simulation Signal Output Adjust

(1)The Converter adjust preparative

When the converter is running 15 minutes, the inner of converter becomes stabilization. Preparative 0.1% amperemeter or 250Ω、 0.1% voltage instrument.



(2)Current zero correct

When the converter getting into parameter setting, selecting to “Analog Zero” and enter to it. **The standard of signal fountain getting to “0”.Adjust parameter make amperemeter is 4mA(±0.004mA).**

(3)The full scale current correct

To select “Anlg Range” to enter.Adjust the converter parameter make amperemeter is 20mA(±0.004mA)

Adjust the current zero and the full range, the current function of the converter reached exactness.The line degree of current output of conversion should be controlled within the scope of 0.1%

(4) Current line degree checking

You can place the standard signal source in 75%、 50%、 25%,and check the line degree of current output.

4.6.3 S-MAG electromagnetic flowmeter converter's connection of current output:

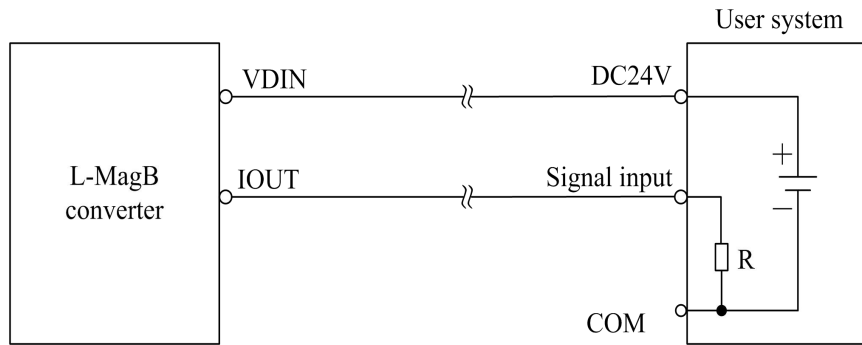


Fig.4.6 (a) L_MagB two connection

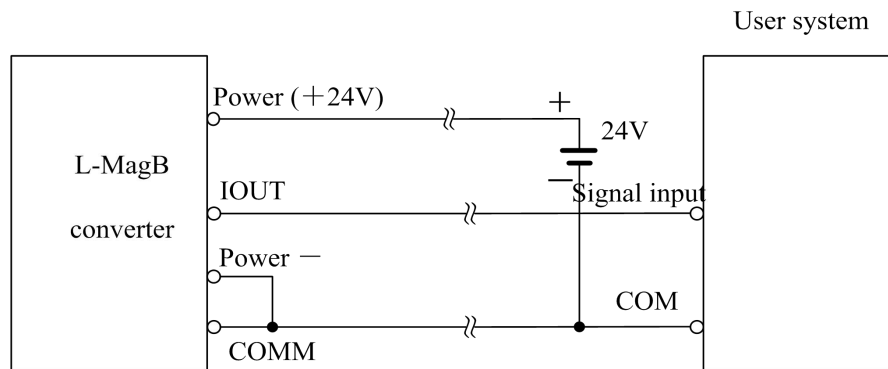


Fig.4.6 (b) L_MagB three connection(power supply and current output are not insulated)

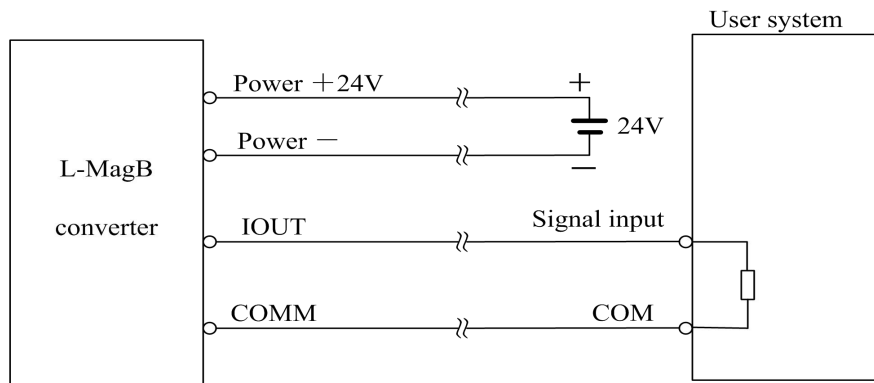


Fig.4.6 (c) L_MagB four connection(power supply and current output are insulated)

5. Setting parameters

After S-MAG electromagnetic flowmeter converter and sensor connect to the pipe (no matter demarcate or use), may do the next work first:

- Connect the pipe fore-and-aft the sensors tighten.
- Make sure the sensor connects the earth.

- Make sure the liquid stillness when regulating zero of the instrument.
- Make sure the oxidation velum of sensor makes steadily (electrode and liquid contact continuously about 48 hours).

5.1 S-MAG_4 key parameters and setting

When electrify, the instrument comes into measure way automatically, and under this way it can do all the functions and display data. Under the parameter setting way, user can set the parameter by the four keys.

5.1.1 Keys function

a) Keys' function in self- testing way

“Down” key: Selecting displayed data on lower line in turn;

“Up” key: Selecting displayed data on higher line in turn;

“Compound” key + “Enter” key: Come into parameter setting

“Enter” key: Press it to come into the picture of select function.

Under the measure, adjust of the LCD contract is used “Compound” key + “Up” key or “Compound” key + “Down” key for several seconds;

b) Function keys for parameters setting

“Down” key: Subtract 1 from the number at cursor area;

“Up” key: Plus 1 to the number at cursor area;

“Compound” key + “Down” key: Cursor turns left;

“Compound” key + “Up” key: Cursor turns right; “Enter” key: In/Out submenu;

“Enter” key: Press for two seconds under any state and will return to automate measure way.

Note: (1) When use “Compound” key, you should press “Compound” key and “Up” or

“Down” both;

(2) It will return to the measure way automatically after 3 minutes when under the parameter setting way;

(3) Direct select of zero correction about the flow, you can move the cursor to the left + or - , and use “Down” or “Up” to switch;

5.1.2 Function keys for setting parameters

To set or correct working parameters, the converter should be running in parameters setting way instead of measuring status. In measuring status, push “Compound”+“Enter” keys getting to the select of parameter and transfer password (0000), and then correct the password with one of the new passwords that are provided by manufacturer. Finally, push the “Compound”+“Enter” keys to work in Parameters Setting Way.

There are 6 Passwords in design and among them 4 for deferent operators in secret and 2 are fixed passwords for system operation.

5.1.3. Functions select menu

Push “Compound”+“Enter” keys to the functions select menu, push “Up” or “Down” keys to select, there are three functions:

| Code | Functions | Notes |
|------|----------------|--|
| 1 | Parameters Set | Select this function; It can enter the picture of parameter. |
| 2 | Clr Total Rec | Select this function, It can be gross reset operation. |
| 3 | Fact Modif Rec | Select this function, It can be check the factor ‘s modif Record |

5.1.3.1 Parameters Set

Press “Compound”+“Enter” key, it displays “Parameters Set” function. Input password. Press “Compound”+“Enter” key, it getting to Parameters Setting status.

5.1.3.2 Clr Total Rec

To push “Compound”+“Enter” keys getting to the select of parameter, then push “Up” key to “Clr Total Rec”, change the display value to “10000”, then push “Compound”+“Enter”, the total rec return “0”.

5.1.3.3 Fact Modif Rec

To push “Compound”+“Enter” keys getting to the select of parameter, then push “Up” key to “Fact Modif Rec”(Detail consult the **Appendix Five**)

5.2 Setting Parameters in Menu - "FLOW CHART"

There are 54 parameters of S-MAG, user can set every parameter. The List of Parameters is shown below:

Setting Parameters in Menu

| Code | Parameter words | Setting Way | Grades | Range |
|------|-----------------|-------------|--------|---|
| 1 | Language | Select | 2 | English |
| 2 | Comm Address | Set count | 2 | 0~99 |
| 3 | Baud Rate | Select | 2 | 300~38400 |
| 4 | Snsr Size | Select | 2 | 3~3000 |
| 5 | Flow Unit | Select | 2 | L/h、 L/m、 L/s、 m ³ /h、 m ³ /m、 m ³ /s |
| 6 | Flow Range | Set count | 2 | 0~99999 |
| 7 | Flow Rspns | Select | 2 | 1~50 |
| 8 | Flow Direct | Select | 2 | Plus/ Reverse |
| 9 | Flow Zero | Set count | 2 | 0~±9999 |
| 10 | Flow Cutoff | Set count | 2 | 0~599.99% |
| 11 | Cutoff Ena | Select | 2 | Enable/Disable |
| 12 | Total Unit | Select | 2 | 0.001m ³ ~1m ³ 、 0.001L~1L、 |
| 13 | SegmaN Ena | Select | 2 | Enable/Disable |
| 14 | Analog Type | Select | 2 | 0~10mA /4~20mA |
| 15 | Pulse Type | Select | 2 | Freque / Pulse |
| 16 | Pulse Fact | Select | 2 | 0.001m ³ ~1m ³ 、 0.001L~1L、 |
| 17 | Freque Max | Select | 2 | 1~ 5999 HZ |
| 18 | Mtsnsr Ena | Select | 2 | Enable/Disable |
| 19 | Mtsnsr Trip | Set count | 2 | 59999 % |
| 20 | Alm Hi Ena | Select | 2 | Enable/Disable |
| 21 | Alm Hi Val | Set count | 2 | 000.0~ 599.99 % |
| 22 | Alm Lo Ena | Select | 2 | Enable/Disable |
| 23 | Alm Lo Val | Set count | 2 | 000.0~599.99 % |
| 24 | Sys Alm Ena | Select | 2 | Enable/Disable |
| 25 | Clr Sum Key | Set count | 3 | 0~99999 |
| 26 | Snsr Code1 | User set | 4 | Finished Y M |
| 27 | Snsr Code2 | User set | 4 | Product number |
| 28 | Field Type | Select | 4 | Type1,2,3 |
| 29 | Sensor Fact | Set count | 4 | 0.0000~5.9999 |
| 30 | Line CRC Ena | Select | 2 | Enable/Disable |
| 31 | Lineary CRC1 | User set | 4 | Set Velocity |

| | | | | |
|----|----------------|--------------|---|-------------------|
| 32 | Lineary Fact 1 | User set | 4 | 0.0000~1.9999 |
| 33 | Lineary CRC2 | User set | 4 | Set Velocity |
| 34 | Lineary Fact 2 | User set | 4 | 0.0000~1.9999 |
| 35 | Lineary CRC3 | User set | 4 | Set Velocity |
| 36 | Lineary Fact 3 | User set | 4 | 0.0000~1.9999 |
| 37 | Lineary CRC4 | User set | 4 | Set Velocity |
| 38 | Lineary Fact4 | User set | 4 | 0.0000~1.9999 |
| 39 | FwdTotal Lo | Correctable | 5 | 00000~99999 |
| 40 | FwdTotal Hi | Correctable | 5 | 00000~9999 |
| 41 | RevTotal Lo | Correctable | 5 | 00000~99999 |
| 42 | RevTotal Hi | Correctable | 5 | 00000~9999 |
| 43 | PlsntLmtEna | Select | 3 | Enable/Disable |
| 44 | PlsntLmtVal | Select | 3 | 0.010~0.800m/s |
| 45 | Plsnt Delay | Select | 3 | 400~2500ms |
| 46 | Pass Word 1 | User correct | 5 | 00000~99999 |
| 47 | Pass Word 2 | User correct | 5 | 00000~99999 |
| 48 | Pass Word 3 | User correct | 5 | 00000~99999 |
| 49 | Pass Word 4 | User correct | 5 | 00000~99999 |
| 50 | Analog Zero | Set count | 5 | 0.0000~1.9999 |
| 51 | Anlg Range | Set count | 5 | 0.0000~3.9999 |
| 52 | Meter Fact | Set count | 5 | 0.0000~5.9999 |
| 53 | MeterCode 1 | Factory set | 6 | Finished Y/M |
| 54 | MeterCode 2 | Factory set | 6 | Product Serial No |

Parameters of converters can decide the running status, process and output ways as well as state of output. Correct option and setting of parameters can keep the converters running optimally and get higher accuracies of output both in display and in measurement.

There are 6 grades of passwords for setting parameters function. Grades 1 to grade 5 of passwords are for users and grade 6 of password is for manufacturer. Users can reset their passwords of grades 1~4 in grade 5.

Users can check converters parameters in any grade of password. However, if users want to change parameters of converters, different grade of parameters have to be used by the users.

Grade 1 of password (set by manufacturer as 00521): users can only read parameter.

Grade 2 of password (set by manufacturer as 03210): users can change 1~24 parameters.

Grade 3 of password (set by manufacturer as 06108): users can change 1~25 parameters.

Grade 4 of password (set by manufacturer as 07206): users can change 1~38 parameters.

Grade 5 of password (Fixed): users can change 1~52 parameters.

Password Grade 5 can be set by skilled users. Grade 4 is mainly used for resetting total volume in password.

Grades 1~3 can be set by any one who can be chosen by users.

MASTER PASSWORD 19818

5.3 Details Parameters

5.3.1 Language

English language for S-MAG converter operation.

5.3.2 Comm Address

It means this instrument's address when communicates with many, and has 01~99, holding the 0.

5.3.3 Baud Rate

300, 1200, 2400, 4800, 9600, 38400, baud rate.

5.3.4 Sensor Size

S-MAG converters can be equipped with some deferent sensors that have deferent diameter of measuring pipes. The pipes in deferent diameters from 3mm to 3000mm can be chosen in relative table.

5.3.5 Flow unit

The flow unit can choose form the parameters (L/s、L/m、L/h、m³/s、m³/m、m³/h),and the user can choose the proper unit according to the technological requirement and using habit.

5.2.6 Flow Range

Flow range means upper limit value, and lower limit value is set "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;

pulse output will not affect.

5.3.7 Flow Rspns

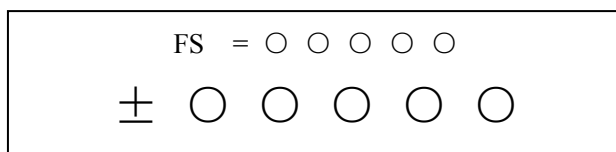
It means time of filter measure value. The long one can enhance the stability of flow display and output digital, and fits for gross add up of pulse flow; the short one means fast respond rate, and fits for production control. It is set by select.

5.3.8 Flow Direct

If users think the direct and design are differ, just change the direct parameter is OK, but not change exciting or signal.

5.3.9 Flow zero

Make sure the sensor is full of flow, and the flow is stillness. Flow zero is shown as velocity of flow, mm/s.



Converter's zero-flow correction displays like this:

Upper small words: FS means measure value of zero;

Lower large words: correction value of zero.

When FS is not "0", make FS = 0. Note: if change the value on next line and FS increases, please change the "+, -" to correct FS to zero.

Flow zero is the compound value of the sensor, and should be recorded in sensor list and band. The unit will be mm/s, and the sign will be opposite with correction value.

5.3.10 Flow cutoff

Flow cutoff is set in percentage of Upper Limit Range of flow, and users can delete all Negligible Small Signals of flow volume, velocity and percentage out of displaying and outputting them. Sometimes user can delete output of current output signal and frequency (pulse) output signal only to have flow, velocity and percentage being displayed.

5.3.11 Total Unit

Converter display is counter with 9 bits, and the max is 999999999.

Integrator units are L, m³、 UKG、 USG (liter, stere,Ukgal,USgal).

Flow integrator value: 0.001L、 0.010L、 0.100L、 1.000L
 0.001m³、 0.010m³、 0.100m³、 1.000m³ ;
 0.001UKG、 0.010UKG、 0.100UKG、 1.000UKG,
 0.001USG、 0.010USG、 0.100USG、 1.000USG。

5.3.12 SegmaN Ena

When “SegmaN Ena” is “enable”, if the flow flows, the sensor will export pulse and current。 When it is “disable”, the sensor will export pulse as “0” and current as “0”(4mA or 0mA) for the flow flows reversals.

5.3.13 Output currents

Output current types can be chosen by users as 1~10mA or 4~20mA practically.

5.3.14 Analog Type

Two kinds of Pulse Outputs are can be chosen: Frequency Output and Pulse Output. Frequency Output is continuous square waveform and Pulse output is a serial wave of square wave. Frequency output is mainly used for instant flow and total integrated flow in short time measurement. Frequency output can be chosen in equivalent frequency unit and volume of integrated flow can be displayed. Frequency Output can be used in long time measurement for total integrated flow with volume units.

Frequency output and pulse output are usually from OC gates so that DC power supplies and load resistors have to be required (See Part 4.5).

5.3.15 Pulse Fact

Equivalent pulse Unit is referred to one pulse for value of flow. The range of pulse equivalent can be chosen:

| | | | |
|---------------------|------|---------------------|------|
| Pulse Equivalent | Flow | Pulse Equivalent | Flow |
|---------------------|------|---------------------|------|

| | | | |
|---|-------------------------|----|--------------|
| 1 | 0.001L/cp | 9 | 0.001USG/cp |
| 2 | 0.01L/cp | 10 | 0.01 USG /cp |
| 3 | 0.1L/cp | 11 | 0.1 USG /cp |
| 4 | 1.0L/cp | 12 | 1.0 USG /cp |
| 5 | 0.001m ³ /cp | 13 | 0.001UKG/cp |
| 6 | 0.01m ³ /cp | 14 | 0.01 UKG /cp |
| 7 | 0.1m ³ /cp | 15 | 0.1 UKG /cp |
| 8 | 1.0m ³ /cp | 16 | 1.0 UKG /cp |

Under the same flow, the smaller pulse, the higher frequency output, and the smaller error will be. The highest pulse output is 100cp/s, and mechanism electromagnetic counter can get 25 frequency/s.

5.3.16 Freque Max

Frequency output range is as the upper limit of flow measure, just the percent flow 100%. Frequency output upper limit can be selected between 1~5000Hz.

The state of empty pipe can be detected with the function of converter. In the case of Empty Pipe Alarm, if the pipe was empty, the signals of analog output and digital output would be zero and displayed flow would be zero, too.

5.3.17 Mtsnsr Ena

The state of empty pipe can be detected with the function of converter. In the case of Empty Pipe Alarm, if the pipe was empty, the signals of analog output and digital output would be zero and displayed flow would be zero, too.

5.3.18 Mtsnsr Trip

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

5.3.19 Alm Hi Ena

Users can choose “Enable” or “Disable”.

5.3.20 Alm Hi Val

The parameter of upper limit alarm is percentage of flow range and can be set in the way of setting one numerical value between 0%~199.9%. When the value of flow percentage is larger than the value of setting value, the converter outputs the alarm signal.

5.3.21 Alm Lo Val

The same as upper limit alarm.

5.3.22 Sys Alm Ena

Selecting Enable will have the function, and selecting Disable will cancel the function.

5.3.23 Clr Sum Key

User use more than 3 byte code to enter , Then set this password in Clr Total Rec.

5.3.24 Snsr Code

It is referred to the produced date of sensor and the serial number of product that can keep the sensors coefficient right and accurate.

5.3.25 Sensor Fact

“Sensor Coefficient” is printed on the Label of the sensor when it is made in factory. The “sensor coefficient” has to be set into Sensor Coefficient Parameter when it runs with converter.

5.3.26 Field Type

S-MAG affords three exciting frequency types: 1/16 frequency (type 1), 1/20 frequency (type 2), 1/25 frequency (type 3). The small-bore one should use 1/16 frequency, and large-bore one should use 1/20 or 1/25 frequency. When using, please select type 1 first, if the zero of velocity is too high, select the type 2 or type 3.

Note: Demarcate on which exciting type, working on it only.

5.3.27 FwdTotal

Positive total volume high byte and low byte can change forthcoming and reverse total value, and be used to maintenance and instead.

User use 5 byte code to enter, and can modify the positive accumulating volume ($\Sigma+$). Usually, it is unsuitable to exceed the maximum the counter set (99999999).

5.3.28 RevTotal

User use 5 byte code to enter, and can modify the negative accumulating volume ($\Sigma-$). Usually, it is unsuitable to exceed the minimum the counter set (99999999) .

5.3.29 PlsntLmtEn

For paper pulp, slurry and other serosity, the flow measure will have "cuspidal disturb", because the solid grain friction or concussion the measure electrode. S-MAG converters use variation restrain arithmetic to conquer the disturbing by designing three parameters to select disturb character.

Set it "enable", start variation restrain arithmetic; set it "disable", close variation restrain arithmetic.

5.3.30PlsntLmtVl

This coefficient can disturb the variation of cuspidal disturb, and calculate as percent of flow velocity, thus ten grades: 0.010m/s, 0.020m/s, 0.030m/s, 0.050m/s, 0.080m/s, 0.100m/s, 0.200m/s, 0.300m/s, 0.500m/s, 0.800m/s, and the smaller percent, the higher delicacy of cuspidal restrain.

Note: when using it, must test for select by the fact, and sometimes it is not the higher delicacy is good.

5.3.31 PlsntDelay

This coefficient can select the width of time of restrain cuspidal disturb and the unit is ms. If the duration is shorter than flow change in some time, S-MAG will think it is cuspidal disturb, and if it is longer, S-MAG will think it is natural. It also needs to select parameter in fact.

5.3.32 User's password 1~4

Users can use 5 grades of passwords to correct these passwords.

5.3.33 Analog Zero

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

5.3.34 Anlg Range

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

5.3.35 Meter Fact


This fact is the special one of sensor-made-factory and the factory use this fact to unite S-MAG electromagnetic flowmeters converters to make sure all the instruments can interchange by 0.1%.

5.3.36 Meter Code 1 and 2

Converter code records the date of manufacturing and serial number of converter.

6. Alarm information

PCB of electromagnetic flowmeters converters uses SMT, so for user, it is unable to service, and cannot open the shell of converter.

S-MAG series Intelligent converters have self-diagnose function. Without trouble of power and hardware circuit, the normal trouble can be alarmed correctly. This information displays  on the left of LCD. The trouble is like this:

FQH ---- Flow high limit alarm; FQL ---- Flow low limit alarm;
 FGP ---- Flow empty pipe alarm; SYS ---- System exciting alarm.
 UPPER ALARM ---- Flow high limit alarm;

LOWER ALARM ---- Flow empty pipe alarm;

LIQUID ALARM ---- Flow empty pipe alarm;

SYSTEM ALARM ---- System exciting alarm.

II Electromagnetic flowmeter Installation

1. The installation site selection

In order to make the sensor reliable and steady work, please pay attention to the following requirements when choose the installation location:

(1) try to avoid magnetic objects and has strong phenolic

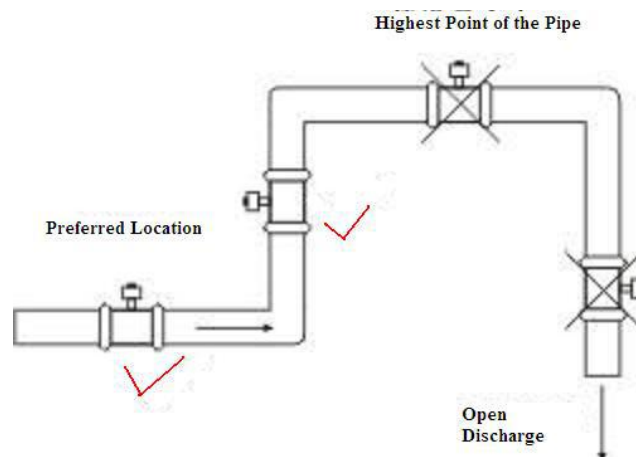
water factory equipment (such as big motor, big transformer, etc), in order to lest affect the work magnetic field of sensors and flow signal.

(2) it should be possible installed in dry and ventilated place, not installed in damp, easy seeper place.

(3)it should try to avoid exposed to the sun and rain, avoid the environment temperature more than 60 °C and relative humidity is more than 95%

(4)it choose to easy to maintenance, and activity convenient place

(5) the flowmeter should be installed in the water pump back end, not installation the suction side; The valve should be installed in downstream side of the flow.



2. Installation requirements

In order to let you can correct measuring, please be pay attention to the following requirements when choosing the line position.

(1) the sensor not only installed in the straight pipe, but also can be installation the in level or tilted pipe, but the required of the center of two electrode attachment on the horizontal state

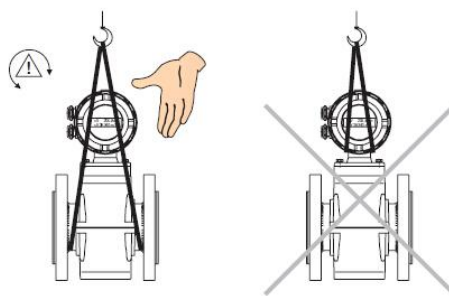
(2) the medium in the installation position should be full pipe flow, avoid not full pipe and gas attached to the electrode.

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

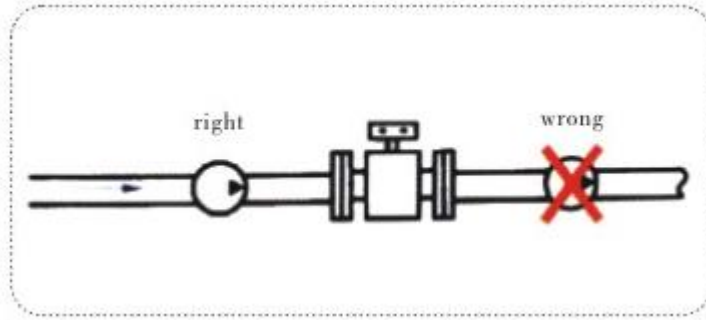
(4) when the flow meter installation position with not full medium, it can raise the end pipeline of the flowmeter, and make its full tube, forbidden in peak and outlet pipe installation flowmeter

(5) Modify piping installation method: when the medium velocity out of requires, it should choose a small caliber flow meter, and should use different caliber taper pipe or modify the sections of pipe, make its same caliber with sensor, but before and after straight pipe section at least requirement the before straight pipe section ≥ 10 DN, after straight pipe section ≥ 5 DN (DN for pipe diameter)

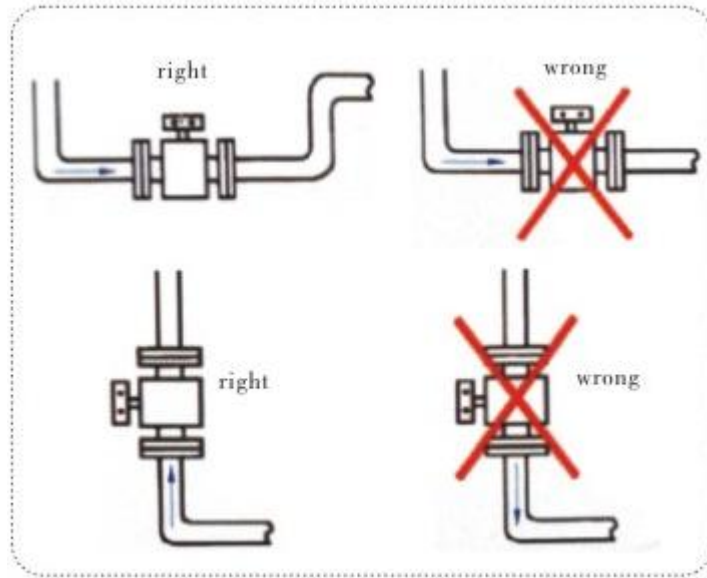
(6) Before and after straight pipe section for the flowmeter , before pipe section ≥ 10 DN, after pipe section ≥ 5 DN



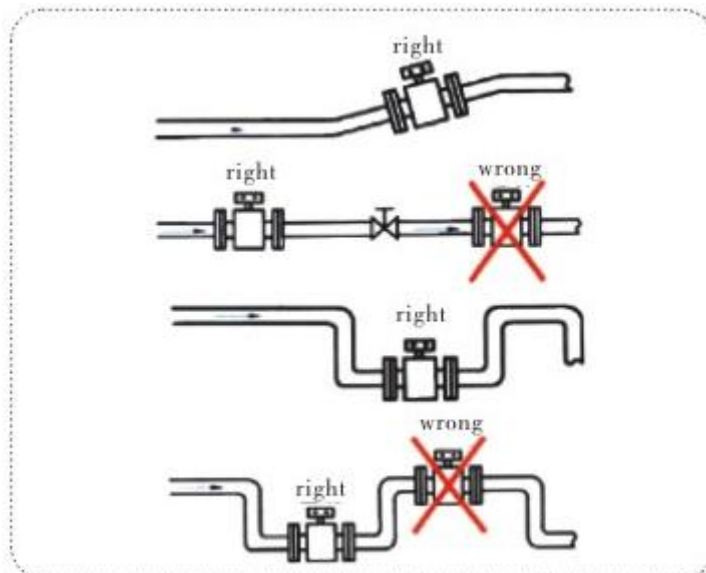
Right Suspending



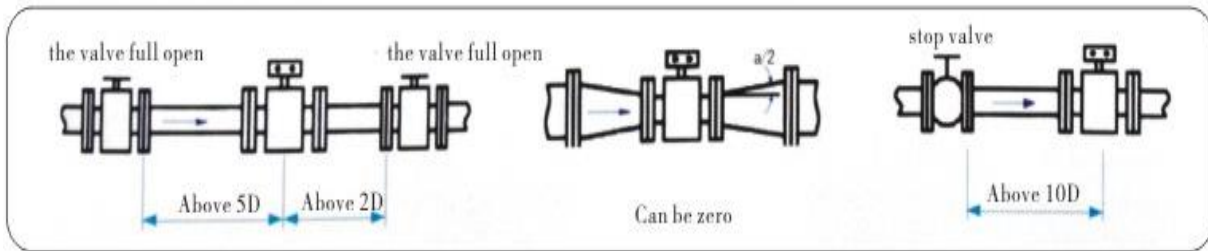
Can't be installed at the pump side



Pipe must be full of Medium



Avoid air bladder



Straight Pipe Requirement

3. The instrument connection

★ If choose the signal of remote version connected, the cable must be use the customized special cables, and the cable shorter the better

★ Excitation cable can choose Yz medium rubber cable, and the length same as signal cable

★ Signal cable must be strictly separate with others power supply, and can not laying in the same pipe inside.

★ Signal cable and excitation cable should choose the shorter as soon as possible, and it can't coil together with the redundant cables, it should cut off the redundant cables, then rewelding the connector

★ when cable mediate sensor interface, in port place to make U, it will prevent the rain penetration to the sensor.

III. Troubleshooting

7.1 No display:

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

7.2 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.

7.3 Empty pipe alarm

- * If measured fluid full of testing pipe of sensor;
- * When shorting circuit three connectors SIG 1, SIG 2, SGND of converter, and no "Empty Alarm" displayed then the converter works OK. In this case, it is possible that conductivity of measured fluid may be small or empty threshold of empty pipe and range of empty pipe are set wrongly.
- * Check if the signal cable is OK;
- * Check if the electro-poles are OK or not.

Let the flow is zero, then the displayed conductivity should be less than 100%.

Resistances of SIG1 to SGND and SIG2 to SGND are all less than $50k\Omega$ (conductivity of water) during measurement operation. (It is better to test the resistances by means of multimeter with pointer to see the charging process well.)

- * The DC voltage should be less than 1V between DS1 and DS2 testing the voltage by means of multimeter. If DC voltage is larger than 1V, the electro poles of sensor were polluted that have to be cleaned.

7.4 Measure flow disallow

- * If measured fluid full of testing pipe of sensor;
- * Check if the signal cable is OK;
- * Check the sensor modulus and sensor zero whether set as the sensor escutcheon or leave factory checkout.

7.5 Flow measurement inaccuracies

- * Measuring fluid sensor tubes are filled;
- * Signal cable is connected properly;
- * Check the sensor coefficient, whether the sensor zero calibration sensor plate or single factory settings

IV. Warranty Period

- When the warehouse storage, should be placed on a dry, ventilated, non-corrosive gases, bad ambient temperature in the range of 0-40°C and relative humidity less than 85% of the sites.
- This company for the products implement 3 packets, the warranty period is a year (from the factory date). During the warranty period, users keep product use, storage and transportation regulations, under the condition of products such as quality problems(not man-made), the company responsible for free repair or replacement.

Appendix One: Selection of exciting frequency(Reference)

S-MAG afford three exciting frequency types: 1/16 frequency (type 1), 1/20 frequency (type 2), 1/25 frequency (type 3). The small-bore one should use 1/16 frequency, and large-bore one should use 1/20 or 1/25 frequency. When using, please select type 1 first, if the zero of velocity is too high, select the type 2 or type 3.

In the user's sensor that S-MAG gives, often the sensor is not fit for the S-MAG converters, at this time can do like this:

(1) Small exciting loop resist

If the exciting loop resist is smaller than the sensor's request, can series resist to get the total value. The series resist's power should be more than one time of fact, for example, series 10Ω on 250mA current, the power will be 3W.

(2) Large exciting loop resist (change exciting current)

If the exciting loop resist is larger than the sensor's request, can change the exciting current, for example, if exciting loop resist is 70Ω, for 250mA this is larger, so can change the current to 187mA.

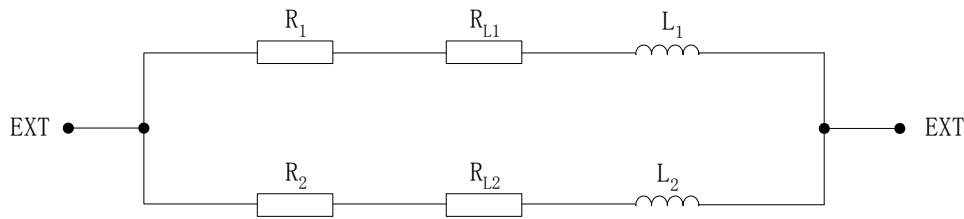
(3) Large exciting loop resist (change loop connect)

If the exciting loop resist is larger than the sensor's request, can change the connect of loop, for example, if exciting loop resist is 200Ω, every exciting loop resist is 100Ω, parallel connection the upper and lower loop is OK.

According the analysis, change the connect of exciting loop, measure from either head of exciting loop,

Total resist = $(R_1 + R_{L1})$ parallel connection $(R_2 + R_{L2}) \leq 120\Omega$;

(As the Fig. R_1, R_2 ---addition resists; R_{L1}, R_{L2} ---exciting resists)



Total resist = $(R_1 + R_{L1})$ parallel connection $(R_2 + R_{L2}) \leq 120\Omega$;

(as the Fig. R_1, R_2 ----addition resists; R_{L1}, R_{L2} ----exciting resists)

(4) Sensor exciting current steady time so long (inductance is too large)

For this question, firstly changing exciting type, select 1/16 or 1/25 frequency.

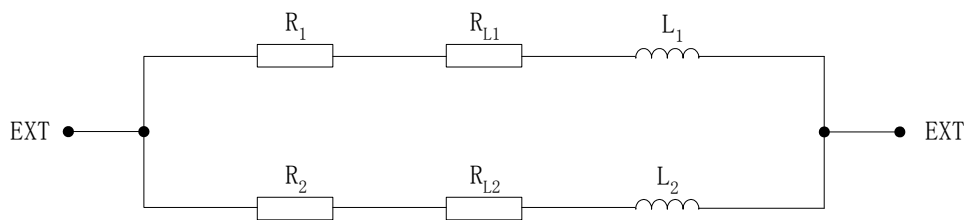
If cannot content, change connect of exciting loop.

$$\text{Exciting current transition time } \tau = L / R$$

L ---- Exciting loop inductance; R ---- exciting loop resist.

So decrease L and increase R both can decrease τ .

According the analysis, change the connect of exciting loop, measure from either head of exciting loop,



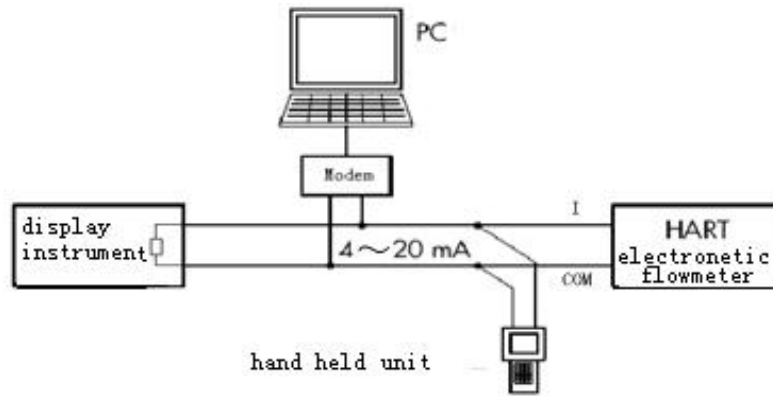
Total resist = $(R_1 + R_{L1})$ parallel connection $(R_2 + R_{L2}) \leq 120\Omega$;

(As the Fig. R_1, R_2 ----addition resists; R_{L1}, R_{L2} ----exciting resists)

Appendix Two: HART function explanation(Reference)

1. HART Bus network fig

HART Bus transfers data-signal through signal line which value is from 4 to 20mA. For this reason, it can save local data communication line and implement data communication. Its adaptive for local using. The local network fig composed by HART Bus is as follows:



2. Instruction for setting of the converter

1. If you use the handset of our company, you need to set the meter address to 1 and set the baud rate to 4800;
2. If you use other handset such as 375 or 275, you need to set the meter address to 2 and set the baud rate to 4800;
3. If the communication mode, the address or the baud rate of the meter is not set correctly, the handset can't set the parameters.

3. Matters need attention of HART using function meter

- 1) Load which is parallel connection between electrical flowmeter and Hand held unit and HARTMODEM is on polarity.
- 2) Resistance of circuit should be greater than 200Ω, less than 500Ω.
- 3) Hand held unit and HARTMODEM shouldn't be connection in series in current circuit.

Appendix Three :B series with nonlinear amendment function Additional Instruction

Nonlinear amendment function, in principle is used for line regulation of low flow which under 0.3m/s. The function is designed to four amendments, and divided into four flow velocity points and four correction factors.

Nonlinear amendment coefficient works on the basis of the original transducer calibration coefficient, so please close nonlinear amendment function before calibrating the transducer coefficient, and open the function to realize nonlinear amendment after calibrating. Set correction points and correction factors according to the nonlinear segment of transducer, if be the appropriate settings, do not have to recalibration.

As a rule, the flow velocity which calculated form transducer coefficient is called original flow velocity, and the other which gained from non-linear amendment is called correction flow velocity. The relationship between them is shown as following:

a. Correction point 1 > Original flow velocity \geq Correction point 2:

$$\text{Correction flow velocity} = \text{Correction coefficient 1} \times \text{Original flow velocity}$$

b. Correction point 2 > Original flow velocity \geq Correction point 3:

$$\text{Correction flow velocity} = \text{Correction coefficient 2} \times \text{Original flow velocity}$$

c. Correction point 3 > Original flow velocity \geq Correction point 4:

$$\text{Correction flow velocity} = \text{Correction coefficient 3} \times \text{Original flow velocity}$$

d. Correction point 4 > Original flow velocity \geq 0:

$$\text{Correction flow velocity} = \text{Correction coefficient 4} \times \text{Original flow velocity}$$

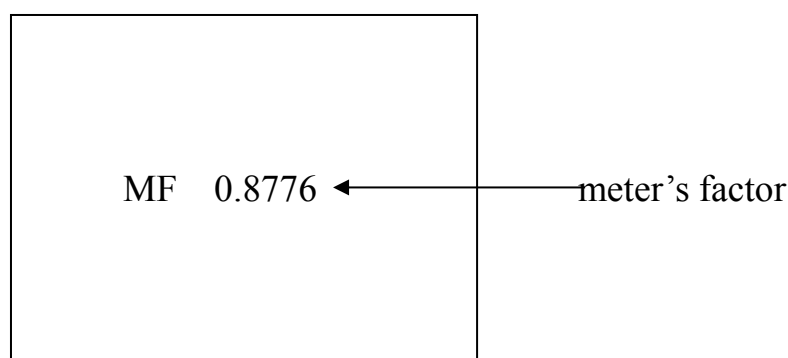
Notice: Correction points must satisfy the following relationship:

$$\text{Correction point 1} > \text{Correction point 2} > \text{Correction point 3} > \text{Correction point 4}$$

The intermediate value of correction coefficient is 1.0000 , when bigger than it is considered as positive coefficient (increase), and smaller is considered as negative coefficient (decrease).

Appendix Four: The function of protecting the Characteristic Flow Factor

S-MAG converter has a function of protecting the Characteristic Flow Factor. The key content is that the factor could not be modified easily. S-MAG converter increases a new function to record the modified procedure and modified times of flow zero, sensor factor, and meter factor, any change of these three factors could be recorded. The sensor factor and modifying times could be recorded in Test Report, and when next time testing the factor in Test Report and factor in the convertor are compared to check whether the Characteristic Flow Factor has been changed. The detail about the Characteristic Flow Factor protection function can be found in the appendix.



SF 0.5820 ← Characteristic' multiply
SZ +.0003 ← flow zero
time → MR=00058 SR=023 ← number

Attention!

The last record is displayed when this item is first entered, if you want to browse the history records press “down key”, and could search for the last record to the thirty-two record ahead. Finally the times of record modified (MR) should be written down on the paper before next time test.