S-MAG-MINI

Misuratore di portata elettromagnetico

Informazioni tecniche e manuale operativo

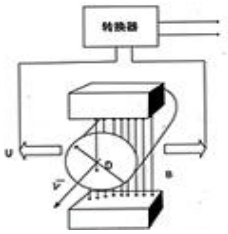
Mini Electromagnetic

CONTENT

I. Magnetic Flow Meter Sensor

1.1 Working Principle

Electromagnetic flow meter works on Faraday's Law, Pic 1：



Pic 1. Working Principle

According to this principle, when conductive medium passes through a magnetic field B, Voltage E is generated which is proportional to the velocity V of the medium, the density of the magnetic field and the length of the conductor.
In a magnetic flow meter, current is applied to wire coils mounted within or outside the meter body to generate a magnetic field. The liquid flowing through the pipe acts as the conductor and this induces a voltage which is proportional to the average flow velocity. This voltage is detected by sensing electrodes mounted in the mag flow meter body and sent to transmitter which calculates the volumetric flow rate based on the pipe dimensions.

E is generated voltage

E=BVD （1）

B - magnetic field strength

D - length of the conductor

V - velocity of the conductor

$$Q = \frac{\pi D^2}{4} V \qquad (2)$$

from（1）to（2）

$$Q = \frac{\pi D}{4B} E = KE$$

K is meter constant

Thus the volume flow rate is proportional to the induced EMF. In practical applications we have to enter the meter constant “K” value in magnetic flow meter which is available in vendor catalogue/manual

1.2 Main Features and Application

The mini electromagnetic flow meter is mainly to measure various acid alkali and salt solution which can be electric and measure the volume flow of solid - liquid binary fluid. It’s mainly used in beverage, sugaring and medicine.

Main features of sensor：

（1）No moving parts, no mechanical loss, small size；

（2）Simple structure， no moving parts， no pressure loss；

（3）Adopt low frequency square wave exciting, good anti - interference， stable zero point；

（4）Measurement can’t be affected by physical parameters, like pressure, viscosity, temperature, density, etc.

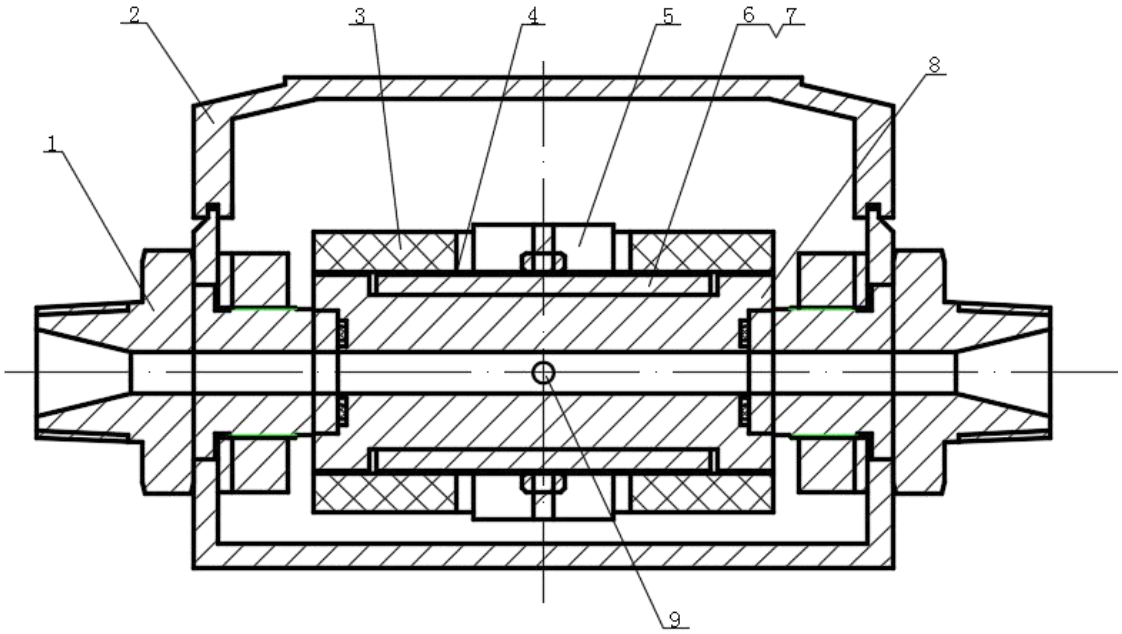
（5）Sensitive respond， Output Signal and flow are linear relation.

（6）Medium just contact with measuring tube and electrode, the flow meter has good anti-corrosive and wear-resisting performance.

（7）Low power consumption， <10VA.

（8）It is convenient when install, use and maintain.

1.3 Structure



Pic 2

① Connector	② Shell	③ Excitation Coil
④ Pole Shoe	⑤ Pole Shoe	⑥ Bracket Plate Assembly
⑦ Fixed Block	⑧ Measuring Tube	⑨ Electrode-assembly

Sensor structure as pic 2, components as follows：

（1）Measuring Tube: material is PEEK, measuring tube and connector are sealing joint.

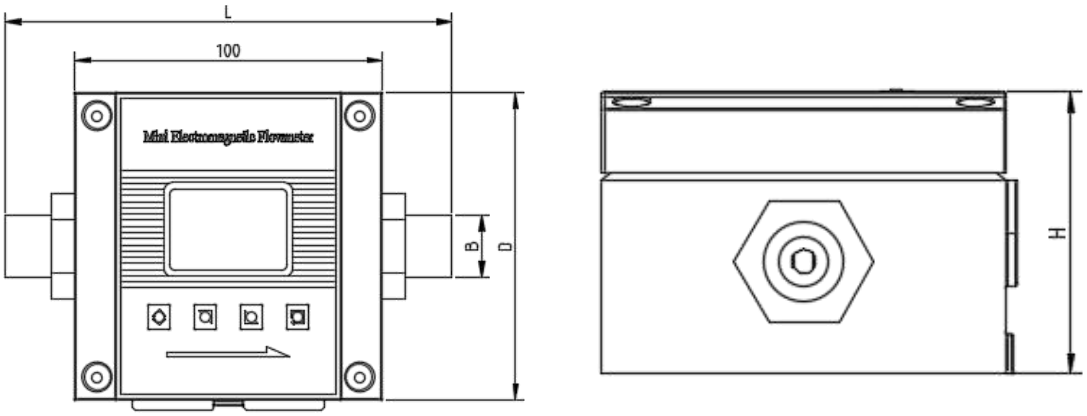
（2）Exciting system: ensuring tube are twined by coils which can produce working magnetic field.

（3）Electrodes components：two electrodes are installed A pair of electrodes are mounted on the wall of a measuring tube perpendicular to the magnetic line of force ,which can detect flow signal, material of electrodes can be adopted according to the property of medium, electrodes components are consisted of electrodes,spring washer, insulating sleeve, fixing nut, Fixed thread.

（4）Shell：Project and seal

1.4 Dimension of Sensor

Caliber (mm)	Nominal Pressure（MPa）	Dimension			
		L	D	H	B
3	0.6~1.6	135	100	70	G 3/8"
6		145			G 3/8"
10		145			G 1/2"
15		155			G 1/2"



1.5 Flow Range

DN（mm）	Flow Range（L/min）		External Thread
	Standard	Special	
3	0.2~2	0.2~4	G 3/8”
6	0.8~8	0.8~16	G 3/8”
10	2~20	2~40	G 1/2"
15	5~50	5~100	G 1/2"

1.6 Installation

If electromagnetic flow meter can’t be installed properly, accuracy will be affected evidently and it won’t work seriously, please read the user manual before install.

1）Installation Method

Sensor is installed by thread, please make sure the center of sensor keep corresponding with center of pipe and connect bottom line well, otherwise, it will cause error.

2）Select Installation Condition

Please notice when install.

（1）Installed at dry ventilation, don't install at stagnant water；

（2）Avoid the sun and rain, make shelter when installed at open-air.

（3）Avoid strenuous exercise；

（4）Avoid strong electromagnetic equipment: big power-generator and big voltage changer.

（5）Easy to maintain place.

3）Installation place

Please note when sensor is installed at pipe

（1）Flow direction is labeled on the sensor should be in accordance with liquid flow direction.

（2）The measuring tube should be fulled with medium.

（3）There is at least 5D straight length in the upstream and at least 3D in the downstream.（from the center of sensor， D is bore size of sensor).

（4）When the pipe size is not in accordance with sensor, expansion pipe or reducing pipe should be installed at the ends of sensor, continuity of expansion pipe or reducing pipe is less than 15°.

（5）Sensor should be installed in the horizontal direction, bubbles won't attach electrodes to cause converter input to open and precipitates won't attach electrodes to cause zero drift.

（6）Vertical installation is better for solid - liquid binary fluid, medium will be bottom-up when it's vertical installation which make sure the measuring tube is filled up medium.

1.7 Grounding

The flow signal which sensor produce is very small, it's just several millivolt, so it's very important that sensor is good grounding. Followings are requirements on grounding:

1）If we analysis from the working principle of electromagnetic Flow meter and the Loop of flow Induction signal, the grounding of sensor and converter must be in same isopotential point.

2）Grounding lead of sensor can't be connected with power -generator or common grounding lead of other equipment, grounding resistance should be less than 10Ω.

3）Grounding ring, grounding flange or nipple with grounding electrode should installed when sensor is installed in PVC or insulating lining pipe.

4）Grounding ring or grounding flange should be installed at the ends of sensor when sensor is installed in cathodic protection pipeline.

1.8 Pre-operational Preparations

After mini electromagnetic flow meter is installed and wiring, it should be checked on installation and wiring strictly before running.

Notice： The flow meter is delivered after strict examination, tested flow calibration and passed inspection, it can be used without any adjustment. If you encounter problems, please inspect one by one, analyse carefully to make trouble clear.

Do as follow：

1）Please open valves set in upstream and downstream to make sure the measuring tube is filled up medium.

2）The wiring is correct if the instrument shows that the value immediately rises to a certain value after power on for a minute. If the flow direction is wrong, please check if the installation direction is correct.

3）zero correction, close the downstream valve after the medium runs 15 minutes, then close the upstream valve to make sure the medium is static and no leakage, the flow is zero. If the zero point is upper or lower, please correct zero point.

1.9 Trouble shooting

Mini electromagnetic flow meter don't need to be maintained regularly, but the in wall and electrodes should be cleared regularly if the medium is apt to attach in wall and electrodes. Please clear dirt carefully, don't damage liner and electrodes.

1.10 Complete Set

Please check if package is sound after open, if sensor model and specification are in accordance with sales contract, if the document is complete.

Packing list	1
Mini electromagnetic flow meter user manual	1
Certificate	1

1.11 Warranty

Customers use mini electromagnetic flow meter according to transport, installation and technique requirements completely and found it not in accordance with technique standards If it's within 12 months, after the flow meter is delivered from factor, flow meters can be returned to us and we will fix it for free.

1.12 Transport and Storage

Please keep original condition after custom receive goods, to keep it undamaged, please store it in the required indoor.

1）Ventilation, rain, moisture, indoor air should not contain corrosive harmful substances

2）No shock

3）Temperature is 0-40°C

4）Humidity is less than 85%

1.13 Order Notes

Please refer to selection model according to measured medium and measuring condition.
Please make sure：

1）Model and measured flow range. Flow range should be larger than real flow value， make sure the normal flow exceeds chosen flow range by 50% to get better accuracy.

2）The working pressure and temperature of flow meter must meet the pressure and temperature of the medium.

3）The electrodes and measuring tube should be anti-corrosive。Customers should choose right model according to medium.

4）Please note if you need matching couple flanges.

1.14 Selection of Electrode Material

The performance of electrode material

Material	Performance
SS 316L	Applicable in water,sewage and corrosive mediums. Widely used in industries of petrol, chemistry, carbamide, etc
Hastelloy C	Be resistant to oxidable acid such as nitric acid,mixed acid as well as oxidable salt such as Fe+++,Cu++and sea water
Titanium	Applicable in seawater,and kinds of chloride,hypochlorite salt,oxidable acid(including fuming nitric acid),organic acid,alkali etc.Not resistant to a pure reducing acid(such as sulphuric acid,hydrochloric acid)corrosion.Acid contains antioxidant(such as Fe+++,Cu++) will greatly reduce corrosion.

II. Magnetic Flow Meter Converter

2.1 Features and Main Application

2.1.1 Features

- Programmable low frequency square wave field excitation, improving measurement stability and reducing power consumption
- Implementing 32 bits MCU, providing high integration and accuracy
- Full-digital processing, high noise resistance and reliable measurement
- Low EMI switching power supply, providing wide mains range adaptability, high efficiency and low temperature rising
- User-friendly operation interface
- High definition LCD display with backlight and -20℃ - +60℃ temperature range
- Forward and reverse measurement
- Three independent 10-digit totalizer: forward, reverse and net totalizer, convenient for

metering or billing

- RS485 interface supporting up to 2km distance at 14400 bps communication
- Intelligent empty pipe detection and electrodes resistance measurement diagnosing empty pipe and electrodes contamination accurately.
- Implementing 'Rate-Of-Change Limit' technology to eliminate sharp electrical noise contained in the flow signal and stabilize the display and outputs
- Totalizer remote control function, providing a contact for starting and stopping totalizing which is convenient for calibration synchronization or batch processing
- System self-diagnosis function
- Non-volatile memory, securing parameter settings and measurement data
- Optional real-time clock, power-failure and history data logging function ,storing up to 30 days measurement records
- Two versions available: remote and compact

2.1.2 Main Applications

The converter and sensor form measuring unit. The flow meter can measure medium with when velocity 15m/s, the converter can be used to measure medium which conductivity can be 5us/cm min. And velocity can be up to 15m /s. It can be widely used various industries

- Chemistry
- Metallurgy
- Water supply and drainage
- Irrigation
- Food and beverage industry
- Pharmaceuticals industry

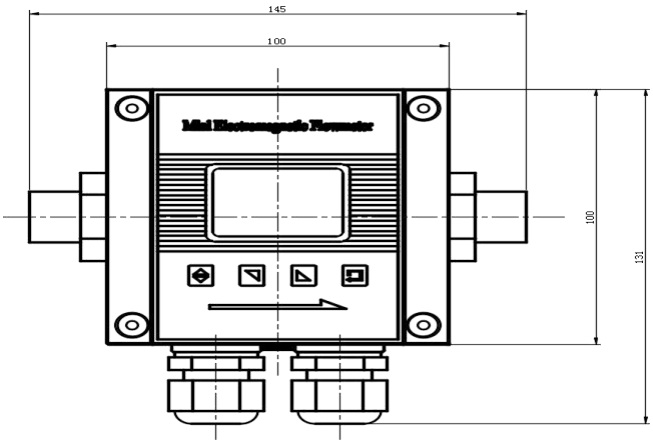
2.1.3 Normal Working Condition

- Ambient Temperature：-10~55°C；
- Relative Humidity：5%~90%；
- Power Supply：AC 85~265V，45~63Hz, DC 16~30V；
- Power Consumption：＜15W (including sensor)

2.1.4 Test Reference Condition

- Ambient Temperature：20°C±2°C
- Relative Humidity：45~85%
- Power Supply：220±2%
- Frequency：50Hz±5%
- Harmonic content：<5%
- Warming-up Time：30min

2.1.5 Outline Overall and Installation Size



2.2 Index of Technical Performance

The converter complies with"JB/T-9248-2015 Electromagnetic Flow Meter"Standard.

2.2.1 Nominal Size（mm）

3,6,10,15

2.2.2 Measured Flow Range

The velocity can be 0.3m/s~15m/s, low limit flow and be 1% of up limit flow.

2.2.3 Accuracy

Caliber size (mm)	Flow range (m/s)	Accuracy
3~15	<0.3	±0.25%FS
	0.3~1	±1.0%R
	1~15	±0.5%R
%FS：for relative ranges；%R for relative value of measurement		

2.2.4 Repeatability Error

Repeatability error <±0.1%

2.2.5 Current Output

a）Current output signal: isolating 0~10mA/4~20mA.

b）Load resistor: 0~10mA，0~1.5KΩ；4~20mA，0~75Ω。

c）Basic Errors： 0.1%±10μA

2.2.6 Frequency Output

Frequency output range: 1~5000Hz. Frequency output is OC gate output of transistor collector with photoelectric isolation, the highest subjected voltage is 35VDC, maximum output current is 50mA.

2.2.7 Pulse Output

Pulse output range: 5000cp/s. pulse pulse equivalency is by volumetric.

Pulse output pulse equivalency: 0.0001L/p, 0.001L/p, 0.01L/p, 0.1L/p, 1.0L/p, 2L/p, 5L/p, 10L/p,

100L/p, 1m^3/p, 10m^3/p, 100m^3/p and 1000m^3/p.
Pulse output width: Automatic, 10ms, 20ms, 50ms, 100ms, 150ms, 200ms, 250ms, 300ms, 350ms and 400ms.

2.2.8 Direction Indication /Range Indication Output

Electromagnetic flow meter can measure flow in forward and reverse direction. Frequency output is OC gate output of transistor collector with photoelectric isolation, the highest subjected voltage is 35VDC, maximum output current is 50mA. If adopt internal 12V power supply, 0VDC low level for forward flow direction and +12VDC high level for reverse flow direction.

2.2.9 Alarm Output (Optional, need special order)

Output isolate: photo electricity isolate. Isolate voltage > 355VDC, max output current is 50 mA. Alarm output junction: ALMH - upper limit, ALML - lower limit.

2.2.10 Serial Communication

Standard configuration is non - isolated type RS232 or RS485 Serial communication interface . Fully isolated type RS232C or RS485 is available, support RTU-MODBUS.

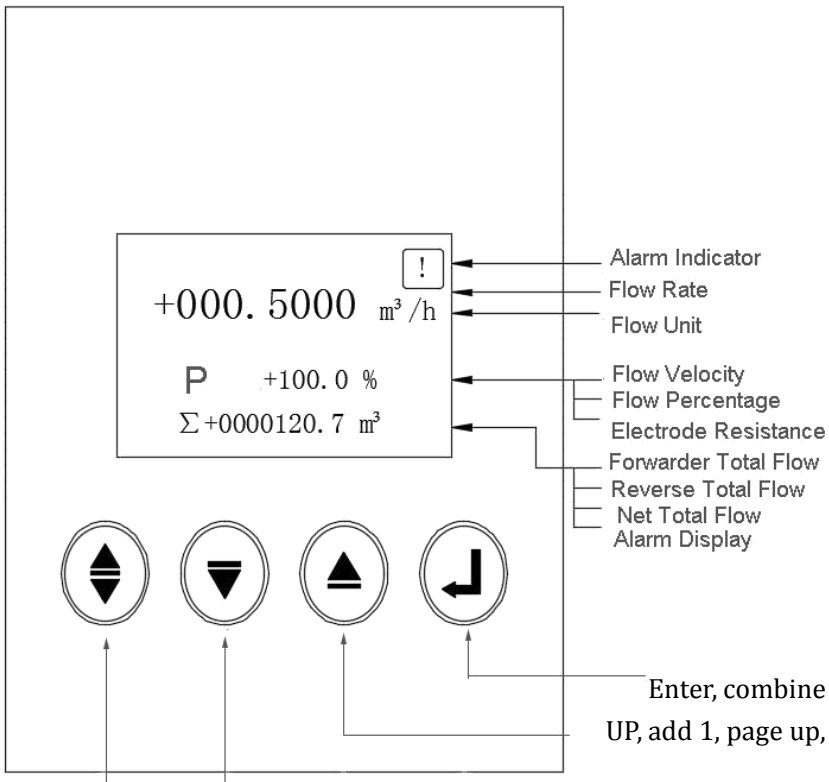
2.2.11 Flow Response

0.2~100s

2.2.12 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 than500V.
Insulated voltage between simulated input 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.

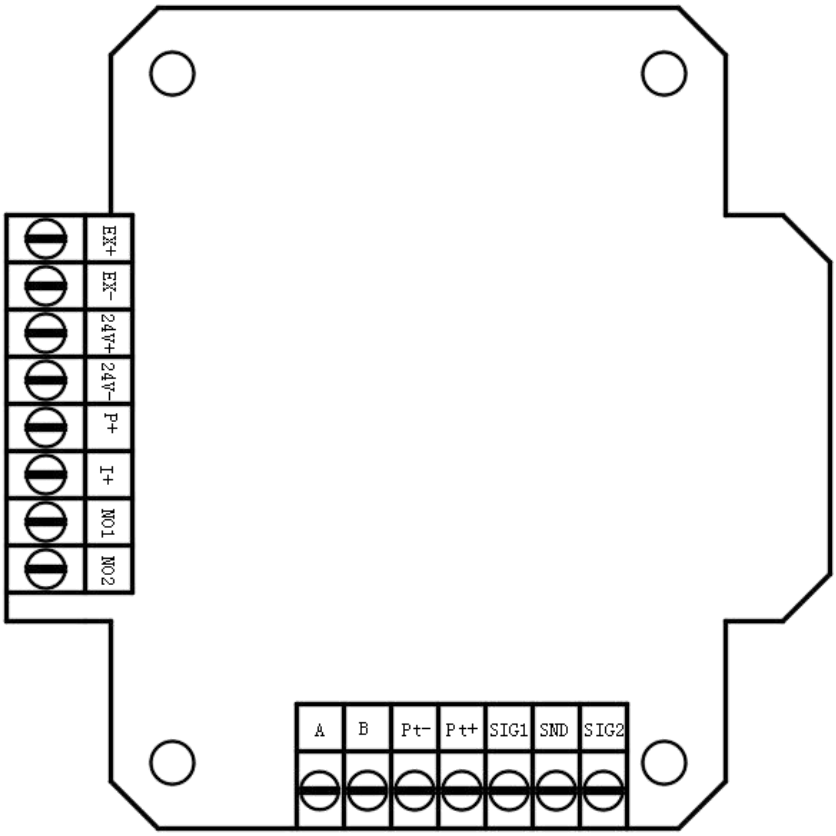
2.3 Key and Display



⚠ Note：Press “ ”, then press“ ”, and then input password when password status “0000”can be seen， key in password, then press“ ” and enter operating menu to set parameter.

Press“ ” for 3 seconds to return running status.

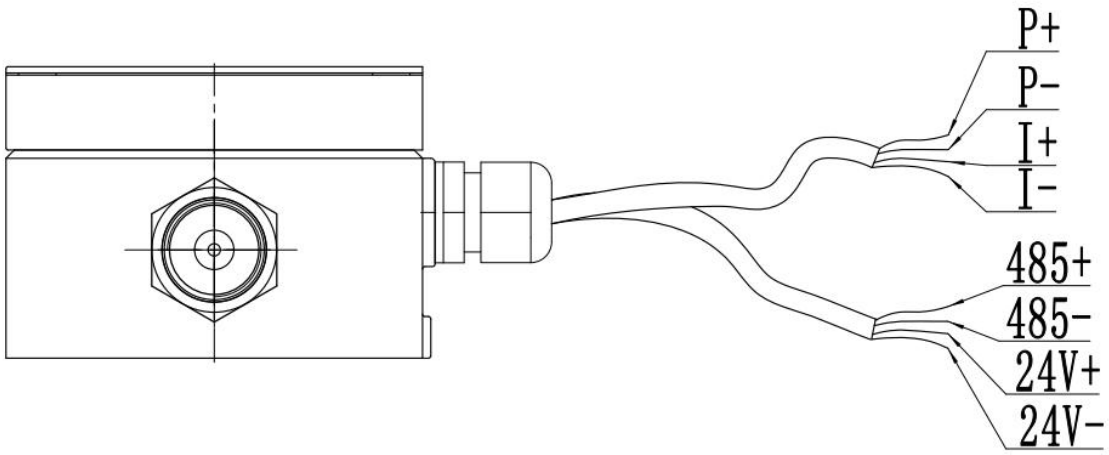
2.4 Connection Terminals and Signs of the Converter



Labels of connectors

EX+	Exciting currency +
EX-	Exciting currency -
24V+	DC power +
24V-	AC power-/Output（COM）
P+	Frequency（pulse）output +
I+	Passive analog current output -
NO1	Port of relay open contact 1 OC gate+ (Reserved)
NO2	Port of relay open contact 2 OC gate- (Reserved)
A	RS485+
B	RS485-
Pt+	Thermal resistance+ (Reserved)
Pt-	Thermal resistance- (Reserved)
SIG1	Signal output +
SND	Grounding
SIG2	Signal output -

2.5 Labels and Connection of Signal Lines



Conductor shielded cable：

24V+	Power Cable
24V-	
P+	Pulse Output
P-	
I+	Current Output
I-	
485+	RS485
485-	

2.5.1 Cable for Flow Signal

When the conductivity of the fluid to be measured is greater than 50μS/cm, RVVP2×32/0.2 PVC cable with shielding net can be used for flow signal transmission and its length should not exceed 100 meters. Signal cable wiring is shown in Fig 2.3.

To reduce the effect of capacitive distribution of cable, the converter provides equipotential shielding drive. When the conductivity is less than 50μS/cm or for long distance transmission, two-core double equipotential shielding cable, e.g. STT3200 or BTY signal cable, is strongly recommended.

2.5.2 Exciting current cable

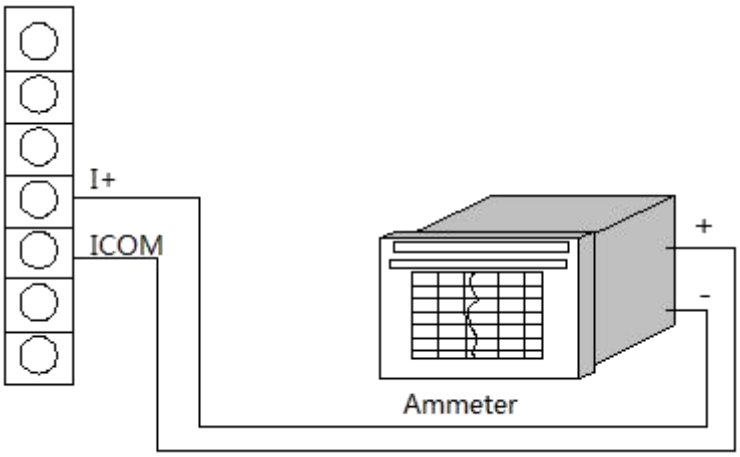
Two conductor and insulating rubber- covered cables can be used as exciting current cables. Suggested model is YHZ-2×1mm 2 . Length of exciting current cable should be equal to that of signal cable. When the model STT3200 cables are used for exciting current and signals, two cables can be put together as one cable.red and yellow core wires can be exciting current.

2.5.3 Power Cable

Two conductor and insulating rubber- covered cables can be used as exciting current cables.
Suggested model is YHZ-2×1mm 2
Cable should be connected to port“24V±”for Ac power supply converter.
If DC power supply, cable resistance is relative with voltage, please pay attention to it. Resistance should be less than 10Ω for 24V DC, resistance is determined by length and cross-section of cable.

2.5.4 Current Output Cable

If adopt current output（like 4～20mA）, the total resistance of loop conductor and load resistance should be less than 600Ω, ICOM is port of 24V-, see pic 7



Pic 7 Current Output Wiring（Active Output）

2.5.5 Wiring of Digital Output

Outputs of frequency (pulse), high/low alarm and flow direction indication are transistor open collector (TOC) output. External power supply and loads are needed when applying, refer to Fig 8

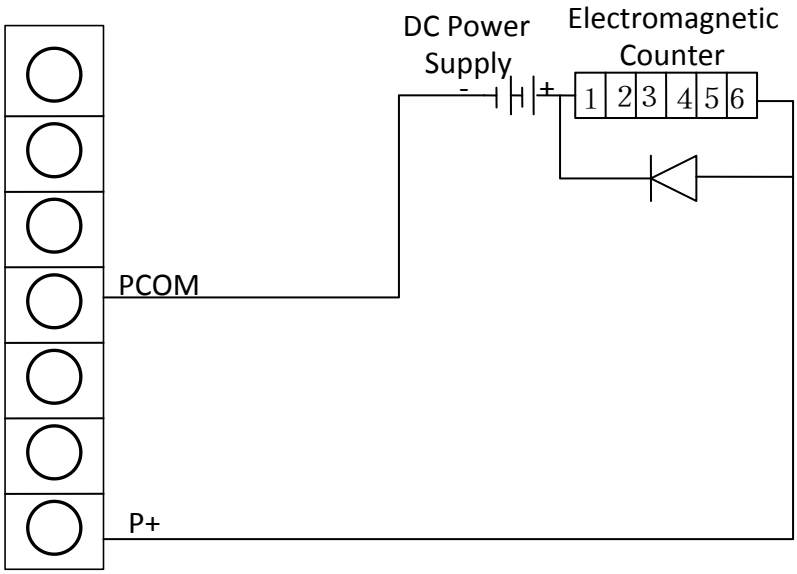


Fig 8 (a) Example of electromagnetic counter connection

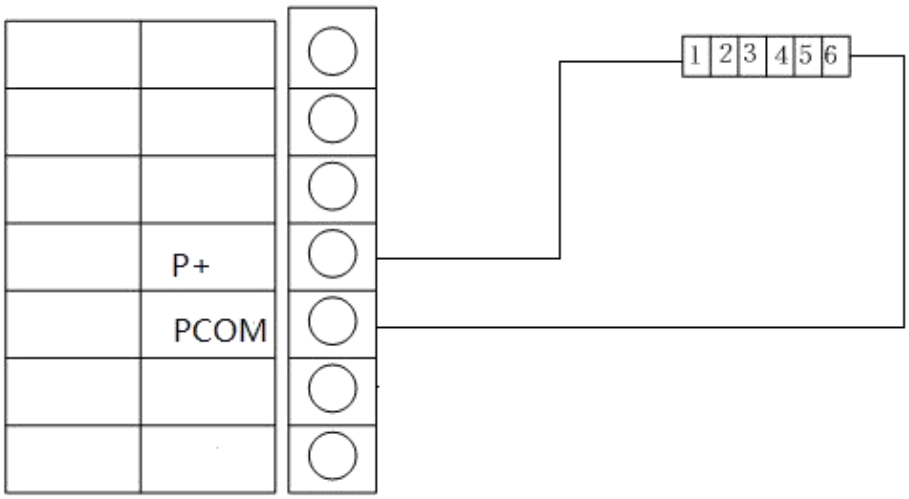


Fig 8 (b) Example of electrical counter connection

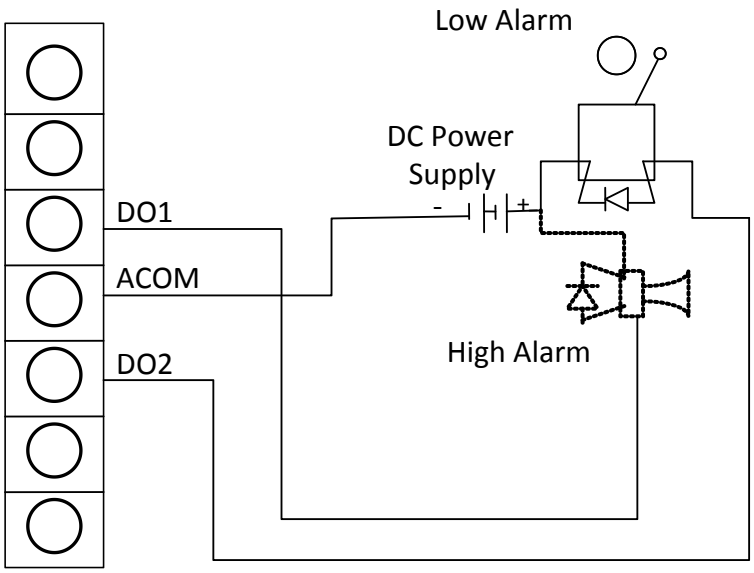


Fig 8 (c) Example of alarm output connection

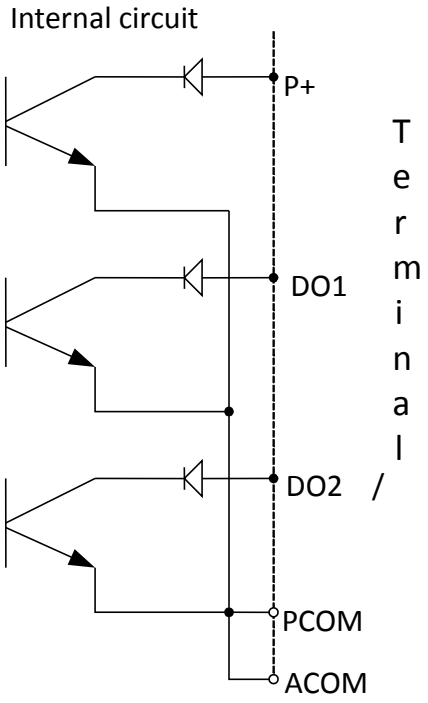
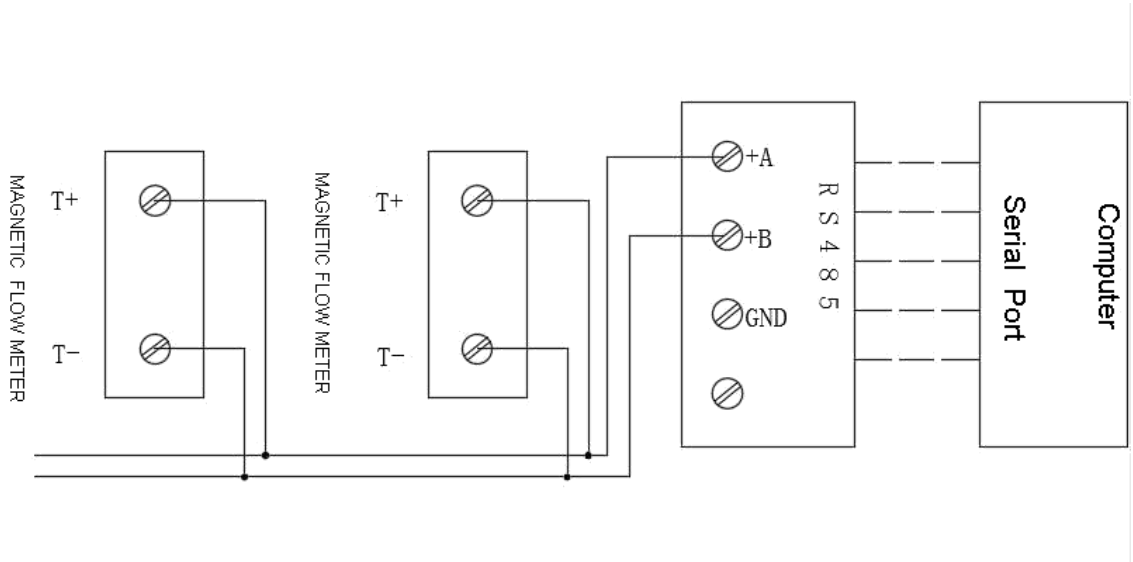


Fig 8 (d) Example of transistor open collector connections

2.6 Digital Communication Interface and Wiring

RS-485 interface： Designed as per IEEE RS-485, standard configuration is non-isolated type, photoelectric isolated type is available, support RTU - MODBUS.



RS485 wiring of converter

2.7 Grounding

⚠Contact area of copper Connector PE on Converter Cabinet for grounding should be larger than 1.6mm 2 .Contact resistance should be less than 10Ω.

2.8 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.

2.8.1 Frequency Output

Frequency output range corresponds the percent of flux：

f (Hz) =（measure value/full scale value）× frequency range= percent flux × frequency range

The up limit of frequency output can be adjusted. Frequency output range can be 0～1000Hz or 0～5000Hz, etc.

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

Eg：Flow range = 100m3/h, instantaneous flow = 28.27m3/h, frequency range = 2000Hz,

So：percent flux =（instantaneous flow/Flow range）×100 =（28.27/100）×100 = 28.27 %

f =（instantaneous flow /flow range）× frequency range =（28.27/100）×2000 = 565.4 Hz

f = percent flux × frequency range= 28.27% ×2000 = 565.4Hz

2.8.2 Pulse Output

As mentioned above, pulse output is often used for metering. To avoid losing pulse count, it is important to select proper pulse factor and pulse width according to the application.

At a certain flow rate, more pulse counts and higher accuracy are obtained in a same period if higher pulse factor is chosen. The counter, however, may overflow in a short time of period. If low pulse factor is chosen, fewer pulses are output and the same counter lasts longer.

If electromagnetic counter is used, attention should be paid to choose proper pulse width. The counter may consume a lot of power with large pulse width, while lose count with small one.

The pulse output differs from the square wave frequency output. The pulse series may not be uniform. To measure pulse, therefore, it is better to choose counter instead of frequency meter.

2.8.3 Terminals for Frequency/Pulse Output

P+: Frequency/pulse output + (internally powered by DC24V)
PCOM: Frequency/pulse output -

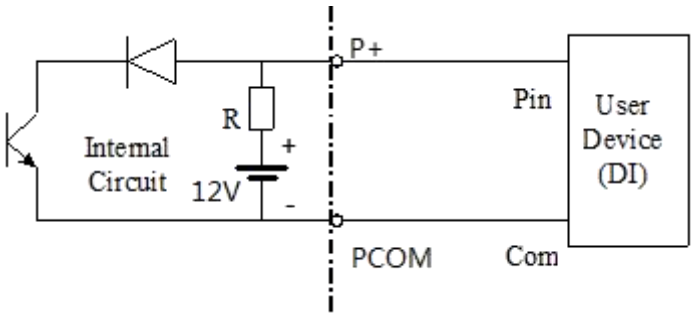


Fig 9 (a) Pulse/frequency Output Powered Internally

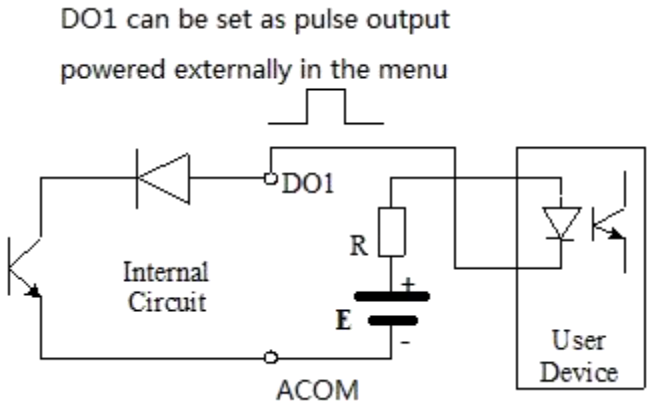


Fig 9 (b) Pulse/frequency Output Powered Externally
(Terminal DO1 must be set as "pulse output" in the menu)

2.8.4 Status Output

The converter outputs four status signals: high flow alarm, low flow alarm, empty pipe alarm and flow direction indication. The terminals used for them are DO1 and DO2 respectively and they share one common terminal ACOM.

DO1 and DO2 are all transistor open collector output. External load and power supply may be therefore necessary. The examples of wiring are given below.

Fig 2.7 shows the case that the digital output signal directly connects user's digital input device.

The connection with a photo-coupler is given in Fig 2.8. Generally, 10mA current is needed to drive a photo-coupler. The load resistance R is around E/10mA. If E ranges from 5 to 24V, the resistance R should be 0.5 to 2.5kΩ.

Fig 2.9 illustrates the connection of the digital output with a relay. D is a surge-absorbing diode, which is usually embedded in the relay. If not, an external one is necessary.

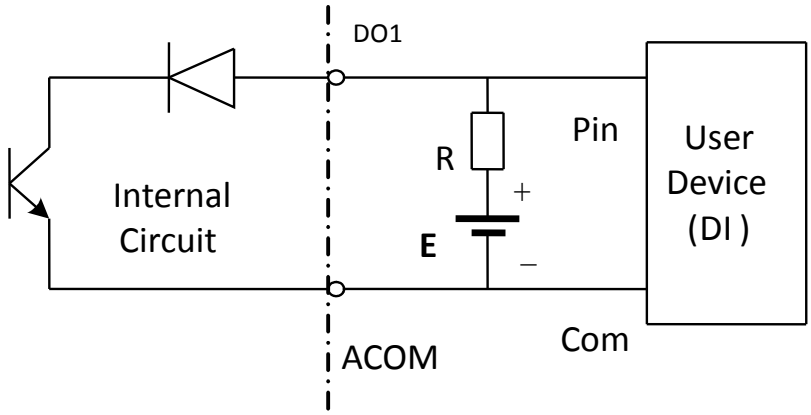


Fig 10 (a)Digital Output Direct Connection

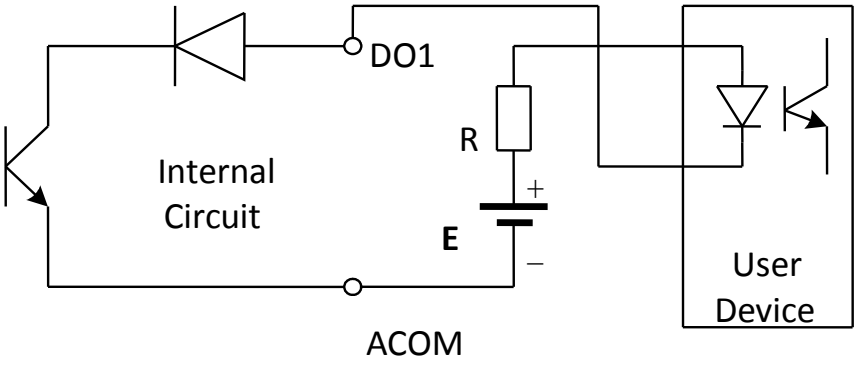


Fig 10 (b) Connection with photo-coupler (e.g. PLC)

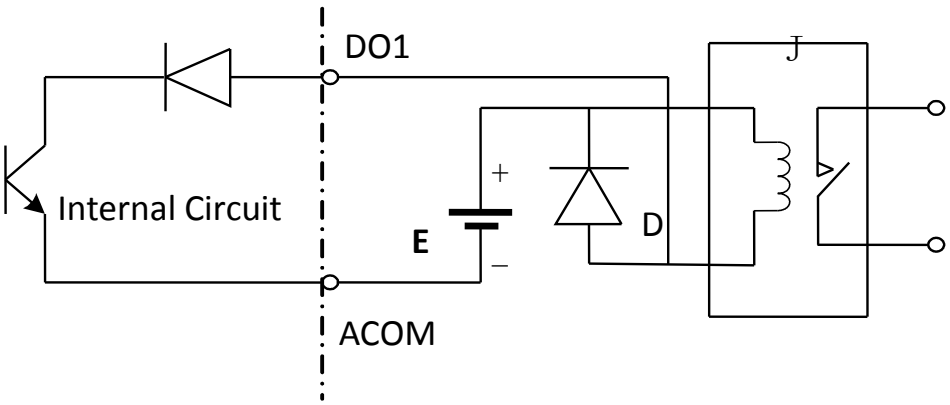


Fig 10 (c) Connection with relay (e.g. PLC)

2.9 Analog Output

Analog current output is powered from internal 24V DC power supply, and can drive load resistance up to 600Ω.

Current output is proportional to flow percentage:

$$I_O = FlowPercentage \bullet CurrentRange + CurrentZero$$

To improve the definition of current output, it is suggested that proper flow range be set. The converter provides an auto-range-shift function to adjust flow range automatically.
Analog output is calibrated by the manufacturer with accurate test rig before shipping. In most cases, it is not necessary for user to adjust again. However, follow these steps if re-calibration needed.

a) Preparation
   Connect an ammeter of 0.1% accuracy (alternatively, connect a 100Ω high accuracy resistance and a voltmeter of 0.1% accuracy). Turn on the converter and warm-up for 15 minutes.
b) Current Zero Adjustment
   Enter into setup mode and select 'Current Zero' menu item. Adjust the factor value until the ammeter reads 4±0.004mA (or voltmeter reads 0.4±0.0004V). Press ENTER to confirm setting.
c) Current Range Adjustment
   Select 'Current Max' menu item and enter. Adjust the factor value until the ammeter reads 20±0.004mA (or voltmeter reads 2±0.0004V). Press ENTER to confirm setting.

After calibration, the converter can output high accuracy current signal of linearity better than 0.1%.

3. Setting Parameters

There are 2 running status: self- testing and parameters setting.
When power on, it enters into self-testing status automatically. Under this status, flow meter can fulfil measuring functions and display corresponding measuring data. Under parameters setting status, users can use 4 keys to set all parameters.

3.1 Keys Function

3.1.1 Automatic Measurement Mode

DOWN	Scroll bottom line display;
UP	Scroll top line display;
ALT + ENTER	Enter into setting mode;
ENTER	Return to measurement mode.

3.1.2 Parameter Setting Mode

DOWN	Subtract one form the digit at the cursor;
UP	Add one on the digit at the cursor
ALT + DOWN	Cursor shifts left
ALT + UP	Cursor shifts right
ENTER	Enter/exit submenu;
ENTER	Return to measurement mode if held for 2 seconds at any location
Notes	①When using ALT key, hold ALT first and then press UP or DOWN. ②Under setting mode, the meter returns to measurement mode automatically if no key is pressed for 3 minutes. ③When adjusting flow zero, UP or DOWN key can be used to change the sign (+/-). ④When setting flow range, UP or DOWN key can be used to change flow unit.

3.2 Function Keys for Setting Parameter

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.

3.2.1 Functions Select Menu

There are 54 parameters of mini electromagnetic flow meter, user can set every parameter. The List of Parameters is shown below:

3.2.2 Parameters Setting

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 accuracy of output bother in display and in measurement.

There are 5 grades of passwords for setting parameters function. Grades 0 to grade 3 of passwords are for users and grade 4 of password is for manufacturer. Users can reset their passwords of grades 1~3 in grade 4.

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

Grade 0 of password (set by manufacturer as 00521): users can only read parameter.

Grade 1 of password (set by manufacturer as 7206): users can change 1~25 parameters.

Grade 2 of password (set by manufacturer as 3110): users can change 1~29 parameters.
Grade 3 of password (set by manufacturer as 2901): users can change 1~38 parameters.
Grade 4 of password (Fixed): users can change 1~38 parameters.

Password Grade 3.4 can be set by skilled users. Grade 3 is mainly used for resetting total volume in password. Grades 0~2 can be set by any one who can be chosen by users.

3.2.2.1 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、2600、2800、3000

3.2.2.2 Flow Range

Flow range means upper limit value, upper limit value is for output signal and percent flux.

It corresponds to current output upper limit value, frequency (pulse) output upper limit value and 100% displayed value, Volumetric flow unit：L/s、L/min、L/h、m 3 /s、m 3 /min、m 3 /h and mass flow unit kg/s、kg/m、kg/h、t/s、t/m、t/h, other unit can be customized.

3.2.2.3 Menu Items

mag converter setting menu consists of 45 items. Many of them are set up by manufacturer before shipping. It is not necessary to change them when applying. There are only a few of them to be set by user according to the application. The menu items are listed in Table 3.1.

Table 3.1 Operation Menu

Item No.	Menu Display	Setting Method	Password Level	Value Range
1	Language	Option	1	English
2	Sensor Size	Option	1	3 - 3000mm
3	Flow Range	Modify	1	0 - 99999
4	Decimal Point	Option	1	0,1,2,3
5	Damping	Option	1	0 - 100 s
6	Flow Dir.	Option	1	Fwd/ Res
7	Flow Zero	Modify	1	+/-0.000
8	L.F. Cutoff	Modify	1	0.0 – 99.9%
9	Cutoff Enable	Option	1	ON / OFF
10	Rate-Of-Chng	Modify	1	0 - 30%
11	Limit Time	Modify	1	0 - 20 s
12	Total Unit	Option	1	0.001L - 1 m3
14	Current Output	Option	1	4-20mA/0-10mA
15	Pulse Output	Option	1	Frq/ Pulse
16	Pulse Factor	Option	1	0.001L - 1 m3
17	Freq Max	Modify	1	1 - 5999 Hz

18	Comm Address	Modify	1	0 - 99
19	Baudrate	Option	1	600 - 14400
20	EmpPipe Det.	Option	1	ON / OFF
21	EmpPipe Alm	Modify	1	150.0 KΩ
22	DO1 Output	Option	1	Disabled/High Flow Alarm/EmpPipe Alarm/Flow Direction/Pulse Output
23	Hi Alm Limit	Modify	1	000.0 - 199.9%
24	DO2 Output	Option	1	Disabled/Low Flow Alarm**(Reserved standby)**
25	Lo Alm Limit	Modify	1	000.0 - 199.9%
26	RevMeas.Enbl	Option	1	ON/OFF
27	Sensor S/N	Modify	2	000000000000-999999999999
28	Sensor Fact.	Modify	2	0.0000 - 3.9999
29	Field Mode	Option	2	Mode 1,2,3
30	Multiplying	Modify	2	0.0000 - 3.9999
31	F. Total Set	Modify	3	0000000000 - 9999999999
32	R.Total Set	Modify	3	0000000000 - 9999999999
33	Input Contrl	Option	3	Disable/Stop Tot/Reset Tot
34	Clr Totalizr	Password	3	00000 - 59999
35	Clr Tot. Key	Modify	3	00000 - 59999
36	Date –y/m/d *	Modify	3	99/12/31
37	Time-h/m/s *	Modify	3	23/59/59
38	Password L1	Modify	3	0000 - 9999
39	Password L2	Modify	3	0000 - 9999
40	Password L3	Modify	3	0000 - 9999
41	Current Zero	Modify	4	0.0000 - 1.9999
42	Current Max	Modify	4	0.0000 - 3.9999
43	Meter Factor	Modify	4	0.0000 - 3.9999
44	Convtr S/N	Modify	4	0000000000-9999999999
45	Sys Reset	Password	4	

Note:

1. Item No. 36 and 37 are optional and only effective for the converter with real clock and power failure recording function.

2. The default key to clear the total is 36666.

3.2.2.4 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.

3.2.2.5 Flow Direct

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

3.2.2.6 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.

3.2.2.7 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.

3.2.2.8 Rate-Of-Chng and Limit Time

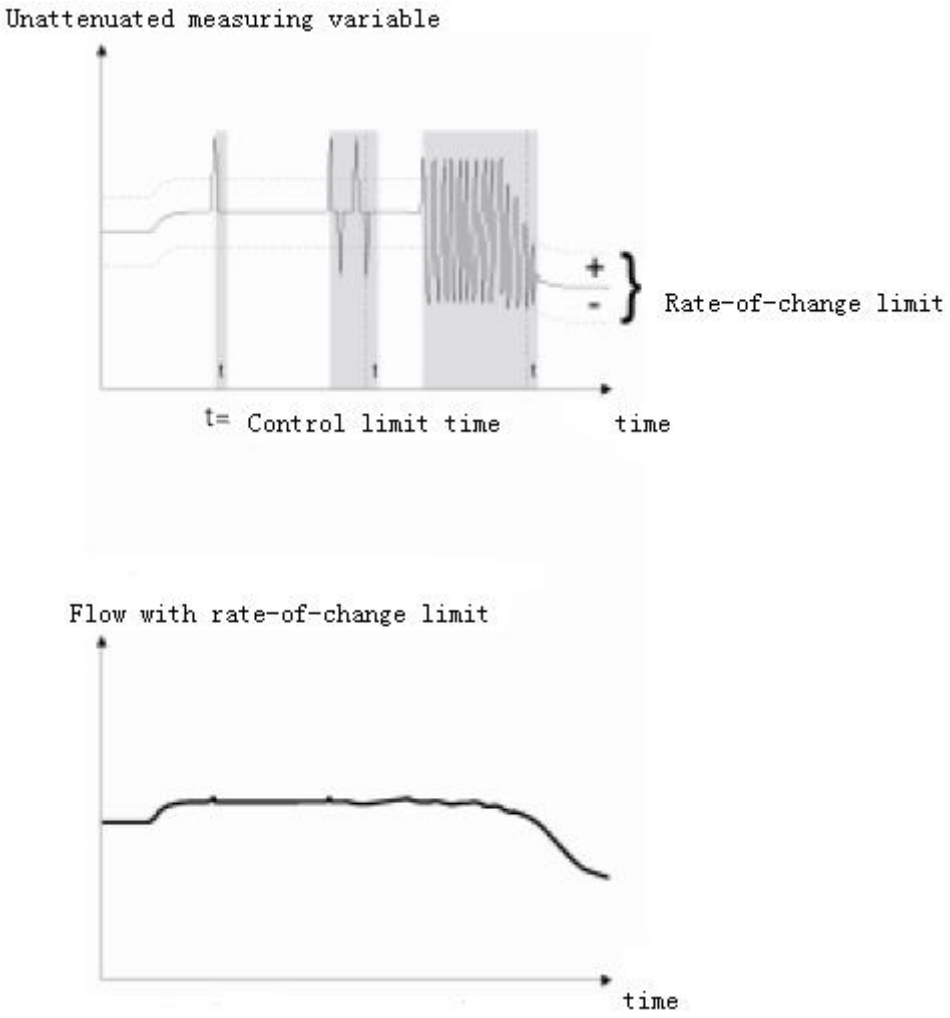


Fig 3.2 Example for the effect of rate-of-change limit

'Rate-of-change' limit technique is used to eliminate application-related high electrical noise contained in the process flow signal.

To check electrical noise, two parameters are defined: 'Rate-of-change' limit and 'Control limit time'. If the sampled flow value exceeds the set rate-of-change limit value based on the averaged flow rate value up until the sampled time, the system will reject that sampled value and instead the averaged value including the rate-of-change limit value in place of the rejected sampled value will be output. However, if the limit-exceeding sampled value continues for the same flow direction for more than the preset control limit time, that data will be used as output signal. Fig 3.2 illustrates the effect of noise-suppressing by rate-of-change limit.

The value of rate-of-change limit can be set from 0 to 30% of flow range and limit time ranges from 0 to 20 seconds. If either of the two parameters is set to nil, the function is disabled.

Note: The rate-of-change limit function is not suitable for short period measurement and flow meter calibration.

3.2.2.9 Total Unit

The converter has three 10-digit counters and the maximum counts are 9999999999. The total flow unit can be L, m^3, US gallon, Imperial gallon, kg or t (metric ton) with a multiplying factor of 0.001, 0.01, 0.1, 1, 10, 100 or 1000.

3.2.2.10 Flow Density

The converter is capable of measuring mass flow if fluid density is set. The density can be set from 0.0001 to 3.9999 and the mass unit is determined automatically by flow unit. The density should be set to 1.0000 (default value) if not used. Otherwise, measurement data will be forced to nil.

3.2.2.11 Current Type

0～10mA or 4～20 mA are available

3.2.2.12 Pulse 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.

3.2.2.13 Pulse Fact

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

0.0001L/p, 0.001L/p, 0.01L/p, 0.1L/p, 1.0L/p, 2L/p, 5L/p, 10L/p, 100L/p, 1m3/p, 10m3/p, 100m3/p, 1000m3/p, pulse max can be up to 5000cp/s.

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

Pulse width can be chosen: Automatic, 10ms, 20ms, 50ms, 100ms, 150ms, 200ms, 250ms, 300ms, 350ms and 400ms. Pulse width can not be conflicted with max frequency.

3.2.2.14 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.

3.2.2.15 Comm Address and Baud rate

substation address is needed when using RS485 communication. The address can be set from 001 to 255. Baud rate is the transmission speed between main and sub stations. It is selectable from 600, 1200, 2400, 4800, 9600, 14400, 19200 and 38400bps.

 Note: the baud rate must be the same as that of the main computer.

3.2.2.16 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

3.2.2.17 EmpPipe Alm.

This item is to set the electrode alarm trip value. Constant current source method is employed to measure the resistance between two electrodes. The variation of the resistance is checked by CPU and CPU recognizes if the pipe is empty or the electrodes are contaminated. The resistance is calculated as following:

$$R \approx 1/d\sigma$$

where, d = electrode radius

σ = Fluid conductivity

The electrodes resistance is usually between 5 to 50kΩ。The variation of the resistance relates to the surface status of electrodes and variation of fluid characteristic. If the sensor is filled with fluid, abnormal resistance signal is detected and empty pipe alarm is output.

The electrode alarm trip value is determined based on the first-time measured electrode resistance. After the installation of the flow meter, measure the resistance between the electrodes when the sensor pipe is filled. Record the resistance value and take it as a basis. Usually, set the trip value as 3 times of the original resistance recorded.

3.2.2.18 DO1 Output (not standard function, Selectable)

User can program the DO1 output by selecting the following options:

(1) Disabled: to disable the DO1 output;
(2) High Flow Alarm: DO1 outputs as a high flow alarm when the flow percentage exceeds the Hi Alm Limit;
(3) EmpPipe Alarm: When the pipe is detected as empty, an alarm signal is output from DO1;
(4) Flow Direction: the DO1 outputs as a flow direction indicator;
(5) Pulse Output: the DO1 outputs pulse signal.

3.2.2.19 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.

3.2.2.20 DO2 Output (Not standard, reserve, standby)

User can program the DO2 output by selecting the following options:

(1) Disabled: to disable the DO2 output;
(2) Low Flow Alarm: DO2 outputs as a low flow alarm when the flow percentage is lower than the Lo Alm Limit;

3.2.2.21 Lo Alm Limit

Low alarm limit value is set in percentage of the upper range of flow rate. The parameter ranges from 0% to 199.9%. The meter outputs alarm signal when the flow percentage is lower than this value.

3.2.2.22 Sensor S/N

Sensor serial number records the information of the sensor equipped with the converter and ensure them match up when installing.

3.2.2.23 Sensor Fact

The sensor factor is set according to the calibration sheet supplied by the manufacturer. Usually this factor has been set up by the manufacturer before shipping. It is an important value that determines the accuracy of measurement. Do not change it without calibration.

3.2.2.24 Field Mode

The converter offers three field exciting modes based on the exciting frequency. Mode 1 is the most-commonly used one and suitable for most cases. Mode 2 and 3 are low-frequency exciting modes and are better for large size meter to measure water. The calibration should be taken under the same exciting mode as that used for measurement.

3.2.2.25 RevMeas.Enbl: Reverse Measurement Enable

If RevMeas.Enbl is set to ON, the converter displays flow and outputs signals when flow direction is reversed. If OFF, the converter displays no flow and does not output signals when reversing.

3.2.2.26 Multiplying

This item is a multiplying factor selectable from 0.0000 to 3.9999. When calculating the flow rate and total, this factor is taken into account. It is often used to measure the flow in the open channel. If not applied, set the value to 1.0000.

3.2.2.27 F. Total Set and R. Total Set

Presetting of forward and reverse total counter is designed to start counting from the existing reading when replacing a converter or flow meter. It provides a continuous total flow read which is convenient for management.

3.2.2.28 Clr Tot. Key

The 'Totalizer Reset Password' is changeable in this menu item if Level-3 password is entered. Remind: keep the new password in a safe place.

3.2.2.29 Clr Tot. Key

The 'Totalizer Reset Password' is changeable in this menu item if Level-3 password is entered. Remind: keep the new password in a safe place.

3.2.2.30 Date –y/m/d and Time-h/m/s

These items are used to change the internal real time clock if equipped.

3.2.2.31 Password L1 ,Password L2 and Password L3

To change the Level-1 to Level-3 passwords, use Level-4 or higher level password to enter and change these two items.

3.2.2.32 Current Zero and Current Max

Adjust the current output zero point and upper range value as detailed in Sec. 2.7. It is not suggested that user make any adjustment since it has been setup to the best condition by the manufacturer.

3.2.2.33 Meter Factor

This factor is used by the manufacturer to normalize the excitation current and amplifier signal of the converter. DO NOT change it.

3.2.2.34 Convtr S/N

This serial number records the manufacturing date and code of converter. DO NOT change it.

3.2.2.35 Sys Reset

This item is reserved for the manufacturer to re-initialize the converter. After system resetting, all settings are set to default values automatically.

4. Self-diagnosis and Troubleshooting

4.1 Self-diagnosis

Converter is not repairable for user. Do not open the converter case.
The self-diagnosis function of the converter is capable of displaying alarm information except power supply or hardware failures. A '!' symbol is displayed on the right corner of LCD top-line and malfunction information can be read from the bottom-line by pressing DOWN key. User may check the flow meter according to the alarm information. Some examples of alarms are given below:

Coil Alm
Elctrd Alm
EpPipe Alm
Low Alarm
High Alarm

4.2 Trouble Shooting

4.2.1 No Display

a) Check the connection of power supply;

b) Check fuse;
C) Check the voltage of power supply;
d) Check if the LCD contrast can be adjusted. Adjust it if possible;
e)Return to base, if a) to d) are OK.

4.2.2 Excitation Alarm

a) Check if exciting cable EXT + and EXT - are open
b) Resistance of converter should be less than 150Ω;
c) if a） and b） are good, there is trouble with converter.

4.2.3 Empty Pipe Alarm and Electrodes Alarm

a) Check if the sensor pipe is filled with fluid;
b) Check the connection of signal wiring;
c) Connect the terminal SIG1, SIG2 and SIG GND. If the alarm display disappears, it is confirmed the converter is normal. The alarm may be caused by the bubble in the fluid;
d) For electrodes alarm, measure the resistance between two electrodes with a multimeter. The read should be between 3 to 50kΩ. Otherwise, the electrodes are contaminated or covered.

4.2.4 High Alarm

Increase the flow range.

4.2.5 Low Alarm

Reduce the flow range.

4.2.6 Inaccurate Measurement

a) Check if the sensor pipe is filled with the fluid to be measured.
b) Check wiring.
c) Check if the sensor factor and flow zero are the same as those on the calibration sheet.

4.2.7 Communication Trouble Shooting

a) Port of RS232 / RS485 is not good.

b) Data cable is not good, it should be shielded twisted-pair cable.if internal two cables are parallel transferring distance can't be so long and transferring speed is also be affected.

c) Communication cable are not connected well or connected reversely.

d) Comm Address and Baud rate are not same as which input in the converter.

e) Communication is not correct, some communications are 2 bytes and some communications are 4 bytes.

f) If transferring distance is more than 1000m, or much interfered by magnetic field, repeater should be adopted.

g) Connect a short cable to computer when testing, disturbance caused by material of cable and magnetic field can be eliminated. The reason why it can't work can be found

immediately if caused by RS232/RS485 port, connection or communication.

5. Shipping and Storage

To prevent the product from damage during shipping, keep the original package of manufacturer. The products should be stored in storehouse that meets following conditions:
a) Keep off raining and moisture;
b) Keep off heavy vibration, and strike;
c) Ambient temperature -20～+60℃;
d) Humidity less than 80%.

Appendix 1 MODBUS COMMUNICATION（V1.8）

1. Code definition of MODBUS protocol order

Function Code	Register Name	Function
01	Read coil status	Reservation
02	Read input status	Reservation
03	Read holding registers	Read flow data
04	Read input register	Read internal parameter
05	Strong set single coil	Reservation
06	Preset single register	Revise internal parameter

2. MODBUS register definition of electromagnetic flow meter

Protocol	Resister definition	Data	Register length

Addresses （Decimal）			format	
Dec	Hex			
4112	1010	Instantaneous flow	float	2
4114	1012	Integer part of the cumulative positive value	long	2
4116	1014	Decimal part of the cumulative positive value	float	2
4118	1016	Instantaneous velocity (m/s)	float	2
4120	1018	Percent flux (%)	float	2
4122	101A	Medium Resistance (KΩ)	float	2
4124	101C	Integer part of the cumulative negative value	long	2
4126	101E	Decimal part of the cumulative negative value	float	2
4128	1020	Instantaneous flow unit	uchar	1
4129	1021	Total flow unit	uchar	1
4130	1022	Alarm	uchar	1
4131	1023	Unsigned	float	2

3. Instant flow unit

00	01	02	03	04	05	06	07
m^3/s	m^3/min	m^3/h	L/s	L/min	L/h	USg/m	Usg/h
08	09	0A	0B	0C	0D	0E	0F
ig/m	ig/h	t/s	t/m	t/h	kg/s	Kg/min	Kg/h

4. Accumulative flow unit

00	01	02	03	04	05
L	m^3	USgal	igal	kg	t

5. Alarm

02	04	08	10	20
Exciting Alarm	Electrode Alarm	Empty Alarm	Upper limit Alarm	Low limit Alarm

6 Application samples（Positive total flow）

Read data： 01 03 10 12 00 04 E0 CC Back：01 03 08 00 09 FB F1 3D FB E7 6D 92 C9

Integral part：00 09 FB F1 Convert to long data：654321

Decimal part：3D FB E7 6D Convert to float data：0.123

Positive total flow：654321.123

SMERI srl
Via Mario Idiomi 3/13 I - 20057 Assago (MI)
Tel +39 02 5398941 E-mail smeri@smeri.com
www.smeri.com