Electromagnetic Flowmeter

MBmag Converter

Instruction Manual

Revising Date: 2011-01

MBmag Electromagnetic Flowmeter Converter

1 General Specification and Application

1.1 Features

- Programmable low frequency square wave field excitation, improving measurement stability and reducing power consumption
- Implementing 16 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℃ - +70℃ 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

1.2 Main Application

MBmag converter, together with magnetic-inductive sensor, forms a microprocessor-controlled accurate measurement unit. The MBmag converter can be used for fluid flow speeds up to 15 m/s for a minimum conductivity of 5 S/cm. The main application range of MBmag widely covers a variety of fields:

- Chemical and petroleum industry
- Metallurgy industry
- Water and waste water
- Agriculture and irrigation

- ♦ Food and beverage industry
- ♦ Pharmaceutical industry

1.2.1 Working Conditions

Ambient temperature:	-10 to + 60℃;
Relative humidity:	5% to 90%;
Power supply:	AC 85 to 265V, 45 to 63Hz
	DC 16 to 30V
Power consumption:	< 15W with sensor

1.2.2 Testing Condition

Ambient temperature:	20℃±2℃
Relative humidity:	45% to 85%
Power supply:	AC 220±2%
Power frequency:	50Hz±5%
Ripple:	< 5%。
Warming time:	30min

2 Technical Data

The MBmag is compliant to Standard “JB/T 9248-1999 Electromagnetic Flow Meter”.

2.1 General Specification

2.1.1 Meter Size (mm)

MBmag converter supports the following meter size:

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, 1100, 1200, 1300, 1400, 1600, 1800, 2000, 2200, 2400, 2600, 2800, 3000

2.1.2 Flow Range

The MBmag is capable of measuring flow speed from 0.3m/s to 15m/s. The minimum measurable speed can be one percent (1%) of the full range.

2.1.3 Accuracy

MBmag converter combined with sensor is tested under testing condition mentioned above. The accuracy is given in Table 2.1

DN mm	Flow Range m/s	Accuracy
3 to 20	< 0.3	±0.25%FS
	0.3 to 1	±1.0R
	1 to 15	±0.5%R
25 to 600	0.1 to 0.3	±0.25%FS
	0.3 to 1	±0.5%R
	1 to 15	±0.3%R
700 to 3000	< 0.3	±0.25%FS
	0.3 to 1	±1.0%R
	1 to 15	±0.5%R
%FS: error of full span; %R: error of rate		

Table 2.1 Accuracy of MBmag converter

2.1.4 Repeatability

Repeatability error < ±0.1%.

2.1.5 Current output

Current output: fully-isolated 0 - 10mA / 4 - 20mA
(a) Load resistance: 0 - 10mA, 0 to 1.5kΩ;
4 - 20mA, 0 to 750Ω.
(b) Basic error: add ±10μA on top of the measurement error

2.1.6 Frequency Output

Frequency output is proportional to the flow percentage of the full range. MBmag provides fully isolated transistor open collector frequency output ranged from 1 to 5000 Hz. The external DC power supply should not exceed 35V and maximum collector current is 250mA.

2.1.7 Pulse Output

The converter can output up to 5000cp/s pulse series, which is dedicated to external totalization. Pulse factor is defined as volume or mass per pulse. It can be set to 0.001L/p, 0.01L/p, 0.1L/p, 1L/p, 2L/p, 5L/p, 10L/p, 100L/p, 1m^3/p, 10 m^3/p, 100 m^3/p or 1000 m^3/p. Pulse width is selectable from auto, 10ms, 20ms, 50ms, 100ms, 150ms, 200ms, 250ms, 300ms, 350ms and 400ms. Photo-coupler isolated transistor open collector circuit is used for pulse output. The external DC power supply should not exceed 35V and maximum collector current is 250mA.

2.1.8 Flow Direction Indication

MBmag converter is capable of measuring both forward and reverse flow and recognizing its direction. The converter outputs 0V low level for forward flow, while +12V high level for

reverse flow.

2.1.9 Alarm Output

Two channels of photo-coupler isolated open collector circuit are used for alarm signal output. There are two alarm outputs: high limit alarm and low limit alarm. The external DC power supply should not exceed 35V and maximum collector current is 250mA.

2.1.10 Communication

The RS485 or RS232C communication interface is embedded in the converter and supports data transfer up to 2km at 14400bps. Surge absorber is optional to protect the interface and converter.

2.1.11 Damping Constant

Damping time is selectable from 0.2 to 100s.

2.1.12 Electrical Isolation

The isolation voltage between analog input and analog output is not less than 500V;
The isolation voltage between analog input and alarm power supply is not less than 500V;
The isolation voltage between analog input and AC power supply is not less than 500V;
The isolation voltage between analog output and AC power supply is not less than 500V;
The isolation voltage between analog output and earth is not less than 500V;
The isolation voltage between pulse output and AC power supply is not less than 500V;
The isolation voltage between pulse output and the earth is not less than 500V;
The isolation voltage between alarm output and AC power supply is not less than 500V;
The isolation voltage between alarm output and the earth is not less than 500V.

2.1.13 Input Contact

External contact ON (close) or OFF (open) signal can be used to remotely control the start/stop or reset of internal counter.

2.2 Keypad and Display

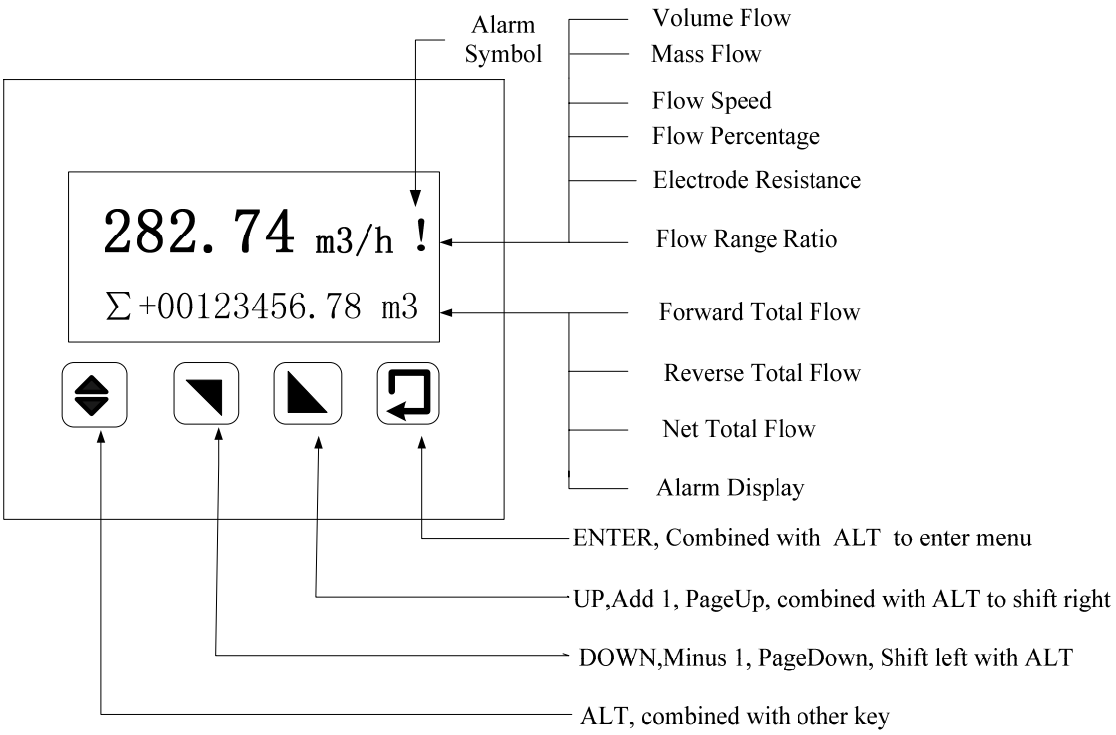

Fig 2.1 (a) Remote Type: Keypad and LCD Display

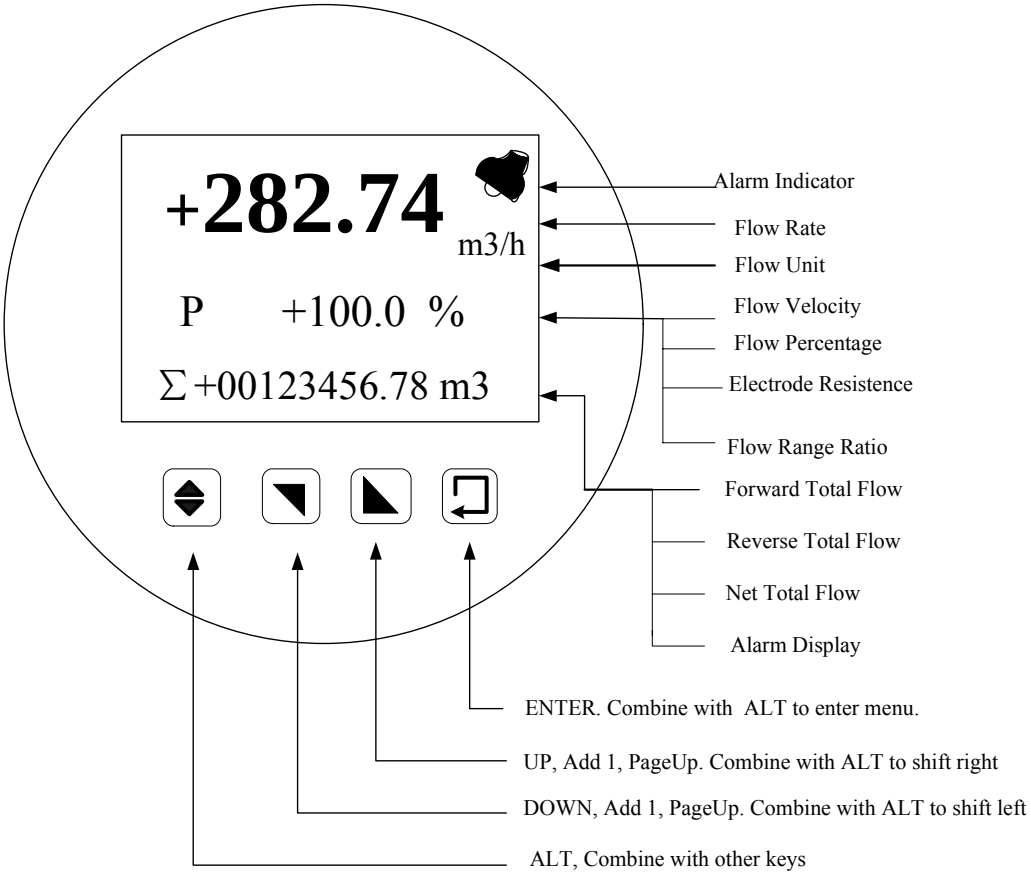

Fig 2.1(b) Compact Type: Keypad and LCD Display

Notes: Hold ALT key and press ENTER key, the converter will display a login page and password is required. Input proper password and press ENTER again. The system enters into the setup mode. To exit from setup mode and return to measurement mode, hole ENTER key for a couple of seconds. The system can automatically return to measurement mode if no key is pressed for 3 minutes.

2.3 Terminal Block and Marks

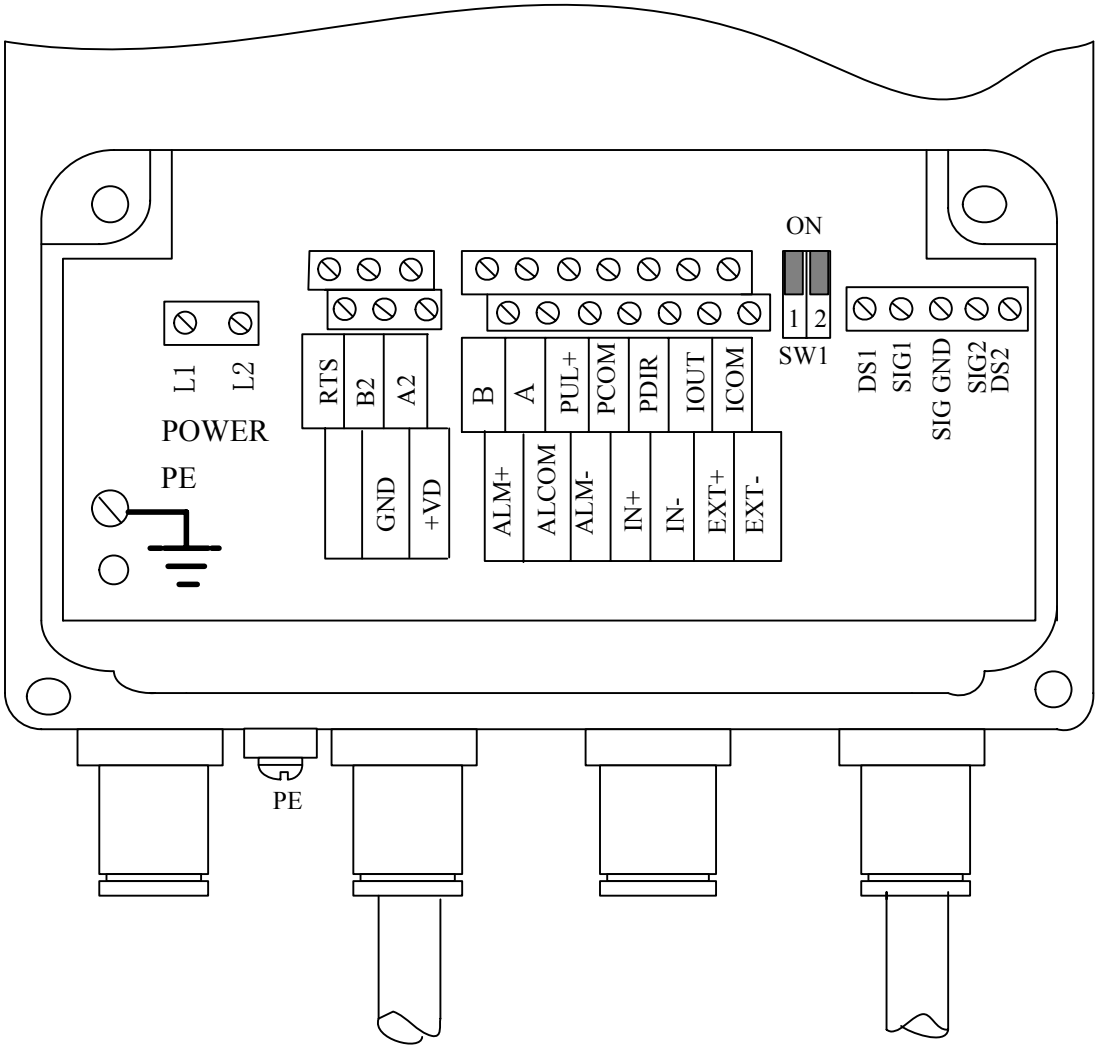

Fig 2.2(a) Remote Type: Terminals and Marks

The definition of terminals and their marks for remote type converter is given as below:

DS1	Shield drive 1
SIG1	Signal input 1
SIG GND	Signal Ground
SIG2	Signal input 2
DS2	Shield drive 2
EXT+	Coil excitation +

EXT-	Coil excitation -
IOUT	Current output +
ICOM	Current output -
PUL+	Frequency/pulse output +
PCOM	Frequency/pulse output -
PDIR	Flow direction indicator +
ALM-	Low alarm output +
ALM+	High alarm output +
ALCOM	Alarm output -
A	RS485 communication A
B	RS485 communication B
IN+	Input contact +
IN-	Input contact -
L1(+)	220V(24V +) input
L2(-)	220V(24V -) input

The dip switch SW1 is set to ON to supply +12V power to pulse output. If external power is used, turn the switch to OFF.

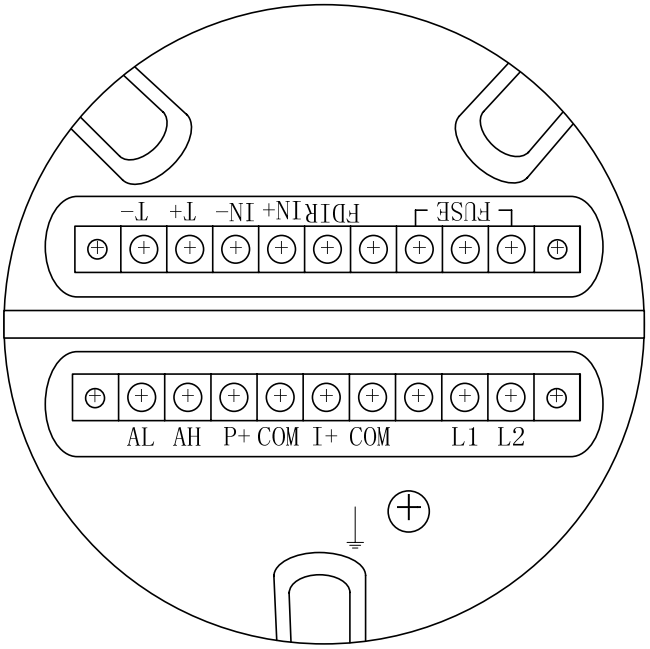

Fig 2.2(b) Compact Type: Terminals and Marks

The definition of terminals and their marks for compact type converter is given as below:

T -	RS485-B
T+	RS485-A
COM	Alarm/flow direction/ pulse output -
FDIR	Flow direction indicator +
AL	Low alarm output +
AH	High alarm output +
IN-	Input contact -

IN+	Input contact +
P+	Frequency/pulse output +
COM	Current/pulse output -
I+	Current output +
L1(+)	220V(24V +) input
L2(-)	220V(24V -) input

2.4 Wiring Cable

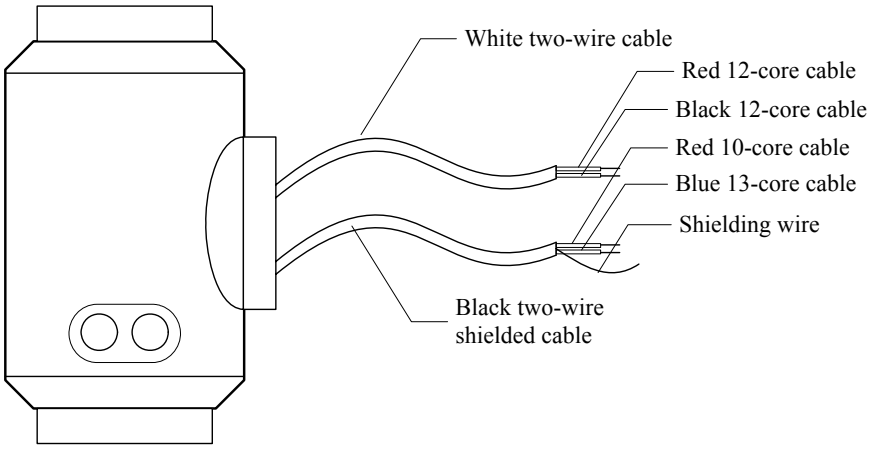

Fig 2.3 Cables for wiring

As shown in Fig 2.3, the converter has two connection cables depicted as below:

- White twist pair: 12-core red for field exciting +
  12-core black for field exciting -
- Black shielded twist pair: 10-core red for signal 1;
  13-core blue signal 2
  shielding layer for signal ground

2.4.1 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.

2.4.2 Cable for Filed Exciting

Two-core isolated soft rubber cable can be used for field exciting. The type of YHZ-2×1mm^2 is recommended. The length is same as the signal cable.

2.4.3 Power Supply Cable

Two-core isolated soft rubber cable, e.g. YHZ-2×1mm^2, is recommended. Cable resistance should be taken into account if DC power supply is used. When using 24V DC power supply, the cable resistance should not be greater than 10Ω。

2.4.4 Cable for Current Output

For current output, total resistance of cable and load should not exceed 750Ω.
Connection of current output refers to the Fig 2.4 as below.

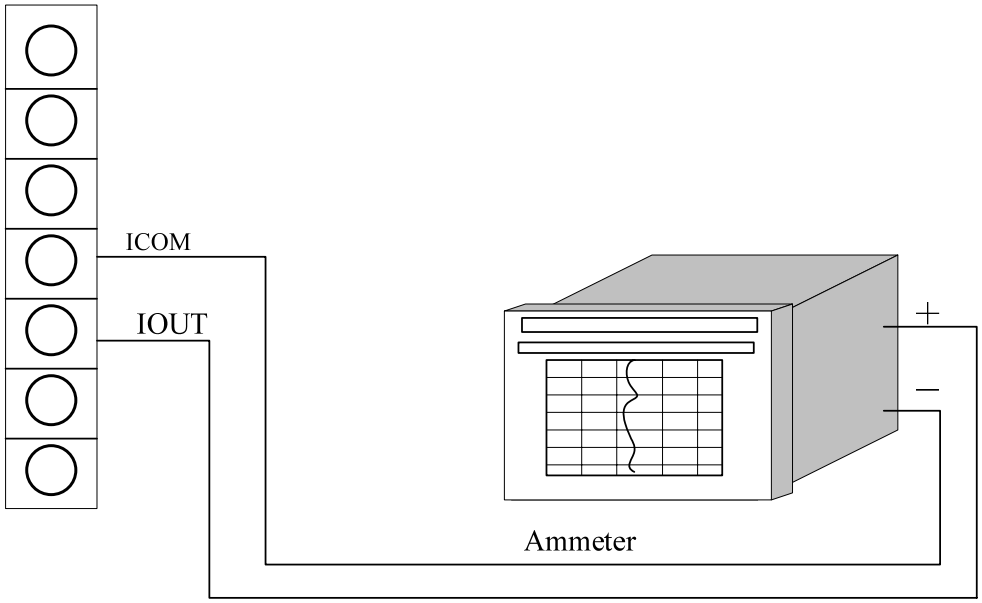

Fig 2.4 Wiring of current output

2.4.5 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 2.5.

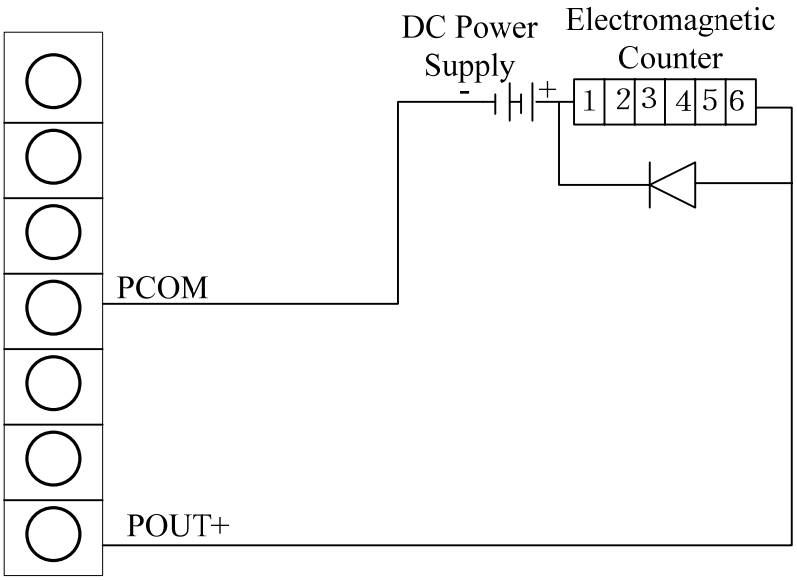

Fig 2.5 (a) Example of electromagnetic counter connection

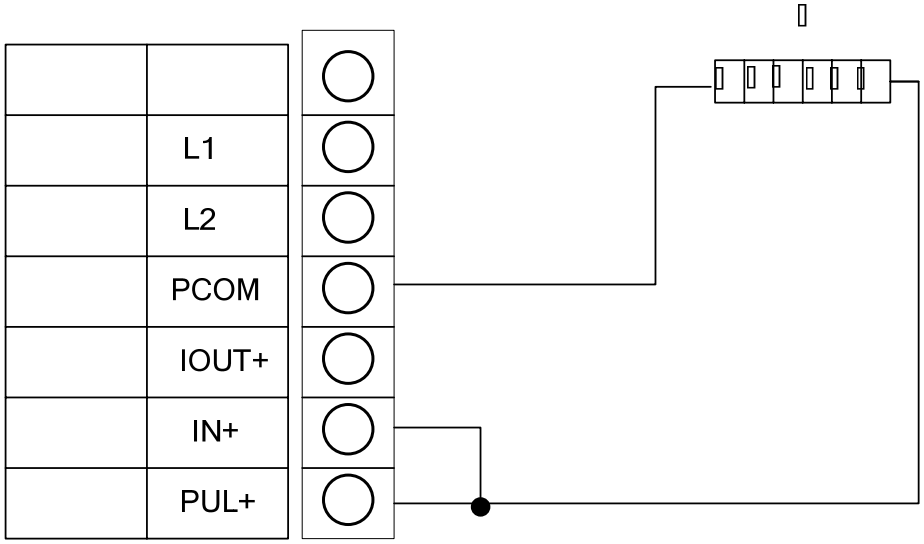

Fig 2.5 (b) Example of electrical counter connection

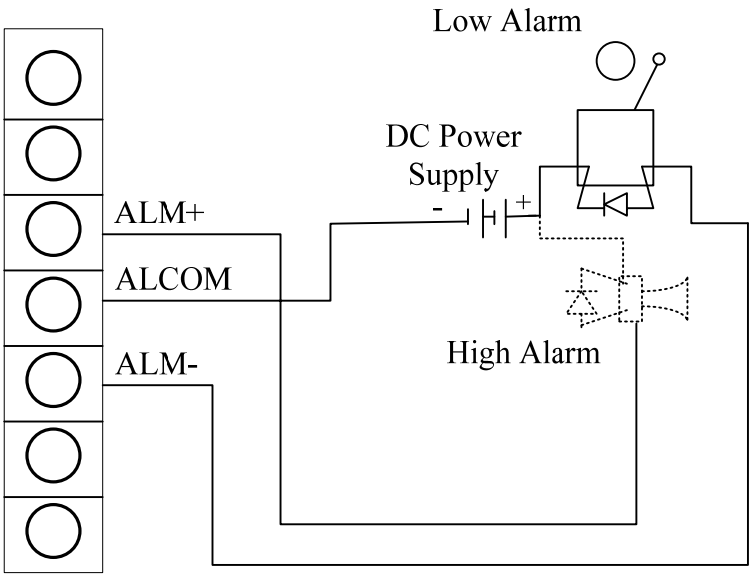

Fig 2.5 (c) Example of alarm output connection

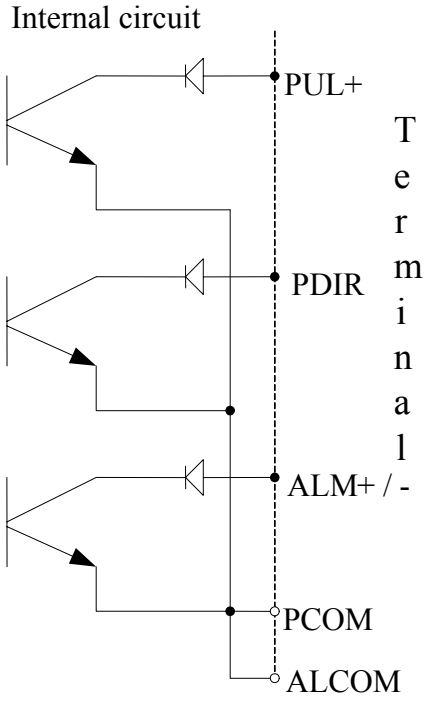

Fig 2.5 (d) Example of transistor open collector connections

2.4.6 Wiring of contact input

Contact input is controlled by external switch or relay ON/OFF signal shown in Fig 2.6. The contact resistance should be less than 5Ω.

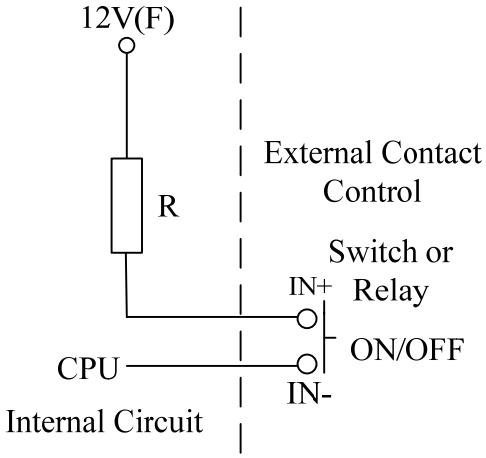

Fig 2.6 Contact Input Control

2.5 Grounding

The terminal PE on the case should be connected to the earth by a copper wire with cross-section area not less than 1.6mm^2. The grounding resistance should not exceed 10Ω.

2.6 Digital Output

Digital output refers to frequency/pulse and status output. The frequency and pulse output share one terminal. It is, therefore, that only one output is available at one time.

2.6.1 Frequency Output

Frequency output is proportional to flow percentage:

$$F = FlowPercentage \bullet FrequencyRange$$

Where, the upper range value of frequency output is adjustable from 0 to 5000Hz.

Frequency output is usually used for control application since it corresponds to the flow percentage. For metering purpose, it is better to take advantage of pulse output.

2.6.2 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.

2.6.3 Terminals for Frequency/pulse Output

PUL+: Frequency/pulse output +
PCOM: Frequency/pulse output -

2.6.4 Status Output

The converter outputs three status signals: high alarm, low alarm and flow direction indication. The terminals used for them are ALM+, ALM- and PDIR respectively and they share one common terminal COM.

PUL+, ALM+, ALM-, and PDIR are all transistor open collector output. External load and power supply are 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.

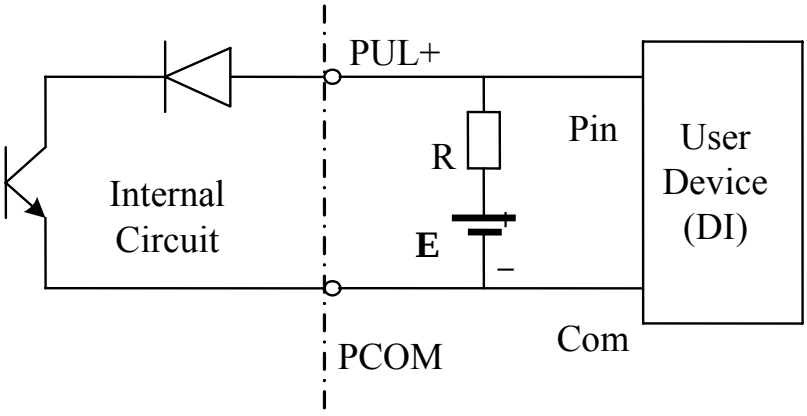

Fig 2.7 Digital Output Direct Connection

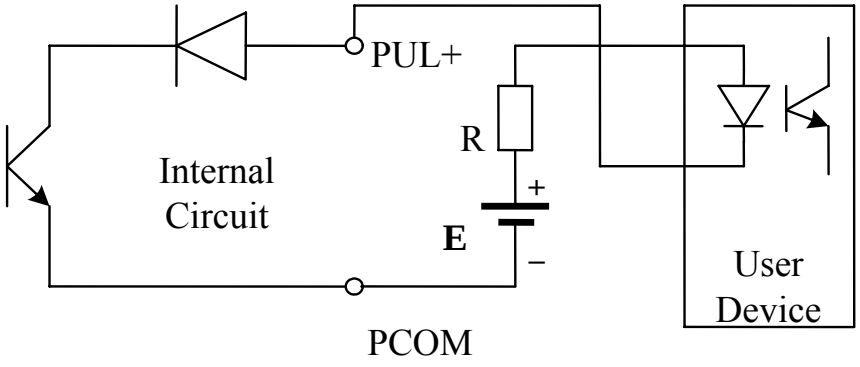

Fig 2.8 Connection with photo-coupler (e.g. PLC)

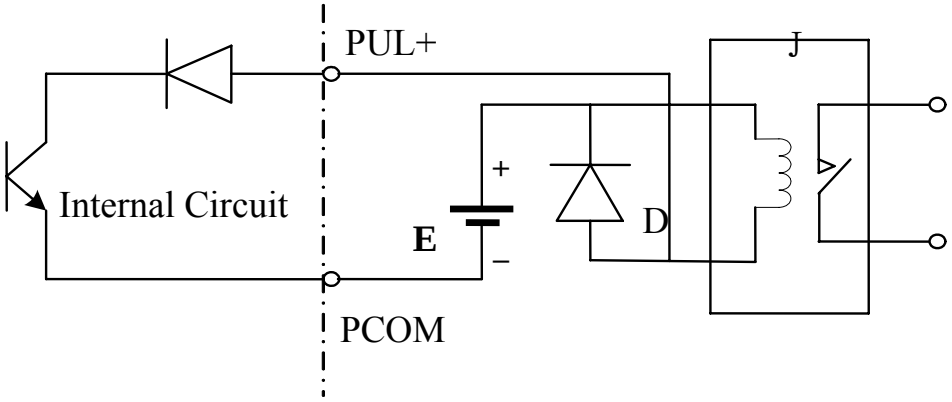

Fig 2.9 Connection with relay (e.g. PLC)

2.7 Analog Output

Analog current output is powered from internal 24V DC power supply, and can drive load resistance up to 750Ω.

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 recalibration 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%.

2.8 Contact Control Input

By controlling the ON/OFF of contact input, a high/low level signal is transferred to CPU to control the start/stop or reset of internal totalizer.

If ‘Stop Totalizer’ function is enabled, a contact ON signal can stop the internal counter, while an OFF signal starts it.

The three internal totalizers can be cleared remotely by a contact ON signal if ‘Reset Totalizer’ Function is active.

3 Parameter Setting

The meter has two running modes: Automatic Measurement Mode and Parameter Setting Mode.

After power-on, the meter enters measurement mode automatically. Under this mode, the meter fulfills all measurement functions, displays data and outputs signals.

There are four keys on the keypad. They can be used to enter the parameter setting mode and change the meter’s configuration. The key operation does not affect the measurement and the output.

3.1 Key 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:

(1) When using ALT key, hold ALT first and then press UP or DOWN.
(2) Under setting mode, the meter returns to measurement mode automatically if no key is pressed for 3 minutes.
(3) When adjusting flow zero, UP or DOWN key can be used to change the sign (+/-).
(4) When setting flow range, UP or DOWN key can be used to change flow unit.

3.2 Parameter Setting Operation

To setup the meter, changing to setting mode from measurement mode is the first step. Enter ALT + ENTER key in measurement mode to pop a login page and password is required to enter. Input authorized password and press ENTER again to confirm. The converter enters into setting mode if the password is approved, otherwise it returns to measurement display.

3.2.1 Menu Items

MBmag converter setting menu consists of 42 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	Chinese/English
2	Sensor Size	Option	1	3 - 3000mm
3	Flow Range	Modify	1	0 - 99999
4	Auto Rng Chg	Option	1	ON / OFF
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 - 99%
9	Cutoff Enble	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	0.0001L - 1 m3
13	Flow Density	Modify	1	0.0000 - 3.9999
14	Current Type	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	200.0 KΩ
22	Hi ALM Enble	Option	1	ON / OFF
23	Hi Alm Limit	Modify	1	000.0 - 199.9%

24	Lo Alm Enble	Option	1	ON / OFF
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	

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

3.2.2 Meter Parameter Description

The setting parameters determine the operation status, calculation method and output mode of the flow meter. Properly setting meter parameter can make the meter work in best condition and higher accuracy of display and output can be obtained.

There are five levels of password, where level 0 - 3 are open for user and level 4 reserved for manufacturer. Level 1 to 2 passwords are changeable by higher level password-holder, e.g. Level-3 password.

Meter setting can be browsed by entering any level of password. However, higher level password is needed to change settings.

- Password Level-0 (default value 0521): fixed and browsing only;
- Password Level-1 (default value 7206): changeable and authorized to modify menu item 1 to 25;
- Password Level-2 (default value 3110): changeable and authorized to modify menu item 1 to 29;
- Password Level-3 (default value 2901): fixed and authorized to modify menu item 1 to 38;
- Password Level-4 (reserved): fixed and authorized to modify any menu item including resetting system.
- Totalizer Reset Password (default value 36666): changeable in menu item 'Clr Tot. Key 'and authorized to clear the three internal counter.

It is suggested that Level-3 password be held by manager or supervisor while Level-0 to 2 passwords be kept by operator. The Level-3 password can also be used to change the password

for totalizer resetting.

3.2.2.1 Sensor Size

MBmag-2500 converter supports sensor diameter ranging from 3 to 3000mm, which can be chosen by pressing UP or DOWN key.

3.2.2.2 Flow Range

Flow range refers to the upper range value (URV) of flow rate. The URV is relative to flow percentage and output signal. At the analog output the amount of the measured values in the range 0 up to URV is displayed linear to the current range 4 to 20mA, at the frequency output to the frequency range 0 to the end frequency. The low flow cutoff and flow limit alarm relates to flow range as well. The maximum measurable flow rate, however, is not limited to the flow range as long as the flow speed does not exceed 15m/s.

In this menu item, user can also choose unit of flow rate. For volume flow, L/s, L/min, L/h, m^3/s, m^3/min and m^3/h are available; while for mass flow, kg/s、kg/m、kg/h、t/s、t/m、t/h can be selected from. It is up to the habits and application requirements to pickup a proper unit.

3.2.2.3 Auto Rng Chg

The converter has a function called Auto-Range-Change that is usually used for control system with wide flow range variation. The primary flow range is the value given by menu item 'Flow Range'. The second flow range (lower range) is obtained by selecting range ratio 1:2, 1:4 or 1:8 of primary one.

Fig 3.1 illustrates how the flow range is changed automatically. To safely change range and avoid vibration of display and output, a 5% to 10% hysteresis is added at the change point.

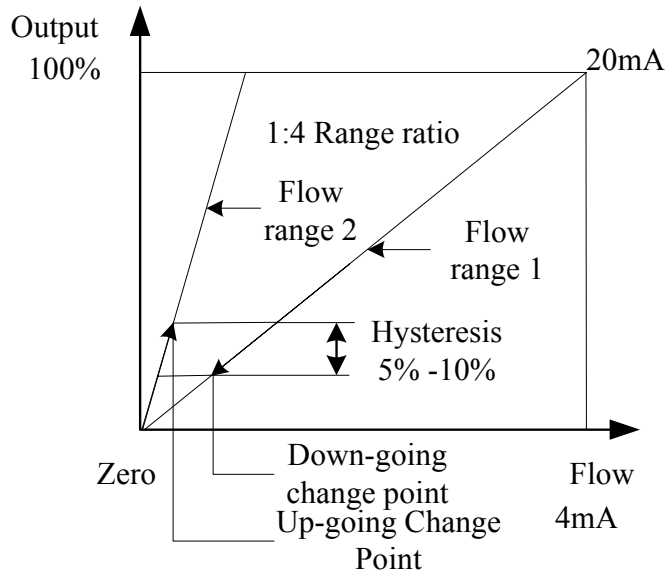

Fig 3.1 Illustration of Auto-Range-Change

3.2.2.4 Damping

Long damping constant can improve the stability of display and output and is suitable to flow control application; while short damping constant has short response time and is suitable to the totalization of pulse flow. Damping time is selectable from 0.2s to 100s.

3.2.2.5 Flow Dir.

If the displayed direction sign is not agreed to the actual flow direction, change this item to the opposite option.

3.2.2.6 Flow Zero

To conduct zero adjustment, the fluid in the sensor pipe must be held still. The flow zero is displayed by flow speed and the unit is m/s. The display of flow zero is shown below:

FS=○○.○○○m/s ±○○○○○

On the LCD, the top line displays the measured zero point while the bottom line shows the adjustment value. If the FS is not equal to 00.000m/s, adjust the sign and value on bottom line until FS back to nil. Remind again: to adjust the flow zero, the sensor pipe must be filled and the fluid must be kept still. The flow zero adjustment value is an important constant of the meter and should be printed on the calibration sheet and label. The value should include the sign and amount by unit of m/s.

3.2.2.7 L.F. Cutoff and Cutoff Enble

Low flow cutoff is set in percentage relative to flow range. If Cutoff is enabled and flow is lower than the set value, the display of flow rate, speed and percentage and signal outputs are forced to nil. If the item is disabled, no action is taken.

3.2.2.8 Rate-Of-Chng and Limit Time

'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.

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

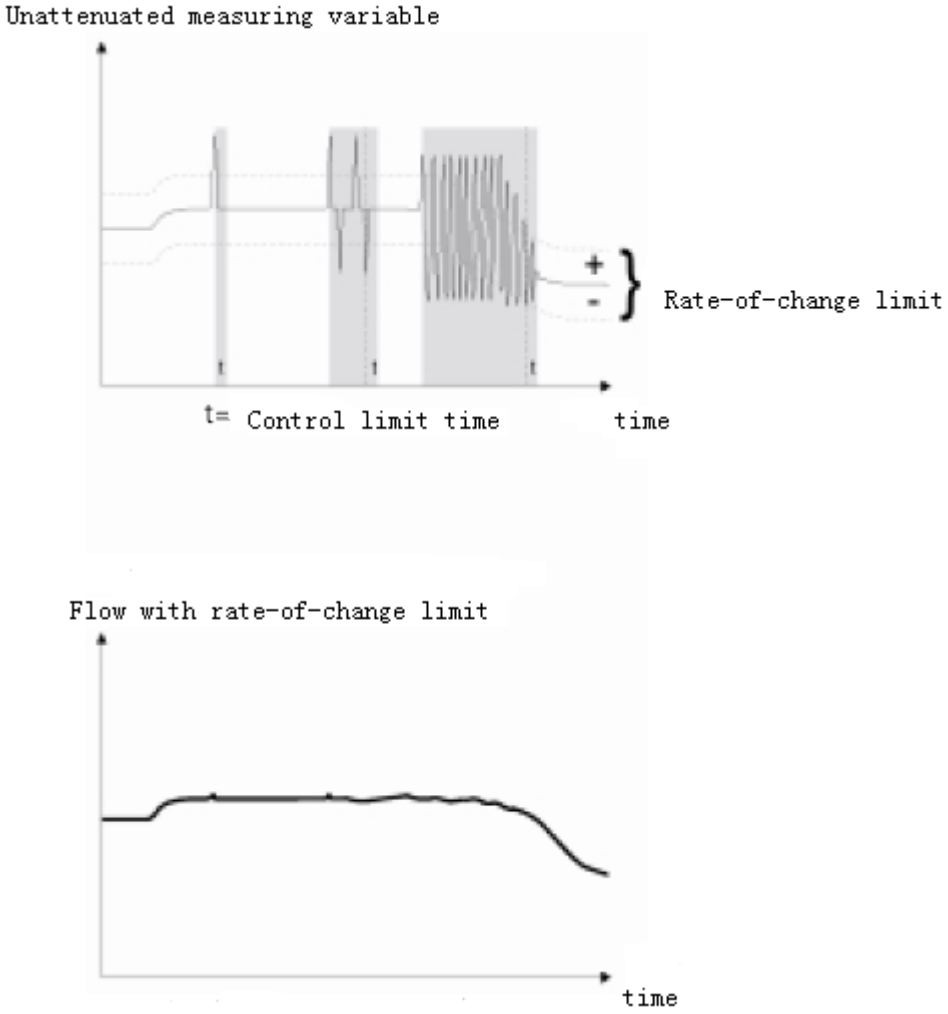

Fig 3.2 Example for the effect of rate-of-change limit

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, 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

Current output type is selectable from 4-20mA to 0-10mA.

3.2.2.12 Pulse Output

Two types of pulse output are available to choose from: frequency output mode and pulse output mode. The meter outputs continuous square wave pulse under frequency mode, while pulse series under pulse mode. Frequency output is usually used for flow rate measurement and short period of time totalization. Pulse output can be connected to an external counter directly and is often used for long period of time totalization.

As mentioned hereinbefore, transistor open collector circuit is used for frequency and pulse output. Therefore, the external DC power supply and load are necessary.

3.2.2.13 Pulse Factor

Pulse factor is defined as: pulse counts per unit volume or mass. The setting of pulse factor is detailed in Section 2.1.7 and 2.6.2.

3.2.2.14 Freq Max

Frequency range corresponds to the upper range value of flow rate, or 100% of flow percentage in other word. Maximum frequency is selectable from 1 to 5999Hz.

3.2.2.15 Comm Address and Baudrate

Substation address is needed when using RS485 communication. The address can be set from 01 to 99. Baud rate is the transmission speed between main and sub station. It is selectable from 600, 1200, 2400, 4800, 9600, 14400bps. Remind: the baud rate must be the same as that of the main computer.

3.2.2.16 EmpPipe Det.

This item is used to enable or disable the empty-pipe detector. If enabled, the meter will force the display value, analog output and digital output to nil when the sensor pipe is not full.

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 flowmeter, 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 Hi ALM Enble

User can enable or disable the high limit alarm.

3.2.2.19 Hi Alm Limit

High 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 higher than this value.

3.2.2.20 Lo Alm Enble

User can enable or disable the low limit alarm.

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 flowmeter. It provides a continuous total flow read which is convenient for management.

3.2.2.28 Input Contrl

As mentioned in Sec. 2.8, this menu item is set to select the function of contact input. There are three options to be chosen from: 'input disabled', 'stop totalizer' and 'reset totalizer'. The converter disables the contact input if 'input disabled' is selected. The contact input is used to start/stop totalizer controlled by ON/OFF switch signal if 'stop totalizer' function is active. If 'reset totalizer' function is enabled, ON (close) contact signal will clear the three internal total flow counters.

3.2.2.29 Clr Totalizr

Enter the 'Totalizer Reset Password' in this menu item and press ENTER to confirm. The converter clears the three internal counter and restart counting if password matched.

3.2.2.30 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.

3.2.2.31 Date –y/m/d and Time-h/m/s

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

3.2.2.32 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.

3.2.2.33 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.

3.2.2.34 Meter Factor

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

3.2.2.35 Convtr S/N

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

3.2.2.36 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

MBmag 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 flowmeter according to the alarm information. Some examples of alarms are given below:

Coil Alm
Elctrd Alm
EpPipe Alm
Low Alarm
High Alarm

4.2 Troubleshooting

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 Coil Alarm

a) Check if terminal EXT+ and EXT- are open;

b) Check if coil resistance is less than 150Ω;
c) Replace converter if a) and b) are OK.

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 the wiring;
c) Check if the sensor factor and flow zero are the same as those on the calibration sheet.