E-mag C type

Electromagnetic Flowmeter

Use Instructions

KAIFENG INSTRUMENT CO., LTD

E-mag C type electromagnetic flowmeter model selection code

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MF/C □ □ □ □ □ □ □ □ □ □ □ □ □ □ □
      ⌐         ⌐ ⌐ ⌐ ⌐ ⌐ ⌐   ⌐ ⌐
      │         │ │ │ │ │ │   │ │
      a         b c d e f g   h i j
```

a. Inside nominal diameter (mm)

Code	Inside diameter	Code	Inside diameter	Code	Inside diameter
030	3	125	125	901	900
060	6	151	150	102	1000
100	10	201	200	122	1200
150	15	251	250	142	1400
200	20	301	300	162	1600
250	25	351	350	182	1800
320	32	401	400	202	2000
400	40	451	450	222	2200
500	50	501	500	242	2400
650	65	601	600	262	2600
800	80	701	700	282	2800
101	100	801	800	302	3000

b. Nominal pressure (MPa)

06	0.6	(DN700～DN3000)
10	1.0	(DN15～DN2200)
16	1.6	(DN15～DN1600)
40	4.0	(DN3～DN700)
63	6.3	(DN15～DN500)
xx	For special orders	

c. Lining material

1. Polytetrafluoroethylene (F4) (DN15～DN1600)
2. Poly neoprene (DN40～DN3000)
3. Polyurethane (DN15～DN600)
4. Fluoroethylenepropylene (F46) (DN15～DN500)
(over DN50, including DN50 additional mesh)
5 PFA (DN15～DN500)
(over DN50, including DN50 additional mesh)

d. Electrode material

1. Stainless steel 316L
2. Hastelloy B
3. Hastelloy C
4. Titanium
5. Platinum-iridium alloy
6. Tantalum
7. Stainless steel is coated with carbide

e. Housing protection

1 IP65
2. IP68+ IP65 (which means sensor IP68+ converter IP65,
(only 2, 3 is optional for C code; only is optional for 0 h code; only CR is optional for f code; only 01-06 is optional for j code)
3. IP67 (only 2, 3 is optional for C code; only 0 is optional for f code; only CH is optional for h code; 07-10 is optional for j code)

f. Explosion-proof mark *

0 without
1 Exdibmb II CT6 Gb (only round converter integrated, magnetic button)
ExdibmbIIB+H2T6 Gb (only square converter integrated, magnetic button)
List out the structure of the converter (square or round) If this code is selected.
2 ExdibmbIIB+H2T6 Gb (only square converter separated, magnetic button)
3 ExibmbIIB+H2T6 Gb (square converter separated, converter in the safe area)

g. Accessories

0 without
1. Grounding electrode (DN25-DN3000)
2. Grounding flange (DN15-DN3000)
3. Inlet protection flange (DN65- DN1600)
4. Electrode scraper mechanism (DN300- DN3000)
5. Grounding ring (DN15-DN3000)
6. Inlet protection ring (DN65-DN600)

h. Structure

CR separated, Chinese menu
CH integrated, Chinese menu
* 10m of STT3200 cable is supplied with the instrument of separated type, order additionally if it is not enough.

i. Power supply

1 85～265V 45～400Hz
2 19～40V D.C.

j. Converter type

01. Square separated, button, single current, single pulse, dual alarm, RS232
02. Square separated, button, single current, single pulse, dual alarm, RS485
03. Square separated, button, single current, single pulse, dual alarm, HART
04. Square separated, magnetic button, single current, single pulse, dual alarm, RS232
05. Square separated, magnetic button, single current, single pulse, dual alarm, RS485
06. Square separated, magnetic button, single current, single pulse, dual alarm, HART
07. Round integrated type, button, single current, single pulse, dual alarm, RS485
08. Round integrated type, button, single current, single pulse, dual alarm, HART
09. Round integrated type, magnetic button, single current, single pulse, dual alarm, RS485
10. Round integrated type, magnetic button, single current, single pulse, dual alarm, HART
11. Square integrated type, button, single current, single pulse, dual alarm, RS232
12. Square integrated type, button, single current, single pulse, dual alarm, RS485
13. Square integrated type, button, single current, single pulse, dual alarm, HART
14. Square integrated type, magnetic button, single current, single pulse, dual alarm, RS232
15. Square integrated type, magnetic button, single current, single pulse, dual alarm, RS485
16. Square integrated type, magnetic button, single current, single pulse, dual alarm, HART
17. Square separated, button, single current, single pulse, dual alarm, Profibus DP

Contents

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A. Flowmeter and sensor

1. Product function and purposes

1.1 Product features

The electromagnetic flowmeter is a kind of flowmeter made by adopting Faraday law of electromagnetic induction. This product is made by adopting the latest technology of modern electromagnetic flowmeter with following features:

a) The measurement is not affected by the change of liquid density, viscosity, temperature, pressure and conductivity;

b) There isn't component which may impede flowing in the measuring tube, without pressure loss, straight pipe section shall be relatively low;

c) The inside nominal diameter DN3- DN3000. Several selections are available for the sensor lining and electrode material;

d) The converter adopts new excitation method, and features low power consumption, stable zero point and high precision.

e) The converter can be formed in integrated or separated type with the sensor;

f) The converter adopts 16-digit high performance microprocessor, 3-line 128×64 LCD lattice Chinese character display, and features convenient parameters setting, reliable programing;

g) The flowmeter is the bidirectional measurement system, and is installed with three integrators to record the total volume: forward total volume, reversed total volume and total difference; it can display forward flow and reverse flow volume, additionally, it can output: current, pulse, digital communication;

h) The converter adopts surface mounting technology (SMT) with the functions of self-inspection and self-diagnosis;

i) The rubber and polyurethane lining sensor adopts intrinsic immersion structure;

j) The explosion-proof instrument can be used for corresponding explosion-proof site.

1.2 Main purpose

E-mag electromagnetic flowmeter is used for measuring the volumetric flowrate of conductive liquid and serous fluid in the closed pipe, and is applicable to chemicals, power, mining and metallurgy, water supply and drain, paper making, medicine, foods and so on.

2. Product type and structure

2.1 Structure

The electromagnetic flowmeter composes of electromagnetic flowrate sensor and electromagnetic flowrate converter.

2.2 Product type (Diagram 1)

Varied lining and electrode materials for the sensor of E-mag C electromagnetic flowmeter are available.

The converter can be assembled in integrated flowmeter or separated flowmeter with the sensor.

The converter of integrated flowmeter has two structure types: square and round.

The converter has press button and magnetic button types according to the operation button type.

E-mag C explosion-proof electromagnetic flowmeter is used for regulated explosion-proof site.
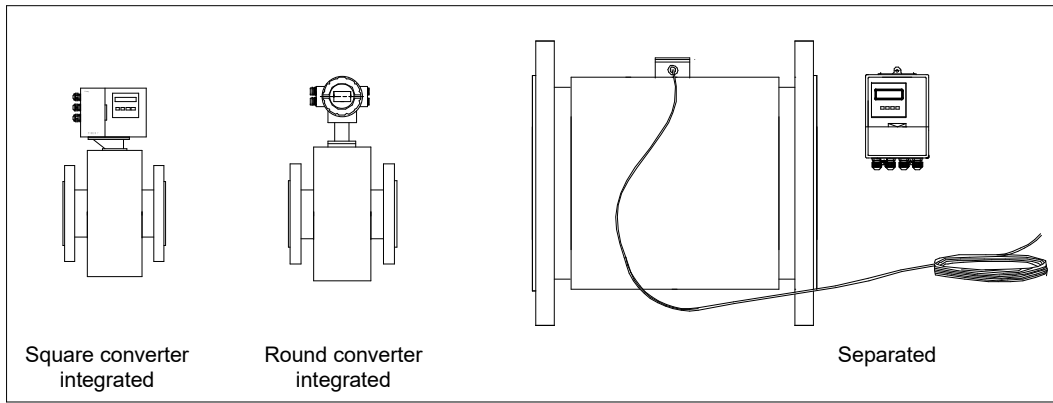
Diagram 1 Product assembly type

2.3 Code and nameplate (Diagram 2)

E-mag C type electromagnetic flowmeter has varied contents for selecting, for the convenience of user in model selection, ordering and factory production management, all elements of the product are indicated with numerical code, please see the code list for the code on the nameplate.

Because the converter is tested according to the auxiliary sensor, please keep the code number on the converter tag consistent with the whole device nameplate. Main parameters of the code are listed on the nameplate of the flowmeter, the actual working temperature and pressure of the flowmeter are not allowed to exceed the rated value.
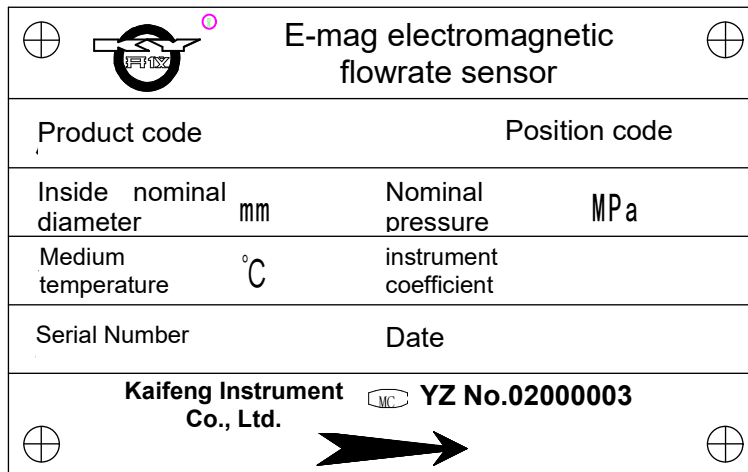

Diagram 2 Nameplate

2.4 External and installation dimension
2.4.1 External and installation dimension of the separated converter (please see Diagram 3)
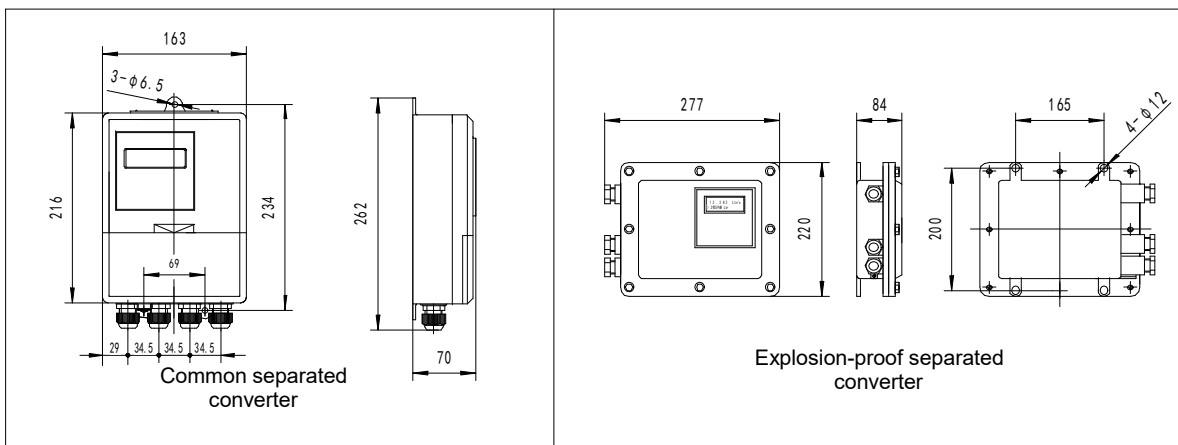

Diagram 3 Outside diagram of the separated converter

2.4.2 External and installation dimension of sensor and integrated type (Diagram 4-Diagram 6)
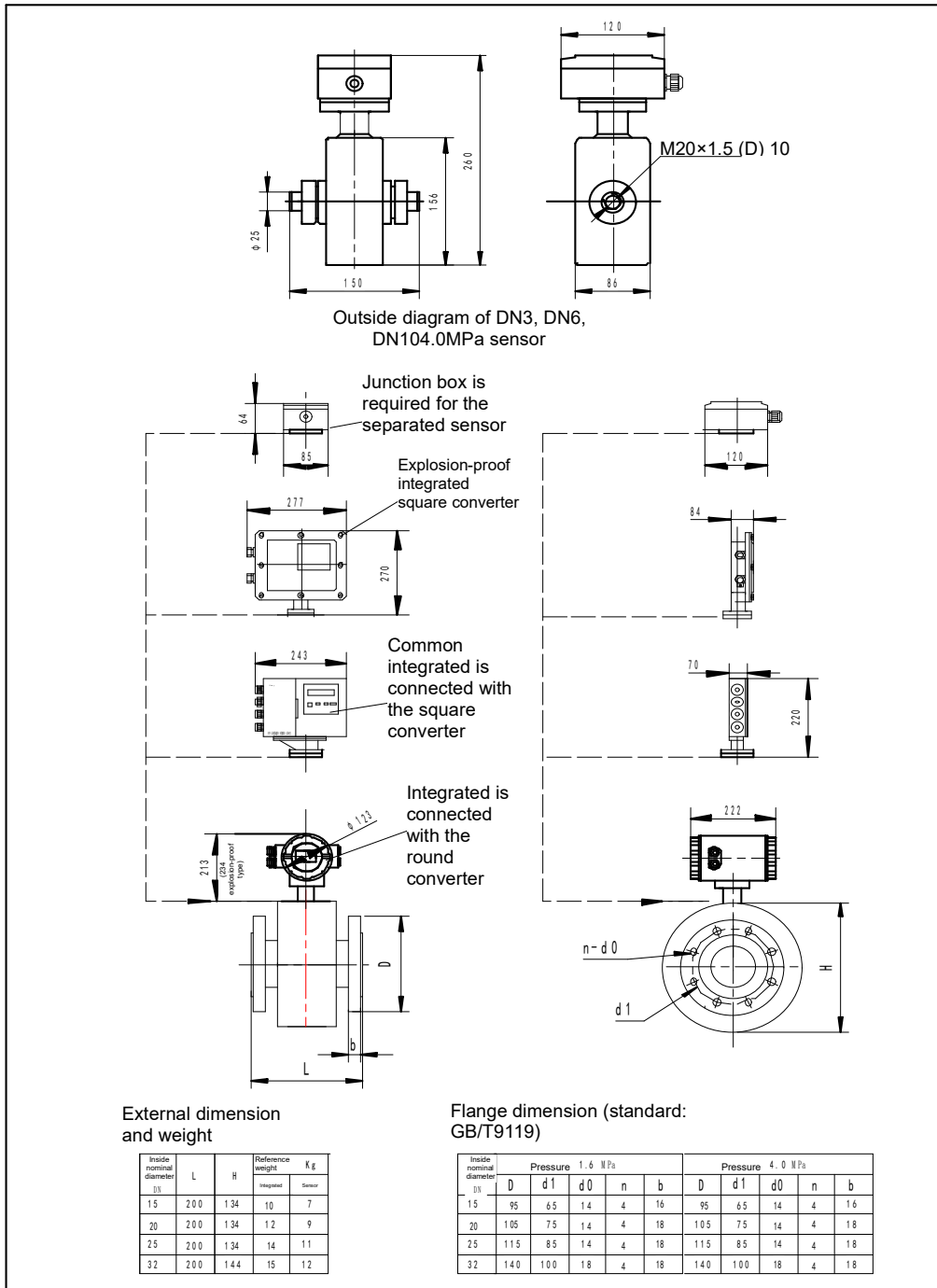

Outside diagram of DN3, DN6, DN104.0MPa sensor

M20×1.5 (D) 10

Junction box is required for the separated sensor

Explosion-proof integrated square converter

Common integrated is connected with the square converter

Integrated is connected with the round converter

External dimension and weight

Inside nominal diameter DN	L	H	Reference weight		Kg
			Integrated	Sensor	
15	200	134	10	7	
20	200	134	12	9	
25	200	134	14	11	
32	200	144	15	12	

Flange dimension (standard: GB/T9119)

Inside nominal diameter DN	Pressure 1.6 MPa					Pressure 4.0 MPa				
	D	d1	d0	n	b	D	d1	d0	n	b
15	95	65	14	4	16	95	65	14	4	16
20	105	75	14	4	18	105	75	14	4	18
25	115	85	14	4	18	115	85	14	4	18
32	140	100	18	4	18	140	100	18	4	18

Diagram 4 Outside diagram of DN3- DN321.6MPa, 4.0MPa sensor and integrated type

Junction box is required for the separated sensor

Explosion-proof integrated square converter

Integrated type is connected with the square converter

Integrated is connected with the round converter

explosion-proof type
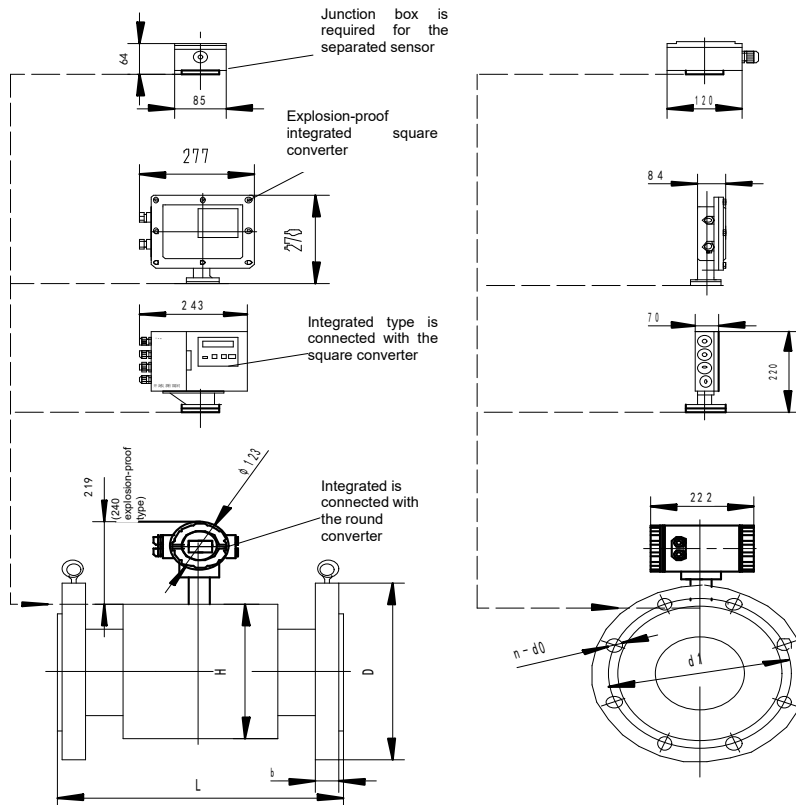
External dimension and reference weight of separated sensor

Inside nominal diameter DN	L	H φ ~	Reference weight Kg
40	200	149	13
50	200	156	14
65	200	156	16
80	200	156	17
100	250	198	30
125	250	234	32
150	300	252	43
200	350	310	45
250	450	358	50
300	500	410	60
350	550	465	145
400	600	515	180
450	600	564	215
500	600	614	245
600	600	722	335

Flange dimension (standard: GB/T9119)

Inside nominal diameter DN	Pressure 1.6MPa					Pressure 4.0MPa				
	D	d1	d0	n	b	D	d1	d0	n	b
40	150	110	18	4	20	150	110	18	4	20
50	165	125	18	4	20	165	125	18	4	20
65	185	145	18	4	20	185	145	18	8	22
80	200	160	18	8	22	200	160	18	8	22
100	220	180	18	8	22	235	190	22	8	26
125	250	210	18	8	22	270	220	26	8	26
150	285	240	22	8	24	300	250	26	8	28

Inside nominal diameter DN	Pressure 1.6MPa					Pressure 1.0MPa				
	D	d1	d0	n	b	D	d1	d0	n	b
200	340	295	22	12	26	340	295	22	8	24
250	405	355	26	12	28	395	350	22	12	26
300	460	410	26	12	32	445	400	22	12	28
350	520	470	26	16	35	505	460	22	16	30
400	580	525	30	16	38	565	515	26	16	32
450	640	585	30	20	42	615	565	26	20	35
500	715	650	33	20	46	670	620	26	20	38
600	840	770	36	20	52	780	725	30	20	42

Diagram 5 Outside diagram of DN40- DN600 integrated type and sensor

External dimension and weight

Inside nominal diameter DN	L	H $\varphi \sim$	Reference weight Kg
700	700	836	435
800	800	936	545
900	900	1036	655
1000	1000	1146	810
1200	1200	1346	875
1400	1400	1552	1235
1600	1600	1752	1555
1800	1800	1964	2085
2000	2000	2172	2610
2200	2200	2364	3210
2400	2400	2564	3910
2600	2600	2764	4280
2800	2800	2960	5000
3000	3000	3160	5600

Flange dimension (standard: GB/T9115)

Inside nominal diameter DN	Pressure MPa	D	d1	d0	n	b
700		895	840	30	24	30
800	1.0	1015	950	33	24	32
900		1115	1050	33	28	34
1000		1230	1160	36	28	34
700		860	810	26	24	26
800		975	920	30	24	26
900		1075	1020	30	24	26
1000		1175	1120	30	28	26
1200		1405	1340	33	32	28
1400		1630	1560	36	36	32
1600	0.6	1830	1760	36	40	34
1800		2045	1970	39	44	36
2000		2265	2180	42	48	38
2200		2475	2390	42	52	42
2400		2685	2600	42	56	44
2600		2905	2810	48	60	46
2800		3115	3020	48	64	48
3000		3315	3220	48	68	50

Diagram 6 Outside diagram of DN700- DN3000 sensor

3. Working principle and structure characteristics

3.1 Working principle

The measuring principle of the electromagnetic flowmeter is based on Faraday law of electromagnetic induction (Diagram 7). The measuring tube of the sensor is the short non-magnetic conductive alloy tube with insulating lining, its diameter is D. Two electrodes cross through the pipe along the pipe radial direction and are fixed on the measuring tube, its electrode tip is basically in parellel with the inside surface of the lining. When excitation coil is excited with the bidirectional square wave pulse, it generates the work magnetic field of magnetic flux density is B at the direction vertical with the axis of the measuring tube. Then, if the liquid of certain conductivity flows through the measuring tube at average flowrate V, it will cut the magnetic lines of force and detect the electrodynamic potential E. The electrodynamic potential E is the product proportional to magnetic flux density B, the measuring tube internal diameter D and average flowrate V, the electrodynamic potential E (flowrate signal) is tested by the electrode and sent to the converter with cable. After amplifying and processing the flowrate signal,

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the converter can display signals such as flowrate, total volume, and can output pulse, analog current and so on.

3.2 Structure of the sensor (Diagram 8)

E-mag C electromagnetic flowmeter features compact structure and short connection dimension, its lining and electrode material are applicable to varied liquid and serous fluid. Because square wave pulse excitation is adoptd, the whole device features low power consumption and stable zero point.

The main parts of the sensor include measuring tube, electrode, excitation coil, iron core and magnetic yoke, housing; independent junction box is also installed for the sensor of the separated flowmeter.

The rubber and polyurethane lining sensor adopts intrinsic immersion structure (IP68). If the sensor is immersed in water or installed in the place where will be easily immersed in water, after confirming the wiring on site, the junction box shall be sealed with sealant according to the use instructions of the sealant.
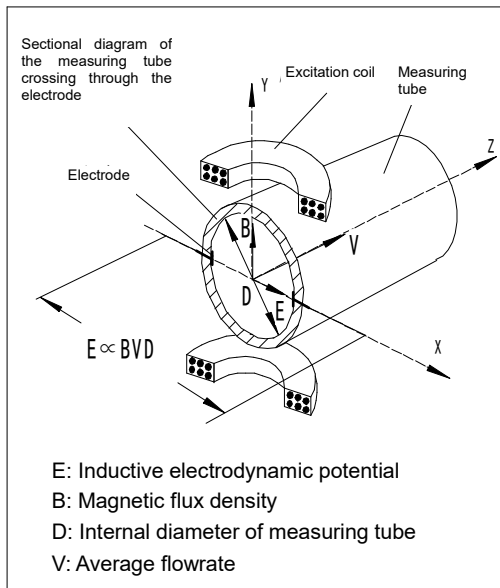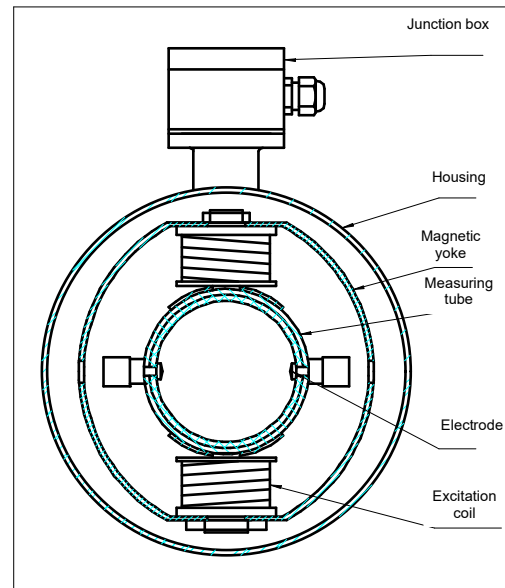
Diagram 7 Working principle diagram   Diagram 8 Sensor structure diagram

4. Main technical data

4.1 Technical data of the whole device and sensor

Standard	JB/T9248-1999					
Inside nominal diameter	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					
Highest flow velocity	15m/s					
Precision	DN15- DN600	±0.3% of the indicating value (flow velocity ≥1m/s); ±3mm/s (flow velocity <1m/s)				
Precision	DN3- DN10 DN700- DN3000	±0.5% of the indicating value (flow velocity ≥0.8m/s); ±4mm/s (flow velocity <0.8m/s).				
Liquid conductivity	≥5uS/cm					
Nominal pressure	4.0MPa	1.6MPa	1.0MPa	0.6MPa	6.3 MPa	10 MPa
Nominal pressure	DN3- DN700	DN15-DN1600	DN15-DN2200	DN700-DN3000	DN15-DN500	For special orders
Lining material	Polytetrafluoroethylene, poly neoprene, polyurethane, fluoroethylenepropylene (F46), additional mesh PFA					
Environment temperature	Sensor	-25℃～+60℃				
Environment temperature	converter and integrated type	-10℃～+60℃; -40℃～+60℃（Special ordering）				
Maximum liquid temperature	Integrated	70℃				
Maximum liquid temperature	Separated	Poly neoprene lining	80℃; 120℃(list out when ordering)			
Maximum liquid temperature	Separated	Polyurethane lining	80℃			
Maximum liquid temperature	Separated	Polytetrafluoroethylene lining	100℃; 150℃(list out when ordering)			
Maximum liquid temperature	Separated	Fluoroethylenepropylene (F46)	100℃; 150℃(list out when ordering)			
Maximum liquid temperature	Separated	Additional mesh PFA	100℃; 150℃(list out when ordering)			
Signal electrode and grounding electrode material	Stainless steel 316L, Hastelloy C, Hastelloy B, titanium, tantalum, platinum-iridium alloy, stainless steel is coated with tungsten carbide					
Electrode scraper mechanism	DN300- DN3000					
Material of connecting flange	Carbon steel					
Material of grounding flange	Stainless steel					
Inlet protection Flange material	DN65- DN150	Stainless steel				
Inlet protection Flange material	DN200- DN1600	Carbon steel + stainless steel				
Housing protection	IP65, IP67, IP68 (applicable range of different levels please refer to product code)					
Explosion-proof mark of the explosion-proof type instrument	Code f is 1(E-mag CH) round	ExdibmbⅡCT6 Gb				
Explosion-proof mark of the explosion-proof type instrument	Code f is 1, 2(E-mag CR, CH) square	ExdibmbIIB+H2T6 Gb				
Explosion-proof mark of the explosion-proof type instrument	Code f is 3(E-mag CR) sensor	ExibmbIIB+H2T6 Gb				
Space (separated)	The distance between the converter and the sensor shall not exceed 100m, special ordering if it exceeds 100m.					

4.2 Technical data of converter

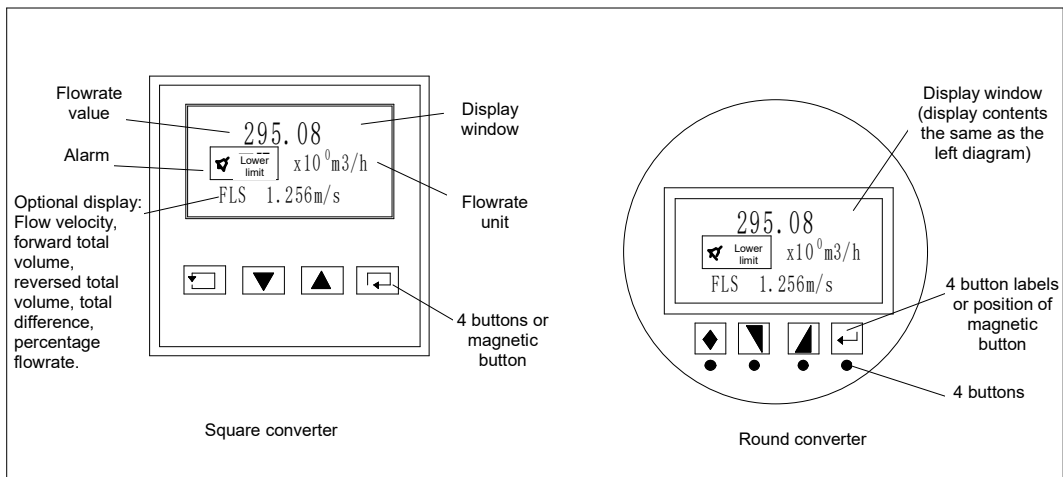| Power supply	AC	85～265V, 45～400Hz
	DC	19- 40V
Power		<20VA (including sensor)
Operation button and display	Depressed button type	• All parameters can be set with 4 membrane buttons (Diagram 9), additionally, the converter can also be set and programmed with external PC (RS232, RS485); • 3-line LCD, wide viewing angle, wide temperature range, with backlight display: The first line is 5-digit 7-section code display, and displays the flow direction and flowrate value; The second and third lines are character type lattice display, width is 16 characters. The second line displays alarm and flowrate unit; The third line display flow velocity, percentage, blank pipe, forward total volume, reversed total volume, and total difference.
	Magnetic button type	The display panel is the same as button type (Diagram 9), approaching the button identifier with magnetic bar respectively, all parameters can be selected, set and programmed with external PC (RS232, RS485).
Internal integrator		With forward total volume integrator, reversed total volume integrator and total difference integrator.
Test mode		Through the converter programing test mode, all outputs are programing values, thus reaching the purpose of testing the system.
Output signal	Current output	• Full isolation, load < 600 Ω (at 20mA); • Range: 4-20mA or 0- 10mA;
	Pulse output	• Frequency range: 0- 5KHz, upper limit 1- 5KHz optional; • Square wave or 25ms wide pulse; • Transistor switch output with isolation protection, it can absor 250mA current, withstand voltage is 35V.
	Alarm output	• Alarm (programing) high/low flowrate, blank pipe, fault state, forward/reversed flowrate, analog value over range, pulse value over range, pulse small signal removal; • Transistor switch output with isolation protection, it can absor 250mA current, withstand voltage is 35V. (Not isolated with pulse output.)
Digital communication		RS232, RS485, HART, Profibus DP
Isolation		Isolation voltage between the output and input is 500V; isolation voltage between the output and ground is 500V.

Diagram 9 Display and operation button of E-mag C type

5. Installation

Safety regulations are available for the design, test and power supply of flowmeter, user must strictly abide by related regulations of this Instructions to ensure safe operation and running of the flowmeter.

5.1 Safety measures

In order to ensure the operator and device safety, the following terms must be abided by:

a) Before selecting the position and installing the flowmeter, please read this Instructions, additionally, the safety requirements of the flowmeter, related device and device body environment must be taken into consideration;

b) The instrument shall be installed and repaired by the technician with certain knowledge on instrument;

c) Correctly install the sensor and pipe of the flowmeter, ensure safe and reliable sealing performance, the liquid pressure is not allowed to exceed the maximum working pressure listed on the nameplate;

d) Certain measures shall be taken to prevent electric shock;

e) The device for hoisting the flowmeter shall meet the safety regulations.

5.2 Check before installing

a) Check the flange, lining, housing and lead-out bushing;

b) Open the case cover, check if the wiring and PCB are loose or damaged;

c) Check if the model code on the nameplate is accordant with the ordering code.

5.3 Hoisting (Diagram 10)

The safe load and protective measures of the hoisting device shall meet the related regulations.

It is prohibited to lift the instrument with rope at the converter case body (integrated flowmeter) or junction box (separated flowmeter).
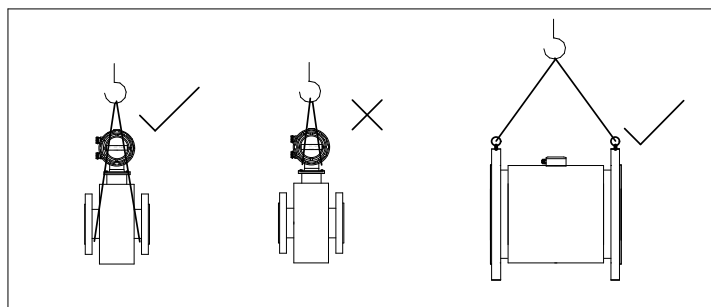

Diagram 10 Correctly hoist the device

5.4 Installation position in the pipe (Diagram 11)

>5DN >2DN

Flow direction

① Ensure the length of straight pipe section

Do not exceed 10°

② The relative position of 2 electrodes shall be basically horizontal.

③ The exhaust valve and pressure meter are installed at the upper reach of the meter for big caliber sensor (used for measuring water) to remove air, monitor the full pipe.
Medium is filled in the pipe

④ The installation position shall be convenient for reading and operation.

Flow direction

⑤ Keep vertical when installing, keep liquid flowing upwards.

Opening discharge

⑥ When discharging via opening, the influence from air bubble and negative pressure shall be prevented.

⑦ Negative pressure shall be avoided, the flowmeter shall not be installed in the suction side of pump.

>5m

⑧ If the fall head exceeds 5m, the automatic exhaust valve shall be installed at instrument lower reach high level, prevent negative pressure difference damaging the lining.
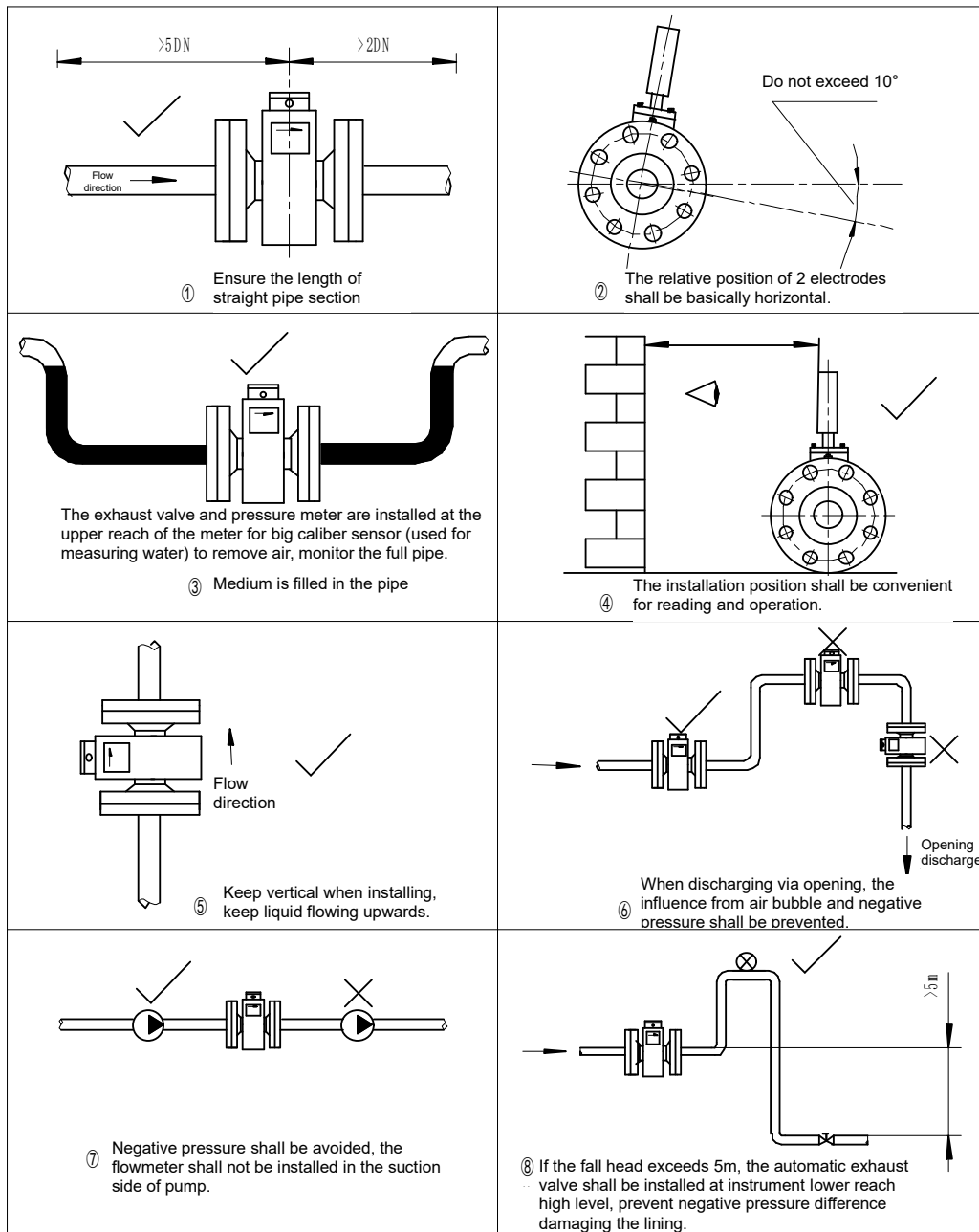
Diagram 11 Installation position of flowmeter in the pipe

a) The flowmeter can automatically test the forward flow and reverse flow. Because the manufacturer has regulated the flow direction arrow on the instrument housing as the forward flow direction, therefore, when installing the instrument, the flow direction arrow shall keep consistent with the actual forward flow direction on site. For separated instrument, exchange the wiring of EXT+ and EXT-terminals at one end of the exchange converter, which means to switch the flow direction (Diagram 11①).

b) In order to ensure the measuring precision, the straight pipe section at the upper reach side of the sensor shall have at least 5 times of pipe radial length. When devices such as tapered pipe, orifice and valve are over 5 times of pipe radial of the sensor, its influence can be neglected. The straight pipe section at lower reach side of the sensor shall be at least 2 times of pipe radial length (Diagram 11①).

c) In order to ensure reliable measurement, what is important is that the electrode shall be completely immersed in the tested liquid, the sensor can be installed at any position (horizontal, vertical, inclined) If the wiring of the electrode basically keeps at horizontal position (the and included angle with the horizontal line is 10°), in order to further reduce the influences of air bubble to measurement, the working pressure may be moderately increased (Diagram 11 ③, ⑥).

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d) In order to ensure that the measuring tube of the sensor is full of liquid, the sensor can be installed at the lowest part of the U type pipe (Diagram 11③);

e) For horizontal installation, the converter case body (or junction box) shall keep at horizontal position shown in Diagram 11①;

f) For vertical or inclined installation, the liquid shall flow downwards, additionally, the installation position shall be convenient for wiring the instrument and reading (Diagram 11④, ⑤).

g) Negative pressure shall be avoided in the pipe, otherwise, it may damage the lining (Diagram 11⑥, ⑦, ⑧).
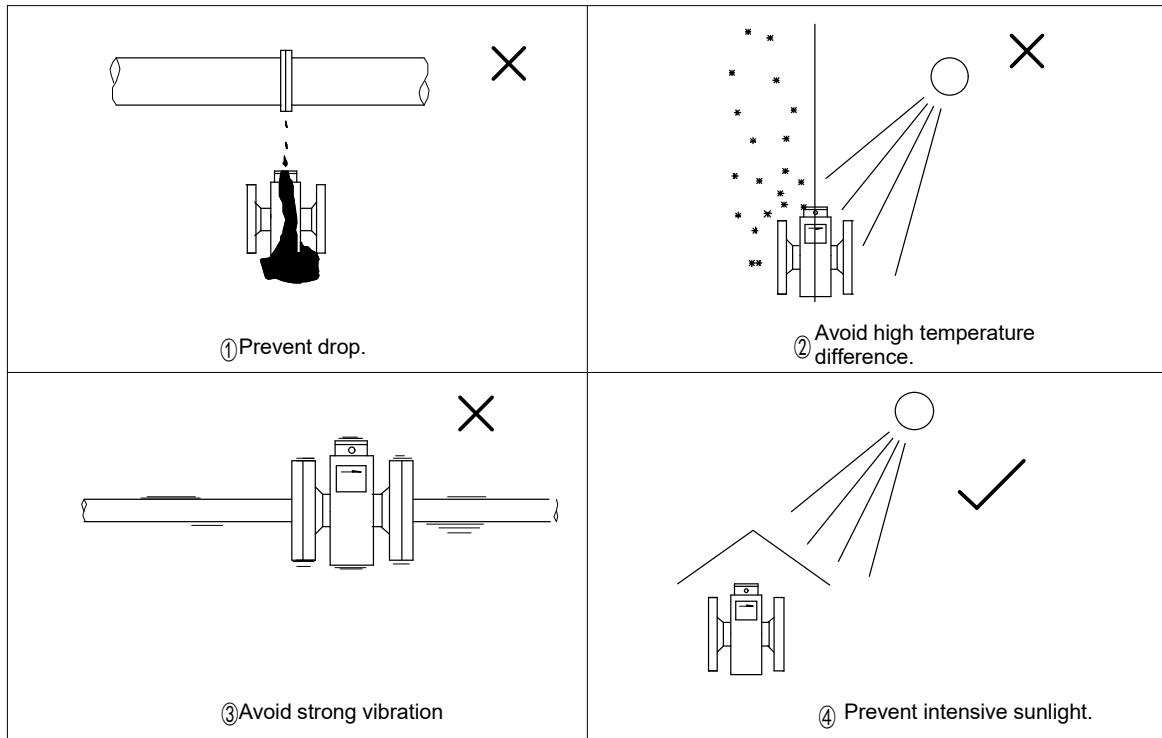
5.5 Selection of installation site (Diagram 12)

Diagram 12 Selection of installation site

If the installation site is exposing in intensive sunlight, shelter shall be constructed. Avoid strong vibration and high temperature change, additionally, prevent corrosive liquid on the instrument, otherwise, it may damage the instrument. The magnetic field strength of the position to install the instrument shall < 400A/m.

5.6 Requirements on the connection of sensor (including integrated) and pipe

First, the sensor itself can't be used as the load supporting point, and can't support the adjoining work pipe which shall be supported with the pipe (Diagram 13①). Additionally, avoid high pull stress when installing the sensor, the influence from the stress of the heat expansion of the adjoining pipe shall be eliminated.

When installing the sensor, the measuring tube shall be coaxial with the process pipe. For the DN≤50 sensor, the axial deviation shall not exceed 1.5mm, for DN65- DN300 sensor, which is not allowed to exceed 2mm, for DN≥350 sensor, which is not allowed to exceed the 4mm;

The flange gasket installed between the flange shall have excellent corrosion resistant performance, this gasket is not allowed to stretch in the pipe (Diagram 13②);

The thread of the bolt and nut for fixing the instrument shall keep good condition without damage, and shall be lubricated excellently. Tighten the bolt with torque wrench according to the flange dimension and moment of force. When welding or cutting the adjacent pipe of the sensor, isolation measures shall be taken to protect the lining from heat (Diagram 13③).

5.7 Special flange

a) Inlet protection flange

If the tested liquid has strong abradability, the inlet protection flange shall be installed at the sensor inlet, its lip insert into the hole of the sensor to reduce the lining wear (Diagram 14①);

b) Grounding flange

For non-conductive pipe, in order to acquire the liquid potential (zero potential), the grounding flange shall be installed between the sensor flange and pipe flange (Diagram 14②).
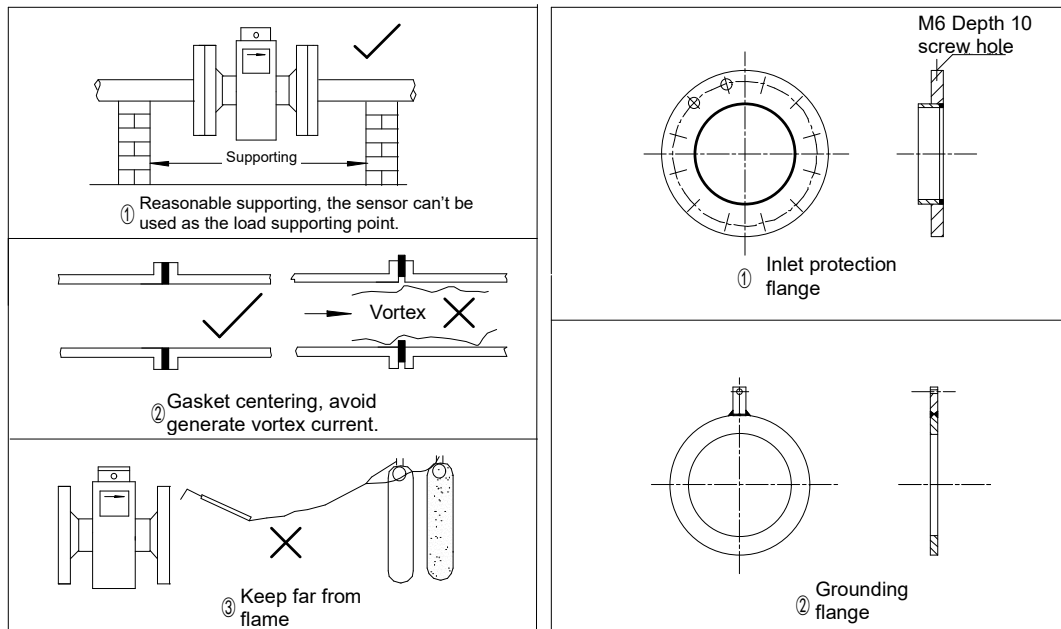

Diagram 13 Connecting cautions diagram   Diagram 14 Special flange

5.8 Connecting with metal pipe, wiring and grounding

The flowrate signal is the differential signal with medium as the reference point (0V), the signal reference point (0V) and metal measuring tube are connected in the sensor. Although the flow meter can acquire medium potential (0V) through the connecting bolt of pipe flange and the instrument flange, but the regular method is to install the electric wiring, shown in Diagram 15①, thus ensuring the reliable output of flowrate with medium of 0V.

The sensor shall also be installed with grounding cable, shown in Diagram 15 ①, the grounding resistance shall < 10Ω.

5.9 Connecting with non-conductive pipe, wiring and grounding

When connecting with non-conductive pipe (such as plastic pipe, metal pipe with lining), please operate according to Diagram 15②, ③.

5.10 Connecting with the cathode protection pipe, wiring and grounding (Diagram 15④)

If the system with sensor adopts cathode protection, or adopts electrolysing process in the flow, then certain measures shall be taken to ensure:

a) The power frequency current is not allowed to flow through the liquid in the sensor;

b) Any power frequency current which flows through the sensor body is not allowed to exceed 10A (effective value).

The pipe network with cathode protection, because its system potential is not fully ground potential, it will generate interference electric potential. To remove such electric interference, add the bypass wiring and grounding flange as shown in Drawing, the insulation between the bolt and flange shall be ensured with insulating bushing and insulating gasket. Additionally, bypass line has adequate carrying capacity to

protect the bypass cathode current. Moreover, the flange on onside of the instrument shall be tightly connected with corresponding grounding point.

① Connecting of sensor and pipe, electric wiring and grounding cable
---- Metal pipe

② Connecting of sensor and pipe, electric wiring and grounding cable
------Non-metal pipe, the sensor is installed with grounding electrode

③ Connecting of sensor and pipe, electric wiring and grounding cable
-----Non-metal pipe, the sensor is not installed with grounding electrode

④ Connecting of sensor and pipe, electric wiring and grounding cable
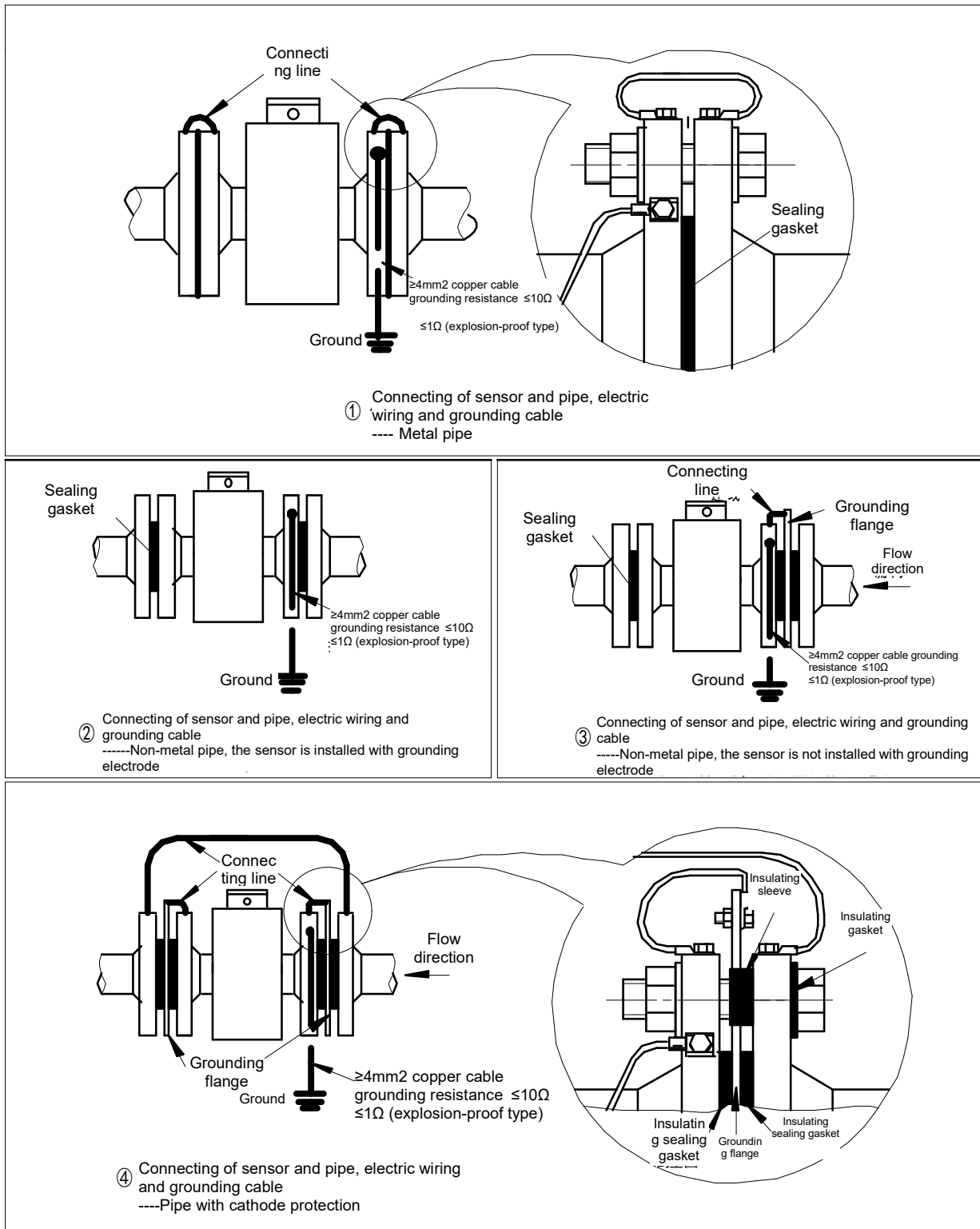----Pipe with cathode protection

Diagram 15 Connecting of sensor and pipe, electric appliance wiring and grounding cable

B Converter

6. Converter structure

Since the combination of converter and sensor has integrated and separated types, therefore, the converter has two structure types: integrated flowmeter converter and separated flowmeter converter (Diagram 16).
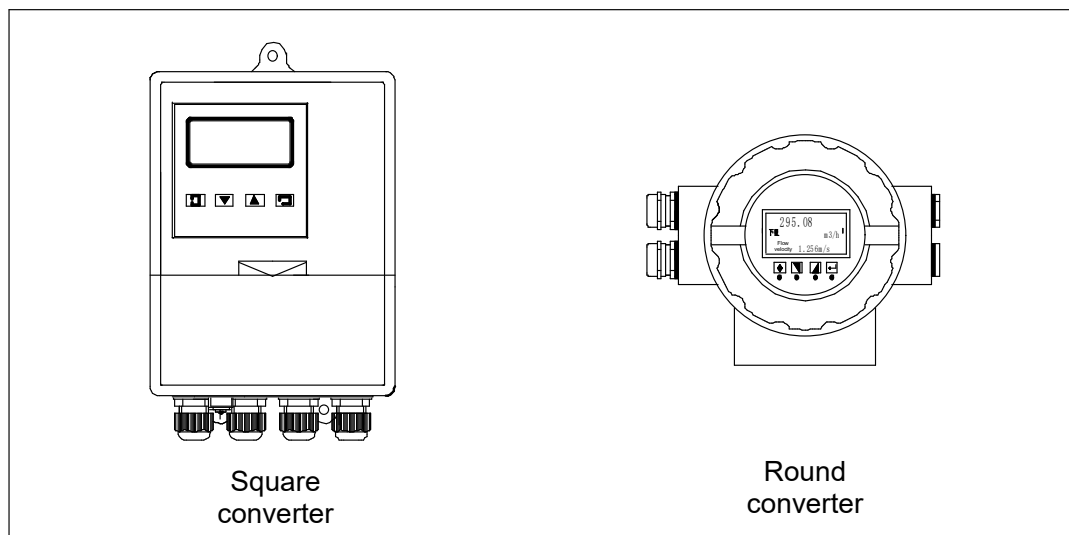

Diagram 16 Structure of converter

Converter itself includes button type and magnetic button type according to the operation mode.

3-line LCD, wide viewing angle, wide temperature range, with backlight display. All parameters can be set with 4 operation buttons, the converter can also be set and programmed with external PC, please see Diagram 33 and Diagram 34 for the programing and connecting with RS232 and RS485 communication protocol.

The converter module is installed in the aluminum alloy case, the converter is fixed on the sensor, or installed independently (wall or panel mounting). The converter mainly has three circuit board subassemblies: main board, display panel, auxiliary board.

The main board achieves the functions of measurement and input output.

The display panel achieves the functions of flowmeter measuring display and parameters setting (which means flowmeter programing).

The auxiliary board achieves the function of communication.

When replace with the well adjusted circuit board on site, basically without precision loss.

All circuits of the converter adopt SMT surface installation type, therefore, user doesn't have the ability of site repair, additionally, static protection is necessary for the boards, therefore, user is not allowed open the converter onsite.

7. Working principle of converter (Diagram 17)

The converter adopts new excitation method, therefore, the flowmeter features with excellent stable zero point and measuring precision. The converter provides precise, frequency variable, bidirectional constant current driving current to the sensor for driving the excitation coil of the sensor. Its work frequency is controlled with SCM computer without the influence from power frequency change. When the excitation circuit is at the reversed direction of the magnetic field, one high reversed voltage is provided by the energy recovery system to accelerate the suppression of magnetic field resistance at reversed direction and drop the power consumption.

The current which flows through the flowmeter generates one light differential signal on the sensor electrode, and the signal is input to the measurement system of the converter. After amplifying with input impedance amplifier, filtering and automatic zero point adjustment and plus control, through high performance and high precision VFC conversion, the analog signal is converted into digital value. After sampling the digital signal, the SCM computer calculates the flow velocity and expected measuring values, analog output, pulse output value etc. LCD screen displays the measuring values.
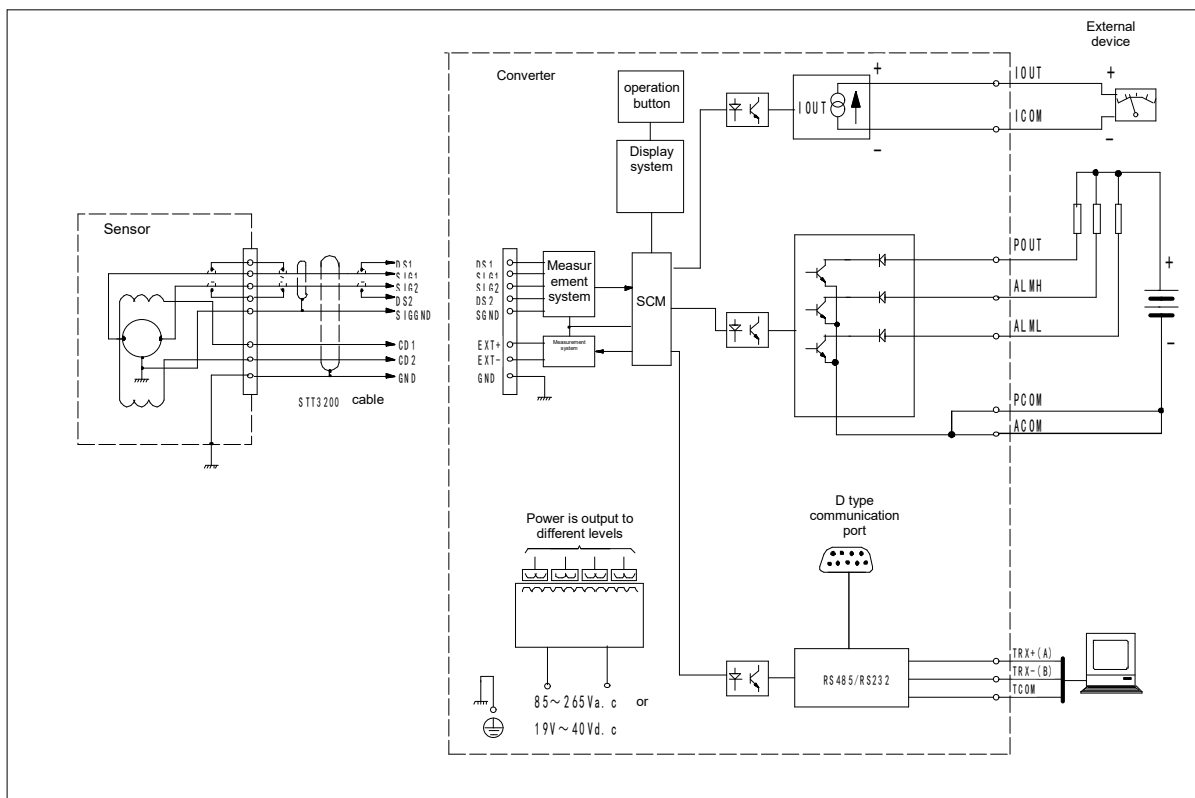
Diagram 17 Working principle of the converter

8. Converter programing (setting)

Electromagnetic flowrate converter may be programmed with operation button or computer programing (setting). When computer programing (RS232 or RS485) is adopted, it can be operated with the demonstration software provided by the manufacturer, or user may edit suitable communication program according to the communication protocol provided by the manufacturer.

The button label of the magnetic button converter is the same as the press button (Diagram 9), their software menu structure is the same, magnetic button changes the action of the press button into approaching and leaving corresponding magnetic button.

The button labels of round converter and square converter are corresponding one by one according to the table below:

Square	↤	▼	▲	↵
Round	◆	◣	◤	↵

The programing (setting) method with operation button is introduced with the square button converter, which is the same for programing the round converter.

8.1 Work parameters menu structure of operation button programing

The work parameters of this converter adopt tree menu structure (Diagram 18), its work parameters are arranged in corresponding menu page (or submenu in the main menu) according to the flow measurement or analog output. ↤ The menu shown in Diagram 19 is applicable to ↵ directly programing with press button or magnetic button on the converter board, user may use "(separated)" or "(integrated)" button to turn the page of the menu vertically; use "(separated)" or "(integrated)" button to turn the page of the menu horizontally. ↵ The right side of the menu item is marked with "I" and "II" mark, which mean the parameters for level 1 and level 2 security parameters respectively, the level 1 or level 2 work parameters can only be modified by inputting corresponding security password (or security code). The work parameters of level 1 security can be adjusted by the user in this level; work parameters of level 2 security can only be adjusted by allowed engineering technicians in this level. The meanings of the work parameters will be introduced respectively in following part according to the operation mode.
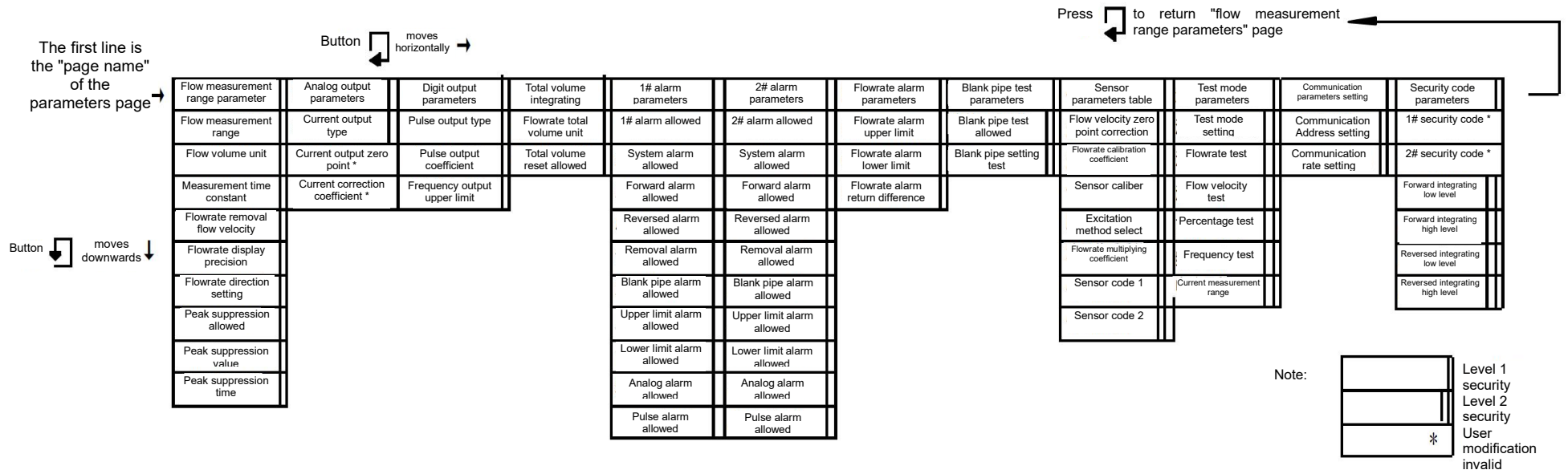
15

The first line is the "page name" of the parameters page →

Button [ ] moves horizontally →

Press [ ] to return "flow measurement range parameters" page

Button [ ] moves downwards ↓

Flow measurement range parameter	Analog output parameters	Digit output parameters	Total volume integrating	1# alarm parameters	2# alarm parameters	Flowrate alarm parameters	Blank pipe test parameters	Sensor parameters table	Test mode parameters	Communication parameters setting	Security code parameters
Flow measurement range	Current output type	Pulse output type	Flowrate total volume unit	1# alarm allowed	2# alarm allowed	Flowrate alarm upper limit	Blank pipe test allowed	Flow velocity zero point correction	Test mode setting	Communication Address setting	1# security code *
Flow volume unit	Current output zero point *	Pulse output coefficient	Total volume reset allowed	System alarm allowed	System alarm allowed	Flowrate alarm lower limit	Blank pipe setting test	Flowrate calibration coefficient	Flowrate test	Communication rate setting	2# security code *
Measurement time constant	Current correction coefficient *	Frequency output upper limit		Forward alarm allowed	Forward alarm allowed	Flowrate alarm return difference		Sensor caliber	Flow velocity test		Forward integrating low level
Flowrate removal flow velocity				Reversed alarm allowed	Reversed alarm allowed			Excitation method select	Percentage test		Forward integrating high level
Flowrate display precision				Removal alarm allowed	Removal alarm allowed			Flowrate multiplying coefficient	Frequency test		Reversed integrating low level
Flowrate direction setting				Blank pipe alarm allowed	Blank pipe alarm allowed			Sensor code 1	Current measurement range		Reversed integrating high level
Peak suppression allowed				Upper limit alarm allowed	Upper limit alarm allowed			Sensor code 2			
Peak suppression value				Lower limit alarm allowed	Lower limit alarm allowed						
Peak suppression time				Analog alarm allowed	Analog alarm allowed						
				Pulse alarm allowed	Pulse alarm allowed						

Note:

	Level 1 security
	Level 2 security
*	User modification invalid

Diagram 18 Menu structure of programing with button

8.2 Button function

⌨ The converter panel has "", "▼", "▲" and "" four membrane button switches, which are used for finishing the operation all programs of the converter. ⌨ This section introduces the button functions after inputting password to enter into programing (setting) state.

8.2.1 "" button (Diagram 19) ⌨

⌨ button is used for switching between the function menu pages. ⌨ When the "page name" is displayed in menu of each page, press the "" button, the converter display window switches from the "page name" of the current menu page to the "page name" of the next menu page.

8.2.2 "" button (Diagram 20) ⌨

⌨ "" button is used for switching between the parameter items (including "page name ") of some menu page, press the "" button, the converter display window switches from certain parameter item to the next parameter item of the current menu page. ⌨
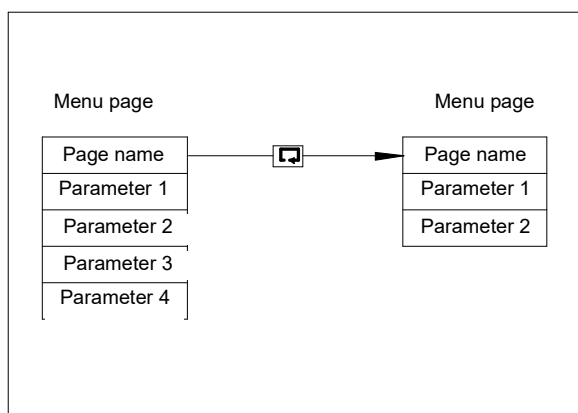

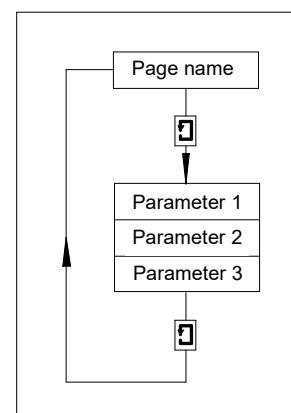Diagram 19 Switching between the menu pages   Diagram 20 Switching between the menu items

8.2.3 "▲" and "▼" button

"▲" and "▼" button are used for adjusting certain parameter, including numerical parameter or selective parameter. For numerical parameters, press the "▲" button to increase the parameter value by one, press the "▼" button to decrease the parameter value by one; for selective parameters, press the "▲" button or "▼" button to change the optional value of once parameter item. ⌨ After adjusting the parameters, press the "" button to save the adjusted parameter value and switch to the next parameter item.

8.3 Programing with button

8.3.1 Starting

After completing the electric connection of the instrument (see C wiring) and confirming correct connection, power on the flowmeter system. After short time delay, the instrument window displays "Kaifeng Instrument Co., Ltd." and "electromagnetic flowmeter V X. X" (version number of the flowmeter software). Then, after several seconds of initialization, the flowmeter displays the flowrate and unit, and enters into measuring state. If fault is foundation during the flowmeter system self-diagnosis, it will timely give and display the alarm indication and alarm type (see Appendix B).

8.3.2 Observing the measuring value (Diagram 21)

When the flowmeter is working, one line of big number is displayed at the upper part of the converter display window, which is used for displaying flowrate, the middle line is text for displaying alarm and flowrate unit, the lowest line is symbol, number and unit, press the "▲" button to select and display one of the following items: Flow velocity, flowrate percentage, forward total volume, total volume of verified reversed total volume. ⌨ When programing is "allowed", hold down the "" button for 2s to reset the total volume.

When there's alarm, besides bell flashes at the left position of the display window, the alarm type will display (if there's over one alarm, the alarm type will be displayed by turn), it can set alarm signal output, user may identify the alarm and find out the reason of fault with reference to the alarm parameter items given in the alarm menu page.

When the flowrate display is negative, it means the flowmeter defines the current flow direction as reversed flow direction. For the separated converter, if the flow direction of liquid in the pipe is consistent with the flow direction mark of the flowmeter, and user want to define the flow direction as forward flow direction, please system cut off power supply of the system, then exchange the EXT+ and EXT- excitation cable of the converter excitation terminal, the supply power, flowrate displays positive value.

The above mentioned measuring parameters are read-only parameters. After powering on, the flowmeter systems work at measuring state, if the user holds down the "" button for 3s, the system enters into security parameters selection menu page, after selecting corresponding security level, the system enters into menu system, which means the programing (setting) state, for adjusting the parameter item according to the security level. At the programing (setting) state, in any menu "page name" position, user holds down the "▼" button for 3s to exit menu system and return flowrate measuring state.

8.3.3 Input security code

When the work parameters of the flowmeter should be adjusted, please enter into programing (setting) state. Input corresponding security code. This code is 5-digit, code value ranges 00000~99999. User level password (level 1 security) is "10760", after inputing, the "level 1 security " parameter item value can be programmed in the menu; after inputing, the "level 2 security" and "level 1 security" parameter item value can be programmed in the menu; (Diagram 18). The parameter item which is not covered in security control of specific level, the value modification is invalid (the new value is not saved).

Under measuring state, hold down the "" button for 3s, the system will require to input security code (Diagram 21). Press the "" button to move the cursor. The digit position pointed by the cursor can be set at the required value by pressing the "▲"or "▼" button. Repeat the above steps, finish inputting all password values, then hold down the "" button for 3s and enters into the first line of the first submenu (page name). If the input password is not correct, the system will return to the measuring state.

8.3.4 Selecting and adjusting theparameters

After confirming the security level, work parameters of the converter can be selected and adjusted (all parameters of corresponding security level). User may press the "" button to switch between the menu page, press the "" button to switch between the parameter items of the menu page, and save the adjusted value of the previous parameter item, press the "▲"or "▼" button to adjust the parameter value or parameter item (such as flowrate unit).

If the parameter value of parameter item is selective, after entering into the parameter item, hold down the "▲"or "▼" button, one line below it displays available items, such as the selection of flow volume unit, please see Diagram 22. If the parameter value of parameter item is numerical (such as flow measurement range), the same as the method of inputting security code.

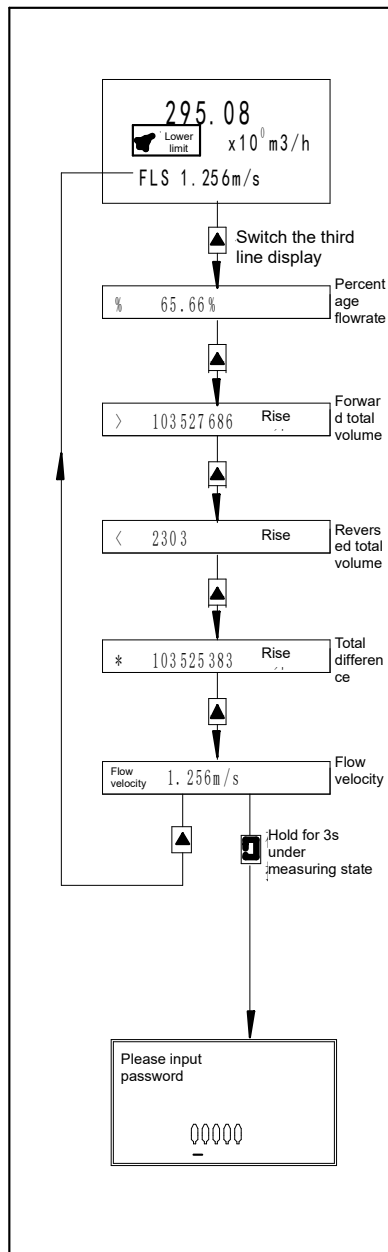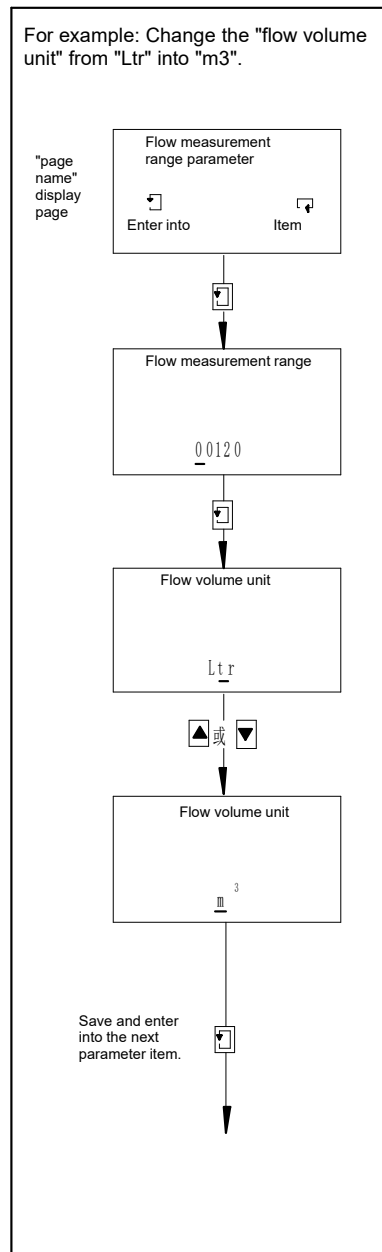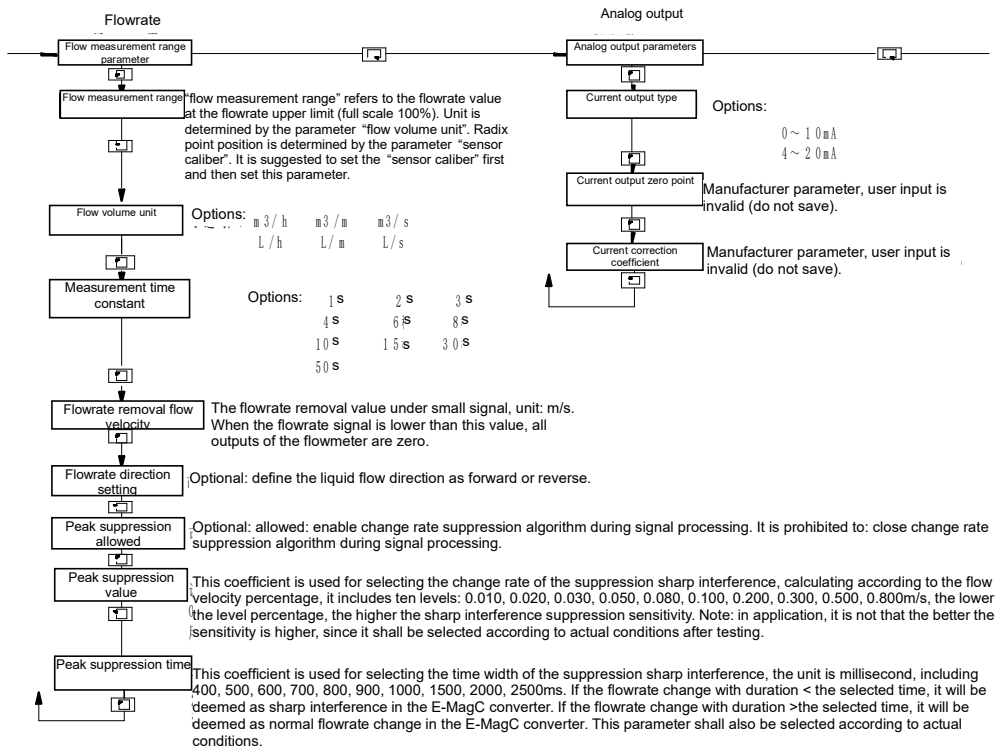Diagram 21 Measuring value display operation

Diagram 22 Selected type parameters programing

8.4 Parameters specifications

In order to conveniently describe the parameters, parameters are listed out according to the menu page and parameter items in menu of each page, shown as below:

8.4.1 Flowrate and analog output menu page

Flowrate

Flow measurement range parameter → [→]

Flow measurement range: "flow measurement range" refers to the flowrate value at the flowrate upper limit (full scale 100%). Unit is determined by the parameter "flow volume unit". Radix point position is determined by the parameter "sensor caliber". It is suggested to set the "sensor caliber" first and then set this parameter.

Flow volume unit — Options: m3/h m3/m m3/s / L/h L/m L/s

Measurement time constant — Options: 1s 2s 3s / 4s 6s 8s / 10s 15s 30s / 50s

Flowrate removal flow velocity: The flowrate removal value under small signal, unit: m/s. When the flowrate signal is lower than this value, all outputs of the flowmeter are zero.

Flowrate direction setting: Optional: define the liquid flow direction as forward or reverse.

Peak suppression allowed: Optional: allowed: enable change rate suppression algorithm during signal processing. It is prohibited to: close change rate suppression algorithm during signal processing.

Peak suppression value: This coefficient is used for selecting the change rate of the suppression sharp interference, calculating according to the flow velocity percentage, it includes ten levels: 0.010, 0.020, 0.030, 0.050, 0.080, 0.100, 0.200, 0.300, 0.500, 0.800m/s, the lower the level percentage, the higher the sharp interference suppression sensitivity. Note: in application, it is not that the better the sensitivity is higher, since it shall be selected according to actual conditions after testing.

Peak suppression time: This coefficient is used for selecting the time width of the suppression sharp interference, the unit is millisecond, including 400, 500, 600, 700, 800, 900, 1000, 1500, 2000, 2500ms. If the flowrate change with duration < the selected time, it will be deemed as sharp interference in the E-MagC converter. If the flowrate change with duration >the selected time, it will be deemed as normal flowrate change in the E-MagC converter. This parameter shall also be selected according to actual conditions.

Analog output

Analog output parameters → [→]

Current output type — Options: 0~10mA / 4~20mA

Current output zero point: Manufacturer parameter, user input is invalid (do not save).

Current correction coefficient: Manufacturer parameter, user input is invalid (do not save).

8.4.2 Pulse output and total volume menu page

Pulse output

Digit output parameters → [→]

Pulse output type: Optional: frequency mode (applicable to instantaneous flowrate observe the) Pulse mode (applicable to pulse count, total volume integrating)

Pulse output coefficient: Tested medium volume of each pulse. Optional range: 1m3, 0.1m3, 0.01m3, 0.001m3; 1L, 0.1L, 0.01L, 0.001L
This parameter must be set for "pulse mode"; This parameter is not set for "frequency mode" mode, input value invalid.

Frequency output upper limit: Optional: 1- 5000Hz This parameter must be set for "frequency mode", the set frequency upper limit corresponding Upper limit of the flowrate set in the "flow measurement range parameters" menu page; This parameter is not set for "pulse mode" mode, input value is invalid.

Total volume

Total volume integrating parameters → [→]

Flowrate total volume unit — Options: 1m3, 0.1m3, 0.01m3, 0.001m3; 1L, 0.1L, 0.01L, 0.001L

Total volume reset allowed: Optional: allowed / Prohibited

8.4.3 1# alarm, 2# alarm and flowrate alarm menu page

1# alarm Note

1# alarm parameters

1# alarm allowed — Optional: allowed / Prohibited

System alarm allowed — Optional: allowed: alarm when the excitation coil open circuit; Prohibited: this alarm is prohibited.

Forward alarm allowed — Optional: allowed: alarm when the forward flowrate; Prohibited: this alarm is prohibited.

Reversed alarm allowed — Optional: allowed: alarm when the reversed flowrate; Prohibited: this alarm is prohibited.

Removal alarm allowed — Optional: allowed: alarm when the small signal removal occurs; Prohibited: this alarm is prohibited.

Blank pipe alarm allowed — Optional: allowed: alarm when the blank pipe; Prohibited: this alarm is prohibited.

Upper limit alarm allowed — Optional: allowed: alarm when the flowrate ≥"flowrate alarm upper limit "; Prohibited: this alarm is prohibited.

Lower limit alarm allowed — Optional: allowed: alarm when the flowrate ≤ "flowrate alarm lower limit" alarm; Prohibited: this alarm is prohibited.

Analog alarm allowed — Optional: allowed: alarm when the current output ≥upper limit; Prohibited: this alarm is prohibited.

Pulse alarm allowed — Optional: allowed: alarm when the pulse output ≥upper limit; Prohibited: this alarm is prohibited.

2# alarm Note

2# alarm parameters

Flowrate alarm

Flowrate alarm parameters

Flowrate alarm upper limit — Unit: Default value: 10

Flowrate alarm lower limit — Unit: Default value: 10

Flowrate alarm return difference — Hysteresis after releasing alarm Unit: Default value: 0
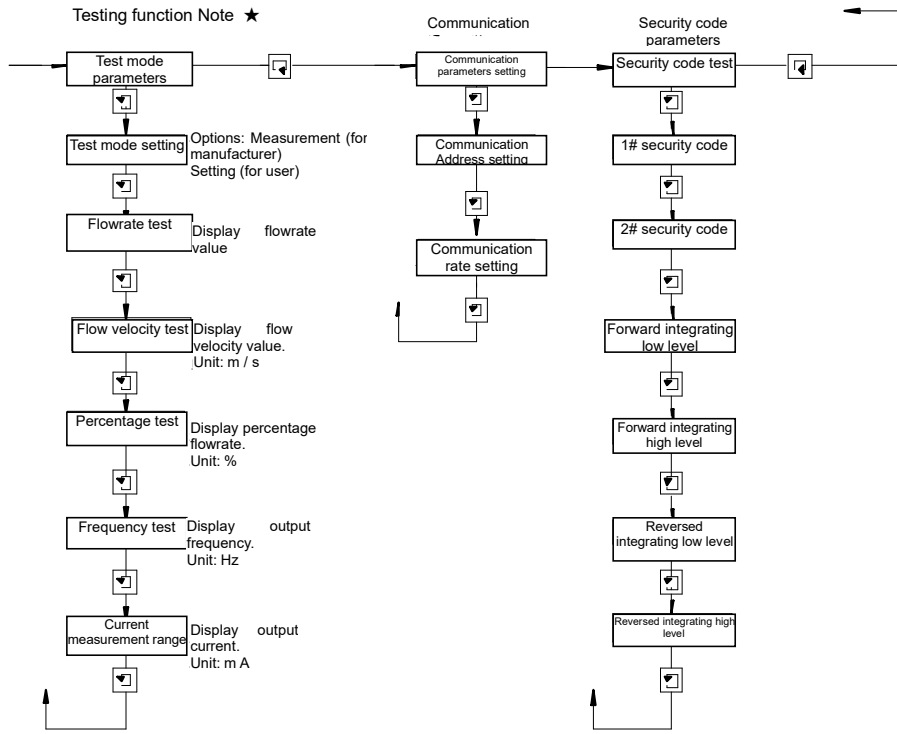
Note   :
1# alarm output signal outputs from terminals ALMH and ALCOM; 2# alarm output signal outputs from terminals ALML and ALCOM. The meaning of corresponding parameter items in two-way alarm output menu page is completely the same.
User may select several items of related parameters in two-way alarm output, and the alarm will be enabled the by turn according to from the top down sequence.

8.4.4 Input control, blank pipe test the and sensor parameters menu page

Blank pipe detection

| Blank pipe test parameters |

↓

| Blank pipe test allowed | Optional: allowed — Prohibited |

↓

| Blank pipe setting test | For blank pipe alarm, then setting as below: "Blank pipe alarm threshold" =5× "measured value", set blank pipe alarm threshold in the middle line of this parameter, and the lower line displays the measured conductivity. |

Sensor

| Sensor parameters table |

↓

| Flow velocity zero point correction | When the sensor is full of medium which doesn't flow, observe the display of the lower line: change the upper line "±" and value, make the lower line display goes to zero, upper line input value is sensor zero point. |

↓

| Flowrate calibration coefficient | The manufacturer will confirm according to the real flow of the sensor and converter, which shall not be modified by the user. |

↓

| Sensor caliber | The inside nominal diameter of sensor, unit: mm |

↓

| Excitation method select | It is determined by the manufacturer, and shall not be modified by the user |

↓

| Flowrate multiplying | It is determined by the manufacturer, and shall not be modified by the user. |

↓

| Sensor code 1 | Management parameters of the manufacturer. |

↓

| Sensor code 2 | Management parameters of the manufacturer. |

8.4.5 Testing function, communication parameters, security code menu page

Communication
Security code
parameters

Test mode parameters		Communication parameters setting	Security code test	

Test mode setting — Options: Measurement (for manufacturer) Setting (for user)

Communication Address setting

1# security code

Flowrate test — Display flowrate value

Communication rate setting

2# security code

Flow velocity test — Display flow velocity value. Unit: m / s

Forward integrating low level

Percentage test — Display percentage flowrate. Unit: %

Forward integrating high level

Frequency test — Display output frequency. Unit: Hz

Reversed integrating low level

Current measurement range — Display output current. Unit: m A

Reversed integrating high level

Note ★: In "setting", converter is connected with the V ME type calibrato to achieve precise test fo the converter.

Example 1: The inside nominal diameter of the instrument is set at DN=100mm, the measurement range is 100m3/h, time constant is 4s, under 4% of the measurement range, small signal is removed.

Then: flow measurement range =100   Flow volume unit =m3/ h

Measurement time constant =4s

Flowrate removal flow velocity =0.142(m/s)   Sensor caliber =100

Example 2: In Example 1, if 4~20mA current output is selected.

Then: current output type =4-20mA

Then: when the flowrate =50(m3/h), current output =12(mA)

When the flowrate =0(m3/h), current output =4(mA)

Example 3: In Example 1, if the max output pulse is selected as 1000Hz.

Then: Pulse output type = frequency   Frequency output upper limit =1000Hz

C Electric wiring, running and repair

9 Electric wiring

The instrument cable shall be far from the power cable, cut off power supply of all wires before operating. The cable is connected with the sensor or converter via lead-out bushing, in order to ensure reliable sealing of the lead-out bushing, round section cable shall be adopted when wiring. Please see Diagram 23 for the method of opening the sliding cover and sealing cover of the square converter. When wiring, first, loosen the compression nut of the lead-out bushing, remove the blocking rod. Install the compression nut and rubber ring for the cable by turn. Then insert the cable in the lead-out bushing. After wiring, sort out the cable, and tighten the compression nut, then the rubber ring will press the cable. Please see Diagram 24, 25 for the wiring terminal and cable lead-in position of the converter.
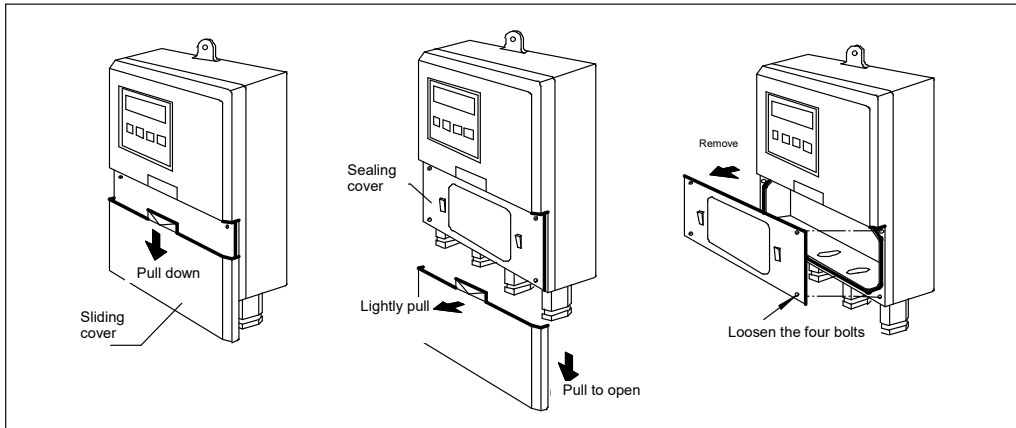
Diagram 23 Open the sliding cover and sealing cover of the square converter
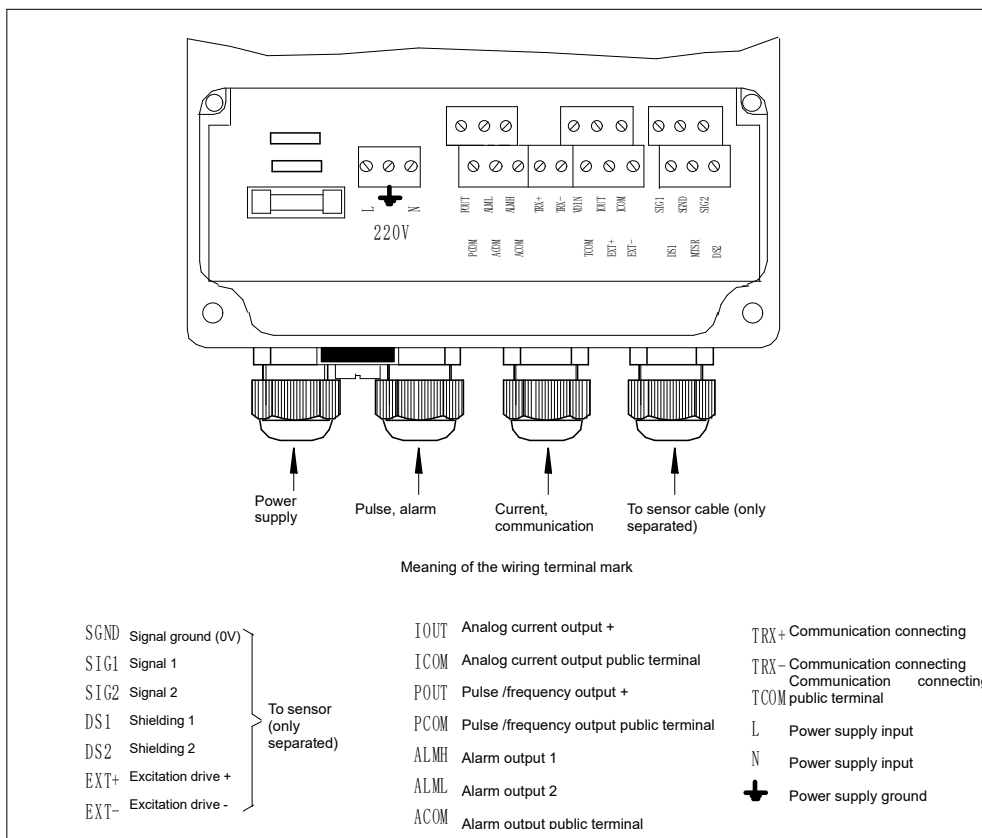
Diagram 24 Wiring terminal and cable lead-in position of the square converter
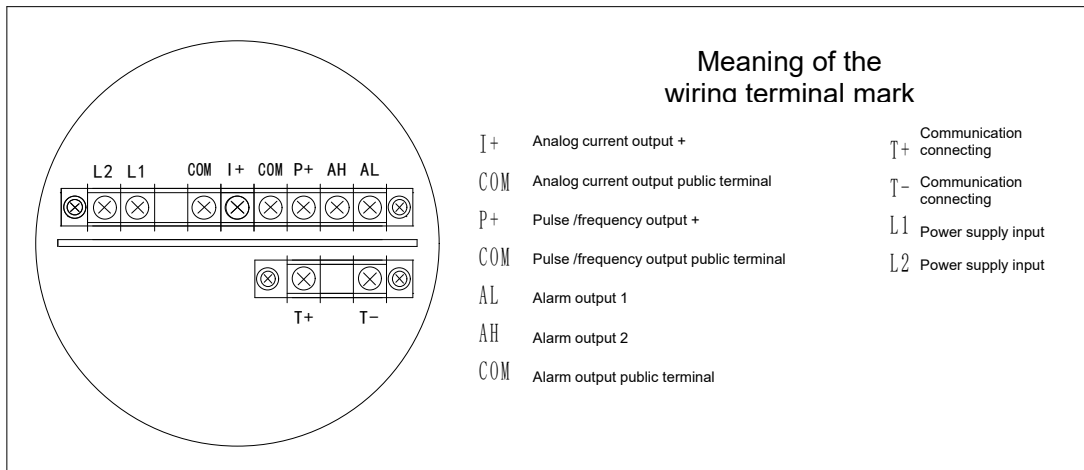
Diagram 25 Wiring terminal of round converter

9.1 Wiring between the sensor and converter

The wiring between the integrated flowmeter sensor and converter is operated by the manufacturer, the contents introduced in this section are only applicable to separated flowmeter. STT3200 cable is adopted for connecting the separated flowmeter sensor and converter, STT3200 cable has 4-core, 2-core are coaxial cable of two shielding layers, the other 2-core is polyvinyl chloride insulated flexible cable. 4-core cable also has outer shielding. The inner shielding of the coaxial cable is metal wire knitting mesh shielding, other 2 shielding layers are foil shielding with leak cable. What should be specified especially is, one black semi-conductive layer is in the inner shielding layer of the coaxial cable, which should be stripped carefully when wiring. Two shielding leak wires of two coaxial cables must be twisted and the bushing should be installed when wiring. Please see Diagram 26 for the cable structure, Diagram 27 for the cable stripping.
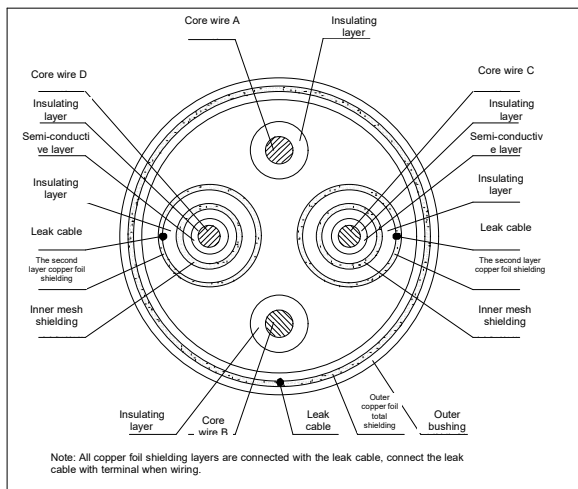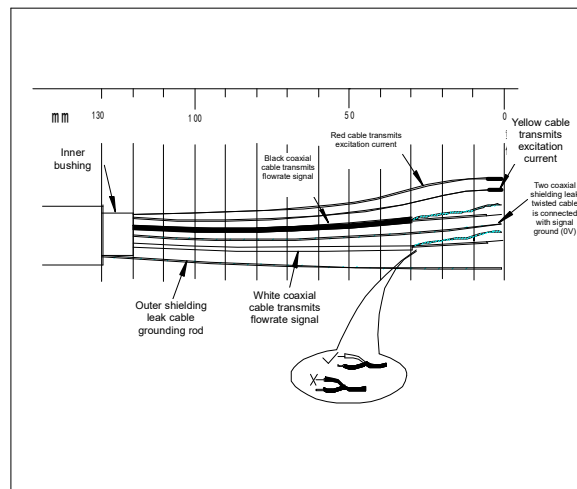

Diagram 26 Cable structure

Diagram 27 Cable stripping

In order to ensure the measurement precision and reduce interference, the converter shall be installed near the sensor. The allowed length of STT3200 cable is calculated according to the formula:

L=σ×4

L--- cable length (m);

σ--- liquid conductivity (μS/cm).

Generally speaking, it is not allowed to exceed 100m. 10m STT3200 cable will be supplied with the instrument, if it is inadequate, user may order additionally according to the actual distance. Please see Diagram 28 for wiring between the sensor and converter Since metal and plastic materials are available for the junction box, the wiring of junction box end is lightly different, please pay attention to it!
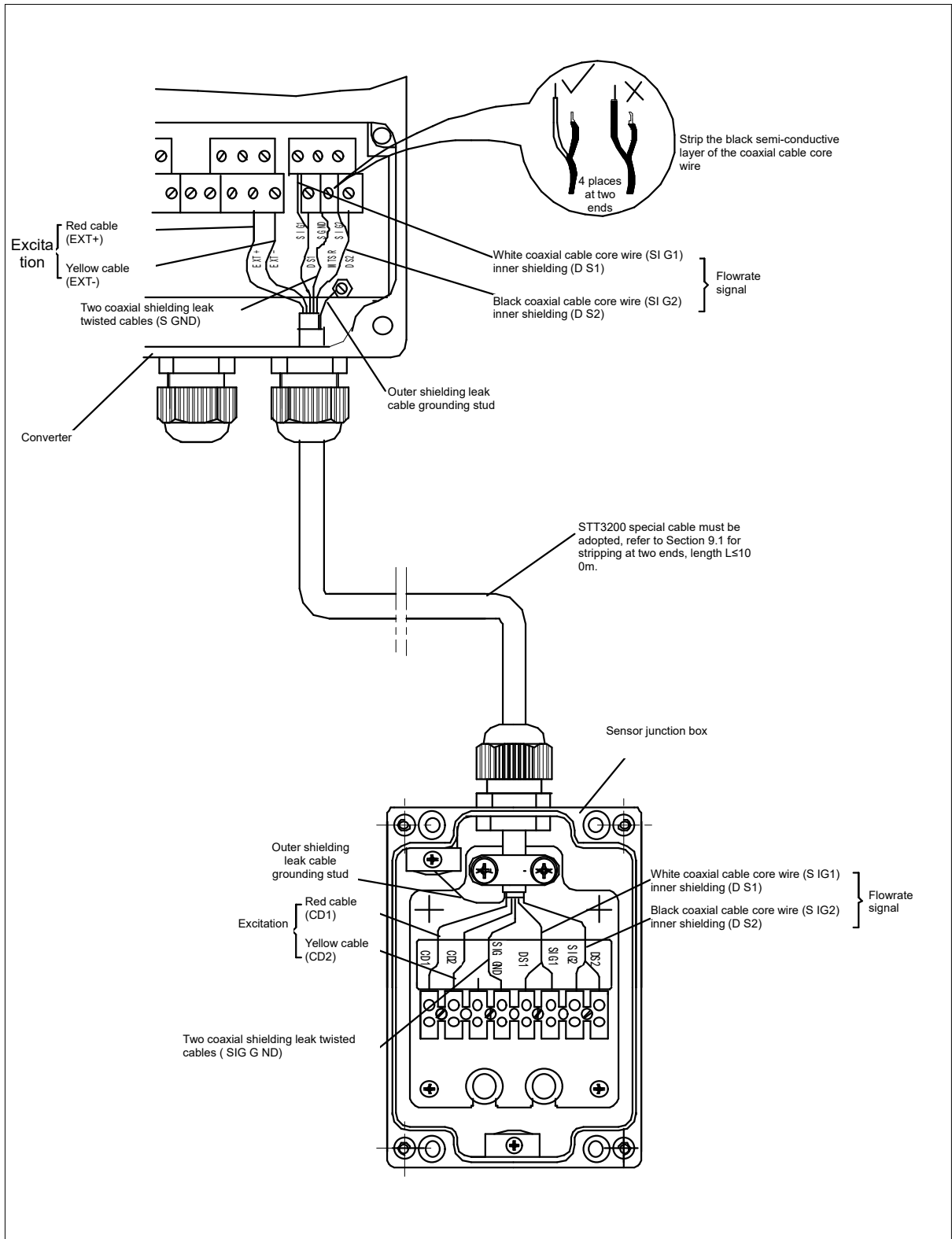
Strip the black semi-conductive layer of the coaxial cable core wire

4 places at two ends

Excitation

Red cable (EXT+)

Yellow cable (EXT-)

Two coaxial shielding leak twisted cables (S GND)

White coaxial cable core wire (SI G1) inner shielding (D S1)

Black coaxial cable core wire (SI G2) inner shielding (D S2)

Flowrate signal

EXT+ EXT- D S1 S GND D S2 S I G1 S I G2

Outer shielding leak cable grounding stud

Converter

STT3200 special cable must be adopted, refer to Section 9.1 for stripping at two ends, length L≤100m.

Sensor junction box

Outer shielding leak cable grounding stud

Excitation

Red cable (CD1)

Yellow cable (CD2)

White coaxial cable core wire (S IG1) inner shielding (D S1)

Black coaxial cable core wire (S IG2) inner shielding (D S2)

Flowrate signal

CD1 CD2 SIG GND DS1 S IG1 S IG2 DS2

Two coaxial shielding leak twisted cables (SIG G ND)

Diagram 28 -1 Wiring between the separated sensor and converter (metal junction box)

The converter terminal wiring is the same as Diagram 28 -1

ST T 3200 special cable must be adopted, refer to Section 9.1 for stripping at two ends,

Sensor junction box (plastic)

Outer shielding leak cable

White coaxial cable core wire (S IG 1) inner shielding (D S 1)

Flowrate signal

Excita tion

Red cable (CD1)

Black coaxial cable core wire (S IG 2) inner shielding (D S 2)

Yellow cable (CD2)

CD1 CD2 S IG GND DS1 S IG1 S IG2 DS2

Two coaxial shielding leak twisted cables (S IG GN D)

Core wire Inner shielding

Diagram 28 -2 Wiring between the separated sensor and converter (plastic junction box)

9.2 Technical data and wiring of power supply, output /input signal sensor junction box

Please see Diagram 29-Diagram 35 for the technical data and wiring of converter power supply, output /input signal. The cable introduced in this section is prepared by the user.
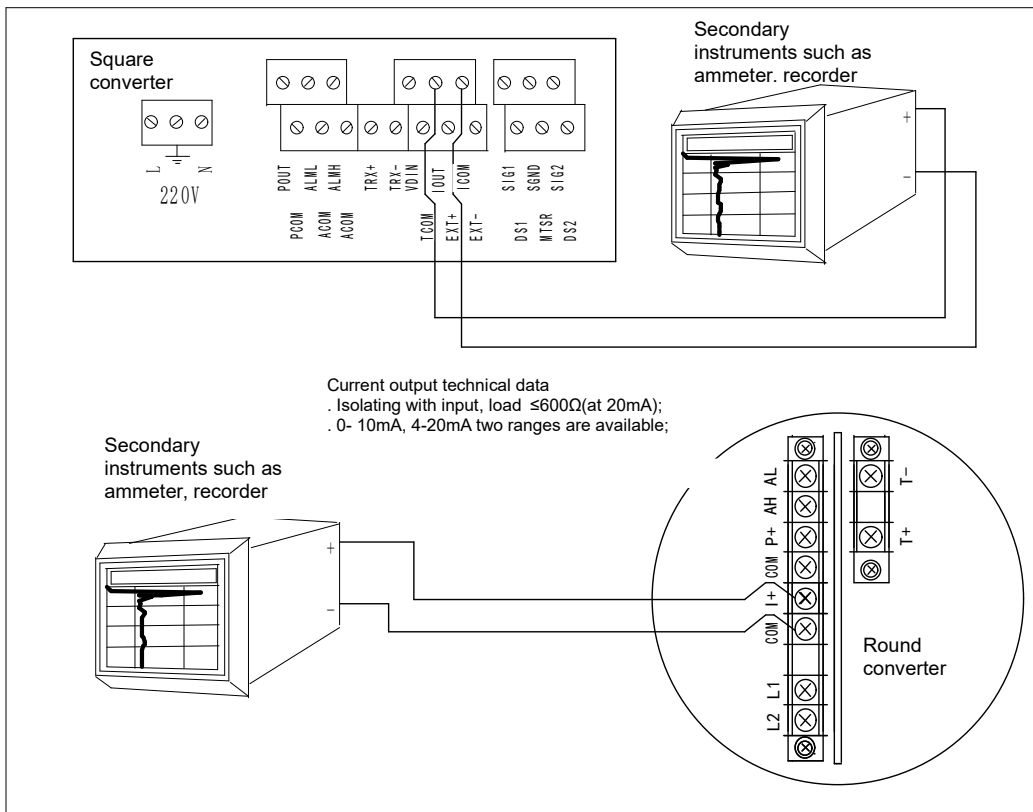
Diagram 29 Current output wiring
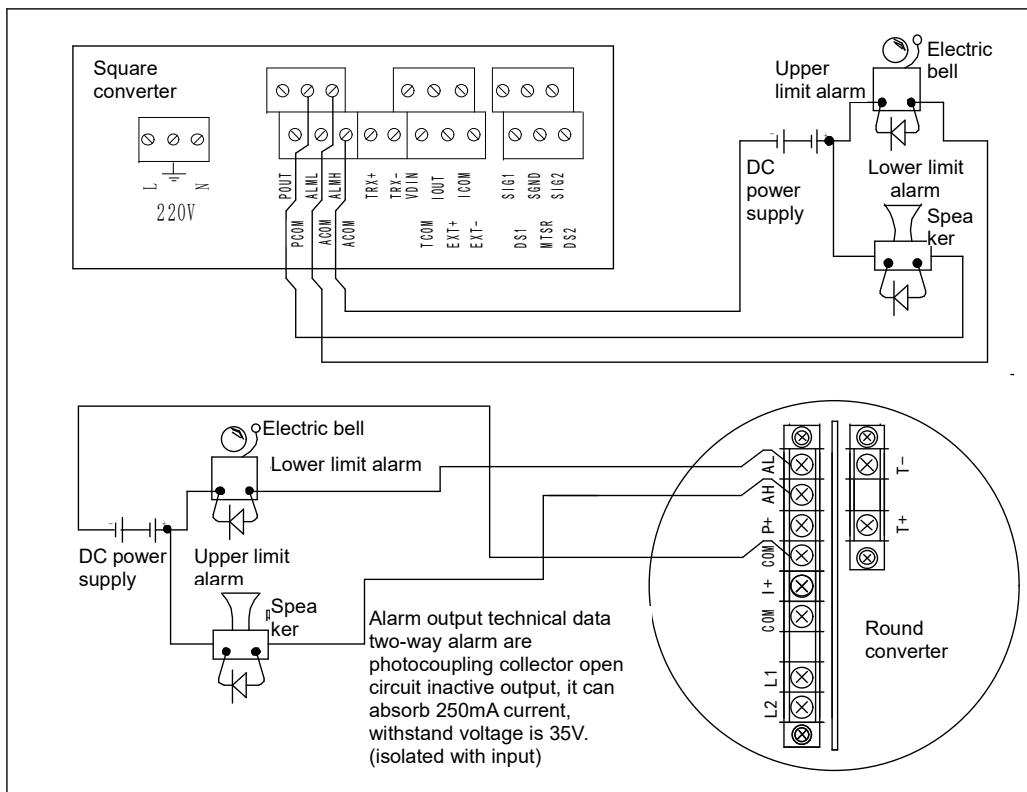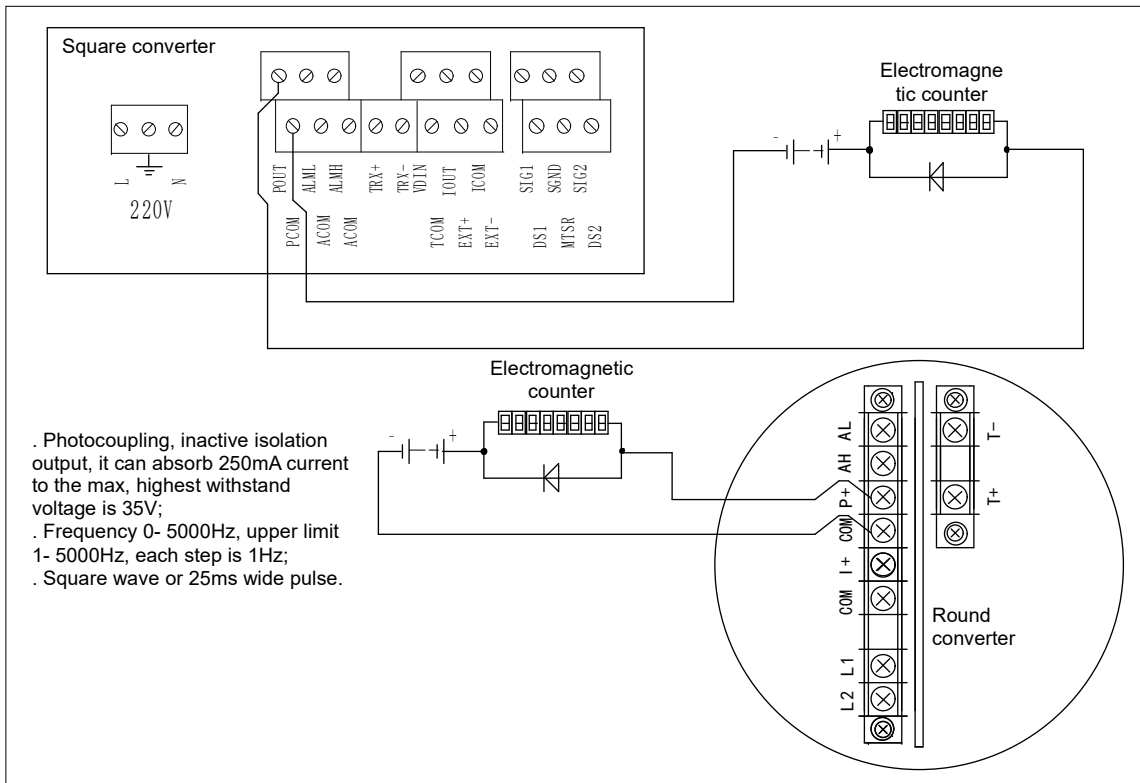

Diagram 30 Alarm output wiring

Square converter

220V

L N

POUT ALML ALMH TRX+ TRY- VDIN IOUT ICOM SIG1 SGND SIG2

PCOM ACOM ACOM TCOM EXT+ EXT- DS1 MTSR DS2

Electromagne tic counter

Electromagnetic counter

. Photocoupling, inactive isolation output, it can absorb 250mA current to the max, highest withstand voltage is 35V;
. Frequency 0- 5000Hz, upper limit 1- 5000Hz, each step is 1Hz;
. Square wave or 25ms wide pulse.

AL
AH
P+
COM
I+
COM
L1
L2
T-
T+

Round converter

Diagram 32 Pulse output is connected with the electromagnetic counter

Square converter

220V

L N

POUT ALML ALMH TRX+ TRY- VDIN IOUT ICOM SIG1 SGND SIG2

PCOM ACOM ACOM TCOM EXT+ EXT- DS1 MTSR DS2

Receiving instrument

+Vd. C (positive terminal of external DC voltage)

R

(Pulse input end)

(power supply and pulse public terminal)

. Photocoupling, inactive isolation output, it can absorb 250mA current to the max, highest withstand voltage is 35V;
. Frequency 0- 5000Hz, upper limit 1- 5000Hz, each step is 1Hz;
. Square wave or 25ms wide pulse.
. When voltage pulse input (input resistance is high) is required for the receiving instrument, R ranges 5K- 10KΩ, pulse amplitude approximately quals to external DC voltage Vd. C.
. When the receiving instrument adopts light emitting diode input, the input current I is set as 5- 15mA, then (R+Ri) =(Vd. C. -1.5V) /I, where, Ri is the input resistance (if this resistance is unavailable Ri=0) in receiving instrument internal which is in parallel with the light emitting diode, thus calculating the R.
. If the receiving instrument doesn't have external DC power supply, it can be connected with the independent external DC power supply according to this diagram.

Receiving instrument

+Vd. c (External DC voltage positive terminal)

(Pulse input end)

(power supply and pulse public terminal)

R

AL
AH
P+
COM
I+
COM
L1
L2
T-
T+

Round converter

Diagram 32 Pulse output is connected with the electronic receiving instrument
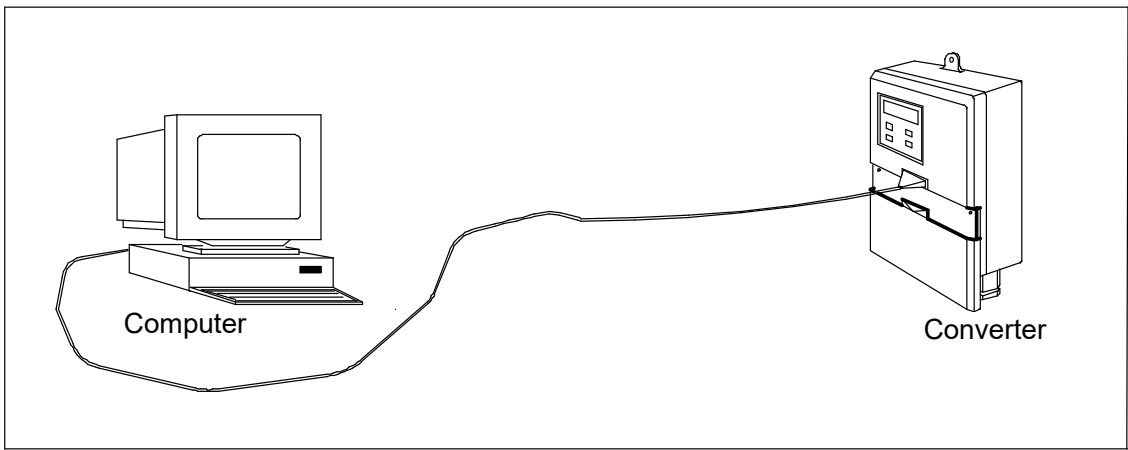
Diagram 33 RS232 communication connecting
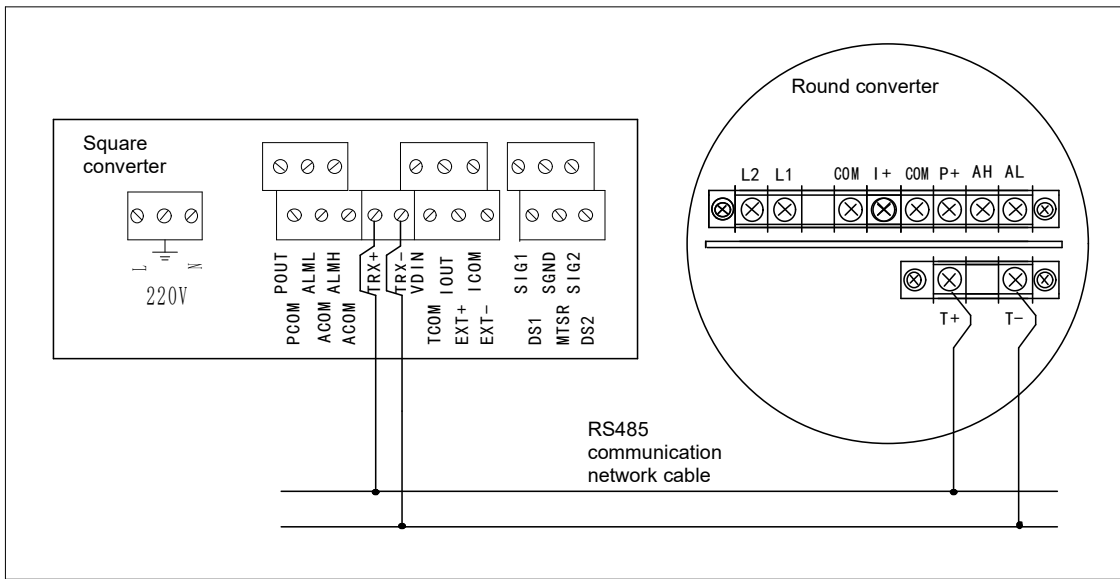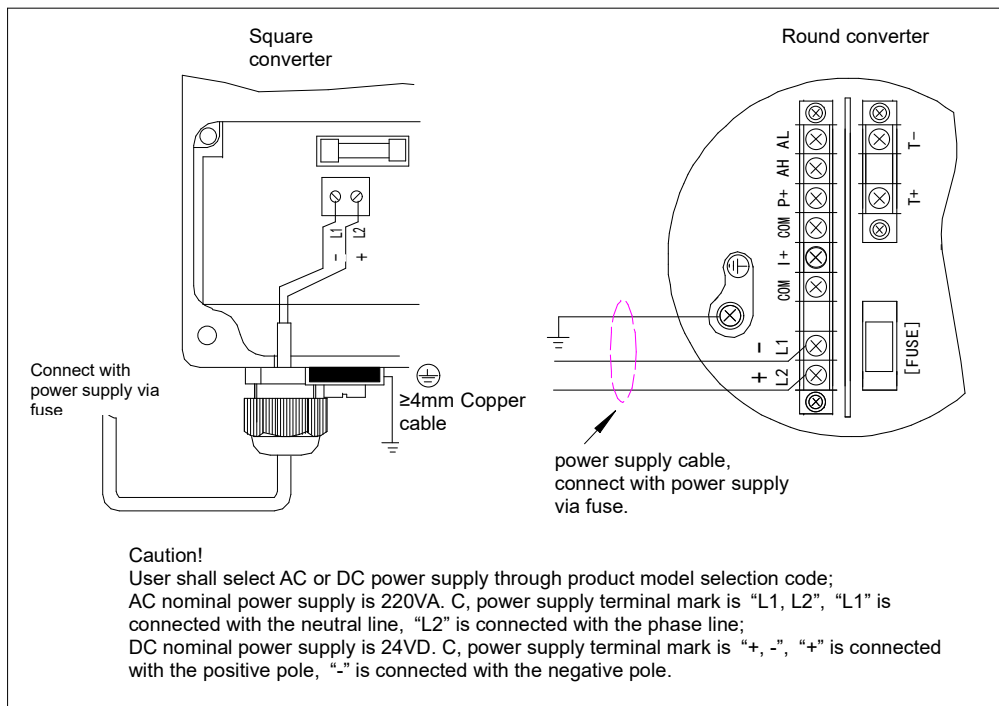

Diagram 34 RS485 communication connecting

Diagram 35 Power supply wiring

10. Running

Abide by the safety regulations listed in Section 5.1.

Check the flowmeter as follows before putting into operation:

a) Check if the flowmeter is damaged during transport and installation;

b) Adopt fuse of correct current value;

c) Check if the working power voltage is accordant with the voltage listed on the nameplate;

d) The instrument is put in place correctly.

After checking, open pipe valve, liquid is filled in the pipe system, eliminate the leakage and remaining gas in the pipe system.

Power on the instrument, after power on the flowmeter and warm it up for 10min, conduct the zero point adjustment, the specific method is: after removing air in the pipe, completely close the lower reach valve, then completely close the upper reach valve, sensor is full of medium and keeps at completely still state, then enter into programing state, visit parameter "flow velocity zero point correction", and make the upper line input and lower line display contrarily symbol, make the lower line display goes to 0. If the lower line display is unstable, adjust the upper line input to keep the lower line display changes near 0. Note: if it can't meet the above zero setting condition, it will affect the zero setting accuracy!

After the steps, the device can work normally.

11 Repair

Before repair, please read the safety regulations in Section 5.1.

When the sensor is faulty, please contact the manufacturer.

11.1 Common repair

Generally speaking, only visual observation is required to check if the electric connection is damaged and the instrument works normally.

11.2 Troubleshooting

If the instrument can't work satisfactorily, please check according to the below steps:

a) Check if the flowmeter pipe valves are all open if the pipe is filled inf liquid, if the flowrate is set in the 50%- 100% range of upper limit;

b) Check if the power supply facilities of the instrument such as power supply, switch and fuse are under normal conditions;

c) Check if the fault point is in the cable or in the receiving instrument;

d) Check if the converter serial number is accordant with the instrument coefficient and sensor;

e) Check if the measurement range setting is correct;

f) Check if the flowmeter output is connected correctly and grounding is reliable;

g) Check according to the regulations of the converter (refer to Appendix B).

D Others

12. Complete set of supply

The set instrument includes sensor and converter. To the separated flowmeter, 10m of STT3200 cable which is connected with the sensor and converter will be supplied with the instrument, if it is inadequate, user may order according to the required amount, and it will be supplied with the instrument according to the ordering amount.

If user requires the manufacturer providing companion flange, please list out when ordering.

Attachment documents includes: one share of Installation and Use Instructions, Product Qualification Certificate and Packing List respectively.

13. Packaging

The package of the flowmeter meets the national standard GB/T12464-2002, GB/T10819-2005. When unpacking, handle (lift) with care, and protect the flowmeter from damage.

14. Transport and storage

In order to prevent the instrument damage during transport, before arriving at the installation site, please keep it under packaging state of the manufacturer.

During storage, the storage site shall meet the following conditions:

a) Rain and moisture proof;

b) Low mechanical vibration, and avoiding impact;

c) Temperature range -20～+60℃;

d) The humidity is < 80%, it is better to be about 50%;

e) To store the used sensor, please remove the tested medium from the lining and electrode surface;

f) If it is stored in the open air, the instrument performance may possibly be influenced.

Appendix A Conversion of flowrate and flow velocity

$$V = \frac{Q(\text{L/s})}{0.0007854 \times d^2};$$

Q(L/s) =0.0007854×d 2×V;

$$V = \frac{Q(\text{L/min})}{0.04712 \times d^2};$$

Q(L/min) =0.04712×d 2×V;

$$V = \frac{Q(\text{L/ hour})}{2.827 \times d^2};$$

Q(L/hour) =2.827×d 2×V.

Where: Q:Flowrate;   V:Flow velocity (m/s);   d:Sensor inside nominal diameter (mm).

Appendix B Self-diagnosis information and troubleshooting

The circuit boards of the electromagnetic flowmeter converter adopt surface mounting technology (SMT), therefore, circuit board is unrepairable to user, user shall not open the open converter case body.

The flowmeter itself with self-diagnosis function, except the power supply and circuit board hardware fault, it can correctly give corresponding alarm information (self-diagnosis information) for the faults occurred during daily use. Besides displaying the alarm information in the window (see table below), the flowmeter can also output alarm signal from the terminal.

Display	Alarm contents
Blank pipe	Sensor blank pipe.
Upper limit	Flowrate exceed the set flowrate upper limit.
Lower limit	Flowrate is lower than the set flowrate lower limit.
Current	Analog output exceeds the limit.
Pulse	Pulse output frequency exceeds the set frequency upper limit.
System	Sensor excitation drive open circuit and so on.
Removal	With small signal removal.
Forward	Flowrate is forward.
Reversed	Flowrate is reverse.

Troubleshooting:

1. The converter doesn't display:

a) Check if power is supplied;

b) Check if the power supply fuse is under good conditions;

c) Check if the power supply is connected correctly;

d) If the above a, b, c items are normal, please send the converter to the manufacturer for repair.

2. The measured flowrate is not correct:

a) Check if the signal is connected correctly;

b) Check the following parameters are accordant with the sensor nameplate and check list:

Flow velocity zero point correction;

Sensor caliber;

Excitation method select;

Flowrate calibration coefficient.

c) Check if the medium in the measuring pipe is full.

3. "System" alarm

a) Check if the excitation drive (EXT+, EXT-) is open circuit;

b) The sensor excitation coil resistance (Between EXT+ and EXT) shall < 60Ω;

c) If a and b are normal, then the converter is faulty.

4. "Blank pipe" alarm

a) Check if the medium in the measuring pipe is full;

b) At the converter side, short connect SIG1 and SIG2 with SIG GND, if the blank pipe alarm is released, it means converter is recovered to normal;

c) Check the sensor electrode are under normal conditions:

If medium is water and is filled in the sensor, the resistance of SIG1 and SIG2 to 0V (the instrument flange) shall range several to dozens of KΩ;

d) Check if the sensor electrode is polluted, if the voltage between DS1 and DS2 exceeds 1V DC, please clean the electrode.

5. "Current" alarm or related fault

a) For analog output over range, please adjust the value of the parameter item "flow measurement range";

b) If the flowrate reaches the full measurement range, current can't reach full scale, check the resistance of the current output loop, which shall <600Ω;

6. "Pulse" alarm or related fault

If the "pulse output type" is "frequency", check and adjust the value of parameter "frequency output upper limit" value;

If the "pulse output type" is "pulse", check and adjust the value of parameter "flow measurement range".