ALIA®

ALIAVTX

Vortex Flowmeter

AVF7000 Series

Operation Manual

CE

ALIA TECHNOLOGY LLC
633 W. 5th Street, 26th Floor, Los Angeles, CA 90071, USA
TEL : +1 - 213 - 533 - 4139 FAX : +1 - 213 - 223 - 2317
URL: http://www.alia-inc.com
E-mail: alia@alia-inc.com

Index

1. Flowmeter Check

A. Check the overwrap first, if any damages occur, contact ALIA Customer Service Center at once.
B. Confirm whether the instrument has been damaged or its spares are lost.
C. It's recommended that you read the manual thoroughly, once you have any quires, please email or fax to ALIA technical department.
D. Ensure all the specifications of instrument are in a normal state.
E. Power on to check whether the LCD screen operates normal.
F. Proper installation is required.
G. Install flowmeter and pipeline under installation instructions.
H. Connect wires and specially attention on whether they have been shielded or grounded.
I. Power on and check whether there is any current leakage (mind your own safety), then if it doesn't display any flow rate, please follow steps above again, particularly wiring, power supply and grounding. If problem remains, please contact ALIA Technical Support center or local agency.

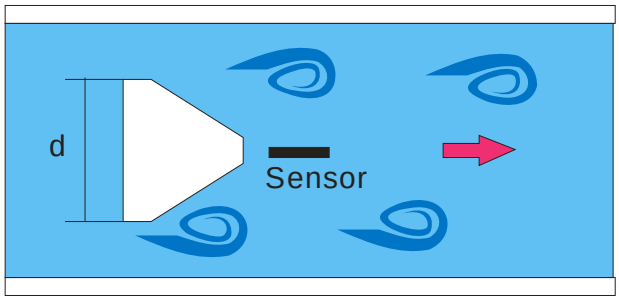
2. Product Overview

Based on Von Karman vortices theory, AVF7000 can be used to measure liquid, gas and steam, even liquid that has slight particles inside or turbid liquid. It's widely used in industries such as petroleum, chemical engineering, pharmacy, paper making, metallurgy, electricity, environmental protection and food.

3. Working Principle

ALIA AVF7000 is newly stress-type flowmeter that's based on von Karman effect. It's made up of a whole body whose internal diameter and nominal diameter are the same and a triangular bluff body inside. Flow will alternately generate vortices when passing by a bluff body. The periodic shedding of eddies occurs first from one side and then from the other side of a bluff body (vortex-shedding body), is called "Karman vortex street" whose frequency is proportional to the flow velocity.

Vortices at both sides cause pressure pulsation, making probe to generate alternation stress. The built-in electronic in probe generates electric charge due to alternation press. And amplifier transmits them into pulsating output signals which are equivalent to vortex shedding frequency.



$$F=St\ v/d$$

F—frequency of vortex shedding (numbers) hz
d—width of bluff body
v—fluid velocity
St—Strouhal number, dimensionless

The actual width of a bluff body within a specific vortex meter is fixed and a function of Reynolds, therefore, a constant. In linear range, from detected frequency F, pipe's velocity is known, then volumetric flow. The relationship between frequency and volumetric flow is defined as below:

$$Q=3600\ F/K$$

K: factor
F: frequency
Q: fluid volume under actual condition (m3/h)

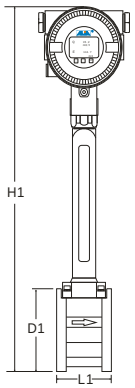
4. Specifications

- Size (mm) : 15, 20, 25, 32, 40, 65, 80, 100, 125, 150,
  200, 250, 300, 350, 400, 450, 500 mm
- Measuring Range : Steam - 1.6 to 540,000 Kg/Hr
  Gas - 3 to4 6,000 m3/Hr
  Liquid - 0.3 to 4950 m3/Hr
- Material : Stainless Steel 304 / 316
- Accuracy
  Liquid : +/- 0.7%
  Gas/Steam : +/- 1.0%
- Repeatability : +/- 0.2%
- Process Connection : Flange / Wafer
- Flange Type : JIS 10K / JIS 20K / JIS 40K
  ANSI 150# / ANSI 300# / ANSI 600#
  DIN PN 10 / PN 16 / PN25 / PN 40
- Wafer Type : 40, 65, 80, 100, 125, 150, 200, 250
  without Temperature / Pressure Sensor
- Temperature : -40 ~ +280℃ （Standard Type)
  -4 ~ +420 ℃ (Explosion Proof Type)
- Ambient Temperature : -20 ~+60℃
- Pressure : 78 Kg/cm2 (Max.)
- Protection Class : IP 65.
  Explosion Proof Exd IIC T6
  Intrinsically safe Exia IIC T4
- Local Display : 2 or 3 Line LCD
  6 digit Flowrate
  8 digit Totalizer
- Output : 4~20 mA (2wire)
  Load : Rohm=(Vdc-12)*30
- Pulse Output : Standard Pulse Output
  Load : 1000 Ω –5000 Ω.
- Communication : HART or RS485
- Data Storage : Operation Parameter, Totalizer Figures are stored by EEPROM.
- Housing Material : Aluminum Alloy
- Cable Entry : 2x0.5mm2
- Power Supply : 12~32 VDC
- Keypad : 3 keys from internal for programming and display control
- Option
  Pressure Transmitter — Pressure Compensation
  Signal Input — 0~30 mV DC
  Temperature Sensor — Temperature Compensation
  Signal Input — PT1000（2 Wire）

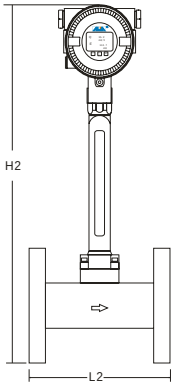
5. Dimensions

Normal Size											
mm	Inch	H1	H2	H3	H4	H5	L1	L2	L3	L4	D1
15	1/2"		430					200			
20	3/4"		435					200			
25	1"		440		455	440		200	275	275	
32	1-1/4"		452		468	452		200	275	275	
40	1-1/2"	415	468	477	505	468	70	200	275	275	85
50	2"	425	480	484	518	480	70	200	275	275	99
65	2-1/2"	440	502	495	535	502	70	200	275	275	118
80	3"	460	515	519	550	515	70	225	300	300	132
100	4"	480	534	543	571	534	70	250	350	350	156
125	5"	500	564	560	599	564	70	275	375	375	184
150	6"	530	593	585	631	593	70	300	400	400	211
200	8"	578	647	635	682	647	98	350	450	450	248
250	10"	628	700	685	735	700	114	400	500	500	298
300	12"		750		785	750		450	550	550	
350	14"		805		840	805		500	600	600	
400	16"		861		895	861		550	650	650	
450	18"		910		945	910		600	700	700	
500	20"		965		998	965		650	750	750	

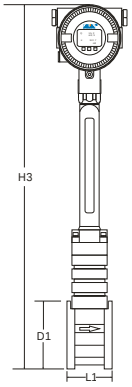
- Note: L5= reduced L4 + pipe diameter before reducing (Example：DN200mm reduce DN150mm , L5 = 400mm + 200mm = 600mm



Wafer Type

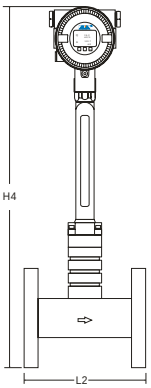


Flange Type



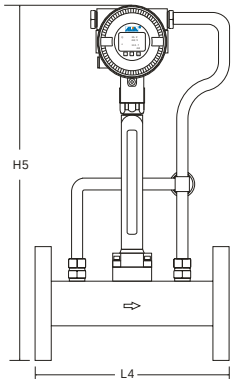
Wafer Tpye

Under Pressure Replace Sensor

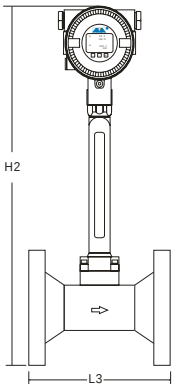


Flange Type

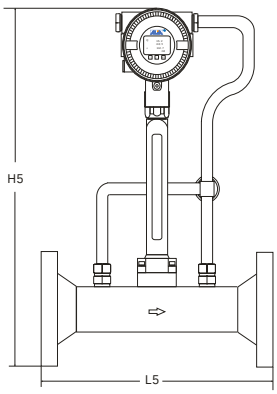
Under Pressure Replace Sensor



Flange Type with T/P Sensor

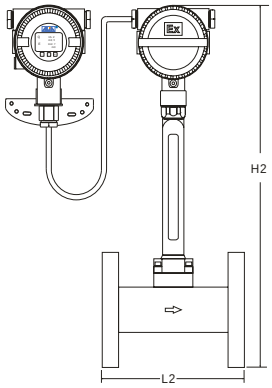


Reduced Bore Type



Reduced Bore Type

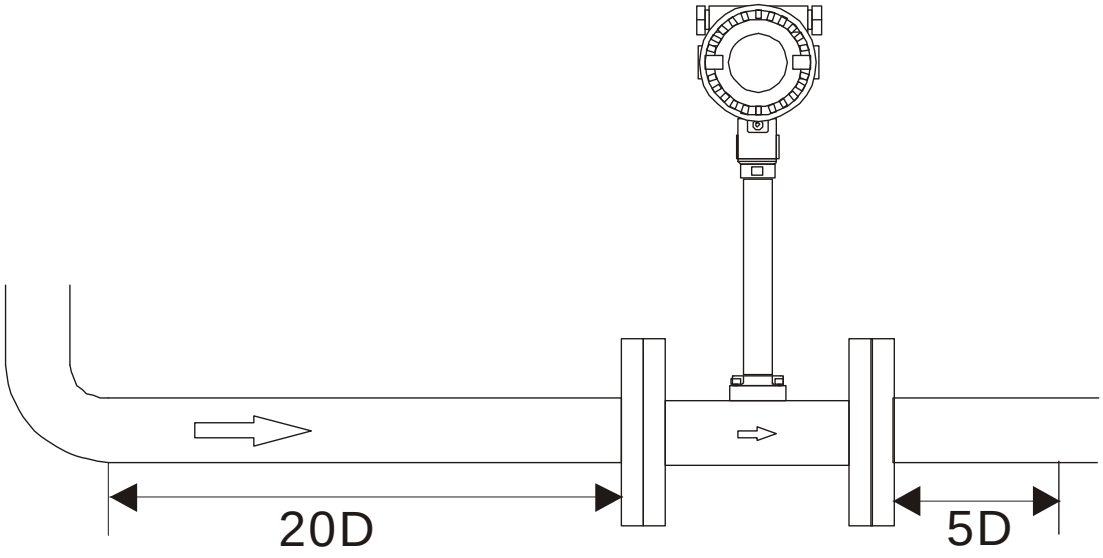
With Temperature Sensor and Pressure Sensor

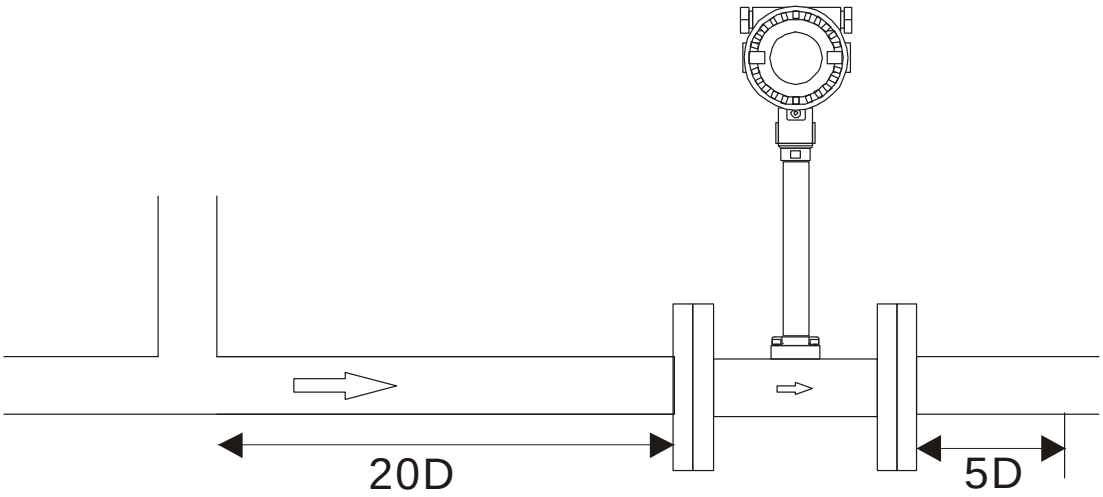


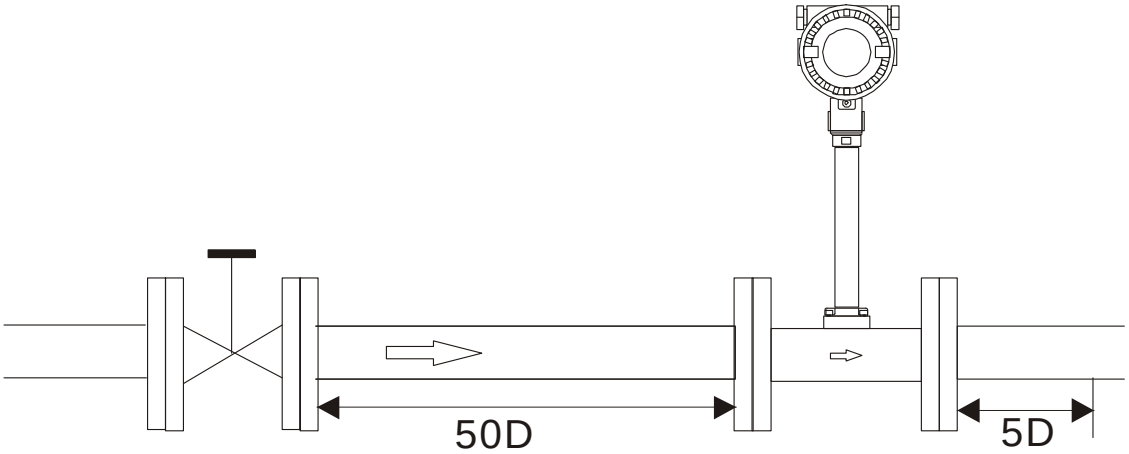
Separate Flange Type

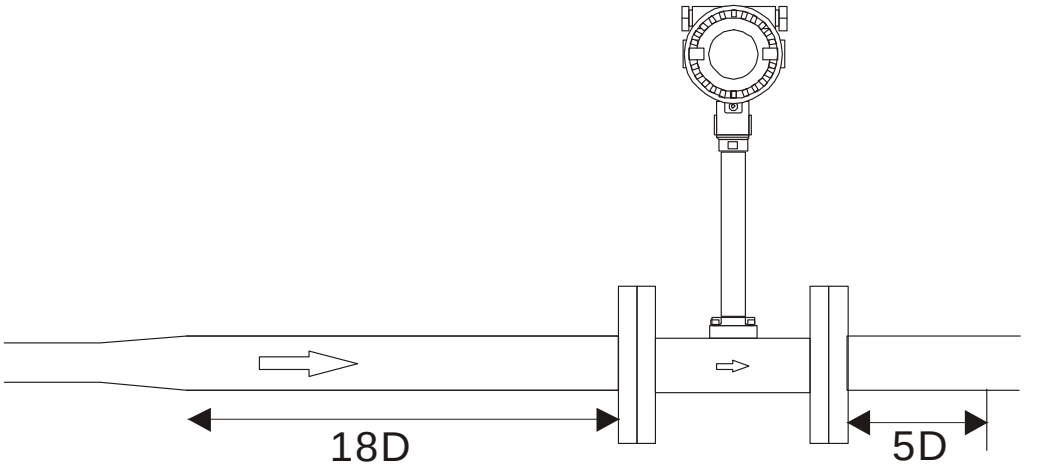
6. Installation

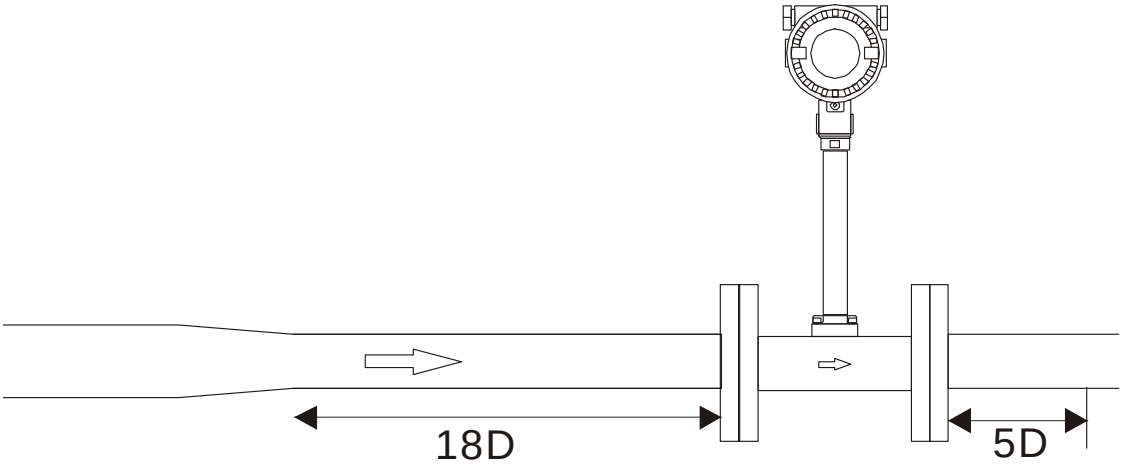
Installation position of Vortex Flowmeter is very important. It concerns measuring accuracy. Please leave more space of straight pipe in upstream and downstream as best as you can. If not permitted, please install as 2/3 of total straight pipe length on the upstream and 1/3 on downstream. However, accuracy this time can not be assured as factory accuracy. For example:





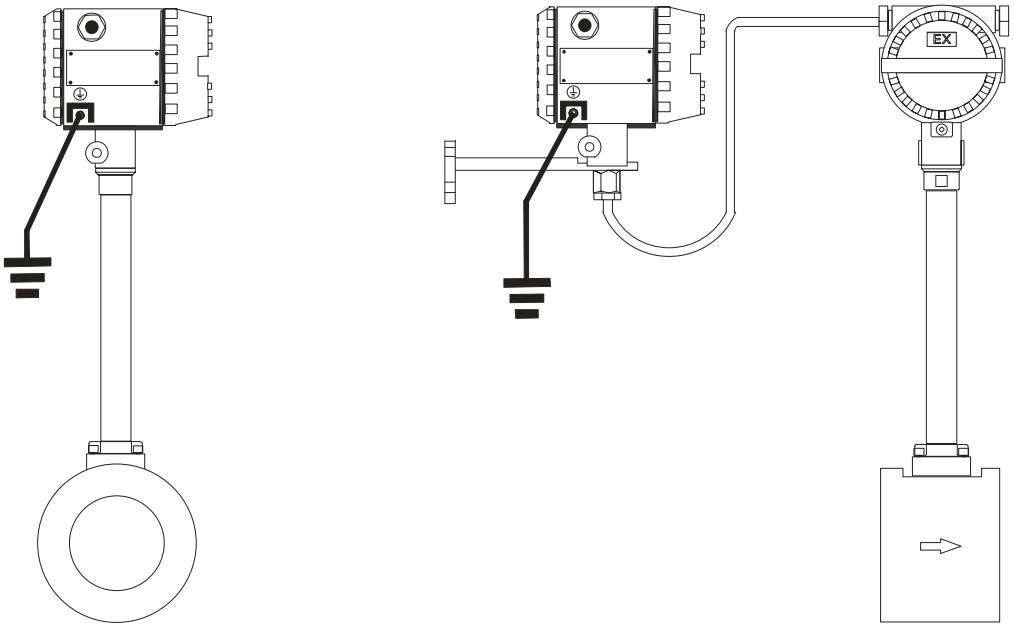






● Grounding

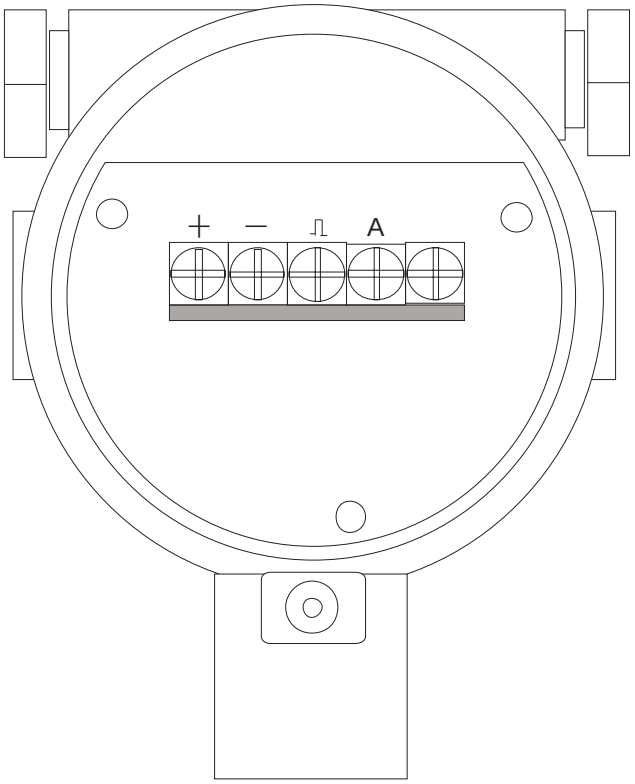
Good grounding is highly demanded so as to avoid signal interference. Please see below pictures, all you need to do is to ground the displayer. And the sensor grounding is unnecessary. Grounding place is like stairs and railing.
To define whether vortex is well grounded initially, user need to check whether frequency is 50HZ or 60HZ or not. If it's always 50HZ or 60HZ, it means grounding is poor. Please see details in ***9.2*** to check frequency value.

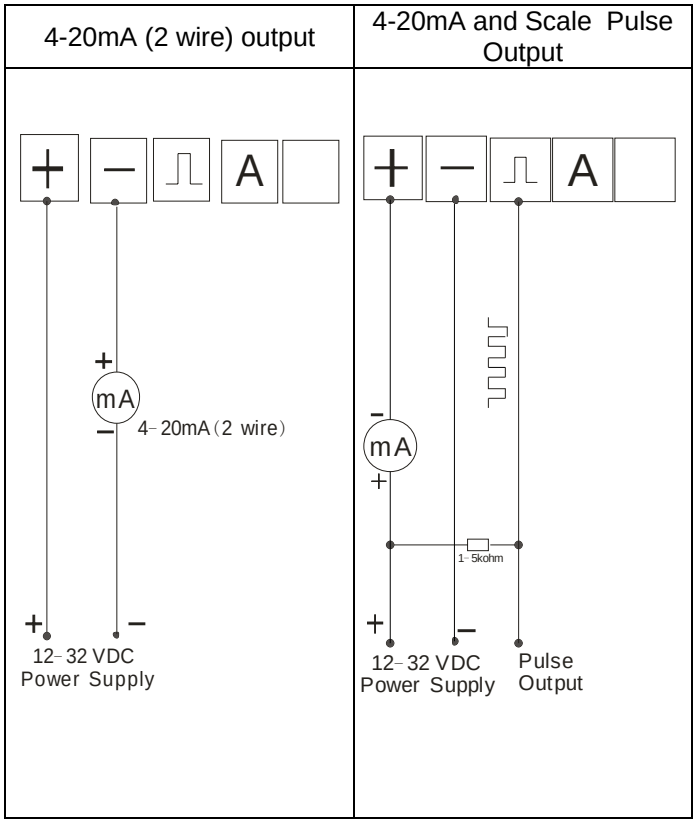


7. Wiring Diagram

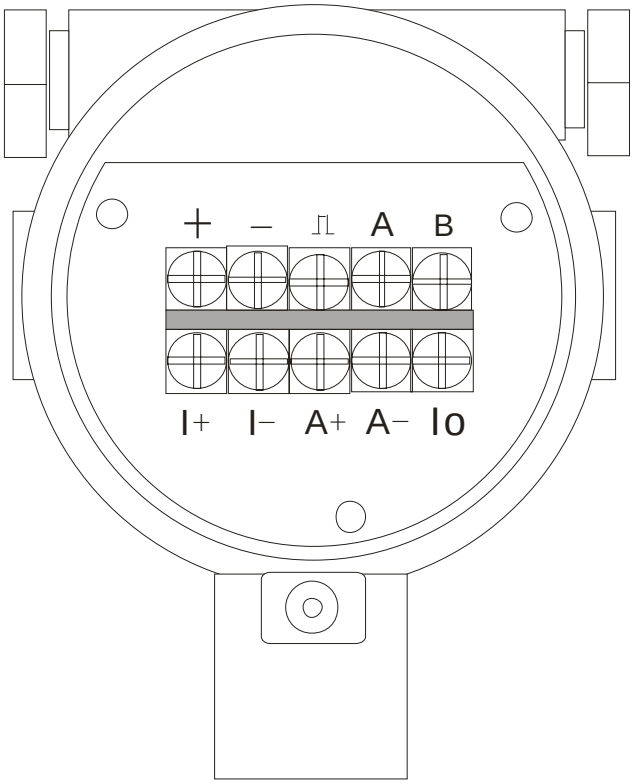
Cable should be equipped as 2-core AVPV2*0.5mm2 or 3-core AVPV3*0.5mm2. Connecting terminals should be firm and tight. Meanwhile, shielding cable must be properly connected to the housing of amplifier.

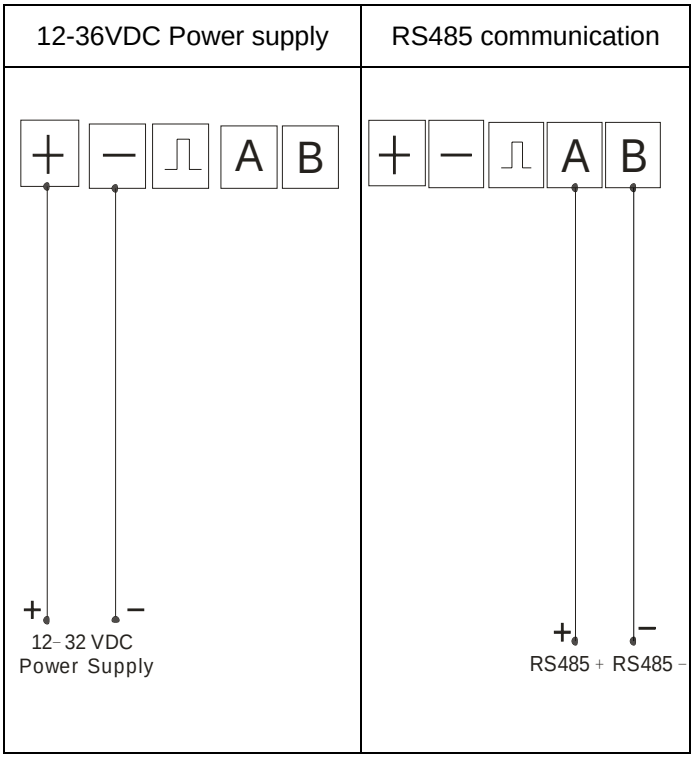
7.1 With 4-20mA(2 wire) or Scale pulse,but without Temp./ Pressure Compensation



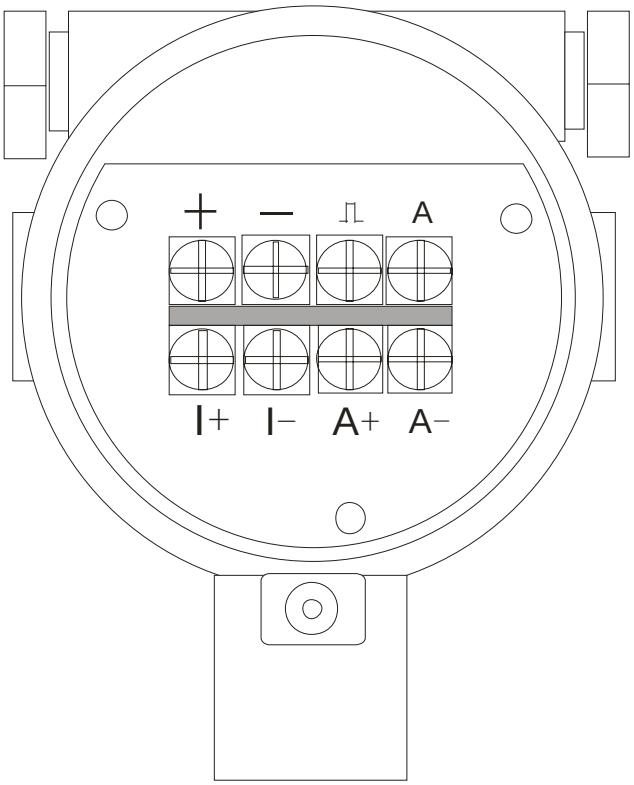


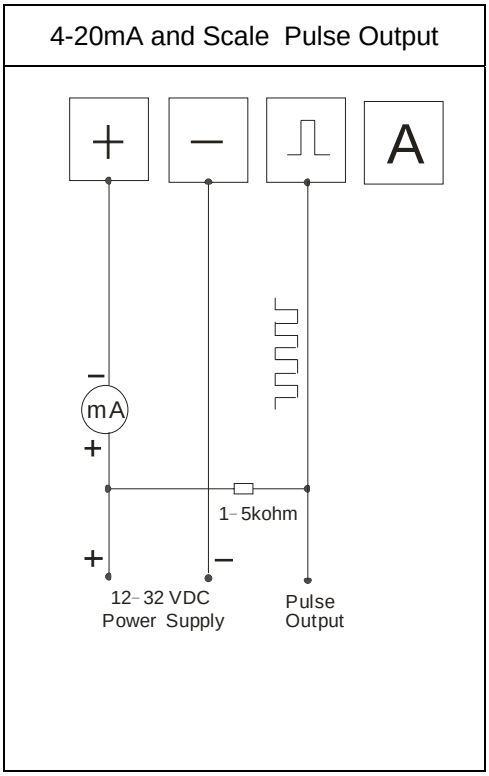
7.2 With RS485 Communication,but without Temp./ Pressure Compensation

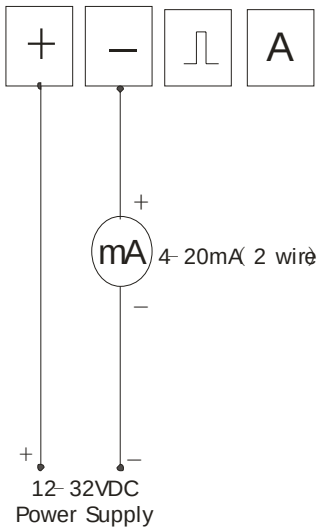
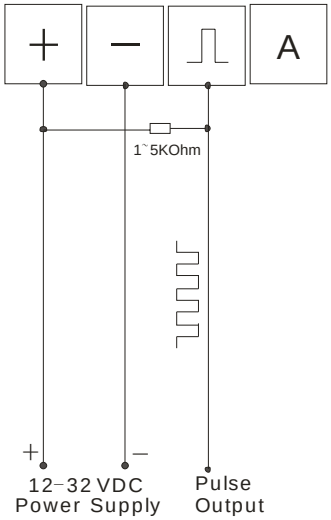
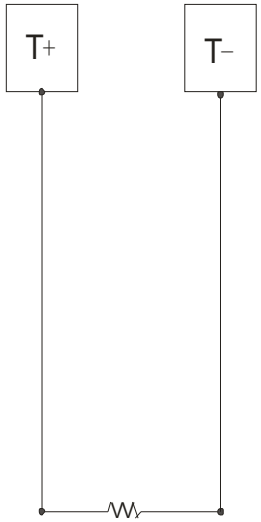
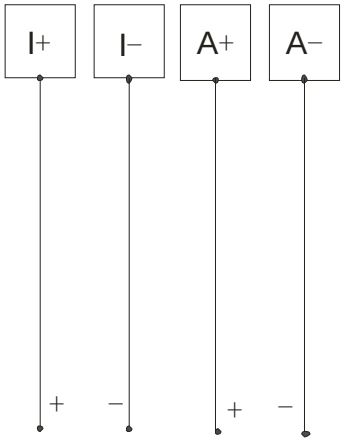




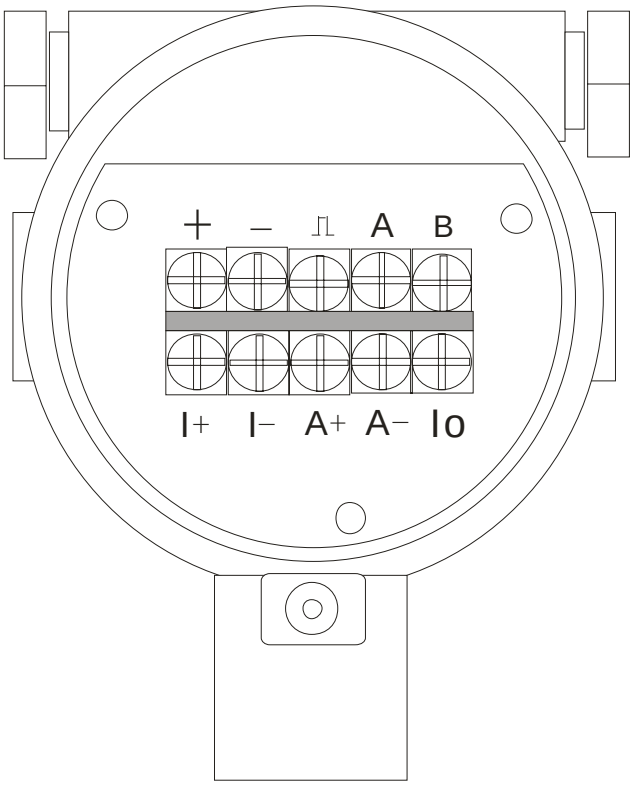
7.3 With Temp./ Pressure Compensation,and 4-20mA(2 wire) or Scale pulse output

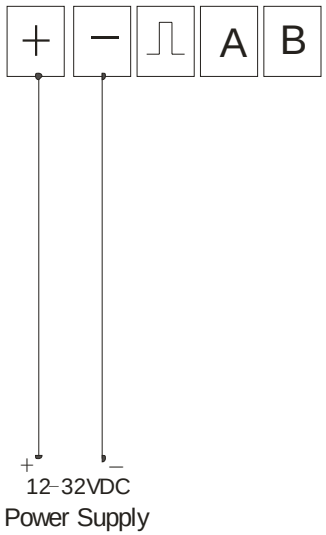
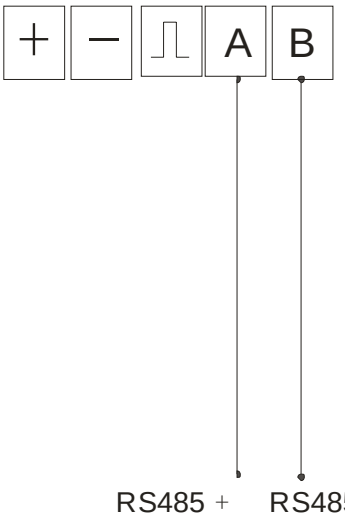
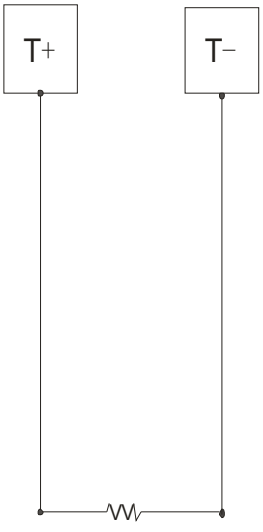
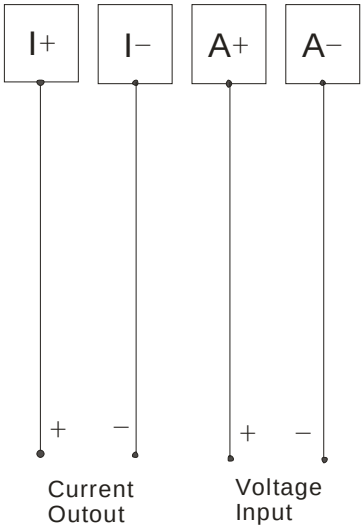




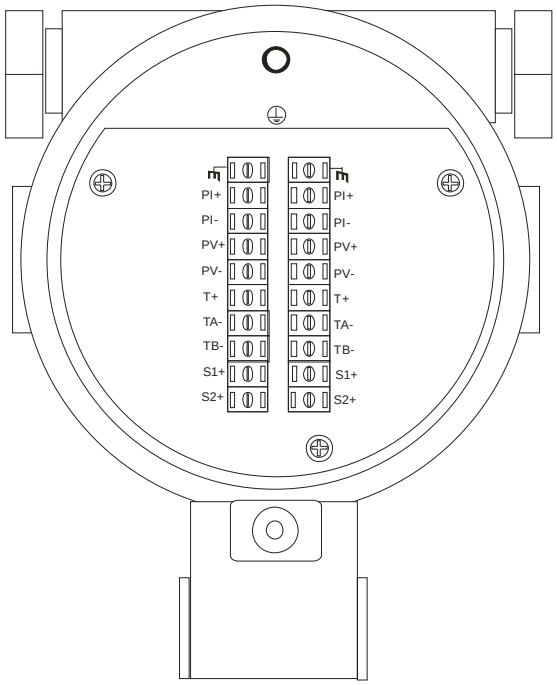
4-20 mA Output	Pulse Output	Sensor Input	
		Temperature	Pressure
			
		PT1000	Pressure Sensor 4 Wire

7.4 With Temp./ Pressure Compensation,and RS485 Communication



12-32 VDC Power supply	RS485 Communication	Sensor Input	
		Temperature	Pressure
			
PT1000			Pressure Sensor 4 Wire

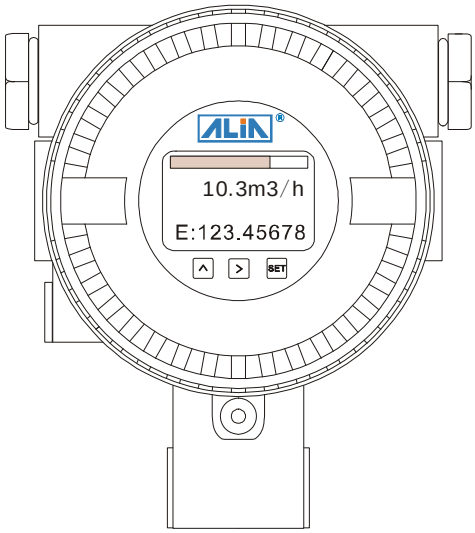
7.5 Separation board



Note: The terminals S1+, S2+ are signal ports of vortex sensor.

Terminal	Cable color	Sensor
PI+	red	Pressure sensor
PI-	blue	
PV+	black	
PV-	yellow	
T+	white	Temperature sensor
TA-	red	
TB-	red	
S1+	orange	Vortex sensor
S2+	orange	

8. Panel Display



9. Function

9.1 Button Function

Key	Button	Function
Setting	SET	Press shortly (1s) to enter menu settings or exit settings.
Move	>	Press shortly (1s) to shift to page down or move digit position when set parameters.
Up	∧	Press shortly (1s) to shift to page up or increase value by “1” when set parameters. Press long for 3s to enter chosen menu settings or confirm.

9.2 Display Function

10.5 m3/h E 20.0 m3	2_Line Display Mode LCD only displays flow rate and totalizer.
10.5 m3/h E 20.0 m3 P=12.5Kpa T=20.0℃	3_Line Display Mode LCD displays flow rate and totalizer + frequency / density / pressure / temperature / current /percentage/ P&T. Press ∧ button to choose pressure, temperature, density, current and percentage……

In normal display interface, press ∧ shortly (3s) and check frequency, density, pressure, temperature, current percentage …as below:

Symbol	F:	Den:	P:	T:	Curr:	Per:	P&T
Content	Frequency	Density	Pressure	Temperature	Current	Percentage	Temperature Pressure

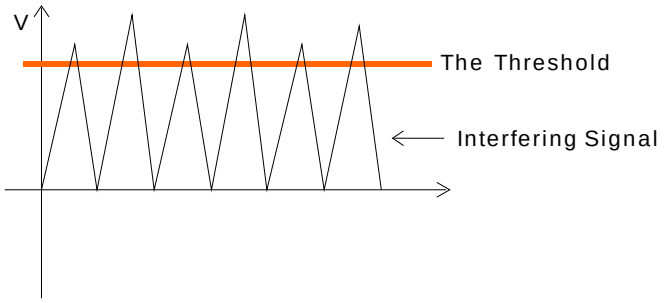
Other display:

- If enable pressure auto acquisition and pressure signal is abnormal, the pressure value in “Temp.&Pressure” interface will flash.
- If enable temperature auto acquisition and temperature signal is abnormal, the temperature value in “Temp.&Pressure” interface will flash.
- .P and T Shows the preset pressure and temperature of circuit board ，P&T Shows the pressure and temperature value from sensor

9.3 Field Application

Two situations will frequently happen at site:
A. No flow, it displays value.
B. Flow, it displays zero.

Reasons for problem A: vortex get interfered by outside environment, keeping receiving interference signals. In the picture below, interference signal is more than vortex's threshold value. So vortex displays value. To solve this problem, interference signal should be smaller than threshold value.



Reasons for problem B: flow frequency is very low, see the flow signal below. It's lower than threshold value, leading to measurement failure. To solve this problem, flow signal should be bigger than threshold value.

Then how to adjust interference signal and flow signal?
The solution lies in signal amplification. Signal amplification adjustment is "2000~2000000".

Default amplification:
If measuring medium is liquid, it's 5000.
If measuring medium is gas or steam, it's 80000.

Amplification adjustment method:
☆ Magnification can be divined into two parts:
amplification factor and magnification gain.
Magnification factor is in "Max AMP"while magnification gain in "AMP. Channel".

If amplification is 5000, amplification factor will be 500 and amplification gain 10^1 , namely $500*10^1=5000$.

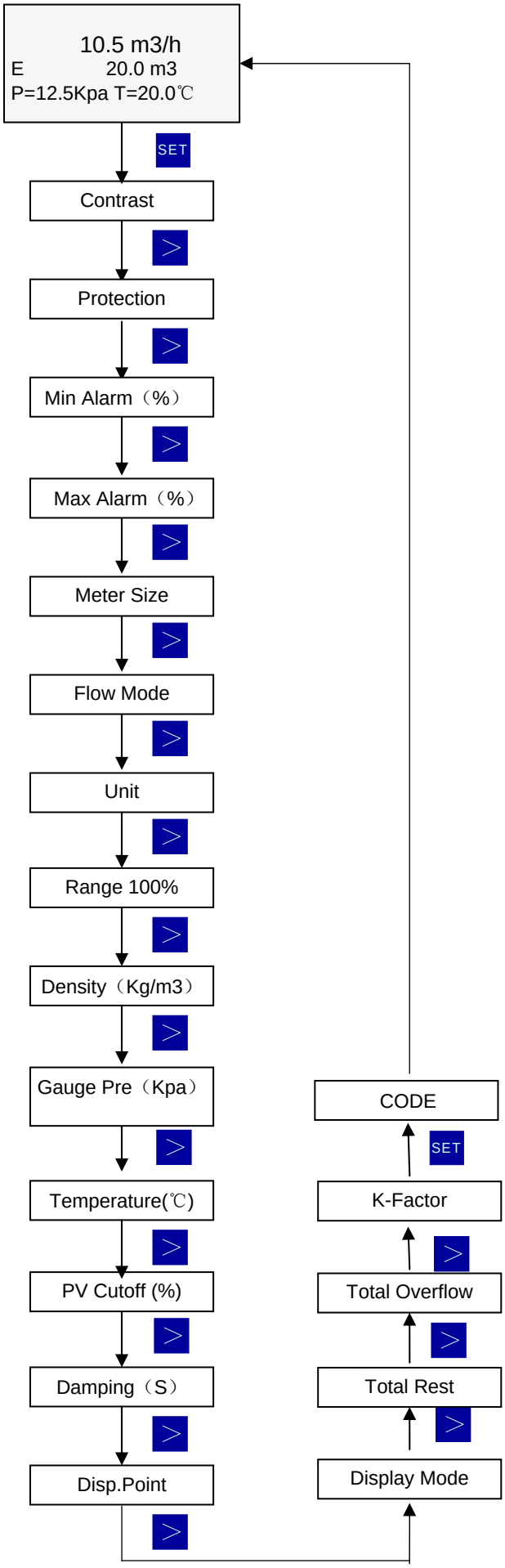
Max AMP	AMP.Channel
500	CH1
Amplification factor (Range: 200~2000)	Amplification gain (CH1=10^1; CH2=10^2; CH3=10^3)

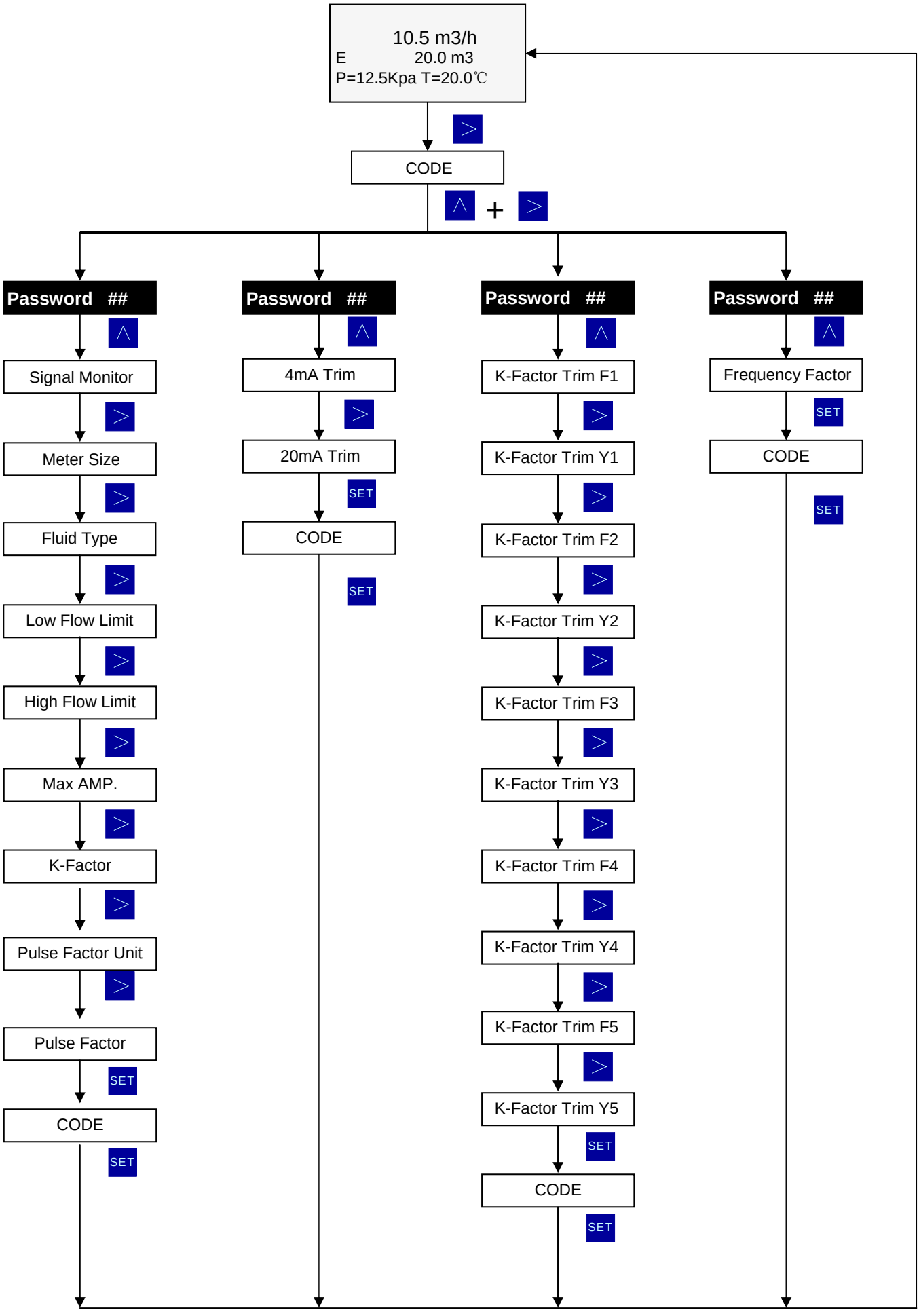
☆ **To solve problem A**: decrease amplification factor. Suppose amplification is 5000 now, change amplification factor (Max AMP) as 400 but keep amplification gain (AMP.Channel) the same (CH1). Then amplification is $400*10^1=4000$. If vortex still displays unusually, adjust amplification factor again.

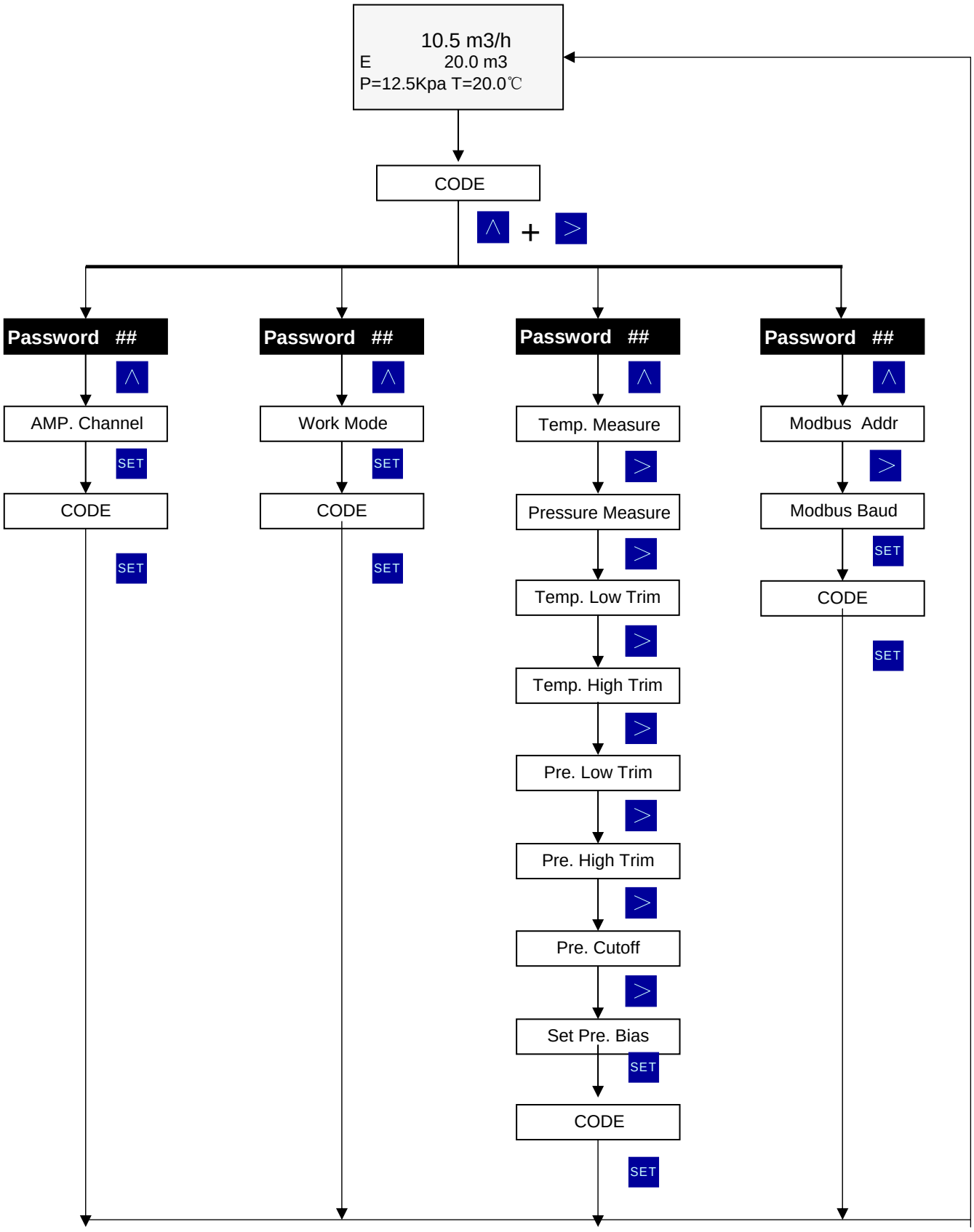
☆ **To solve problem B**: it happens to be on the contrary of A, namely adjust amplification from 5000 to 30000. Then:
Change amplification factor (Max AMP) as 300;
Change amplification gain (AMP. Channel) as CH2;
Amplification number is: $300*10^2=30000$

☆ In conclusion, amplification has to be set according to actual condition, making vortex displays properly, namely it displays zero when there is no flow and displays correct values when there is flow.

10. Parameter Operation Chart

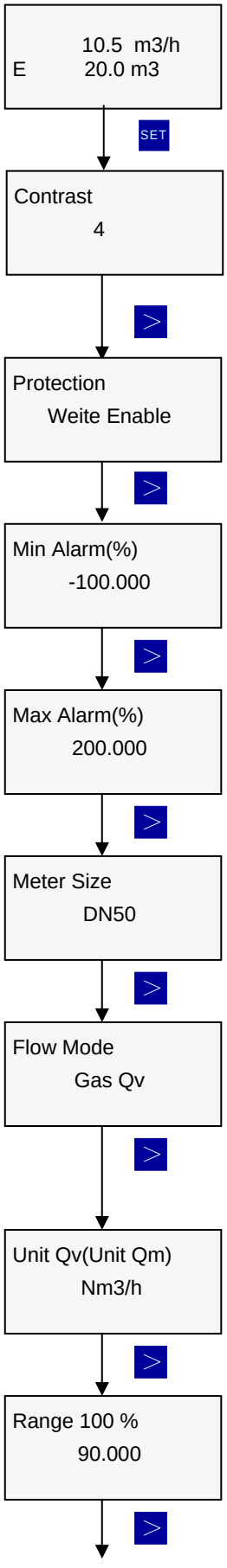



10.5 m3/h
E 20.0 m3
P=12.5Kpa T=20.0℃
CODE
Password ##
Signal Monitor
Meter Size
Fluid Type
Low Flow Limit
High Flow Limit
Max AMP.
K-Factor
Pulse Factor Unit
Pulse Factor
SET
CODE
SET
Password ##
4mA Trim
20mA Trim
SET
CODE
SET
Password ##
K-Factor Trim F1
K-Factor Trim Y1
K-Factor Trim F2
K-Factor Trim Y2
K-Factor Trim F3
K-Factor Trim Y3
K-Factor Trim F4
K-Factor Trim Y4
K-Factor Trim F5
K-Factor Trim Y5
SET
CODE
SET
Password ##
Frequency Factor
SET
CODE
SET


10.5 m3/h
E 20.0 m3
P=12.5Kpa T=20.0℃
CODE
∧ + ＞
Password ##
AMP. Channel
SET
CODE
SET
Password ##
Work Mode
SET
CODE
SET
Password ##
Temp. Measure
＞
Pressure Measure
＞
Temp. Low Trim
＞
Temp. High Trim
＞
Pre. Low Trim
＞
Pre. High Trim
＞
Pre. Cutoff
＞
Set Pre. Bias
SET
CODE
SET
Password ##
Modbus Addr
＞
Modbus Baud
SET
CODE
SET

11. Parameter Settings

11.1 Basic Settings



Normal Display
This interface shows flow rate and totalizer.
Press SET to enter next setting interface.

Contrast
Set the contrast, 1-5 are optional. The larger the number, the deeper the font color(default is 3). Set by ^ and > keys.
Press > to enter next setting interface.

Parameter Lock
Parameter settings are protected and locked. Press ^ long to shift in Enable / Disable. If Disable, all parameters can not be edited but can be checked only.
Press > to enter next setting interface.

Alarm Low Limit
Set by ^ and > keys, for instance, -100%, it means alarm low limit is -100%*Full scale. If displayed value is less than the low limit, the current output is 3.8mA. (This function is only effective for 4-20mA output.)

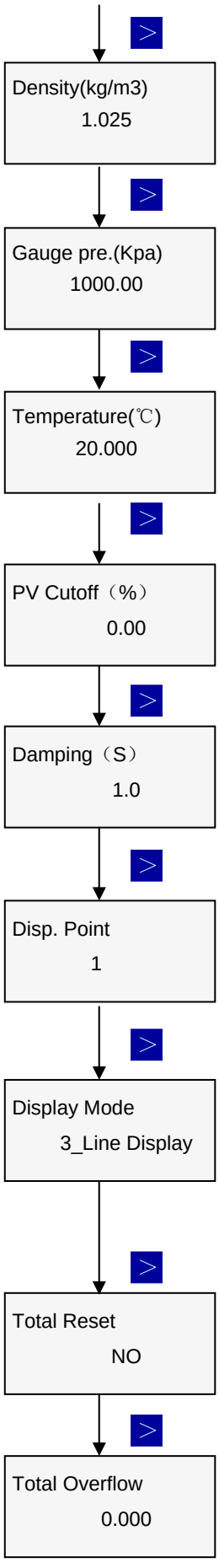
Alarm High Limit
Set by ^ and > keys, for instance, 200%, it means alarm high limit is 200%*Full scale. If displayed value is more than the high limit, the current output is 22mA. (This function is only effective for 4-20mA output.)

Meter Size
Only-read window. Check meter size.
Press > to enter next setting interface.

Flow Mode
Set by ^ and > keys. Liquid Qv: liquid volume; Liquid Qm: liquid mass; Gas Qv: gas volume; Gas Qv: gas mass; Steam Qv: steam volume; Steam(P/T):superheated steam
Sat Steam(T): saturated steam mass (temperature compensation); Sat_Steam(P) : saturated steam mass (pressure compensation).Press > to enter next setting interface.

Unit
Set by ^ and > keys. Nm3/h, Nm3/m, Nm3/s, m3/d, m3/h, m3/m, m3/s, l/h, l/m, l/s, t/d, t/h, t/m, kg/d, kg/h, kg/m, kg/s, g/h, g/m, g/s, G/h, G/m, G/s, bbl/h, bbl/d, lb/h, lb/d. Flow mode determines flow unit, it flow mode is different, flow unit will be different. Press > to enter next setting interface.

Full Scale
Set by ^ and > keys.
Press > to enter next setting interface.



Fluid Density
Set by ^ and > keys. Gas density (unit: kg/m3); liquid density (unit: g/cm3)
Press > to enter next setting interface.

Gas Pressure (gauge pressure)
Set by ^ and > keys. This is used for inputting pressure (unit: Kpa) manually (in Pressure Measure window). This value is pressure value for temperature/pressure compensation when it is on. If measuring liquid, no such option is available. Press > to enter next setting interface.

Gas Temperature (Celsius)
Set by ^ and > keys. This is used for inputting temperature (unit ℃) manually (in Temp.Measure window). This value is temperature value for temperature/pressure compensation when it is on. If measuring liquid, no such option is available. Press > to enter next setting interface.

Low Cut
Set by ^ and > keys. Available input is 0%~20%.
Press > to enter next setting interface.

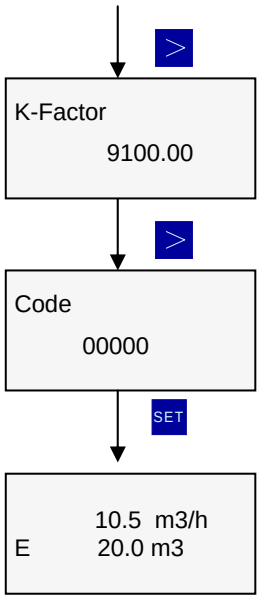
Damping
Set by ^ and > keys. Available time is 0~64s.
Press > to enter next setting interface.

Decimal point
Press ^ or > to set decimal point, 3 decimal points at most.
Press > to enter next setting interface.

Display Mode
Press ^ or > to set display mode.
2_Line Display: LCD only shows flow rate and totalizer.
3_Line Display: LCD shows Flow rate and totalizer+frequency/density/pressure/temperature/current/ percentage /P&T.
Press > to enter next setting interface.

Totalizer Reset
Set by ^ and > keys. Choose YES and then press ^ long to reset totalizer.
Press > to enter next setting interface.

Totalizer Overrange Cycle
This interface is read only. When flow total is over 99999999, the overrange cycle will be 1. And then flow total will start accumulating from 0 again.
Press > to enter next setting interface.



K-Factor

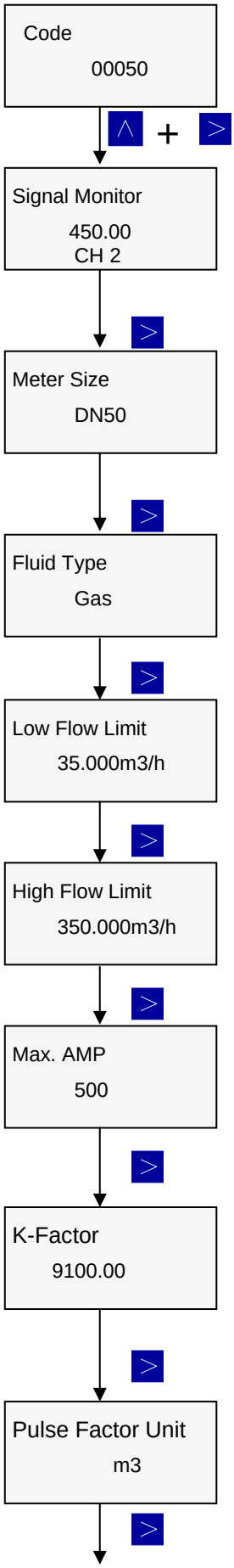
Read-only window. Check K-factor.

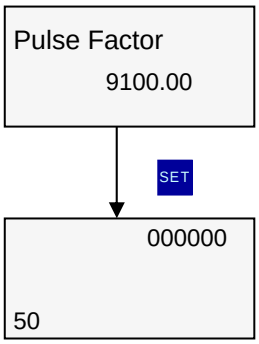
Press > to back to normal display interface.

Password

Set by ^ and > keys. Enter advanced settings by password. Press > to return parameter protection interface. Press SET to back to normal display interface.

11.2 Advanced Parameter Settings





Pulse Factor

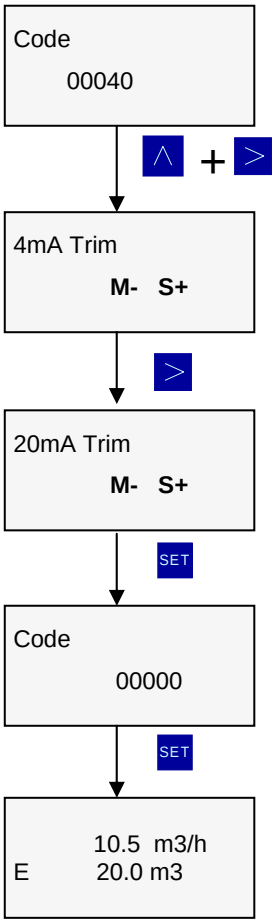
Press ^ and > to select unit for pulse factor. Optional unit: t, kg, Nm3, m3, Scf, cf, USG, UKG, bbl, Ib. If select kg, the value means pulse/kg. Others apply the same.

Press > to return to signal strength and SET to password interface.

Password

Press ^ and > keys to input password. Press SET to return normal interface.

11.3 Output 4-20mA Current Calibration



Password

Set by ^ and > keys. Enter password 00040 then press ^ long for 3s to enter advanced parameter settings. Non-engineer is not suggested to operate this, otherwise output accuracy of 4-20mA will be changed after this calibration.

4mA-20mA Calibration

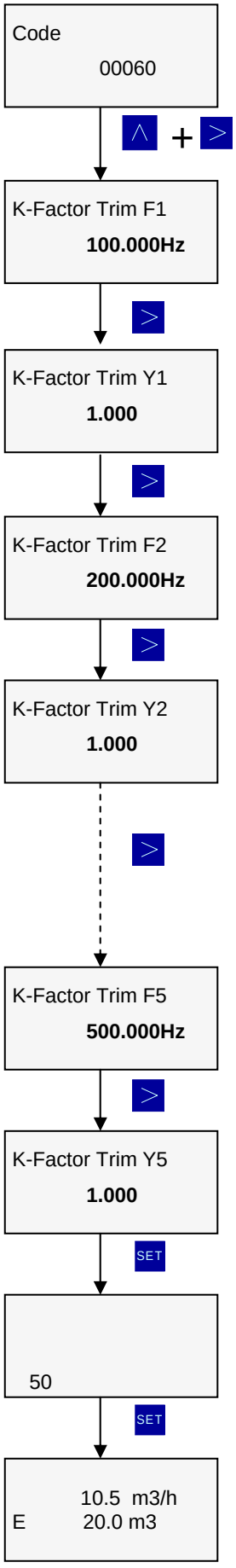
Before calibration, please connect ammeter in series with 4-20mA loop, current of flow rate will be displayed in the ammeter. Press^ long for 3s to enter 4mA calibration. If current displayed is not 4mA, press > to increase current or press ^ to decrease until the ammeter displays 4mA.

Each time you press, 0.016mA will be changed. After calibration, press ^ long for 3s to save calibration; or press SET to exit without saving calibration.

After calibrating 4mA, press > for 1s to enter 20mA calibration. The way is the same with that of 4mA calibration above.

Once 4-20mA calibration completed, press SET to return password interface.

11.4 5 Points linear Calibration



Password

Set by ^ and > keys. Enter password 00060 then press ^ long for 3s to enter revision settings. Non-engineer is not suggested to operate this, otherwise output accuracy of 4~20mA will be changed.

5 Points linear Calibration

Generally accuracy can be met with K factor. If something particular needs more complete linear calibration, 5 points linear calibration is necessary. Steps:

Input password to enter 1st point calibration frequency F1 interface, press > to enter 1st point calibration coefficient Y1 interface and then press > again to enter F2, Y2 / F3, Y3 / F4, Y4 / F5, Y5 interface one by one. The initial value of each point is 1.0000.

E.g. When you find the flow rate is not displaying accurate, you can check corresponding flow rate of different velocities in normal display interface and press ^ shortly to check corresponding frequency of each flow rate. Record the flow rate and frequency as table below:

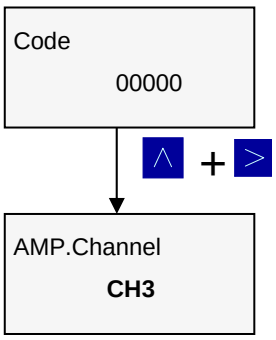
Measuring Point	1	2	3	4	5
Displayed Flow Rate	129m3/h	216m3/h	345m3/h	431m3/h	517m3/h
Frequency	30	50	80	100	120
Actual Flow Rate	132m3/h	216m3/h	345m3/h	425m3/h	510m3/h

Calibration Coefficient Y=Actual Flow Rate/Displayed Flow Rate e.g. Y1=132 / 129 = 1.0233

So frequency P and coefficient Y of 5 points linear calibration should be:

F1	F2	F3	F4	F5
30	50	80	100	120
Y1	Y2	Y3	Y4	Y5
1.0233	1.0000	1.0000	0.9861	0.9865

11.5 Amplification Gain Settings



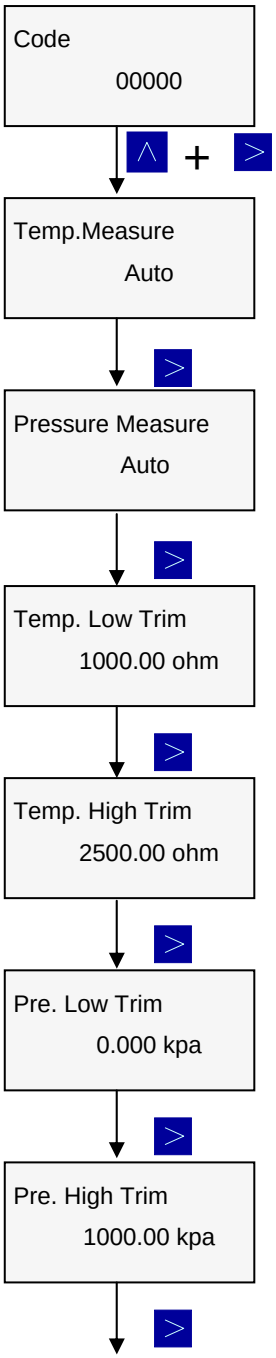
Password

Press ^ and > to enter password 00062, then hold ^ key for 3s to enter channel setting interface.

Amplification Gain Settings

Press ^ and > to set amplification gain: CH1, CH2, CH3; CH_1 means amplifying 10^1 times on amplification factor, it's usually used to measure liquid. CH3 means amplifying 10^3 times on amplification factor, it's usually used to measure gas. CH2 means amplifying 10^2 times on amplification factor, it's usually used to make adjustment according to fluid condition and interference strength. Press SET twice to return to normal interface.

11.6 Temperature / Pressure Calibration



Password

Set by ^ and > keys. Enter password XXXXX then press ^ long for 3s to enter temperature/ pressure calibration settings (If necessary, please contact ALIA).

Temperature Input Mode

There are 2 options: Manual and Auto. Manual mode, achieving temperature/pressure compensation with setting value in window Temperature. Auto mode, PT1000 should be connected externally. Press > to enter next setting interface.

Pressure Input Mode

There are 2 options: Manual and Auto. Manual mode, achieving temperature/pressure compensation with setting value in window Pressure. Auto mode, a pressure sensor should be connected externally. Press > to enter next setting interface.

Temp Low Point Calibration(Not proceed unless necessary, otherwise low accuracy)

Connect a standard 1000Ohm resistance externally with the circuit board then press ^ for 3s and release until value 1000.00 flashes; after this press ^ for 3s again until value 1000 Ohm stops flashing then release. Temp Low point calibration is finished. Press > to enter next setting interface.

Temp High Point Calibration(Not proceed unless necessary, otherwise low accuracy)

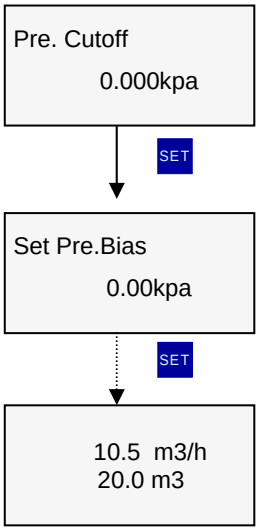
Connect a standard 2500Ohm resistance externally with the circuit board then press ^ for 3s and release until value 2500.00 flashes; after this press ^ for 3s again until value 2500 Ohm stops flashing then release. Temp High point calibration is finished. Press > to enter next setting interface.

Pressure Low Point Calibration(Not proceed unless necessary, otherwise low accuracy)

Connect a pressure sensor externally and input 0kpa then press ^ for 3s and release until value 0.00000 is flashing; after this press ^ for 3s again and release until value 0.00000 stops flashing. Pressure Low point calibration is finished. Press > to enter next setting interface.

Pressure High Point Calibration(Not proceed unless necessary, otherwise poor accuracy)

Connect a pressure sensor externally and input pressure, such as 1000kpa, and press ^ for 3s and release until value 1000.00 is flashing; after this press ^ for 3s again and release until value 1000.00 stops flashing. Pressure High point calibration is finished. Press > to enter next setting interface.



Low Pressure Cutoff

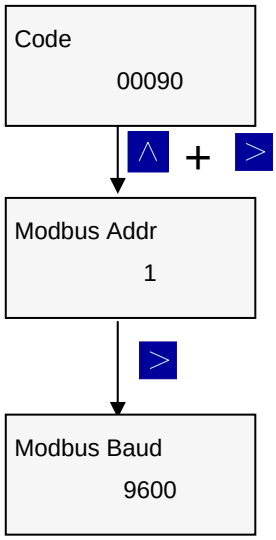
Set by ^ and > keys. If measuring pressure is less than the value you set, it will display 0Kpa. Press > to enter next setting interface.

Pressure Shift

Set by ^ and > keys. Unit: KPa. If pressure is auto measuring, and displaying pressure is inaccurate, you can input actual pressure in this window to achieve pressure shift directly. Do not change it (if necessary, please contact ALIA). Press SET twice to return to normal display interface.

12. Modbus Communication Settings

Mode: standard MODBUS-RTU. Details:
Modbus: MODBUS-RTU mode
Baudrate: 9600bps
Serial data mode:
Parity: None
Databit: 8
Stopbit: 1
Communication address: 01



Password
Press ^ and > to enter password 00090. Hold ^ for 3s to enter MODBUS settings.

Communication Address
Press ^ and > to set range: 1-247. Default address: 1.
Press > to enter next setting interface.

Baud Rate
Press ^ and > to set baud rate: 9600/4800/2400/1200/600; default address: 9600.
Press SET twice to return to normal interface.

13. Commonly Seen Problems

1. Vortex displays flow rate when valve is closed.
   ① If frequency is detected to be 50hz or 60hz, it means grounding needs to be checked. AVF7000 demands high in grounding such as the position, stairs or railing to eliminate interference signals. Try to avoid vortex's cable share the same grounding terminal with those of other devices or intertwined together. Built up a remote grounding pole for vortex if conditions are permitted.
   ② Huge pipe vibration. If vibration exceeds vortex's bear ability, please reinforce its installation position or add a hose terminal to reduce vibration.
   ③ Strong-current equipment or strong interference around.
   ④ Big amplification. Try to reduce it if necessary.

2. Vortex displays 0 when flow is running in pipe.
   ① Actual flow rate in pipe is too low. Please increase it to make sure it reaches vortex's min. measurement value.
   ② Small amplification. Try to increase it if necessary.
   ③ If measuring medium is steam, please make sure actual temperature&pressure parameters are conformed with those inside circuit board.
   ④ Circuit board or sensor is faulted. Please send them back to ALIA for repair.

3. Vortex's flow rate is unstable.
   ① Actual flow rate is unstable.
   ② Huge pipe vibration. If vibration exceeds vortex's bear ability, please reinforce its installation position or add a hose terminal to reduce vibration.
   ③ Small amplification, try to increase it if necessary.

4. Vortex's displayed flow rate deviates a lot with actual flow rate.
   ① Installation direction is wrong. Make sure vortex is installed as the direction indicated in its body.
   ② Installation is not concentric. Make sure vortex is installed concentric and use tools if necessary.
   ③ Gasket is not suitable. Its internal size is smaller than that of pipe or it slide into pipe, leading to turbulence. Make sure gasket is proper.
   ④ If measuring steam, when process temperature or process pressure changes, please make sure whether Temperature&pressure inside vortex is conformed to actual process temperature&pressure.
   ⑤ K factor is wrong. New K factor=(Display flowrate/Actual flowrate)*K(original)