



INSTALLATION AND OPERATION MANUAL

AVM80 Vortex Meter



Please read and save these instructions.

359-A

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Icon Legend

If instructions are not followed:



Injury or death and property damage are imminent



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1.0 GENERAL

Every AVM80 vortex flowmeter will be carefully inspected before delivered to users. Please carefully check if there is any damage to the package and product when you received them Please check if the package contains all the accessories according to 1.2 or your purchase order. Please make sure the person in charge of this device has carefully read this manual and understand its descriptions.

> 1.1 Model Number and General Specifications

Please check if the model number and specifications on the name plate (figure 1.1) match your requirement on the purchase order.

Please kindly record the model number and instrument ID code, which will be required if you need and service or support from us.

> 1.2 Packing List

When you receive the package, please check if it contains the items as below:

- | Vortex flowmeter x1
- | User's manual x1
- | Calibration certificate x1
- | Quality certificate x1
- | Cable (For remote type only, length according to customer's requirement)
- | Counter flanges (For wafer type, or for flanged type when customer required so)
- | Screws and bolt (For wafer type, or for flanged type when customer required so)t.

> 1.3 Storage

If the product needs to be stored for a long period before use, please be aware of below:

1. The product should be kept in the original package and same as it was when received.
2. Please store the product in a proper location according to the requirements below:
 - | Not in an uncovered field.
 - | Not in a location with vibration.
 - | Please keep the enclosure of the meter closed.
 - | The ambient temperature, atmospheric pressure and humidity should be:

Temperature: -20~+70°C° C; RH: 5%~99% ;
Atmospheric pressure: 86~106Kpa - Imperial (metric)s.

Temperature Rating	Medium Temperature F° (C°)
T6	-40 - +176 (-40 - +80)
T5	-40 - +212 (-40 - +100)
T4	-40 - +275 (-40 - +135)
T3	-40 - +392 (-40 - +200)
T2	-40 - +572 (-40 - +300)
T1	-40 - +842 (-40 - +450)

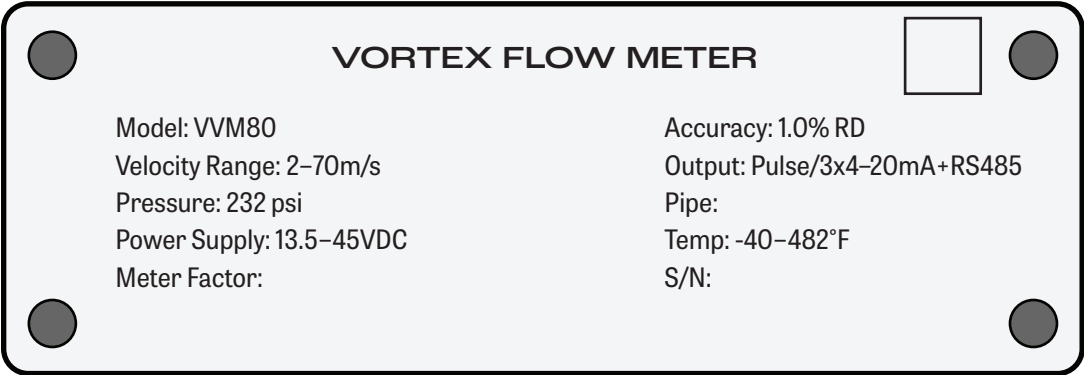


Figure 1.1 Vortex Meter name plate

> 1.4 Measuring Principle

Vortex flowmeter measures the flow by sensing the vortices in the flow according to “Karman Vortex Street”. When a shedder is in the path of flow, vortices are alternately shed on each side (see picture 1.2)

The frequency of vortices (f) is in direct ratio with velocity of flow (v) and in inverse ratio with width

St is Strouhal Number, a dimensionless constant related to shape of the shedder, which can be determined by testing.

AVM80 series digital vortex flowmeter is designed to provide the most reliable performance. Every part utilized is universal for all AVM80 series products. The circuit boards use signal isolation and self-diagnose technology. AVM80 series utilizes spectrum analyzing signal process technology, which ensures a better turndown ratio. The enhanced version uses a unique dual-sensor design and vibration signal analyzing technology to improve its anti-vibration capability and provides a stable reading. AVM80 also has density calculation functions as option, which means it can calculate the density and measure mass flow rate of air/saturated steam/superheated steam without a secondary device. It also has AGA-8 algorithm to measure natural gas directly.

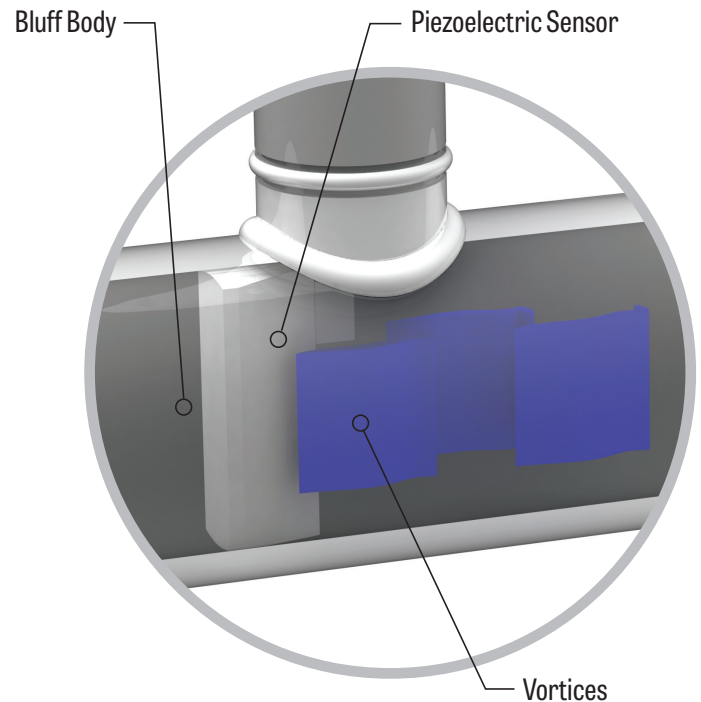


Figure 1.2 Von Karman vortices

2.0 OPERATION

> 2.1 Find a Suitable Location

(1) Ambient Temperature Please avoid installing the flowmeter at a location where temperature could dramatical changes. If the meter is under heavy heat radiation, please implement effective heat insulation and proper venting.

(2) Atmosphere Please do not install the meter at a location where the atmosphere contains a high level of corrosive substance. If there are no better options, make sure there is enough venting.

(3) Vibration The meter should not be installed at a location where there is heavy vibration. If there is significant vibration, install the meter with supportive pipe racks to minimize it.

(4) Caution

- (A) All screws and bolts should be tightened.
- (B) Make sure there are no leaks.
- (C) The process pressure should not be higher than the meter's rated pressure.
- (D) Once the meter is under pressure, do not tighten screw or bolts.



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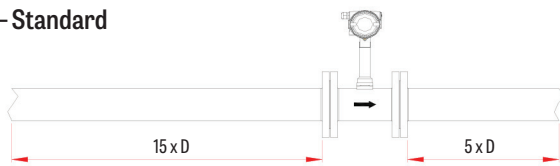
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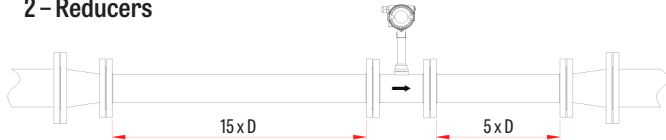
> 2.2 Straight Run Pipe Requirement

(D = diameter of pipe size)

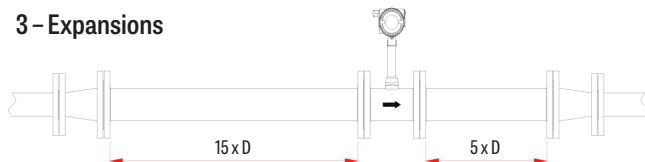
1 – Standard



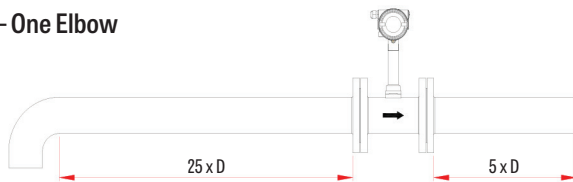
2 – Reducers



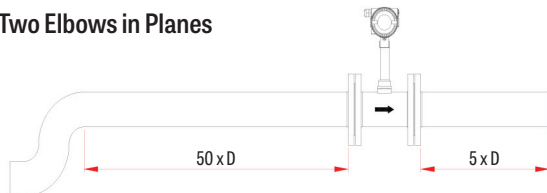
3 – Expansions



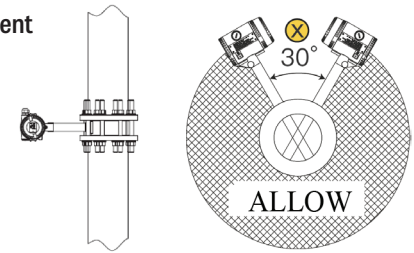
4 – One Elbow



5 – Two Elbows in Planes



6 – Stream Measurement



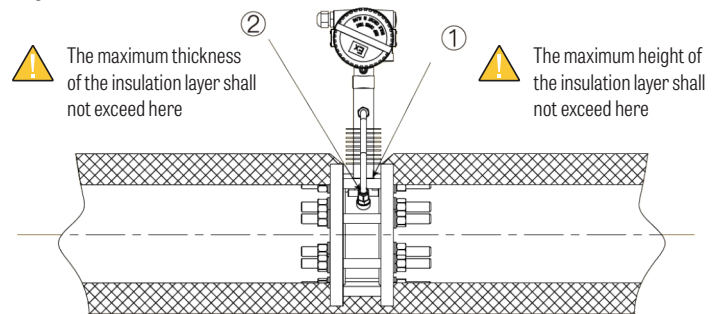
Install in the shaded area when the medium temperature is over 160°C (320°F) (top drawing), or install the meter in a vertical pipeline (bottom drawing)

It is recommended to add an insulation to the pipe, for temperatures higher than

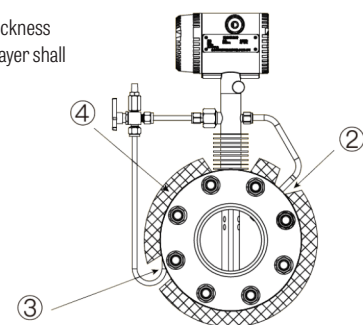
+160°C (320°F), to protect the transmitter from temperature higher than +80°C (176°F).

The insulation should not cover the stem.

Only install insulation 4 in the 1, 2 and 3 marked positions in the figure below



The maximum thickness of the insulation layer shall not exceed here



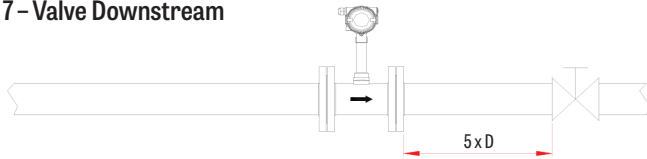
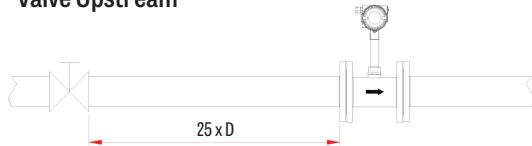
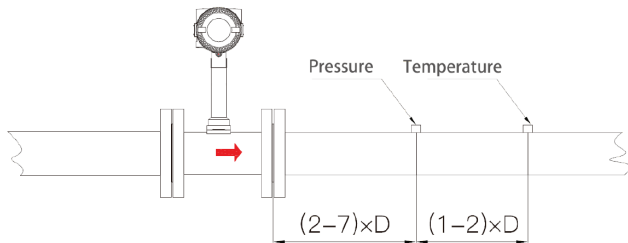
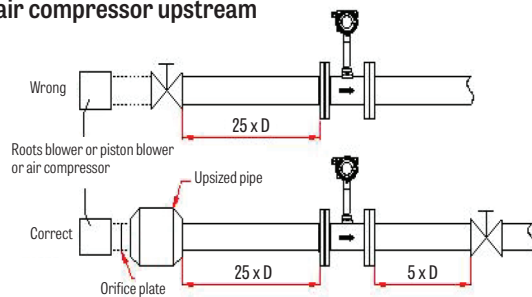
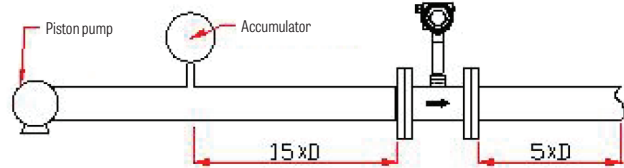
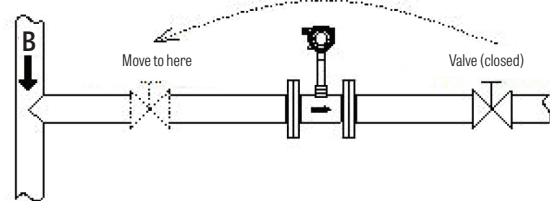
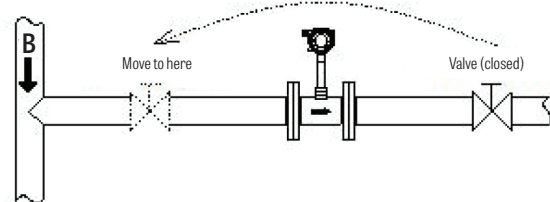
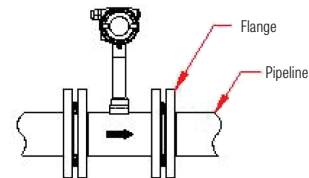
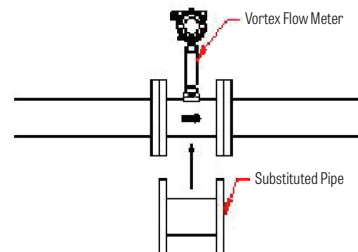
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7 – Valve Downstream**8 – Valve Upstream**
9 – Pressure Sensor: 2-7D downstream of flow meter
Temperature Sensor: 1-2D downstream of pressure sensor

**10 – Roots blower or piston blower or
air compressor upstream**
**11 – After a piston pump****12 – T Upstream****13 – Gaskets should not protrude in the pipe****13 – Gaskets should not protrude in the pipe**
14 – Pipe Cleaning If the pipeline needs to be cleaned, please use a
 spool piece to replace the flow meter to void the meter from being
 damaged by the cleaning fluid


> 2.3 Install – Wafer Type

The following is for fixed pipe. For expandable pipe, ignore steps 1 and 2

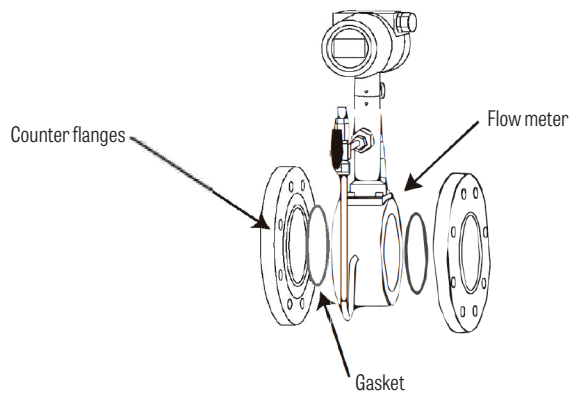
Step 1 Calculate the cut pipe width $S=A+2B+2C$

A: Width of wafer vortex flowmeter body

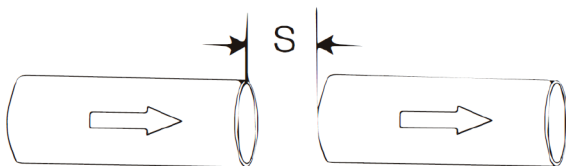
B: Thickness of the spiral wound gasket

C: Thickness of matching flanges

(Use caliper to measure above, or see Table 1 on page xx for S size)

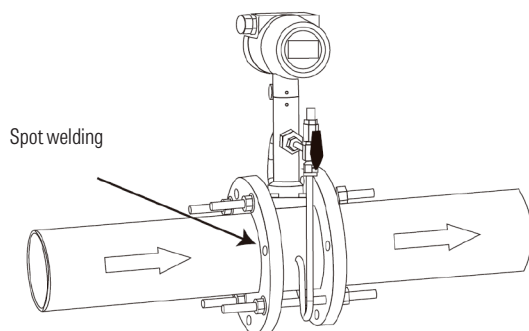


Step 2 Cut the width S calculated in step 1 at the pipe

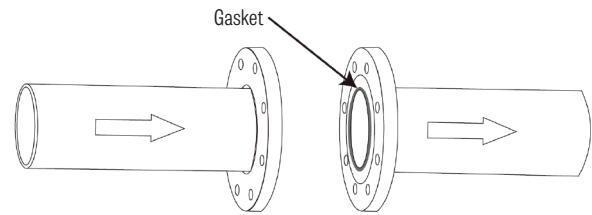


Step 3 Place two metal spiral wound gaskets in the flange slots, clamp the vortex flowmeter as shown in the figure, and fix the flowmeter with matching bolts. Spot weld the matching flange at the cut to make sure the flange is firm.

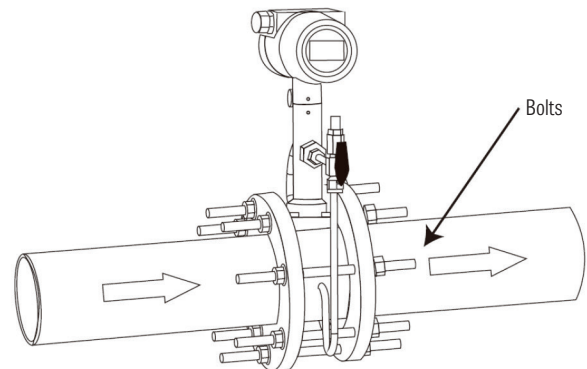
To avoid damage to the probe due to high-temperature welding, the flow meter must be removed from the pipeline after spot welding is completed.



Step 5 After the welding part cools down, place a matching metal spiral wound gasket on each side of the flange.



Step 6 Clamp the flowmeter (note that the flow indication direction of the flowmeter is the same as the direction of the pipeline fluid) and fix the flowmeter with matching bolts.



> 2.4 Install – Flange Type

The following is for a fixed pipeline type. For the expandable pipe, ignore steps 1 and 2

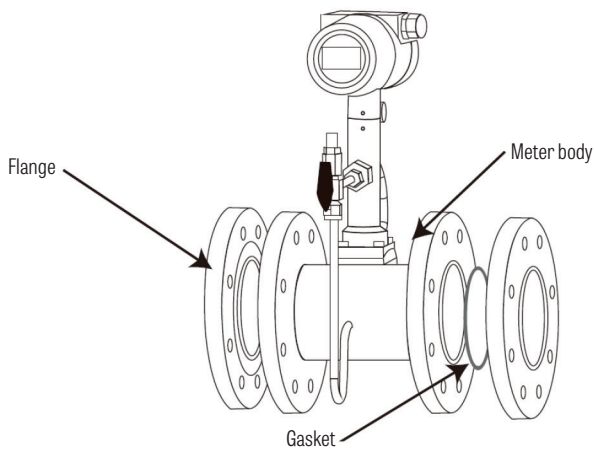
Step 1 Calculate the width of the cut pipeline $S=A+2B+2C=L+2C$

A: The width of the flanged vortex flowmeter body (including the flanges on both sides)

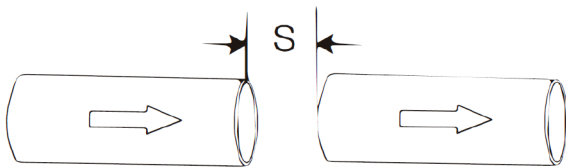
B: The thickness of the metal spiral wound gasket

C: The thickness of the flange slot welded on the pipeline

(The above is measured with a caliper, or the L size is shown in table 2 on page 14)



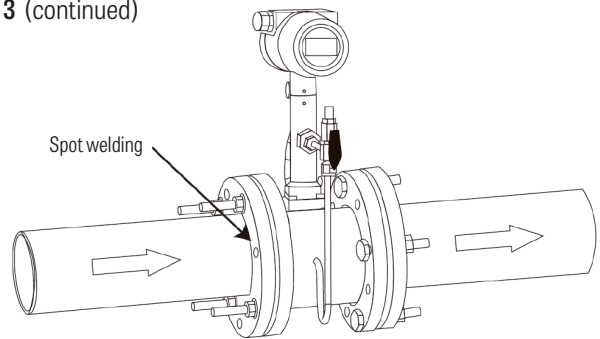
Step 2 Cut a notch of width S on the pipe



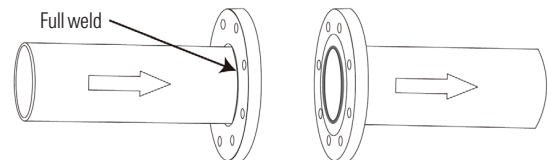
Step 3 Place two metal spiral wound gaskets in the flange slots, clamp the vortex flowmeter as shown in the figure, and fix the flowmeter with fastening bolts. Spot weld the flanges at the cut to make sure the flange is firm.

To avoid damage to the probe due to high-temperature welding, the flow meter must be removed from the pipeline after spot welding is completed.

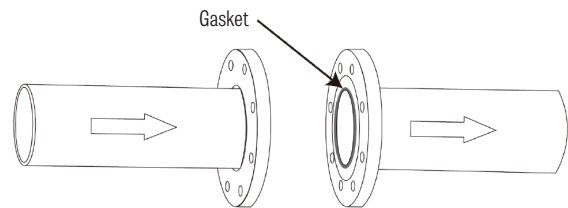
Step 3 (continued)



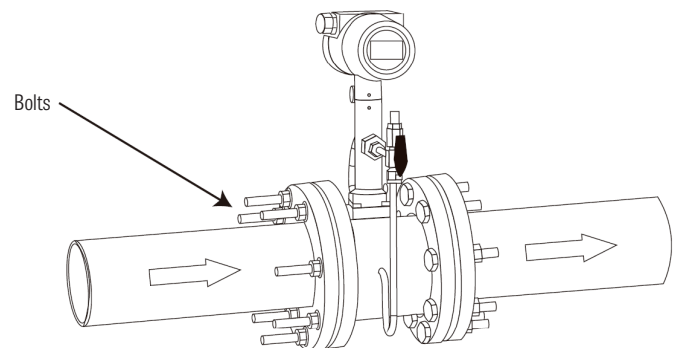
Step 4 Remove the vortex flowmeter and metal spiral wound gasket, and fully weld the two flanges.



Step 5 After the weld has cooled, place a metal spiral wound gasket on each side of the flange.



Step 6 Clamp the flowmeter (note that the flow indication direction of the flowmeter is the same as the direction of the pipeline fluid) and fix the flowmeter with fastening bolts.



3.0 WIRING

AVM80 vortex flowmeter has different terminal boards for different output requirements, the 12 terminals board and the remote display terminal board. Please reference to picture 3.1 and 3.2 below.

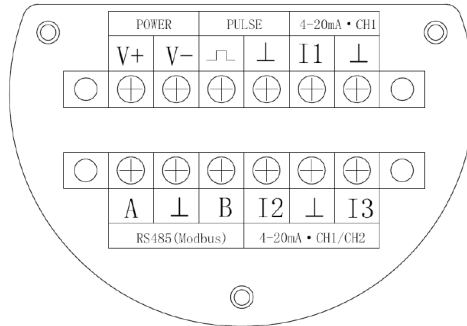


Figure 3.1 12-terminals board
(power+4~20mA+RS485)

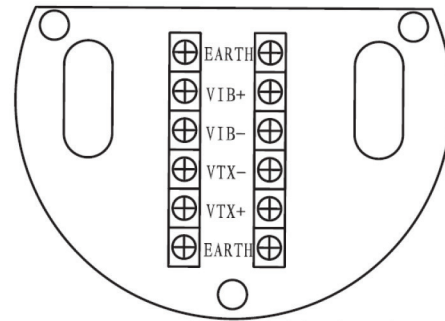


Figure 3.2 Remote display terminal board

> 3.1 Shell Grounding and Elimination of Interference

In the AVM80 digital vortex flowmeter the power supply of signal processing circuit is transferred from outside power supply by an isolation type DC-DC transmitter with advanced grounding technology. The field frequency interference can be isolated well.

When using this product, the “V-” power supply should not be connected with the ground. When this product is used in an environment with strong interference, the shell should be grounded to earth through cable, so the interference can be eliminated.

> 3.2 Wiring Requirement

- 1 – Only connect wiring when the power is off
- 2 – Please open the rear cover first, then inert the cable into back zone of housing through the water-proof cable gland.
- 3 – Conduct wiring according to 3.3, 3.4, 3.5 and 3.6.
- 4 – If possible, please connect the wiring according to picture 3.0 to avoid water getting into the housing through the cable.

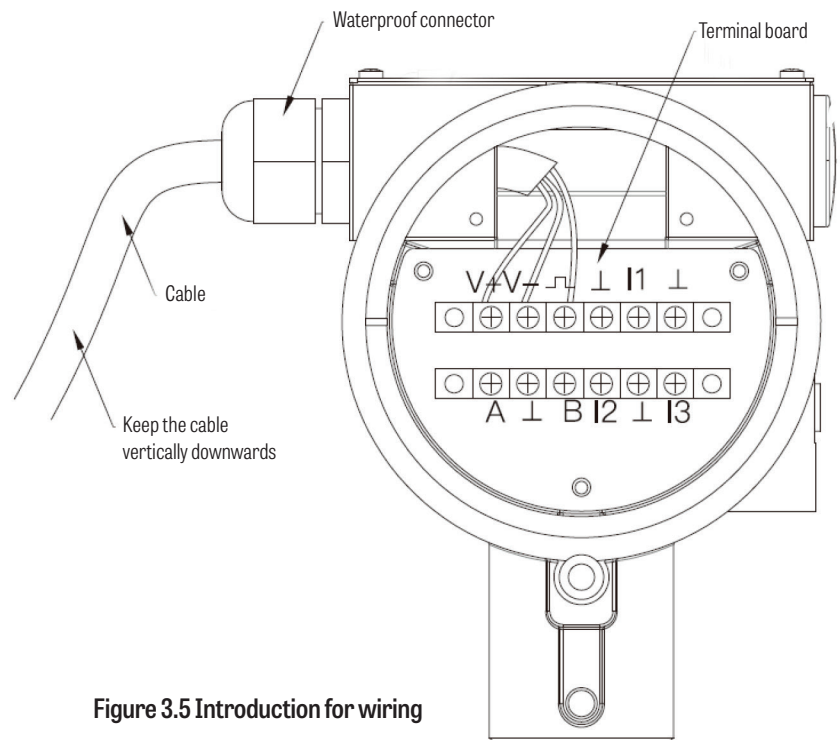


Figure 3.5 Introduction for wiring



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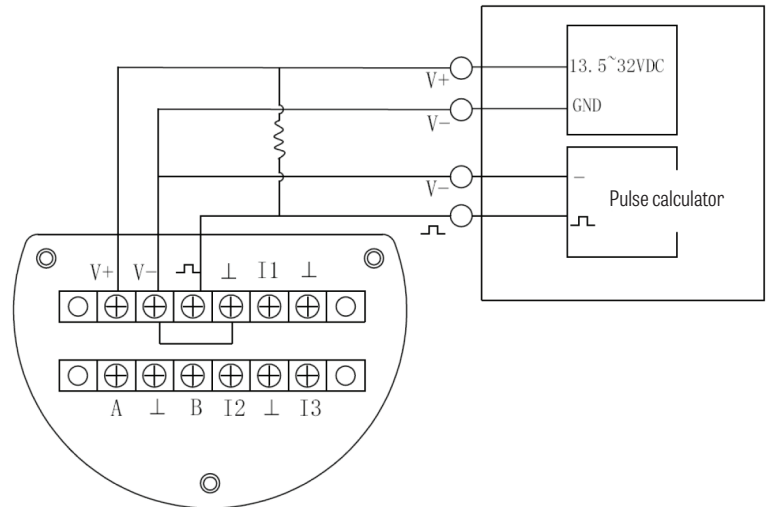
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3.3 Wiring for 12-Terminal Board (power+RS485+4-20mA)

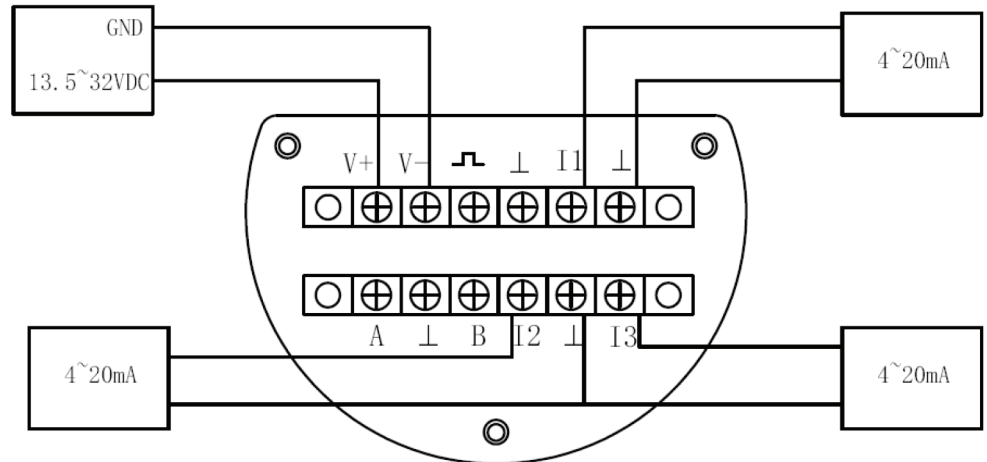
3.3.1 Wiring for Pulse Output

Pulse output requires a power source of 13.5~42VDC. AVM80 use a current pulse output with 50% duty ratio. If the pulse receiving instrument require voltage pulse, please add a resistor between "I1" and "V-", the resistance should be within 500-1000, and power consumption should be no less than 0.5W.



3.3.2 Wiring for 3-Way 4~20mA

When the power supply is 13.5~32VDC input, the meter supports 3 channels of 4~20mA output at the same time, 4~20mA comes with power input, no external power supply is required.



3.3.3 Wiring for 4-Way 4~20mA

When power source is 24VDC, the max load for 4~20mA analog is 500ohms

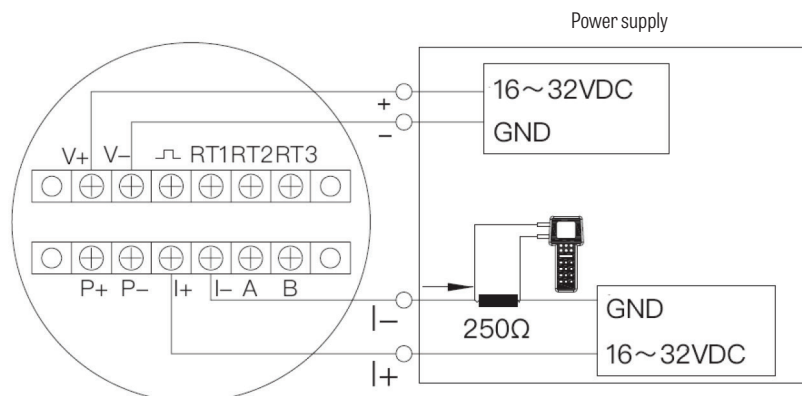


Figure 3.3.3 4-wire HART@4~20mA



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3.3.4 Wiring for RS485

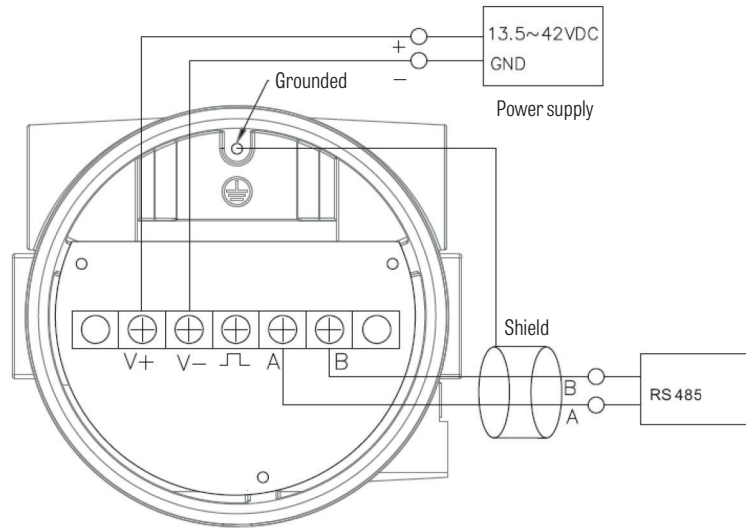


Figure 3.3.4 Wiring for RS485

> 3.4 Wiring on Remote Display

The split-type connection cable is pre-connected at the factory.

During installation and operation, it is recommended to route the cable through a protective conduit to enhance anti-interference performance.

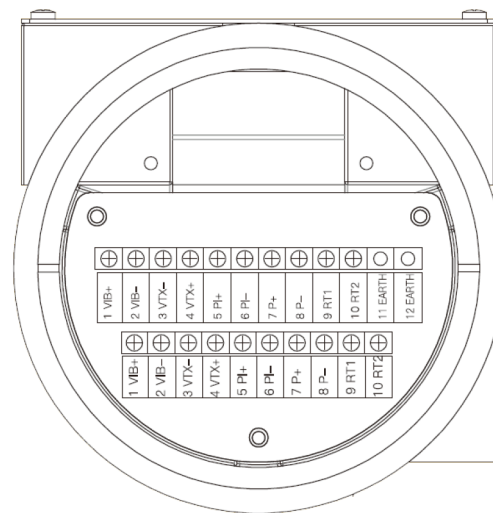
1. Unscrew and remove the back cover of the flow meter.
2. Disconnect the cables connected to the 12P terminal block located on the upper section near the cable entry side. The terminals correspond to **VIB+**, **VIB-**, **VTX-**, **VTX+**, **PI+**, **PI-**, **P+**, **P-**, **RT1**, **RT2**, and **EARTH**.

Loosen the waterproof cable gland and carefully pull the cable out.

3. Route the cable through a protective conduit.
4. Pass the cable back through the waterproof cable gland.

According to the identification labels on each conductor (e.g. **VIB+**), reconnect the wires to the corresponding terminals on the 12P terminal block as marked on the terminal board.

5. Tighten the waterproof cable gland and reinstall the rear cover of the flow meter housing.



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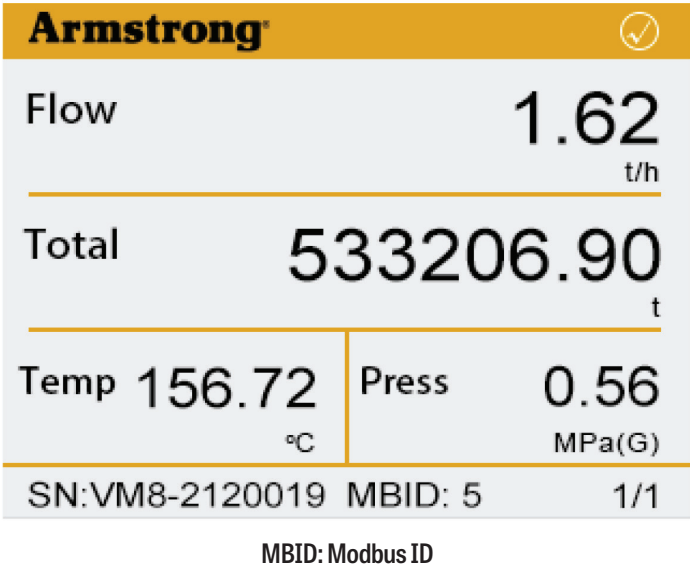
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4.0 USER INTERFACE

The AVM80 has an integral display with setting functions, and can display various operating parameters on its multi-functional display.



> 4.1 Multi-Function Display

The AVM80 upper screen will display the logo and status of the application along with flow variables. The lower screen will display the hardware version, software version, Modbus ID and Page #.

> 4.2 Data Display

AVM80P display indicates “Flow”, “Total flow”, “Temperature”, “Pressure.” Many different units of measure are available.

Data Display Units of Measure		
Page	Display	Unit
1	Flow Rate	Nm³h, Nm³/min, Nm³s
	Total Flow	Nm³, m³, NL, L, scf
2	Temperature	°C, °F, K
	Pressure	MPa, KPa, Psi, Bar

4.3 Button Operation Introduction

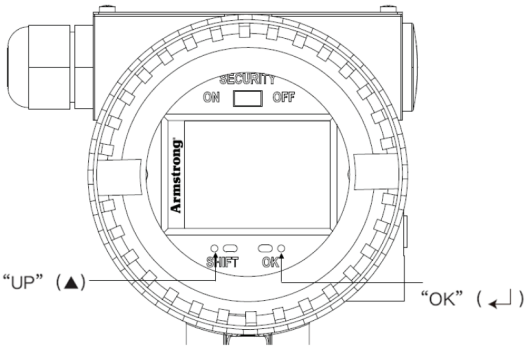
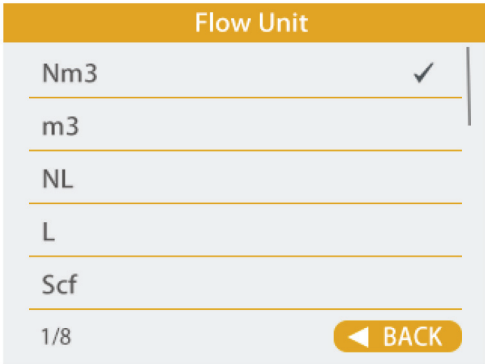
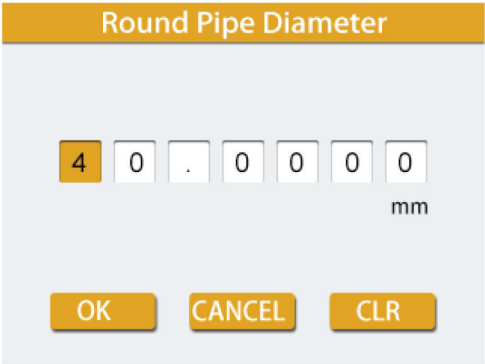


Figure 4.3

Press and hold “OK” (for at least 3s) enter settings.

There are two main methods for setting parameters: digital edit and list selection. For example, input the round pipe diameter or select the unit of volume flow (as below):



1. Digital Setting

1. Button Navigation
2. To move through the menu press the Shift button. Use the Shift button to move through the menu. Press Shift to enter the setting you chose.
3. For example to get started. Place your finger over the OK button for 3 seconds, this will take you to settings. Press the Shift button to move to sensor set up, then press the OK button to enter the sensor set up menu.
4. Once you are in the Sensor Set Up menu, use the Shift button to move to Medium, then press the OK button to enter the Medium menu.
5. Once in the Medium menu, press Shift and move to the required Medium, then press the OK button to select it.
6. Once you have selected the Medium press Shift until Back is highlighted, then press OK to return to the previous menu.
7. Using the above information let's change the pipe size. Press OK for 3 seconds, press Shift to move to Senor Set Up and press OK. In the Sensor Set Up menu press Shift to move down to Pipe Diameter and press OK. Use the Shift button to move to the position you want to change and press OK to highlight it. Use Shift to change the number and press OK to turn off the highlight state. Use Shift to move to the next number and repeat. When finished use Shift to move to the OK button and press OK to save.

2. List Select

Some of the AVM80 functions are completed by selecting List, as shown in picture 4.5. Notice:

1. When the user enters the list display interface for the first time, the default selection is the "Back" button. In the display interface, the parameter with a check mark "✓" shows the current selection
2. Select the required Flow Unit by pressing the Shift button. The selected parameter background color will be yellow.
3. When the user switches to the list column that needs to be modified, press "OK" to confirm.
4. A dialog box will pop up will prompt you to confirm the Modification.
5. Press "SHIFT" to select "YES", "NO" or "CANCEL", and press "OK" to save the settings.

> 4.4 Operating Status

"Status" indicates its operating normally or in Alarm mode.

Operation Icon Functionality	
Icon	Explanation
	Normal
	Exceeding the pressure limit
	Exceeding the temperature limit
	Continuous master-slave communication errors
	Total flow reading error

Figure 4.3



5.0 SETTING

AVM80 parameters have been preset by the factory, please do not make modifications without prior factory authorization.

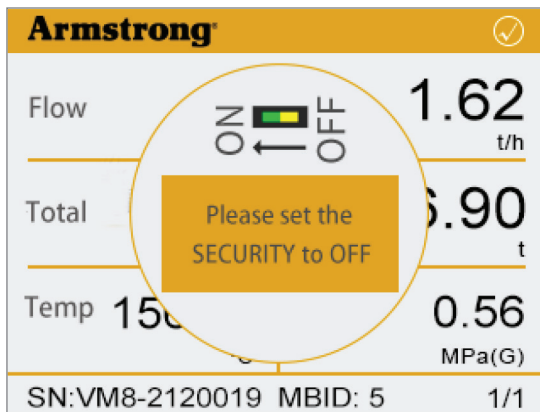
AVM80 parameter settings including, damping, output, Modbus, pipe size, 4–20mA output range, flow meter factor, etc.

> 5.1 Security Function

The AVM80 display board is equipped with a security function that controls the enable/disable status of the keypad operation.

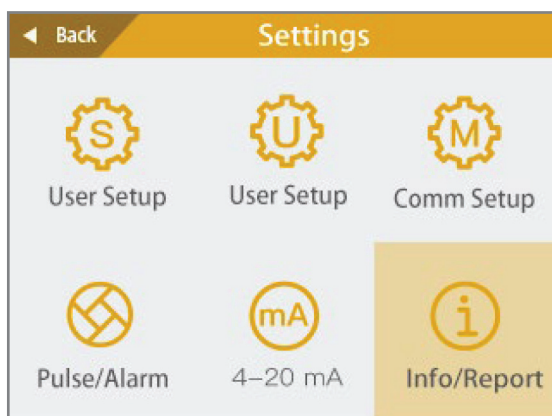
When the security switch is set to **ON**, the keypad operation is disabled.

To enable keypad operation, ensure that the security switch is set to **OFF**.



> 5.2 Setting Interface

Press and hold "OK" for at least 3 seconds, enter Setting.

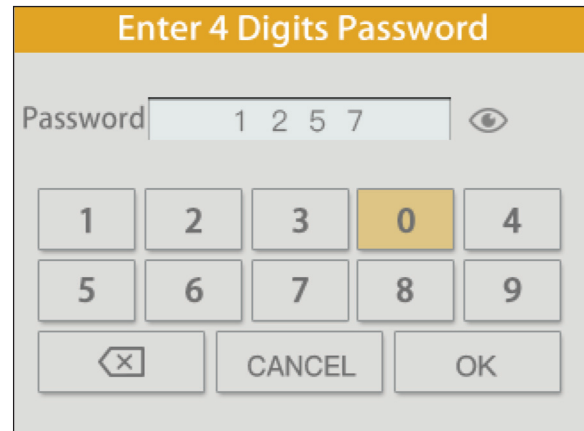


> 5.3 Password Input

If the password protection is already open, Press "OK" button to input the 4 digits password as required.

Switch and select with the "SHIFT" key and then confirm selection by pressing "OK"

Password entered incorrectly three consecutive times. Please contact the sales representative

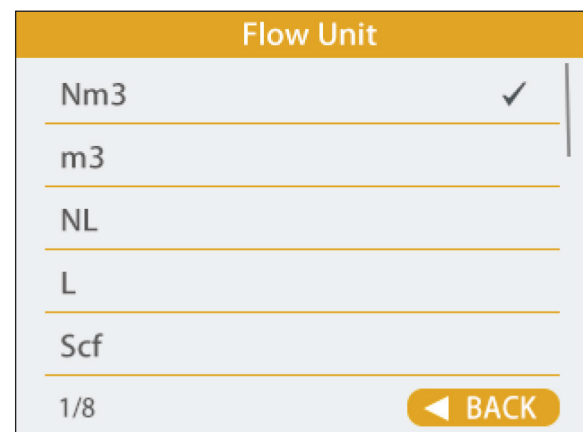


> 5.4 Volume Flow Unit Setting

Setting->Sensor setup-> Unit-> Flow Unit

In order to change the flow unit, press "SHIFT" to enter the Sensor Setup, and select the Flow Unit.

The context with ✓ means the current selection.



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> 5.5 Total Flow Reset

Setting->Sensor setup->Advanced->Reset the total flow

Setting->Sensor setup->Advanced, then press "SHIFT" to move to "Reset total flow", then

Press "OK".

Advanced	
Damping	>
Diff pressure Cut Off	>
Reset Total Flow	>
Standard Temperature	
Medium Density	
3/8	◀ BACK

> 5.6 Modbus

Setting->Comm->RS485

Setting->Comm setup->RS485 there "Device ID", "Baud rate", "Byte order", menu. Press "▲" to select the parameters need to set and press to enter to interface

RS485		Baudrate	
Device ID	>	57600-n-1	
Baudrate	>	57600-e-1	
Byte Order	>	57600-o-1	
	>	115200-n-1	✓
	>	115200-e-1	
1/3	◀ BACK	22/24	◀ BACK

Byte order	
DCBA	
ABCD	
CDAB	
BADC	✓
3/4	◀ BACK

> 5.7 Pulse Alarm

AVM80 vortex meter pulse output supports vortex frequency, pulse equivalency, IO output.

Settings		
		
Sensor Setup	User Setup	Comm Setup
		
Pulse/Alarm	4-20 mA	Info/Report

Pulse/Alarm	
Out Type	>
200-1000Hz	>
Pulse Output Variable	>
Pulse Equivalent Value	>
Quantitative Control	>
1/5	◀ BACK

Output Type	
Vortex Freq	✓
4-20mA	
200-1000Hz	
Pulse Equivalent	
IO	
1/5	◀ BACK



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5.7.1 Vortex Frequency

Vortex frequency output is use to calibration procedure.

5.7.2 200-1000Hz Output

200~1000Hz output can use to output Flow, Pressure or Temperature.

200Hz means the min value, and 1000Hz is the max value of the parameter.

200-1000Hz Parameter

Flow ✓

Pressure

Temperature

1/3
◀ BACK

5.7.3 Pulse Equivalency

When select Pulse equivalency output, we can know the value of the parameters via count the quantity of pulse. E.g., Equivalency parameter for Total flow, and pulse equivalency is 1; flow unit is kg; when total flow adds 1 kg, it will output one pulse;

Pulse Output Variable

Flow ✓

Pressure

Temperature

Total

1/4
◀ BACK

Pulse Output Variable

1

.

0

0

0

0

0

OK

CANCEL

CLR



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5.7.4 IO Output

When the pulse output is configured as an I/O output, users can implement external control based on changes in the primary variable through parameter settings.

The operating procedure of the I/O mode is as follows:

First need to select the alarm threshold variable, which can be: Flow, Total flow, Temperature, or Pressure. Then sets the alarm threshold value, alarm mode, and normal switch state.

During operation, the flow meter determines the alarm condition based on the selected threshold variable and the configured alarm mode. For example, if Flow is selected and the high-threshold alarm mode is enabled, an alarm will be triggered when the flow exceeds the preset threshold value. The system then evaluates the normal switch state.

If the normal switch state is set to Normally Open (high level), the I/O output will switch to the open state and output a low-level signal when the alarm condition is triggered.

1. Quantitative Control

Quantitative Control	
Alarm Threshold Variable	>
Alarm Mode	>
Alarm Threshold	>
Switch Normal State Setting	>

1/4 ◀ BACK

(1) Alarm Threshold Variable Threshold variable can set to Flow, Total Flow, Temperature and Pressure.

Alarm Threshold Variable	
Flow	✓
Total	
Temperature	
Pressure	

1/4 ◀ BACK

(2) Alarm Mode Users can set a high threshold value for IO Control or a Low Threshold Value, depending on their actual control needs.

Alarm Mode	
Alarm (Above Threshold)	✓
Alarm (Below Threshold)	

1/2 ◀ BACK

(3) Alarm Threshold Before setting, please set alarm threshold variables and alarm modes first, and be sure to confirm the unit of the current variable before setting the threshold.

Alarm Threshold	
4	0 . 0 0 0 0

OK CANCEL CLR



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(4) Switch Normal State Setting Based on the on-site requirements for relay use, the normal operating state of the switch needs to be set in advance.

Switch Normal State Setting

Open (High Level) ✓

Open (Low Level)

Close (High Level)

Close (Low Level)

1/4

◀ BACK

2. Example of Quantitative Control

Taking temperature control at 300°C as an example, when the temperature is below or equal to 300°C, IO operates in normal state, output high level; when the temperature exceeds 300°C, IO will output a low level. The setup process is as follows:

- 1. Select “Pulse Output Type: IO” Quantitative Control”;
- 2. Select “Alarm Threshold Variable: Temperature”;
- 3. Select “Alarm Mode: Above Threshold Alarm”;
- 4. Set “Alarm Threshold”: 300;
- 5. Set “Switch Normal State: Normal Open (High Level)”

> 5.8 Flow Meter Billing

The AVM80 vortex flow meter supports users in calculating flow rate by time period (flat, valley, and peak); users can configure the billing mode and time-of-use settings:

◀ BACK Settings

Sensor Setup

User Setup

Comm Setup

Pulse/Alarm

4–20 mA

Info/Report

User Setup

Display Resolution >

Auto Scroll >

Password >

Language >

Meter Billing Mode >

5/7

◀ BACK

Meter Billing Mode

Billing Mode >

Time-of-Use Settings >

1/2

◀ BACK



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> 5.9 Password Function

Setting > User Setup > Password

5.9.1 Password Settings

Password

Pwd Protection >

Pwd Digits >

Pwd Reset >

5/7

BACK

Enter the "Password" menu.
"Pwd Protection" – Password Protection
"Pwd Digits" – Password Digits
"Pwd Reset" – Reset the Password;

Pwd Protection

CLOSE ✓

OPEN

1/2

BACK

"Pwd Protection" – Default is closed, users can open or close the protection function in this menu.

Pwd Digits

4 Digits ✓

6 Digits

1/2

BACK

"Pwd Digits" – Default is "4 digits", users can select input 4 or 6 digits password in this menu.

Set 4 Digits New Password

NEW PWD 1234

Confirm PWD *****

12340

56789

BACK CANCEL OK

In the "Pwd Protection" menu – users can set 4-digits (by default) password as their required.

5.9.2 Reset the Password

Enter 4 Digits Password

Password 1 2 5 7

12340

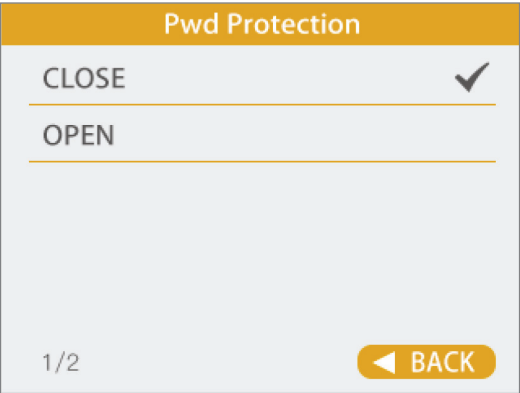
56789

BACK CANCEL OK

If "Pwd Protection" was opened" – when click "Pwd reset", users have to input the original password.



5.9.3 Turn Off the Password Protection



Enter“Setting > User setup > Password > Pwd Protection (Password Protection)” and select “CLOSE”

6.0 STATISTICS AND REPORTS

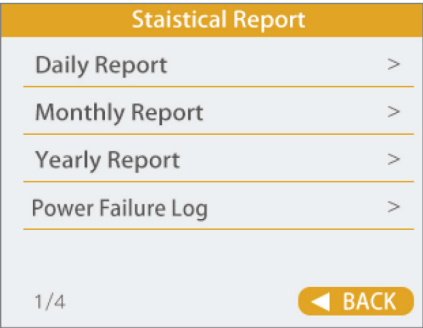
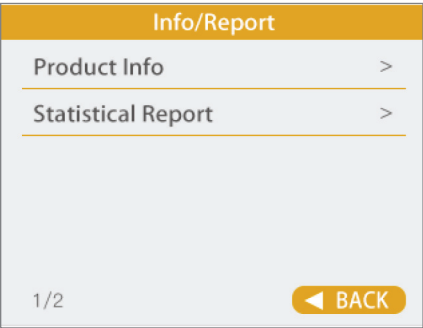
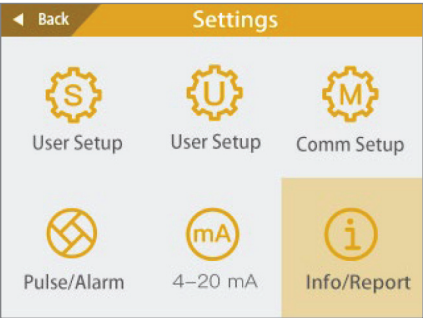
The AVM80 vortex flow meter supports data record and query of measurement data.

Users can query daily, monthly, and yearly reports, as well as power-off records.

- | Daily reports are generated at 00:00:00 of the following day.
- | Monthly reports are generated at 00:00:00 on the first day of the following month.
- | Yearly reports are generated at 00:00:00 on the first day of the following year.

When measuring steam or compressed air, users can configure flow billing modes in the user settings, including:

- | Non-time-based billing, or
- | Time-based billing.
- | For time-based billing, the start and end times of Peak, Off-peak (Valley), and Flat periods can be configured separately. The statistical reports can independently record the accumulated flow values for each time (Peak / Valley / Flat).
- | Users can query statistical reports through the flow meter display interface.



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Daily Report Query Example

In the report query menu, select Daily Report to enter the daily report query interface.

The flow meter automatically stores daily reports for the most recent one year. Annual reports can be viewed for the most recent 5 years.

Daily Report Start Time

22Y06M01D

OK

CANCEL

CLR

Daily Total

Time	Total
22-05-29	845621.68 kg
22-05-28	742934.24 kg
22-05-27	845621.68 kg
22-05-26	742934.24 kg

↑ UP

↓ DOWN

◀ BACK

Users can input the required start date and confirm to enter the daily accumulated flow report. Pages can be browsed using the “UP” and “DOWN” key.

Power Failure Log		
01	Duration: 2 min	
OFF	2022-03-21	09:50:58
ON	2022-03-21	09:52:59
02	Duration: 15min	
OFF	2022-04-21	06:00:31
ON	2022-04-21	06:15:57
↑ UP ↓ DOWN ◀ BACK		

Power Failure Log Query

In the report query menu, select Daily Report to enter the daily report query interface.

The flow meter automatically stores daily reports for the most recent one year. Annual reports can be viewed for the most recent 5 years.

Users can input the required start date and confirm to enter the daily accumulated flow report.

Pages can be browsed using the “UP” and “DOWN” key.



7.0 MODBUS – RS485

> 7.1 Interface Regulation

- | The communication interface should be RS485, the range of Baud rate should be 1200~115200.
 - | The wiring terminal is “A” and “B”.
 - | The communication should comply with MODBUS-RTU statute.
- The combination of a communication signal: Address code - function code - date segment - CRC calibration code. The distance between two characters should not be longer than one character, or it will be considered as the beginning of a new message or the end of a old message. The message is combined with hexadecimal arrays.
- | Definition of the dates: Please reference to the chart 6.1 below.

Chart 1 Address of the Displayed Date

Register Address	Usage	Qty	Usage	Date Type
0x0001	Flow Rate	2 bytes	Read only	Float
0x0003	Frequency	2 bytes	Read only	Float
0x0007	Pressure	2 bytes	Read only	Float
0x0009	Temperature	2 bytes	Read only	Float
0x000B	Density	2 bytes	Read only	Float
0x0019	Total Flow	2 bytes	Read only	Float

The displayable date including flow rate, frequency, pressure, temperature, density and total flow, if the meter do not have density compensation, then the reading of pressure and temperature will both be 0. The date of the parameters in above chart can be read by using function code 03 according to the address above and shifting.

> 7.2 Command

Function Code 03 – Read Register	
Request	Response
01: Address	01: Address
03: Function Code	03: Function Code
00: Register Address Higher	04: Quantity of Bit
00: Register Address Lower (display the address)	80: Date 1
00: Register Number Higher	04: Date 2
02: Register Number Lower	80: Date 3
CRCL: CRC Parity Code Lower	80: Date 4
CRCH: CRC Parity Code Higher	CRCL: CRC Parity Code Lower
—	CRCH: CRC Parity Code Higher

Note: To read a float date, the quantity of the register address and its value have to be even, or response will be error.

> 7.3 Calculation of CRC Parity Code

CRC Parity Code	
Request	Response
01: Address	N1 CRC=0FFFFH is initial value
10: Function Code	N2 XOR Operation the CRCL and N1
00: Register Address Higher	N3 CRC Move 1 bit right, if move out is 1 bit
01: Register address lower	N4 CRC=CRX X)R A001H
00: Register Quantity Higher	N5 if move out is 0, CRC=CRX
04: Register Quantity Lower	N6 Move right for 8 times to finish the N1 calculation
04: Date Quantity	N7 ...
80: Date 1	N8 XOR operation the CRCL and N11
04: Date 2	N9 CRC move 1 bit right, if move out is 1 bit
80: Date 3	N10 CRC=CRX XOR A001H
80: Date 4	N11 if move out is 0, CRC=CRX
CRCL: CRC Parity Code Lower	Move right for 8 times to finish the N11 calculation
CRCH: CRC Parity Code Higher	Get the CRC calibration value



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> 7.4 The Float Date Format of the Instrument

The storage sequence of 4 bits float format is as below:

Storage Sequence Format				
Address	0	1	2	3
Content	MMMMMMMM	MMMMMMMM	EMMMMMMM	SEEEEEEE

Use IEEE standard method, do not store 1 on top digit, if top digit is 1, means negative; if top digit is 0, means positive. So the 23 mantissas and a 1 on top digit, which is concealed, constitute a 24 bits fixed point true form decimal, which is a decimal have mantissas less than 1 and more than or equal to 0.5. The lowest 8 bits are exponent-marker using shift code method. The exponent marker equals to the actual value minus 127. For example: 7=86H-7FH, -10=75H-7FH

E.g. 100=0x00,0x00,0x42,0xc8

-100=0x00,0x00,0xc2,0xc8

0=0x00.0x00.0x00.0x00 (exponent-marker is 0, the number is 0)

> 7.5 The Sequence of the Float Date Bytes of Instrument

Code setting C38 is used for setting the sequence of the float date bytes of instrument.

Float date will occupy 4 bytes (2 registers). To set the bytes order of float date, please modify register:

1. LL_LH_HL_HH the lower 16 bytes registers come first, the lower 8 bytes within the 16 bytes registers come first.

E.g.: 100=0x00,0x00,0xc8,0x42

-100=0x00,0x00,0xc8,0xc2

2. HH_HL_LH_LL the higher 16 bytes registers come first, the higher 8 bytes within the 16 bytes registers come first.

E.g.: 100=0x42,0xc8,0x00,0x00

-100=0xc2,0xc8,0x00,0x00

3. LH_LL_HH_HL the lower 16 bytes registers come first, the higher 8 bytes within the 16 bytes registers come first.

E.g.: 100=0x00,0x00,0x42,0xc8

-100=0x00,0x00,0xc2,0xc8

4. HL_HH_LL_LH the higher 16 bytes registers come first, the lower 8 bytes within the 16 bytes registers come first.

E.g.: 100=0xc8,0x42,0x00,0x00

-100=0xc8,0xc2,0x00,0x00

> 7.6 Modbus Error Response

When the host sends a command and asks for a correct response, one of the three items below is going to happen:

1. If the command from the host is correct and processable, the flow meter will give a correct response.
2. If the flowmeter received a command, but detected parity, the error of LRC and CRC will cause no response. The host will process an overtime command.
3. If the flowmeter received a correct command, but cannot process it (read or write a none-existing register etc.), the flowmeter will send an error response.

An error response has two byte sections to show its difference from a correct response.

Function Code Section In a correct response, the flowmeter will copy the origin function code sent from the host, and the highest bytes to one. The host can detect the error code and know the content of the error when it detects that the highest bytes of function codes are one.

Value Section In an error response, the flowmeter will reply a byte as the error code to definite the content of the error. Please reference to the chart below for the error codes and its definition:

Error Code Definitions		
Code	Name	Meaning
01	Illegal function	Flowmeter cannot process the function code in a command. Maybe this function code can only be used on a new device, or it can also indicate that the flowmeter is under error statues.
02	Illegal address	The flowmeter cannot process with the address in the command. The initiate address plus address diversion are higher than the highest address.
03	Illegal Content of Value	The content of the value in the command is not acceptable for the flowmeter.
04	Flow Meter Function Failed	An unrecoverable failure happened when the flowmeter is trying to response.
05	Response	The flow meter will take a long while to process the command. So response this error code to prevent the host from processing a overtime command.
06	Flowmeter is Busy	To advise the host that the flowmeter is processing a command which will takes a long time. So, the host should resend the command when the flowmeter is free.



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8.0 EXAMPLES OF COMMUNICATION

> 8.1 Safety Introduction

Please do not open the cover on the flame proof enclosure if in a explosive environment.

When trying to wire to HART or RS485 device, please make sure that the process of wiring the device into the loop complies with the intrinsic safety requirement. Or please process the wiring in a none-explosive environment.

Please make sure the environment the flowmeter in can meet the requirement of the certificate.

When power is wired, please make sure the front and rear cover is closed properly.

> 8.2 Self-Diagnose Function

AVM80 digital vortex flowmeter display can also indicate the self-diagnose code as below

Self-Diagnose Codes		
Error	Problem	Repair
Err-03	Temperature sensor disconnected	Check temperature sensor
Err-04	Pressure sensor disconnected	Check pressure sensor
Err-05	About to over total flow	This is a reminding message
Err-06	Display value over limit	The value is over the physical limit of the display
Err-11	Superheated steam temperature is over limit	Reduce the steam temperature
Err-12	Superheated steam pressure is over limit	Reduce steam pressure
Err-13	Button is pressed and held for too long of time	Check the button circuit
Err-14	Reset code setting failed	Check EEPROM
Err-15	Reset digital setting failed	Check EEPROM
Err-16	Read total flow error	Check EEPROM
Err-17	Temperature calibration setting is wrong	Check the record of temperature calibration
Err-18	Pressure calibration setting is wrong	Check the record of pressure calibration
Err-20	Flow rate limit setting is incorrect	Check the flow rate limit setting
Err-21	Temperature limit setting is incorrect	Check the temperature limit setting
Err-23	Pressure limit setting is incorrect	Check the pressure limit setting
Err-25	Frequency output for total flow is over limit	Reset the total flow frequency output factor
Err-26	Reset the total flow frequency output factor	Check the circuit board
Err-27	Reset the total flow frequency output factor	Check the range of frequency
Err-28	The master is disconnected from the slave	Check the cable wiring between local and remote transmitter



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> 8.3 Troubleshooting and Repair

Troubleshooting Guide			
Symptom	Reason	Trouble Shooting	Repair
No display	Power supply failure	Test the voltage on the power source with a universal meter	Re-wire the power or use a new power supply
	Power is not wired	Test the voltage on the power source with a universal meter	Wire the power
	Cable is broken	Check if there is a break off point on the cable	Check the cable and re-wire
	Wrong wiring	Check if wiring to the correct terminal	Re-wire
Displayed flow rate is 0 but there is flow in pipe	Flow rate is lower than the meter's lower limit	Increase the flow rate to check	Increase the flow rate or replace a new proper flowmeter
	The flow rate of small signal cut off function is too high	Check the small signal cut off setting	Set the small signal cut off to a proper value
	Energy threshold value is too high	Check if the energy threshold value is too high in spectrum analyzing checking mode	Set the Energy threshold value to a proper value (please reference to Note 1 for how to set)
	Transmitter function failure	Replace the transmitter with another transmitter of same type to check	Replace the transmitter
	Sensor is damaged	First, increase the flow rate to check then install the transmitter to another flowmeter of the same type to check	Replace the sensor
	Pipeline blocked or sensor jammed	If all above possibilities are eliminated, please check the pipeline and installation	Re-install the flowmeter
The flowmeter has flow reading while there is no flow in the pipe	Power frequency interference	Check the frequency display on meter is stable at the value that same as the power frequency	Re-wire the meter with shielded cable according to requirement
	There is high voltage instrument of high frequency interference close to the flowmeter	Check if there is high voltage instrument or high frequency interference close to the flowmeter	Re-locate the flowmeter
	There is heavy vibration on the pipeline	Sense the vibration on the pipeline by touch with hand	Tighten the pipeline where the flowmeter is installed
	Valve is not closed properly that there flow leak into the pipe	Check pressure and check pressure and check if valve is closed and sealed	Repair the valve
The flow rate reading fluctuates significantly	The gasket and the pipe are not concentric	Check the position of the gasket	Re-install the gasket
	The flowmeter pipe body and the pipeline are not concentric	Check if the flowmeter pipe body and the pipeline are not concentric	Re-install the meter
	Straight pipe length not enough or the inner diameter of flowmeter pipe body do not match the pipeline	Check the straight pipe length and the diameter of the pipeline	Re-locate the flowmeter
	There is heavy vibration in the pipeline	Sense the vibration on the pipeline by touch with hand	Tighten the pipeline where the flowmeter is installed
	The fluid has not completely filled the pipeline	Check the fluid status and the location of the meter	Re-locate the flowmeter
	2-phase flow	Check if there is 2-phase flow according to the pressure and temperature of the fluid	If the media is 2-phase flow, a filter or separator should be installed upstream of the flowmeter.
	Transmitter failure	Replace the transmitter with another transmitter of same type to check	Replace the transmitter
There is big difference between the flow reading and the process flow rate	No density compensation for steam measurement	Check the density compensation devices and the setting	Fix density compensation
	The estimated flow rate before using the meter is incorrect	Use other flowmeter to confirm the actual flow rate	Adjust K factor ONLY if second flowmeter can be confirmed to be accurate and correct.
	Setting incorrect	Check the settings of meter K factor, upper and lower limit of flow rate	Set the meter correctly



Questions? Call (269) 243-1415 from 8am – 5pm EST, Mon-Fri

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9.0 LIMITED WARRANTY AND REMEDY

Armstrong International warrants to the original user of those products supplied by it and used in the service and in the manner for which they are intended shall be free from defects in material and workmanship for a period of five (5) years from the date of installation, but not longer than 63 months from the date of shipment from the Armstrong International factory, unless a Special Warranty Period applies, as noted below. This warranty does not extend to any product that has been subject to misuse, neglect or alteration after shipment from the Armstrong International factory. Except as may be expressly provided in a written agreement between Armstrong International and the user, which is signed by both parties. Except as may be expressly provided in a written agreement between Armstrong International and the user, which is signed by both parties, Armstrong International **DOES NOT MAKE ANY OTHER REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.**

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Specialty Warranty Periods are as follows:

Vortex Sheddors, Venturi, Orifice Plates, Flow Nozzles and Wedge Meters: One (1) year from the date of installation but not longer than 15 months from the date of shipment from the Armstrong International factory.

Electronic components including without limitation, differential pressure transmitters, multivariable transmitters, flow computers, rate or totalizer displays: One (1) year from the date of installation, but not longer than 15 months from the date of shipment from the Armstrong International factory.



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