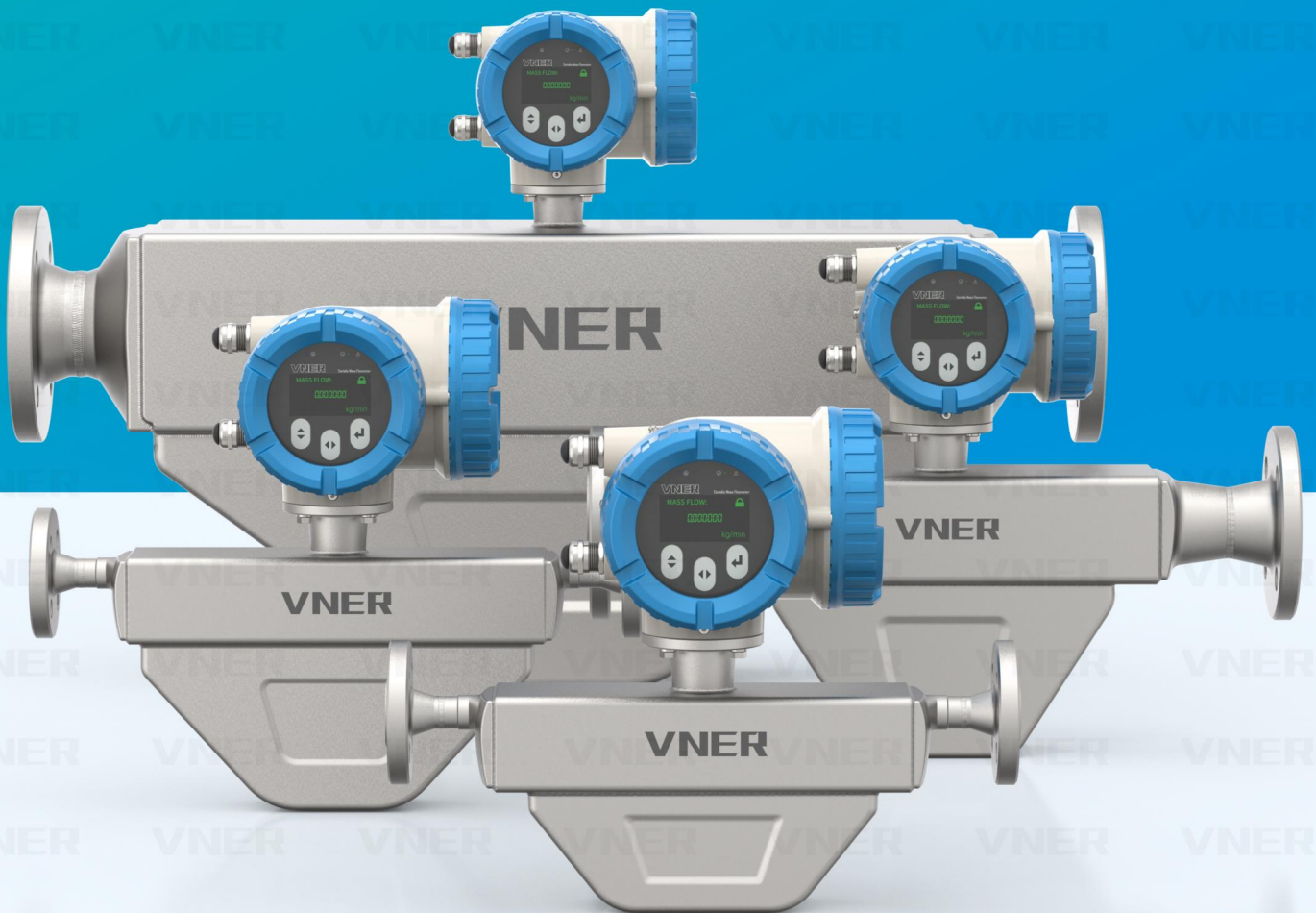


VNER

GENERAL HIGH ACCURACY CORIOLIS MASS FLOWMETER

A-SERIES



JIANGSU VNER ELECTRONIC TECHNOLOGY LTD

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INTRODUCTION

1. ABOUT THIS DOCUMENT

This document mainly describes the installation, wiring, configuration, maintenance, operation and troubleshooting information of the Coriolis Mass Flow Meter for A-series. Please read this user manual carefully before using. Incorrect installation and usage may cause measurement failure or even damage the instrument.

2. SAFETY

- When installing the flow meter in a dangerous area, please confirm that the explosionproof performance of the flow meter is consistent with the environment to prevent potential hazards.
- Please ensure that the power supply has been disconnected when connecting the transmitter, to avoid electric shock.
- Follow the instructions in this document to install and use the flow meter, ensuring its proper operation.

3. EQUIPMENT INSPECTION

- Check for mechanical damage due to improper disposal that may have occurred during transportation.
- Make sure the delivery range and the information on the nameplate matches the order information.

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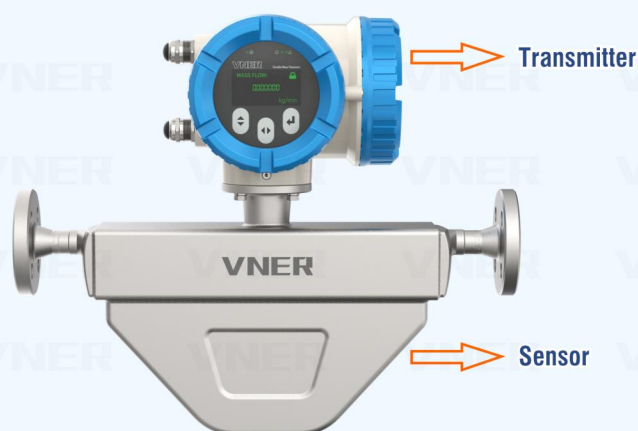
PRODUCT INTRODUCTION

1. CORIOLIS MASS FLOW METER FOR A-SERIES

The A-series Coriolis mass flowmeter is a precision instrument designed and manufactured using the principle of Coriolis force, integrated with mechanical vibration characteristics for accurate flow measurement. It can directly measure the mass flow rate, density, and temperature parameters of the fluid. It can be used in multiple industries such as petroleum, petrochemicals, chemicals, papermaking, and new energy. It exhibits equally excellent flow and density measurement performance in both process control and trade settlement, providing accurate and reliable flow measurement solutions for industrial applications.

2. PRODUCT COMPOSITION

The A-series Coriolis mass flowmeter is mainly composed of sensors and transmitters.

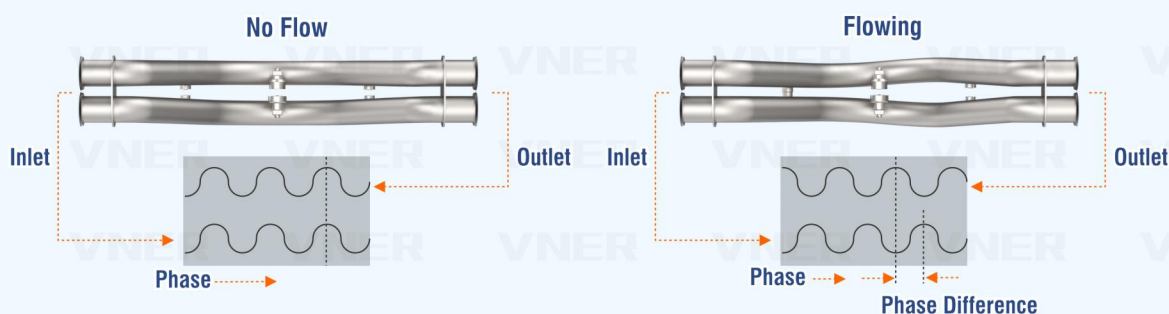


The sensor is used to measuring the vibration and the flow signal, as well as the fluid temperature.

The transmitter provides the power to drive the sensor process flow signal. The transmitter also provides the data communication interfaces.

3. MEASUREMENT PRINCIPLES

As a practical application of the Coriolis effect, the Coriolis mass flow meter operating principle involves inducing a vibration of the flow tube through which the fluid passes. The vibration, though it is not completely circular, provides the rotating reference frame which gives rise to the Coriolis effect. While specific methods vary according to the design of the flow meter, sensors monitor and analyze changes in frequency, phase shift, and amplitude of the vibrating flow tubes. The changes observed represent the mass flow rate and density of the fluid.



The measuring tubes are forced to oscillate producing a sine wave. At zero flow, the two tubes vibrate in phase with each other. When flow is introduced, the Coriolis forces cause the tubes to twist resulting in a phase shift. The time difference between the waves is measured and is directly proportional to the mass flow rate. Volume flow rate is calculated from mass flow rate and the density measurement.

4. PRODUCT FEATURE

The Coriolis mass flowmeter can directly measure the mass flow rate of fluid in a pipeline without the need for conversion through intermediate parameters. It offers high measurement accuracy and repeatability, and can achieve highly accurate direct measurement of fluid mass flow rate over a wide range of flow rates.

The Coriolis mass flowmeter has a wide range of fluid measurement capabilities. In addition to measuring uniform fluids with general viscosity, it can also measure various highviscosity, non-Newtonian fluids, and even two-phase flows.

The small vibration amplitude of the measuring tube in the Coriolis mass flowmeter enables it to be considered as a stationary component. With no moving parts inside the flowmeter pipeline through which the fluid flows, it boasts high reliability, long service life, and minimal daily maintenance requirements.

The Coriolis mass flowmeter can not only directly measure the mass flow rate of fluids, but also directly measure the density and temperature of fluids. It can also calculate the concentration of solutes in two-component solutions based on the mass flow rate and fluid density. It is a multifunctional flow measurement instrument.

TECHNICAL PARAMETER

1. A-SERIES PRODUCTS

The A-series Coriolis mass flowmeter includes 7 basic model products: AC006/AC015/AC025/AC040/AC050/AC080/AC100.

2. PERFORMANCE INDICATORS

- Flow Measurement and Zero Stability

SPECIFICATIONS	AC006	AC015	AC025	AC040	AC050	AC080	AC100
Range ratio	1:20	1:20	1:20	1:20	1:20	1:20	1:20
Batch flow accuracy	±0.15%	±0.15%	±0.15%	±0.15%	±0.15%	±0.15%	±0.15%
Batch flow repeatability	±0.075%	±0.075%	±0.075%	±0.075%	±0.075%	±0.075%	±0.075%
Nominal flow range (kg/h)	1350	4200	19800	30000	39000	135000	330000
Zero stability (kg/h)	0.07	0.21	1	1.5	2	6.8	16.5

The accuracy and repeatability are obtained under the measurement conditions of 20-25°C and 0.1-0.2MPa aqueous medium.

- Density measurement

ACCURACY	REPEATABILITY	RANGE
±1.00 kg/m ³	±0.50 kg/m ³	0 ~ 5000 kg/m ³

- Temperature measurement

ACCURACY	REPEATABILITY	RANGE
±1.00 °C	±0.20 °C	-100 ~ 200 °C

3. FUNCTIONAL SPECIFICATION

Current Loop Output

- Output Range: 4mA~20mA,
- Power Supply Mode: Active
- Output Resolution: 0.24uA
- Assignable Measurement Variables: Mass flow rate, Volumetric flow rate, Temperature, Density.
- Basic Error: ±0.2% F.S
- The maximum loop load is less than 500Ω.

HART Communication Specification

- Manufacturer ID
- Device Type ID
- HART Revision Version Number
- HART Load: greater than 250Ω, less than 600Ω
- Dynamic Parameters:
- Primary Variable (PV): Mass Flow Rate, Volumetric Flow Rate, Standard Volumetric Flow Rate, Temperature, Density
- Secondary Variable (SV), Tertiary Variable (TV), Quaternary Variable (QV): Total Mass, Total Volume, Total Standard Volume, Mass Inventory, Volume Inventory, Standard Volume Inventory, Flow Tube Frequency, Drive Gain, Drive Current, LPO/RPO Amplitude, Instrument Temperature.
- Device Parameters: General User Parameters

Pulse Output

- Output Range: 0Hz~10kHz,
- Power Supply Mode: Active
- Maximum Output Value: 24Vd.c. 20mA
- Resolution: 0.067Hz
- Assignable Measurement Variables: Mass flow rate, Volumetric flow rate.
- Pulse Width: 0.05~1000ms
- Polarity: High Level
- Basic Error: ±0.005%
- Standard Load 5000Ω.
- Pulse equivalent: Settable

RS-485 Modbus Output

- Mode: Modbus-RTU
- Device type: Slave device
- Device address: 1~ 127
- Function code: 01; 03; 04; 06; 16
- Baud rate: 9600; 19200; 38400
- Parity: None; Odd; Even
- Stop bits: 1; 2
- Data bits: 8

4. ENVIRONMENTAL CONDITION

- Vibration limits
- Meets GB/T 2423.10, endurance sweep.
- Environmental temperature and humidity

COMPONENT	FLUID TEMPERATURE	AMBIENT TEMPERATURE	RELATIVE HUMIDITY
Range	-40°C ~ +55°C	-40°C ~ +70°C	≤95% non-condensing

5. PRESSURE RATINGS

The maximum working pressure of the A-series products is 10.0 MPa, and the temperature of the environment and process fluid may reduce the pressure rating of the process connections and pressure-bearing components.

6. MATERIALS

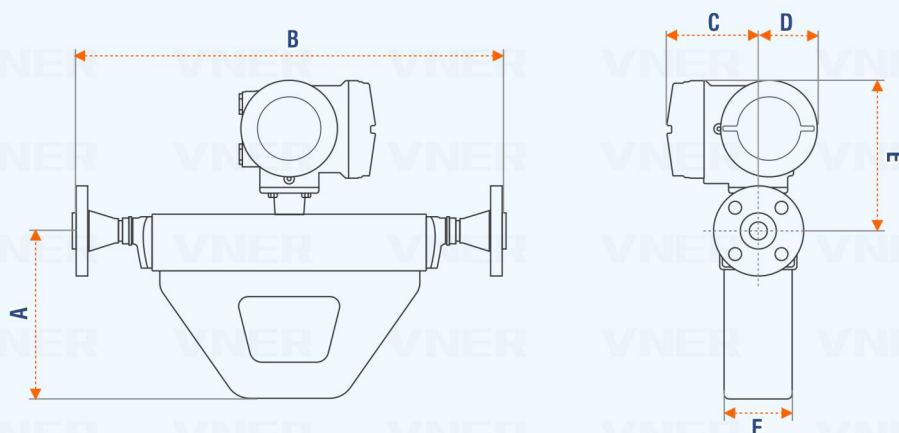
TYPE	AC006
SS316 Series Stainless Steel	SS316 Series Stainless Steel
SS304 Series Stainless Steel	SS304 Series Stainless Steel
Transmitter housing	Die-casting aluminum with epoxy polyurethane coating

7. POWER SUPPLY

Power supply: 24Vd.c. / 0.3A, 220Va.c./50Hz / 0.1A,

Power: 15W

DIMENSIONS



MODEL	A	B	C	D	E	F
AC006	130	416	125	82	200	67
AC015	170	469	125	82	200	65
AC025	232	588	125	82	207	94
AC040	195	549	125	82	237	80
AC050	195	551	125	82	237	80
AC080	300	954	125	82	267	170
AC100	292	1111	125	82	260	196

Notes: (1) Dimensional units: mm;

(2) The data refers to ASME CL300 process connections. For more detailed information, please consult a sales representative.

INSTALLATION

1. SAFETY REMIND

- Please consider the extra stress and load due to earthquake, transport or fire during installation.
- Please ensure there is no stress concentration right at the flow meter through the pipeline, external loads are not allowed for the meter.
- Please provide protection to minimize the heat transfer if needed.

2. PREPARATION BEFORE INSTALL







- Please ensure the Explosion-proof grade of the meter meets the requirement of hazardous areas.
- Check the ambient and process temperature within the limits of the meter.
- Please ensuring the process pressure not exceed the pressure rating of the meter whether the meter is installed indoor or outdoor.

3. INSTALLATION ORIENTATION

The flow direction on the flow sensor case must be consistent with the flow direction of the process fluid.

4. INSTALLING TYPE

Please refer to the below recommendations base on different applications.

FLUID TYPE	PREFERRED ORIENTATION	SECONDARY ORIENTATION	ALTERNATIVE ORIENTATION
Liquid, slurry, Self-emptying applications			
gas			

5. INSTALLATION GUIDE

- Torque and bending load need to be minimized during installation. The sensor should be aligned with the pipeline as far as possible. Please DO NOT use the sensor to support the pipeline.
- The meter should be firmly installed and supported to avoid vibration impact.
- The working environment temperature of the electronic components should be within the range of $-40^{\circ}\text{C} \sim +60^{\circ}\text{C}$, and waterproof actions are recommended.
- Please refer to the meter dimensions before installation.
- Please confirm the installation orientation and installation type.
- Ensure that the sensor is full of process fluid to prevent gas accumulation.
- Regulating valve should be installed at downstream of the meter.
- Expansion joints can be used to eliminate the impact of vibration.
- Please ensure that the process static pressure is greater than the vapor pressure of the fluid, especially measuring media easy to be vaporized, such as liquefied petroleum gas, propylene, propane.
- The meter needs to be calibrated regularly, cut-off valves need to be installed on the upstream downstream, a bypass is also recommended.
- For intermittent filling application, a better installation position is recommended to avoid the water hammer which may damage the meter. Higher back pressure will also reduce the flow accuracy while the measurement start-stop frequently.

WIRING

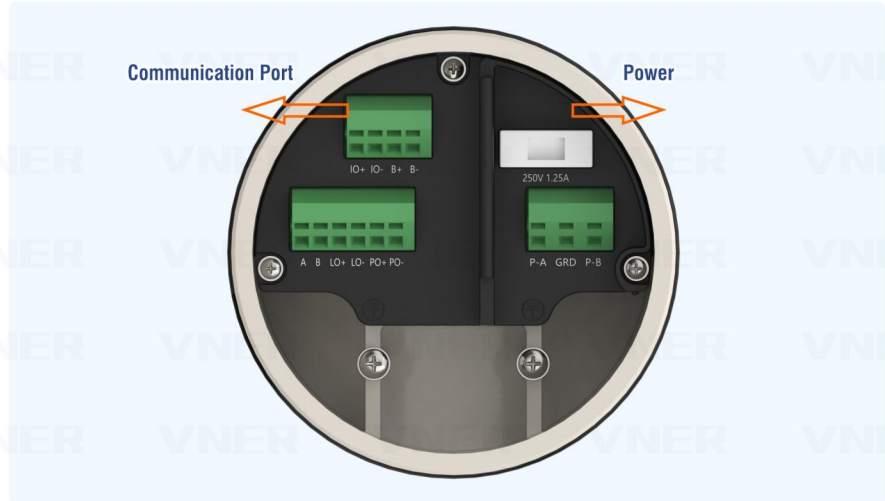
1. PREPARE BEFORE WIRING

- The maximum length of the self-provided cable at the user end.

WIRING FUNCTION	WIRE DIAMETER	WIRING FUNCTION
Power supply (VDC)	0.326 mm ²	90 m
	0.518 mm ²	100 m
	0.823 mm ²	300 m
Communication line	0.326 mm ² or greater	300 m

2. TRANSMITTER WIRING

- Power supply: 15VDC~36VDC
- Terminal point: Power-A / Power-B
- RS485 communication Terminal point: A/B



3. PULSE OUTPUT WIRING

- Wiring terminal: PO+(Positive) / PO-(Negative)
- 24V active signal, maximum load resistance of 5000Ω, wire according to the diagram provided.



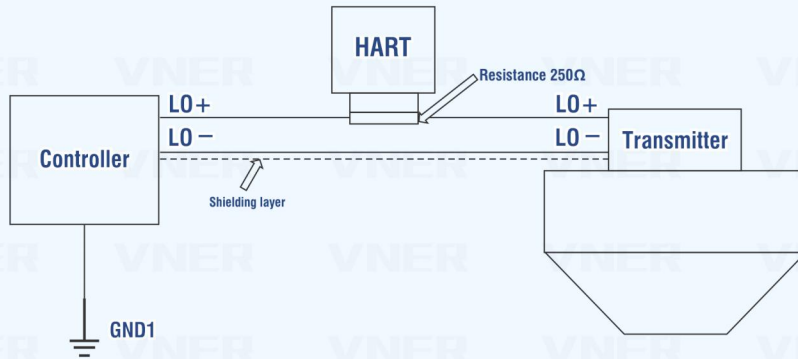
4. RS485 COMMUNICATION WIRING

- Wiring terminal: A (Positive) / B (Negative)
- Route according to the diagram.



5. CURRENT OUTPUT WIRING

- Wiring terminal: LO+(Positive) / LO-(Negative)
- 24V active signal, maximum load resistance of 500Ω, wire according to the diagram provided.



6. GROUNDING

• Prepare

The instrument must be grounded according to the applicable field standards.

Perform grounding operations according to the following instructions:

- Use copper wire, 14AWG (2.0m²) or larger wire diameter.
- All ground wires should be as short as possible with an impedance of less than 1 ohms.
- Ground the grounding wire directly, or follow factory standards.

• Process

- Check pipe connection

If the pipe connection is already grounded, the sensor is automatically grounded and no other action is required (unless otherwise required by local regulations). If the pipe connection is not grounded, use a ground wire to connect to the internal or external ground screw on the transmitter.

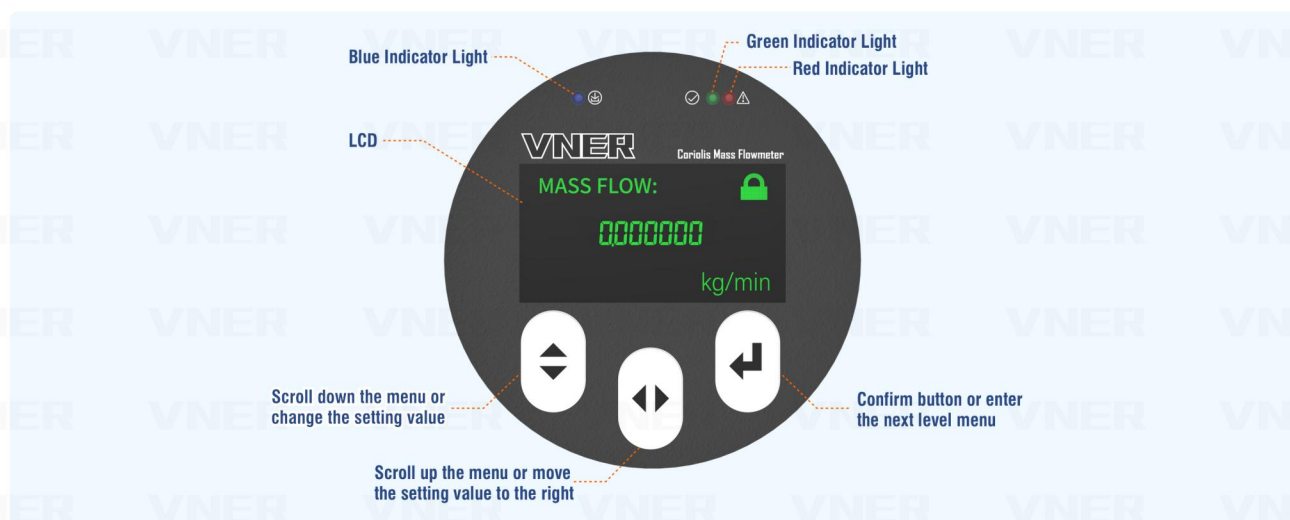
- The ground screw is at the transmitter housing.



CONFIGURATION AND OPERATION

1. SUMMARIZE

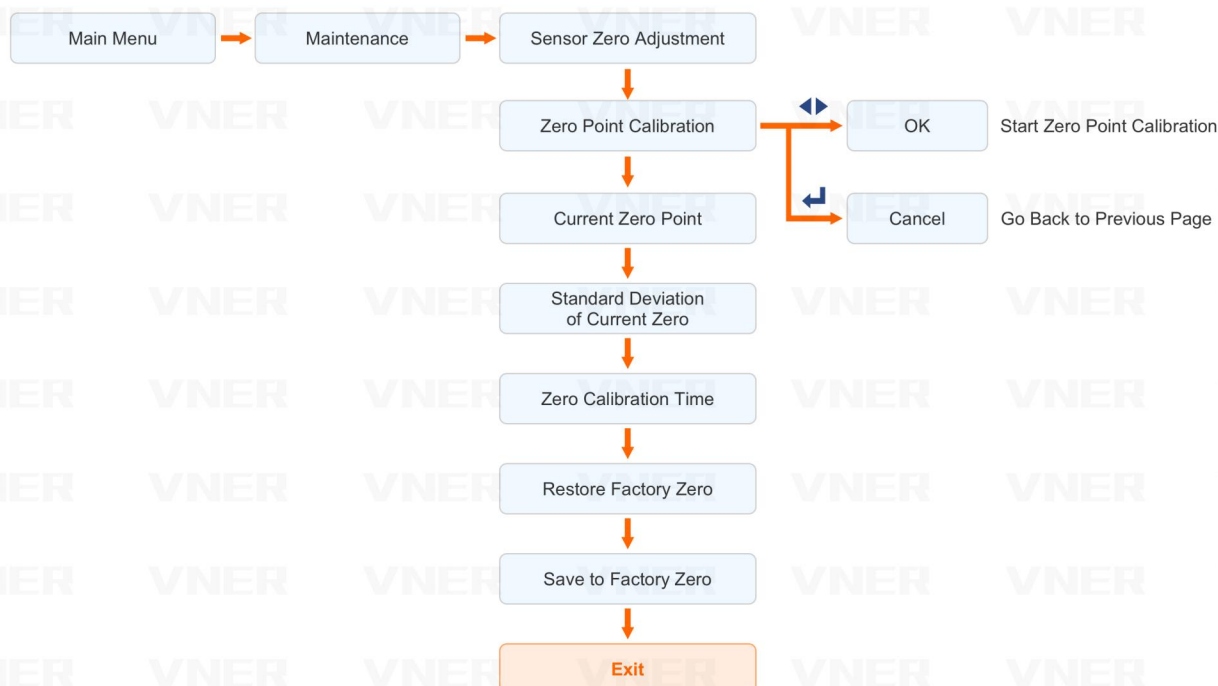
Users can configure the mass flow transmitter using its operation panel, including zeropoint verification, calibration, output configuration, small signal cutoff, simulation, and accumulator reset operations.



2. PERFORM ZERO

Perform Zero Step:

- Allow the meter to warm up for at least 15 minutes after powering on;
- Let the fluid pass through the sensor until the sensor temperature reaches the normal operating temperature;
- Close downstream valve, then close upstream valve (if available);
- Verify that the flow has stopped and the sensor is fully filled with process fluid;
- If you need to modify the zero time can refer to the following steps, for most working conditions, the default zero time is appropriate;
- Perform zero calibration according to the following steps.
- After the zero calibration is completed, the new zero value will be displayed on the current zero-point page.



3. CONFIGURATION OUTPUT

The standard configuration of the mass flow transmitter includes three output channels: RS485, milliampere output (note: corresponding to milliampere 2 in the display screen), and frequency output.

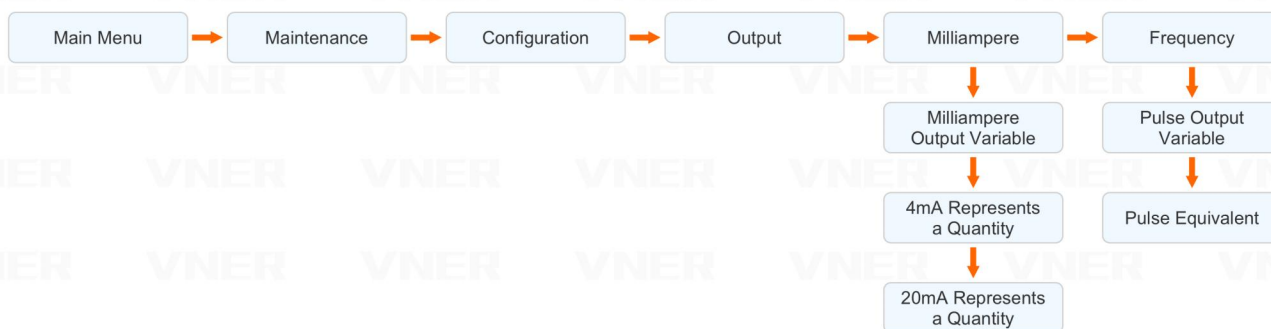
The configuration content for the milliampere output channel includes:

- Milliampere Output Variable: Select the variable based on practical application.
- 4 mA: Generally corresponds to the lower limit of the variable.
- 20 mA: Generally corresponds to the upper limit of the variable.

The configuration content for the frequency output channel includes:

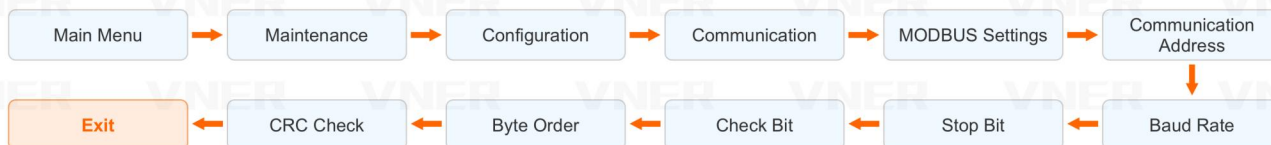
- Frequency Output Variable: Select the variable based on practical application.
- Pulse Equivalent: The default unit is g (or pieces)/P. The pulse equivalent setting needs to match the acquisition device. For example, if the K coefficient (unit: 1/kg) in the acquisition device is 2000, the pulse equivalent should be entered as 0.5 ($=1/(K \text{ coefficient} * 1000)$).

The milliampere output and frequency settings can be referenced as follows:



The MODBUS communication settings include:

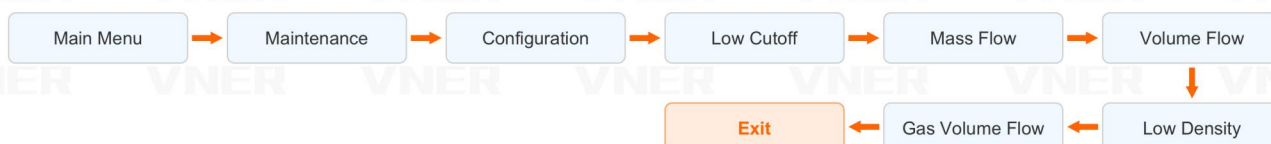
- Communication Address: The default value is 1, with an address range of 1 to 127.
- Baud Rate: The default value is 38400.
- Stop Bits: The default value is 1.
- Parity Bit: The default value is None (No Parity).
- Byte Order: The default value is 1-2-3-4.
- CRC Check: The default value is Low to High.



4. LOW CUTOFF AND SIMULATION

The content of Low Cutoff includes:

- Mass Flow: The default value is 1% of the maximum flow rate, and a value less than the setpoint will be displayed as 0.
- Volume Flow: The default value is 1% of the maximum flow rate, and a value less than the setpoint will be displayed as 0.
- Low Density: The default value is 0.2g/cm3 of the maximum flow rate, and a value less than the setpoint will be displayed as 0.
- Gas Volume Flow: The default value is 1% of the maximum flow rate, and a value less than the setpoint will be displayed as 0.



When the simulation function is enabled, the red indicator light will flash rapidly, and the transmitter will not output the sensor measurements. Details are as follows:

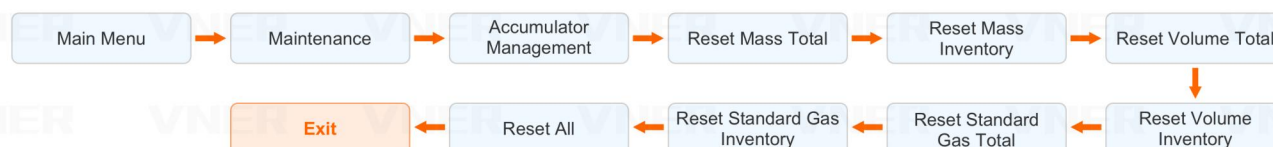
- Flow Simulation: The frequency terminal and current terminal output the set value of the flow simulation.
- Current Output: Currently not available in this version.
- Frequency Output: The frequency terminal outputs this set value.



5. ACCUMULATOR MANAGEMENT

The content of accumulator management includes:

- Reset total mass: Set the total mass value to zero;
- Reset quality inventory: Set the quality inventory value to zero;
- Reset total volume: Set the total volume value to zero;
- Reset volume inventory: Set the volume inventory value to zero;
- Reset total standard gas volume: Set the total standard gas volume value to zero;
- Reset standard gas inventory: Set the standard gas inventory value to zero;
- Reset All: Set the values of total mass, quality inventory, total volume, volume inventory, total standard gas volume, and standard gas inventory to zero.



STATUS AND DIAGNOSIS

1. SUMMARIZE

The transducer panel of the mass flowmeter features status indicator lights for monitoring the instrument's operational status. During the initial installation, commissioning, and throughout the operation process, it is necessary to check the instrument's working status according to the status indications in order to avoid any abnormalities.

2. DIAGNOSIS

For troubleshooting a mass flowmeter, users can rely on the LED indicator lights and display on the panel. The different colors and flashing frequencies of the LED indicator lights represent the working status of the mass flowmeter, making it easy for users to observe the operational state. The display can show alarm information from the transducer's selfdiagnosis, aiding users in making judgments and defining the faults.

LED STATUS		DESCRIPTION	DIAGNOSIS
Red, Green, Blue	All lit up	Initialization or self-check	Normal Operation
Blue Light	Rapidly flashing	Button-triggered indication	Normal Operation
Red Light	Rapidly flashing	Motherboard communication failure	Contact the Manufacturer
	Constantly lit	Sensor Failure	Check for wiring faults or contact the manufacturer
	Slowly flashing	Internal Fault	View fault codes on the display
Green Light	Rapidly flashing	Warning for Slug Flow	Confirm process status
	Slowly flashing	Normal Operation	Normal Operation

SAFETY AND PROTECTION

Meets the following standards:

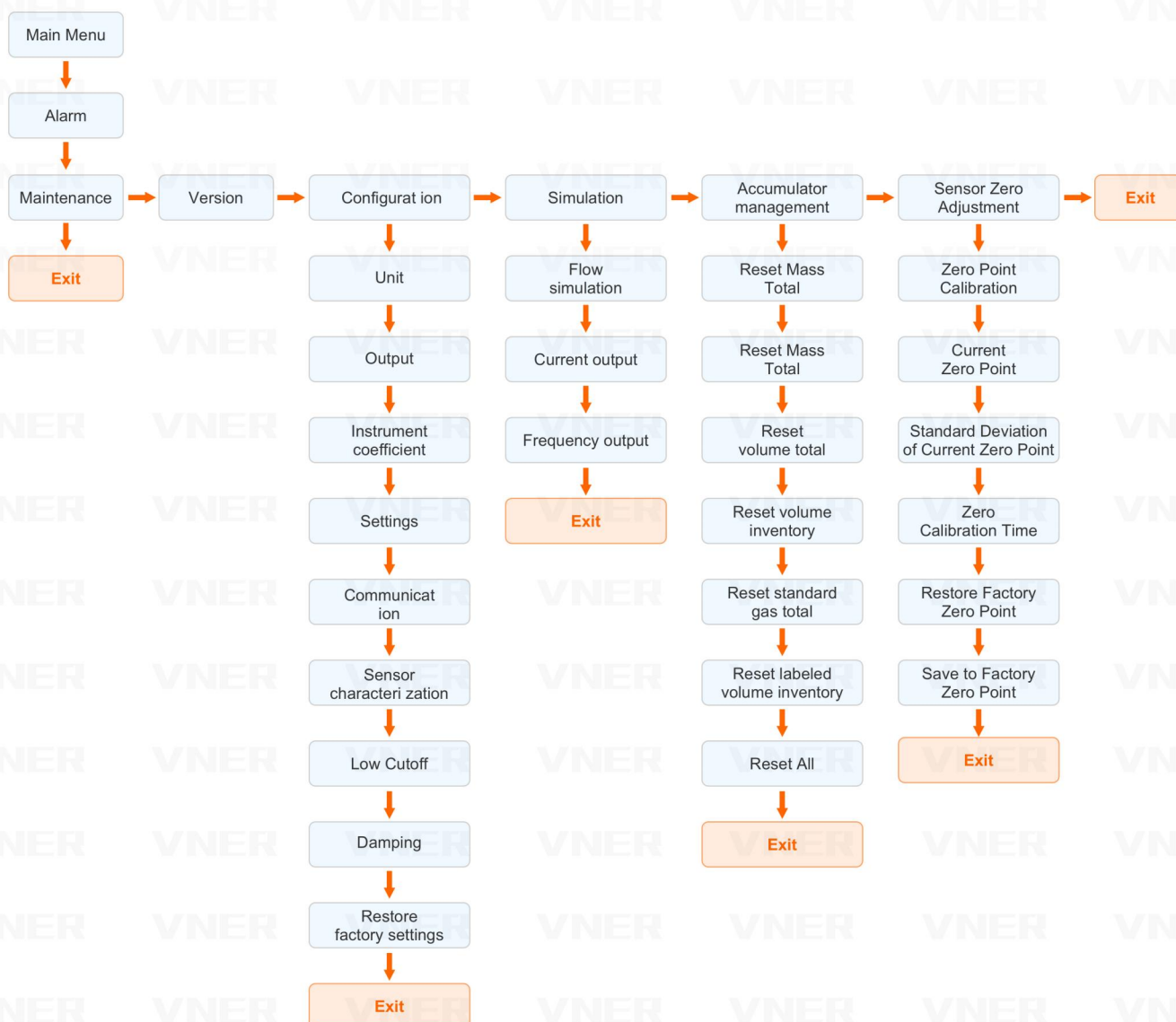
GB 3836.1-2021 Explosive Atmospheres-Part 1: Equipment-General requirements

GB 3836.4-2021 Explosive Atmospheres-Part 4: Equipment protection by intrinsic safety "i"

The instrument is approved and certified by the National Explosion-proof Electrical Product Center.

MODEL	EXPLOSION-PROOF CLASS	CERTIFICATE NUMBER	PROTECTION GRADE
Coriolis mass flow meter	Ex ib II C T1 ~ T6 Gb	EETI24.0013X	IP66/67

Appendix 1: Transducer Display Screen English Menu Tree



Appendix 2: Data Register Addresses

ADDRESSES	TYPES	TYPES	DESCRIPTION	READ/WRITE PERMISSIONS	DIAGNOSIS
0001, 0002	Float	Mass Flow	Same as the set unit	Read	
0007, 0008	Float	Temperature	°C	Read	
0021, 0022	Float	Total Mass Flow	kg	Read	
0027, 0028	Float	Mass Flow Inventory	kg	Read	
0047, 0048	Float	Total Accumulated Operating Time	h	Read	
0051, 0052	Float	Factory Zero Point	us	Read	
0159, 0160	Float	Current Zero Value	us	Read / Write	Write 1 to execute command, revert to 0 upon completion
0001	Integer	Clear Total Mass		Read / Write	Write 1 to execute command, revert to 0 upon completion
0006	Integer	Set Zero Point,		Read / Write	Write 1 to execute command, revert to 0 upon completion
0015	Integer	Clear Mass Inventory		Read / Write	Write 1 to execute command, revert to 0 upon completion

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JIANGSU VNER ELECTRONIC TECHNOLOGY LTD

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