RIELS® INSTRUMENTS

RIF500

CORIOLIS MASS FLOWMETER

INSTRUCTION MANUAL

ENG

Contents

Notice

RIF500 Coriolis Mass Flow Meter is a high-tech mass flow meter (hereinafter referred to as Flow Meter) that applies Coriolis force principle to measure fluid flow. It consists of Mass Flow Meter Sensor (hereinafter referred to as Sensor) and Mass Flow Meter Transmitter (hereinafter referred to as Transmitter). This manual mainly introduces the principle, features, specifications, installation, maintenance, troubleshooting and other precautions of the Sensors and Transmitters.

This is a composite instrument with explosion-proof and intrinsically safe circuits. If it is installed in an explosion-hazardous place such as an oil depot or gas station, person who installs, operates and maintains it should have basic safety technical knowledge and knowledge of the use of corresponding intrinsically safe equipmentand associated equipment.

1.0 Introduction

1.1 Applicable Scope

Coriolis Mass Flow Meter is a new type of advanced flow measurement instrument and are widely used for process detection and custody transfer measurement in many industries such as petroleum, petrochemical, chemical, pharmacy, marine, pharmaceutical, municipal, paper, food and energy and so on.

Sensors combined with Transmitters delivers the most accurate measurement in instantaneous flow, flow totals, and offers real-time monitoring of density and temperature.

1.2 Components

Coriolis Mass Flow Meter Sensors are mainly composed of flanges, measuring tubes, driving system and pickoff system (see Figure 1).

Figure 1

Transmitter is composed of intelligent measurement control systems based on DSP and ARM, to achieve accurate measurement of mass flow, density and temperature.

1.3 Measurement Principles

Coriolis Mass Flow Meters are based on the Coriolis principle, using magnets and coil components installed on the measuring tubes, under the action of alternating current, the measuring tubes vibrate periodically at a fixed frequency. When the process flow is introduced to the measuring tubes, the Coriolis force effect will occur, and torsional vibrations will happen to the two measuring tubes. At this time, the pickoff coils installed at both ends of the measuring tubes will generate two signals with different phases, and the phase difference is proportional to the mass of the fluid flowing through the measuring tube of the Sensor. Therefore, the mass value of the fluid can be obtained by measuring the phase difference.

In addition, the vibration frequency of the measuring tube is determined by the total mass of the measuring tube and the fluid in the tube. Therefore, when the density of the fluid changes, the vibration frequency will also change accordingly. According to this, the density value of the fluid in the tube can be obtained.

The temperature Sensor installed on the measuring tube can monitor the fluid temperature in real time.

1.4 Features

1) Configurable output: Transmitter offers three output connectivity options: 4~20mA, 10 KHz pulse, Modbus RTU. Contact the supplier if you need other output options. 4-20mA current output and 0-10kHz pulse output delivers information of mass flow, volume flow, temperature and density in active or passive means. The Transmitter uses RS485 interface based on MODBUS RTU communication protocol. Through digital communication, all measured values and intermediate values can be output. The factory also offer Configuration software which can be used to view, store, and modify data variables. So customers can view process variables (including mass flow rate, volume flow rate, mass total, volume total, temperature and density) with the field mounted transmitter, customer supplied communicator.
2) Convenient man-machine interface: the Transmitter is equipped with photosensitive explosion-proof buttons and OLED display. Customers can view process variables including mass flow rate, volume flow rate, density, temperature with OLED display. Customers can also configure digitals and perform zero calibration with OLED display and don’t need to remove the transmitter housing cover.
3) Temperature and pressure compensation: all internal circuits of the Transmitter

adopt industrial-grade low-temperature drift series components, so that the Transmitter is less affected by the ambient temperature, ensuring the measurement accuracy within the normal operating temperature range. In addition, there is a built-in pressure compensation program, and the user can manually input the pipeline pressure value so that the Transmitter will be able to calculate the pressure compensation value.

4) Coriolis mass flow meters also have the following advantages:

a) The mass flow meter can directly measure the process fluid without the conversion of the intermediate parameter, which avoids the measurement error caused by the intermediate conversion. Therefore, it has high measurement accuracy and good repeatability, and can achieve high-precision direct measurement of instantaneous mass flow in a larger range ratio.

b) The measuring tube of mass flow meter has small amplitude and no moving parts inside, so it has high reliability, long service life and less daily maintenance.

2.0 Performance Specifications

2.1 Accuracy and Repeatability

Model	Flange Compatibility	Nominal Flow Rate (Kg/h)	Maximum Flow Rate (Kg/h)	Zero Stability (Kg/h)
DN1	DN10/DN15	19.5	28	0.0010
DN2	DN10/ DN15/ DN20/ DN25	96	110	0.0048
DN3	DN10/ DN15/ DN20/ DN25	270	310	0.0135
DN6	DN15/ DN20/ DN25	1, 000	1, 420	0.05
DN15	DN15/ DN20/ DN25	3, 000	4, 200	0.15
DN20	DN25/ DN32	7, 700	11, 000	0.39
DN25	DN25/ DN32/DN40	15, 200	21, 600	0.76
DN40	DN40/ DN50	32, 500	46, 000	1.63
DN50	DN40/ DN50/ DN65	52, 500	75, 000	2.63
DN80	DN80/ DN100	96, 000	136, 000	4.80
DN100	DN80/ DN100/(DN125)	155, 000	220, 000	7.75
DN125	DN100/ DN125/ DN150	290, 000	403, 000	14.50
DN150	DN150/ (DN175)/ DN200	462, 000	652, 000	23.10
DN200	DN200/ (DN225)/ DN250	950, 000	1, 550, 000	47.50
DN250	DN200/ (DN225)/ DN250/ DN300	1, 600, 000	2, 500, 000	80.00
DN300	DN250/ DN300/ DN350	2, 380, 000	3, 266, 000	119.00

Mass Flow Accuracy①	Within 20: 1 Turndown②	±0.1%
	Within 30: 1 Turndown	±0.15%
Mass Flow Repeatability	Within 20: 1 Turndown	±0.025%
Volume Flow Accuracy③	Within 20: 1 Turndown	±0.1%

① The stated flow accuracy includes the combined effects of repeatability, linearity and hysteresis. All liquid indicators are based on water at 20 ~ 25℃ and 0.1 ~ 0.2Mpa reference conditions, unless otherwise stated.

② Turndown is the ratio of maximum flow rate and minimum flow rate.

③ The volume flow error is based on the process fluid with a density of 1g/cm³. For process fluids with a density other than 1g/cm³, the volume flow is equal to the mass flow divided by the fluid density.

④ When the flow value is close to the low end of the flow range, the accuracy of the flow meter begins to deviate from the stated accuracy. At this time, the zero point stability must be considered. The zero point stability is measured under the condition of no installation stress.

2.2 Typical Accuracy, Flow and Pressure Drop Curve

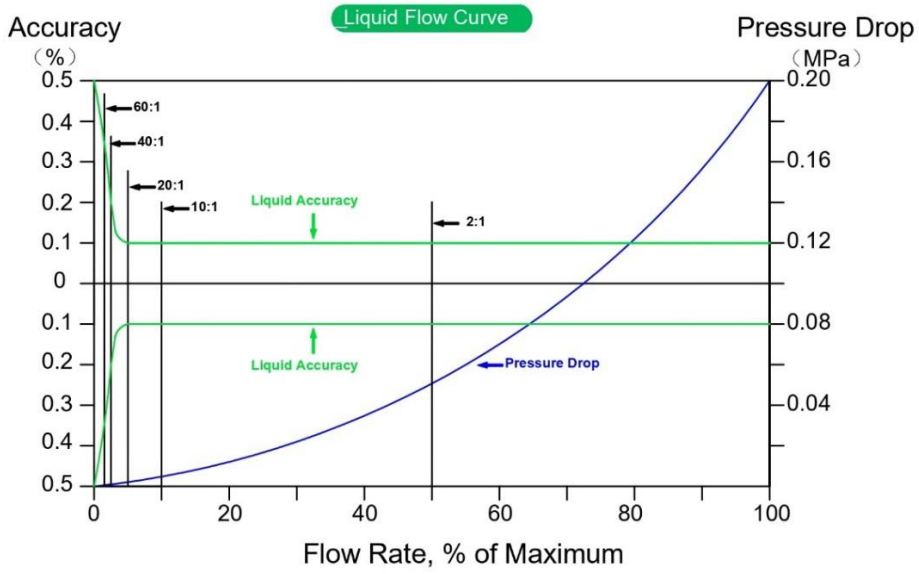


Figure 2

Turndown	60:1	40:1	20:1	10:1	2:1	1:1
Accuracy (±%) ①	0.35	0.2	0.1	0.1	0.1	0.1
Pressure Drop (Mpa)	0.00008	0.0002	0.0003	0.002	0.051	0.2

① Accuracy is the actual measurement accuracy. Since the best accuracy of "JJG 1038-2008 Coriolis Mass Flow Meter" is 0.15, accuracy on the relevant certificates and qualifications are not supposed to be better than 0.15.

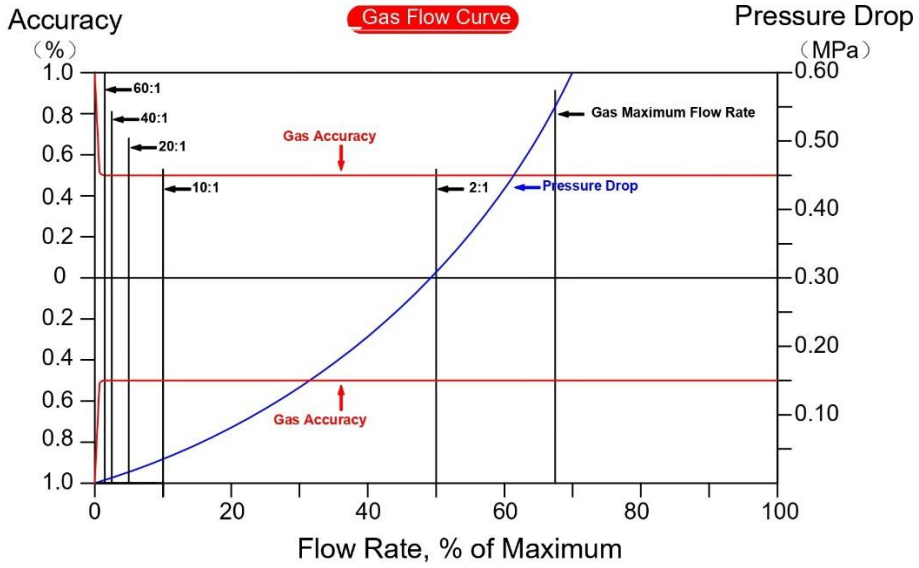


Figure 3

Turndown	60:1	40:1	20:1	10:1	2:1	Gas Maximum Flowrate
Accuracy (±%)	0.5	0.5	0.5	0.5	0.5	0.5
Pressure Drop (Mpa)	0.0004	0.0009	0.001	0.013	0.31	0.55

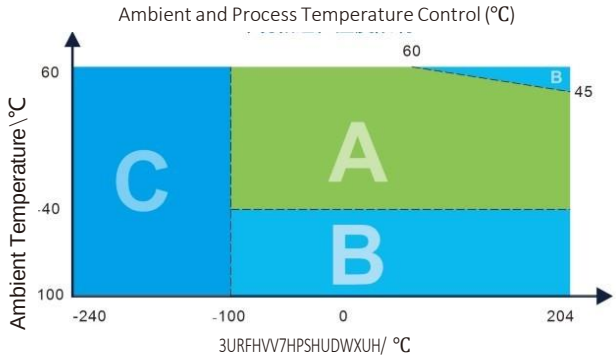
2.3 Density Accuracy (For Liquid)

Density Accuracy ①	±0.0005g/cm³	±0.5kg/m³
Repeatability	±0.0001g/cm³	±0.1kg/m³
Measurement Range	(0.2 ~ 2.0) g/cm³	(200 ~ 2000) kg/m³

① Density error includes the combined effects of repeatability, linearity and hysteresis. The density error of ±0.0005g/cm³ (±kg/m³) is based on water under the reference conditions of 20℃ and 0.1 ~ 0.2 Mpa. Under different operating conditions, accuracy may be reduced.

2.4 Temperature Accuracy

Accuracy	±0.2℃	② If installed in a hazardous location, the explosion-proof certification shall define the applicable temperature range.
Repeatability	±0.1℃	
Temperature Limit②	(-240 ~ +350) ℃	
Temperature Measurement Range	(-240 ~ +350) ℃	
Ambient Temperature	Operating Temperature	(-40 ~ 60) ℃
	Storage Temperature	(-40 ~+70) ℃



Zone A: Integral Mount/ Separate Mount

Zone B: Separate Mount

Zone C: Low-temperature split installation when the operating process temperature is below -100°C. In all cases, electronic components shall not be used at ambient temperatures below -40 °C or above 60 °C.

Note: If the sensor is to be used at ambient temperatures beyond the permissible limits of the electronic component, it must be mounted separately, as shown. The sensor can be used within the process and ambient temperature range shown in the temperature limit diagram.

2.5 Hazardous Area Classifications

Explosion-proof Grade	**Sensor**	Ex ia IIC T1-T6 Ga
	Transmitter	Ex db [ib Gb] IIC T6 Gb
	Explosion-proof performance conforms to GB3836.1-2010, GB3836.2- 2010, GB3836.4-2010	
	Application: suitable for Zone 1 and Zone 2 of explosive hazardous locations, equipment category IIC, backward compatible with IIA, IIB, temperature group T1~T6	
Protection Level	**Sensor**	IP66/IP67
	Transmitter	IP66/IP67

Note: Separate or integral mount of the Sensor and Transmitter does not affect the explosion-proof performance.

2.6 General Technical Specifications

a. Current Output

Output Range	(4 ~ 20) mA
Resolution	0.000244 mA
Basic Error	0.1% F S.
Temperature Effect	±0.005% F S./℃
Load Resistance	(250 ~ 750) Ω
Power Supply	active or passive
One 4 ~ 20mA current output can be configured as mass flow or volume flow.	

b. Pulse Output

Output Range	(0 ~10)KHz
Resolution	0.152Hz
Basic Error	±0.075%
Temperature Effect	±0.001% F S./℃
Standard Load	5 KΩ
Power Supply	active or passive
One 4 ~ 20mA current output can be configured as mass flow or volume flow.	

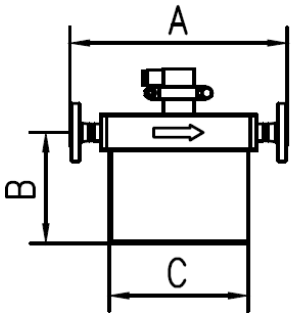
Pressure Resistance and Sealing	The compressive strength test was carried out on the pressure part of the flow meter with water, and the test pressure was 1.5 times the nominal pressure, which lasted 5 minutes, and there was no leakage at each connection.

c. Others

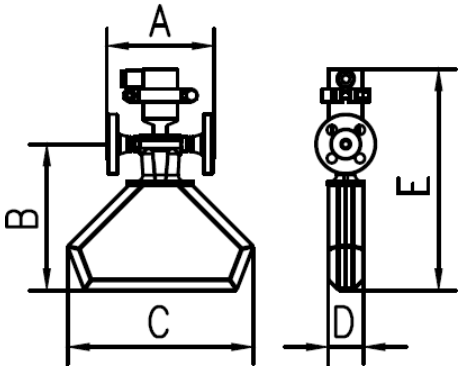
Working Pressure	DC Input	(18 ~ 32) VDC
	AC Input	(110 ~ 265) VAC
System Power Consumption	≤5W	
485 Communication	Standard Modbus RTU Protocol	
	Port	RS485
	Baud Rate	9600, 19200, 38400, etc.
Mount Type	Integral Mount	
	Separate Mount: Transmitter + Sensor + 10-wire cable	

2.7 Dimensions

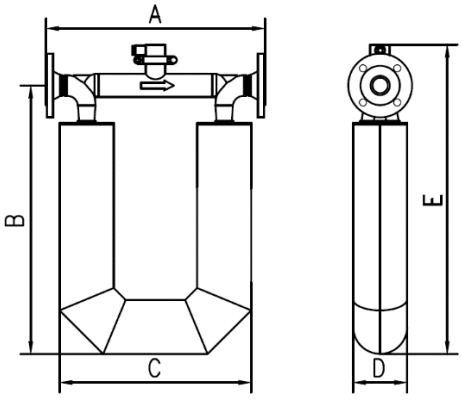
2.7.1 Coriolis Mass Flow Meter Dimensions (Separate Type)



DN1 ~ DN3



DN6 ~ DN25



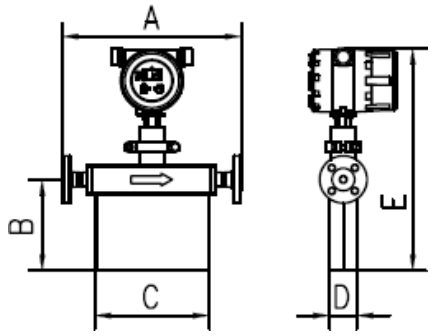
DN40 ~ DN300

Unit: mm

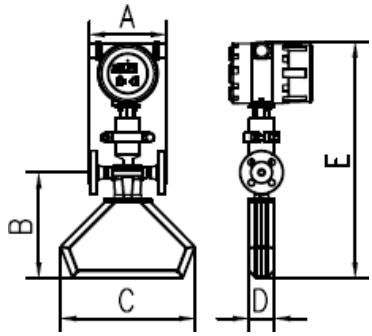
Types	Model	Flange Compatibility	A (Customizable)	B	C	D	E
Δ	**DN6**	DN15/ DN20/ DN25	159 ~ 163	219	278	53	337
	DN15	DN15/ DN20/ DN25	187 ~ 191	306	410	69	429
	DN20	DN25/ DN32	200 ~ 204	348	465	82	476
	DN25	DN25/ DN32/DN40	206 ~ 210	412	568	106	540
U	**DN1**	DN10/ DN15	343 ~ 353	183	216	54	293
	DN2	DN10/ DN15/ DN20/ DN25	343 ~ 353	183	216	54	293
	DN3	DN10/ DN15/ DN20/ DN25	343 ~ 353	183	216	54	293
	DN40	DN40/ DN50	455 ~ 479	494	385	110	597
	DN50	DN40/ DN50/ DN65	562 ~ 576	696	496	140	801
	DN80	DN80/ DN100	676 ~ 702	777	610	170	902
	DN100	DN80/ DN100/(DN125)	835 ~ 865	976	768	208	1107
	DN125	DN100/ DN125/ DN150	835 ~ 881	961	751	234	1105
	DN150	DN150/ (DN175)/ DN200	964 ~ 1030	1075	840	280	1236
	DN200	DN200/ (DN225)/ DN250	1024 ~ 1054	1235	826	325	1422
	DN250	DN200/ (DN225)/ DN250/ DN300	1023 ~ 1100	1374	884	397	1573
	DN300	DN250/ DN300/ DN350	1190 ~ 1350	1878	815	490	1892

Note: The flange standard adopts GB/T 9115-2010, HG/T 20592-2009.

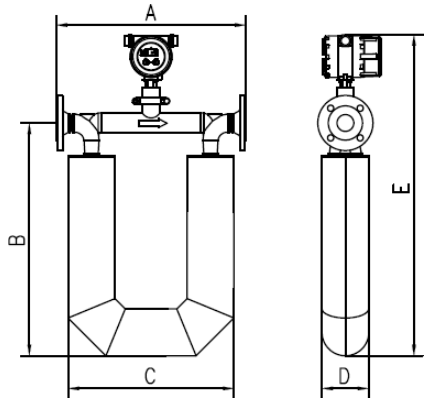
2.7.2 Coriolis Mass Flow Meter Dimensions (Integral Type)



DN1 ~ DN3



DN6 ~ DN25



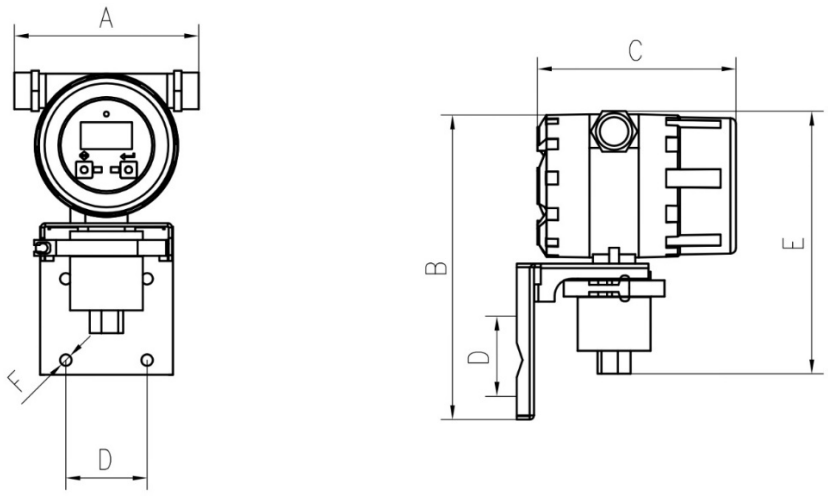
DN40 ~ DN300

Unit: mm

Types	Model	Flange Compatibility	A (Customizable)	B	C	D	E	F
Δ	DN6	DN15/ DN20/ DN25	159~163	219	278	53	495	174
	DN15	DN15/ DN20/ DN25	187~191	306	410	69	587	174
	DN20	DN25/ DN32	200 ~ 204	348	465	82	634	174
	DN25	DN25/ DN32/DN40	206~210	412	568	106	698	174
U	DN1	DN10/ DN15	343~353	183	216	54	451	174
	DN2	DN10/ DN15/ DN20/ DN25	343~353	183	216	54	451	174
	DN3	DN10/ DN15/ DN20/ DN25	343~353	183	216	54	451	174
	DN40	DN40/ DN50	455~479	494	385	110	755	174
	DN50	DN40/ DN50/ DN65	562~576	696	496	140	959	174
	DN80	DN80/ DN100	676~702	777	610	170	1060	174
	DN100	DN80/ DN100/(DN125)	835~865	976	768	208	1265	174
	DN125	DN100/ DN125/ DN150	835~881	961	751	234	1263	174
	DN150	DN150/ (DN175)/ DN200	964~1030	1075	840	280	1394	174
	DN200	DN200/ (DN225)/ DN250	1024~1054	1235	826	325	1580	174
	DN250	DN200/ (DN225)/ DN250/ DN300	1023~1109	1374	884	397	1731	174
	DN300	DN250/ DN300/ DN350	1120~1270	1694	816	452	2050	174

Note: The flange standard adopts GB/T 9115-2010, HG/T 20592-2009

2.7.3 Transmitter Dimensions



Unit: mm

Transmitter	A	B	C	D	E	F
	161	269	174	71	269	4xΦ10

3.0 Installation and Commissioning

3.1 Installation Instructions

3.1.1 Check before Installation

1) If the meter is about to be installed in a hazardous area, ensure that the explosion-proof performance indicated on the sensor approvals tag is applicable to the environment.
2) For newly-built pipelines, install the Sensor after completing the pipeline presetting and pipeline purge to prevent debris from entering the Sensor and prevent accidental damage to the Sensor due to pipeline construction.
3) Handling the meter carefully, avoid permanent damage to the Sensor due to falling and knocking.

3.1.2 Installation Guide

1) Reduce vibration

a. Don not use the sensor to support valves and pumps. The meter are supposed to install after the pump and before the valve.

b. The Sensor should be supported by the pipeline system, the pipe support should be as close as possible to the inlet and outlet flanges (about 2-10 times of the pipe diameter), and ensure that the pipe support is attached to the common structure.

c. After the Sensor is installed, its housing should be in free floating state. For installation methods a and b, the support rods should be symmetrically distributed with the Sensor as the center; for installation method c, the choice of the support point of the support depends on the situation. If the lower end of the support rod is fixed to the ground, it must be a cement and reinforced foundation. The purpose is to stabilize the support and to reduce vibration. The more stable the foundation, the better effect of vibration reduction.

d. When the Sensor is installed on the process pipeline, ensure that the piping system is firmly connected to the solid support at the upstream and downstream positions of the Sensor. All threaded connections must be tightened. Clamping the process pipeline helps to reduce potential vibration interference.

2) Installation stress relief

a. Excessive mechanical stress will affect the zero point of the mass flow meter. If these stresses are constantly changing, the instrument will have an unacceptable

zero drift.

b. When installing the Sensor, in order to eliminate the installation stress, the most effective method is to install the pipeline in the very beginning, pre-install the process pipeline, valve and Sensor, then hoist it, and then weld it to the process main line. In order to achieve the best effect of stress relief, the center of the Sensor, shut-off valve and process main line should be in the same vertical plane.

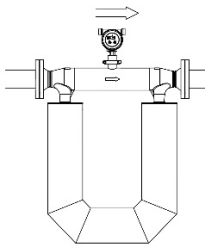
c. The Sensor flange must be coaxially connected to the pipe flange to avoid compression, bending or twisting to reduce installation stress and ensure measurement accuracy.

3.1.3 Sensor Installation

The flow meter can only work normally when the measuring tubes are filled with process fluid. In principle, the flow meter can be installed in any way that will fill the measuring tube with process fluid.

The specific Sensor installation should be determined according to the fluid phase and on-site working conditions. It is mainly divided into the following three types:

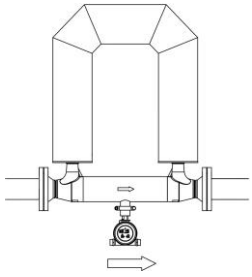
flow direction



Horizontal installation—bottom mounted Generally, the Sensor is installed with the shell facing down to prevent air from accumulating in the Sensor measurement tube, thereby achieving the purpose of accurately measuring the mass flow.

Measuring tube under the pipeline

Applicable medium: liquid



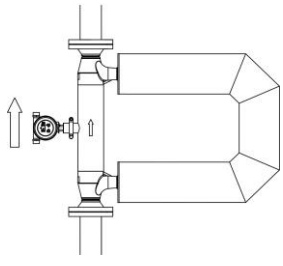
Horizontal installation—top mounted Generally, the Sensor is installed with the shell facing upward to avoid the accumulation of condensate in the measuring tube of the Sensor.

flow direction

Measuring tube above the pipeline

Applicable medium: gas

flow direction



Flag installation—side mounted

Generally, the Sensor is installed on the vertical pipeline to avoid the accumulation of particles in the measuring tube of the Sensor.

Measuring tube on the side of the pipeline

Applicable medium: liquid or solid-liquid mixing

3.1.4 Installation of Mass Flow Meter Transmitter (Separate Type)

Before installing the Transmitter in a hazardous area, ensure that the installation environment is suitable for the explosion-proof performance indicated on the Transmitter nameplate and installed correctly. The Transmitter should be installed where the ambient temperature is between -40 ℃ and +60℃， and where the humidity is ≤90%.

The Transmitters usually use instrument columns for support and fixation. Please make sure that the instrument column protrudes from the hard base at least 500 mm (usually 1500 mm is appropriate), and its diameter does not exceed 50.8 mm.

The Transmitter should be installed to the end of the instrument column, otherwise it will be inconvenient to unscrew the rear end cover and wiring. For details, see the following figure:

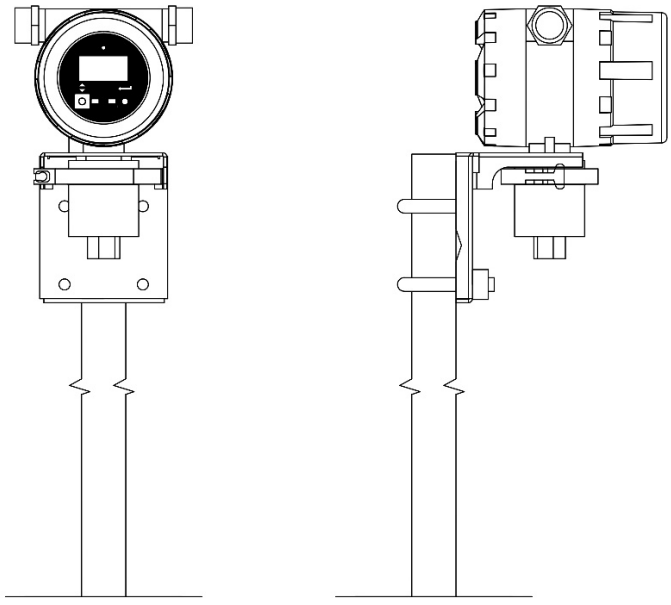


Figure 4

3.2 Wiring

3.2.1 Basic Requirements

Cable Type	Cable Specification	Maximum Length	Remarks
Dedicated 10-wire cable	Dedicated	20 meters	Standard length is 2 meters
Power cable	≥1.5mm2 shielded cable	500 meters	Separate power and signal cables
RS485 communication cable	Shielded twisted pair	300 meters	

3.2.2 Transmitter Wiring

1) When the Sensor and Transmitter are installed integrally, connect the power cable and signal cable of the Transmitter, the flow meter can work normally.
2) When the Sensor and Transmitter are installed separately, in addition to connecting the Transmitter power cable and signal cable, a special 10- wire cable must be used to connect the junction box on the Sensor and the intrinsically safe cavity on the Transmitter.
3) The Flow Meter Sensor is generally equipped with a 2-meter special 10- wire cable for connecting the Sensor and Transmitter. If you need a longer cable, please contact the supplier.
4) Wiring

   Before installing the special ten-wire cable, please cut off the power supply, strip the cable sheath of about 50mm, remove the metal foil around the insulated wire and the filling material between the wires, and retain the metal foil of about 10mm in length, then separate the wires. Combine the shielded woven wire into one strand (see Figure 4).

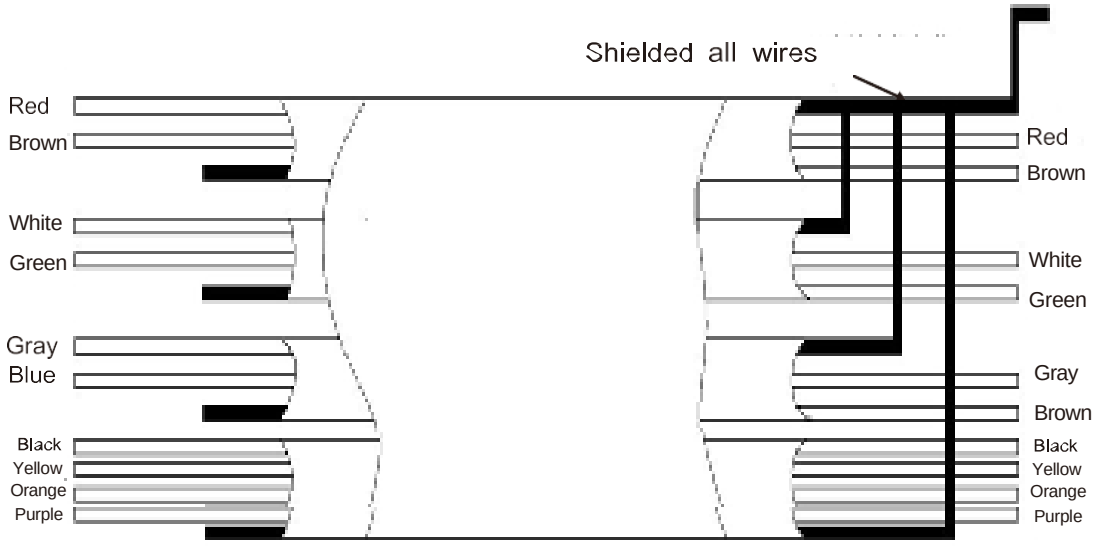


Figure 5

Strip the insulation of the end of each wire, press the wire into the terminal according to the color and port number of the wire, and connect the synthetic shielded woven wire to the grounding screw of the intrinsically safe cavity. Tighten the lock nut.

If the site is an explosion-proof place, it is necessary to protect the nine-core cable with an explosion-proof flexible tube.

3.2.3 Special 10-wire cable wiring

Installation description:

1) Read this manual carefully before installation and connect wires correctly.
2) The Transmitter should be installed in a place that is ventilated, dry, non- corrosive, cool and has a small temperature change. If installed in the open air, a protective cover should be added to avoid direct sunlight and rain to avoid product performance reduction or failure.
3) When the flameproof Transmitter is used in a hazardous location, the cover of the Transmitter must be tightened. In order to ensure the safety of use, the safety regulations should be strictly followed, and it is absolutely not allowed to open the cover of the Transmitter when it is powered on.

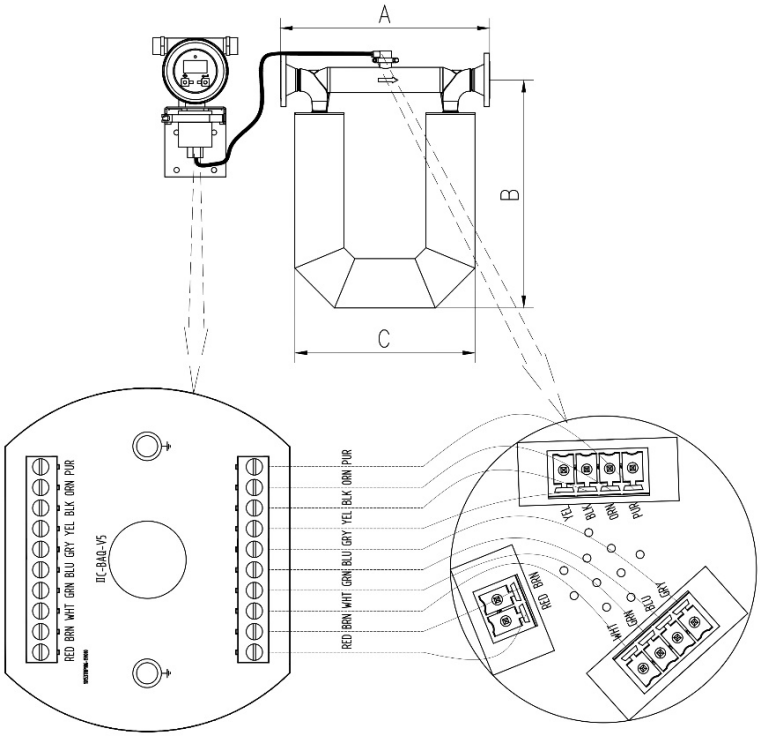


Figure 6

Wire No.	Wire Color	Function
1	Green	The left coil+
2	White	The left coil-
3	Blue	The right coil+
4	Gray	The right coil-
5	Brown	Driving coil+
6	Red	Driving coil-
7	Yellow	Temperature+
8	Orange	Temperature +
9	Black	Temperature -
10	Purple	Temperature -

3.2.4 Signal Connection

See the following figure:

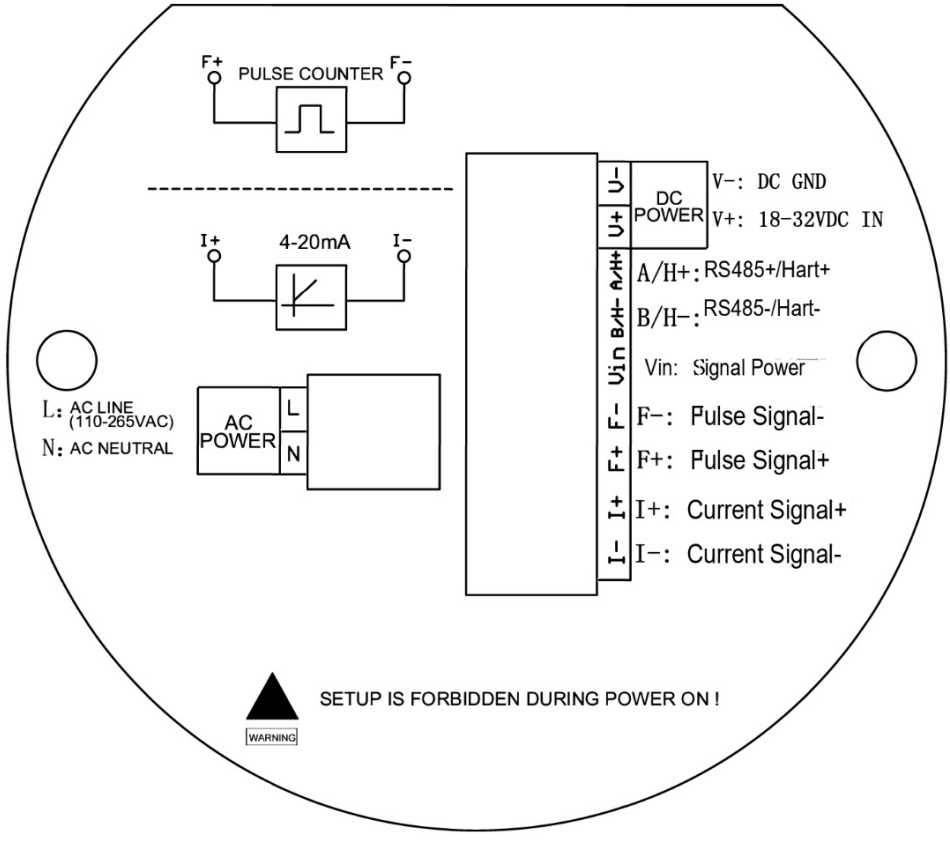


Figure 7

3.2.5 Grounding

Both the Sensor and the Transmitter need to be properly grounded, otherwise it will cause measurement errors, it may even cause the instrument not to work properly. If the process pipeline is not connected to the ground, it is necessary to ground the Sensor separately. Refer to the corresponding national standard or follow the manufacturer's standard for the specific grounding method.

3.3 Commissioning

3.3.1 Zero Calibration

Zero calibration provides a reference point for flow measurement for the flow meter. After the Mass Flow Meter is installed for the first time or the medium is replaced, zero calibration must be performed.

How to perform zero calibration: Before calibration, close the downstream shut-off valve of the flow meter, and then close the upstream shut-off valve, and let it stand for 30 minutes. At the same time, ensure that the Sensor measurement tube is filled with process fluid during the zero calibration process. Then operate on the transmitter by following instruction on chapter 4.3.1 "Zero Calibration".

3.3.2 Instrument Parameters

Each Mass Flow Sensor has its own unique instrument parameters, which include a flow coefficient and three density coefficients (flow calibration coefficient, density coefficient: K1, K2, TC). Please find instrument parameters on the Transmitter and Sensor nameplates.
Normally, the Sensor and Transmitter are shipped from the factory in pairs. The instrument parameters have been input into the Transmitter, and the user does not need to make any changes. But if you replace either the Sensor or Transmitter, then you need to re-input the information on the Sensor nameplate.

3.3.3 Flow Correction Coefficient

The mass flow rate measured by the mass flow meter is obtained by multiplying the time difference between the two detection signals and the flow calibration coefficient. The meter will be calibrated before delivery, and usually does not need to be corrected on site, but after long-term use, periodic verification should be performed according to the method described in "JJG1038-2008 Coriolis Mass Flow Meter Verification Regulations".

If it is found that the measurement accuracy cannot meet the technical

requirements, the following formula can be used to correct the flow meter coefficient, and the flow correction coefficient is 1.0 when shipped from the factory. The calculation of flow correction coefficient (MF) is as follows:

MF=M/Mt

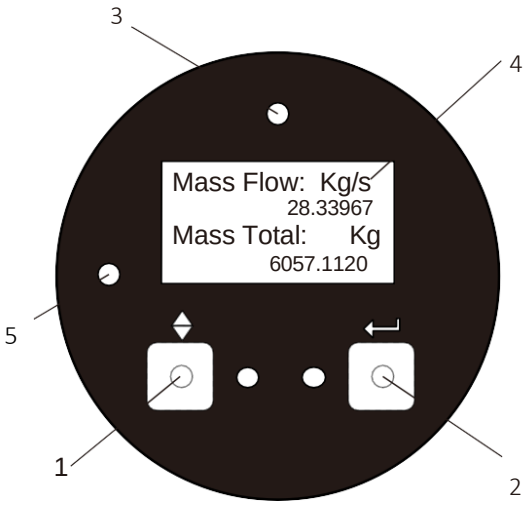
MF-- Flow correction coefficient

M--standard total mass (generally weighed mass), in kg Mt--

the total mass displayed by the flow meter, in kg

4.0 Configuration Instruction

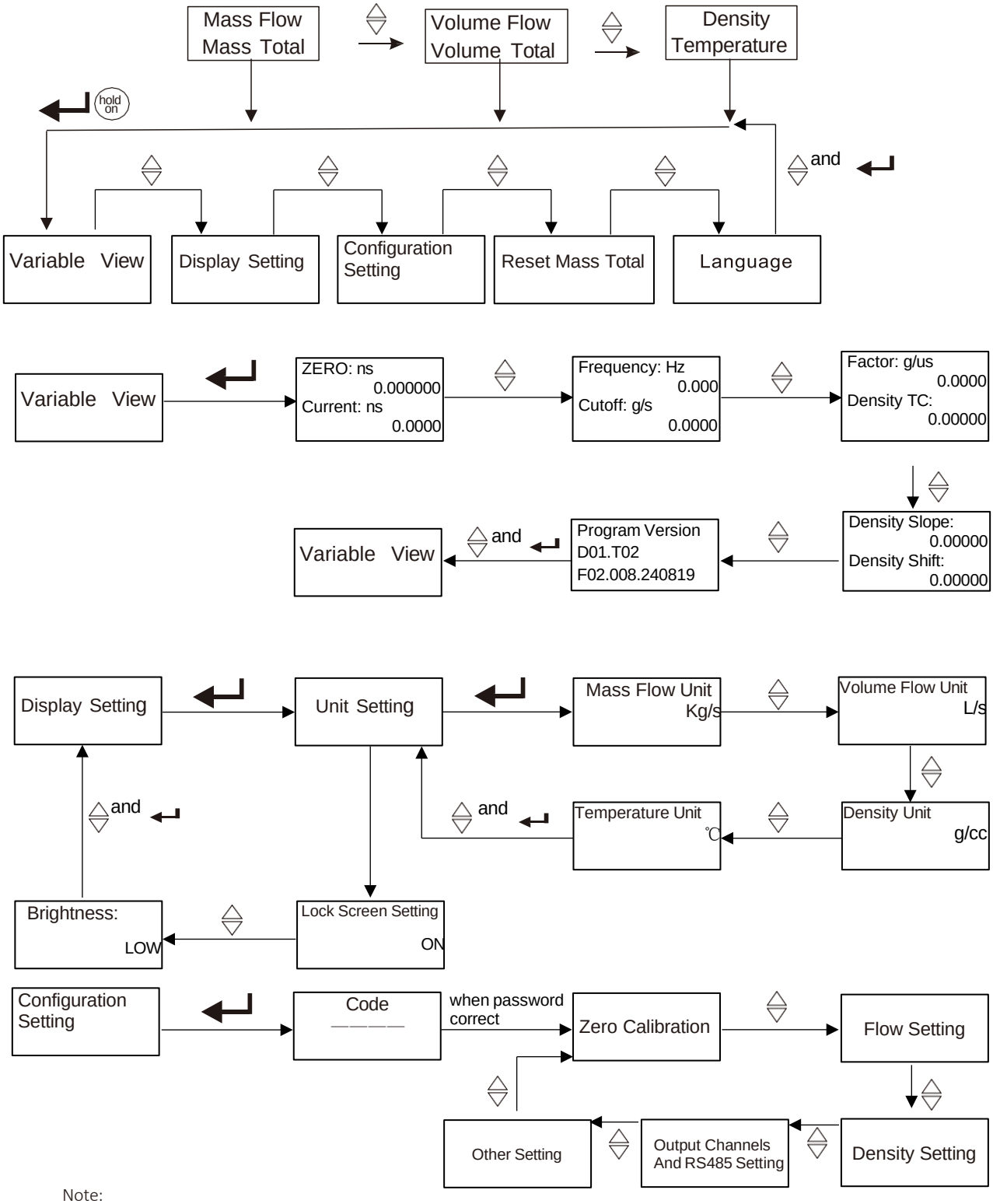
4.1 Display Interface Description



No.	Notes
1	L ◇ Key: scroll
2	R↵ Key: select and enter
3	Indicator for working status
4	OLED display
5	Keys for working status

Note:
The buttons are photosensitive. When short press the button, the indicator will turn green. When long press the buttons for 3 seconds, the indicator will turn red.

4.2 Main Menu

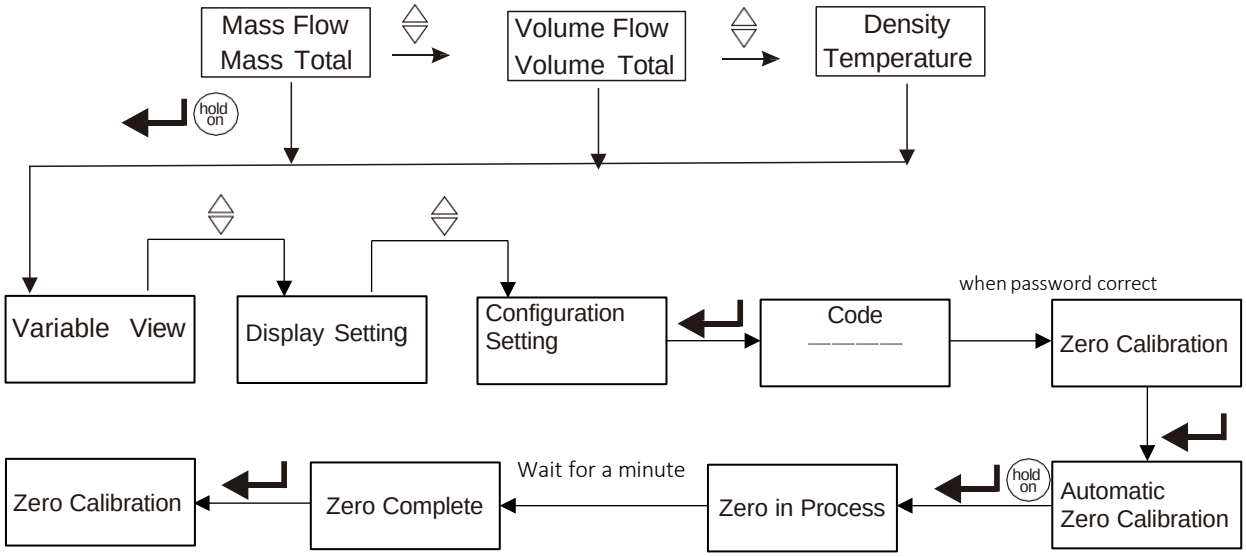


Note:

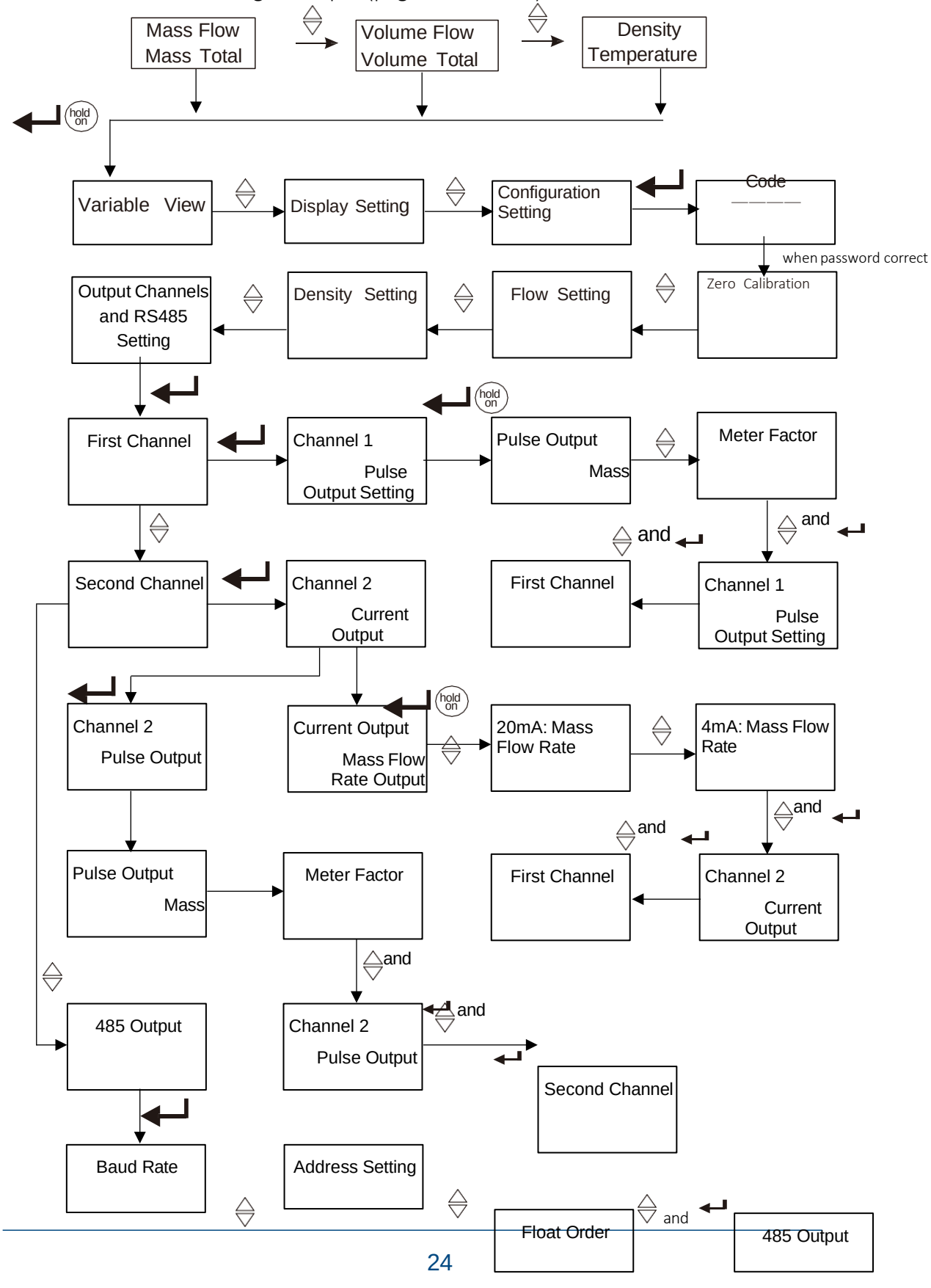
1. hold on long press the button for at least 3 seconds.
2. To modify the data, press the left button to increase the number and press the right button to confirm.

4.3 Optional Configuration

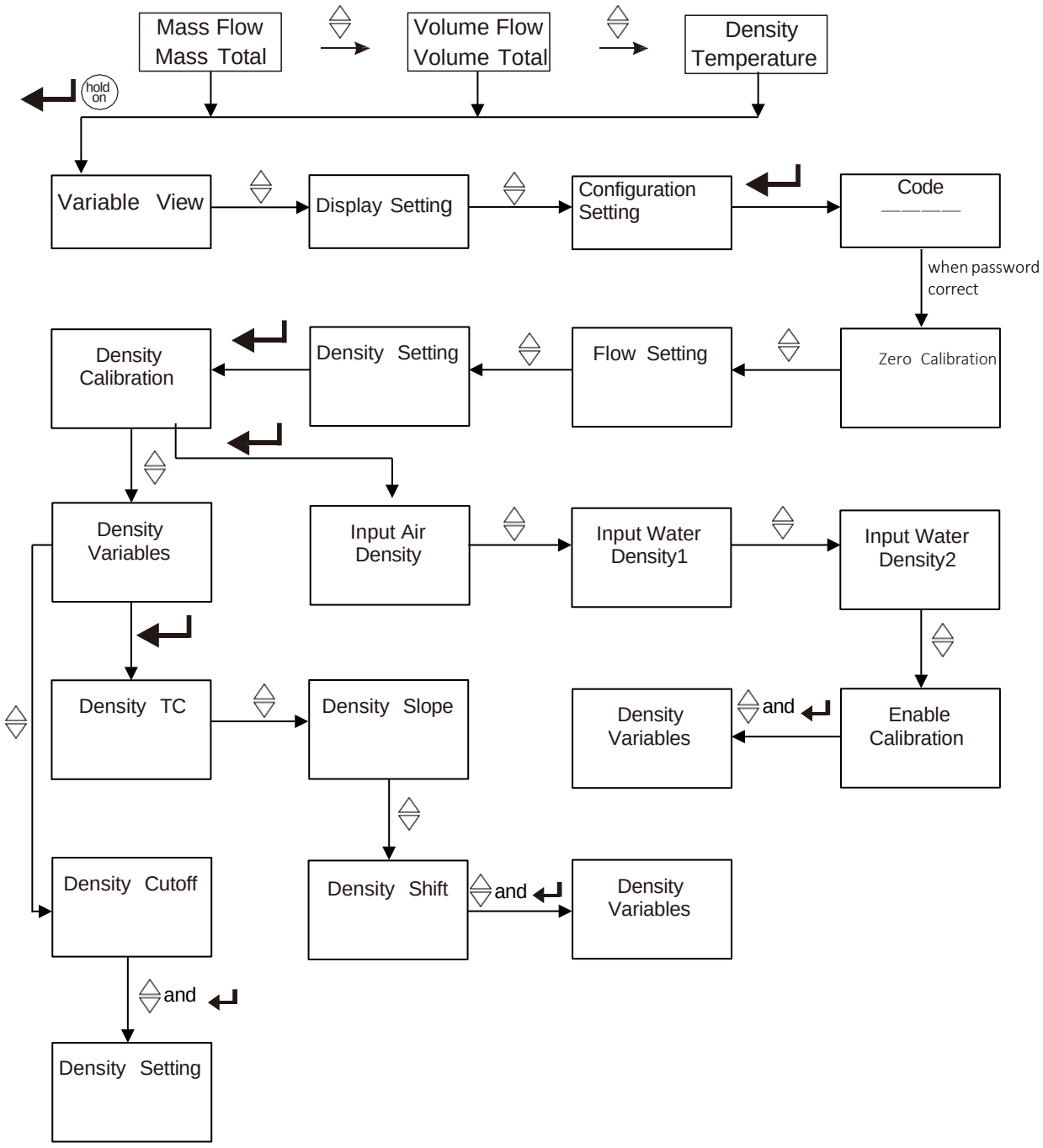
4.3.1 How to perform zero calibration (page 2 for details)



4.3.2 How to set the signal output (page 4 for details)



4.3.3 How to set the density factor (page 5 for details)



5.0 Troubleshooting

5.1 Overview

During the first installation and use, if the flow meter works abnormally, the cause of the failure should be determined. The causes of failure can be divided into two types: application problems and flow meter system problems. Application problems are more complicated, such as measurement fluctuation errors caused by process, medium state changes, etc., should be analyzed according to the actual situation. This part mainly describes the causes and solutions of flow meter system failures.

5.2 Diagnostic Tools and Methods

For the fault diagnosis of the flow meter, the user can make use of the LED indicators and OLED display on the display panel to judge. Among them, the different colors of the LED indicators represent different working conditions of the flow meter, which is convenient for users to view; the OLED display can display the alarm information of the Transmitter's self-diagnosis, which is helpful for the user to judge and determine the cause of the failure.

Error Codes	Codes Description
T	Temp Error
C	DSP COMM Error
D	Phase Differ Error
F	Frequency Error

5.3 Sensor Failure Detection

When checking the flow meter failure, check whether the resistance value of the Sensor coil is normal according to the following table in the very beginning.

6.0 Cautions for Users

1) Before starting the meter, ensure the 9-wire cable connect the Transmitter and the Sensor is correctly wired, and the power input of the Transmitter is correct, and the Transmitter housing is reliably connected to the ground.
2) Coriolis Mass Flow Meter Sensor of separate type must be matched with BPM Transmitter (intrinsically safe related equipment), and connected with our company's special nine-wire cable (model K. X), special nine-wire cable wiring bending radius ≥120mm.
3) The user cannot arbitrarily change the standard mode and electrical structure parameters of the explosion-proof components in the Sensor.
4) Intrinsically safe and non-intrinsically safe wires must be routed separately.
5) The outer diameter range of the cable sheath introduced is ϕ7-ϕ13. When used on site, the compression nut should be tightened so that the inner diameter of the sealing rubber column tightly covers the outer diameter of the cable. The sealing rubber column should be replaced in time when it is wearing out.
6) There should be no harmful gases corrosive to the aluminum alloy at the installation site.
7) Make sure that maintenance be carried out in a safe place, and there is no flammable gas on site.
8) When installing and using the product, users must abide by the product instruction manual and other standards.
9) The components and structures are not allowed to be randomly changed. For products that has passed the explosion-proof inspection because it may affect the explosion-proof performance.

For abnormal circumstances

a) For slurry with abrasiveness, the flow rate should be controlled to be less than 3m/s.
b) For concentrated sulfuric acid, the flow rate should be controlled to be less than 3m/s.
c) The mass flow meter can be used in both directions. If the installation direction is opposite to the actual flow direction, just modify the flow direction in the Transmitter.

7.0 Other Information

7.1 Electrical Interface Specifications

The standard configuration of the interface between the signal cable and the power cable is G3/4 (internal threads), and the standard interface of the intrinsically safe cable is G1/2 (internal threads).

7.2 Product Materials

1) Transmitter housing is ADC12 aluminum alloy, tensile strength is no less than 120MPa. It can withstand 7J impact energy test. The remaining connecting parts of the Transmitter are 304 stainless steel.
2) The material of the measuring tube of the Sensor is 316L stainless steel, and the remaining connecting parts are 304 stainless steel.

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