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DDTOP ELECTRONICS INSTRUMENT (GROUP) CO.,LTD

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LD-DT-JS-1030-2022（B）

ELECTRONICS INSTRUMENT

LD

MAGNETIC FLOW METER

PRODUCT INSTRUCTIONS

PREFACE

Thank you for choosing the products of Dandong Top Electronics Instrument (Group)Co.,Ltd.

This operation manual provides you with important information on installation, connection and commissioning as well as on maintenance, troubleshooting and storage. Please read it carefully before installation and commissioning and keep it as part of the product near the meter for easy reading.

This manual can be downloaded by entering the version number at www.ddtop.com .

If the instructions are not followed, the protection provided by the meter may be destroyed.

Trademark, Copyright and Restriction Instructions.
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The performance specifications of the meter are effective as of the date of publication and are subject to change without notice. Dandong Top Electronics Instrument (Group)Co.,Ltd. reserves the right to modify the products described in this manual at any time without prior notice.

Quality Assurance
Dandong Top Electronics Instrument (Group) Co.,Ltd. guarantees that all glass plate level gauge have no defects in materials and manufacturing processes within one year from the date of delivery.

During the warranty period, if the product returns with quality problems and the claim is determined by the manufacturer to be within the scope of warranty, Dandong Top Electronics Instrument (Group) Co.,Ltd. is responsible for repair or replacement of the buyer (or owner) free of charge.

Dandong Top Electronics Instrument (Group) Co.,Ltd. is not responsible for the costs caused by improper use of equipment, labor claims, direct or subsequent damage and installation and use of equipment. In addition to the special written warranty certificate for certain products of Dandong Top Electronics Instrument (Group) Co.,Ltd., Dandong Top Electronics Instrument (Group) Co.,Ltd. does not provide any express or implied warranty.

Quality
Dandong Top Electronics Instrument (Group) Co.,Ltd. has passed the ISO9001 quality system certification. The whole process of product production is strictly in accordance with the scope of the quality system, providing the strongest guarantee for product and service quality.

DDTOP ELECTRONICS INSTRUMENT | ENSURE SAFETY

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CONTENTS

DDTOP ELECTRONICS INSTRUMENT | ENSURE SAFETY

1. Safety Tips

It is expressly prohibited to modify or change products for safety reasons, repair or replacement only allows the use of accessories specified by the manufacturer.

1.1 Explosion may result in death or serious injury.
When installing equipment in an explosive atmosphere, be sure to follow applicable local, national, international standards, codes, and procedures. Be sure to install the equipment in Intrinsically safe or non-flammable site operating procedures.

1.2 Process leaks can cause serious injury or death.
Care should be taken to lift the transmitter. If the process seal is damaged, the medium may leak at the joint.

1.3 Failure to follow safe installation guidelines may result in death or serious injury.
The operations described in this manual are performed by professionally trained and qualified professionals or end-user specialized professionals to complete.

2. Product Instructions

2.1 Pipe type magnetic flow meter measuring principle

Magnetic flow meter working principle is based on Faraday's law of electromagnetic induction. Figure 1 in the upper and lower ends of the two electromagnetic coils to produce a constant or alternating magnetic field, when the conductive medium flow through the magnetic flow meter, the flow meter tube wall between the left and right two electrodes can be detected between the induction electromotive force, the size of this induction electromotive force and conductive medium flow rate, magnetic induction strength of the magnetic field, the width of the conductor (flow meter measuring tube inner diameter) is proportional, and then through the calculation can get the medium flow.

The equation for the induced electric potential is $E=K\times B\times V\times D$
Among them: E-Induced electric potential.
K - Instrument constant.
B - Magnetic susceptibility.
V- Measuring the average flow rate in the tube cross-section.
D- Measure the inner diameter of the tube.

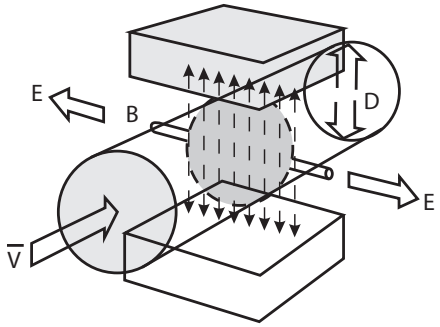


Figure 1 Measuring principle

When measuring flow, the fluid flows through a magnetic field perpendicular to the direction of flow, the flow of conductive fluid induces an induced potential proportional to the average flow rate, therefore the conductivity of the flowing liquid being measured is required to be higher than the minimum conductivity - 5us/cm (magnetic flow meter can theoretically measure conductivity greater than 5μs/cm conductive media, but the actual measurement should ensure that the magnetic flow meter is used in the Measurement medium conductivity in 50μs/cm and above (greater than the theoretical value of one to two orders of magnitude) in the environment, and must be online measurement of the conductivity value obtained as a benchmark). The induced voltage signal is detected by the two electrodes and transmitted via cable to the converter, where the accumulated and instantaneous flow rates are displayed on the converter's display after a series of analogue and digital signal processing.

2.2 Pipe type magnetic flow meter structure

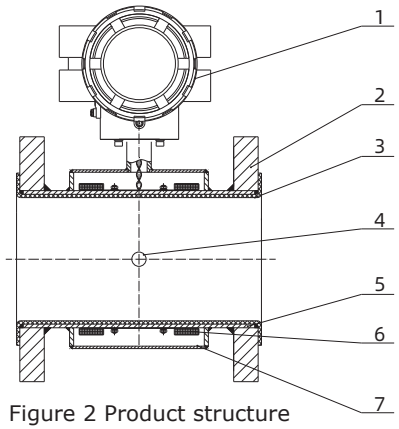


Figure 2 Product structure

1. Converter
2. Flange
3. Insulation lining
4. Electrode
5. Measuring tube
6. Excitation coil
7. Housing

Pipeline magnetic flow meter is mainly composed of two major parts: sensor, including flange, lining, electrode, measuring tube, excitation coil, sensor housing and other parts; converter, including the internal circuit board and converter housing and other parts.

1. Converter:
   To provide a stable excitation current for the sensor and to amplify the induced electric potential obtained through the sensor and convert it into a standard electrical signal or frequency signal, while displaying the real-time flow rate and parameters, etc., for the display, control and regulation of the flow rate.

2. Flanges.
   For connection to process piping.

3. Lining.
   A complete layer of electrically insulating corrosion resistant material on the inside of the measuring tube and on the sealing surface of the flange.

4. Electrodes.
   A pair of electrodes is fitted on the wall of the measuring tube perpendicular to the magnetic force line to detect the flow signal, the electrode material can be selected according to the corrosive properties of the measured medium. Another grounding electrode is fitted for the grounding and anti-interference of the flow signal measurement.

5. Measuring tube.
   The measuring tube flows through the medium to be measured. The measuring tube is made of non-magnetic stainless steel and flanges welded together and lined with an insulating lining.

6. Excitation coil
   The outer side of the measuring tube is equipped with a set of coils at the top and bottom to generate the working magnetic field.

7. Housing
   The magnetic circuit is isolated from the outside world and protected.

2.3 Insertion type magnetic flow meter working principle - Figure 3

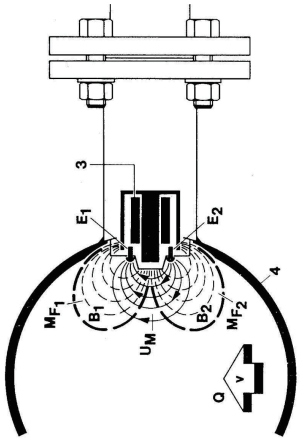


Figure 3

According to Faraday's law of electromagnetic induction, an induced voltage (Um) will be induced when a conductor moves in a magnetic field (B). With electromagnetic induction measurements, the fluid medium is equivalent to a conductor in motion and the direction of fluid flow (V) is perpendicular to the direction of the electromagnetic field (B1, B2). As the constant alternating magnetic field is generated by a switching DC current with alternating polarity, the magnetic field strength (B) and the distance between the electrodes (E1, E2) are constant, the induced voltage (Um) is proportional to the fluid flow velocity (v). In the signal converter, the induced signal voltage is amplified and converted into analogue and digital signals, and the fluid flow rate and flow rate, etc., are calculated based on the pipe diameter.

2.4 Insertion type magnetic flow meter structure

Insertion type magnetic flow meter is mainly composed of two major parts: the sensor and the converter, the converter including internal circuit board and converter shell and other parts.

The structure of the sensor is shown in Figure 4, mainly composed of flow rate measuring head (hereinafter referred to as the probe), insertion rod, junction box, mounting base, sealing and positioning mechanism, etc.

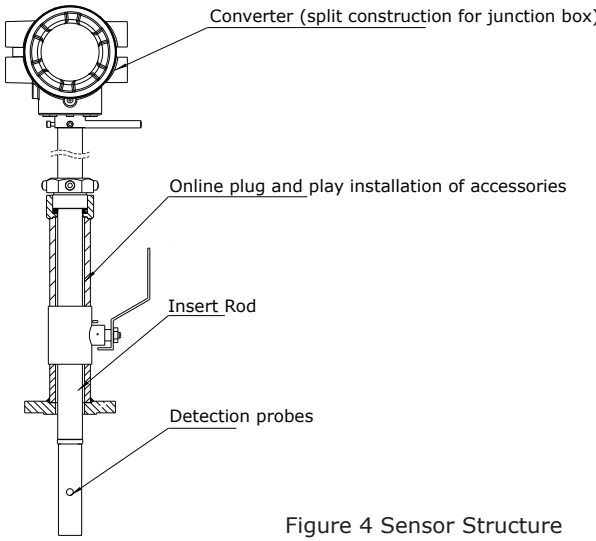


Figure 4 Sensor Structure

1. Detection probe: at the location of the measured flow rate point in the pipe, used to detect the flow rate at that point. The probe is made of insulating material and has a pair of electrodes on it.

2. Insertion rod: made of stainless steel, the probe is fixed to the insertion rod. The excitation leads and electrode leads are sealed to the measured medium through the insertion rod and connected to the junction box (or converter). The insertion rod is fitted with a direction indication mark to ensure that the working magnetic field, the flow rate and the electrode connection are perpendicular to each other during installation, in accordance with Faraday's Law of Induction.

3. Junction box: The junction box is located in the upper part of the sensor and the terminals in the box are used to connect the sensor and the converter to each other.

4. In-line plug-in installation accessories: made of stainless steel connecting flange assembly, ball valve, sealing sleeve, sealing pressure ring, and positioning screws and other components inserted into the electromagnetic flow sensor sealing system. The insertion lever is inserted through the opening and closing of the ball valve, allowing the sensor to be inserted in the sealing sleeve with some space for movement, allowing the flow sensor to be installed or removed at low pressure or under pressure.

2.5 Instructions for use of split brackets

Tips!

Check the instrument nameplate and determine if the supply is the same as your order.

Check that the power supply on the nameplate is correct.

Figure 7 shows the reference to the nameplate.

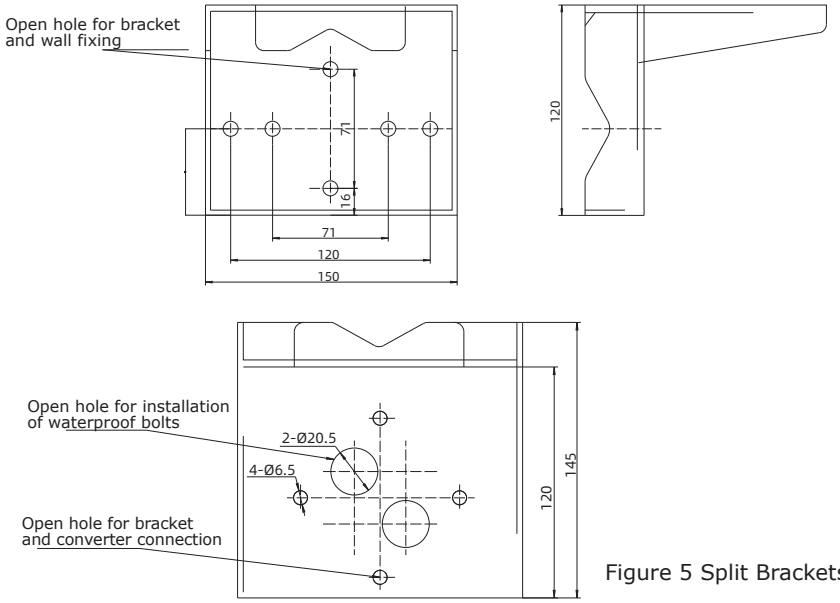


Figure 5 Split Brackets

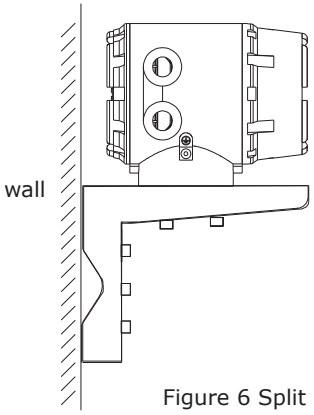


Figure 6 Split bracket installation

Instructions for Use

1. Converter and the split bracket can be fixed to each other by means of hexagonal bolts.

2. Split bracket is fixed to the wall using screws.

3. Split bracket is mounted on the corresponding pipe using clamps.

2.6 Instrument Description

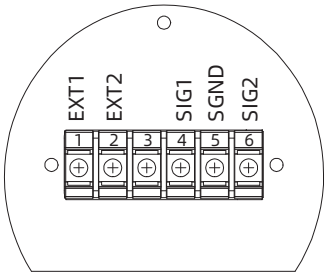
Please use quality lifting equipment and lifting straps, and pay attention to safety. The magnetic flow meter is only suitable for measuring the instantaneous flow of liquids with electrical conductivity or liquid-solid two-phase fluids, and has a flow accumulation function. Usually, the factory parameters of the meter will be pre-set according to the order requirements, the user does not need to set parameters before use, but the user needs to check whether the parameters on the nameplate have been pre-set before use, and check with the actual use of working conditions.

Magnetic flow meter theoretically can measure conductivity greater than 5μs/cm conductive media, but the actual measurement should ensure that the magnetic flow meter used in the measured medium conductivity in the environment of 30μ s/cm and above, the conductivity of the medium must be measured online, otherwise it will cause deviations in the measured conductivity value of the medium.3.4 Piping design.

2.7 Terminal Description

Split type - Fig. 7

The Q53 converter needs to be connected to the sensor split junction box when used as a split type, the split junction box is wired as follows:



SIG1, SIG2:Signal positive, Signal negative

SGND:Signal ground

EXT1, EXT2:Excitation positive, excitation negative

The excitation signal and the sensor signal are connected to the converter via separate signal lines.

Fig. 7 Wiring diagram for split type

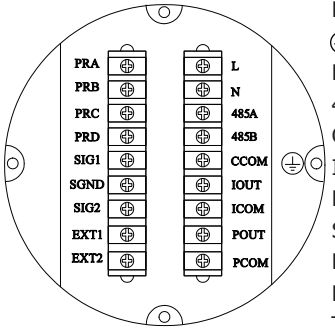


Figure 8

L, N:AC power supply 220V
⏚ :Ground
POUT,PCOM:Pulse / frequency output interface
485A,485B:485 erial communication interface
CCOM: 485 Serial communication grounding
IOUT,ICOM: 4-20mA Output interface
EXT1,EXT2:Excitation signal (split installation only)
SIG1,SIG2,SGND:Electrode signal (split installation only)
PRA,PRB,PRC,PRD:Pressure signal (only with pressure function)
Note:
The left row of terminals is restricted to wiring with pressure function/split mounting.

2.8 Nameplate

Tips

Please check the instrument nameplate and make sure that the supply is the same as your order.

Check that the power supply on the nameplate is correct.

Figure 9 shows the reference to the nameplate.

LD Magnetic Flow Meter

FM: 12F221-21

Model			
Accuracy class		Lining materials	
Flow range		Electrode materials	
Power supply		Instrument factor	
DN/PN		Serial No.	
Max. operating Tem.		Tag No.	
IP rating		Explosion protection certificate No.	

Dandong Top Electronics Instrument (Group) Co., Ltd

Fig. 9 Product Nameplate

3. Pipe type magnetic flow meter installation

3.1 Pipe type magnetic flow meter installation

Tips
Please check carefully that the box is not damaged or that it has been brutally loaded or unloaded. If there is any damage, please report the damage to the delivery person and the manufacturer or instrument shipper.

Tips
Please check the packing list to ensure you receive a complete shipment.

Tips
Check the nameplate of the instrument and make sure that the supply is the same as your order. Check that the power supply information on the nameplate is correct. If it is not correct, please contact the manufacturer or the instrument seller.

3.2 Storage

- Please store the instrument in a dry and dust-free place.
- Protect it from prolonged exposure to direct sunlight.
- The instrument should be stored in its original packaging.

3.3 Installation Requirements

Tips
To ensure a reliable installation, the following measures are necessary.

- Keep sufficient space on the sides.
- Do not subject the magnetic flow meter to severe vibrations.

3.4 Piping Design

The following items are considered in the design of the pipeline:

1. Location

- The magnetic flow meter should be installed in a dry and ventilated place, and should normally be avoided in places where water can easily accumulate.

- Magnetic flow meter should avoid the sun and rain, open-air installation, there should be rain and sun protection facilities. The ambient temperature is between -20℃～ +60℃.

● Magnetic flow meter should avoid installation in places where the temperature changes greatly and by the high temperature radiation of the equipment, if it must be installed, there must be insulation, ventilation measures.

● Magnetic flow meter should avoid installation in the environment containing corrosive gases, must be installed, ventilation and anti-corrosion measures.

● Magnetic flow meter installation site as far as possible to avoid strong vibration, such as pipeline vibration, in the magnetic flow meter on both sides of the pipe should be fixed bracket.

● The sensor section of an electromagnetic flow meter with IP68 (3 m underwater) protection can be placed in water; an electromagnetic flow meter with IP65 protection cannot be immersed in water.

2. Avoid magnetic interference

● Do not install the electromagnetic flow meter near motors, transformers or other power sources that can easily cause electromagnetic interference. Do not install the electromagnetic flow meter near a frequency converter or obtain power from a frequency converter distribution cabinet to avoid introducing interference.

3. Length of straight pipe section

● To ensure the accuracy of the flow meter, it is recommended that the length of the straight pipe section upstream of the sensor should be at least 5 times the pipe diameter (5D) and the length of the straight pipe section downstream should be at least 3 times the pipe diameter (3D). -Figure 10, Figure 11

4. Maintenance space

● maintenance and servicing, ample installation space is required around the electromagnetic flow meter.

5. For pipelines where flow interruptions are not allowed in the process

● In the installation of electromagnetic flow meter should be added bypass tube and cleaning port, as shown in Figure 12, this device can be used in the case of the flow meter out of use, to ensure that the equipment system continuous work.

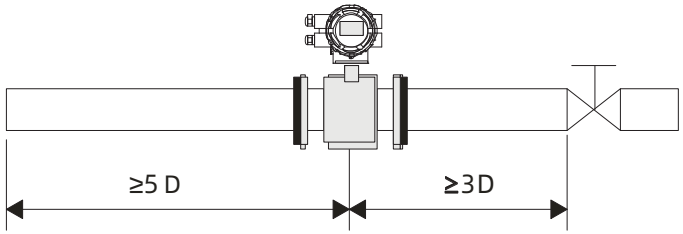


Fig. 10 Installation with the valve located downstream of the sensor

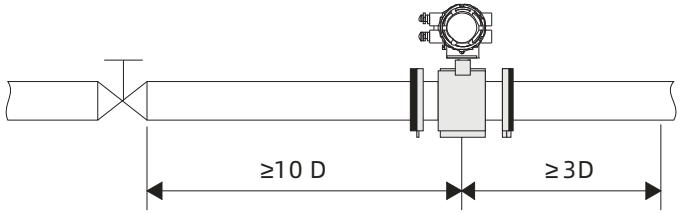


Fig. 11 Installation with the valve upstream of the sensor

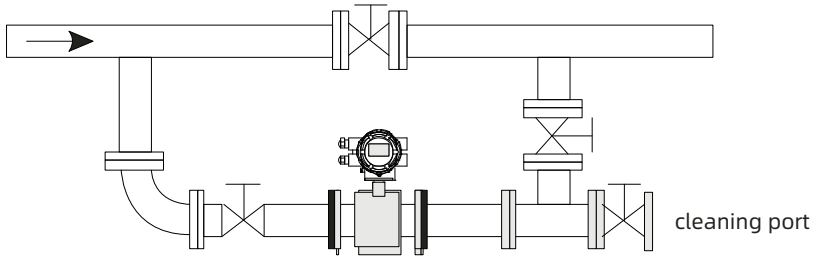


Fig. 12 Addition of bypass pipe and cleaning port

3.5 Sensor Installation Process

1. Direction of flow

● The flow meter can be set to automatically detect positive and negative flow directions, with the flow direction arrow on the sensor housing being the positive flow direction specified by the manufacturer. In general, the user should install the meter so that the flow direction arrow is consistent with the process flow direction on site.

Figure 13 below shows the preferred position for the installation of electromagnetic flow meters.

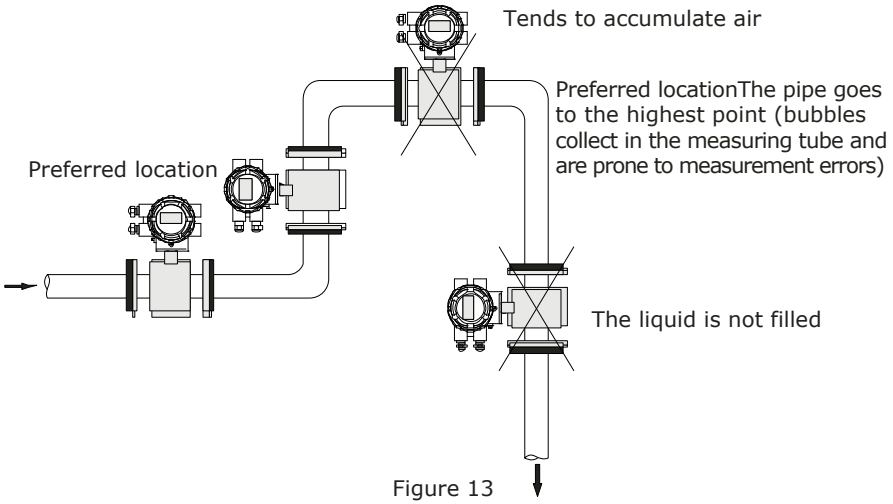


Figure 13

2. Magnetic flowmeter installation direction and sensor electrode installation orientation

● The sensor can be mounted horizontally or vertically. The sensor should be installed horizontally so that the electrode is in a horizontal position, so that if the medium contains air bubbles or precipitated material, the air bubbles will not adsorb near the electrode and cause an open circuit at the signal end of the transducer, and the precipitated material will not cover the electrode and cause a zero drift. As shown in Figure 14

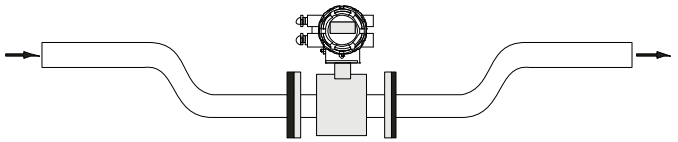


Figure 14

3. Fluid should always fill the pipe

● The pipe construction should ensure that the measuring tube of the magnetic flow meter is always filled with liquid.

● For the liquid or slurry containing solid particles recommended vertical installation of electromagnetic flow meter, one can prevent the measured medium phase separation, two can make the sensor lining wear more uniform, three impurities will not produce precipitation at the bottom of the measuring tube.

● The bottom-up flow direction must be ensured to ensure that the measuring tube of the sensor is always filled with medium.

4. It is not possible to install an electromagnetic flow meter on the suction side of the pump to prevent negative pressure from the vacuum as shown in Figure 15

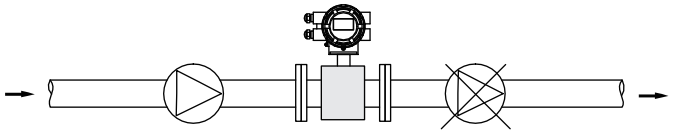


Figure 15

5. For long pipelines, control valves are generally installed downstream of the electromagnetic flow meter, as in Figure 16

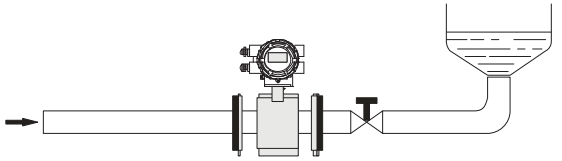


Figure 16

6. For pipes with open discharge, the electromagnetic flow meter should be installed in the bottom section (lower part of the pipe), as shown in Figure 17.

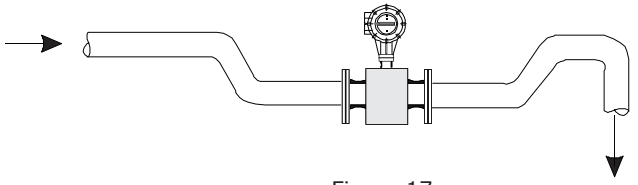


Figure 17

7. For pipeline drop more than 5 m, an air valve should be installed downstream of the electromagnetic flow meter, as shown in Figure 18

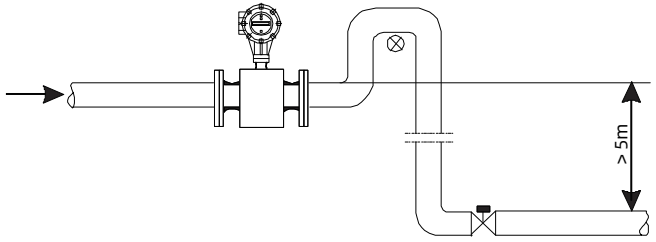


Figure 18

8. Avoidance of measurement errors caused by incidental gases and damage to the lining caused by vacuum.

9. He pipe should be free of air bubbles

The piping should be designed in such a way that no gas is separated from the liquid.

He flow meter should be installed upstream of the valve, as the pressure in the pipe will be reduced due to the valve, thus creating bubbles.

The meter should also be installed in the lower section to reduce the effect of entrained gas bubbles in the fluid on the measurement, as in Figure 19.

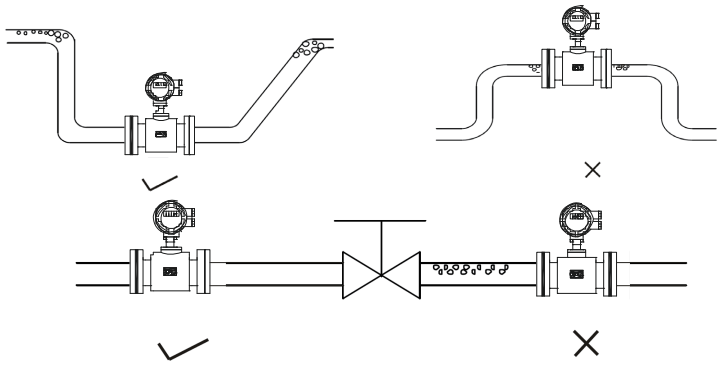


Figure 19

10. Liquid conductivity

Do not install the electromagnetic flow meter where the conductivity of the liquid is extremely uneven. The injection of chemicals upstream of the meter can easily lead to an uneven conductivity of the liquid, which can cause serious interference with the flow indication of the meter. In such cases it is recommended that the chemical is injected downstream of the meter; if the chemical must be injected upstream of the meter, a minimum of 30 times the pipe diameter of the straight upstream section must be ensured to ensure adequate mixing of the liquid.

11. Grounding

Because the induction signal voltage of electromagnetic flow meter is very small, vulnerable to external noise or other electromagnetic signals, so electromagnetic flow meter in many occasions need to be grounded, its role is to form a shield against external interference through the flow meter shell grounding internal space, thereby improving the accuracy of measurement.

3.6 Mechanical Installation

Installation of flow meter pipes

1. Before the installation of the flow meter, the pipeline should be corrected to ensure that the diameter of the meter and the user pipe have a good coaxiality. For the sensor whose nominal diameter is less than 50mm, the height of its axis shall not exceed 1.5mm, the nominal diameter of 65-300mm shall not exceed 2mm, and the nominal diameter of 350mm and above shall not exceed 4mm.

2. Newly installed pipes usually have foreign matter (such as welding slag). The debris should be flushed out before the flow meter is installed to prevent not only damage to the lining but also measurement errors caused by foreign objects passing through the measuring pipe during the measurement.

🛈 Notes

Operating Instructions

1. Be careful not to damage the instrument when unpacking. It is best not to unpack the instrument until it is transported to the installation site to avoid damage to the instrument. Use mounting rings when lifting the instrument, never lift the instrument with a rod or rope through the sensor measurement tube. The correct way to lift the instrument is shown in Figure 20.

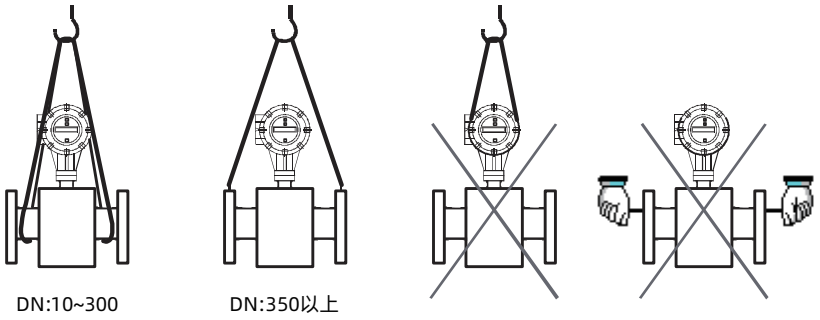


Figure 20

2. Protection of instruments from vibration.
Prevent heavy dropping and compression of the instrument, especially the surface of the flange must not be stressed (may damage the lining and prevent the instrument from working properly).

3. Flange protection
The instrument should pay attention to the protection of the flange after opening the box, do not put the flange on the ground without a liner or other uneven board.

4. Junction boxes
Before leaving the factory, the cable has been connected, no need to open the junction box.

If the electromagnetic flow meter selection for IP68 protection level, the instrument factory has done a waterproof seal.

5. Prolonged non-use
After the instrument has been installed, prolonged periods of non-use should be avoided. If the instrument is not used for an extended period of time, the following measures must be taken with respect to the instrument.

A. Check the sealing of the end caps and junction ports to ensure that moisture and water do not enter the instrument.

B. Check regularly. Check all the measures mentioned above and the condition inside the junction box at least once a year. Check the instrument immediately when there is a possibility of water ingress into the instrument (e.g. after heavy rain, etc.).

6. Installation of pipe type electromagnetic flow meter - as shown in Figure 21

(1) Installation direction
Installation direction the flow direction of the measured fluid and the flow meter flow direction mark should be consistent.

(2) The flange gasket installed between the flanges should have good corrosion resistance, the gasket shall not be extended into the inside of the pipe.

(3) In the sensor adjacent to the pipe welding or flame cutting, should take isolation measures to prevent heat deformation of the lining.

(4) Such as installation in the well or immersed in water work, after installation and commissioning of the system, the sensor junction box must be potted with sealant. (If the magnetic flow meter selection protection level of IP68, the instrument factory has done a waterproof seal.

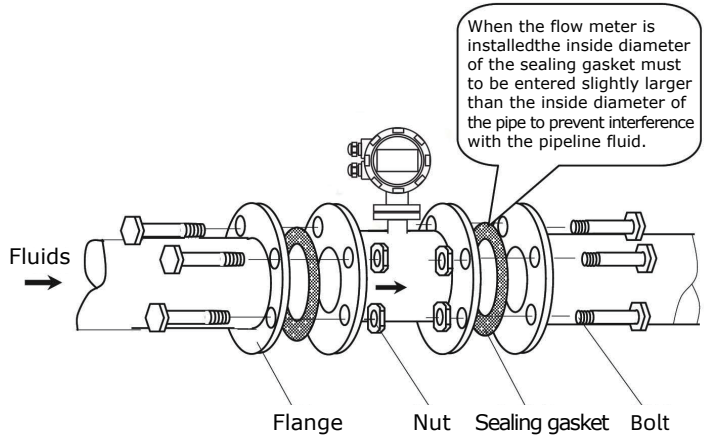


Figure 21

3.7 Sensor and converter dimensions of a pipeline magnetic flow meter

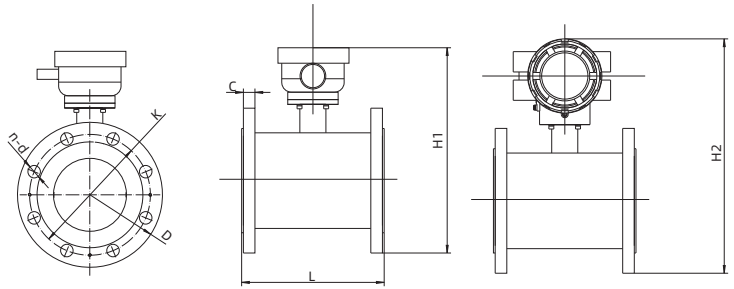


Figure 22

nominal caliber	Nominal pressure (MPa)	External dimension (mm)			Connection size (mm)				
		L	H1	H2	D	K	d	n	C
15	4.0	200	220	315	95	65	14	4	14
20		200	220	315	105	75	14	4	16
25		200	220	315	115	85	14	4	16
32		200	220	315	140	100	18	4	18
40		200	220	315	150	110	18	4	18
50		200	225	320	165	125	18	4	20
65		200	225	350	185	145	18	8	22
80		200	275	365	200	160	18	8	24
100	1.6	250	285	380	220	180	18	8	22
125		250	315	410	250	210	18	8	22
150		300	345	440	285	240	22	8	24
200	1.0	350	400	495	340	295	22	8	24
250		450	465	560	395	350	22	12	26
300		500	505	600	445	400	22	12	26
350		550	575	670	505	460	22	16	30
400		600	625	720	565	515	26	16	32
450		600	670	765	615	565	26	20	36
500		600	725	820	670	620	26	20	38
600		600	835	930	780	725	30	20	42
700	0.6	700	915	1010	860	810	26	24	40
800		800	1015	1110	975	920	30	24	44
900		900	1115	1210	1075	1020	30	24	48
1000		1000	1215	1310	1175	1120	30	28	52
1200		1200	1445	1540	1405	1340	33	32	60

⚠ Note: The size and weight of the magnetic flow meter marked here may be different from the physical product, subject to the physical.

External dimensions of the converter: as in Figure 23,unit:mm

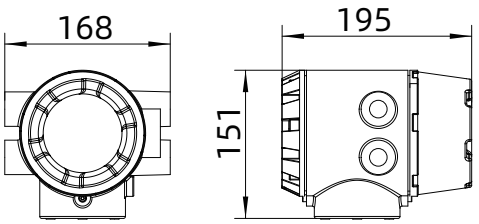


Figure 23

4. Insertion type magnetic flow meter installation

4.1 Installation Tips

Tips
Please check carefully that the box is not damaged or that it has been brutally loaded or unloaded. If there is any damage, please report the damage to the delivery person and the manufacturer or instrument shipper.

Tips
Please check the packing list to ensure you receive a complete shipment.

Tips
Check the nameplate of the instrument and make sure that the supply is the same as your order. Check that the power supply information on the nameplate is correct. If it is not correct, please contact the manufacturer or the instrument seller.

4.2 Storage

- Please store the instrument in a dry and dust-free place.
- Avoid prolonged exposure to direct sunlight.
- The instrument should be stored in its original packaging.

4.3 Installation Requirements

Tips
To ensure a reliable installation, the following measures are necessary.

- Adequate space is reserved for the sides.
- Do not subject the electromagnetic flow meter to severe vibrations.

4.4 Selection of mounting position

(1) The installation location must ensure that the pipeline is always filled with the fluid to be measured.
(2) Choose a place where the fluid flow pulsation is small, i.e. it should be away from pumps and local resistance parts such as valves and elbows.
(3) When measuring biphasic (solid, liquid or gas, liquid) fluids, choose a place where biphasic separation is not easily caused.
(4) Negative pressure at the measurement site should be avoided.
(5) The diameter or circumference of the pipe to be measured is easy to measure and the ellipticity should be small.

4.5 Length of straight pipe section

To ensure the full development of the flow velocity distribution in the pipe with the central axis as symmetry, the length of the straight pipe section upstream of the insertion type electromagnetic flow meter should comply with the provisions of the international standard ISO 7145 (see ISO 7145 regulations schedule), the length of the straight pipe section downstream should not be less than 5DN (DN for the nominal diameter of the pipe).

ISO 7145 Schedule of regulations

Type of upstream flow stopper	Minimum upstream straight pipe section length (D = inner diameter of pipe)	
	Installation at the mean flow point	Installation in the central axis of the pipe
90° elbow or T-way	50*DN	25*DN
A flat 90° elbow	50*DN	25*DN
90° elbows that are not in the same plane	80*DN	50*DN
Reducing tubes with a taper angle of 18° to 36°	30*DN	10*DN
Enlarged tubes with a taper angle of 14° to 28°	55*DN	25*DN
Fully open butterfly valve	45*DN	25*DN
Fully open ball and gate valves	30*DN	15*DN

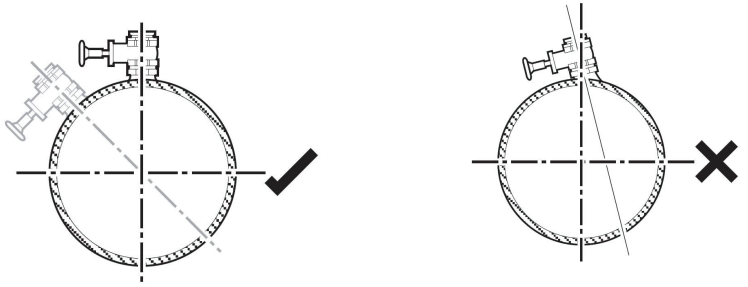
4.6 Flow control valves and regulating valves

The flow control valve should be installed on the measured pipe on the upstream side of the sensor and the flow regulation valve should be installed on the downstream side of the sensor. The flow control valve should normally be fully open during the measurement.

4.7 Welding of riser flanges or mounting joints

The technical requirements are as follows.

(1) The axis of the mounting joint and the axis of the pipe being measured are perpendicular to each other (see Figure 24) and the mounting joint should be flush with the inner wall of the measuring pipe.
(2) Stainless steel welding rod is used for flat welding. The weld shall be solid and able to withstand the specified pressure without leakage.



A. Installation illustration at the central axis of the pipe cross-section

B. Installation illustration not at the central axis of the pipe cross-section

Figure 24 Axis of the mounting joint perpendicular to the axis of the pipe under test

4.8 Inspection of the sensor before installation

1. Before installation, gently and carefully wipe off grease, dust and other contaminants from the surfaces of both poles of the measuring head of the sensor with an alcohol cotton ball or a clean gauze. Do not damage the electrode surfaces and insulating materials with hard objects.

2. Check the sensor with a multi meter before installation to comply with the following technical specifications: (split type structure only)

(1) Check the resistance value of the excitation coil: use a multi meter to measure the resistance value between the "EX +, EX -" terminals in the junction box between about 20Ω ~ 60Ω. If the measured resistance value is infinity, the coil is open; if the resistance value is 0Ω, the coil is short-circuited.

(2) The resistance value between the electrode on the end face of the measuring head and the corresponding terminal (SIG 1 or SIG 2) should be 0Ω.

(3) The ground (signal reference point) terminal (SIG GND) has been electrically connected inside the sensor to the stainless steel insert rod in good condition, the resistance value between the SIG GND terminal and the stainless steel insert rod should be 0 Ω.

(4) Insulation resistance check: the resistance value between the excitation coil, signal terminal and insertion rod is infinity. Use a multi meter to measure the resistance of the terminals "SIG 1", "SIG 2" to "SIG GND" and "EX +, EX -" to "SIG GND". "to "SIG GND" is infinite. The resistance between terminals "SIG 1" and "SIG 2" to terminals "EX1" and "EX2" is infinite.
(If the measurement does not match the above, please contact us.)

4.9 Measurement of the internal diameter of the pipe to be measured

The measured or calculated internal diameter data of the pipe to be measured is set in the data sheet of the magnetic flow converter parameters.

1. The internal diameter of the pipe to be measured can be measured

Where the internal diameter of the pipe can be measured, a vernier caliper or steel tape measure can be applied to at least four diameters within the pipe at approximately equal angles to each other for lateral measurements. If the difference between two adjacent diameters is greater than 0.3%, the number of measurements should be doubled and the arithmetic mean of the diameters measured should then be taken as the diameter of the pipe.

2. Internal diameter of the pipe to be measured is not measurable

When the internal diameter of a pipe cannot be measured directly, the internal diameter can be calculated by measuring the pipe circumference and wall thickness.

$$D = L \div 3.14 - 2e \quad \text{.....(1)}$$

D --- Internal diameter of the pipe to be measured,m
L --- Outer circumference of pipe,m
e --- Pipe wall thickness,m

4.10 Installation of sensors

(1) Clean weld slag and burrs from the base of the tube being tested.
(2) Turn off the upstream flow control valve or use a low pressure water supply.

4.11 Fixed-edge mounting type sensors

See Figure 25 for the installation of the fixed-edge mounting type sensor, insertion depth A (mm) = 0.5 times or 0.125 times the internal diameter of the pipe to be measured.

4.12 In-line pluggable mounting type sensors

The in-line pluggable mounting type sensor is installed as shown in Figure 26. The connection flange assembly, G1 1/2 ball valve and sealing sleeve are connected to the lead-in flange as a whole in the order of the parts shown. Next, the matching seal and pressure cap are inserted into the sensor insertion rod. At this point the ball valve is opened and the positioning screw on the pressure cap is loosened. The sensor insertion rod is then inserted into the pipe to be measured via the sealing sleeve and ball valve via the necking pipe. Finally, the face seal and sealing pressure ring are pressed into the sealing sleeve. Measure the insertion rod from the bottom of the adapter plate to the outer wall of the pipe to be measured dimension H, should meet the insertion depth requirements, and pay attention to the sensor direction rod should be consistent with the flow direction of the pipe, the sealing pressure ring screwed and fixed positioning screws to complete the installation process.

Connection flange specifications default for HG/T20595 DN40 PN4.0 RF, can also be made according to user requirements.

4.13 Calculation of insertion depths for in-line pluggable installation types

According to the length of the insertion rod L, there are two specifications: 600 mm and 900 mm. The diameters of the measuring pipes to which the sensors with different insertion rod lengths can be adapted are shown in the "Comparison table of insertion rod lengths and measuring pipe diameters for in-line pluggable installation types".

Comparison of sensor insertion rod lengths and measuring pipe diameters for in-line pluggable installation types

Sensor Insertion Rod Length（mm）	Nominal diameter of the pipe to be measured (D = internal diameter of the pipe)	
	Inserted at (1/2)*D	Inserted at (1/8)*D
600	DN100 ~ DN200	——
900	DN250 ~ DN400	DN450 ~ DN2000

See Figure 25, where the insertion height H is used for ease of measurement. The insertion height H is the height from the bottom of the sensor junction box to the position where the pipe meets the necking pipe. H can be calculated using the following formula.

$$H = L - A - B \quad \text{.....（2）}$$

H --- mm; Insertion height

L --- L=600mm、900mm; Nominal length corresponding to the sensor specification

A --- mm; Sensor insertion depth

B --- Wall thickness of the pipe being measured

The height H from the bottom of the sensor adapter plate to the position where the pipe meets the necking pipe should match the calculated value, measured with a vernier caliper or steel tape measure.

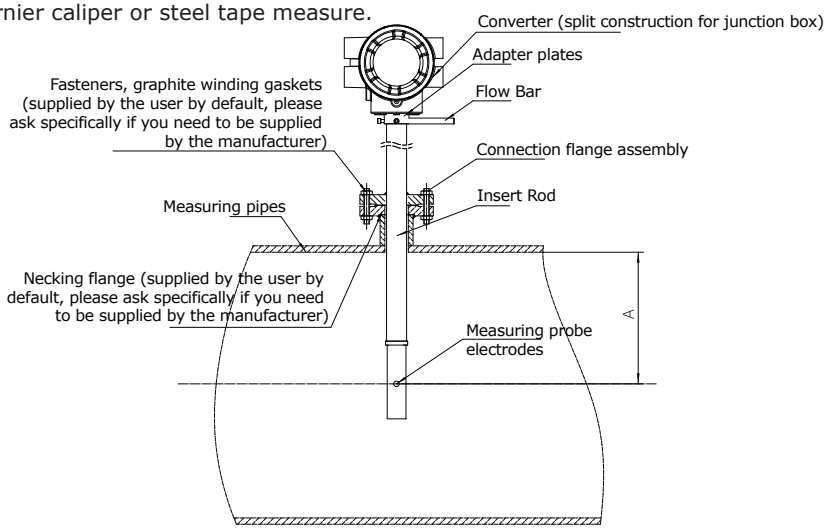


Figure 25 Illustration of the insertion depth of the sensor for the fixed-foot mounting pattern

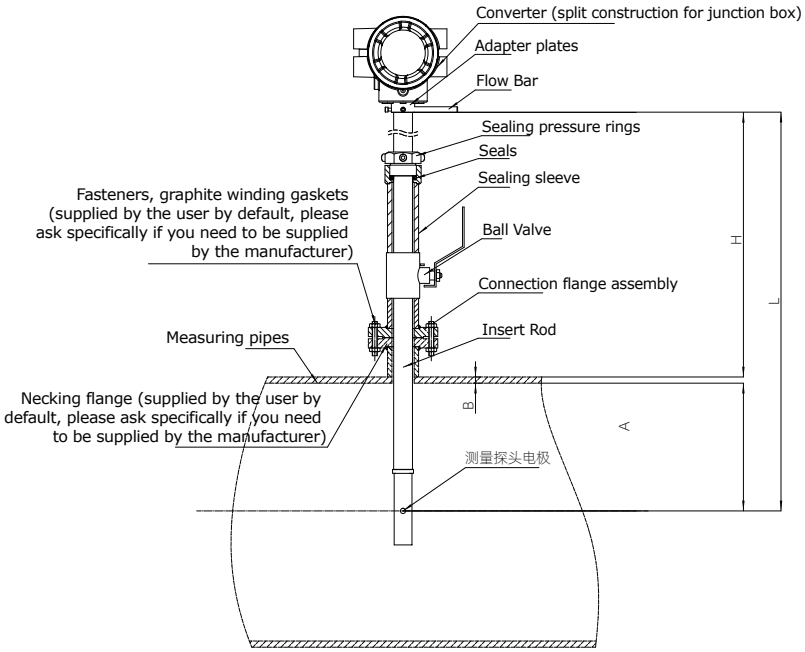


Figure 26 Illustration of the insertion depth of the inline pluggable mounting type sensor

4.14 Grounding

The flow signal generated by the sensor is very weak, usually on the order of microvolts or millivolts. Therefore, in order to prevent the impact of external electrical interference, an important factor in using a good flow meter is good grounding.

Sensor grounding requirements are mainly grounded by the measured medium. The grounding terminal of the sensor and converter (terminal "SIG GND") and the metal shield of the flow signal cable are connected and connected to the measured medium via an insertion rod. When the measured pipeline is non-metallic pipeline or serious corrosion of the inner wall, in order to ensure good grounding, can be installed in the vicinity of the flow meter set up a separate grounding, the sensor grounding terminal directly connected to the earth. At this point the grounding should be required resistance less than 10Ω.

5. Electrical Connection

5.1 Safety Tips

⚠ Danger!
All work concerning the electrical connection must be carried out with the power supply disconnected. Pay attention to the power data on the nameplate!

⚠ Danger!
Please follow your country's installation regulations.

⚠ Warning!
Please strictly adhere to local occupational health and safety regulations. Allow only properly trained personnel to work on electrical equipment.

Tips
Please check the nameplate of the instrument and make sure that the contents of the nameplate are the same as your order. Check that the power information on the nameplate is correct, if not, contact the manufacturer or instrument seller.

5.2 Connecting signal and excitation cables

⚠ Danger!
The signal cable and the excitation current cable may only be connected when the power supply is disconnected.

⚠ Danger!
The instrument must be grounded as specified to ensure safe operation.

⚠ Danger!
For instruments used in explosive atmospheres, it is also necessary to pay attention to the safety instructions given in the special explosion-proof manual.

⚠ Warning!
Strictly adhere to occupational health and safety regulations and allow only properly trained personnel to work on electrical equipment.

1. Integrated signal wiring - Fig. 27

Wiring instructions
Excitation wire:
EXT1 - the positive end of the sensor excitation coil.
EXT2 - the negative side of the sensor excitation coil.

Signal line:
SIG1 - the positive signal electrode of the sensor.
SIG2 - the signal negative electrode of the sensor.
SGND - Signal Ground.

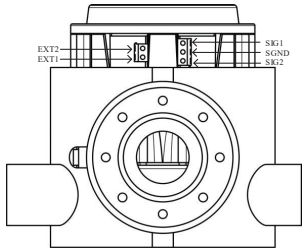


Figure 27

2. Split type signal wiring - Fig. 28

Wiring instructions
Excitation wire:
EXT1 - positive end of the sensor excitation coil; (red wire)
EXT2 - negative end of the sensor excitation coil; (yellow wire)

Signal wire:
SIG1 - signal positive electrode of the sensor; (white wire)
SIG2 - negative signal electrode of the sensor; (pink wire)
SGND - signal ground. (black wire)

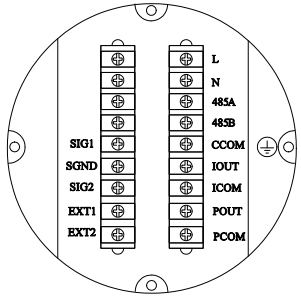


Figure 28

3. Split junction box - Fig. 29

Excitation line:
EXT1 - positive end of the sensor excitation coil.
EXT2 - the negative end of the excitation coil of the sensor.

Signal lines:
SIG1 - signal positive electrode of the sensor.
SIG2 - the negative electrode of the signal of the sensor.
SGND - signal ground.

The excitation signal and the sensor signal can be connected to the split meter head via a shielded cable line.

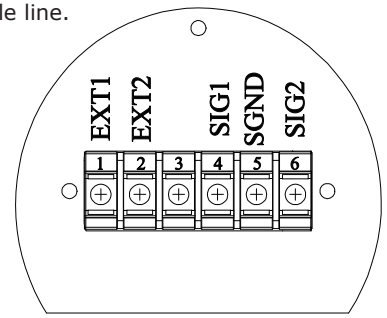


Figure 29

5.3 Measuring sensor grounding

⚠ Danger!

No potential difference is allowed between the measurement sensor and the housing or converter protection ground. Magnetic flow meter in use must be grounded separately, if the common grounding with other instruments or electrical devices, grounding leakage current in the grounding line may produce crosstalk interference on the measurement signal, will lead to magnetic flow meter can' t work in serious cases.

- The measuring sensor shall be properly grounded.
- The ground wire should not transmit any disturbing voltage.
- It is not permitted to connect other electrical equipment to the ground wire at the same time.

5.4 Converter power connections

⚠ Danger!
The apparatus must be grounded as specified to protect the operator from electric shock, as shown in Figure 30

1. 220VAC power supply-Figure 30
- Included in the allowable range: 100VAC - 240VAC, 50Hz - 60Hz
- Alternating current phase line.
- Alternating current zero line.
- Connect the ground wire to the symbol ⏚ marked copper post ground screw.

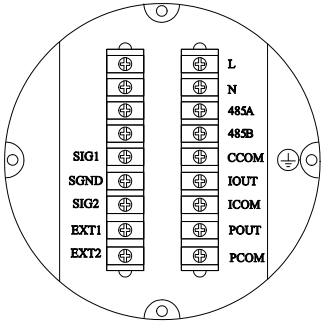


Figure 30

2. 24VDC power supply - Fig. 31

- Included in the allowable range: 22VDC -26VDC
- 24V+: positive 24VDC power supply.
- 24V-: 24VDC negative power supply.
- Connect the ground wire to the ground screw marked with the symbol.

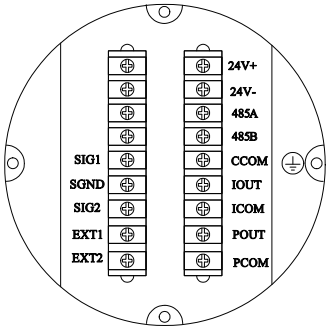


Figure 31

5.5 Input description

⚠ Warning!
Only appropriately trained and authorized personnel are permitted to install, use, operate and maintain the instrument. This document will help you establish operating conditions that will ensure the safe and efficient use of your instrument.

1. Current output
• IOUT, ICOM: 4 - 20mA output.
• Active mode: load $R_L \leq 750\Omega$, $I \leq 22mA$.
• Current corresponds to flow percentages.

2. Communication outputs
• 485A, 485B: 485 serial communication outputs.
• CCOM: 485 serial communication ground.
• Protocol: ModBus RTU.

3. Pulse, frequency and alarm outputs
• Pulse/Frequency output terminals
• 5mA Active mode: 24V high, 5mA drive current
• Output galvanic isolation: opto-isolated, isolation voltage > 1000VDC.
• Scale: Frequency output: frequency 2kHz (configurable 0-5kHz output) Electrical isolation: optoelectronic isolation, isolation voltage > 1000VDC.
• Corresponding flow range upper limit
Fmax <= 5000 cp/s; Pulse output: each pulse corresponds to the number of flow volumes (configurable), output pulse width: 0.1ms ~ 100ms, duty cycle 1:1,

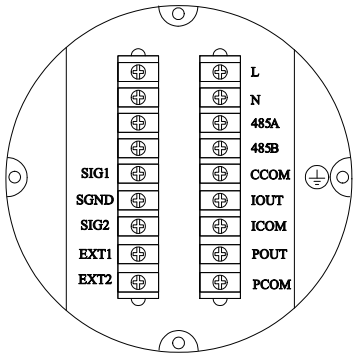


Figure 32

• Wiring schematic-Fig.33

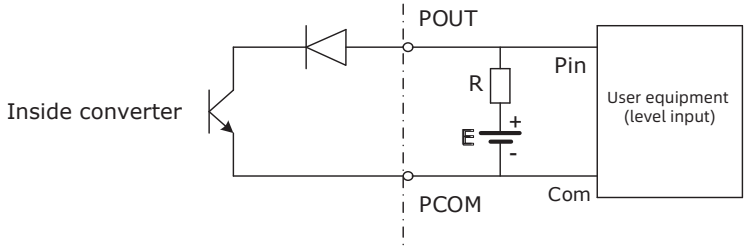


Figure 33

Additional note: The pulse output is an OC gate output and requires an external power supply. General counters have pull-up resistors, the signal can be directly connected to the counter.

Manufacturer's advice: the pull-up resistor R in the diagram is recommended to use a 2K, 0.5W resistor, in addition the power supply E is recommended to use 24V DC.

6. Start

6.1 Power on

Check that the equipment is installed correctly before turning on the power. Includes.

The flow meter must be installed in a safe and compliant manner.

Power connections shall be made as specified.

Please check the correct electrical connection of the power supply.

Tighten the back cover of the converter housing.

6.2 Converter activation

The measuring instruments, consisting of measuring sensors and signal converters, are supplied ready for immediate use. All operating parameters and hardware settings have been set according to your order.

As soon as the power supply is switched on, the instrument performs a self-test. Immediately afterwards, the instrument starts measuring and displays the current value.

Start-up screen - Figure 34

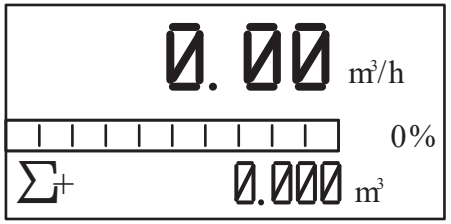


Figure 34

7. Operation

7.1 Flow display screen

Default home

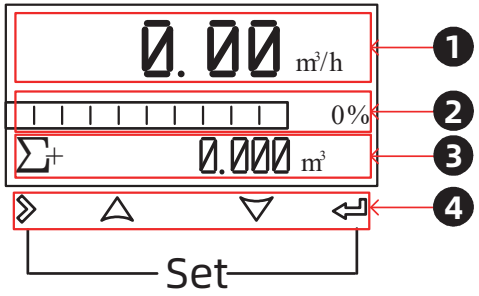


Figure 35

1. Flow rate display line 1
• Default value: Instantaneous flow
• Selectable: Instantaneous flow, Σ + forward accumulation, Σ - reverse accumulation, Σ net accumulation
• Settable cycle: instantaneous flow, Σ+ forward accumulation, Σ-reverse accumulation, Σ-net accumulation or off

2. Flow display line 2
• Default: flow bar graph
• Selectable: instantaneous flow rate, empty tube MT, flow bar graph, Σ + forward accumulation, Σ - reverse accumulation, Σ net accumulation
• Settable cycle: instantaneous flow rate, empty tube MT, flow bar graph, Σ+ forward accumulation, Σ-reverse accumulation, Σ-net accumulation or off

3. Flow display line 3
• Default: Σ + forward accumulation
• Selectable: instantaneous flow rate, empty tube MT, flow bar graph, Σ + forward accumulation, Σ - reverse accumulation, Σ net accumulation
• Settable cycles: instantaneous flow rate, empty tube MT, flow bar graph, Σ+ forward accumulation, Σ-reverse accumulation, Σ-net accumulation or off

Note:

1. Fixed and cyclic display values for display line 1/2/3 can be modified in flow configuration 12, with a cyclic interval of 10s for each parameter. 2.

2. When an alarm occurs, the alarm message (containing empty pipe alarm, upper flow limit alarm, lower flow limit alarm, pulse over limit alarm and upper flow limit) screen has a cyclic interval of 5s and a duration of 2s. The message occupies flow display rows 2 and 3 in the display screen as shown in Figure 36 below.

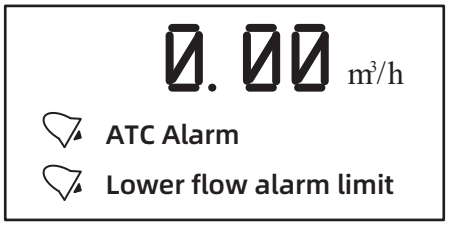


Figure 36

7.2 Operating keys: mechanical keys

Symbols	Measurement mode	Menu mode	Functional mode	Data model
>	--	Toggle menu categories	--	Data Bit Right Shift
↲	Information such as switchover accumulation	Toggle menu subcategories	Confirmation function	Confirmation data
↑ ↓	--	--	Select Function	Change data
>+↲	Enter menu mode	Exit menu	--	--

7.3 Mechanical button operation instructions

To operate the mechanical keys, open the front cover of the converter.
See the next section for details on how to access the configuration of the mechanical keypad.

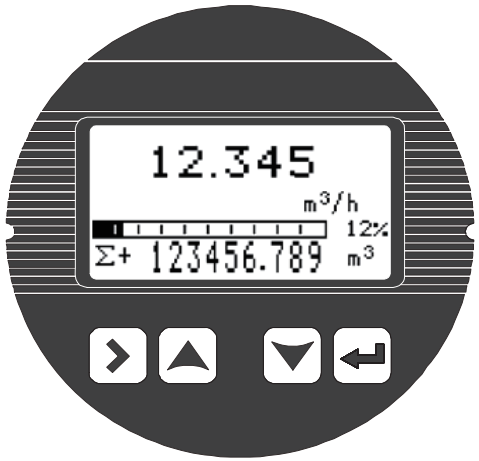


Figure 37

7.4 Operating Instructions

Selection and adjustment of parameters

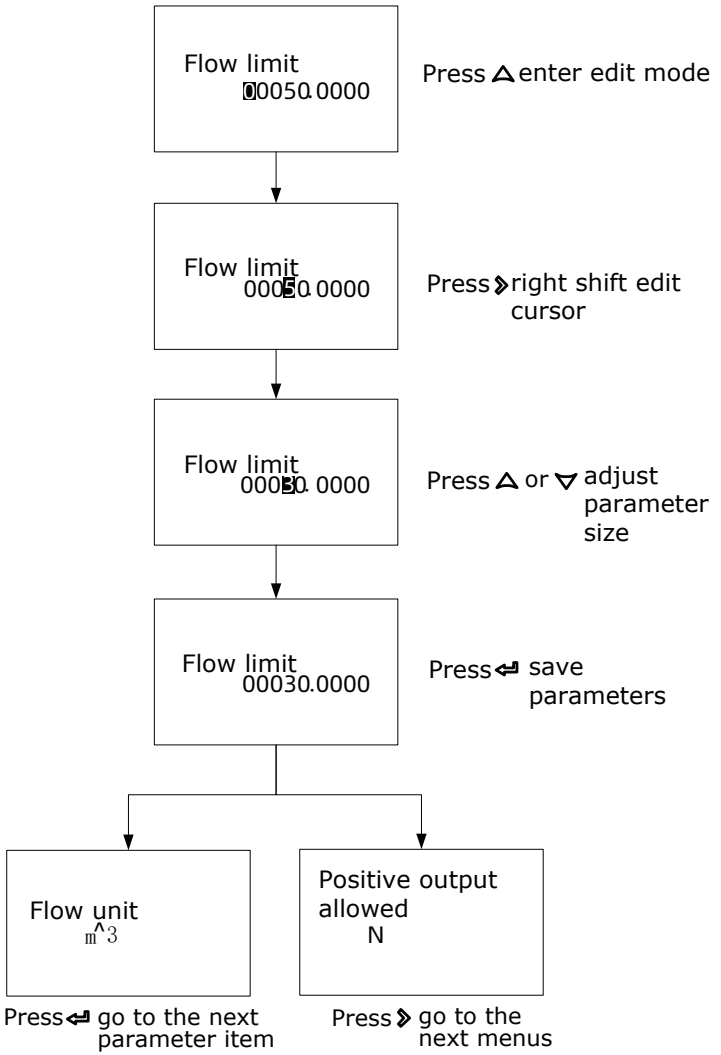
Press ⟩ and ⏎ hold simultaneously to enter the parameter setting screen.
At this point the password needs to be entered.

Initial user password: 200000 (for modifying user-level parameters)
Initial manufacturer password: 100000 (for modifying manufacturer-level parameters)
Initial manufacturer password: 300000 (for quick parameter setting)

After entering the configuration parameters the parameters can be modified by the following operations.

The user can switch between the menu pages with ⟩ key, switch between the parameter items in the menu pages with ⏎ key and store the adjusted value of the previous parameter item at the same time, and adjust the parameter value with △ and ▽ keys. For example, to adjust the "upper limit of flow".

1. Flow settings and analogue output menu



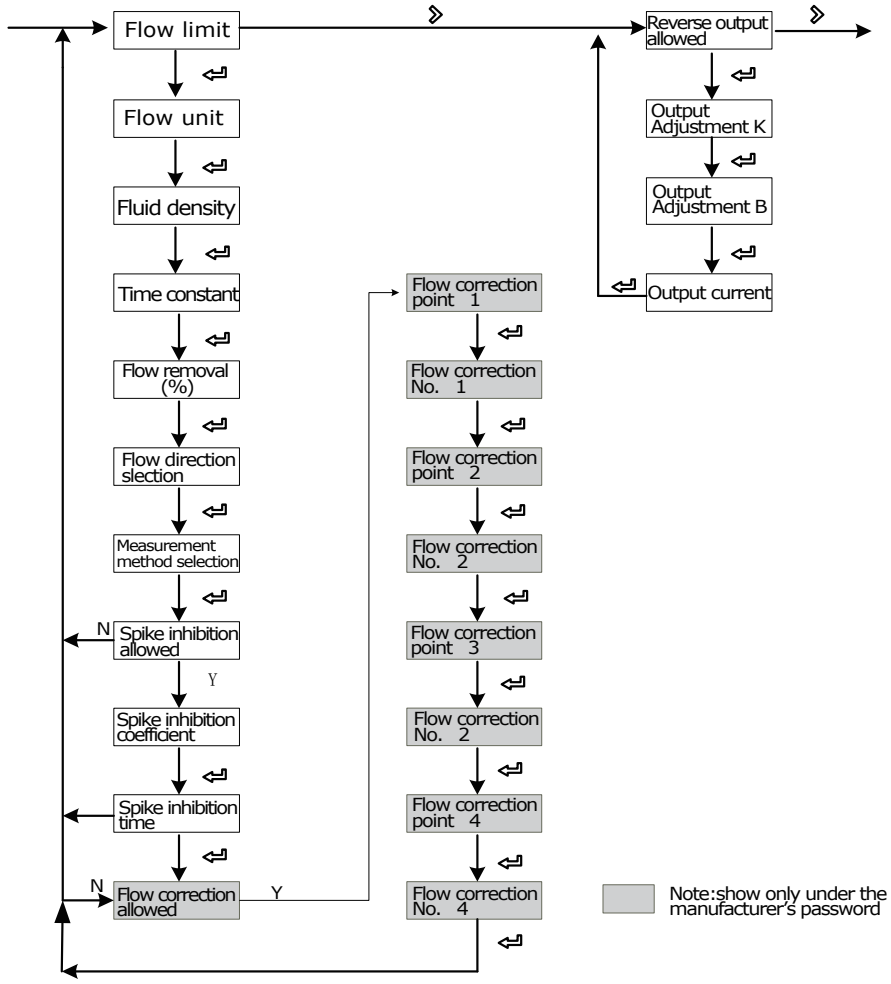


Figure 38

2. Pulse output and total setting menu

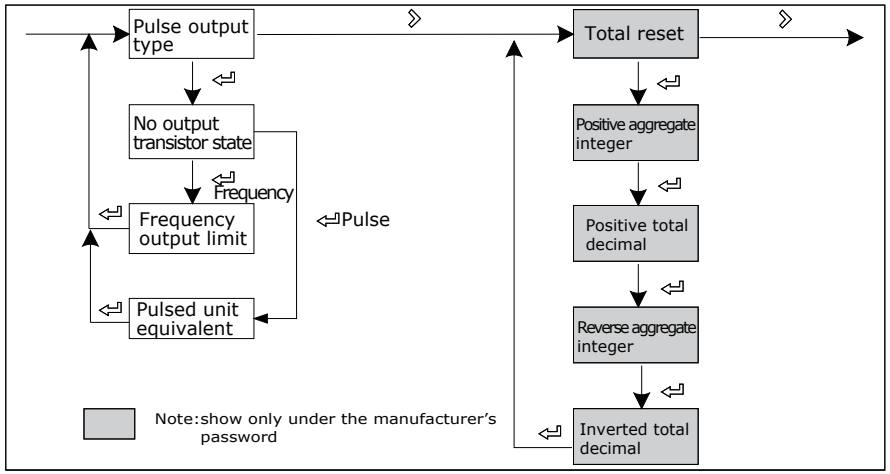


Figure 39

3. Alarm settings menu

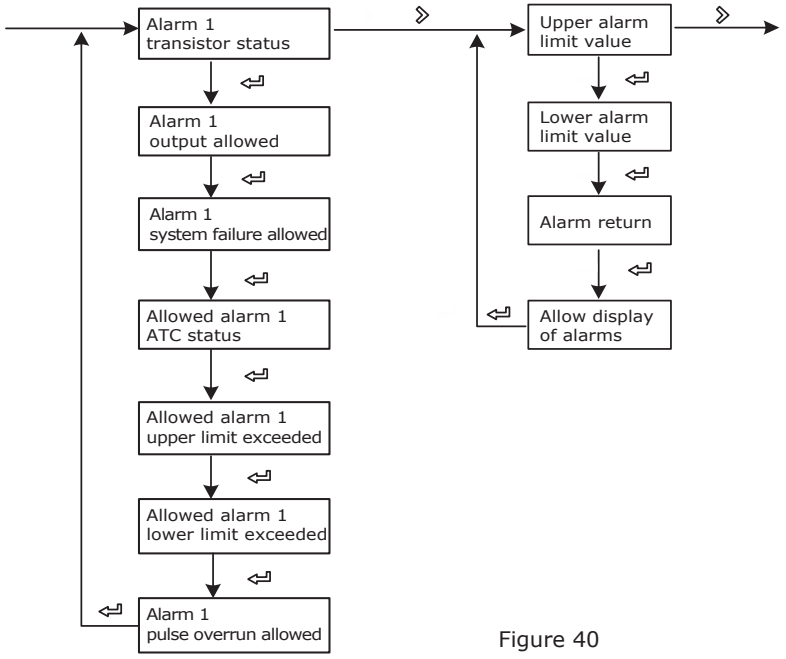


Figure 40

4. System functions, ATC functions, sensor functions, test function setup menu

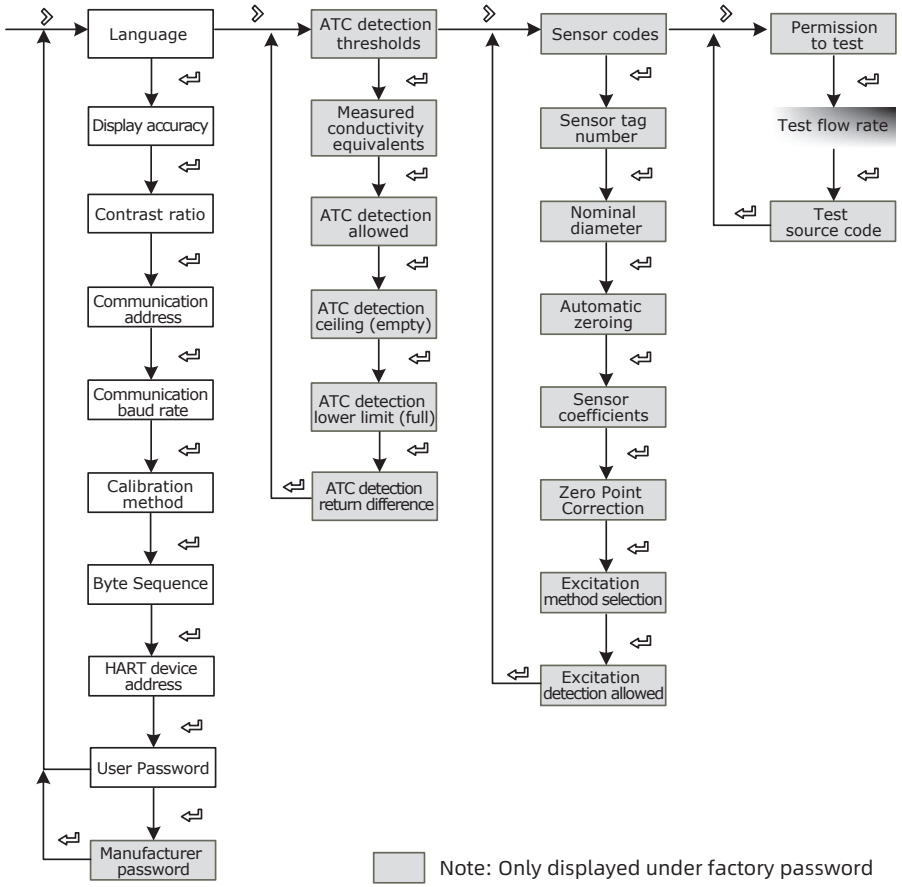


Figure 41

5. Display of parameters, pressure function setting menu

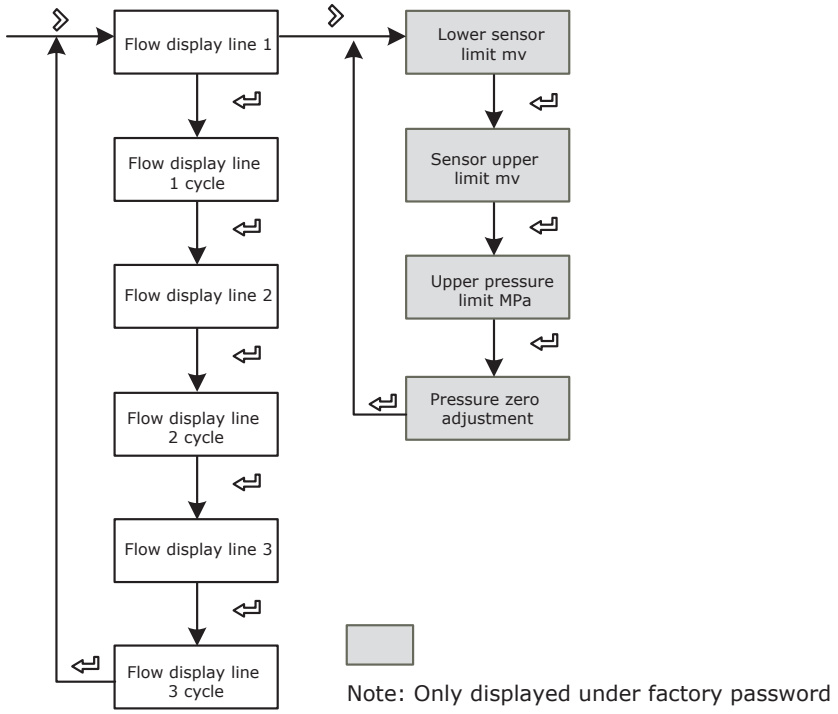


Figure 42

7.5 Detailed description of the flow configuration

No.	Parameter	Setting	Password	Parameter	Default value
1 - Flow					
1-0	Flow range		User	0-99999	35.000
	Sets the maximum upper limit value for flow rate. Used for calculating frequency, current output limit calculation; alarm and other threshold value calculation.				
1-1	Flow rate unit	Option	User	L、m^3、Kg、t	m^3/h
	The density will not be involved in the calculation by selecting a unit of volume such as L, m3, etc. The choice of mass units such as Kg, t, etc., needs to be coupled with 1-2 density parameters.				
1-2	Fluid density	Numbers	User	0.000-99.000	1.000
	Used to calculate the mass flow rate, QM = ρVM This parameter is not displayed when the flow rate is in volume units. Density unit: g/cm3				
1-3	Time constant	Numbers	User	0-99S	2s
	Filter damping coefficient, averaged over the time selected for the parameter as an instantaneous quantity.				
1-4	Flow removal	Numbers	User	0-10%	1%
	Indicates that the flow rate is below the set value and considered zero, 0 means no resection.				
1-5	Flow direction	Option	User	Forward,	Forward
	Used to change the direction of flow, when the positive and negative user signal wires are reversed, or when the sensor is mounted backwards.				
1-6	Measurement Method	Option	User	Bidirectional, Forward,	Two-way
	Sets the direction of flow measurement, forward means only forward flow is measured, reverse means only reverse flow is measured, bi-directional means flow is measured in both directions.				
1-7	Spike inhibition	Option	User	Y、N	N
	Indicates whether the spike suppression function is enabled or not. This function is used to filter out interfering signals in the working condition where the interference signal is large. The 1-8 and 1-9 configuration screens are not displayed when set to N. When the signal beating amplitude is greater than the parameters set in 1-8 and duration is less than the time set in 1-9, the system considers it to be an interfering signal and will not display and measure it.				
1-8	Spike inhibition	Numbers	User	0.01-0.8m/s	0.8
	Amplitude of spikes (not shown when spike suppression is allowed to close the configuration)				
1-9	Peak inhibition	Option	User	0-3s	1

1-10	Flow correction	Option	Manufacturers	Y、N	N
	Indicates whether or not non-linear flow correction is enabled. In principle, it is used for linear adjustment for low flow rates (0.5 m/s) or less. The feature is designed with 4 stages of correction, divided into 4 flow rate points and 4 correction factors. The flow rate corresponding to the correction point must satisfy. Correction point 1 ≥ Correction point 2 ≥ Correction point 3 ≥ Correction point 4 ≥ 0. The correction calculation is based on the original sensor flow coefficient curve, so the nonlinear correction function should be turned off first and the sensor coefficients marked. Then allow the nonlinear correction function to set the correction coefficients according to the marked sensor nonlinearity and correct it in sections. If the coefficients are set appropriately, no need to recalibrate. Wherein the original flow rate is the actual standard flow rate, the corrected flow rate said the corrected flow rate, the correction formula is as follows. In the interval between correction point 1 > original flow velocity ≥ correction point 2. Corrected flow rate = correction factor 1 x original flow rate. In the interval between correction point 2 > original flow velocity ≥ correction point 3. Corrected flow rate = correction factor 2 x original flow rate. In the interval between correction point 3 > original flow velocity ≥ correction point 4. Corrected flow rate = correction factor 3 x original flow rate. In the correction point 4 > original flow rate ≥ 0. Corrected flow rate = correction factor 4 x original flow rate. Note: When setting correction points, the following relationship should be maintained. Correction point 1 > Correction point 2 > Correction point 3 > Correction point 4 > 0 The median value of the correction factor is 1.0000, with a factor greater than 1 correcting the flow rate higher and a factor less than 1 correcting the flow rate lower.				
1-11	Flow correction	Numbers	Manufacturers	0.0-99.999	0
	Flow correction point 1, this parameter is not displayed when the flow function is off.				
1-12	Flow	Numbers	Manufacturers	0.0-99.999	1.000
	Flow trim factor 1, which is not displayed when the flow function is off.				
1-13	Flow	Numbers	Manufacturers	0.0-99.999	0
	Flow correction point 2, this parameter is not displayed when the flow function is off.				
1-14	Flow	Numbers	Manufacturers	0.0-99.999	1.000
	Flow trim factor 2, which is not displayed when the flow function is off.				
1-15	Flow	Numbers	Manufacturers	0.0-99.999	0
	Flow correction point 3, this parameter is not displayed when the flow function is off.				
1-16	Flow	Numbers	Manufacturers	0.0-99.999	1.000
	Flow trim factor 3, which is not displayed when the flow function is off				
1-17	Flow	Numbers	Manufacturers	0.0-99.999	0
	Flow correction point 4, this parameter is not displayed when the flow function is off.				
1-18	Flow	Numbers	Manufacturers	0.0-99.999	1.000
	Flow trim factor 4, which is not displayed when the flow function is off.				

2-Current output					
No.	Type	Option	Password level	Parameter	Default value
2-0	Reverse output allowed	Option	User	Y、N	N
	4-20mA output required for flow rate reversal, pulse/frequency; cannot be turned off for flow rate reversal.				
2-1	Adjustment K	Numbers	User	0-99999	1
	For adjusting the current output value, I = Kx + B				
2-2	Adjustment B	Numbers	User	0-99999	0
	For adjusting the current output value, I = Kx + B				
2-3	Output Current	Display	User	4.00-20.00	--
	Displays the current milliamp value of the output current.				
3-pulse/frequency/alarm output					
3-0	Pulse output type	Option	User	Frequency,	frequency
	Selectable frequency/pulse equivalent/				
3-1	No output transistor	Option	User	High/Low	High level
	Selects the output level when there is no frequency output, no pulse equivalent output, and no alarm output.				
3-2	Frequency output limit	Numbers	User	0-5000	2000
	Set the frequency value corresponding to the upper limit of the instantaneous flow rate; when frequency output is selected, this parameter is displayed.				
3-3	Pulse equivalent (L/P)	Option	User	0.001-999.999	1
	Sets the cumulative amount represented by each pulse; this parameter is displayed when Equivalent Output is selected.				
4 - Cumulative					
4-1	Accumulate to zero	Option	Manufacturers	Y、N	N
	Cumulative total removals				
4-2	Positive cumulative	Numbers	Manufacturers	0-999999999	0
	Set the positive total integer part				
4-3	Positive cumulative	Numbers	Manufacturers	0.0-0.999	0
	Set the decimal part of the positive total				
4-4	Inverse cumulative	Numbers	Manufacturers	0-999999999	0
	Set the inverse total integer part				
4-5	Inverted cumulative	Numbers	Manufacturers	0.0-0.999	0
	Set the reverse total decimal part				

5-Alarm contact 1					
No.	Type	Option	Password level	Parameter range	Default value
5-1	Allow alarm 1 output.	Option	User	Y/N	N
	Contact 1 is allowed to output the total switch, and when set to N, the following parameters are not displayed.				
5-3	Allow alarm 1 empty pipe status.	Option	User	Y/N	N
	Allow empty pipe alarm output switch, the system detects an empty pipe, contact 1 will automatically output an alarm signal. When the alarm output configuration is allowed to be N, this parameter is not displayed.				
5-4	Allow alarm 1 limit over run	Option	User	Y/N	N
	The allowable flow limit alarm output switch will automatically output an alarm signal to contact 1 when the instantaneous volume is greater than the set value of the flow limit. The specific setting is described in 7-0. This parameter is not displayed when the allowable alarm output configuration is N.				
5-5	Allow alarm 1 lower limit over ride.	Option	User	Y/N	N
	The allowable lower flow limit alarm output switch will automatically output an alarm signal when the instantaneous volume is less than the lower flow limit setting value, contact 1. The specific setting is described in 7-1. This parameter is not displayed when the allowable alarm output configuration is N.				
7-Alarm settings					
No.	Type	Option	Password level	Parameter range	Default value
7-0	Upper limit for alarms	Numbers	User	0-999.9%	100%
	Set the alarm value of the upper limit alarm, percentile of the range.				
7-1	Lower alarm limit	Numbers	User	0-999.9%	0%
	Set the alarm value of the lower alarm limit, percentile of the range.				
7-2	Alarm return differential	Numbers	User	0-99.9%	1%
	Used to eliminate disturbances on alarm				
	Upper limit alarm conditions: instantaneous quantity less than upper limit alarm value - return difference				
	Lower limit alarm condition: instantaneous quantity greater than lower limit alarm value + return difference				
7-3	Display alarm permission	Option	User	Y/N	N
	Allows alarm messages to be displayed on the main screen.				

8-System					
8-0	Language	Option	User	Chinese/English	Chinese
	Language for configuration display				
8-1	Display accuracy	Numbers	User	0-4	2
	The number of decimal places in the instantaneous quantity				
8-2	Contrast	Numbers	User	0-100%	50%
	LCD Contrast LCD contrast				
8-3	Instrument Address	Numbers	User	1-247	8
	Instrument address based on RS485 Modbus RTU communication protocol				
8-4	Communication baud rate	Option	User	1200、2400、4800、9600、	9600
	Baud rate for physical layer serial communication				
8-5	Calibration method	Option	User	None / Odd / Even	N/A
	Physical Layer Serial Communication Checksum				
8-6	Byte order	Option	User	2-1 4-3、3-4 1-2、4-3 1-2、1-2	2-1 4-3
	Byte exchange sequence for physical layer serial communication				
8-6	User password	Numbers	User		0
	User-level passwords for viewing and modifying user-level parameter configurations.				
	This parameter is not displayed when entering with the manufacturer's password.				
	Factory initial password：200000				

9 - ATC parameters					
9-0	ATC detection threshold	Numbers	Manufacturers	0-100%	40%
	Validity of ATC Alarm Judgment				
9-1	Equivalent value of measured conductivity	Display	Manufacturers		
	Displays the equivalent value of the measured conductivity of the fluid. General natural water: in full pipe equivalent value <200, in empty pipe >1200 (actual and fluid conductivity and the length of the measurement line has a relationship, when the wiring distance of 20m is recommended to use double shielded line, otherwise it will affect the empty pipe detection function)				
9-2	ATC testing permits	Option	Manufacturers	Y，N	Y
	Set whether to turn on ATC detection function				
9-3	Upper limit for ATC testing	Numbers	Manufacturers	0-9999	1200
	The equivalent value of the measured conductivity when the tube is empty, and the default value can be used directly for general natural water. The special fluid needs to observe the 9-1 value of the empty tube and write 9-3				
9-4	Lower limit for ATC	Numbers	Manufacturers	0-9999	174
	The equivalent value of the measured conductivity when the pipe is full, generally natural water can directly use the default value. Special fluids need to observe the value of 9-1 when the empty pipe, write 9-4				
9-5	Empty pipe detection backlash	Numbers	Manufacturers	0-9999	30
	For the return difference judged by the empty pipe detection, the default value can be directly used within 20 meters of the signal line.				

10-Sensors					
10-0	Sensor code	Numbers/symbols	Manufacturers	16 digits	
	For identification of sensors				
10-1	Sensor Tag No.	Numbers	Manufacturers	6 digits	000000
	Product Manufacturer Number				
10-2	Nominal diameter	Option	Manufacturers	3-2000	50
	Size of the sensor				
10-3	Zero-point adjustment	Option	Manufacturers	-9.99-9.99mv	0.00mv
	The code value of the sensor in the case of a static full tube (average value within 30 seconds) Generally, when the sensor has good symmetry and good wiring (with good shielding), the code value is within ±0.1, and no adjustment is required.				
10-4	Sensor coefficient	Numbers	Manufacturers	0-99999	
	The sensor manufacturer calibrates the coefficient of this flow meter to the actual water volume. Detailed sensor coefficient calibration section.				
10-5	Calibration factor	Numbers	Manufacturers		
	Factory normalized calibration factor for converter manufacturers				
10-6	Zero correction	Numbers	Manufacturers	0-99.999	
	For correction of sensor nonlinearity at low flow rates (up to 0.3 m/s). Detail Sensor Coefficient Calibration Section.				
10-7	Excitation mode selection	Option	Manufacturers	3.125Hz、6.25 Hz、12.5 Hz、25 Hz	6.25Hz
	Selection of excitation frequency Mode 1: 3.125Hz Mode 2: 6.25Hz				
10-9	Gain option	Option	Manufacturers	1/3/9	3
	Gain option: Change the gain of the instrument to change the range of the measured flow rate. Options for gain size: 1, 3, 9				

11- Test Parameters					
11-0	Permission to test	Selection	Manufacturer	Y/N	N
	Set to Y to make the test flow rate valid and automatically revert to N after power failure.				
11-1	Test flow rate (m/s)	Figures	Manufacturer	-12.000~12.000	1.000
	To set the simulated flow rate, set "11-0 Allow Test" to "Y".				
11-2	Test source code	Selection	Manufacturer	Y/N	N
	When set to Y the signal original code will be displayed on the run screen, this screen also displays the firmware version number and the product serial number.				

12- Display Parameters					
12-0	Flow display line 1	Selection	User	Instantaneous flow, forward accumulation, reverse accumulation, net accumulation	Instantaneous flow
	A parameter can be selected as the display parameter for flow display line 1.				
12-1	Flow display line 1 cycle	Selection	User	Instantaneous flow, forward accumulation, reverse accumulation, net accumulation, shutdown	Close
	A parameter can be switched off or another parameter can be selected as a cyclic display parameter for flow display line 1.				
12-2	Flow display line 2	Selection	User	Instantaneous flow rate, empty tube MT, flow bar graph, forward accumulation, reverse accumulation, net accumulation, pressure	Flow bar diagram
	One parameter can be selected as the display parameter for line 2 of the flow display and "Pressure" is optional for the optional pressure function.				
12-3	Flow display line 2 cycle	Selection	User	Instantaneous flow rate, empty tube MT, flow bar graph, forward accumulation, reverse accumulation, net accumulation, pressure, shutdown	Close
	A parameter can be switched off or selected as a recurring parameter in line 2 of the flow display, and "Pressure" is optional for the optional pressure function.				
12-4	Flow display line 3	Selection	User	Instantaneous flow rate, empty tube MT, flow bar graph, forward accumulation, reverse accumulation, net accumulation, pressure	Positive Accumulation
	One parameter can be selected as the display parameter for line 3 of the flow display and "Pressure" is optional for the optional pressure function.				

12-5	Flow display line 3 cycle	Selection	User	Instantaneous flow rate, empty tube MT, flow bar graph, forward accumulation, reverse accumulation, net accumulation, pressure, shutdown	Close
	A parameter can be switched off or selected as a recurring parameter in line 3 of the flow display, and "pressure" is optional with the optional pressure function.				

30- Pressure Parameters					
30-1	Lower sensor limit mv	Figures	Manufacturer	-99.999~99.999	+00.000
	The lower mv value of the pressure sensor can be set.				
30-2	Upper sensor limit mv	Figures	Manufacturer	-999.9~999.9	120
	The upper mv value of the pressure sensor can be set.				
30-3	Upper pressure limit MPa	Figures	Manufacturer	0~99.999	1.6
	Upper pressure limit can be set.				
30-4	Pressure zero adjustment	Figures	Manufacturer	-99.999~99.999	+00.000
	The measured pressure value can be adjusted by increasing or decreasing the value of the zero point.				

7.6 Quick Setup Menu

Access to the quick setup menu

1. Press ❯ and ↵ hold simultaneously to enter the parameter setting interface.
2. Enter the password: 300000.
3. Once in the quick setting interface, the user can use the ↵ keys to switch between menu pages, adjust the parameter values with ▲and he ▼ keys, and confirm with the ↵ key.
4. The parameters that can be set are listed below.
5. After changing, move to the menu page [Exit Configuration], select Y and ↵ confirm with the key.

No.	Parameter text	Setting Method	Parameter range	Default value
1	Nominal Diameter	Option	3-2000	50
2	Flow limit	Numbers	0-99999	35.000
3	Sensor coefficient	Numbers	0-99999	1.000
4	Zero correction	Numbers	0-99999	0.0
5	Accumulate to zero	Option	Y、N	N
6	Flow removal	Numbers	0-99%	1%
7	time constant	Numbers	0-99S	03

8. Functions

8.1 System information

The flow meter itself has a self-diagnostic function, in addition to the power supply and circuit board hardware failure, for the general application of the fault can correctly give the corresponding alarm information.

Position displayed in the measurement screen

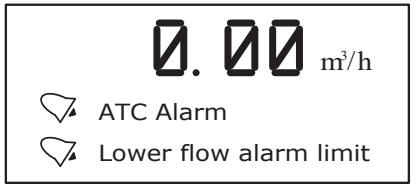


Figure 43

System Information Sheet

Display	Alarm Content
ATC alarms	Sensor vacant tube
Flow alarm upper limit	Current instantaneous exceedance of the set flow alarm upper limit
Lower Flow Alarm Limit	Current instantaneous below the set lower limit of the flow alarm
Pulse over limit alarm	Pulse output frequency exceeds the set frequency limit
Flow rate over limit	The current instantaneous flow rate exceeds the user-set flow limit

8.2 Flow correction function operating instructions

In principle, it is used for linear adjustment of small flow rates (0.5m/s) or less. The correction calculation is performed on the original sensor flow coefficient curve, therefore, the non-linear correction function should be switched off first and the sensor coefficients marked out. The non-linear correction function is then allowed and the correction coefficient is set according to the marked sensor non-linearity and corrected in sections. If the coefficients are set appropriately, there is no need to recalibrate. The function is designed with a 4 segment correction, divided into 4 flow rate points and 4 correction coefficients.

The flow rates corresponding to the correction points must satisfy.

Correction point 1 ≥ Correction point 2 ≥ Correction point 3 ≥ Correction point 4 ≥ 0.

Where the original flow rate is the actual standard flow rate, the corrected flow rate is called the corrected flow rate, and the corrected formula is as follows.

• In the interval where the original flow rate > correction point 1: the flow rate is not corrected and the original flow rate is maintained.

• In the interval correction point 1 > original flow rate ≥ correction point 2: correction flow rate = correction factor 1 × original flow rate.

• In the interval correction point 2 > original flow rate ≥ correction point 3: correction flow rate = correction factor 2 × original flow rate.

• In the interval of correction point 3 > original flow rate ≥ correction point 4: correction flow rate = correction factor 3 × original flow rate.

• In the interval of correction point 4 > original flow rate ≥ 0: correction flow rate = correction factor 4 × original flow rate.

Note: A correction factor equal to 1 will not correct the flow rate, a factor greater than 1 will correct the flow rate higher and a factor less than 1 will correct the flow rate lower.

Example of site requirements 1

The original flow rate was in the range of 0 to 0.4m/s and the factor was changed to 1.2 times.

Parameter settings

Point of correction 1 (m/s)	Point of correction 2 (m/s)	Point of correction 3 (m/s)	Point of correction 4 (m/s)
0.4	0	0	0
Number of corrections 1	Number of corrections 2	Number of corrections 3	Number of corrections 4
1.2	1	1	1

Corrected flow rate

Original flow velocity between 0 and 0.4m/s
Corrected to 1.2 × original flow rate

Example of site requirements 2

First section, original flow velocity in the range of 0.2 to 0.4m/s, with the factor changed to 0.9 times.

Second section, original flow rate at 0.4~0.5m/s, coefficient changed to 1.1 times.

Parameter settings

Point of correction 1 (m/s)	Point of correction 2 (m/s)	Point of correction 3 (m/s)	Point of correction 4 (m/s)
0.5	0.4	0.2	0
Number of corrections 1	Number of corrections 2	Number of corrections 3	Number of corrections 4
0.9	1.1	1	1

Corrected flow rate

Original flow velocity between 0.2 and 0.4m/s	Original flow velocity between 0.4 and 0.5m/s
Corrected to 1.1 × original flow rate	Corrected to 0.9 × original flow rate

Example of site requirement 3.

First section, original flow velocity in the range of 0.1 to 0.2m/s, with the coefficient changed to 0.9 times.

Second section, original flow velocity in the range of 0.2 to 0.3m/s, with the coefficient changed to 1.1 times.

In the third section, the original flow velocity is in the range of 0.3 to 0.4m/s and the coefficient is changed to 0.8 times.

Point of correction 1 (m/s)	Point of correction 2 (m/s)	Point of correction 3 (m/s)	Point of correction 4 (m/s)
0.4	0.3	0.2	0.1
Number of corrections 1	Number of corrections 2	Number of corrections 3	Number of corrections 4
0.8	1.1	0.9	1

Corrected flow rate

Original flow velocity between 0.1 and 0.2m/s	Original flow velocity between 0.2 and 0.3m/s	Original flow velocity between 0.3 and 0.4m/s
Corrected to 0.9 × original flow rate	Corrected to 1.1 x original flow rate	Corrected to 0.8 × original flow rate

Example of site requirements 4.

First section, original flow velocity in the range of 0.1 to 0.2m/s, with the factor changed to 0.9 times.

Second section, original flow rate at 0.3~0.4m/s, coefficient changed to 1.1 times.

Parameter settings

Point of correction 1 (m/s)	Point of correction 2 (m/s)	Point of correction 3 (m/s)	Point of correction 4 (m/s)
0.4	0.3	0.2	0.1
Number of corrections 1	Number of corrections 2	Number of corrections 3	Number of corrections 4
1.1	1	0.9	1

Corrected flow rate

Original flow velocity between 0.1 and 0.2m/s	Original flow velocity between 0.3 and 0.4m/s

8.3 Pulse/Frequency/Current Outputs

Pulse-equivalent output

It is mainly used for sensor manufacturer coefficient calibration and user metering. Set in group 3 configuration parameters.

The pulse equivalent corresponds to the cumulative volume, indicating the corresponding number of volumes per pulse.

Example: Parameter set to 0.1L/p
The current instantaneous volume is 3.6m3/h.
Number of pulses per second: 3.6 x 1000/3600/0.1 = 10

Note: When the parameter is set to 0.4L/p
The current instantaneous volume is 3.6m3/h
The number of pulses output per second is: 3.6×1000/3600/0.4 = 2.5

In the above case, the fractional part of 2.5 pulses will automatically accumulate to the next second output without data loss.

When the flow in the pipeline is large, the pulse equivalent should not be too small, otherwise it will cause the pulse output to exceed the upper limit. At this time, the system alarm information of Pls will appear on the main screen. The user needs to reset the pulse equivalent parameters. Similarly, when the flow in the pipeline is small, the selected pulse equivalent should not be too large, otherwise it will cause the instrument to output a pulse for a long time, causing errors in the measurement.

Pulse equivalent output is different from frequency output, pulse output can accumulate enough pulse equivalent to output one pulse, so the pulse output is uneven. When measuring the pulse output, you should use a counter instead of a frequency counter.

Frequency output

It is mainly used for factory coefficient calibration and user metering. Set in group 3 configuration parameters.

The frequency corresponds to the instantaneous volume and the upper frequency limit corresponds to the maximum flow rate.

Note: The maximum frequency setting is 5000Hz.

Current output

Mainly used for variable transmission output to other intelligent instruments, such as: digital meters, recorders, PLC, DCS and so on.

The output current type is: 4-20mA.

The current value corresponds to the instantaneous quantity of flow, 20mA corresponds to the upper limit of range, and 4mA corresponds to the lower limit of range.

Conversion relationship.

$$I_{\substack{actual\\time}} = \frac{Q_{\substack{actual\\time}}}{Q_{max}} 16.00 + 4.00$$

Note: Q represents instantaneous flow in real time.
Q MAX represents the current meter range.
I represents real-time current value in real time.

8.4 Serial Communication

This instrument provides standard RS485 serial communication interface, adopts international MODBUS-RTU communication protocol, supports 04 read input register command.

Register address

Communication data and register addresses are listed in the following table.

Parameters	Type	Add.	Description
Instantaneous flow rate	float	100	
Instantaneous velocity of flow	float	102	
Percentage of flow	float	104	50 for 50%
conductivity	float	106	
Positive flow cumulative integer	ulong	108	
Cumulative decimal of positive flow	ulong	110	The decimal part is magnified 1000 times, and 123 represents 0.123.
Reverse flow cumulative integer	ulong	112	
Reverse Flow Cumulative Decimal	ulong	114	The decimal part is magnified 1000 times, and 123 represents 0.123.

Note: For float/ulong/long type data, communication is transmitted in byte order 2-1-4-3; for push type data, it is transmitted in 2-1.

Communication Configuration

Communication Address：1-247.

Default address: 8
Baud rate：1200、2400、4800、9600、19200、38400、57600.
Default Baud Rate：9600.

Checksum: no checksum, odd checksum, even checksum.
No checksum by default.

For the way 32-bit data (long plastic or floating point) is arranged in the communication frame.

Example: Long shaping 16909060 (01020304H): 03 04 01 02
Floating point number 4.00 (40800000H): 00 00 40 80

1. Example of reading real time floating point communication:
Real-time volume floating point reading
Send a message：08 04 00 63 00 02 81 4C
Return message：08 04 04 22 6E 41 3F 79 61(瞬时流量 Instantaneous flow：11.95)

Positive flow accumulation reading
Send a message：08 04 00 6B 00 04 80 8C
Return message：08 04 08 00 6C 00 00 00 7B 00 00 D6 8E (Cumulative integer: 108, cumulative decimal: 0.123, cumulative: 108.123)

8.5 Hart Communications

The instrument provides a Hart 6.0 communication interface and supports the following communication commands.

1. HART command 0: Read the identification code
Returns the extended device type code, version and device identifier.

Request	
None	
Response	
Byte 0	254
Byte 1	Manufacturer ID
Byte 2	Type of equipment
Byte 3	Minimum number of precursors requested (master->slave)
Byte 4	Generic command file version number
Byte 5	Equipment specification version number
Byte 6	Device software version number
Byte 7	(first five bits) the device hardware version number, (last three bits) the physical signal type
Byte 8	Device markings
Byte 9-11	Equipment ID number
Byte 12	Minimum number of leading codes for the response (slave->master)
Byte 13	Maximum number of device variables
Byte 14-15	Configuration modification count
Byte 16	Additional equipment status (maintenance required/parameter alarms)

2. HART command 1: Read main variable (PV)
Returns the value of the main variable as a floating point type.

Request	
None	
Response	
Byte 0	Primary variable unit code
Byte 1-4	Main variable value

3. HART command 2: Reads the main variable current value and percentage
Read the main variable current and the percentage, the main variable current always matches the AO output current of the device. The percentages are not limited to 0-100% and will track to the upper and lower limits of the sensor if the range of the main variable is exceeded.

Request	
None	
Response	
Byte 0-3	Main variable current in milliamps (mA)
Byte 4-7	Main variable range percentage (%)

4. HART command 3: Read dynamic and main variable currents
Reading of the main variable current and 4 (max.) pre-defined dynamic variables, the main variable current always matches the AO output current of the device. The second, third and fourth variables are defined for each device type, e.g. the second variable is the sensor temperature etc.

Request	
None	
Response	
Byte 0-3	Main variable current in milliamps (mA)
Byte 4	Primary variable unit code
Byte 5-8	Main variable value
Byte 9	Second variable unit code
Byte 10-13	Second variable value
Byte 14	Third variable unit code
Byte 15-18	Third variable value
Byte 19	Fourth variable unit code
Byte 20-23	Fourth variable value

5. HART command 6: Write POLLING address

This is the data link layer management command. This command writes the Polling address to the device, which is used to control the primary variable AO output and to provide the device identification.

The main variable AO of the device can only be output if the Polling address of the device is set to 0. If the address is 1 to 15 then the AO is inactive and does not respond to the application process, when the AO is set to minimum; and the third bit of the transmission status is set - the analog output of the main variable is fixed; the upper/lower limit alarm is invalid. If the Polling address is changed back to 0, the main variable AO is active again and can also respond to the application process.

The second byte returns whether the device is in current mode. The following commands can only be used if current mode is enabled.

40#: enter/exit fixed current mode
45#: Adjusts the current zero point
46#: Adjust current gain
66#, 67#, 68#: Analogue output mode

Request	
Byte 0	Polling address of the device
Byte 1	Current mode code
Response	
Byte 0	Polling address of the device
Byte 1	Current mode code

6. HART command 14: Read master variable sensor information
Read the master variable sensor serial number, sensor upper and lower limit/minimum accuracy (Span) unit code, master variable sensor upper limit, master variable sensor lower limit and sensor minimum accuracy. The sensor upper and lower limit/minimum accuracy (Span) units are the same as those for the master variable.

Request	
None	
Response	
Byte 0-2	Master variable sensor serial number
Byte 3	Primary variable sensor upper and lower limit and minimum accuracy unit codes
Byte 4-7	Upper limit of the main variable sensor
Byte 8-11	Lower limit of the main variable sensor
Byte 12-15	Minimum accuracy of the main variable sensor

7. command 15: Read device information
Read master variable alarm selection code, master variable transfer function code, master variable range unit code, master variable upper limit value, master variable lower limit value, master variable damping value, write protect code and master issuer code.

The main variable damping values are used for equipment range percentages and variable flows.

Request	
None	
Response	
Byte 0	Master variable alarm selection code
Byte 1	Master variable passing Transfer function code
Byte 2	Unit codes for upper and lower range values of main variables
Byte 3-6	Upper limit value of the main variable
Byte 7-10	Lower limit value of the main variable
Byte 11-14	Damping value of main variable in seconds
Byte 15	Write protection code
Byte 16	Trademark issuer code
Byte 17	Master variable analogue channel flag, whether it is an analogue input channel for a field device.
Byte 18-20	Date

8. Command 34: Write main variable damping value
This is a command about a primary variable.
The damping value of the main variable represents a time constant (the output to the step response should be 63% of the steady state value when this time is reached). Both the analogue and digital outputs of the variable use this variable.

Request	
Byte 0-3	Damping value of main variable in seconds
Response	
Byte 0-3	Actual main variable damping value in seconds

9. Command 35: Write main variable range value
This is a command concerning the range of the main variable.

The upper and lower limits of the main variable range are independent and most devices allow the upper range of the device to be lower than the lower limit to allow the device to operate at the reverse output.

The units of the master variable range received by this command do not affect the units of the master variable for this device. The master variable range value is returned in the units received.

Request	
Byte 0	Main variable range unit codes
Byte 1-4	Upper range limit for main variables
Byte 5-8	Lower limit of the main variable range
Response	
Byte 0	Main variable range unit codes
Byte 1-4	Upper range limit for main variables
Byte 5-8	Lower limit of the main variable range

10. Command 40: Enter/exit fixed main variable current mode
This is a command concerning the loop current.

The device is configured in fixed mains current mode and the response value shows the actual current value of the current device.

If the request value is set to "0", the fixed current mode will be exited, as will the device when it is powered off.

Request	
Byte 0-3	Fixed main variable current value in milliamps
Response	
Byte 0-3	Actual fixed main variable current values in

11. Command 44: Write primary variable units
This is a command concerning the master variable.

A master variable unit is selected and both the master variable value and the range are returned in that unit. The master variable sensor upper and lower limits and the master variable minimum accuracy Span also use this value as a unit.

Request	
Byte 0	Primary variable unit code
Response	
Byte 0	Primary variable unit code

12. Command 45: Adjust the circuit current zero point
This is a command relating to the loop current.

The loop current value is adjusted to 0 or a lower value, typically setting the loop current to 4.00mA. the current value sent may be rounded or truncated and the current current value will be returned.

If the device is not in the correct loop current mode or the current is not set to the exact minimum, a response code 9 - Incorrect current mode or value - will be returned.

Request	
Byte 0-3	Externally measured current values in milliamps
Response	
Byte 0-3	Actual measured main variable current values in milliamps

13. Command 46: Adjust loop current gain
This is a command relating to the loop current.

The loop current value is adjusted to a maximum and will normally set the loop current to 20.00mA. the current value sent may be rounded or truncated and will return the current current value.

If the device is not in the correct loop current mode or the current is not set to the exact minimum, a response code 9 - Incorrect current mode or value - is returned.

Request	
Byte 0-3	External measurement of the main variable current value in milliamps
Response	
Byte 0-3	Actual measurement of main variable current values

14. Command 59: Number of response leading characters to write
This is a data link layer management command and should only be used for asynchronous physical layer links such as FSK.

This command selects the minimum number of leading characters to be sent before the response packet starts. This number includes the two leading characters included in the message header. The number may be set to between 5 and 20.

Request	
Byte 0	The number of leading characters to be sent in the response message
Response	
Byte 0	The number of leading characters to be sent in the response message

15. Example: Adjusting the circuit current zero point

The 4-20mA loop transmits a dynamic master variable via an analogue signal, which requires the loop current values to be unified between the master and the slaves. The loop current command allows the master to impose a loop current value on the field device and to perform a two-point adjustment of the field device loop current value (corresponding to ZERO and SPAN). The loop current adjustment process is as follows.

(a) With command 40, enter/exit the fixed current mode and set the current to the minimum value for the device, normally 4mA.

With command 45, the loop current zero point is adjusted. The device returns the current value after adjustment, which may deviate from the host setting due to rounding.

With command 40, enter/exit the fixed current mode and set the current to the maximum value of the device, usually 20mA.

With command 46, adjust the loop current gain.

If a more accurate setting is required, repeat steps 1-4. When the loop current has been calibrated, exit the fixed current mode (set to 0mA) via command 40.

9. Technical Parameters

9.1 Technical Parameters

Measurement System

Measuring Principle	Faraday's theorem of electromagnetic induction	
Function	Real-time measurement of instantaneous flow, flow rate, mass flow (when density is constant) and flow accumulation.	
Modular structure	The measurement system consists of a measuring sensor, a signal converter and a pair of PT1000 temperature sensors.	
Converter		
Integral Type	Protection class IP65	
Split Type	Protection class IP65	
Measuring Sensor		
Calibre	DN15-DN450	
Flange	Comply with GB/T 9119-2000 standard carbon steel (optional stainless steel flanges), other standard flanges can be	
Rated Pressure Rating (High pressure can be customized)	DN6 - DN50, PN<4.0MPa	
	DN65 - DN150, PN<1.6MPa	
	DN200 – DN600, PN<1.0MPa	
	DN700 – DN2000, PN<0.6MPa	
Lining material	Polychloroprene Rubber(CR), Perfluoroethylenethelene F46(FEP), Perfluoroethylenethelene F46(FEP) plus stencil, PFA plastic(PFA), PTFE, PVDF	
Electrodes	Stainless Steel 316L, Hastelloy (HB and HC), Titanium, Tantalum, Platinum	
Protection class	IP68	IP65
Medium temperature	-25 – 180℃	-10 – 80℃
Embeddability	Less than 5m (split sensor with IP68 protection only)	
Immersion depth	Less than 3m (split sensor with IP68 protection only)	
Sensor Cables	For split use only, 10m of cable is standard; other cables are recommended for customization up to a maximum of 20m.	
Insertion Sensor		

Functions

Communication	Serial, Hart, Bluetooth
Output	Current (4-20mA), pulse, frequency, status switching quantity
Function	Air tube identification, electrode contamination

Display User Interface

Graphic display	Monochrome LCD display, white backlight, 128*64 pixels OLED display, green, 128*64 pixels
Display function	3 measured value screens (measurement, status, etc.) with automatic cycling
Language	Chinese language
Unit	The units can be selected via the configuration menu, see "6.3 Configuration details", section "1-1 flow units" and "4-0 accumulation units".
Operating unit	4 mechanical keys or 4 optical keys

Measurement Accuracy

Accuracy Rating	Tube section type: 0.5 class Insertion type: 1.5 class
Repeatability	Tube section type: 0.15% Insertion type: 0.5%
Max. measured flow rate	12m/s

Operating Environment

Temperature	
Ambient temperature	Integral Flow Meter -10℃ – 55℃, Sensor section of split flow meter -10°C - 60°C Transducer section of split flow meter -10°C - 55°C
Storage temperature	-40℃ – 65℃
Conductivity	
Water	Minimum 20μS/cm (actual measurable conductivity should be greater than 30μS/cm)
Other	Minimum 5μS/cm (actual measurable conductivity should be greater than 30μS/cm)

Materials

Sensor housing	Carbon steel
Converter	Standard die-cast aluminum

Electrical Connection

Power supply voltage	100-240VAC，50/60Hz
Power consumption	Maximum 15VA
Signal Cable	For split type only
Shielded cable	Signal section, lead wire: 0.5mm2 Cu /AWG20

Output

Current output		
Function	Measurement of volume and mass (with constant density)	
Set up	Scope	4-20mA
	Range limit	20mA
	lower limit of range	4mA
Internal voltage	24VDC	
Load	≤750Ω	
Pulse and frequency output		
Function	Can be set as pulse output or frequency output	
Pulse output	Basic	Output pulse width：0.1ms ~100ms
	Set up	0.001L – 1m3
Frequency	Range limit	Fmax ≤ 5000Hz
	Set up	0-5000Hz
Active	Active frequency/pulse output voltage U internal ≤ 24VDC	
	Active frequency/pulse output current I ≤ 4.52mA	
Passive	U external ≤ 36VDC	
Status output		
Function	Can be used as an alarm status output	
Passive	U external ≤ 36VDC	
Active	Active output voltage U internal ≤ 24VDC	
	Active output current I≤ 4.52mA	

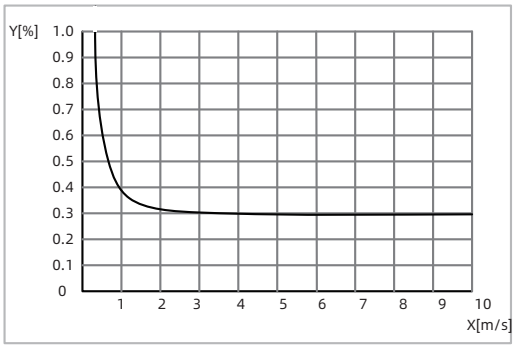
9.2 Flow Sheet

Conversion formula: flow rate Q = flow rate V x π x (DN/2)2, in m/s and m3/h

	Q100% Unit m3/h			
V[m/s]	0.3	1	3	7
DN[mm]	Minimum Flow Rate	Common Flow Rate		Maximum Flow Rate
10	0.08	0.28	0.85	1.96
20	0.34	1.13	3.39	7.91
25	0.53	1.77	5.30	12.39
32	0.87	2.90	8.69	20.27
40	1.36	4.52	13.57	31.67
50	2.12	7.07	21.21	49.48
65	3.58	11.95	35.84	83.62
80	5.43	18.10	54.29	126.67
100	8.48	28.27	84.82	197.92
125	13.25	44.18	132.54	309.25
150	19.09	63.62	190.85	445.32
200	33.93	113.10	339.30	791.70
250	53.01	176.71	530.13	1236.97
300	76.34	254.47	763.41	1781.29
350	103.91	346.36	1039.08	2424.52
400	135.72	452.39	1357.17	3166.73
500	212.06	706.86	2120.58	4948.02
600	305.37	1017.90	3053.70	7125.30
700	415.62	1385.40	4156.20	9697.80
800	542.88	1809.60	5428.80	12667.20
900	687.06	2290.20	6870.60	16031.40
1000	848.22	2827.40	8482.20	19791.80

9.3 Accuracy

Reference conditions - Figure 44
Medium: water
Temperature: 20°C
Pressure：0.1MPa
X [m/s]: Flow rate
Y [%]: Deviation from the actual measured value



10. Disassembly

10.1 Warning

Before disassembly, be aware of hazardous process conditions, e.g., pressure in the vessel, high temperatures, corrosive or toxic media.
Refer to the installation procedures in 6.3 and the instructions in section 7.2 Electrical Wiring for dismantling of the completed components in reverse order of operation.

10.2 Waste removal

Please follow the existing guidelines for waste disposal in your region.

11. Product Certifications

Product Certification			
Certification		Certificate No.	Scope of certification
Functional safety integrity level SIL3	SIL		SIL 2 @ HFT=0; SIL 3 @ HFT=1, Route 2_H
CE certification	CE	E8A160896863001	Rated Voltage : 10-240VAC,50-60Hz Rated Power: <=15W Prontection Class: I
Explosion Proof Certificate	Ex NEPSI	GYB19.2641X	Ex ia/ d e IIC T4 Ga/Gb
Type approval certificate of measuring instruments	PA	12F211-21	