

LD-C INSERTION MAGNETIC FLOW METER

Summary

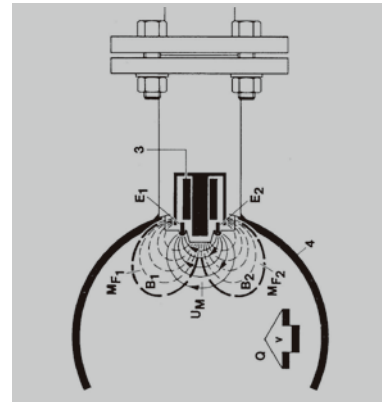
The plug-in electromagnetic flow meter is composed of two parts: a plug-in sensor and a converter. The sensor is composed of a rod, an electrode, an exciting coil, a ball valve, a sealing connecting rod, etc. The converter includes an internal circuit board and a converter housing, whose function is to amplify, process and calculate the flow signal, which can display instantaneous flow, cumulative flow, and output pulse, analog current and other signals for the measurement and control of fluid flow. LD-C series plug-in electromagnetic flow meter adopts intelligent converter, which not only has measurement, display and other functions, but also supports data remote transmission, wireless remote control, alarm and other functions.

Functional Characteristics

- Compared with the conventional pipe flowmeter, the one-time input cost is low and the installation cost is low.
- Fixed size installation type product structure is simple, reliable, simple debugging and maintenance.
- Online pluggable installation type products can be easily installed and disassembled under low pressure or with pressure without stopping water.
- Can be simply installed in the existing pipeline, very suitable for the existing pipeline to increase flow measurement and monitoring points.
- The measurement accuracy is not affected by the temperature, pressure, density, viscosity, electrical conductivity (conductivity greater than $20\mu\text{s}/\text{cm}$) of the measured medium.
- Sensor has almost no pressure loss and very low energy loss. Especially suitable for large and medium diameter pipeline flow measurement and control.
- Adopt advanced low frequency square wave excitation, zero stability, strong anti-interference ability, reliable operation.
- Wide flow measurement range, the full scale flow rate in the measured pipeline can be arbitrarily set from 0.5m/s to 10m/s, and the output signal is linear with the flow.

Working principle

According to Faraday's law of electromagnetic induction, an induced voltage (U_m) is generated when a conductor moves in a magnetic field (B). Using the electromagnetic induction measurement method, the fluid medium is equivalent to a conductor in motion, and the direction of fluid flow (V) is perpendicular to the direction of electromagnetic field (B_1, B_2). Since the constant alternating magnetic field is generated by switching DC current with alternating polarity, the distance between the magnetic field intensity (B) and the electrode (E_1, E_2) is constant. The induced voltage (U_m) is proportional to the fluid flow rate (v). In the signal converter, the induced signal voltage is amplified and converted into analog and digital signals, and the fluid velocity and flow rate are calculated according to the pipe diameter.





Application scope of the product

The LD-C plug-in electromagnetic flowmeter is used to measure the volume flow of conductive fluid in the closed pipeline, which is suitable for the flow measurement and control of the production process of petrochemical industry, iron and steel metallurgy, water supply and drainage, water irrigation, water treatment, environmental sewage total control, papermaking, medicine, food and other industrial and agricultural departments.

Type LD-C is suitable for DN100~DN2000 pipelines, which can measure and monitor the flow rate or velocity of the fluid medium with an electrical conductivity of not less than $20\mu\text{S}/\text{cm}$. The measurement of the LD-C type is independent of changes in fluid pressure, temperature, density and viscosity, and can also be measured with small amounts of solid particles or bubbles.

Performance parameter

product appearance	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Figure 1 Monotype</p> </div> <div style="text-align: center;">  <p>Figure 2 Polytype</p> </div> </div>
Applicable nominal diameter	DN100-DN2000
Accuracy of measurement	When the flow rate is measured, $v > 1\text{m/s}$, the measurement accuracy is $\pm 1.5\%$; When measuring the flow rate, $0.1\text{m/s} < v \leq 1\text{m/s}$, the measurement accuracy is $\pm 2.5\%$
Measured velocity range	0.5m/s~10m/s
Maximum temperature of the measured medium	0°C~+70°C
Ambient temperature	-10°C~60°C
Dielectric conductivity	>30uS/cm
Nominal pressure	0.6MPa、1.0MPa、1.6MPa 2.0Mpa(Customizable up to 4.0MPa)
Electrode structure	2 electrode structure
Electrode material	316L/ Hastelloy C276
Insert probe housing material	Measuring head PEEK 120°C
Connecting format	General purpose G2 pipe threaded connection, flange connection optional
Sensor protection class	One body IP65 ,Polytype IP68
Split type special signal cable	Standard configuration 10m , 100m Collected

Product form

The type LD-C electromagnetic flowmeter is composed of a plug-in electromagnetic flow sensor (hereinafter referred to as the sensor) and an electromagnetic flow converter (hereinafter referred to as the converter). The sensor detects an induced signal of the flow rate of the fluid flowing through the pipe, and the converter converts the induced signal into a standard electrical signal (4 to 20 mA or pulses, etc.). The sensor is mounted together with the converter, called a body (see Figure 1), and is used for in-situ measurement to display velocity and flow rate, etc. The sensor and the converter are respectively installed as split-type (see Figure 2). When the split-type sensor is installed, the sensor and the converter are connected together in the junction box with a special signal cable. When the IP68 FANG grade is required, the converter is far away from the measurement site, and the terminals and cable joints are sealed and insulated with sealant in the junction box.

The sensor structure is shown in Figure 3, and consists of the main speed measuring head (hereinafter referred to as the probe), insertion rod, junction box, mounting base, sealing positioning mechanism, etc.

1. Detection probe: in the pipeline is measured at the point of flow, used to detect the flow rate of the point. The probe is made of an insulating material on which a pair of electrodes are installed.

2. Insert rod: made of stainless steel material, the detection probe is fixed on the insert rod. The excitation leads and electrode leads are sealed with the measured medium by means of an insert rod and connected to a junction box (or converter). The orientation indication mark is installed on the insert rod to ensure that the working magnetic field, flow rate and electrode connection are perpendicular to each other during installation, in line with the requirements of Faraday's induction law.

3. Junction box: used in a separate structure, the junction box is located on the upper part of the sensor, and the terminal in the junction box connects the sensor and the converter.

4. Online insertion and removal of installation accessories: The sealing system is composed of stainless steel connecting flange components, ball valves, sealing sleeves, sealing pressure rings, and positioning screws to insert the electromagnetic flow sensor. Through the ball valve open and close insert rod, so that the sensor inserted in the sealing sleeve within a certain movement space, you can install or remove the flow sensor under low pressure or pressure conditions.

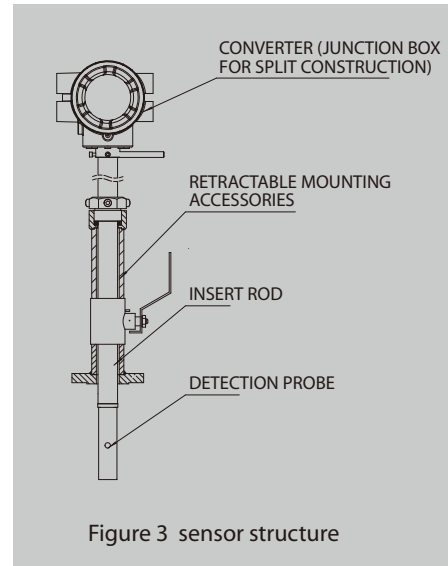


Figure 3 sensor structure

Product Type

Model	Suffix Code										Instruction
LD-	<input type="checkbox"/>	<input type="checkbox"/>	—	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Electromagnetic flowmeter
Pressure rating	0.6										0.6 MPa
	1.0										1.0 MPa
	1.6										1.6 MPa
	2.0										2.0 MPa
	4.0										4.0 MPa
TypeType	C										Plug-in
Diameter	100										Pipe minimum dia (see dia table)
	2000										Pipe max dia (see dia table)
Installation			F								Flange installation
			L								G2 thread installation
Electrode material			K1								Stainless 316L
			K2								Hastelloy C(HC)
Lining material			F7								PEEK project plastic
Protection Level			W65								IP65
			W68								IP68
Converter installation			C3								One body
			S								Polytype
Power Supply			P0								100VAC-220VAC 50Hz/60Hz
			PI								22V D0 24VDC
Selected function			/T1								4-20mA output
			/TH1								4-20mA output+ HART communication function
			/EX								Explosion proof
			/KD1								OLED Scree

Selection example

The model of the electromagnetic flowmeter, LD-1.0C-300FK1F7W65C3P0/T1, indicates that the function of the instrument is: Working pressure 1.0MPa, plug-in structure, pipe diameter DN300, flange connection, stainless steel 316L electrode, PEEK lining, protection grade IP65, one-type machine structure (meter head and sensor installed together), working power AC 110/220V, 1 channel 4-20mA signal output.

Select the installation environment

- (1) should be as far away as possible from equipment with strong fields, such as large motors, large transformers, etc.
- (2) The installation site should not have strong vibration, the pipeline is fixed firmly, the ambient temperature should not change much, and the sun is not directly exposed.
- (3) The installation environment should be easy to install and maintain.

Installation location selection

- (1) The installation position must ensure that the pipeline is always filled with the measured flow body.
- (2) Select a place where the fluid flow pulsation is small, that is, it should be far away from local resistance parts such as pumps and valves and elbows.
- (3) When measuring two-phase (solid, liquid or gas, liquid) fluids, a place that is not easy to cause two-phase separation should be selected.
- (4) Negative pressure should be avoided at the measurement site.
- (5) The diameter or circumference of the pipeline to be measured is easy to measure, and the ellipticity should be small.

Length of straight pipe section

In order to ensure the full development of the flow rate distribution in the pipeline with the central axis as the symmetry, the length of the upstream straight pipe section of the plug-in electromagnetic flowmeter should comply with the provisions of the international standard ISO7145 (see the ISO7145 schedule), and the length of the downstream straight pipe section should not be less than 5DN (DN is the nominal

ISO 7145 Required Schedule

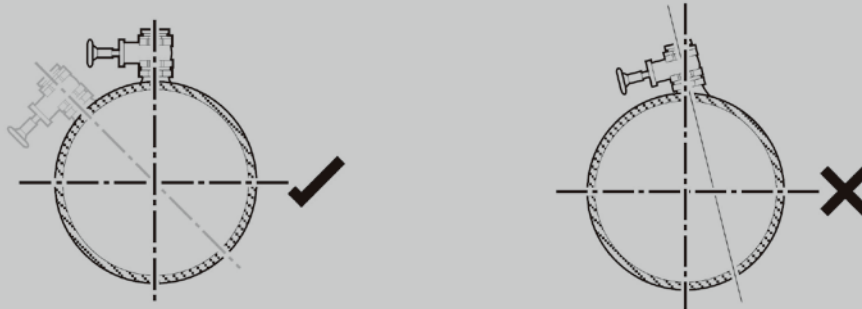
Type of upstream choke of instrument	Minimum upstream straight pipe length (D= pipe diameter)	
	Installation at average flow rate points (D/8)	Installation of pipe center shaft (D/2)
90° elbow or T-tee	50*DN	25*DN
A flat 90° elbow	50*DN	25*DN
Not 90° elbows in the same plane	80*DN	50*DN
Taper Angle 18° to 36° reduced pipe	30*DN	10*DN
Expansion tube with cone Angle 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

Flow control valves and regulating valves

The flow control valve shall be installed on the measured pipeline on the upstream side of the sensor, and the flow regulation valve shall be installed on the downstream side of the sensor. When measuring, usually the flow control valve should be in full open state. Welding of riser flanges or mounting joints.

The technical requirements for welding are as follows

- (1) The axis of the installation joint is perpendicular to the axis of the pipeline to be measured (see Figure 4), and the installation joint should be flush with the inner wall of the measurement pipeline.
- (2) Flat welding with stainless steel electrode. The weld is firm and can withstand the specified pressure without leakage.



A. Install the diagram on the central axis of the pipe cross section

B. Do not install the diagram on the central axis of the pipe cross section

Pic 4. The axis of the installation joint is perpendicular to the axis of the pipeline under test

Check the sensor before installation

A. Before installation, use an alcohol cotton ball or clean gauze to gently and carefully wipe off grease, dust and other dirty materials on the surface of the sensor measuring head poles. Do not use hard objects to damage the electrode surface and insulation material.

B. Before installation, use a multimeter to check the sensor, which meets the following technical indicators: (only sub-body structure)

(1) Check the resistance value of the excitation coil: Use a multimeter to measure the resistance value between the "EX +" and "EX -" terminals in the terminal box (see Figure 9), which is about 20Ω~60Ω. If the measured resistance value is infinite, 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 0 Ω.

(3) The grounding (signal reference point) wiring terminal (SIG GND) has been electrically connected with the stainless steel insert rod inside the sensor, and 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 insert rod is infinite. Use a multimeter to measure that the resistance between the wiring terminals "SIG 1" and "SIG 2" and "EX + and EX -" and "SIG GND" is infinite. The resistance of terminals "SIG 1" and "SIG 2" to terminals "EX1" and "EX2" is infinite.

(If the measurement is inconsistent with the above, please contact us.)

Measurement of the inner diameter of the pipeline under test

Set the measured or calculated pipe diameter data to the electromagnetic flow converter parameter data sheet.

1. The inner diameter of the pipeline under test can be measured

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

2. The inner diameter of the pipeline under test cannot be measured

When the inner diameter of the pipe cannot be measured directly, the inner diameter can be calculated by measuring the circumference and wall thickness of the pipe:

$$D = L \div 3.14 - 2e$$

Calculation:

- D --- Inside diameter of pipeline to be measured, m
- L --- Outer perimeter of pipe, m
- e --- pipe wall thickness, m

Sensor installation

- (1) Clean the welding slag and burr of the installation base of the tested pipe.
- (2) Turn off the upstream flow control valve or use low pressure water supply.

Size mounting type sensor

The installation of the sensor is shown in Figure 5. Insertion depth A (mm) = 0.5 times or 0.125 times of the inner diameter of the measured pipe.

Inline pluggable mounting type sensor

The installation of the in-line pluggable mounting type sensor is shown in Figure 6. Install the G1 1/2 ball valve to the joint on the welded pipe under test (seal the joint by wrapping the external thread with teflon tape). Then wrap the outer thread end of the sealing sleeve with teflon tape to install the other end of the ball valve. Next, the matching standard rubber O-ring and pressure cap are fitted into the sensor insertion rod. At this point, open the ball valve and loosen the positioning screw on the pressure cap. Then the sensor insertion rod is inserted into the pipeline under test through the sealing sleeve and ball valve. Finally, the rubber O-ring and pressure cap are pressed into the sealing sleeve. Measure the measurement insert rod from the bottom of the junction box to the outer wall of the pipeline to be measured, H, should meet the insertion depth requirements, and pay attention to the sensor direction rod should be consistent with the pipeline flow direction, close the ball valve, tighten the pressure cap and fix the positioning screw to complete the installation.

On-line pluggable mounting type sensor insertion depth calculation

According to its insertion rod length L is divided into: 600mm, 900mm two specifications. For measuring pipe diameters adapted to sensors with different insertion rod lengths, see "Comparison Table between sensor insertion rod length and measurement pipe diameter for online pluggable installation types".

On-line pluggable mounting type of sensor insertion rod length and measuring pipe diameter comparison table

Sensor Insert rod length (mm)	Nominal diameter of pipe to be measured (D= inside diameter of pipe)	
	Insert to (1/2) *D	Insert to (1/8) *D
600	DN100 ~ DN200	---
900	DN250 ~ DN400	DN450 ~ DN2000

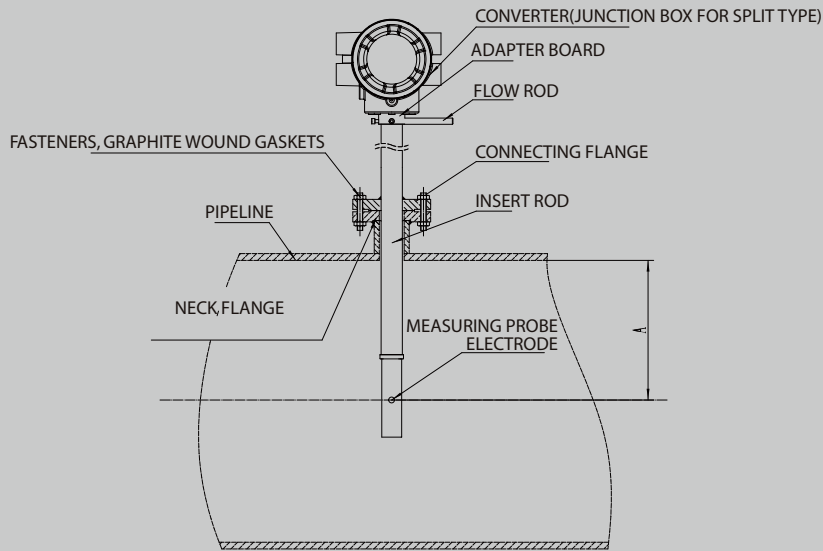
See pic 6, For easy measurement, insert height H is used here. Insertion height H refers to the height from the bottom of the sensor junction box to the position where the pipe meets the neck tube. H can be calculated by the following formula:

$$H=L-A-B$$

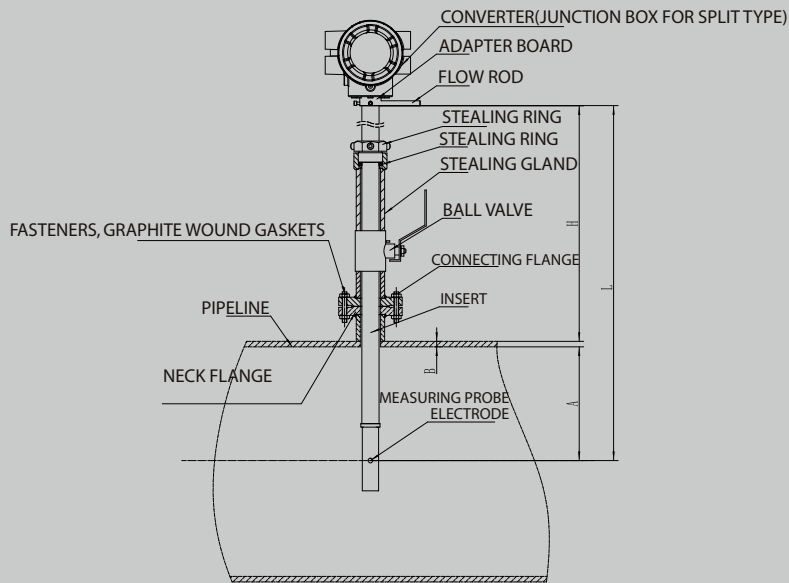
Calculation :

- H --- Insert height, mm
- L --- Nominal length corresponding to sensor specifications, L=600mm, 900mm
- A --- Sensor insertion depth (D/2 or D/8) ,mm
- B --- The wall thickness of the measured pipe, mm

Measurement with vernier calipers or steel tape from the bottom of the sensor adapter plate to the position where the pipe meets the neck tube height H should conform to the calculated value.



Pic 5. Fixed size mounting type sensor insertion depth diagram



Pic 6 Inline pluggable mounting type sensor insertion depth diagram

Ground connection

The flow signal generated by the sensor is very weak, usually in the microvolt or millivolt class. Therefore, in order to prevent the influence of external electrical interference, an important factor in using the flow meter is good grounding.

The sensor grounding requirements are mainly grounded to the measured medium. The ground terminal of the sensor and converter (terminal "SIG GND") is connected to the metal shielding network of the flow signal cable and is connected to the measured medium by means of an insert rod. When the pipeline to be measured is a non-metal pipeline or the inner wall is seriously corroded, in order to ensure good grounding, a separate grounding can be set near the installation of the flow meter, and the sensor grounding terminal is directly connected to the ground. In this case, the grounding resistance must be less than 10Ω .

Maintenance and troubleshooting

(1) Maintenance

Sensors generally do not require maintenance. However, for the situation where the measured medium is easy to adhere to the surface or inner wall of the electrode and the measuring head (measuring tube), regular cleaning must be carried out. The cleaning cycle depends on the rate of adhesion scaling. When cleaning the electrode and measuring head (measuring tube), be sure not to damage the insulation material and electrode.

(2) Common troubleshooting

Fault Phenomenon	Cause	Elimination methods
Converter flow is negative	<ol style="list-style-type: none"> The direction of the sensor indicates the opposite of the fluid flow direction There is a reverse connection between EXT+ and EXT- or SIG 1 and SIG 2 in the sensor junction box 	<ol style="list-style-type: none"> Rotate the sensor 180° Interchange the lines of "EXT+" and "EXT-"
The converter output is out of tolerance	<ol style="list-style-type: none"> Fluid does not fill the pipe The Settings are incorrect The zero is offset 	<ol style="list-style-type: none"> Turn off the regulator Reset the Settings Adjust zero
The output signal fluctuates too much	<ol style="list-style-type: none"> There is gas at the sensor electrode, resulting in poor contact between the electrode and the medium There are deposits on the electrode There is gas in the pipeline There is a flow block upstream of the instrument installation, and the length of the straight pipe section is not enough Too close to the upstream dosing point, resulting in uneven fluid conductivity The electrode is contaminated and attached Sensor insulation changes 	<ol style="list-style-type: none"> Exhaust the gas in the pipeline Clean the electrodes Exhaust upstream Select another position or install flow straightener The position of the injection point is selected downstream of the flow meter Clean the electrodes Replace the sensor
The output signal gradually drifts to zero	<ol style="list-style-type: none"> Water enters the sensor The electrode is covered 	<ol style="list-style-type: none"> Replace the sensor Clean the electrodes