SEM600H Electromagnetic Heat Meter

SMART
GREEN DEVICES

1.Introduction

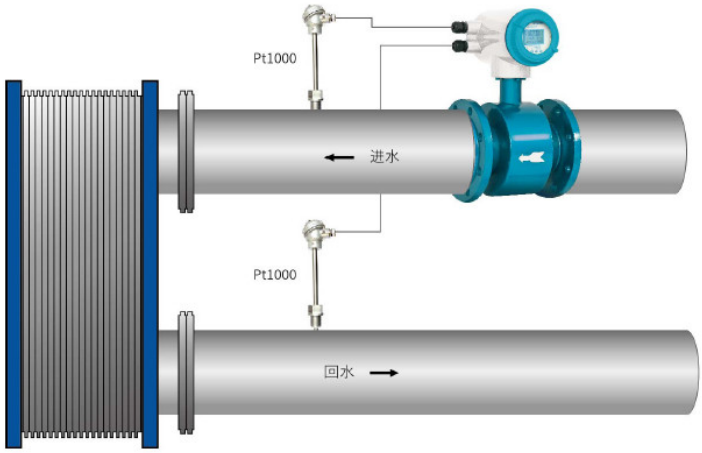
1.1 Brief introduction

SEM600H Electromagnetic Heat Meter is designed and manufactured with the most advanced domestic and abroad technology, featuring high accuracy, reliability, good stability and long service life.

We pay our attention to every detail in the process of the product structure design, material selection, manufacturing, assembly and factory testing etc. With a water tower up to 35m as pressure stabilizer for actual flow calibration, we have a professional production line for electromagnetic heat meter, also we design and develop a series of software and hardware for electromagnetic heat meter for mass production to ensure high quality in long term use. The product has backlight and wide temperature-ranged LCD display. With fully practical function, visual display, easy operation, it saves troubles for on-site installation operation and maintenance.

SEM600H can be widely used in the measurement of heat such as central heating, heating and air conditioning in residential quarters, office buildings and enterprises.

1.2 Features



1. The heat meter has the function of measuring cold and heat, and comes standard with 2pcs Pt1000. It does not need to be equipped with a calculator, which is convenient for installation and reduces procurement and installation costs.
2. The converter uses low-power single-chip microcomputer to process data, using SMD's electronic components and SMT surface mount technology, with reliable performance, high precision, low power consumption and zero stability. Dot matrix Chinese LCD display, showing parameters like accumulated heat and instantaneous flow rate.
3. Multi-electrode structure, high precision, grounding electrode, no need for grounding ring, saving cost.
4. When power off, EEPROM protects set and accumulated values.
5. Electromagnetic heat meter has no mechanical inertia and is responsive. It can measure instantaneous pulsating flow and has good linearity.
6. Low frequency rectangular wave excitation, improving flow stability, low power loss, and

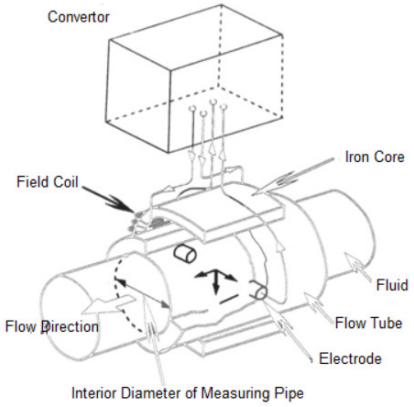
excellent low flow rate.

7. Password protection function, all menus can only be viewed to prevent misuse by personnel.
8. Support daily, monthly, and annual reports.

2. Working Principle

The electromagnetic heat meter adds temperature measurement and integration functions to the flowmeter.

The sensor of the electromagnetic flowmeter works according to the Faraday electromagnetic induction principle. A pair of detecting electrodes are mounted on the wall of the tube perpendicular to the magnetic field lines of the measuring tube and the magnetic field lines of the magnetic field. When the conductive liquid moves along the axis of the measuring tube, the conductive liquid acts as a cutting magnetic line. Inductive potential, the induced potential, the induced potential is detected by two detecting electrodes on the measuring tube, and the numerical value is as follows:



$E = K \times B \times V \times D$

Where is:

E: Induced electromotive force

K: Instrument Constant

B: Magnetic flux density

V: Velocity

D: Interior diameter of measuring pipe

The following conditions should be satisfied in order to obtain satisfactory measuring accuracy:

a. The measured liquid shall possess the electrical conductivity;

b. The pipe shall be full of liquid;

c. The components of liquid shall be well mixed;

d. If the liquid has magnetic permeability, the magnetic field of the flowmeter will change, so the flowmeter shall be modified.

During measurement, when the fluid flows through the magnetic field perpendicularly to the flow direction, the flow of the conductive liquid induces an electric potential proportional to the average velocity, thus requiring the conductivity of the flowing liquid measured is higher than the minimum conductivity. The induced voltage signal is detected by the two electrodes. And it is transmitted through the cable to the converter, after signal processing and related operations, integrated flux and instantaneous flux will be displayed on the display screen of the converter.

When the water flows through the heat meter installed in the heat exchange system, according to the flow rate measured by the flow sensor and the supply and return temperature signal measured

by the paired temperature sensor, and the time when the water flows, the calculator calculates and displays the release of the system or Heat absorbed. The heat released or absorbed by the system is calculated as follows:

$$Q = \int_{\tau_0}^{\tau_1} q_m \times \Delta h \times d\tau = \int_{\tau_0}^{\tau_1} \rho \times q_v \times \Delta h \times d\tau$$

Where is:

Q ——Heat released or absorbed by the system, unit: J;

q_m ——Mass flow of water flowing through the heat meter, unit: kg/h;

q_v ——Volume flow of water flowing through the heat meter, unit: m^3/h;

ρ——Density of water flowing through the heat meter, unit: kg/m^3;

△h——The difference in water enthalpy between the water supply and return water temperatures of the heat exchange system, unit: J/kg;

τ—— Time, unit: h.

3. Specification

3.1 Converter specification:

Power supply: 220V AC; 24V DC

Accuracy class: 1

Protection class: IP65

Max.flow reading(m^3): 99999999999 (11 digits)

Max. heat reading (MWh): 99999999999 (11 digits)

Heat flow unit: MJ/h, GJ/h, kWh/h, MWh/h optional

Output signal: 4mA～20mA DC/frequency output/pulse output

Communication output: Physical output RS485, communication protocol Modbus

Display function: Chinese

Display data: instantaneous heat, instantaneous flow, accumulated heat, cumulative flow, flow rate

Wire connector: M20×1.5 water-proof joint

3.2 Flow sensor specification

Nominal diameter: DN25~DN400

Nominal pressure: 0.6MPa/1.6MPa

Lining material: neoprene, Polyurethane rubber, F4, F46

Electrode material: molybdenum-containing stainless steel, Hastelloy B, Hastelloy C, titanium, platinum/rhodium alloy, tantalum

Structure type: separated type, integrated type

Connection method: flange type

Media conductivity: >5μS/cm

3.3 Temperature sensor specification

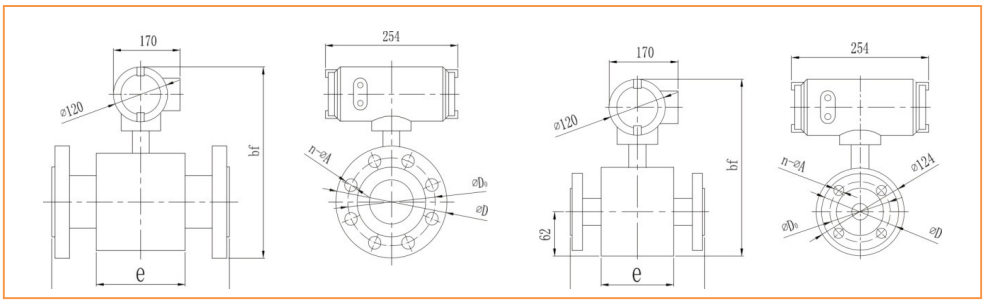
Temperature sensor: PT1000

Installation method: protection casing

Temperature measured range: -50℃～200℃

4. Outline Dimension

1. Integrated type unit: mm



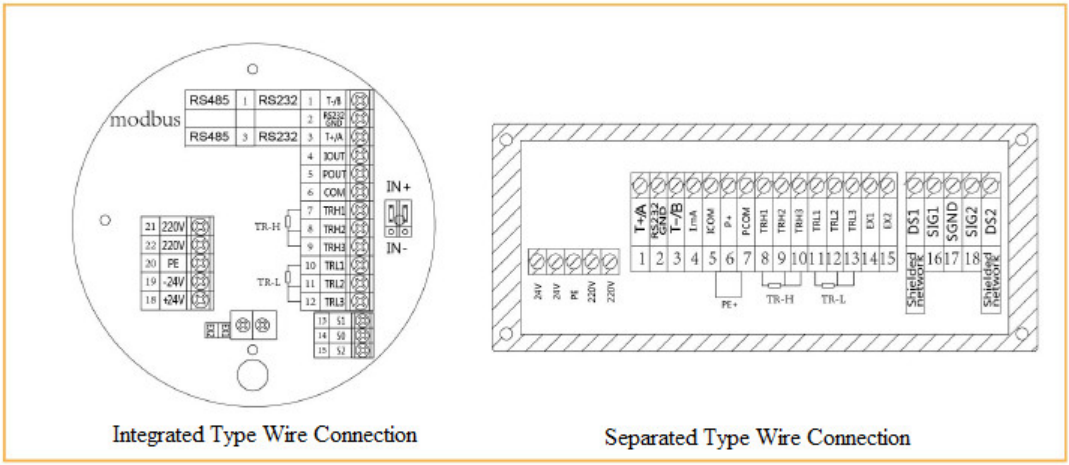
Diameter (DN)	Rated Pressure (MPa)	Instrument dimension (mm)		Flange connection dimension (mm)		
		a	Bf	D	D0	n×A
25	4.0	150	312	115	85	4-Φ14
32		150	330	140	100	4-Φ18
40		150	340	150	110	4-Φ18
50		200	338	165	125	4-Φ18
65		200	358	185	145	8-Φ18
80		200	374	200	160	8-Φ18
100	1.6	250	402	220	180	8-Φ18
125		250	425	250	210	8-Φ18
150		300	458	285	240	8-Φ23
200	1.0	350	522	340	295	8-Φ23
250		400	574	395	350	12-Φ23
300		500	624	445	400	12-Φ23
350		500	678	500	460	16-Φ23
400		600	742	565	515	16-Φ25

2 Separated type

Diameter (DN)	Rated Pressure (MPa)	Instrument dimension (mm)		Flange connection dimension (mm)		
		a	Bf	D	D0	n×A
25	4.0	150	252	115	85	4-Φ14
32		150	270	135	100	4-Φ18
40		150	280	145	110	4-Φ18
50		200	278	160	125	4-Φ18
65		200	298	180	145	8-Φ18
80		200	315	195	160	8-Φ18
100	1.6	250	342	215	180	8-Φ18
125		250	365	245	210	8-Φ18
150		300	398	280	240	8-Φ23

200	1.0	350	462	335	295	8-Φ23
250		400	515	390	350	12-Φ23
300		500	565	440	400	12-Φ23
350		500	618	500	460	16-Φ23
400		600	682	565	515	16-Φ25

5. Electrical connection



Integrated Type Wire Connection

Separated Type Wire Connection

Terminal Symbol		Definition for integrated type	Terminal Symbol		Definition for separated type
1	T_/B	RS485 communication output RS232 communication output (optional)	1	T+/A	RS485 communication output RS232 communication output (optional)
2	RS232 GND		2	RS232 GND	
3	T+/A		3	T_/B	
4	IOUT	4mA~20mA DC current output	4	I.mA	4mA~20mA DC current output
5	POUT	Two direction flow pulse output/frequency output	5	ICOM	Current output grounding
6	COM	Pulse/frequency output grounding	6	P+	Two direction flow pulse output/frequency output
7	TRH1	Inlet thermal resistance	7	PCOM	Pulse/frequency output grounding
8	TRH2		8	TRH1	Inlet thermal resistance
9	TRH3		9	TRH2	
10	TRL1	Outlet thermal resistance	10	TRH3	
11	TRL2		11	TRL1	Outlet thermal resistance
12	TRL3		12	TRL2	
13	S1	Electrode wire	13	TRL3	
14	S0	Grounding wire	14	EX1	Excitation current
15	S2	Electrode wire	15	EX2	

21	220V	220V power source	Shielding network	DS1	
22	220V		16	S1G1	Electrode wire
20	PE		17	SGND	Grounding wire
19	24V	24V DC power source	18	S1G2	Electrode wire
18	24V		Shielding network	DS2	
				220V	220V power source
				220V	
				PE	
				24V	24V DC power source
				24V	

Please notice the following suggestions when connecting wires:

1. In order to ensure interior insulation of sensor junction box, in case of the poor insulation caused by moisture, it is not suggested to connect cable outdoors in the raining weather.
2. When connecting the power cable and signal cable, both ends of the cable should be wrapped with circular lugs.
3. Conduit tube is suggested to use. The conduit tube material can use thick and sturdy steel pipe or flexible metal pipe.
4. All the power cable and non 4-core 24V DC signal cable must be equipped with metal cable protection tube.
5. When equipped with waterproof seal cable connector, it must be tightened to ensure that no water seepage inside the box.
6. In order to protect the operator and maintenance personnel from electric shocks and to prevent the influence of external noise, the ground should be connected to the sign (≤10Ω).

6. Model Selection

6.1 Flow rate range

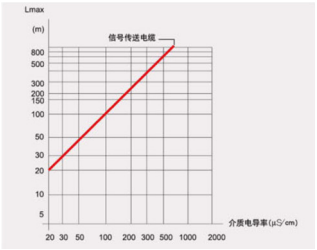
When measuring clean media, the economic flow rate is (1.5 ~ 3) m / s. When measuring the crystallization solution, the flow rate should be appropriately increased and (3~4) m/s is suitable, which can play the role of self-cleaning and adhesion deposition. In practical applications, it is normally <7m/s, and 10m/s is even more rare.

One limitation of the selection is that media with a conductivity lower than 5 μS/cm cannot be used.

6.2 Instrument structure

Separated installation is required when the instrument is installed below the ground;

When the meter is inevitably installed at the outlet of the pump, please use the instrument with separated structure.



6.3 Distance for separated type

The picture on the right shows the relationship between the cable and the dielectric conductivity of the separated type.

In practical applications, the shorter the distance of separated type, the better. The cable length is too long, and it is easy to cause signal interference due to its distributed capacitance.

For example, the conductivity of general tap water is about 100μS/cm, and the maximum distance of separated type is about 100m (the conductivity of acid-base salt solution is large, and the distance can be more than 100m. The specific value can be decided by conductivity and cable copper core section).

6.4 Normal diameter and rated pressure

Rated pressure	Applied diameter
PN10	DN200～DN400
PN16	DN100～DN150
PN40	DN25～DN80
Customized pressure is available	

6.5 Antifouling electrode

Anti-fouling electrodes are recommended when measuring fluids that are prone to fouling and deposits, such as slurries, sewage, etc.

6.6 Negative pressure

The electromagnetic flow sensor is installed in the case of a negative pressure pipe system, and the F46 is recommended for the lining material.

6.7 Diameter selection of electromagnetic heat meter sensor

1. Firstly, the following process parameters must be clarified.
   a) composition, density, conductivity of the fluid to be measured
   b) maximum flow, common flow, minimum flow
   c) maximum working pressure
   d) highest temperature, lowest temperature
2. The volumetric flow rate of the electromagnetic heat meter is proportional to the flow rate of the fluid. Therefore, the flux of the electromagnetic heat meter can be obtained by knowing the flow rate and limiting the flow rate range.

$$q_v = \pi r^2 \times V \times 3600 \times 10^{-6} = \frac{\pi D^2 \times V \times 3600 \times 10^{-6}}{4}$$

$$D = \sqrt{\frac{q_v \times 4 \times 10^6}{3600 \pi V}}$$

Where is, qv: volumetric flow rate of the fluid to be measured, unit: m^3/h

D: diameter of the flow sensor, unit: mm

V: flow rate of the fluid to be measured, unit: m/s

6.8 Selection of the electrode material

The electrode material should be selected according to the corrosivity of measured medium, and selected by the users who are familiar with the on-site conditions. In general, the corrosion resistance of electrode material is higher than that of pipeline material by one grade.

For ordinary media, please consult related anti-corrosion manuals. For media having complex components such as mixed acid, coupon tests should be done.

Electrode Material	Material Measured Performance（for reference only）	Corrosion Resistance
316L	Domestic water, industrial water, raw water well water, urban sewage, weak corrosive acid, alkali, salt solution Central air-conditioning water, heat exchange station, first and second network hot water	Not suitable for inorganic acids, organic acids, chlorides
Hastelloy B(HB)	Hydrochloric acid (concentration <10%) and other non-oxidizing acid Sodium hydroxide (concentration <50%), Ammonium hydroxide alkaline solution on all concentration level; Phosphoric acid, organic acid	not suitable for Nitric acid
Hastelloy C(HC)	Mixed acid such as chromic acid and sulfuric acid solution Oxidizing salts such as: Fe^{2+}, Cu^{2+}, seawater	not suitable for Hydrochloric acid
Titanium	Salts, such as: (1) chloride (oxide / magnesium / aluminum / calcium / ammonium / iron, etc.) (2) the sodium salt, potassium salt, ammonium salt and sodium hypochlorite salts, as well as potassium hydroxide, ammonium hydroxide, barium hydroxide caustic soda solutions with sea water concentration <50%	Not suitable for reducing acids such as hydrochloric acid, sulfuric acid, phosphoric acid, hydrofluoric acid
Tantalum	Hydrochloric acid (concentration <40%), dilute sulfuric acid and concentrated sulfuric acid (not including oleum) chlorine dioxide, ferric chloride, hypochlorite acid, sodium hydroxide, lead acetate Nitric acid (including fuming nitric acid) and other oxidizing acid, aqua regia at temperature below 80℃	Not suitable for alkali and hydrofluoric acid
Platinum	Almost all of the acid, alkali, salt solution (including fuming sulfuric acid, fuming nitric acid)	Not suitable for aqua regia, ammonium salt
Tungsten Carbide	Pulp, sewage, solid particles with anti-interference property	Not suitable for inorganic acids,

		organic acids, chlorides

6.9 Lining material selection

The lining material should be selected according to the corrosiveness, wear and temperature of the measured medium.

Lining material	Name	Sign	Max. Operating temp.	Aied liquid	Applied diameter
Rubber	chloroprene rubber	CR	-10℃~60℃	Central air conditioning cold and hot water	DN50~DN400
	polyurethane rubber	PU	-10℃~80℃	Central air conditioning cold and hot water	DN50~DN400
Fluorous rubber	Polytetrafluoroethylene	F4 (PTFE)	-10℃~120℃	Secondary network hot water	DN25~DN400
	polytetrafluoroethylene	F46 (FEP)	-10℃~150℃	Secondary network hot water	DN25~DN400

6.10 Rated pressure selection

The actual maximum working pressure must be less than the rated working pressure of the heat meter.

7 Heat meter Model Instruction

MFE600H	Electromagnetic Heat Meter		
Measurement Pipe Diameter	XXX	For Example: 100 represents DN100	
Electrode Type		1	Standard Mount (required)
Electrode Material		0	SS316L
		1	Platinum Pt
		2	Hastelloy B (HB)
		3	Tantalum (Ta)
		4	Titanium (Ti)
		5	Hastelloy C (HC)
Lining Material		3	Neoprene
		4	Polyurethane Rubber
		5	F4(PTFE) Polyfluoroethylene F4
		6	F46(FEP) Polyperfluorethylene-propylene F46
			DN25～DN80

Pressure (MPa)	1.6	DN100～DN150		
	1.0	DN200～DN400		
Media Working Temp.	E	＜60℃		
	H	＜120℃		
Ground	1	Built-in Grounding Electrode		
	*	No built-in Grounding Electrode		
Protection		0	IP65	
		1	IP68	
Converter Type		0	Integrated	
		1	Separated	
Analog Signal		0	4mA~20mA DC (with pulse/frequency)	
		*	No Analog output	
Digital Signal		0	No digital output	
		1	RS485(Modbus protocol)	
		2	Others (customized)	
Housing Material			0	Carbon Steel
			1	Stainless Steel
Flange Material			0	Carbon Steel
			1	Stainless Steel
Companion Flange			0	Without
			1	With
Power Supply			0	220VAC
			1	24VDC
			2	Battery supply

SEM600H	200	106	1.0H1	0001	0010	2230 (Factory Default)

Version code example: SEM600H-200-106-1.0H1-0001-0010-2230

Explanation: Electromagnetic heat meter; DN200 diameter; with Fixed stainless steel electrode, F46 (FEP) polyperfluoroethylene propylene lining; with rated pressure of 1.0MPa and internal grounding electrode, temperature <120℃; IP65 protection, integrated, with 4mA~20mA DC(frequency or pulse output) and RS485 digital signal; carbon steel housing and flange, with companion mounting flange (including bolts and nuts), 220VAC power supply.