



HPAC301 series electromagnetic energy meter

Description

HPAC301 series electromagnetic energy meter is based on standard requirement for chilled and hot water energy audit design, it includes high accuracy electromagnetic energy meter, temperature sensors and integrated energy calculator to perform the data collection and processing function, making the measured data available for statistical, monitoring or control purposes.

The energy meter and integrated energy calculator for measurement of energy & volume, monitor in heating or cooling system.

Featuring

The measurement of energy is in a close circuit with water using an electromagnetic principle with higher accuracy compared to ultrasonic series. Important properties are:

- **Non-wearing due to non-moving parts**
- **Mounting in flow or return, no settling sections or flow strengtheners**
- **Large liquid-crystal screen, humanization interface operation, easy to use**
- **Abundance intuitionist records**
- **Demand measurements with maximum values**
- **Permanent EEPROM to keep configured parameters and measured data**
- **Support Modbus or BACnet communication protocol**
- **Support Bluetooth communication tools, easy inspection and maintenance**
- **Combined heating/ cooling system application**
- **Also operable as a flow meter or cold meter or heat/cold meter**
- **Can measure the forward / reverse flow rate and cold / heat power**
- **Self-diagnostics**

Application

HPAC301 series energy meters are used to measure heat consumption in district heating networks and residential development. It can be used for cold water measurement at the same time (solely or together with heat measurement) and for flow measurement in systems using water as medium.

Heat meter design

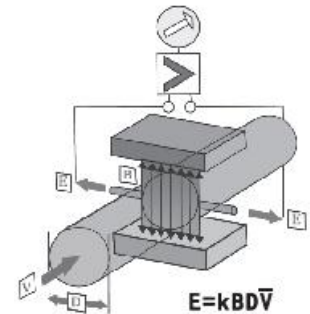
The heat meter comprises a calculator, a flow measuring part and two temperature sensors.

Method of operation

The thermal energy transferred from the water to the heat consumer over a defined period of time is proportional to the temperature difference between the flow and return and the volume of water that has flowed through.

The water volume measurement principle is law of Faraday's Electromagnetic Induction:

When the conductive liquid passes the measuring pipe surrounded in the magnetic field, induction electromotive force (E) will be produced in the direction vertical to the flow direction and the magnetic field, which is in proportion to the average flow rate (V). Magnetic field strength B is a constant (by the coil current control), the distance D between the detect electrodes is fixed, so the liquid flow rate (V) is the only variable of induction electromotive force(E), and it is Linear relationship between the output signal of the flow sensor and the flow.



The water volume is then calculated using these relationships.

The flow and return temperatures are determined using platinum resistors. Water volume and the difference in temperature between the flow and return are multiplied and its product integrated. The result which is the consumed quantity of thermal energy or cold is registered and displayed in the physical units **KWh / MWh**, or **MJ / GJ**, the quantity of flow in **m³ / L**.

Calculator

A standard calculator is used for all flow rate values with identical operation and an integrated service unit.

Technical data

Display	LCD display with at most 9 digits, directly display real time clock various Flow data and energy measurement.
Product structure	In-line type design, Integrated or Split type
Application range	Hot water or chilled water, combined heating / cooling system
Diameter (mm)	15 ~ 600,maximum 1200mm on request
Temperature range	0~120°C,maximum 180°C on request
Differential temp.	Δt:3~60k for heating system, Δt:2~20k for cooling system
Compensation	Temperature compensation is allowed
Input	Pt1000 for temperature of supply and return,2-wire or 4-wire optional
Output	4~20mA for instantaneous flow or power optional 0~5Hz pulse for cumulate flow or energy optional
Communication	Support Modbus or BACnet protocol optional
Communication tools	Support Bluetooth communication in Android mobile tools
Connection	Flange type connection for size from DN15~DN1200 Screw type connection for size from DN15~DN40 is optional
Certificate	According to CE and EMC 2004/108/EC and LVD 2006/95/EC EN 61326-1:2013, Immunity (Conformity to EN61000-6-1 and 6-2) EN 61326-1:2013, Emission (Conformity to EN61000-6-3 and 6-4) EN61000-3-2:2014 Limits for Harmonic Current Emissions Comply with the EN61010-1 and IEC61010-1 standard
Protection class	IP67 Standard
Power supply	AC (100~242Vac) 50Hz or DC (18V~36Vdc) max.10VA
Working ambient	Temperature 5~55°C
Storage ambient	Temperature -20~70°C

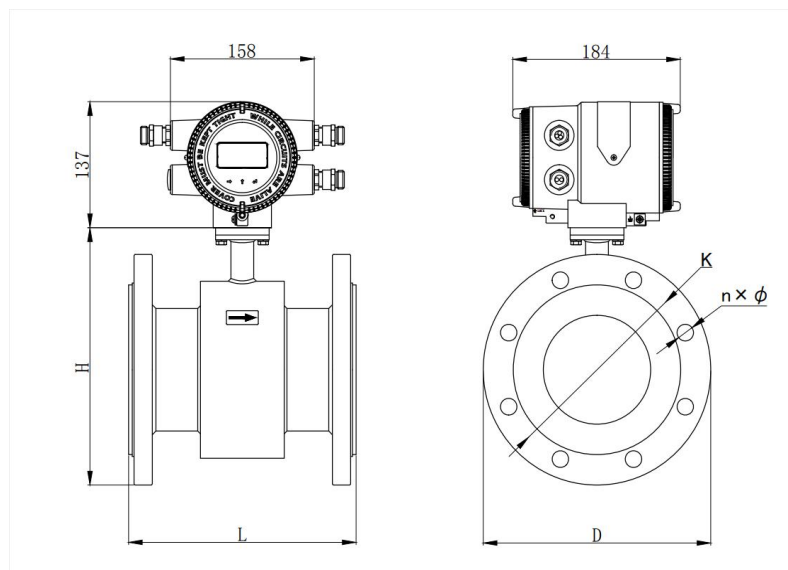
Electromagnetic flow sensor

The shell of the flow sensor is welded from carbon steel. Only the electrode and lining is contacted with the media. The flow sensor is matched with the calculator to form one set of integrated type energy meter or Split type energy meter.

Technical data of flow sensor

Application range	including all conductive liquid such as HVAC cold and hot water, fresh water, sea water, various corrosive media.
Measuring accuracy	The accuracy is $\pm 0.5\%$ in 10~100% Q_{max} scale range
Diameter (mm)	15 ~ 1200mm
Nominal pressure	PN16 or PN25 or PN40 optional
Electrode material	Stainless steel 316L electrode for fresh water of HVAC application Ti electrode for sea water, others on request (e.g. Hc, Hb, Ta, W)
Lining material	Ne, PU, PTFE or FEP optional
Media temperature	0~70°C for Ne lining, 0~85 °C for PU lining, -20~120°C for PTFE lining, maximum 180°C for FEP lining on request Note: it is limited by the thermal resistance features of the lining materials
Tube material	Stainless steel 304 tube
Shell material	Carbon steel shell for DN15~DN1200 flange type flow sensor Carbon steel shell for DN15~DN40 screw type flow sensor others on request (e.g. Stainless steel 304 shell)
Protection class	IP67 for Integrated type, IP68 is optional for Split type
Connection standard	Flange type connection adapt to pipeline flange of various standards (e.g. BS EN1092-2 , ISO 7005-2, BS4504, HG20593-199, GB9119) The screw connection is complied with BS21 or ISO7-1 standard
Pressure loss	Inline type without obstructing the flow, So the head friction lost is little.

Dimensions





Technical data of flange type meter

DN mm	PN MPa	Lining materials			Flow range selection Flow volume (m ³ /h)			Overall dimensions(mm)			Connection dimensions (mm)				
		Ne	PU	PTFE	Norm. flow	Min. flow	Max. flow	L	D	H	K	n	MA		
15	4.0		•	•	1.5	0.03	3	150	95	145	65	4	M12		
20			•	•	2.5	0.05	5		105	150	75	4	M12		
25				•	•	3.5	0.07		7	115	155	85	4	M12	
32				•	•	6	0.12		12	140	165	100	4	M16	
40				•	•	10	0.2		20	150	180	110	4	M16	
50				•	•	15	0.3		30	200	165	190	125	4	M16
65	1.6		•	•	25	0.5	50	185	200		145	8	M16		
80			•	•	40	0.8	80	200	235		160	8	M16		
100				•	•	60	1.2	120	250		220	250	180	8	M16
125				•	•	100	2	200	250		250	280	210	8	M16
150				•	•	150	3	300	300		285	310	240	8	M20
200		1.6		•	•	250	5	500	350	340	370	295	12	M20	
250				•	•	400	8	800	400	405	430	355	12	M24	
300				•	•	600	12	1200	450	460	495	410	12	M24	
350				•	•	750	15	1500	450	520	550	470	16	M24	
400				•	•	900	18	1800	500	580	605	525	16	M27	
450				•	•	1200	24	2400	600	640	660	585	20	M27	
500			•		•	1500	30	3000	600	715	725	650	20	M30	
600			•		•	2500	50	5000	600	840	835	770	20	M33	
700			•		•	4000	80	8000	700	910	915	840	24	M33	
800			•		•	5000	100	10000	800	1025	1020	950	24	M36	
900			•		•	6000	120	12000	900	1125	1130	1050	28	M36	
1000			•		•	8000	160	16000	1000	1255	1250	1170	28	M39	
1200			•		•	10000	200	20000	1200	1485	1465	1390	32	M45	

K = Bolt circle diameter, n = Number of holes, MA = Size of bolt

Remark

- 1) “•” in the a.m. table means optional lining various diameter’s flow sensor
 Ne lining materials can be chose for DN500~DN1200 flange type pipe
 PU lining materials can be chose for DN15~DN450 flange type or DN15~DN40 screw type pipe
 PTFE lining materials can be chose for DN15~DN1200 flange type
 PU or Ne lining materials for HVAC system cooling or heating application
 PTFE lining materials for PD system or hot water application
- 2) When the normal diameter of the flange type flow sensor is DN15~DN80, the pressure standard chosen as PN40. When the normal diameter of the flange type flow sensor is DN100~DN600, the pressure standard chosen as PN16, PN25 or PN40 is optional. When the normal diameter of the flange type flow sensor is DN700 or above, the pressure standard chosen as PN16. When the normal diameter of the screw type flow sensor is DN15~DN40 ,the pressure standard chosen as PN16.



Calculator

HPAC series intelligent type calculator is programmed according to the size of electromagnetic energy meter that will be connected to it. If energy measurement is required then standard Pt1000 sensor pairs must be ordered also.

HPAC series intelligent type calculator receives the flow analogue signal from meter and makes the instantaneous flow rate available at the LCD display. The meter also record the accumulative energy and instantaneous energy upon the temperature sensors are connected, a calculation is made base on the flow rate (Volume), the differential temperature and the coefficient for the medium used for the energy transfer.

Calculation of energy is based on the following formula:

$$\text{Energy} = \text{Volume} \times (\text{T}_{\text{Hot}} - \text{T}_{\text{Cold}}) \times \text{K}_{\text{factor}} (\text{Ti})$$

Note:

Volume: Volume [m³] of a given amount of water

T_{Hot}: Measured temperature in the flow

T_{Cold}: Measured temperature in the return

K_{factor} (Ti): Thermal coefficient of water based on the polynomial associated with Dr. Stuck's tables of enthalpy and heat content

Permanent memory

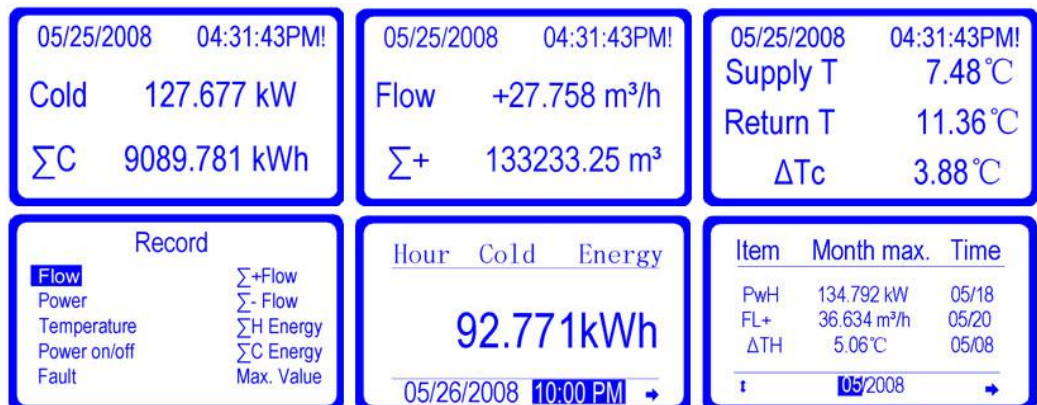
The LOG of the calculator records the following values: instantaneous flow, power, temperature (supply, return), power on/ power off information, fault information, hour/day/month/year data of Σ +Flow, Σ -Flow, Σ H Energy, Σ C Energy, and max. values.

The above data are stored to enable output to a selected date in the year. All data are stored for a further 1080 hours (hourly), and 365 days (daily), and 36 months (monthly), and 15 years (yearly) in a record for possible subsequent study of operating conditions in the system.

Display description

HPAC series intelligent type calculator has an easily-read at most 9 digits LCD display with associated pictograms for the various functions.

Can display the following data: forward / reverse instantaneous flow, cold / heat power, cumulative flow, cumulative energy, and temperature of the supply water, temperature of the return water, the differential temperature, All the permanent memory data can be displayed too.



Communication

RS485 communication mode, support Modbus or BACnet protocol optional.
 Communication baud rate optional for 1200, 2400, 4800, 9600, 19200, 38400.

- **Modbus communication mode**

Open Modbus RTU communication Protocol

- **BACnet communication mode**

Also support BACnet MSTP communication protocol

You can read all the permanent memory data and other information in this mode such as instantaneous flow, power, accumulated energy, accumulated flow, supply water temperature, and return water temperature.

Note1: RS485 network only support Max. 32 pcs device

Note2: Basic communication settings is 8N1/9600

Communication tools

Support Bluetooth communication for Android mobile phone

- **Bluetooth communication mode**

You can display all instrument data such as instantaneous flow, power, accumulated energy, accumulated flow, supply water temperature, and return water temperature.

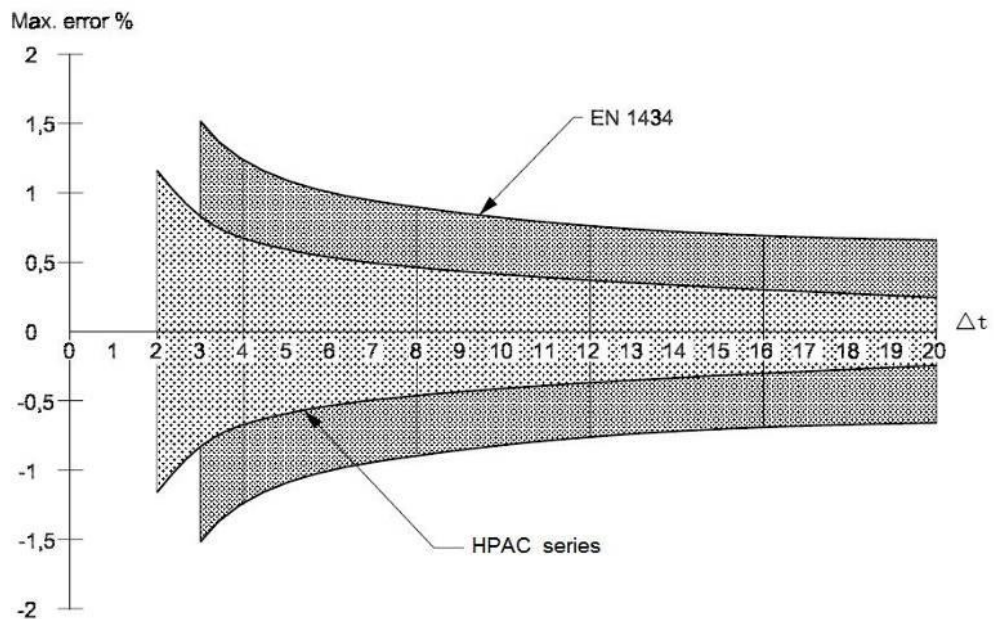
You can set the coefficient of meter diameter, sensor direction, power, temperature, display units.

All the calibrations such as: temperature calibration, 4~20mA, frequency.

Automatically records and perform data backup, easy inspection and maintenance.

Note: Bluetooth communication only work with Android mobile phone.

Measuring accuracy



The diagram shows tolerances of energy calculator relative to the requirements of

$$EN\ 1434 = \pm(0.5 + \frac{3K}{\Delta t}) [\%]$$



Technical data of calculator

Application type	Heating / Hot water	Cooling / Chilled water
Temperature range	0~120°C maximum 180°C on request	2~30°C
Differential temperature	Δt: 3~60K	Δt: 2~20K
Δt measurement error without sensor	± (0.25+3K/Δt) [%]	± (0.1+2K/Δt) [%]
Measuring accuracy	Θ ≤ 1.5%	
Flow range	Max. Flow ≤ 20000 m³/h	
Compensation	Temperature compensation is allowed	
Temperature Input	Pt1000 2-wire for Class A Δt = ±(0.15° C + 0.002 ltl) Pt1000 4-wire for Class 1/3 DIN Δt = ± 1/3 (0.3° C + 0.005 ltl) Measurement resolution : 0.01°C	
Current output	4~20mA , resistance ≤ 500Ω	
Pulse output	0~5Hz passive(OC gate) output, max.24VDC, ≤200mA , pulse width 100ms	
Display	128*64 LCD display at most 9 digits with backlight	
Display unit	m³/h, m³/m, m³/s, L/h, L/m, L/s display unit optional for flow rate kW, MW, kJ,MJ,GJ display unit optional for power	
Communication	Support Modbus RTU or BACnet MSTP protocol optional	
Communication tools	Support Bluetooth communication for Android mobile tools	
Power supply	AC (100~242Vac) 50Hz or DC (18~36Vdc) max.10VA	
lithium battery	3V lithium battery of 10 years or above lifetime	
EMC immunity	EN 61326-1:2013, Immunity (Conformity to EN61000-6-1 and EN61000-6-2)	
EMC emission	EN 61326-1:2013, Emission (Conformity to EN 61000-6-3 and EN61000-6-4)	
Limits for Harmonic Current Emissions	Compliance to EN 61000-3-2:2014	
LVD 2006/95/EC	Comply with the EN61010-1 and IEC61010-1 standard	
Protection class	IP67	
Working ambient	5~55°C	
Storage ambient	-20~70°C	

Temperature sensor

The Pt1000 temperature sensor is designed for applications with HPAC series intelligent type energy calculator for energy measurement for cold and hot water application.

Temperature sensor

Temperature sensors in the following versions are recommended:

Product standard	Along with DIN EN 60751 requirement (according to IEC 751)
Sensing element	Pt1000 (3850)
Element accuracy	IEC751 Class A with $\pm 0.15^{\circ}\text{C}$ limit variation temp $^{\circ}\text{C}$ for 2-wire IEC751 Class 1/3 DIN with $\pm 0.1^{\circ}\text{C}$ and 4-wire on request
Temperature range	0~105 $^{\circ}\text{C}$ for HVAC application, optional -70~180 $^{\circ}\text{C}$ on request
Operation R.H.	<95 % r.h. (non-condensing)
Nominal pressure	PN25
Protection class	IP67
Sheath well material	Stainless steel 316L
Sheath O.D. (D)	5~10 mm
Immersion type	Direct immersion with protection pocket
Immersion length (EL)	50 mm pocket sensor for HVAC DN15 to DN50 70 mm pocket sensor for HVAC DN65 to DN125 100 mm pocket sensor for HVAC DN125 to DN200 150 mm pocket sensor for HVAC DN200 to DN300 200 mm pocket sensor for HVAC DN300 to DN400 250 mm pocket sensor for HVAC DN450 or above
Mounting fittings(M)	G1/2 for screw type fittings
Sensor connection	2 wire as standard configuration for HVAC application 4 wire as special configuration for high-accuracy application
Sensing cable (AI)	2 meters or 5 meters cable optional, Max. 10 meters for split type optional offer of sensing cable can be provided upon request

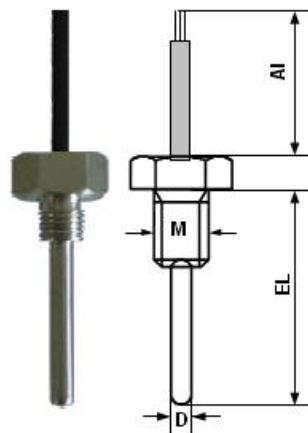


Fig. T-type temperature sensor

Note: EL= Immersion length, AI= cable length, M= Mounting fitting, D= Sheath O.D.

Product selection

Diameter selection

When the normal velocity of flow of the measured pipeline is more than 0.5 m/s, select the meter with diameter same to that of the process pipeline.

Select the meter with diameter smaller than that of the process pipeline in following conditions:

The velocity of flow in the pipeline is somewhat slow, which cannot meet the requirement of velocity limit of the energy meter or the measurement precision is not satisfying under this velocity (the velocity limit to obtain relatively high precision is more than 1m/s).

Application type selection

Considering the actual application situation, we make the design directions as follows to avoid miss measurement and over measurement:

Application type	Supply water temperature(°C)	Differential temperature(°C)	Install position
Chilled water application	---	≥1	Return water pipe for Chilled water, Supply water pipe only for Hot water.
Hot water application	---	≥2	
Combined cooling/heating	Cooling ≤ 18 Heating ≥ 30	≥1	

Note1: Differential temperature is 1°C,2°C,3°C optional (same value for cooling/heating)

Lining materials selection

Lining materials	Corrosive resistance	Working temp.	Range of application
Ne	Neoprene It can resist low concentration acid alkali salt.	0~70°C	Can be used in Industrial water, sewage, and low concentration acid alkali salt solution. Ne lining materials can be chose for DN500 or above pipe.
FEP	Fluorinated ethylene propylene It has heat resistance and corrosive resistance. It has high mechanical strength, abrasiveness resistance and when cleaning surface the lining is seldom broken.	-40~120°C	Can be used where has sanitary requirement like drinking water. All fluid except high abrasive medium like mortar. Maximum 180°C on request FEP lining materials can be chose for DN15~DN150 pipe or DN15~DN40 screw type pipe.
PTFE	Polytetrafluoroethylene It can resist almost all chemical medium's corrosion. It has low wear resistance.	-20~120°C	Can be used in high temperature liquid, suitable to apply on domestic hot water and drinking water. Not suitable for pipe with egative pressure or high abrasive medium. PTFE lining material can be chose for DN15~DN1200 pipe.
PU	Polyurethane It can resist low concentration alkali, salty and organic solvents corrosion resistant It has high mechanical strength, abrasiveness resistance and when cleaning surface the lining is seldom broken.	0~85°C	Can be used in HVAC cooling or heating application. Can use in harsh environments instead of Neoprene. Maximum 90°C on request PU lining materials can be chose for DN15~DN450 flange type or DN15~DN40 screw type pipe.



Connection type selection

Flange type connection for size from DN15~DN1200.

When the normal diameter of the flange type flow sensor is DN15~DN80, the pressure standard chosen as PN40. When the normal diameter of the flange type flow sensor is DN100~DN600, the pressure standard chosen as PN16, PN25 or PN40 is optional. When the normal diameter of the flange type flow sensor is DN700 or above, the pressure standard chosen as PN16.

Screw type connection for size from DN15~DN40 is optional, the pressure standard is PN16.

Output signal selection

4~20mA or frequency for instantaneous flow or power optional.

0~5Hz pulse (non-active frequency) for cumulate flow or energy optional.

May be select two output signal at the same time, eg. 4~20mA and 0~5Hz pulse.

Communication selection

HPAC301 series calculator support Modbus RTU or BACnet MS/TP protocol optional.

Note1: RS485 network only support Max. 32 pcs device

Note2: Basic communication settings is 8N1/9600

Structure selection

Consider from the aspect of convenient installation and use, selection priority is given to IP67 integrated type energy meter.

When the energy meter is installed underground or places that is easily to be flooded by water, select Split type energy meter.

Note: when the energy meter is installed in the high temperature pipeline or high corrosive environment, to suggest select Split type energy meter for those whose medium is frozen water to avoid frosting or moisture condensation inside the sensor.

Temperature sensor selection

Pt1000 2-wire or Pt1000 4-wire temperature sensor as standard configuration for HVAC application, The sensor can be configured with different specifications according to customer requirements.

Direct immersion with protection pocket for flange type pipe,immersion length 50~250 mm optional.

Note1: 2-wire Class A sensor as standard configuration for HVAC application.

Note2: 4-wire Class 1/3 DIN sensor as special configuration for high-accuracy application.

Note3: Sensing cable 2 meters or 5 meters optional, Max.10 meters for split type.

Power supply selection

Can use AC220V or DC24V power supply, Maximum power dissipation under 10W.

Consider from the aspect of convenient installation and use, selection priority is given to AC220V.

Examples of model code

e.g. **HPAC301-100-34001C21**

Description:

HPAC301 series energy meter for cooling/heating application, consists of energy calculator and 100mm EM type flow sensor. PU is used as lining materials. Its temperature grade is 0~85 °C , PN16 flange type connection,output signal is no need, support Modbus protocol, Integrated install, include pairs Pt1000 2-wire Class A sensor and 5m cable, operation power supply is AC220V.



Ordering code

HPAC301- { } - [] [] [] [] [] [] [] []

Operation power supply
 0 DC24V
 1 AC220 V

Temperature sensor type (Note 4)
 0 no need
 1 Pt1000 2-wire Class A and 2m cable
 2 Pt1000 2-wire Class A and 5m cable
 3 Pt1000 2-wire Class A and 10m cable
 4 Pt1000 4-wire Class 1/3 DIN sensor

Structure
 C Integrated type
 S Split type

Communication protocol (Note 3)
 0 no need
 1 Modbus RTU protocol
 2 BACnet MS/TP protocol

Output signal
 0 no need
 1 4~20mA
 2 non-active frequency
 3 4~20mA + non-active frequency

Connection type (Note 2)
 0 Flange type / PN16
 1 Flange type / PN25
 2 Flange type / PN40
 3 Screw type / PN16 for DN15~DN40

Lining materials (Note 1)
 1 Ne (0~70℃)
 2 FEP (-40~120℃)
 3 PTFE (-20~120℃)
 4 PU (0~85℃)

Application type
 1 Chilled water application
 2 Hot water application
 3 Combined cooling&/heating

Diameter
 e.g. 15,100...600,1200

Note1: Ne lining materials only for chilled water
 FEP lining materials only for drinking water
 PTFE lining materials for PD system
 PU lining materials for HVAC system

Note2: DN15~65 flange type only for PN40
 DN15~40 screw type only for PN16

Note3: RS485 only support Max.32 pcs device
 Basic communication settings is 8N1/9600

Note4: Pt1000 2-wire (Class A) sensor as standard configuration for HVAC application.
 Pt1000 4-wire (Class 1/3 DIN) sensor only for high-accuracy application optional.

Information in this publication is based on current specifications. Our company reserves the right to make changes in specifications and models as design improvements are introduced.