HPAC series energy calculator

Description

HPAC series energy calculator is based on standard requirement for chilled and hot water energy audit design to perform the data processing function, making the measured data available for statistical, monitoring or control purposes.

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

Featuring

Important properties of the HPAC series energy calculator are:

- **Standard in accordance with EN1434**
- **Large liquid-crystal screen, humanization interface operation, easy to use**
- **Abundance intuitionistic records**
- **Demand measurements with maximum values**
- **Permanent EEPROM to keep configured parameters and measured data when power off**
- **Support MODBUS / M-bus communication protocol**
- **Combined heating/ cooling system application**
- **Also operable as a flow calculator**
- **Self-diagnostics**

Application

HPAC series energy calculator is 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.

Method of operation

The energy calculator is programmed according to electromagnetic flow meter that will be connected to it. If energy measurement is required then standard Pt1000 sensor pairs must be ordered also.

The calculator receives the flow analogue signal from meter and makes the instantaneous flow rate available at the LCD display. The calculator 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:

$$\textbf{Energy} = \textbf{Volume} \times (T_{Hot} - T_{Cold}) \times K_{factor}(Ti)$$

Note:

Volume: Volume [m^3] 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

All relevant storage data are stored in EEPROM and updated at some intervals.

- **Cumulated energy**

  The cumulated energy is the quantity of thermal heat or the quantity of cold that the energy calculator acquires in the period of time between commissioning and readout. The cumulated energy is a calibration-related value and can only be cleared in special cases .

  Units that can be parameterized are kWh, MWh, KJ, MJ, and GJ.

- **Cumulated volume**

  The cumulated volume is the amount of water the energy calculator acquires in the period of time between commissioning and readout. The cumulated volume is a calibration related value and can only be cleared in special cases.

  Units that can be parameterized are m^3/h, m^3/m, m^3/s L/h, L/m, ,L/s.

- **Yearly values**

  The following yearly values of the previous 15 years are stored :

  - Cumulated heat energy;
  - Cumulated cold energy;
  - Cumulated forward flow;
  - Cumulated reverse flow;

- **Monthly values**

  The following monthly values of the previous 36 months are stored :

  - Cumulated heat energy;
  - Cumulated cold energy;
  - Cumulated forward flow;
  - Cumulated reverse flow;

- **Daily values**

  The following daily values of the previous 60 days are stored :

  - Cumulated heat energy;
  - Cumulated cold energy;
  - Cumulated forward flow;
  - Cumulated reverse flow;

- **Hourly values**

  The following hourly values of the previous 960 hours are stored :

  - Cumulated heat energy;
  - Cumulated cold energy;
  - Cumulated forward flow;
  - Cumulated reverse flow;

- **Maximum values**

  The following yearly/monthly values are stored(15years/36months) :

  - Instantaneous heat power;
  - Instantaneous cold power;
  - Instantaneous forward flow;
  - Instantaneous reverse flow ;
  - Positive temperature differential;
  - Negative temperature differential;

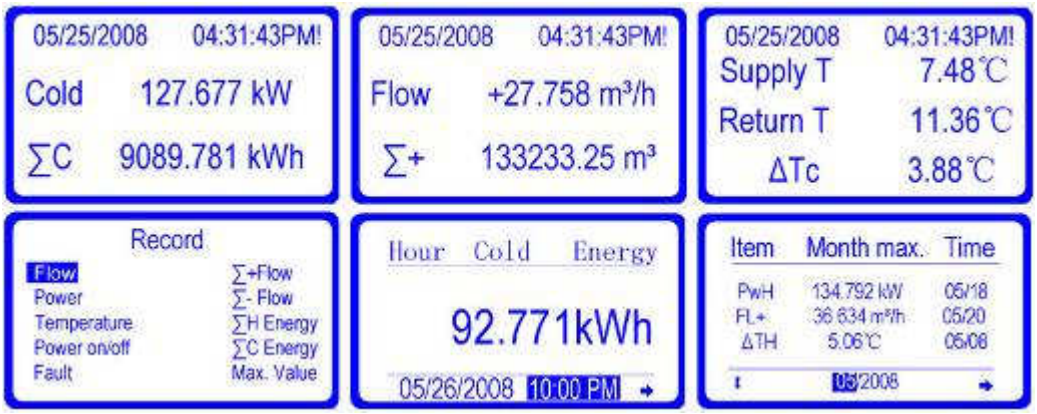
- **There are two ways of further processing the permanent memory values:**

  - Readout of all relevant values on the display
  - Remote readout of the monthly values via RS485 network/M-bus protocl.

Display description

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

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

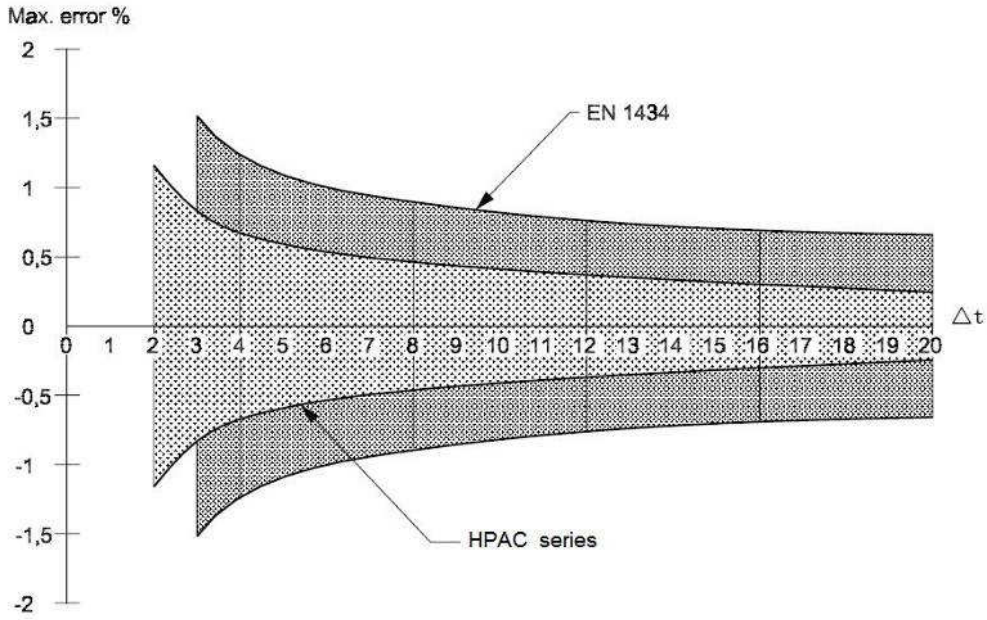


Communication

- RS485 communication mode, baud rate optional for 1200, 2400, 4800, 9600, 19200, 38400. Protocol: open modbus communication protocol.
- M-bus communication is optional.

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.

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

Standard in accordance with	Heat meter EN1434	Chilled water EN1434 pr.A1
Temperature range	0~95℃ maximum 180℃ on request	2~30℃
Differential temperature	Δt: 3~60K	Δt: 2~20K
Δt measurement error without sensor	± (0.5+3K /Δt) [%]	± (0.1+2K /Δt) [%]
Measuring accuracy	Θ≤1.5%	
Flow range	Max. flow≤20000 m^3/h	
Compensation	Temperature compensation is allowed	
Temperature Input	Pt1000 2-wire, measurement resolution:0.01℃	
Current input	4~20mA	
Frequency input	0~5K Hz	
Current output	4~20mA , resistance≤750Ω	
Pulse output (2 port)	0~5Hz passive(OC gate) output, max.24VDC, ≤200mA , pulse width 150ms	
Display	LCD display at most 9 digits with backlight	
Communication	RS485 (MODBUS protocol) or M-bus optional	
Power supply	220VAC±10% 50Hz or 24VDC, max.15VA	
EMC emission	EN 61326-1:2006, Emission (Conformity to BS EN61000-6-4:2001)	
EMC immunity	EN 61326-1:2006, Immunity (Conformity to BS EN61000-6-1:2001)	
Limits for Harmonic Current Emissions	Compliance to EN 61000-3-2:2006	
CE product safety	EN 61010-1:2001, Safety – Part 1:General requirements	
Protection class	IP54 or IP65 optional	
Ambient temperature	5~55℃	
Ambient hhumidity	<85 % r.h. (non-condensing)	

Temperature sensor

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

Technical data of temperature sensor

2-wire or 3-wire temperature sensors are recommended:

Sensing element	Pt1000 (3850) or Pt1000 (3800)
Temperature range	0~105℃
Operation R.H.	<95 % r.h. (non-condensing)
Nominal pressure	PN25
Protection class	IP67
Sheath well material	Stainless steel 316L
Sheath O.D. (D)	5~12 mm
Immersion type	Direct immersion with ball valve for DN25 or below flow meter,
	Direct immersion with protection pocket for DN32 or above
Immersion length (EL)	35 mm direct sensor for DN25 or below flow sensor
	50 mm pocket sensor for DN32 to 50
	100 mm pocket sensor for DN65 to 100
	150 mm pocket sensor for DN125 to 200
	200 mm pocket sensor for DN250 or above
Mounting fittings(M)	M10×1.0×5 for DN25 or below
	G1/4 for DN32 to 100
	G1/2 for DN125 to 200
	G3/4 for DN250 or above
Sensor connection	2 wire or 3 wire
Sensing cable (AI)	2 meters or 5 meters cable optional ,10 meters for separate type

Optional offer of sensing cable can be provided upon request

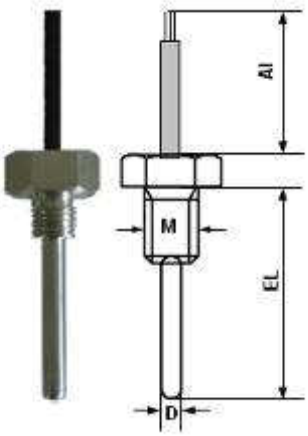


Fig.T-type temperature sensor

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

Product selection

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(℃)	Differential temperature(℃)	Install position
Chilled water application	---	≥1	Return water pipe
Hot water application	---	≥2	Supply water pipe
Combined cooling/heating	Cooling ≤18 Heating ≥30	1,2,3 optional(same value for cooling/heating)	Return water pipe

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.

Protection class selection

Select the protection class according to above requirement and the working environment of the flow sensor.

Select IP65 class to avoid frosting or moisture condensation inside the calculator.

Communication selection

Modbus protocol or M-bus protocol optional. This option will depend on the applying network.

Temperature sensor selection

Direct immersion with ball valve for DN25 or below, immersion length 35 mm.

Direct immersion with protection pocket for DN32 or above, immersion length 50~200 mm optional.

Note: sensing cable 2 meters or 5 meters optional, 10 meters or above for separate type.

Power supply selection

Can use 220V AC or 24V DC power supply. Consider from the aspect of convenient installation and using, selection priority is given to 220V AC.

Examples of model code:

e.g. HPAC301-351121

HPAC301 series energy calculator for cooling/heating application, consists of energy calculator and pairs Pt1000 2-wire direct sensor. output signal is 4~20mA and 0~5Hz pulse, protection class is IP65, using MODBUS protocol for RS485 communication, include pairs Pt1000 2-wire pocket sensor, operation power supply is 220V AC.

Ordering code

HPAC 301 - □ □ □ □ □ □

Operation power supply

0 24 Vdc
1 220 Vac

Temperature sensor type (Note 3)

0 No sensors include
1 Pt1000 2-wire direct sensor
2 Pt1000 2-wire pocket sensor
3 Pt1000 3-wire direct sensor
4 Pt1000 3-wire pocket sensor

Communication

0 no need
1 MODBUS protocol
2 M-bus protocol

Portection class (Note 2)

0 IP54
1 IP65

Output signal

0 no need
1 4~20mA
2 active frequency
3 non-active frequency
4 4~20mA + active frequency
5 4~20mA + non-active frequency

Application type (Note 1)

1 Chilled water application
2 Hot water application
3 Combined cooling/heating

Note 1: Install the flow sensor on the reture pipe for chilled water application or combined cooling/heating application,and on the supply pipe for hot water application,

Note 2: Select IP65 class to avoid frosting or moisture condensation inside the calculator.

Note 3: Direct immersion with ball valve for DN25 or below, Direct immersion with protection pocket for DN32 or above.

2-wire and 3-wire are recommended. But these two types should be connected differently.