RCH series ultrasonic energy meter

Description

RCH series ultrasonic energy meter is based on standard requirement for hot water or cold water energy audit design, it includes high accuracy ultrasonic energy meter, temperature sensors and integrated energy calculator to perform the data collection and processing function, making the measured data available for billing, 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 ciRCHuit with water using an ultrasonic principle with higher accuracy compared to mechanical series. Important properties are:

- **Non-wearing due to non-moving parts**
- **Mounting in flow or return, no settling sections or flow straightening**
- **Demand measurements with maximum values**
- **Support M-bus or MODBUS or BACnet communication protocol**
- **Also operable as a flow meter or heat/cold meter**
- **Self-diagnostics**

Application

RCH series ultrasonic 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.
Note: The following sections largely refer to 'heating' but heating/cooling applications should be considered inclusive.

System

The heat meters are approved for use with water as an energy transfer medium. Duly dosed additives or conditioning are permitted. Water quality conforming to AGFW sheet 5/15 (see follows :).

The plant should be operated at a gauge pressure of at least 2 bar (absolute pressure at least 3 bar) at q_p (nominal flow) and 3 bar at q_s (maximum flow) to prevent the water from off-gassing. To eliminate cavitations, the steam pressure curve must be observed. In the case of pressure shocks exceeding 1.5 times the nominal pressure, the flow sensor may get damaged.

If the flow sensor can reach temperatures above 55 °C, must keep the calculator perpendicular to the flow sensor to lengthen the distance for better heat dissipation.

Recommend values for water chemistry for the water in the ciRCHuit of directly or indirectly heated systems:

Dependant from water conductivity the following table shows recommended values for water chemistry (acc. to AGFW Merkblatt 5/15, 1989):

	Unit	Low salt content		High salt content
Elec. conductivity at 25 °C	µS / cm	10 to 30	>30 to 100	>100 to 1500
General requirements:		clear, without sediment		
pH-value at 25 °C	–	9 to 10[1)]	9 to 10.5[1)]	9 to 10.5[1)]
Oxygen (O_2)	mg/l	< 0.1[2)]	< 0.05[2)]	< 0.02[2)3)]
Alkaline-earth metals (Ca + Mg)	mmol/l	< 0.02	< 0.02	< 0.02
Phosphate (PO_4)[1)]	mg/l	< 5[4)]	< 10[4)]	< 15
If oxygen binders are used:				
Hydrazine (N_2H_4)[5)]	mg/l	0.3 to 3	0.3 to 3	0.3 to 3
Sodium sulfide (Na_2SO_3)	mg/l	–	–	< 10

1) If the stipulations of the drinking water regulations/drinking water treatment regulations are to be observed, the pH values must not exceed 9.5 and the PO_4 concentration 7 mg/l.

2) During continuous operation, this quantity normally settles at much lower values.

3) If suitable inorganic corrosion inhibitors are used, the oxygen concentration in the ciRCHuit water can be up to 0.1 mg/l

4) For heat water generators with firetube heating surfaces, e.g. in firetube boilers, the minimum phosphate concentration of half the maximum value of 2.5 or 5 mg/l PO_4 must be observed

5) Only for heating systems without direct drinking water heating

Lightning protection

In areas where there is a risk of lightning, additional protective measures against lightning must be taken outside the heat meter.

Piping system

Settling sections are not required.

Flow straighteners are not required.

With the types of heat meters with threaded connections, it is recommended to use meter fittings of the appropriate nominal size for mounting the heat meter.

If, during operation, the medium must be expected to carry larger dirt particles, strainers must be mounted upstream of the flow sensor.

The flow sensor should be mounted between two shutoff valves.

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 is measured in the measuring tube by ultrasonic pulses which are transmitted in the direction of flow and against the direction of flow. Downstream, the delay between the transmitter and receiver is reduced, upstream it is increased. The water volume is then calculated using the measured values for the delay. 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** or **MWh** or **GJ**, the quantity of flow in **m^3**.

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 least 8 digits, directly display real time clock and various flow data and energy measurement.
Product structure	In-line type design
Application range	Hot water or chilled water, combined heating / cooling system
Diameter (mm)	15~ 100 mm, maximum 300mm on request
Operating pressure	PN16
Temperature range	4~95℃
Temperature resolution	0.01℃
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
Communication	M-bus or MODBUS or BACnet protocol optional
Installing type	Integrated indoor type
Connection	Screw connection for size from DN15~DN40 Flange connection for size from DN50~DN300
Certificate	According to CE and LVD 2006/95/EC and EMC 2004/108/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) EN61000-3-2:2006 Limits for Harmonic Current Emissions Comply with the EN61010-1 and IEC61010-1 standard
Power supply	3.6V lithium battery for 10 years or above RS485 communication only for lithium battery and 5~12Vdc power supply
Protection class	IP67 for flow sensor, IP65 for calculator
Working ambient	Temperature 5~55℃, humidity <90 % r.h. (Non-condensing)
Storage ambient	Temperature -20~70℃, humidity <85 % r.h. (Non-condensing)

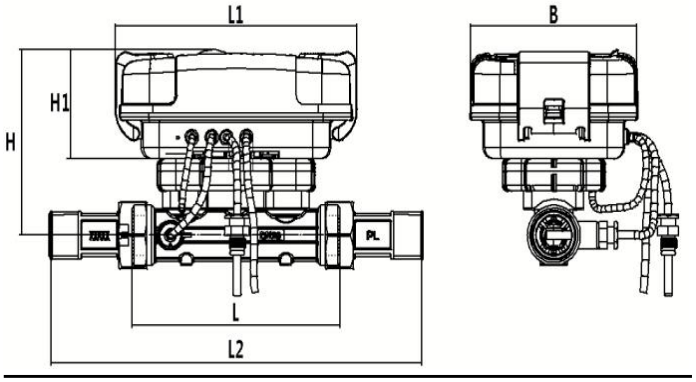
Ultrasonic flow sensor

Technical data of screw type meter

Application range	Not sensitive to materials such as impurities and rust in the heating/cooling system.
Measuring accuracy	Class 2
Diameter (mm)	15~40mm
Nominal pressure	PN16
Media temperature	0~95℃
Shell material	Metallic copper
Protection class	IP67
Connection standard	Rp to BS21 or ISO 7/1 screw thread connection

Model	Nominal diameter	Norm. flow	Min. flow	Max. flow	Connection diameter		Nipple diameter			height	height	Width
	DN (mm)	q_p (m^3/h)	q_i (m^3/h)	q_s (m^3/h)	Length	Connection	Length	Length	Close nipple			
					L(mm)	D(inch)	L1(mm)	L_2(mm)	D_1(inch)	H(mm)	H_1(mm)	B(mm)
RCH-15	15	1.5	0.03	3	110	G3/4B	150	204	R1/2	105	60	105
RCH-20	20	2.5	0.05	5	130	G1B	150	234	$R^3/_4$	108	60	105
RCH-25	25	3.5	0.07	7	160	$G1^1/_4B$	150	280	R1	111	60	105
RCH-32	32	6	0.12	12	180	$G1^1/_2B$	150	300	$R1^1/_4$	114	60	105
RCH-40	40	10	0.2	20	200	G2B	150	328	$R1^1/_2$	118	60	105

Dimensions



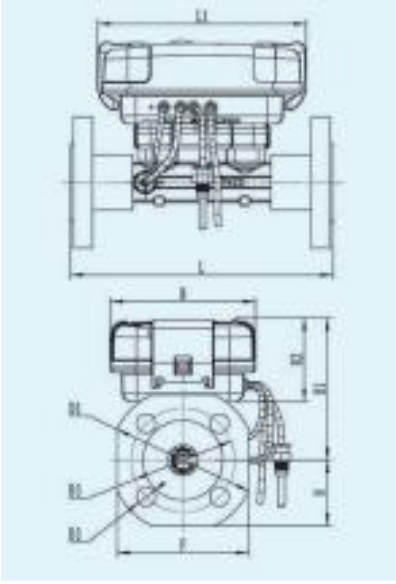
Technical data of flange type meter

Application range	Not sensitive to materials such as impurities and rust in the heating/cooling system.
Measuring accuracy	Class 2
Diameter (mm)	50~ 100mm, maximum 300mm on request
Nominal pressure	PN16
Media temperature	0~95℃
Shell material	Stainless steel
Protection class	IP67
Connection standard	Adapt to pipeline flange of various standards (e.g. BS EN1092-2 , ISO 7005-2, BS4504, HG20593-199, GB9119)

Model	Nominal diameter	Flow range selection Flow volume (m^3/h)			Overall dimensions(mm)			Connection dimensions (mm)		
	DN (mm)	Norm. flow	Min. flow	Max. flow	L	D	H	K	n	MA
RCH-50	50	15	0.3	30	200	165	190	125	4	M16
RCH-65	65	25	0.5	50		185	210	145	4	M16
RCH-80	80	40	0.8	80	225	200	220	160	8	M16
RCH-100	100	60	1.2	120	250	220	240	180	8	M16
RCH-125	125	80	1.6	120	350	250	350	210	8	M16
RCH-150	150	120	2.4	180	350	285	380	240	8	M20
RCH-200	200	200	4	300	350	340	430	295	12	M20
RCH-250	250	350	7	500	400	405	500	355	12	M24
RCH-300	300	500	10	600	450	460	550	410	12	M24

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

Dimensions



Calculator

The energy calculator is programmed according to the size of ultrasonic energy 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 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:

$$\textbf{Energy = Volume x (} T_{Hot} - T_{Cold} \textbf{) x Kfactor (Ti)}$$

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

Kfactor (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 is updated with the following values: cumulative heat energy, cumulative cool energy, cumulative flow, error type and time, working time,

Date items	Stored content	Stored number
Date of record	Cumulative amount of heat/ cold/flow	720
Maximum value	Monthly maximum instantaneous power and time	1
	Monthly maximum instantaneous flow rate and time	1
	Monthly maximum temperature difference and time	1
	Year maximum instantaneous power and time	1
	Year maximum instantaneous flow rate and time	1
	Year maximum temperature difference and time	1
	Cumulative maximum instantaneous power and time	1
	Cumulative maximum instantaneous flow rate and time	1
	Cumulative maximum temperature difference and time	1
Fault information	Fault code + start time + run time	46
Flow rate parameter modification	Parameter + points	10
Thermal parameter modification	Parameter + points	20
Temperature sensor parameter modification	Parameter + points	10

Display description

Energy calculator has an easily-read at least 8 digits LCD display with associated pictograms for the various functions.

The meter 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.

Month of accumulated flow, month of accumulated energy.

Info. Code, date, hours, operations hours, customer numbers, serial number (version/week/year), display test, and alarm information (like" Battery is low").

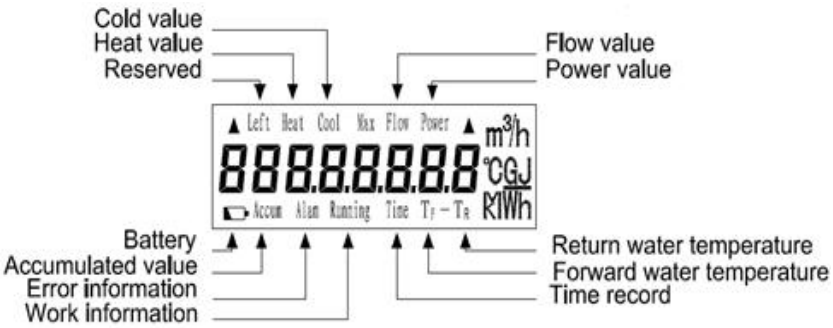
In normal operation, the display will show cumulative energy values.

Primary items

A long press on the operating button changes from one main menu to the next main menu.

Secondary items

A short press changes the display to the associated sub-menu.



Communication

M-bus or RS485 communication mode optional, baud rate optional for 1200/2400/4800/9600,

Protocol: M-bus protocol or open MODBUS RTU protocol and BACnet MSTP protocol .

You can read user's ID, instantaneous flow, power, accumulated energy, accumulated flow, supply water temperature, and return water temperature, working time, power off time, power off tab.

Note1: application of M-bus communication only for 3.6V lithium battery power supply, application of RS485 communication only for lithium battery and 5~12Vdc power supply.

Note2: M-bus or RS485 communication network only support Max. 128 pcs device.

Technical data of calculator

Standard	Heating system	cooling system
Temperature range	4~95	4~30
Differential temperature	Δt: 3~60K	Δt: 2~20K
Δt measurement error without sensor	± (0.5+3K/Δt) [%]	± (0.2+2K/Δt) [%]
Overall accuracy	Θ≤1.5%	
Flow range	Max. flow≤5000 m^3/h	
Compensation	Temperature compensation is allowed	
Temperature Input	Pt1000 2-wire, measurement resolution:0.01℃	
Display	LCD display at least 8 digits	
Display unit (default)	kWh, m^3, m^3/h, ℃	
Communication	M-bus or MODBUS RTU or BACnet MSTP protocol optional	
Power supply	3.6V lithium battery for 10 years or above Optional 5~12Vdc, max.10VA for RS485 communication	
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 61000-3-2:2006	
LVD 2006/95/EC	Comply with the EN61010-1 and IEC61010-1 standard	
Protection class	IP65	
Ambient temperature	5~55	
Ambient humidity	<90 % r.h. (non-condensing)	

Temperature sensor

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

Technical data of temperature sensor

Temperature sensors in the following two-wire versions are recommended:

Product standard	Along with DIN EN 60751 requirement (according to IEC 751)
Sensing element	Pt1000 (3850)
Element accuracy	IEC751 Class B
	optional Class A or Class 1/3 DIN ($\Delta T = \pm(0.1+0.0017 |t|)$ ℃)
Temperature range	0~105℃, maximum 120℃ 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)	5~8 mm
Immersion type	Direct immersion with ball valve for screw type pipe DN25 or below,
	Direct immersion with protection pocket for flange type pipe
Immersion length (EL)	35 mm direct sensor for screw type DN25 or below
	45 mm pocket sensor for screw type DN32 to 50
	100 mm pocket sensor for flange type DN65 to 100
	150 mm pocket sensor for flange type DN125 to 300
Mounting fittings(M)	Ball valve for screw type DN25 or below optional
	M10×1.0×5 for screw type pipe DN15 to 50
	G1/2 for flange type pipe DN65 or above
Sensor connection	2 wire
Sensing cable (AI)	1.5 meters for screw type meter,1.5~5 meters for flange type meter
	optional offer of sensing cable can be provided on request

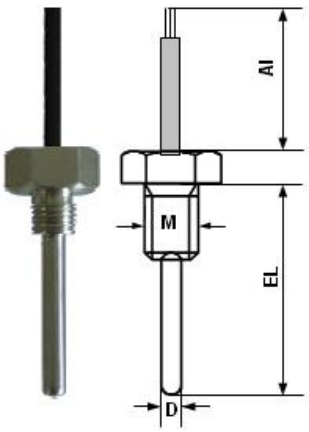


Fig.T-type temperature sensor

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(℃)	Differential temperature(℃)	Install position
For hot water use only	---	≥2	Supply water pipe
Combined heating/cooling	Heating ≥30 Cooling ≤18	≥1	Return water pipe
For flow meter use only	---	---	---

Power supply selection

To apply to different power supply situation, the energy meter can use two different powers:

Power supply type	Function	Application range
Lithium battery	Support M-bus communication	Civil building application Life 10 years or above
Lithium battery and 5～12Vdc	5~12Vdc power supply only for RS485 communication（MODBUS or BACnet MSTP）	HVAC application Life 10 years or above

Communicatio selection

The M-bus communication can only be selected when the power supply type is lithium battery.

The RS485 communication (support MODBUS RTU protocol or BACnet MSTP protocol) can only be selected when the power supply type is lithium battery and 5～12Vdc.

Temperature sensor type selection

Direct immersion type with ball valve for DN25 or below,

Direct immersion type with protection pocket for DN32 or above.

Include 1.5 meters signal cable for screw type meter only, 1.5~5 meters for flange type meter

Display unit selection

Display unit for calculator display is kWh or MWh or m^3 optional.

kWh only for screw type meter. MWh or GJ for flange type meter (e.g. DN50 or above)

Ordering code

RCH – [ ] – [ ] [ ] [ ] [ ] [ ] [ ]

Display unit

0	kWh
1	MWh
2	m^3

Temperature sensor type

0	No need
1	Pt1000 2-wire Class B sensor
2	Others (Class A or 1/3 DIN)

Communication

0	No need
1	M-bus protocol
2	BACnet MSTP protocol
3	MODBUS RTU protocol

Power supply

0	Lithium battery
1	Lithium battery and 5Vdc
2	Lithium battery and 12Vdc

Install location

0	water supply pipe
1	water return pipe

Application type

0	For hot water use only
1	Heat/Cold measurement
2	For flow meter use only

Nominal diameter (mm)

15/20/25 32/40	DN15~40 screw type meter
50/65/80 100/125/ 150/200 250/300	DN50~300 flange type meter