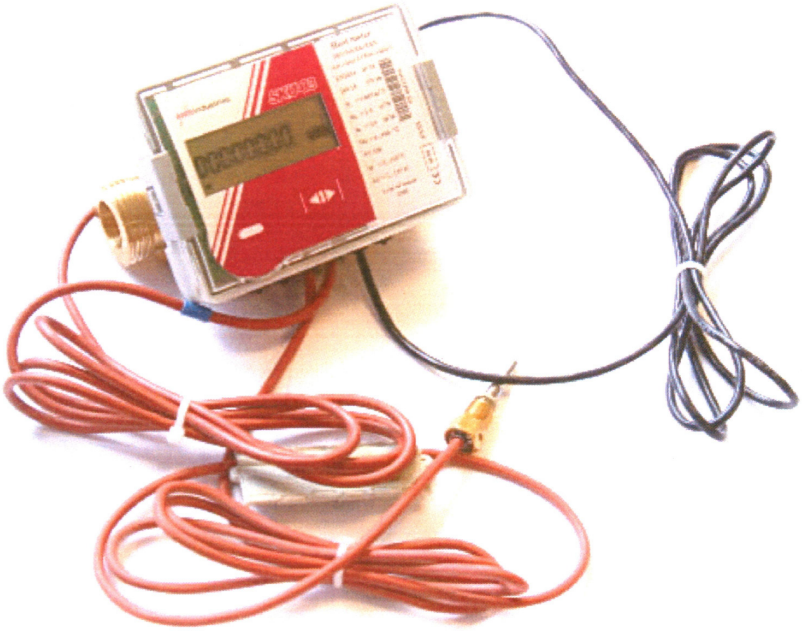
AB “AXIS INDUSTRIES”

ULTRASONIC METER FOR HEATING AND COOLING SKU-03



BASIC TECHNICAL DESCRIPTION

KAUNAS

Contents

EC DECLARACION OF CONFORMITY

AB „Axis Industries“ herewith declares, that this product complies with the relevant requirements of the following directives:

- 2004/22/EC Measuring instruments Directive
- 2004/108/EC EMC Directive
- 2006/95/EC Low voltage Directive

EC-type examination certificate **LT-1621-MI004-005**

For EU Customers only - WEEE Marking.

Marking of electrical and electronic equipment in accordance with Article 11 (2) of Directive 2002/96/EC

This symbol on the product indicates that it will not be treated as household waste. It must be handed over to the applicable take-back scheme for the recycling of electrical and electronic equipment. For more detailed information about the recycling of this product, please contact your local municipal office.

SAFETY INFORMATION

Before beginning installation works you must to read this document and follow its instructions.

- The meter is powered from the battery (3.6 V), risk factors during the meter installation and service is a heat conveying fluid flowing within flow sensor with inner pressure up to 1,6 MPa and temperature up to 180^0C.
- Only qualified technical personnel may install and maintain heat meters. Personnel must be familiar with appropriate technical documentation and general safety instructions. It is necessary to follow general safety requirements during installation and maintenance process.
- Device comply with safety class II. Protective grounding is not required, because housing is made from plastics, and conductive parts are not exposed to the surface.
- Safety guarantees at installation and service of meter is:
  - Reliable insulation of electrical circuits,
  - Hermetic fitting of primary flow and temperature sensors into the pipeline,
  - Reliable fastening of a sub-assemblies of heat meter at installation.
- Safety requirements for temperature sensors are provided in appropriate technical documentation.

Warning! Mounting of the sub-assemblies of heat meter is permissible only after ensuring of absence of heat conveying fluid in the pipeline.

1. APPLICATION FIELD

The ultrasonic meter for heating and cooling SKU-03 is designed for measuring heating and cooling energy and the recording of data in two separate registers.

It is intended for commercial accounting of energy consumption in objects of local or district heating systems: in dwelling houses, office buildings or energy plants and the like.

The microprocessor compact heat and cooling energy meter, can be mounted in both flow or return pipe.

The meter is available with the inseparable pair of temperature sensors installed at factory or the user can apply pair of temperature sensors which corresponds to requirements of Directive 2004/22/EC of 31 March 2004 on measuring instruments and has the type examination certificate

Heat meter corresponds to essential requirements of the Technical Regulation for Measuring Instruments, dated 30 March 2006 (transposing in the NB's country law Directive 2004/22/EC of 31 March 2004 on measuring instruments):

- Annex I Essential requirements
- Annex MI-004 Heat meter ,

SKU-03 complies with the European standard EN 1434 "Heat meters" parts 1+6.

SKU-03 fulfils "C" class environment protection requirements according to EN1434-1:2007

Climatic ambient temperature range: from 5 ° to 55 ° C,

Mechanical environment class: M1 ,

Electromagnetic environment class: E2.

Type number combination of the heat meter SKU-03:

Meter **SKU-03** **– 1-1-1-1-1*-15***

Type

The flow sensor installation:	**Code**
In flow pipe	**1**
In return pipe	**2**

Application type:	**Code**
Heat meter (Only for measurement of energy consumed for heating)	**1**
Heating and cooling meter (for measurement of energy consumed for heating and cooling)	**2**

The ratio of the permanent flow rate to the ower limit of the flow-rate (q_p/q_i):	**Temperature difference measurement range:**	**Code**
100	**(2…150) K**	**1**
250**	**(2…150) K**	**2**
100	**(3…150) K**	**3**
250**	**(3…150) K**	**4**

Flow sensor:

Permanent flow rate, m^3/h	**Mounthing length, mm**	**Connection to the pipeline**	**Code**
0,6	**110**	**G ¾**	**1**
1,0	**110**	**G ¾**	**2**
1,5	**110**	**G ¾**	**3**
2,5	**130**	**G1**	**4**
3,5	**260**	**G1 ¼**	**5**
6,0	**260**	**G1 ¼**	**6**
10,0	**300**	**G2**	**7**
10,0	**300**	**DN40**	**8**
15,0	**270**	**DN50**	**9**

Communication module:	**Code**
None	**0**
M-bus module	**1**
CL module	**2**
Module RF 868 MHz	**4**

Length of temperature sensors connection cable, m (not more 5 m), example 1,5 m

Remark: * - marked number are used only for order coding (It is not used for meter marking).
**** - only for meters q_p=1,5 m^3/h; 2,5 m^3/h; 6,0 m^3/h; 10 m^3/h; 15 m^3/h.**

2. TECHNICAL DATA

Accuracy class 2 by LST EN1434-1:2007.
Energy units kWh, MWh, GJ, Gcal
Maximum value of thermal power 2,63 MW

Flow measurement

The ratio of the permanent flow rate to the lower limit of the flow-rate (the user selects during order):

$q_p/q_i = 100$,

or $q_p/q_i = 250$ (only for flow sensors with $q_p = 1,5$ m^3/h; 2,5 m^3/h; 6,0 m^3/h; 15 m^3/h)

Flow sensor can be delivered for threaded connection (up to qp =10,0 m^3/h) or flanged.
Technical data of the flow sensor are presented in table 1.1

Table 1.1

Limits of flow rate, m^3/h			Threshold value of flow rate, m^3/h	Overall length L, mm	Pressure losses at q_p, kPa	Joining to the pipeline (Thread – G, flange– DN)
Permanent flow rate qp	Upper flow rate qs,	Lower flow rate qi				
0,6	1,2	0,006	0,003	110	23	G3/4“
1,0	2,0	0,01	0,005	110	11,3	G3/4“
1,5	3,0	0,015	0,003	110	17,1	G3/4“
1,5	3,0	0,006	0,003	110	17,1	G3/4“
2,5	5,0	0,025	0,005	130	19,8	G1“
2,5	5,0	0,01	0,005	130	19,8	G1“
3,5	7,0	0,035	0,017	260	4	G1 1/4“
6,0	12,0	0,06	0,012	260	10	G1 1/4“
6,0	12,0	0,024	0,012	260	10	G1 1/4“
10,0	20,0	0,04	0,02	300	18	G2“or DN40
10,0	20,0	0,100	0,02	300	18	G2“or DN40
15,0	30,0	0,150	0,03	300	12	DN50
15,0	30,0	0,06	0,03	300	12	DN50

Temperature limits of heat conveying liquid:

- for flow sensors qp ≤ 2,5 m^3/h 5 ^{o}C....130 ^{o}C.
- for flow sensors qp ≥ 3,5 m^3/h 10^{o}C....130 ^{o}C.

Note: For heat conveying liquid temperature below 90 ^{o}C, the calculator can remain on the flow sensor or be mounted on the wall.
For heat conveying liquid temperature above 90 ^{o}C the calculator must be mounted on the wall.

Connection cable length between the calculator and the flow sensor 1,2 m

Maximum admissible working pressure 16 bar.

Behaviour of the meter, when the flow rate exceeds the maximum value q_s:

- At the flow rate $q < 1,2 \cdot q_s$ -linear,
- At the flow rate $q > 1,2 \cdot q_s$ - constant ($q = 1,2 \cdot qs$ is applied to calculations of thermal energy). The error „Maximum allowable value of flow rate is exceeded“ is registered and duration of error is calculated.

Pulse inputs (additional)

Number of pulse inputs	2
Measurement units	m^3
Pulse value	programmable
Type of pulses	IB by LST EN1434-2
Maximum permissible frequency of input pulses	3 Hz
Maximum permissible voltage of input pulses	3,6 V
Condition of maintenance of high level	3,6V via 3,3MΩ resistor

Temperature measurement

Temperature measuring range(for calculator) 0 °C....180 °C.

Temperature difference measuring range 2K.....150 K. (or 3…150 °C)

Temperature sensor :

- Platinum resistance temperature sensors (corresponding EN60751 and are selected as matched pairs under requirements EN1434 and MI004 of Directive 2004/22/EC) — Pt500 (or Pt1000–according to the special order)
- For meters with threaded connection G3/4, G1 or G1 ¼ — Direct mounted short probes type DS in accordance with LST EN1434-2
- For other types of connection — Pocket mounted long probes type PL in accordance with LST EN1434-2

2-wire connection method, cable length:

- for temperature sensors type DS — 1,5m –standard version; 2,5;5m – according to the special order
- for temperature sensors type PL — 2,5m - standard version; 5m – according to the special order

Display (LCD)

The device is equipped with 8-digits LCD (Liquid Crystal Display) with special symbols to display parameters, measurement units and operation modes

The following information can be displayed: integral and instantaneous measured parameters, and archive data, and device configuration information listed in p.7.3.

Display resolution, depending on permanent flow rate value is provided in the Table 1.2

Table 1.2

Permanent flow rate value q_p	Display resolution of volume , m^3	Display resolution of energy, kWh (MWh)	Display resolution of energy, Gcal	Display resolution of energy, GJ
< 6 m^3/h	00000,001	0000000,1 kWh	00000,001 Gcal	00000,001 GJ
≥ 6 m^3/h	00000,001	00000,001 MWh	00000,001 Gcal	00000,001 GJ

Data registration and storage

Every hour, day and month values of the measured parametres are stored in memory of the meter
All data from archive can be read only by means of the remote reading (see p.7.5)
In addition data logger records of monthly parameters can be seen on the display (see p. 7.3.1)
Following daily, weekly and monthly parameter values are recorded in heat meter memory:

1	Integrated energy
2	Integrated cooling energy
3	Integrated energy of tariff 1
4	Integrated energy of tariff 2
5	Integrated volume of liquid
6	Integrated pulse value in pulse input 1

7	Integrated pulse value in pulse input 2
8	Maximum thermal power value for heating and date
9	Maximum thermal power value for cooling and date
10	Maximum flow rate value and date
11	Maximum value of flow temperature of heat conveying liquid and date
12	Maximum value of return temperature of heat conveying liquid and date
13	Minimum value of flow temperature of heat conveying liquid and date
14	Minimum value of return temperature of heat conveying liquid and date
15	Minimum value of temperature difference and date
16	Average value of flow temperature of heat conveying liquid
17	Average value of return temperature of heat conveying liquid
18	Operating time without an error of thermal energy calculation
19	Total error code
20	Time when the flow rate exceeded 1.2 qs
21	Time when the flow rate was less than qi

Data logger capacity:
up to 960 h – for hourly records.
up to 1116 days -. for daily records,
up to 36 last months -. for monthly records,
Archive data storage time not less than 36 months
Storage time of measured integrated parameters
even if device is disconnected from power supply not less than 15 years

External communication modules and interfaces

Optical interface

Integrated into the front panel of calculator. It is designed for data reading via M-bus protocol and parameterization of the meter.

The optical interface starts work (is activated) only after pressing control button and automatically shuts down after 5 minutes, after the last pressing any button or after completing data transmission via interface.

Optional plug in modules

M-Bus module
CL-module (Current loop)
RF-module 868 MHz

It is designed for data reading via M-bus protocol and parameterization of the meter.
The total working time of serial communication interface (for protection of the battery against premature discharge), is limited up to 130 minutes per month. Unused limit of communications are summarized. The interface is blocked after the expiration of a limit and only after change of the hour, the new time limit of communications will be given (for 11 seconds for each next hour).

Pulse outputs

2 (OB-normal mode, OD-test mode)
Type: open collector, permissible current up to 20mA, voltage up to 50V.
Pulse duration: 100 ms – in the normal operating mode, 1.6 ms – in the test mode

Pulse values (energy and volume) on pulse output device in the operating mode as specified in the table below :

- energy pulse output values:

Energy units	„kWh“, „MWh“	„GJ“	„Gcal“
Pulse value of thermal energy	1 kWh/pulse	0,005 GJ/pulse	0,001 Gcal/pulse

- flow (volume) pulse output values:

Permanent flow rate, q_p, m^3/h	0,6 ... 2,5	3,5; 6	10; 15
Pulse value, l/pulse	1	2	5

Supply voltage:

Internal baterry — size AA, 3,6 V, 2,4 Ah, lithium baterry(Li-$SOCl_2$)
service life not less than 11 years

Mechanical data :

Dimensions of calculator — 117 mm x 44 mm x 89,5 mm,
Dimensions of flow sensors — According to Annex B
Weight**:**

Connection type of flow sensor	Weight of meter, not more than, kg
G3/4“	0,7
G1“	0,7
G1 ¼“	3,2
G2“	3,7
DN40	6,8
DN50	8,5

Envoronmental class — Meets EN1434 class C
Ambient temperature:
Calculator — at +5 °C to +55 °C (non-condensing,indoor installation)
Flow sensors — at -30 °C to 55 °C
Relative humidity — < 93 %
Mechanical environment class: — M1
Electromagnetic environment class: — E2
Protection class of calculator enclosure — IP65
Protection class of flow sensor enclosure — IP65 (IP67 – by special ordering)

3. OPERATING PRINCIPLE

The flow measuring principle is based on ultrasonic measurement method. The ultrasonic signal along the measuring section moves many times before, and the flow downstream between the ultrasonic sensors have to perform transmitter and receiver functions. From the resulting time difference the flow rate is calculated.

The liquid temperature is measured with standard platinum resistance temperature sensors Pt500 or Pt1000. Pairs of temperature sensors with 2-wire connection method for measurement temperatures on flow and return pipelines are used. Flow and return temperature sensors can be replaced only in pairs.

Energy calculation formulas:

- Flow sensor in flow pipe

$$Q = V1 * \cdot \rho_1 * (h_{T1}-h_{T2})$$

- Flow sensor in return pipe

$$Q = V1 * \rho_2 * (h_{T1}-h_{T2})$$

There: Q –thermal energy,

V1 –Water volume, m^3

ρ_1 ρ_2 – Water densities, according to supplied and return water temperatures Θ1, Θ2

h_{T1},h_{T2} – The enthalpies, according to water temperatures Θ1, Θ2

When function of cooling energy is made active and at negative temperature difference, the energy for cooling will be registered and in the additional tariff register:

$$\sum Q = Q\,1 + Q\,2$$

- Flow sensor in flow pipe:

When Θ1 > Θ2: $Q1=V1\cdot\rho_1\cdot(h_{T1}-h_{T2})$, $Q2=0$

When Θ1< Θ2: $Q2=V1\cdot\rho_1\cdot(h_{T2}-h_{T1})$, $Q1=0$

- Flow sensor in return pipe:

When Θ1 > Θ2: $Q1=V1\cdot\rho_2\cdot(h_{T1}-h_{T2})$, $Q2=0$

When Θ1< Θ2: $Q2=V1\cdot\rho_2\cdot(h_{T2}-h_{T1})$, $Q1=0$

Heat meter calculator provides all the necessary measurements and data storage functions.

4. MARKING AND SEALING

4.1.Marking

Calculator

There are following information on the front panel of calculator - manufacturer's trade mark , type of meter, serial number, year of manufacture, EC-type examination certificate number, limits of the temperature, limits of the temperature diferences, accuracy class, environmental class by LST EN1434-1, el;ectromagnetic and mechanical environmental class, enclosure protection class, type of temperature sensors, flow sensor installation site (flow or return pipe), the limiting values of the flow rate(qi,qp,qs), maximum temperature range for flow sensor , the maximum admissible working pressure, nominal pressure, voltage level for power supply.

Numbers of terminal pins are marked close to the terminal

Flow sensor

There are following information on the flow sensor:

-nominal diameter,

- arrow for indication of a flow direction

4.2.Security seals

Manufacturer seals:

- One warranty seal on the one screw of protective cover of electronic unit inside the calculator (see Annex C, Fig.C1).
- Seals on the screws of protective cover of flow sensor (Sticker or hanging seal according see Annex C, Fig.C2).

Calibration (verification) seal:

- One seal on the one screw of protective cover of electronic unit inside the calculator (see Annex C, Fig.C1).
- Seals on the screws of protective cover of flow sensor (Sticker or hanging seal according Annex C, Fig.C2).

Mounting seal:

- Hanging seal on the junction between upper and lower part of the housing of the calculator (see AnnexC, Fig.C1)
- Seals on the protective cover and mounting bolt of temperature sensors (see Annex C, Fig.1...2).

The meter must be sealed to ensure that after the installation, it is not possibility of dismantle, remove or altering the meter without evident damage on the meter or the seal.

5. INSTALLATION

5.1. Basic requirements

Heat meter is designed for installation in heating or combined heating and cooling systems.

Before installing the device:

- check if all parts listed in the documentation are available,
- check if there are no visible mechanical defects,
- check if there are valid labels of manufacturer and certification authority.

Only qualified personnel may install the equipment, following the requirements listed in this document, in technical documentation of other system components and in heat meter installation project

It is forbidden to wire signal cables nearby (less than 5 cm) with power cables or cables of other devices.

It is forbidden to change length of a cable.

5.2. Electrical wiring

5.2.1. Temperature sensor connection:

Factory installed sensors

With factory-installed sensors do not split, shorten or extend the cables. If the screw terminals are accessible on the calculator, to facilities installation cables can be temporarily disconnected from the terminals and reconnected afterwards.

Customer sensors

Only approved and matching pairs of temperature sensors with two wire connection method are to be used.

Connection of the customer temperature sensors:

Before installation check that the temperature sensors are paired with each other (T1 to T2)

By means of tweezers remove a protective knolls from sealant holes 1 and 2 at left side of calculator

Run the wire of flow temperature sensor T1 through the hole 1 and the wire of return temperature sensor T2 through the hole 2.

Use two wire connection method for temperature sensors connection – T1 connect to the terminals 5/6, T2 - connect to the terminals 7/8 as shown in Annex B, Figure B1.

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5.2.2. Installation of additional communication modules

In the bottom, right-hand corner of the calculator, communication module can be installed and must by connected. Connector of the communication module are set in a calculator connector. The module is fastening with two screws

Connection of the communication module (except the module RF):

By means of tweezers remove a protective knoll from not used sealant hole of calculator

Run the wire through the hole and fix as shown in chapter 5.3.1.

Connect a wire to the module under the scheme specified on the module.

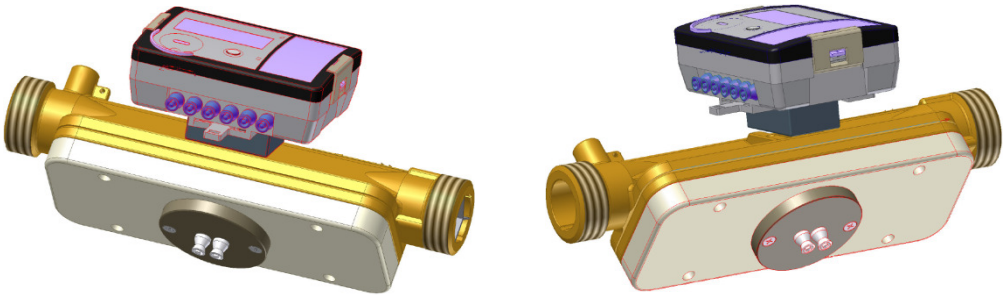
5.3 Mounting

5.3.1. Mounting of calculator

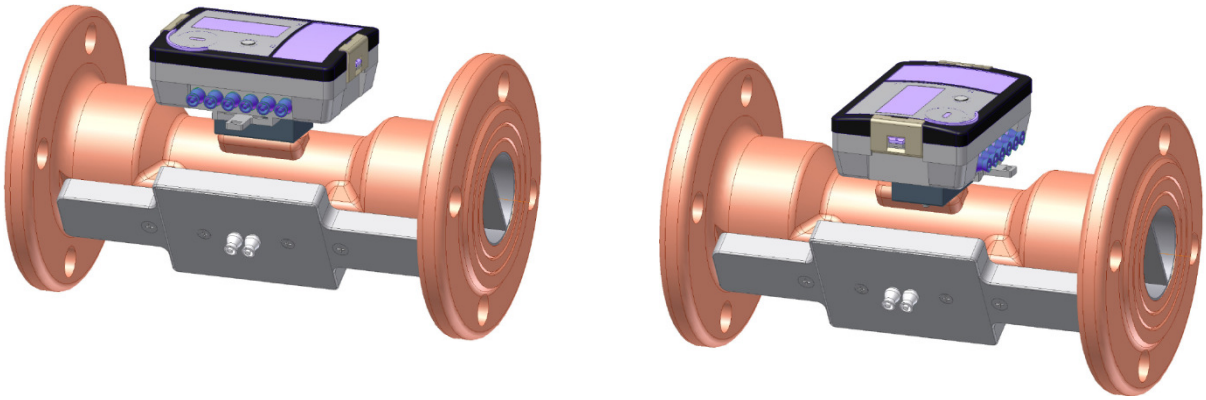
Heat meter calculator may be installed in heated premises, working ambient temperature shall be not more than 55 ° C. It may not be exposed to direct sunlight.

Calculator can be mounted in several different ways:

- Wall mounting, without possibility sealing of mounting
- Wall mounting, with possibility sealing of mounting
- Mounting on standard DIN-rail
- Panel mounting
- Direct mounting on ultrasonic flow sensor housing, turning every 90° (only when the temperature of the flow does not exceed 90 ° C):

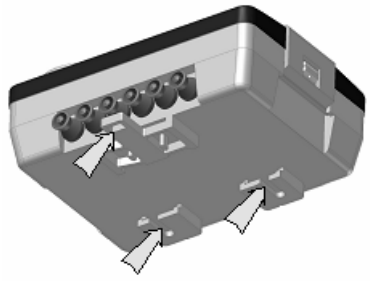


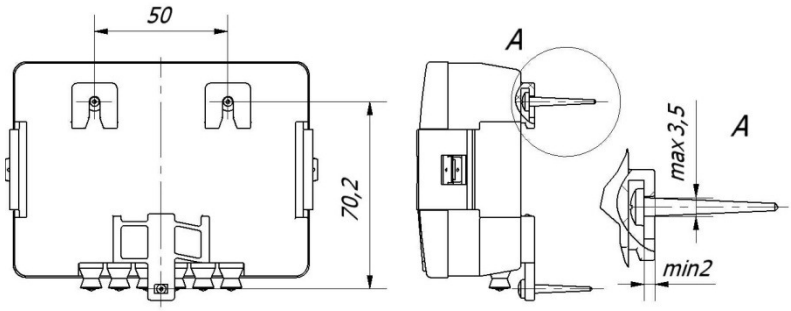
a) On the flow sensor with a thread connection



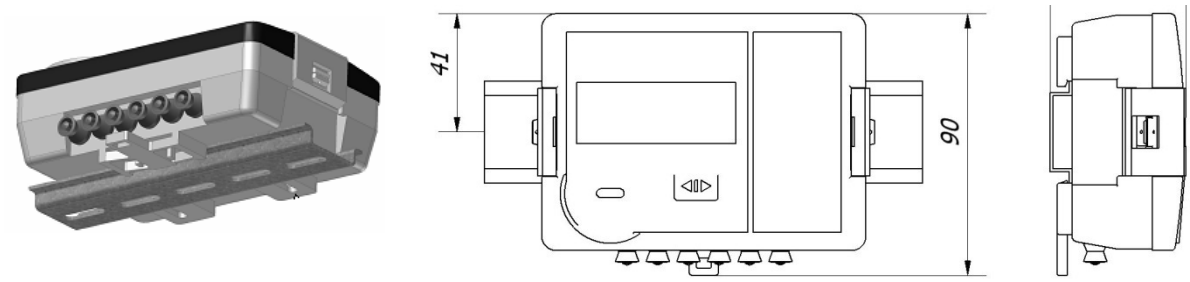
b) On the flow sensor with flange connection

- On the wall:

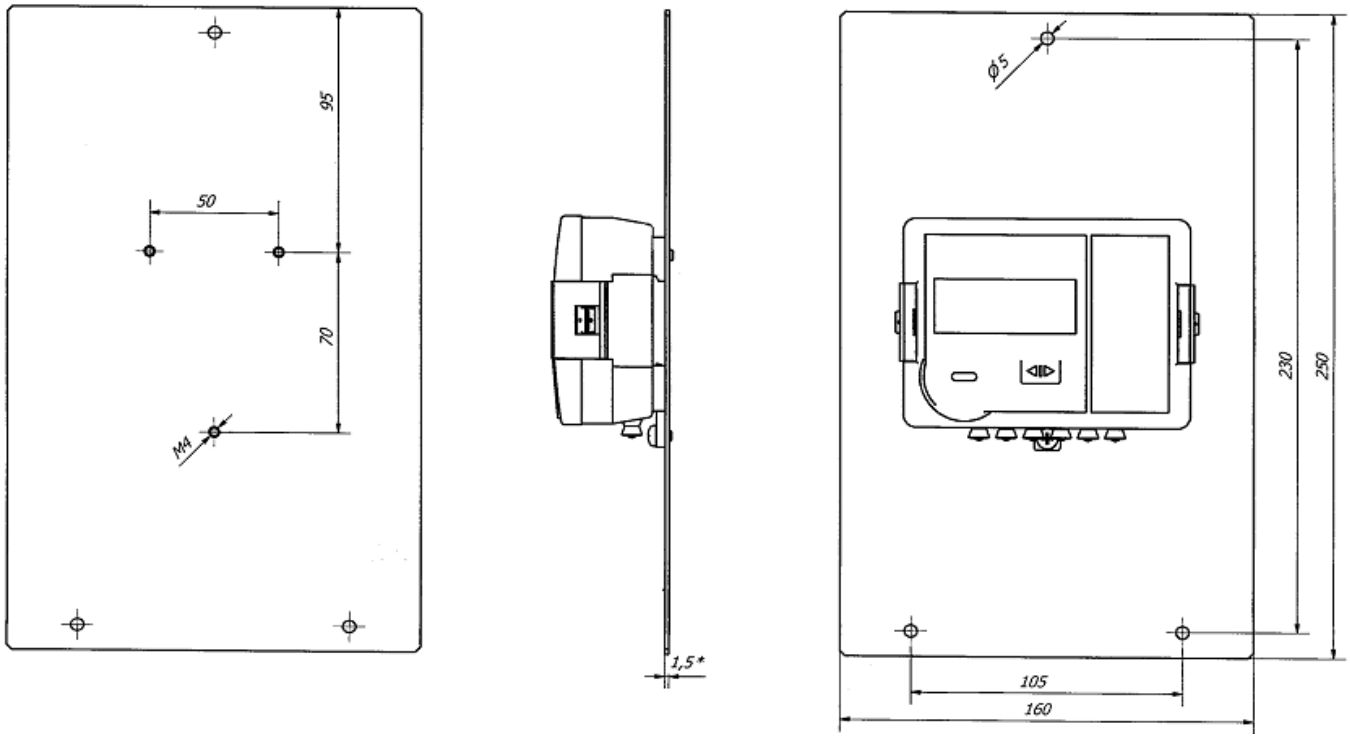




- Panel mounting on standard DIN-rail.



- Adapter plate according to figure 8 of EN1434-2:2007 for wall mounting of calculator can be used (if the aperture in the wall is too large for the calculator) :



Important: It is forbidden to attach the calculator directly to a wall if there is a risk that on walls can be condensed humidity or temperature of a surface of a wall can fall lower than 5 °. In this case, it is recommended to attach the calculator so that between it and wall surfaces there was an air gap not less than 5 cm.

5.3.2. Mounting of flow sensors

Sizes and mounting dimensions of flow sensors are provided in Annex B.
Requirements for flow sensor installation in pipeline:

- For flow sensors DN15…DN32: no requirements for straight pipeline length in upstream and down stream directions.
- For flow sensors DN40…DN50:
  - upstream straight pipeline length must be not less 5DN and downstream straight pipeline length must be not less 3DN

Avoid the flow sensor installation near after the pumps which can cause cavitations.

Flow sensor can be mounted both vertically and horizontally in pipelines. Vertically mounting of the flowmeter is allowed only if flow direction in the pipeline is from down to up.

The direction of the sensor installation (is indicated with the arrow on the label of flow sensor) must mach with the flow direction in pipeline.

The flange gaskets must mach with the pipe diameter. During the installation gasket must be exactly centered with the center of the pipe cross-section to avoid sticking out gaskets inside the pipe.

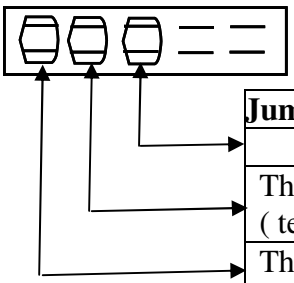
5.3.3. Mounting of temperature sensors

Temperature sensors are mounted by head upwards, is perpendicular to the pipe axis or inclined by 45 ° angle on fluid flow direction so that the sensing element has been inserted in medium at least up to the pipe axis or beyond (as shown in Annex C).

For meters with flow sensor joining G3 / 4 ', G1, and G1 ¼' – one temperature sensor is mounted in the flow sensor housing.

5.4. Setting up the jumpers (J)

The connector J is on the calculator plate between the temperature sensors and pulse input / output connection terminals (Figure A1). Joining or leaving open the connector contacts, you can choose the normal or verification (test) mode, activate the pulse inputs or outputs:



Jumper is not set (contacts are opened)	**Jumper is set (contacts are conected)**
NORMAL MODE	VERIFICATION (TEST) MODE
The first pulse output is active (terminals 52,53)	The first pulse intput is active (terminals 52,53)
The second pulse output is active (terminals 50,51)	The second pulse intput is active (terminals 50,51)

Fig. 6.1. Definition of jumpers

5.5. Verification of installation and set-up

After installing the heat meter, let measured fluid flow through the flow sensor. Measured parameter values should be indicated on the display, if the heat meter (calculating unit, flow and temperature sensors) is installed correctly. If measured parameter values are not displayed correctly, it is necessary to verify the installation.

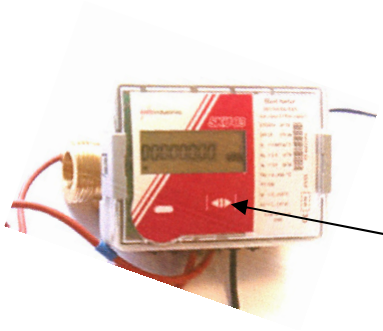
5.6. Sealing after installation

The meter must be sealed according to p.4.2 to ensure that after the installation, it is not possibility of dismantle, remove or altering the meter without evident damage on the meter or the seal.

Mounting seal:

- Hanging seal on the junction between upper and lower part of the housing of the calculator (see Annex C, Fig.C1)
- Seals on the protective cover and mounting bolt of temperature sensors (see Annex C, Fig.C3).
- Connection of flow sensor with the pipeline should be sealed in addition.

6. OPERATION



The information can be displayed using control button  which are on the top of the calculator

6.2. Display function

The calculator of heat meter is equipped with 8-digits LCD (Liquid Crystal Display) with special symbols to display parameters, measurement units and operation modes.

Destination of the special symbols:

→	-	the flow is flowing forward (right direction)
←	-	the flow is flowing backwards
arrow is not displayed	-	the flow does not flow

Destination of the other symbols are described in sections 6.3.1...6.3.3

The following information can be displayed:
- integral and instantaneous measured parameters,
- archive data and set day data,
- device configuration information,

The display constantly shows the total thermal energy.

6.3. Menu structure

6.3.1. Viewing the readings in normal mode (Users meniu)

The menu structure in a normal operating mode is presented in the Fig 6.1

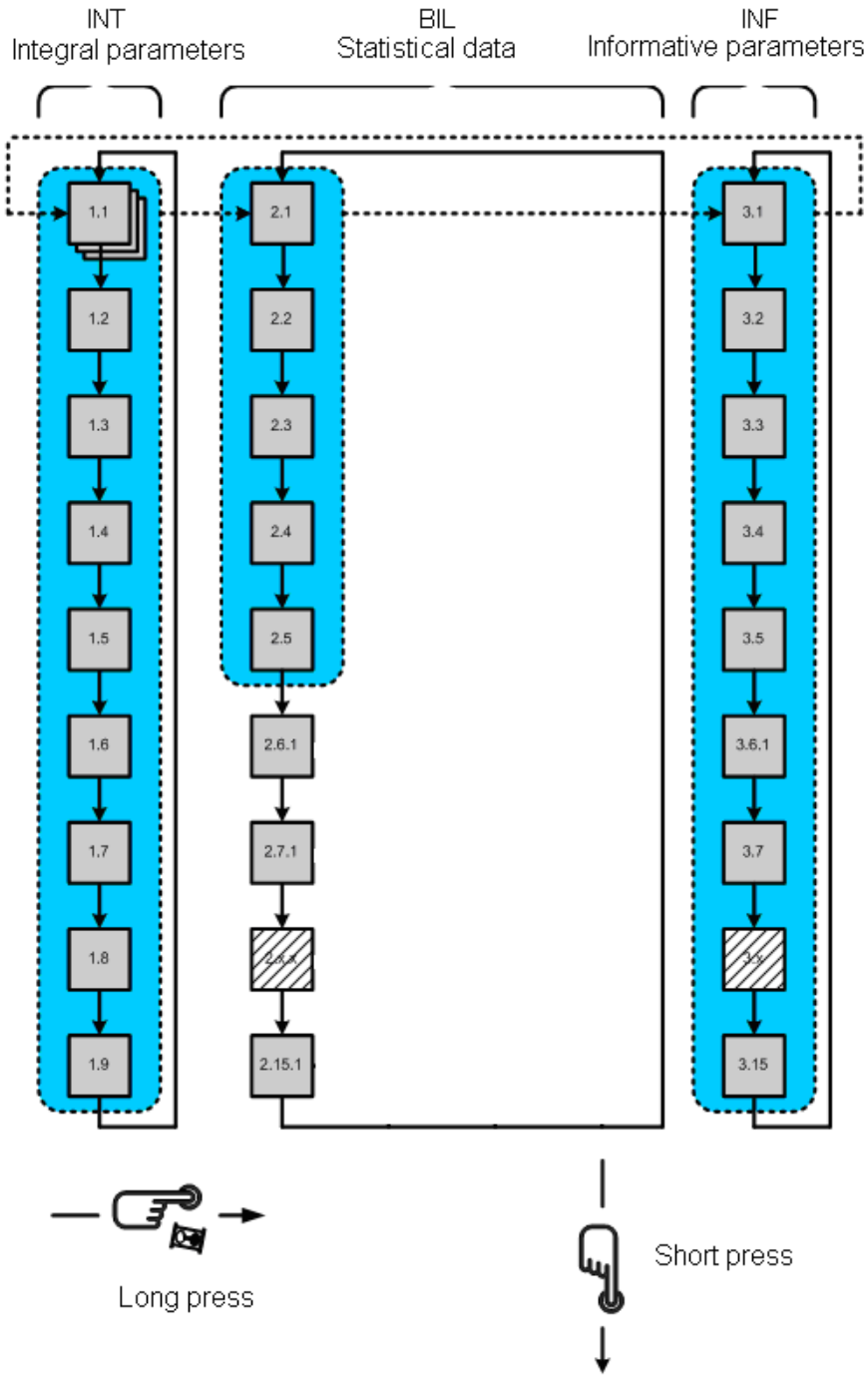


Fig. 6.1 Viewing the readings in normal mode.

Integral parameters values (1.2) or– if at least one error has been detected – error code (1.1) are displayed if the button has not been presed for more than 60 seconds.

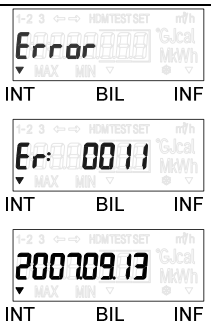
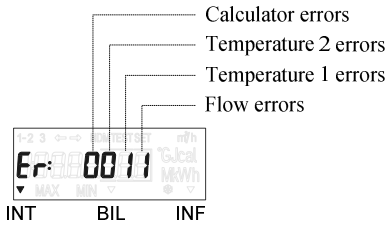
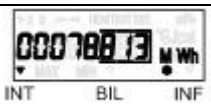
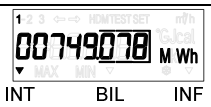
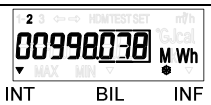
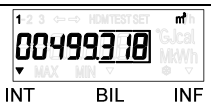
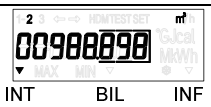
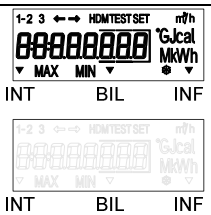
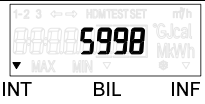
(INT - integral parameters, BIL – statistical data, INF- informative parameters

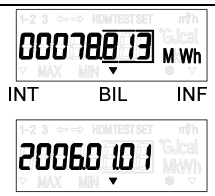
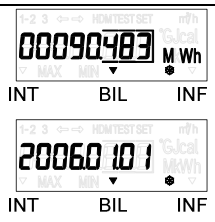
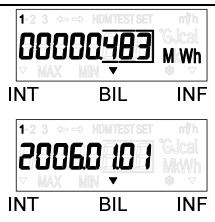
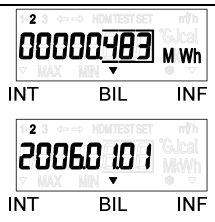
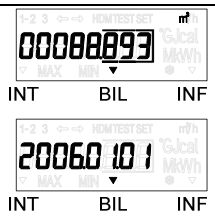
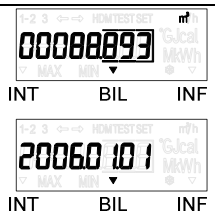
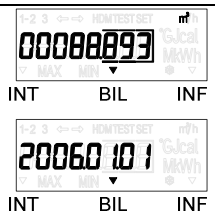
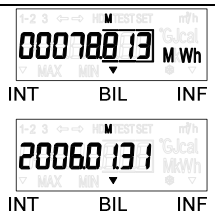
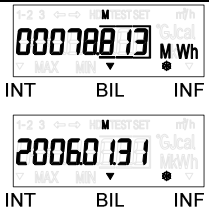
— ☞ → - long press (> 3 s) - shift to the right

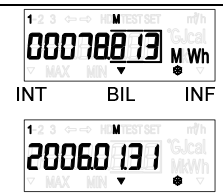
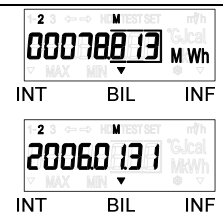
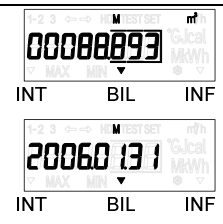
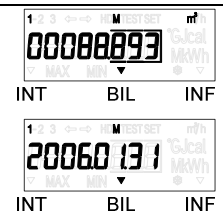
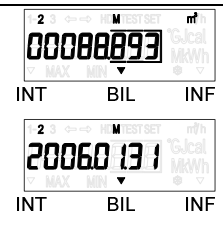
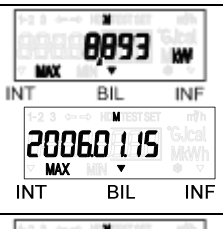
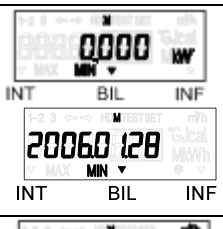
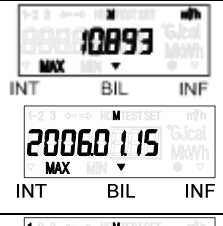
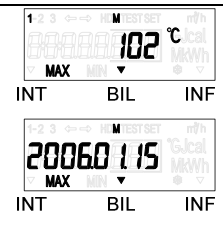
| ☟ ↓ - short press(< 3 s) – shift down)

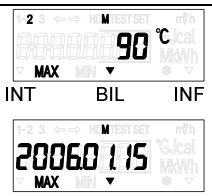
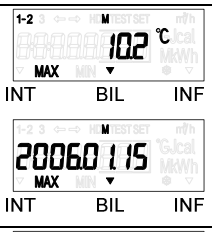
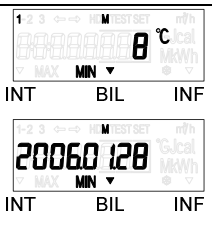
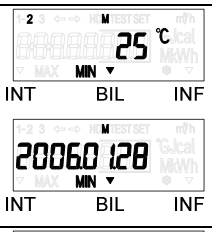
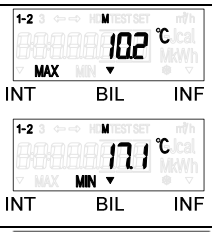
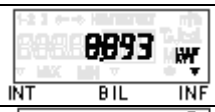
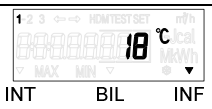
6.3.1. Viewing the readings in normal mode (Users meniu)

Remark: Here the full list of shown parametres is represented. For the specific meter it can be reduced

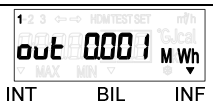
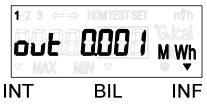
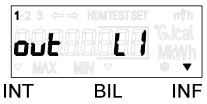
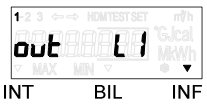
ID	Parameter	Value	Description
1.1	Error code with data stamp of starting oferror *Are shown only at an error in meter work*		All three displays, will be displayed in turns in one second interval  Description of Error codes is presented in p. 6.3.3
1.2	Energy for heating		
1.3	Energy for cooling		Are shows only in the heating and cooling energy meters
1.4	Integrated energy of tariff 1		"Snowflake" indicates that the tariff is linked to the meter of cooling energy
1.5	Integrated energy of tariff 2		"Snowflake" indicates that the tariff is linked to the meter of cooling energy
1.6	Integrated quantity of heat-conveying liquid		
1.7	Integrated reading of pulse input 1		The additional flow sensor can be connected to a pulse input 1
1.8	Integrated reading of pulse input 2		The additional flow sensor can be connected to a pulse input 2
1.9	Segment test		changes each 1 second
1.10	Working hours without a energy calculation error		
1.11	Customer number		Corresponds to a wire transmission via MBus protocol
1.12	Control number		

2.1	Quantity of thermal energy on set day with date stamp		Changing with date stamp every 1 second
2.2	Quantity of thermal energy for cooling on set day with date stamp		When meter is intended for heating and cooling, the two separate displays are shown. Changing with date stamp every 1 second
2.3	Tariff register 1 on set day with date stamp		Changing with date stamp every 1 second
2.4	Tariff register 2 on set day with date stamp		Changing with date stamp every 1 second
2.5	Volume of liquid on set day with date stamp		Changing with date stamp every 1 second
2.6	1st pulse input pulse value on set day with date stamp		Changing with date stamp every 1 second
2.7	2nd pulse input pulse value on set day with date stamp		Changing with date stamp every 1 second
2.8	Quantity of thermal energy on set day of previous month with date stamp		The user chooses set day in the month according to needs. (If it is set up 31, the data will be recorded in the last day of the month) Registration Time: 23:59:59
2.9	Quantity of thermal energy for cooling on set day of previous month with date stamp		Changing with date stamp every 1 second

2.10	Tariff register 1 on set day of previous month with date stamp		Changing with date stamp every 1 second
2.11	Tariff register 2 on set day of previous month with date stamp		Changing with date stamp every 1 second
2.12	Volume of liquid on set day of previous month with date stamp		Changing with date stamp every 1 second
2.13	1st pulse input pulse value on set day of previous month with date stamp		Changing with date stamp every 1 second
2.14	2nd pulse input pulse value on set day of previous month with date stamp		Changing with date stamp every 1 second
2.15	Maximum Power of previous month with date stamp		Changing with date stamp every 1 second
2.16	Minimum Power (or maximum Power for cooling) of previous month with date stamp		Changing with date stamp every 1 second
2.17	Maximum flow rate of previous month with date stamp		Changing with date stamp every 1 second
2.18	Maximum temperature in flow pipe of previous month with date stamp		Changing with date stamp every 1 second

2.19	Maximum temperature in return pipe of previous month with date stamp		Changing with date stamp every 1 second
2.20	Maximum temperature difference of previous month with date stamp		Changing with date stamp every 1 second
2.21	Minimum temperature in flow pipe of previous month with date stamp		Changing with date stamp every 1 second
2.22	Minimum temperature in return pipe of previous month with date stamp		Changing with date stamp every 1 second
2.23	Minimum temperature difference of previous month with date stamp		Changing with date stamp every 1 second
3.1	Thermal power		
3.2	Flow rate		
3.3	Temperature in flow pipe		
3.4	Temperature in return pipe		
3.5	Temperatute difference		
3.6*	Next replacement date of the battery		
3.7*	Real time calendar		
3.8*	Real time clock		

3.9*	Yearly set day		
3.10*	Monthly set day		
3.11*	Tariff 1	Tariff 1, when T1-T2 < 10.0 oC  Or >10.0 oC  Or in interval from 10.0 to 40.0oC (changes each 1 s.)   Or there is the time interval in hours (00-24h.)  Or tariff is activated directly by pulse input: 	It is possible to choose: One of the measured parameters, 1st or 2nd pulse input (if it is configured as an input), one of the temperature or the temperature difference.
3.12*	Tariff 2	Similarly ID 3.11, only „L1“,changes in the „L2“	See 3.11
3.13*	1st pulse input/output configuration	Input:  Input (tariff activation):  Outputs: energy, quantity of liquid	Inputs: Can be configured only for a quantity of water. Maximum pulse resolution is displayed 0.00001 m3. Outputs: Can be configured for a quantity of water (m3), for heating (In a shown case) / cooling(additional snowflake is displayed) energy or to one of tariffs.

		 Tariff   Tariff condition: 	
3.14*	2nd pulse input/output configuration	Similarly ID 3.13, only „1“,changes in the „2“	See 3.13
3.15	Type of heat-conveying liquid		Type of heat-conveying liquid: “---“ (crosses) - water
3.16	Pressure value for energy calculations		"160E4"-corresponds to the pressure 1.6 MPa
3.17*	Customer number		Are transferred on telegram Mbus
3.18	Softvare version number		
3.19	Serial number		
3.20*	MBus adress		
3.21	Working hours without a power calculation error		
3.22*	Battery operation time		

Remark: Values of the parameters marked with "*" and energy measurement units (MWh, Gcal or GJ) can be modified by installing a meter. Replacement is possible via optical interface and in conjunction with the special configuration programme in a test mode, when jumper is set (see p.6.4). In the same way it is possible to switch off indication of irrelevant parameters.

6.3.2. Viewing the readings in TESTmode (Service meniu)

The menu structure in a test mode is presented in the Fig 6.2

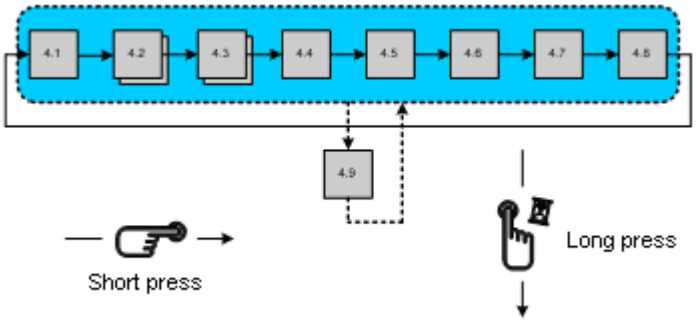


Fig.6.2. Viewing the readings in verification (test) mode

— ☞ → - short press(< 3 s) - shift to the right

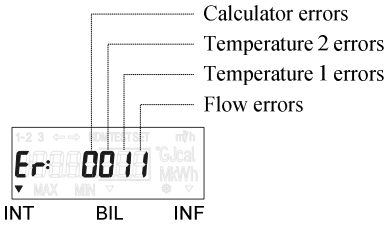
↓ - long press (> 3 s) – shift down)

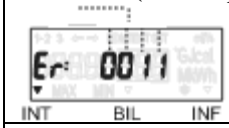
Viewing the readings in verification (test) mode (Service meniu)

ID	Parameter	Value	Description
4.1	High- resolution energy	TEST 000788 13 kWh INT BIL INF TEST PULSE INT BIL INF	It is updated every second if the test mode is made active
4.2	High-resolution integrated volume	m³ 00 149 1 18 INT BIL INF TEST PULSE INT BIL INF	It is updated every second if the test mode is made active
4.3	Number of pulses of 1st pulse input	1 TEST in 18 INT BIL INF	
4.4	Number of pulses of 2nd pulse input	2 TEST out 448 INT BIL INF	
4.5	Temperature of heat conveying liquid in flow pipe	1 TEST 36.6 °C INT BIL INF	
4.6	Temperature of heat conveying liquid in return pipe	2 TEST 38.8 °C INT BIL INF	
4.7	Temperature difference	1-2 TEST -2.23 °C INT BIL INF	
4.8	Actuation of flow simulation	TEST m³/h SF 15000 INT BIL INF	During test, the value of flow is constantly displayed. After the ending of test, the values of energy and quantity of a liquid are registered in memory till the successive test or before following actuating of the flow simulation
4.9	High-resolution flow rate	m³/h 10893 INT BIL INF	

6.3.3. Error codes

Error code may consist from up to 4 symbols. Each symbol may have values 0…8



Code	Description
Status of calculator 	0 - no error, normal operation 1 - warning – ending battery life 2- temperature difference is greater than the permitted limits 4- temperature difference is less than the permitted limits 8- electronics failure
Status of temperature sensor 2 (return pipe) 	0- no error, normal operation 4- short circuit 8- sensor failure (oper circuit or short circuit)
Status of temperature sensor 1 (flow pipe) 	0- no error, normal operation 4- short circuit 8- sensor failure (oper circuit or short circuit)
Status of flow sensor 	0- no error, normal operation 1- no signal, flow sensor is empty 2- flow flows in an reverse direction 4- flow rate greater than 1.2·qs (are displayed q=1,2qs) 8- electronics failure

Active error codes are added and simultaneously displayed, if it is detected more than one error

3 - corresponds errors 2 + 1
5 - corresponds errors 4 + 1
7 - corresponds errors 4 + 2 + 1
9 - corresponds errors 8 + 1
A - corresponds errors 8 + 2
B - corresponds errors 8 + 2 + 1
D - corresponds errors 8 + 4 + 1
E - corresponds errors 8 + 4 + 2
F - corresponds errors 8 + 4 + 2 +1

In a case when value at least one digit of error code is ≥ 8 - calculation of thermal energy and summation of volume of water and operation time without errors are stoping
In the case of the flow sensor error "4" - duration of time, "when the flow rate q> 1.2 · qs" is registered in addition.

6.4. Activating test mode

Destination of contacts of connector J

The 2-line,10-pole connector is on the calculator plate between temperature sensors and pulse input /output terminals (see fig.A1, Annex A). Destination of contacts of connector J is presented in fig. 6.3.

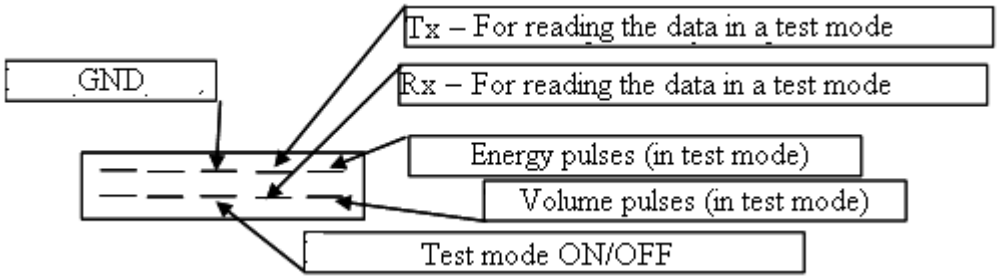


Fig. 6.3. Destination of contacts of connector J

Activation of test (verification) mode

In test mode it is possible to achieve precise results within short measuring time.

For activation of Verification (Test) mode you must opening device and set up jumper on the connector (J) contacts as shown in Figure 6.4.

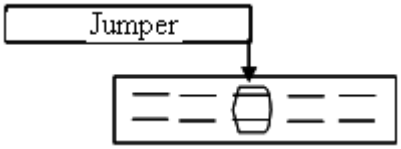


Fig. 6.4. Test mode activation

For working in this mode, the calculator can not be closed.

When the jumper "J" is set, the device enters test mode – label "TEST" appears on the LCD, calculation process is stopped and all integral parameter values are saved in the memory. After return to normal mode, the original values from before the test are displayed again.

The readings of meter in verification (test) mode are presented in p. 6.3.2

LCD resolution in verification mode „TEST" are presented in Table 6.1

Table 6.1

Energy measurement units	„kWh", „MWh"	„GJ"	„Gcal"
Display resolution of energy	000000,01 Wh	0000000,1 kJ	0000000,1 kcal
Display resolution of volume	00,000001 m^3		

Energy and volume pulse values in verification mode „TEST" are presented in Table 6.2

Table 6.2

Nominal (permanant) flow rate q_p, m^3/h	Volume pulse value, l/pulse	Energy pulse value		
		„kWh", „MWh"	„GJ"	„Gcal"
0,6	0,002	0,1 Wh/pulse	0,5 kJ/ pulse	0,1 kcal/ pulse
1,0	0,002	0,2 Wh/ pulse	1 kJ/ pulse	0,2 kcal/ pulse
1,5	0,004	0,2 Wh/ pulse	1 kJ/ pulse	0,2 kcal/ pulse
2,5	0,005	0,5 Wh/ pulse	2 kJ/ pulse	0,5 kcal/ pulse
3,5	0,02	1 Wh/ pulse	5 kJ/ pulse	1 kcal/ pulse
6,0	0,02	1 Wh/ pulse	5 kJ/ pulse	1 kcal/ pulse
10,0	0,05	2 Wh/ pulse	10 kJ/ pulse	2 kcal/ pulse
15,0	0,05	5 Wh/ pulse	20 kJ/ pulse	5 kcal/ pulse

Ending of verification mode

Remove jumper J to leave test mode and return to normal mode. After leaving test mode, previously recorded integral parameter values are displayed.

6.5. Remote data reading

For data transmission from meter it can be used optical interface. The optical head is placed on the calculator and is connected to RS-232 interface of reading device.

In addition for remote reading of data can be used two pulse outputs, or one of the following communication modules:

CL-module (Current loop)
M-Bus
RF-module

Pulse outputs

The pulse outputs are active when the corresponding contacts of connector (J) is open (see Fig. 6.3)

All communication interfaces does not affect the measured parameters and their calculation, and therefore can be replaced by another type without removing of verification seal.

Data collection from meters can be realised via PC, via telephone modem, via GSM modem, via Internet, and so on.

7. VERIFICATION

Metrological control of heat meter parameters is performed according to requirements defined in EN 1434-5.

8. TRANSPORTATION AND STORAGE REQUIREMENTS

Requirements for safe transportation and storage of temperature and pressure sensors are provided in relevant technical documentation.

Packed equipment may be transported in any type of covered vehicle. Equipment should be anchored reliably to avoid shock and possibility to shift inside vehicle.

Equipment should be protected against mechanical damage and shock.

Equipment should be stored in dry, heated premises, where environment temperature is not lower than +5 ^{o}C. No agresive chemical substances should be stored together because of corrosion hazard.

9. WARRANTY

Manufacturer gives the warranty that equipment parameters will meet the technical requirements, listed in the paragraph 2 of this document, if transportation, storage and operation conditions will be followed.

Waranty period - 12 months from bringing into operation, but not more than 18 months from manufacturing date.

Manufacturer's address:

AB "Axis Industries ", Kulautuvos g. 45a, Kaunas LT-47190, Lithuania
tel. +370 37 360234; fax. +370 37 360358.

Annex A

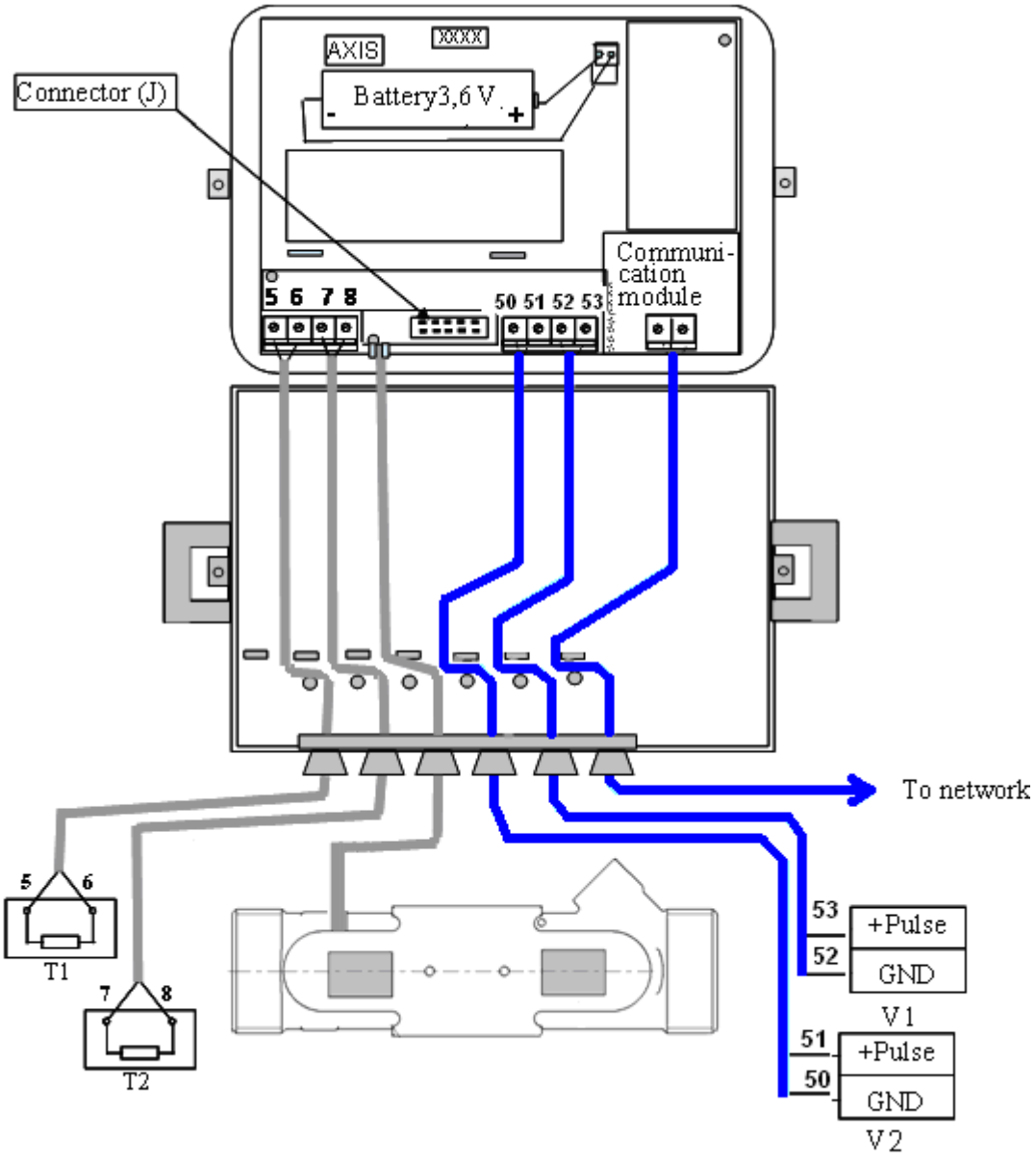


Fig.A1. Electrical wiring diagrams

T1 –flow temperature sensor, T2 –return temperature sensor,
V1-additional pulse input / output 1, V2 –additional pulse input / output 2

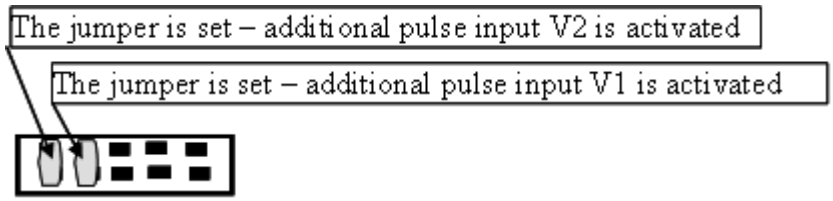


Table A1. Numbering of terminals

Calculator:

Terminal Nr.	Destination
5	High temperature sensor (T1)
6	High temperature sensor (T1)
7	Low temperature sensor (T2)
8	Low temperature sensor (T2)
50	2nd additionl pulse input/output GND
51	2nd additionl pulse input/output (In/Out2) (Volume output for TEST mode)
52	1st additionl pulse input/output GND
53	1st additionl pulse input/output(In/Out1) (Energy output for TEST mode)

Additional plug- in modules:

Terminal Nr.	Destination
24	M-bus (Mbus module)
25	M-bus (Mbus module)
20	CL+ (CL module)
21	CL- (CL module)

Annex B

Fig. B1. Mechanical dimensions of calculator of heat meter SKU-03

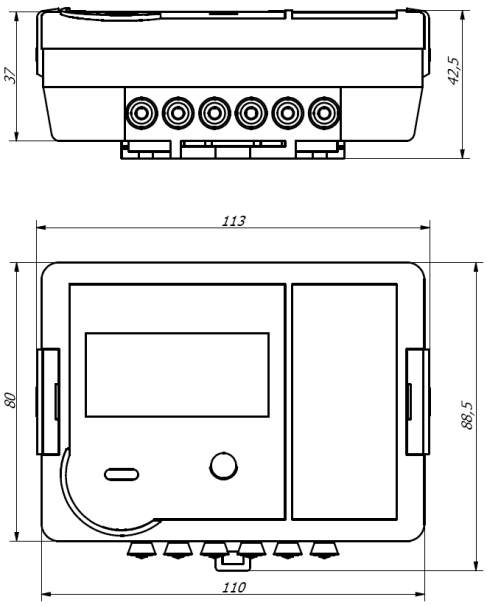


Fig. B2. Sizes and dimensions of heat meter SKU-03

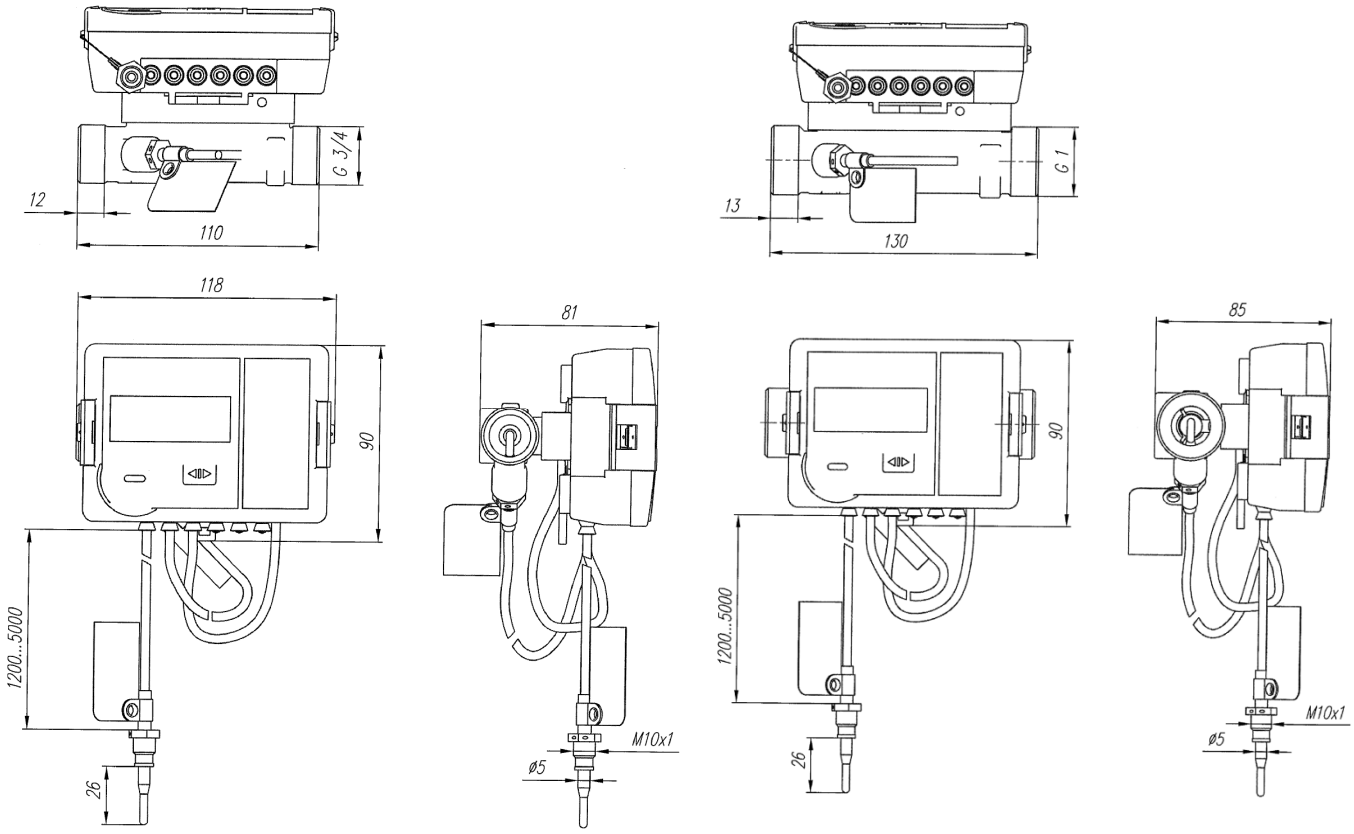


Fig.B2.1. Threaded end connections G3/4“ , mounting lenght L=110 mm

Fig.B2.2. Threaded end connections G1“, mounting lenght L=130 mm

Annex B

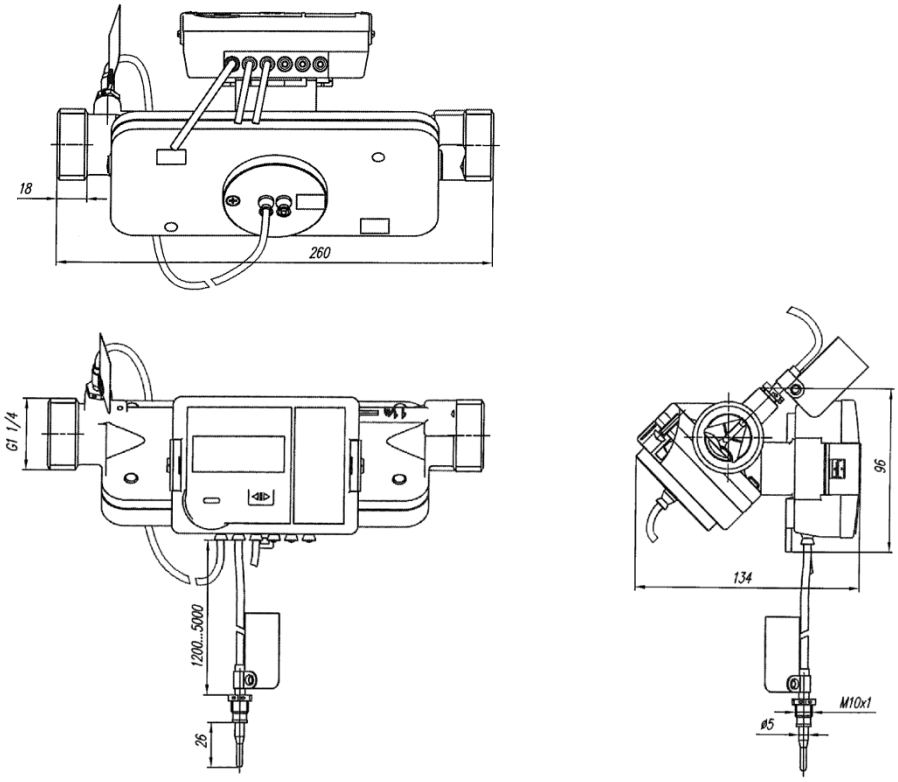


Fig.B2.3. Threaded end connections G1 1/4“, mounting lenght L=260 mm

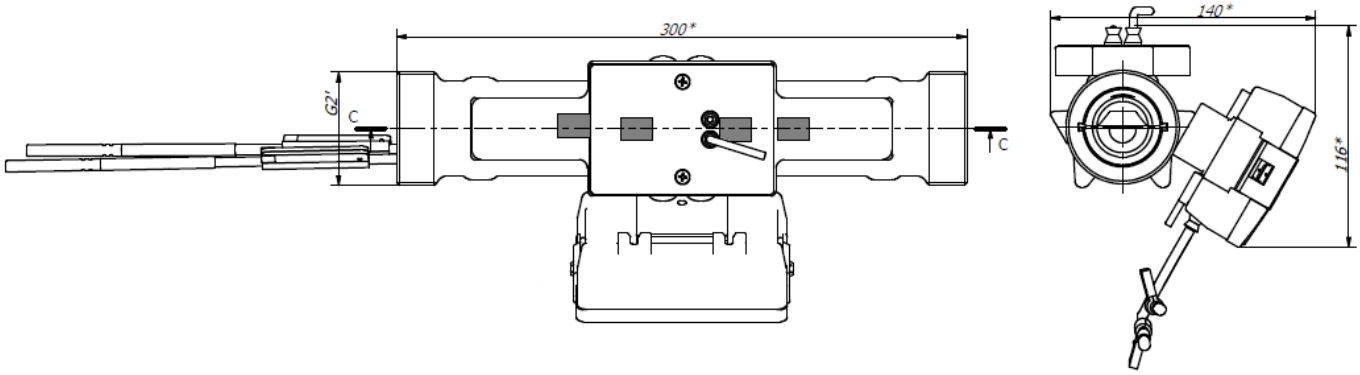


Fig. B2.4. Threaded end connections G2“ , mounting lenght L=300 mm

Annex B

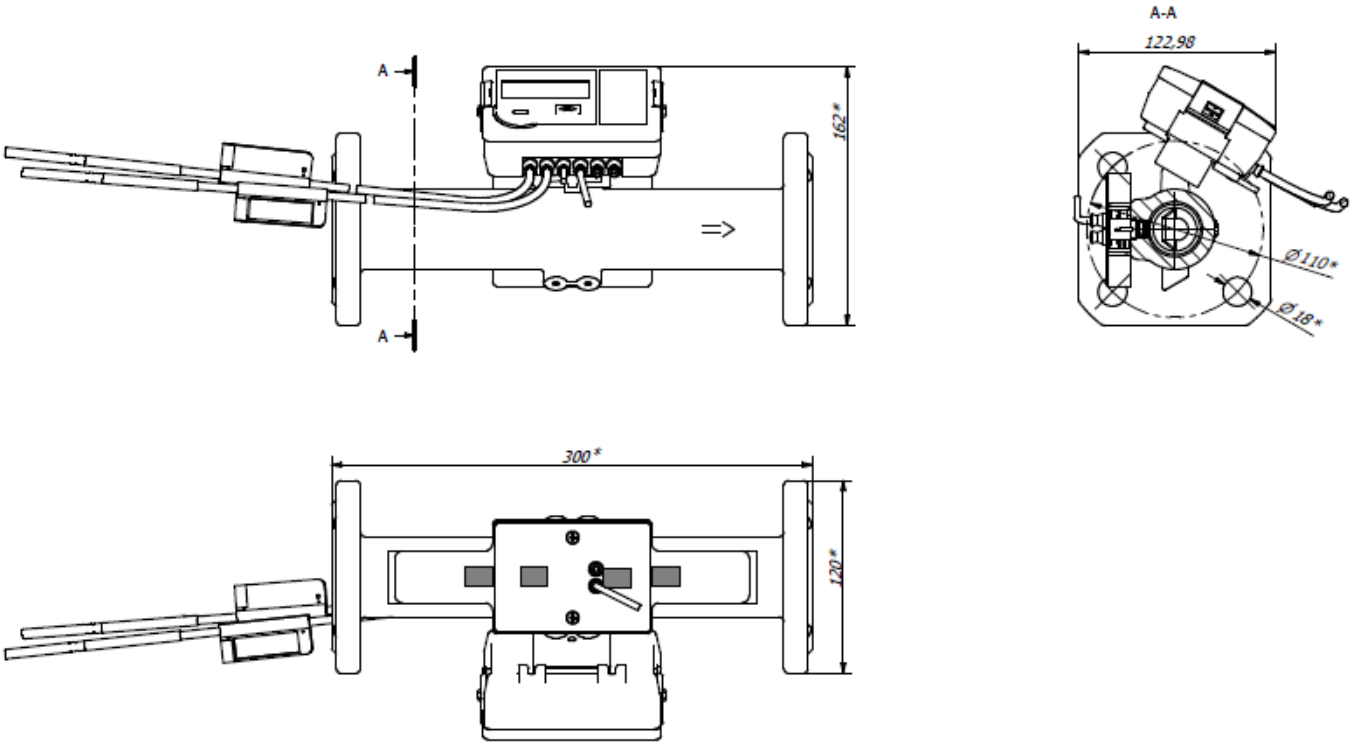


Fig.B2.5. Flanged connection DN40, mounting lenght L =300 mm

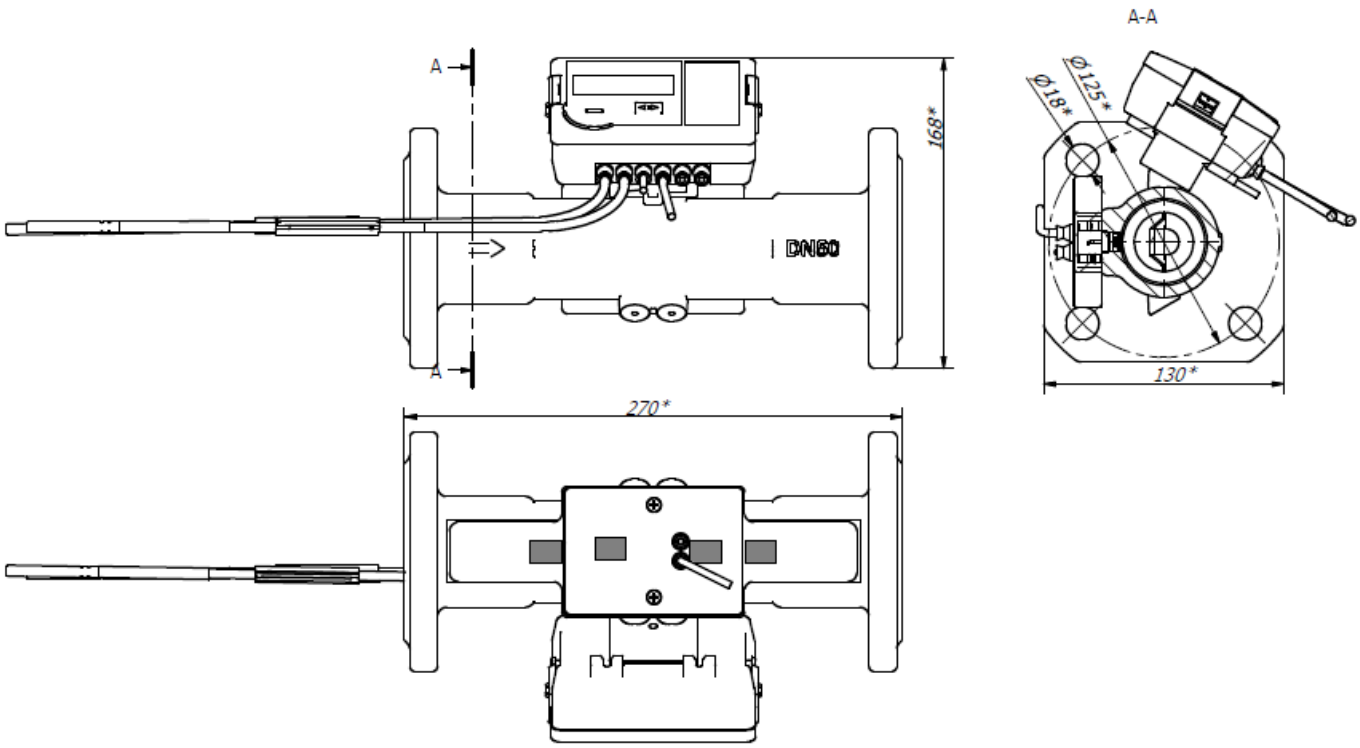


Fig. B2.6. Flanged connection DN50 , mounting lenght L= 270 mm

Annex C
Security sealing

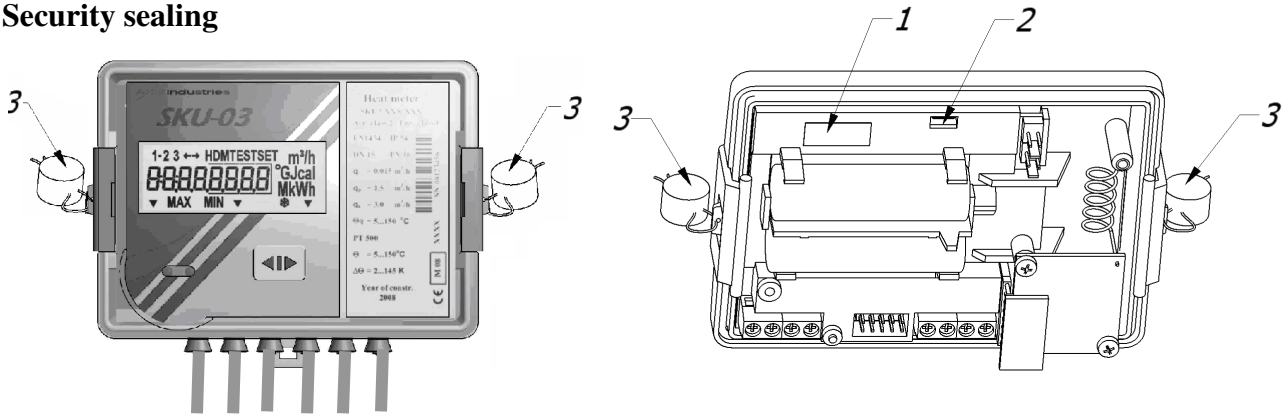
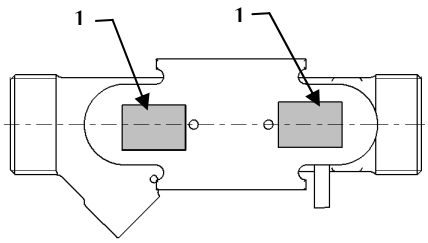
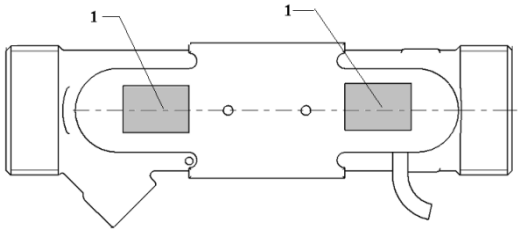


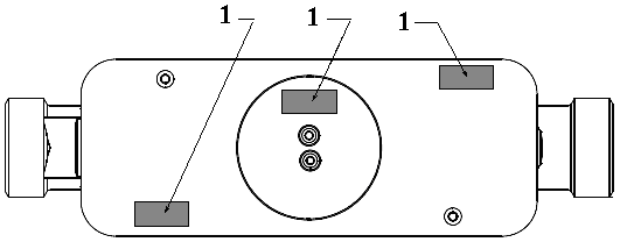
Fig.C1. Calculator sealing
Calculator general view: the cover is closed, and the cover is opened
(1-verification seal, 2-manufacturer security seal , 3 –mounting seal)



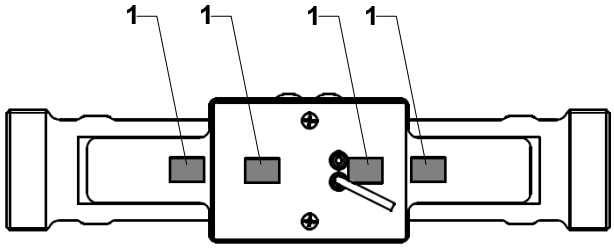
a) Flow sensor q_p 0,6; q_p 2,5; L=110 mm



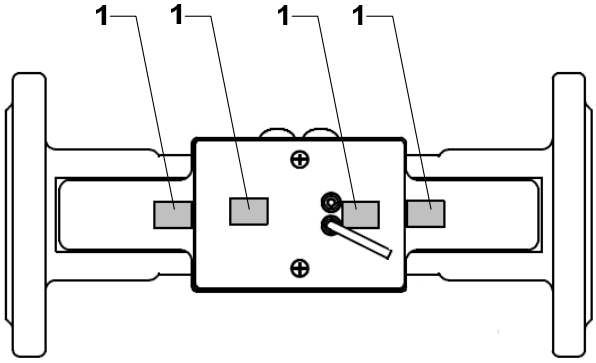
b) Flow sensor q_p 1,5; q_p 2,5, L=130 mm



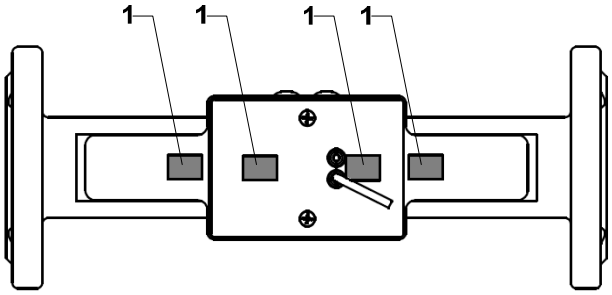
c) Flow sensor G1 ¾“



d) Flow sensor G2“



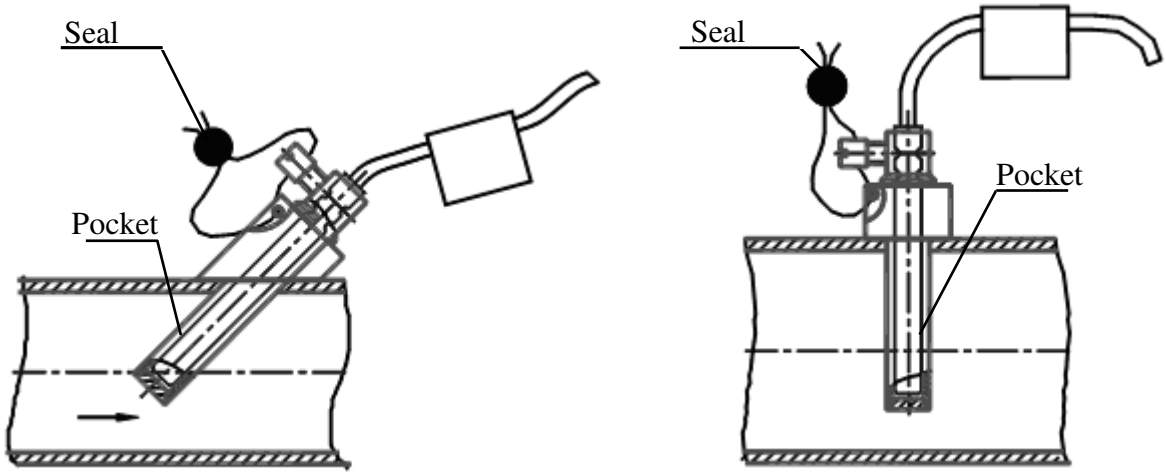
e) Flow sensor DN50



f) Flow sensor DN50

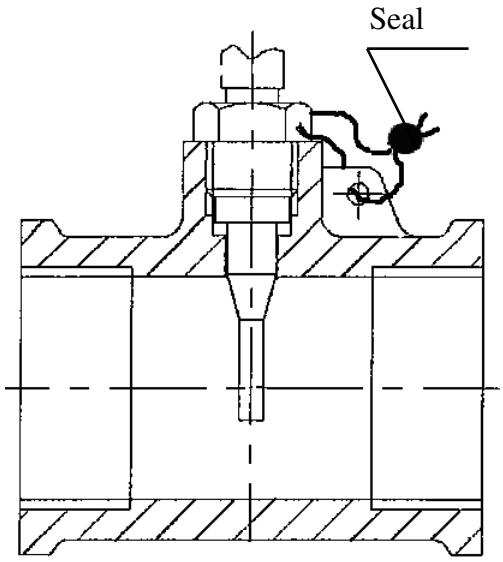
Fig.C2. Flow sensors sealing
(1-verification seal)

Annex C
Security sealing



a) angled 45^{o} b) perpendicular

a) Installation recomendations for temperature sensors type PL with permanently connected signal leads



b) Installation recomendations for temperature sensors type DS

Fig. C3. Temperature sensors installation and sealing