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Standards and documents applied:

LST EN 1434-1:2015+A1:2019;
LST EN 1434-2:2015+A1:2019;
LST EN 1434-4:2015+A1:2019;
LST EN 1434-5:2015+A1:2019;
WELMEC 7.2:2015.

The measuring instrument must correspond to following specifications:

1 Design of the instrument

1.1 Construction

Thermal energy meter IFX-M4-E4 can be produced in two design options:

- a complete meter consisting of inseparably connected an ultrasonic flow sensor, a calculator and 2 temperature sensors Pt 500;
- a combined meter consisting of an ultrasonic flow sensor inseparably connected to a calculator and a pair of Pt 500 temperature sensors of an approved type.

The body of the flow sensor is made of plastic.

In both cases, the flow sensor is inseparably connected to the calculator by 1,2 m length cable. The body of the flow sensor with threaded connection G $\frac{3}{4}$ or G 1 has a place for mounting a temperature probe.

The calculator of the thermal energy meter can be mounted directly on the flow sensor or separately on the wall or on a standard DIN rail.

The meter can be powered by:

- 3,6 V DC lithium battery (1 or 2 AA- cells);
- remote 12 V to 42 V DC or 12 V to 36 V AC power source;
- 230 V AC mains.

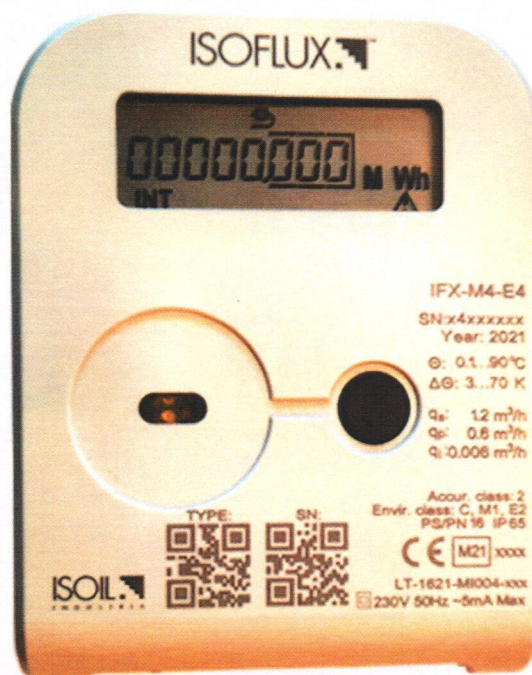


Fig.1. Calculator of the thermal energy meter IFX-M4-E4

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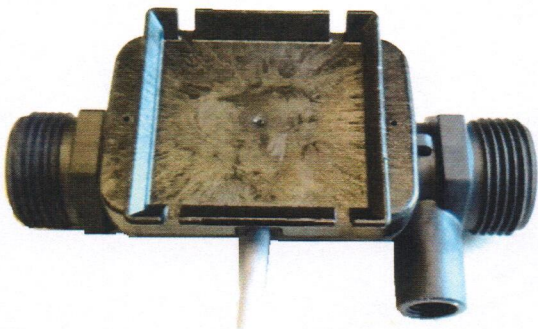
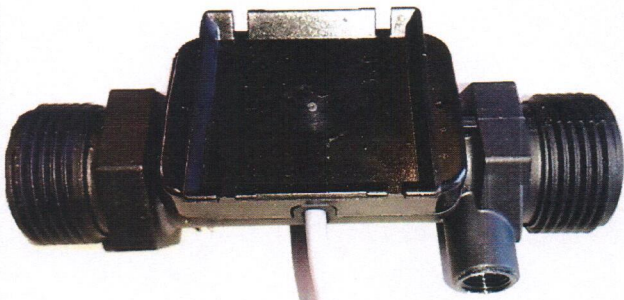

	
<p>a) Flow sensor of the meter $q_p = 0,6/1,0/1,5 \text{ m}^3/\text{h}$ with threaded end connections G $\frac{3}{4}$ or G 1</p>	<p>b) Flow sensor of the meter $q_p = 1,5/2,5 \text{ m}^3/\text{h}$ with threaded end connection G 1</p>
	
<p>c) Flow sensor of the meter $q_p = 3,5/6,0 \text{ m}^3/\text{h}$ with threaded end connection G $1\frac{1}{4}$</p>	
	
<p>d) Flow sensor of the meter $q_p = 3,5/6,0 \text{ m}^3/\text{h}$ with threaded end connection G $1\frac{1}{2}$</p>	

Fig.2. Flow sensor of the thermal energy meter IFX-M4-E4

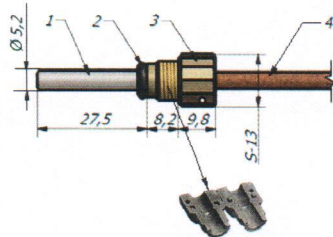
1.2 Sensor

The thermal energy meter hardware consist of an ultrasonic flow sensor and calculator with inseparably connected resistance temperature sensors Pt 500 or with connected type approved temperature sensor Pt 500 pair.

Direct mounted DS design type temperature probes and pocket mounted PL design type temperature probes according to LST EN 1434-2 are used for the meters.

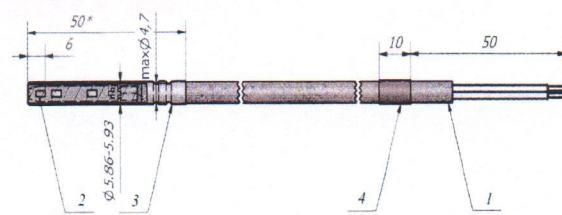
The design and main dimensions of the temperature probes are shown in Fig. 3.

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- 1- protective sheath
- 2- sealing ring
- 3- nut
- 4- connected cable

a) temperature probe type DS



- 1 - connected cable
- 2 - temperature sensing element
- 3 - protective sheath
- 4 - thermos tube

b) temperature probe type PL

Fig.3. Design and main dimensions of the temperature probes

1.3 Measurement value processing

The energy, consumed for heating, is calculated by integrating the temperature difference and the volume of the heat-conveying liquid over time. The temperature difference is calculated from the resistance of the temperature sensors pair connected to the calculator and converts it to temperature according to formulas of LST EN 60751.

1.4 Indication of the measurement results

The accumulated quantity of thermal energy is presented on the LCD display in the MWh. Other units (kWh, Gcal, GJ) can be chosen too as an option.

1.5 Optional equipment and functions subject to MID requirements

None.

1.6 Technical documentation

Ultrasonic heating and cooling energy meter IFX-M4-E4. Technical description and operation guide: IFX-M4-E4-M_E_2021_38_Rev.0, 09-2021.

Test instruction of the thermal energy meter IFX-M4-E4, 09-2021.

Other reference documents on which basis this certificate is issued, are stored in a file Nr. LEI-12-MP-120.21.

1.7 Integrated equipment and functions not subject to MID

Optical interface according to the requirements of LST EN 62056-21, integrated in the meter, is intended for data reading, meter parameters setting and optical pulse output in test mode.

Two pulse outputs for energy and volume pulses (optional). Class of pulse output device according to LST EN 1434-2: OB in operating mode, OD in test mode.

Two programmable pulse inputs for volume pulses (optional). Class of pulse input device – IB according to LST EN 1434-2.

When the complete meter has a pulse input/output function, it is supplied with inseparably connected 1,5 m input/output cable.

The meter can be without a communication interface or equipped with one or both of the following communication interfaces:

- M-Bus;
- RF 868 MHz (wM-Bus S1, T1 or LoRa).

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The meter can be equipped with one of the following additional communication interfaces:

- M-Bus;
- CL (current loop);
- RS485 (MODBUS or BacNet);
- MiniBus.

The meter can be used also for cooling energy measurement under rated operating conditions, listed in section 2.1.

2 Technical data

2.1 Rated operating conditions

2.1.1 Measurand

Thermal energy, calculated from the measured volume of water and the measured difference of water temperature in flow and return pipes.

2.1.2 Measurement range

Limits of the temperature ϑ : 0 °C to 90 °C

Limits of temperature differences $\Delta\vartheta$: 2K* to 70 K, or 3 K to 70 K;

Note: * - for meters with the lower limit of the temperature difference 2 K the requirements of the Directive 2014/32/EU are not applied.

The technical characteristics of the meter flow sensor are given in Table 1.

Table 1

End connections	Flow-rate, m ³ /h			Overall length, mm
	Permanent q_p	Maximum q_s	Minimum q_i	
G 3/4	0,6	1,2	0,006	110
G 3/4	1,0	2,0	0,004	110
G 3/4	1,0	2,0	0,01	110
G 3/4	1,5	3,0	0,006	110
G 3/4	1,5	3,0	0,015	110
G 1	1,5	3,0	0,006	130
G 1	1,5	3,0	0,015	130
G 1	2,5	5,0	0,01	130
G 1	2,5	5,0	0,025	130
G 1 1/4	3,5	7,0	0,014	260
G 1 1/4	3,5	7,0	0,035	260
G 1 1/4	6,0	12,0	0,024	260
G 1 1/4	6,0	12,0	0,060	260
G 1 1/2	3,5	7,0	0,035	260
G 1 1/2	6,0	12,0	0,024	260
G 1 1/2	6,0	12,0	0,060	260

Temperature limits of heat-conveying liquid ϑ_q : 0,1 °C to 90 °C;

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2.1.3 Accuracy class

Accuracy class : 2 or 3 according to LST EN 1434-1.

2.1.4 Environmental conditions / Influence quantities

Ambient temperature : 5 °C to 55 °C;
Humidity level : condensing;
Installations : indoor;
Mechanical environment : class M1;
Electromagnetic environment : class E2.
Protection class : for calculator – IP65 (IP67 or IP68 – optional);
for temperature sensors – IP68;
for flow sensor – IP65 (IP67 or IP68 – optional).

2.1.5 Maximum admissible working pressure

The maximum admissible working pressure/nominal pressure (PS/PN) of the meter is 16 bar.

2.1.6 Mounting position of the flow sensor

Flow sensor of the meter can be mounted either horizontally, vertically or inclined.
With respect to the longitudinal axis of the pipe, the flow sensors can be mounted to be rotate at any angle.

3 Interfaces and compatibility conditions

The combined heat meter has two temperature measurement channels for connecting Pt 500 temperature sensors. Connection of the temperature sensors is according to the two-wire scheme.

Communication interfaces of the meter are presented in section 1.7 of this appendix.

4 Requirements on production, putting into use and utilization

4.1 Requirements on production

At the end of the manufacturing and adjustment process the heat meters shall be tested according to the requirements of the LST EN 1434-5. Errors of heat meters shall not exceed the maximum permissible errors, described in Annex VI (MI-004) of Directive 2014/32/EU.

The flow sensors can be tested with cold water (25 ± 5) °C.

Note: the energy measuring error determination test shall be carried out when the flow sensor is installed in inlet and when the flow sensor is installed in outlet (in both cases).

4.2 Requirements on putting into use

Thermal energy meter must be installed in accordance with the requirements of technical description listed in section 1.6.

Before the putting into use, the meter can be supplied in transport mode (this is indicated by the „<->“ symbol on LCD display). In this mode, the configuring of the meter parameters (referred to the technical description, section 5.2.1) by means of a button or via the optical interface using the E3-CONFIGURATOR software is possible without affecting the seals on the meter (see section 6.1.1 of this appendix). Transport mode switches off itself after 0,001 m³ of water volume passed through the meter, or it can be switched of by means via the optical interface using the E3-CONFIGURATOR software.

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4.3 Requirements for consistent utilization

No special requirements identified.

5 Control of the measuring process after tasks of the instrument in use

5.1 Documentation of the procedure

Test instruction of the thermal energy meter IFX-M4-E4, 09-2021.

5.2 Special equipment or software

- optical reading head according to standard LST EN 62056-21;
- service software **E3-CONFIGURATOR**.

5.3 Identification of hardware and software

Identification of hardware:

- see Fig. 1, Fig. 2 and Fig. 3 of this appendix.

Identification of software: version number of the software is **0.01**. This number can be displayed on the device's display according to the request.

5.4 Calibration-adjustment procedure

The tests are carried out according to the test instruction of the thermal energy meter IFX-M4-E4 given on pages 10 to 12 of this appendix in accordance with the requirements of the LST EN 1434-5.

6 Security measures

6.1 Sealing

6.1.1 Sealing of the meter calculator

The newly manufactured complete meter calculator shall not be subject to additional sealing. Access to the calculator cover release latch (Fig. 4, pos. 1), the parameter change and test mode activation contacts (Fig. 4, pos. 2) and adjustment data activation contacts (Fig. 4, pos. 3) is protected by easy break-out screens.

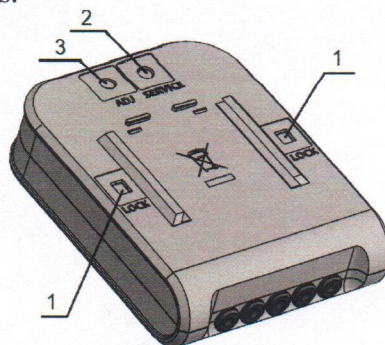


Fig.4. Sealing of the calculator of the thermal energy meter

When the abovementioned casing screens are break-out (after opening the calculator casing, changing the meter parameters, adjusting the meter or activation the test mode), open slots are sealed with metrological seal-stickers (Fig. 4, pos. 1 and pos. 3) and with the protective seal-sticker of heat supplier (Fig 4, pos. 2).

For the combined device, additional metrological seals shall be used to seal access to the protective cap mounting screw (Fig. 5, pos. 1) and the activation contacts for the adjustment data if the protective screen (Fig. 5, pos. 2) has been broken.

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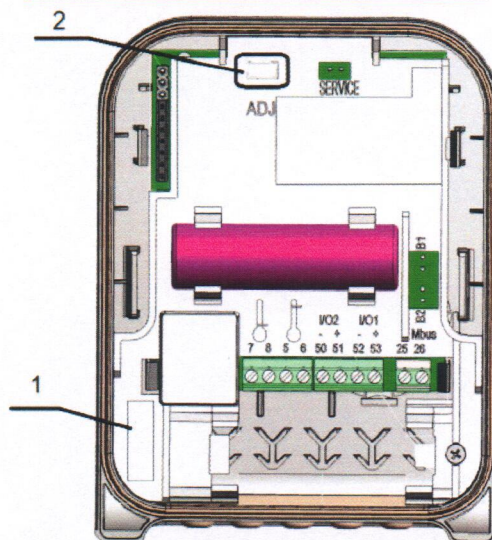


Fig. 5. Additional sealing of the combined device calculator

6.1.2 Sealing of the flow sensor

For flow sensor $q_p = 3,5/6 \text{ m}^3/\text{h}$, the manufacturer's adhesive warranty seal - sticker is sealed on the one bolt of the cover (Fig. 6).

For flow sensors $q_p = 0,6/1,0/1,5/2,5 \text{ m}^3/\text{h}$ sealing does not apply.

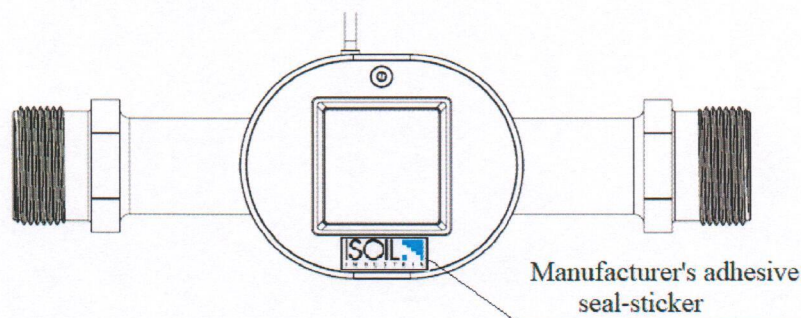


Fig.6. Sealing of the flow sensor $q_p = 3,5/6 \text{ m}^3/\text{h}$

6.1.3 Sealing of the temperature sensor pair

The temperature probes must be sealed with hanged seal of heat supplier to ensure that after the temperature probes have been installed, it is not possibility of dismantle, remove or altering the probes without evident damage on the probes or the seal (Fig. 7 and Fig. 8).



Fig. 7. Sealing of the PL type temperature probes

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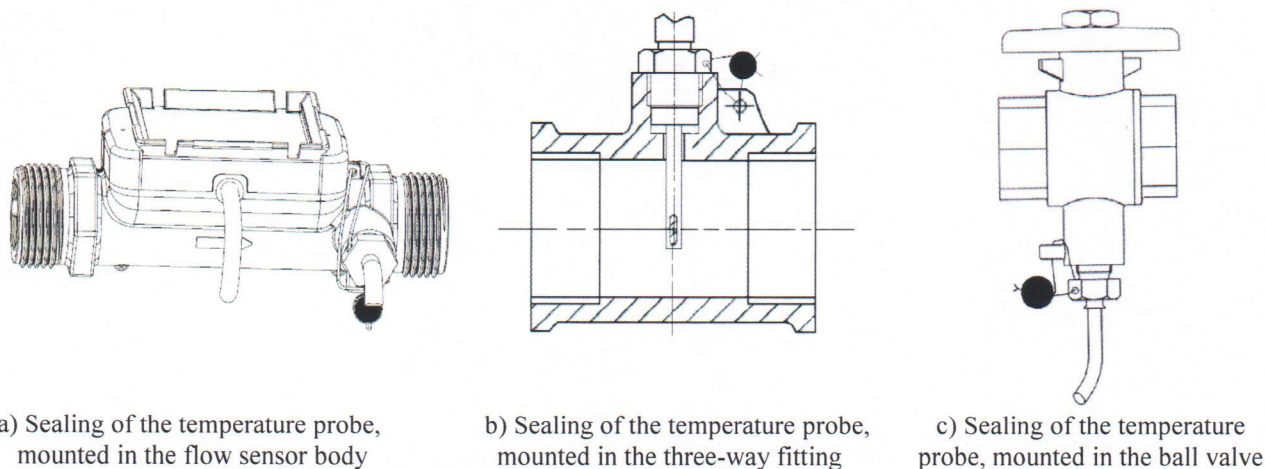




Fig. 8. Sealing of the DS type temperature probes

7 Marking and inscriptions

7.1 Information to be borne by and to accompany the measuring instrument

At least the following information shall appear on the thermal energy meter calculator label:

- EU-type examination certificate number;
- manufacturer's mark or name;
- type designation;
- year of manufacture and serial number;
- limits of the temperature;
- limits of temperature differences;
- type of temperature sensors – Pt 500 (for combined meter);
- limits of flow-rate: maximum q_s , permanent q_p and minimum q_i ;
- the maximum admissible working pressure/nominal pressure (PS/PN);
- voltage level for external power supply;
- accuracy class;
- climatic class;
- electromagnetic class;
- mechanical class;
- IP code.

Information about the location of the meter's flow sensor is shown on the device's LCD indicator: when the flow sensor is installed in inlet – the  sign, when the flow sensor is installed in outlet – the  sign.

Arrow to indicate the direction of the flow shall appear on flow sensor body.

For the complete meter, the supply line temperature probe cable is marked with a red plastic tube and the outlet temperature probe cable must be marked with a blue color plastic tube.

Pockets, in which the PL type temperature probes are fitted, must be marked with the mark "EN 1434".



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7.2 Conformity marking

In addition, the label of heat meter calculator should contain the following marking:

- „CE” marking;
- metrology marking, consisting of the capital letter „M” and the last two digits of the year of its affixing, surrounded by a rectangle;
- identification number of the notified body, which carried out the conformity assessment.

8 List of the drawings attached to the certificate.

None.

9 Certificate history

Issue	Date and reference №	Description
1	2	3
LT-1621-MI004-048	13-10-2021, No. LEI-12-MP-120.21	Type examination certificate first issued

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Test instruction of the thermal energy meter IFX-M4-E4

1. Activation of the test mode

The test mode can be activated in one of the following ways:

1.1. Activation of the test mode with the button

The test mode is activated by the meter's control button according to the following procedure:

- long press the button, on the meter's LCD select page „INF“;
- short press the button, select „tEST on Wh“ (when it is necessary to activate the energy pulse output via the optical interface) or „tEST On m³“ (when it is necessary to activate the volume pulse output via the optical interface);
- long press the button, open the 4- digits security password input window:

PS: 0 _ _ _
INF

- short press the button, select digit in the first position, after that long press the button and go to the next position;
- after selecting the digit in the fourth position, long press the button, the message „PASS“ appears briefly (when the password entered correctly) and the meter switches to test mode – the sign „TEST“ appears;
- if the password was entered incorrectly, the message „FAIL“ appears briefly and the meter returns to the operating mode, and the procedure for turning on the test mode must be repeated initially;
- the password value is fixed: 0001.

NOTE: when the test mode is activated by the button, the volume and energy accumulated in the test mode are added to the meter's energy and volume readings in operating mode (after turning off the test mode).

1.2. Activation of the test mode by short-circuiting the contacts

Remove the screen „SERVICE“ on the back of the calculator or, if the screen has already broken down, a protective seal-sticker is removed (Fig. 4, pos. 2 of this appendix), or, for a combined device, opens the calculator box. By short-circuiting the contacts „SERVICE“, the SERVICE mode is activated, symbol „<->“ and sign „TEST“ are displayed on the LCD.

In this mode:

- volume pulses are generated via the optical interface of the meter. The button can be used to toggle the energy pulse output by selecting the menu item „tEST on Wh“;
- the energy pulses are generated in the 1st pulse output and the volume pulses in the 2st pulse output (when the meter is supplied with a connected pulse input/output cable or the meter is combined);
- it is possible to simulate volume pulses for determination the energy measurement errors;
- it is possible to change the parameters of the meter configuration.

NOTE: when the test mode is activated by short-circuiting the contacts „SERVICE“, the volume and energy accumulated in the test mode are not added to the meter's operating mode volume and energy readings.

1.3. Activation of test mode with software E3-CONFIGURATOR

The test mode can be activated via the optical interface using the software E3-CONFIGURATOR and optical scan head in accordance with LST EN 62056-21 standard. In this case, optionally volume or energy pulses are generated via the optical interface of the meter.

2. Estimation of measurement errors of the meter

2.1. Volume measuring errors estimation test

The estimation of volume measurement errors shall be carried out in the hydrodynamic test bench in the following order:

- 1) The test mode is activated in accordance with section 1.1, 1.2, or 1.3 of this instruction;

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- 2) The volume measuring errors should be estimated at control flow rates specified in LST EN1434-5, section 6.2. The volume of water, passing through the meter can be read directly from the indicating device (with resolution 1 ml), via meter optical output, using the optical reading head according to LST EN 62056-21 or through wired volume pulse 2nd output (for a complete meter with a connected pulse input /output cable and for a combined meter activated in test mode according to p.1.2 of this instruction);
- 3) Volume pulse values in test mode are presented in table 1p:

Table 1p

Permanent flow-rate q_p of the thermal energy meter, m ³ /h	Volume pulse value in test mode, litre/pulse
0,6	0,002
1,0	0,002
1,5	0,004
2,5	0,005
3,5	0,02
6,0	0,02

2.2. Energy measurement errors estimation test

The energy measurement error of a calculator with temperature sensors pair shall be estimated by immersing the temperature sensors in a temperature regulated baths. The test shall be performed in the following order:

- 1) The test mode is activated in accordance with section 1.2 of this instruction;
- 2) The meter temperature sensors are immersed in thermostatic baths, which form the supply and return line temperature and temperature difference values specified in LST EN 1434-5.

NOTE: for a combined meter, the energy measurement error estimation may be performed separately for a calculator with a flow sensor. In this case, the temperature and temperature differences of the supply and return line specified in LST EN 1434-5 are simulated by connecting the reference resistors to the calculator terminals No.5;6;7;8.

- 3) Long press the button (for more than 5 seconds) activates the simulation of the volume pulses (the meter display periodically shows "SF" with the nominal flow rate of the meter, m³/h):

TEST m ³ /h
SF 1.500

- 4) After 2,5 min. the volume simulation is completed, the sign „SF“ turns off. To calculate the energy measurement error, the simulated volume and energy readings shall be visually read from the meter display;
- 5) The amount of volume or energy can be read through the wired pulse output (if it is equipped in the meter);
- 6) The amount of volume or energy can be read through the meter's optical interface output using an optical scan head that complies with LST EN 62056-21;
- 7) Energy pulse values in test mode are presented in table 2p:

Table 2p

Permanent flow-rate q_p of the meter, m ³ /h	Energy pulse value based on displayed energy units:		
	„kWh“, „MWh“	„GJ“	„Gcal“
0,6	0,1 Wh/pulse	0,5 kJ/ pulse	0,1 kcal/ pulse
1,0	0,2 Wh/ pulse	1 kJ/ pulse	0,2 kcal/ pulse
1,5	0,2 Wh/ pulse	1 kJ/ pulse	0,2 kcal/ pulse
2,5	0,5 Wh/ pulse	2 kJ/ pulse	0,5 kcal/ pulse
3,5	1 Wh/ pulse	5 kJ/ pulse	1 kcal/ pulse
6,0	1 Wh/ pulse	5 kJ/ pulse	1 kcal/ pulse

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NOTE: The energy measurement error estimation test may also be performed when the test mode is activated in accordance with section 1.1 or 1.3 of this instruction. In this case, the meter shall be tested using the test method for the complete meter in accordance with LST EN 1434-4, section 6.7. The flow in this case must be generated in the hydrodynamic test bench.

3. Turn off the test mode

The test mode can be turned off in one of the following ways:

- long press the button, select page „INF“ on the meter's LCD, short presses the button, select „tEST off“ on the LCD, long press the button and the test mode is turn off, there is no sign „TEST“ on the screen (when the test mode is activated in accordance with section 1.1 of this instruction);
- by short-circuiting the contacts “SERVICE”, (when the test mode is activated in accordance with section 1.2 of this instruction);
- via the optical interface, using the software E3-CONFIGURATOR and optical head that complies with LST EN 62056-21 standard (when the test mode is activated in accordance with section 1.1 or 1.3 of this instruction);
- the meter switches to the operating mode by itself 12 hours after activation the test mode.

