

## **EC-Type Examination Certificate**

### **Measuring Instrument Directive**

**Certificate number: DK-0200-MI004-031**

Issued by FORCE Certification A/S, Denmark  
EC-notified body number 0200

In accordance with The Danish Safety Technology Authority's statutory order no. 313 of March 30, 2016 which implements the Directive 2014/32/EC of the European Parliament and Council of February 26, 2014 on measuring instruments (MID).

**Issued to:**           **Kamstrup A/S**  
**Industrivej 28, Stilling**  
**DK-8660 Skanderborg**

Type of instrument:   Heat Meter, complete meter

Type designation:     MULTICAL<sup>®</sup> 302 (type 302-T)

Valid until:           30-10-2023

Number of pages:     16, including appendix

Date of issue:         19-05-2016

Version No.:          8  
This new version of DK-0200-MI004-031 is issued due to changes to the product.  
All previous certificates are withdrawn.

Approved by



Lars Poder  
Certification Manager

Processed by



Michael Møller Nielsen  
Examiner

The conformity markings may only be affixed to the above type approved equipment. The manufacturer's Declaration of Conformity may only be issued and the notified body identification number may only be affixed on the instrument when the production/product assessment module (D or F) of the directive is fully complied with and controlled by a written inspection agreement with a notified body. This EC-type examination certificate may not be reproduced except in full, without written permission by FORCE Certification A/S.

FORCE Certification references:

TASK no.: 114-33017.04.08.03 and ID no.: DK-0200-MID-00661

## Appendix to

### EC-Type Examination Certificate Measuring Instrument Directive

**Number: DK-0200-MI004-031**

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Version	Issue date	Changes
DK-0200-MI004-031	30-10-2013	Original certificate
DK-0200-MI004-031 rev 1	19-12-2013	<ul style="list-style-type: none"> <li>• New software version</li> <li>• New IP class</li> <li>• New pressure loss value</li> </ul>
DK-0200-MI004-031 rev 2	14-01-2014	New software version
DK-0200-MI004-031 rev 3	15-05-2014	New software version
DK-0200-MI004-031 rev 4	07-07-2014	<ul style="list-style-type: none"> <li>• New hardware variant</li> <li>• New software revision</li> <li>• Changed sealing</li> </ul>
DK-0200-MI004-031 rev 5	24-09-2014	<ul style="list-style-type: none"> <li>• New software version</li> <li>• New M-Bus variant</li> <li>• New temperature sensor variant</li> </ul>
DK-0200-MI004-031 rev 5.1	02-10-2014	Replacement certificate issued due to an error in the revision history in version 5
DK-0200-MI004-031 rev 6	26-05-2015	<ul style="list-style-type: none"> <li>• Material modification of measuring tubes</li> <li>• New measuring tube added</li> </ul>
DK-0200-MI004-031 rev 7	26-02-2016	New meter type with $\theta_{hc}$ change-over function added
DK-0200-MI004-031 ver 8	19-05-2016	<ul style="list-style-type: none"> <li>• Language neutral type labels added</li> <li>• Previous versions of this certificate withdrawn</li> </ul>

**Applied standards and documents:**

EN 1434:2007 and prEN 1434-4:2013/TC176-WG2\_N441

The instruments/measuring systems shall correspond with the following specifications:

**Type designation:**

MULTICAL® 302

**Description:**

The meter consists of a calculator and a flow sensor, which make out a heat meter together with a Pt500 type approved temperature sensor pair. The electrical connection between the calculator and the flow sensor is a 120 cm long cable, and the units cannot be disassembled. The calculator unit has a display indicating registered thermal energy, and additionally via a push button, other values can be shown.

The calculator includes either wired or wireless M-Bus communication, or no communication. The volume measurement is made by means of bi-directional ultrasonic technique according to the transit time method. Through two ultrasonic transducers sound signals are sent both with and against the flow direction. The flow sensor consists of a meter body made of brass, in which the ultrasonic heads are placed. Above the meter body a two-parted plastic cabinet forms the calculator. The calculator cabinet has a rail for mounting of the calculator on the wall or on the meter body.

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Integrated functions that are not under the Measuring Instruments Directive:

The meter is also type tested as a cooling meter and as a combined Heating/Cooling meter according to EN 1434:2007 and prEN 1434-4:2013, and can therefore be used as so, under the nominal operating temperatures as described in Technical data in this certificate.

**Technical documentation:**

Reference no.:

- 114-33017.04.08.03
- 114-33017.04.08.02
- 114-33017.04.08.01
- 114-21535.0004.0021
- 114-21535.0004.0016
- 114-21535.0004.0015
- 114-21535.0004.0011
- 113-21029.0004.0010
- 113-21029.0004.0009

## Technical data

Instrument type according to	: EN 1434:2007 (prEN 1434-4:2013/TC176-WG2_N441)
Instrument types	: Complete instrument or  : Hybrid instrument (A heat meter, which for the purpose of pattern approval and verification can be treated as a combined instrument. However, after verification, its sub- assemblies shall be treated as inseparable)
Sub-assembly for the Hybrid instrument	: Calculator, flow sensor and temperature sensor pair : Flow sensor with optional built-in temperature sensor
Energy indication	: GJ, kWh or MWh (Wh in calibration mode)
Temperature range	: $\theta_{\min} - \theta_{\max}$ : 2°C...150°C (or narrower range)
Temperature diff. range	: $\Delta\theta_{\min} - \Delta\theta_{\max}$ : 3K...130K (or narrower range)
Temperature sensors	: 2 paired Pt 500 sensors used as direct short (DS) sensors or installed in pockets type 6557302 Max. 1.5 m unshielded 2-wire cable
Flow sensor, nominal sizes	: From $q_p$ 0.6 m <sup>3</sup> /h, $q_p$ 1.5 m <sup>3</sup> /h and $q_p$ 2.5 m <sup>3</sup> /h
Flow sensor, position	: Inlet or outlet pipe (programmable via push button)
Flow meter cable (shielded)	: 1.2 m
Temperature of medium, flow sensor	: $\theta_q$ 2°C...130°C
Pressure stages	: PN16 and PN25
Nominal volume flow rate	: $q_p$ [m <sup>3</sup> /h]                      0.6              1.5              2.5
Pressure loss, max. @ $q_p$	: $\Delta p$ [bar]                              0.02              0.09              0.09
Dynamic range, $q_p$ 0.6 /1.5 /2.5 m <sup>3</sup> /h	: $q_i:q_p$ 1:100 $q_s:q_p$ 2:1
Dynamic range, $q_p$ 1.5 /2.5 m <sup>3</sup> /h	: $q_i:q_p$ 1:250 $q_s:q_p$ 2:1
Accuracy class	: 2 and 3
Environment class	: E1, M1 and M2
Climatic class	: 5...55°C, non-condensing, closed location
Durability specification	: 10 years
Protection class	: Flow sensor IP 68 : Calculator IP 65
Power supply	: 3.65 VDC, 1x A-cell Lithium battery or 3.65 VDC, 2x A-cell Lithium battery

## Software identification

The software versions are related to the product type number. The product type number is written on the front of the meter.

Software versions for the following product type number ranges (where "x" means all combinations):

- 302-x-**00**-x-xx-xx-x-xx
- 302-x-**20**-x-xx-xx-x-xx
- 302-x-**30**-x-xx-xx-x-xx

Version no.	Checksum for metrological part of the software
xxxx0301/ C1	57344
xxxx0302 / C2	21441
xxxx0401 / D1	5888
xxxx0501 / E1	22365
xxxx0601 / F1	31835
xxxx0701 / G1	5622

*(xxxx is the meter type)*

*The SW version is shown under Index 2-11-08 in the display (See "TECH loop" in the Technical Description for MULTICAL® 302)*

Software versions for the following product type number ranges (where "x" means all combinations):

- 302-x-**58**-x-xx-xx-x-xx

Version no.	Checksum for metrological part of the software
xxxx0301 / C1	32717
xxxx0401/D1	44950

*(xxxx is the meter type)*

*The SW version is shown under Index 2-11-08 in the display (See "TECH loop" in the Technical Description for MULTICAL® 302)*

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## Type number combination

Type MULTICAL® 302			□	□□	□	□□	□□	□	□□
<b>Sensor connection</b>									
Pt500 sensor inputs			<b>T</b>						
<b>Communication</b>									
No communication				<b>00</b>					
M-Bus (delivered with 1.5 m premounted cable)				<b>20</b>					
M-Bus (delivered with 2.0 m premounted cable)				<b>21</b>					
Wireless M-Bus, 868 MHz (configurable mode C1 or T1)				<b>30</b>					
Radio TC, 868 MHz				<b>58</b>					
<b>Battery supply</b>									
6 years battery life, Normal Response meter					<b>1</b>				
12 years battery life, Normal Response meter					<b>2</b>				
6 years battery life, Fast Response meter					<b>3</b>				
<b>Temperature sensors</b>									
Pt500, ø 5.2 mm temperature sensors with 1.5 m cable						<b>Q9</b>			
Pt500, ø 5.2 mm temperature sensors with 1.5 m cable and brass unions						<b>QF</b>			
<b>Flow part</b> $q_p$									
[m <sup>3</sup> /h]	Connection	Lenght [mm]							
0.6	G $\frac{3}{4}$ B (R $\frac{1}{2}$ ) DN 15	110						<b>1Y</b>	
1.5	G $\frac{3}{4}$ B (R $\frac{1}{2}$ ) DN 15	110						<b>4Y</b>	
1.5	G1B (R $\frac{3}{4}$ ) DN 20	130						<b>7Y</b>	
2.5	G1B (R $\frac{3}{4}$ ) DN 20	130						<b>AY</b>	
<b>Meter type</b>									
Heat meter		MID Module B+D $\theta_{hc} = \text{OFF}$							<b>2</b>
Heat meter with cooling register		MID Module B+D $\theta_{hc} = \text{OFF}$							<b>3</b>
Heat meter with cooling register		MID Module B+D $\theta_{hc} = \text{ON}$							<b>6</b>
<b>Country code</b>									
Country code (language on label etc.)									<b>XX</b>

**Y:** Used e.g. dynamic range and accessories

## Verification

Errors:	Maximum permissible errors according to Directive 2014/32/EC of the European Parliament and Council of February 26, 2014 on measuring instruments (MID), Annex VI
Procedure:	Test points and verification requirements according to EN 1434-5:2007
	Complete instrument according to: [3.] (5.7)
	Hybrid instrument according to: [7.1] (5.2), [7.2] (5.3), [7.3] (5.4), (5.5) [MID 2014/32/EC, Annex VI] (EN 1434-5:2007)

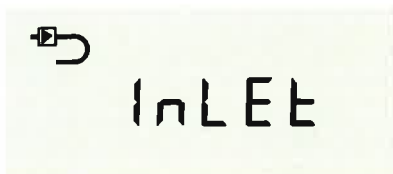
## Test points

Inlet	Outlet		Inlet	Outlet
a) 44.3°C	41°C	or	a) 43°C	40°C
b) 80°C	65°C		b) 50°C	40°C
c) 147°C	20°C		c) 130°C	40°C
or			or	
Inlet	Outlet		Inlet	Outlet
a) 53°C	50°C		a) 43°C	40°C
b) 70°C	50°C		b) 110°C	40°C
c) 130°C	20°C		c) 130°C	40°C

After verification, but before commissioning, the meter can be reprogrammed with a view to:

Placing of flow sensor in inlet pipe or outlet pipe, measuring unit of energy indication (kWh, MWh or GJ)\* and decimal point in energy\* and volume\* indication\*

Mounting the flow sensor in Inlet or in Outlet:



If the meter is set to be an inlet meter, the "Inlet arrow" is displayed.



If the meter is set to be an outlet meter, the "Outlet arrow" is displayed.

\*) Register resolution requirements according to EN 1434-1:2007, point 6.3.7 must be observed.

## Test description

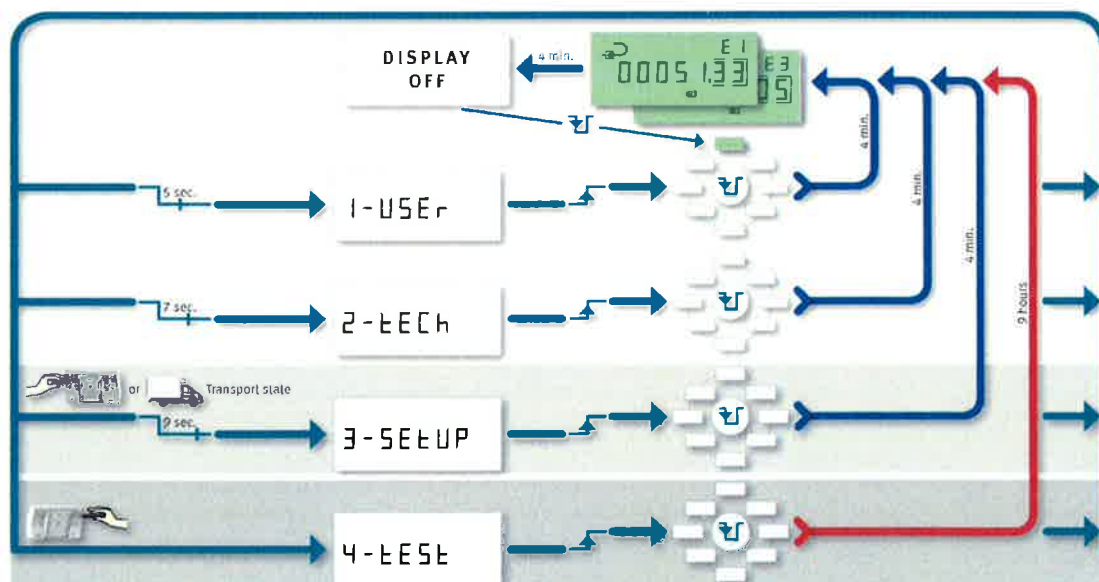
MULTICAL<sup>®</sup> 302 can be tested as a complete meter or as a hybrid meter determined by the available equipment.

The test as a complete meter can be carried out without disassembling the meter, except from the fact that the "TEST" seal must be broken (see "Test mode"). The high-resolution test registers can be read from the display, via serial data reading, or via high-resolution pulses.




Before test as a hybrid meter MULTICAL<sup>®</sup> 302 must be disassembled and the sensor pair must be soldered off. Subsequently, the calculator is tested separately by means of precision resistors and the meter's built-in "Auto-integration". Flow sensor and temperature sensors are tested separately too. During test of the flow sensor it is important that the temperature sensor, to be mounted in the flow sensor, is installed.

If "energy verification" with separate temperature baths is used, it is important that the medium in the flow sensor and the temperature bath, in which the temperature sensor mounted in the flow sensor is placed, have the same temperature.

By means of the push-button on the front of the meter you can choose between four display loops. No matter which display you have selected you can change to User-loop by pressing the push-button for 5 sec. until "1-User" is displayed and then releasing the button. If the button is pressed for 7 sec. instead, "2-Tech" is displayed, and if you release the push-button now, you have access to Tech loop.



### Front key:

-  = Press and hold the specified number of seconds
-  = Activated on release
-  = Activated on click

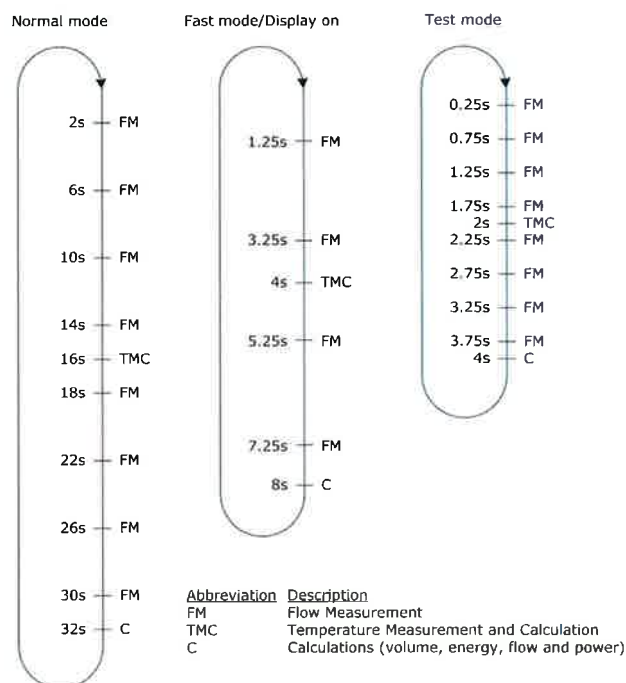


In order to obtain quick test/verification of MULTICAL® 302, the meter has a test mode which repeats the measuring sequence every four seconds, i.e. eight times faster than in normal mode or twice as fast as in fast mode. In test mode heat energy, cooling energy and volume are displayed with a resolution which is higher than normal in order to enable a shorter test duration.

MULTICAL® 302 uses more current in test mode, but under normal circumstances where the meter is in test mode a few times during its lifetime, this is without importance for the meter's battery lifetime.

### Meter modes

The meter can operate in three different modes: "Normal", "Fast" and "Test" mode, as shown to the right. The choice between normal and fast mode must be made when ordering the meter and this choice cannot be changed subsequently. No matter whether the meter is supplied with normal mode or fast mode, test mode (see "Test mode") can be selected.



### Test mode



In order to access test mode the "TEST" seal (S) on the back of the meter must be carefully broken with a screwdriver and the contact points behind the seal short-circuited with a short-circuit pen or a screwdriver.

Subsequently, test is displayed.



The meter remains in test mode until the front button is activated for 5 sec. However, a time-out secures that the meter returns from test mode to normal mode after 9 hours.

When tests are finished the seal must be re-established using a void label size 15 x 15 mm. The seal is important with a view to the meter's approval and to maintain its protection class.

## Test loop

Test loop includes six different main readings and three different sub-readings:

Test loop (Loop_4) Main	Test loop (Loop_4) Sub	Index number in display
----------------------------	---------------------------	----------------------------

1.0	High-resolution heat energy *)			4-01
		1.1	Heat energy (E1)	4-01-01
2.0	High-resolution cooling energy *)			4-02
		2.1	Cooling energy (E3)	4-02-01
3.0	High-resolution volume *)			4-03
		3.1	Volume	4-03-01
4.0	T1 (Flow)			4-04
5.0	T2 (Return)			4-05
6.0	Flow			4-06

After 9 hours the meter reverts to energy reading in "User loop".

\*) Register/resolution of the high-resolution registers are as follows: "0000001 Wh" and "00000.01 l"

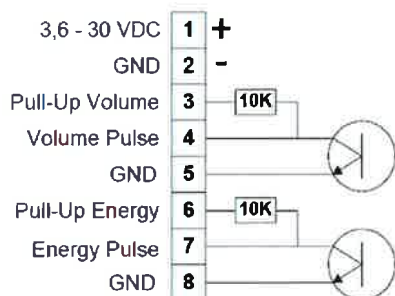
Test-loop can only be displayed if the verification seal is broken and the switch activated. The high-resolution registers can only be reset in connection with a total reset.

## Test connection

During test either optical reading head with USB plug (66-99-099) for serial reading of high-resolution energy and volume registers, or Pulse Interface (66-99-143) with optical reading head and connection unit for high-resolution pulse outputs is used. Do not forget that the meter must be in Test mode.



## Verification pulses



When Pulse Interface type 66-99-143 is connected to power supply or battery, the unit is placed on the meter, and the meter is in test mode, the following pulses are transmitted:

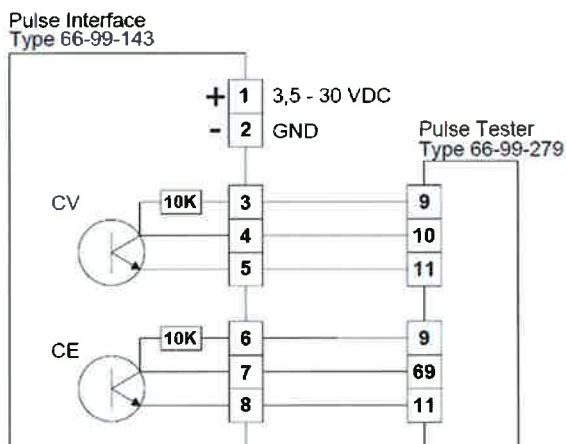
- High-resolution energy pulses (1 Wh/pulse) on terminals 7 and 8
- High-resolution volume pulses (10 ml/pulse) on terminals 4 and 5

Pulse Interface 66-99-143, technical data

Supply voltage	3.6 – 30 VDC
Current consumption	< 15 mA
Pulse outputs	< 30 VDC < 15 mA
Pulse duration	3.9 ms.
Energy pulse	1 Wh/pulse (1000 pulses/kWh)
Volume pulse	10 ml/pulse (100 pulses/litre)

## Use of high-resolution pulses

High-resolution energy and volume pulses can be connected to the test stand used for calibration of the meter, or to Kamstrup's Pulse Tester, type 66-99-279, as shown in the drawing below.



## Auto-integration

The purpose of auto-integration is to test the calculator's accuracy. During auto-integration the water flow through the meter must be cut off to make it possible to read the volume and energy counted during auto-integration without the meter continuing normal counting in the registers afterwards.

At the beginning of an auto-integration the meter receives a serial data command with test volume and number of integrations over which the meter is to distribute the volume.

In MULTICAL® 302 the high-resolution test registers cannot be separately reset, so the test must

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be based on the increase in the high-resolution registers during test. After auto-integration all volume and energy registers – incl. the high-resolution test registers – have been enumerated by the given volume and the calculated energies. Furthermore, the average of the temperatures measured during auto-integration has been saved in two registers, "T1 average inlet temperature" and "T2 average outlet temperature".

For calculation of accuracy the below-mentioned registers can be read after auto-integration:

Verification registers		RID
Heat energy	E1HighRes	266
Cooling energy	E3HighRes	267
Volume	V1HighRes	239
T1 average inlet temperature	T1average_AutoInt	229
T2 average outlet temperature	T2average_AutoInt	230

## Handling different test methods

### Standing start/stop

Standing start/stop is a method used for testing the flow sensor's accuracy. During the test the meter must be mounted in a flow test stand. The flow through the sensor is cut off. Subsequently, water flow is added for a certain period, during which the water passing through the sensor is collected. Having switched off the flow the volume of the collected water is compared to the volume counted by the meter. In general, standing start/stop requires bigger test volume than flying start/stop.

### Standing start/stop via display reading

Condition: MULTICAL<sup>®</sup> 302 must be in test mode (see "Test mode").  
 The high-resolution display readings are updated at 4-second intervals.

### Standing start/stop using pulse outputs

Condition: MULTICAL<sup>®</sup> 302 must be in test mode (see "Test mode").  
 Verification pulses are connected as described in "Verification pulses" above.

### Flying start/stop

Condition: MULTICAL<sup>®</sup> 302 must be in test mode (see "Test mode").  
 Verification pulses are connected as described in "Verification pulses" above.

"Flying start/stop" is the most frequently used method for testing the accuracy of flow sensors. During the test the meter must be mounted in a flow test stand and there is constant water flow through the sensor.

Verification pulses, as described in "Verification pulses", can be directly used for the test stand if it is designed to control the start/stop synchronization. Alternatively, Pulse Tester, type 66-99-279, can be used as external start/stop pulse counter.

As the meter calculates volume and energy every four seconds in test mode (see "Test mode"), the verification pulses will also be updated every four seconds as described in "Verification pulses".

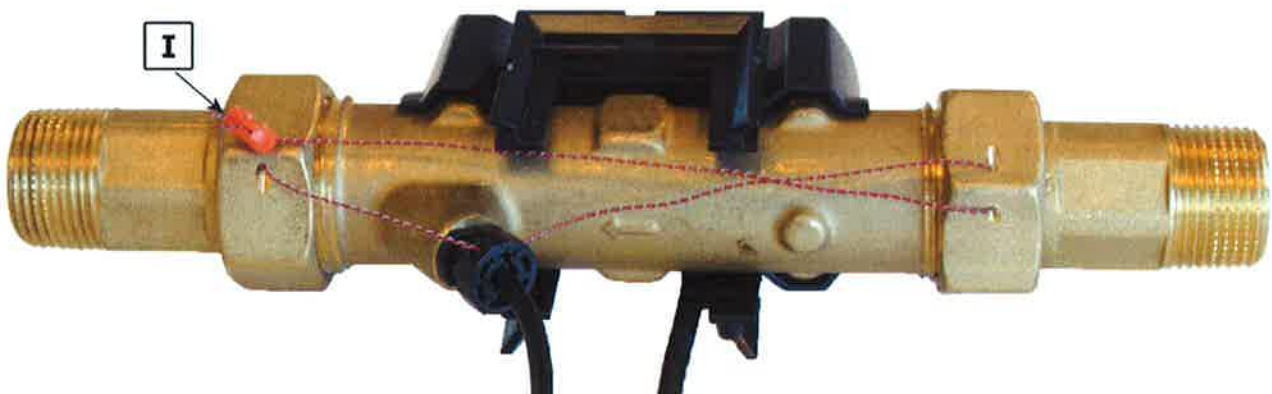
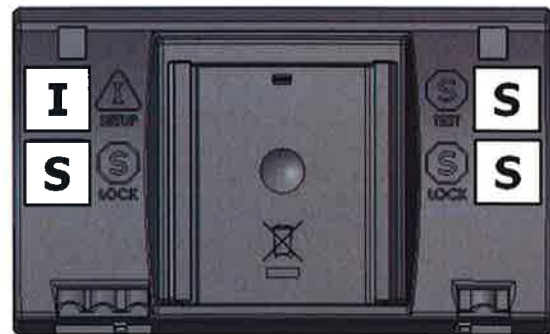
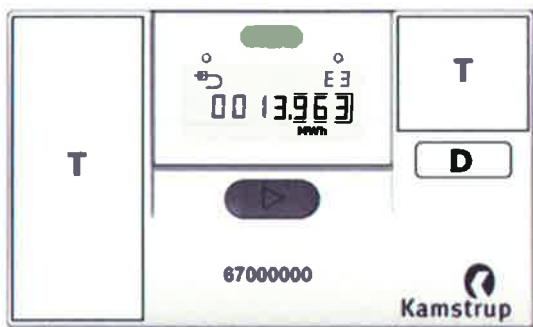
It is important to allow for this time interval, which means that the test duration from start to stop must be so long that the update time does not influence the measuring uncertainty to any very considerable extent.

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**Security measures**

**Sealing**

- S** Security seals. "LOCK" = Covering release for PCB box (Label or integrated part of PCB box)
- D** Module D marking (Part of type label/engraving or separate label)
- T** Type label
- I** Installation seals (Seal, Label or integrated part of PCB box)



## Inscriptions

### Front cover for MULTICAL® 302

System designation  
Manufacturer designation or logo  
Manufacturer postal address  
Type, production year and serial number  
Mechanical and electromagnetic environment classes  
Temperature limits ( $\theta_{\min}$  -  $\theta_{\max}$ )  
Differential temperature limits ( $\Delta\theta_{\min}$  -  $\Delta\theta_{\max}$ )  
Temperature sensor type (Pt500)

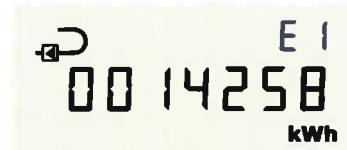
### Additional info in the display

Unit of measurement  
Software version

Mounting the flow sensor in Inlet or in Outlet:

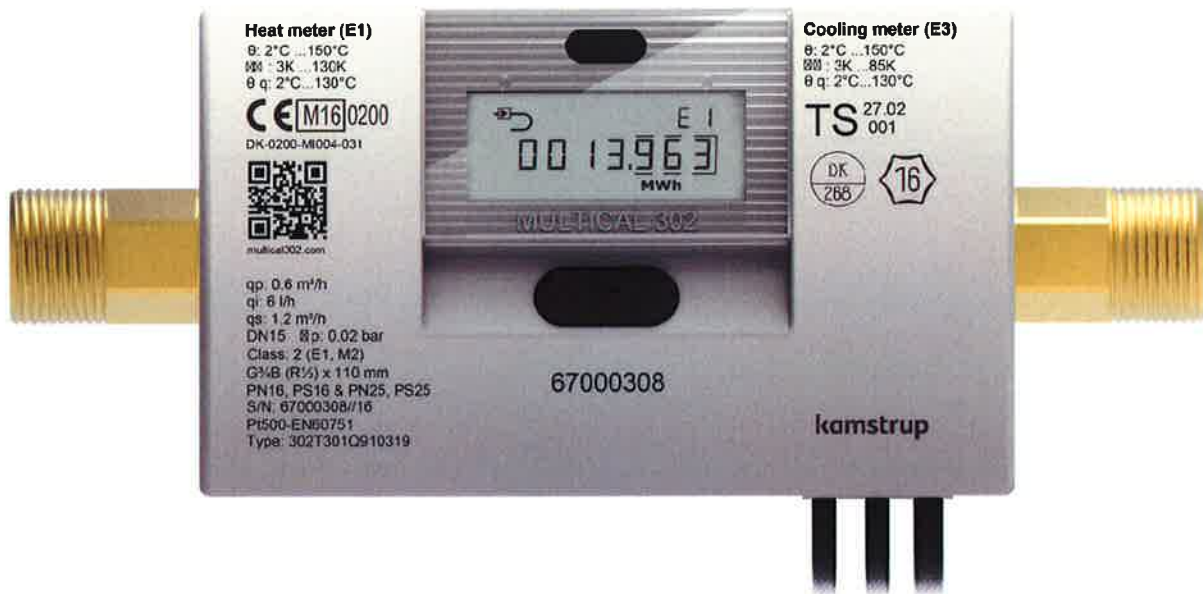


If the meter is set to be an inlet meter, the "Inlet arrow" is displayed.

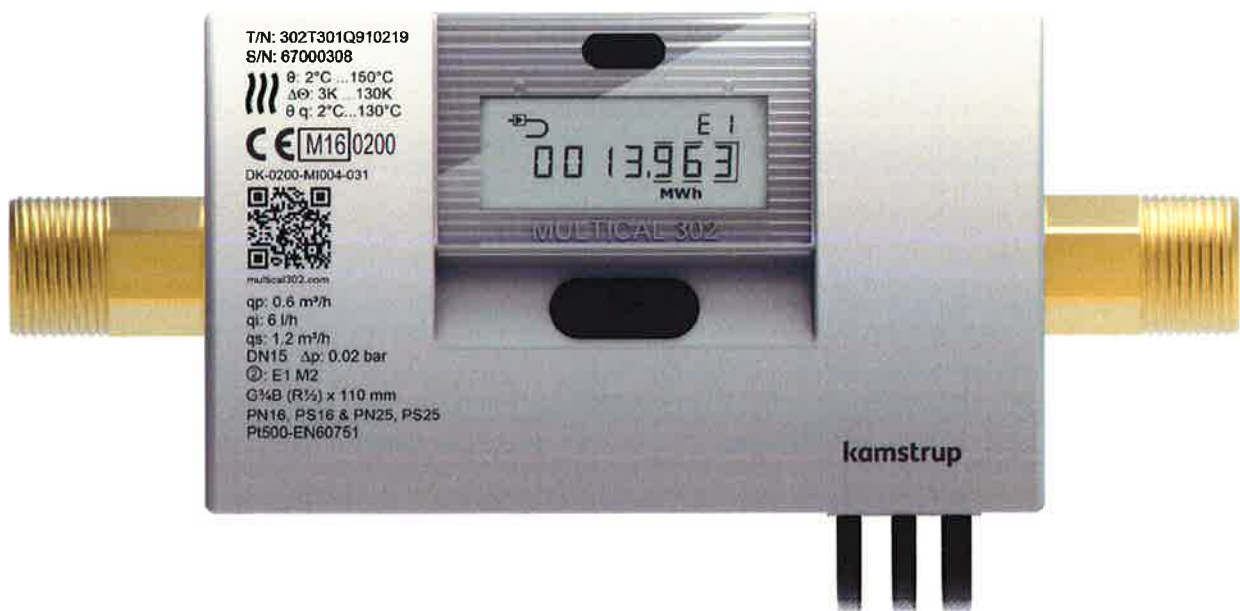


If the meter is set to be an outlet meter, the "Outlet arrow" is displayed.

**Example of inscriptions for MULTICAL® 302**



Heat meter, Inlet or Outlet (Traditional text, individual for each country)



Heat meter, Inlet or Outlet (Language neutral version)

Symbols, as an alternative to textual inscriptions, are acceptable if explained in the manual that accompanies the instrument.

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**Photos of MULTICAL® 302**

