

## **EC-Type Examination Certificate**

### **Measuring Instrument Directive**

**Certificate number:** DK-0200-MI004-037

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

Type designation: MULTICAL® 403 (type 403-V/W/T)

Valid until: 2026-02-26

Number of pages: 14, including appendix

Date of issue: 2016-05-26

Version: 2  
This new version of DK-0200-MI004-037 is issued due to changes in the product.  
The previous certificate is withdrawn.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.: 114-33017.04.15 and ID no.: DK-0200-MID-00785

## **EC-Type Examination Certificate**

### **Measuring Instrument Directive**

#### **Number: DK-0200-MI004-037**

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Revision	Issue date	Changes
DK-0200-MI004-037	2016-02-26	Original certificate
DK-0200-MI004-037 rev 1	2016-04-19	Two new software versions added
DK-0200-MI004-037 ver 2	2016-05-26	New software version added

#### **Applied standards and documents:**

EN1434:2007 and EN1434:2015

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

#### **Type designation:**

MULTICAL® 403 (type 403-V/W/T)

#### **Description:**

The meter consists of a calculator and a flow sensor, which make out a heat meter together with a type approved Pt100 or Pt500 temperature sensor pair.  
The electrical connection between the calculator and the flow sensor is a 150 cm long cable, and the units can either be physically assembled or mounted separately.  
The calculator unit has a display indicating registered thermal energy, and additionally via two pushbuttons also accumulated volume, operating hour counter, inlet and outlet temperatures etc.

The calculator can be retrofitted with various approved plug-in modules, e.g. pulse and wM-Bus modules (see page 5). The modules are mounted under the top cover of the calculator without subsequent re-verification.

The volume measurement is made by means of bi directional ultrasonic technique according to the transit time method. Through two ultrasonic transducers, the sound signals are sent both with and against the flow direction. The flow sensor consists of a meter case made of brass or stainless steel, in which the ultrasonic elements are placed. Above the meter case a two-parted plastic cabinet with a rail for possible mounting of the calculator is mounted.

#### **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 EN1434:2007 and EN1434-4:2015, and can therefore be used as so, under the nominal operating temperatures as described in Technical data in this Certificate.

#### **Technical documentation:**

Reference no.:

- 114-33017.04.13
- 114-33017.04.14
- 114-33017.04.15

## Technical data

Legal measuring data			
According to			: EN1434:2007 (EN1434:2015)
Instrument type			: Complete instrument Combined instrument Parts: Calculator and flow sensor with separate exchangeable temperature sensor pair
Accuracy class			: 2 and 3
Environment class			: E1, M1 and M2
Climatic class			: 5...55 °C, non-condensing, closed location
Energy indication			: kWh, MWh or GJ
Temperature range, calculator	$\theta_{\min} - \theta_{\max}$		: 2...180 °C (or narrower range)
Temperature difference range	$\Delta\theta_{\min} - \Delta\theta_{\max}$		: 3...178 K (or narrower range)
Temperature sensors			: 2 paired Pt500 or Pt100 sensors, depending on type. Max 10 m un-shielded 2-wire cable
Flow sensor, position			: Inlet or outlet pipe
Temperature of medium flow sensor	$\theta_q$		: 2...130 °C (or narrower range)
Pressure stage			: PN16 and PN25
Nominal volume flow rate	$q_p$ [m <sup>3</sup> /h]		: 0.6 1.5 2.5 3.5 6 10 15
Pressure loss	$\Delta p$ [bar]		: 0.03 0.09 0.09 0.07 0.06 0.06 0.14
Dynamic range, $q_p$ 0.6		$q_p:q_i$	: 100:1 or 50:1
Dynamic range, $q_p$ 1.5 -2.5 -3.5 -6 -10 -15		$q_p:q_i$	: 250:1 or 100:1 or 50:1
		$q_s:q_p$	: 2:1
Durability specification			: Minimum 10 years (Long life flow sensor)
Protection class			: Flow sensor IP68 : Calculator IP54
Installation angle for flow sensor			: Horizontally, vertically or at an angle
Provision for direct temperature sensor in the flow sensor (M10x1 connection)			: G <sup>3</sup> / <sub>4</sub> - G1 - G5/4 - G2 - DN25 - DN40 Threaded and flanged flow sensors
Power supply options			: 230 VAC with transformer, 48...62 Hz : 24 VAC with transformer, 48...62 Hz : 230 VAC Switch mode supply : 24 VDC/VAC Switch mode supply : 3.65 VDC, Lithium battery 1 x D-cell, 2 x A-cell or 2 x AA-cell

### **Software identification**

Software revision	H1(0801)	0 8 0 1
Kamstrup Internal Item No.	50981163	1 1 6 3
		↓
Software Identification		1 1 6 3 0 8 0 1

*The Software identification and checksum can be shown on the display of the meter (display No. 10 and No. 11)*

<b>Software Identification</b>	<b>Date</b>	<b>CRC sum</b>	<b>Description</b>
11630801 (H1)	2016-01-25	53579	First release for type approval.
11630802 (H2)	2016-01-25	52804	Second release for type approval. Copy of 11630801 for the purpose of demonstration of software download.
11631001 (J1)	2016-03-17	21922	First release for production
11631101 (K1)	2016-03-30	49192	Second release for production
11631201 (L1)	2016-05-13	29840	Third release for production

### **Only for member states where software download is allowed:**

#### **Software download according to WELMEC 7.2**

The meter is approved for software download, both direct (via cable) and remote (via wireless). The software download function is separated between legally relevant (the software in the meter) and legally non-relevant software (the software in the communication module). The software separation is implemented via hardware separation, whereby the level of separation exceeds Extension S. The meter is a Type P instrument and Risk Class C applies.

The legally relevant software download function can be disabled for use in member states where software download for instruments in use is not allowed. In this case download of legally relevant software cannot be done without breaking the verification seal.

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**Type number combination MULTICAL® 403**

			Static data 403-XXXXXX Printed on the meter				Dynamic data - XXXXX Displayed		
			□	□□	□	□□	□□	□	□□
<b>Type 403-</b>									
<b>Sensor connection</b>									
Pt100 Heat meter			V						
Pt500 Heat meter			W						
Pt500 Heat/Cooling meter			T						
<b>Flow sensor</b>	<b>Connection</b>	<b>Length</b>							
q <sub>p</sub> [m <sup>3</sup> /h]		[mm]							
0.6	G¾B (R½)	110		1X					
0.6	G1B (R¾)	190		3X					
1.5	G¾B (R½)	110		4X					
1.5	G¾B (R½)	165		5X					
1.5	G1B (R¾)	130		7X					
1.5	G1B (R¾)	165		8X					
1.5	G1B (R¾)	190		9X					
2.5	G1B (R¾)	130		AX					
2.5	G1B (R¾)	190		BX					
3.5	G1¼B (R1)	260		DX					
6.0	G1¼B (R1)	260		FX					
6.0	DN25	260		GX					
10	G2B (R1½)	300		HX					
10	DN40	300		JX					
15	DN50	270		KX					
<b>Meter type</b>									
Heat meter (MID module B, prepared for module F)									1
Heat meter (MID module B+D)									2
Heat meter with additional cooling register (MID module B+D) θ <sub>hc</sub> =OFF									3
Heat meter with additional cooling register (MID module B+D) θ <sub>hc</sub> =ON									6
<b>Country code</b>						XX			
<b>Temperature sensor pair</b>							XX		
<b>Supply</b>									
No supply									0
Batteries, 2xAA-cells									1
Batteries, 2xA-cells									9
Battery, 1xD-cell									2
230 VAC high power supply									3
24 VDC/VAC high power supply									4
230 VAC supply									7
24 VAC supply									8
<b>Modules</b>									
No module									00
Data + 2 pulse inputs (A, B)									10
Data + 2 pulse outputs (C, D)									11
M-Bus, configurable + 2 pulse inputs (A, B)									20
M-Bus, configurable + 2 pulse outputs (C, D)									21
Wireless M-Bus, EU, configurable, 868 MHz + 2 pulse inputs (A, B)									30

## Verification

Errors: Maximum permissible errors according to Directive 2004/22/EC of the European Parliament and Council of March 31, 2004 on measurement instruments (MID), Annex MI-004

Procedure: Test points and verification requirements according to EN1434-5:2007

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 2004/22/EC, Annex MI-004]  
(EN 1434-5:2007)

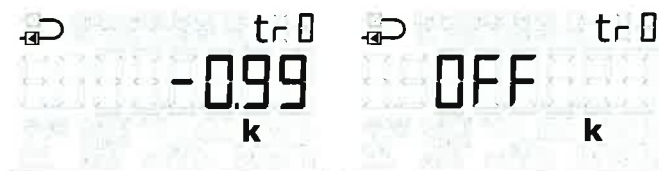
## Alternative test points

	Inlet	Outlet		Inlet	Outlet		Inlet	Outlet
	a) 44.3 °C	41 °C	or	a) 43 °C	40 °C	or	a) 43 °C	40 °C
	b) 80 °C	65 °C		b) 50 °C	40 °C		b) 50 °C	40 °C
	c) 160 °C	20 °C		c) 130 °C	40 °C		c) 160 °C	40 °C
or	Inlet	Outlet	or	Inlet	Outlet	or	Inlet	Outlet
	a) 53 °C	50 °C		a) 43 °C	40 °C		a) 43 °C	40 °C
	b) 70 °C	50 °C		b) 110 °C	40 °C		b) 110 °C	40 °C
	c) 130 °C	20 °C		c) 130 °C	40 °C		c) 160 °C	40 °C

For dynamic ranges  $q_p:q_i$  100:1 and 50:1, the dynamic range 100:1 can be used.  
For dynamic ranges  $q_p:q_i$  250:1 and 100:1 and 50:1, the dynamic range 250:1 can be used.

The temperature reading can be offset adjusted from 0,99...0,99 K, commonly for the inlet and outlet, in order to compensate for the sensor cable influence on the absolute temperature. During change of temperature sensor pairs it is recommended to adjust to meters offset temperature according to the newly mounted sensor pair. Alternatively adjust the offset to 0,00 K whereby the function is disabled (OFF).

Example: If the temperature sensor pair has an error at +0,20 K at zero, then the meters offset should be -0,20 K in order to compensate.

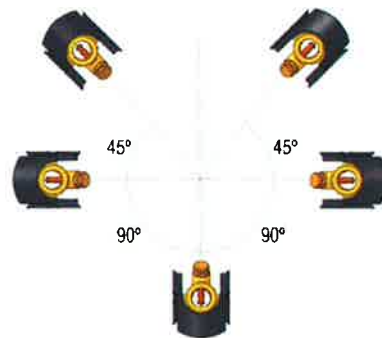


## Installation angle

The flow sensor can be installed horizontally, vertically or at an angle



The flow sensor can be turned up to max. 45° and down to max. 90° in respect to the pipe axis.



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 EN1434-1:2007, point 6.3.7 must be observed



## **Test description**

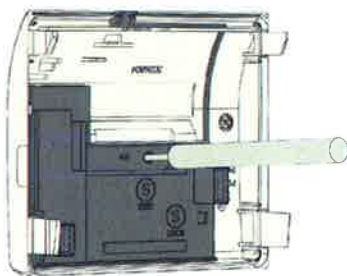
MULTICAL<sup>®</sup> 403 can be tested as a complete meter or as a hybrid meter depending of the available test equipment.


Before test as a complete meter the top cover must be opened and 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, the temperature sensors should be removed from MULTICAL<sup>®</sup> 403. 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.

By means of the push-buttons 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 left push-button for 5 sec. until "1-User" is displayed and then releasing the button. If the left 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.

In order to obtain quick test/verification of MULTICAL<sup>®</sup> 403, the meter has a test mode which repeats the measuring sequence every four seconds, i.e. eight times faster than in normal mode. In test mode heat energy, cooling energy and volume are displayed with a resolution which is higher than normal in order to enable shorter test duration.



In order to access test mode the "TEST" seal  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.



## **Test loop**

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

Test loop (Loop_4)		Test loop (Loop_4)		Index number in display
Main		Sub		
1.0	High-resolution heat energy *)			4-001-00
		1.1	Heat energy (E1)	4-001-01
2.0	High-resolution cooling energy *)			4-002-00
		2.1	Cooling energy (E3)	4-002-01
3.0	High-resolution volume *)			4-003-00
		3.1	Volume	4-003-01
4.0	t1 (Inlet)			4-004-00
5.0	t2 (Outlet)			4-005-00
6.0	Flow			4-006-00

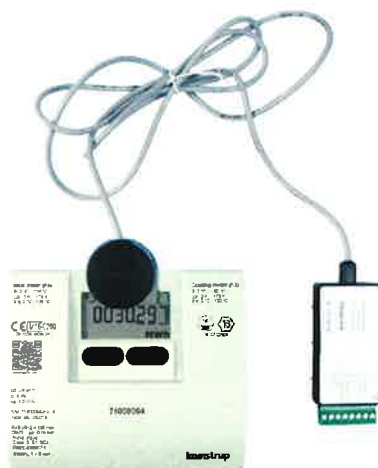
After 9 hours the meter reverts to energy reading in "User loop".

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

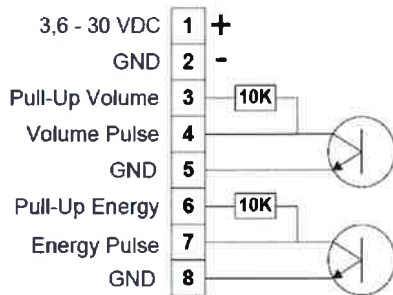
Test-loop can only be displayed if the verification seal is broken and the switch activated. The high-resolution registers can only be reset in connection with a total reset.

## **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:

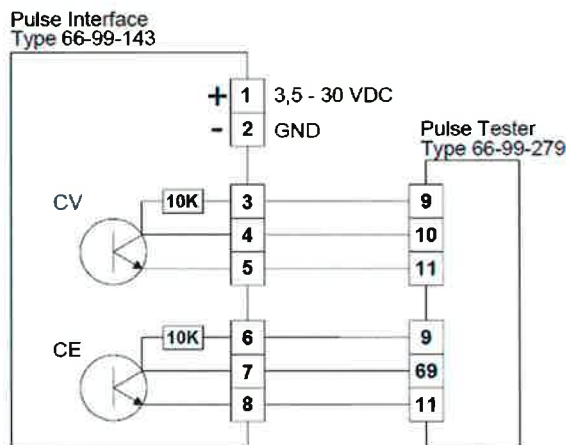
- High-resolution energy pulses (1 Wh/pulse) on terminals 7 and 8
- High-resolution volume pulses (10 ml/pulse) on terminals 4 and 5

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.

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	
Heat energy	E1HighRes
Cooling energy	E3HighRes
Volume	V1HighRes
t1 average inlet temperature	t1average_AutoInt
t2 average outlet temperature	t2average_AutoInt

### 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® 403 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® 403 must be in test mode (see "Test mode").

Verification pulses are connected as described in "Verification pulses" above.

#### Flying start/stop

Condition: MULTICAL® 403 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.

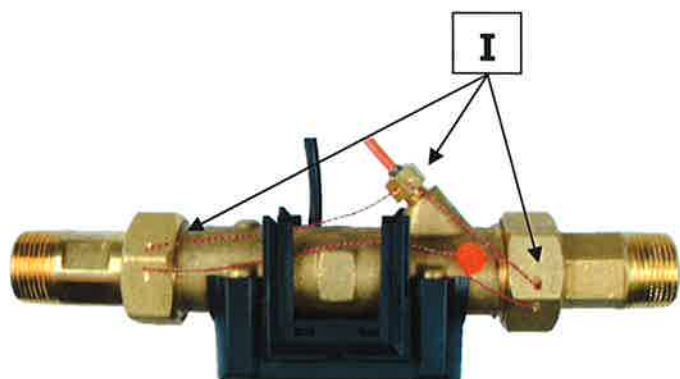
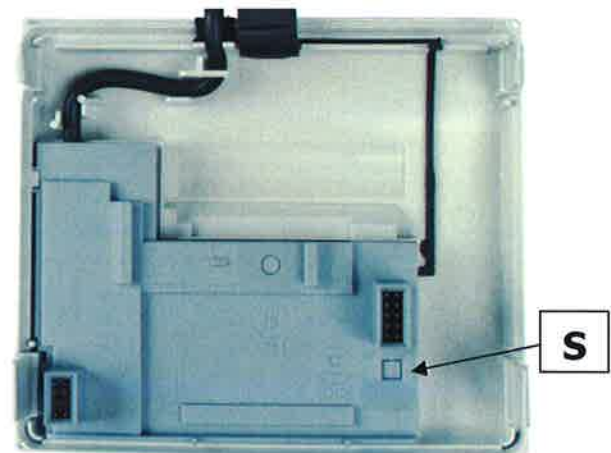
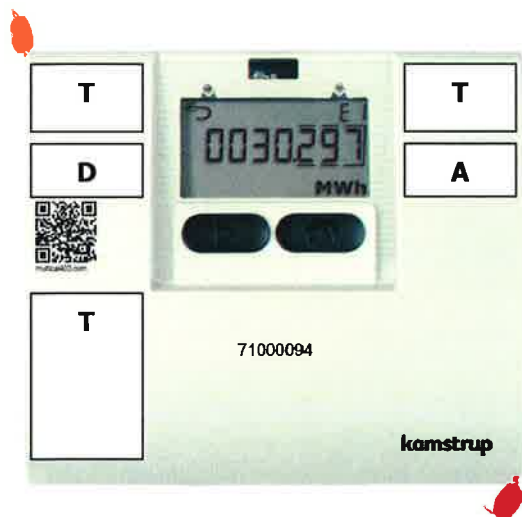
Verification pulses, as described in "Verification pulses", can be directly used for the test stand if it is designed to control the start/stop synchronisation. Alternatively, Pulse Tester, type 66-99-279, can be used as external start/stop pulse counter.

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.

## **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 (Sealing wire or Void label)
- A Alternative approval marking



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## Inscriptions

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

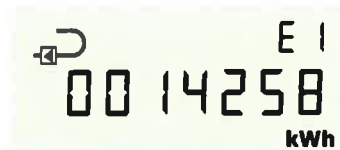
### Additional info in the display

Unit of measurement  
 Software version

### Mounting the flow sensor in Inlet or in Outlet:

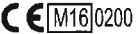

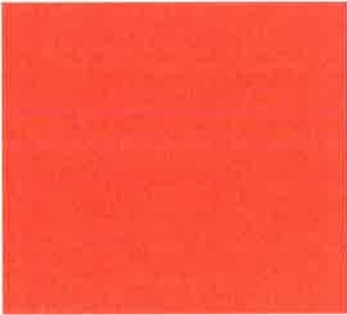




If the meter is set to be an inlet meter, the "Inlet arrow" is displayed.



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

### Example of inscriptions for MULTICAL® 403

<p><b>Heat meter (E1)</b>  <math>\theta</math>: 2 °C ... 180 °C  <math>\Delta\theta</math>: 3 K ... 178 K  <math>\theta</math> q: 2 °C ... 130 °C</p> <p> M16 0200  <small>DK-0200-MI004-037</small></p> <p></p> <p>qp: 2,5 m³/h        qi: 25 v/h        qs: 5,0 m³/h</p> <p>S/N: 71000154/LJ/16        Type: 403TA0319</p> <p>G1B (R3/4) x 130 mm        Δp: 0,09 bar DN20        PN16 PS16        Class 2 (E1, M2)        Pt500-EN60751</p> <p>Battery: 1 x D-cell</p>		<p><b>Cooling meter (E3)</b>  <math>\theta</math>: 2 °C ... 180 °C  <math>\Delta\theta</math>: 3 K ... 178 K  <math>\theta</math> q: 2 °C ... 130 °C</p> <p>   <small>TS 27 02 009</small></p>
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MULTICAL® 403 shown as an example with both the MID mark (to the left) and additional approval mark (to the right) outside the scope of the Measuring Instrument Directive



← Customer specific area

**kamstrup**

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**Photos of MULTICAL® 403**

