

Data sheet

## MULTICAL® 603

### The future-proof heat and cooling meter with full flexibility

- Fully programmable data logger with minute loggers
- 2 second integration interval
- 16 years battery lifetime at a reading interval down to 10 seconds
- Possibility of built-in M-Bus
- 2 communication modules
- 7 or 8 digit display resolution
- User-friendly interface with 3 push buttons
- Possibility of backlit display
- Auto Detect of ULTRAFLOW®
- Mixed fluid compatible



MID 2014/32/EU

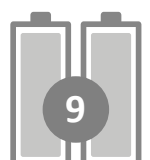
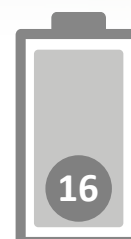
**CE M19 0200**

EN 1434

DK-BEK 1178 – 06/11/2014



EN 1434



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## Description

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MULTICAL® 603 is an all-round calculator, suitable as heat meter, cooling meter or combined heat/cooling meter together with 1 or 2 flow sensors and 2 or 3 temperature sensors. The meter is intended for energy measurement in almost all types of thermal installations where water is used as the energy-conveying medium.

MULTICAL® 603 can, in addition to heat and cooling measurement, be used for leakage monitoring, permanent performance monitoring, as power and flow limiter with valve control as well as for energy measurement in both open and closed systems.

According to EN 1434 and MID, MULTICAL® 603 can be designated as a "calculator" with separate type approval and verification, and it can be delivered either as a separate calculator or as a complete meter, with mounted temperature sensors and flow sensor according to customer requirements.

MULTICAL® 603 has 2 flow sensor inputs that can be used for both electronic and mechanical flow sensors. The pulse figure can be programmed from 0.001 to 300 pulses/liter, and the calculator can be programmed to all nominal flow sensor sizes from 0.6 to 15,000 m<sup>3</sup>/h. The calculator can be delivered with both galvanically connected and separated flow sensor inputs.

The accumulated heat energy and/or cooling energy can be displayed in kWh, MWh, GJ or Gcal, all in the form of seven or eight significant digits plus measuring unit. The display

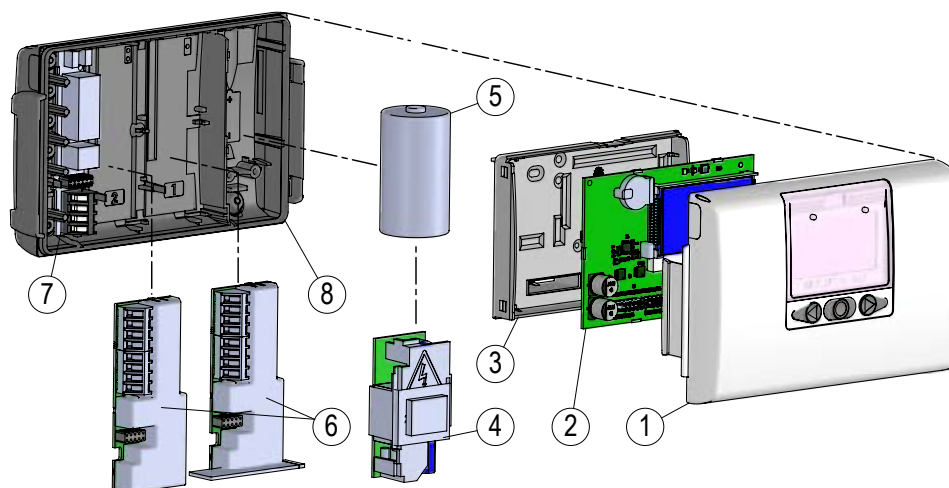
has been specially designed with a view to obtaining long lifetime and sharp contrast in a wide temperature range. Furthermore, MULTICAL® 603 can be delivered in a variant with backlit display (type 603-F).

MULTICAL® 603 is powered by an internal D-cell lithium battery with a lifespan of up to 16 years or a 2xAA lithium packet with a lifespan of up to 9 years. Alternatively, the meter can be mains supplied, either by 24 VAC or 230 VAC.

In designing MULTICAL® 603, great importance has been attached to flexibility through programmable functions and plug-in modules in order to secure optimum use in a wide range of applications. The meter has been configured from the factory and is ready for use. It can, however, be changed/reconfigured after installation via the front keys of the meter, READY or METERTOOL HCW.

Auto Detect enables the exchange of ULTRAFLOW® X4 on MULTICAL® 603 without the need for reconfiguration (change of the CCC code). MULTICAL® 603 can automatically adjust the pulse figure and  $q_p$  to match the connected ULTRAFLOW® X4 via Auto Detect. Auto Detect is active with CCC code 8xx and is initiated when the calculator top and base are separated and reassembled.

## Mechanical construction



- |   |   |   |  |
|---|---|---|--|
| 1 | Calculator top with front keys and laser engraving                  | 5 | ... or a battery can be mounted                    |
| 2 | PCB with microcontroller, display, etc.                             | 6 | 1 or 2 communication modules                       |
| 3 | Verification cover (may only be opened at an authorised laboratory) | 7 | Connection of temperature sensors and flow sensors |
| 4 | Either a power supply module can be mounted...                      | 8 | Calculator base                                    |

## Mechanical data

Weight	450 g
Ambient temperature	5...55 °C. Non-condensing, closed location (indoor installation)
Protection class	IP65
Medium temperatures ULTRAFLOW®	2...130 °C

At medium temperatures below ambient temperature or above 90 °C in the flow sensor, we recommend that the calculator is wall-mounted.

Medium in ULTRAFLOW®	Water (district heating water as described in CEN TR 16911 and AGFW FW510)
Storage temperature	-25...60 °C (drained flow sensor)
Connection cable	ø3.5...6 mm
Supply cable	ø5...8 mm

### Materials

Calculator case	
– Top and base	Thermoplastic, PC 10 % GF with TPE (thermoplastic elastomer)
– Verification cover	ABS
Cables	Silicone cable with inner Teflon insulation

## Approved meter data

### Approvals

- Heat meter	DK-0200-MI004-040	The stated minimum temperatures apply to the type approval only. The meter has no cutoff for low temperature and thus measures as low temperatures as 0.01 °C and 0.01 K.
- Temperature range	$\theta$ : 2 °C...180 °C	
- Differential area	$\Delta\theta$ : 3 K...178 K	
- Cooling meter	TS 27.02 012	
- Temperature range	$\theta$ : 2 °C...180 °C	
- Differential area	$\Delta\theta$ : 3 K...178 K	
- Bifunctional heat/cooling meter	Marked with DK-0200-MI004-040 and TS 27.02 012 as well as yearly mark of MID	
- Temperature range	$\theta$ : 2 °C...180 °C	
- Differential area	$\Delta\theta$ : 3 K...178 K	

### Standard

EN 1434:2015

### EU directives

Measuring Instrument Directive, Low Voltage Directive, Electromagnetic Compatibility Directive, Radio Equipment Directive, RoHS directive, Pressurised Equipment Directive

### EN 1434 designation

Environmental class A and C

### MID designation

- Mechanical environment	Class M1 and M2
- Electromagnetic environment	Class E1 and E2

### Temperature sensor connection

- Type 603-A	Pt100 – EN 60751, 2-wire connection
- Type 603-B	Pt100 – EN 60751, 4-wire connection
- Type 603-C/E/F/M	Pt500 – EN 60751, 2-wire connection
- Type 603-D/G/H	Pt500 – EN 60751, 4-wire connection

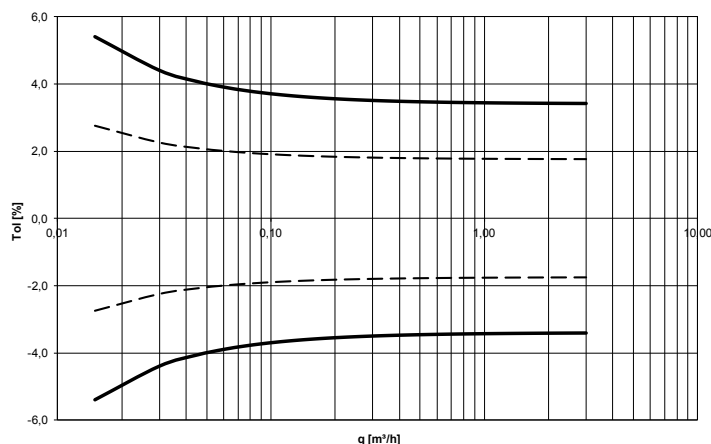
## Measurement accuracy

Heat meter components	MPE according to EN 1434-1	Typical accuracy
MULTICAL® 603	$E_c = \pm [0.5 + \Delta\theta \text{ min}/\Delta\theta] \%$	$E_c = \pm [0.15 + 2/\Delta\theta] \%$
ULTRAFLOW®	$E_f = \pm [2 + 0.02 q_p/q]$ , but not above $\pm 5 \%$	$E_f = \pm [1 + 0.01 q_p/q] \%$
Temperature sensor set	$E_t = \pm [0.5 + 3 \Delta\theta \text{ min}/\Delta\theta] \%$	$E_t = \pm [0.4 + 4/\Delta\theta] \%$

### MULTICAL® 603 and ULTRAFLOW® $q_p 1.5 \text{ m}^3/\text{h} @ \Delta\theta 30\text{K}$

Total typical accuracy of MULTICAL® 603, sensor pair and ULTRAFLOW® compared to EN 1434-1.

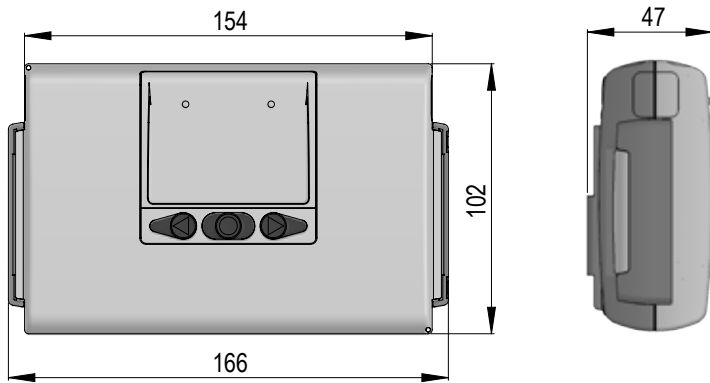
$E_c+E_t+E_f$ (EN)	$E_c+E_t+E_f$ (Typ)
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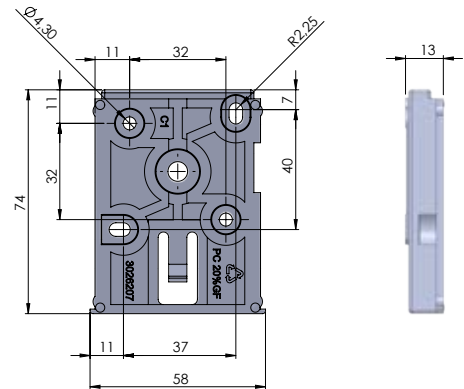
## Dimensioned sketches

All measurements in [mm].

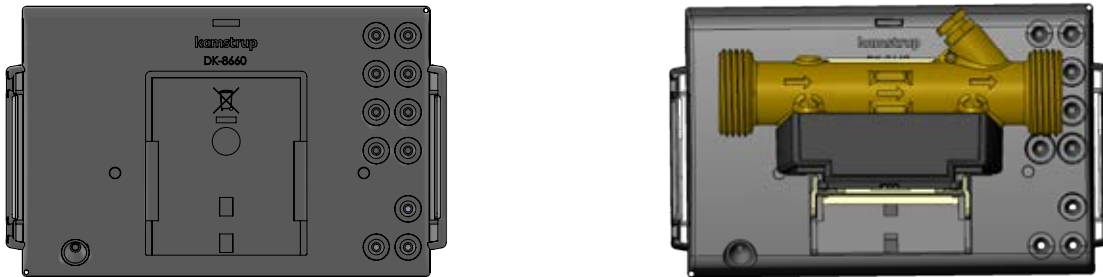
### Mechanical measurements for MULTICAL® 603 calculator



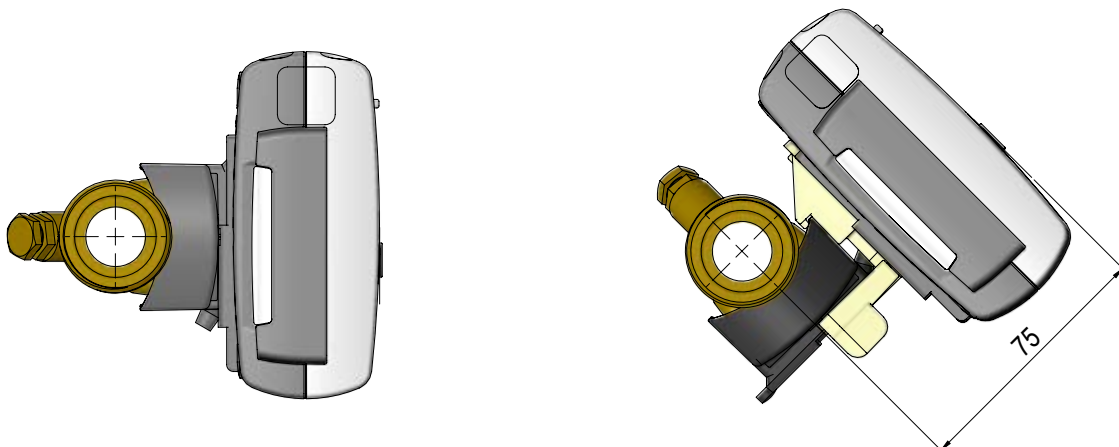
### Bracket for wall mounting



### Calculator base separate and mounted on ULTRAFLOW®



### MULTICAL® 603 mounted on ULTRAFLOW® with G $\frac{3}{4}$ threaded connection



## Electrical data

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### Calculator data

Display	LCD – 7 or 8 digits, digit height 8.2 mm
Resolutions	999,9999 – 9999,999 – 99999,99 – 999999,9 – 9999999 9999,9999 – 99999,999 – 999999,99 – 9999999,9 – 99999999
Energy units	MWh – kWh – GJ – Gcal
Data logger (EEPROM)	
– Logger contents	Programmable – all registers can be selected
– Logging interval	Programmable – from 1 minute to 1 year
– Logging depth	Programmable – standard: 20 years, 36 months, 460 days, 1400 hours
Info logger (EEPROM)	250 info codes (last 50 are shown in the display)
Clock/calender (with backup battery)	Clock, calendar, leap year compensation, target date
Daylight saving time/wintertime (DST)	Programmable This function can be disabled so that “technical normal time” is used
Time accuracy	Without external adjustment: Less than 15 min./year With external adjustment every 48 hours: Less than 7 s from legal time
Data communication	KMP protocol with CRC16 used for optical communication as well as for modules
Power in temperature sensors	< 10 $\mu$ W RMS
Power supply	3.6 VDC $\pm$ 0.1 VDC
Battery	

	<b>3.65 VDC, D-cell lithium</b>	<b>3.65 VDC, 2xA cell lithium</b>
Wall-mounted	16 years @ $t_{BAT} < 30\text{ }^{\circ}\text{C}$	9 years @ $t_{BAT} < 30\text{ }^{\circ}\text{C}$
Mounted on flow sensor	14 years @ $t_{BAT} < 40\text{ }^{\circ}\text{C}$	7 years @ $t_{BAT} < 40\text{ }^{\circ}\text{C}$

**Note:** Depends on the meter and module configuration

Mains supply	230 VAC $\pm$ 15/-30 %, 50/60 Hz 24 VAC $\pm$ 50 %, 50/60 Hz
Insulation voltage	3.75 kV
Power consumption	< 1 W
Backup supply	Integrated supercap eliminates interruptions due to short-term power failures (only supply modules type 7 and 8)

## Electrical data

Temperature measurement	t1 Inlet	t2 Outlet	t3 Inlet	t4 Outlet	$\Delta\ominus$ (t1-t2) Heat measurement	$\Delta\ominus$ (t2-t1) Cooling measure- ment	t5 Preset for A1 and A2	
Measuring range 603-A, 2-wire, Pt100 603-B, 4-wire, Pt100 603-C/E/F, 2-wire, Pt500 603-D/G/H, 4-wire, Pt500 603-M, 2-wire, Pt500	0.00...185.00 °C (t1 and t2: Approved for 2.00...180.00°C) 0.00...185.00 °C (t1 and t2: Approved for 2.00...180.00°C) 0.00...185.00 °C (t1 and t2: Approved for 2.00...180.00°C) 0.00...185.00 °C (t1 and t2: Approved for 2.00...180.00°C) -40...140 °C							
Offset adjustment	± 0.99 K joint zero point adjustment for t1, t2 and t3 <b>Note:</b> The offset adjustment is only active on measured temperatures. If, for example, t3 has been selected for a preset value, the offset adjustment will not influence the preset value.							
Max cable lengths (max $\varnothing$ 6 mm cable)	Pt100, 2-wire	Pt100, 4-wire	Pt500, 2-wire	Pt500, 4-wire				
	2 x 0.25 mm <sup>2</sup> : 2.5 m 2 x 0.50 mm <sup>2</sup> : 5 m 2 x 1.00 mm <sup>2</sup> : 10 m	4 x 0.25 mm <sup>2</sup> : 100 m	2 x 0.25 mm <sup>2</sup> : 10 m	4 x 0.25 mm <sup>2</sup> : 100 m				
Flow measurement V1/V2	ULTRAFLOW® V1: 9-10-11 V2: 9-69-11	Reed contacts V1: 10-11 V2: 69-11	FET contacts V1: 10-11 V2: 69-11	24 V active pulses V1: 10B-11B				
CCC-code	1xx-2xx-4xx-5xx-8xx	0xx	9xx	2xx and 9xx				
EN 1434 pulse class	IC	IB	IB	(IA)				
Pulse input	680 k $\Omega$ pull-up to 3.6 V	680 k $\Omega$ pull-up to 3.6 V	680 k $\Omega$ pull-up to 3.6 V	12 mA at 24 V				
Pulse ON	< 0.4 V in > 1 ms	< 0.4 V in > 300 ms	< 0.4 V in > 30 ms	< 4 V in > 3 ms				
Pulse OFF	> 2.5 V in > 4 ms	> 2.5 V in > 100 ms	> 2.5 V in > 70 ms	> 12 V in > 4 ms				
Pulse frequency	< 128 Hz	< 1 Hz	< 8 Hz	< 128 Hz				
Integration frequency	< 1 Hz	< 1 Hz	< 1 Hz	< 1 Hz				
Electrical isolation	No	No	No	2 kV				
Max cable length	10 m	10 m	10 m	100 m				
Max cable length with Cable Extender Box, Type 66-99-036	30 m	30 m	30 m	-				
Pulse inputs In-A/In-B	Electronic switch		Reed-switch					
Pulse input	680 k $\Omega$ pull-up to 3.6 V		680 k $\Omega$ pull-up to 3.6 V					
Pulse ON	< 0.4 V in > 30 ms		< 0.4 V in > 500 ms					
Pulse OFF	> 2.5 V in > 30 ms		> 2.5 V in > 500 ms					
Pulse frequency	< 3 Hz		< 1 Hz					
Electrical isolation	No		No					
Max cable length	25 m		25 m					
Requirements to external contact	Leakage current at function open < 1 $\mu$ A							
Pulse outputs Out-C/Out-D	HC-003-11 HC-003-21/-31	(before 2017-05) (before 2018-04)	HC-003-11 HC-003-21/-31	(after 2017-05) (after 2018-04)				
Pulse output type	Open collector (OB)		Opto FET					
External voltage	5...30 VDC		1...48 VDC/VAC					
Current	< 10 mA		< 50 mA					
Residual stress	U <sub>CE</sub> $\approx$ 1 V at 10 mA		R <sub>ON</sub> $\leq$ 40 $\Omega$					
Electrical isolation	2 kV		2 kV					
Max cable length	25 m		25 m					

## Product variants

### MULTICAL® 603 type number

					Statistical data Written on the meter's front 603-X X XX -			Dynamic data Appearing from display X XX X XX XX						
Type 603-					□	□	□□	-	□	□□	□	□□	□□	□□
<b>Calculator type</b>														
Pt100 2-wire	t1-t2	V1	M-Bus	A										
Pt100 4-wire	t1-t2	V1	M-Bus	B										
Pt500 2-wire	t1-t2	V1	M-Bus	C										
Pt500 4-wire	t1-t2	V1	M-Bus	D										
Pt500 2-wire	t1-t2-t3	V1-V2		E										
Pt500 2-wire	t1-t2-t3	V1-V2	Backlit display	F										
Pt500 4-wire	t1-t2	V1 (24 V active pulses)	M-Bus	G										
Pt500 4-wire	t1-t2-t3	V1-V2		H										
Pt500 2-wire	t1-t2-t3	V1-V2	(Mixed fluid only)	M										
<b>Meter type</b>														
Heat meter		MID module B		1										
Heat meter		MID module B+D		2										
Heat/cooling meter		MID module B+D & TS 27.02	$\theta_{HC} = OFF$	3										
Heat meter		National approval		4										
Cooling meter		TS 27.02+BEK1178		5										
Heat/cooling meter		MID module B+D & TS 27.02	$\theta_{HC} = ON$	6										
Volume meter, hot				7										
Volume meter, cold				8										
Energy meter				9										
<b>Country code</b>														
Determined by Kamstrup upon receipt of order														XX



## Product variants

### MULTICAL® 603 type number

	Statistical data Written on the meter's front 603-X XX X -				Dynamic data Appearing from display X XX X XX XX					
	Type 603-	□	□	□□	-	□	□□	□	□□	□□
<b>Flow sensor connection type</b>										
Delivered with one ULTRAFLOW®										1
Delivered with two identical ULTRAFLOW®										2
Prepared for one ULTRAFLOW®										7
Prepared for two identical ULTRAFLOW®										8
Prepared for flow sensor with fast and bounce-free electronic pulses										C
Prepared for flow sensor with slow and bounce-free electronic pulses										J
Prepared for flow sensor with slow pulses with bounce										L
Prepared for flow sensor with 24 V active pulses										P
Delivered with one flow sensor (Mixed fluid only)										G
<b>Temperature sensor set</b>										
Supplied without temperature sensors										00
<b>2-wire Pt500 temperature sensors</b>										
Direct short temperature sensors, 2 pcs.			DS 27.5 mm		L 1.5 m - 3.0 m					1x
Direct short temperature sensors, 2 pcs.			DS 38.0 mm		L 1.5 m - 3.0 m					2x
Pocket temperature sensors, 2 pcs.			PL ø5.8 mm		1.5 m - 10 m					3x
<b>2-wire Pt100 temperature sensors</b>										
Direct short temperature sensors, 2 pcs.			DS 27.5 mm or DS 38.0		L 2.0 m					Jx
<b>4-wire Pt500/Pt100 temperature sensors</b>										
Pocket temperature sensors with connection head, 2 pcs.			PL ø6.0 mm		L 105 mm - 230 mm					Ax
Pocket temperature sensors with connection head, 2 pcs.			PL ø5.8 mm		L 90 mm - 180 mm					Bx
<b>Supply</b>										
No supply										0
Battery, 1 x D-cell										2
230 VAC high-power SMPS										3
24 VAC/VDC high-power SMPS										4
230 VAC power supply										7
24 VAC power supply										8
Battery, 2 x A-cells										9
<b>Communication module (2 module slots)</b>										
No module										M1 00 M2 00
Data Pulse, inputs (In-A, In-B)										10 10
Data Pulse, outputs (Out-C, Out-D)										11 11
Wired M-Bus, inputs (In-A, In-B)										20 20
Wired M-Bus, outputs (Out-C, Out-D)										21 21
Wired M-Bus, Thermal Disconnect										22 22
Wireless M-Bus, inputs (In-A, In-B), 868 MHz										30 30
Wireless M-Bus, outputs (Out-C, Out-D), 868 MHz										31 31
Analog outputs 2 x 0/4...20 mA										40 40
Analog inputs 2 x 4...20 mA / 0...10 V										41 41
PQT Controller										43 43
Low Power Radio, inputs (In-A, In-B), 434 MHz										50 50
Low Power Radio GDPR, inputs (In-A, In-B), 434 MHz										51 51
LON TP/FT-10, inputs (In-A, In-B)										60 60
BACnet MS/TP, inputs (In-A, In-B)										66 66
Modbus RTU, inputs (In-A, In-B)										67 67
2G/4G Network										80 80
High Power Radio Router, inputs (In-A, In-B), 444 MHz										84 84
High Power Radio Router GDPR, inputs (In-A, In-B), 444 MHz										85 85

Contact Kamstrup A/S for further information about product variants.

## Meter configuration

	A	B	CCC	DDD	EE	FF	GG	L	M	N	PP	RR	T	VVV
<b>Flow sensor position</b>														
Inlet		3												
Outlet		4												
<b>Measuring unit</b>														
GJ		2												
kWh		3												
MWh		4												
Gcal		5												
<b>Auto Detect CCC codes (UF x4)</b>														
Normal resolution (7 digits)			807											
High resolution (8 digits)			818											
<b>Static CCC codes</b>														
Reed contact (7 digits)			0xx											
Electronic, fast pulses (7 digits)			1xx											
Electronic, fast pulses (8 digits)			2xx											
Kamstrup, UF X4 (7 digits)			4xx											
Kamstrup, UF X4 (8 digits)			5xx											
Electronic, slow pulses (7 digits)			9xx											
<b>Display</b>														
Heat meter (standard)				210										
Heat/cooling meter (standard)				310										
Cooling meter (standard)				510										
<b>Tariffs</b>														
No active tariff					00									
Power tariff					11									
Flow tariff					12									
t1-t2 tariff					13									
Inlet tariff					14									
Outlet tariff					15									
Time-controlled tariff					19									
Heat/cooling volume tariff					20									
PQ tariff					21									
<b>Pulse inputs In-A/In-B</b>														
10 m <sup>3</sup> /h, 10 l/imp, pre-counter 1 (standard)						24	24							
<b>Integration mode</b>														
Adaptive mode (2-64 s)		Display on												1
Normal mode (32 s)		Display on												2
Fast mode (8 s)		Display on												3
Fast mode (2 s)		Display on												4
Adaptive mode (2-64 s)		Display off												5
Normal mode (32 s)		Display off												6
Fast mode (8 s)		Display off												7
<b>Leakage limits (V1/V2)</b>														
OFF														0
1.0 % of q <sub>p</sub> + 20 % of q														1
1.0 % of q <sub>p</sub> + 10 % of q														2
0.5 % of q <sub>p</sub> + 20 % of q														3
0.5 % of q <sub>p</sub> + 10 % of q														4
<b>Cold water leakage limits (In-A/In-B)</b>														
OFF														0
30 min. without pulses														1
One hour without pulses														2
Two hours without pulses														3

## Meter configuration

A - B - CCC - DDD - EE - FF - GG - L - M - N - PP - RR - T - VVVV

### Pulse outputs Out-C/Out-D

Out-C: V1/4	5.0 ms	73
Out-C: V1/1, Out-D: V2/1	3.9 ms	80
Out-C: V1/1	3.9 ms	82
Out-C: V1/4	22 ms	83
E1 and V1 or E3 and V1	10 ms	94
E1 and V1 or E3 and V1	32 ms	95
E1 and V1 or E3 and V1	100 ms (0.1 s)	96
Controlled output based on data commands		99

### Data logger profile

Standard data logger profile	10
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### Encryption level

Individual key	3
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### Customer label

Serial number	0000
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Contact Kamstrup A/S for further information about meter configuration.

## Information code types in display

1	Display digit							Description
	2	3	4	5	6	7	8	
Info	t1	t2	t3	V1	V2	In-A	In-B	
1								No voltage supply
2								Low battery level
9								External alarm [e.g. via KMP]
	1							t1 Above measuring range or switched off
		1						t2 Above measuring range or switched off
			1					t3 Above measuring range or switched off
	2							t1 Below measuring range or short-circuited
		2						t2 Below measuring range or short-circuited
			2					t3 Below measuring range or short-circuited
	9	9						t1-t2 Invalid temperature difference
				1				V1 Communication error
					1			V2 Communication error
				2				V1 Wrong pulse figure
					2			V2 Wrong pulse figure
				3				V1 Air
					3			V2 Air
				4				V1 Wrong flow direction
					4			V2 Wrong flow direction
				6				V1 Increased flow (flow1 > q <sub>s</sub> , for more than 1 hour)
					6			V2 Increased flow (flow2 > q <sub>s</sub> , for more than 1 hour)
				7				V1/V2 Burst, water loss (flow1 > flow2)
					7			V1/V2 Burst, water penetration (flow1 < flow2)
				8				V1/V2 Leakage, water loss [M1 > M2]
					8			V1/V2 Leakage, water penetration [M1 < M2]
						7		In-A2 Leakage in the system
						8		In-A1 Leakage in the system
						9		In-A1/A2 External alarm
							7	In-B2 Leakage in the system
							8	In-B1 Leakage in the system
							9	In-B1/B2 External alarm

### Example:

1	0	2	0	0	0	9	0
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**Note:** Info codes are configurable. Therefore, it is not certain that all the parameters are available in a given MULTICAL® 603.

An info logger saves the info code every time the info log is changed. It is possible to read the latest 250 changes of the info code and the date of the change.

## Accessories

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### Article number Description

HC-993-02	Battery module with 1 x D-cell
HC-993-03	230 VAC High Power supply module
HC-993-04	24 VAC/VDC High Power supply module
HC-993-07	230 VAC supply module
HC-993-08	24 VAC supply module
HC-993-09	Battery module with 2 x A-cells
2006-681	Supply module label
3026-207	Wall bracket
3026-517	Sealing cap for temperature sensors, blue 2 pcs.
3026-518	Sealing cap for temperature sensors, red 2 pcs.
3026-858	Angle fitting ULTRAFLOW® (qp 0.6...2.5)
3026-963	Disassemble tool for MULTICAL® 603
3130-269	Cable clamp with screws
5000-337	Module cable, 2 m (2 x 0.25 mm <sup>2</sup> )
6699-035	USB module configuration cable
6699-036	Cable Extender Box
6699-042	Metal plate for optical read-out head (20 pcs)
6699-099	Infrared optical reading head w/USB plug
6699-102	Infrared optical reading head w/D-sub plug
6699-110	Panel bracket
6699-447.E	Internal antenna for Kamstrup radio, 434 MHz
6699-448	Mini Triangle antenna for Wireless M-Bus and 2G/4G Network Module
6699-482.E	Internal antenna for Wireless M-Bus 868 MHz
6699-724	METERTOOL HCW
6699-725	LogView HCW
6699-903	Pulse Transmitter Box

### Calibration units

#### Article number Description

6699-363	2-wire Pt500, heat/cooling (used with METERTOOL HCW)
6699-364	4-wire Pt500, heat/cooling (used with METERTOOL HCW)
6699-365	2/4-wire Pt100, heat/Cooling (used with METERTOOL HCW)

Find more information on ULTRAFLOW®, temperature sensors and ball valves on [products.kamstrup.com](https://products.kamstrup.com).

Contact Kamstrup A/S for information about further accessories.

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