kamstrup

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®

MID
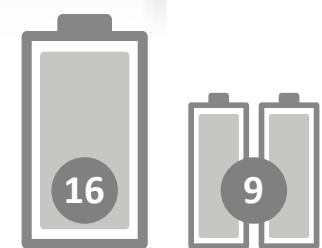
CE M18 0200

EN 1434

DK-BEK 1178 – 06-11-2014

DK 268   18

EN 1434

16   9

Contents

Description

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 m³/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).
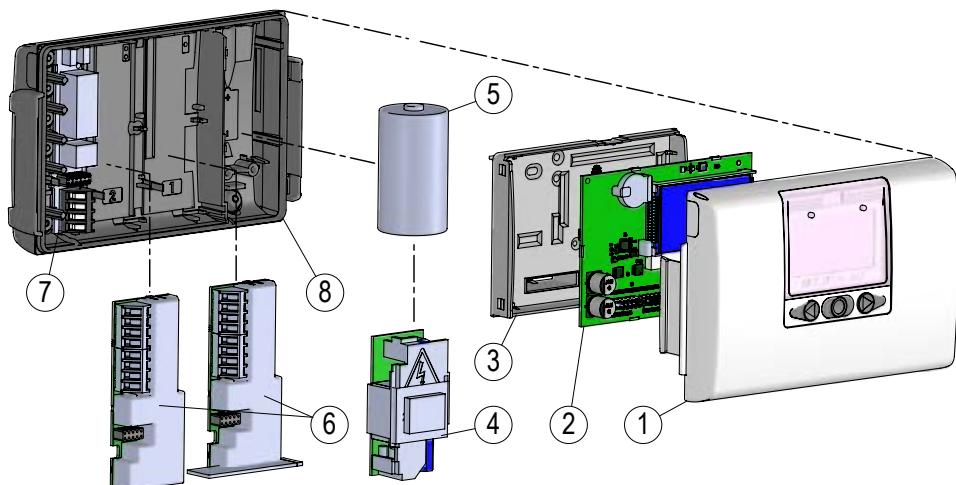
MULTICAL® 603 is powered by an internal D-cell lithium battery with a lifespan of up to 16 years or a 2xAA lithium packet with a lifespan of up to 9 years. Alternatively, the meter can be mains supplied, either by 24 VAC or 230 VAC.

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
2   PCB with microcontroller, display, etc.
3   Verification cover (may only be opened at an authorised laboratory)

4   Either a power supply module can be mounted...

5   ... or a battery can be mounted
6   1 or 2 communication modules
7   Connection of temperature sensors and flow sensors

8   Calculator base

Mechanical data

Weight	450 g
Ambient temperature	5...55 °C. Condensing, closed location (installation indoors).
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
  - Temperature range θ: 2 °C...180 °C
  - Differential area $\Delta\Theta$: 3 K...178 K
– Cooling meter   TS 27.02 012
  - Temperature range θ: 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 θ: 2 °C...180 °C
  - Differential area $\Delta\Theta$: 3 K...178 K

> 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.

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
                                                 Non-condensing environment, closed location (indoors), 5...55 °C

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   Pt500 – EN 60751, 2-wire connection
– Type 603-D/G/H   Pt500 – EN 60751, 4-wire connection

Measurement accuracy
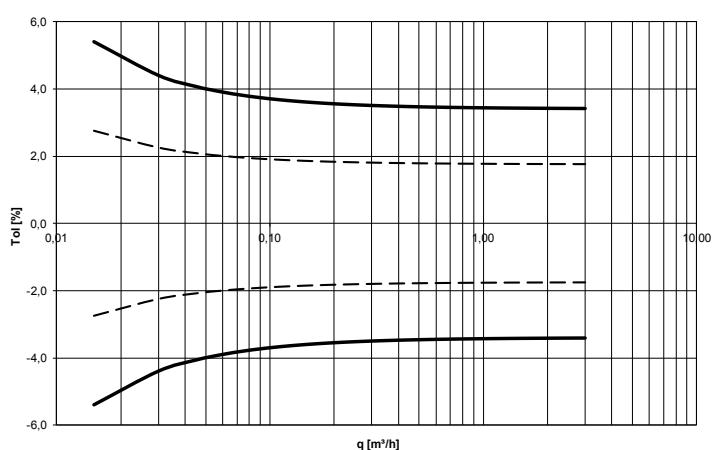
Heat meter components	MPE according to EN 1434-1	Typical accuracy
MULTICAL® 603	$E_c = \pm (0.5 + \Delta\Theta \min/\Delta\Theta)$ %	$E_c = \pm (0.15 + 2/\Delta\Theta)$ %
Sensor pair	$E_t = \pm (0.5 + 3 \Delta\Theta \min/\Delta\Theta)$ %	$E_t = \pm (0.4 + 4/\Delta\Theta)$ %
ULTRAFLOW®	$E_f = \pm (2 + 0.02 q_p/q)$, but not above ± 5 %	$E_f = \pm (1 + 0.01 q_p/q)$ %

**MULTICAL® 603
and ULTRAFLOW® q_p 1.5 m³/h @$\Delta\Theta$ 30K**

Total typical accuracy of MULTICAL® 603, sensor pair and ULTRAFLOW® compared to EN 1434-1.
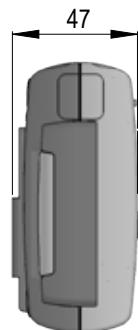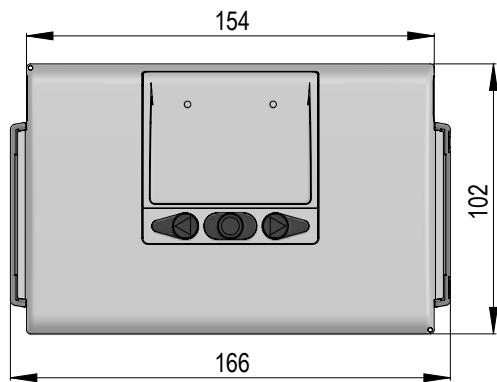
| ——— Ec+Et+Ef (EN)	– – – Ec+Et+Ef (Typ)
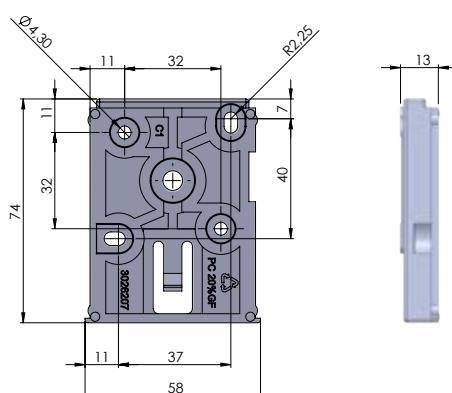
Dimensioned sketches

All measurements in [mm].
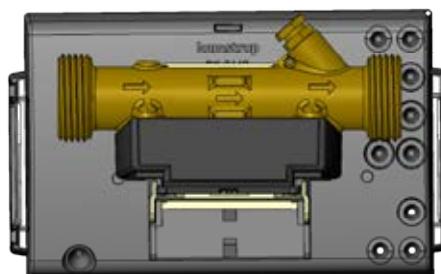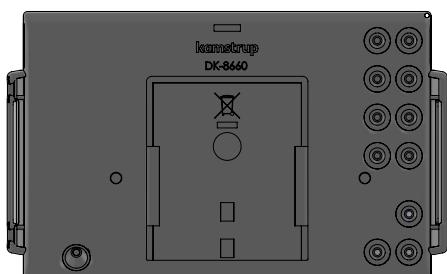
Mechanical measurements for MULTICAL® 603 calculator

154
102
166
47
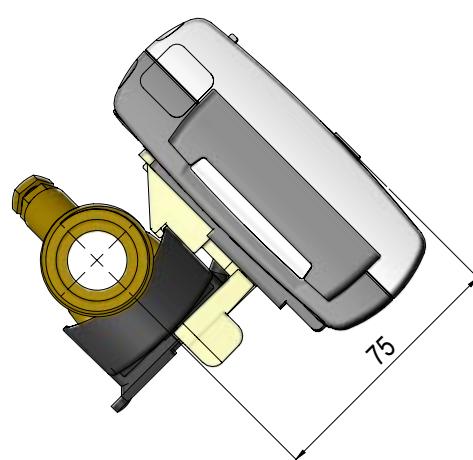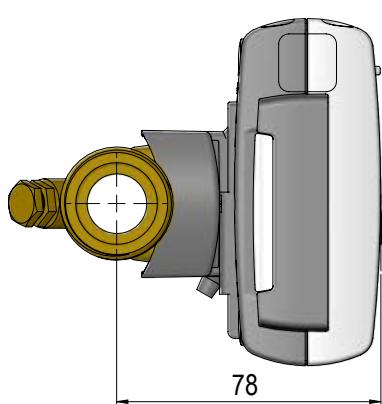
Bracket for wall mounting

Ø4,30
11
32
R2,25
11
5
32
7
74
40
11
37
58
13

Calculator base separate and mounted on ULTRAFLOW®

MULTICAL® 603 mounted on ULTRAFLOW® with G¾ threaded connection

78
75

Electrical data

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 – Logging interval – Logging depth	 Programmable – all registers can be selected Programmable – from 1 minute to 1 year 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 μW RMS
Power supply	3.6 VDC ± 0.1 VDC

Battery

	3.65 VDC, D-cell lithium	3.65 VDC, 2xA cell lithium
Wall-mounted	16 years @ t_{BAT} < 30 °C	9 years @ t_{BAT} < 30 °C
Mounted on flow sensor	14 years @ t_{BAT} < 40 °C	7 years @ t_{BAT} < 40 °C

Note: Depends on the meter and module configuration

Mains supply	230 VAC +15/-30 %, 50/60 Hz 24 VAC ±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	ΔΘ (t1-t2) Heat measurement	ΔΘ (t2-t1) Cooling measurement	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	0.00...185.00 °C (t1 and t2: Approved for 2.00...180.00°C)						
Offset adjustment	± 0.99 K joint zero point adjustment for t1, t2 and t3 **Note:** 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 ø6 mm cable)	Pt100, 2-wire	Pt100, 4-wire	Pt500, 2-wire	Pt500, 4-wire
	2 x 0.25 mm²: 2.5 m 2 x 0.50 mm²: 5 m 2 x 1.00 mm²: 10 m	4 x 0.25 mm²: 100 m	2 x 0.25 mm²: 10 m	4 x 0.25 mm²: 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 kΩ pull-up to 3.6 V	680 kΩ pull-up to 3.6 V	680 kΩ 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 kΩ pull-up to 3.6 V		680 kΩ 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 µA			

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	$U_{CE} \approx 1$ V at 10 mA		$R_{ON} \leq 40\ \Omega$	
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 XX X –			Dynamic data Appearing from display X XX X XX XX				
				Type 603-	□	□	□□ –	□	□□	□	□□	□□
Calculator type												
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								
Meter type												
Heat meter	MID module B				1							
Heat meter	MID module B+D				2							
Heat/cooling meter	MID module B+D & TS 27.02		θ_{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		θ_{HC} = ON		6							
Volume meter					7							
Energy meter					9							
Country code												
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-	☐ ☐ ☐☐ –	☐ ☐☐	☐	☐☐	☐☐

Flow sensor connection type						
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			
Temperature sensor set						
No temperature sensors				00		
2-wire Pt500 temperature sensors						
Short direct sensor pair	DS 27.5 mm	L 1.5 m - 3.0 m		1x		
Short direct sensor pair	DS 38.0 mm	L 1.5 m - 3.0 m		2x		
Pocket sensor pair	PL ø5.8 mm	1.5 m - 10 m		3x		
2-wire Pt100 temperature sensors						
Short direct sensor pair	DS 27.5 mm or DS 38.0	L 2.0 m		Jx		
4-wire Pt500/Pt100						
Pocket sensor pair with connecting head	PL ø6.0 mm	L 105 mm - 230 mm		Ax		
Pocket sensor pair with connecting head	PL ø5.8 mm	L 90 mm - 180 mm		Bx		
Supply						
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	

Communication module (2 module slots)					**M1**	**M2**
No module					00	00
Data + 2 pulse inputs (In-A, In-B)					10	10
Data + 2 pulse outputs (Out-C, Out-D) + pulse transmitter (V1+V2)					11	11
M-Bus, configurable + 2 pulse inputs (In-A, In-B)					20	20
M-Bus, configurable + 2 pulse outputs (Out-C, Out-D)					21	21
M-Bus, configurable with Thermal Disconnect					22	22
Wireless M-Bus, EU, configurable, 868 MHz + 2 pulse inputs (In-A, In-B)					30	30
Wireless M-Bus, EU, configurable, 868 MHz + 2 pulse outputs (Out-C, Out-D)					31	31
Analog output module 2x 0/4...20 mA					40	40
Analoge input module 2 x 0...20 mA/0...10 V					41	41
PQT controller					43	43
Kamstrup Radio (low power) + 2 pulse inputs (In-A, In-B)					50	50
Kamstrup Radio GDPR (low power) + 2 pulse inputs (In-A, In-B)					51	51
LON FT-X3 + 2 pulse inputs (In-A, In-B)					60	60
BACnet MS/TP (RS-485) + 2 pulse inputs (In-A, In-B)					66	66
Modbus RTU (RS-485) + 2 pulse inputs (In-A, In-B)					67	67
2G/4G Network module					80	80
High Power Radio Router + 2 pulse inputs (In-A, In-B)					84	84
High Power Radio Router GDPR + 2 pulse inputs (In-A, In-B)					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	-	VVVV

Flow sensor position

Inlet	3
Outlet	4

Measuring unit

GJ	2
kWh	3
MWh	4
Gcal	5

Auto Detect CCC codes (UF x4)

Normal resolution (7 digits)	807
High resolution (8 digits)	818

Static CCC codes

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

Display

Heat meter (standard)	210
Heat/cooling meter (standard)	310
Cooling meter (standard)	510

Tariffs

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

Pulse inputs In-A/In-B

	FF	GG
10 m³/h, 10 l/imp, pre-counter 1 (standard)	24	24

Integration mode

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

Leakage limits (V1/V2)

OFF	0
1.0 % of q_p + 20 % of q	1
1.0 % of q_p + 10 % of q	2
0.5 % of q_p + 20 % of q	3
0.5 % of q_p + 10 % of q	4

Cold water leakage limits (In-A/In-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		09	
Encryption level			
Common key		2	
Individual key		3	
Customer label			
Serial number		0000	

Contact Kamstrup A/S for further information abour meter configuration.

Information code types in display

Display digit								Description
1	**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_s, for more than 1 hour)
					6			V2 Increased flow (flow2 > q_s, 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	

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

Article number	Description
HC-993-02	Battery module with one 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 A-cells
2006-681	Supply module label for MULTICAL® 403/603
3026-207	Wall bracket
3026-517	Sealing cap for temperature sensors, blue
3026-518	Sealing cap for temperature sensors, red
3026-858	Angle fitting ULTRAFLOW® (q_p 0.6...2.5)
3026-963	Disassemble tool for MULTICAL® 603
3130-269	Cable clamp with screws kit set
5000-337	Module cable, 2 m (2 x 0.25 mm²)
6699-035	USB module configuration cable
6699-036	Cable Extender Box
6699-042	Metal plate for optical reader
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
6699-482.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 information about ULTRAFLOW®, temperature sensors and ball valves on products.kamstrup.com.

Contact Kamstrup A/S for information about further accessories.