

MULTICAL[®] Energy meter

Can be connected to flow meters from
qp 0.6 to 3000 m³/h

Additional connection for electricity or
water meters

Measures heat or cooling

Leak detection

Battery back-up

Data logging for 15 years

Power and flow limitation

Net supply or up to 10 years' battery supply

Plug-in modules for CTS, RS232, Modem,
M-Bus, LONWorks, Radio and Analog output



TS	27.01	TS	27.01	PTB	22.52	22.55
	062		098		01.03	00.03
	DS 2340		EN 1434			

Application

MULTICAL[®] type 66-C is used to measure both heating and cooling in all water based plants with flow temperatures from 2°C to 160°C and with all flow meter sizes between qp 0.6 m³/h and qp 3000 m³/h.

If a flow meter is installed in both the flow and return pipes, MULTICAL[®] type 66-C can monitor leaks and bursts in the heating/cooling system. Furthermore, leakages in the tap water system can be monitored by means of pulses, if a water meter is connected.

Power and water flow can be limited by means of MULTICAL[®] type 66-C if a 3-point motor-operated valve is connected in the return pipe.

MULTICAL[®] type 66-D and type 66-E can also be used to measure energy in open or closed systems.

MULTICAL[®] type 66-CDE receives volume pulses from the connected flow meters and calculates the energy for every predetermined water volume .

The energy calculation includes temperature measurements in flow and return as well as correction for density and heat content according to EN 1434.

MULTICAL[®] type 66-CDE has a battery back-up for the calculator. The meter can be supplied by either 230 VAC, 24 VAC or by a 3.6 V lithium battery.

Data can be read either by means of optical reading placed on the front cover in accordance with EN 61 107 or by means of plug-in modules, which can be inserted in the calculator itself.



Kamstrup A/S
Industrivej 28, Stilling
DK-8660 Skanderborg
TEL: +45 89 93 10 00
FAX: +45 89 93 10 01
info@kamstrup.com
www.kamstrup.com

Calculator features

1. Display

MULTICAL® is equipped with a liquid crystal display with 8 numerical digits plus 3 alphanumeric characters. During normal operation the accumulated values for thermal energy and water consumption are shown using 7 digits and the relevant units of measurement using 3 alphanumeric characters (MWh, m³ etc.).

If a customer number is to be displayed, up to 11 digits can be used, though without measuring unit.

The accumulated value for thermal energy in MWh, kWh or GJ is constantly displayed, the unit depends on the individual programming. If the left or right front panel is pressed, the display indicates as follows:

1.1 MULTICAL® 66C, standard and leak

Left key	○	Right key	▶
Cooling energy		Thermal energy	
m³*tF		Volume	
m³*tR		Hour counter	
TA2		T1	
TA3		T2	
TL2		Δt	
TL3		Power	
VA		Monthly peak power	
VB		Year's peak power	
T3		Year's peak date	
P1		Flow	
P2		Peak flow	
Customer No.		Year's peak flow	
Clock		Info codes	
Date		Info counter	
Target date			
Segment test			

1.2 MULTICAL® 66D, open system

Left key	○	Right key	▶
VA		Δ-energy	
VB		V1-volume	
P1		V1-density	
P2		V1-flow	
Customer No.		V1-peak flow	
Clock		V1-power	
Date		V2-volume	
Target date		V2-density	
Qsum1		V2-flow temp.	
Qsum2		t1-flow temp.	
Segment test		t2-reference temp.	
		t3-return	
		Hour counter	
		PR1	
		PR2	
		Info	
		Info hour counter	

1.3 MULTICAL® 66E, closed system

Left key	○	Right key	▶
TA2		V1-energy	
TA3		V1-volume	
TL2		V1-density	
TL3		V1-flow	
VA		V1-peak flow	
VB		V1-power	
P1		V2-volume	
P2		V2-density	
Customer No.		V2-flow	
Clock		t1-flow temp.	
Date		t2-return temp.	
Target date		Δt(t1-t2)	
Segment test		Hour counter	
		PR1	
		PR2	
		Info	
		Info hour counter	

220 sec. after a key has been pressed, the display will automatically revert to the accumulated thermal energy.

2. Calculation

MULTICAL® uses volume-based energy integrations, which means that the speed with which the calculator calculates energy consumption is proportional to the actual water flow. Depending on the size of the flow part, integrations are performed with intervals from 0.001 m³ to 10 m³.

The water quantity and degree of cooling are multiplied using the k-factor from EN 1434, thus ascertaining the amount of thermal energy. The meter is very accurate, working with energy measurements in fractions. The value displayed will, however, be rounded off. Fractions remaining will be added to the next reading.

Heating and cooling energy is calculated in the same manner. However, the total is stored in separate registers, depending on whether the temperature difference is positive or negative. If the meter is used for combined heating and cooling installations, the cooling power and temperature difference will be indicated by a minus (-) in the display.

The current flow calculation, l/h or m³/h, is performed depending on the number of pulses generated by the flow meter. The display is updated every 10 sec. when connecting flow meters with electronic output (CCC=1xx), though only every 30 sec. when connecting mechanical flow meters with reed-switch (CCC=0xx).

Pulse separation (imp/l), which is determined by the CCC-program, ensures that the flow meter and the calculator are totally compatible.

The actual power, kW or MW, is calculated on the basis of the current values for: water flow, differential temperature and k-factor. The display value is updated every 10 sec. as is the water flow.

The peak power and peak flow are determined as the average peak over a given period of time, typically 60 min., but can be configured in the range 1...1440 min.

3. Measuring temperature

Prior to each temperature measurement, the calculator measures two internal reference resistors, compensating for temperature and long-term drift. The temperatures of T1, T2 and T3 are measured several times at different points, thus ensuring forceful mains immunity.

The measurements are linear in the complete temperature range from 0...165°C with a resolution of 0.01°C. An information code is recorded if the temperature is above or below this range (see section 5).

The temperature measurements are effectuated at every energy integration as well as every 10 sec. when the display is updated.

4. Permanent memory

The calculator's EEPROM is updated hourly with all the accumulated values, thus ensuring minimum loss in the event of total power cut (concurrent failure on back-up and primary supply). On the programmed billing date, e.g. 1 June, all relevant data is saved with regard to annual billing reading.

Additionally, the EEPROM comprises an extensive data logger with intervals from hours to years. The data logger's capacity is 960 hours/60 days/36 months/15 years. Furthermore, all changes in the info code are logged (see section 5), which facilitates effective trouble shooting.

Calculator features

5. Information codes

During normal operation the information code will be "000". If one or more of the following errors occur, the information codes will be added together and the letter "E" will be shown in the display. The information code will be displayed if you activate the right key on the front panel until the measurement unit shows "info".

When the error is corrected, the information code automatically resets after approx. 10 min. The information codes for leakage are, however, reset at midnight, provided that no leakages have been registered for the past 24 hours.

The latest 10 changes in the information codes are saved in the EEPROM, together with information on date, clock and energy reading.

001	Failure in primary supply, battery or net supply
004	T2 temperature sensor below or above measurement range
008	T1 temperature sensor below or above measurement range
032	T3 temperature sensor below or above measurement range
064	Leakage in the tap water system
256	Leakage in the heat/cooling system
512	Burst in the heat/cooling system

6. Optical reading

An optical, infra-red/transmitter is placed in the bottom left-hand corner on the front of MULTICAL® in accordance with EN 61 107. By means of the IR head, type 66-99-102 (with 9-pole D-sub), the optical interface can be directly connected to a hand-held terminal or a PC. Then all data can be read and all the meter's parameters can be reconfigured. Calibrated parameters, e.g. pulse/l, cannot be reprogrammed without breaking the verification seal.

The optical interface can also be used for printing from the hourly or 24-hourly dataloggers. An optical IR head, type 66-99-107 (with 25 pole D-sub), uses printers with a serial interface.

7. Voltage supply

MULTICAL® is constructed with two separate voltage supplies: a back-up battery, which is incorporated in the calculator top, as well as a primary supply, which is placed in the base of the unit.

The primary supply is either a D-cell lithium battery or a supply module designed for external net supply. A change from one supply type to another can be carried out on site without re-verification.

Battery, type 66-00-200-100

"High Capacity D-cell" lithium batteries must be used. These are very reliable and ensure safe, reliable metering for up to 10 years, depending on the application (see technical data).

230 VAC, type 66-00-700-000

Supply module with galvanic separation from the net supply. The module meets the demands of double isolation and is designed for direct net connection.

NB: National installation rules and regulations must be complied with!

24 VAC, type 66-00-800-000

Supply module galvanically separated from the input voltage. E.g. the module can be connected to 24 VAC from the safety transformer type 66-99-403 (230/24 V).

24 VDC with S0 input, type 66-00-500-000

Is used for combined supply and retrieval of pulses from the electricity meter to the calculator's input B, via an S0-converter.

24 VDC with flow meter input, type 66-00-600-000

Is used for combined supply and retrieval of volume pulses from net-supplied volume meters which simultaneously supply the calculator.

8. Tariff functions

MULTICAL® type 66-C and 66-E have a number of various tariff functions which can be used for accumulated energy under a defined condition, calculation of average values of flow and return temperatures as well as control of a 3-point motor-operated valve for limitation of flow and power.

1	Power tariff
2	Flow tariff
3	Cooling tariff
5	Return temperature tariff
6	Average values for tF and tR per month
7	Average values for tF and tR per year
9	Time-controlled tariff
A	PQ-limitations

Tariff type as well as tariff limitations can be re-configured via PC. The tariff limits can also be changed using a hand-held terminal.

9. Plug-in modules

MULTICAL® can be extended by means of a plug-in module as required - and without re-verification. The modular space communicates with the calculator's microprocessor by means of an internal databus, which for safety reasons, is galvanically separated from the plug-in module.

The plug-in modules now available, which are listed in the order specification, can be supplied together with the calculator or separately for retrofitting in meters that are already installed.

10. Programming & verification

METERTOOL for MULTICAL® type 66-CDE is Windows® based software, which contains all facilities necessary to program the calculator. When the software is used with VERIFICATION EQUIPMENT, type 66-99-28x, the calculator can be tested and calibrated. See "Accessories" for type number of METERTOOL and VERIFICATION EQUIPMENT.

Approved measuring data

Approv. authority/standard	DS/EN 1434 and DIN/EN 1434	Accuracy	EC $\pm(0.5 + \Delta q \text{ min}/\Delta q) \%$
Heat meter		Temperature sensors	Pt500 - EN 60 751
- Temperature range	q 10°C...160°C	Flow meter sizes	qp 0.6 m ³ /h...3000 m ³ /h
- Differential range	Δq 3K...150K	Environment class	A
Cooling meter			
- Temperature range	q 2°C...30°C		
- Differential range	Δq 3K...20K		

Technical data

Temperature inputs T1, T2 and T3

Temperature range	0°C...165°C
Differential range	0K...160K
Display resolution	0.01K
Sensor type	Pt500 - EN 60 751

Flow meter inputs V1 and V2

Input resistance	> 100 k Ω
Pulse ON (< 0.5 V)	> 0.5 msec.
Pulse OFF (> 2.0 V)	> 10 msec.
Pulse frequency	< 128 Hz
Integration frequency	< 1 Hz

Material characteristics

Calculator top	SAN
PCB casing	ABS
Connection unit	PP
Gaskets	Sarlink 3150 B
Wall bracket	PC +30% glass

Type approvals

TS 27.01 062	TS 27.01 098
DS 2340	EN 1434

PTB	22.52	22.55
	01.03	00.03

Complies with following standards EN 1434, DS 2340, OIML R75, PTB

CE-mark LVD and EN 50 081-1 and EN 50 082-1



General data

Accuracy, calculator	$\pm(0.15 + 2/\Delta\theta) \%$
Accuracy, sensors pair	$\pm(0.4 + 4/\Delta\theta) \%$
Voltage supply	3.65 VDC $\pm 10\%$
Power consumpt. - idle	< 35 μ A excl. flow meter
Back-up battery - lifetime	1/2 AA lithium cell 20 years with wall mounting
Primært batteri - lifetime	D-cell lithium, HiCap 10 years with wall mounting 8 years with compact mounting 5 years with 2 flow meters connected
Net supply	230 VAC +15/-30%, 48...52 Hz 24 VAC $\pm 50\%$
Power absorbtion	< 1 W (1 VA)
Supply back-up	Integral SuperCap which eliminates operation stop due to power cuts up to 5 min.
Data output	Passive, isolated serial data Req: 300 Baud, Data: 1200 Baud Can be converted to RS232
Permanent memory	EEPROM
Display	LCD, 8+3 digits, 7 mm digit height
Optical IR head	EN 61 107

Pulse output, CE and CV

Max. voltage/power	30V/10 mA
Pulse duration	32 msec.

Pulse input

Input A (< 0,5 Hz)	Pulse duration > 1 sec.
Input B (< 3,0 Hz)	Pulse duration > 0.15 sec.

General

Ambient temperature	0°C...55°C
Storage temperature	-20°C...60°C
Protection class	IP 54
Weight	0.4 kg, excl. flow meter

Order specifications

Type number 66 - □ - □ - □ - □ - □ - □ - □□□

Standard and leak systems	C						
Open systems	D						
Closed systems	E						
Plug-In modules	None	0					
Data/pulse inputs		1					
Data/pulse outputs		2					
Telephone modem/pulse inputs		3					
M-Bus, EN 1434/pulse inputs - MC® III		4					
Telephone modem/pulse outputs		5					
M-Bus, EN 1434/pulse outputs - MC® III		7					
M-Bus, EN 1434/pulse inputs - MC® 66		8					
M-Bus, EN 1434/pulse outputs - MC® 66		9					
Radio module/pulse inputs		A					
Radio module/pulse inputs - external antenna		B					
4...20 mA inputs/data/pulse inputs		D					
Analog output module		E					
LONWorks, FTT-10A/pulse inputs		F					
Radio/pulse outputs		G					
Radio/pulse outputs/external antenna		H					
Supply modules	None	0					
D-cell, HiCap lithium battery		2					
24 VDC supply with S0 input		5					
24 VDC supply with flow meter input		6					
230 VAC supply module		7					
24 VAC supply module		8					
Pt 500 Temperature sensors	None	0					
Pocket sensor pair 1.5 m cable		A					
Pocket sensor pair 3.0 m cable		B					
Pocket sensor pair 5.0 m cable		C					
Pocket sensor pair 10.0 m cable		D					
Short direct sensors 1.5 m cable		F					
Short direct sensors 3.0 m cable		G					
3 pcs. pocket sensor set 1.5 m cable		L					
3 pcs. pocket sensor set 3.0 m cable		M					
3 pcs. pocket sensor set 5.0 m cable		N					
3 pcs. pocket sensor set 10.0 m cable		P					
Pick-up/Flow meter	None	0					
Delivered with 1 pcs. ULTRAFLOW® *)		1					
Delivered with 2 pcs. (identical) ULTRAFLOW® *)		2					
Kamstrup pick-up with spring lock 2.5 m cable		F					
Delivery code							XXX

*) ULTRAFLOW® type must be stated separately

Accessories

Description	Type No.
IR head with 9 pole FD-sub	66-99-102
IR head with 25 pole MD-sub	66-99-107
Data cable with 9 pole FD-sub	66-99-106
Panel fitting set (144 x 192 mm)	66-99-104
Short-circuit pen for resetting and programming	66-99-278
VERIFICATION EQUIPMENT for MULTICAL® 66-C	66-99-284
VERIFICATION EQUIPMENT for MULTICAL® 66-D	66-99-286
VERIFICATION EQUIPMENT for MULTICAL® 66-E	66-99-285
METER TOOL for MULTICAL® 66 (configuration)	66-99-702
METER TOOL LogView (data read-out)	66-99-703

Program number (determined when ordering)

Prog. number	A	-	B	-	CCC (V1)	-	CCC (V2)
	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Flow meter installation:							
k-factor table - Flow							
- Return	3						
	4						
Measuring unit, energy							
- GJ			2				
- kWh			3				
- MWh			4				
- Gcal			5				
Flow Meter Code					CCC		CCC

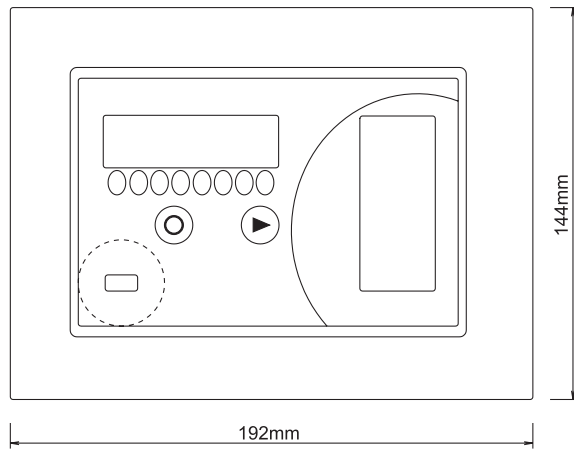
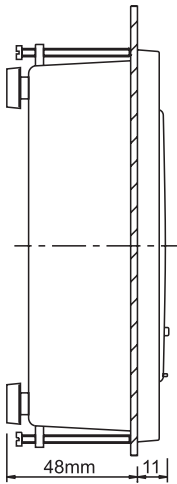
Configuration number

Config. number	DD	-	E	-	FF	-	GG	-	M	-	N
	<input type="checkbox"/> <input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/> <input type="checkbox"/>		<input type="checkbox"/> <input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>
Display readings											
Tariff type											
Input A (water meter)											
Input B (electricity/water meter)											
Leak-detection for district heating											
Leak-detection for cold water											

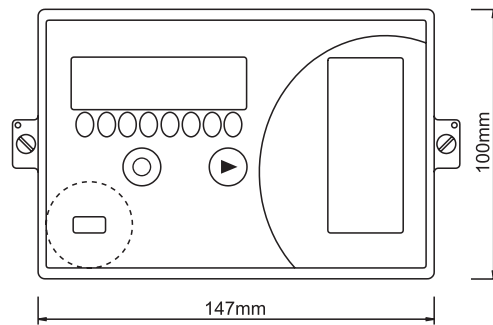
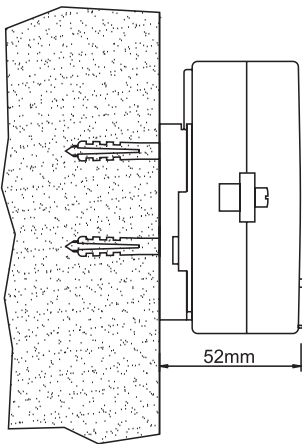
Dimensional drawings

MULTICAL® panel-mounted

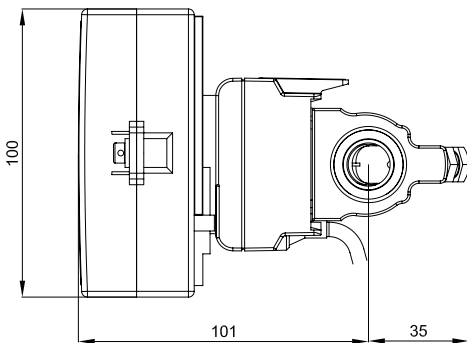
Panel cut-out 137 x 185 mm, ±1 mm



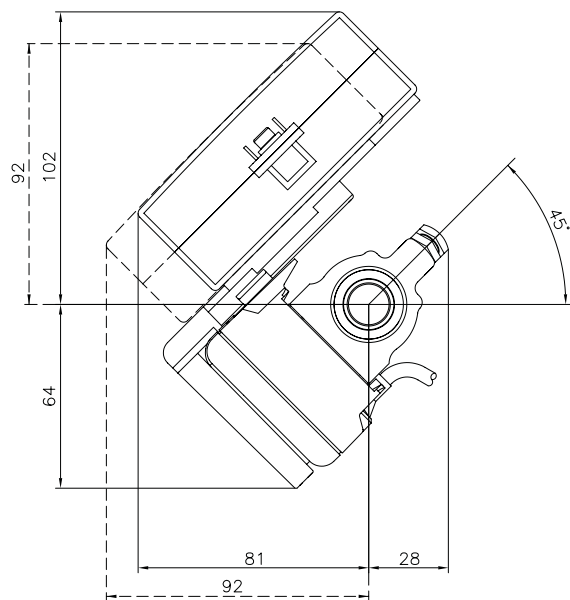
MULTICAL® wall-mounted



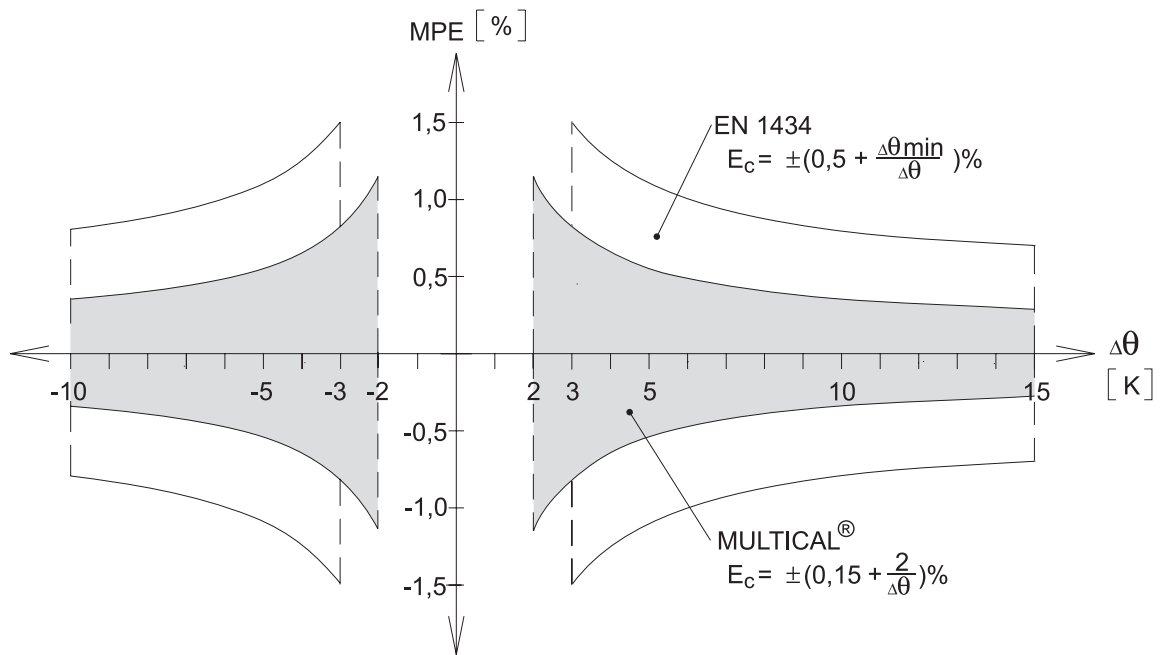
MULTICAL® installation with ULTRAFLOW® 1.5 m³/h



MULTICAL® installation with ULTRAFLOW® by means of angle brace



Tolerance band



The above diagram shows MULTICAL®'s tolerance band, compared with tolerance requirements in EN 1434.