kamstrup

Data sheet

MULTICAL® 801

- Precise measuring of heat and cooling up to 30,000 m³/h
- Remote reading with four communication channels
- 4 analogue outputs
- Two plug-in modules simultanously: GSM, M-Bus, RadioRouter, LonWorks pulse inputs for electricity and water meters
- Data logger with latest 460 days, 36 months and 15 years as well as programmable data logger
- Complies with EN 1434:2015 Class A and C (MID Class E1 and E2)

MID 2014/32/EU
CE M19 0200
EN 1434

DK-BEK 1178 – 06/11/2014
DK 268 19
EN 1434

Contents

Application

MULTICAL ® 801 is a robust and rugged calculator. It is ideal for buildings and industries using extra communication possibilities, programmable functions and a wide range of other modules.

MULTICAL® 801 is used for measurement of both heat and cooling in all water based plants with flow temperatures from 2 °C to 180 °C and with all flow meter sizes between qp 0.6 m^3/h and qp 30,000 m^3/h.

The meter is simple to install, read and verify. Furthermore,

MULTICAL® 801 contributes to keeping the annual operating costs at a minimum with its unique combination of high measuring accuracy and long lifetime.

If MULTICAL® 801 is connected to flow meters installed in both inlet and outlet pipes, the meter can monitor leaks and burst 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.

MULTICAL® 801 receives volume pulses from the connected flow meters and calculates the energy for every predetermined water volume. The energy calculation includes temperature measurements in inlet and outlet as well as correction for density and heat content according to EN 1434.

MULTICAL® 801 can be supplied by 230 VAC or 24 VAC.

MULTICAL® 801 can be extended by two independent modules in the form of GSM/GPRS, M-Bus, RadioRouter and LonWorks. The modules also include two extra pulse inputs for connection of water and electricity meters. The modules make remote reading of the meter possible.

MULTICAL® 801 fulfils the IP67 requirements to very rugged design and robust functionality. The IP67 seal guarantees that the meter is resistant to dust, humidity and water.

Pulse outputs, valve control, battery backup and many other features are standard functions in MULTICAL® 801.

Calculator functions

Energy calculation

MULTICAL® 801 calculates energy based on the formula in EN 1434-1:2015, in which the international temperature scale from 1990 (ITS-90) and the pressure definition of 16 bar is used.

The energy calculation can in a simplified way be expressed as:
Energy = V x ΔΘ x k.

V is the supplied water volume

ΔΘ is the temperature difference measured

k is the thermal coefficient of water

The calculator always calculates energy in [Wh], and then it is converted into the selected measuring unit.

E [Wh] =	V x ΔΘ x k x 1000
E [kWh] =	E [Wh] / 1.000
E [MWh] =	E [Wh] / 1.000.000
E [GJ] =	E [Wh] / 277.780
E [Gcal] =	E [Wh] / 1.163.100

Application types

MULTICAL® 801 operates with 9 different energy formulas, E1...E9, that are all calculated in parallel in connection with each integration no matter how the meter is configured.

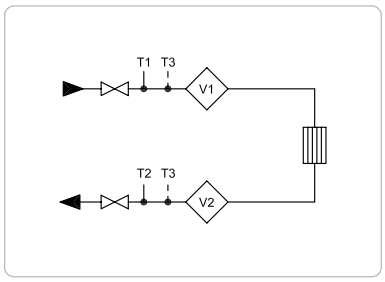
The energy types E1 to E9 are calculated as follows:

E1=V1(T1-T2)k	Heat energy	(V1 in inlet or outlet)
E2=V2(T1-T2)k	Heat energy	(V2 in outlet)
E3=V1(T2-T1)k	Cooling energy	(V1 in inlet or outlet)
E4=V1(T1-T3)k	Inlet energy	
E5=V2(T2-T3)k	Outlet energy or tapping from outlet	
E6=V2(T3-T4)k	Tap water energy, separate	
E7=V2(T1-T3)k	Tap water energy, inlet pipe	
E8=m^3xT1	(Inlet pipe)	
E9=m^3xT2	(Outlet pipe)	

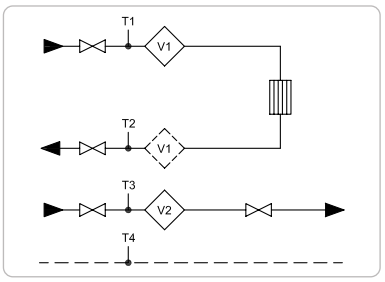
This renders MULTICAL® 801 capable of calculating the heat and cooling energy of most applications, both closed and open systems.

All energy types are data logged and can be displayed independent of configuration.

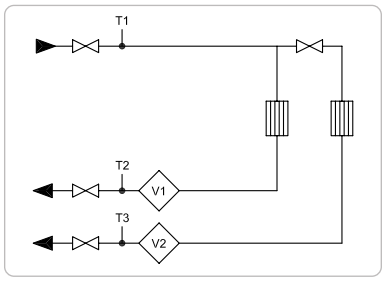
Calculator functions



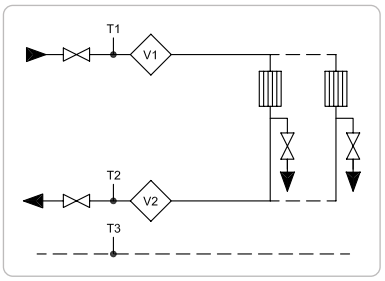
Example 1:
Closed thermal system with 1 or 2 flow meters



Example 2:
Closed thermal system with 2 flow meters



Example 3:
2 heat circuits with joint flow

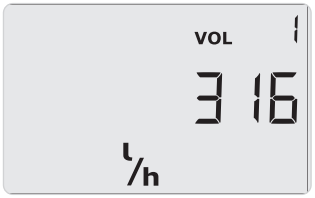


Example 4:
Open system with 2 flow meters

Flow measurement

MULTICAL® 801 calculates current water flow according to two different principles depending on the connected flow meter type:

- The flow indication of electronic flow meters is updated every 10 seconds.
- The flow indication of mechanical flow meters, typically with reed contact, is calculated on the basis of periodic time measurement and is updated with each volume pulse.



Power measurement

MULTICAL® 801 calculates current power on the basis of current water flow and the temperature difference measured in connection with the latest integration.

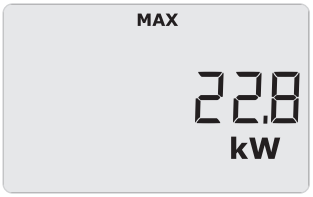
Current power is updated in the display simultaneously with the flow update.

Calculator functions

Min. and max. flow and power

MULTICAL® 801 registers minimum and maximum flow and power on a monthly as well as on a yearly basis. The registrations which appear from the display or can be read via data communication include max. and min. flow and power values, all with date indication.

All max. and min. values are calculated as largest and smallest average respectively of a number of current flow or power measurements. The average period used for all calculations is selected in the interval 1...1440 min.

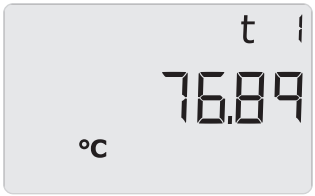


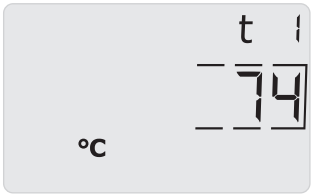
Temperature measurement

MULTICAL® 801 is available in different versions for either Pt100 or Pt500 sensors as well as in 2-wire and 4-wire versions.

The measuring circuit includes a high resolution analog/digital converter with a temperature range of 0.00...185.00 °C.

In addition to current temperatures used for the energy calculation, average temperatures on a yearly and monthly basis can also be displayed.

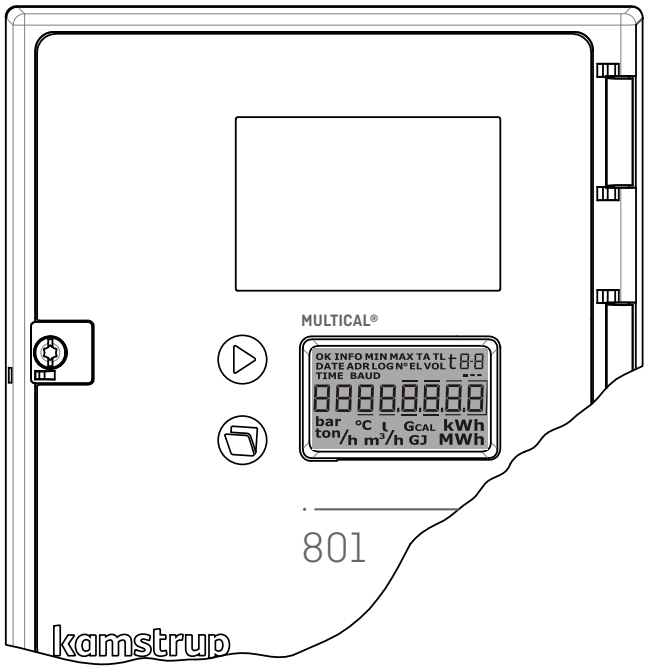




Display functions

MULTICAL® 801 is equipped with a clear LC display including 8 digits, units of measurement and information panel. In connection with energy and volume readings, 7 digits are used, together with the relevant unit, whereas 8 digits are used when e.g. the meter number is displayed.

As a starting point the display shows accumulated energy. When the push buttons are activated the display reacts immediately by calling other readings. The display automatically returns to accumulated energy reading 4 minutes after the latest activation of the push buttons..



The upper push button is used to switch between the primary readings. The consumers typically use the first primary readings in connection with self-reading for billing purposes.
The lower push button is used to show secondary information on the selected primary reading.

Calculator functions

Info codes

MULTICAL® 801 constantly monitors a number of important functions, e.g. power supply, temperature sensors and leakage alarms. Should a serious error occur in the measuring system or in the installation, a flashing 'info' will appear in the display whilst the error exists. The 'info' panel will automatically disappear when the error has been corrected.

An info event logger indicates how many times the info code has been changed.

The info logger stores the latest 50 changes, of which 36 can be displayed.

Standard

Info code	Description	Response time
0	No irregularities	-
1	The supply voltage has been interrupted	-
8	Temperature sensor T1 outside measuring range	1...10 min.
4	Temperature sensor T2 outside measuring range	1...10 min.
32	Temperature sensor T3 outside measuring range	1...10 min.
64	Leak in cold water system	24 hours
256	Leak in heating system	24 hours
512	Burst in heating system	120 sec.

ULTRAFLOW® X4 info (enabled when CCC=4XX)

Info code	Description	Response time
16	Flow meter V1 communication error	After reset and 24 hours (at 00:00)
1024	Flow meter V2 communication error	After reset and 24 hours (at 00:00)
2048	Flow meter V1 wrong pulse value	After reset and 24 hours (at 00:00)
128	Flow meter V2 wrong pulse value	After reset and 24 hours (at 00:00)
4096	Flow meter V1, signal too weak (air)	After reset and 24 hours (at 00:00)
8192	Flow meter V2, signal too weak (air)	After reset and 24 hours (at 00:00)
16384	Flow meter V1 wrong flow direction	After reset and 24 hours (at 00:00)
32768	Flow meter V2 wrong flow direction	After reset and 24 hours (at 00:00)

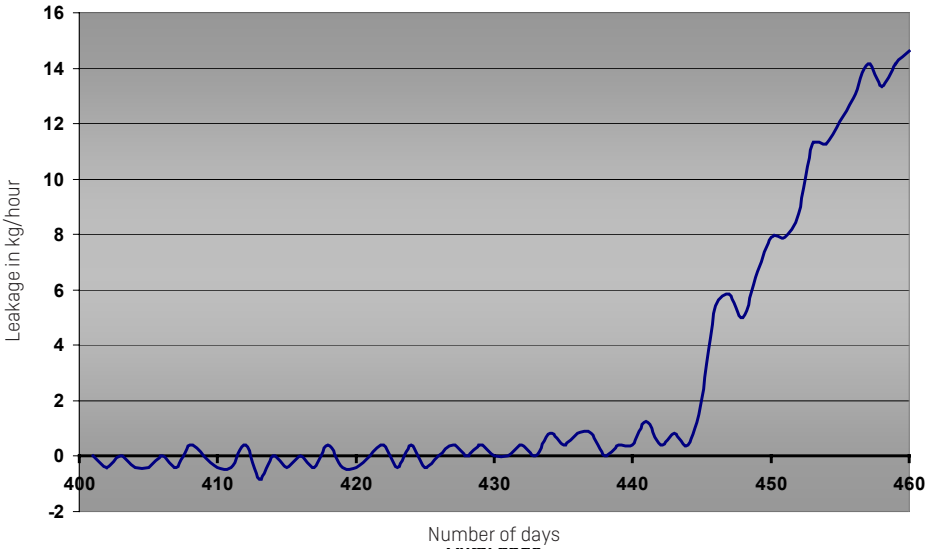
Data loggers

MULTICAL® 801 contains a permanent memory (EEPROM), where the results of a number of various data loggers are stored. The meter contains the following data loggers which can be read on the display or via serial data:

Data logging interval	Data logging depth	Logged value
Yearly logger	15 years	Counter register
Monthly logger	36 months	Counter register
Daily logger	460 days	Consumption (increase)/day
Programmable data logger	1080 loggings (e.g. 45 days' hour loggings or 11 days' 15 min. loggings)	30 registers and values
Info logger	50 events	Info code and date

Calculator functions

Leak surveillance



District heating systems

The leak surveillance system is primarily intended for direct connected district heating installations. The surveillance system consists of two flow meters based on the ultrasonic principle, placed in the inlet and outlet pipes respectively, and of temperature sensors in both pipes. MULTICAL® 801 monitors the mass difference that may appear between inlet and outlet pipes.

Tap water systems

The pulse signal from a tap water meter can be connected to MULTICAL® 801. In this way it is possible to monitor the tap water consumption. A running toilet cistern, leaky heating coils in the water tanks or other leaks can be monitored. If pulses from the tap water meter are received continuously for 24 hours, this indicates leakage.

Pulse outputs CE and CV

MULTICAL® 801 has pulse outputs for energy and volume pulses respectively. CE on terminals 16-17 releases one pulse per least significant digit of the energy count in the display and CV on terminals 18-19 releases one pulse per least significant digit of the volume count in the display.

If a higher resolution of pulse outputs is required, a CCC code with high resolution must be selected.

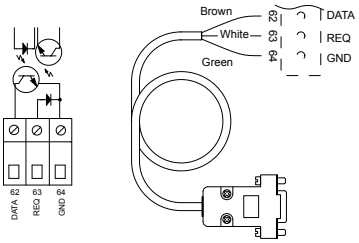
Calculator functions

Pulse inputs VA and VB

MULTICAL® 801 has two pulse inputs, VA and VB, to collect and accumulate pulses remotely, e.g from tap water meters and electricity meters. The pulse inputs are physically placed on 'Module 1'.

The pulse inputs VA and VB function independently of the other inputs/outputs.

Data connection [62-64]



MULTICAL® 801 has data connection on terminals 62-63-64. The data connection is passive and optoisolated, as shown in the block diagram to the right. Adaption to RS232 level is possible via data cable type 6699-106. Adaption to USB is possible via data cable 6699-098.

The data connection uses the KMP protocol. Please contact Kamstrup for further details on the KMP protocol.

Voltage supply

MULTICAL® 801 is available with 230 VAC or 24 VAC supply voltage. Both types have battery backup that ensures the operation of the RTC and the energy calculation during power failure.

Plug-in modules

Two plug-in modules, Module 1 and 2, can be added to MULTICAL® 801, in order for the meter to adapt to various applications and data reading methods.

Programming and verification

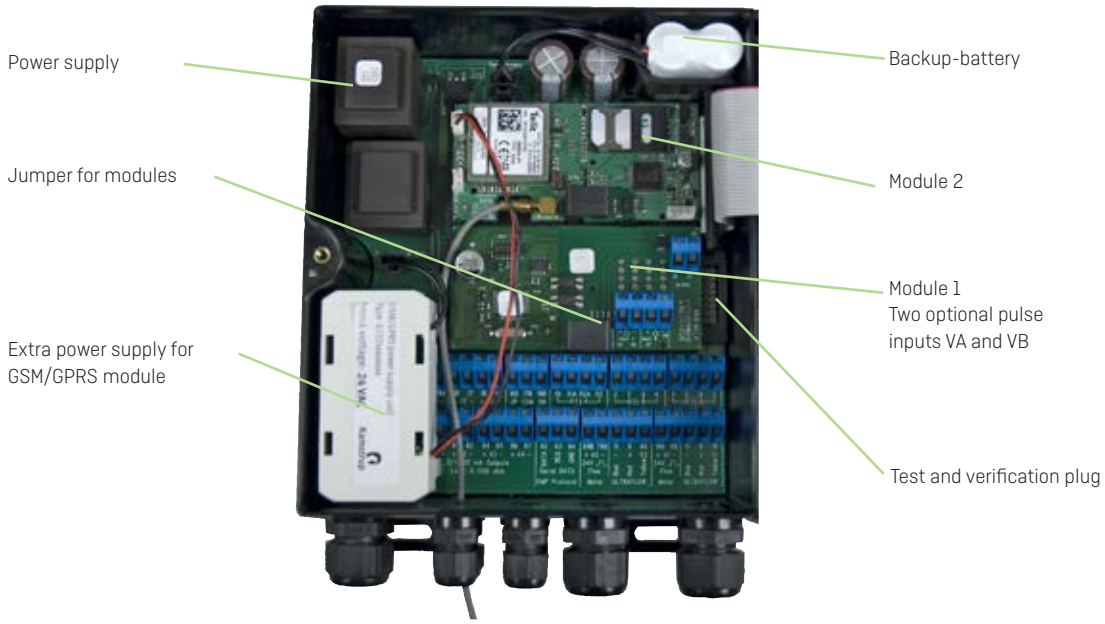
METERTOOL HCW is a Windows® -based software which includes all facilities for calculator programming. If the software is used together with VERIFICATION EQUIPMENT for MULTICAL® 801, the calculator can be tested and verified.

Tariff functions

MULTICAL® 801 has 2 extra registers, TA2 and TA3, to accumulate energy in parrallel to the main register based on a programmed tariff condition. Regardless of the tariff type selected, the tariff registers will be displayed as TA2 and TA3.

The main register is always accumulated, irrespective of the selected tariff function, since it is considered to be the legal billing register. Tariff conditions TL2 and TL3 are monitored before each integration. If the tariff conditions are fulfilled, the consumed heat energy is accumulated in either TA2 or TA3, as well as in the main register.

Cabinet design



Approved meter data

Approval	DK-0200-MI004-009 and TS 27.02 006
Standard	EN 1434:2015 and OIML R75:2002
EU-directives	
– MID (Measuring Instruments Directive)	
– LVD (Low Voltage Directive)	
– EMC (Electromagnetic Compatibility Directive)	
Temperature range	θ: 2...180 °C
Differential range	$\Delta\Theta$: 3...170 K
Accuracy	E_C ±{0,5 + $\Delta\Theta_{min}/\Delta\Theta$}%
Temperature sensors	
– Type 67-F and 67-K	Pt100 – EN 60 751, 4-wire connection
– Type 67-G and 67-L	Pt500 – EN 60 751, 4-wire connection
Flow meter types	
– ULTRAFLOW®	
– Electronic meters with active and passive pulse output	
– Mechanical meters with electronic pick-up	
– Mechanical meters with reed switch	
Flow meter sizes	
– [kWh]	q_p 0,6 m³/h...q_p 15 m³/h
– [MWh]	q_p 0,6 m³/h...q_p 15000 m³/h
– [GJ]	q_p 0,6 m³/h...q_p 30000 m³/h
EN 1434 designation	Environmental class A and C
MID designation	
– Mechanical environment	Class M1
– Electromagnetic environment	Class E1 and E2
– Non condensing, closed location (indoor installation), 5...55 °C	

Electrical data

Calculator data

Typical accurac	
– Calculator	E_C ±{0,15 + 2/ΔΘ}%
– Sensor set	E_T ±{0,4 + 4/ΔΘ}%
Display	LCD – 7 (8) digits with a digit heigth of 7.6 mm with back illumination
Resolution	9999,999 – 99999,99– 999999,9 – 9999999– 99999999
Energy units	MWh – kWh – GJ – Gcal
Data logger (EEPROM)	
– Standard	460 days, 36 months, 15 years, 50 info codes
– Standard	Programmable data logger with a logging depth of 1080 registers
Clock/calendar	
– Standard	Clock, calendar, leap-year compensation, target date
– Standard	Real time clock with battery backup
– Standard	Battery backup of energy measurement incl. ULTRAFLOW®
Data communication	
– Standard	KMP protocol with CRC16 used for optical communication and for base modules
Power in temperature sensors	< 10 µW RMS
Mains supply	
– 230 VAC	+15/-30%, 50/60 Hz (all types)
– 24 VAC	±50%, 50/60 Hz (Type 67-F/G without analogue outputs)
– 24 VAC	±25%, 50/60 Hz (Type 67-K/L with analogue outputs)
Insulation voltage	4 kV
Power consumption	< 3 W without analogue outputs < 9 W with analogue outputs
Current	Maks. 50 mA/230 VAC Maks. 450 mA/24 VAC
Battery backup	3.65 VDC, 2 pcs A-cell lithium (Type No. 6699-619)
Replacement interval	10 years at normal operation (with supply)
Backup period	1 year (without supply) The replacement interval is reduced at high ambient temperature
EMC-data	Meets EN 1434 Class A and C (MID Class E1 and E2)
Analogue outputs	
– Output type	0...20 mA or 4...20 mA
– Loop voltage	0...12.5 VDC
– Output load	0...500 Ohm
– Current limitation	24 mA
– Accuracy	0.15 %

Electrical data

Temperature measurement	T1	T2	T3	T4	T4
67-F and 67-K	Measuring range	0.00...185.00 °C	0.00...185.00 °C	0.00...185.00 °C	N/A
4-W Pt100	Preset range	0.01...180.00 °C	0.01...180.00 °C	0.01...180.00 °C	0.01...180.00 °C
67-G and 67-L	Measuring range	0.00...185.00 °C	0.00...185.00 °C	0.00...185.00 °C	N/A
4-W Pt500	Preset range	0.01...180.00 °C	0.01...180.00 °C	0.01...180.00 °C	0.01...180.00 °C

Max. cable length	Pt100, 2-wire	Pt500, 2-wire	Pt500, 4-wire
	2 x 0.25 mm^2: 2.5 m	2 x 0.25 mm^2: 10 m	4 x 0.25 mm^2: 100 m
	2 x 0.50 mm^2: 5 m	2 x 0.50 mm^2: 20 m	-

Flow measuring V1 and V2	ULTRAFLOW® V1: 9-10-11 and V2: 9-69-11	Reed switches V1: 10-11 and V2: 69-11	24 V active pulses V1: 10B-11B and V2: 69B-79B
EN 1434 pulse class	IC	IB	(IA)
Pulse input	220 kΩ pull-up to 3.6 V	220 kΩ pull-up to 3.6 V	12 mA at 24 V
Pulse ON	< 0.4 V for > 0.5 msec.	< 0.4 V for > 50 msec.	< 4 V for > 0.3 msec.
Pulse OFF	> 2.5 V for > 10 msec.	> 2.5 V for > 50 msec.	> 12 V for > 10 msec.
Pulse frequency	< 128 Hz	< 1 Hz	< 128 Hz
Integration frequency	< 1 Hz	< 1 Hz	< 1 Hz
Electrical isolation	No	No	2 kV
Max. cable length	10 m	25 m	100 m

Pulse inputs VA and VB VA: 65-66 and VB: 67-68	Water meter connection FF(VA) and GG(VB) = 01...40	Electricity meter connection FF(VA) and GG(VB) = 50...60
Pulse input	680 kΩ pull-up to 3.6 V	680 kΩ pull-up to 3.6 V
Pulse ON	< 0.4 V for > 30 msec.	< 0.4 V for > 30 msec.
Pulse OFF	> 2.5 V for > 30 msec.	> 2.5 V for > 30 msec.
Pulse frequency	< 1 Hz	< 3 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 CE and CV Energy (16-17) Volume (18-19)	
Type	Open collector (OB)
Pulse length	Programmable 32 msec., 100 msec. or 247 msec. via METERTOOL HCW
External voltage	5...30 VDC
Current	1...10 mA
Residual voltage	UCE ≈ 1 V at 10 mA
Electrical isolation	2 kV
Max. cable length	25 m

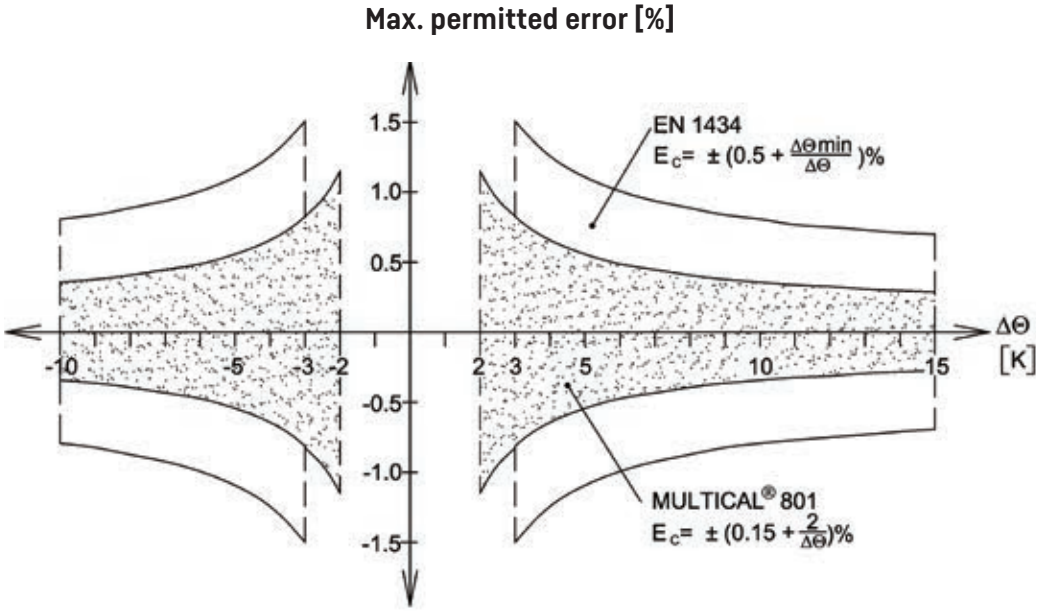
Mechanical data

Environmental class	Meets EN 1434 Class A and C
Ambient temperature	5…55 °C non condensing, closed location (indoor installation)
Protection class	IP67
Storage temperature	-25…60 °C (drained flow meter)
Weight	1.4 kg excluding sensors and flow meter
Connection cables	6 pcs ø3…6 mm and 3 pcs ø4…8 mm

Materials

Top cover	PC
Base unit	PC + 10 % GF
Sealing cover, top	ABS
Sealing cover, bottom	PC
Prism behind display	PMMA

Tolerance band



The above diagram shows the typical tolerance band of MULTICAL® 801 compared to the tolerance requirements of EN 1434.

Order specifications

MULTICAL® 801	☐	☐	☐☐	☐	☐	☐	☐	☐☐
Sensor connection								
Pt100 4-wire (T1-T2-T3) no analogue outputs	**F**							
Pt500 4-wire (T1-T2-T3) no analogue outputs	**G**							
Pt100 4-wire (T1-T2-T3) 4 analogue outputs	**K**							
Pt500 4-wire (T1-T2-T3) 4 analogue outputs	**L**							
Module 2 (VA and VB are not available at module place 2)								
None		**0**						
SIOX module (Auto detect baud rate)		**M**						
M-Bus (Alternative registers)		**P**						
M-Bus module with MC-III data package		**Q**						
Ethernet/IP (IP201)		**T**						
3G GSM/GPRS (GSM8H)		**U**						
M-Bus		**V**						
RadioRouter *		**W**						
LonWorks, FTT-10A		**Y**						
GSM/GPRS *		**Z**						
Module 1 (VA and VB are available at module place 1)								
None			**00**					
M-Bus + pulse inputs			**20**					
RadioRouter + pulse inputs *			**21**					
Data logger + 4-20 mA inputs + pulse inputs			**22**					
LonWorks, FTT-10A + pulse inputs			**24**					
M-Bus with alternative registers + pulse inputs			**27**					
M-Bus with MULTICAL® III data package + pulse inputs			**29**					
Wireless M-Bus Mode C1 + pulse inputs			**30**					
Wireless M-Bus Mode T1 OMS 15 Min. (Incl. Key)			**31**					
Wireless M-Bus Mode C1 with alternative registers + pulse inputs			**35**					
ZigBee 2.4 GHz int.ant. + pulse inputs			**60**					
Metasys N2 (RS485) + pulse inputs			**62**					
SIOX module (Auto detect baud rate)			**64**					
BACnet MS/TP + pulse input			**66**					
Modbus RTU + pulse inputs			**67**					
High Power Radio Router + pulse inputs			**84**					
Supply								
230 VAC				**7**				
24 VAC				**8**				
Pt500 sensor set (2-wire sensors)								
No sensor set					**0**			
Pocket sensor set w/1.5 m cable					**A**			
Pocket sensor set w/3.0 m cable					**B**			
Pocket sensor set w/5 m cable					**C**			
Pocket sensor set w/10 m cable					**D**			
Short direct sensor set w/1.5 m cable					**F**			
Short direct sensor set w/3.0 m cable					**G**			
3 pocket sensors in sets w/1.5 m cable					**L**			
3 short direct sensors in sets w/1.5 m cable					**Q3**			
Flow meter/pick-up unit								
Supplied w/1 ULTRAFLOW® ** (specify type)						**1**		
Supplied w/2 (identical) ULTRAFLOW® ** (specify type)						**2**		
Prepared for 1 ULTRAFLOW® (specify type)						**7**		
Prepared for 2 (identical) ULTRAFLOW® (specify type)						**8**		
Prepared for meters w/reed switch output (both V1 and V2)						**L**		
Prepared for foreign flowpart with passive/active pulses						**N**		
Meter type								
Heat meter, delivered with MID marking							**2**	
Heat meter, closed systems							**4**	
Cooling meter							**5**	
Heat/cooling meter							**6**	
Volume meter, hot water							**7**	
Volume meter, cold water							**8**	
Energy meter, open systems							**9**	
Country code (language on label etc.)								**XX**

* GSM and RF modules must not be combined in the same meter.

** ULTRAFLOW® is delivered in a separate box which is strapped together with the MULTICAL® 801 carton. The cable between MULTICAL® 801 and ULTRAFLOW® is not connected on delivery.

Accessories

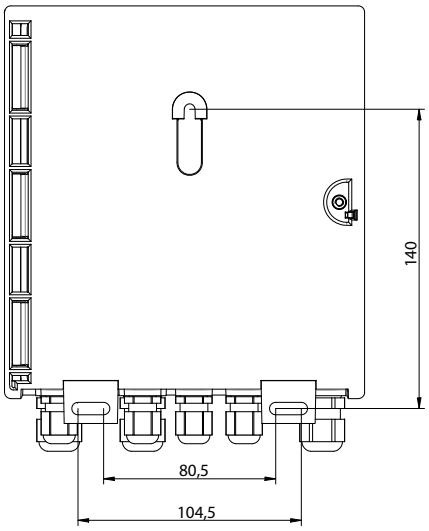
Description	Type No.
Data cable w/USB plug	6699-098
Infrared optical reading head w/USB plug	6699-099
Infrared optical reading head RS232 w/D-sub 9F	6699-102
Q144 dummy cover (144 mm x 144 mm) for blinding in panels/racks	6699-103
Data cable RS232, D-sub 9F	6699-106
Infrared optical reading head for Kamstrup/EVL w/RS232 w/D-sub 9F	6699-136
Infrared optical reading head for Kamstrup/EVL w/USB plug	6699-144
Verification unit, Pt100 (used with METERTOOL HCW)	6699-370
Verification unit, Pt500 (used with METERTOOL HCW)	6699-371
Battery backup (2xA cell lithium battery)	6699-619
Short circuit pen (for total reset and total programming)	6699-278
Short circuit jumper (for use with 2-wire temperature sensors)	6699-209
230 VAC High Power SMPS module	6699-622
24 VAC High Power SMPS module	6699-634
Jumper for modules	1640-080
Temperature sensor set with connecting head (2/4 wired)	6556-4x-xxx
External communication box	679x-xxxxx-2xx
Cable gland wrench 15 mm	5920-177
Cable gland wrench 19 mm	5920-178
METERTOOL HCW	6699-724
LogView HCW	6699-725

Please contact Kamstrup for questions concerning further accessories.

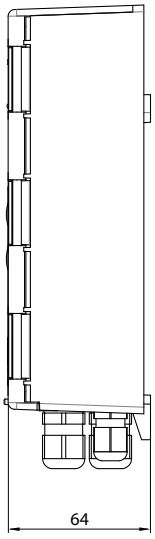
Dimensional sketches

Front dimensions of MULTICAL® 801

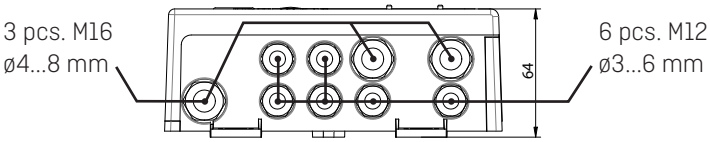
Mounting dimensions of MULTICAL® 801



Wall-mounted MULTICAL® 801 seen from the side



MULTICAL® 801 cable connections



All dimensions in [mm]

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