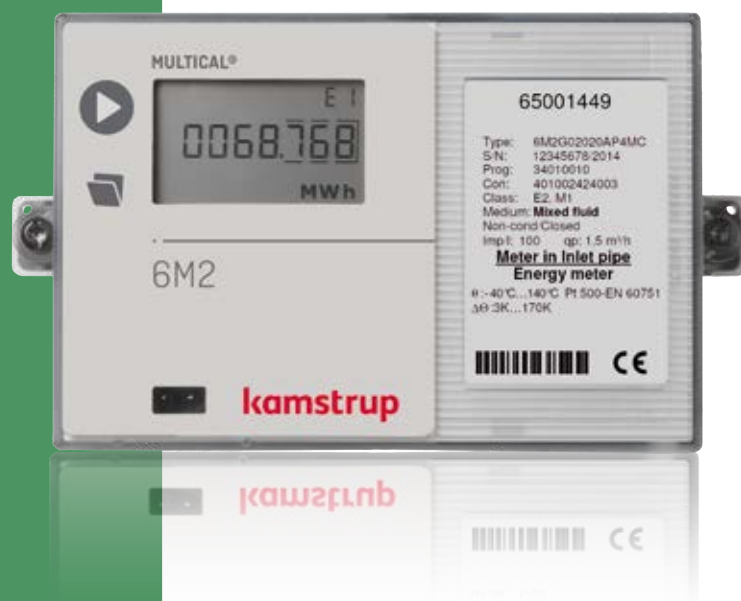


Data sheet

## MULTICAL® 6M2

- Tailored for mixed fluids
- Data loggers
- Info loggers
- Data backup in case of power failure
- Measurement at subzero temperatures
- Configurable fluid type and concentration level



## Contents

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## MULTICAL® 6M2

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### Application

MULTICAL® 6M2 is an all-purpose energy calculator for mixed fluid applications which works together with a pulsed flow sensor and a pair of 2-wire temperature sensors. The calculator registers precise consumption throughout the whole lifetime. The calculator is maintenance-free and has a long lifetime which guarantees minimum yearly operating costs.

MULTICAL® 6M2 is used for heat and cooling measurements in all mixed fluid-based systems with medium temperatures from -40 °C to 140 °C.

### Functionality

MULTICAL® 6M2 is used together with a flow sensor and two temperature sensors. The calculator can be used with different types of flow sensors suitable for mixed fluids, such as mechanical or electronic pick-up units as well as magnetic inductive flow parts. The calculator can be used with flow parts up to  $q_p 3,000 \text{ m}^3/\text{h}$ . The temperature sensors fitted to this calculator are Pt500 sensors.

The calculator's range of communication modules makes it easy to fit the meter into various applications. The calculator

can be fitted with LON, M-Bus, ModBus and BACnet MS/TP for wired communication.

The calculator's info codes and data loggers make up an invaluable tool for troubleshooting, error correction and analysis of energy consumption. The info logger constantly monitors a number of key functions in the meter, such as error in the temperature measurement. In such cases, a flashing "INFO" and an info code appear in the display.

MULTICAL® 6M2 saves consumption data on a yearly, monthly, daily and hourly basis, which provides the operations manager with a complete performance analysis. In case of power failure, data is backed up.

### Tailored for mixed fluids

Mixed fluids have a lower specific heat capacity compared to that of water. The type of antifreeze liquid and the concentration are freely programmable and thus MULTICAL® 6M2 can compensate for the unique specific heat capacity in each application, ensuring a high accuracy regardless of the chemical composition or the application.

## Calculator functions

### Energy calculation

MULTICAL® 6M2 calculates energy based on the formula in prEN 1434-1:2009 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:

$$\text{Energy} = V \times \Delta\Theta \times k$$

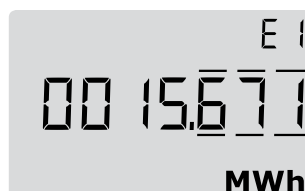
V is the supplied fluid volume

$\Delta\Theta$  is the temperature difference measured

k is the thermal coefficient of fluid

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

E [Wh] =	$V \times \Delta\Theta \times k \times 1,000$
E [kWh] =	$E [\text{Wh}] / 1,000$
E [MWh] =	$E [\text{Wh}] / 1,000,000$
E [GJ] =	$E [\text{Wh}] / 277,780$



### Application types

MULTICAL® 6M2 operates with two different energy formulas, E1 and E3, that both are calculated in parallel in connection with each integration no matter how the meter is configured.

The energy types are calculated as follows:

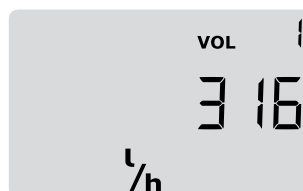
$E1=V1(T1-T2)k$	Heat energy (V1 in inlet or outlet)
$E3=V1(T2-T1)k$	Cooling energy (V1 in inlet or outlet)

Both energy types are data logged.

### Flow measurement

MULTICAL® 6M2 calculates current fluid flow according to two different principles depending on the connected flow sensor type:

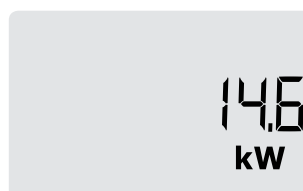
- The flow indication of electronic flow meters is updated every 10 seconds.
- The flow indication of mechanical flow meters, typically with reed contact, is calculated on the basis of periodic time measurement and is updated with each volume pulse.



### Power measurement

MULTICAL® 6M2 calculates current power on the basis of current fluid 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

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### Min. and max flow and power

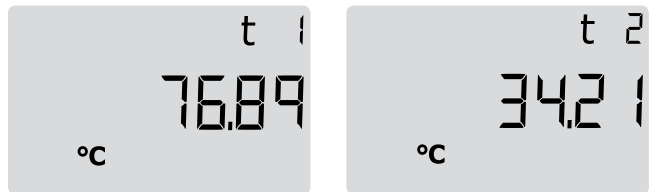
MULTICAL® 6M2 registers minimum and maximum flow and power on a monthly as well as on a yearly basis. The registrations include max and min. flow and power values, all with date indication. These registrations can be viewed in the display or be read through the data communication, such as a communication module or via the optical communication.

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® 6M2 is available with Pt500 sensors in a 2-wire configuration.

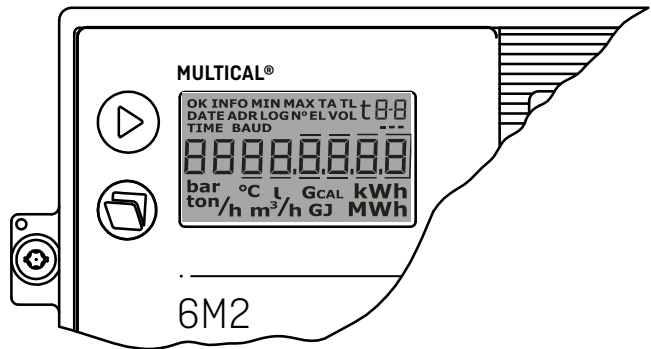
The measuring circuit includes a high resolution analog/digital converter with a temperature range of -40...140 °C.



### Display functions

MULTICAL® 6M2 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, whereas 8 digits are used when e.g. meter number is read.

When the front keys are activated, the display reacts immediately by calling other readings. The display automatically returns to the first reading 4 minutes after the latest activation of the front keys.



The main-key is used to switch between the primary readings.  
The sub-key is used to show secondary information about the selected primary reading.

## Calculator functions

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### Set/reset function

The set/reset function of MULTICAL® 6M2 makes it possible to change a number of parameters by means of the two front keys on the calculator's front.

The following parameters can be changed:

- Date
- Hour
- Input A (preset of register)
- Input B (preset of register)
- Meter no. of Input A
- Meter no. of Input B
- Pulse value for Input A
- Pulse value for Input B
- Primary M-Bus address
- Operating hour counter (reset)
- Info event counter (reset)

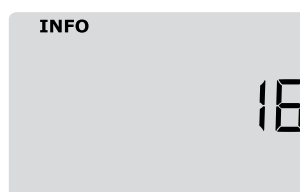
Changing the above parameters requires that the installation seals are broken. Therefore, these parameters can only be set/reset by the energy supplier.

### Info codes

MULTICAL® 6M2 constantly monitors a number of important functions, e.g. power supply and temperature sensors. 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 automatically disappears when the error has been corrected.

An info event logger indicates how many times the info code has been changed. The info event logger stores the latest 50 changes.

An error hour counter registers the hours during which the info code exceeds zero.



Info code	Description	Response time
0	No irregularities	-
1	Supply voltage has been cut off	-
8	Temperature sensor T1 outside measuring range	1...10 min.
4	Temperature sensor T2 outside measuring range	1...10 min.

## Calculator functions

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### Data loggers

MULTICAL® 6M2 contains a permanent memory (EEPROM) where the results of a number of various data loggers are stored. The meter contains the following data loggers:

Data logging interval	Data logging depth	Logged value
Yearly logger	15 years	Counter registers
Monthly logger	36 months	Counter registers
Daily logger	460 days	Consumption (increase)/day
Hourly logger	1392 hours	Consumption (increase)/hour
Info logger	50 events	Info code, date, time and energy (E1/E3)

### Voltage supply

MULTICAL® 6M2 is available with battery supply, 230 VAC mains module or 24 VAC mains module. The supply modules are exchangeable under the installation seal.

### Plug-in modules

Plug-in modules can be added to MULTICAL® 6M2 both in the calculator's top (top module) and in the base unit (base modules). In this way the meter can be adapted to various applications and data reading methods. The modules can be seen in "Order specifications" on page 13.

### Programming and verification

METERTOOL for HCW is a Windows® based software which includes all facilities for calculator programming. If the software is used together with test equipment for MULTICAL® 6M2, the calculator can be tested.

### Pulse inputs VA and VB

MULTICAL® 6M2 has two extra pulse inputs, VA and VB, to collect and accumulate pulses remotely, e.g from cold water meters and electricity meters. The pulse inputs are physically placed on the base modules.

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



## Calculator functions

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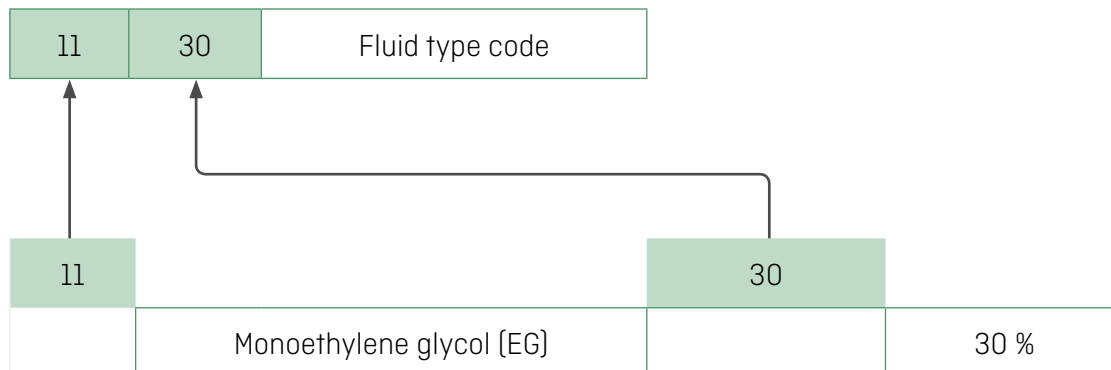
### Fluid types

MULTICAL® 6M2 is compatible with the most commonly used antifreeze liquids, e.g. ethylene glycol and propylene glycol.

The type of antifreeze liquid and the concentration are freely programmable, and thus MULTICAL® 6M2 can compensate for the unique specific heat capacity in each application, ensuring a high accuracy regardless of the chemical composition or the application. From factory the calculator is programmed with a 4 digit fluid type code, which states what fluid type and concentration level (vol. %) the calculator is programmed to.

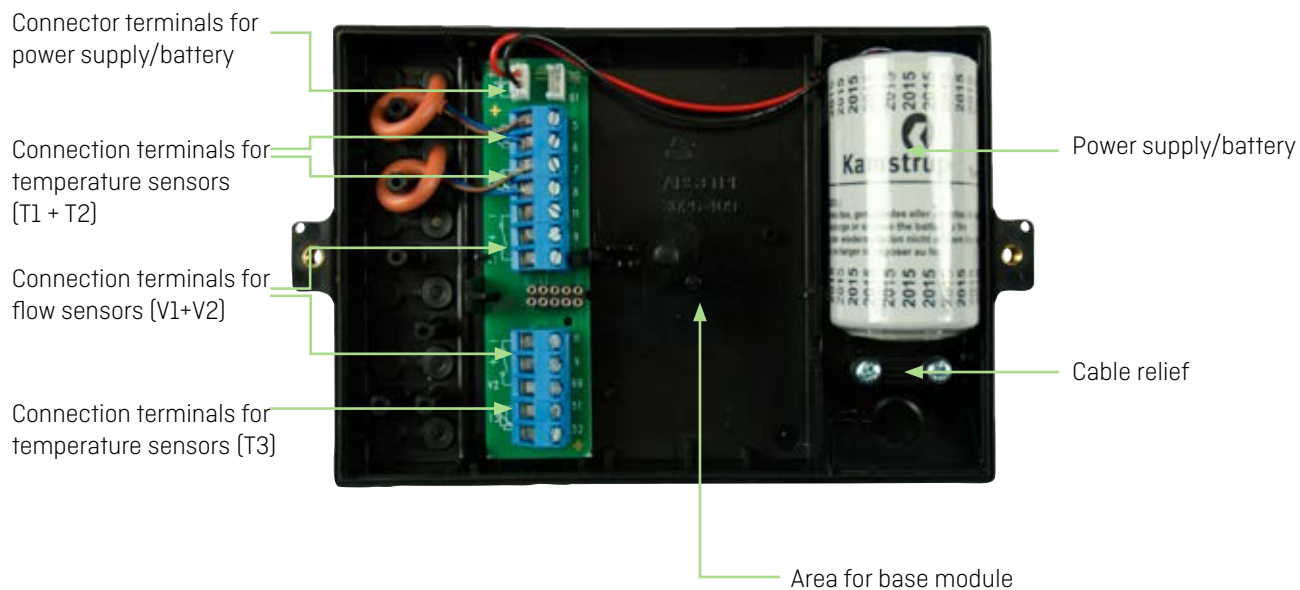
The 4 digit fluid type code can be viewed in the calculator's display (reference number 71). Furthermore, the fluid type code is configurable through METERTOOL which means that you can reconfigure the chemical (fluid type) as well as the concentration level.

New fluid types are added continuously, and therefore, the complete overview of compatible fluid types can be viewed online at [www.Kamstrup.com](http://www.Kamstrup.com).



## Cabinet design

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## Meter data

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Approval	No approval is available for mixed fluids, but tested in compliance with standards EN 1434:2007, prEN 1434:2009 and OIML R75:2002	
EU directives	<ul style="list-style-type: none"> <li>- LVD (Low Voltage Directive)</li> <li>- EMC (Electromagnetic Compatibility Directive)</li> </ul>	
Heat meter		The stated minimum temperatures apply to best practice. The meter has no cutoff for low $\Delta\Theta$ and thus measures as low differential temperatures as 0.01 K.
- Temperature range	$\Theta$ : -40 °C...140 °C	
- Differential range	$\Delta\Theta$ : 3 K...170 K	
Cooling meter		
- Temperature range	$\Theta$ : -40 °C...140 °C	
- Differential range	$\Delta\Theta$ : 3 K...40 K	
Temperature sensors		
- Type 6M2-G/H	Pt500 EN 60 751, 2-wire connection	
Typical accuracy		
- Calculator	$E_c \pm [0.5 + 2/\Delta\Theta] \%$	
- Sensor set (-40...140 C)	$E_T \pm [0.4 + 5/\Delta\Theta] \%$	
Flow sensor types	Mechanical meters with reed switch Electronic meters with active 24 V pulse output Electronic pick-up units	
Flow sensor sizes		
- [kWh]	qp 0.6 m <sup>3</sup> /h...qp 15 m <sup>3</sup> /h	
- [MWh]	qp 0.6 m <sup>3</sup> /h...qp 1500 m <sup>3</sup> /h	
- [GJ]	qp 0.6 m <sup>3</sup> /h...qp 3000 m <sup>3</sup> /h	
EN 1434 designation	Environmental class A and C	
MID designation		
- Mechanical environment	Class M1	
- Electromagnetic environment	Class E1 and E2	

## Electrical data

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### Calculator data

Display	LCD – 7 (8) digits with a digit height of 7.6 mm
Resolution	9999.999 – 99999.99 – 999999.9 – 9999999
Energy units	MWh – kWh – GJ
Data logger (EEPROM) – Standard	1392 hours, 460 days, 36 months, 15 years, 50 info codes
Clock/calendar	Clock, calendar, leap-year compensation, target date, real-time clock with battery back-up
Data communication	KMP protocol with CRC16 used for optical communication and for top and base modules
Power in temperature sensors	< 10 µW RMS
EMC data	Meets prEN 1434-4:2009 Class C (MID Class E2)

### Supply

Supply voltage	3.6 VDC ± 0.1 VDC
Battery	3.65 VDC, D-cell lithium
Closed circuit	< 35 µA excluding flow sensor
Replacement interval – Mounted on wall	12 + 1 years @ $t_{BAT} < 30\text{ °C}$ The replacement interval is reduced when using data modules, frequent data communication or high ambient temperature.
Mains supply	230 VAC +15/-30 %, 50/60 Hz 24 VAC ± 50 %, 50/60 Hz
Insulation voltage	4 kV
Power consumption	< 1 W
Backup supply	Integral super-cap eliminates operational stop-down due to short term power cuts (this only applies for supply modules type 6M2-0000-7 and 6M2-0000-8).

### Temperature measurement

Sensor inputs T1, T2, T3 – Measuring range	-40...140 °C
Max cable lengths – Pt500, 2-wire	2 x 0.25 mm <sup>2</sup> : 10 m 2 x 0.50 mm <sup>2</sup> : 20 m

## Pulse connections

<b>Flow measuring V1 and V2</b>	<b>Reed switches V1: 10-11 and V2: 69-11</b>	<b>24 V active pulses V1: 10B-11B and V2: 69B-79B</b>
EN 1434 pulse class	IB	[IA]
Pulse input	680 k $\Omega$ pull-up to 3.6 V	12 mA at 24 V
Pulse ON	< 0.4 V for > 100 msec.	< 4 V for > 3 msec.
Pulse OFF	> 2.5 V for > 100 msec.	> 12 V for > 10 msec.
Pulse frequency	< 1 Hz	< 128 Hz
Integration frequency	< 1 Hz	< 1 Hz
Electrical isolation	No	2 kV

<b>Pulse inputs <u>without</u> bounce damping VA and VB VA: 65-66 and VB: 67-68</b>	<b>Water meter connection FF(VA) and GG(VB) = 71...90</b>	<b>Electricity meter connection FF(VA) and GG(VB) = 50...60</b>
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 for > 30 msec.	< 0.4 V for > 30 msec.
Pulse OFF	> 2.5 V for > 100 msec.	> 2.5 V for > 100 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 $\mu$ A	

<b>Pulse inputs <u>with</u> bounce damping VA and VB VA: 65-66 and VB: 67-68</b>	<b>Water meter connection FF(VA) and GG(VB) = 01...40</b>
Pulse input	680 k $\Omega$ pull-up to 3.6 V
Pulse ON	< 0.4 V for > 200 msec.
Pulse OFF	> 2.5 V for > 500 msec.
Pulse frequency	< 1 Hz
Electrical isolation	No
Max cable length	25 m
Requirements to external contact	Leakage current at function open < 1 $\mu$ A

<b>Pulse outputs CE and CV</b>	<b>Via top module 602-0C</b>
Type	Open collector (OB)
Pulse length	Optional 32 msec. or 100 msec.
External voltage	5...30 VDC
Current	1...10 mA
Residual voltage	$U_{CE} \approx 1$ V at 10 mA
Electrical isolation	2 kV
Max cable length	25 m

## Mechanical data

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Environmental class	Meets EN 1434 Class A and C
Ambient temperature	5...55 °C non-condensing, closed location (indoor installation)
Protection class	IP54
Storage temperature	-20...60 °C (drained flow meter)
Weight	0.4 kg excluding sensors and flow sensor
Connection cables	ø3.5...6 mm
Supply cable	ø5...10 mm

## Materials

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Top cover	PC
Base unit	ABS with TPE gaskets (thermoplastic elastomer)
Print box	ABS
Wall bracket	Thermoplastic, PC 20 % GF

## GWF flow sensor

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GWF volume measuring meters can withstand installations where antifreeze agents are present. The measuring dynamics are, however, influenced depending on the concentration. With an antifreeze concentration:

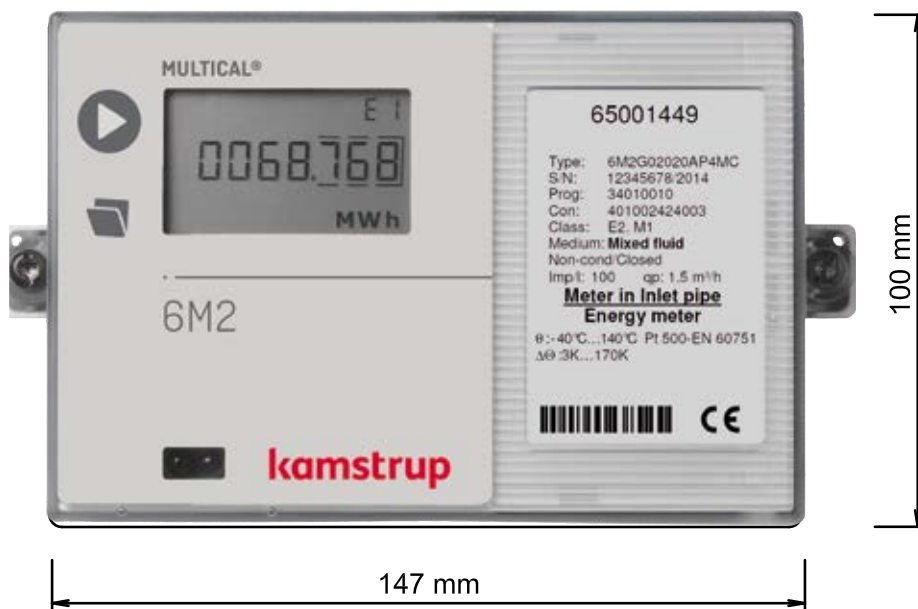
1. Below 5 % there is no influence on the measuring dynamics.
2. At 30 % the  $q_i$  value is doubled.  
**Note:** The  $q_i$  increases between 5-30 %. This degradation takes place proportionally.
3. Above 30 %, we do not recommend these meters.

## Order specifications

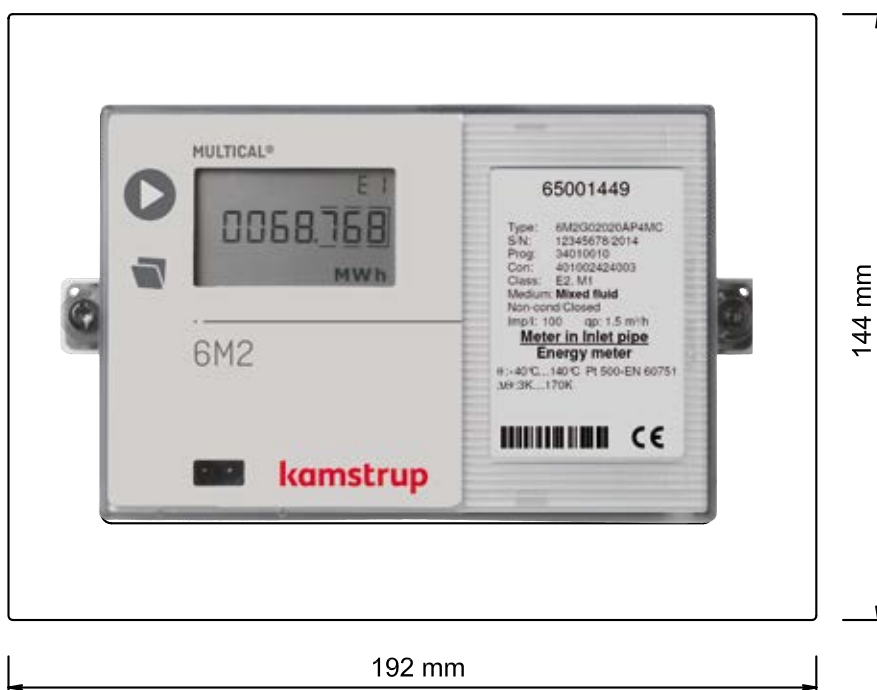
MULTICAL® 6M2	Type 6M2-	□	□	□□	□	□□	□	□	□□
<b>Sensor connection</b>									
Pt500, 2-wire (T1-T2-T3)	G								
Pt500, 2-wire (T1-T2-T3) w/24 V pulse inputs	H								
<b>Top module</b>									
No module		0							
2 pulse outputs CE and CV		C							
<b>Base module</b>									
No module				00					
M-Bus + pulse inputs (rev. B1 or higher)				20					
LonWorks + pulse inputs (rev. A1 or higher)				24					
BACnet MS/TP module + pulse inputs (rev. J1 or higher)				66					
ModBus RTU + pulse inputs (rev. B1 or higher)				67					
<b>Supply</b>									
No supply					0				
Battery, D-cell					2				
230 VAC isolated linear supply					7				
24 VAC isolated linear supply					8				
<b>Pt500 sensor set</b>									
No sensor set						00			
Pocket sensor set w/1.5 m cable						0A			
Pocket sensor set w/3.0 m cable						0B			
Pocket sensor set w/5 m cable						0C			
Pocket sensor set w/10 m cable						0D			
Short direct sensor set w/1.5 m cable						0F			
Short direct sensor set w/3.0 m cable						0G			
3 Pocket sensors in sets w/ 1.5 m cable						0L			
3 Short direct sensors in sets w/ 1.5 m cable						Q3			
<b>Flow sensor/pick-up unit</b>									
Prepared for meters w/ electronic pulse output (both V1 and V2)							K		
Prepared for meters w/reed switch output (both V1 and V2)							L		
Prepared for meters w/24 V active pulses (both V1 and V2)							M		
Supplied w/1 pcs. mechanical meter (Please specify type)							P		
<b>Meter type</b>									
Heat meter, closed system								4	
Cooling meter								5	
<b>Country code (language on label, etc.)</b>									XX

## Dimensional sketches

Front dimensions of MULTICAL® 6M2



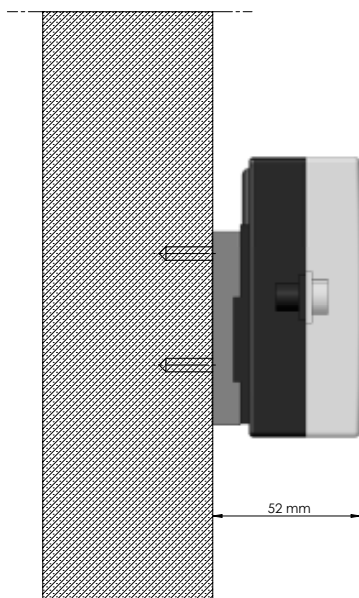
Panel mounted MULTICAL® 6M2 seen from the front



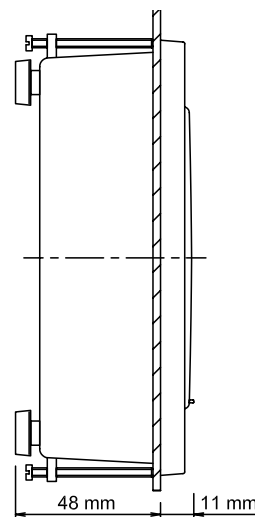
## Dimensional sketches

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Wall-mounted MULTICAL® 6M2  
seen from the side



Panel-mounted MULTICAL® 6M2  
seen from the side



## Accessories

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Description	Item number
D-cell battery	1606-064
230 VAC isolated linear supply	60200007000000
24 VAC isolated linear supply	60200008000000
Data cable w/USB plug	6699-098
Infrared optical reading head w/USB plug	6699-099
Infrared optical reading head w/D-sub 9F	6699-102
Data cable RS232, D-sub 9F	6699-106
Verification unit (used with METERTOOL)	6699-397/-398/-399
Temperature sensor set with connecting head (2/4 wired)	6556-4x-xxx
METERTOOL HCW	6699-724
LogView HCW	6699-725

Please contact Kamstrup A/S for questions about further accessories.