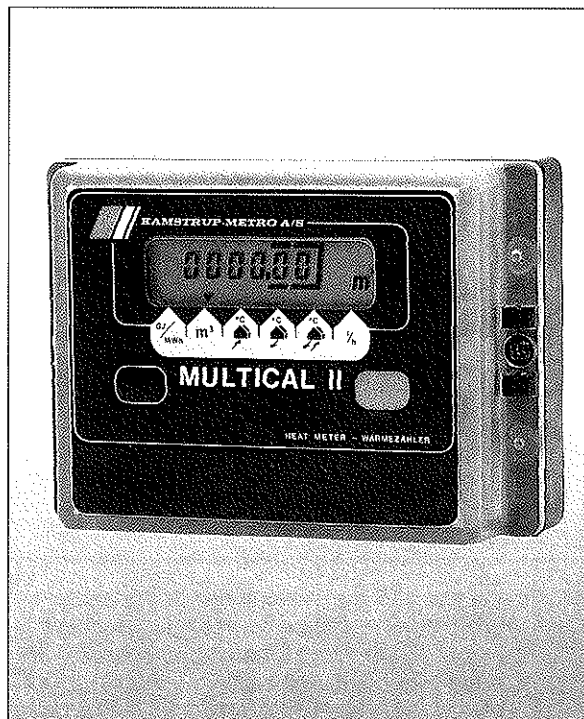- **Data is stored at monthly intervals**

- **Self-adjusting**

- **Permanent memory**

- **Easily readable display**

- **Errors monitored automatically**

- **Battery or mains operated**

- **Flexible design**

- **Data output**

- **Optional addressable data output**

MULTICAL II heat meter

APPLICATION

The MULTICAL II integrating unit, with corresponding flow part and temperature sensors, is used as a thermal energy meter for accumulating energy units in plants, where the heat conducting medium is water. Together with various sized flow meters, MULTICAL II is used with a wide range of connected effects.

MULTICAL II is supplied with data or pulse output, which makes is ideal for installations where data logging is required.

DESIGN

MULTICAL II heat meter comprises three units: a set of temperature sensors, a flow part and an integrating unit. The temperature sensors are mounted in the forward and return pipes. The flow part, which can be mounted in either the forward or return pipe, generates pulses that are proportional to the water flow. The flow pulses accumulate in the integrating unit. When a predetermined number of pulses, e.g. corresponding to 10 litres, has been accumulated the integrating unit performs an integration, i.e. calculation and accumulation. To begin with the temperature measurement is automatically adjusted, then the temperatures in the forward and return pipes are measured.

KAMSTRUP ENERGI

Based on the temperatures measured, the degree of cooling is calculated and multiplied by the volume of water and the K-factor (correction for density and heat content).

The quantity of heat derived is accumulated in the energy integrating unit. That part which cannot be shown due to the resolution of the display, is stored and added to the next energy calculation.

The MULTICAL II display constantly shows the accumulated quantity of energy in either MWh or GJ. Using the green key on the front of MULTICAL II, it is possible to display the water volume in m³, forward, return and differential temperatures in °C, water flow in l/h, information code and No. operating hours.

The water flow is given as an average, measured over 1 minute. However, If MULTICAL II is used together with flow meters with a low pulse frequency, reed-contact and similar, the number of water pulses per minute is displayed in l/h.

Any deviation from standard operation is registered by MULTICAL II. An information code is stored, which can be displayed at will. The letter "E" appears in the left of the MULTICAL II display informing both the consumer and the heat supplier that something untoward has been registered.

At hourly intervals, the accumulated heat and water volumes, together with the reading on the hour counter, are stored in a permanent memory. This feature ensures that data is retained in the event of a power failure.

The MULTICAL II integrating unit has 12 internal registers for storing consumption data. One register is used solely for storing hourly readings. The remaining 11 registers are used for storing data at intervals of 30 days (730 hours). Heat quantity, water volume and information codes are stored in "hour registers" (register for current month). Permanently stored data can be retrieved using MULTITERM II.

MONITORING ERRORS

MULTICAL II stores all information codes in a register. These information codes indicate operational inconsistencies which have arisen in the temperature sensors, flow part or in the integrating unit itself.

Each information code has its own number. If problems arise, the value of the respective code number is added to the register, e.g. information code 12 consists of two information codes 4 and 8. The information code numbers should be understood as follows:

+1 Power supply failure

+2 No flow pulses. Will occur when the temperature difference has been constantly higher than 12°C for 42 hours without a single integrating pulse being registered.

+4 Return pipe sensor defective. Will occur when the resistance value of the return pipe sensor of two measurements following each other is outside its normal operating range.

+8 Forward pipe sensor defective. Will occur when the resistance value two consecutive measurements from the forward pipe sensor exceed the normal operating range.

+128 Change of battery. Will occur if the hour counter exceeds 53,248 hours (6 years, 1 month).

+256 Pulse error for flow meter. Occurs if the pulse frequency increases to more than one integration per second. (Is not shown for XX=00 to YY=07).

+512 Program error. Occurs if the program deviates from its normal course, or if the automatic program test registers an error.

TECHNICAL DATA

TEMPERATURE SENSOR INPUT
Type of sensor Pt 500 IEC 751 B

FLOW METER INPUT
Input impedance Min. 100kΩ

For programming numbers XX 00X XX XXX up to and incl. XX 07X XX XXX:

Pulse Potentialfree, puls frequency max. 1 Hz. If data are read from the data output more than once an hour the max. pulse frequency is 0.5 Hz, pulse/pause min. 1,000 ms

Pulse duration Min. 500 ms (bounce attenuation)

Interval Min. 500 ms (bounce attenuation)

For programming numbers XX 08X XX XXX up to and incl. XX 80X XX XXX:

Pulse Potentialfree, integration frequency max. 1 Hz.

Active sensor Pulse duration min. 0.5 ms Interval min. 0.5 ms

Passive sensor Pulse duration min. 0.5 ms Interval min. 25 ms

INTEGRATING UNIT

Temperature range	0 - 130°C
Temperature difference	2 - 110°C
Power consumption	average 25 µA max. average 50 µA
Supply voltage	3.65 V ±10%
Display	LCD, 7 segments, 6 digits + control digit, if any
Digit height	7 mm
Housing material	Impact-proof PS
Bracket	ABS
Protection class	IP 54
Ambient temperature	0 - 35°C, short-term -10 +70°C
Weight	0.5 - 0.7 kg depending on version, incl. battery

BATTERY SUPPLIED BRACKETS

For type no. 65 C1 1XX (with C-cell)

Battery	Lithium-thionyl chloride 3.65 V, 6.5 Ah
Renewal time	Typically 5 years

For type no. 65 C1 3XX (with D-cell for ULTRAFLOW)

Battery	Lithium-thionyl chloride 3.65 V, 11 Ah
Renewal time	Typically 5 years

BRACKETS FOR MAINS SUPPLY

For type no. 65 C2 4XX & 65 C4 4XX (with back-up unit)

Supply voltage	230 V AC + 10% - 15%
Power consumption	Max 1 W

Back-up time

In the event of power failure, data is backed-up for a short period. Subsequent to long power failures, the heat meter starts up with the permanently stored data (which is updated hourly)

For type no. 65 C3 4XX (with back-up unit)

Supply voltage	12-35 V DC 9-24 V AC eff.
Power consumption	20 µA + power consumption integrating unit
Start-up	Approx. 105 sec. at 24 V DC

Back-up time

In the event of power failure, data is backed-up for a short period. Subsequent to long power failures, the heat meter starts up with the permanently stored data (which is updated hourly)

BRACKETS WITH DATA OUTPUT

For type no. 65 C1 XXX & 65 C2 4XX

Data output	RS 232 open collector, 1200 baud
Power consumption data collection	Approx. 0.5 mAs/reading

BRACKET WITH CTS OUTPUT

For type no. 65 C4 4XX (230 V power supply only)
Pulse output through opto couplers (DIN 43 865 "SO")

Max. current	27 mA
Max. voltage	27 V DC
Interval between pulses	>30 ms

ACCURACY
(Max. tolerances)

Temperature indication	±0.1% ±0.1°C
Δt - indication	±0.1% ±0.05°C
Flow indication	±1% excl. flow meter tolerances
Energy counting	$\pm 0.1\% \pm \dfrac{0.05 \times 100}{\Delta t}$ % excl. temperature sensor and flow meter tolerances
Hour counting	±0.01% ±1 digit
Temperature drift	±0.01%/°C ±0.01°C/°C compared to 20°C
Long-term drift	±0.1%/10,000h ±0.1°C/ 10,000h

Energy counting

$$\pm\sqrt{(0.1+\frac{0.05 \times 100}{\Delta t})^2+(0.5+\frac{0.05 \times 100}{\Delta t})^2} \text{ %}$$

incl. the tolerance of one set of Pt 500 temperature sensor from KAMSTRUP

Example:

If Δt = 40°C the max. error of the energy counting, excl. flow meter tolerance, will be:

$$\pm\sqrt{(0.1+\frac{0.05 \times 100}{40})^2+(0.5+\frac{0.05 \times 100}{40})^2} = \pm 0.66 \text{ %}$$

ORDER SPECIFICATION

```
                              65 - C ☐ - ☐ ☐ ☐ - ☐ ☐ ☐
```

Connecting bracket with data output (battery supply) ——————— 1
Connecting bracket with data output (230 V supply) ——————— 2
Connecting bracket with data output (24 V supply) ——————— 3
Connecting bracket with CTS output (230 V supply) ——————— 4

Lithium battery C-cell ————————————————————— 1
Litium battery D-cell ————————————————————— 3
Back-up unit (for 230 V supply brackets) ————————————— 4

Pt 500 set of sensors with 1.5 m cable ————————————— 1
Pt 500 set of sensors with 3.0 m cable ————————————— 2
Pt 500 set of direct sensors with 1.5 m cable ———————————— 3
Pt 500 set of direct sensors with 3.0 m cable ———————————— 4
Pt 500 set of direct short sensors with 1.5 m cable ——————— 5
Pt 500 set of direct short sensors with 3.0 m cable ——————— 6

For flow meter with own pulse transmitter —————————————— 0
Pulse pick-up unit for GWF Unico flow meter, 0.2 m pulse cable ————— A
Pulse pick-up unit for GWF Unico flow meter, 2.5 m pulse cable ————— B
Pulse pick-up unit for GWF MTW flow meter, 0.2 m pulse cable ————— C
Pulse pick-up unit for GWF MTW flow meter, 2.5 m pulse cable ————— D
Pulse pick-up unit for Kamstrup flow meter, 0.2 m pulse cable ————— E
Pulse pick-up unit for Kamstrup flow meter, 2.5 m pulse cable ————— F

Ordering code concerning final mounting etc. (Will be added by Kamstrup) ————— X X X

In addition to the above number combination a programming number must be included in the order.

```
                              W  X  Y  Y  Z   U  U   A  A  A
Programming number    PROG - ☐  ☐ ☐ ☐ ☐ - ☐ ☐ - ☐ ☐ ☐
```

Data output ——————————————————————— 0
Addressable data output ———————————————————— 1

Accumulation of energy in MWh —————————————— 0
Accumulation of energy in GJ ——————————————— 4

Flow meter pulse figure and placing of decimal point (see table) —— 00-99

Flow meter in return pipe ——————————————————— 2
Flow meter in forward pipe ——————————————————— 3
Flow meter in return pipe and control digit in display ——————— 6
Flow meter in forward pipe and control digit in display ——————— 7

Full user display, no registration of information code 2 as standard [1] ——— 11
Reduced user display and/or information codes on inquiry

Address, address required, only if addressable data output has been selected ————— 001-126

[1] Standard coding 11 will only be written on the side label of MULTICAL if the meter is addressable.

ORDER SPECIFICATION (cont.)

Flow meter pulse figure and decimal point

No. (YY)[2]	Flow meter type	MULTICAL II Integrating unit				
		Pulse signal litres per pulse	Litres per integration	Decimals after the point		
				MWh	GJ	m³
00	With built-in pulse transmitter	1	10	3	2	2
01	With built-in pulse transmitter	2.5	10	3	2	2
02	With built-in pulse transmitter	10	10	3	2	2
03	With built-in pulse transmitter	25	25	2	2	1
04	With built-in pulse transmitter	10	100	2	1	1
05	With built-in pulse transmitter	25	250	1	1	0
06	With built-in pulse transmitter	100	100	2	1	1
07	With built-in pulse transmitter	250	250	1	1	0
		Pulses/litre				
08	GWF Unico Q_n 0.6m³/h	140.3	10	3	2	2
09	GWF Unico Q_n 1.0 m³/h	95.7	10	3	2	2
10	GWF Unico Q_n 1.5 m³/h	64.6	10	3	2	2
11	GWF Unico Q_n 2.5 m³/h	40.4	10	3	2	2
12	GWF MTW Q_n 1.5/2.5 m³/h	50.2	10	3	2	2
13	GWF MTW Q_n 3.5/6 m³/h	23.5	100	2	1	1
14	GWF MTW Q_n 10/15 m³/h	7.12	100	2	1	1
15	GWF MTW Q_n 1.0 m³/h	75.7	10	3	2	2
19	ULTRAFLOW I/II q_{vmax} 1.5 m³/h	100	10	3	2	2
22	Kamstrup flow meter single-jet Q_n 0.6 m³/h	166.8	10	3	2	2
23	Kamstrup flow meter multi-jet Q_n 1.0 m³/h	86.4	10	3	2	2
24	Kamstrup flow meter multi-jet Q_n 1.5 m³/h	52.2	10	3	2	2
25	Kamstrup flow meter single-jet Q_n 1.5 m³/h	60.7	10	3	2	2
26	Kamstrup flow meter multi-jet Q_n 2.5 m³/h	42.0	10	3	2	2
27	Kamstrup flow meter single-jet Q_n 2.5 m³/h	29.82	100	2	1	1
"	Kamstrup flow meter multi-jet Q_n 3.5 m³/h	29.82	100	2	1	1
29	Kamstrup flow meter multi-jet Q_n 6 m³/h	18.54	100	2	1	1
30	Kamstrup flow meter multi-jet Q_n 10 m³/h	7.7	100	2	1	1
31	Kamstrup flow meter multi-jet Q_n 15 m³/h	7.0	100	2	1	1
36	ULTRAFLOW I q_{vmax} 3 m³/h	50	10	3	2	2
37	ULTRAFLOW I/II q_{vmax} 6 m³/h	25	100	2	1	1
51	ULTRAFLOW II q_{vmax} 3.0 m3/h	50	100	2	1	1

Other pulse figures and decimal point positions are available on request.

[2] For YY=00 - 07 pulses per minute are shown instead of flow in l/h.

MOUNTING ACCESSORIES

FLOW METERS

ULTRAFLOW   See data sheet no. E20 499

Vane wheel meter   See data sheet no. E20 899

Temperature sensors   See data sheet no. E90 799

ORDERING DETAILS

WITH SEPARATE FLOW PART

Please state the type nos. of

a)   Integrating unit with connecting bracket, battery/back-up unit and temperature sensors as well as the corresponding number for the program required.

b)   Flow part

c)   Sensor pockets, screw joints etc.

COMPACT MOUNTED WITH ULTRAFLOW

Please state the type nos for

a)   Integrating unit with ULTRAFLOW II, battery and temperature sensors as well as the corresponding number for the program required.

b)   Sensor pockets, screw joints etc.

## ORDERING EXAMPLE

EXAMPLE 1

1 MULTICAL II heat meter is required, as follows:

Connecting bracket with data output and 230 V DC supply (integrating unit for wall mounting) - back-up unit - set of Pt500 sensors with 3 m cable - ULTRAFLOW flow part (own pick-up unit) - energy accumulation in MWh - flow meter in return pipe, no control digit - standard user display and information codes.

Initially, determine the combination number for the parts required and the number for the program. Then find the numbers for the flow part, wall bracket, sensor pockets and screw joints.

1 no.   65-C2-420-XXX, program no. 00192

2 nos.   65-57-209, 90 mm R 1/2 (1/2" BSP conical) brass sensor pockets

1 no.   65-54-A1, ULTRAFLOW II with blind cover, 165 mm overall length, G 3/4 B (3/4" thread) connecting thread on meter and 2.5 m connecting cable

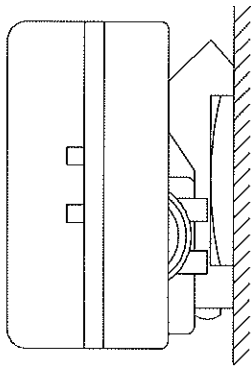2 nos.   65-61-311, R 1/2 (1/2" BSP conical) screw joints for flow meter
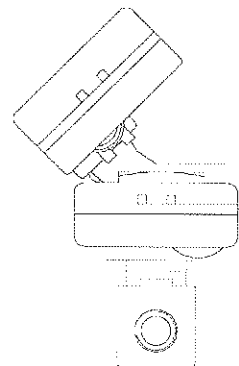
DIMENSIONAL SKETCH
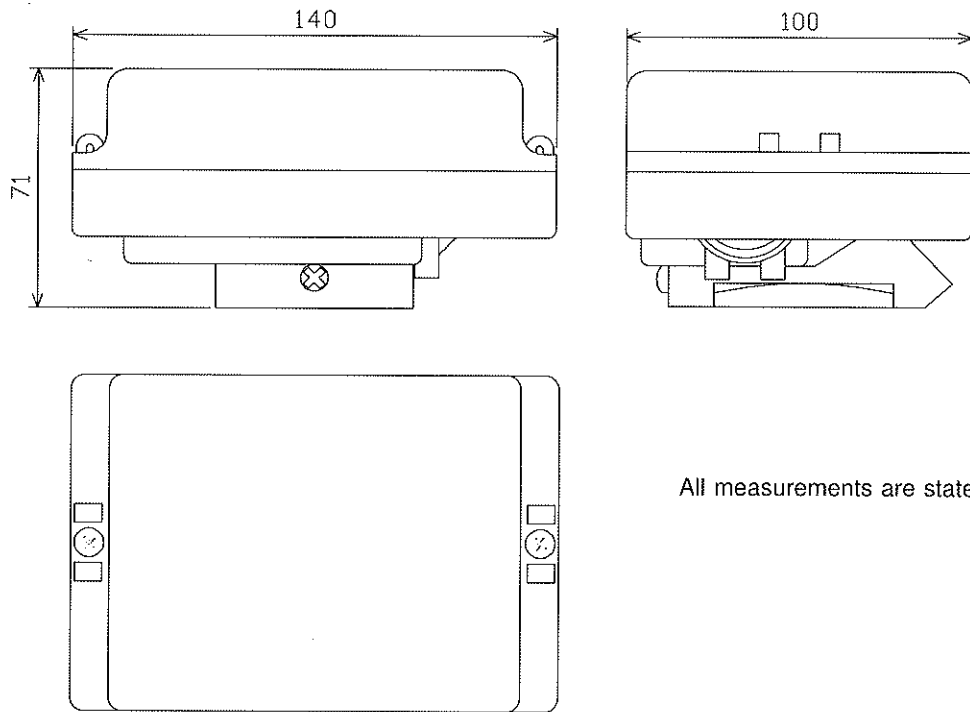
All measurements are stated in [mm]
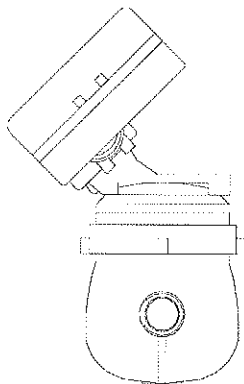
EXAMPLE OF MOUNTING

MULTICAL II with integrating
unit for wall mounting

MULTICAL II compact mounted
directly on ULTRAFLOW

MULTICAL II compact
mounted with multi-jet vane
wheel meter

MULTICAL II compact mounted
with single-jet vane wheel meter