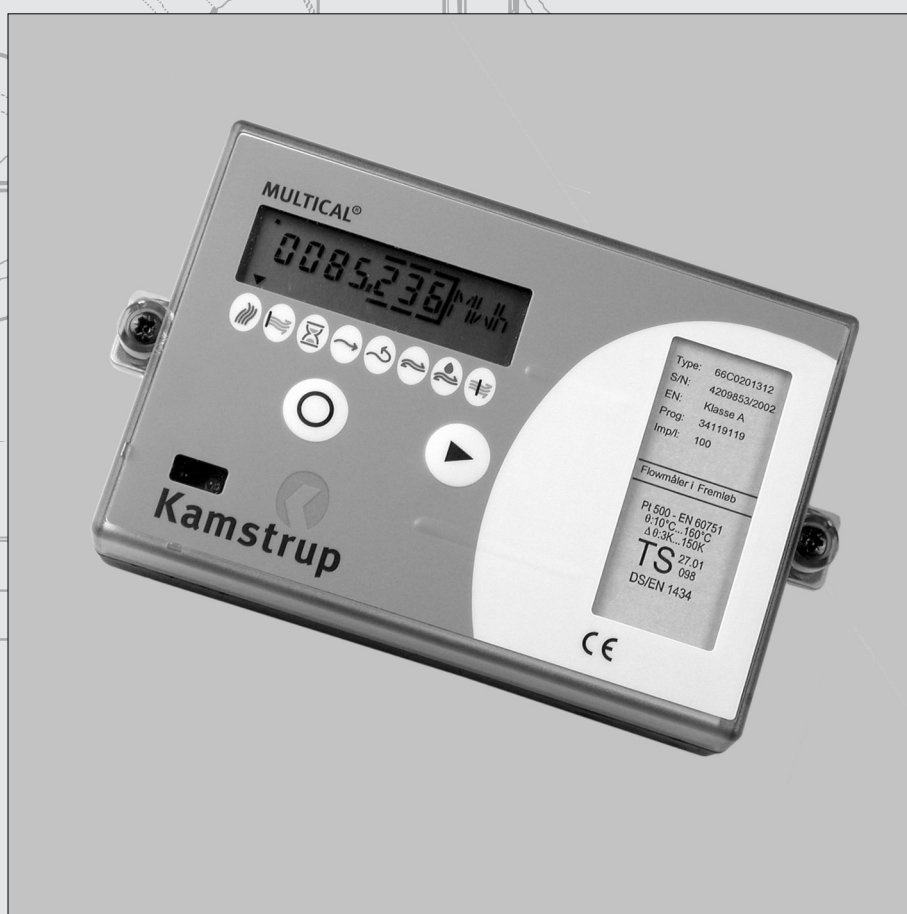


# MULTICAL® TYPE 66-CDE

## Technical Description



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# Table of contents

|   |           |                                       |           |
|---|-----------|---------------------------------------|-----------|
| <b>Preface</b>                            | <b>5</b>  | <b>7. Programming via METERTOOL</b>   | <b>43</b> |
| <b>1. General description</b>             | <b>7</b>  | 7.1 PC and printer requirements       | 43        |
| 1.1 66-C, Energy meter                    | 7         | 7.2 Installation of software          | 43        |
| 1.2 66-D, Energy meter for open systems   | 8         | 7.3 Connecting MULTICAL®              |           |
| 1.3 66-E, Energy meter for closed systems | 8         | Type 66-CDE to PC                     | 44        |
| 1.4 Display functions                     | 9         | 7.4 Reading of MULTICAL® Type 66-CDE  | 44        |
| 1.5 Temperature measuring                 | 10        | 7.5 Programming                       | 44        |
| 1.6 Flow measuring                        | 10        | 7.6 File                              | 45        |
| 1.6.1 Pulse transmitter                   | 11        | 7.7 Utility                           | 45        |
| 1.7 Energy calculation                    | 12        | 7.8 Options                           | 45        |
| 1.8 Info codes                            | 14        | 7.9 Windows                           | 45        |
| 1.9 Reset functions                       | 15        | 7.10 Help                             | 46        |
|   |           | 7.11 Supplementary programs           | 46        |
| <b>2. Number system</b>                   | <b>16</b> | <b>8. Verification via METERTOOL</b>  | <b>47</b> |
| 2.1 Type number                           | 17        | 8.1 Function                          | 47        |
| 2.2 Prog., A-B-CCC-CCC                    | 18        | 8.2 Verification data                 | 47        |
| 2.3 CONFIG, DD-E-FF-GG-M-N                | 22        | 8.3 Verification                      | 48        |
| 2.4 ›DATA‹ for configuration              | 29        | 8.4 Maintenance                       | 48        |
| 2.5 Valve specification                   | 29        | 8.5 Certificate                       | 49        |
| <b>3. Voltage supply</b>                  | <b>30</b> | <b>9. Dimensional drawings</b>        | <b>50</b> |
| <b>4. Data communication</b>              | <b>33</b> | 9.1 File                              | 50        |
| 4.1 66-B compatible data                  | 34        | 9.2 Command                           | 50        |
| 4.2 Specific data loggers for 66-CDE      | 35        | 9.3 Option                            | 50        |
| 4.3 Specific data string for 66-CDE       | 36        | 9.4 View Chart                        | 50        |
| 4.4 EN 61 107, Optical data read-out      | 36        | 9.5 Window                            | 50        |
| <b>5. Plug-in modules</b>                 | <b>37</b> | 9.6 Help                              | 50        |
| 5.1 Data/pulse inputs                     | 38        | <b>10. Alphabetical register</b>      | <b>51</b> |
| 5.2 Data/pulse outputs                    | 38        | <b>11. Dimensional drawings</b>       | <b>53</b> |
| 5.3 Telephone modem/pulse inputs          | 39        | <b>12. Temperature sensors</b>        | <b>54</b> |
| 5.4 M-Bus, EN 1434/pulse inputs           | 39        | 12.1 EN 60751 table for Pt500 sensors | 54        |
| 5.5 Telephone modem/pulse outputs         | 39        | 12.2 Sensor types                     | 55        |
| 5.6 4...20 mA inputs/Data/pulse inputs    | 39        | 12.3 Pt500 pocket sensors             | 55        |
| 5.7 LonWorks, FTT-10A/pulse inputs        | 40        | 12.4 Sensor cables                    | 56        |
| 5.8 M-Bus – EN1434/Pulse outputs          | 40        | <b>13. Trouble shooting</b>           | <b>57</b> |
| 5.9 Data cables                           | 40        | <b>14. Approvals</b>                  | <b>58</b> |
| 5.10 Radio/Pulse inputs/outputs           | 41        | 14.1 Type approval                    | 58        |
| 5.11 Data cables                          | 41        | 14.2 CE-Declaration                   | 58        |
| <b>6. Printing logged data</b>            | <b>42</b> | 14.3 Leakage detection                | 58        |
|   |           | <b>15. Disposing of energy meters</b> | <b>59</b> |
|   |           | <b>16. Documents</b>                  | <b>60</b> |



## Preface

MULTICAL® type 66-CDE is an energy meter with many applications. In addition to being an accurate and reliable heat meter for battery or mains operation 66-CDE can also be used for:

- Cooling metering in water-based systems
- Bifunctional metering in heating/cooling systems
- Leak detection in heating/cooling installations
- Power and flow limiter with valve control
- Datalogger
- Energy metering in open systems

Flexibility has been an essential parameter when designing MULTICAL® Type 66-CDE. Programmable functions and plug-in modules ensure optimum use in a number of applications. In addition, this construction makes it possible to retrofit the modules in meters that have already been installed, subsequently updating via the METERTOOL PC-program.

This technical description has been written with a view to giving works managers, meter technicians, consulting engineers and distributors, in depth information pertaining to all MULTICAL® Type 66-CDE functions, so that these can be utilized in full. Furthermore, the description will be a helpful tool for laboratories performing tests and verifications.

During the preparation of this technical description we have focused on emphasizing the functional differences between MULTICAL® III, Type 66-B and MULTICAL® Type 66-CDE to ensure established users of MULTICAL® III, Type 66-B a safe product conversion. Under each relevant paragraph involving this product conversion, comments marked by “66-B ⇒ 66-CDE” will appear.



# 1. General description

MULTICAL® Type 66-CDE is a name which describes three types of MULTICAL®: 66-C, 66-D and 66-E. The type designation indicates which application the individual type is suited to. The most important characteristics of each type are described in the following paragraphs.

Common functions, such as data reading, plug-in modules and datalogging are described in separate paragraphs:

4. Data communication
5. Plug-in modules
6. Datalogging

## 1.1 66-C, Energy meter

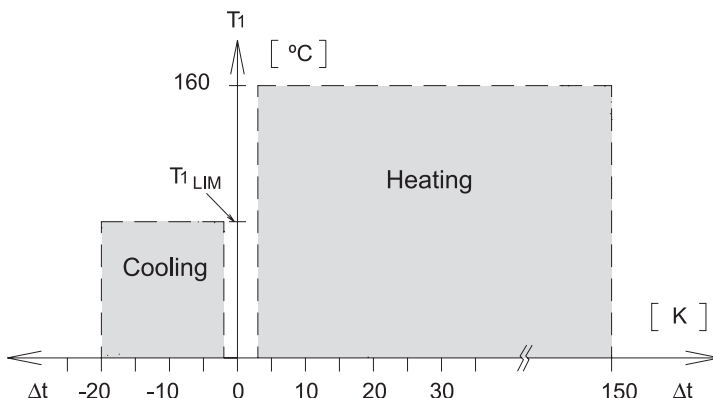
MULTICAL® Type 66-C is used for metering, calculating and registering thermal heat and cooling energy in all plants using water as an energy leading medium. MULTICAL® Type 66-C can perform a number of functions relevant to heating and cooling plants:

### Heat metering

The calculation of thermal energy is made on the basis of volume based integrations. The typical integration interval is 10 litres at a flow meter of qp 1,5 m³/h. The calculations are made more frequently as the water flow increases. The water volume is then multiplied by the actual cooling and the appropriate correction factor, according to EN 1434, this gives the real energy. The part of the energy increase which cannot be shown on the display due to the screen resolution will be stored in the memory and added to the next integration.

### Cooling metering

Metering of cooling energy is made in the same way as described above. In both instances the temperature sensor marked with red is placed in the flow pipe and temperature sensor marked with blue in the return. In connection with cooling metering a negative differential temperature will appear by means of which MULTICAL® Type 66-C will register the cooling energy in a separate register, provided the flow temperature is less than the programmed limit of e.g. 25°C. (see the graph below). Cooling energy, cooling effect and negative differential temperature are all marked with (-) minus in the display.



### Bifunctional energy metering

In plants which circulate heat during the winter season and are used for cooling during the summer season, MULTICAL® Type 66-C can be used for bifunctional energy metering. Thermal heat and cooling energy are measured in separate registers, which make differentiated user billing possible.

See paragraph 1.7 *Calculation of energy for further information on calculation* and paragraph 2.3.1.1 *»DD« Display readings for 66-C* for information on possible readings with this meter type.

### Leak detection

When two ULTRAFLOW® flow meters are connected to MULTICAL® Type 66-C flow meters, flow and return, can make a constant comparison of the mass (temperature adjusted volume) which passes in and out of the installation. When exceeding a programmed limit an alarm message can be sent e.g. through a built-in modem module.

Leak detection is divided into two functions;

- At 24-hour intervals, relatively small mass differences of approx. 9 kg/hour can be monitored.
- Differences larger than 20% of the flow meters' measuring area qp will release an alarm after 90 seconds.

In addition, leakages can also be monitored in cold tap water. When input A, by means of a water meter with pulse outlet, is used for accumulating the cold-water consumption, a monitoring function can be activated e.g. that the consumption for the past 1 hour/24 hours has been zero. In this way dripping taps and defective toilet systems can be detected after max. 24 hours. The sensitivity can be configured for a period of time, or permanently via a PC or a hand-held terminal.

Alarm for leaks in the cold-water system will also be activated e.g. via a built-in modem module.

See paragraph 2.3.4 *Configuration of leakage limits* for further information.

### PQ-controls

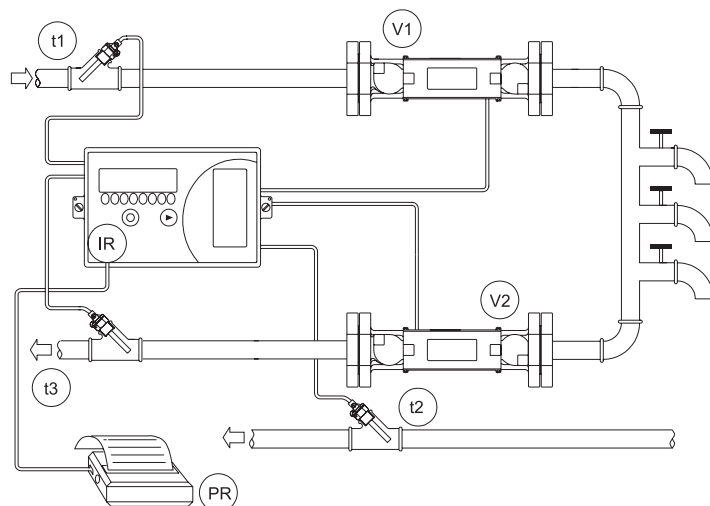
Using built-in regulating devices MULTICAL® Type 66-C can control a 3-point motor-operated valve, through a Solid State Relay, with a view to implementing power or flow limitation.

In applications where max. heat power or water flow must be limited, the customer will obtain an extremely simple system, as the installation is insignificant and power/flow limits can be set via PC or hand-held terminal.

See paragraph 2.3.2.1 *Tariff types* for further information.

## 1.2 66-D, Energy meter for open systems

MULTICAL® Type 66-D is used for measuring “differential energy” in hot tap water for flats. The hot tap water is produced in a boiler station in which the cold tap water is heated by means of district heating or natural gas, and the hot tap water is then circulated to a number of homes.



Application drawing – open systems

A MULTICAL® Type 66-D is placed in each building together with two flow meters and three temperature sensors. The energy for water is calculated on the basis of the flow temperature minus the cold tap water, whereas the energy returned is calculated on the basis of the return flow temperature minus the cold tap water. MULTICAL® Type 66-D will calculate both energy amounts separately after which it reads out the difference as consumed energy.

In certain installations where it is only possible to measure flow and return flow temperatures T1 and T3 due to the distance, the cold water temperature T2 will automatically change to a pre-programmed value, when the temperature sensor T2 is not in use.

See section 2.3.1.2 >DD< Display readings for 66-D for further information on possible readings for this meter type.

In installations where the water pressure needs to be monitored, two pressure transmitters with 4...20 mA output can be connected to a plug-in module, which is placed in the base of the unit. It is then possible to read the water pressure in the flow and return flow pipes in the display, and these values will also be included in the data-loggers. See paragraph 5. Plug-in modules.

If monthly billing is required, a printer can be connected directly to MULTICAL® Type 66-D via an IR read-out head. See section 6. Printing logged data.

## 1.3 66-E, Energy meter for closed systems

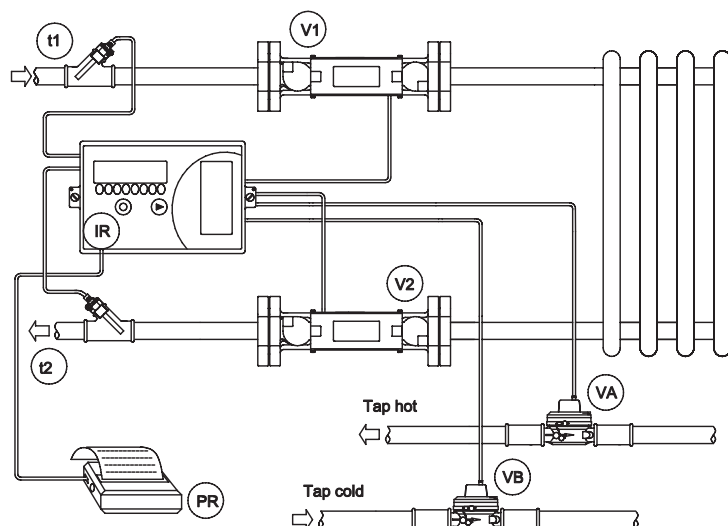
MULTICAL® Type 66-E is used for measuring thermal energy in closed systems with special requirements to readings, datalogging and monthly report directly from the printer.

Thermal energy is measured and calculated in the same way as 66-C. In addition, with 66-E it is possible to read and register accumulated volume and mass for both flow meter inlets V1 and V2.

See section 2.3.1.3 >DD< Display readings for 66-E for information on possible readings for this meter type.

In installations where the water pressure is to be monitored, two pressure transmitters can be connected as described above.

If monthly billing is required, a printer can be connected directly to the MULTICAL® Type 66-E via an IR-head. See section 6. Printing logged data.



Application drawing – closed systems



#### 1.4 Display functions

MULTICAL® Type 66-CDE is equipped with an easy-to-read LC-display containing 8 digits and 3 alphanumeric characters. During normal operation the accumulated values for thermal energy and water consumption are shown with 7 digits. The measuring units for the value (MWh, Gcal, m³ etc.) are shown with the 3 alphanumeric characters.

The first digit, to the left, is used in cases of an irregularity in the energy meter or in the installation – an “E” (Error) will appear.

The display can show a programmed customer number of up to 11 digits, however without measuring unit.

The display constantly shows the total thermal energy in MWh, kWh, GJ or Gcal, depending on the meter's programming. When activating either the right or left front key, the following readings are displayed:

| 66-C   |                 | DD=00...59        |                 | 66-D              |                 | DD=80...99 |  | 66-E          |  | DD=60...79 |  |
|--|-----------------|-------------------|-----------------|-------------------|-----------------|------------|--|---------------|--|------------|--|
| Standard & leak                                  |                 |                   |                 | Open system       |                 |            |  | Closed system |  |            |  |
| ➤ Primary readings in display (right front key)  |                 |                   |                 |                   |                 |            |  |               |  |            |  |
| Thermal energy                                   | kWh-MWh-GJ-Gcal | Δ-energy          | kWh-MWh-GJ-Gcal | V1-energy         | kWh-MWh-GJ-Gcal |            |  |               |  |            |  |
| Volume   | m3-0m3          | V1-volume         | m3-0m3          | V1-volume         | m3-0m3          |            |  |               |  |            |  |
| Hour counter                                     | HRS             | V1-mass           | Ton             | V1-mass           | Ton             |            |  |               |  |            |  |
| t1   | °C              | V1-flow           | l/h-m3/h        | V1-flow           | l/h-m3/h        |            |  |               |  |            |  |
| t2   | °C              | V1-Peak flow      | l/hP-m3P        | V1-peak flow      | l/hP-m3P        |            |  |               |  |            |  |
| Δt   | °C              | V1-power          | kW-MW           | V1-power          | kW-MW           |            |  |               |  |            |  |
| Power  | kW-MW           | V2-volume         | m3-0m3          | V1-peak power     | kWP-MWP         |            |  |               |  |            |  |
| Month Peak power                                 | kWP-MWP         | V2-mass           | Ton             | V2-volume         | m3-0m3          |            |  |               |  |            |  |
| Annual peak power                                | kWP-MWP         | V2-flow           | l/h-m3/h        | V2-mass           | Ton             |            |  |               |  |            |  |
| Annual peak date                                 | dat             | t1                | °C              | V2-flow           | l/h-m3/h        |            |  |               |  |            |  |
| Flow   | l/h-m3/h        | t2                | °C              | t1                | °C              |            |  |               |  |            |  |
| Month Peak flow                                  | l/hP-m3P        | t3                | °C              | t2                | °C              |            |  |               |  |            |  |
| Annual peak flow                                 | l/hP-m3P        | Hour counter      | HRS             | Δt (t1-t2)        | °C              |            |  |               |  |            |  |
| Info   | info            | PR1               | 1 PRT           | Hour counter      | HRS             |            |  |               |  |            |  |
| Info hour counter                                | info            | PR2               | 2 PRT           | PR1               | 1 PRT           |            |  |               |  |            |  |
|  |                 | Info              | info            | PR2               | 2 PRT           |            |  |               |  |            |  |
|  |                 | Info hour counter | info            | Info              | info            |            |  |               |  |            |  |
|  |                 |                   |                 | Info hour counter | info            |            |  |               |  |            |  |
| ○ Secondary readings in display (left front key) |                 |                   |                 |                   |                 |            |  |               |  |            |  |
| Cooling energy                                   | kWh-MWh-GJ-Gcal | VA                | m3a             | TA2               | TA2             |            |  |               |  |            |  |
| m3tf   | -               | VB                | m3b - EL        | TA3               | TA3             |            |  |               |  |            |  |
| m3tr   | -               | P1                | Bar             | TL2               | TL2             |            |  |               |  |            |  |
| TA2  | TA2             | P2                | Bar             | TL3               | TL3             |            |  |               |  |            |  |
| TA3  | TA3             | Customer No.      | -               | VA                | m3a             |            |  |               |  |            |  |
| TL2  | TL2             | Time              | Clk             | VB                | m3b - EL        |            |  |               |  |            |  |
| TL3  | TL3             | Date              | dat             | t3                | °C              |            |  |               |  |            |  |
| VA   | m3a             | Target date       | dat             | P1                | Bar             |            |  |               |  |            |  |
| VB   | m3b - EL        | Qsum1             | -               | P2                | Bar             |            |  |               |  |            |  |
| t3   | °C              | Qsum2             | -               | Customer No.      | -               |            |  |               |  |            |  |
| P1   | Bar             | Segment test      | -               | Time              | CLK             |            |  |               |  |            |  |
| P2   | Bar             |                   |                 | Date              | dat             |            |  |               |  |            |  |
| Customer No.                                     | -               |                   |                 | Target date       | dat             |            |  |               |  |            |  |
| Time   | CLK             |                   |                 | Segment test      | -               |            |  |               |  |            |  |
| Date   | dat             |                   |                 |                   |                 |            |  |               |  |            |  |
| Target date                                      | dat             |                   |                 |                   |                 |            |  |               |  |            |  |
| Segment test                                     | -               |                   |                 |                   |                 |            |  |               |  |            |  |

However, only the readings selected when programming the meter will appear. See the possibilities in section 2.3 Config., DD-E-FF-GG-M-N.

Approx. 220 sec. after the latest activation of the front keys, the display will automatically return to the reading marked with a “1” in the DD-table – typically accumulated thermal energy.

PR1 and PR2: Print-out is activated when both front keys are activated at the same time, when the display shows

“001 PRT” or “002 PRT”.

When activating both front keys simultaneously, when the display shows accumulated energy, Qsum 1 will be shown in the display.

At the same time the leak function will be turned off until the following midnight. If both keys are depressed for approx. 10 sec. “Call” will appear on the display and a call will be activated over the built-in modem, if installed.

## 1.5 Temperature measuring

MULTICAL®'s high resolution A/D-converter measures both the flow and return temperatures T1 and T2 and the additional temperature sensor input T3 with a resolution of 0.01°C. Prior to each temperature measurement, an adjustment is automatically made by the internal measuring circuit. This ensures a very accurate measurement and a long term drift which is almost immeasurable.

The temperature is measured every 10th minute partly for use in calculating "average/time" and partly for each volume quantity (e.g. per 10 litres at CCC=119) for use in connection with energy calculation display readings. A temperature measurement is made every 10 sec. while the display shows one of the three temperatures.

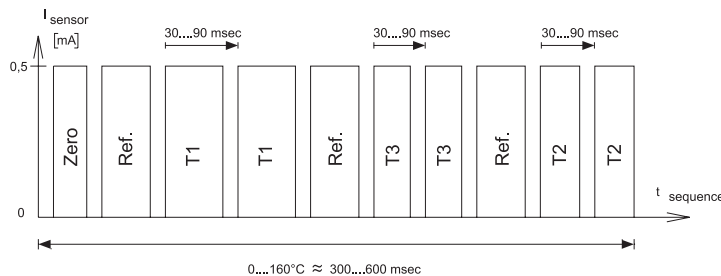
The calculated average temperatures, per hour and per 24 hours, are only accessible via datalogging, and cannot be shown in the display.

The datalogger's "average temperature/hour" is calculated on the basis of 144 measurements (6 measurements x 24 hours).

If one or more of the temperature sensors exceed the working range 0...165°C (sensor break down or short circuit), an info code will appear after max. 10 minutes, see section 1.8 *Info codes*.

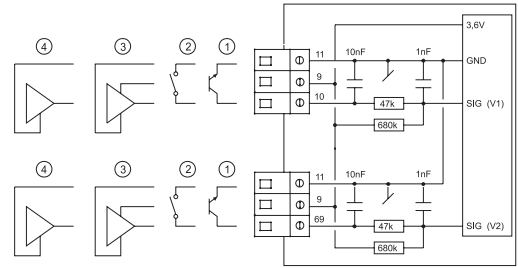
If temperature sensor T2 is turned off or short-circuited, T2 will change to an internal table value, e.g. 5°C. This internal table value will then be used for both display reading as for calculation of energy in open systems (66-D).

See section 10. *Temperature probes* for further information on resistance table, sensor types and installation conditions.



## 1.6 Flow measuring

Depending on the selected flow meter type the pulse input can be set to either fast pulses (CCC > 100) or to slow pulses (CCC < 100). In both instances a low-pass filter moderates bouncing, if any. Furthermore, the slow pulses are moderated by a software filter.



### 1 Flow meter with transmitter output

The signaller is typically an optocoupler with FET or transistor output, which is connected to clamp 10 and 11 for water meter V1 or clamp 69 and 11 for water meter V2.

Transistor leakage must not exceed 1 µA in OFF-state and 0.5 V in ON-state.

### 2 Flow meter with relay or Reed contact output

The signaller is a Reed contact, typically mounted on vane wheel and Woltmann meters or relay output from e.g. MID-meters. This type of signaller is usually used together with slow codings (CCC < 100).

### 3 Flow meter with active pulse output supplied by MULTICAL®

This connection is both used together with Kamstrup's ULTRAFLow® and Kamstrup's electronic pickup for vane wheel meters. The power consumption of these units is very low and moreover is covered by MULTICAL®'s battery life time.

Connection(V1) 9: Red 10: Yellow 11: Blue  
Connection(V2) 9: Red 69: Yellow 11: Blue

### 4 Flow meter with active output and own supply

Flow meters with active signal output as shown in circle 4. The signal level must be between 3.5 and 5 V. Larger signal levels may be connected through a passive voltage divider, e.g. of 47 kΩ/10 kΩ at a 24 V signal level.

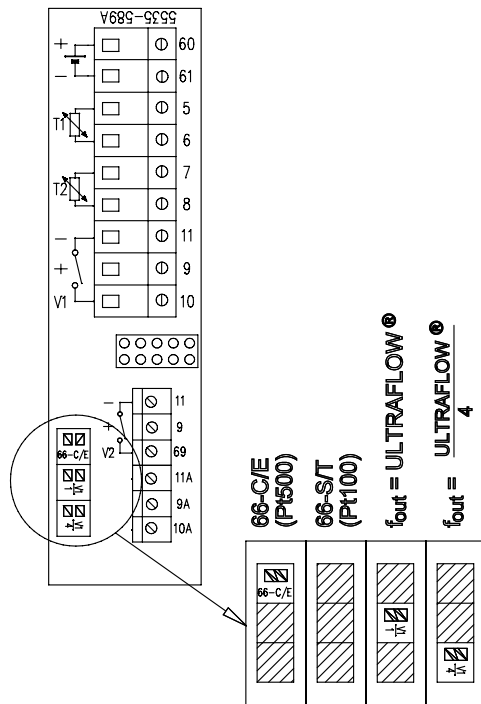
The input has the following trigger levels:

OFF > 2.0 V

ON < 0.5 V

### 1.6.1 Pulse transmitter/divider

The pulse transmitter/divider, type 66-99-608 is used as an alternative to the connection PCB, which is standard in both MULTICAL® type 66-C/E and in MULTICAL® type 66-S/T.



In addition to the ordinary connection PCB terminal strips for battery voltage, temperature sensors and flow meters, the pulse transmitter/divider is furnished with a galvanic isolated pulse output, which either transmits the pulses directly from the flow meter (V1) or makes a division into four of the frequency.

The pulse transmitter/divider, type 66-99-608 does not comprise connection for temperature sensor T3, and thus the PCB cannot be used for MULTICAL® type 66-D or other applications in which T3 is used.

### Configuration

As the pulse transmitter/divider has several functions it is necessary to configure the PCB before making the electrical connection.

### Pulse divider

If the pulse frequency on the output terminals of 9A-10A-11A has to be identical with the pulse frequency on the input terminals of 9-10-11, a piece of solder must be placed at the "V1/1" symbol. If the output frequency should be divided by 4, the solder must be placed at the "V1/4" symbol.

"V1/1" results in a pulse duration of approx. 3.9 msec., whereas "V1/4" results in a pulse duration of approx. 22 msec.

**NB.:** When the pulse transmitter/divider, type 66-99-608 is installed in a MULTICAL® with battery supply, the battery lifetime will typical be halved, depending on the average water flow/number of pulses. Furthermore, the MULTICAL® receiving the pulses will get a battery load corresponding to an ULTRAFLW®. If this is not acceptable, please select net supply.

## 1.7 Energy calculation

MULTICAL® 66-C + 66-E calculate energy according to the formula in EN 1434-1, which simplified can be summed up as follows:

|           |                                  |        |
|-----------|----------------------------------|--------|
| $EMJ =$   | $V \times \Delta\theta \times k$ | [MJ]   |
| $EGJ =$   | $\frac{EMJ}{1000}$               | [GJ]   |
| $EkWh =$  | $\frac{EMJ}{3.6}$                | [kWh]  |
| $EMWh =$  | $\frac{EMJ}{3600}$               | [MWh]  |
| $EGcal =$ | $\frac{EMJ}{4186.8}$             | [Gcal] |

$V$  is the added (or simulated) water volume during verification. In connection with a MULTICAL® e.g. with qp 1.5 m³/h flow meter and CCC-code = 119, the integrator will be programmed to receive 100 volume pulses per liter.

If e.g. 10,000 volume pulses are added, this will correspond to  $10,000/100 = 100$  litres, or  $0.1 \text{ m}^3$ .

$\Delta\theta$  is the difference between the flow and the return temperature ( $t_F - t_R$ ).

$k$  indicates the water heat coefficient, which is found by consulting "Tabellen von Wärmekoeffizienten für Wasser als Wärmeträgermedium", published in 1986 by Wirtschaftsverlag NW.

Please note that when consulting these tables following information must be available:

- Flow temperature,  $t_F$
- Return temperature,  $t_R$
- Flow meter placing: flow or return flow
- Installation pressure (16 bar according to EN 1434)

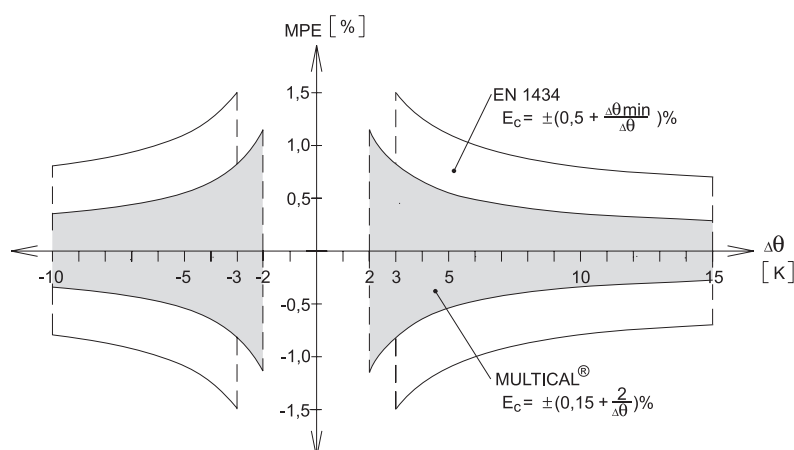
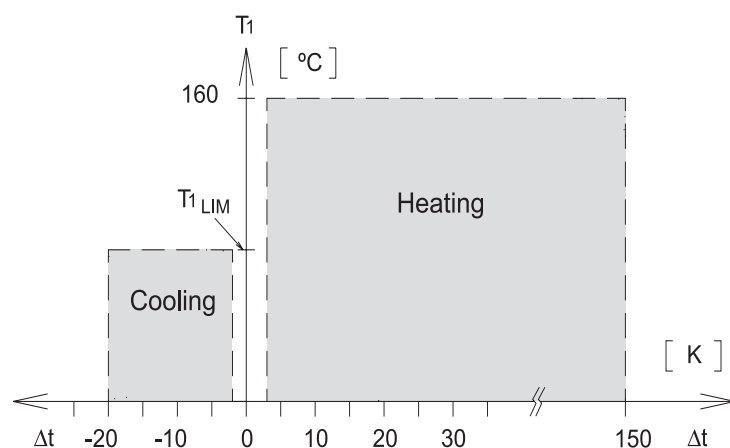
The  $k$ -factor is stated in the table as basis for the energy calculation in MJ and must, therefore, be converted according to above formulars, when the energy should be expressed in other units of measurement.

In connection with bifunctional energy metering, heat is measured with positive  $\Delta\theta$ , whereas cooling is measured with negative  $\Delta\theta$ . However, cooling metering implies that the flow temperature is less than a programmed limit of e.g. 25°C as shown in the graph below.

MULTICAL® measures energy throughout the temperature range 0...160°C, with a high degree of accuracy – as illustrated below.

### 66-D:

$$EMJ = (V1 \times (T1 - T2) \times k_{(T1)}) - (V2 \times (T3 - T2) \times k_{(T3)}) \text{ [MJ]}$$



### 1.7.1 Σ Quick figures

The sum of the Quick figures, which e.g. is calculated during a verification process is called Σ Quick figures.

Quick figures are displayed by a zero followed by 6 digits. Thus, the Quick sum has a maximum value of 999.999. If the total Quick sum exceeds 999.999, a roll-over will occur. The Quick sum is accessed through the data output and on the display, and in addition it can be transmitted as pulses from a test print.



Display prior to overflow

The accumulated Quick figure, which MULTICAL® under ideal circumstances should emit during commissioning, can be determined as a calculation of the “true” energy multiplied by the high-resolution Quick-factor:

Quick figure =  $E_{GJ} \cdot Q_{GJ}$  or  $E_{MWh} \cdot Q_{MWh}$ , where  $Q_{GJ}$  and  $Q_{MWh}$  can be read in below Quick table:

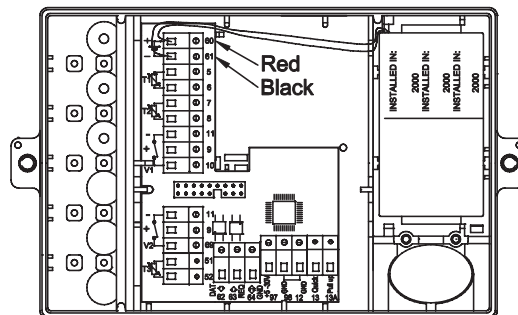
| CCC-kode (see section 2.2.1)   | $Q_{GJ}$   | $Q_{MWh}$  | No. of decimals [m³] in display |
|--|------------|------------|---------------------------------|
| 107, 184   | 23,889,000 | 86,000,000 | 3                               |
| 000, 001, 002, 009, 108, 109, 110, 111, 112, 115, 116, 117, 118, 119, 121, 122, 123, 124, 125, 126, 132, 133, 134, 136, 138, 139, 156, 163, 164, 165, 183, 185 | 2,388,900  | 8,600,000  | 2                               |
| 003, 004, 006, 113, 114, 120, 127, 128, 129, 130, 131, 135, 137, 140, 141, 142, 143, 151, 152, 153, 157, 168, 178, 179, 184, 186, 187, 188, 189                | 238,890    | 860,000    | 1                               |
| 005, 007, 008, 144, 145, 146, 147, 148, 149, 150, 158, 169, 170, 173, 175, 176, 177, 180, 181, 191, 192, 193   | 23,889     | 86,000     | 0                               |
| 166, 167, 171, 172   | 2,388.9    | 8,600      | x10                             |

Example of calculation of the “true” Quick figure:

- MULTICAL, programmed for qp 1.5 m³/h flow meter (CCC=119)
  - Placed in flow pipe
  - 10,000 volume pulses are emitted, corresponding to 0.1 m³
  - The temperature is simulated as  $t_F = 43.00^\circ\text{C}$  and  $t_R = 40.00^\circ\text{C}$
- $EMJ = V \times \Delta\theta \times k = 0.1 \times 3 \times 4.1408 = 1.2422 \text{ [MJ]}$
- True Quick =  $GJ \cdot \text{Quick factor} = 0.0012422 \cdot 2,388,900 = \mathbf{2967.49}$

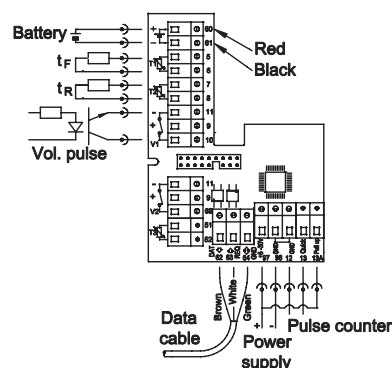
### 1.7.2. QuickTransmitter

The QuickTransmitter type 66-99-277 can be used when testing and verifying MULTICAL® Type 66-C/E, if high resolution energy pulses are required. However, the QuickTransmitter cannot be used to test and verify MULTICAL® 66-D.



The unit is supplied from an external voltage supply with 5...30 VDC, max. 15 mA. The Quick pulses are emitted as an open collector signal on clamp nos. 12 and 13 – an internal pull-up resistance of 10 kW can be connected via clamp no. 13A (see connection diagram below).

Volume and temperature simulation can be connected onto T1-T2-V1. In addition, the unit can be connected to serial data reading on clamp nos. 62-63-64, using data cable type 66-99-106 to connect to the com port of a computer (see paragraph 5.1 for how to connect the data cable), to read data use PC program “METERTOOL LogView”.



- Voltage supply: 5...30 VDC, < 15 mA.
- Volume simulation: 0-128 Hz ; depending on CCC-coding.
- Quickpulse output: Open collector, 5...30 VDC, < 15 mA.
- Quickpulse resolution: See Quick table paragraph 1.7.1.
- Quickpulse frequency: Approx. 40 kHz in burst/integration.
- Maintenance: The 17-poled plug should be replaced after every 500 tests.



## 1.9 Reset functions

### 1.9.1 Reset hour counter

Reset of both hour counters for operating hours and info hours is made by first lifting the top of the calculator from the connection base for at least 10 seconds until the control segments in the display stop. The left front key is then activated, and at the same time the top of the calculator is put back in place on the connection base. The left front key is now activated for up till 10 seconds, until the control segments in the display start moving again.



### 1.9.2 Total reset

Zero setting of the legal registers in MULTICAL® Type 66-CDE for energy and water can only be made by activating “RESET”, which is placed on the underside of the top of the calculator.

“RESET” is protected by a verification label. When “RESET” has been made the meter must be reverified according to current national requirements, after which “RESET” and “LOCK” must be sealed again.



**All display registers, peak values and average calculations will be cancelled by “RESET”. “RESET” does not affect dataloggers.**



*Reset pen, type 66-99-278*

### 1.9.3 Reset of dataloggers

To reset the dataloggers in MULTICAL® Type 66-CDE the verification seal must be broken after which the dataloggers can be reset by means of the PC-program METERTOOL.

See section 7. *Programming via METERTOOL.*

### 1.9.4 Reset peak values

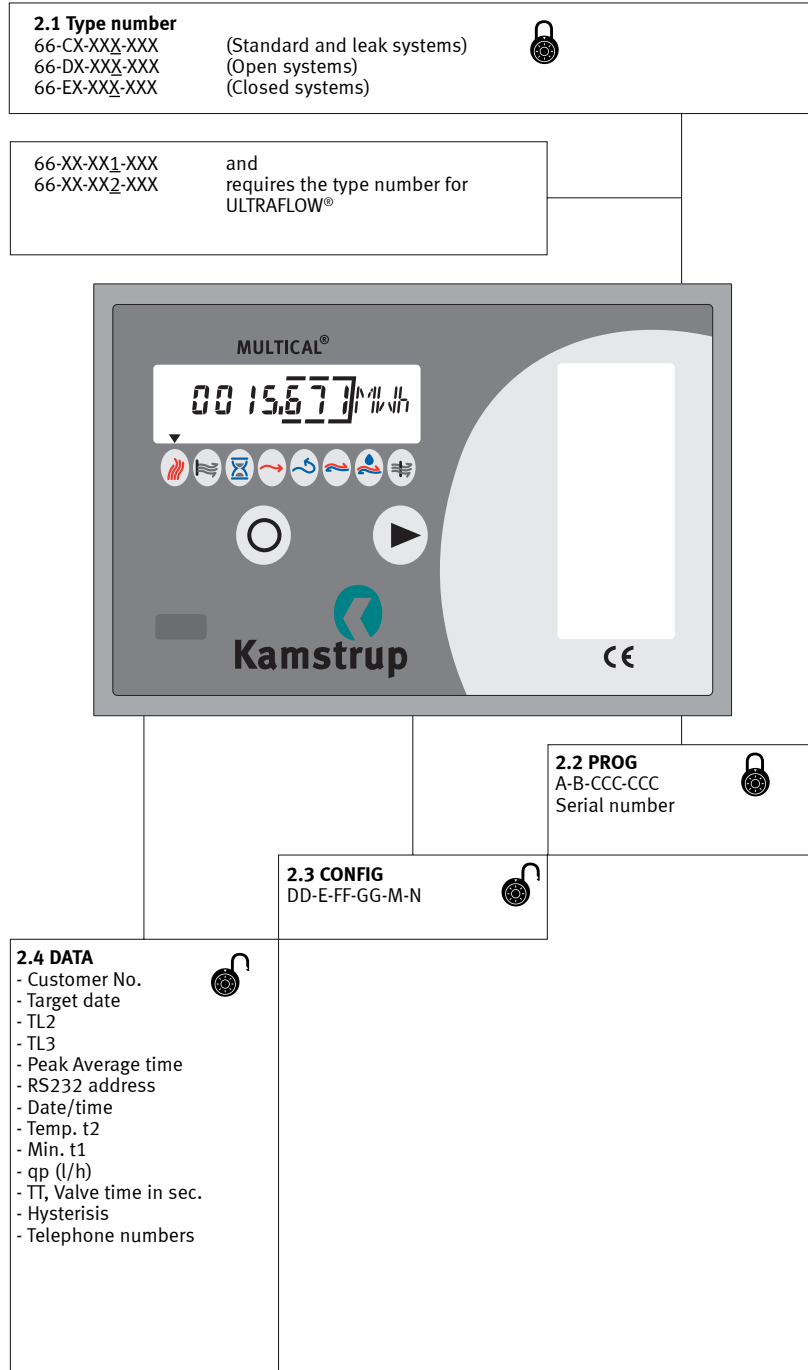
Separate adjustment of peak values for monthly and yearly peak can be made by lifting the top of the integrator from the connection for at least 10 sec. until the control segment of the display stops. The right front key is activated, and at the same time the top of the integrator is placed in the connection bracket. The right front key is activated for up to 10 sec., until the control segments of the display moves again.



**This facility can only be used for meters with S/N > 4050375**

## 2. Number system

The number system below describes the way in which MULTICAL® Type 66-CDE is built up with a view to ordering.





## 2.1 Type number

| Type number                                   |  | 66   | - | □ | - | □ | - | □ | - | □ | - | □ | - | □□□ |
|---|--|------|---|---|---|---|---|---|---|---|---|---|---|-----|
| Standard and leak systems                     |  | C    |   |   |   |   |   |   |   |   |   |   |   |     |
| Open systems                                  |  | D    |   |   |   |   |   |   |   |   |   |   |   |     |
| Closed systems                                |  | E    |   |   |   |   |   |   |   |   |   |   |   |     |
| <b>Plug-In modules</b>                        |  | None | 0 |   |   |   |   |   |   |   |   |   |   |     |
| Data/pulse inputs                             |  |      | 1 |   |   |   |   |   |   |   |   |   |   |     |
| Data/pulse outputs                            |  |      | 2 |   |   |   |   |   |   |   |   |   |   |     |
| Telephone modem/pulse inputs + Data           |  |      | 3 |   |   |   |   |   |   |   |   |   |   |     |
| M-Bus, EN 1434/pulse inputs - MC®66           |  |      | 4 |   |   |   |   |   |   |   |   |   |   |     |
| Telephone modem/pulse outputs                 |  |      | 5 |   |   |   |   |   |   |   |   |   |   |     |
| M-Bus, EN1434/pulse outputs - MC®III          |  |      | 7 |   |   |   |   |   |   |   |   |   |   |     |
| M-Bus/pulse inputs - MC®66                    |  |      | 8 |   |   |   |   |   |   |   |   |   |   |     |
| M-Bus/pulse outputs - MC®66                   |  |      | 9 |   |   |   |   |   |   |   |   |   |   |     |
| Radio/pulse inputs                            |  |      | A |   |   |   |   |   |   |   |   |   |   |     |
| Radio/pulse inputs external Antenne           |  |      | B |   |   |   |   |   |   |   |   |   |   |     |
| 4...20 mA inputs/Data /pulse inputs           |  |      | D |   |   |   |   |   |   |   |   |   |   |     |
| Analogue outputs                              |  |      | E |   |   |   |   |   |   |   |   |   |   |     |
| LonWorks, FTI-10A/pulse inputs/outputs        |  |      | F |   |   |   |   |   |   |   |   |   |   |     |
| Radio/pulse outputs                           |  |      | G |   |   |   |   |   |   |   |   |   |   |     |
| Radio/pulse outputs external Antenne          |  |      | H |   |   |   |   |   |   |   |   |   |   |     |
| <b>Supply modules</b>                         |  | None | 0 |   |   |   |   |   |   |   |   |   |   |     |
| D-cell, HiCap lithium battery                 |  |      | 2 |   |   |   |   |   |   |   |   |   |   |     |
| 230 VAC supply module                         |  |      | 7 |   |   |   |   |   |   |   |   |   |   |     |
| 24 VAC supply module                          |  |      | 8 |   |   |   |   |   |   |   |   |   |   |     |
| 24 V supply with S0 input                     |  |      | 5 |   |   |   |   |   |   |   |   |   |   |     |
| 24 V supply with flow meter input             |  |      | 6 |   |   |   |   |   |   |   |   |   |   |     |
| <b>Pt 500 Temperature sensors</b>             |  | None | 0 |   |   |   |   |   |   |   |   |   |   |     |
| Pocket sensor set with 1.5 m cable            |  |      | A |   |   |   |   |   |   |   |   |   |   |     |
| Pocket sensor set with 3.0 m cable            |  |      | B |   |   |   |   |   |   |   |   |   |   |     |
| Pocket sensor set with 5.0 m cable            |  |      | C |   |   |   |   |   |   |   |   |   |   |     |
| Pocket sensor set with 10.0 m cable           |  |      | D |   |   |   |   |   |   |   |   |   |   |     |
| Short direct sensor set with 1.5 m cable      |  |      | F |   |   |   |   |   |   |   |   |   |   |     |
| Short direct sensor set with 3.0 m cable      |  |      | G |   |   |   |   |   |   |   |   |   |   |     |
| 3 Pcs. Pocket sensor set with 1.5 m cable     |  |      | L |   |   |   |   |   |   |   |   |   |   |     |
| 3 Pcs. Pocket sensor set with 3.0 m cable     |  |      | M |   |   |   |   |   |   |   |   |   |   |     |
| 3 Pcs. Pocket sensor set with 5.0 m cable     |  |      | N |   |   |   |   |   |   |   |   |   |   |     |
| 3 Pcs. Pocket sensor set with 10.0 m cable    |  |      | P |   |   |   |   |   |   |   |   |   |   |     |
| <b>Pick-up/Flow meter</b>                     |  | None | 0 |   |   |   |   |   |   |   |   |   |   |     |
| Supplied with 1 pcs. ULTRAFLOW® *)            |  |      | 1 |   |   |   |   |   |   |   |   |   |   |     |
| Supplied with 2 pcs. (alike) ULTRAFLOW® *)    |  |      | 2 |   |   |   |   |   |   |   |   |   |   |     |
| Kamstrup pick-up with spring lock 2.5 m cable |  |      | F |   |   |   |   |   |   |   |   |   |   |     |
| Country code                                  |  |      |   |   |   |   |   |   |   |   |   |   |   | XXX |

\*) ULTRAFLOW® must be stated separately (see next page)



**66-C and 66-D must use identical flow meters on V1 and V2 ( $CCC_{V1}=CCC_{V2}$ ) 66-E can use individual flow meters on V1 and V2.**

### 2.1.1 ULTRAFLOW® type numbers

When placing an order it should be noted that MULTICAL® Type 66-CDE can be ordered for supply without a flow meter or together with one or two

ULTRAFLOW® flow meters. However, supply with two pcs. ULTRAFLOW® is only possible in connection with the smallest construction sizes. The list below indicates which meter types can be used in leak detecting systems:

Type number 66 - C/D/E - ☐ - ☐ - ☐ - ☐ - ☐

Supplied without flow meter/pick-up

0

Supplied with 1 pcs. ULTRAFLOW®

1

Supplied with 2 pcs. (identical) ULTRAFLOW®

2

| UF 65-X Type number | qp (m³/h) | CCC | Size   | Leakage | 1 | 2 |
|---------------------|-----------|-----|--|---------|---|---|
| 65-X-CAAA-XXX       | 0.6       | 116 | G <sup>3</sup> / <sub>4</sub> B (R <sup>1</sup> / <sub>2</sub> ) | ✓       | ✓ | ✓ |
| 65-X-CAAD-XXX       | 0.6       | 116 | G1B (R <sup>3</sup> / <sub>4</sub> )                             | ✓       | ✓ | ✓ |
| 65-X-CDAC-XXX       | 1.5       | 119 | G <sup>3</sup> / <sub>4</sub> B (R <sup>1</sup> / <sub>2</sub> ) | ✓       | ✓ | ✓ |
| 65-X-CDAD-XXX       | 1.5       | 119 | G1B (R <sup>3</sup> / <sub>4</sub> )                             | ✓       | ✓ | ✓ |
| 65-X-CDAE-XXX       | 1.5       | 119 | G1B (R <sup>3</sup> / <sub>4</sub> )                             | ✓       | ✓ | ✓ |
| 65-X-CDAF-XXX       | 1.5       | 119 | G1B (R <sup>3</sup> / <sub>4</sub> )                             | ✓       | ✓ | ✓ |
| 65-X-CDAA-XXX       | 1.5       | 119 | G <sup>3</sup> / <sub>4</sub> B (R <sup>1</sup> / <sub>2</sub> ) | ✓       | ✓ | ✓ |
| 65-X-CFAF-XXX       | 3.0       | 136 | G1B (R <sup>3</sup> / <sub>4</sub> )                             | ✓       | ✓ | ✓ |
| 65-X-CFBA-XXX       | 3.0       | 136 | DN20   | ✓       | ✓ | x |
| 65-X-CGAG-XXX       | 3.5       | 151 | G <sup>5</sup> / <sub>4</sub> (R1)                               | ✓       | ✓ | x |
| 65-X-CGBB-XXX       | 3.5       | 151 | DN25   | ✓       | ✓ | x |
| 65-X-CHAG-XXX       | 6.0       | 137 | G <sup>5</sup> / <sub>4</sub> B (R1)                             | ✓       | ✓ | x |
| 65-X-CHBB-XXX       | 6.0       | 137 | DN25   | ✓       | ✓ | x |
| 65-X-C1AJ-XXX       | 10        | 137 | G2B (R1 <sup>1</sup> / <sub>2</sub> )                            | ✓       | ✓ | x |
| 65-X-C1BD-XXX       | 10        | 137 | DN40   | ✓       | ✓ | x |
| 65-X-C1AJ-XXX       | 10        | 178 | G2B (R1 <sup>1</sup> / <sub>2</sub> )                            | ✓       | ✓ | x |
| 65-X-C1BD-XXX       | 10        | 178 | DN40   | ✓       | ✓ | x |
| 65-X-CKBE-XXX       | 15        | 120 | DN50   | ✓       | ✓ | x |
| 65-X-CLBG-XXX       | 25        | 179 | DN65   | ✓       | ✓ | x |
| 65-X-C2BG-XXX       | 25        | 120 | DN65   | ✓       | ✓ | x |
| 65-X-CMBH-XXX       | 40        | 158 | DN80   | ✓       | ✓ | x |
| 65-X-FABL-XXX       | 60        | 170 | DN100  | x       | x | x |
| 65-X-FACL-XXX       | 60        | 170 | DN100  | x       | x | x |
| 65-X-FBCL-XXX       | 100       | 180 | DN100  | x       | x | x |
| 65-X-FCBN-XXX       | 150       | 147 | DN150  | x       | x | x |
| 65-X-FCCN-XXX       | 150       | 147 | DN150  | x       | x | x |
| 65-X-FDBN-XXX       | 250       | 181 | DN150  | x       | x | x |
| 65-X-FDCN-XXX       | 250       | 181 | DN150  | x       | x | x |
| 65-X-FEBN-XXX       | 400       | 171 | DN150  | x       | x | x |
| 65-X-FECN-XXX       | 400       | 171 | DN150  | x       | x | x |
| 65-X-FECP-XXX       | 400       | 171 | DN200  | x       | x | x |
| 65-X-FEBR-XXX       | 400       | 171 | DN250  | x       | x | x |
| 65-X-FECR-XXX       | 400       | 171 | DN250  | x       | x | x |
| 65-X-FFCP-XXX       | 600       | 172 | DN200  | x       | x | x |
| 65-X-FFCR-XXX       | 600       | 172 | DN250  | x       | x | x |
| 65-X-F1BR-XXX       | 1000      | 172 | DN250  | x       | x | x |
| 65-X-F1CR-XXX       | 1000      | 172 | DN250  | x       | x | x |

Country code

### 2.2 Prog., A-B-CCC-CCC

Following programs are usually determined when placing the order, and thus they can only be chan-

ged by total programming, which subsequently demands reverification.

Prog. number A - B - CCC (V1) - CCC (V2)

☐

☐

☐

☐

Flow meter installation:

k-factor

table

- Flow 3

- Return 4

Measuring unit, Energy

- GJ

2

- kWh

3

- MWh

4

- Gcal

5

Flow meter code  
(CCC-table)

CCC

CCC

66-B ⇒ 66-CDE

A=1 & 2 is removed – total reset of counter registers only can be made by short circuiting behind the seal. See section 1.9 Reset functions.

**Note!** Gcal is not an SI-unit and may therefore not be used in Europe.

## 2.2.1 CCC-Table for MULITCAL® Type 66-CDE

### 2.2.1.1 ULTRAFLOW®II

| CCC No. | Pre-counter | Flow factor | Number of decimals displayed |          |     |     |     |      |    |    | pulse/l | qp (m³/h)          | Type No.  |
|---------|-------------|-------------|------------------------------|----------|-----|-----|-----|------|----|----|---------|--------------------|---|
|         |             |             | kWh                          | MWh Gcal | GJ  | m³  | l/h | m³/h | kW | MW |         |                    |   |
| 116     | 3000        | 102         | 0                            | 3        | 2   | 2   | 0   |      | 1  |    | 300     | 0.6                | 65 54 A8X<br>65 54 AAX  |
| 119     | 1000        | 307         | 0                            | 3        | 2   | 2   | 0   |      | 1  |    | 100     | 1.5                | 65 54 A6X<br>65 54 A7X<br>65 54 A1X<br>65 54 A2X<br>65 54 A3X |
| 136     | 500         | 614         | 0                            | 3        | 2   | 2   | 0   |      | 1  |    | 50.0    | 2.5                | 65 54 A4X<br>65 54 ADX  |
| 151     | 5000        | 614         |                              | 2        | 1   | 1   | 0   |      | 1  |    | 50.0    | 3.5                | 65 54 B1X<br>65 54 B7X  |
| 137     | 2500        | 1229        |                              | 2        | 1   | 1   | 0   |      | 1  |    | 25.0    | 6<br>6<br>10<br>10 | 65 54 B2X<br>65 54 B5X<br>65 54 BGX<br>65 54 BHX              |
| 120     | 1000        | 3072        |                              | 2        | 1   | 1   | 0   |      | 1  |    | 10.0    | 15<br>25           | 65 54 B4X<br>65 54 B8X  |
| 158     | 5000        | 614         |                              | 1        | 0   | 0   |     | 2    | 0  |    | 5       | 40                 | 65 54 B9X   |
| 170     | 2500        | 1229        |                              | 1        | 0   | 0   |     | 2    |    | 3  | 2.5     | 60                 | 65 54 BAX   |
| 147     | 1000        | 3072        |                              | 1        | 0   | 0   |     | 2    |    | 3  | 1       | 150                | 65 54 BBX   |
| 171     | 4000        | 768         |                              | 0        | x10 | x10 |     | 1    |    | 2  | 0.4     | 400                | 65 54 BCX   |
| 172     | 2500        | 1229        |                              | 0        | x10 | x10 |     | 1    |    | 2  | 0.25    | 1000               | 65 54 BKX   |

### 2.2.1.2 ULTRAFLOW® type 65-X

| CCC No. | Pre-counter | Flow factor | Number of decimals displayed |          |     |     |     |      |    |    | pulse/l | qp (m³/h)                  | Type No.  |
|---------|-------------|-------------|------------------------------|----------|-----|-----|-----|------|----|----|---------|----------------------------|---|
|         |             |             | kWh                          | MWh Gcal | GJ  | m³  | l/h | m³/h | kW | MW |         |                            |   |
| 116     | 3000        | 102         | 0                            | 3        | 2   | 2   | 0   |      | 1  |    | 300     | 0.6                        | 65-X-CAAA-XXX<br>65-X-CAAD-XXX  |
| 197     | 1500        | 205         | 0                            | 3        | 2   | 2   | 0   |      | 1  |    | 150     | 1                          |   |
| 119     | 1000        | 307         | 0                            | 3        | 2   | 2   | 0   |      | 1  |    | 100     | 1.5                        | 65-X-CDAC-XXX<br>65-X-CDAD-XXX<br>65-X-CDAE-XXX<br>65-X-CDAF-XXX<br>65-X-CDAA-XXX |
| 198     | 600         | 512         | 0                            | 3        | 2   | 2   | 0   |      | 1  |    | 60      | 2.5                        |   |
| 136     | 500         | 614         | 0                            | 3        | 2   | 2   | 0   |      | 1  |    | 50.0    | 3.0                        | 65-X-CFAF-XXX<br>65-X-CFBA-XXX  |
| 151     | 5000        | 614         |                              | 2        | 1   | 1   | 0   |      | 1  |    | 50.0    | 3.5                        | 65-X-CGAG-XXX<br>65-X-CGBB-XXX  |
| 137     | 2500        | 1229        |                              | 2        | 1   | 1   | 0   |      | 1  |    | 25.0    | 6<br>6<br>10<br>10         | 65-X-CHAG-XXX<br>65-X-CHBB-XXX<br>65-X-C1AJ-XXX<br>65-X-C1BD-XXX                  |
| 178     | 1500        | 2048        |                              | 2        | 1   | 1   | 0   |      | 1  |    | 15.0    | 10                         | 65-X-CJAJ-XXX<br>65-X-CJBD-XXX  |
| 120     | 1000        | 3072        |                              | 2        | 1   | 1   | 0   |      | 1  |    | 10.0    | 15                         | 65-X-CKBE-XXX   |
| 179     | 600         | 5120        |                              | 2        | 1   | 1   | 0   |      | 1  |    | 6.0     | 25                         | 65-X-CLBG-XXX   |
| 120     | 1000        | 3072        |                              | 2        | 1   | 1   | 0   |      | 1  |    | 10.0    | 25                         | 65-X-C2BG-XXX   |
| 158     | 5000        | 614         |                              | 1        | 0   | 0   |     | 2    | 0  |    | 5.0     | 40                         | 65-X-CMBH-XXX   |
| 170     | 2500        | 1229        |                              | 1        | 0   | 0   |     | 2    |    | 3  | 2.5     | 60                         | 65-X-FABL-XXX<br>65-X-FACL-XXX  |
| 180     | 1500        | 2048        |                              | 1        | 0   | 0   |     | 2    |    | 3  | 1.5     | 100                        | 65-X-FBCL-XXX   |
| 147     | 1000        | 3072        |                              | 1        | 0   | 0   |     | 2    |    | 3  | 1.0     | 150                        | 65-X-FCBN-XXX<br>65-X-FCCC-XXX  |
| 181     | 600         | 5120        |                              | 1        | 0   | 0   |     | 2    |    | 3  | 0.6     | 250                        | 65-X-FDBN-XXX<br>66-X-FDCN-XXX  |
| 171     | 4000        | 768         |                              | 0        | x10 | x10 |     | 1    |    | 2  | 0.4     | 400                        | 65-X-FEBN-XXX<br>65-X-FEBR-XXX<br>65-X-FECN-XXX<br>65-X-FECP-XXX<br>65-X-FECR-XXX |
| 172     | 2500        | 1229        |                              | 0        | x10 | x10 |     | 1    |    | 2  | 0.25    | 600<br>600<br>1000<br>1000 | 65-X-FFCP-XXX<br>65-X-FFCR-XXX<br>65-X-F1BR-XXX<br>65-X-F1CR-XXX                  |
| 182     | 1500        | 2048        |                              | 0        | x10 | x10 |     | 1    |    | 2  | 0.15    | 1000                       | 65-X-FGBR-XXX   |

### 2.2.1.3 ULTRAFLOW® CCC codes for testing

| CCC No. | Pre-counter | Flow factor | Number of decimals displayed |          |    |    |     |      |    |    | pulse/l | qp (m³/h) | Type No. |
|---------|-------------|-------------|------------------------------|----------|----|----|-----|------|----|----|---------|-----------|----------|
|         |             |             | kWh                          | MWh Gcal | GJ | m³ | l/h | m³/h | kW | MW |         |           |          |
| 184     | 300         | 102         | 1                            |          | 3  | 3  | 0   |      | 1  |    | 300     | 0.6       | Test     |
| 199     | 150         | 205         | 1                            |          | 3  | 3  | 0   |      | 1  |    | 150     | 1         | Test     |
| 107     | 100         | 307         | 1                            |          | 3  | 3  | 0   |      | 1  |    | 100     | 1.5       | Test     |
| 136     | 500         | 614         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 50.0    | 3.5       | Test     |
| 138     | 250         | 1229        | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 25.0    | 6<br>10   | Test     |
| 183     | 150         | 2048        | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 15.0    | 10        | Test     |
| 185     | 100         | 3072        | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 10.0    | 15<br>25  | Test     |
| 186     | 500         | 614         |                              | 2        | 1  | 1  |     | 2    | 0  |    | 5.0     | 40        | Test     |
| 187     | 250         | 1229        |                              | 2        | 1  | 1  |     | 2    |    | 3  | 2.5     | 60        | Test     |
| 188     | 150         | 2048        |                              | 2        | 1  | 1  |     | 2    |    | 3  | 1.5     | 100       | Test     |
| 189     | 100         | 3072        |                              | 2        | 1  | 1  |     | 2    |    | 3  | 1.0     | 150       | Test     |
| 191     | 400         | 768         |                              | 1        | 0  | 0  |     | 1    |    | 2  | 0.4     | 400       | Test     |
| 192     | 250         | 1229        |                              | 1        | 0  | 0  |     | 1    |    | 2  | 0.25    | 1000      | Test     |
| 193     | 150         | 2048        |                              | 1        | 0  | 0  |     | 1    |    | 2  | 0.15    | 1000      | Test     |

Note! Above CCC codes cause 10 times more integrations compared to standard codes, and thereby the battery lifetime is reduced. Furthermore, there will be no possibility of data communication at high actual water flow, neither via input modules nor via the optical eye.

### 2.2.1.4 Mechanical flow meters with Reed-contact

| CCC No. | Pre-counter | Flow-factor | Number of decimals displayed |          |    |    |      |    | l/imp. | imp./l | Qmax (m³/h) |
|---------|-------------|-------------|------------------------------|----------|----|----|------|----|--------|--------|-------------|
|         |             |             | kWh                          | MWh Gcal | GJ | m³ | m³/h | MW |        |        |             |
| 000     | 10          | 3072        |                              | 3        | 2  | 2  | 2    | 3  | 1      | 1      | 3           |
| 001     | 4           | 7680        |                              | 3        | 2  | 2  | 2    | 3  | 2.5    | 0.4    | 6           |
| 002     | 1           | 3072        |                              | 3        | 2  | 2  | 1    | 2  | 10     | 0.1    | 30          |
| 003     | 4           | 7680        |                              | 2        | 1  | 1  | 1    | 2  | 25     | 0.04   | 60          |
| 004     | 10          | 3072        |                              | 2        | 1  | 1  | 1    | 2  | 10     | 0.1    | 30          |
| 005     | 40          | 7680        |                              | 1        | 0  | 0  | 1    | 2  | 25     | 0.04   | 60          |
| 006     | 1           | 3072        |                              | 2        | 1  | 1  | 0    | 1  | 100    | 0.01   | 300         |
| 007     | 4           | 7680        |                              | 1        | 0  | 0  | 0    | 1  | 250    | 0.004  | 600         |
| 008     | 1           | 30720       |                              | 1        | 0  | 0  | 0    | 1  | 1000   | 0.001  | 2500        |
| 009     | 28          | 1097        | 0                            | 3        | 2  | 2  | 2    | 3  | 0.357  | 2.8000 | 1.5         |

⚠ With CCC=00X the display updating of water flow and power will be 30 sec. as opposed to 10 sec. for other CCC-codes.

CCC=00X cannot be used in connection with meters with S/N < 4.047.000

### 2.2.1.5 Electronical flow meters with passive output

| CCC No. | Pre-counter | Flow-factor | Number of decimals displayed |     |     |      |    | l/pulse | pulse/l | qp (m³/h)   | Type    |
|---------|-------------|-------------|------------------------------|-----|-----|------|----|---------|---------|-------------|---------|
|         |             |             | MWh Gcal                     | GJ  | m³  | m³/h | MW |         |         |             |         |
| 147     | 1000        | 3072        | 1                            | 0   | 0   | 2    | 3  | 1       | -       | 18...75     | SC-18   |
| 148     | 400         | 7680        | 1                            | 0   | 0   | 2    | 3  | 2.5     | -       | 120...300   | SC-120  |
| 166     | 1000        | 3072        | 0                            | x10 | x10 | 1    | 2  | 10      | -       | 450...1200  | SC-450  |
| 167     | 200         | 15360       | 0                            | x10 | x10 | 1    | 2  | 50      | -       | 1800...3000 | SC-1800 |
| 175     | 7500        | 410         | 1                            | 0   | 0   | 2    | 3  | -       | 7.5     | 15...30     | DF-15   |
| 176     | 4500        | 683         | 1                            | 0   | 0   | 2    | 3  | -       | 4.5     | 25...50     | DF-25   |
| 177     | 2500        | 1229        | 1                            | 0   | 0   | 2    | 3  | -       | 2.5     | 40...80     | DF-40   |

### 2.2.1.6 Vane wheel meters with pick-up

| CCC No. | Pre-counter | Flow-factor | Number of decimals displayed |          |    |    |     |      |    |    | pulse/l | qp (m³/h)        | T type    |
|---------|-------------|-------------|------------------------------|----------|----|----|-----|------|----|----|---------|------------------|-----------|
|         |             |             | kWh                          | MWh Gcal | GJ | m³ | l/h | m³/h | kW | MW |         |                  |           |
| 102     | 560         | 549         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 56.0    | 1.5/2.5          | GWF-MT3   |
| 103     | 300         | 1024        | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 30.0    | 3.5              | GWF-MT3   |
| 104     | 2520        | 1219        |                              | 2        | 1  | 1  | 0   |      | 1  |    | 25.2    | 6                | GWF-MT3   |
| 105     | 1230        | 2498        |                              | 2        | 1  | 1  | 0   |      | 1  |    | 12.3    | 10               | GWF-MT3   |
| 106     | 1080        | 2844        |                              | 2        | 1  | 1  | 0   |      | 1  |    | 10.8    | 15               | GWF-MT3   |
| 108     | 1403        | 219         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 140.3   | 0.6              | GWF       |
| 109     | 957         | 321         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 95.7    | 1.0              | GWF       |
| 110     | 646         | 476         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 64.6    | 1.5              | GWF       |
| 111     | 404         | 760         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 40.4    | 1.5<br>2.5       | HM<br>GWF |
| 112     | 502         | 612         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 50.2    | 1.5 - 2.5*       | GWF       |
| 113     | 2350        | 1307        |                              | 2        | 1  | 1  | 0   |      | 1  |    | 23.5    | 3.5 - 6*         | GWF       |
| 114     | 712         | 4315        |                              | 2        | 1  | 1  | 0   |      | 1  |    | 7.12    | 10 - 15*         | GWF       |
| 115     | 757         | 406         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 75.7    | 1.0*             | GWF       |
| 116     | 3000        | 102         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 300.0   | 0.6*             | GWF       |
| 117     | 269         | 1142        | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 26.9    | 1.5              | Brunata   |
| 118     | 665         | 462         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 66.5    | 1.5              | Aquastar  |
| 119     | 1000        | 307         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 100.0   | 0.6              | HM        |
| 121     | 294         | 1045        | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 29.4    |                  |           |
| 122     | 1668        | 184         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 166.8   | 0.6              | HM        |
| 123     | 864         | 356         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 86.4    | 0.75 - 1*        | HM        |
| 124     | 522         | 589         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 52.2    | 2.5<br>1.5*      | CG<br>HM  |
| 125     | 607         | 506         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 60.7    | 1.5 - 1*<br>1.5* | HM        |
| 126     | 420         | 731         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 42.0    | 1.0<br>2.5*      | CG<br>HM  |
| 127     | 2982        | 1030        |                              | 2        | 1  | 1  | 0   |      | 1  |    | 29.82   | 2.5-3.5*         | HM        |
| 128     | 2424        | 1267        |                              | 2        | 1  | 1  | 0   |      | 1  |    | 24.24   | 3.5*             | HM        |
| 129     | 1854        | 1657        |                              | 2        | 1  | 1  | 0   |      | 1  |    | 18.54   | 6*               | HM        |
| 130     | 770         | 3990        |                              | 2        | 1  | 1  | 0   |      | 1  |    | 7.7     | 10*              | HM        |
| 131     | 700         | 4389        |                              | 2        | 1  | 1  | 0   |      | 1  |    | 7.0     | 15*              | HM        |
| 132     | 365         | 841         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 36.54   | 2.5              | Wehrle    |
| 133     | 604         | 508         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 60.47   | 1.5              | Wehrle    |
| 134     | 1230        | 250         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 123.05  | 0.6              | Wehrle    |
| 135     | 1600        | 1920        |                              | 2        | 1  | 1  | 0   |      | 1  |    | 16.0    | 10*              | HM        |
| 139     | 256         | 1200        | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 25.6    | 1.5 - 2.5        | GWF       |
| 140     | 1280        | 2400        |                              | 2        | 1  | 1  | 0   |      | 1  |    | 12.8    | 3.5 - 5.0        | GWF       |
| 141     | 1140        | 2695        |                              | 2        | 1  | 1  | 0   |      | 1  |    | 11.4    | 6                | GWF       |
| 142     | 400         | 768         |                              | 2        | 1  | 1  |     | 2    |    | 3  | 4       | 10               | GWF       |
| 143     | 320         | 960         |                              | 2        | 1  | 1  |     | 2    |    | 3  | 3.2     | 10 - 15          | GWF       |
| 144     | 1280        | 2400        |                              | 1        | 0  | 0  |     | 2    |    | 3  | 1.28    | 25 - 40          | GWF       |
| 145     | 640         | 4800        |                              | 1        | 0  | 0  |     | 2    |    | 3  | 0.64    | 60               | GWF       |
| 146     | 128         | 24000       |                              | 1        | 0  | 0  |     | 2    |    | 3  | 0.128   | 125              | GWF       |
| 152     | 1194        | 2573        |                              | 2        | 1  | 1  | 0   |      | 1  |    | 11.94   | 10               | GWF       |
| 153     | 1014        | 3030        |                              | 2        | 1  | 1  | 0   |      | 1  |    | 10.14   | 15               | GWF       |
| 156     | 594         | 517         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 59.4    | 1.5              | Metron    |
| 157     | 3764        | 816         |                              | 2        | 1  | 1  | 0   |      | 1  |    | 37.64   | 2.5              | Metron    |
| 163     | 1224        | 251         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 122.4   | 0.6 - 1.0        | GWF/U2    |
| 164     | 852         | 360         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 85.24   | 1.5              | GWF/U2    |
| 165     | 599         | 513         | 0                            | 3        | 2  | 2  | 0   |      | 1  |    | 59.92   | 2.5              | GWF/U2    |
| 168     | 449         | 6848        |                              | 2        | 1  | 1  | 0   |      | 1  |    | 4.486   | 15/25            | HM/WS     |
| 169     | 1386        | 2216        |                              | 1        | 0  | 0  |     | 2    | 0  |    | 1.386   | 40               | HM/WS     |
| 173     | 500         | 615         |                              | 1        | 0  | 0  |     | 1    |    | 2  | 0.5     | 80               | Westland  |

\* = multijet

### 2.3 CONFIG., DD-E-FF-GG-M-N

CONFIG. describes the configuration possibilities that MULTICAL® Type 66-CDE can offer.

Changes in CONFIG. which do not change the legal energy calculation, can be made without subsequent reverification.

As MULTICAL® Type 66-C is type approved for billing with respect to both "energy" and "volume" changes affecting the first two display readings can only be made by total programming.

66-B ⇒ 66-CDE

The table at the right indicates which DD-codes from 66-B are totally or partially covered by DD-codes for 66-C.

| 66-C | 66-B        |
|------|-------------|
| 12   | 13-23-32    |
| 16   | 17-22-27-31 |
| 18   | 19-33       |
| 20   | 29-34       |
| 24   | 37          |

#### 2.3.1.1 >DD< Display indication codes for 66-C

| 66-C<br>Standard og læk | DD=00...59 |
|-------------------------|------------|
|-------------------------|------------|

|                   | ➤ Primary display readings |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
|-------------------|----------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|
|                   | 12                         | 16 | 18 | 20 | 21 | 24 | 28 | 36 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 |  |
| Heat energy       | 1                          | 1  | 1  | 1  | 1  | 1  |    | 11 | 1  | 1  | 1  | 1  | 1  |    | 1  | 1  | 1  | 1  | 2  | 1  | 1  | 1  |    | 1  | 2  | 2  | 1  | 1  |  |
| Volume            | 2                          | 2  | 2  | 2  | 2  | 2  | 3  | 1  | 2  | 2  | 2  | 2  | 2  | 1  | 2  | 2  | 2  | 2  | 1  | 2  | 2  | 2  | 2  | 2  | 1  | 1  | 2  | 2  |  |
| Hour counter      | 3                          | 3  | 3  | 3  | 3  | 3  |    | 2  | 3  | 3  | 3  | 3  | 3  | 4  | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3  |  |
| t1                | 4                          | 4  | 4  | 4  | 4  | 4  |    | 3  | 4  | 4  | 4  | 4  | 4  |    | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  |  |
| t2                | 5                          | 5  | 5  | 5  | 5  | 5  |    | 4  | 5  | 5  | 5  | 5  | 5  |    | 5  | 5  | 5  | 5  | 5  | 5  | 5  | 5  | 5  | 5  | 5  | 5  | 5  | 5  |  |
| Δt (t1-t2)        | 6                          | 6  | 6  | 6  | 6  | 6  |    | 5  | 6  | 6  | 6  | 6  | 6  |    | 6  | 6  | 6  | 6  | 6  | 6  | 6  | 6  | 6  | 6  | 6  | 6  | 6  | 6  |  |
| Power             | 7                          | 7  | 7  | 7  | 7  | 7  |    | 6  | 7  | 7  | 7  | 7  | 7  |    | 7  | 7  | 7  | 7  |    | 7  | 7  | 7  | 7  |    |    | 8  | 7  |    |  |
| Peak power        | 8                          | 8  | 8  | 8  |    |    |    |    |    |    | 8  | 8  |    |    | 8  |    | 8  |    |    |    | 8  | 8  |    |    |    |    |    |    |  |
| Annual Peakpwr    |                            |    |    | 9  |    |    |    |    |    |    | 9  | 9  | 8  |    |    | 8  | 9  | 8  |    |    |    |    |    |    | 8  | 9  |    |    |  |
| Annual Peak date  |                            |    |    | 10 |    |    |    |    |    |    | 10 | 10 | 9  |    |    | 9  | 10 | 9  |    |    |    |    |    |    | 9  | 10 |    |    |  |
| Flow              | 9                          | 9  | 9  | 11 | 8  | 8  | 1  | 7  | 8  | 8  | 11 | 11 | 10 | 2  | 9  | 10 | 11 | 10 | 7  | 8  | 9  | 9  | 8  |    | 7  | 7  | 8  | 7  |  |
| Peak flow         |                            |    |    | 12 | 9  | 9  | 2  | 8  |    |    | 12 | 12 |    | 3  | 10 |    | 12 |    |    |    | 10 | 10 |    |    |    |    |    |    |  |
| Annual Peak flow  |                            |    |    | 13 | 10 |    |    |    |    |    | 13 | 13 |    |    |    |    | 13 |    |    |    |    |    |    |    |    |    |    |    |  |
| Info              | 10                         | 10 | 10 | 14 | 11 | 10 |    | 9  | 9  | 9  | 14 | 14 | 11 |    | 11 | 11 | 14 | 11 | 8  | 9  | 11 | 11 | 9  | 7  | 10 | 11 | 9  | 8  |  |
| Info hour counter | 11                         | 11 | 11 | 15 | 12 | 11 |    | 10 | 10 | 10 | 15 | 15 | 12 |    | 12 | 12 | 15 | 12 | 9  | 10 | 12 | 12 | 10 | 8  | 11 | 12 | 1  | 9  |  |

|                | ○ Secondary readings |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|----------------|----------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|                | 12                   | 16 | 18 | 20 | 21 | 24 | 28 | 36 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 |
| Cooling energy |                      |    |    |    |    |    |    |    | A  |    |    |    |    |    |    |    |    |    |    |    |    |    | A  |    |    |    |    |    |
| m3tf           |                      |    |    |    |    |    |    |    |    |    |    |    | C  |    |    | C  |    | C  |    |    |    |    |    |    |    |    |    |    |
| m3tr           |                      |    |    |    |    |    |    |    |    |    |    |    | D  |    |    | D  |    | D  |    |    |    |    |    |    |    |    |    |    |
| TA2            |                      | A  |    | A  |    | A  |    | A  |    | A  | A  | A  | A  |    |    | A  | A  | A  | A  | B  | A  |    | C  | A  | A  | A  | C  |    |
| TA3            |                      | B  |    | B  | A  | B  |    | B  |    | B  | C  | C  | B  |    |    | B  | C  | B  | B  | C  | B  |    | 1  | B  | B  | B  | E  |    |
| TL2            |                      | C  |    | C  |    |    |    |    |    | C  | B  | B  |    |    | A  |    | B  |    |    |    |    |    | D  | C  |    |    | D  |    |
| TL3            |                      | D  |    | D  |    |    |    |    |    | D  | D  | D  |    |    | B  |    | D  |    |    |    |    |    | B  | D  |    |    | F  |    |
| VA             |                      |    | A  | E  |    |    |    |    | B  | E  |    | E  |    |    |    | E  |    | E  |    | A  |    |    |    | E  |    |    | A  |    |
| VB             |                      |    | B  | F  |    |    |    |    | C  | F  |    | F  |    |    |    | F  |    |    |    |    |    |    |    | F  |    |    | B  |    |
| t3             |                      |    |    | G  |    |    |    |    | D  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| P1             |                      |    |    | H  |    |    |    |    | E  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| P2             |                      |    |    | I  |    |    |    |    | F  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Costumer No.   | A                    | E  | C  | J  | B  | C  | A  | C  | G  | G  | E  | G  | E  | A  | C  | G  | E  | F  | C  | D  |    | A  | E  | G  | C  | C  | G  | A  |
| Clock          |                      |    |    | K  |    |    |    |    |    |    |    |    |    |    | D  |    | F  | G  |    |    |    |    |    |    |    |    | B  |    |
| Date           | B                    | F  | D  | L  | C  | D  |    | D  | H  | H  | F  | H  | F  |    | E  | H  | G  | H  | D  | E  | C  | B  | F  | H  | D  | D  | H  | C  |
| Target date    | C                    | G  | E  | M  | D  | E  |    | E  |    |    | G  | I  | G  |    |    | I  | H  | I  | E  | F  | D  |    | G  |    | E  | E  |    |    |
| Segment test   | D                    | H  | F  | N  | E  | F  | B  | F  | I  | I  | H  | J  | H  | B  | F  | J  | I  | J  | F  | G  | E  | C  | H  | II | F  | F  | J  | D  |

### 2.3.1.2 >DD< Display indication codes for 66-D

|                                   |                   |
|-----------------------------------|-------------------|
| <b>66-D</b><br><b>Open system</b> | <b>DD=80...99</b> |
|-----------------------------------|-------------------|

| <b>&gt; Primary display readings</b> |           |           |           |  |  |  |  |  |  |  |  |  |
|--------------------------------------|-----------|-----------|-----------|--|--|--|--|--|--|--|--|--|
|                                      | <b>80</b> | <b>81</b> | <b>82</b> |  |  |  |  |  |  |  |  |  |
| Δ-energy                             | 1         | 1         | 1         |  |  |  |  |  |  |  |  |  |
| V1-volume                            | 2         |           | 2         |  |  |  |  |  |  |  |  |  |
| V1-mass <sup>1)</sup>                |           | 2         |           |  |  |  |  |  |  |  |  |  |
| V1-flow                              | 3         | 3         |           |  |  |  |  |  |  |  |  |  |
| V1-Peak flow                         | 4         | 4         |           |  |  |  |  |  |  |  |  |  |
| V1-Power                             | 5         |           |           |  |  |  |  |  |  |  |  |  |
| V2-volume                            | 6         |           | 3         |  |  |  |  |  |  |  |  |  |
| V2-mass <sup>1)</sup>                |           | 5         |           |  |  |  |  |  |  |  |  |  |
| V2-flow                              | 7         | 6         |           |  |  |  |  |  |  |  |  |  |
| t1                                   | 8         | 7         | 4         |  |  |  |  |  |  |  |  |  |
| t2                                   | 9         | 8         | 5         |  |  |  |  |  |  |  |  |  |
| t3                                   | 10        | 9         | 6         |  |  |  |  |  |  |  |  |  |
| Hour counter                         | 11        | 10        | 7         |  |  |  |  |  |  |  |  |  |
| PR1                                  | 12        | 11        | 8         |  |  |  |  |  |  |  |  |  |
| PR2                                  | 13        | 12        | 9         |  |  |  |  |  |  |  |  |  |
| Info                                 | 14        | 13        | 10        |  |  |  |  |  |  |  |  |  |
| Info hour counter                    | 15        | 14        | 11        |  |  |  |  |  |  |  |  |  |

| <b>O Secondary display readings</b> |           |           |           |  |  |  |  |  |  |  |  |  |
|-------------------------------------|-----------|-----------|-----------|--|--|--|--|--|--|--|--|--|
|                                     | <b>80</b> | <b>81</b> | <b>82</b> |  |  |  |  |  |  |  |  |  |
| VA                                  | A         | A         | A         |  |  |  |  |  |  |  |  |  |
| VB                                  | B         | B         | B         |  |  |  |  |  |  |  |  |  |
| P1                                  | C         | C         | C         |  |  |  |  |  |  |  |  |  |
| P2                                  | D         | D         | D         |  |  |  |  |  |  |  |  |  |
| Customer No.                        | E         | E         | E         |  |  |  |  |  |  |  |  |  |
| Clock                               | F         | F         | F         |  |  |  |  |  |  |  |  |  |
| Date                                | G         | G         | G         |  |  |  |  |  |  |  |  |  |
| Target date                         | H         | H         | H         |  |  |  |  |  |  |  |  |  |
| Qsum1                               | I         | I         | I         |  |  |  |  |  |  |  |  |  |
| Qsum2                               | J         | J         | J         |  |  |  |  |  |  |  |  |  |
| Segment test                        | K         | K         | K         |  |  |  |  |  |  |  |  |  |

<sup>1)</sup> Display of mass will be updated every hour.

### 2.3.1.3 >DD< Display indication codes for 66-E

|                                     |                   |
|-------------------------------------|-------------------|
| <b>66-E</b><br><b>Closed system</b> | <b>DD=60...79</b> |
|-------------------------------------|-------------------|

|                       | ➤ <b>Primary display readings</b> |    |    |    |    |    |    |    |  |    |  |  |  |
|-----------------------|-----------------------------------|----|----|----|----|----|----|----|--|----|--|--|--|
|                       | 60                                | 61 | 62 | 63 | 64 | 65 | 66 | 67 |  | 79 |  |  |  |
| V1-energy             | 1                                 | 1  | 1  | 1  | 1  | 1  | 1  | 1  |  |    |  |  |  |
| V1-volume             | 2                                 | 2  | 2  | 2  | 2  | 2  | 2  | 2  |  |    |  |  |  |
| V1-mass <sup>1)</sup> |                                   |    |    |    |    | 3  |    |    |  |    |  |  |  |
| V1-flow               | 3                                 | 3  | 3  | 3  | 3  | 4  | 3  |    |  | 3  |  |  |  |
| V1-peak flow          |                                   |    | 4  | 4  |    | 5  | 4  |    |  |    |  |  |  |
| V1-Power              | 4                                 | 4  | 5  | 5  | 4  | 6  | 5  |    |  |    |  |  |  |
| V1-peak power         | 5                                 | 5  |    |    | 5  | 7  | 6  |    |  |    |  |  |  |
| V2-volume             | 6                                 |    | 6  |    | 6  | 8  | A  | 3  |  |    |  |  |  |
| V2-mass <sup>1)</sup> |                                   |    |    |    |    | 9  |    |    |  |    |  |  |  |
| V2-flow               | 7                                 |    | 7  |    | 7  | 10 | B  |    |  | 4  |  |  |  |
| t1                    | 8                                 | 6  | 8  | 6  | 8  | 11 | 7  | 4  |  | 1  |  |  |  |
| t2                    | 9                                 | 7  | 9  | 7  | 9  | 12 | 8  | 5  |  | 2  |  |  |  |
| Δt (t1-t2)            | 10                                | 8  | 10 | 8  | 10 | 13 | 9  | 6  |  |    |  |  |  |
| Hour counter          | 11                                | 9  | 11 | 9  | 11 | 14 | 10 | 7  |  |    |  |  |  |
| PR1                   | 12                                | 10 | 12 | 10 | 12 | 15 |    | 8  |  |    |  |  |  |
| PR2                   | 13                                | 11 | 13 | 11 | 13 | 16 |    | 9  |  |    |  |  |  |
| Info                  | 14                                | 12 | 14 | 12 | 14 | 17 | 11 | 10 |  |    |  |  |  |
| Info hour counter     | 15                                | 13 | 15 | 13 | 15 | 18 | 12 | 11 |  |    |  |  |  |

|              | ○ <b>Secondary display readings</b> |    |    |    |    |    |    |    |  |    |  |  |  |
|--------------|-------------------------------------|----|----|----|----|----|----|----|--|----|--|--|--|
|              | 60                                  | 61 | 62 | 63 | 64 | 65 | 66 | 67 |  | 79 |  |  |  |
| TA2          |                                     |    |    |    |    |    |    |    |  |    |  |  |  |
| TA3          |                                     |    |    |    |    |    |    |    |  |    |  |  |  |
| TL2          |                                     |    |    |    |    |    |    |    |  |    |  |  |  |
| TL3          |                                     |    |    |    |    |    |    |    |  |    |  |  |  |
| VA           | A                                   | A  | A  | A  | A  | A  |    | A  |  | A  |  |  |  |
| VB           | B                                   | B  | B  | B  | B  | B  |    | B  |  | B  |  |  |  |
| t3           |                                     |    |    |    | C  | C  |    |    |  |    |  |  |  |
| P1           |                                     |    |    |    | D  | D  |    |    |  |    |  |  |  |
| P2           |                                     |    |    |    | E  | E  |    |    |  |    |  |  |  |
| Customer No. | C                                   | C  | C  | C  | F  | F  | C  | C  |  |    |  |  |  |
| Clock        | D                                   | D  | D  | D  | G  | G  |    | D  |  |    |  |  |  |
| Date         | E                                   | E  | E  | E  | H  | H  | D  | E  |  |    |  |  |  |
| Target date  | F                                   | F  | F  | F  | I  | I  | E  | F  |  |    |  |  |  |
| Segment test | G                                   | G  | G  | G  | J  | J  | F  | G  |  | C  |  |  |  |

<sup>1)</sup> Display of mass will be updated every hour.

Number/letter = Display choice

1 = First primary reading

A = First secondary reading

66-B ⇒ 66-CDE

Info code only displays current conditions. Info code will be reset shortly after the fault has been corrected. While the fault is apparent the hour counter will stop and info hour counter will be activated.



**2.3.2 >E< CONFIGURATION OF MULTITARIF**  
MULTICAL® Type 66-C and -E have 2 extra energy registers; TA2 and TA3 which can accumulate energy for a programmed tariff condition parallel with the main register. The measuring unit for TA2 and TA3 is always identical to that of the main register (kWh, MWh, GJ or Gcal), but only TA2 and TA3 appear in the unit section.

The main register is always accumulated, as this is considered to be the legal billing register,

irrespective of the selected tariff function. The tariff conditions TL2 and TL3 are monitored at each integration for temperature regulated tariffs, and at every 30th second for power and flow controlled tariffs. When the tariff conditions are fulfilled, the amount of thermal energy used will be enumerated in either TA2 or TA3 parallel to the main register.

2 tariff conditions – TL2 and TL3 – are linked to each tariff function, used in the same tariff type. It is not possible to “mix” the two tariff types.

The table states which tariff types MULTICAL® Type 66-C and -E can be configured to:

| E= | TARIFF TYPE  | Pil | FUNCTION   |
|----|--|-----|--|
| 0  | No tariff active   | -   | No function  |
| 1  | Power tariff   | 7   | Energy will be accumulated in TA2 and TA3 based on the flow limits in TL2 and TL3.   |
| 2  | Flow tariff  | 8   | Energy will be accumulated in TA2 and TA3 based on the flow limits in TL2 and TL3.   |
| 3  | Cooling tariff   | 6   | Energy will be accumulated in TA2 and TA3 based on the $\Delta t$ -limits in TL2 and TL3.  |
| 4  | Not in use   | -   | No function  |
| 5  | Return temperature tariff  | 5   | Energy will be accumulated in TA2 and TA3 based on the $t_r$ -limits in TL2 and TL3.   |
| 6  | TA2= $t_f$ and TA3= $t_r$ ,<br>Average per month<br>(TL2 and TL3 are not in use) | -   | Average is calculated every 24 hours on the basis of $m3 \cdot t_f$ and $m3 \cdot t_r$ . Reset every month on the appointed day and transferred to monthly logger (TA2 and TA3 in the annual logger are set to “0”).     |
| 7  | TA2= $t_f$ and TA3= $t_r$ ,<br>Average per year<br>(TL2 and TL3 are not in use)  | -   | Average is calculated every 24 hours on the basis of $m3 \cdot t_f$ and $m3 \cdot t_r$ . Reset every year on the appointed date and transmitted to the annual logger (TA2 and TA3 in the monthly logger are set to “0”). |
| 9  | Time controlled tariff   | -   | TL2=Start time for TA2<br>TL3=Start time for TA3   |
| A  | PQ-limiter<br>(TA2 and TA3 are not in use)                                       | -   | TL2 = Power limit and TL3 = Flow limit.<br>(With just power limitation Q is set at max. and vice versa).   |

66-B  $\Rightarrow$  66-CDE

Two of the tariff functions in 66-B, *Bonus numbers and External controlled tariff*, are not included in 66-CDE.

#### 2.3.2.1 TARIFF TYPES

##### E=0) NO TARIFF ACTIVE

If the tariff function should not be used, the set up is selected to E=0.

However, the tariff function can later be made active by reconfiguration using METERTOOL for MULTICAL® Type 66-CDE.

See section 7. *Programming via METERTOOL*.

##### E=1) POWER CONTROLLED TARIFF

When the current heat power (P), in kW or MW, is larger than TL2 but less than TL3, the thermal energy in TA2 is counted parallel to the primary register. If the current power becomes larger than TL3, the thermal energy in TA3 is counted parallel to the primary register.

|                 |   |
|-----------------|---|
| $P < TL2$       | Only counting in the primary register       |
| $TL3 > P > TL2$ | Counting in TA2 and in the primary register |
| $P > TL3$       | Counting in TA3 and in the primary register |

TL3 must always be set to a higher value than TL2. The power controlled tariff can be used as a basis for the individual heat consumer's connection fee. In addition this tariff form can give valuable statistical data, when the district heating stations evaluate new plant activities.

##### E=2) FLOW CONTROLLED TARIFF

When the current water flow (q), in l/h or m<sup>3</sup>/h, is larger than TL2 but less than TL3, the thermal energy in TA2 is counted parallel to the primary register. If the actual water flow becomes larger than TL3, the thermal energy in TA3 is counted parallel to the main register.

|                 |   |
|-----------------|---|
| $q < TL2$       | Only counted in the primary register    |
| $TL3 > q > TL2$ | Counted in TA2 and the primary register |
| $q > TL3$       | Counted in TA3 and the primary register |

TL3 must always be set to a higher value than TL2.

The flow controlled tariff can be used as a basis for the individual heat consumer's connection fee. In addition this tariff form can give valuable statistical data, when the district heating stations evaluating plant activities.

When the power or flow controlled tariff is used, a general survey is given of the total consumption compared to the part of the consumption which is used in excess of the tariff limits.



**E=3) COOLING TARIFF ( $\Delta t$ )**

When the actual cooling ( $\Delta t$ ), in °C, is less than TL2, but larger than TL3, the thermal energy in TA2 is counted parallel to the primary register. If the actual cooling drops to less than TL3, the thermal energy in TA3 is counted parallel to the main register.

|                        |   |
|------------------------|---|
| $\Delta t > TL2$       | Counting only in primary register       |
| $TL3 < \Delta t < TL2$ | Counting in TA2 and in primary register |
| $\Delta t < TL3$       | Counting in TA3 and in primary register |

TL3 must always be set to a lower value than TL2 as shown in below example with TL2=30.00°C and TL3=20.00°C:



The cooling tariff can form the basis of a weighted user payment. A low cooling (small difference between flow and return flow temperature) results in poor economy from the heat supplier's point of view.

**E=5) RETURN TEMPERATURE TARIFF**

When the current return temperature ( $t_r$ ), in °C, is larger than TL2 but less than TL3, the thermal energy in TA2 is counted parallel to the main register.

|                   |                                      |
|-------------------|--------------------------------------|
| $t_r < TL2$       | Counting only in main register       |
| $TL3 > t_r > TL2$ | Counting in TA2 and in main register |
| $t_r > TL3$       | Counting in TA3 and in main register |

TL3 must always be set to a higher value than TL2. The return temperature tariff can form the basis of a weighted user payment. A high return temperature indicates an inadequate utilization of the heat and thereby a poor economy from the heat supplier's point of view.

**E=6) AVERAGE TEMPERATURE PER MONTH**

This tariff type does not use TL2 and TL3. For each energy integration the flow temperature ( $t_f$ ) and the return temperature ( $t_r$ ) are used in an average calculation which is updated every 24 hours at midnight.

The average calculation covers 1 month at a time and will automatically be reset every month on the target day. The results are stored as monthly data and will be available for 36 months.

|               |                  |     |
|---------------|------------------|-----|
| Average $t_f$ | $\Sigma t_f / n$ | TA2 |
| Average $t_r$ | $\Sigma t_r / n$ | TA3 |

The display shows the current month's average temperatures covering  $t_f$  and  $t_r$  respectively as TA2 and TA3. The display definition is °C without decimals as shown in examples below:



**E=7) AVERAGE TEMPERATURE PER YEAR**

This tariff type does not use TL2 and TL3. For each energy integration the flow temperature ( $t_f$ ) and the return temperature ( $t_r$ ) are put in an average calculation which is updated every 24 hours at midnight.

The average calculations cover 1 year and will automatically be reset every year on the target date. The results are stored as annual data and will be available for 15 years.

|               |                  |     |
|---------------|------------------|-----|
| Average $t_F$ | $\Sigma t_F / n$ | TA2 |
| Average $t_R$ | $\Sigma t_R / n$ | TA3 |

The display shows the current year's average temperatures for  $t_F$  and  $t_R$  respectively as TA2 and TA3. The display definition is °C without decimals as shown in above examples.

### E=9) TIME CONTROLLED TARIFF

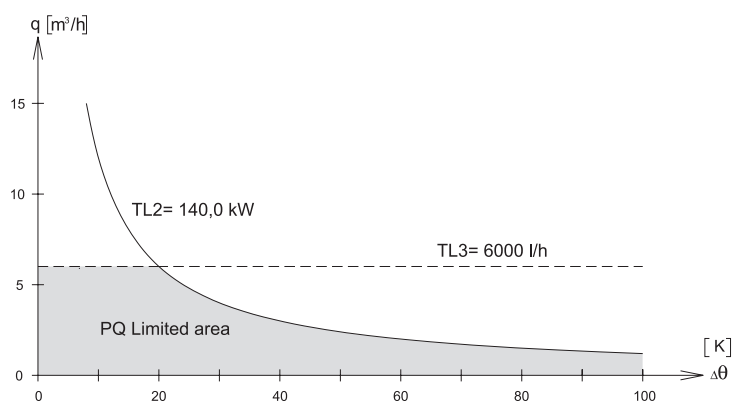
The time controlled tariff is used to register heat consumption for a particular period. If TL2 = 08.00.00 and TL3 = 16.00.00, the entire day's consumption will be registered in TA2 while the evening's and the night's consumption will be registered in TA3.

|                   |                                      |
|-------------------|--------------------------------------|
| TL2 < Clock < TL3 | Counting in TA2 and in main register |
| TL3 < Clock < TL2 | Counting in TA3 and in main register |

### E=A) PQ-LIMITER

When this function is selected MULTICAL® Type 66-C is able to control a motor-operated valve based on the power and flow limits which have been set for TL2 = power limit value and TL3 = flow limit value.

TA2 and TA3 are not in use when the PQ-limiter is selected.



Above diagram shows how the PQ-limiter function ensures that a power limit of 140 kW is not exceeded. In connection with low cooling (e.g. below 20 K) the limiter function also ensures that a flow limit of 6,000 l/h is not exceeded.

If just a power limit is required, the flow limit value TL3 is set to the maximum area  $q_s$  of the flow meter and vice versa if just a flow limit is required.

When tariff type E=A is selected the pulse outputs CE and CV are used as UP and DOWN control outputs for a motor-operated valve. The pulse outputs can be used together with following plug-in modules:

- Data/pulse outputs Type: 66-02
- Telephone modem/pulse outputs Type: 66-05
- M-Bus pulse outputs Type: 66-09

The limiter function requires a relatively fast signal from the flow meter, and thereby mechanical flow meters with Reed-contact outputs (CCC=0XX) cannot be used. In addition CONFIG FF and GG have to be set to *outputs* as shown below:

| CE output<br>Terminal 16-17 |  | CV output<br>Terminal 18-19 |  |
|-----------------------------|--|-----------------------------|--|
| FF                          |  | GG                          |  |
| 00                          |  | 00                          |  |

As the pulse outputs from the meter only are intended for electric signal levels (small circuits and voltages) a Flow Controller module, Type No. S7590006 must be used.

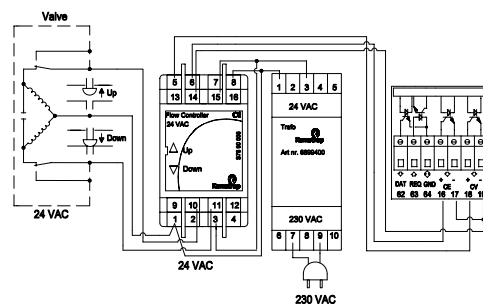
### Technical data

Flow Controller, Type No. S7590006

|                          |  |
|--------------------------|--|
| Relay type:              | Solid State,<br>galvanically separated |
| Power supply (8-15):     | 24 VAC +/- 30%                         |
| Motor supply (1-3):      | 24 VAC                                 |
| Motor current (1-10-11): | < 1.0 A                                |
| Mutual lock-out:         | Built-in                               |

Most 24 VAC motor-operated valves on the market can be used.

The motor-operated valve must have a total valve drift of 120...460 sec.



If a motor-operated valve has a spindle velocity of 10 sec./mm and the matching valve a spindle drift of 25 mm, the total valve drift will be 250 sec. Faster motor-operated valves with spindle velocities of e.g. 1...3 sec./mm are generally not suitable for heat systems and cannot be used in connection with MULTICAL® Type 66-C.

The regulation parameters are set to (qp/180 sec) on delivery. When running the PQ-Controller in, the parameters can be changed with MULTITERM or METERTOOL.

### Entering tariff limits

When MULTITERM is used for entering tariff limits for MULTICAL® Type 66-C and -E's they must be written as digits and decimals, without decimal points. The temperature tariffs (E=3 and E=5) must always be entered in °C with 2 decimals, whereas the power and flow tariffs (E=1 and E=2) will vary both as regards unit of measurement and number of decimals, depending on the flow meter code (CCC No.) selected.

In addition please note that:

TL3 must be *larger* than TL2 in connection with code E=1, 2, 5, 9 and A.

TL3 must be *less* than TL2 in connection with code E=3 (Δt tariff).

### Ex. 1: Δt tariff (E=3)

TL2 = 30.00°C and TL3 = 20.00°C result in:  
TL2 = 3000 and TL3 = 2000

**Ex. 2: Power tariff (E=1)**

TL2 = 10.0 kW and TL3 = 15.0 kW result in:

TL2 = 100 and TL3 = 150

**Ex. 3: PQ-limiter (E=A)**

TL2 = 140.0 kW and TL3 = 6000 l/h result in:

TL2 = 1400 and TL3 = 6000

When using METERTOOL the decimal point is placed by the PC program.

**2.3.3 >FF< and >GG< Configuration of extra pulse input and output**

In addition to the two flow meter inputs – V1 and V2 – MULTICAL® Type 66-CDE also has 2 additional I/O ports which can be used either as in or output, depending on the configuration.

The >FF< and >GG< codes determine whether the 2 additional I/O ports are used as in or outputs, provided that the plug-in module fits. When I/O ports are used as inputs, the >FF< and >GG< codes also determine pulse separation and resolution.

**2.3.3.1 Pulse outputs**

The pulse outputs are activated by configuring both FF=00 and GG=00. The I/O ports then function as pulse outputs, where CE (Counter Energy) transmits 1 pulse for the least important digit in the energy display for heat energy, and CV (Counter Volume) transmits 1 pulse for the least important digit in the volume display.

When tariff type E=A is selected the outputs are instead as UP/DOWN control outputs for a motor-operated valve.

The pulse outputs can be used together with following plug-in modules:

- 2 Data/pulse outputs
- 5 Telephone modems/pulse outputs
- 9 M-Bus/pulse outputs
- G Radio/pulse outputs
- H Radio/pulse output external antennae

| CE output<br>Terminal 16-17 |  | CV output<br>Terminal 18-19 |  |
|-----------------------------|--|-----------------------------|--|
| FF                          |  | GG                          |  |
| 00                          |  | 00                          |  |

**2.3.3.2 Pulse inputs**

When the two extra I/O ports are set up as pulse inputs, FF and GG can be configured individually. This makes it possible to connect e.g. a water meter and an electricity meter. The register values can be preset via METERTOOL (S/N > 4,047,000).

The pulse inputs can be used together with the following plug-in modules:

- 1 – Data/pulse inputs
- 3 – Telephone modem/pulse inputs + Data
- 4 – M-Bus/pulse inputs
- A – Radio/pulse inputs
- B – Radio/pulse inputs external antennae
- D – 4..20 mA inputs/Data/pulse inputs
- F – LonWorks FTT-10A/pulse inputs
- 8 – M-Bus/pulse inputs

Please refer to section 5. *Plug-in modules* for information pertaining to electrical connections.

| Input a<br>Terminal 65-66 |                          | Input b<br>Terminal 67-68 |                          |            |          |         |                                     |          |
|---------------------------|--------------------------|---------------------------|--------------------------|------------|----------|---------|-------------------------------------|----------|
| FF                        | Max. Input<br>f ≤ 0.5 Hz | GG                        | Max. Input<br>f ≤ 3.0 Hz | Precounter | Wh/pulse | l/pulse | Measuring unit and<br>comma placing |          |
| 01                        | 50 m³/h                  | 01                        | 250 m³/h                 | 1          | -        | 100     | m³a - m³b                           | 000000.0 |
| 02                        | 25 m³/h                  | 02                        | 125 m³/h                 | 2          | -        | 50      | m³a - m³b                           | 000000.0 |
| 03                        | 12 m³/h                  | 03                        | 60 m³/h                  | 4          | -        | 25      | m³a - m³b                           | 000000.0 |
| 04                        | 5 m³/h                   | 04                        | 25 m³/h                  | 10         | -        | 10      | m³a - m³b                           | 000000.0 |
| 05                        | 2.5 m³/h                 | 05                        | 12 m³/h                  | 20         | -        | 5.0     | m³a - m³b                           | 000000.0 |
| 06                        | 1 m³/h                   | 06                        | 6 m³/h                   | 40         | -        | 2.5     | m³a - m³b                           | 000000.0 |
| 07                        | 0.5 m³/h                 | 07                        | 2.5 m³/h                 | 100        | -        | 1.0     | m³a - m³b                           | 000000.0 |
| 24                        | 5 m³/h                   | 24                        | 25 m³/h                  | 1          | -        | 10      | m³a - m³b                           | 00000.00 |
| 25                        | 2.5 m³/h                 | 25                        | 12 m³/h                  | 2          | -        | 5.0     | m³a - m³b                           | 00000.00 |
| 26                        | 1 m³/h                   | 26                        | 6 m³/h                   | 4          | -        | 2.5     | m³a - m³b                           | 00000.00 |
| 27                        | 0.5 m³/h                 | 27                        | 2.5 m³/h                 | 10         | -        | 1.0     | m³a - m³b                           | 00000.00 |
| 40                        | 500 m³/h                 | 40                        | 2500m³/h                 | 1          | -        | 1000    | m³a - m³b                           | 0000000  |
| 50                        | 2500 kW                  |                           |                          | 1          | 1000     | -       | EL                                  | 0000000  |
| 51                        | 50 kW                    |                           |                          | 60         | 16.67    | -       | EL                                  | 0000000  |
| 52                        | 40 kW                    |                           |                          | 75         | 13.33    | -       | EL                                  | 0000000  |
| 53                        | 25 kW                    |                           |                          | 120        | 8.333    | -       | EL                                  | 0000000  |
| 54                        | 10 kW                    |                           |                          | 240        | 4.167    | -       | EL                                  | 0000000  |
| 55                        | 8 kW                     |                           |                          | 340        | 2.941    | -       | EL                                  | 0000000  |
| 56                        | 6 kW                     |                           |                          | 480        | 2.083    | -       | EL                                  | 0000000  |
| 57                        | 5 kW                     |                           |                          | 600        | 1.667    | -       | EL                                  | 0000000  |
| 58                        | 2.5 kW                   |                           |                          | 1000       | 1.000    | -       | EL                                  | 0000000  |
| 59                        | 250 kW                   |                           |                          | 10         | 100      | -       | EL                                  | 0000000  |

#### 2.3.4 >MN< Configuration of leak limits

| District heating leak detection (V1-V2) |                            | Cold water leak detection (VA) |   |
|---|----------------------------|--------------------------------|---|
| M=                                      | Sensitivity in leak search | N=                             | Constant leak at no consumption (Pulse resolution 10 l/imp) |
| 0                                       | OFF                        | 0                              | OFF   |
| 1                                       | 1.0% qp + 20% q            | 1                              | 30 l/h  |
| 2                                       | <b>1.0% qp + 10% q</b>     | 2                              | <b>20 l/h</b>   |
| 3                                       | 0.5% qp + 20% q            | 3                              | 15 l/h  |
| 4                                       | 0.5% qp + 10% q            |                                |   |

**M=2 and N=2 are recommended for single-family houses**

#### 2.4 >DATA< for configuration

|                               | Automatically   | Order placement     | Default on delivery              |
|-------------------------------|---|---------------------|----------------------------------|
| Serial no./year               | e.g. 1000000/2000                                     | -                   | -                                |
| Customer no.                  | -   | 11 digits           | Customer no.=Serial no.          |
| Target date                   | -   | MM=1-12 and DD=1-28 | 06.01                            |
| TL2                           | -   | 5 digits            | 0                                |
| TL3                           | -   | 5 digits            | 0                                |
| Peak Avr. time                | -   | 1...1440 min.       | 60 min.                          |
| RS232 data add.               | -   | Addr. 0...126       | Addr. 0                          |
| Temp t2, Open system          | -   | 0.00 to 50.00 °C    | 66C+E = 0.00 °C<br>66D = 5.00 °C |
| Max. t1 for cooling measuring | -   | 0.00 to 40.00 °C    | 0.00 °C                          |
| Date/time                     | YY.MM.DD/hh.mm.ss<br>GMT+offset acc.<br>delivery code | GMT ±12 hours       | -                                |
| qp (l/h)                      | from CCC-table  | -                   | -                                |
| Valve drift time, TT          | 180 sec.  | (10...460 sec.)     | -                                |
| Hysteresis                    | -   | 0.5...5 sec.        | 0.5 sec.                         |
| Tel. no. #1                   | -   | Max. 24 digits      | -                                |
| Tel. no. #2                   | -   | Max. 24 digits      | -                                |
| Tel. no. #3                   | -   | Max. 16 digits      | -                                |

**Note! The three phone numbers may consist of max. 48 digits**

#### 2.5 Valve specification

##### General data:

Control function: 3-point-operating contact  
 Motor: 24 VAC or 230 VAC  
 Characteristic: Linear  
 Valve drift: > 240 sec.

##### Dynamic area:

Power: ps...ps/10 (100...10%)  
 Flow: qs...qs/50 (100...2%)

## 5511-634 GB/06.2006/Rev. C1

intended for mains supply. Irrespective of which supply type is selected, there will be 3.6 V available internally on the two supply mains, and they should be connected with red 60 (+) and black on 61 (-).

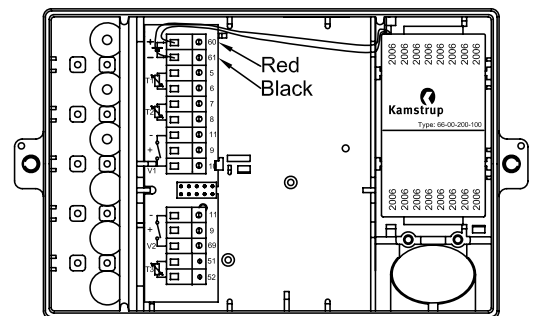
Diagram illustrating the evolution of a 6-bit register over 7 time steps (0 to 6). The register is represented by a vertical bar with 6 segments. The top segment is labeled '0' at the bottom. The segments are numbered 0 to 5 from bottom to top. The register is initially set to 0. At time 1, the top segment (segment 5) is set to 1. At time 2, the top segment (segment 5) is set to 0. At time 3, the top segment (segment 5) is set to 1. At time 4, the top segment (segment 5) is set to 0. At time 5, the top segment (segment 5) is set to 1. At time 6, the top segment (segment 5) is set to 0. The register is labeled '0' at the bottom.

None  
D-cell, HiCap lithium battery  
230 V AC supply module  
24 V AC/DC supply module  
24 V DC supply with S0 input  
24 V DC supply with flow meter input

If the back-up battery needs to be replaced this must be done with an original spare part, no. 1606-055. If installed in very hot surroundings or if installed for a long time without a primary supply, the lifetime of the back-up cell will be reduced.

|                          |          |
|--------------------------|----------|
| <b>Back-up lifetime</b>  |          |
| Without a primary supply | 2 years  |
| With a primary supply    | 20 years |

When battery is selected as supply for MULTICAL® Type 66-CDE an extremely long lifetime is obtained together with a high degree of reliability. The battery is a 3.6 V D-cell of the Lithium type with an extra high capacity, which in some applications makes it possible to obtain a replacement interval of 10 years. Batteries, type 66-00-200-100 must be used as replacements.

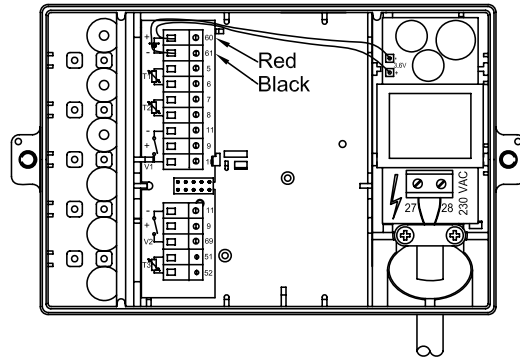


| Application  | Battery temperature | Battery lifetime |
|--|---------------------|------------------|
| With mechanical flow meter (Reed-switch or electronic pick-up) | < 45°C              | 10 years         |
| With 1 ULTRAFLOW®  | < 45°C              | 8 years          |
| With 2 ULTRAFLOW®  | < 45°C              | 5 years          |
| With 1 ULTRAFLOW® and wall-mounted MULTICAL®                   | < 30°C              | 10 years         |

30

### 230 VAC

MULTICAL® Type 66-CDE can be supplied directly from the mains supply through a built-in module containing double-chamber safety transformer. The module is constructed to withstand large voltage variations and mains transients. In addition, a built-in Super Cap will ensure that all functions are maintained for up to 5 minutes in case of short-term power cuts.



230 VAC mains supply is connected via terminal 27 and 28. No safety ground is used as MULTICAL® with 230 VAC module is doubly isolated.

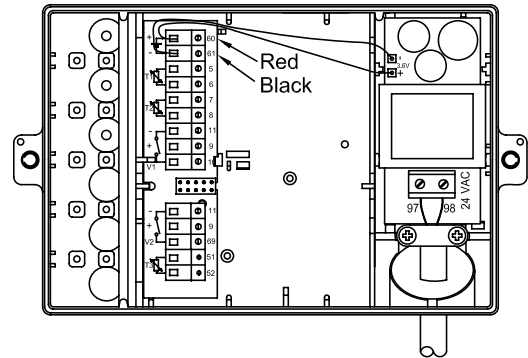
Mains voltage: 230 VAC  $\pm 15/-30\%$   
Mains frequency: 48-52 Hz  
Power consumption:  $< 1\text{W}$   
Reactive power:  $< 1\text{VA}$   
Insulating voltage: 4 kV



**National regulations for network installation must be obeyed. 230 V modules and 230/-24 V transformer meters must be installed by authorized personnel only. In Denmark installation specifications from "Elråd nr. 5/98" or later edition apply.**

### 24 VAC

MULTICAL® type 66-CDE can be supplied with 24 VAC via an integral module with double-chamber safety transformer. The module is constructed to resist big voltage variations and transients. Furthermore, a built-in SuperCap maintains all functions up to 5 min. in case of power failure.

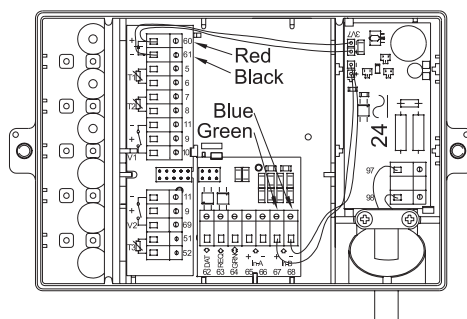


230/24 V trafo for DIN-skinne or panel-mounted can be delivered from No. 66-99-403.

Supply: 24 VAC  $\pm 50\%$   
Power input:  $< 1.5\text{ W}$  with 230/24 V trafo  
Reactive power:  $< 2.5\text{ VA}$   
Galvanic isolation: Via external trafo  
Type 66-99-403

#### 24 V DC supply with S0 input

This module is used when connecting an active S0 signal from the electricity meters, where input B in MULTICAL® is used as telecounter for the electricity meter. The S0 signal supplies MULTICAL® Type 66-CDE on the same two wires that send pulse signals from the electricity meter. The connection polarity is of no consequence as the module is furnished with a bridge input.



Power consumption: < 1.5 W From active S0 output

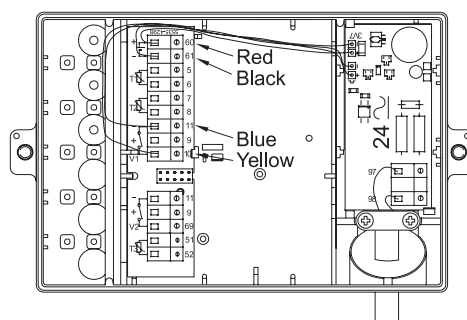
Reactive power: < 1.6 VA

Galvanic separation: Via external S0 output

Kamstrup's static electricity meters can be supplied with a built-in S0 supply module, type 68-50-001, whereas mechanical electricity meters must use the S0 converter type 68-30-001. Please contact Kamstrup for further information.

#### 24 V DC supply with flow meter input

This supply module is used when connecting flow meters with active pulse output and negative pulses. Both supply and volume pulses are transmitted through 2 wires, and the connection polarity is of no consequence, as the module is furnished with a bridge input.

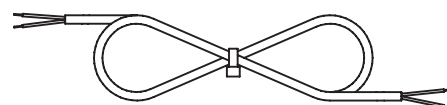


In the intervals between the pulses the output voltage is approx. 24 V, which is used to supply MULTICAL® Type 66-CDE. When a negative pulse appears it is detected by the module which retransmits the pulse to the flow meter input on terminal 10-11.

Pulse voltage: 18- 32 V From flow meter  
Pulsating current: < 10 mA with active pulse  
Pulse polarity: Negative outputs  
Pulse duration: 2-6 msec.  
Galvanic isolation: Via flow meter

### **3.1 Network cables**

MULTICAL Type 66-CDE can be supplied with the following cable: (l=1.5 m)



2 x 0.75 mm<sup>2</sup>

Supply cable, type 5000-286



## 4. Data communication

MULTICAL® Type 66-CDE has a number of data communication possibilities which enable transmission of all registers, actual values and data loggers from the meter to a PC. In addition, the most important data strings can be transmitted through one of the plug-In modules, as described in section 5.

The communication lines are fundamental:

- Via plug-In modules in the connection unit
- Via an IR-head placed on the front of the meter

Additional data strings can be used by both data/pulse modules as via the IR-head. However, "EN 61 107 data" can only be used via the IR-head.

As MULTICAL® Type 66-CDE controls a large number of different data strings and registers, the following communication description is split up as follows:

- 66-B compatible data
- Specific dataloggers for 66-CDE
- Specific data strings for 66-CDE
- Optical data acquisition

### Communication priority

As a type approved energy meter MULTICAL® Type 66-CDE, the meter is of course furnished with a software priority ensuring that data communication cannot effect the energy calculations. When the meters operates with maximum water flow, some request signals may, therefore, be ignored. Furthermore, requests instigated via the Plug-in modules will have higher priority than requests instigated via optical data acquisition.

When compiling software to receive data from MULTICAL® Type 66-CDE, we would recommend request signals always be transmitted a number of times at an interval of min. 5 sec., until data is received.

### Transmission speed and format

Communication is based on Ascii characters and is set up as follows:

The response time from request to data is normally 1-2 sec., i.e. response times down to 0.3 sec. can occur in connection with temperature measurements and datalogging.

Request=300 baud and Data=1200 baud.

The signal format is: 1 start bit, 7 data bit, equal parity and 2 stop bit.

The registers are separated by [SP] and each line is ended with [CR].

### 66-B ⇒ 66-CDE

Data communication in 66-B requires 1 or 2 stop bits, whereas 66-CDE always requires 2 stop bits.

### Example of receiving software

When reading data from MULTICAL® Type 66-CDE using the customer's own custom-built software, it is necessary to adapt the PC's communication software.

Except from optical reading, section 4.4, the other data strings neither contain measuring units nor placing of decimals.

Note 1 Information on measuring units and placing of decimals can be seen in the CCC-table in this Technical Description.

Note 2 Every request which is transmitted from the PC to MULTICAL® must be transmitted with 300 Baud, and all data transmitted from MULTICAL® to the PC must be transmitted with 1200 Baud.

Following example of source code shows how this function is implemented.

### Example of a communication program

#### in VisualBasic

A "request" for standard data #1 with 300 Baud and receiving data with 1200 Baud.

```
MSComm1.Settings = "300,E,7,2"  
MSComm1.Output = "/"#1"  
Delay (10) "Wait to clear output buffer"  
MSComm1.Settings = "1200,E,7,2"  
Temp = MSComm1.Input
```

Contact Kamstrup A/S for further informations.

#### 4.1 66-B compatible data

##### 66-B $\Rightarrow$ 66-CDE

Following data strings #1...#5 are compatible with similar data strings in MULTICAL® III, Type 66-B, which means that it is possible to use 66-B's plug-In modules and hand-held terminal.

Note! /#4 is amended in the following registers:

|        |              |              |                    |      |      |               |
|--------|--------------|--------------|--------------------|------|------|---------------|
| 66-CDE | Qsum2        | Vol2         | Pre-counter 1      | In-A | In-B | Pre-counter 2 |
| 66-B   | Water rest 1 | Water rest 2 | $\Delta t \cdot k$ | tF   | tR   | ABCCC         |

Additionally, peak registers in 66-CDE only comprise power as opposed to peak registers in 66-B. In the latter it is possible to select power or flow by means of the DD-codes.

| Req | STANDARD DATA 1 |         |         |         |         |         |         |         |            |         |
|-----|-----------------|---------|---------|---------|---------|---------|---------|---------|------------|---------|
| /#1 | E1-E2           | Vol 1   | Op. hrs | T1      | T2      | T1-T2   | Power 1 | Flow 1  | P.pwr act. | Info    |
|     | 7 ascii         | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii    | 7 ascii |

| Req | STANDARD DATA 2 |         |         |         |         |         |         |         |         |         |
|-----|-----------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| /#2 | Cust.no.        | TA2     | TL2     | TA3     | TL3     | In-A    | In-B    | ABCCC   | DDEFFGG | Date    |
|     | 11 ascii        | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii |

| Req | TARGET DATA |             |         |         |         |         |         |         |          |
|-----|-------------|-------------|---------|---------|---------|---------|---------|---------|----------|
| /#3 | Cust. no.   | Target date | E1-E2   | Vol1    | TA2     | TA3     | In-A    | In-B    | P.pwr yr |
|     | 11 ascii    | 7 ascii     | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii  |

| Req | VERIFICATION DATA |        |        |        |        |               |        |        |               |
|-----|-------------------|--------|--------|--------|--------|---------------|--------|--------|---------------|
| /#4 | E1-E2             | Qsum1  | Qsum2  | Vol 1  | Vol 2  | Pre-counter 1 | In-A   | In-B   | Pre-counter 2 |
|     | 7ascii            | 7ascii | 7ascii | 7ascii | 7ascii | 7ascii        | 7ascii | 7ascii | 7ascii        |

| Req | MONTHLY DATA |             |         |         |         |         |         |         |         |
|-----|--------------|-------------|---------|---------|---------|---------|---------|---------|---------|
| /#5 | Cust. no.    | Target date | E1-E2   | Vol 1   | TA2     | TA3     | In-A    | In-B    | P.power |
|     |              | Target date | E1-E2   | Vol1    | TA2     | TA3     | In-A    | In-B    | P.power |
|     |              |             |         |         |         |         |         |         |         |
|     | 11 ascii     | 7 ascii     | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii |
|     | 31 months    |             |         |         |         |         |         |         |         |

#### 4.2 Specific data loggers for 66-CDE

Below dataloggers can be read by the PC program METERTOOL and by the hand-held terminal MULTITERM. However, the latter requires an updated FlashCard.

66-B ⇒ 66-CDE

Following dataloggers are specially designed for MULTICAL® Type 66-CDE and are not supported by plug-in modules and the hand-held terminal, developed for MULTICAL® III, Type 66-B.

| Req | DAILY DATA LOGGER   |         |         |         |         |         |         |         |         |         |         |         |
|-----|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| /#6 | Date  | E1-E2   | Mass1   | Mass2   | In-A    | In-B    | P1mid   | P2mid   | T1mid   | T3mid   | T2mid   | Info_D  |
|     | 7 ascii   | 5 ascii | 5 ascii | 5 ascii | 5 ascii | 5 ascii | 5 ascii | 5 ascii | 5 ascii | 5 ascii | 5 ascii | 7 ascii |
|     |   |         |         |         |         |         |         |         |         |         |         |         |
|     | 60 days (lines) total, Growth/24-hrs or average values/24-hrs |         |         |         |         |         |         |         |         |         |         |         |

| Req | HOURLY DATA LOGGER  |         |         |         |         |         |         |         |         |         |         |         |
|-----|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| /#7 | Date  | E1-E2   | Mass1   | Mass2   | In-A    | In-B    | P1mid   | P2mid   | T1mid   | T3mid   | T2mid   | Info_H  |
|     | 7 ascii   | 5 ascii | 5 ascii | 5 ascii | 5 ascii | 5 ascii | 5 ascii | 5 ascii | 5 ascii | 5 ascii | 5 ascii | 7 ascii |
|     |   |         |         |         |         |         |         |         |         |         |         |         |
|     | 960 hours (lines) total, Growth/hour or average values/hour |         |         |         |         |         |         |         |         |         |         |         |

| Req | MONTHLY LOGGER                                  |         |         |         |         |         |         |         |         |         |         |         |
|-----|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| /#8 | Date  | E1-E2   | Vol1    | TA2     | TA3     | In-A    | In-B    | Peff1   | Pflow1  | Vol2    | E_cold  | Info_M  |
|     | 7 ascii   | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii |
|     |   |         |         |         |         |         |         |         |         |         |         |         |
|     | 36 months (lines), counter values, monthly peak |         |         |         |         |         |         |         |         |         |         |         |

| Req | YEARLY LOGGER   |         |         |         |         |         |         |         |         |         |      |         |        |
|-----|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|---------|--------|
| /#9 | Dato  | E1-E2   | Vol1    | TA2     | TA3     | In-A    | In-B    | Ppwr1X  | Pkdate  | Pflow1  | Vol2 | E_cold  | Info_Y |
|     | 7 ascii   | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7    | 7 ascii | 7      |
|     |   |         |         |         |         |         |         |         |         |         |      |         |        |
|     | 15 years (lines), counter values, annual peak, date of power peak |         |         |         |         |         |         |         |         |         |      |         |        |

| Req | INFO LOGGER             |         |         |         |
|-----|-------------------------|---------|---------|---------|
| /#J | Info                    | Date    | Clk     | E1_2    |
|     | 7 ascii                 | 7 ascii | 7 ascii | 7 ascii |
|     | 10 lines (events) total |         |         |         |

| Req | CURRENT COUNTS               |         |         |         |         |         |         |         |         |         |         |         |
|-----|------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| /#B | E1-E2                        | E_cold  | Vol1    | Vol2    | Mass1   | Mass2   | In-A    | In-B    | TA2     | TA3     | m3tf    | m3tr    |
|     | 7 ascii                      | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii |
|     | Current data, counter values |         |         |         |         |         |         |         |         |         |         |         |

| Req | INSTANTANEOUS VALUES                   |         |         |         |         |         |         |         |
|-----|--|---------|---------|---------|---------|---------|---------|---------|
| /#C | T1                                     | T3      | T2      | P1      | P2      | Flow1   | Flow2   | Power1  |
|     | 7 ascii                                | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii | 7 ascii |
|     | Programming data, instantaneous values |         |         |         |         |         |         |         |

| Req | PROGRAMMING DATA AND TIMESTAMP  |         |           |          |         |         |             |                  |
|-----|---------------------------------|---------|-----------|----------|---------|---------|-------------|------------------|
| /#D | Cust. No.                       | ABCCCCC | DDEFFGGMN | Calendar | Clock   | Op. hrs | Target date | Error hr counter |
|     | 11 ascii                        | 8 ascii | 9 ascii   | 7 ascii  | 7 ascii | 7 ascii | 7 ascii     | 7 ascii          |
|     | Programming data, actual values |         |           |          |         |         |             |                  |

#### 4.3 Data reading

The shown dataloggers can be read by use of PC program METERTOOL LogView (See section 9) or by use of handheld terminal MULTITERM Workabout. (Workabout can not read request # 4, 5, 9, B, C and D).

#### 4.4 EN 61 107, Optical data reading

Following data can only be read through the optical eye placed on the front of MULTICAL® Type 66-CDE.

| COMMAND (300BAUD) | RETURN STRING (300BAUD)  |
|-------------------|--|
| /?! [CR] [LF]     | /KAM 0 MC [CR] [LF]<br>[STX]0.0(xxxxxxxxxx) [CR] [LF]<br>6.8(E1-E2 * enhed) [CR] [LF]<br>6.26(Vol1 * m3) ! [CR] [LF]<br>6.31 (Operating hours * h)! [CR] [LF]<br>[ETX] [BCC] |

In general, the text is built up according to EN61107/IEC1107, Mode A, but BCC is calculated arithmetically as on M-Bus and not as module 2.- binary sum ISO 1155.

Communication is based on ASCII characters with the following setup:

300 baud req /300 baud reply, 1 start bit,  
7 data bit, equal parity, 2 stop bit.



**Optical reading may not be used with special display codes such as DD=28-36-44, where the first and second display are energy and volume respectively.**

## 5. Plug-in modules

MULTICAL® Type 66-CDE can be supplied with several different plug-in modules, each with their own type of data communication. All data clamps on the modules are galvanically separated from the calculator, which protects the calculator from error functions resulting from eventual transients and similar on the data communication.

All the modules are included in the type tests as well as in the type approval, which means they can be used together with verified energy meters.

### Type number 66 -

#### Plug-in modules

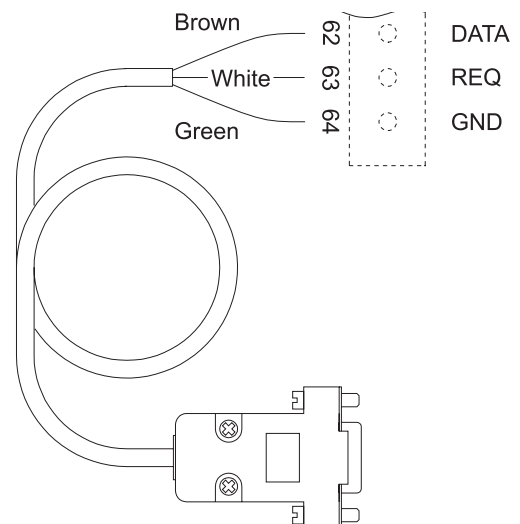
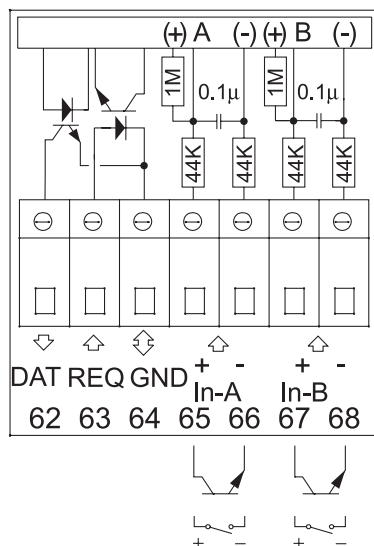
|                                       |   |
|---------------------------------------|---|
| None                                  | 0 |
| Data/pulse inputs                     | 1 |
| Data/pulse outputs                    | 2 |
| Telephone modem/pulse inputs + Data   | 3 |
| M-Bus, EN 1434/pulse inputs MC® III   | 4 |
| Telephone modem/pulse outputs         | 5 |
| M-Bus, EN 1434/pulse output MC® III   | 7 |
| M-Bus, EN 1434/pulse inputs           | 8 |
| M-Bus, EN 1434/pulse outputs          | 9 |
| Radio/pulse inputs                    | A |
| Radio/pulse inputs external antennae  | B |
| 4...20 mA inputs/Data /pulse inputs   | D |
| Analogue output module                | E |
| LonWorks, FTT-10A/pulse inputs        | F |
| Radio/pulse outputs                   | G |
| Radio/pulse outputs external antennae | H |



**Note! The modules 8-9-D-E are not compatible with MULTICAL® III, type 66-B, but can be used in MULTICAL® 66-CDE.**

### 5.1 Data/pulse inputs

The module comprises data connection, which can be used for external data plug, designed for use with the hand-held terminal MULTITERM, or as a semi-permanent PC connection.



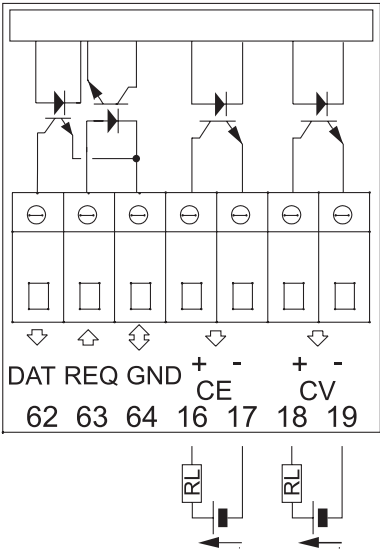
The data connection is galvanically isolated from the optocouplers which makes it necessary to use data cable type 66-99-105 or 66-99-106 in order to adjust the signal to RS-232 level, which is used by PC and MULTITERM. See section 4. *Data communication* for information on data strings and protocols.

If the computer does not have a COM port, a data cable with USB connection, type 66-99-098, can be used.

Two extra pulse signals, e.g. from consumer water and electricity meters can also be connected to the module. Meters with both contact and transistor output can be connected, provided that the leak current in the output is less than 1 µA.

The pulse inputs can be configured most pulse values, in addition to leak detecting of tap water systems on input A. See section 2.3.3.2 *Pulse input* for information on configuration of pulse values as well as section 2.3.4 *Configuration of leak limits*.

5.2 Data/pulse outputs



The data connection in this module is identical to that described earlier.

The module can also transmit energy and volume pulses to CTS-systems or similar remote accumulation. The pulse outputs are convenient for connecting electronic counter inputs, while electromechanical counters normally needs higher current and pulse duration.

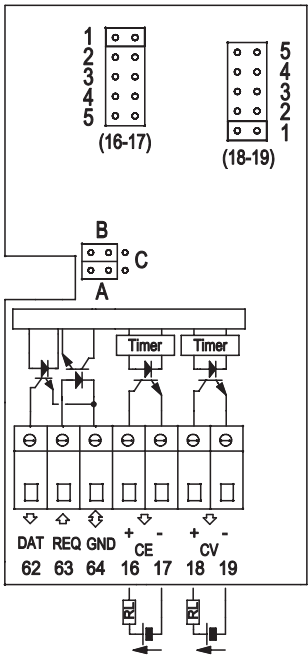
Every time the energy and volume display is updated, one pulse on respectively the CE and CV outputs is transmitted (CE only heat energy).

Example: CCC=119 causes 1 kWh/puls and 0.01 m³/pulse

Voltage: < 30 V  
Load: < 10 mA  
Pulse duration: = 32 msec.

The pulse outputs can also be used as UP/DOWN control signals, when MULTICAL® Type 66-C is used as PQ-controller. See tariff type “E=A” in section 2.3.2.1 *Tariff types* for further information on the PQ-controller function.

5.2.1 Pulse extension  
If a pulse duration of more than 32 msec. is required, a data/pulse module type S7590007 can be used.



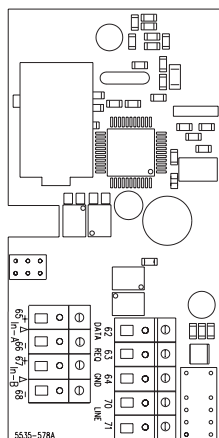
Voltage: < 30V  
Load: < 10mA  
Pulse duration: 0.125 - 2 sec.  
(jumper setting)

| JP | Pulse duration<br>sec. |
|----|------------------------|
| 1  | 0.125                  |
| 2  | 0.25                   |
| 3  | 0.5                    |
| 4  | 1                      |
| 5  | 2                      |

⚠ When 79-64-440 is used in MULTICAL® the battery lifetime will be reduced by 1-2 years

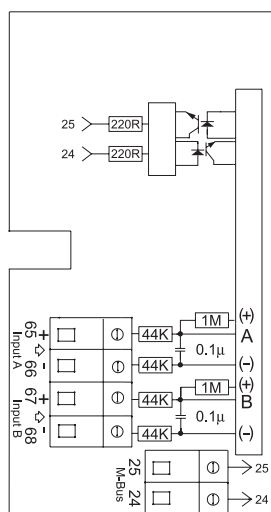
| Jumper setting | Output<br>16 - 17 | Output<br>18 - 19 |
|----------------|-------------------|-------------------|
| A + B<br>      | Energy            | Vol.              |
| A + C<br>      | Energy            | Energy            |
| B + C<br>      | Vol.              | Vol.              |

### 5.3 Telephone modem/pulse inputs



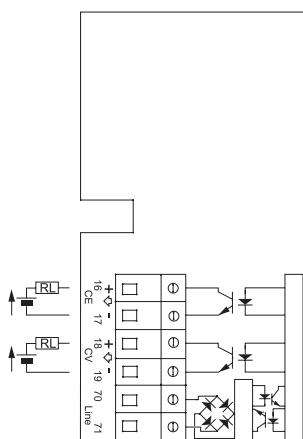
For further information, please see the Technical Description for Modem, 5511-713. The pulse inputs in this module are identical to those described earlier.

### 5.4 M-Bus, EN 1434/pulse inputs



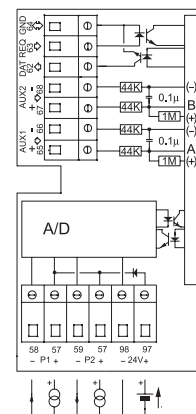
For further information on M-Bus, please see Technical Description for M-Bus, 5511-710. The pulse inputs in this module are identical with those described earlier.

### 5.5 Telephone modem/pulse output



Modem and pulse outputs in this module are identical with those described earlier.

### 5.6 4...20 mA inputs/Data /pulse inputs



The data connection and the pulse inputs in this module are identical with those described earlier.

The module makes it possible to connect two pressure transmitters to MULTICAL® Type 66-CDE. This function is primarily intended to monitor water pressure in the flow- and return pipes, with respect to datalogging and display readings.

The module requires a 24 VDC voltage supply, which is connected on clamp 97(+) and 98(-).

The two pressure transmitters, for measurement of P1 and P2, are connected to clamps 57(+) and 58(-) respectively clamps 57(+) and 59(-).

The pressure can be selected individually for P1 and P2 – please see table on next page – by means of the 8-poled DIP-switch on the printed circuit board.

| P1 (P2) |       |       |       | Area             |
|---------|-------|-------|-------|------------------|
| 1 (5)   | 2 (6) | 3 (7) | 4 (8) |                  |
| OFF     | OFF   | OFF   | OFF   | <b>mA (Test)</b> |
| ON      | OFF   | OFF   | OFF   | <b>1 bar</b>     |
| OFF     | ON    | OFF   | OFF   | <b>6 bar</b>     |
| OFF     | OFF   | ON    | OFF   | <b>10 bar</b>    |
| OFF     | OFF   | OFF   | ON    | <b>16 bar</b>    |
| OFF     | OFF   | ON    | ON    | <b>25 bar</b>    |
| ON      | ON    | ON    | ON    | <b>40 bar</b>    |

E.g.: Two pressure transmitters are installed with measuring range 0-16 bar and output of 4...20 mA. DIP-switch 4 and 8 must be **ON**, the rest must be **OFF**.

Irrespective of the measuring range selected, the measured pressure will be shown with two decimal places on the display and in the data logger. The display values are updated approx. every 10th minute.





If all DIP-switches are OFF, the meter will change to test-mode, where the display for P1 and P2 is up-dated at 2-4 sec. intervals and the measured mA value is shown directly on the display – with [Bar] as the measuring unit. This function is used e.g. when the pressure transmitters' zero point (4 mA) has to be monitored or adjusted, together with module control.

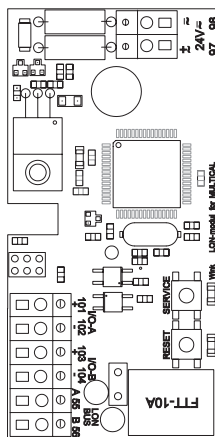
After 2 hours in this test-mode the module automatically increases the interval up to 10 minutes in order to reduce the meter's power consumption.

#### Technical data:

|                                       |  |
|---------------------------------------|--|
| Supply voltage:                       | 18 - 32 VDC, max. 70 mA                                    |
| Transmitter inputs:                   | 4...20 mA  |
| Test-mode:                            | 3.9 - 24 mA range  |
| Input resistance:                     | < 250 Ohm<br>(< 5 V @ 20 mA)                               |
| Accuracy:                             | ±0.75% of chosen<br>measuring area, without<br>adjustment. |
| Demands for pressure<br>transmitters: | 4...20 mA, 2-wire<br>Loop voltage < 18 V @<br>24 V supply  |

Recommended voltage supply (DIN rail can be mounted): Bourdon Haenni, type 89-13-313.

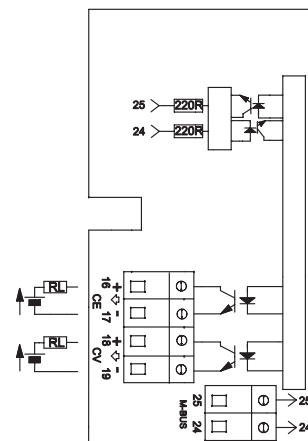
### 5.7 LonWorks, FTT-10A/pulse inputs/outputs



Inputs/outputs (I/O) are configured automatically from the MULTICAL® setup. At pulse inputs both "FF" and "GG" codes must be different from "00". For further information on the LonWorks module, please refer to the Installation guide S7210-038 or Technical Description of LonWorks S7220-064.

Pulse inputs/outputs in this module are identical to those described earlier.

### 5.8 M-Bus – EN 1434/pulse outputs



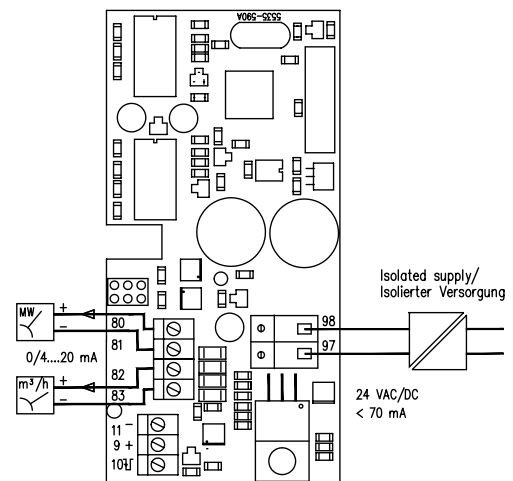
For further information on M-Bus, please refer to *Technical Description for M-Bus (5511-710)*.

The pulse inputs in this module are identical with those previously described.

### 5.9 Analogue output module

The analogue output module can either be placed in the modular space in MULTICAL® type 66-CDE, 66-MP and 66-ST, or it can be used for ULTRAFLow® in connection with a pulse transmitter.

The module is furnished with two active analogue outputs, which can both be configured for 0...20 mA or for 4...20 mA. In addition, the outputs can be configured to any measuring value (power, flow or temperature) and to any range scaling.



Furthermore, the module can be connected to an External Communication Unit, type S7590-032 via a 3-wire data connection, which must be connected to a data module in MULTICAL®. In this way, e.g. pulse outputs and analogue outputs can be used from the same MULTICAL®.

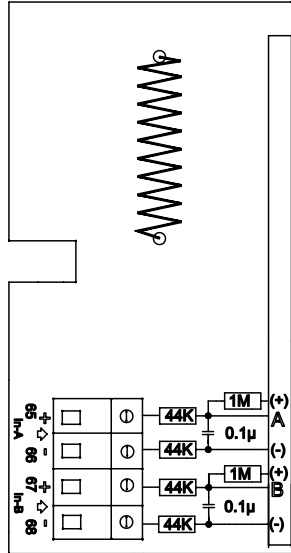
The module is configured via Kamstrup PC program METERTOOL – see section 7.10.



### 5.10 Radio/Pulse inputs/outputs

The radio module is used for wireless communication within a licence-free radio band and is available with internal antenna or external antenna connection. For further information please refer to *Technical Description* of radio (5512-013).

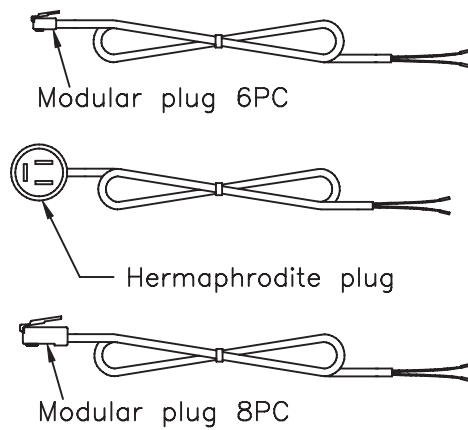
Pulse inputs/outputs in this module are identical to those described earlier.



### 5.11 Data cables

MULTICAL® type 66-CDE can be supplied with one of following cables: (1.8 m)

- Data cable with 6PC module plug, type 66-99-125
- Data cable with 8PC module plug, type 66-99-127
- Telephone cable with dk plug, type 66-99-126



## 6. Printing logged data

As described in section 4.2 *Specific datalogger for 66-CDE*, the calculator includes a number of data-loggers which are updated at different intervals. All dataloggers can be transmitted to a PC or a hand-held terminal. Additionally, the hour and 24-hour loggers can also be printed by means of the IR head with 25 poled plug for printer (type 66-99-107).

The serial printer can be EPSON LX300 or similar. Before connecting the printer must be adjusted for following parameters:

Data format 1200 Baud - 7 data bit - EVEN parity - 2 stop bit

Mark format 96 characters per. line

The print is activated by pressing the right push button until 001 PRT for hour data or 002 PRT for 24 hour data are displayed. Then you must press both buttons simultaneously and printing will begin.

If you need to abort the print, one of the push buttons must be activated.

### 001 PRT Hour data

Is used when a print showing hourly intervals for the preceeding 40 days is required. The print is very detailed and is therefore a good basis for diagnostic testing.

Please note that the print takes approx. 15 minutes for all 960 lines.

| Req  |                                |       |        |        |       |       |       |       |       |       |       |         |
|--|--------------------------------|-------|--------|--------|-------|-------|-------|-------|-------|-------|-------|---------|
| Push-button  | Esc codes for printer          |       |        |        |       |       |       |       |       |       |       |         |
| *1   | MULTICAL 66-D C/N xxxxxxxxxxxx |       |        |        |       |       |       |       |       |       |       |         |
|  | Print date xxxxxxxx            |       |        |        |       |       |       |       |       |       |       |         |
|  | Free text                      |       |        |        |       |       |       |       |       |       |       |         |
|  |                                | MWh   | Ton- 1 | Ton- 2 | M3- a | M3-b  | Bar-1 | Bar-2 | C- T1 | C -T3 | C -T2 | Info    |
|  | *                              | 0.001 | 0.01   | 0.01   | 0.1   | 0.1   | 0.001 | 0.001 | 0.01  | 0.01  | 0.01  |         |
|  | 990122                         | 23-24 | Xxxxx  | Xxxxx  | Xxxxx | Xxxxx | Xxxxx | Xxxxx | Xxxxx | Xxxxx | Xxxxx | Xxxxxxx |
|  | 990121                         |       |        |        |       |       |       |       |       |       |       |         |
| 960 lines of hourly data (terminated by pressing the button) |                                |       |        |        |       |       |       |       |       |       |       |         |

### 002 PRT 24 hourly data

Is used when a print of last month's consumption is required. 24 hour data is controlled by the meter's target date and the desired account date can be chosen in the configuration.

| Req  |                                |       |        |        |       |       |       |       |       |       |       |         |
|--|--------------------------------|-------|--------|--------|-------|-------|-------|-------|-------|-------|-------|---------|
| Push-button  | Esc code for printer           |       |        |        |       |       |       |       |       |       |       |         |
| *2   | MULTICAL 66-D C/N xxxxxxxxxxxx |       |        |        |       |       |       |       |       |       |       |         |
|  | Print date xxxxxxxx            |       |        |        |       |       |       |       |       |       |       |         |
|  | Free text                      |       |        |        |       |       |       |       |       |       |       |         |
|  |                                | Mwh   | Ton- 1 | Ton- 2 | M3- a | M3 -b | Bar-1 | Bar-2 | C- T1 | C -T3 | C -T2 | Info    |
|  | *                              | 0.001 | 0.01   | 0.01   | 0.1   | 0.1   | 0.001 | 0.001 | 0.01  | 0.01  | 0.01  |         |
|  | 990122                         | 00-24 | Xxxxx  | Xxxxx  | Xxxxx | Xxxxx | Xxxxx | Xxxxx | Xxxxx | Xxxxx | Xxxxx | Xxxxxxx |
|  | 990121                         | 00-24 |        |        |       |       |       |       |       |       |       |         |
| Total month's consumption                                    |                                |       |        |        |       |       |       |       |       |       |       |         |
| 28-31 lines 24-hour data (terminated by pressing the button) |                                |       |        |        |       |       |       |       |       |       |       |         |
| Info-log   |                                |       |        |        |       |       |       |       |       |       |       |         |
| 10 lines   |                                |       |        |        |       |       |       |       |       |       |       |         |



**If you make a print of the preceeding month's consumption data, the results for the last two 24-hour periods will be incorrect.**

**E.g. If the taget date is programmed to 20th January [01.20], the monthly print-out will cover from 20/M to 19/M+1. This print will be available from 20/M+1 until 18/M+2.**

### Parallel printer

If a printer furnished with Centronics interface is to be used, an adapter is required, e.g. MAXXTRO CVTSP2.

Remember to supply the adapter with 9 VDC.

## 7. Programming via METERTOOL

### Introduction

METER TOOL for MULTICAL® Type 66-CDE is a Windows software, which can be installed on a PC and used to program and verify the calculator. METER TOOL is developed with a view to offering distributors, heating plants and laboratories a simple and effective access to programming and verification of the integrator.

### 7.1 PC and printer requirements

METER TOOL is suitable for installation under Windows 95/98/NT/2000/XP on Pentium based PCs with at least 16 MB RAM, 20 MB free hard disk and VGA monitor min. 640 x 480. Recommended 800 x 600 or higher.

In order to be able to install the program, the PC must be supplied with a 680 MB CD-drive.

To facilitate programming of MULTICAL® Type 66-CDE, serial data connection (COM-port) between the calculator and PC is used. An IR head type 66-99-102 can be used for configuration. If verification equipment type 66-99-28x is used both programming and verification can be made.

With all types of connection, the program can be set up to use the PC's COM1...8.

The program can meanwhile be used for printing labels for MULTICAL® Type 66-CDE. The printer must be compatible with Windows and be suitable for printing small self-adhesive label sheets.

The printer is connected to the computer's parallel port, LPT1.

Kamstrup A/S recommends e.g. an OKI 610ex, OKI 410ex or a HP4 laser printer, but other printer types can also be used.

Sheets with original self-adhesive labels, type 2008-259, can be ordered from Kamstrup A/S.

### 7.2 Installation of software

Please check that the computer has min. 20 MB free space on the hard disk, e.g. by means of Windows File Manager. Close all active Windows programs before installing the program.

Insert the CD in the drive and follow the program's instructions as they appear on your screen.

When the installation is completed, the icon "METER TOOL" will appear in the Start menu. Double click on the new icon "METER TOOL" to start the program.

Please note: If the right printer driver is not installed, the program will not be able to print labels or certificates.

### 7.3 Connecting MULTICAL® Type 66-CDE to PC

The calculator is programmed for serial data transmission between the calculator and the computer. The data can be transmitted by means of optical IR head type 66-99-102 or verification equipment, e.g. type 66-99-284.

#### Optical IR head type 66-99-102

The optical head is placed between the two pins on the front of the calculator where it is held in place by means of a magnet. The IR head cable must always point downward  $\pm 20^\circ$ . The optical IR head MUST NOT be used or stored near diskettes or computers as the magnet can damage the data. Always cover the magnet with the protection plate when it is not in use.



The optical head, combined with a lap-top computer is the ideal way to program the meter. E.g. new tariff limits can be programmed quickly and simply on site without removing the energy meter. If MULTICAL® Type 66-CDE is furnished with a plug-in communication module, e.g. M-Bus or LonWorks, programming via the optical head may be non-functional. In these cases, we would recommend that you use the verification equipment for the task.

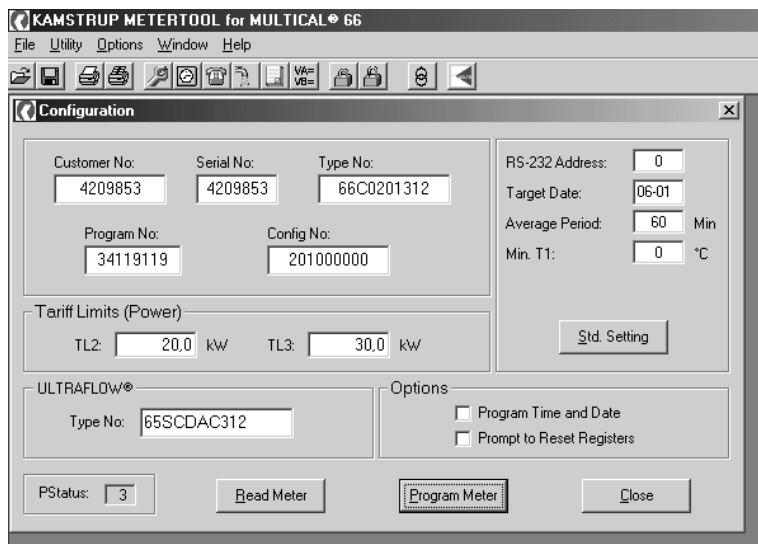
If the computer has a 25-pole COM-plug, a 9M/25F adapter, type 66-99-120 must be used.

#### Verification equipment type 66-99-28x

See section 8. *Verification via METER TOOL* for further information.

If the computer does not have a COM port, optical head with USB connection, type 66-99-099, can be used.

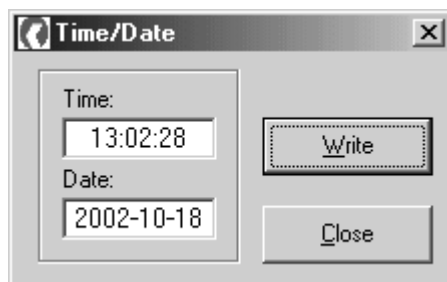
Connect the serial data communication as described in previous paragraph and start the program by clicking on the icon "METER TOOL". Choose the button "Read meter" and data will be transmitted from the meter and shown on the monitor.



## 7.4 Programming

It is important that you are familiar with all calculator functions before programming.

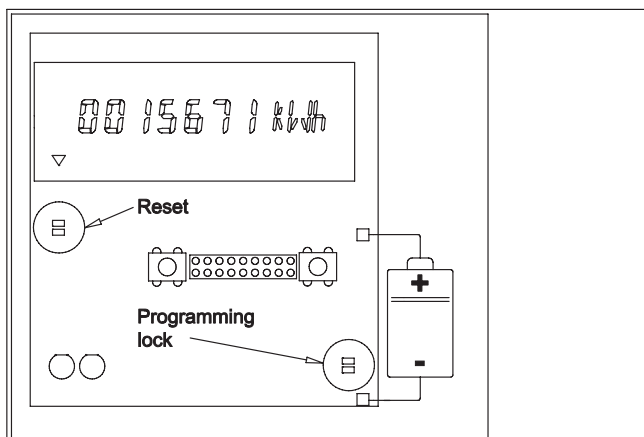
All necessary information appear in this Technical description.



Furthermore, you must check the computer's internal clock before programming – date and time will be transmitted from the PC to the calculator when you program "Time/Date".

### 7.4.1 Partial programming

If the programming lock in MULTICAL® Type 66-CDE (indicated by a ring in the diagram below) is open, the meter can only be partially programmed.



The limitation means that the legal parameters A-B-CCC-CCC and type and serial No. cannot be changed, while all other data can be programmed as required. This limitation is used to prevent the original operating parameters from being changed on type approved and verified meters.

National verification demands must be checked before the integrator's verification seal is broken.

### 7.4.2 Complete programming

If the programming lock is short-circuited, it is possible to reprogram MULTICAL® Type 66-CDE, incl. the legal data A-B-CCC-CCC and type- and serial No.

For security reasons, a soldering iron should not be used to short-circuit the programming lock.

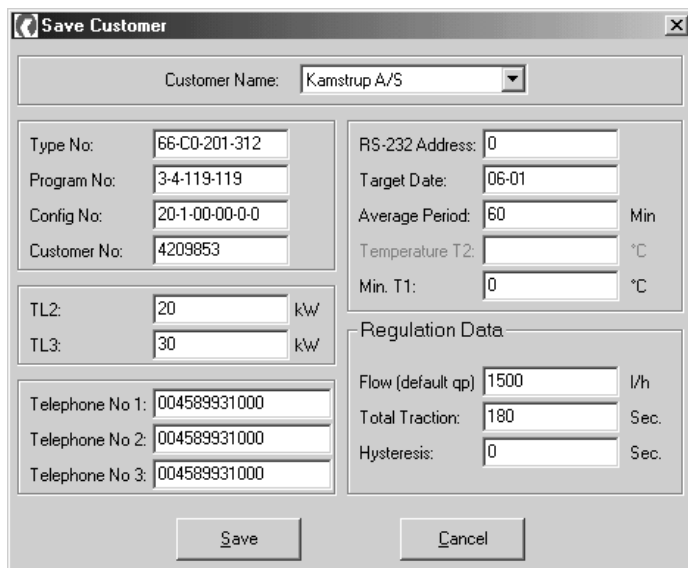
Instead, please use the original short-circuit pen, type 66-99-278, which can be ordered from Kamstrup A/S.

Please note that the data logging memory in the calculator can not be changed/erased during programming, unless this is selected in the software.

## 7.5 File

Under the menu "File" one of the following functions can be selected:

|                          |   |
|--------------------------|---|
| <b>Open Customer</b>     | Fetch stored customer settings from the data base.      |
| <b>Save Customer</b>     | Save new customer settings in the data base.            |
| <b>Print Setup</b>       | Printer setup for printing front label and certificate. |
| <b>Print Label</b>       | Starts print of front label.                            |
| <b>Print Certificate</b> | Starts print of test certificate.                       |
| <b>Exit</b>              | Terminates METERTOOL.                                   |



**Save Customer**

Customer Name: Kamstrup A/S

Type No: 66-C0-201-312  
 Program No: 3-4-119-119  
 Config No: 20-1-00-00-0  
 Customer No: 4209853

RS-232 Address: 0  
 Target Date: 06-01  
 Average Period: 60 Min  
 Temperature T2: °C  
 Min. T1: 0 °C

TL2: 20 kW  
 TL3: 30 kW

Regulation Data  
 Flow (default qp) 1500 l/h  
 Total Traction: 180 Sec.  
 Hysteresis: 0 Sec.

Telephone No 1: 004589931000  
 Telephone No 2: 004589931000  
 Telephone No 3: 004589931000

Save Cancel

## 7.6 Utility

This menu gives access to the following dialog boxes:

**Configuration** General view which is used when reading and programming.

**Time/Date** The PC's date and time is transmitted to MULTICAL®.

**Telephone No.** 3 different telephone numbers can be programmed in MULTICAL®.

**PQ Controller data** Is used to change regulating parameters.

**Log printer settings** Setting of MULTICAL®'s own printer control.

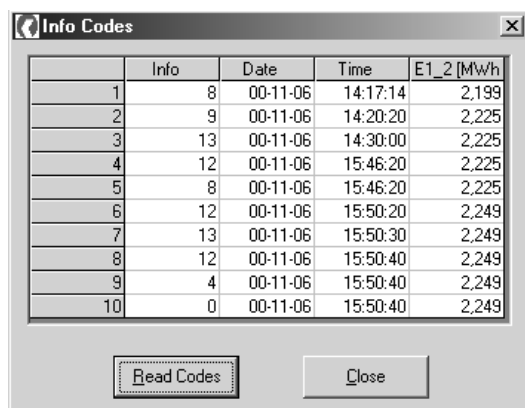
**Preset VA/VB** Used to preset the register values for the 2 additional pulse inputs for water and electricity meters.

**Info Codes** Is used for reading the latest 10 Info-codes.

**Meter type** Reads the internal software revision of the meter.

**Reset dataloggers** Resets all dataloggers if the programming lock is short-circuited.

**Verification** See section 8. *Verification via METERTOOL.*



**Info Codes**

|    | Info | Date     | Time     | E1_2 [MWh] |
|----|------|----------|----------|------------|
| 1  | 8    | 00-11-06 | 14:17:14 | 2,199      |
| 2  | 9    | 00-11-06 | 14:20:20 | 2,225      |
| 3  | 13   | 00-11-06 | 14:30:00 | 2,225      |
| 4  | 12   | 00-11-06 | 15:46:20 | 2,225      |
| 5  | 8    | 00-11-06 | 15:46:20 | 2,225      |
| 6  | 12   | 00-11-06 | 15:50:20 | 2,249      |
| 7  | 13   | 00-11-06 | 15:50:30 | 2,249      |
| 8  | 12   | 00-11-06 | 15:50:40 | 2,249      |
| 9  | 4    | 00-11-06 | 15:50:40 | 2,249      |
| 10 | 0    | 00-11-06 | 15:50:40 | 2,249      |

Read Codes Close

## 7.7 Options

The menu has a few settings which are not used very often:

**Programming** Setting of partial or total programming.

**Verification data** See section 8. *Verification via METERTOOL.*

**ComPort** Indicates the choice of Com1...8.



**Set ComPort**

☒ Comport 1  
☐ Comport 2  
☐ Comport 3  
☐ Comport 4  
☐ Comport 5  
☐ Comport 6  
☐ Comport 7  
☐ Comport 8

Ok Cancel

## 7.8 Windows

This function makes it possible to switch between open dialogue boxes.

## 7.9 Help

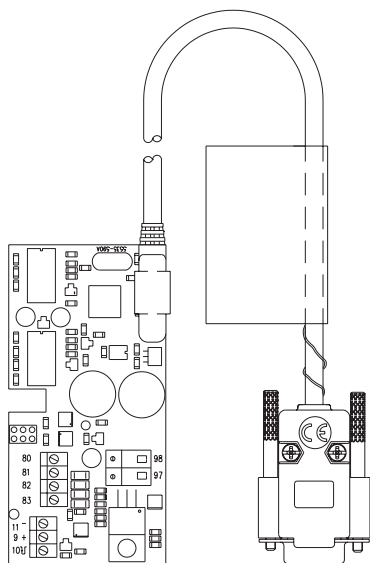
Online help F1:  
offers description of the program functions.

About:  
Provides information about program numbers and revisions in the METERTOOL® program.

## 7.10 Supplementary programs

Configuration is made via Kamstrup's PC program METERTOOL type 66-99-702.

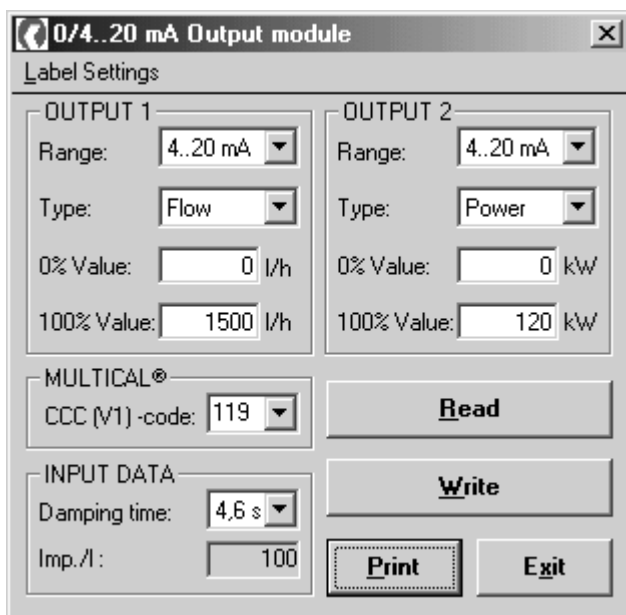
The data connection between the PC and the analogue module is made via the interface cable type 66-99-140.



Select the program METERTOOL for MULTICAL® 66 and afterwards select the function in the upper toolbar.



When the interface cable is connected to the module test plug, select "Read" in the program, and the actual configuration will be shown in the display.



Enter the changes and transfer them to the module by activating the "Write" key.

### Output:

Select between 0-20 mA or 4-20 mA. The outputs are selected individually.

### Type:

Select input source for each of the two outputs.

"Pulseinput" can only be selected, if a flow meter is connected to the terminal 11-9-10 of the module.

### 0% value:

Indicates the measuring value at 0 mA and 4 mA, respectively.

### 100% value:

Indicates the measuring value at 20 mA. The value must be higher than the indicated measuring value for 0%.

### CCC-code:

Must always be stated.

### Damping time:

Only state, when a flow sensor is connected to terminal 11-9-10 of the module.

### Imp/l:

The pulse value is automatically shown based on the selected CCC-code.

## 7.11 Delta program

The Delta program provides the possibility of calculating true energy with compensation of the k-factor.

## 8. Verification via METERTOOL

### Equipment description

Verification equipment type 66-99-28x is used for testing and verifying the MULTICAL® Type 66-CDE calculator. The test includes volume simulation of up to four flow meter inputs, ie. V1 - V2 - VA and VB.

Different temperatures for all three sensor inputs, T1 - T2 - T3, are simulated and, together with the volume simulation, form the basis of verification of the energy calculation.

The equipment is primarily designed for use in laboratories which test and verify energy meters, but it can also be used to test meter operation.

The computer program METERTOOL type 66-99-702 is used to configure, test and verify.

All data communication between the computer and the integrator is transmitted via the computer's serial ports; COM1...4, which are connected to the verification equipment. Please note that the equipment must be supplied via the associate mains adapter.

The computer must comply with demands specified in section 7. *Programming via METERTOOL*.

Verification does not include temperature sensors and the flow part.



The verification equipment is supplied in 3 different types, depending on which MULTICAL® type is applied as well as the temperature points which are to be tested.

|  |                |                |                |
|--|----------------|----------------|----------------|
| <b>66-99-284<br/>Standard (EN 1434)<br/>Type 66-C</b>      | <b>T1 [°C]</b> | <b>T2 [°C]</b> | <b>T3 [°C]</b> |
|  | 160            | 20             | -              |
|  | 80             | 60             | -              |
| <b>66-99-285<br/>Closed systems<br/>Type 66-C and 66-E</b> | <b>T1 [°C]</b> | <b>T2 [°C]</b> | <b>T3 [°C]</b> |
|  | 160            | 10             | -              |
|  | 80             | 60             | -              |
| <b>66-99-286<br/>Open systems<br/>Type 66-D</b>            | <b>T1 [°C]</b> | <b>T2 [°C]</b> | <b>T3 [°C]</b> |
|  | 160            | 5              | 10             |
|  | 80             | 5              | 60             |
|  | 43             | 5              | 40             |

### 8.1 Function

Verification equipment type 66-99-28x is mounted in a standard MULTICAL® base and contains battery, connection print, verification print, microprocessor, control relays and precision resistors.

The calculator can be mounted on this base quite simply.

During the test the calculator is supplied by the battery. The verification print is supplied via the associate external mains adaptor with 12 V DC. The microprocessor simulates the volume based on pulse frequency and the number of pulses per test point, which have been selected in the computer program. Temperature is simulated by means of permanent precision resistors which are changed automatically via relays controlled by the microprocessor.

After testing the computer reads all registers in the calculator and compares the values with the calculated values.

Deviation, determined for each test point – shown as a percentage – can be printed on a test certificate or stored in the computer under the serial number of the tested MULTICAL®.

### 8.2 Verification data

The first time that METERTOOL and the verification equipment are used, a number of calibration data must be entered in the menu "Verification data". As these data are of crucial importance for the verification result, they are protected by a password which can only be disclosed by Kamstrup A/S.

Permissible error and uncertainty

Max. permissible error, indicated as a percentage, and the equipment's measuring uncertainty must be indicated under each of the three verification points; 1st, 2nd and 3rd. The "permitted error" minus "uncertainty" will be indicated as MPE on the verification certificate. According to EN 1434 is  $MPE \pm (0,5 + \Delta\theta \min/\Delta\theta)\%$ .

Heat coefficient in flow and return

When the calibration values for the temperature simulators are entered in the program, it automatically calculates the true k-factor, according to the formula in EN 1434.

Test points

The test points 1st, 2nd and 3rd are determined by the size of the temperature simulation resistances fitted in the test equipment. The rated temperature points are indicated in the preceeding paragraph.

Measured resistance

In order to update the temperature simulators' calibration, the temperature resistances' latest measured resistance values are entered. A calibration sheet with declaration of measured resistance values for all simulators is supplied by Kamstrup A/S together with the verification equipment. The temperature simulators must be calibrated at Kamstrup A/S once a year.

Enter number of integrations

Enter the number of integrations required at each test point in this field. If the programming number is e.g. A-B-119-119 (corresponding to ULTRAFLOW® II, qp 1.5 m³/h), 1000 volume pulses must be received for each integration corresponding to 0.01 m³. In case of doubt please see the CCC-table in section 2.2.1.

**8.3 Verification**

All necessary information can be transmitted directly from the calculator via serial data transmission, which simplifies verification. Before test or verification can be started, a control must be made to confirm that all verification data are correct. The procedure is started by clicking on "Start test".

The test takes between one and five minutes depending on the test type selected and the size of the meter.

When the test is completed, the results are shown on the monitor. If the results can be approved, click on "Save" and all verification data will be stored in the data base under the calculator serial number. It is possible to save data both on verification and control.

If a printed certificate with the test results is desired, select "Print" from the "File" menu.

The field "Test Type" is used for selecting either combined verification and volume test, separate volume test or verification. When verifying MULTICAL® Type 66-C with only one water meter connected (V1), separate verification can be selected and the test duration is reduced.

If the time consumption of a test is uncritical, we recommend that a combined verification and volume test always be selected as all inputs are then tested.

**8.4 Maintenance**

Verification equipment type 66-99-28x is designed to work a number of years with a minimum of maintenance. The following must, however, be executed frequently in order to secure optimal operation:

Recalibration

On delivery, a calibration certificate is enclosed issued by Kamstrup A/S. The applied calibrated resistance values must be entered under "Verification data". The equipment must be recalibrated at least once a year.

Change of connection print

The connection print (in the left side of the unit) must be changed with regular intervals as the connection pins for the calculator top will wear down in time – depending on how often it is applied. Under normal circumstances the print should be replaced for every 500 verified calculators (Type 5550-492).

**Verification**

Heat Meter Data

Date Of Test: 2002-10-21  
 Manufacturer: Kamstrup A/S  
 Serial No: 4209853  
 Customer No: 4209853  
 Program No: 3-4-119-119  
 Config No: 20-1-00-00-00  
 Type No: 66-C0-201-312

Test Type  
 Verification and Volume Test ☒  
 Energy Verification ☐  
 Volume Test ☐

Save... Start Test

---

Verification Of Heat Energy

|     | True Vol. | True Tf | True Tr | True Quick |
|-----|-----------|---------|---------|------------|
| 1st | 50        | 43,332  | 39,993  | 1651,07    |
| 2nd | 20        | 79,752  | 59,991  | 3843,30    |
| 3rd | 10        | 159,721 | 20,001  | 12785,59   |

|     | Quick | Error % | MPE ± % |        |
|-----|-------|---------|---------|--------|
| 1st | 1650  | -0,06   | 1,2     | Passed |
| 2nd | 3849  | 0,15    | 0,4     | Passed |
| 3rd | 12795 | 0,07    | 0,4     | Passed |

---

Volume Test

|               | Vol. V1 | Vol. V2 | Vol. A | Vol. B |    |
|---------------|---------|---------|--------|--------|----|
| Test Initial: | 106,34  | 0,85    | -----  | -----  | m³ |
| Test End:     | 106,35  | 0,86    | -----  | -----  | m³ |
|               | Passed  | Passed  |        |        |    |

---

Test Conditions

|               | Energy |     | Vol. V1 |    |
|---------------|--------|-----|---------|----|
| Test Initial: | 3,246  | MWh | 106,26  | m³ |
| Test End:     | 3,250  | MWh | 106,35  | m³ |

Close



# CERTIFICATE OF CALIBRATION

## Verification Equipment for MULTICAL<sup>®</sup>

Customer: **Kamstrup A/S, Industrivej 28, DK-8660 Skanderborg, Denmark**

Type No.: **66-99-286**

Type of Multical<sup>®</sup>: **66-D**

Serial No.: **998877**

Procedure: Kamstrup A/S No.: 5509-405 QI

### Test equipment:

DMM, Datron 1271, Kamstrup A/S No.: 14-021-010

Standard Resistor, Vishay RTB 10, Kamstrup A/S No.: 14-061-020

This certificate provides traceability of measurement to recognised national/international standards

Expanded Uncertainty:  $\pm 15$  ppm  
(Coverage factor  $k=2$ )

### Measurements:

|     |    | Nominal<br>temperature [°C] | Nominal<br>resistance [ohm] * | Measured<br>resistance [ohm] | Calculated<br>temperature [°C] * |
|-----|----|-----------------------------|-------------------------------|------------------------------|----------------------------------|
| 1st | T1 | 43                          | 583.495                       | <b>583.456</b>               | 42.980                           |
|     | T2 | 5                           | 509.764                       | <b>509.822</b>               | 5.030                            |
|     | T3 | 40                          | 577.704                       | <b>577.611</b>               | 39.952                           |
| 2nd | T1 | 80                          | 654.484                       | <b>654.299</b>               | 79.903                           |
|     | T2 | 5                           | 509.764                       | <b>509.822</b>               | 5.030                            |
|     | T3 | 60                          | 616.210                       | <b>616.255</b>               | 60.024                           |
| 3rd | T1 | 160                         | 805.272                       | <b>805.134</b>               | 159.926                          |
|     | T2 | 5                           | 509.764                       | <b>509.822</b>               | 5.030                            |
|     | T3 | 10                          | 519.513                       | <b>519.688</b>               | 10.090                           |

\* According to IEC 751/EN 60751 Amendment 2, 1995-07 "Industrial platinum resistance thermometer sensors"

Date: **1999-09-03**

Calibrated by: **JLH**

Tamb.: **23.2 °C**

Kamstrup A/S - Industrivej 28 - DK-8660 Skanderborg - Denmark

5509-491 FM, Rev.:A1

**Have you lost your certificate?**

**Call Kamstrup and state No. and S/N of the equipment, and we will send you a new certificate.**

## 9. Data reading with METERTOOL LogView

### Introduction

METERTOOL LogView (Part no. 6699703) is a Windows software, that makes it possible to read data from Kamstrup meter types MAXICAL III, MULTICAL®, MULTICAL® Compact and MULTICAL® III.

Data will be processed according to the meter configuration and will be presented with comma-placing and units.

Requirements, installation and connection are identical with those stated in paragraph 7.1 - 7.3



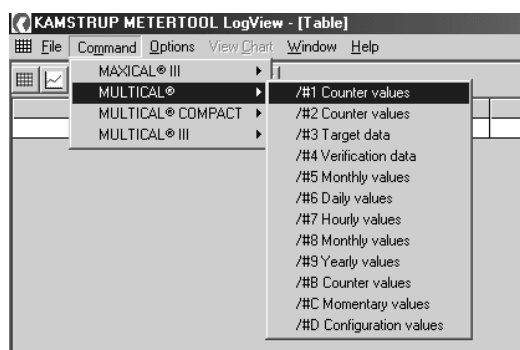
### 9.1 File

Under the "File" menu one of below functions can be selected:

|               |   |
|---------------|---|
| Open          | Retrieve stored data records                                    |
| Save As       | Save reading data   |
| Send to       | Send data as an HTML file on e-mail                             |
| Add comments  | To be used in cases where the text should be added to the table |
| Print         | Start printing the table  |
| Page Settings | Set up margins and paper format                                 |

### 9.2 Command

Select the Kamstrup meter type to be read and the required reading (see paragraph 4 for optional data).



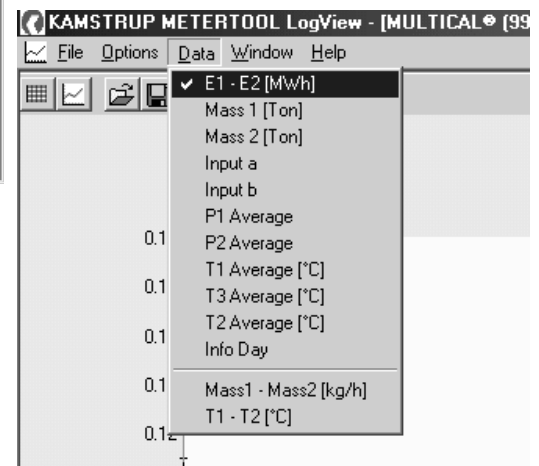
### 9.3 Option

|             |                                      |
|-------------|--------------------------------------|
| New Table   | New table                            |
| New Chart   | New chart                            |
| Set ComPort | Indicates the selection of Com 1...8 |

### 9.4 View Chart

View Chart Shows energy data as a chart, at the same time the menus are changed and a field "Data" appears. Here can be selected between the columns found in the reading, select the one in question and it will be presented as a chart.

Example.:



Charts can be stored under "File" or printed.

### 9.5 Window

This function makes it possible to change screen reading and to shift between the open tables and charts.

### 9.6 Help

Help Index Offers instructions and descriptions of the various functions of the program. Is activated directly from the program functions by using the F1 key.

About

Contains program numbers and revisions.

## 10. Alphabetical register

The following alphabetical register explains the terms which appear on the monitor.

The register can both read as an integral part of the Technical Description, or used as a reference when a question arises.

### A

A-B-CCC-CCC

The calculator's programming number. Determines the flow meter's placement in flow or return, measuring unit and number of pulses/liter.

E  
E

EN1434

Energy

The required tariff is selected by means of "E". E.g. E=3 means "cooling tariff", whereas E=0 means "no tariff".

European standard for heat meters.

The total energy (e.g. in kWh) is stored in the memory when the info code is changed.

Address

(RS-232) The calculator contains an addressable data sequence which can be used when several meters are connected in one mains, e.g. via external RS 232/485 converters.

E  
FF

Flow

Flow meter coding of water meter VA. E.g. FF=04 means that water meter VA is coded for 10 l/imp.

The actual flow of water meter V1 can be used as tariff basis (E=2).

Average

Indicates the averaging period, of which the peak flow or power is measured.

G  
GG

Flow meter coding for water meter VB or connected electricity meter. E.g. GG=04 means that water meter VB is coded for 10 l/imp.

### B

### C

CCC

Flow meter code. E.g. CCC=119 is used with 100 imp/l for ULTRAFLOW® II, qp 1.5 m³/h.

H

Com 1...4

The computer's serial data port no. 1, 2, 3 or 4.

I

Info code

The latest 10 changes to the information code can be read.

Config. No.

The meter's configuration number = DD-E-FF-GG-M-N indicates display reading, tariff type, pulse coding for the extra water meters as well as leak detection set up.

Info date

The date when the information code appeared.

L

Landscape

Means that sheets with front labels will be printed horizontally.

Customer No.

11-digit customer number which can be read on the display. The customer number can be changed without changing the serial number.

M

Min

The number of minutes selected as average time for peak flow or peak power.

Between 1 ... 1440 minutes can be chosen.

### D

Date

The computer's calendar which is transferred to the calculator. The format is YY-MM-DD.

mm

DD

Display code which indicates the display reading selected.

MPE

The number of millimeters with which the front label's print must be adjusted.

(Maximum Permissible Error) Max. permitted error.

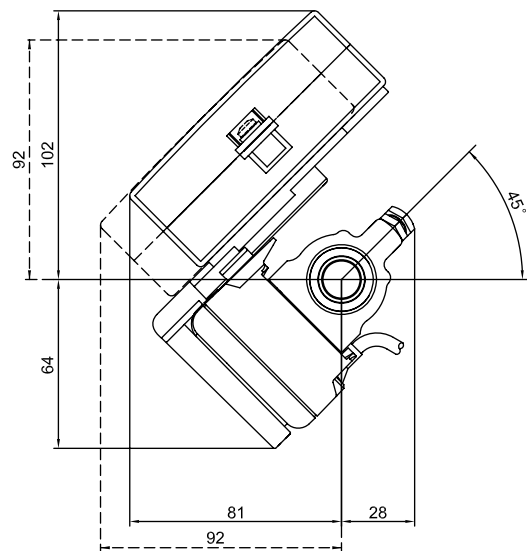
DD-E-FF-GG-M-N

The meters configuration number = DD-E-FF-GG-M-N indicates display reading, tariff type, pulse coding of extra water meters required as well as leak detection set up.

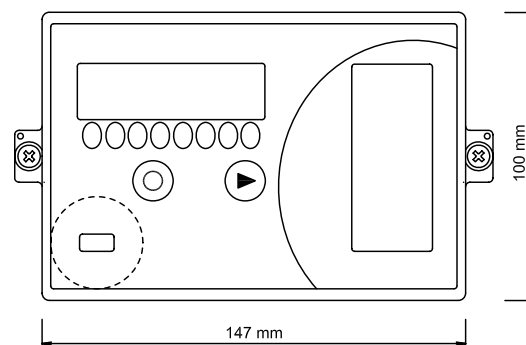
Q

|               |  |  |               |   |
|---------------|--|--|---------------|---|
| <u>P</u>      |  |  | <u>I</u>      |   |
| Power         | The actual heat power of water meter V1 can be used as tariff basis (E=1).   |  | Target date   | The yearly target date which most often is the district heating company's billing date. On the target date all relevant registers are stored for later reading. The format is MM-DD, where MM=1...12 and DD = 1...28. |
| Print         | Starts print of the table displayed.   |  |               |   |
| Programming   | Starts programming the meter. All the data displayed will be transmitted to the meter.   |  | Tariff limits | The tariff limits decide when the tariff registers TA2 and TA3 must accumulate energy parallel with the energy reading. The tariff limits are only used with E=1, 2, 3, 5, 9 or A.                                    |
| P Status      | The programming counter which indicates how many times the meter has been programmed since leaving factory.  |  |               |   |
|               |  |  | Test initial  | Registers the value before verification.  |
| <u>Q</u>      |  |  |               |   |
| Quick         | (Qsum) High resolution measuring unit for heat energy.   |  | Time          | The computers actual time which is transmitted to the meter at programming.   |
|               |  |  | TL2           | Tariff limit 2 indicates the start conditions for TA2.  |
| <u>R</u>      |  |  | TL3           | Tariff limit 3 indicates the start conditions for TA3.  |
| Read meter    | Reads the meters setting. All the meter's data are transmitted to the display.   |  | Type No.      | The meter's type number contains information on power supply, data module, sensor type, pick-up unit and language on the front label.   |
| RS-232        | (Address) calculator contains an adressable data string which can be used if a number of meters are connected in one mains, e.g. via external RS 232/485 converters. |  |               |   |
|               |  |  | <u>V</u>      |   |
| <u>S</u>      |  |  | VA            | Secondary water meter VA which is connected to clamp 65 and 66. The pulse value is set up via FF.   |
| Save Customer | Stores a setting in the data base.   |  |               |   |
| Serial No.    | The meter's serial number.   |  | VB            | Secondary water meter VB which is connected to clamp 67 and 68. The pulse value is set up via GG.   |
| Start test    | This command is used to start the automatic verification sequence.   |  | V1            | Flow meter V1 which is connected to clamp 9-10-11.  |
|               |  |  | V2            | Flow meter V2 which is connected to clamp 9-69-11.  |
|               |  |  | View Chart    | See data as a chart.  |

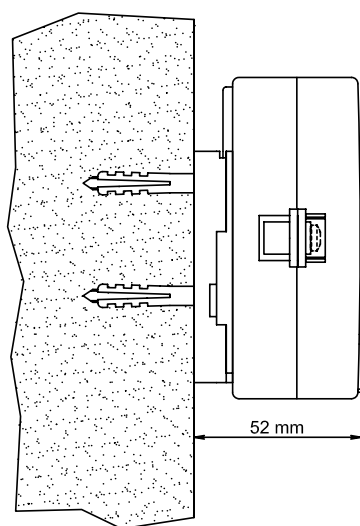
## 11. Dimensional drawings



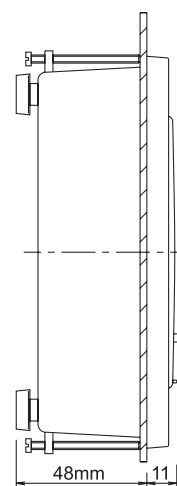
*MULTICAL® Type 66-CDE  
mounted on ULTRAFLOW® II*



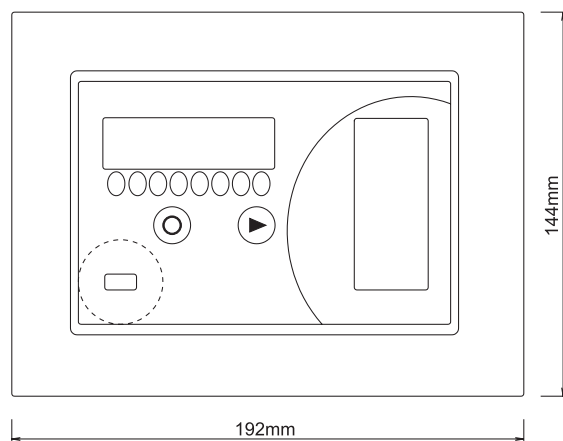
*MULTICAL® Type 66-CDE's front measurements*



*Wall-mounted MULTICAL® Type 66-CDE  
viewed from the side*



*Panel mounted MULTICAL® Type 66-CDE,  
viewed from the side.*



*Panel mounted MULTICAL® Type 66-CDE,  
viewed from the front*

## 12. Temperature sensors

### 10.1 EN 60751 table for Pt500 sensors

Pt500 temperature sensors are used for MULTICAL® Type 66-CDE, according to EN 60751 (IEC 751). A Pt500 temperature sensor is a resistance sensor with a nominal resistance of 500  $\Omega$  at 0.00°C and 692.528  $\Omega$  at 100.00°C. All values for the resistance are stated in the

international standard IEC 751, which apply to Pt100 temperature sensors. The values for the resistances in Pt500 sensors are five times higher and can be seen in the table below [ $\Omega$ ]:

| °C  | 0       | 1       | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9       |
|-----|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 0   | 500.000 | 501.954 | 503.907 | 505.860 | 507.812 | 509.764 | 511.715 | 513.665 | 515.615 | 517.564 |
| 10  | 519.513 | 521.461 | 523.408 | 525.355 | 527.302 | 529.247 | 531.192 | 533.137 | 535.081 | 537.025 |
| 20  | 538.968 | 540.910 | 542.852 | 544.793 | 546.733 | 548.673 | 550.613 | 552.552 | 554.490 | 556.428 |
| 30  | 558.365 | 560.301 | 562.237 | 564.173 | 566.107 | 568.042 | 569.975 | 571.908 | 573.841 | 575.773 |
| 40  | 577.704 | 579.635 | 581.565 | 583.495 | 585.424 | 587.352 | 589.280 | 591.207 | 593.134 | 595.060 |
| 50  | 596.986 | 598.911 | 600.835 | 602.759 | 604.682 | 606.605 | 608.527 | 610.448 | 612.369 | 614.290 |
| 60  | 616.210 | 618.129 | 620.047 | 621.965 | 623.883 | 625.800 | 627.716 | 629.632 | 631.547 | 633.462 |
| 70  | 635.376 | 637.289 | 639.202 | 641.114 | 643.026 | 644.937 | 646.848 | 648.758 | 650.667 | 652.576 |
| 80  | 654.484 | 656.392 | 658.299 | 660.205 | 662.111 | 664.017 | 665.921 | 667.826 | 669.729 | 671.632 |
| 90  | 673.535 | 675.437 | 677.338 | 679.239 | 681.139 | 683.038 | 684.937 | 686.836 | 688.734 | 690.631 |
| 100 | 692.528 | 694.424 | 696.319 | 698.214 | 700.108 | 702.002 | 703.896 | 705.788 | 707.680 | 709.572 |
| 110 | 711.463 | 713.353 | 715.243 | 717.132 | 719.021 | 720.909 | 722.796 | 724.683 | 726.569 | 728.455 |
| 120 | 730.340 | 732.225 | 734.109 | 735.992 | 737.875 | 739.757 | 741.639 | 743.520 | 745.400 | 747.280 |
| 130 | 749.160 | 751.038 | 752.917 | 754.794 | 756.671 | 758.548 | 760.424 | 762.299 | 764.174 | 766.048 |
| 140 | 767.922 | 769.795 | 771.667 | 773.539 | 775.410 | 777.281 | 779.151 | 781.020 | 782.889 | 784.758 |
| 150 | 786.626 | 788.493 | 790.360 | 792.226 | 794.091 | 795.956 | 797.820 | 799.684 | 801.547 | 803.410 |
| 160 | 805.272 | 807.133 | 808.994 | 810.855 | 812.714 | 814.574 | 816.432 | 818.290 | 820.148 | 822.004 |

IEC 751 Amendment 2-1995-07

The advantages of using resistance sensors with a high ohmic value (Pt500) compared to resistance sensors with a low ohmic value (Pt100) are several, including among others:

- Less influence from wire resistance in sensor cables and contact resistance in connections.
- Major ohmic change per °C gives better accuracy in the computer unit's analogue/digital converter.
- Better possibility of accurately pairing temperature sensor set.

12.2 SENSOR TYPES

MULTICAL® Type 66-CDE can be supplied with three different temperature sensor sets, all with either 1.5 meter or 3.0 meter cable. Further pocket sensors with 5, 10 or 20 meter cable can be supplied.

For application in open heating systems together with 66-D, 3 pocket sensors paired in sets can be supplied.

The three different sensor pairs function almost identically but are mounted differently. Below the most important characteristics for each type are indicated:

| Type number -              |  | □□ - □ - □ - □ - □□□ |
|----------------------------|--|----------------------|
| Pt 500 Temperature sensors |  |                      |
| 65                         | 2 x Pocket sensor with 1.5 m cable       | A                    |
|                            | 2 x Pocket sensor with 3.0 m cable       | B                    |
|                            | 2 x Pocket sensor with 5 m cable         | C                    |
|                            | 2 x Pocket sensor with 10 m cable        | D                    |
| 66                         | 2 x Short direct sensor with 1.5 m cable | F                    |
|                            | 2 x Short direct sensor with 3.0 m cable | G                    |
| 65                         | 3 x Pocket sensor with 1.5 m cable       | L                    |
|                            | 3 x Pocket sensor with 3 m cable         | M                    |
|                            | 3 x Pocket sensor with 5 m cable         | N                    |
|                            | 3 x Pocket sensor with 10 m cable        | P                    |

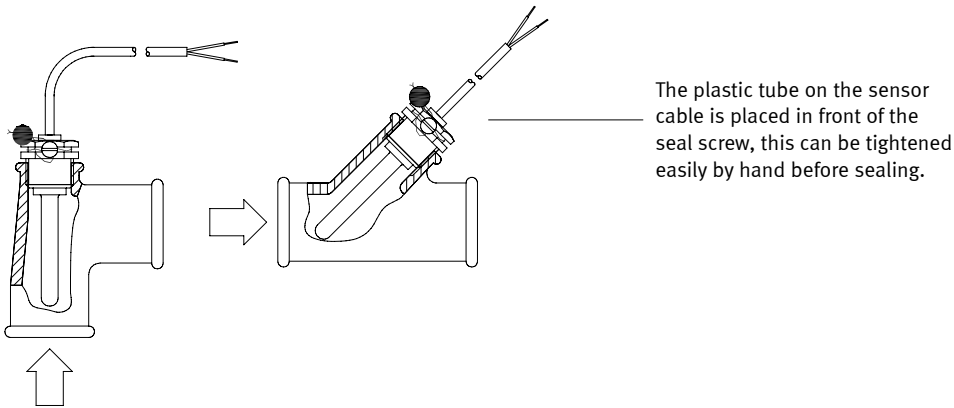
12.3 Pt500 TEMPERATURE SET FOR POCKETS

Pt500 cable sensor, based on a 3.5 mm dia. 2-wire silicone cable. A 5.8 mm stainless tube protects the sensor element.

The stainless tube is fitted in a sensor pocket which has an internal dimension of 6 mm. The sensor pocket is supplied with a 1/2" BSP connection in stainless steel in 65, 90 and 140 mm lengths.

The sensor design with separate pocket means that the sensor can be replaced without shutting the water off. Additionally, the large selection of pocket lengths means that the sensors can be fitted in all pipe sizes.

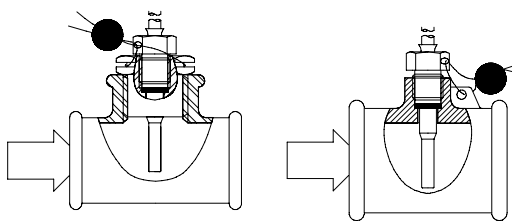
The sensor pockets can be used up to a plant pressure of PN25.



### 12.3.1 Pt500 DIRECT SHORT TEMPERATURE SENSORS

Pt500 direct short temperature sensors are designed in accordance with European standards for thermal energy meters EN 1434. The sensor is designed for fitting directly into the measuring medium, this means without a sensor pocket.

As above, this sensor also comprises a 3.5 mm diameter, 2-wire silicone cable. The sensor tube is made of stainless steel and has a diameter of 4 mm at its end. The sensor can be fitted in a special T-section, which can be supplied for 1/2", 3/4" and 1" pipe installations. Furthermore, the direct mounted short temperature sensor can also be fitted in a standard 90° T using a 1/2" or 3/4" BSP to M10 nipple. The sensor can also be fitted directly into many types of flow meters – which obviously reduces installation costs.

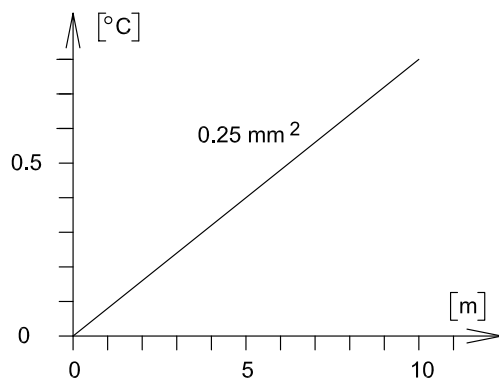


### 12.4 SENSOR CABLE

As mentioned previously, the temperature sensor comprises silicone cable. This is both heat resistant and flexible.

The cross-sectional area is 0.5 mm<sup>2</sup> for pocket mounted sensor sets which corresponds to 0.04K/metre. The two other sensor types have a cross sectional area of 0.25 mm<sup>2</sup>, which corresponds to a positive measure deviation of 0.08K/metre. The figures stated apply for 2 individual cross sectional areas in a 1 meter length.

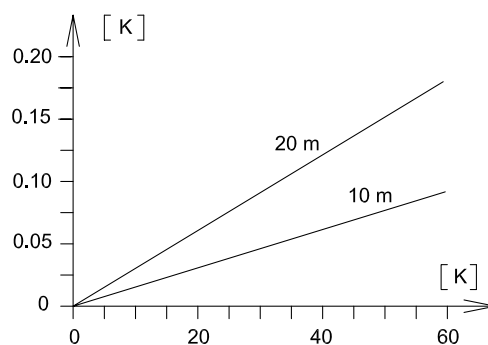
With all temperature probe types the cable length for the forward and return probes must be identical. If the lengths are not the same, the cable resistance will affect the measurement of the differential temperature.



We would generally advise customers to use the temperature sensors with the cable supplied. If the cable is too long, the excess can be rolled up and secured with cable strips.

If after careful consideration, you decide to shorten the cable, please note that both cables must have exactly the same length. Extension of the sensor cables must not take place as the cable joints can contribute to decreased long-term stability.

In applications where the temperature sensors have long cables, consideration must be shown during installation. The sensor cables must be installed with at least 25 cm distance to other cables out of regard to EMC. Besides the flow and return cables must be installed in such a way that the temperature differences between the two cables are minimized. The graph below shows how large a measuring error temperature differences between the cables can result in:



If the temperature difference between the two cables amounts to e.g. 60K, this would, with 20 m sensor cables, cause a measuring error of 0.18K at measuring of  $\Delta t$ , which in all applications must be seen as unacceptable. Generally it is recommended to keep the temperature difference between the two cables below 10K.



## 13. Trouble shooting

Before the meter is sent for repair or control, we would recommend that you check the table below to find a possible cause for the error:

| Symptom  | Possible cause   | Suggestion for correction  |
|--|--|--|
| No updating of display values.<br>Control segments in the display do not move. | Voltage supply is missing  | Change battery or control mains supply<br><br>Apply info-hour counter to evaluate duration of supply shortage                              |
| No function on the display<br>(blank display)                                  | Power supply and Back-up supply is missing   | Change Back-up cell<br><br>Change battery or check mains supply  |
| Energy and m <sup>3</sup> not accumulated                                      | Read "info" on the display.<br>If "info" = 000 ⇒<br><br>If "info" > 000 ⇒              | Check both flow meter and temperature sensor<br><br>Check the fault indicated by the info code<br><br>Read Info logger for further details |
| Accumulation of m <sup>3</sup> , but not of energy (e.g. MWh)                  | The flow and return sensors are swoped either in the installation or in the connection | Install the sensors correctly  |
| No accumulation of m <sup>3</sup>  | No volume pulses   | Check the flow meter connection<br><br>Check flow meter direction<br><br>Change the flow meter   |
| Incorrect accumulation of m <sup>3</sup>                                       | Error in flow meter<br><br>Flow meter is placed wrong<br><br>Wrong programming         | Submit the meter for repair<br><br>Place the flow meter correctly<br><br>Send MULTICAL® for check  |
| Wrong temperature displayed  | Defective temperature sensor<br><br>Insufficient installation                          | Change the sensor set<br><br>Overhaul the installation   |
| Temperature displayed is too low or accumulated energy (e.g. MWh) is too low   | Poor thermal sensor contact<br><br>Heat dissipation<br><br>Pocket sensors too short    | Place the sensors right at the bottom of the temperature pockets<br><br>Isolate the sensor pockets<br><br>Replace with longer sensors      |
| No registration of cooling energy  | "Min. T1" is programmed to 0°C   | Program "Min. T1" to e.g. 25°C via METERTOOL   |
| Faulty temperature indication and no data after replacement of 66-B to 66-CDE  | The connection print 5550-492 must always be used for 66-CDE                           | Replace the connection print   |
| The PQ-Controller is not functioning   | Faulty programming   | Program:<br>E=A<br>FF=00<br>GG=00<br>Set "PQ-Controller Data"  |

## 14. Approvals

### 14.1 TYPE APPROVAL

MULTICAL® Type 66-CDE has been approved by DELTA in accordance with EN1434-4 and OIML R75. The type approval encompasses all plug-in modules and supply modules.

The test report – No. K286095 – has been used as a basis for type approval in a number of countries, incl. Denmark.

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

Please contact Kamstrup A/S for further information relating to type approvals and verification facilities.

### 14.2 CE-DECLARATION

MULTICAL® Type 66-CDE is CE-marked in accordance with EMC-directive 89/336/EEC, paragraph 10.2. The declaration of compliance has been drawn up by DELTA, with certificate No. 307.

### 14.3 Leakage detection

Test report from Danish Technological Institute can be commissioned from Kamstrup A/S.

DELTA Electronics Testing

# ATTESTATION OF CONFORMITY

## EMC assessment - Certificate no. 307

Since 1992 DELTA Electronics Testing has been appointed Competent Body by the notified authority National Telecom Agency, Denmark. The attestation of conformity is in accordance with Article 10.2 of the Council EMC Directive 89/336/EEC

**DELTA client**  
Kamstrup A/S  
Industrivej 28, Stilling  
DK-8660 Skanderborg  
Telephone: +45 89 93 10 00  
Telefax: +45 89 93 10 01

**Product identification (type(s), serial no(s).)**  
A calculator used as a subassembly for a heat or cooling meter  
Type MULTICAL 66 C "X" "Y"  
"X": From 1 up to 5 or D or F  
"Y": From 2 up to 6

**Manufacturer**  
Kamstrup A/S

**Technical report(s)**  
Assessment sheet no. 307

**Standards/Normative documents**  
EMC Directive 89/336/EEC Article 10.2

The product identified above has been assessed and complies with the specified standards/normative documents. The attestation does not include any market surveillance. It is the responsibility of the manufacturer that mass-produced apparatus have the same EMC quality. The attestation does not contain any statements pertaining to the EMC protection requirements pursuant to other laws and/or directives other than the above mentioned if any.

Hørsholm, 2000-02-04

Jørgen Duvald Christensen

Jørgen Duvald Christensen  
Department Manager, EMC

Per Thåstrup Jensen

Per Thåstrup Jensen  
Project Manager, EMC

DELTA - Danish Electronics, Light & Acoustics is an independent organisation, affiliated to the Danish Academy of Technical Sciences (ATV).



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Divisions:  
Electronics Testing  
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## 15. Disposing of energy meters

Kamstrup's energy meters have been designed and constructed for many years' reliable operation at heat consumers. But, as you know, all good things must come to an end, and a worn out energy meter must be disposed of with consideration to the environment. In constructing MULTICAL® and ULTRAFLOW® we have aimed at recycling as many components as possible.

### ■ DISPOSAL BY THE SUPPLIER

Kamstrup are willing to dispose of worn out energy meters MULTICAL® and ULTRAFLOW® in an environmentally safe manner – please contact us before sending the meters. The disposal arrangement is free of charge to the customer, who only pays for transportation to Kamstrup A/S.

### ■ CUSTOMER SENDS TO DISPOSAL

The meters must not be separated previous to destruction. The entire meter is sent to nationally/locally approved electronics scrap centres. A copy of this page should be enclosed in the shipment and the customer made aware of the contents.

### ■ CUSTOMER DISPOSAL

The meters must be separated as listed, parts must be sent to separate, approved destruction.

The lithium batteries must not be postponed to mechanical thrust and the lead-in wires must not be shorted during transportation.

Please send any questions you may have concerning environmental matters, to:

#### **Kamstrup A/S**

Att.: Quality Control Dept.

Fax.: +45 89 93 10 01

E-mail: [energi@kamstrup.dk](mailto:energi@kamstrup.dk)

| Part   | Information on materials   | Recommended disposal                             |
|--|--|--|
| Lithium battery in MULTICAL®<br>(½ AA-cell and D-cell)                                       | Lithium and Thionyl-chloride<br>>UN 3091<<br>- ½ AA-cell: 0.3 g lithium<br>- D-cell: 4.9 g lithium | Approved destruction of lithium cells            |
| PC boards in MULTICAL® and ULTRAFLOW®<br>(LC-display and electrolytic capacitor are removed) | Copper epoxide laminate with soldered components   | PC board scrap for concentration of noble metals |
| LC-display   | Glass and liquid crystals  | Approved scrap centre for LC-displays            |
| Electrolytic capacitor   | Can contain PCB  | Approved destruction of electrolytic capacitors  |
| Cables for flow meters and sensors   | Copper with PVC- or silicone mantle  | Cable recycling                                  |
| Plastic parts, cast  | Noryle and ABS   | Plastic recycling                                |
| ULTRAFLOW® meter case  | Brass/red brass and stainless steel  | Metal recycling                                  |
| Packing  | Recycled cardboard   | Cardboard recycling                              |

## 16. Documents

List of data sheets, installation and operation instructions for this product.

|                           | <b>Danish</b> | <b>English</b> | <b>German</b> | <b>Russian</b> |
|---------------------------|---------------|----------------|---------------|----------------|
| Technical Description     | 5511-633      | 5511-634       | 5511-635      | 5511-636       |
| Data sheet                | 5810-279      | 5810-280       | 5810-281      | 5810-282       |
| Installation instructions | 5511-540      | 5511-542       | 5511-544      | 5511-554       |
| Operation instructions    | 5511-541      | 5511-543       | 5511-545      |                |



