Technical description

MULTICAL® 803

Heat meter (E1)
θ: 2 °C ...180 °C
ΔΘ: 3 K ...178 K

CE M22 0200

DK-0200-MI004-042

qp, p/l, Pt: See display
S/N: 79800234/HG/22
Type: 803A219

Pt100/500-EN60751

24 VAC/VDC / 50 Hz / 1 W

MULTICAL 803

E 1

00089.375

MWh

79800234

kamstrup

# List of words and symbols

| Word/symbol | Meaning | Unit | Expired designations |
|---|---|---|---|
| qi | Minimum approved flow | [l/h] | $Q_i$, $q_{vmin}$, $Q_{min}$, $q_{min}$ |
| qp | Permanent/approved nominal flow | [m³/h] | $Q_s$, $q_{vmax}$, $Q_n$, $q_n$, $q_{max}$ |
| qs | Maximum approved flow [1] | [m³/h] | $Q_{max}$ |
| Θ | Temperature range of calculator | [°C] | |
| $\theta_q$ | Temperature range of flow sensor (medium) | [°C] | |
| $\theta_{hc}$ | Limit value for shift between heat and cooling [2] | [°C] | |
| ΔΘ | Temperature difference of inlet and outlet | [K] | |
| Δflow | Difference in actual flow between V1 and V2 | [m³/h] | |
| ΔMass | Difference in mass between M1 and M2 | [kg] | |
| $t_{BAT}$ | Battery temperature | [°C] | |
| DN | Nominal diameter | [mm] | |
| PN | Nominal pressure | [bar] | |
| $E_c$ | Max permissible error of calculator | [%] | |
| $E_f$ | Max permissible error of flow sensor | [%] | |
| $E_t$ | Max permissible error of temperature sensors | [%] | |
| MPE | Maximum permissible error | [%] | |
| PQ | Power and flow in connection with tariff | | |
| GF | Glass fibre reinforcement | | |
| KMP | Kamstrup Meter Protocol | | |
| CP | Coefficient of Performance (COP) | | |

[1] *Less than an hour/day and less than 200 hours/year*
[2] *Only available in meter type 6*

# Contents

MULTICAL® 803

# 1   General description

MULTICAL® 803 is a robust and all-round calculator, suitable as heat meter, cooling meter or bifunctional heat/cooling meter together with 1 or 2 flow sensors and 1, 2, 3 or 4 temperature sensors. The calculator is intended for energy measurement in almost all types of thermal installations where water is used as the energy-conveying medium.

MULTICAL® 803 can, in addition to heat and cooling energy measurement in both open and closed systems, be used for leakage monitoring, permanent performance monitoring, power, flow and temperature limiter with valve control.

The MULTICAL® 803 calculator variant "M" (Mixed fluid) can operate in sub-zero temperatures, with a temperature range of -40...+140 °C. In applications where sub-zero temperatures can be expected, it is important to select temperature sensors and flow sensors with a suitable temperature range. Mixed fluids have a lower specific heat capacity compared to that of water. Kamstrup's mixed fluid calculator variant can compensate for this and thereby provide precise measurements regardless of the chemical composition in the installation.

According to EN 1434 and MID, MULTICAL® 803 can be designated as a "calculator" with separate type approval and verification. The MULTICAL® 803 calculator top can be separated from the connection base by means of a screw driver HEX 4 (4 mm Allen key) when the installation seals have been broken. This provides free access to the installation of flow sensor, temperature sensors, backup battery and communication modules. The calculator top is sealed from factory. The calculator can only be disassembled on approved meter laboratories. If the factory seal is broken, the factory guarantee no longer applies.

MULTICAL® 803 has 2 flow sensor inputs that can be used for both electronic and mechanical flow sensors. The pulse value can be configured from 0,001 to 300 pulses/liter and the calculator can be configured for all nominal flow sensor sizes from 0,6 to 15.000 m³/h. By default, the calculator is supplied with galvanically coupled flow sensor inputs that fit ULTRAFLOW® and, for example, reed switches. In addition, a connection board with 2 galvanically isolated flow sensor inputs can also be supplied.

MULTICAL® 803 has automatic conversion between Pt100 and Pt500 sensors. The calculator even detects the type of the connected temperature sensor. However, all connected sensors must be of the same type. Accurately matched Pt500 or Pt100 sensors measure the temperatures in inlet and outlet pipes according to EN 60 751 and EN 1434. MULTICAL® 803 has 4 temperature sensor inputs that all have 4-wire connection allowing up to 100 m sensor cable. Sensor inputs can, however, also be used with 2-wire connection, either by shortening the outer terminals in each 4-wire connection or by inserting a common 2x8 jumper above the connection terminals 3-7-8-4.

The accumulated heat energy and/or cooling energy can be displayed in kWh, MWh, GJ or Gcal with 7 or 8 significant digits plus measuring unit. The display has been specially designed with a view to obtaining long lifetime and sharp contrast in a wide temperature range and, by default, MULTICAL® 803 has backlit display.

Other reading options are: accumulated water consumption, operating hour counter, error hour counter, current temperature measurements, actual flow and power readings. Furthermore, MULTICAL® 803 can be configured to display monthly and yearly loggings, target date data, max/min. flow, max/min. power, information code, current date as well as user-defined tariffing.

MULTICAL® 803 can be mains-supplied either by 24 VAC or 230 VAC. A built-in battery backup also ensures that the calculator continues the energy measurement for up to 6 years in case of a voltage failure. The backlight of the display is always off during backup, but the display can be read in illuminated rooms. Furthermore, it is possible to connect a battery backup to module slot M1 by which, for example, M-Bus or wM-Bus will continue to operate during a voltage failure.

In addition to the energy meter's own data, MULTICAL® 803 can display the accumulated consumptions of four extra water meters, e.g. cold and hot water meters, which supply a pulse signal to MULTICAL® 803 via reed switch or electronic output. The contact signals from the extra water meters are connected via the communication modules M1 and M2.

On the back of the top cover, several multi connectors are located, which to some extent create the link between calculator, connection base and communication modules. In addition, these multi connectors enable calibration and adjustment. MULTICAL® 803 is available with up to 4 communication modules for Wireless M-Bus, M-Bus, RS232 and

many more. Most of the modules are available with either pulse inputs or pulse outputs for use in the module slots M1 and M2.

In designing MULTICAL® 803, great importance has been attached to flexibility through programmable functions and plug-in modules (see paragraph 11) to secure optimum use in a wide range of applications. In addition, the construction makes it possible to update previously installed MULTICAL® 803 via the PC-program METERTOOL HCW.

This technical description has been written with a view to enabling operations managers, meter installers, consulting engineers and distributors to utilize all functions comprised in MULTICAL® 803. Furthermore, the description is targeted at laboratories performing tests and verification.

The technical description is continuously updated. Find the latest edition at
www.kamstrup.com/en-en/product-centre

## 1.1      Mechanical construction
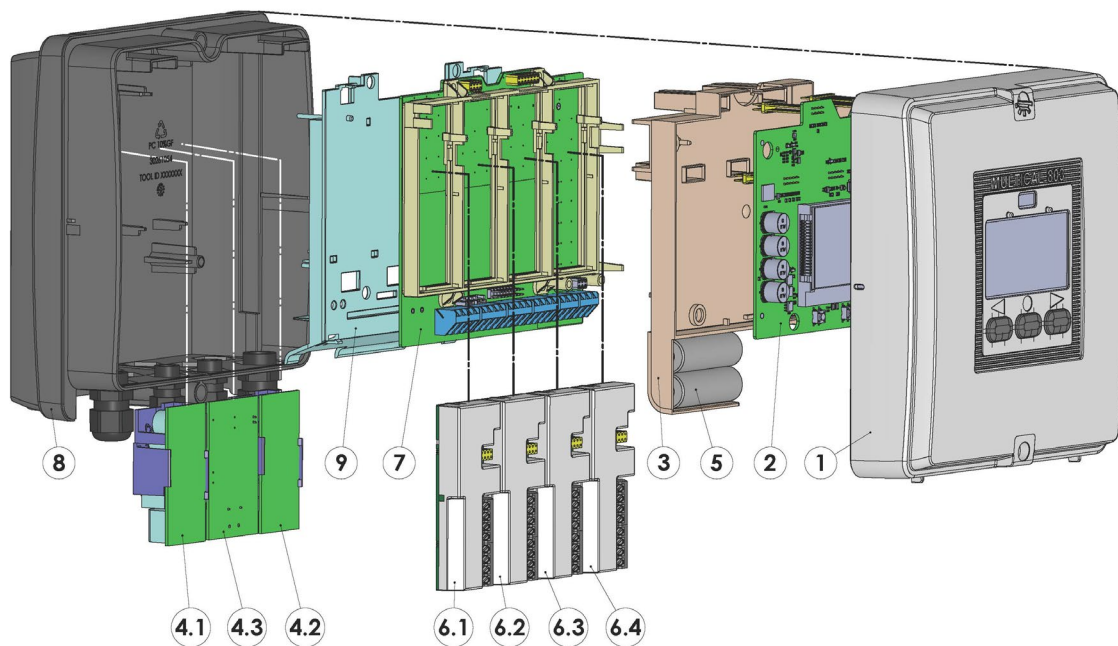


*Figure 1*

| 1 | Top cover with front keys and laser engraving | 6.1 | Module slot M1 |
|---|---|---|---|
| 2 | PCB with microcontroller, display, etc. | 6.2 | Module slot M2 |
| 3 | Verification cover<br>**Note:** May only be opened by an authorised laboratory. | 6.3 | Module slot M3 |
| 4.1 | Mandatory power supply to supply the calculator and M1 and M2 (delivered with all variants) | 6.4 | Module slot M4 |
| 4.2 | Optional power supply to supply the modules M3 and M4 | 7 | Connection board |
| 4.3 | Optional power supply (isolated 24 VDC) | 8 | Base cover with cable glands |
| 5 | Backup battery | 9 | Power supply cover<br>**Note:** May only be removed by authorized personnel |

# MULTICAL® 803

## 1.2 Electronic structure

The electronic construction of MULTICAL® 803 is shown in the block diagram below. The module slots in MULTICAL® 803 can be used with up to four communications modules that in addition to data communications also contain pulse inputs or pulse outputs. An overview of the available communication modules can be found in paragraph 11.
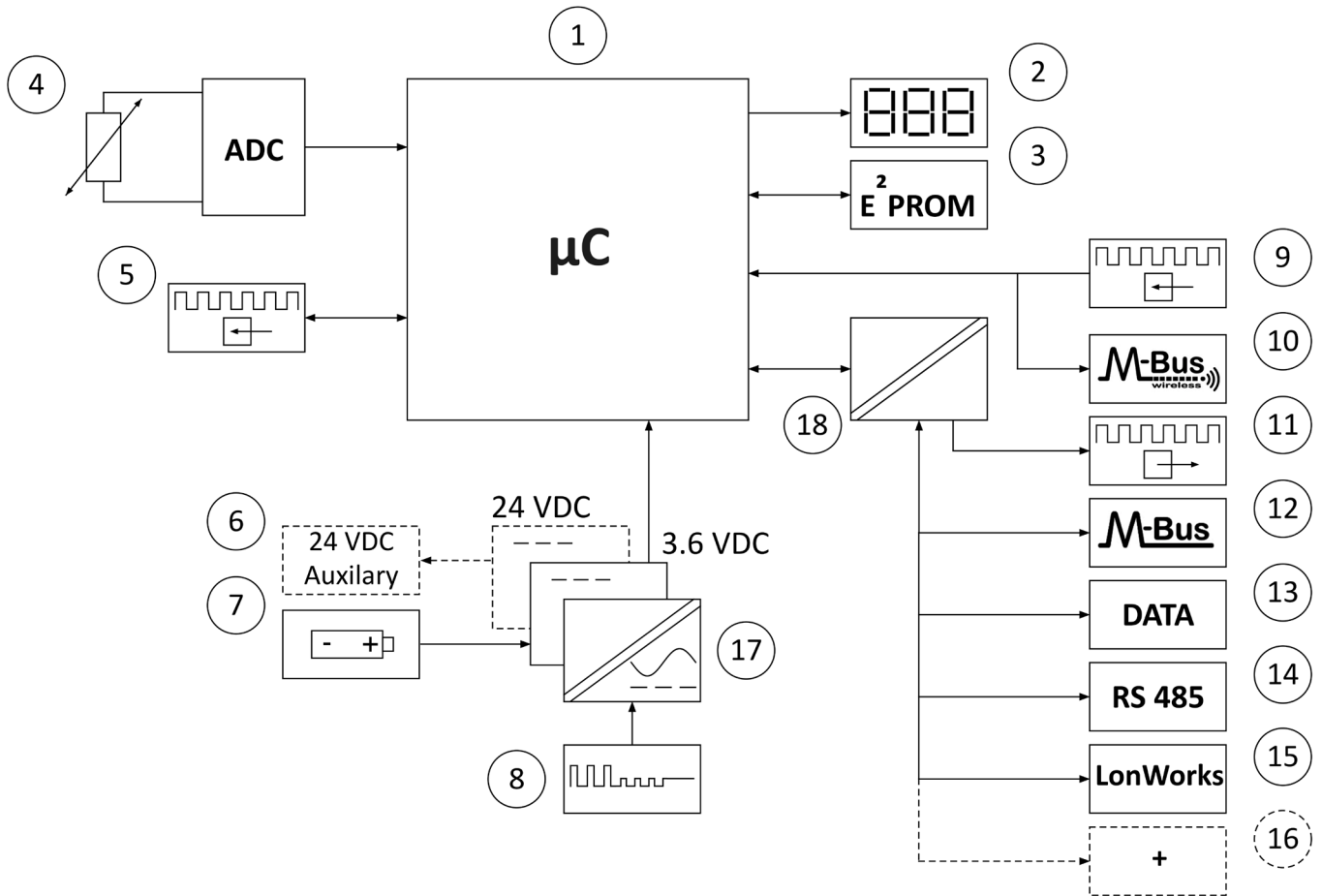
| 1 | Microcontroller | 10 | Wireless M-Bus |
|---|---|---|---|
| 2 | Display, eight-digit seven-segment + symbols | 11 | Pulse outputs |
| 3 | Non-volatile memory, EEPROM | 12 | M-Bus |
| 4 | Temperature sensors, Pt100 or Pt500, 2- or 4-wire | 13 | Data communication |
| 5 | Pulse inputs for flow sensors | 14 | RS 485, Modbus and BACnet |
| 6 | 24 VDC supply for analog outputs (option) | 15 | LonWorks |
| 7 | Backup battery, 2 x A-cells | 16 | … and even more communication options |
| 8 | High-power SMPS, 24 VAC/VDC or 230 VAC | 17 | Galvanic separation, power supplies |
| 9 | Pulse inputs for additional water and electricity meters | 18 | Galvanic separation, communication modules |

**Note:** The arrows in the figure indicate the signal direction.

# 2   Technical data

## 2.1   Approved meter data

Approvals

**DK-0200-MI004-042, heat meter**
according to MID 2014/32 EU, EN 1434:2007/AC:2007,
EN 1434:2015+A1:2018, FprEN 1434:2022 from 2022-04 and
WELMEC 7.2:2021

**TS 27.2 013, cooling meter**
according to DK-BEK 1178, EN 1434:2007/AC:2007,
EN 1434:2015+A1:2018 and FprEN 1434:2022 from 2022-04

**Bifunctional heat/cooling meter**
Marked with DK-0200-MI004-042 and TS 27.02 013 as well as yearly mark of
MID

EU directives

Measuring Instruments Directive, Low Voltage Directive,
Electromagnetic Compatibility Directive, Radio Equipment Directive,
Pressurized Equipment Directive for ULTRAFLOW® and RoHS Directive

| | | |
|---|---|---|
| Heat meter approval | DK-0200-MI004-042 | |
| Temperature range | $\theta$: 2 °C…180 °C | The stated minimum temperatures are related to the type approval. |
| Differential range | $\Delta\Theta$: 3 K…178 K | |
| Cooling meter approval | TS 27.2 013 | The calculator has no cutoff for low temperature and thus measures down to 0,01 °C and 0,01 K. |
| Temperature range | $\theta$: 2 °C…180 °C | |
| Differential range | $\Delta\Theta$: 3 K…178 K | |
| Differential range,cut-off | 0,00…2,50 K | |
| Media temperature, ULTRAFLOW® | $\theta_q$: 2 °C…130 °C | |

Accuracy
- Calculator                        $E_c = \pm\, (0,5 + \Delta\Theta_{min}/\Delta\Theta)$ %
- Flow sensor, ULTRAFLOW®          $E_f = \pm\, (2 + 0,02\ qp/q)$, but not exceeding ±5 %

Temperature sensor type          Pt100 or Pt500 – EN 60 751 (the calculator switches automatically)
Temperature sensor connection    2- or 4-wire connection*

* By mounting one common 2x8 jumper above the connection terminals 3-7-8-4, all connections are changed to 2-wire inputs.

EN 1434 designation          Environmental classes A and C

MID designation          Mechanical environment: Classes M1 and M2

Electromagnetic environment: Classes E1 and E2

Non-condensing environment, closed location
(indoors), 5…55°C

Condensing environment, closed location
(indoors), 5…55°C

## 2.2 Accuracy of the calculator
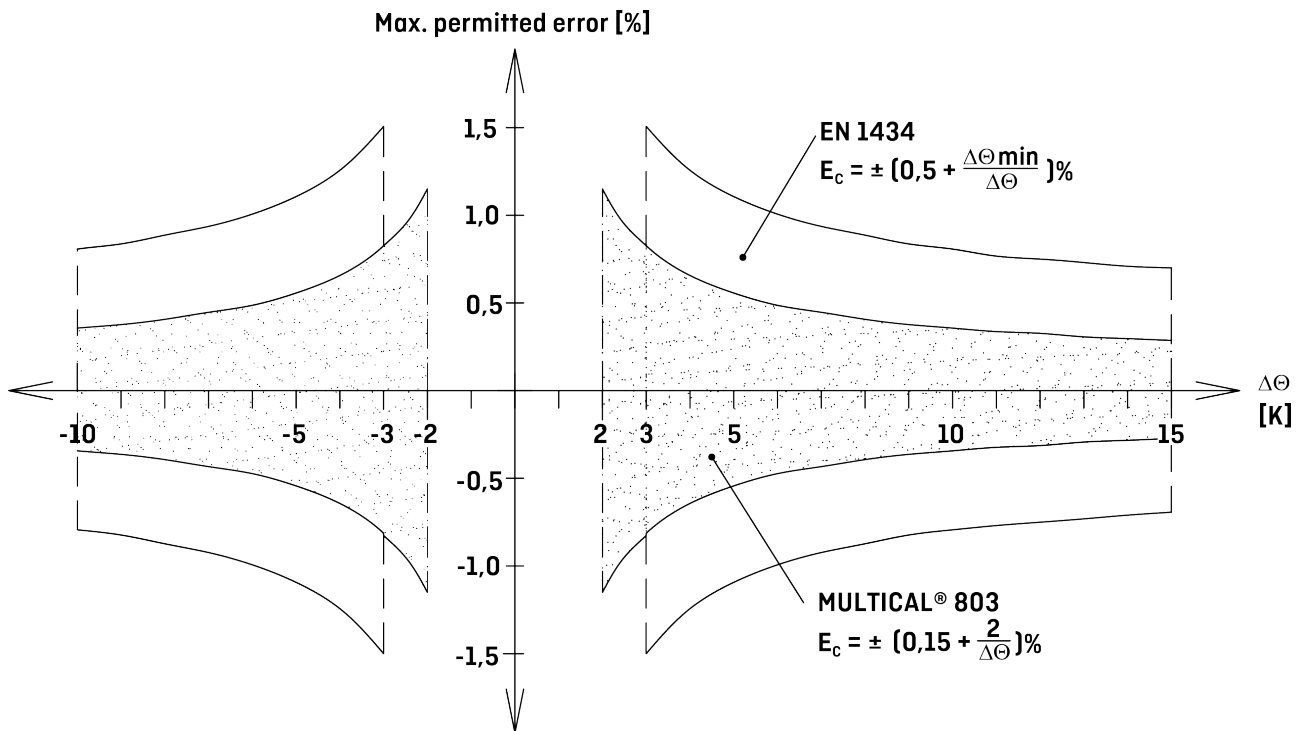


*Figure 2: Typical accuracy of MULTICAL® 803 compared to EN 1434.*

## 2.3 Accuracy of a total meter

| Heat meter components | MPE according to EN 1434-1 | Typical accuracy |
|---|---|---|
| ULTRAFLOW® | $E_f = \pm (2 + 0{,}02\ qp/q)$, but not exceeding ±5 % | $E_f = \pm (1 + 0{,}01\ qp/q)$ % |
| MULTICAL® 803 | $E_c = \pm (0{,}5 + \Delta\Theta_{min}/\Delta\Theta)$ % | $E_c = \pm (0{,}15 + 2/\Delta\Theta)$ % |
| Sensor pair | $E_t = \pm (0{,}5 + 3\ \Delta\Theta_{min}/\Delta\Theta)$ % | $E_t = \pm (0{,}4 + 4/\Delta\Theta)$ % |

**MULTICAL® 803 and ULTRAFLOW® qp 1.5 m³/h @ΔΘ 30K**
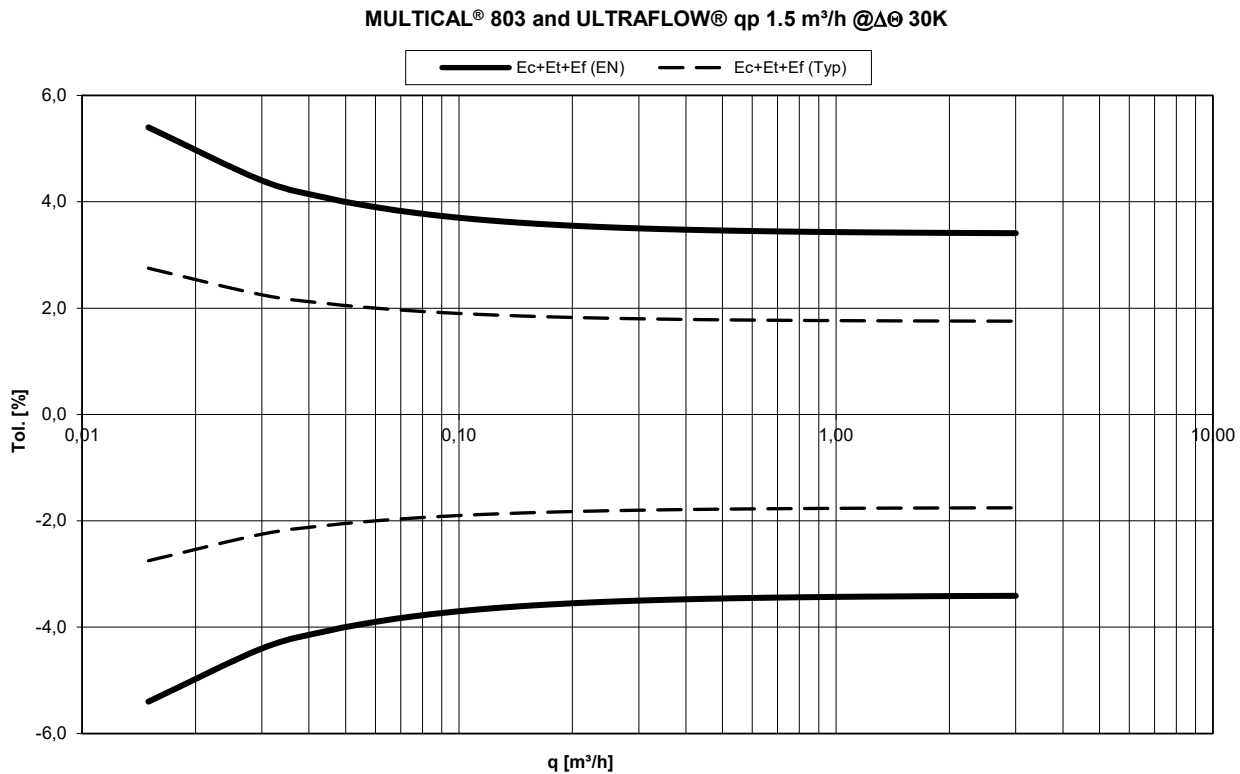


*Diagram 1: Total typical accuracy of MULTICAL® 803, sensor pair and ULTRAFLOW® compared to EN 1434-1.*

## 2.4  Electrical data

### Calculator data

| | |
|---|---|
| Typical accuracy | Calculator: $E_c \pm (0{,}15 + 2/\Delta\Theta)$ %        Sensor pair: $E_t \pm (0{,}4 + 4/\Delta\Theta)$ % |
| Display | LCD with white LED (32 x 63 mm) - 7 or 8 digits with 10 mm digit height |
| Resolutions | 999,9999 - 9999,999 – 99999,99 – 999999,9 – 9999999 |
| | 9999,9999 - 99999,999 – 999999,99 – 9999999,9 – 99999999 |
| Energy units | MWh – kWh – GJ – Gcal |
| Data logger (EEPROM), programmable | Logging intervals: From one minute to one year |
| | Logger content: All registers can be selected |
| | Standard logger profile: 20 years, 36 months, 460 days, 1400 hours |
| Info logger (EEPROM) | 280 info codes can be read out via LogView, the latest 50 info codes can be read on the calculator's display |
| Config logger (EEPROM) | 50 config loggings |
| Clock/calendar (with backup battery) | Clock, calendar, leap year compensation, target date |
| Summer/winter time (DST) | Programmable under country code<br>The function can be disabled so that "technical normal time" is used. |
| Time accuracy | Without external adjustment:    Deviation less than 15 min./year from legal time |
| | With external adjustment every 48hours:     Deviation less than 7 s from legal time |
| Data communication | KMP protocol with CRC16 used for optical communication as well as modules. |

# MULTICAL® 803

| | |
|---|---|
| **Power of temperature sensors** | < 10 μW RMS |
| **Internal supply voltage** | 3,6 VDC ± 0.1 VDC |
| **Backup battery**<br>Replacement interval | 3,6 VDC, 2xA lithium<br>10 years |
| **Supply, 230 V**<br>*Type 803-xxxxxxx-A/-C* | 230 VAC +15/-30 %, 50/60 Hz |
| **Supply, 24 V**<br>*Type 803-xxxxxxx-b/-d* | 24 VAC ±50 %, 50/60 Hz or 24 VDC +75/-25 %<br>**Note**: The internal 24 VDC auxiliary supply for, for example, analog outputs requires that the supply is > 15 VAC or > 20 VDC |
| Insulation voltage | 3,75 kV |
| Power consumption | < 1 W for type 803-0000000-A and -b<br>< 7 W for type 803-0000000-C and -d |
| EMC data | Fulfils EN 1434 class A and C (MID class E1 and E2) |

**Temperature measurement**

| | | t1<br>Inlet | t2<br>Outlet | t3<br>Control | t4<br>Extra | ΔΘ (t1-t2)<br>Heat<br>measurement | ΔΘ (t2-t1)<br>Cooling<br>measurement | t5<br>Preset<br>for A1 and A2 |
|---|---|---|---|---|---|---|---|---|
| **803-A**<br>Pt100/Pt500,<br>2/4-wire | Measuring range | 0,00...185,00 °C<br>(t1 and t2: Approved for 2,00...180,00 °C) | | | | | | |
| **803-M**<br>Pt100/Pt500,<br>2/4-wire | | -40,00...140,00 °C | | | | | | |

**Offset adjustment**

± 0,99 K joint zero point adjustment for t1, t2, t3 and t4.
See paragraph 7.3

**Note:** The offset adjustment is only active on measured temperatures. If, for example, t3 has been selected for a preset value, the offset adjustment will not influence the preset value.

**Max cable lengths**

| | Pt100, 2-wire | Pt500, 2-wire |
|---|---|---|
| Max ø8 mm cable | 2 x 0,25 mm$^2$: 2.5 m<br>2 x 0,50 mm$^2$: 5 m<br>2 x 1,00 mm$^2$: 10 m | 2 x 0,25 mm$^2$: 10 m |
| | **Pt100, 4-wire** | **Pt500, 4-wire** |
| | 4 x 0,25 mm$^2$: 100 m | 4 x 0,25 mm$^2$: 100 m |

**Flow measurement V1 and V2**

| | ULTRAFLOW®<br>V1: 9-10-11 and V2: 9-69-11 | Reed switches<br>V1: 10-11 and V2: 69-11 | FET switches<br>V1: 10-11 and V2: 69-11 | 24 V active pulses<br>V1: 10B-11B and V2: 69B-79B |
|---|---|---|---|---|
| CCC code | 1xx-2xx-4xx-5xx-8xx | 0xx | 9xx | 2xx and 9xx |
| EN 1434 pulse class | IC | IB | IB | (IA) |
| Pulse input | 680 kΩ pull-up to 3.6 V | 680 kΩ pull-up to 3.6 V | 680 kΩ pull-up to 3.6 V | 12 mA at 24 V |

| | | | | |
|---|---|---|---|---|
| Pulse ON | < 0,4 V i > 1 ms | < 0,4 V i > 300 ms | < 0,4 V i > 30 ms | < 4 V i > 3 ms |
| Pulse OFF | > 2,5 V i > 4 ms | > 2,5 V i > 100 ms | > 2,5 V i > 70 ms | > 12 V i > 4 ms |
| Pulse frequency | < 128 Hz | < 1 Hz | < 8 Hz | < 128 Hz |
| Integration frequency | < 1 Hz | < 1 Hz | < 1 Hz | < 1 Hz |
| Electrical isolation | No | No | No | 2 kV |
| Max cable length | 10 m | 10 m | 10 m | 100 m |
| Max cable length with Cable Extender Box, Type 66-99-036 | 30 m | 30 m | 30 m | - |

### Pulse inputs A and B
In-A 65-66 and In-B: 67-68 via modules in slots M1 and M2

| | Electronic switch | Reed switch |
|---|---|---|
| Pulse input | 680 kΩ pull-up to 3.6 V | 680 kΩ pull-up to 3.6 V |
| Pulse ON | < 0,4 V i > 30 ms | < 0,4 V i > 500 ms |
| Pulse OFF | > 2,5 V i > 30 ms | > 2,5 V i > 500 ms |
| Pulse frequency | < 3 Hz | < 1 Hz |
| Electrical isolation | No | No |
| Max cable length | 25 m | 25 m |
| Requirements to external contact | Leak current at open contact < 1 µA | |
| Update of display | 2 s | |

### Pulse outputs C and D
Out-C: 16-17 and Out-D: 18-19 via modules in slots M1 and M2

| | | | Pulse duration: |
|---|---|---|---|
| Pulse value | Heat meter: | Out-C = CE+ | |
| | | Out-D = CV | Selectable: |
| *When pulse outputs are used for, for example, remote count of energy and volume with the same resolution as the display [1]* | Cooling meter: | Out-C = CE-<br>Out-D = CV | 10 ms, 32 ms or 100 ms |
| | Heat/cooling meter: | Out-C = CE+<br>Out-D = CE- | |
| Pulse value | Transmitter: | Out-C = V1<br>Out-D = V2 | 4 ms |
| *When pulse outputs are used as Pulse Transmitter/Divider, e.g. for regulatory purposes* | Divider: | Out-C = V1/4 | 22 ms |

| Communication module | HC-003-11 (Before 2017-05)<br>HC-003-21 & -31 (Before 2018-04) | HC-003-11 (After 2017-05)<br>HC-003-21 & -31 (After 2018-04) |
|---|---|---|
| Pulse output type | Open collector (OB) | Opto FET |
| External voltage | 5…30 VDC | 1…48 VDC/AC |
| Current | < 10 mA | < 50 mA |
| Residual voltage | $U_{CE} \approx 1$ V at 10 mA | $R_{ON} \leq 40\ \Omega$ |
| Electrical isolation | 2 kV | 2 kV |
| Max cable length | 25 m | 25 m |

[1] *At a high resolution, the pulse outputs are down-divided into 1:10 when selecting 32 ms and 100 ms. See paragraph 10 about PP codes.*

# MULTICAL® 803

## 2.5  Mechanical data

| | |
|---|---|
| Environmental class | Fulfils MID classes M1 and M2 |
| Ambient temperature | 5...55 °C, closed location (installation indoors) |
| Protection class | Calculator: IP65 according to EN/IEC 60529 |

**Medium temperatures**

| | | |
|---|---|---|
| ULTRAFLOW® | } 2...130 °C | At media temperatures below the ambient temperature or above 90 °C in the flow sensor, wall-mounting of the calculator is recommended |

| | |
|---|---|
| Medium in ULTRAFLOW® | Water (district heating water as described in  AGFW FW510) |
| Storage temperature | -25...60 °C (drained flow sensor) |
| Connecting cables | M12: ø3...8 mm and M16: ø4...10 mm |
| Supply cable | M16: ø4...10 mm |

## 2.6  Materials

| | |
|---|---|
| Cast plastic parts | Thermoplastic, PC 10 % GF |
| Gasket | Neoprene rubber |
| Push buttons | EPDM rubber |

## 2.7  Tools for installation

| | |
|---|---|
| Connection terminals | Screwdriver with straight slot 3,5 mm |
| Screws in the cover | HEX 4 (also known as Allen key 4 mm) |
| | **Note:** Torx 25 can also be used |

# 3  Type overview

MULTICAL® 803 can be ordered in countless combinations as required by the customer. First, select the required hardware from the type overview and next, select the required software configuration via the configuration number (config number). Further, certain data is configured under the country code, e.g. the definition of GMT, the primary M-Bus address as well as the yearly and monthly target dates. Through these selections and configurations, MULTICAL® 803 can be adjusted for its current task.

The calculator has been configured from the factory and is ready for use. It can, however, be changed/reconfigured after installation. Reconfiguration can take place from the calculator's "SETUP loop" or by using either METERTOOL HCW or READy. Read more about the "SETUP loop" in paragraph 6.3 and in the technical description of METERTOOL HCW (5512-2097).
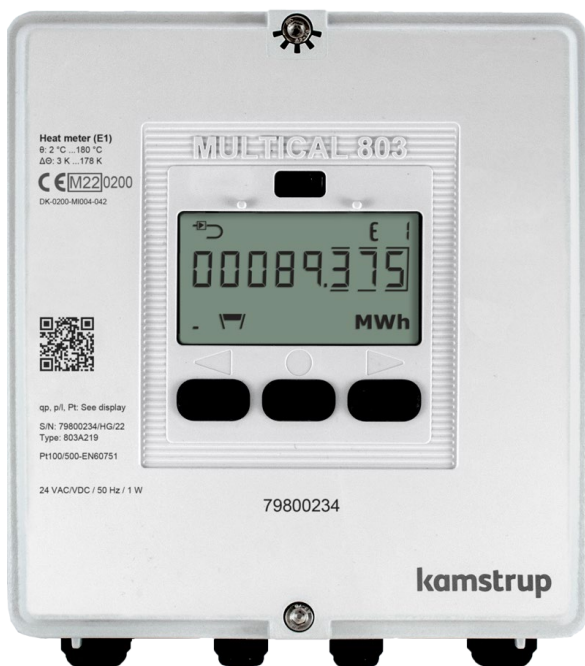
## Type number:
### >803-xxxx-xxxx-xxxxxxxx<

The *first* 4 digits of the calculator's type number (803-**xxxx**-xxxx-xxxxxxxx) are written on the calculator's front and <u>cannot</u> be changed after production.

The 4 digits *in the middle* of the type number (803-xxxx-**xxxx**-xxxxxxxx) are not written on the calculator, but are shown in the display.

The *last* 8 digits of the calculator's type number (803-xxxx-xxxx-**xxxxxxxx**) show the 4 communications modules mounted in the meter. This is not written on the calculator, but can be read from the display.

## Config. number:
### >A-B-CCC-DDD-EE-FF-GG-L-M-N-PP-RR-T-VVVV<

The config number is not written on the calculator, but can be displayed distributed on four readings in "TECH loop".

Config 1: >A-B-CCC-DDD<

    Flow sensor position-Measuring unit-Resolution-Display code

Config 2: >EE-FF-GG-L-M<

    Tariff-Pulse inputs-Integration mode-Leakage

Config 3: >N-PP-RR-T<

    Cold water leakage-Pulse outputs-Data logger profile-Encryption level

Config 4: >VVVV<

    Customer label

## Serial number:
### >xxxxxxxx/WW/yy<

Consisting of:

8-digit serial number (**xxxxxxxx**)
2-digit device code for extended availability **(WW)**
2-digits for production year **(yy)**

The unique serial number is written on the calculator and <u>cannot</u> be changed after factory programming.

Data:
During production, MULTICAL® 803 is programmed with a number of measuring values. See paragraph 3.4 for more details about these measuring values.

## 3.1 Type number

**MULTICAL® 803 type number**

| | Static data | - | Dynamic data | - | Dynamic data |
|---|---|---|---|---|---|
| | 803-xxxx | | xxxx | | xxxxxxxx |
| | Written on the calculator's front | | Shown in display | | Shown in display |

| | | Type 803 - | ☐ | - | ☐ | - | ☐☐ | - | ☐ | - | ☐☐ | - | ☐ | - | ☐☐ ☐☐ ☐☐ ☐☐ |

**Calculator type**

| | | | | | | |
|---|---|---|---|---|---|---|
| Pt100/Pt500, 2/4-wire | t1, t2, t3, t4 | V1,V2 | Backlit display | | A |
| Pt100/Pt500, 2/4-wire | t1, t2, t3, t4 | V1,V2 | Backlit display (Mixed fluid only) | | M |

**Meter type**

| | | | |
|---|---|---|---|
| Heat meter | MID module B | | 1 |
| Heat meter | MID module B+D | | 2 |
| Heat/cooling meter | MID module B+D & TS 27.02 | $\Theta_{HC}$= OFF | 3 |
| Heat meter | National approval | | 4 |
| Cooling meter | TS 27.02+BEK1178 | | 5 |
| Heat/cooling meter | MID module B+D & TS 27.02 | $\Theta_{HC}$ = ON | 6 |
| Volume meter, hot | National approval | | 7 |
| Volume meter, cold | National approval | | 8 |
| Energy meter | National approval | | 9 |

**Country code**

| | |
|---|---|
| See paragraph 3.5 | XX |

**Flow sensor connection type**

| | |
|---|---|
| Delivered with one ULTRAFLOW® | 1 |
| Delivered with two identical ULTRAFLOW® | 2 |
| Prepared for one ULTRAFLOW® | 7 |
| Prepared for two identical ULTRAFLOW® | 8 |
| Prepared for flow sensors with fast and bounce-free electronic pulses | C |
| Prepared for flow sensors with slow and bounce-free electronic pulses | J |
| Prepared for flow sensors with slow pulses with bounce | L |
| Prepared for flow sensors with 24 V active/passive pulses* | P |
| Delivered with one flow sensor (Mixed fluid only) | G |

**Temperature sensor pair** (see paragraph 9)

| | | | |
|---|---|---|---|
| Delivered without temperature sensors | | | 00 |
| **2-wire Pt500 temperature sensors** | | | |
| Direct short sensor pair | DS 27,5 mm | L 1,5 m - 3,0 m | 5x |
| Direct short sensor pair | DS 38,0 mm | L 1,5 m - 3,0 m | 2x |
| Pocket sensor pair or 3 pairs | PL ø5,8 mm | L 1,5 m - 10,0 m | 8x |
| **2-wire Pt100 temperature sensors** | | | |
| Direct short sensor pair | DS 27,5 mm | L 2,0 m | J6 |
| **4-wire Pt500/Pt100** | | | |
| Pocket sensor pair with connection head | PL ø6,0 mm | L 105 mm - 230 mm | Ax |
| Pocket sensor pair with connection head | PL ø5,8 mm | L 65 mm - 180 mm | Cx |

**MULTICAL® 803 type number**

| | Static data 803-xxxx | - | Dynamic data xxxx | - | Dynamic data xxxxxxxx |
|---|---|---|---|---|---|
| | Written on the calculator's front | | Can be displayed | | Shown in display |

| Type 803 - | □ | - | □ | - | □□ | - | □ | - | □□ | - | □ | - | □□ | □□ | □□ | □□ |

**Supply\*\***

| | | | |
|---|---|---|---|
| 1 x 230 VAC | Supply of module slots M1+M2 | | A |
| 1 x 24 VAC/VDC | Supply of module slots M1+M2 | | B |
| 2 x 230 VAC | Supply of module slots M1+M2+M3+M4 | 1 x 24 VDC auxiliary supply\*\*\* | C |
| 2 x 24 VAC/VDC | Supply of module slots M1+M2+M3+M4 | 1 x 24 VDC auxiliary supply\*\*\* | d |

**Communication module (4 module slots)**

| | M1 | M2 | M3 | M4 |
|---|---|---|---|---|
| No module | 00 | 00 | 00 | 00 |
| Data Pulse, inputs (In-A, In-B) | 10 | 10 | 10 | 10 |
| Data Pulse, outputs (Out-C, Out-D) | 11 | 11 | 11 | 11 |
| Wired M-Bus, inputs (In-A, In-B) | 20 | 20 | 20 | 20 |
| Wired M-Bus, outputs (Out-C, Out-D) | 21 | 21 | 21 | 21 |
| Wired M-Bus, Thermal Disconnect | 22 | 22 | 22 | 22 |
| LinkIQ/wM-Bus, inputs (In-A, In-B), EU | 32 | 32 | - | - |
| LinkIQ/wM-Bus, outputs (Out-C, Out-D), EU | 33 | 33 | - | - |
| wM-Bus, inputs (In-A, In-B), 912,5/915/918,5 MHz | 34 | 34 | - | - |
| Analog outputs 2 x 0/4…20 mA\*\*\* | - | - | 40 | 40 |
| Analog inputs 2 x 4…20 mA / 0…10 V\*\*\* | - | - | 41 | - |
| PQT Controller | - | - | 43 | - |
| Low Power Radio, inputs (In-A, In-B), 434 MHz | 50 | 50 | - | - |
| Low Power Radio GDPR, inputs (In-A, In-B), 434 MHz | 51 | 51 | - | - |
| NB-IoT, inputs (In-A, In-B) | 56 | 56 | - | - |
| LON TP/FT-10, inputs (In-A, In-B) | 60 | 60 | 60 | 60 |
| BACnet MS/TP, inputs (In-A, In-B) | 66 | 66 | 66 | 66 |
| Modbus RTU, inputs (In-A, In-B) | 67 | 67 | 67 | 67 |
| 2G/4G network module + 2 pulse inputs (In-A, In-B) | 80 | 80 | - | - |
| BACnet IP, inputs (In-A, In-B) | 81 | 81 | 81 | 81 |
| Modbus/KMP TCP/IP + 2 pulse inputs (In-A, In-B) | 82 | 82 | 82 | 82 |
| READy Ethernet, inputs (In-A, In-B) | 83 | 83 | 83 | 83 |
| High Power Radio Router, inputs (In-A, In-B), 444 MHz | 84 | 84 | - | - |
| High Power Radio Router GDPR, inputs (In-A, In-B), 444 MHz | 85 | 85 | - | - |

*\* Supplied with connection board for 24 V active/passive pulses (see paragraph 8.4 and 8.5)*
*\*\* The type number A, b, C, d are shown in this way in the display*
*\*\*\* 24 VDC auxiliary supply can be used as external supply for these modules (see paragraph 11.2.11 and  paragraph 11.2.12)*

## 3.2 Module combinations

MULTICAL® 803 supports up to four communication modules. It is possible to order a wide range of combinations of the four communication modules, however with few limitations, see type number overview in paragraph 3.1. The limitations are made so that MULTICAL® 803 can support most of the installation and communication requirements.

However, there are in fact far fewer technical limitations for the location of the communication modules than what is indicated in the type number overview in paragaph 3.1. It is thus possible to put together an alternative combination by ordering the communication modules separately and installing them in MULTICAL® 803 as needed. When installing loose communication modules, the guidelines in the guide below **must** be followed to ensure the proper functioning of the total meter.

---

### MULTICAL® 803
### Guide for combinations of communication modules

1. **Wireless communication**
   Only one wireless communication module

2. **Management and regulation**
   Only one PQT or analog input module

3. **Internal antenna**
   Internal antenna only on module slot 1 (M1)

4. **Battery backup**
   Battery backup on module slot 1 (M1) can be selected for, for example, wM-Bus and M-Bus.

5. **Pulse inputs and pulse outputs**
   Only on module slots 1 and 2 (M1 and M2)

6. **Supply**
   The module area's two sides, module slots 1 and 2 [M1-M2] and module slots 3 and 4 [M3-M4], respectively, have separate power supplies. With regard to the power supply, it is only allowed to install one type of the 8x communication module per side.

---

## 3.3 Accessories

Supply modules

| Article no. | Description |
|---|---|
| HC-993-10 | Backup battery, 2xA-cell |
| HC-993-11 | 230 VAC to 3,6 VDC supply module |
| HC-993-12 | 24 VAC/VDC to 3,6 VDC supply module |
| HC-993-13 | 230 VAC to 24 VDC auxiliary supply module |
| HC-993-14 | 24 VAC/VDC to 24 VDC auxiliary supply module |
| 5000-503 | Connection cable 3,6 VDC (red/black cable with two white connectors) |
| 5000-504 | Connection cable 24 VDC for modules (red/black cable with one white connector) |
| 5000-505 | Connection cable 230 VAC / 24 VAC/VDC (white cables with black connectors) |
| 6699-049 | Connection PCB 230 VAC (green) |
| 6699-050 | Connection PCB 24 VAC/VDC (blue) |
| 6699-048 | Supply label MULTICAL® 803, 10 pcs. (2006-776) |

Various accessories

| Article no. | Description |
|---|---|
| 3026-517 | Sealing cap for DS sensor, blue, 2 pcs |
| 3026-518 | Sealing cap for DS sensor, red, 2 pcs |
| 2105-002 | Sealing cap , G¾B (R½) |
| 3026-1148 | Sealing cap self locking G¾B (R½) coupling |
| 3026-857 | Bracket ULTRAFLOW® |
| 3130-262 | Blind plug with O-ring |
| 5000-337 | Module cable 2 m (2x0,25 m²) |
| 6699-035 | USB cable for module configuration |
| 6699-036 | Cable extension box |
| 6699-042 | Metal plate for optical read-out head, 20 pcs |
| 6699-045 | Connection PCB 24V pulses |
| 6696-005 | Bluetooth optical read-out head |
| 6699-099 | Infrared optical read-out head with USB connector |
| 6699-909 | Holder for optical reading head |
| 6699-285 | Accessory bag with cable glands M12 and M16 |
| 6699-447.E | Internal antenna for Kamstrup radio, 434 MHz |
| 6699-448 | Mini triangle antenna for wM-Bus and 2G/4G network module |
| 6699-482.E | Internal antenna for wM-Bus 868 MHz |

Calibration units

| Article no. | Description |
|---|---|
| 6699-361 | Calibration unit for MC803 Pt500 |
| 6699-362 | Calibration unit for MC803 Pt100 |

Software

| Article no. | Description |
|---|---|
| 6699-724 | METERTOOL HCW |
| 6699-725 | LogView HCW |

# MULTICAL® 803

## Couplings PN16/PN25

| Article no. | Description |
|---|---|
| 6561-323 | Coupling incl. gasket, DN15, G¾B - R½, 2 pcs |
| 6561-324 | Coupling incl. gasket, DN20, G1B - R¾, 2 pcs |
| 6561-349 | Coupling incl. gasket, DN25, G1¼B - R1, 2 pcs |
| 6561-350 | Coupling incl. gasket, DN32, G1½B - R1¼, 2 pcs |
| 6561-351 | Coupling incl. gasket, DN40, G2B - R1½, 2 pcs |

## Extensions PN16/PN25

| Article no. | Description |
|---|---|
| 1330-010 | Extension excl. gaskets, 110 - 165 mm/165 - 220 mm, G¾B - G1B, 1 pc * |
| 1330-011 | Extension excl. gaskets, 190 - 220 mm, G1B - G1B, 1 pc |
| 1330-012 | Extension excl. gaskets, 110 - 220 mm, G¾B - G1B, 1 pc * |
| 1330-013 | Extension excl. gaskets, 110 - 130 mm, G¾B - G1B, 1 pc * |
| 1330-015 | Extension excl. gaskets, 110 - 130 mm, G¾B - G¾B, 1 pc. |
| 1330-019 | Extension excl. gaskets, 110 - 165 mm, G¾B - G¾B, 1 pc. |
| 1330-023 | Extension excl. gaskets, 130 - 165 mm, G1B - G1B, 1 pc |

*\* 2 pcs to be ordered per calculator*

## Sensor nipples and pockets

| Article no. | Description |
|---|---|
| 6561-330 | 11 mm adapter for 38 mm short direct sensor |
| 6556-546 | R½ nipple for short direct sensor |
| 6556-547 | R¾ nipple for short direct sensor |
| 6557-424 | 2 pc, R½ x 65 mm sensor pocket, ⌀5.8 mm |
| 6557-427 | 2 pc, R½ x 90 mm sensor pocket, ⌀5.8 mm |
| 6557-414 | 2 pc, R½ x 140 mm sensor pocket, ⌀5.8 mm |

## Ball valves

| Article no. | Description |
|---|---|
| 6556-570 | ½" ball valve with M10 connection for direct temperature sensor |
| 6556-571 | ¾" ball valve with M10 connection for direct temperature sensor |
| 6556-572 | 1" ball valve with M10 connection for direct temperature sensor |
| 6556-526 | 1¼" ball valve with M10 connection for direct temperature sensor |
| 6556-527 | 1½" ball valve with M10 connection for direct temperature sensor |

## Gaskets

| Article no. | Description |
|---|---|
| 2210-233 | Gasket for short direct temperature sensor, 1 pc |
| 2210-061 | Gasket for G¾B (R½) flow sensor (thread), 1 pc |
| 2210-062 | Gasket for G1B (R¾) flow sensor (thread), 1 pc |
| 2210-063 | Gasket for G1¼B (R1) flow sensor (thread), 1 pc |
| 2210-064 | Gasket for G1½B (R1¼) flow sensor (thread), 1 pc |
| 2210-065 | Gasket for G2B (R1½) flow sensor (thread), 1 pc. |

| Article no. | Description |
|---|---|
| 2210-147 | Gasket for DN25 PN25 flow sensor (flange), 1 pc |
| 2210-133 | Gasket for DN25 PN25 flow sensor (flange), 1 pc |
| 2210-217 | Gasket for DN32 PN25 flow sensor (flange), 1 pc |
| 2210-132 | Gasket for DN40 PN25 flow sensor (flange), 1 pc |
| 2210-099 | Gasket for DN50 PN25 flow sensor (flange), 1 pc |
| 2210-141 | Gasket for DN65 PN25 flow sensor (flange), 1 pc |
| 2210-140 | Gasket for DN80 PN25 flow sensor (flange), 1 pc |
| 1150-142 | Gasket for DN100 PN25 flow sensor (flange), 1 pc |
| 1150-153 | Gasket for DN125 PN25 flow sensor (flange), 1 pc |
| 1150-140 | Gasket for DN150 PN25 flow sensor (flange), 1 pc |
| 1150-139 | Gasket for DN200 PN25 flow sensor (flange), 1 pc |
| 1150-141 | Gasket for DN250 PN25 flow sensor (flange), 1 pc |
| 1150-164 | Gasket for DN300 PN 16 flow sensor (flange), 1 pc |

*2 pcs to be ordered per calculator*

### Safety transformer

| Article number | Description |
|---|---|
| 6699-404 | 230/24 VAC safety transformer 10 VA |
| 6699-405 | 230/12/24 VAC safety transformer 63 VA |

Contact Kamstrup A/S for information about further accessories.

## 3.4  Configuration number

The software configuration of MULTICAL® 803 is defined on the basis of the configuration number. Below you see an overview of the calculator's configuration number. Each part of the configuration number is described in more detail in the following paragraphs.

A - B - CCC - DDD - EE - FF - GG - L - M - N - PP - RR - T - VVVV

**Flow sensor position**

| | |
|---|---|
| Inlet | 3 |
| Outlet | 4 |

**Measuring unit**

| | |
|---|---|
| GJ | 2 |
| kWh | 3 |
| MWh | 4 |
| Gcal | 5 |

**Auto Detect CCC codes**

| | |
|---|---|
| Normal resolution (7 digits) | 8 0 7 |
| Normal resolution (8 digits) | 8 0 8 |
| High resolution (8 digits) | 8 1 8 |

**Static CCC codes**

| | |
|---|---|
| Reed switch (7 digits) | 0 x x |
| Electronic, fast pulse (7 digits) | 1 x x |
| Electronic, fast pulse (8 digits) | 2 x x |
| Kamstrup, UF X4 (7 digits) | 4 x x |
| Kamstrup, UF X4 (8 digits) | 5 x x |
| Electronic, slow pulse (7 digits) | 9 x x |

**Display**

| | |
|---|---|
| Heat meter | 2xx |
| Heat/cooling meter | 3xx |
| Cooling meter | 5xx |

**Tariffs**

| | |
|---|---|
| No active tariff | 00 |
| Power tariff | 11 |
| Flow tariff | 12 |
| t1-t2 tariff | 13 |
| Inlet tariff | 14 |
| Outlet tariff | 15 |
| Time-controlled tariff | 19 |
| Heat/cooling volume tariff | 20 |
| PQ tariff | 21 |

**Pulse inputs A and B**

| | | |
|---|---|---|
| See paragraph 3.4.7 | FF | GG |

**Integration mode**

| | | |
|---|---|---|
| Fixed mode (2 s) | Backlight by push button | 4 |
| Fixed mode (2 s) | Backlight always on | 9 |

**Leakage limits (V1/V2)**

| | |
|---|---|
| OFF | 0 |
| 1,0 % of qp + 20 % of q | 1 |
| 1,0 % of qp + 10 % of q | 2 |
| 0,5 % of qp + 20 % of q | 3 |
| 0,5 % of qp + 10 % of q | 4 |

**Leakage limit, Cold water (In-A, In-B)**

| | |
|---|---|
| OFF | 0 |
| 30 minutes without pulses | 1 |
| One hour without pulses | 2 |
| Two hours without pulses | 3 |

**Pulse Transmitter/Divider**

| | | |
|---|---|---|
| Out-C: V1/4 | 5 ms | 73 |
| Out-C: V1/1, Out-D: V2/1 | 3,9 ms | 80 |
| Out-C: V1/1 | 3,9 ms | 82 |
| Out-C: V1/4 | 22 ms | 83 |

**Pulse outputs for count registers**

| | | |
|---|---|---|
| E1 and V1 or E3 and V1 | 10 ms | 94 |
| E1 and V1 or E3 and V1 | 32 ms | 95 |
| E1 and V1 or E3 and V1 | 100 ms (0,1 s) | 96 |

**Controlled output based on data commands**

| | |
|---|---|
| Controlled output | 99 |

| | RR | - | T | - | VVVV |
|---|---|---|---|---|---|
| **Data logger profile** | | | | | |
| Standard data logger profile | 10 | | | | |
| Current values | 11 | | | | |
| Ludwig | 12 | | | | |
| Madrid | 13 | | | | |
| Peter | 14 | | | | |
| Diagnostic | 15 | | | | |
| Kiev | 17 | | | | |
| Information sensitive | 18 | | | | |
| KM RF | 90 | | | | |
| **Encryption level** | | | | | |
| Common key | | | 2 | | |
| Individual key | | | 3 | | |
| **Customer label** | | | | | |
| See paragraph 3.4.14 | | | | | VVVV |

### 3.4.1  Flow sensor position >A<

Code A indicates installation of flow sensor in inlet or outlet. As the density and heat capacity of water vary with temperature, the calculator must correct this based on the installation position (A code). Incorrect programming or installation leads to error of measuring. See paragraph 4.3 for further details on the installation of the flow sensor in inlet and outlet as far as heat and cooling installations are concerned.

| Flow sensor position | A code |
|---|---|
| Inlet | 3 |
| Outlet | 4 |

### 3.4.2  Measuring unit >B<

The B code indicates the measuring unit used in the energy register. The options are GJ, kWh, MWh or Gcal.

| Measuring unit | B code |
|---|---|
| GJ | 2 |
| kWh | 3 |
| MWh | 4 |
| Gcal [1] | 5 |

[1] Note that Gcal is not an SI unit. Read more about how Gcal is supported by M-Bus or wM-Bus in paragraph 11.

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## 3.4.3    Flow sensor coding >CCC<

The CCC code optimises the display resolution for the selected flow sensor size. At the same time the type approval regulations as to minimum resolution and maximum register overflow are observed. Below, possible display resolutions in MULTICAL® 803 according to the type approval rules are shown.

| | | Number of decimals in display | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Energy | | | Volume / Mass | Flow / Power | | | |
| qp [m³/h] | 7/8 digits | kWh | MWh Gcal | GJ | m³ tons | l/h | m³/h | kW | MW |
| 0,6 ≤ 1,5 | 7 | 1 | 4 | 3 | 3 | 0 | - | 1 | - |
| 0,6 ≤ 15 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - |
| | 8 | 1 | 4 | 3 | 3 | | - | 1 | - |
| 4 ≤ 150 | 7 | - | 2 | 1 | 1 | - | 2 | 0 | - |
| | 8 | 0 | 3 | 2 | 2 | | | | - |
| 40 ≤ 1500 | 7 | - | 1 | 0 | 0 | - | 1 | - | 2 |
| | 8 | - | 2 | 1 | 1 | | | | |
| 400 ≤ 15000 | 7 | - | - | - | - | - | - | - | - |
| | 8 | - | 1 | 0 | 0 | | 0 | | 1 |

The CCC codes for MULTICAL® 803 are grouped in relation to the type of flow sensor that is connected to the calculator. There are nine groups, all of which are linked to a connection type. The connection type is selected as part of the calculator's type number.

| CCC | Flow sensor type | Pulse frequency | Bounce damping | Pulses + Data | Auto Detect | 7/8 digits | Connection type | | Meter factor | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Direct | Opto | ON (LO) | OFF (HI) |
| 0XX | Mechanical meters delivering slow pulses with bounce | < 1 Hz | Yes | P | | 7/8 | L | - | >300 ms | >10 ms |
| 1XX | Electronic meters with quick and bounce-free pulses | < 128 Hz | No | P | No | 7 | C [2] | P | >1 ms | >4 ms |
| 2XX | | | | | | 8 | | | | |
| 4XX | Electronic meters with quick and bounce-free pulses as well as data for info codes for ULTRAFLOW® X4 | | | P+D | | 7 | 1-2-7-8 [1] | - | | |
| 5XX | | | | | | 8 | | | | |
| 8XX | Electronic meters with quick and bounce-free pulses as well as data for info codes for ULTRAFLOW® X4 and Auto Detect | | | | Yes | 7/8 | | | | |
| 9XX | Electronic meters with slow and bounce-free pulses | < 8 Hz | | P | No | | J | P | >30 ms | >100 ms |

[1] Connection type 1-2 means connection of 1 or 2 supplied ULTRAFLOW®, 7-8 means prepared for 1 or 2 ULTRAFLOW®.

[2] Connection type C is used for previous versions of ULTRAFLOW® such as ULTRAFLOW® II and ULTRAFLOW® 65.

In the following five paragraphs, the CCC codes are described:

3.4.3.1          ULTRAFLOW® X4

3.4.3.2          Mechanical flow sensors, reed switch

3.4.3.3          Electronic flow sensors, slow pulses

3.4.3.4          Electronic flow sensors, quick pulses

3.4.3.5          ULTRAFLOW® II, 65-SRT and X4


### 3.4.3.1    ULTRAFLOW® X4

Auto Detect ULTRAFLOW® (UF) enables the exchange of ULTRAFLOW® X4 on MULTICAL® 803 without the need for changing the CCC code. MULTICAL® 803 can automatically adjust its CCC code to match the connected ULTRAFLOW® X4 via the function Auto Detect UF. Auto Detect UF is active with the CCC code 8xx.

Auto Detect UF works in such a way that MULTICAL® 803, during start-up, automatically collects the correct information about meter factor and qp from the connected ULTRAFLOW® X4 flow sensors. MULTICAL® 803 adapts its configuration to the values that are received from ULTRAFLOW® X4. Auto Detect UF is initiated when the calculator top and base are separated and reassembled. Read more about the connection of ULTRAFLOW® and Auto Detect UF in paragraph 8.1.

MULTICAL® 803 can be supplied with Auto Detect UF if this comes with CCC code 8xx, but can also be supplied with a static CCC code 4xx (7 digits) or 5xx (8 digits). After delivery, it is possible to change the CCC code and select Auto Detect UF or disable it.

| 4XX | | 5XX | |
|---|---|---|---|
| *Normal resolution*<br>*7 digits* | *High resolution*<br>*7 digits* | *Normal resolution*<br>*8 digits* | *High resolution[1]*<br>*8 digits* |

| | | | | Number of decimals in display | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CCC | qp | Imp./L | 7/8 digits | kWh [2] | MWh Gcal | GJ | m³ tons | l/h | m³/h | kW | MW | Connection type |
| 807 | 0,6…1000 | 300…0,15 | 7 | Auto Detect, CCC codes:<br>416-419-498-451-437-478-420-479-458-470-480-447-481-491-492-493 | | | | | | | | 1-2-7-8 |
| 808 [1] | 0,6…1000 | 300…0,15 | 8 | Auto Detect, CCC codes:<br>584-507-598-551-537-578-520-579-558-570-580-547-581-591-592-593 | | | | | | | | 1-2-7-8 |
| 818 | 0,6…1000 | 300…0,15 | 8 | Auto Detect, CCC codes:<br>584-507-598-536-538-583-585-579-586-587-588-589-581-591-592-593 | | | | | | | | 1-2-7-8 |

[1] *With this CCC code, the number of pulses on the pulse outputs is reduced by factor 10 when selecting the PP codes 95 (32 ms), 96 (100 ms) and 93 (250 ms). The number of pulses is not reduced when selecting PP code 94 (10 ms).*

[2] *When kWh is selected, the calculator automatically switches to MWh if the CCC code is selected for large meters.*

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| 4XX | | 5XX | |
|---|---|---|---|
| *Normal resolution* <br> *7 digits* | *High resolution* <br> *7 digits* | *Normal resolution* <br> *8 digits* | *High resolution* [1] <br> *8 digits* |

| CCC | qp | Imp./L | 7/8 digits | Number of decimals in display | | | | | | | | Connection type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | kWh | MWh Gcal | GJ | m³ tons | l/h | m³/h | kW | MW | |
| 416 | 0,6 | 300 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | 1-2-7-8 |
| 484 | 0,6 | 300 | 7 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | 1-2-7-8 |
| 584 [1] | 0,6 | 300 | 8 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | 1-2-7-8 |
| 419 | 1,5 | 100 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | 1-2-7-8 |
| 407 | 1,5 | 100 | 7 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | 1-2-7-8 |
| 507 [1] | 1,5 | 100 | 8 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | 1-2-7-8 |
| 498 | 2,5 | 60 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | 1-2-7-8 |
| 598 [1] | 2,5 | 60 | 8 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | 1-2-7-8 |
| 451 | 3,5 | 50 | 7 | - | 2 | 1 | 1 | 0 | - | 1 | - | 1-2-7-8 |
| 436 | 3,5 | 50 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | 1-2-7-8 |
| 551 | 3,5 | 50 | 8 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | 1-2-7-8 |
| 536 | 3,5 | 50 | 8 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | 1-2-7-8 |
| 437 | 6 | 25 | 7 | - | 2 | 1 | 1 | 0 | - | 1 | - | 1-2-7-8 |
| 438 | 6 | 25 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | 1-2-7-8 |
| 537 | 6 | 25 | 8 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | 1-2-7-8 |
| 538 | 6 | 25 | 8 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | 1-2-7-8 |
| 478 | 10 | 15 | 7 | - | 2 | 1 | 1 | 0 | - | 1 | - | 1-2-7-8 |
| 483 | 10 | 15 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | 1-2-7-8 |
| 578 | 10 | 15 | 8 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | 1-2-7-8 |
| 583 | 10 | 15 | 8 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | 1-2-7-8 |
| 420 | 15 | 10 | 7 | - | 2 | 1 | 1 | 0 | - | 1 | - | 1-2-7-8 |
| 485 | 15 | 10 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | 1-2-7-8 |
| 520 | 15 | 10 | 8 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | 1-2-7-8 |
| 585 | 15 | 10 | 8 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | 1-2-7-8 |
| 479 | 25 | 6 | 7 | - | 2 | 1 | 1 | - | 2 | 0 | - | 1-2-7-8 |
| 579 [1] | 25 | 6 | 8 | 0 | 3 | 2 | 2 | - | 2 | 0 | - | 1-2-7-8 |
| 458 | 40 | 5 | 7 | - | 1 | 0 | 0 | - | 2 | 0 | - | 1-2-7-8 |
| 486 | 40 | 5 | 7 | - | 2 | 1 | 1 | - | 2 | 0 | - | 1-2-7-8 |
| 558 | 40 | 5 | 8 | - | 2 | 1 | 1 | - | 2 | 0 | - | 1-2-7-8 |
| 586 | 40 | 5 | 8 | 0 | 3 | 2 | 2 | - | 2 | 0 | - | 1-2-7-8 |
| 470 | 60 | 2,5 | 7 | - | 1 | 0 | 0 | - | 2 | 0 | - | 1-2-7-8 |
| 487 | 60 | 2,5 | 7 | - | 2 | 1 | 1 | - | 2 | 0 | - | 1-2-7-8 |
| 570 | 60 | 2,5 | 8 | - | 2 | 1 | 1 | - | 2 | 0 | - | 1-2-7-8 |
| 587 | 60 | 2,5 | 8 | 0 | 3 | 2 | 2 | - | 2 | 0 | - | 1-2-7-8 |
| 480 | 100 | 1,5 | 7 | - | 1 | 0 | 0 | - | 2 | 0 | - | 1-2-7-8 |
| 488 | 100 | 1,5 | 7 | - | 2 | 1 | 1 | - | 2 | 0 | - | 1-2-7-8 |
| 580 | 100 | 1,5 | 8 | - | 2 | 1 | 1 | - | 2 | 0 | - | 1-2-7-8 |
| 588 | 100 | 1,5 | 8 | 0 | 3 | 2 | 2 | - | 2 | 0 | - | 1-2-7-8 |
| 447 | 150 | 1 | 7 | - | 1 | 0 | 0 | - | 2 | 0 | - | 1-2-7-8 |
| 489 | 150 | 1 | 7 | - | 2 | 1 | 1 | - | 2 | 0 | - | 1-2-7-8 |
| 547 | 150 | 1 | 8 | - | 2 | 1 | 1 | - | 2 | 0 | - | 1-2-7-8 |
| 589 | 150 | 1 | 8 | 0 | 3 | 2 | 2 | - | 2 | 0 | - | 1-2-7-8 |
| 481 | 250 | 0,6 | 7 | - | 1 | 0 | 0 | - | 1 | - | 2 | 1-2-7-8 |
| 581 [1] | 250 | 0,6 | 8 | - | 2 | 1 | 1 | - | 1 | - | 2 | 1-2-7-8 |
| 491 | 400 | 0,4 | 7 | - | 1 | 0 | 0 | - | 1 | - | 2 | 1-2-7-8 |
| 591 [1] | 400 | 0,4 | 8 | - | 2 | 1 | 1 | - | 1 | - | 2 | 1-2-7-8 |
| 492 | 600 | 0,25 | 7 | - | 1 | 0 | 0 | - | 1 | - | 2 | 1-2-7-8 |

| 4XX | | 5XX | |
|---|---|---|---|
| Normal resolution 7 digits | High resolution 7 digits | Normal resolution 8 digits | High resolution [1] 8 digits |

| CCC | qp | Imp./L | 7/8 digits | \multicolumn{8}{c}{Number of decimals in display} | Connection type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | kWh | MWh Gcal | GJ | m³ tons | l/h | m³/h | kW | MW | |
| 592 [1] | 600 | 0,25 | 8 | - | 2 | 1 | 1 | - | 1 | - | 2 | 1-2-7-8 |
| 493 | 1000 | 0,15 | 7 | - | 1 | 0 | 0 | - | 1 | - | 2 | 1-2-7-8 |
| 593 [1] | 1000 | 0,15 | 8 | - | 2 | 1 | 1 | - | 1 | - | 2 | 1-2-7-8 |

[1] On this CCC code, the number of pulses on the pulse outputs is divided by factor 10 when selecting PP codes 95 (32 ms),96 (100 ms) and 93 (250 ms).The number of pulses is not divided when selecting PP code 94 (10 ms).

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### 3.4.3.2    Mechanical flow sensors, reed switch

| CCC | qp | L/imp. | 7/8 digits | kWh | MWh Gcal | GJ | m³ tons | l/h | m³/h | kW | MW | Connection type |
|-----|-----|--------|------------|-----|----------|-----|---------|-----|------|-----|-----|-----------------|
| | | | | | | | | | | | | | Number of decimals in display |
| 010 | 0,6…1.5 | 1 | 7 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | L |
| 011 | 1,0…15 | 10 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | L |
| 012 | 10…150 | 100 | 7 | - | 2 | 1 | 1 | - | 2 | 0 | - | L |
| 032 [1] | 10…150 | 100 | 8 | 0 | 3 | 2 | 2 | - | 2 | 0 | - | L |
| 013 | 100…1.500 | 1.000 | 7 | - | 1 | 0 | 0 | - | 1 | - | 2 | L |
| 033 [1] | 100…1.500 | 1.000 | 8 | - | 2 | 1 | 1 | - | 1 | - | 2 | L |
| 020 | 0,6…4 | 2,5 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | L |
| 021 | 3…40 | 25 | 7 | - | 2 | 1 | 1 | - | 2 | 0 | - | L |
| 022 | 30…400 | 250 | 7 | - | 1 | 0 | 0 | - | 1 | - | 2 | L |

[1] *On this CCC code, the number of pulses on the pulse outputs is divided by factor 10 when selecting PP codes 95 (32 ms) and 96 (100 ms). The number of pulses is not divided when selecting PP code 94 (10 ms).*

### 3.4.3.3    Electronic flow sensors, slow pulses

| CCC | qp | L/imp. | 7/8 digits | kWh | MWh Gcal | GJ | m³ tons | l/h | m³/h | kW | MW | Connection type |
|-----|-----|--------|------------|-----|----------|-----|---------|-----|------|-----|-----|-----------------|
| | | | | | | | | | | | | | Number of decimals in display |
| 910 | 0,6…1,5 | 1 | 7 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | J-P |
| 935 | 0,6…10 | 1 | 8 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | J-P |
| 911 | 1,5…15 | 10 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | J-P |
| 936 | 10…100 | 10 | 8 | - | 2 | 1 | 1 | - | 2 | 0 | - | J-P |
| 912 | 15…150 | 100 | 7 | - | 2 | 1 | 1 | - | 2 | 0 | - | J-P |
| 932 [1] | 15…150 | 100 | 8 | 0 | 3 | 2 | 2 | - | 2 | 0 | - | J-P |
| 913 | 150…1.500 | 1.000 | 7 | - | 1 | 0 | 0 | - | 1 | - | 2 | J-P |
| 933 [1] | 150…1.500 | 1.000 | 8 | - | 2 | 1 | 1 | - | 1 | - | 2 | J-P |
| 934 [1,2] | 150…15.000 | 1.000 | 8 | - | 1 | 0 | 0 | - | 0 | - | 1 | J-P |
| 920 | 0,6…15 | 2,5 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | J-P |
| 921 | 4…150 | 25 | 7 | - | 2 | 1 | 1 | - | 2 | 0 | - | J-P |
| 922 | 40…1.500 | 250 | 7 | - | 1 | 0 | 0 | - | 1 | - | 2 | J-P |

[1] *On this CCC code, the number of pulses on the pulse outputs is divided by factor 10 when selecting PP codes 95 (32 ms) and 96 (100 ms). The number of pulses is not divided when selecting PP code 94 (10 ms).*

[2] *qs = 1,8 x qp*

### 3.4.3.4    Electronic flow sensors, quick pulses

| CCC | qp | imp./L | 7/8 digits | kWh | MWh Gcal | GJ | m³ tons | m³/h | kW | MW | Connection type |
|-----|-----|--------|------------|-----|----------|-----|---------|------|-----|-----|-----------------|
| | | | | | | | | | | | | Number of decimals in display |
| 175 | 15…30 | 7,5 | 7 | - | 1 | 0 | 0 | 2 | 0 | - | C-P |
| 176 | 25…50 | 4,5 | 7 | - | 1 | 0 | 0 | 2 | 0 | - | C-P |

| CCC | qp | L/imp. | 7/8 digits | kWh | MWh Gcal | GJ | m³ tons | m³/h | kW | MW | DN size | Connection type |
|-----|-----|--------|------------|-----|----------|-----|---------|------|-----|-----|---------|-----------------|
| | | | | | | | | | | | | | Number of decimals in display |
| 201 [1] | 4…150 | 1 | 8 | 0 | 3 | 2 | 2 | 2 | 0 | - | 25-200 | C-P |
| 202 [1] | 40…400 | 2,5 | 8 | - | 2 | 1 | 1 | 1 | - | 2 | 65-300 | C-P |
| 204 [1] | 40…1.500 | 10 | 8 | - | 2 | 1 | 1 | 1 | - | 2 | 65-600 | C-P |
| 205 [1] | 400…8.000 | 50 | 8 | - | 1 | 0 | 0 | 0 | - | 1 | 250-1400 | C-P |
| 206 [1] | 400…15.000 | 100 | 8 | - | 1 | 0 | 0 | 0 | - | 1 | 250-1800 | C-P |

[1] *On this CCC code, the number of pulses on the pulse outputs is divided by factor 10 when selecting PP codes 95 (32 ms) and 96 (100 ms).*

*The number of pulses is not divided when selecting PP code 94 (10 ms).*

**Note:** *CCC = 147…150 is not created, but CCC = 201…206 can be used instead. In MULTICAL® 602, CCC = 201…205 consisted of 7 digits, but in MULTICAL® 603, all have been changed to 8 digits. CCC = 206 only existed in MULTICAL® 801, but is now also available in MULTICAL® 803.*

### 3.4.3.5  ULTRAFLOW® II, 65-SRT and X4

| CCC | qp | Imp./L | 7/8 digits | Number of decimals in display | | | | | | | | Connection type |
| | | | | kWh | MWh Gcal | GJ | m³ tons | l/h | m³/h | kW | MW | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 116 | 0,6 | 300 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | C-P |
| 184 | 0,6 | 300 | 7 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | C-P |
| 284 | 0,6 | 300 | 8 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | C-P |
| 119 | 1,5 | 100 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | C-P |
| 107 | 1,5 | 100 | 7 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | C-P |
| 207 | 1,5 | 100 | 8 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | C-P |
| 198 | 2,5 | 60 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | C-P |
| 298 [1] | 2,5 | 60 | 8 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | C-P |
| 151 | 3,5 | 50 | 7 | - | 2 | 1 | 1 | 0 | - | 1 | - | C-P |
| 136 | 2,5 - 3,5 | 50 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | C-P |
| 236 [1] | 3,5 | 50 | 8 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | C-P |
| 137 | 6 | 25 | 7 | - | 2 | 1 | 1 | 0 | - | 1 | - | C-P |
| 138 | 6 | 25 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | C-P |
| 238 [1] | 6 | 25 | 8 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | C-P |
| 100 | 10 | 25 | 7 | - | 2 | 1 | 1 | 0 | - | 1 | - | C-P |
| 178 | 10 | 15 | 7 | - | 2 | 1 | 1 | 0 | - | 1 | - | C-P |
| 183 | 10 | 15 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | C-P |
| 283 [1] | 10 | 15 | 8 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | C-P |
| 120 | 15 | 10 | 7 | - | 2 | 1 | 1 | 0 | - | 1 | - | C-P |
| 185 | 15 | 10 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | C-P |
| 285 [1] | 15 | 10 | 8 | 1 | 4 | 3 | 3 | 0 | - | 1 | - | C-P |
| 101 | 25 | 10 | 7 | - | 2 | 1 | 1 | 0 | - | 1 | - | C-P |
| 179 | 25 | 6 | 7 | - | 2 | 1 | 1 | - | 2 | 0 | - | C-P |
| 279 [1] | 25 | 6 | 8 | 0 | 3 | 2 | 2 | - | 2 | 0 | - | C-P |
| 158 | 40 | 5 | 7 | - | 1 | 0 | 0 | - | 2 | 0 | - | C-P |
| 186 | 40 | 5 | 7 | - | 2 | 1 | 1 | - | 2 | 0 | - | C-P |
| 286 [1] | 40 | 5 | 8 | 0 | 3 | 2 | 2 | - | 2 | 0 | - | C-P |
| 170 | 60 | 2,5 | 7 | - | 1 | 0 | 0 | - | 2 | 0 | - | C-P |
| 187 | 60 | 2,5 | 7 | - | 2 | 1 | 1 | - | 2 | 0 | - | C-P |
| 287 [1] | 60 | 2,5 | 8 | 0 | 3 | 2 | 2 | - | 2 | 0 | - | C-P |
| 180 | 100 | 1,5 | 7 | - | 1 | 0 | 0 | - | 2 | 0 | - | C-P |
| 188 | 100 | 1,5 | 7 | - | 2 | 1 | 1 | - | 2 | 0 | - | C-P |
| 288 [1] | 100 | 1,5 | 8 | 0 | 3 | 2 | 2 | - | 2 | 0 | - | C-P |
| 147 | 150 | 1 | 7 | - | 1 | 0 | 0 | - | 2 | 0 | - | C-P |
| 189 | 150 | 1 | 7 | - | 2 | 1 | 1 | - | 2 | 0 | - | C-P |
| 289 [1] | 150 | 1 | 8 | 0 | 3 | 2 | 2 | - | 2 | 0 | - | C-P |
| 181 | 250 | 0,6 | 7 | - | 1 | 0 | 0 | - | 1 | - | 2 | C-P |
| 281 [1] | 250 | 0,6 | 8 | - | 2 | 1 | 1 | - | 1 | - | 2 | C-P |
| 191 | 400 | 0,4 | 7 | - | 1 | 0 | 0 | - | 1 | - | 2 | C-P |
| 291 [1] | 400 | 0,4 | 8 | - | 2 | 1 | 1 | - | 1 | - | 2 | C-P |
| 192 | 600 | 0,25 | 7 | - | 1 | 0 | 0 | - | 1 | - | 2 | C-P |
| 292 [1] | 600 | 0,25 | 8 | - | 2 | 1 | 1 | - | 1 | - | 2 | C-P |
| 195 [2] | 1000 | 0,25 | 7 | - | 1 | 0 | 0 | - | 1 | - | 2 | C-P |
| 193 | 1000 | 0,15 | 7 | - | 1 | 0 | 0 | - | 1 | - | 2 | C-P |
| 293 [1] | 1000 | 0,15 | 8 | - | 2 | 1 | 1 | - | 1 | - | 2 | C-P |

[1] *On this CCC code, the number of pulses on the pulse outputs is divided by factor 10 when selecting PP codes 95 (32 ms) and 96 (100 ms). The number of pulses is not divided when selecting PP code 94 (10 ms).*

[2] *qs = 1,8 x qp*

# MULTICAL® 803

## 3.4.4 Display code >DDD<

MULTICAL® 803 has 4 display loops: USER, TECH, SETUP and TEST. The "TECH loop" contains all display views, except for logged values and the differential registers (ΔE and ΔV), and this loop is _not_ configurable. The "USER loop", however, is configurable and can be adapted to customer requirements by means of the DDD code (display code). As a minimum, the "USER loop" always comprises the calculator's legal readings.

The calculator's legal readings, e.g. energy and volume readings, are basically displayed as 7-digit or 8-digit values. The number of digits and resolution of the calculator's legal registers are configured with the CCC code, see paragraph 3.4.3.

The first digits of the three-digit DDD code define the meter type comprised by the DDD code in question. The table shows examples of a number of DDD codes within each meter type. In the table, "1" indicates the first primary reading, whereas e.g. "1A" is the first secondary reading. The display automatically returns to reading "1" after 4 minutes.

Contact Kamstrup A/S for information about available display codes.

| Display ref. | Primary display | Display ref. | Secondary display | Heat meter DDD = 110 | Heat meter DDD = 210 | Heat/cooling meter DDD = 310 | Heat meter DDD = 410 | Cooling meter DDD = 510 | Heat/cooling meter DDD = 610 | Volume meter DDD = 710 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.0 | Heat energy, E1 | | | 1 | 1 | 1 | 1 | | 1 | |
| | | 1.1 | Date of yearly logger | 1A | 1A | 1A | 1A | | 1A | |
| | | 1.2 | Data of yearly logger [1] | | | | | | | |
| | | 1.3 | Date of monthly logger | 1B | 1B | 1B | 1B | | 1B | |
| | | 1.4 | Data of monthly logger [1] | | | | | | | |
| | | 1.5 | E1 high res. | | | | | | | |
| 2.0 | Cooling energy, E3 | | | | | 2 | | 1 | 2 | |
| | | 2.1 | Date of yearly logger | | | 2A | | 1A | 2A | |
| | | 2.2 | Data of yearly logger [1] | | | | | | | |
| | | 2.3 | Date of monthly logger | | | 2B | | 1B | 2B | |
| | | 2.4 | Data of monthly logger [1] | | | | | | | |
| | | 2.5 | E3 High resolution | | | | | | | |
| 3.0 | Energy E2 | | | | | | | | | |
| | | 3.1 | Energy E4 | | | | | | | |
| | | 3.2 | Energy E5 | | | | | | | |
| | | 3.3 | Energy E6 | | | | | | | |
| | | 3.4 | Energy E7 | | | | | | | |
| | | 3.5 | Energy E12 | | | | | | | |
| | | 3.6 | Energy E13 | | | | | | | |
| | | 3.7 | Energy E14 | | | | | | | |
| | | 3.8 | Energy E15 | | | | | | | |
| | | 3.9 | Energy E16 | | | | | | | |
| 4.0 | Volume, V1 | | | 2 | 2 | 3 | 2 | 2 | 3 | 1 |
| | | 4.1 | Mass M1 (V1[t1/t2]) | | | | | | | |
| | | 4.2 | Pressure P1 | | | | | | | |
| | | 4.3 | Date of yearly logger | 2A | 2A | 3A | 2A | 2A | 3A | 1A |
| | | 4.4 | Data of yearly logger [1] | | | | | | | |
| | | 4.5 | Date of monthly logger | 2B | 2B | 3B | 2B | 2B | 3B | 1B |
| | | 4.6 | Data of monthly logger [1] | | | | | | | |
| | | 4.7 | E1 high res. | | | | | | | |

| Display ref. | Primary display | Display ref. | Secondary display | Heat meter DDD = 110 | Heat meter DDD = 210 | Heat/cooling meter DDD = 310 | Heat meter DDD = 410 | Cooling meter DDD = 510 | Heat/cooling meter DDD = 610 | Volume meter DDD = 710 |
|---|---|---|---|---|---|---|---|---|---|---|
| 5.0 | Volume, V2 | | | | | | | | | |
| | | 5.1 | Mass M2 (V2[t2]) | | | | | | | |
| | | 5.2 | Pressure P2 | | | | | | | |
| | | 5.3 | Date of yearly logger | | | | | | | |
| | | 5.4 | Data of yearly logger [1] | | | | | | | |
| | | 5.5 | Date of monthly logger | | | | | | | |
| | | 5.6 | Data of monthly logger [1] | | | | | | | |
| | | 5.7 | Mass M3 (V2[t3]) | | | | | | | |
| | | 5.8 | Mass M4 (V2[t4]) | | | | | | | |
| 6.0 | Hour counter | | | 3 | 3 | 4 | 3 | 3 | 4 | 2 |
| | | 6.1 | Error hour counter | 3A | 3A | 4A | 3A | 3A | 4A | 2A |
| 7.0 | t1 (inlet) | | | 4 | 4 | 5 | 4 | 4 | 5 | |
| | | 7.1 | Year-to-date average [2] | 4A | 4A | 5A | 4A | 4A | 5A | |
| | | 7.2 | Month-to-date average [2] | 4B | 4B | 5B | 4B | 4B | 5B | |
| 8.0 | t2 (outlet) | | | 5 | 5 | 6 | 5 | 5 | 6 | |
| | | 8.1 | Year-to-date average [2] | 5A | 5A | 6A | 5A | 5A | 6A | |
| | | 8.2 | Month-to-date average [2] | 5B | 5B | 6A | 5B | 5B | 6B | |
| 9.0 | t1-t2 (ΔΘ) (cooling indicated by -) | | | 6 | 6 | 7 | 6 | 6 | 7 | |
| | | 9.1 | E8 (V1 x t1) | | | | | | | |
| | | 9.2 | E9 (V1 x t2) | | | | | | | |
| 10.0 | t3 | | | | | | | | | |
| | | 10.1 | E10 (V1 x t3) | | | | | | | |
| | | 10.2 | E11 (V2 x t3) | | | | | | | |
| 11.0 | t4 | | | | | | | | | |
| 12.0 | Flow, V1 | | | 7 | 7 | 8 | 7 | 7 | 8 | 3 |
| | | 12.1 | Date of max this year [3] | 7A | 7A | 8A | 7A | 7A | 8A | 3A |
| | | 12.2 | Data of max this year [1] | | | | | | | |
| | | 12.3 | Date of max yearly logger | | | | | | | |
| | | 12.4 | Data of max yearly logger [1] | | | | | | | |
| | | 12.5 | Date of max this month [3] | 7B | 7B | 8B | 7B | 7B | 8B | 3B |
| | | 12.6 | Data of max this month [1] | | | | | | | |
| | | 12.7 | Date of max monthly logger | | | | | | | |
| | | 12.8 | Data of max monthly logger [1] | | | | | | | |
| | | 12.9 | Date of max this year [3] | 7C | 7C | 8C | 7C | 7C | 8C | 3C |
| | | 12.10 | Data of min. this year [1] | | | | | | | |
| | | 12.11 | Date of min. yearly logger | | | | | | | |
| | | 12.12 | Data of min. yearly logger [1] | | | | | | | |
| | | 12.13 | Date of min. this month [3] | 7D | 7D | 8D | 7D | 7D | 8D | 3D |
| | | 12.14 | Data of min. this month [1] | | | | | | | |
| | | 12.15 | Date of min. monthly logger | | | | | | | |
| | | 12.16 | Data of min. monthly logger [1] | | | | | | | |

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| Display ref. | Primary display | Display ref. | Secondary display | Heat meter DDD = 110 | Heat meter DDD = 210 | Heat/cooling meter DDD = 310 | Heat meter DDD = 410 | Cooling meter DDD = 510 | Heat/cooling meter DDD = 610 | Volume meter DDD = 710 |
|---|---|---|---|---|---|---|---|---|---|---|
| 13.0 | Flow, V2 | | | | | | | | | |
| | | 13.1 | Thermal power, V2(t3-t4) | | | | | | | |
| 14.0 | Thermal output, V1 | | | 8 | 8 | 9 | 8 | 8 | 9 | |
| | | 14.1 | Date of max this year [3] | 8A | 8A | 9A | 8A | 8A | 9A | |
| | | 14.2 | Data of max this year [1] | | | | | | | |
| | | 14.3 | Date of max yearly logger | | | | | | | |
| | | 14.4 | Data of max yearly logger [1] | | | | | | | |
| | | 14.5 | Date of max this month [3] | 8B | 8B | 9B | 8B | 8B | 9B | |
| | | 14.6 | Data of max this month [1] | | | | | | | |
| | | 14.7 | Date of max monthly logger | | | | | | | |
| | | 14.8 | Data of max monthly logger [1] | | | | | | | |
| | | 14.9 | Date of max this year [3] | 8C | 8C | 9C | 8C | 8C | 9C | |
| | | 14.10 | Data of min. this year [1] | | | | | | | |
| | | 14.11 | Date of min. yearly logger | | | | | | | |
| | | 14.12 | Data of min. yearly logger [1] | | | | | | | |
| | | 14.13 | Date of min. this month [3] | 8D | 8D | 9D | 8D | 8D | 9D | |
| | | 14.14 | Data of min. this month [1] | | | | | | | |
| | | 14.15 | Date of min. monthly logger | | | | | | | |
| | | 14.16 | Data of min. monthly logger [1] | | | | | | | |
| 15.0 | Input A1 [4] | | | 9 | 9 | 10 | 9 | 9 | 10 | 4 |
| | | 15.1 | Meter number of input A1 | 9A | 9A | 10A | 9A | 9A | 10A | 4A |
| | | 15.2 | L/imp. or Wh/imp. for input A1 | 9B | 9B | 10B | 9B | 9B | 10B | 4B |
| | | 15.3 | Date of yearly logger | 9C | 9C | 10C | 9C | 9C | 10C | 4C |
| | | 15.4 | Data of yearly logger [1] | | | | | | | |
| | | 15.5 | Date of monthly logger | 9D | 9D | 10D | 9D | 9D | 10D | 4D |
| | | 15.6 | Data of monthly logger [1] | | | | | | | |
| 16.0 | Input B1 [4] | | | 10 | 10 | 11 | 10 | 10 | 11 | 5 |
| | | 16.1 | Meter number of input B1 | 10A | 10A | 11A | 10A | 10A | 11A | 5A |
| | | 16.2 | L/imp. or Wh/imp. for input B1 | 10B | 10B | 11B | 10B | 10B | 11B | 5B |
| | | 16.3 | Date of yearly logger | 10C | 10C | 11C | 10C | 10C | 11C | 5C |
| | | 16.4 | Data of yearly logger [1] | | | | | | | |
| | | 16.5 | Date of monthly logger | 10D | 10D | 11D | 10D | 10D | 11D | 5D |
| | | 16.6 | Data of monthly logger [1] | | | | | | | |
| 17.0 | Input A2 [4] | | | | | | | | | |
| | | 17.1 | Meter number of input A2 | | | | | | | |
| | | 17.2 | L/imp. or Wh/imp. for input A2 | | | | | | | |
| | | 17.3 | Date of yearly logger | | | | | | | |
| | | 17.4 | Data of yearly logger [1] | | | | | | | |
| | | 17.5 | Date of monthly logger | | | | | | | |
| | | 17.6 | Data of monthly logger [1] | | | | | | | |

| Display ref. | Primary display | Display ref. | Secondary display | Heat meter DDD = 110 | Heat meter DDD = 210 | Heat/cooling meter DDD = 310 | Heat meter DDD = 410 | Cooling meter DDD = 510 | Heat/cooling meter DDD = 610 | Volume meter DDD = 710 |
|---|---|---|---|---|---|---|---|---|---|---|
| 18.0 | Input B2 [4] | | | | | | | | | |
| | | 18.1 | Meter number of input B2 | | | | | | | |
| | | 18.2 | L/imp. or Wh/imp. for input B2 | | | | | | | |
| | | 18.3 | Date of yearly logger | | | | | | | |
| | | 18.4 | Data of yearly logger [1] | | | | | | | |
| | | 18.5 | Date of monthly logger | | | | | | | |
| | | 18.6 | Data of monthly logger [1] | | | | | | | |
| 19.0 | TA2 | | | 11 | 11 | 12 | 11 | 11 | 12 | 6 |
| | | 19.1 | TL2 | 11A | 11A | 12A | 11A | 11A | 12A | 6A |
| 20.0 | TA3 | | | 12 | 12 | 13 | 12 | 12 | 13 | 7 |
| | | 20.1 | TL3 | 12A | 12A | 13A | 12A | 12A | 13A | 7A |
| 21.0 | TA4 | | | 13 | 13 | 14 | 13 | 13 | 14 | 8 |
| | | 21.1 | TL4 | 13A | 13A | 14A | 13A | 13A | 14A | 8A |
| 22.0 | A1 Heat energy at a discount (A-) | | | | | | | | | |
| | | 22.1 | A2 Heat energy with an addition (A+) | | | | | | | |
| | | 22.2 | t5 | | | | | | | |
| 23.0 | CP (moving average) | | | | | | | | | |
| | | 23.1 | Actual power of input B1 [5] | | | | | | | |
| | | 23.2 | Date of yearly logger | | | | | | | |
| | | 23.4 | Data of yearly logger [1] | | | | | | | |
| | | 23.5 | Date of monthly logger | | | | | | | |
| | | 23.6 | Data of monthly logger [1] | | | | | | | |
| 24.0 | Info code | | | 14 | 14 | 15 | 14 | 14 | 15 | 9 |
| | | 24.1 | Info event counter | 14A | 14A | 15A | 14A | 14A | 15A | 9A |
| | | 24.2 | Date for info logger | 14B | 14B | 15B | 14B | 14B | 15B | 9B |
| | | 24.3 | Data for info logger | | | | | | | |
| 25.0 | Customer no. (Nº 1) | | | 15 | 15 | 16 | 15 | 15 | 16 | 10 |
| | | 25.1 | Customer number (Nº 2) | 15B | 15B | 16A | 15B | 15B | 16A | 10A |
| | | 25.24 | Meter factor | 18 | 18 | 19 | 18 | 18 | 19 | 13 |
| | | 25.25 | Nominal flow (qp) | 19 | 19 | 20 | 19 | 19 | 20 | 14 |
| | | 25.26 | Pt sensor type | 17 | 17 | 18 | 17 | 17 | 18 | 12 |
| | | 25.27 | Supply | 16 | 16 | 17 | 16 | 16 | 17 | 11 |
| 26.0 | Differential energy (dE) | | | | | | | | | |
| | | 26.1 | Control energy (cE) | | | | | | | |
| 27.0 | Differential volume (dV) | | | | | | | | | |
| | | 27.1 | Control volume (cV) | | | | | | | |

[1] Depending on the selected depth of yearly and monthly logs in the programmable data logger, these display readings can be empty.

[2] The average is volume-based.

[3] Only the date of min./max is displayed in format 20xx.xx.xx. Serial reading includes the time (hh.mm) of the average value calculation too.

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[4] *Inputs A and B are currently updated in the display of MULTICAL® 803, i.e. the display of the connected water or electricity meter will be in accordance with the display of MULTICAL® 803 without delay.*

[5] *The unit of this reading is fixed at kW.*

### 3.4.5    Tariffs >EE<

MULTICAL® 803 has three extra registers TA2, TA3 and TA4, which can accumulate heat energy or cooling energy (EE=20 accumulates volume) parallel to the main register based on preprogrammed tariff conditions (to be stated in the order of the calculator). Irrespective of the selected tariff type, the tariff registers are named TA2 TA3 and TA4 in the display.

As the main register is considered the legal billing register, it is accumulated no matter the selected tariff function. Tariff conditions TL2, TL3 and TL4 are monitored at every integration. If the tariff conditions are fulfilled, consumed heat energy is accumulated in either TA2, TA3 or TA parallel to the main register.

**Example of power tariff (EE=11)**
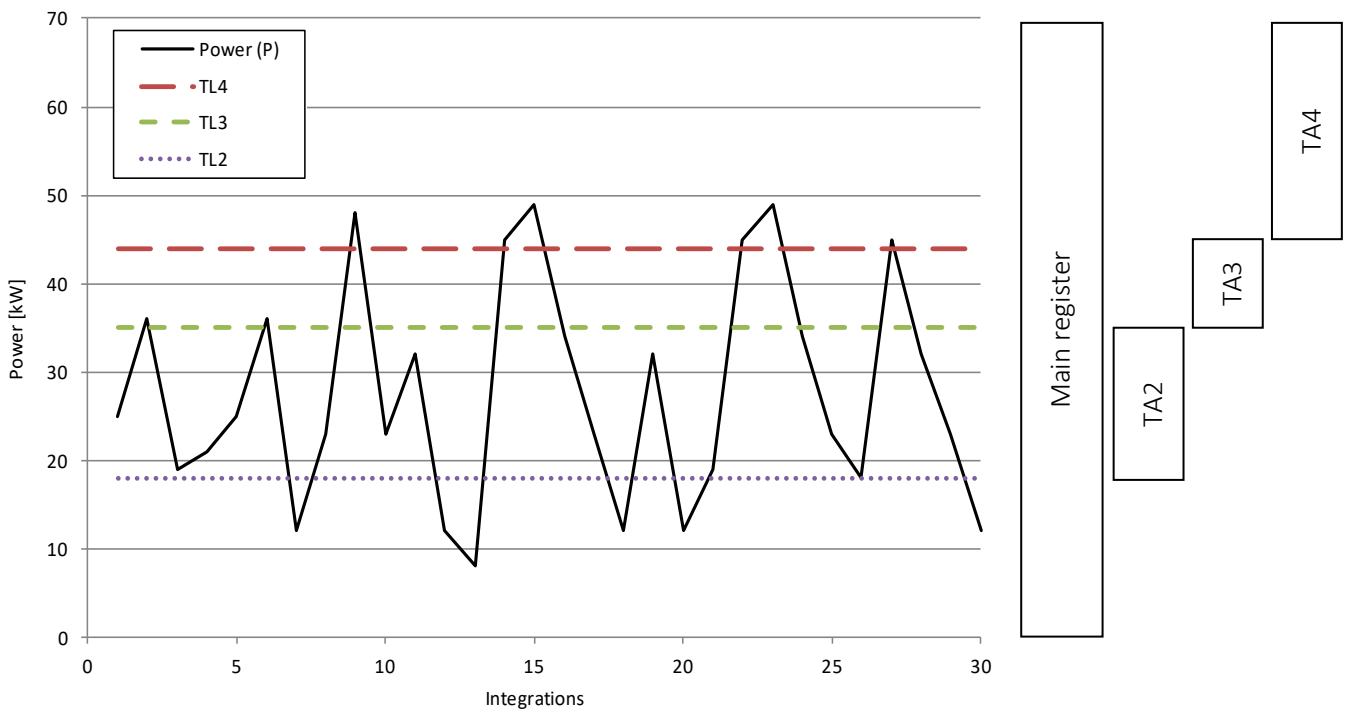


Three tariff conditions, TL2, TL3 and TL4, which are always used in the same tariff type, are connected to each tariff function. Therefore, it is not possible to "mix" two tariff types, except from the PQ tariff (EE=21).

TA2 shows energy consumed…          …above the power limit TL2
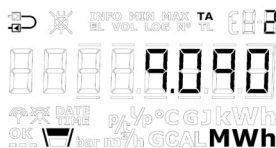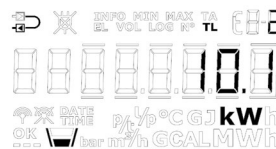


**IMPORTANT:** Out of consideration for backwards compatibility, tariff register TA4 can be deactivated. Thus, the meter uses TA2 and TA3 only, and the tariff function works as in the previous model, MULTICAL® 801. TA4 is deactivated by setting the tariff limit TL4 to 0.

The below table lists the tariff types for which MULTICAL® 803 can be configured and shows the tariff types available for each meter type.

| EE= | Tariff type | Function | Heat meter Meter type 2 | Heat/cooling meter Meter type 3 | Heat meter Meter type 4 | Cooling meter Meter type 5 | Heat/cooling meter Meter type 6 | Volume meter Meter type 7 |
|---|---|---|---|---|---|---|---|---|
| 00 | No active tariff | No function | • | • | • | • | • | • |
| 11 | Power tariff | Energy is accumulated in TA2, TA3 and TA4 on the basis of the power limits entered in TL2, TL3 and TL4 | • | | • | • | | |
| 12 | Flow tariff | Energy is accumulated in TA2, TA3 and TA4 on the basis of the flow limits entered in TL2, TL3 and TL4 | • | | • | • | | |
| 13 | t1-t2 tariff | Energy is accumulated in TA2, TA3 and TA4 on the basis of the Δt-limits entered in TL2, TL3 and TL4 | • | | • | • | | |
| 14 | Inlet temperature tariff | Energy is accumulated in TA2, TA3 and TA4 on the basis of t1 limits entered in TL2, TL3 and TL4. | • | | • | • | | |
| 15 | Outlet temperature tariff | Energy is accumulated in TA2, TA3 and TA4 on the basis of t2 limits entered in TL2, TL3 and TL4. | • | | • | • | | |
| 19 | Time-controlled tariff | TL2=Start time of TA2 <br> TL3=Start time of TA3 <br> TL4=Start time of TA4 | • | | • | • | | |
| 20 | Heat/cooling volume tariff (TL2, TL3 and TL4 are not used) | Volume (V1) is divided into TA2 for heat (t1>t2) and TA3 for cooling (t1<t2). For heat/cooling meters of meter types 3 and 6, the energy accumulation also depends on $\Theta_{HC}$ (TA4 is not used in this tariff type). | | • | | | • | • |
| 21 | PQ tariff | Energy is accumulated in TA2 if P>TL2 and in TA3 if Q>TL3 | • | | • | • | | |

## EE=00 No active tariff

If no tariff function is required, you select the setup EE=00.

However, the tariff function can, at a later stage, be activated through reconfiguration via METERTOOL HCW. See the technical description of METERTOOL HCW (5512-2097).

## EE=11 Power-controlled tariff

If the actual power (P) exceeds TL2, but is lower than or equal to TL3, energy is counted in TA2 parallel to the main register. If the actual power exceeds TL3, but is lower than or equal to TL4, energy is counted in TA3 parallel to the main register. If the actual power exceeds TL4, energy is counted in TA4 parallel to the main register.

| | |
|---|---|
| P ≤ TL2 | Accumulation in main register only |
| TL3 ≥ P > TL2 | Accumulation in TA2 and main register |
| TL4 ≥ P > TL3 | Accumulation in TA3 and main register |
| P > TL4 | Accumulation in TA4 and main register |

TL4 > TL3 > TL2
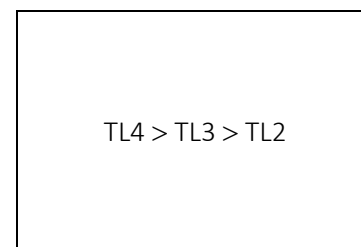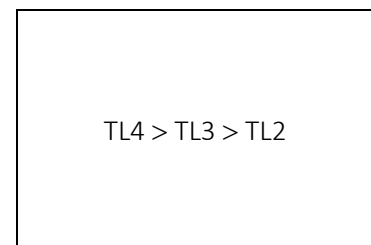
Setting up data, TL3 must be higher than TL2 and TL4 must be higher than TL3.

The power-controlled tariff is e.g. used as a basis for the individual heat consumer's connection fee. Furthermore, this tariff type can provide valuable statistical data if the heating plant considers new construction activities.

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### EE=12 Flow-controlled tariff

If the current water flow (Q) exceeds TL2, but is lower than or equal to TL3, energy is counted in TA2 parallel to the main register. If the current water flow exceeds TL3, but is lower than or equal to TL4, energy is counted in TA3 parallel to the main register. If the current water flow exceeds TL4, energy is counted in TA4 parallel to the main register.

| | | |
|---|---|---|
| Q ≤ TL2 | Accumulation in main register only | |
| TL3 ≥ Q > TL2 | Accumulation in TA2 and main register | TL4 > TL3 > TL2 |
| TL4 ≥ Q > TL3 | Accumulation in TA3 and main register | |
| Q > TL4 | Accumulation in TA4 and main register | |

Setting up data, TL3 must be higher than TL2 and TL4 must be higher than TL3.

The flow-controlled tariff is e.g. used as a basis for the individual heat consumer's connection fee. Furthermore, this tariff type can provide valuable statistical data if the heating plant considers new construction activities.

When either power or flow tariff is used, you obtain an overview of the total consumption compared to the part of the consumption used above tariff limits.

### EE=13 t1-t2 tariff (ΔΘ)

If the current t1-t2 (ΔΘ) is lower than TL2, but exceeds or is equal to TL3, heat energy is counted in TA2 parallel to the main register. If the current cooling becomes lower than TL3, but is higher than or equal to TL4, energy is counted in TA3 parallel to the main register. If the current t1-t2 (ΔΘ) is lower than TL4, energy is counted in TA4 parallel to the main register.

| | | |
|---|---|---|
| ΔΘ ≥ TL2 | Accumulation in main register only | |
| TL3 ≤ ΔΘ < TL2 | Accumulation in TA2 and main register | TL4 < TL3 < TL2 |
| TL4 ≤ ΔΘ < TL3 | Accumulation in TA3 and main register | |
| ΔΘ < TL4 | Accumulation in TA4 and main register | |

Setting up tariff limits, TL3 must be lower than TL2 and TL4 must be lower than TL3.

The t1-t2 tariff can be used as a basis for weighted user charge. Low ΔΘ (small difference between inlet and outlet temperatures) is uneconomical for the heat supplier.

## EE=14 Inlet temperature tariff

If the current inlet temperature (t1) exceeds TL2, but is lower than or equal to TL3, energy is counted in TA2 parallel to the main register. If the current inlet temperature exceeds TL3, but is lower than or equal to TL4, energy is counted in TA3 parallel to the main register. If the current inlet temperature exceeds TL4, energy is counted in TA4 parallel to the main register.

| | | |
|---|---|---|
| t1 ≤ TL2 | Accumulation in main register only | |
| TL3 ≥ t1 > TL2 | Accumulation in TA2 and main register | TL4 > TL3 > TL2 |
| TL4 ≥ t1 > TL3 | Accumulation in TA3 and main register | |
| t1 > TL4 | Accumulation in TA4 and main register | |
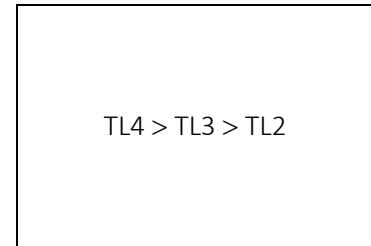
Setting up data, TL3 must be higher than TL2 and TL4 must be higher than TL3.

The inlet temperature tariff can be used as a basis for billing consumers who are guaranteed a certain inlet temperature. If the "guaranteed" minimum temperature is entered in TL4, the payable consumption is accumulated in TA4.

## EE=15 Outlet temperature tariff

If the current outlet temperature (t2) exceeds TL2, but is lower than or equal to TL3, energy is counted in TA2 parallel to the main register. If the current outlet temperature exceeds TL3, but is lower than or equal to TL4, energy is counted in TA3 parallel to the main register. If the current outlet temperature exceeds TL4, energy is counted in TA4 parallel to the main register.

| | | |
|---|---|---|
| t2 ≤ TL2 | Accumulation in main register only | |
| TL3 ≥ t2 > TL2 | Accumulation in TA2 and main register | TL4 > TL3 > TL2 |
| TL4 ≥ t2 > TL3 | Accumulation in TA3 and main register | |
| t2 > TL4 | Accumulation in TA4 and main register | |

Setting up data, TL3 must be higher than TL2 and TL4 must be higher than TL3.

The outlet temperature tariff can be used as a basis for weighted user charge. A high outlet temperature indicates insufficient heat utilization, which is uneconomical for the heat supplier.

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### EE=19 Time-controlled tariff

The time-controlled tariff is used for time division of heat consumption. If TL2 = 08:00, TL3 = 16:00 and TL4=23:00, the daily consumption from 08:00 until 15:59 is accumulated in TA2, whereas the consumption during the evening from 16:00 until 22:59 is accumulated in TA3 and the consumption during the night from 23:00 until 07:59 is accumulated in TA4.

TL2 must include fewer hours than TL3 and TL3 must include fewer hours than TL4.

| | | |
|---|---|---|
| From and incl. TL2 to TL3 | Accumulation in TA2 and main register | TL3 must follow TL2 |
| From and incl. TL3 to TL4 | Accumulation in TA3 and main register | TL4 must follow TL3 |
| From and incl. TL4 to TL2 | Accumulation in TA4 and main register | |

The time-controlled tariff is suitable for billing in housing areas close to industrial areas with large district heating consumption as well as for billing industrial customers.

### EE=20 Heat/cooling volume tariff

The heat/cooling volume tariff is used to divide volume into heat and cooling consumption in combined heat/cooling meters, i.e. the tariff divides the consumed volume into heat and cooling volume for combined heat/cooling meters. The total volume is accumulated in the register V1, whereas TA2 accumulates the volume consumed together with E1 (heat energy) and TA3 accumulates the volume consumed together with E3 (cooling energy).

EE=20 only functions in heat/cooling meters of the meter types 3 and 6.

(TA4 is not used in this tariff type).

| | | |
|---|---|---|
| $t1 > t2$ and $t1 \geq \theta_{hc}$ | Volume is accumulated in TA2 and V1 (heat energy) | TL2 and TL3 are not used |
| $t1 > t2$ and $t1 \leq \theta_{hc}$ | Volume is accumulated in V1 only | |
| $t2 > t1$ and $t1 \leq \theta_{hc}$ | Volume is accumulated in TA3 and V1 (cooling energy) | |
| $t2 > t1$ and $t1 \geq \theta_{hc}$ | Volume is accumulated in V1 only | |
| $t1 = t2$ and $t1 \geq \theta_{hc}$ | Volume is accumulated in V1 only, no counting in energy registers | |
| $t1 = t2$ and $t1 \leq \theta_{hc}$ | Volume is accumulated in V1 only, no counting in energy registers | |

### EE=21 PQ tariff

The PQ tariff is a combined power and flow tariff. TA2 functions as power tariff and TA3 functions as flow tariff.

| | | |
|---|---|---|
| $P \leq TL2$ and $Q \leq TL3$ | Accumulation in main register only | TL2 = power limit (P) |
| $P > TL2$ | Accumulation in TA2 and main register | TL3 = flow limit (Q) |
| $Q > TL3$ | Accumulation in TA3 and main register | |
| $P > TL2$ and $Q > TL3$ | Accumulation in TA2, TA3 and main register | |

The PQ tariff can, for example, be used for customers who pay a fixed charge based on max power and max flow (TL4 and TA4 are not used in this tariff type).

### 3.4.6 Tariff limits with Auto Detect UF of ULTRAFLOW® X4

Auto Detect UF enables the exchange of ULTRAFLOW® X4 on MULTICAL® 803 without the need for changing the CCC code. MULTICAL® 803 can automatically adjust its CCC code to match the connected ULTRAFLOW® X4 via the function Auto Detect UF. Auto Detect UF is active with the CCC code 8xx. Read more about it in paragraph 8.1.1.

The resolution of the tariff limits is adapted to the nominal flow qp and is thus controlled by the selected CCC code. The tariff limits do not change value by Auto Detect UF, but the value resolution and device can change. An example with a flow-controlled tariff is shown below.

<div style="border:1px solid">

**Qp = 1,5 m³/h**

<u>Tariff limit, TL2</u>

Used/Display:        350 l/h

Base resolution (stored in the calculator):
     350 l/h

</div>

↓ - Auto Detect - ↓

<div style="border:1px solid">

**Qp = 150 m³/h**

<u>Tariff limit, TL2</u>

Used/Display:        0,3 m³/h

Base resolution (stored in the calculator):
     350 l/h

</div>

→ Reconfiguration of tariff limits →

<div style="border:1px solid">

**Qp = 150 m³/h**

<u>Tariff limit, TL2</u>

Used/Display:        0,2 m³/h

Base resolution (stored in the calculator):
     200 l/h

</div>

↓ - Auto Detect - ↓

<div style="border:1px solid">

**Qp = 1,5 m³/h**

<u>Tariff limit, TL2</u>

Used/Display:        350 l/h

Base resolution (stored in the calculator):
     350 l/h

</div>

↓ - Auto Detect - ↓

<div style="border:1px solid">

**Qp = 1,5 m³/h**

<u>Tariff limit, TL2</u>

Used/Display:        200 l/h

Base resolution (stored in the calculator):
     200 l/h

</div>

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### 3.4.7   Pulse inputs A and B >FF-GG<

Up to four communication modules can be mounted in MULTICAL® 803. Pulse inputs are supported on communication modules placed in slot M1 and slot M2. See paragraph 11 for further information about the communication modules.

The pulse inputs are used for collection and remote accumulation of pulses from e.g. mechanical water meters and electricity meters. The pulse inputs function independently of the calculator itself. Therefore, they are not included in any energy calculation. The four pulse inputs are identically constructed and can be set up to receive pulses from water or electricity meters.

Pulse inputs A and B are placed on selected communication modules. If the module is installed in slot M1 in MULTICAL® 803, the inputs A1 and B1 are identified, and the same applies to slot M2; with inputs A2 and B2.



---
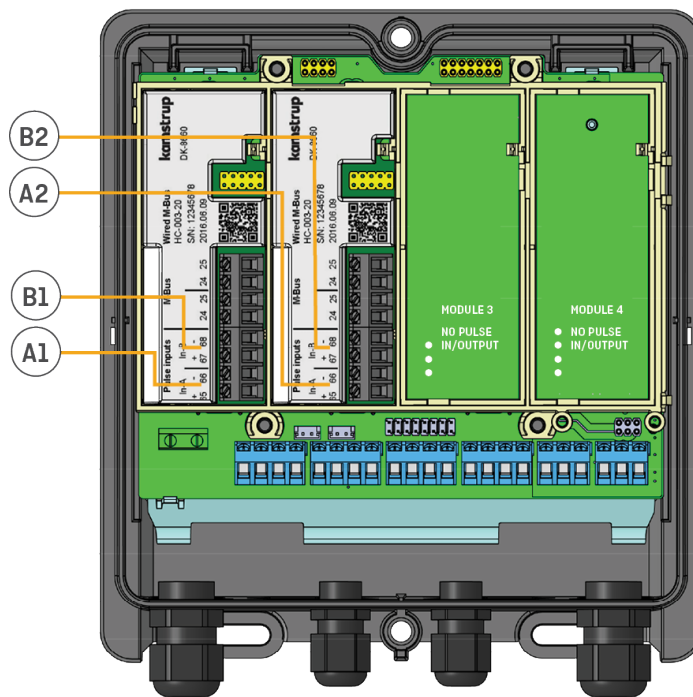
**Note:**
The pulse inputs A1 and A2 will always be identically configured through the FF code and likewise, the pulse inputs B1 and B2 will always be identically configured through the GG code. Therefore, pay special attention to this when the modules are installed in the meter so that they have the right module slots in relation to the equipment that they must be coupled with.

---

All modules with pulse inputs are clearly marked with this.



Terminals for In-A and terminals for In-B are marked as well.

Se paragraph 11.2 for more details about the available modules.

MULTICAL® 803 registers the accumulated consumption of the meters connected to the inputs and saves the counter values every month and every year on target date. The number of these yearly and monthly loggings depends on the selected logger profile (RR code). Read more about data logger profiles in paragraph 3.4.12. In order to facilitate the identification during data reading, it is also possible to save the meter numbers of the four meters connected to the inputs. The meter numbers can be either programmed in the meter via the "SETUP loop" (for A1 and B1) or via METERTOOL HCW (for A1, B1, A2 and B2).

---

**Note:**
Which pulse input registers are collected through the module is controlled by the selected datagram profile of the module, which is configured through the module's ZZZ code.
By default, In-A1 and In-B1 are collected.

---

Two alarm types are connected to the pulse inputs: cold water leakage and external alarm, respectively. Unless otherwise informed by the customer, the calculator is, in general, prepared for external alarm on all four inputs from the factory, but only with one active leakage alarm on inputs A1 and A2. Please contact Kamstrup A/S if you need leakage alarm possibility on input B1 and B2. Read more about cold water leakage in paragraph 3.4.10 and info codes in paragraph 7.8.

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Below, the requirements for pulse duration and pulse frequency for meters connected to the pulse inputs are specified:

| Pulse inputs A and B<br>In-A 65-66 and In-B: 67-68 via module | Electronic switch | Reed switch |
|---|---|---|
| Pulse input | 680 kΩ pull-up to 3,6 V | 680 kΩ pull-up to 3,6 V |
| Pulse ON | < 0,4 V for > 30 ms | < 0,4 V for > 500 ms |
| Pulse OFF | > 2,5 V for > 30 ms | > 2,5 V for > 500 ms |
| Pulse frequency | < 3 Hz | < 1 Hz |
| Electrical isolation | No | No |
| Max cable length | 25 m | 25 m |
| Requirements to external contact | Leak current at open contact < 1 μA | |
| Update of display | 2 s | |

The pulse inputs are placed on the module with the following terminal numbering:

| | | Connected meter | MULTICAL® 803 |
|---|---|---|---|
| Input A1/A2: | Connection terminals 65-66 | | |
| Input B1/B2: | Connection terminals 67-68 | | |
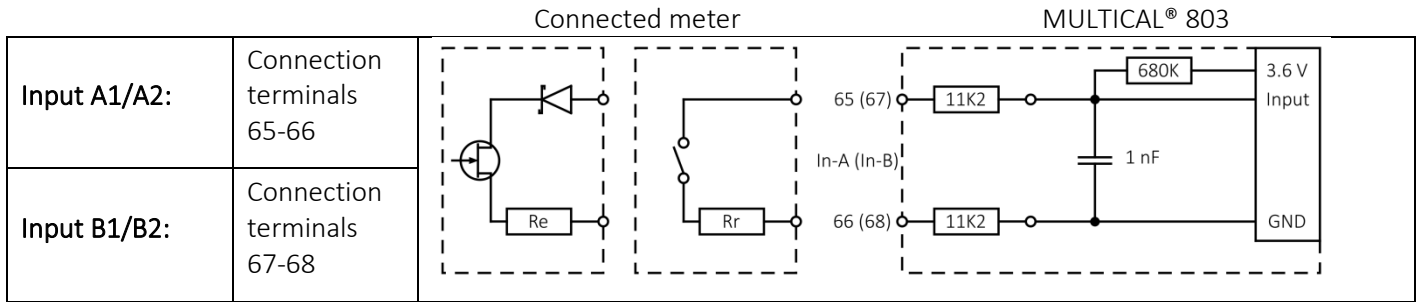
The pulse inputs are configured as a part of the calculator's configuration number via the FF and GG codes. Upon receipt of order, the FF and GG codes are configured at 24 by default (unless otherwise informed by the customer). Valid FF and GG codes appear from the table below. The default code 24 is marked in green. The FF and GG codes can be reconfigured by means of METERTOOL HCW. See the technical description of METERTOOL HCW (5512-2097).

| Input A1/A2 | | Input B1/B2 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| FF code | Max flow Water meter | GG code | Max flow Water meter | Pre-counter[2] | Wh/imp | l/imp | Measuring unit and decimal place | |
| 01 | 100 m³/h | 01 | 100 m³/h | 1 | - | 100 | vol A/vol b (m³) | 000000,0 |
| 02 | 50 m³/h | 02 | 50 m³/h | 2 | - | 50 | vol A/vol b (m³) | 000000,0 |
| 03 | 25 m³/h | 03 | 25 m³/h | 4 | - | 25 | vol A/vol b (m³) | 000000,0 |
| 04 | 10 m³/h | 04 | 10 m³/h | 10 | - | 10 | vol A/vol b (m³) | 000000,0 |
| 05 | 5 m³/h | 05 | 5 m³/h | 20 | - | 5 | vol A/vol b (m³) | 000000,0 |
| 06 | 2,5 m³/h | 06 | 2,5 m³/h | 40 | - | 2,5 | vol A/vol b (m³) | 000000,0 |
| 07 | 1 m³/h | 07 | 1 m³/h | 100 | - | 1 | vol A/vol b (m³) | 000000,0 |
| 24 | 10 m³/h | 24 | 10 m³/h | 1 | - | 10 | vol A/vol b (m³) | 00000,00 |
| 25 | 5 m³/h | 25 | 5 m³/h | 2 | - | 5 | vol A/vol b (m³) | 00000,00 |
| 26 | 2,5 m³/h | 26 | 2,5 m³/h | 4 | - | 2,5 | vol A/vol b (m³) | 00000,00 |
| 27 | 1 m³/h | 27 | 1 m³/h | 10 | - | 1 | vol A/vol b (m³) | 00000,00 |
| 40 | 1000 m³/h | 40 | 1000 m³/h | 1 | - | 1000 | vol A/vol b (m³) | 0000000 |
| FF code[1] | Max power Electricity meter | GG code | Max power Electricity meter | Pre-counter[2] | Wh/imp | l/imp | Measuring unit and decimal place | |
| 50 | 2500 kW | 50 | 2500 kW | 1 | 1000 | - | EL A/EL b (kWh) | 0000000 |
| 51 | 150 kW | 51 | 150 kW | 60 | 16,67 | - | EL A/EL b (kWh) | 0000000 |
| 52 | 120 kW | 52 | 120 kW | 75 | 13,33 | - | EL A/EL b (kWh) | 0000000 |
| 53 | 75 kW | 53 | 75 kW | 120 | 8,333 | - | EL A/EL b (kWh) | 0000000 |
| 54 | 30 kW | 54 | 30 kW | 240 | 4,167 | - | EL A/EL b (kWh) | 0000000 |
| 55 | 25 kW | 55 | 25 kW | 340 | 2,941 | - | EL A/EL b (kWh) | 0000000 |
| 56 | 20 kW | 56 | 20 kW | 480 | 2,083 | - | EL A/EL b (kWh) | 0000000 |
| 57 | 15 kW | 57 | 15 kW | 600 | 1,667 | - | EL A/EL b (kWh) | 0000000 |
| 58 | 7.5 kW | 58 | 7.5 kW | 1000 | 1 | - | EL A/EL b (kWh) | 0000000 |
| 59 | 750 kW | 59 | 750 kW | 10 | 100 | - | EL A/EL b (kWh) | 0000000 |
| 60 | 2500 kW | 60 | 2500 kW | 2 | 500 | - | EL A/EL b (kWh) | 0000000 |
| 61 | 75 kW | 61 | 75 kW | 100 | 10 | - | EL A/EL b (kWh) | 0000000 |
| 62 | 15 kW | 62 | 15 kW | 500 | 2 | - | EL A/EL b (kWh) | 0000000 |
| 70 | 25000 kW | 70 | 25000 kW | 1 | 10000 | - | EL A/EL b (MWh) | 00000.00 |

Inputs for external alarm:

| 98 | | 98 | | External alarm input; Alarm=LO (connect function, normally open) | | | | |
|---|---|---|---|---|---|---|---|---|
| 99 | | 99 | | External alarm input; Alarm=HI (breaker function, normally closed) | | | | |

[1] **Note:** If pulse input In-A1 or In-A2 is used for counting of energy from an electricity meter, this value will not be readable via M-Bus, see further information about the location of pulse inputs at the beginning of this paragraph.

[2] **Note**: Pre-counter is the needed number of pulses to increment the display.

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The registers which are connected to the pulse inputs can be read in the calculator's "TECH loop", in "USER loop" (depending on selected DDD code) and via data communication. Furthermore, it is possible to preset the meter count of the four pulse inputs to the values that the connected meters have at the time of the commissioning. This can be done either via the calculator's "SETUP loop" (for A1 and B1) or via METERTOOL HCW (for A1, B1, A2 and B2).

| Input A1 | | Input B1 | |
|---|---|---|---|
| Meter count | 0035937 | Meter count | 0005388 kWh |
| Meter no. A1 | 12345678 | Meter no. B1 | 12345678 |
| L/imp. for A1 | 10 l/p | Wh/imp. for B1 | 2.942 Wh |
| Yearly date | 2019.01.01 | Yearly date | 2019.01.01 |
| Yearly data | 00329.11 | Yearly data | 0005064 kWh |
| Monthly date | 2019.06.01 | Monthly date | 2019.06.01 |
| Monthly data | 00345.79 | Monthly data | 0005160 kWh |

### 3.4.8    Integration mode >L<

MULTICAL® 803 uses time-based integration, which means that accumulated volume and energy are calculated at fixed time intervals and independently of the water velocity.

MULTICAL® 803 can only be mains-supplied. The calculator has a backup battery, but in normal operation, the calculator is mains-supplied. Therefore, the calculator display will always be switched on and the integration interval will always be 2 seconds. Only the backlight of the display is configured via the L code.

It is possible to choose between two integration modes; one mode in which the backlight of the display remains on and one mode in which the backlight of the display turns off after 15 seconds after the latest registered keystroke. Via the "heart beat" indication in the bottom left corner of the display, the calculator display will at all times show that the calculator is active.

| Integration mode | Backlight period | L code | |
|---|---|---|---|
| | | Display on | Display off |
| Fast mode (2 s) | 15 s. | 4 | - |
| Fast mode (2 s) | On | 9 | - |

**Note:** When MULTICAL® 803 is powered by the backup battery, the calculator automatically adjusts the integration interval to 8 seconds to conserve power.

#### Fast mode (2 s)

In fast mode, the integration interval is set to 2 seconds, which means that the calculator calculates accumulated volume and energy every 2 seconds.

Fast mode (2 s) is recommended for all systems including those with tap water exchanger. Fast mode is especially suitable for applications in which the meter is equipped with analog outputs. Together with ULTRAFLOW® X4, fast mode (2 s) meets the requirements for "Fast response meter" in EN 1434.

Filter 1-10 are used for changing the filter value of actual flow and actual power. This value also influences the analog outputs. With this filter setting, a filtration of actual flow and actual power of up to 10 x the integration time can be achieved.

#### Integration concept
The integration concept of MULTICAL® 803 is illustrated in the figure below.

MULTICAL® 803
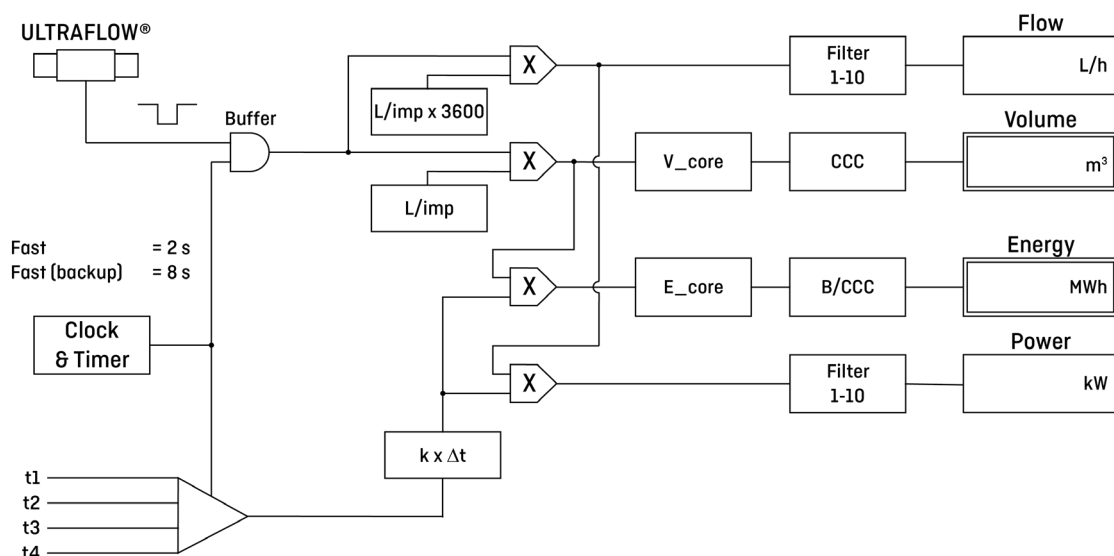
## Filter

Filter 1-10 are used to change the filter value of actual flow and actual power. The filter value influences the actual flow and actual power readings on the display, on the data readout and on the analog outputs. With this filter setting, an averaging of actual flow and actual power of up to 10 x the integration time can be achieved.
See the below curves for the effect of different filter values on the same fluctuating flow rate:



**Actual flow rate at different filter values, F=1 to F=10**
*Config L=4: Fast mode (2 s)*

**Average periods at different filter values**
- F=1
- F=3
- F=5
- F=10
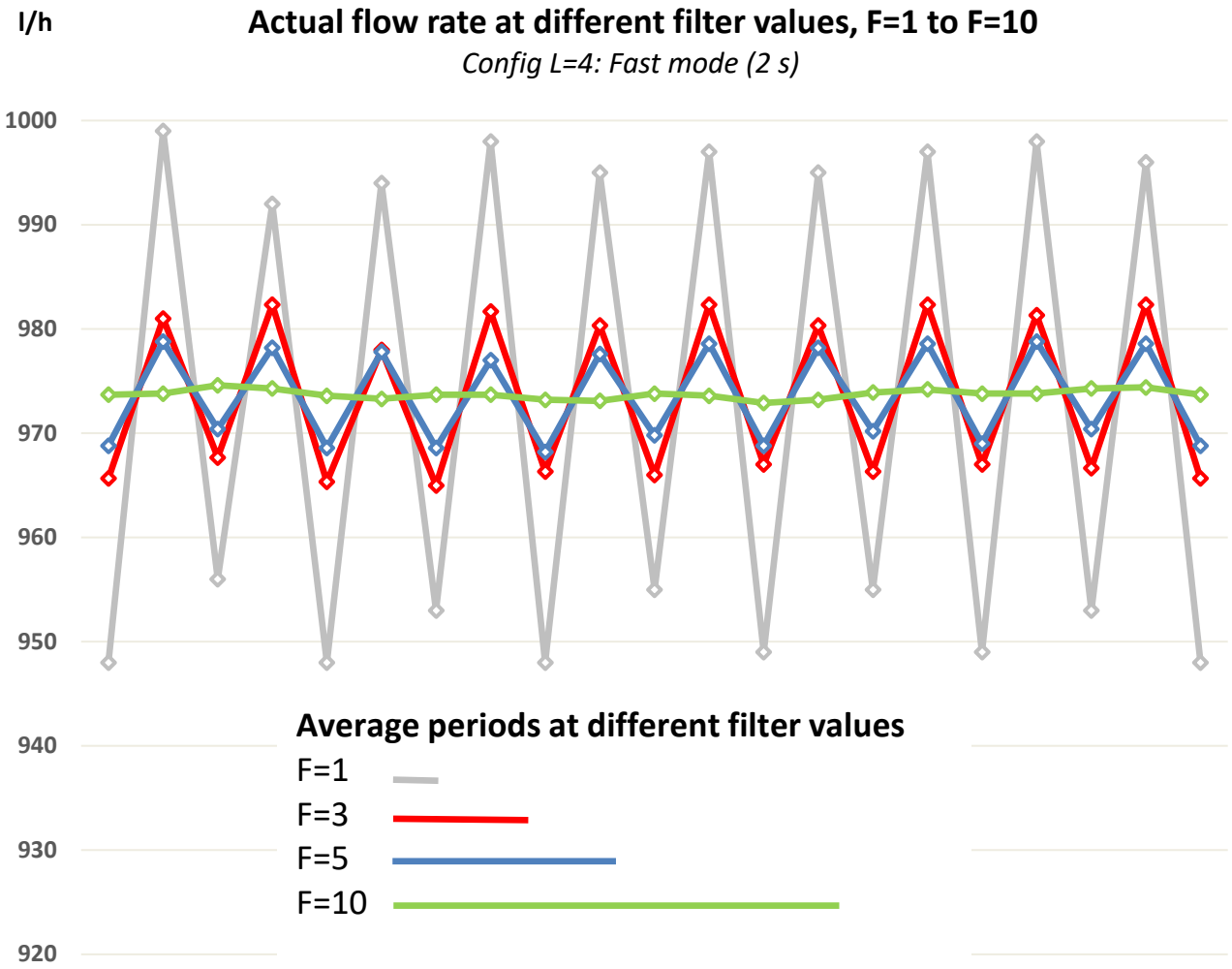
The averaging time at different filter values and integration modes is shown in the table below. Please note that the response time is equal to the chosen integration mode (e.g. 2 s for Fast mode (2 s)), but the higher filter value, the less change per integration period is shown.

| Integration mode | Filter value | F=1 | F=3 | F=5 | F=10 |
|---|---|---|---|---|---|
| Fast mode (2 s) | | 2 s | 6 s | 10 s | 20 s |
| Fast mode (8 s), only at backup battery | | 8 s | 24 s | 40 s | 80 s |

When using Fast mode and F=5, the meter calculates the average value every 2 seconds based on values from the last 10 seconds. The display is still updated and data provided for the communication modules every 2 seconds. The factory setting is F=5 for meters produced from July 2021. Previous produced meters have factory setting F=3. If another filter value is needed, this value can be changed using METERTOOL.

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## 3.4.9 Leakage limits (V1, V2) >M<

MULTICAL® 803 can be used for leakage monitoring when two flow sensors are connected to MULTICAL® 803 on inputs V1 and V2.

The M code defines the leakage limit, i.e. the leakage monitoring sensibility. If a leakage is detected in the system, the info code for leakage or burst is activated, depending on the size of the leakage. The leakage search is based on a difference in mass (ΔMass) between the calculated mass for V1 and V2, respectively. The calculation of this difference in mass is carried out over 24 hours why the reaction time of the info code for leakage is 24 hours. The burst search is based on a difference in flow for V1 and V2, respectively. The burst search is performed over a period of 120 seconds. Read more about these info codes in the info code overview in paragraph 7.8.

The sensibility of a leakage can be adjusted via the M code while the sensibility of a burst is fixed. This also appears from the table of the M code below. It is possible to detect leakages down to 15 kg/h with the connection of two flow sensors of qp 1,5 m³/h. Both the info code for leakage and for burst can be disabled via the M code (M = 0).

| Leakage limits (V1, V2) | | M code |
|---|---|---|
| Leakage | Burst | |
| No active leak search | No active burst search | 0 |
| ΔMass ≈ > 1,0 % of qp + 20 % q | Δflow > 20 % of qp | 1 |
| ΔMass ≈ > 1,0 % of qp + 10 % q | Δflow > 20 % of qp | 2 |
| ΔMass ≈ > 0,5 % of qp + 20 % q | Δflow > 20 % of qp | 3 |
| ΔMass ≈ > 0,5 % of qp + 10 % q | Δflow > 20 % of qp | 4 |

### Leakage limit for qp 1,5 m³/h
#### M code = 2 (1,0 % of qp + 10 % q)
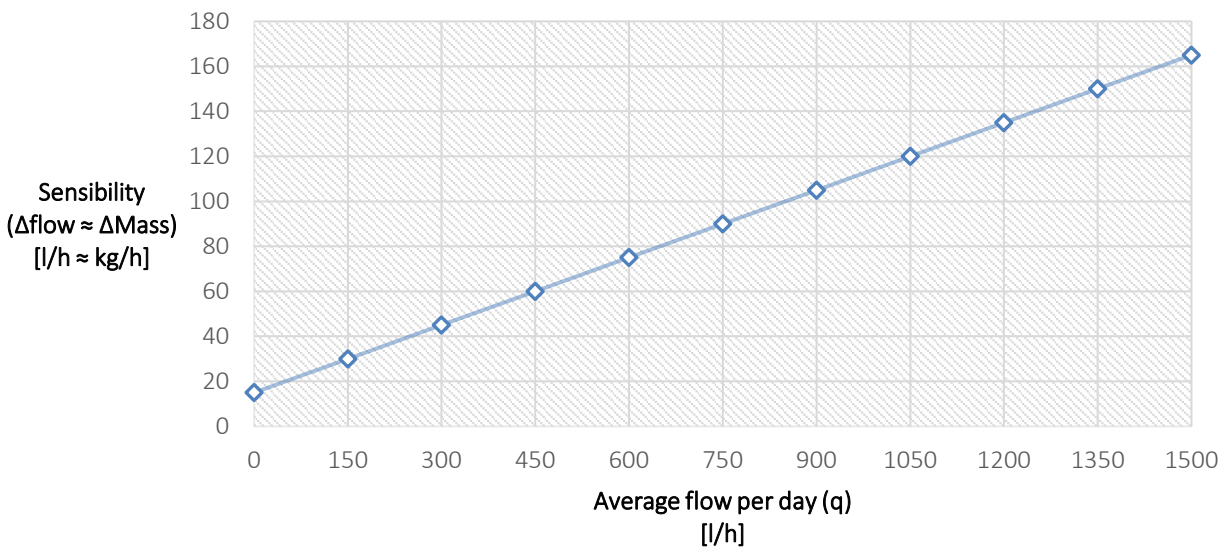


### Permanent operational monitoring

Leakage monitoring can with advantage be extended to include permanent performance monitoring as it just requires the installation of a set of three sensors instead of a sensor pair. In Denmark, for example, permanent performance monitoring reduces the number of random samples to three meters per random sampling lot, no matter the size of the measuring lot. Read more in the permanent performance monitoring guide (5512-1486_GB). The purpose of this guide is to provide caretakers, installers and consulting engineers with the information needed on Kamstrup's leak monitoring system and permanent performance monitoring.

## 3.4.10 Cold water leakage (In-A/In-B) >N<

The pulse inputs A and B of MULTICAL® 803 can be used for cold water leakage monitoring. Basically, however, the cold water leakage monitoring is only active on input A (A1/A2), unless otherwise agreed with the customer. When MULTICAL® 803 is used for leak monitoring, the sensitivity is determined by the configuration of the N code.

Leakage monitoring is measured over a period of 24 hours. The N code defines the resolution by which the 24 hours are divided; either 48 intervals of half an hour, 24 intervals of one hour or 12 intervals of two hours. If the calculator registers minimum one pulse during each of these intervals over the full period, info code 8, which indicates leakage, is activated. The info code is not activated until after the 24-hour period. However, it is reset again immediately as soon as the calculator registers an interval without pulses.

The table below shows the three available N codes. Upon receipt of order, the N code is configured to 2 by default (unless otherwise informed by the customer).

| Cold water leakage search (In-A1/A2) | N code |
|---|---|
| No active leak search | 0 |
| 30 minutes without pulses | 1 |
| One hour without pulses | 2 |
| Two hours without pulses | 3 |

## 3.4.11 Pulse outputs C and D >PP<

Up to four communication modules can be mounted in MULTICAL® 803. Pulse outputs are supported by communication modules placed in slot M1 and slot M2. See paragraph 11 for further information about the communication modules.

MULTICAL® 803 can have up to four pulse outputs (C1, C2, D1 and D2), which are placed on the communication modules. The pulse outputs have three possibilities of use:

- Transmission of selected meter count registers (which are controlled by the selected country code).
- Controlled output, which means that the pulse outputs can be controlled via data commands.
- Pulse Transmitter/Divider so that the pulse signal from V1 and V2 is transmitted via the pulse outputs.

Pulse outputs C and D are placed on selected communication modules. If the module is installed in slot M1 of MULTICAL® 803, the outputs C1 and D1 are identified, and the same applies to slot M2; with the outputs C2 and D2.

---
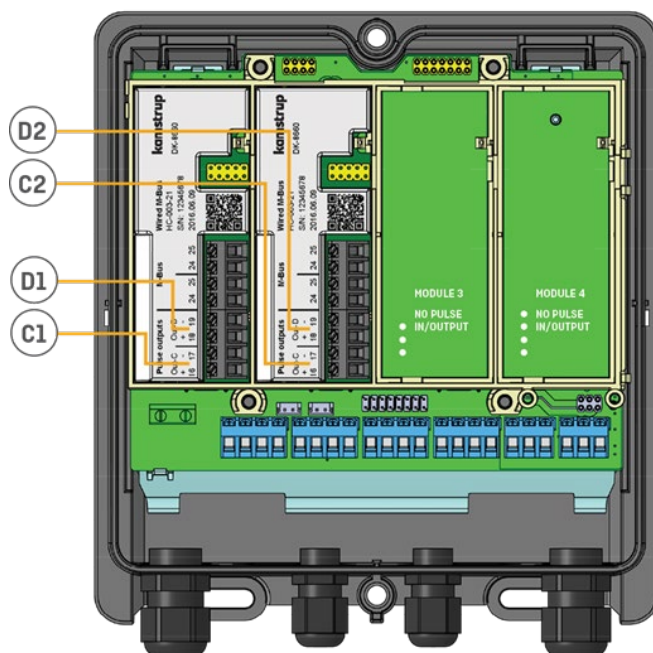
**Note:**
The pulse outputs C1 and C2 will always be identically configured and in the same way, the outputs D1 and D2 will always be identically configured. All four outputs are configured through the meter's PP code. Therefore, pay special attention to this when the modules are installed in the meter so that they have the right module slots in relation to the equipment that they must be coupled with.

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All modules with pulse outputs are clearly marked with this.
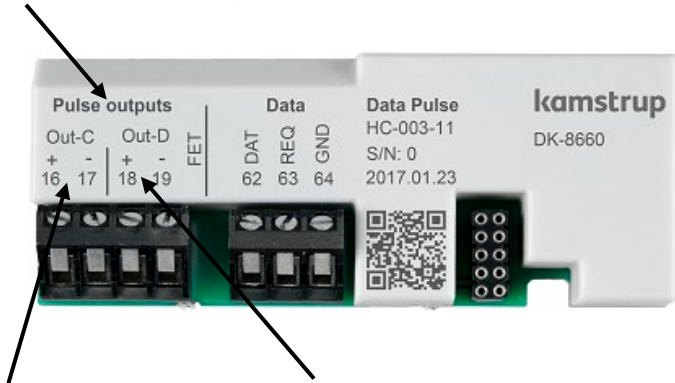


Terminals for Out-C and terminals for Out-D are marked as well.

See paragraph 11.2 for more details about the available modules.

### Technical data for pulse outputs

| | |
|---|---|
| Output type | Opto FET |
| External voltage | 1…48 VDC/AC |
| Current | < 50 mA |
| On-resistance | $\leq 40\ \Omega$ |
| Electric isolation | 2 kV |
| Max cable length | 25 m |

Note the polarity when making the connection.
The pulse outputs are placed on the module with the following terminal numbering:

| | | Opto FET |
|---|---|---|
| **Pulse output C:** | Terminals 16-17 |  |
| **Pulse output D:** | Terminals 18-19 | |
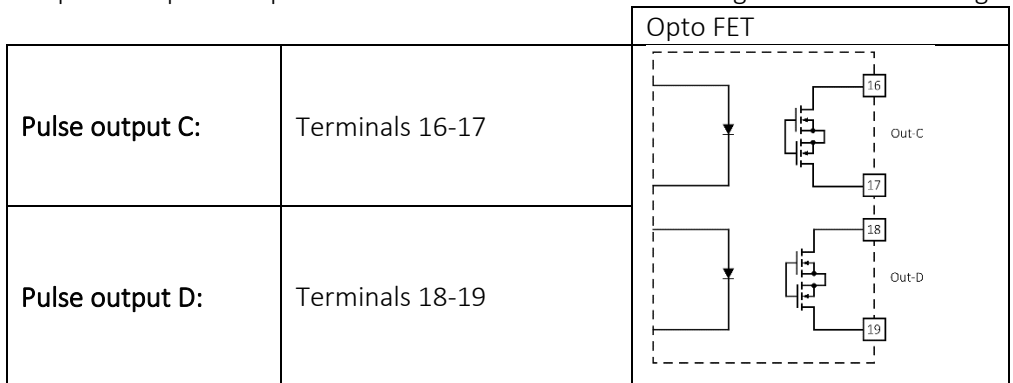
**Note:** For specifications on previous versions of pulse outputs, see "Electrical Data" in paragraph 2.4

The pulse outputs are configured as part of the calculator's configuration number via the PP code. Upon receipt of order, the PP code is configured to 95 by default (unless otherwise informed by the customer). Valid PP codes appear from the table below. The default code 95 is marked in green. The PP code can be reconfigured by means of METERTOOL HCW. See the technical description of METERTOOL HCW (5512-2097).

| Pulse outputs C and D | PP code |
|---|---|
| Pulse Transmitter/Divider | |
| Out-C: V1/4 (5 ms) | 73 |
| Out-C: V1/1, Out-D: V2/1 (3,9 ms) | 80 |
| Out-C: V1/1 (3,9 ms) | 82 |
| Out-C: V1/4 (22 ms) | 83 |
| Pulse outputs for meter count registers | |
| 10 ms | 94 |
| 32 ms | 95 |
| 100 ms (0,1 s) | 96 |
| 250 ms | 93 |
| Controlled output via data commands | |
| Controlled output | 99 |

### 3.4.11.1  Pulse Transmitter/Divider

The calculator can be configured so that the pulse outputs serve as either Pulse Transmitter or Pulse Divider. If the outputs must serve as Pulse Transmitter, the calculator's PP code is configured to either 80 or 82. Regardless of whether both outputs are connected or floating, the PP code 80 with Pulse Transmitter on both Out-C and Out-D causes an increased power consumption. If the outputs must serve as Pulse Divider, the calculator's PP code is configured to 83 with 22 ms pulse duration or PP code 73 with 5 ms pulse duration.

Pulse Transmitter/Divider can, among other things, be used for external leak protection and makes it possible to connect an additional calculator to the same flow sensor and to external control systems that regulate according to flow pulses, for example Siemens RVD 250 and Danfoss ECL 310, both of which can use the PP code 73 with 5 ms pulse duration.

### 3.4.11.2  Pulse outputs for meter count registers

As previously described, the outputs are configured in pairs (C1/C2 and D1/D2), which means that it is possible to transmit output from two of the following meter count registers on pulse output C1/C2 and pulse output D1/D2, respectively:

- E1 (Heat energy)
- E3 (Cooling energy)
- V1 (Volume)

**Note:** As the selected meter count registers are configured by the country code, the configuration *cannot* be changed after delivery.

Pulse outputs are by default configured with the following registers:

| Meter function | Out-C1/C2 | Out-D1/D2 | Meter type |
|---|---|---|---|
| Heat meter | E1 (CE+) | V1 (CV) | 1, 2, 4 |
| Heat/cooling meter | E1 (CE+) | E3 (CE-) | 3, 6 |
| Cooling meter | E3 (CE-) | V1 (CV) | 5 |
| Volume meter | V1 (CV) | V1 (CV) | 7 |

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The resolutions of the pulse outputs always follow the least significant digit in the display, which is determined by the CCC code (see paragraph 3.3.3). The following table shows examples for a heat meter.

| CCC | qp | Imp./L | 7/8 digits | Number of decimals in display | | | | | | | | Connection type |
|-----|-----|--------|-----------|------|-------------|----|-------------|-----|-------|----|----|-----------------|
| | | | | kWh | MWh Gcal | GJ | m³ ton | l/h | m³/h | kW | MW | |
| 119 | 1,5 | 100 | 7 | 0 | 3 | 2 | 2 | 0 | - | 1 | - | C-P |
| 479 | 25 | 6 | 7 | - | 2 | 1 | 1 | - | 2 | 0 | - | 1-2-7-8 |
| 480 | 100 | 1,5 | 7 | - | 1 | 0 | 0 | - | 2 | 0 | - | 1-2-7-8 |

CCC code 119:     Output CE = 1 pulse/1 kWh     Output CV = 1 pulse/0,01 m³

CCC code 479:     Output CE = 1 pulse/10 kWh     Output CV = 1 pulse/0,1 m³

CCC code 480:     Output CE = 1 pulse/100 kWh   Output CV = 1 pulse/1 m³

Note that the pulses are accumulated in the integration interval and transmitted by each integration with a fixed frequency. This is shown in the example below.
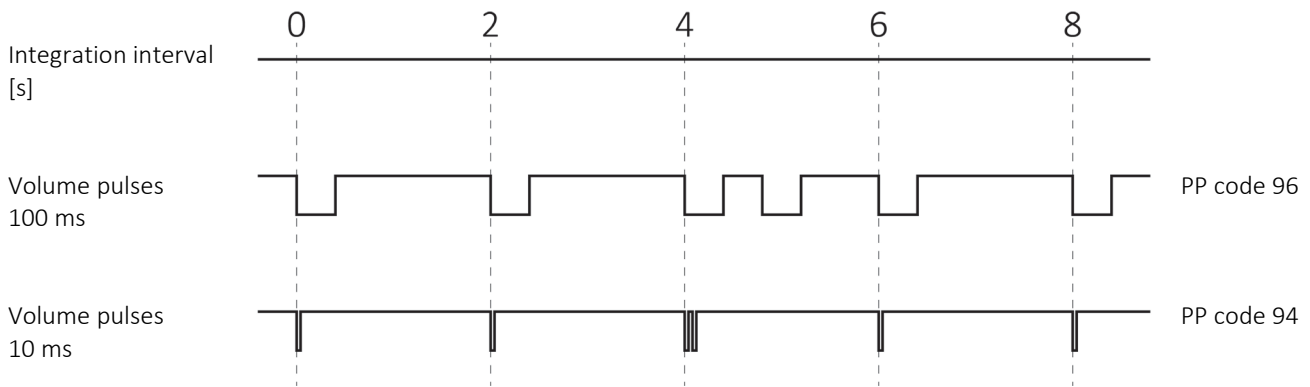


### 3.4.11.3   Controlled output

The calculator can be configured for data command control of pulse outputs. If controlled output is required, the PP code is to be configured to 99. As previously described, the outputs are configured in pairs (C1/C2 and D1/D2), which means that externally connected equipment can set the calculator's outputs, in the pairs C1/C2 and D1/D2, to respectively OFF (open opto transistor output) and ON (closed opto transistor output) via KMP data commands.

The output status can be read via the KMP registers and after a power-on reset, the outputs will have the same status as before the power failure as every change of status is saved in the calculator's EEPROM.

### 3.4.12 Data logger profile >RR<

MULTICAL® 803 has a permanent memory (EEPROM) in which the results from various data loggers are saved. The data logger is programmable. The required data logger profile is selected via the RR code of the configuration number. Unless otherwise stated by the customer, the RR code is set to 10, which is the default data logger profile (equal to the data logger in MULTICAL® 603). If data logging of other registers, different intervals and logging depths are required, other data logging profiles can be composed to match individual requirements.

The programmable data logger includes the following six data loggers:

- Yearly logger
- Monthly logger
- Daily logger
- Hourly logger
- Minute logger 1
- Minute logger 2

> **Note:**
> When the datagram of the modules are configured via the module's ZZZ code, it is important that the necessary registers that you want to transmit via the datagram also exist in the meter. Therefore, there must be consistency between the choice of the meter's RR code and the module's ZZZ code. Please contact Kamstrup A/S for further information.

Below is an example of a logger profile (RR code=10).

| Logger type | | Year | Month | Day | Hour | Minute 1 | Minute 2 |
|---|---|---|---|---|---|---|---|
| Logging interval | | - | - | - | - | 15m | 1m |
| Logging depth | | 20 | 36 | 460 | 1400 | 0 | 0 |
| Date (YY.MM.DD) | Year, month and day of logging time. | X | X | X | X | X | X |
| Clock (hh.mm.ss) | Time | X | X | X | X | X | X |
| E1 | E1 = V1(t1-t2)k   Heat energy | X | X | X | X | | |
| E2 | E2 = V2(t1-t2)k   Heat energy | X | X | | | | |
| E3 | E3 = V1(t2-t1)k   Cooling energy | X | X | X | X | | |
| E4 | E4 = V1(t1-t3)k   Inlet energy | X | X | | | | |
| E5 | E5 = V2(t2-t3)k   Outlet energy or tap from outlet | X | X | | | | |
| E6 | E6 = V2(t3-t4)k   Tap water energy, separate | X | X | | | | |
| E7 | E7 = V2(t1-t3)k   Tap water energy from inlet | X | X | | | | |
| E8 | E8 = m3 x t1  (inlet) | X | X | | | | |
| E9 | E9 = m3 x t2  (outlet) | X | X | | | | |
| E10 | E10 = t3 x V1 | X | X | | | | |
| E11 | E11 = t3 x V2 | X | X | | | | |
| E12 | E12 = V2 x (t2-t1)k t2 | | | | | | |
| E13 | E13 = V1 x (t3-t4)k t1/t2 | | | | | | |
| E14 | E14 = V2 x (t3-t4)k t3/t4 | | | | | | |
| E15 | E15 = V1 x (t4-t3)k t1/t2 | | | | | | |
| E16 | E16 = V2 x (t4-t3)k t3/t4 | | | | | | |
| ΔE | Differential energy | | | | | | |

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| | Logger type | Year | Month | Day | Hour | Minute 1 | Minute 2 |
|---|---|---|---|---|---|---|---|
| cE | Control energy: | | | | | | |
| A1 | Heat at a discount | | | | | | |
| A2 | Heat energy with an addition | | | | | | |
| TA2 | Tariff register 2 | X | X | | | | |
| TA3 | Tariff register 3 | X | X | | | | |
| TA4 | Tariff register 4 | X | X | | | | |
| V1 | Volume register for Volume 1 | X | X | X | X | | |
| V2 | Volume register for Volume 2 | X | X | X | X | | |
| ΔV | Differential volume | | | | | | |
| cV | Control volume | | | | | | |
| In-A1 | Additional water meter connected to Input A1 | x | x | x | x | | |
| In-B1 | Additional water or electricity meter connected to Input B1 | x | x | x | x | | |
| In-A2 | Additional water meter connected to Input A2 | x | x | x | x | | |
| In-B2 | Additional water or electricity meter connected to Input B2 | x | x | x | x | | |
| M1 | Mass-corrected V1 with t1 | X | X | X | X | | |
| M2 | Mass-corrected V2 with t2 | X | X | X | X | | |
| M3 | Mass-corrected V2 with t3 | | | | | | |
| M4 | Mass-corrected V2 with t4 | | | | | | |
| INFO | Information code | X | X | X | X | | |
| Flow1 Max Date Year | Date stamp of max flow V1 in the year | X | | | | | |
| Flow1 Max Year | Value of max flow V1 in the year | X | | | | | |
| Flow1 Min Date Year | Date stamp for min. flow V1 in the year | X | | | | | |
| Flow1 Min Year | Value of min. flow V1 in the year | X | | | | | |
| Power1 Max Date Year | Date stamp for min. flow in the year | X | | | | | |
| Power1 Max Year | Value for max power in the year | X | | | | | |
| Power1 Min Date Year | Date stamp for min. power in the year | X | | | | | |
| Power1 Min Year | Value for min. power in the year | X | | | | | |
| Flow1 Max Date Month | Date stamp for max flow V1 in the month | | X | | | | |
| Flow1 Max Month | Value for max flow V1 in the month | | X | | | | |
| Flow1 Min Date Month | Date stamp for min. flow V1 in the month | | X | | | | |
| Flow1 Min Month | Value for min. flow V1 in the month | | X | | | | |
| Power1 Max Date Month | Date stamp for max power in the year | | X | | | | |
| Power1 Max Month | Value for max power in the month | | X | | | | |
| Power1 Min Date Month | Date stamp for min. power in the month | | X | | | | |
| Power1 Min Month | Value for min. power in the month | | X | | | | |
| t1 Max Year Date/time | Date stamp for max temperature t1 in the year | | | | | | |
| t1 Max year | Value for max temperature t1 in the year | | | | | | |
| t1 Min year Date/time | Date stamp for min. temperature t1 in the year | | | | | | |
| t1 Min year | Value for min. temperature t1 in the year | | | | | | |
| t2 Max year Date/time | Date stamp for max temperature t2 in the year | | | | | | |
| t2 Max year | Value for max temperature t2 in the year | | | | | | |
| t2 Min year Date/time | Date stamp for min. temperature t2 in the year | | | | | | |
| t2 Min year | Value for min. temperature t2 in the year | | | | | | |

| Logger type | | Year | Month | Day | Hour | Minute 1 | Minute 2 |
|---|---|---|---|---|---|---|---|
| t1 Max month Date/time | Date stamp for max temperature t1 in the month | | | | | | |
| t1 Max month | Value for max temperature t1 in the month | | | | | | |
| t1 Min month Date/time | Date stamp for min. temperature t1 in the month | | | | | | |
| t1 Min month | Value for min. temperature t1 in the month | | | | | | |
| t2 Max month Date/time | Date stamp for max temperature t2 in the month | | | | | | |
| t2 Max month | Value for max temperature t2 in the month | | | | | | |
| t2 Min month Date/time | Date stamp for min. temperature t2 in the month | | | | | | |
| t2 Min month | Value for min. temperature t2 in the month | | | | | | |
| COP Year (SCOP) | Coefficient of Performance, year | | | | | | |
| COP Month | Coefficient of Performance, month | | | | | | |
| t1 Time Average Day | Time-averaged temperature (day) for t1 | | | | | | |
| t2 Time Average Day | Time-averaged temperature (day) for t2 | | | | | | |
| t3 Time Average Day | Time-averaged temperature (day) for t3 | | | | | | |
| t4 Time Average Day | Time-averaged temperature (day) for t4 | | | | | | |
| t1 Time Average Hour | Time-averaged temperature (hour) for t1 | | | | | | |
| t2 Time Average Hour | Time-averaged temperature (hour) for t2 | | | | | | |
| t3 Time Average Hour | Time-averaged temperature (hour) for t3 | | | | | | |
| t4 Time Average Hour | Time-averaged temperature (hour) for t4 | | | | | | |
| P1 Average Day | Time-averaged analog input (day) for P1 | | | | | | |
| P2 Average Day | Time-averaged analog input (day) for P2 | | | | | | |
| P1 Average Hour | Time-averaged analog input (hour) for P1 | | | | | | |
| P2 Average Hour | Time-averaged analog input (hour) for P2 | | | | | | |
| Hour Counter | Accumulated number of operating hours | X | X | | | | |
| Error Hour Counter | Accumulated number of error hours | X | X | | | | |
| t1 | Current value for t1 | | | | | | |
| t2 | Current value for t2 | | | | | | |
| t3 | Current value for t3 | | | | | | |
| t4 | Current value for t4 | | | | | | |
| t1-t2 (Δt) | Current differential value | | | | | | |
| Flow (V1) | Current water flow of V1 | | | | | | |
| Flow (V2) | Current water flow of V2 | | | | | | |
| Power E1/E3 | Current heating power (E1/E3) | | | | | | |
| Power E14/E16 | Current heating power (E14/E16) | | | | | | |
| P1 | Current value for analog input for P1 | | | | | | |
| P2 | Current value for analog input for P2 | | | | | | |

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### 3.4.13 Encryption level >T<

MULTICAL® 803 must be ordered with encrypted data transmission between module and reading system. Data is encrypted with 128 bit AES counter mode encryption. Data transmission can be encrypted with either a common or an individual encryption key.

If you select individual encryption key (T code 3), the reading system must know the encryption key of the individual calculator in order to read the meter. The encryption key is sent to the customer and then "matched" with the serial number of the individual meter in the reading system.

If you select common encryption key (T code 2), the key can be used for reading a customer-specific number of meters. The key is created by Kamstrup A/S. A customer can have several encryption keys, e.g. one for each meter type.

**Note:** The common encryption key is only offered to customers on request.

The encryption level is configured as part of the calculator's configuration number via the T code. Upon receipt of order, the T code is by default configured at 3 - individual encryption key (unless otherwise informed by the customer). The encryption level can be configured when submitting the order. The encryption level cannot be changed after delivery.

| Encryption level | T code |
|---|---|
| Encryption with common key (customer-specific) | 2 |
| Encryption with individual key | 3 |

Encryption keys can be downloaded from Kamstrup's customer portal "My Kamstrup" at www.kamstrup.com. Encryption keys are automatically entered in USB Meter Reader and READy.

> **IMPORTANT:** If the encryption key in the meter is changed after the meter is supplied, and the encryption type is thus changed from individual to common key or vice versa, the T code is not changed. The T code shown in the meter's display always indicates with which encryption type the meter was ordered and <u>not</u> the current encryption type of the meter.

### 3.4.14 Customer label >VVVV<

A 20x50 mm customer label can be engraved on the calculator's front. The customer label to be engraved on the calculator's front is determined by the calculator's configuration number VVVV code. The customer label can show utility logo, a bar code or the like. By default, the calculator's serial number is engraved in the customer label field.

Please contact Kamstrup A/S for information about possible customer labels as well as the creation of a new customer label.
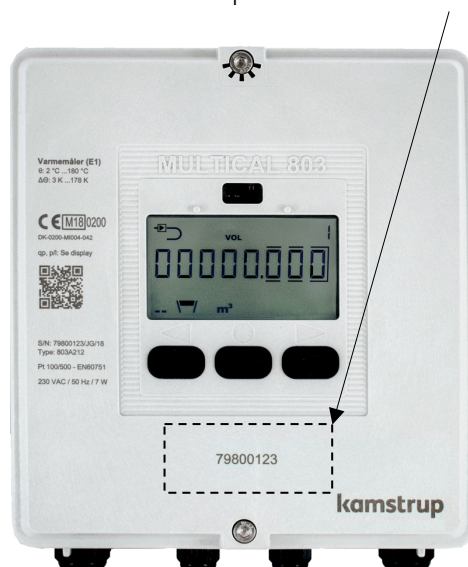
## 3.5 Data

The country code is selected as the last two characters of the calculator's static part of the type number.

|  | *Static data* | | *Dynamic data* |
|---|---|---|---|
|  | **803-xxxx** | **-** | **xxxx** |
|  | Written on the calculator's front | | Can be displayed |

**Type 803 -**  ☐  -  ☐  -  **XX**  -  ☐  -  ☐☐  -  ☐

In addition to being used to define the language on the meter label and the approval and verification labels, the country code is used to control the configuration of certain meter data.

During production, MULTICAL® 803 is programmed with a number of measuring values in the fields listed overleaf. Unless the order includes specific requirements as to configuration, MULTICAL® 803 is supplied with the default values from the table.

| | Automatic | To be stated in order | Default |
|---|---|---|---|
| Serial no. (S/N) [1] | 79.800.000 | - | - |
| Customer no.<br>Display No. 1 = 8 digits MSD<br>Display No. 2 = 8 digits LSD | - | Up to 16 digits | Customer no. equal to S/N |
| Yearly target date 1 (MM.DD) | - | MM=1-12 and DD=1-31 | Depends on country code |
| Monthly target date 1 (DD) | - | DD = 1-31 | |
| Yearly target date 2 (MM.DD) | - | MM=1-12 and DD=1-31 + 00.00 (disabled) [2] | |
| Monthly target date 2 (DD) | - | DD = 1-31 + 00 (disabled) [2] | |
| Averaging period 1 of min./max of power (P) and flow (Q) for yearly and monthly loggers<br>(See paragraph 7.5) | - | 1...1440 minutes | 60 minutes |
| Averaging period of min./max temperature (t) for yearly and monthly loggers<br>(See paragraph 7.5) | 5 min. | - | Depends on country code |
| Averaging period of CP<br>(See paragraph 7.2) | - | 5...30 days | 7 days |
| $\theta_{Hc}$ Heat/cooling shift<br><br>Only active if meter type 6 is selected<br>(See paragraph 7.4) | - | 2...180,00 °C + 250,00 °C [3] | Heat/cooling, meter type 6:<br>25,00 °C |
| Date/time | 20YY.MM.DD/ hh.mm.ss | GMT ± 12,0 hours<br><br>(Can be defined at half hour intervals) | - |
| GMT offset | - | - | Depends on country code |

# MULTICAL® 803

| | Automatic | To be stated in order | Default |
|---|---|---|---|
| Primary Address for M-Bus, Modbus and BACnet [4] | - | Address 0-250 | Last 2-3 digits of customer number |
| M-Bus ID No. (used for secondary address) | - | - | Customer no. |
| wM-Bus ID no. | - | - | Serial number |
| Offset of t1, t2, t3, t4 (± 0.99K) [4] (See paragraph 7.3) | To be entered on the basis of $R_0$ of the sensor element as well as the cable resistance. If no sensor data is available, offset is set to 0.00 K. | - | - |
| t2 preset Only active if meter types 4 and 9 are selected. | - | 0,01...185,00 °C + 250.00 °C | 250,00 °C |
| t3 preset | - | 0,01...185,00 °C + 250.00 °C | 250,00 °C |
| t4 preset | - | 0,01...185,00 °C + 250.00 °C | 250,00 °C |
| t5 preset Only relevant for meter types 1 and 2. (See paragraph 7.1.3) | - | 0.01...185,00 °C | 50,00 °C |
| Scheduler profile (See paragraph 7.13) | - | Created scheduler profiles | Depends on the country code (Disabled by default) |
| DST (Daylight Saving Time) (See paragraph 7.12) | - | Enabled / Disabled | Depends on country code |
| Fluid type code [6] | - | 4-digit code for fluid type and concentration level | - |

[1] Serial no. (factory-set unique serial number) is written on the calculator and <u>cannot</u> be changed after factory programming.

[2] Yearly target date 2 (MM.DD) and monthly target date 2 (DD) set to 00.00 and 00, respectively. If these target dates are disabled, the calculator just uses yearly target date 1 and monthly target date 1.

[3] $\theta_{hc}$ = 250,00 °C disconnects the function. In all other meter types than 6, $\theta_{hc}$ is disabled and cannot be enabled after delivery.

[4] At order submission, you can select "fixed address", which means that all calculators included in the order will be configured with the same primary address.

[5] $R_0$ is the resistance value of the sensor element in ohm (Ω) at 0 °C.

[6] MULTICAL® 803-M only

### 3.5.1 Serial number and extended availability

The serial number consists of 8 digits (**xxxxxxxx**/WW/yy). a two-digit device code for extended availability (xxxxxxxx/**WW**/yy) as well as the production year (xxxxxxxx/WW/**yy**). The serial number (factory-set unique serial number) is written on the calculator and <u>cannot</u> be changed after factory programming.

You need the encryption key of a specific calculator to be able to read the calculator via wireless M-Bus. This encryption key is sent to the customer if the calculator is purchased directly from Kamstrup A/S. Customers who buy their meters from wholesalers can download their encryption keys from Kamstrup's "Encryption Key Service" where the customer can create a user profile without contacting Kamstrup A/S. Next, the customer enters the calculator's serial number as well as the two digits (device code) for extended availability and downloads the encryption key. The two digits have been introduced to provide a secure method for customers who buy Kamstrup meters from a wholesaler to obtain the necessary encryption key.

# MULTICAL® 803

### 3.5.2   Target date

MULTICAL® 803 can be configured with up to two yearly target dates and two monthly target dates. These dates determine on which date data is to be logged (saved) in the calculator's interval logger. To avoid confusion about which time of the day the calculator saves data, MULTICAL® 803 also, in addition to the date, includes a time stamp for the logging. This time stamp is not included in this calculator's predecessor, MULTICAL® 801, which simply stamps data with a date. This difference also means that the date stamps of the two calculators vary in spite of the fact that both calculators are configured with a target date, e.g. 01.01 [MM.DD]. Note that although the date stamps of the two calculators are different, both calculators will in practice log (save) data at the same time. This is illustrated by the following example:

| | *MULTICAL® 402/602/801* | *MULTICAL® 303/403/603/803* |
|---|---|---|
| *Yearly target date [MM.DD]* | 01.01 | 01.01 |
| *Monthly target date [DD]* | 01 | 01 |
| *Date/time [20YY.MM.DD/ hh.mm.ss]* | 2021.12.31 / 24.00.XX [1] | 2022.01.01 / 00.00.XX |

[1] *Note that it is not possible to read out this time stamp from the calculator.*
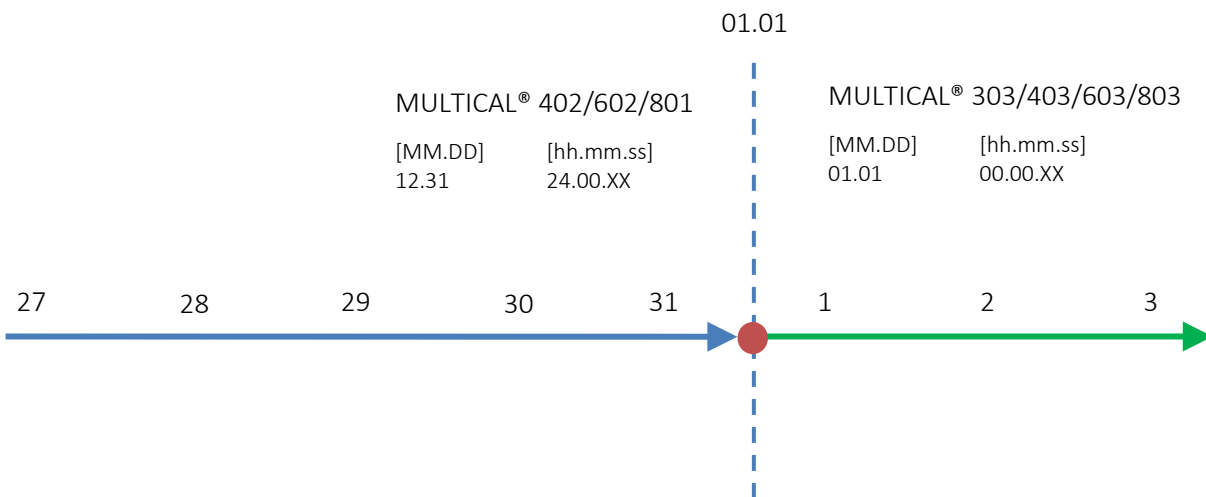


When using MULTICAL® 803 together with systems that are dependent on data being logged with a given target date, it is important to select this date as target date in the calculator's configuration. The target date can be configured both via the calculator's front keys in the "SETUP loop" and via METERTOOL HCW, see paragraph 6.4 and the technical description of METERTOOL HCW (5512-2097), respectively. If the target date is required to be set to the last day of the month, the monthly target date *[DD]* is set to 31. MULTICAL® 803 automatically logs on the last day of months with less than 31 days.

# 4   Installation

## 4.1   Installation requirements

Prior to installation of MULTICAL® 803 in connection with flow sensors, the heating system should be flushed while a fitting piece replaces the flow sensor. When installing an ULTRAFLOW®, the adhesive wafers are removed from the flow sensor's inlet and outlet and the flow sensor is mounted with couplings/flanges. New fibre gaskets in original quality must be used.

If other couplings than the original ones from Kamstrup A/S are used, you must make sure that the threaded lengths of the couplings do not prevent proper tightening of the sealing surface.

The calculator is configured for mounting of flow sensor in inlet or outlet before commissioning, see paragraph 6.4 about the "SETUP loop". The flow direction is indicated by an arrow on the flow sensor.

To avoid cavitation, the back pressure at ULTRAFLOW® (the pressure at the flow sensor outlet) must typically be minimum 1 bar at qp and minimum 2 bar at qs. This applies to temperatures up to approx. 80 $^{\circ}$C.

When the installation has been completed, water flow can be turned on. The valve on the flow sensor's inlet side must be opened first.

ULTRAFLOW® must not be exposed to lower pressure than the ambient pressure (i. e. a vacuum).

**Permissible operating conditions**

| | |
|---|---|
| Ambient temperature: | 5...55°C (indoors). Max 30 °C for optimum battery lifetime on backup. |
| Medium temperature of heat meter: | 2...130 °C with calculator mounted on a wall |
| | 15...90 °C with calculator mounted on ULTRAFLOW® |
| Medium temperature of cooling meter: | 2...130 °C with calculator mounted on a wall |
| Medium temperature of heat/cooling meter: | 2...130 °C with calculator mounted on a wall |
| | |
| Installation pressure ULTRAFLOW®: | 1,0...16 bar for threaded meters |
| | 1,5...25 bar for flange meters |

**Electrical installations**

MULTICAL® 803 is available with either 24 VAC/VDC  or 230 VAC supply. Mains connection of MULTICAL® 803 is made with a two-wire cable without protective earth.
**Use a strong connection cable with an outer diameter of max 5-8 mm and ensure correct cable stripping and cable relief in the meter. It must be ensured that the whole installation complies with current regulations, the cabling to the meter and/or safety transformer must never be protected by a fuse larger than the one permitted. In case of doubt, it is recommended to seek advice from an authorised electrician, see more about supply opportunities in paragraph 10..**

**Service**

Neither welding nor freezing is allowed whilst ULTRAFLOW® is mounted. Before initiating the work, ULTRAFLOW® must be dismounted and the mains supply must be disconnected.

To facilitate the replacement of the meter, stop valves should always be mounted on both sides of the flow sensor.

Under normal operating conditions, no pipe strainer is required in front of the meter.

## 4.2 Mounting of MULTICAL® 803 calculator

### 4.2.1 Mounting of calculator top

Be careful not to overtighten the two screws in the calculator top. The screws should not be tightened with a tightening torque larger than 1,5 Nm.

Torque ≈ 1,5 Nm
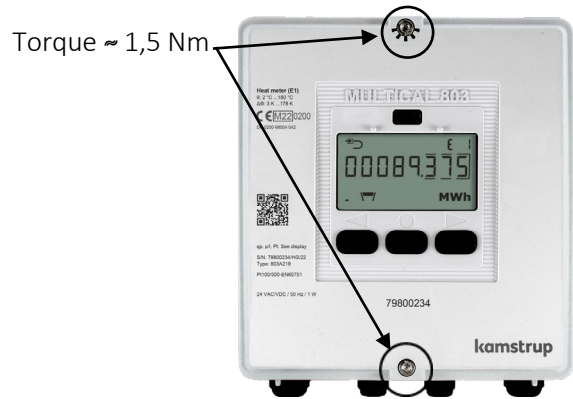
### 4.2.2 Wall-mounting

It is recommended to mount the calculator directly on an even wall. Wall-mounting requires the use of three screws with corresponding rawlplugs. It is recommended to use 6 mm rawlplugs and 4...4,5 mm screws. MULTICAL® 803 is mounted on the wall by first mounting the upper screw in the wall and screwing this almost all the way in. Then, the calculator is hung on this screw. With the calculator mounted on the upper screw, the positions of the lower two screw eyes are marked on the wall after which screws for these can be mounted.
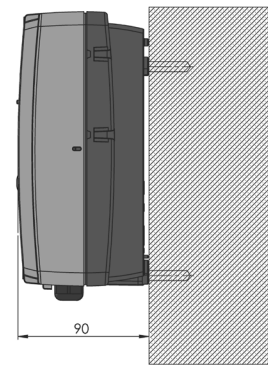
### 4.2.3 Compact mounting

In some cases, compact mounting of the MULTICAL® 803 calculator may be an advantage. The MULTICAL® 803 calculator is large and only suitable for compact mounting in places where the installation can be secured against mechanical influences such as draught and impacts. By compact mounting, the calculator is mounted directly on ULTRAFLOW® using mounting bracket 3026-857. If there is risk of condensation (e.g. in cooling applications), the calculator ought to always be wall-mounted. Furthermore, ULTRAFLOW® in cooling applications must be the condensation-proof version.
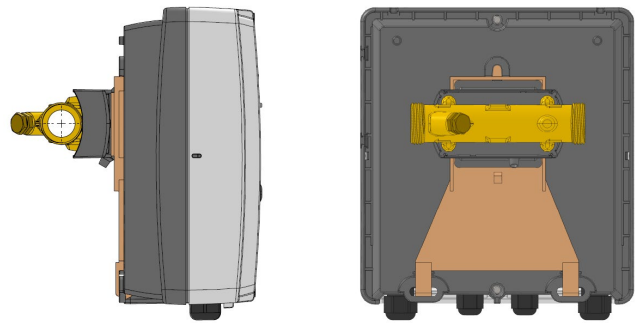
## 4.3 Mounting in inlet or outlet pipe

MULTICAL® 803 is configured for flow sensor mounted in either inlet or outlet pipe during installation. In the display, the flow sensor position is indicated by a symbol; subsequently, the A code of the configuration number is selected as 3 or 4 for flow sensor mounting in inlet and outlet, respectively. The table below indicates installation conditions of heat meters and cooling meters: See more about the inlet and outlet positions and the importance to the energy calculation in paragraph 7.

| Formula | k-factor | A code and display | Hot pipe | Cold pipe | Installation |
|---|---|---|---|---|---|
| Heat meter $E1=V1(t1-t2)k$ | k-factor for t1 and V1 in inlet | A code = 3 Display | V1 and t1 | t2 | See application no. 1 in paragraph 7.1 |
| | k-factor for t2 and V1 in outlet | A code = 4 Display | t1 | V1 and t2 | See alternative position of the flow sensor in application no. 1 in paragraph 7.1 |
| Cooling meter $E3=V1(t2-t1)k$ | k-factor for t1 and V1 in inlet | A code = 3 Display | t2 | V1 and t1 | See application no. 1 in paragraph 7.1 |
| | k-factor for t2 and V1 in outlet | A code = 4 Display | V1 and t2 | t1 | See alternative position of the flow sensor in application no. 1 in paragraph 7.1 |

## 4.4 Connection of temperature sensors and flow sensors

MULTICAL® 803 always has the same number of connection terminals on the connection board. The connection terminals are placed in a row at the bottom of the calculator base and all connection terminals are numbered. When ordering MULTICAL® 803 prepared for flow sensors with 24 V active/passive pulses (type P), an additional connection board will, in addition to the connection terminals on the connection board, be mounted across the connection terminals of the flow sensor connection for galvanic separation between 24 V pulses and calculator. It is always possible to rebuild and reconfigure MULTICAL® 803 to flow sensors with 24 V active/passive pulses (type P) using this extra connection board (6699-045) and METERTOOL HCW. An overview of the possible connections are shown in the figure below. This figure is also available on the grey verification cover in the calculator top of MULTICAL® 803.
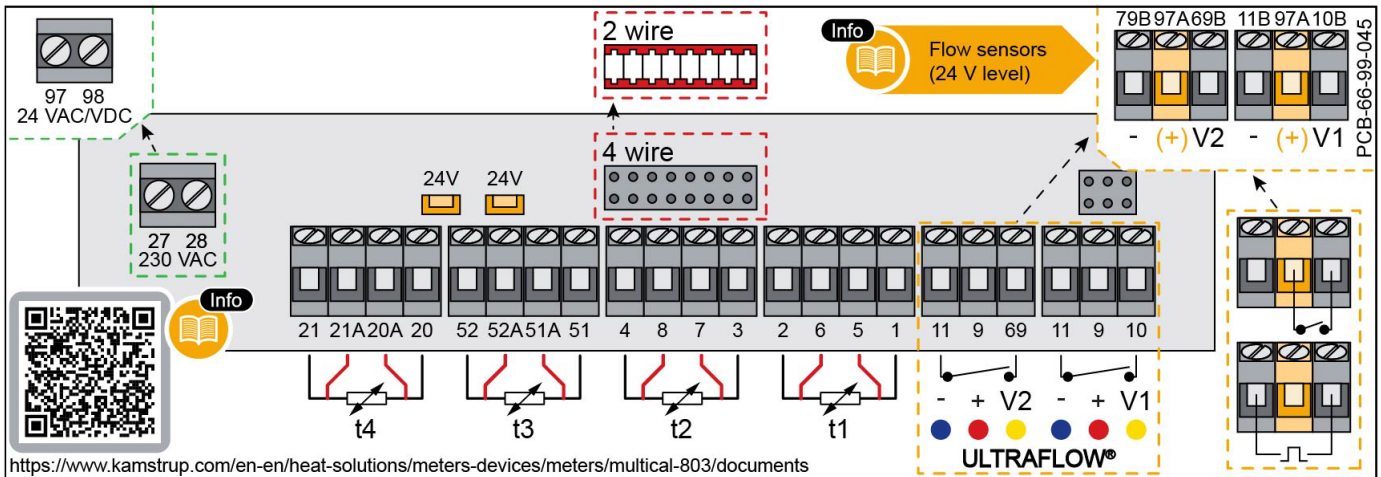
*Figure 3: For the use of 2-wire sensor pair, install supplied short-circuit jumper marked in red. For the use of internal 24 VDC supply marked in orange, MULTICAL® 803 must be delivered with supply type C or d. Additional connection boards for flow sensors with 24 V active/passive pulses (type P) are shown in the upper right corner (66-99-045).*

## 4.5   Commissioning

Carry out an operational check when the energy meter has been fully mounted. Open thermoregulators and valves to enable water flow through the heating system. Use the front keys on MULTICAL® 803 to change the display view and check that credible display values for temperatures and water flow are shown. Read more about the MULTICAL® 803 display content in paragraph 3.4.4.

### Using meters with Auto Detect Pt and/or Auto Detect UF
Note that MULTICAL® 803 has a built-in engagement delay of up to 20 seconds to ensure that all plug connections between calculator top and base are established before a detection of Pt-sensors and/or ULTRAFLOW® X4 is initiated.

## 4.6   EMC conditions

MULTICAL® 803 has been designed and CE-marked according to EN 1434 Class A and C (corresponding to electromagnetic environment: Class E1 and E2 of the Measuring Instruments Directive) and can thus be installed in both domestic, light industry and industrial environments.

All control cables must be drawn separately and not parallel to e.g. power cables or other cables with the risk of inducing electromagnetic interference. There must be a distance of min. 25 cm between signal cables and other installations.

## 4.7   Climatic conditions

MULTICAL® 803 is designed for indoor installation with ambient temperatures from 5…55 °C, but max 30 °C in order to obtain optimal battery lifetime. Protection class IP65 of the calculator allows splashes of water, but not flooding.

## 4.8   Sealing

According to EN 1434, MULTICAL® 803 <u>must</u> have protection devices, which can be sealed to the effect that after sealing, both before and after the heat calculator has been correctly installed, it is impossible to dismount, remove or change the calculator or its adjustment devices without visibly damaging the calculator or sealing. Correct sealing of MULTICAL® 803 includes two levels, installation sealing and verification sealing. A breach of sealing has different consequences on each level.

### Installation sealing

Having completed the installation of MULTICAL® 803, installation sealing is the last thing to be done. The installation seal is the 'outermost' sealing level to be completed by the installer/utility. The installation sealing must make sure that calculator top and base cannot be separated and that flow sensor and temperature sensors cannot be dismounted without visible signs that a separation has taken place. In practice, the installation sealing can be done by means of wire and seal, sealing label or a combination. The sealing is the utility's security that unauthorized persons cannot undiscovered change the installation around the calculator. A breach of the installation sealing alone does not influence the calculator's possibility for renewed installation sealing or the fact that it is legal in relation to its approval and verification.

### Installation sealing and "SETUP loop"

In order to bring MULTICAL® 803 back to "SETUP loop" after installation, the calculator top and base must be separated after which "SETUP loop" can be accessed either via front keys or via METERTOOL HCW. Separation of calculator top and base implies that the calculator's installation seal is broken.

### Verification seal
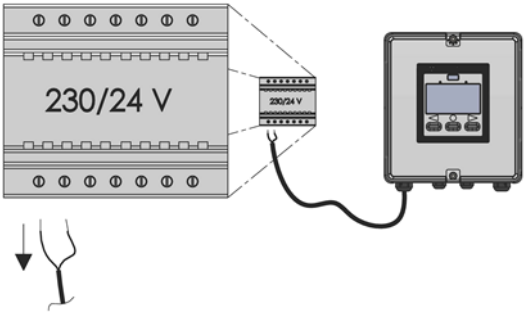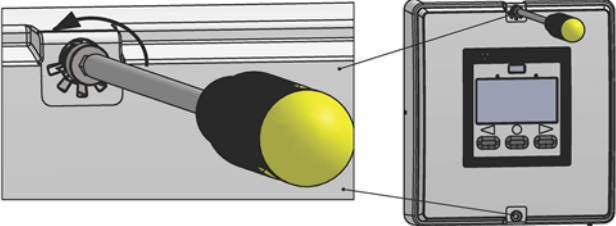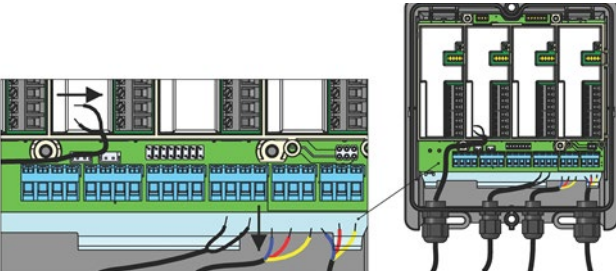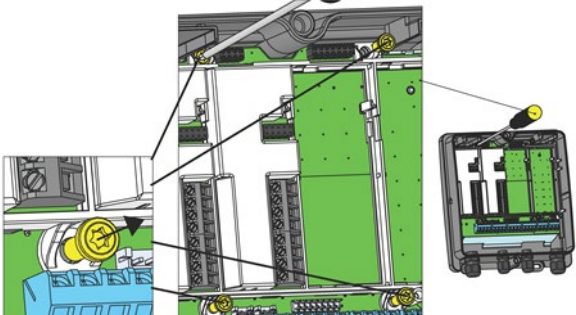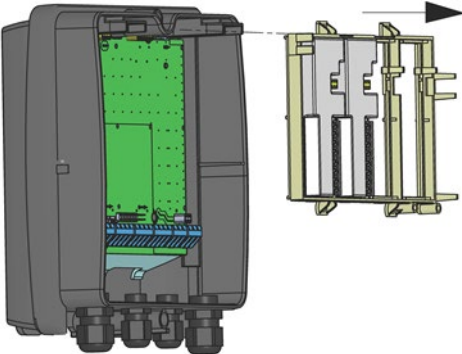
The MULTICAL® 803 verification seals consist of both mechanical and electronic sealing. Verification seals, marked with "TEST" and three seal marks (void labels) marked with "Red Kamstrup", are placed on the grey verification cover in the calculator top. These seals can be seen as the 'innermost' sealing level, which may only be broken by authorized laboratories in connection with test and reverification of the calculator. If the calculator is to be used for legal operation in relation to approval and verification after breach of the verification sealing, the broken seals must be resealed. The sealing must be carried out by an authorized laboratory using the sealing mark (void label) of the laboratory.
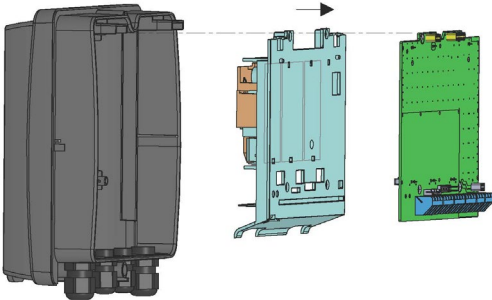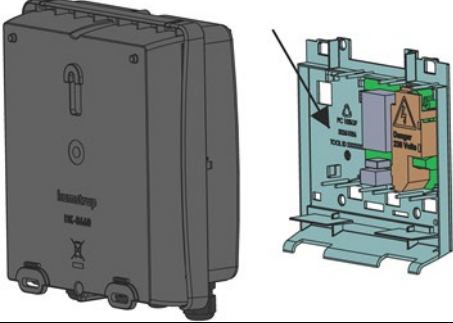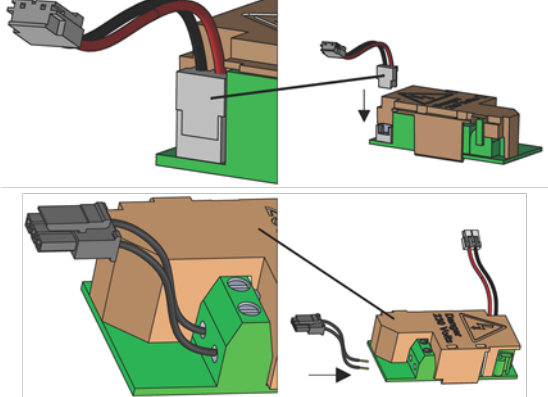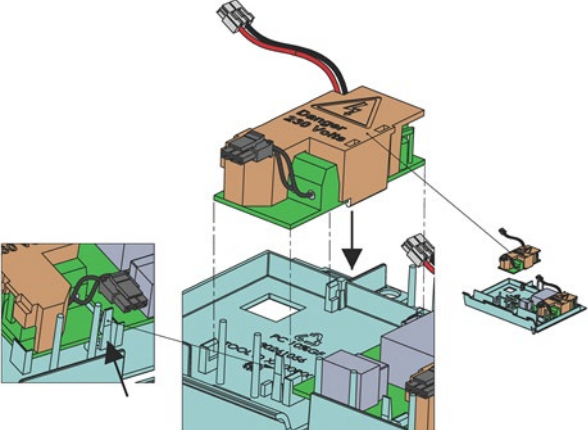
## 4.9   Replacement and installation of supply modules
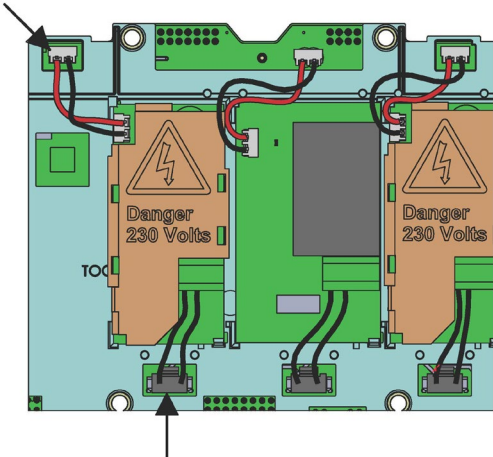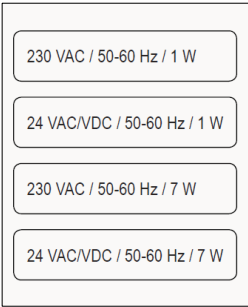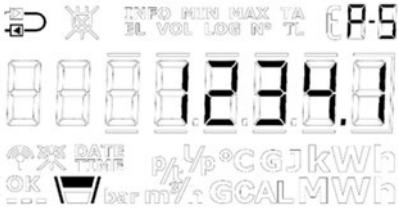
Supply modules should only be replaced by qualified persons. For the replacement and installation, exclusively original spare parts must be used. Prior to any replacement of supply modules, MULTICAL® 803 must be placed in a <u>deenergized</u> state.

It is possible to replace or add supply modules to MULTICAL® 803 after delivery. The connection board is dedicated to either 24 VAC/VDC or 230 VAC. Therefore, it is only possible to replace or add supply modules to the same voltage range as the supply module(s), which MULTICAL® 803 is delivered with, unless the connection board is also replaced, see the list of accessories in paragraph 3.3. Furthermore, it is essential to change the marking on the calculator front so that it always matches the installed supply. Supply modules for MULTICAL® 803 come with labels to be used on the calculator front. If just one supply module is used in the calculator, the label is attached with the correct voltage and 1 W. If two or three supply modules are installed, the label with the correct voltage and 7 W is attached. The label is attached so that it covers the original marking. The label sheet can also be ordered separately, see the list of accessories in paragraph 3.3.

The supply modules are placed at the bottom of the calculator base on a bracket underneath the connection board and the bracket for communication modules. A step-by-step guide for replacing/adding supply modules to MULTICAL® 803 can be found on the next page.

| Step | Action | Illustration | Notes |
|------|--------|--------------|-------|
| ① | Disconnect the voltage supply if this has not already been done. |  | The backup battery can remain mounted in the calculator top during the work with the supply modules. |
| ② | Remove the calculator top by loosening the two screws on the calculator front. |  | Use either HEX4 or TX25 screwdriver. |
| ③ | Remove all cable connections from the connection terminals on the connection board as well as on the communication modules. |  | Use a 0.6 x 3.5 mm screwdriver with straight slot. |
| ④ | Disassemble the four screws that fix the module bracket and connection board to the calculator base. |  | Use screwdriver with TX20 slot. |
| ⑤ | Lift the bracket for the communication modules up from the calculator base. |  | It is not necessary to remove the communication module to remove the bracket.\
\
Put the bracket aside so that it is not damaged. |

| Step | Action | Illustration | Notes |
|---|---|---|---|
| ⑥ | Lift the connection board and the bracket for supply modules up from the calculator base. | | |
| ⑦ | Turn the connection board bracket 180° to gain access to the supply modules. | | |
| ⑧ | Prepare the supply module for mounting by installing the correct cables on both the inlet and outlet sides. | | Cables and supply modules are available as accessories for MULTICAL® 803. The order numbers appears from the accessories list in paragraph 3.3. |
| ⑨ | Snap the supply module to the bracket. | | 3.6 VDC supply modules are snapped to the outer slots[1] while 24 VDC supply modules are snapped in the middle[2]. The physical size of the supply modules ensures that they cannot be placed incorrectly. |

| Step | Action | Illustration | Notes |
|------|--------|--------------|-------|
| ⑩ | Mount the cable connectors to the supply module in the connectors at the supply module's slot. |  | **Important:** There must under no circumstances be used cables with lengths that make it possible to mount the connectors incorrectly. This will result in damage to MULTICAL® 803. |
| ⑪ | Reinstall the connection board and both module brackets by following the steps ⑦ to ①. The steps are executed in reverse order of disassembling. | | Be alert not to over-tighten the screws at reassembly. |
| ⑫ | Attach the correct new supply label to the calculator front, the supply label is provided with the supply modules. | 230 VAC / 50-60 Hz / 1 W<br><br>24 VAC/VDC / 50-60 Hz / 1 W<br><br>230 VAC / 50-60 Hz / 7 W<br><br>24 VAC/VDC / 50-60 Hz / 7 W | Correct label depends on the number of installed supply modules. The top two labels fit one mounted power module, the two lower labels fit two or three installed supply modules. |
| ⑫ | After connecting the voltage supply, check the voltage supply in the MULTICAL® 803 display.<br><br>See paragraph 10. |  | **Note:** It may take up to 20 seconds before the display with supply is updated. |

[1] One 3,6 VDC power supply, supplies calculator and module M1 and module M2 (*Figure 4.1* in paragraph 1.1 "Mechanical construction"). One additional 3.6 VDC power supply, supplies module M3 and module M4 (*Figure 4.2* in paragraph 1.1 "Mechanical construction").

[2] One 24 VDC power supply, provides galvanically separated 24 VDC voltage supply for, for example, analog signal outputs and flow sensors with passive output (*Figure 4.3* in paragraph 1.1 "Mechanical construction").

# 5 Dimensioned sketches

All measurements are stated in [mm]. The weight of a MULTICAL® 803 calculator depends on the configuration, see examples below. The weight includes backup battery.

| | |
|---|---|
| MULTICAL® 803 including two communication modules, one supply module and one accessory bag | 1190 gram |
| MULTICAL® 803 including four communication modules, three supply modules and two accessory bags. | 1360 gram |
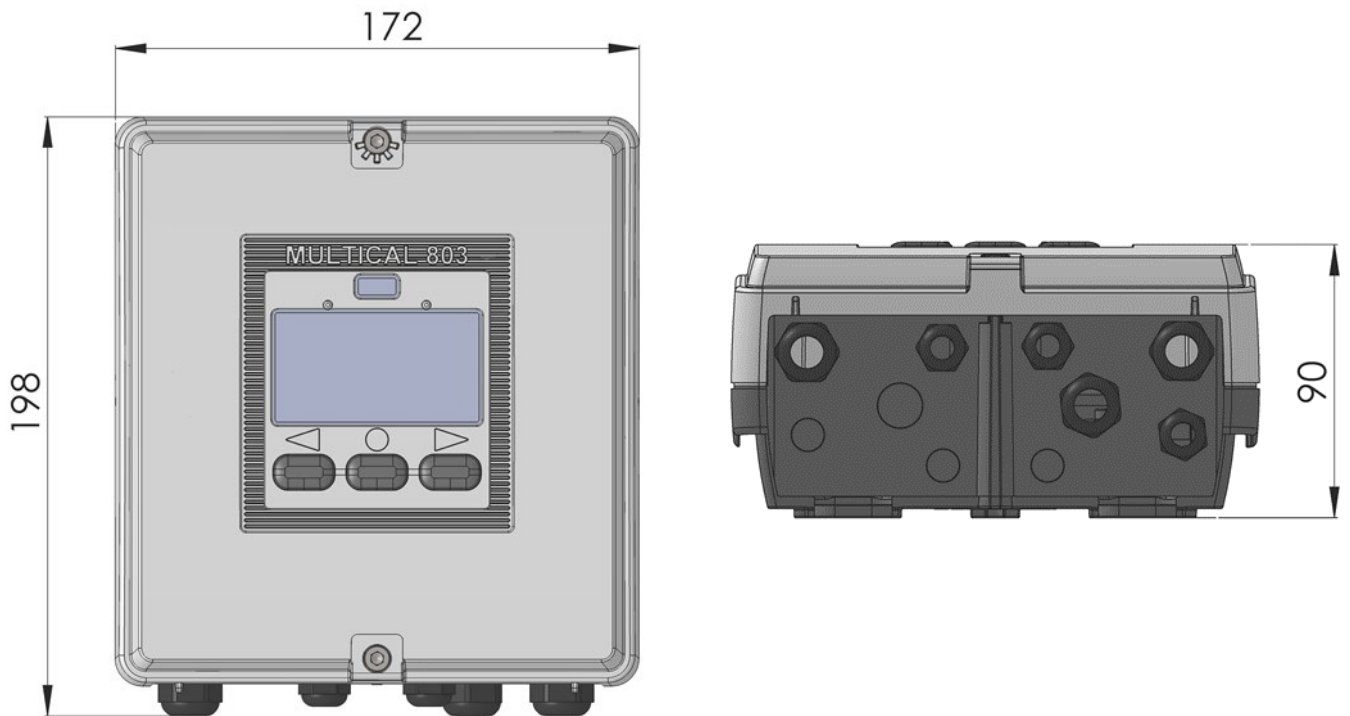
*Figure 4: Mechanical measurements of MULTICAL® 803 calculator*
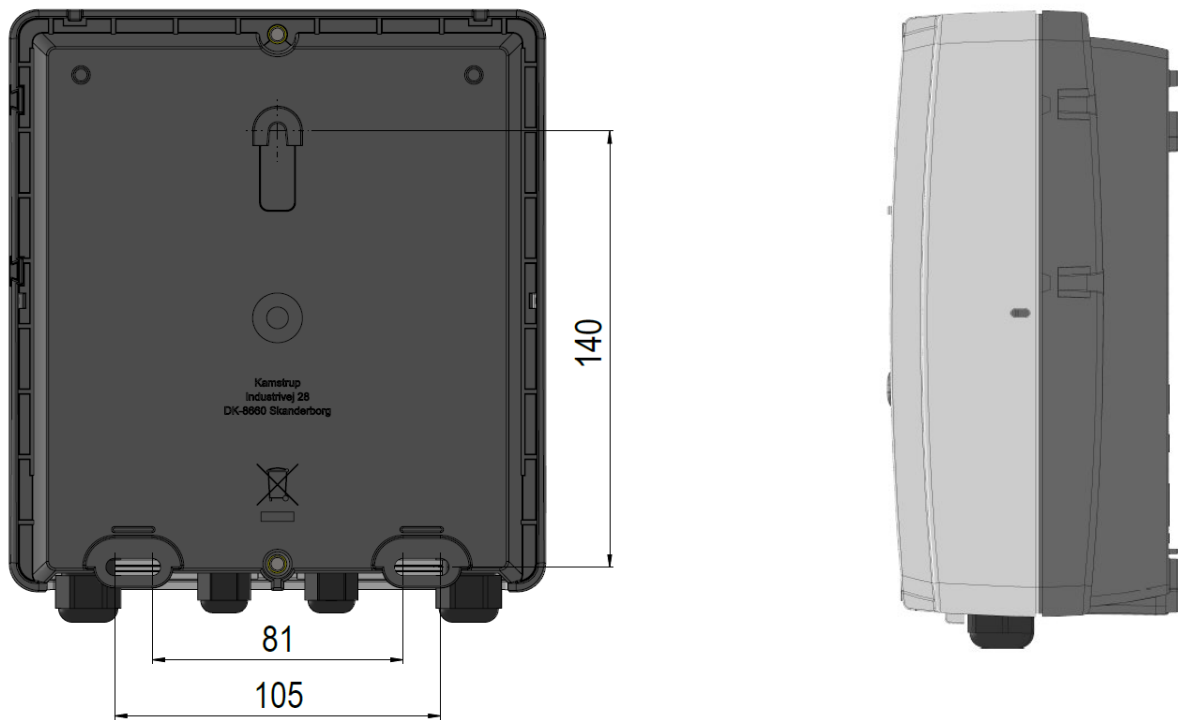
# MULTICAL® 803



*Figure 5: Calculator base*
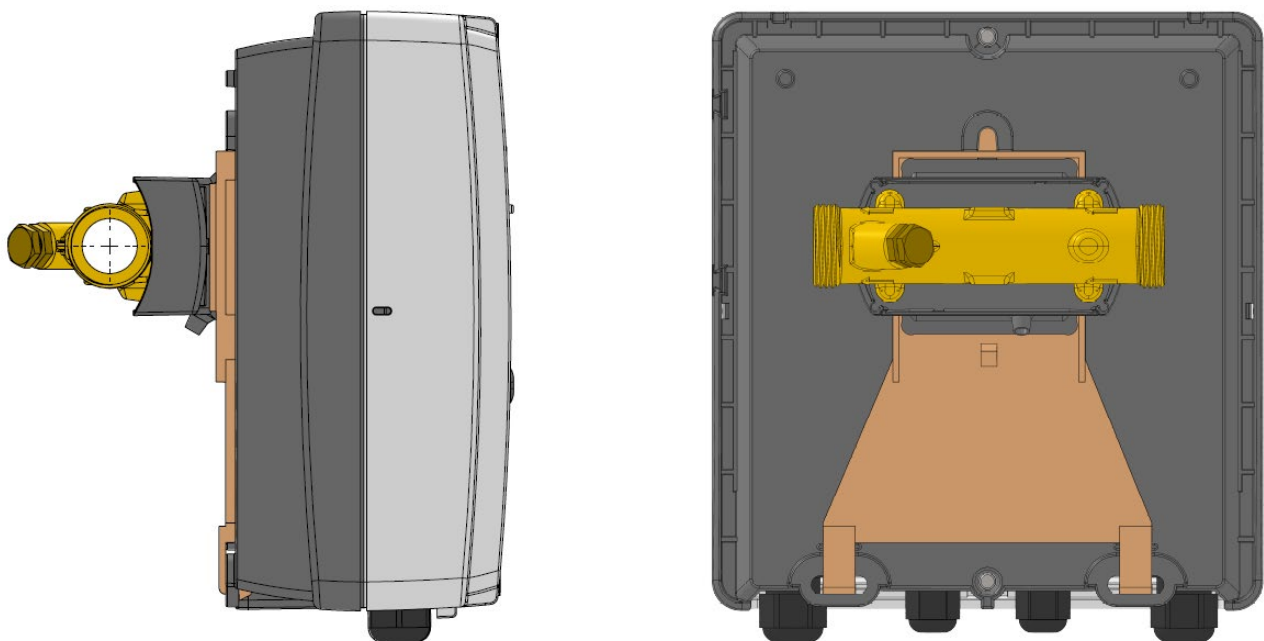


*Figure 6: MULTICAL® 803 mounted on ULTRAFLOW® with G¾ x 110 mm threaded connection with bracket 3026-857*

# 6 Display

MULTICAL® 803 has a bright and clear display including 7 or 8 digits depending on the configuration as well as a number of symbols for measuring units, info, inlet and outlet, radio on/off, etc. The display changes view or turns on by pressing one of the buttons on the calculator front. MULTICAL® 803 also has illumination in the display that can be configured to be permanently on or to automatically turn off 15 seconds after the last keystroke, depending on the selected integration mode (L code). Read more about the calculator's integration modes in paragraph 3.4.8.
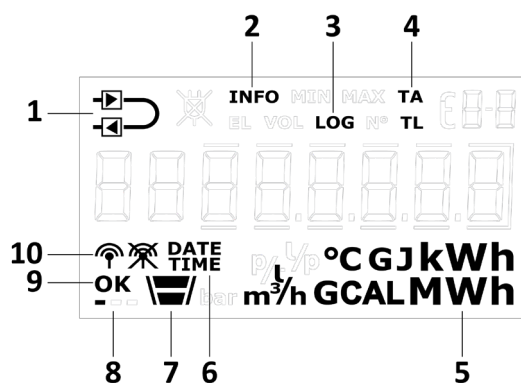


| 1 | The meter is configured as inlet or outlet meter | | 6 | Date and time |
|---|---|---|---|---|
| 2 | Flashes at active info code | | 7 | Level indicator for menu loops |
| 3 | Active at historic views | | 8 | Heart beat indication shows that both calculator and display are active |
| 4 | Tariff registers/tariff limits | | 9 | "OK" is displayed when a changed value has been saved |
| 5 | Measuring unit | | 10 | The calculator's radio communication is switched on or off |

The calculator uses four different display loops. The four loops are intended for four different usage situations.

- **"USER loop"**
  The calculator's configurable display loop which is intended for the user. The readings in this loop can be adjusted to the utility company's requirements via the DDD code. See paragraph 3.4.4 for an overview of possible readings in the calculator's "USER loop". The same paragraph includes examples of DDD codes.

- **"TECH loop"**
  This loop is intended for technicians and is <u>not</u> configurable. The "TECH loop" contains all display readings, except for logged values and the differential registers (ΔE and ΔV). The loop comprises readings such as serial number, date, time, configuration number, software revision and segment test. See paragraph 6.2 for a complete overview of the readings.

- **"SETUP loop"**
  The "SETUP loop" is intended for the technician too. In this loop, the technician can configure the calculator via the front keys. In general (unless otherwise informed by the customer), the loop is open in transport state. First time the calculator detects a flow of 1 % of qp or greater, the access to the "SETUP loop" is blocked. From now on, it is no longer possible to access the "SETUP loop" unless you break the installation seal. See paragraph 6.4 for further details about the various parameters that can be configured in the "SETUP loop" and see paragraph 7.9 for details about the calculator's transport state.

- **"TEST loop"**
  This loop is used by authorized laboratories for reverification of the calculator. This loop is not available unless the calculator's test seal (verification seal) is broken.

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By means of the calculator's primary keys, you can choose from and switch between the four display loops. When delivered, the calculator is in transport state, which means that the "USER-", "TECH-" and "SETUP loop"s are available. Depending on country code, the access to the "SETUP loop" can be blocked in transport state and is thus not available on delivery. The ""TEST loop"" can only be accessed if the test seal (verification seal) is broken.

By keeping the primary key activated for 5 seconds, the Select loop appears. Here, it is possible to use the arrow keys to switch between the calculator's display loops. In the "TECH", "SETUP" and "s, use index numbers as the views in these display loops are allocated to a specific index number. The index numbers facilitate navigation to the required reading. Index numbers are not used in the configurable "USER loop". The figure below illustrates how it is possible to navigate in the calculator's display by means of the front keys.
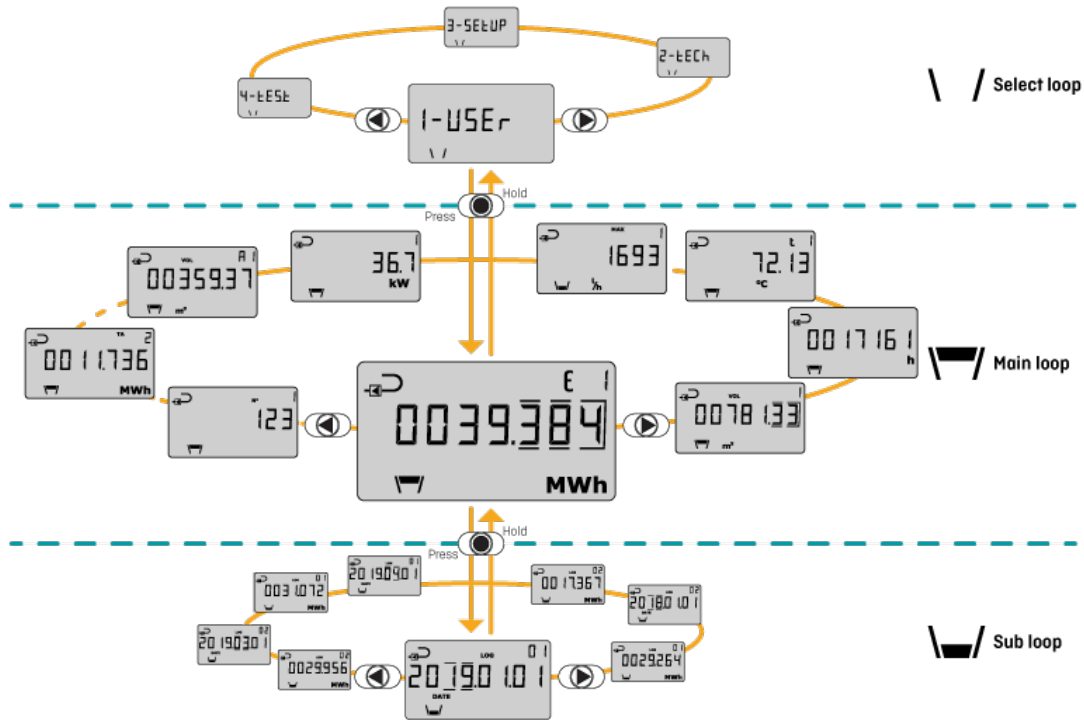


## Readings in case of error

In order to facilitate the diagnostics work, lines are shown in the display readings (current values) which are influenced by the error and at the same time, counting stops in the registers, which are dependent on the given parameter and thus influenced by the error. In case of an interrupted or short-circuited temperature sensor, the corresponding display reading shows lines and energy calculations, which are dependent on the faulty measurement, will stop. MULTICAL® 803 registers these errors and sets an info code, which can easily be read from the display. Read more about the info codes in paragraph 7.8.
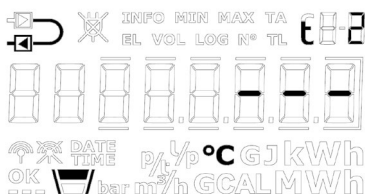


*Display of t2 in case of temperature sensor error*
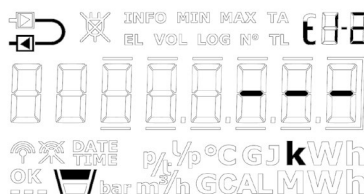


*Display of differential temperature t1-t2 in case of temperature sensor error*
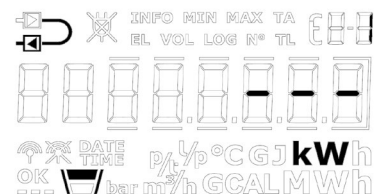


*Error in the display of power as a result of a temperature sensor error*

|  | t1 error | t2 error | t3 error | t4 error | V1 Flow error | V2 Flow error |
|---|---|---|---|---|---|---|
| t1 inlet | Display - - - |  |  |  |  |  |
| t2 outlet |  | Display - - - |  |  |  |  |
| Δt (t1-t2) | Display - - - | Display - - - |  |  |  |  |
| t3 |  |  | Display - - - |  |  |  |
| t4 |  |  |  | Display - - - |  |  |
| Flow, V1 |  |  |  |  |  |  |
| Power, V1 | Display - - - | Display - - - |  |  |  |  |
| E1 | No counting | No counting |  |  |  |  |
| E2 | No counting | No counting |  |  |  |  |
| E3 | No counting | No counting |  |  |  |  |
| E4 | No counting |  | No counting |  |  |  |
| E5 |  | No counting | No counting |  |  |  |
| E6 |  |  | No counting | No counting |  |  |
| E7 | No counting |  | No counting |  |  |  |
| E8 | No counting |  |  |  |  |  |
| E9 |  | No counting |  |  |  |  |
| E10 |  |  | No counting |  |  |  |
| E11 |  |  | No counting |  |  |  |
| E12 | No counting | No counting |  |  |  |  |
| E13 | No counting | No counting | No counting | No counting |  |  |
| E14 |  |  | No counting | No counting |  |  |
| E15 | No counting | No counting | No counting | No counting |  |  |
| E16 |  |  | No counting | No counting |  |  |
| V1 |  |  |  |  |  |  |
| V2 |  |  |  |  |  |  |
| A1 | No counting | No counting |  |  |  |  |
| A2 | No counting | No counting |  |  |  |  |

## Display reading in case of blocking of flow

After a blocking of the installation, the flow display in MULTICAL® 803 will drop to 0 l/h within a few seconds when a flow sensor with quick pulses such as ULTRAFLOW® is used.

When MULTICAL® 803 is connected to flow sensors with slow pulses, e.g. reed switch, the flow display first shows a decreasing flow several minutes after a blocking. MULTICAL® 803 automatically sets the flow display to 0 l/h after 60 minutes without pulses. For flow sensors with slow pulses, the flow display generally responds slower and is less suitable for displaying low flows than when using flow sensors with quick pulses.

# MULTICAL® 803

## Heart beat and status indications

MULTICAL® 803 uses the three small display segments in the lower left corner of the display to indicate different status scenarios. Each segment will, depending on whether it is static or flashes, provide information about given functionality in the calculator. A description can be found in the figure below:
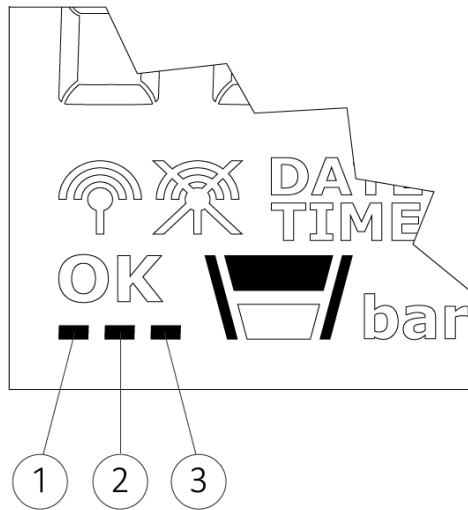


| ① Heart beat segment | **Flashes** - This segment always flashes to indicate that both calculator and display are active. |
|---|---|
| ② SETUP and config segment | **Permanently on** - The calculator's configuration log is full and it is therefore no longer possible to modify the configuration. <br> **Flashes** - It is possible to access the "SETUP loop". The segment flashes as long as the calculator is in transport mode or 4 minutes after the calculator top and base have been separated. <br> **Off** - It is not possible to access the "SETUP loop" or configure the calculator via METERTOOL HCW. |
| ③ Optical interface segment[1] | **Permanently on** - The calculator's optical interface is disabled and optical communication is therefore not possible. <br> **Flashes** - The optical interface is temporarily active, flashes 4 minutes after the calculator top and base have been separated. In this period, it is possible to activate the optical interface permanently. <br> **Off** - The optical interface is active and it is possible to communicate with the calculator. |

[1] The optical interface can be deactivated and activated via the optical read-out head and METERTOOL HCW. See the technical description of METERTOOL HCW (5512-2097).

## Positive/negative signs in heat/cooling applications

The accumulated energy registers, E1 and E3, are both always displayed as positive values. Differential temperature and power are either displayed as positive (heat) or negative (cooling) values when reading the values on MULTICAL® 302, 303, 403, 603 and 803

## 6.1 "USER loop"



"USER loop" is the calculator's primary loop, which includes legal and mostly used readings. The loop is intended for the user and is configured according to the user's requirements via the DDD code. See paragraph 3.3.4 for further information about the "USER loop" and DDD codes.

**Note:** No display index numbers are used in the "USER loop".

## 6.2 "TECH loop"



The "TECH loop" is intended for the technician who is interested in viewing more readings than the ones available in the "USER loop".

The "TECH loop" contains all display readings, except for logged values and the differential registers (ΔE and ΔV), and this loop is _not_ configurable. The module readings consist of a number of fixed readings as well as a number of readings that depend on the installed modules.

The calculator's "TECH loop" is shown below. You change back and forth between the readings by means of the arrow keys while pressing the primary key briefly causes the change between the primary and secondary readings.

| "TECH loop" | | | | | Display | |
|---|---|---|---|---|---|---|
| Primary display | | Secondary display | | | Index number in display | Logging depth/Ref. number |
| 1 | Heat energy E1 | | | | 2-001-00 | |
| | | 1.1 | Date of yearly logger | | 2-001-01 | Log 01-02 |
| | | 1.2 | Data of yearly logger [1] | | 2-001-02 | |
| | | 1.3 | Date of monthly logger | | 2-001-03 | Log 01-12 |
| | | 1.4 | Data of monthly logger [1] | | 2-001-04 | |
| | | 1.5 | E1 high res. | | 2-001-05 | |
| 2 | Cooling energy E3 | | | | 2-002-00 | |
| | | 2.1 | Date of yearly logger | | 2-002-01 | Log 01-02 |
| | | 2.2 | Data of yearly logger [1] | | 2-002-02 | |
| | | 2.3 | Date of monthly logger | | 2-002-03 | Log 01-12 |
| | | 2.4 | Data of monthly logger [1] | | 2-002-04 | |
| | | 2.5 | E3 High resolution | | 2-002-05 | |

| "TECH loop" | | | | Display | |
|---|---|---|---|---|---|
| Primary display | | Secondary display | | Index number in display | Logging depth/Ref. number |
| 3 | Energy E2 | | | 2-003-00 | |
| | | 3.1 | Energy E4 | 2-003-01 | |
| | | 3.2 | Energy E5 | 2-003-02 | |
| | | 3.3 | Energy E6 | 2-003-03 | |
| | | 3.4 | Energy E7 | 2-003-04 | |
| | | 3.5 | Energy E12 | 2-003-05 | |
| | | 3.6 | Energy E13 | 2-003-06 | |
| | | 3.7 | Energy E14 | 2-003-07 | |
| | | 3.8 | Energy E15 | 2-003-08 | |
| | | 3.9 | Energy E16 | 2-003-09 | |
| 4 | Volume V1 | | | 2-004-00 | |
| | | 4.1 | Mass M1 (V1[t1/t2]) | 2-004-01 | |
| | | 4.2 | Pressure 1 | 2-004-02 | |
| | | 4.3 | Date of yearly logger | 2-004-03 | Log 01-02 |
| | | 4.4 | Data of yearly logger [1] | 2-004-04 | |
| | | 4.5 | Date of monthly logger | 2-004-05 | Log 01-12 |
| | | 4.6 | Data of monthly logger [1] | 2-004-06 | |
| | | 4.7 | E1 high res. | 2-004-07 | |
| 5 | Volume V2 | | | 2-005-00 | |
| | | 5.1 | Mass M2 (V2[t2]) | 2-005-01 | |
| | | 5.2 | Pressure 2 | 2-005-02 | |
| | | 5.3 | Date of yearly logger | 2-005-03 | Log 01-02 |
| | | 5.4 | Data of yearly logger [1] | 2-005-04 | |
| | | 5.5 | Date of monthly logger | 2-005-05 | Log 01-12 |
| | | 5.6 | Data of monthly logger [1] | 2-005-06 | |
| | | 5.7 | Mass M3 (V2[t3]) | 2-005-07 | |
| | | 5.8 | Mass M4 (V2[t4]) | 2-005-08 | |
| 6 | Hour counter | | | 2-006-00 | |
| | | 6.1 | Error hour counter | 2-006-01 | N° 60 |
| 7 | t1 (inlet) | | | 2-007-00 | |
| | | 7.1 | Year-to-date average [2] | 2-007-01 | |
| | | 7.2 | Month-to-date average [2] | 2-007-02 | |

| "TECH loop" | | | | Display | |
|---|---|---|---|---|---|
| | Primary display ⏤ | | Secondary display ⏤ | Index number in display | Logging depth/Ref. number |
| 8 | t2 (outlet) | | | 2-008-00 | |
| | | 8.1 | Year-to-date average [2] | 2-008-01 | |
| | | 8.2 | Month-to-date average [2] | 2-008-02 | |
| 9 | Δt (t1-t2) cooling indicated by - | | | 2-009-00 | |
| | | 9.1 | E8 (V1·t1) | 2-009-01 | |
| | | 9.2 | E9 (V1·t2) | 2-009-02 | |
| 10 | t3 | | | 2-010-00 | |
| | | 10.1 | E10 (V1·t3) | 2-010-01 | |
| | | 10.2 | E11 (V2·t3) | 2-010-02 | |
| 11 | t4 | | | 2-011-00 | |
| 12 | Flow V1 | | | 2-012-00 | |
| | | 12.1 | Date of max this year [3] | 2-012-01 | |
| | | 12.2 | Data of max this year [1] | 2-012-02 | |
| | | 12.3 | Date of max this month [3] | 2-012-03 | |
| | | 12.4 | Data of max this month [1] | 2-012-04 | |
| | | 12.5 | Date of min. this year [3] | 2-012-05 | |
| | | 12.6 | Data of min. this year [1] | 2-012-06 | |
| | | 12.7 | Date of min. this month [3] | 2-012-07 | |
| | | 12.8 | Data of min. this month [1] | 2-012-08 | |
| 13 | Flow V2 | | | 2-013-00 | |
| | | 13.1 | Thermal power, V2 (t3-t4) | 2-013-01 | |
| 14 | Thermal output, V1, cooling indicated by - | | | 2-014-00 | |
| | | 14.1 | Date of max this year [3] | 2-014-01 | |
| | | 14.2 | Data of max this year [1] | 2-014-02 | |
| | | 14.3 | Date of max this month [3] | 2-014-03 | |
| | | 14.4 | Data of max this month [1] | 2-014-04 | |
| | | 14.5 | Date of min. this year [3] | 2-014-05 | |
| | | 14.6 | Data of min. this year [1] | 2-014-06 | |
| | | 14.7 | Date of min. this month [3] | 2-014-07 | |
| | | 14.8 | Data of min. this month [1] | 2-014-08 | |

| "TECH loop" | | | | Display | |
|---|---|---|---|---|---|
| | Primary display  | | Secondary display  | Index number in display | Logging depth/Ref. number |
| 15 | Input A1 [4] | | | 2-015-00 | |
| | | 15.1 | Meter no. of input A1 | 2-015-01 | |
| | | 15.2 | L/imp. of input A1 | 2-015-02 | N° 65 |
| | | 15.3 | Date of yearly logger | 2-015-03 | Log 01-02 |
| | | 15.4 | Data of yearly logger [1] | 2-015-04 | |
| | | 15.5 | Date of monthly logger | 2-015-05 | Log 01-12 |
| | | 15.6 | Data of monthly logger [1] | 2-015-06 | |
| 16 | Input B1 [4] | | | 2-016-00 | |
| | | 16.1 | Meter no. of input B1 | 2-016-01 | |
| | | 16.2 | L/imp. of input B1 | 2-016-02 | N° 67 |
| | | 16.3 | Date of yearly logger | 2-016-03 | Log 01-02 |
| | | 16.4 | Data of yearly logger [1] | 2-016-04 | |
| | | 16.5 | Date of monthly logger | 2-016-05 | Log 01-12 |
| | | 16.6 | Data of monthly logger [1] | 2-016-06 | |
| 17 | Input A2 [4] | | | 2-017-00 | |
| | | 17.1 | Meter no. of input A2 | 2-017-01 | |
| | | 17.2 | L/imp. of input A2 | 2-017-02 | N° 65 |
| | | 17.3 | Date of yearly logger | 2-017-03 | Log 01-02 |
| | | 17.4 | Data of yearly logger [1] | 2-017-04 | |
| | | 17.5 | Date of monthly logger | 2-017-05 | Log 01-12 |
| | | 17.6 | Data of monthly logger [1] | 2-017-06 | |
| 18 | Input B2 [4] | | | 2-018-00 | |
| | | 18.1 | Meter no. of input B2 | 2-018-01 | |
| | | 18.2 | L/imp. of input B2 | 2-018-02 | N° 67 |
| | | 18.3 | Date of yearly logger | 2-018-03 | Log 01-02 |
| | | 18.4 | Data of yearly logger [1] | 2-018-04 | |
| | | 18.5 | Date of monthly logger | 2-018-05 | Log 01-12 |
| | | 18.6 | Data of monthly logger [1] | 2-018-06 | |
| 19 | TA2 | | | 2-019-00 | |
| | | 19.1 | TL2 | 2-019-01 | |
| 20 | TA3 | | | 2-020-00 | |
| | | 20.1 | TL3 | 2-020-01 | |

| "TECH loop" | | | | Display | |
|---|---|---|---|---|---|
| | Primary display  | | Secondary display  | Index number in display | Logging depth/Ref. number |
| 21 | TA4 | | | 2-021-00 | |
| | | 21.1 | TL4 | 2-021-01 | |
| 22 | A1 (A-) Heat discount | | | 2-022-00 | |
| | | 22.1 | A2 (A+) Heat addition | 2-022-01 | |
| | | 22.2 | t5 | 2-022-02 | |
| 23 | CP | | | 2-023-00 | |
| | | 23.1 | Actual power of input B1 [5] | 2-023-01 | |
| | | 23.2 | Averaging period of CP | 2-023-02 | |
| | | 23.3 | Date of yearly logger | 2-023-03 | Log 01-02 |
| | | 23.4 | Data of yearly logger [1] | 2-023-04 | |
| | | 23.5 | Date of monthly logger | 2-023-05 | Log 01-12 |
| | | 23.6 | Data of monthly logger [1] | 2-023-06 | |
| 24 | Info code | | | 2-024-00 | |
| | | 24.1 | Info event counter | 2-024-01 | |
| | | 24.2 | Date for info logger | 2-024-02 | Log 01-50 |
| | | 24.3 | Data for info logger | 2-024-03 | |
| 25 | Customer number (first part) | | | 2-025-00 | N° 1 |
| | | 25.1 | Customer number (last part) | 2-025-01 | N° 2 |
| | | 25.2 | Date | 2-025-02 | |
| | | 25.3 | Time | 2-025-03 | |
| | | 25.4 | Yearly target date 1 | 2-025-04 | |
| | | 25.5 | Monthly target date 1 | 2-025-05 | |
| | | 25.6 | Yearly target date 2 | 2-025-06 | |
| | | 25.7 | Monthly target date 2 | 2-025-07 | |
| | | 25.8 | Serial number | 2-025-08 | N° 3 |
| | | 25.9 | Type number (dynamic) | 2-025-09 | N° 21 |
| | | 25.10 | Installed modules [9] | 2-025-10 | N° 23 |
| | | 25.11 | Config 1 (ABCCCDDD) | 2-025-11 | N° 5 |
| | | 25.12 | Config 2 (EEFFGGLM) | 2-025-12 | N° 6 |
| | | 25.13 | Config 3 (NPPRRT) | 2-025-13 | N° 7 |
| | | 25.14 | Config 4 (VVVV) | 2-025-14 | N° 8 |
| | | 25.15 | Software revision | 2-025-15 | N° 10 |
| | | 25.16 | Software checksum | 2-025-16 | N° 11 |
| | | 25.17 | MID-004 certificate revision | 2-025-17 | N° 12 |

| "TECH loop" | | | | Display | |
|---|---|---|---|---|---|
| Primary display | | Secondary display | | Index number in display | Logging depth/Ref. number |
| | | 25.18 | BEK-1178 certificate revision | 2-025-18 | Nº 13 |
| | | 25.19 | National certificate revision | 2-025-19 | Nº 14 |
| | | 25.20 | Average time of min./max P and Q | 2-025-20 | |
| | | 25.21 | Averaging time of min./max temperature | 2-025-21 | |
| | | 25.22 | $\theta_{hc}$ | 2-025-22 | |
| | | 25.23 | T offset | 2-025-23 | |
| | | 25.24 | Meter factor (Imp./l or l/imp.) | 2-025-24 | |
| | | 25.25 | Nominal flow rate (qp) | 2-025-25 | |
| | | 25.26 | Pt sensor type | 2-025-26 | |
| | | 25.27 | Meter supply | 2-025-27 | |
| | | 25.28 | Temperature cutoff ($\Delta\Theta$) | 2-025-28 [10] | |
| | | 25.29 | Segment test | 2-025-29 [11] | |
| 101 | Info Module 1 Config no. [6] | | | 2-101-00 | Nº 31 |
| | | 101.x | Firmware revision [7] | 2-101-xx | Nº 32 |
| | | 101.x | Module serial number [7] | 2-101-xx | Nº 33 |
| | | 101.x | Primary address [7] | 2-101-xx | Nº 34 [8] |
| | | 101.x | M-Bus secondary addressing [7] | 2-101-xx | Nº 35 [8] |
| | | 101.x | M-Bus enhanced secondary addressing [7] | 2-101-xx | Nº 36 [8] |
| | | 101.x | KM-RF frequency [7] | 2-101-xx | Nº 37 |
| | | 101.x | KM-RF network address [7] | 2-101-xx | Nº 38 |
| 201 | Info Module 2 Config no. [6] | | | 2-201-00 | Nº 31 |
| | | 201.x | Firmware revision [7] | 2-201-xx | Nº 32 |
| | | 201.x | Module serial number [7] | 2-201-xx | Nº 33 |
| | | 201.x | Primary address [7] | 2-201-xx | Nº 34 [8] |
| | | 201.x | M-Bus secondary addressing [7] | 2-201-xx | Nº 35 [8] |
| | | 201.x | M-Bus enhanced secondary addressing [7] | 2-201-xx | Nº 36 [8] |
| | | 201.x | KM-RF frequency [7] | 2-201-xx | Nº 37 |
| | | 201.x | KM-RF network address [7] | 2-201-xx | Nº 38 |

| "TECH loop" | | | | Display | |
|---|---|---|---|---|---|
| Primary display | | Secondary display | | Index number in display | Logging depth/Reference number |
| 301 | Info Module 3 Config no. [6] | | | 2-301-00 | Nº 31 |
| | | 301.x | Firmware revision [7] | 2-301-xx | Nº 32 |
| | | 301.x | Module serial number [7] | 2-301-xx | Nº 33 |
| | | 301.x | Primary address [7] | 2-301-xx | Nº 34 [8] |
| | | 301.x | M-Bus secondary addressing [7] | 2-301-xx | Nº 35 [8] |
| | | 301.x | M-Bus enhanced secondary addressing [7] | 2-301-xx | Nº 36 [8] |
| | | 301.x | KM-RF frequency [7] | 2-301-xx | Nº 37 |
| | | 301.x | KM-RF network address [7] | 2-301-xx | Nº 38 |
| 401 | Info Module 4 Config no. [6] | | | 2-401-00 | Nº 31 |
| | | 401.x | Firmware revision [7] | 2-401-xx | Nº 32 |
| | | 401.x | Module serial number [7] | 2-401-xx | Nº 33 |
| | | 401.x | Primary address [7] | 2-401-xx | Nº 34 [8] |
| | | 401.x | M-Bus secondary addressing [7] | 2-401-xx | Nº 35 [8] |
| | | 401.x | M-Bus enhanced secondary addressing [7] | 2-401-xx | Nº 36 [8] |
| | | 401.x | KM-RF frequency [7] | 2-401-xx | Nº 37 |
| | | 401.x | KM-RF network address [7] | 2-401-xx | Nº 38 |

[1] *Depending on the selected depth of yearly and monthly logs in the programmable data logger, these display readings can be empty.*

[2] *The temperature average is volume-based.*

[3] *The date of min./max is displayed in the format 20xx.xx.xx. By serial reading, the time (hh.mm) is included too.*

[4] *Inputs A1, B1 A2 and B2 are updated continuously in the display of MULTICAL® 803, i.e. the display of the connected water or electricity meter will be in accordance with the display of MULTICAL® 803 without delay.*

[5] *The unit of this reading is fixed at kW. The reading is updated at the same speed as the integration interval, which is determined by the L code.*

[6] *This reading is fixed under module info.*

[7] *These readings depend on the module and are thus not fixed readings. The order of the readings can vary depending on the module. That is why the index number is set to "xx".*

[8] *For module 60 - LON FT-X3, the reference numbers 34, 35 and 36 will be used for displaying the module's neuron ID divided into three parts. The module's neuron ID is displayed in decimal format on the display. The read values must be converted from decimal to hexadecimal for use in the LON system.*

[9] *The module number is automatically updated when the modules are replaced. If slot M1, M2, M3 or M4 is deenergized, for example during backup operation, the two-digit number of each module slot shows 99 in the display to indicate that the communication with any module on a given module slot is not possible.*
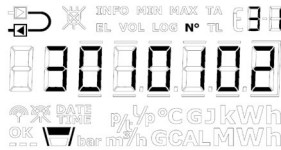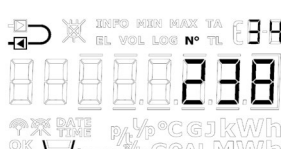
[10] *Temperature cutoff has been introduced from software revision 14890601 (F1), this display will not be available in earlier versions.*

[11] *In software revisions prior to 14890601 (F1), the segment test is found on index number 2-025-28.*

## 6.3  Module readings

The "TECH loop" includes a number of module readings which depend on the mounted modules. These readings are described in the respective technical descriptions of the modules. Simple modules, however, only include the primary reading "Type/Config. no." (for module on slot 1: index number 2-101-00). If the calculator is not equipped with a module, "Type/Config. no." is displayed as "00000000".

Note: Module readings can be empty due to delay or interrupted communication between calculator and module. The heart beat indication shows that both calculator and display are active. See the beginning of this paragraph for more information about the heart beat and status indications.

| | Index number in display | Display reading | Display reference number |
|---|---|---|---|
| **Type/Config no.** | 2-101-00 / 2-201-00 <br> 2-301-00 / 2-401-00 | 30 10 102 | N° 31 |
| **Firmware no./rev.** <br> Firmware example: <br> 13570301 = 1357 C1 | 2-101-xx / 2-201-xx <br> 2-301-xx / 2-401-xx [1] | 1357 030 1 | N° 32 |
| **Module serial number** <br> Example: <br> No. 12345678 | 2-101-xx / 2-201-xx <br> 2-301-xx / 2-401-xx [1] | 12345678 | N° 33 |
| **Primary address** | 2-101-xx / 2-201-xx <br> 2-301-xx / 2-401-xx [1] | 238 | N° 34 [8] |
| **M-Bus secondary ID** | 2-101-xx / 2-201-xx <br> 2-301-xx / 2-401-xx [1] | 12345678 | N° 35 [8] |
| **M-Bus enhanced secondary ID** | 2-101-xx / 2-201-xx <br> 2-301-xx / 2-401-xx [1] | 12345678 | N° 36 [8] |

[1] *These readings depend on the module and are thus not fixed readings. The order of the readings may vary. That is why the index number is set to "xx". However, the reference number will remain the same.*

[8] *For module 60 - LON FT-X3, the reference numbers 34, 35 and 36 will be used for displaying the module's neuron ID divided into three parts. The module's neuron ID is displayed in decimal format on the display. The read values must be converted from decimal to hexadecimal for use in the LON system.*

## 6.4 "SETUP loop"

In this loop, the technician can configure the calculator via the front keys. This enables the technician to configure the calculator both before installation and after the commissioning of the calculator. Configuration of the calculator after commissioning requires that the installation seal is broken, and that the calculator top and base are subsequently separated and reassembled.

> **Note that it is only possible to configure the meter 50 times via the SETUP loop.**
> After 50 times, the meter is locked against further configuration and total reset and reverification of the meter are required to regain access to the SETUP loop.

### How to enter the "SETUP loop"?

1. In general (unless otherwise informed by the customer), the "SETUP loop" is available when the calculator is in transport state. The calculator leaves the transport state the first time it detects a flow of 1 % of qp or greater or if the "SETUP loop" is exited through the menu item "EndSetup". A total reset of the calculator is the only way to return to transport state.

2. When the calculator is in operation, i.e. the calculator has left transport state, the "SETUP loop" can be accessed by breaking the calculator's installation seal and separating and reassembling the calculator top and the calculator base.

### How to exit the "SETUP loop"?

You can exit the "SETUP loop" in three ways. All three ways can be used both in transport state and after commissioning of the calculator.

1. Keep the primary key activated and navigate to one of the calculator's other loops.

2. After 4 minutes, the calculator reaches timeout and reverts to the first reading in the "USER loop".

3. Navigate to the menu item "EndSetup" in the "SETUP loop" and keep the primary key activated for 5 seconds while the frames around the reading counts up and the display in the end shows "OK".
   **Note: This locks the access to the "SETUP loop" and thereby, the calculator is locked against further configuration. If the calculator is to be reconfigured subsequently, the installation seal must be broken and the calculator top and base must then be separated and reassembled.**

> **IMPORTANT:** "EndSetup" is an important function when the meter is in transport state, but when the meter is in operation, "EndSetup" is just one of three ways to exit the SETUP loop.

As it appears from the table below, the purpose of the menu item "EndSetup" is to enable the technician to lock the access to the "SETUP loop" in transport state and thus lock the calculator against further configuration. This function is, for example, relevant to a technician who knows that a calculator is to be mounted in the installation for some time before the first integration will be carried out and wants to lock the access to the "SETUP loop" immediately after the installation to make sure that no further configuration is possible.

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It also appears from the table below that no matter how the "SETUP loop" is exited when the calculator is in operation, the installation seal must be broken again and calculator top and base must be separated and reassembled if the technician wants to regain access to the "SETUP loop".

|  | Transport state | In operation |
|---|---|---|
| 1. Primary key | ✔ Access to "SETUP loop" | ✖ Access to "SETUP loop" locked |
| 2. Timeout | ✔ Access to "SETUP loop" | ✖ Access to "SETUP loop" locked |
| 3. EndSetup | ✖ Access to "SETUP loop" locked | ✖ Access to "SETUP loop" locked |

## 6.4.1 Change of parameters in "SETUP loop"

The technician can navigate to the "SETUP loop" from the "USER loop" by keeping the primary key activated for 5 seconds and then use the arrow keys to navigate to 3-SETUP, which can be accessed with a single touch of the primary key. The "SETUP loop" does not include secondary readings and therefore, the index number always consists of 4 digits. See the table with SETUP parameters on the next page. The arrow keys are used to switch between readings.

In the "SETUP loop", the primary key is used to access individual readings with the purpose of changing the parameter in question. Pressing the primary key, the first digit of the parameter in question (the digit farthest to the left) starts flashing. The flashing digit can now be changed through brief activations of the primary key. Switch between the digits by pressing the arrow keys. You can freely switch to both right and left. When the desired setup is entered, keep the primary key activated until "OK" appears on the display. The calculator has now saved the change and the display shows the set values.



Depending on the calculator's configuration, one or more menu items in the "SETUP loop" are displayed as "OFF". This means that the function is not available in the calculator, i.e. the function has been disabled during factory programming. If you try to access these readings via the primary key, the frames around "OFF" are shown to indicate that the function is not available in the calculator.
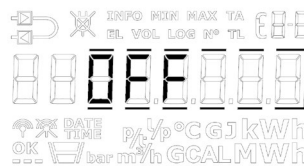
## 6.4.2   Setup parameters

The table below shows the parameters that can be changed via the "SETUP loop". Below the table, a detailed explanation of the individual parameters is found.

| "SETUP loop" | | Index number in display |
|---|---|---|
| 1 | Customer number (N° 1) | 3-001 |
| 2 | Customer number (N° 2) | 3-002 |
| 3 | Date | 3-003 |
| 4 | Time [1] | 3-004 |
| 5 | Yearly target date 1 (MM.DD) | 3-005 |
| 6 | Monthly target date 1 (DD) | 3-006 |
| 7 | Flow sensor position: Inlet or outlet flow (A code) | 3-007 |
| 8 | Energy unit (B code) (Can be set to kWh, MWh, GJ and Gcal) | 3-008 |
| 9 | Primary address of module slot 1 (N° 34) | 3-009 |
| 10 | Primary address of module slot 2 (N° 34) | 3-010 |
| 11 | Primary address of module slot 3 (N° 34) | 3-011 |
| 12 | Primary address of module slot 4 (N° 34) | 3-012 |
| 13 | Averaging period of min./max P and Q | 3-013 |
| 14 | Heat/cooling shift ($\theta_{hc}$) [2] (Only active on meter type 6) | 3-014 |
| 15 | Temperature sensor offset ($t_{r0}$) [3] | 3-015 |
| 16 | Radio on/off | 3-016 |
| 17 | Input A1 (preset register) | 3-017 |
| 18 | Input B1 (preset register) | 3-018 |
| 19 | Meter number of Input A1 | 3-019 |
| 20 | Meter number of Input B1 | 3-020 |
| 21 | TL2 | 3-021 |
| 22 | TL3 | 3-022 |
| 23 | TL4 | 3-023 |
| 24 | Preset t5 | 3-024 |
| 25 | EndSetup | 3-025 |

[1] In addition to adjusting the clock via the "SETUP loop", the clock and the date can also be changed via METERTOOL HCW and the modules.

[2] $\theta_{hc}$ can only be changed in meters configured as meter type 6. On this meter type, the user can both change $\theta hc$ and disable the function. If users attempt to access this menu in calculators configured as other meter types, the message "OFF" is displayed.

[3] This function can have been disabled via the selected country code.

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## 1. and 2. Customer number

The customer number is a 16-digit number distributed on two 8-digit menu items. The complete customer number can be adjusted via the two menu items in the "SETUP loop".
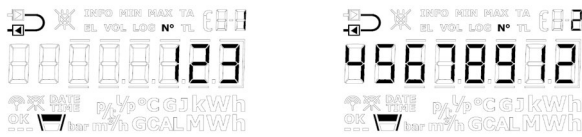


## 3. Date

The calculator's date can be adjusted in the "SETUP loop". We recommend you to verify that the date was adjusted correctly, especially if time was adjusted too.



## 4. Time

The calculator's time can be adjusted in the "SETUP loop". We recommend you to verify that the time was adjusted correctly, especially if the date was adjusted too.



## 5. Yearly target date 1

The calculator's yearly target date 1 can be adjusted in the "SETUP loop". In MULTICAL® 803, yearly target date 2 can be activated. This function is switched off by default, i.e. set to 00.00. If yearly target date 2 is active in a calculator, we recommend that both yearly target dates are adjusted via METERTOOL HCW to ensure that they are correctly set with respect to each other. Note that activation of yearly target date 2 influences the depth of the yearly log as the calculator now makes two yearly loggings.



## 6. Monthly target date 1

The calculator's monthly target date 1 can be adjusted in the "SETUP loop". In MULTICAL® 803, monthly target date 2 can be activated. This function is switched off by default, i.e. set to 00. If monthly target date 2 is active in a calculator, we recommend that both monthly target dates are adjusted via METERTOOL HCW to ensure that they are correctly set with respect to each other. Note that activation of monthly target date 2 influences the depth of the monthly log as the calculator now makes two monthly loggings.

## 7. Flow sensor position: Inlet or outlet flow (A code)

The installation position of the flow sensor can be adjusted in the "SETUP loop". This means that the calculator can be changed from being an outlet meter to being an inlet meter and vice versa. A symbol in the top left corner of the calculator's display shows whether the calculator is configured as an inlet or outlet meter.
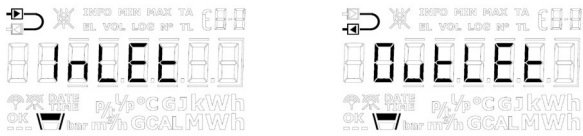
## 8. Energy unit (B code)

The calculator's measuring unit (B code) and resolution (CCC code) can be adjusted in the "SETUP loop". It is thus possible to change if the calculator's energy readings should be displayed in kWh MWh, GJ or Gcal.
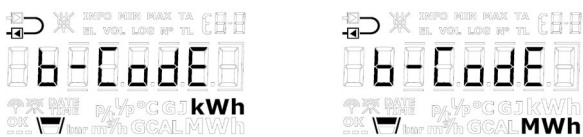
**Note:** The resolution of the energy unit will always follow the one specified for the CCC code that a given MULTICAL® 803 is configured with. See the CCC tables in paragraph 3.4.3. Note that if you select kWh for a MULTICAL® 803 calculator with a CCC code where kWh is not possible, MULTICAL® 803 automatically switches to MWh.

## 9. Primary address of module slot 1

The primary address of module slot 1 in MULTICAL® 803 can be adjusted in the "SETUP loop". The address can be selected in the interval 0…250.

## 10. Primary address of module slot 2

The primary address of module slot 2 in MULTICAL® 803 can be adjusted in the "SETUP loop". The address can be selected in the interval 0…250.

## 11. Primary address of module slot 3

The primary address of module slot 3 in MULTICAL® 803 can be adjusted in the "SETUP loop". The address can be selected in the interval 0…250.

## 12. Primary address of module slot 4

The primary address of module slot 4 in MULTICAL® 803 can be adjusted in the "SETUP loop". The address can be selected in the interval 0…250.



## 13. Averaging period of min./max P and Q

The averaging period used in the calculation of minimum and maximum values of power (P) and flow (Q) can be adjusted. The averaging period is entered in the range 1…1440 minutes. Read more about the averaging period of min./max of P and Q in paragraph 7.5.
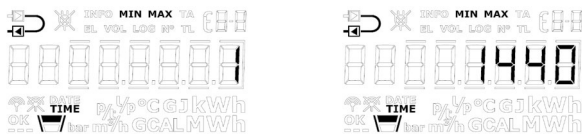


## 14. Heat/cooling shift ($\theta_{hc}$)

The limit ($\theta_{hc}$) for heat/cooling shift can be adjusted in the "SETUP loop", however only in calculators ordered as meter type 6 (heat/cooling meter). The value can be selected in the range 2…180,00 °C as well as at 250,00 °C if the user wants to disable the function. The function is enabled again by setting the limit at a value in the valid area of 2…180 °C. Heat/cooling shift is permanently disabled in other meter types and therefore, "OFF" is displayed in all other meter types than 6. Read more about heat/cooling shift in paragraph 7.4.

| Meter type: 1, 2, 3, 4, 5, 7 | Meter type: 6 |
| --- | --- |
|  |  |
| The frames around "OFF" will be shown as long as the primary key remains activated. | The first digit flashes and each digit can now be set to a value within the range 0…9.<br><br>If you choose a value outside the valid range (2…180,00 °C), the value is automatically adjusted to 250,00 °C, which indicates that the function has been switched off. |

## 15. Temperature sensor offset (t_{r0})

Temperature sensor offset (tr0) can be adjusted in the "SETUP loop". Depending on the calculator's configuration, this function can be disabled and the menu item will in that case display "OFF".

Offset can be adjusted in the interval -0,99...0,99 K. Pressing the primary key, the 0 and the sign start flashing and it is now possible to switch between – and +, indicated in the display by the fact that the minus sign flashes and switches of respectively. Use the arrow keys to shift to the digits to the right of the decimal point, i.e. it is not possible to change the value of the first digit as the valid interval is -0,99...0,99 K. Both the first and the second decimal can be set to a value between 0 and 9. Read more about temperature sensor offset in paragraph 7.3.

> **Be aware of setting the required offset adjustment, not the error of the temperature sensor pair.**
> If the selected temperature sensor pair contributes with an error of -0,20 K, the meter's offset must be set to 0,20 K.

**Note:** The set offset is active for all temperature sensors connected to MULTICAL® 803, i.e. both t1, t2, t3 and t4.
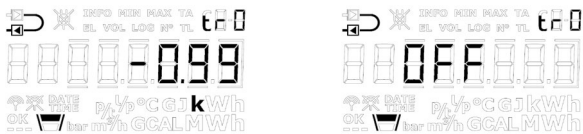


## 16. Radio on/off

The calculator's radio/wireless communication can be adjusted to being switched on or switched off. The calculator automatically turns on the radio when the calculator leaves the transport state, i.e. when the calculator has detected a flow of 1 % of qp or greater. The radio on/off function in the "SETUP loop" is primarily used for switching on the radio in transport state without the calculator having registered a flow as well as for switching off the radio when the calculator is dismounted after having been in operation, e.g. if it is to be sent by airfreight. The calculator's present condition is indicated by two symbols in the bottom left corner of the display.

> **IMPORTANT:**
> - If the meter's radio communication is switched off via the SETUP loop, the calculator subsequently switches on radio communication again the first time it registers a flow of 1 % of qp or greater.
>
> - The symbols for radio on/off indicate whether the meter allows radio communication, not whether a radio module has activated its radio communication. Be aware of this when troubleshooting the meter's wireless communication.

The above definition of the radio on/off symbols simplify the use of radio on/off in the "SETUP loop" too as it is possible to switch between radio on and radio off regardless of whether a module is mounted in the calculator or not. This offers flexibility that enables a utility company to configure the calculator prior to mounting a module and thus to make sure that radio is either by default switched on in transport state or switched off when the module is subsequently mounted.

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If a module is not installed in the calculator or if the mounted module is not a radio module, both symbols are turned off in the calculator's other loops, independently of the setting of the radio on/off in the "SETUP loop". MULTICAL® 803 always allows radio communication during operation.

|  | Radio ON | Radio OFF | No module / not radio module |
|---|---|---|---|
| "SETUP loop" | rF On | rF OFF | rF OFF |
| "USER-loop" /"TECH loop" | 0039.297 MWh | 0039.297 MWh | 0039.297 MWh |

## 17. + 18. Inputs A1 and B1 (presetting of registers)

It is possible to preset the values of the pulse inputs A1 and B1 in the "SETUP loop" so that the calculator's display is in accordance with the connected water and/or electricity meters. The example is based on the connection of a water meter.

00248.73 m³

**Note:** If the pulse inputs A2 and B2 are to be used, METERTOOL HCW is used for presetting the registers.

## 19. + 20. Meter numbers of inputs A1 and B1

Meter numbers of the water and/or electricity meters connected to the pulse inputs A1 and B1 can be adjusted in the "SETUP loop". In the example shown, the meter number is connected to pulse input B1.

12345678

**Note:** If the pulse inputs A2 and B2 are to be used, METERTOOL HCW is used for setting the meter numbers.

## 21. + 22. + 23. Tariff limits (TL2, TL3 and TL4)

The calculator's three tariff limits can be adjusted in the "SETUP loop". The tariff limits are only active if a tariff type has been selected during configuration of the calculator, i.e. the EE code differs from "00". The EE code is shown in the "TECH loop", see paragraph 6.2. If a tariff type has been selected, the menu items reflect this by displaying the correct tariff limit units. If no tariff type has been selected, the menu items will be without units. Read more about tariff types in paragraph 3.4.5.

10.00 kW          08.00 TIME          1000 t/h

*Note:* It is *__not__* possible to have different types of tariff limits. The display readings shown are just examples.

## 24. Preset t5

The temperature value t5 can be adjusted in the interval 0,01...185,00 °C in the "SETUP loop". This value is used in connection with the calculation of outlet energy registers, i.e. registers A1 (A-, heat at a discount) and A2 (A+, heat with an addition). Read more about this calculation and function in paragraph 7.1.3.



## 25. EndSetup

The menu item "EndSetup" enables the technician to lock the access to the "SETUP loop" in transport state and thus lock the calculator against further configuration. In order to do so, the user must keep the primary key activated for five seconds. During the five seconds, the frames around the reading EndSetup will be shown in the calculator's display. This action can be undone by releasing the primary key before the whole frame has been shown, i.e. before the five seconds have passed.
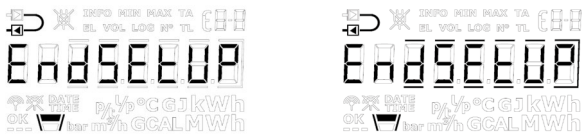


"EndSetup" is an important function when the calculator is in transport state.If  the calculator is in operation, "EndSetup" is just one of three ways to exit the "SETUP loop". See paragraph 6.4.

## 6.5 "TEST loop"



The "TEST loop" is, for example, used by authorized laboratories for reverification of the calculator, among other things.

Before the calculator can enter the "TEST loop" and thus the TEST mode, the verification seal marked "TEST" on the calculator's verification cover must be carefully broken with a screwdriver and the contact points behind the seal be short-circuited. For this purpose, a short-circuit pen (6699-278) from Kamstrup A/S can be used.



It is recommended to complete the work in the "TEST loop" before starting a reconfiguration via the ""SETUP loop"" or METERTOOL HCW as every reconfiguration is logged in MULTICAL® 803 (it is only possible to reconfigure MULTICAL® 803 50 times).

The calculator either leaves the "TEST loop" and returns to the first reading in the "USER loop" after 9 hours (timeout) or if the user keeps the primary key activated for 5 seconds and manually leaves the "TEST loop" via the Select loop.

| "TEST loop" | | | | | Display |
|---|---|---|---|---|---|
| Main | | | Sub | | Index number in display |
| 1.0 | High-resolution heat energy [1] | | | | 4-001-00 |
| | | | 1.1 | *Heat energy (E1)* | 4-001-01 |
| 2.0 | High-resolution cooling energy [1] | | | | 4-002-00 |
| | | | 2.1 | *Cooling energy (E3)* | 4-002-01 |
| 3.0 | High-resolution volume V1 [1] | | | | 4-003-00 |
| | | | 3.1 | *Volume V1* | 4-003-01 |
| 4.0 | t1 (inlet) | | | | 4-004-00 |
| 5.0 | t2 (outlet) | | | | 4-005-00 |
| 6.0 | Flow V1 | | | | 4-006-00 |

[1] *The resolution of the high-resolution registers is shown in the following table.*

*The registers can only be reset by a total reset of the calculator.*

## 6.6  Registers and resolution

Energy and volume counted in the meter count registers in MULTICAL® 803 are displayed in normal resolution in the "USER loop". Normal resolution is available in four levels according to the selected CCC code and flow sensor size. The resolution levels are indicated in relation to selected display units in the table below.

| | Display | | | | | |
| | Normal resolution | | | | High resolution | |
| Resolution level | MWh<br>Gcal | kWh | GJ | m³<br>tons | kWh | l |
|---|---|---|---|---|---|---|
| 3 | 0,0001 | 0,1 | 0,001 | 0,001 | 0,0001 | 0,001 |
| 2 | 0,001 | 1 | 0,01 | 0,01 | 0,001 | 0,01 |
| 1 | 0,01 | - | 0,1 | 0,1 | 0,01 | 0,1 |
| 0 | 0,1 | - | 1 | 1 | 0,1 | 1 |

*Table 1_ Normal and high resolution for meter count registers, depending on the CCC code*

| | Energy | Volume |
|---|---|---|
| Normal resolution |  |  |
| High resolution |  |  |

*Table 2: Examples of normal and high resolution, flow sensor size qp 1,5 m³/h*

While the calculator is in "TEST loop", all integrations are carried out with 2 second interval regardless of whether the calculator is supplied from mains supply or backup battery. The above high-resolution registers can also be seen in the "TECH loop", see paragraph 6.2.

While the calculator is in the "TEST loop", high-resolution pulses for test purposes can be generated via the pulse interface (see paragraph 13).

# 7 Calculator functions

## 7.1 Application types and energy calculations

MULTICAL® 803 operates with 20 different energy formulas, E1, E2, E3, E4, E5, E6, E7, E8, E9, E10, E11, E12, E13, E14, E15, E16, A1, A2, dE(ΔE) and cE, which are all calculated in parallel at every integration no matter how the calculator is configured. E8, E9, E10 and E11 are used as a basis for the calculation of average temperatures of inlet and outlet, whereas E1 and E3 are used for heat and cooling measurement, respectively. E4 to E7 and E12 to E16 are used in a number of energy applications that are shown below. A1 and A2 are used as a basis for discount/addition based on the outlet temperature (see paragraph 7.1.6).
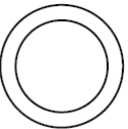
| Formula | ΔΘ | Example of application | Included in application no. | Register type |
|---|---|---|---|---|
| $E1=V1(t1-t2)k_{t1/t2}$ | t1 > t2 | Heat energy  (V1 in inlet or outlet) | 1+2+3+4+5+6+8+10 | **Legal** Display/Data/Log |
| $E2=V2(t1-t2)k_{t2}$ | t1 > t2 | Heat energy (V2 in outlet) | 2+7 | Display/Data/Log |
| $E3=V1(t2-t1)k_{t1/t2}$ | t2 > t1 | Cooling energy  (V1 in inlet or outlet) | 1+11 | **Legal** Display/Data/Log |
| $E4=V1(t1-t3)k_{t1}$ | t1 > t3 | Inlet energy | 7+9+11 | Display/Data/Log |
| $E5=V2(t2-t3)k_{t2}$ | t2 > t3 | Outlet energy or tap from outlet | 5+7+9 | Display/Data/Log |
| $E6=V2(t3-t4)k_{t3}$ | t3 > t4 | Tap water energy, separate | 3+6 | Display/Data/Log |
| $E7=V2(t1-t3)k_{t3}$ | t1 > t3 | Outlet energy or tap from inlet | 4+8 | Display/Data/Log |
| $E8=V1[m^3] \times t1$ | - | Average temperature in inlet | See paragraph 7.1.5 | Display/Data/Log |
| $E9=V1[m^3] \times t2$ | - | Average temperature in outlet | | Display/Data/Log |
| $E10=V1[m^3] \times t3$ | - | Average t3 in V1 | | Display/Data/Log |
| $E11=V2[m^3] \times t3$ | - | Average t3 in V2 | | Display/Data/Log |
| $E12=V2(t2-t1)k_{t2}$ | t2 > t1 | Cooling energy (V2 in outlet) | 32 | Display/Data/Log |
| $E13=V1(t3-t4)k_{t1/t2}$ | t3 > t4 | Heat energy serial circuit | 30 | Display/Data/Log |
| $E14=V2(t3-t4)k_{t3/t4}$ | t3 > t4 | Heat energy parallel circuit | 31 | Display/Data/Log |
| $E15=V1(t4-t3)k_{t1/t2}$ | t4 > t3 | Cooling energy serial circuit | 30 | Display/Data/Log |
| $E16=V2(t4-t3)k_{t3/t4}$ | t4 > t3 | Cooling energy parallel circuit | 31 | Display/Data/Log |
| Additional registers | | | | |
| A1 | t5 > t2 | Heat energy at a discount | See paragraph 7.1.6 | Display/Data/Log |
| A2 | t2 > t5 | Heat energy with an addition | | Display/Data/Log |
| dE(ΔE)=E4-E5 | - | Differential energy | 7 | - |
| cE=E5-E4 | - | Control of differential energy | 7 | - |

### 7.1.1 Approvals for energy and applications

The symbols in the following table are used for specifying whether an energy calculation in a given application has been legally approved and for showing which approval is valid.

| Symbol | Approvals |
|---|---|
| ❷ | MID 2014/32/EU – Heat meter (EU) |
| ❺ | TS 27.02 – Cooling meter (EU) |

## Symbols used in application figures

| | | | | | |
|---|---|---|---|---|---|
| † | Temperature sensor | ⋈ | Stop valve | ▢ 000 / Σ m³ | Flow sensor |
| ▢ 000 / Σ kWh | Calculator | ◎ | Consumer, e.g. heaters | ◸ | Non-return valve |
| ◪ | Heat exchanger | | | | |

### 7.1.2 Components used in applications

The table below shows which components are necessary in the individual applications.

| Application | Energy | System type | | Flow sensor | | Temperature sensors | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Closed | Open | V1 | V2 | t1 | t2 | t3 | t4 |
| 1 | E1-E3 | ● | | ● | | ● | ● | | |
| 2 | E1-E2 | ● | | ● | ● | ● | ● | ○ | |
| 3 | E1-E6 | ● | ● | ● | ● | ● | ● | ○ | ○ |
| 4 | E1-E7 | ● | | ● | ● | ● | ● | ○ | |
| 5 | E1-E5 | | ● | ● | ● | ● | ● | ○ | |
| 6 | E1-E6 | | ● | ● | ● | ● | ● | ○ | ○ |
| 7 | E2-E4-E5-dE(ΔE) | | ● | ● | ● | ● | ● | ○ | |
| 8 | E1-E7 | | ● | ● | ● | ● | ● | ● | |
| 9 | E4-E5 | ● | | ● | ● | ● | ● | ● | |
| 10 | E1 | | ● | ● | | ● | ○ | | |
| 11 | E3-E4 | ● | | ● | | ● | ● | ● | |
| 30 | E1-E3-E13-E15 | ● | | ● | | ● | ● | ● | ● |
| 31 | E1-E3-E14-E16 | ● | | ● | ● | ● | ● | ● | ● |
| 32 | E3-E12 | ● | | ● | ● | ● | ● | ○ | |

### 7.1.3 Application drawings

The energy types E1…E16 are described by application examples below.

| | |
|---|---|
|  | **Application no. 1**<br><br>**Closed thermal system with 1 flow meter**<br><br>❷ Heat energy: $E1 = V1\,(t1-t2)k_{t1:\text{Inlet or }t2:\text{Outlet}}$<br><br>❺ Cooling energy: $E3 = V1\,(t2-t1)k_{t1:\text{Inlet or }t2:\text{Outlet}}$<br><br>Flow sensor V1 is mounted in inlet or outlet as selected during configuration.<br><br>Mass: $M1 = V1\,(Kmass\ t1)$ or<br>Mass: $M1 = V1\,(Kmass\ t2)$ depending on the programming of inlet/outlet.<br><br>Config A = 3 (inlet) or 4 (outlet) |
|  | **Application no. 2**<br><br>**Closed thermal system with 2 identical flow meters Leak monitoring and Permanent operational monitoring**<br><br>❷ Billing energy: $E1 = V1\,(t1-t2)k_{t1:\text{Inlet}}$<br><br>Control energy: $E2 = V2\,(t1-t2)k_{t2:\text{Outlet}}$<br><br>t3 can be used for check measurement of either the inlet or outlet temperature, but t3 is not used for calculating the energy.<br><br>Mass: $M1 = V1\,(Kmass\ t1)$<br>Mass: $M2 = V2\,(Kmass\ t2)$<br><br>Config. A = 3 (inlet) |
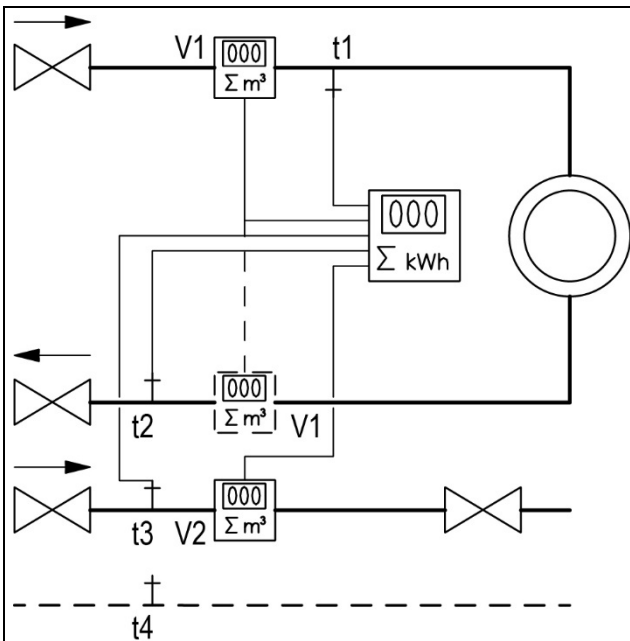
## Application no. 3

### 2-string system with 2 flow sensors

❷ Heat energy: $E1 = V1\,(t1-t2)k_{\text{t1:Inlet or t2:Outlet}}$

Tap water energy: $E6 = V2\,(t3-t4)k_{t3}$

t3 and t4 are measured or programmed

Flow sensor V1 is mounted in inlet or outlet as selected during configuration.

Mass: $M1 = V1\,(\text{Kmass } t1)$ or
Mass: $M1 = V1\,(\text{Kmass } t2)$ depending on the programming of inlet/outlet.
Mass: $M3 = V2\,(\text{Kmass } t3)$

Config A = 3 (inlet) or 4 (outlet)
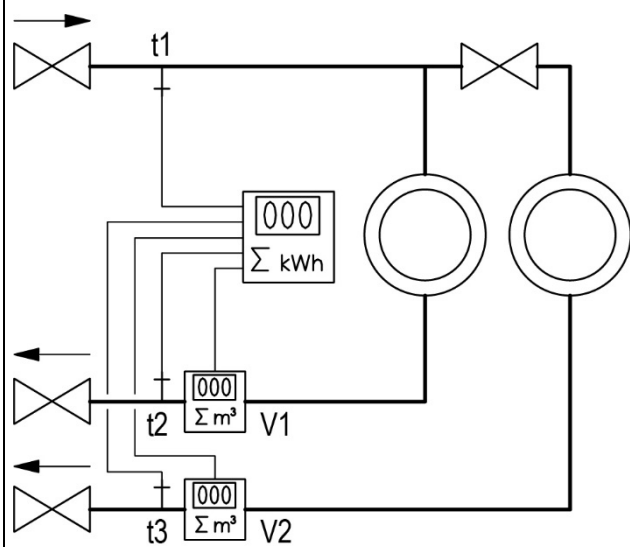


## Application no. 4

### 2 heating circuits with joint inlet pipe

❷ Heat energy #1: $E1 = V1\,(t1-t2)k_{t2}$

Heat energy #2: $E7 = V2\,(t1-t3)k_{t3}$

t3 is measured or programmed

Mass: $M1 = V1\,(\text{Kmass } t1)$
Mass: $M3 = V2\,(\text{Kmass } t3)$
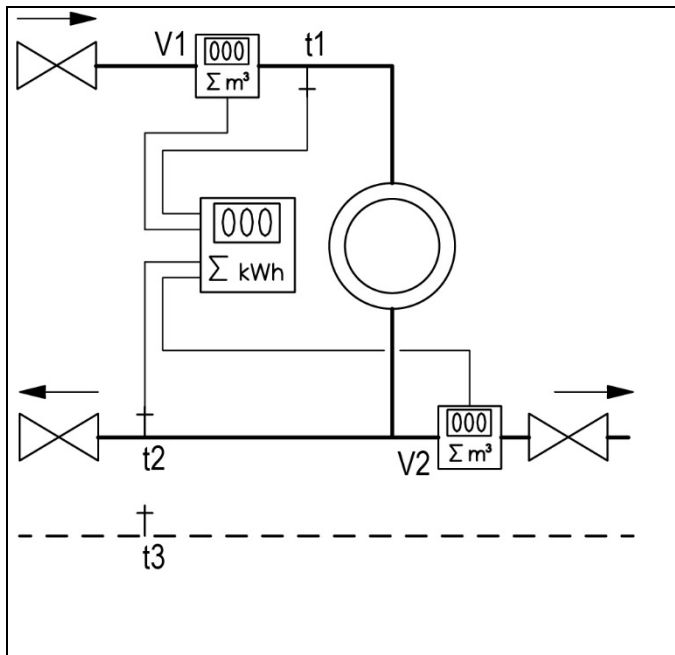
Config. A = 4 (outlet)

**Application no. 5**

**Open system with tapping from outlet pipe**
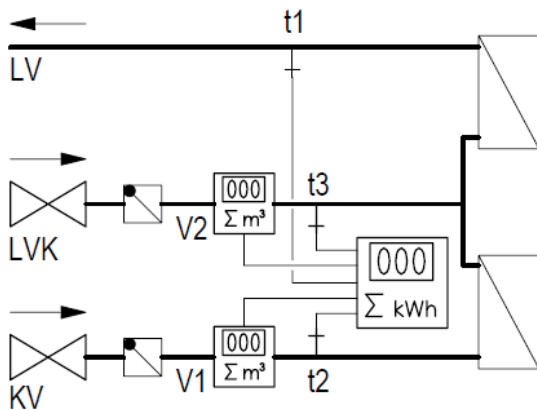
Heat energy: $E1 = V1\,(t1-t2)k_{t1}$

Tap water energy: $E5 = V2\,(t2-t3)k_{t2}$

t3 is measured or programmed

Mass: $M1 = V1\,(Kmass\ t1)$
Mass: $M2 = V2\,(Kmass\ t2)$

Config. A = 3 (inlet)
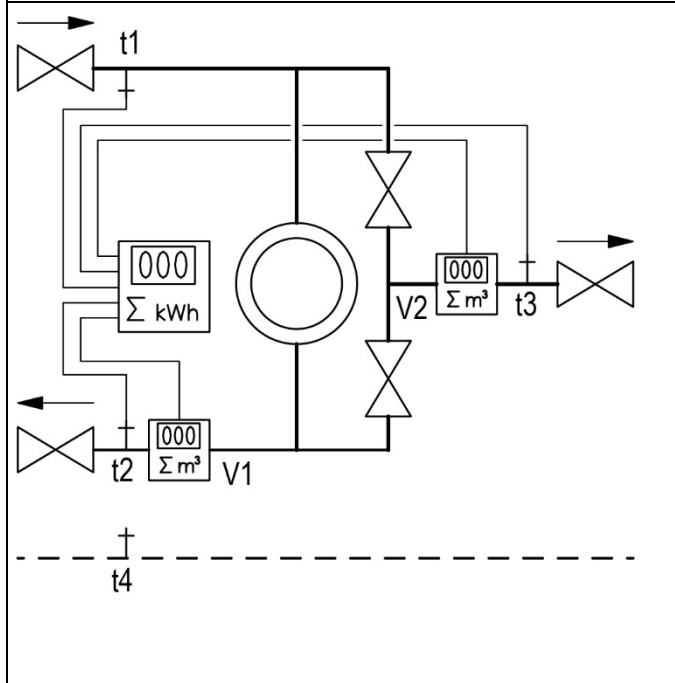


**Application no. 6**

**Open system with separate flow meter for tapping**

Heat energy: $E1 = V1\,(t1-t2)k_{t2}$

Tap water energy: $E6 = V2\,(t3-t4)k_{t3}$

t3 and t4 are measured or programmed

Mass: $M1 = V1\,(Kmass\ t1)$
Mass: $M3 = V2\,(Kmass\ t3)$
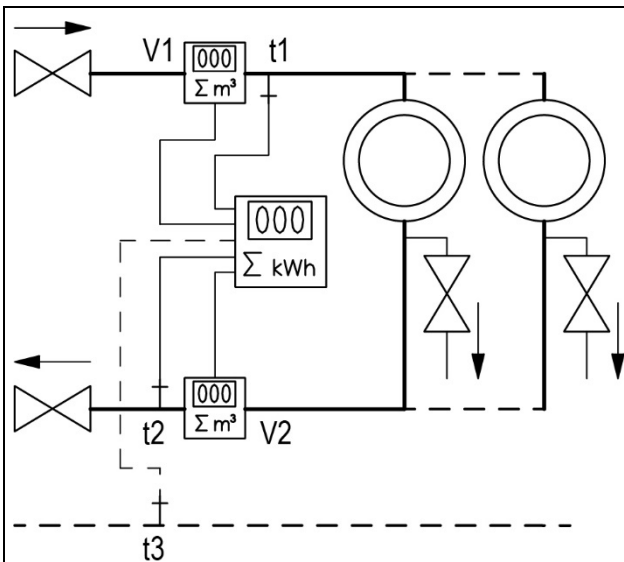
Config. A = 4 (outlet)

| | |
|---|---|
|  | Application no. 7<br><br>**Open system with 2 flow meters**<br><br>Inlet energy: $E4 = V1\ (t1-t3)k_{t1}$<br><br>Outlet energy: $E5 = V2\ (t2-t3)k_{t2}$<br><br>$dE(\Delta E) = E4-E5$ can be calculated by the meter.<br><br>Heat energy: $E2 = V2\ (t1-t2)k_{t2}$<br><br>t3 is measured or programmed<br><br>Mass: $M1 = V1\ (Kmass\ t1)$<br>Mass: $M2 = V2\ (Kmass\ t2)$<br><br>Config. A = 3 (inlet) |
|  | Application no. 8<br><br>**Hot water boiler with circulation**<br><br>Tap water energy: $E1 = V1\ (t1-t2)k_{t2}$<br><br>Circulated energy: $E7 = V2\ (t1-t3)k_{t3}$<br><br>Mass: $M1 = V1\ (Kmass\ t1)$<br>Mass: $M3 = V2\ (Kmass\ t3)$<br><br>*LV: Domestic hot water*<br>*LVK: Heat circulation*<br>*KV: Cold water*<br><br>Config. A = 4 (outlet) |
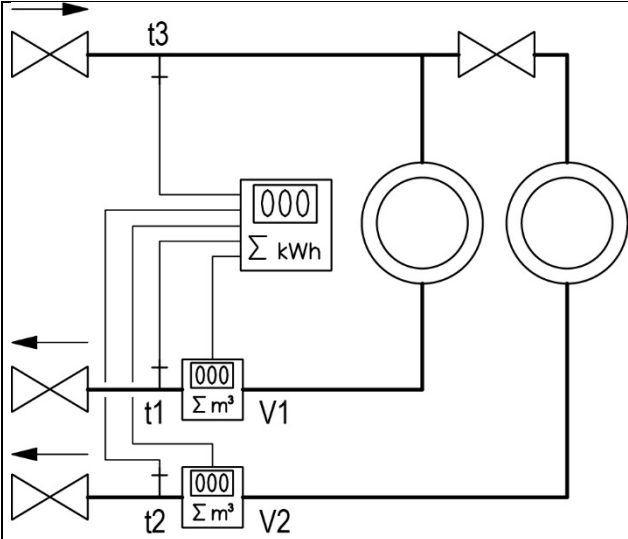
## Application no. 9

### 2 cooling circuits with joint inlet pipe

Cooling energy #1: $E4 = V1\,(t1-t3)k_{t1}$

Cooling energy #2: $E5 = V2\,(t2-t3)k_{t2}$

Mass: $M1 = V1\,(K_{mass}\,t1)$
Mass: $M2 = V2\,(K_{mass}\,t2)$

Config. A = 4 (outlet)
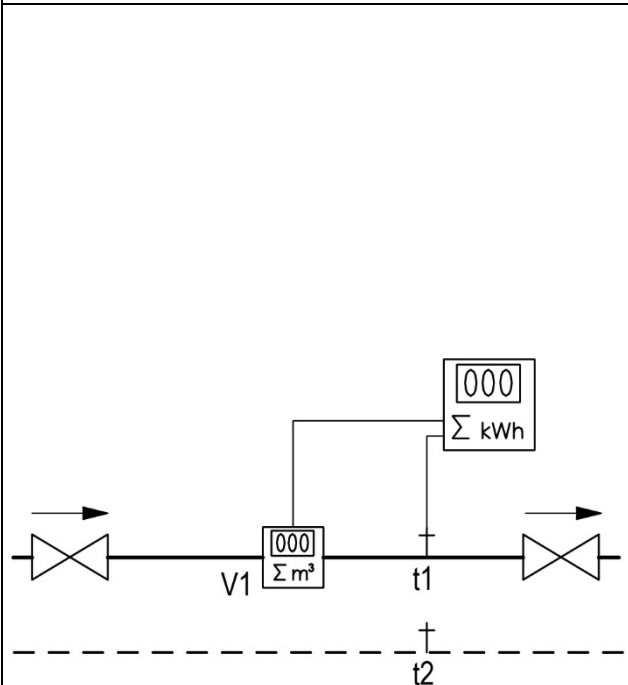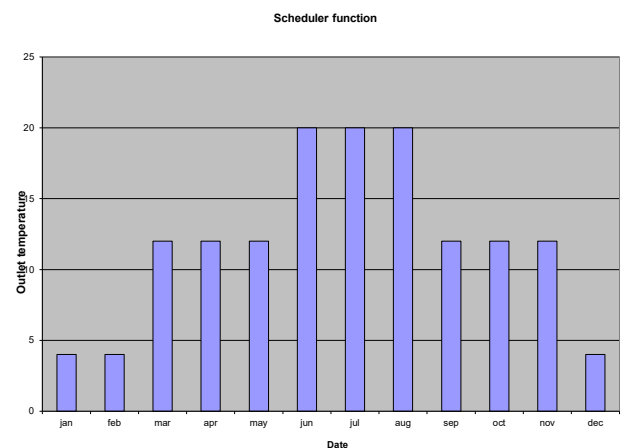
## Application no. 10

### Energy of domestic hot water

Tap water energy: $E1 = V1\,(t1-t2)k_{t1}$
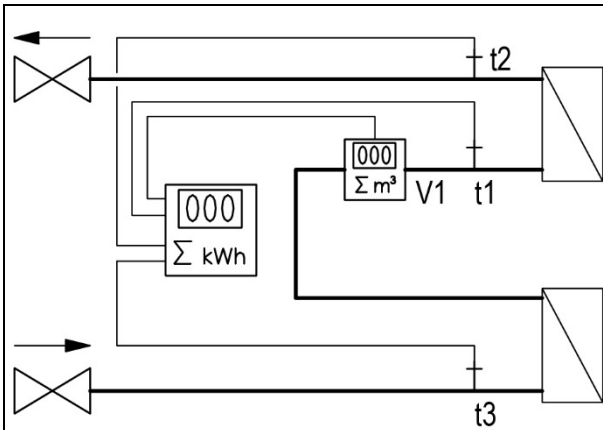
Mass: $M1 = V1\,(K_{mass}\,t1)$

t1 and t2 are measured with 2-wire sensors or 4-wire sensors.

Alternative:
t2 is programmed with a fixed temperature value or t2 is programmed via the scheduler function that is built into MULTICAL® 803. The temperature t2 follows a table, within which t2 can be changed up to 12 times a year.
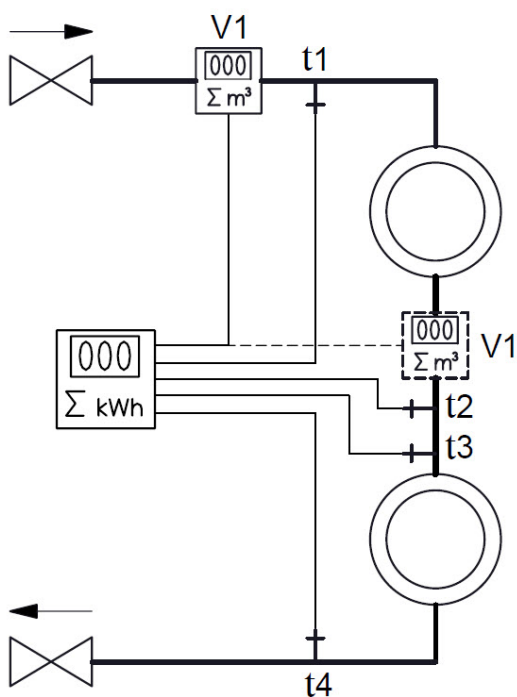
**Scheduler function**

Config. A = 3 (inlet)

<u>Application no. 11</u>

**2-step boiler system with 1 flow sensor**

Boiler energy "B": $E3 = V1\ (t2-t1)k_{t1}$
*(Upper boiler)*

Boiler energy "A": $E4 = V1\ (t1-t3)k_{t1}$
*(Lower boiler)*

Config. A = 3 (inlet)



<u>Application no. 30</u>

**Closed thermal system with 2 consumers and 1 common flow sensor**

Heat energy:
❷      $E1 = V1\ (t1-t2)k_{t1\ or\ t2}$
      $E13 = V1\ (t3-t4)k_{t1\ or\ t2}$
Cooling energy:
❺      $E3 = V1\ (t2-t1)k_{t1\ or\ t2}$
      $E15 = V1\ (t4-t3)k_{t1\ or\ t2}$

Mass: M1 = V1 (Kmass t1) or
Mass: M1 = V1 (Kmass t2) depending on the programming of inlet/outlet.

Config A = 3 (inlet) or 4 (outlet)

# MULTICAL® 803
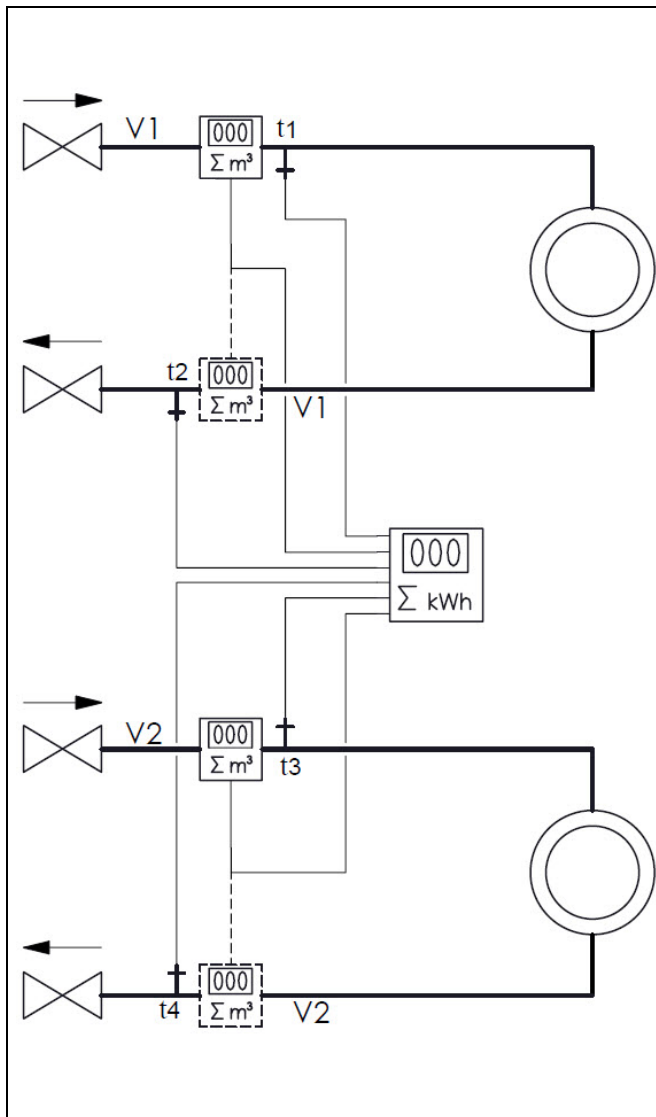


## Application no. 31

**2 separately closed thermal systems with common calculator**

Heat energy:

❷  $E1 = V1 \, (t1-t2)k_{\text{t1:Inlet or t2:Outlet}}$

$E14 = V2 \, (t3-t4)k_{\text{t3:Inlet or t4:Outlet}}$

Cooling energy:

❺  $E3 = V1 \, (t2-t1)k_{\text{t1:Inlet or t2:Outlet}}$

$E16 = V2 \, (t4-t3)k_{\text{t3:Inlet or t4:Outlet}}$

Mass upper circuit:
M1 = V1 (Kmass t1) or
M1 = V1 (Kmass t2),
depending on the programming of inlet/outlet.

Mass lower circuit:
Inlet: M3 = V2 (Kmass t3) and
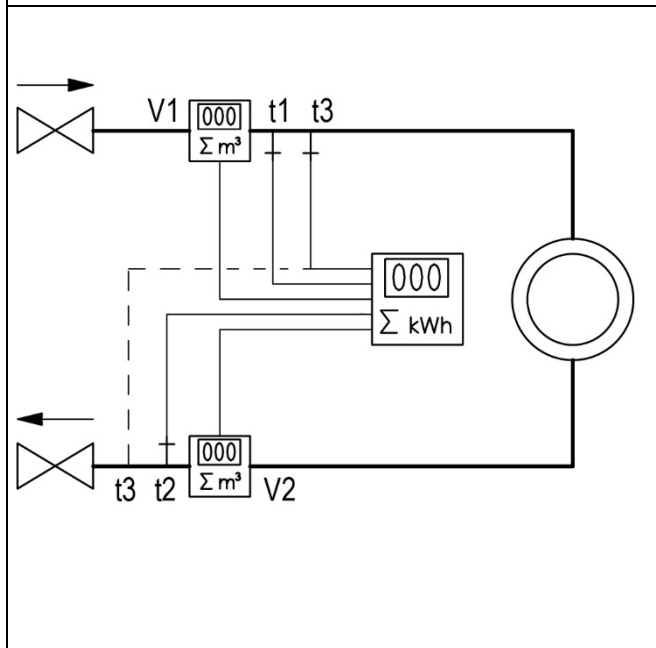Outlet: M4 = V2 (Kmass t4)

Power upper circuit:
Power E1/E3 (V1, t1, t2)

Power lower circuit:
Power E14/E16 (V2, t3, t4)

Config A = 3 (inlet) or 4 (outlet)

The choice of inlet or outlet applies to the legal circuits E1 and E3 as well as E14 and E16.

## Application no. 32

**Closed thermal system (cooling) with 2 identical flow sensors Leak monitoring and Permanent operational monitoring**

Billing energy: $E3 = V1 \, (t2-t1)k_{\text{t1:Inlet}}$

Control energy: $E12 = V2 \, (t2-t1)k_{\text{t2:Outlet}}$

t3 can be used for check measurement of either the inlet or outlet temperature, but t3 is not used for calculating the energy.

Mass: M1 = V1 (Kmass t1)
Mass: M2 = V2 (Kmass t2)

Config. A = 3 (inlet)

### 7.1.4 Energy calculations and registers E1 and E3

MULTICAL® 803 calculates energy on the basis of the formula stated in EN 1434-1, which uses the international temperature scale issued in 1990 (ITS-90) and the pressure definition of 16 bar.

In a simplified form, the energy calculation can be expressed as: Energy = V x $\Delta\Theta$ x k. The calculator always calculates energy in [Wh] and then converts the value to the selected measuring unit.

| E [Wh] = | V x $\Delta\Theta$ x k x 1000 |
|---|---|
| E [kWh] = | E [Wh] / 1,000 |
| E [MWh] = | E [Wh] / 1,000,000 |
| E [GJ] = | E [Wh] / 277,800 |

**V**     is the added (or simulated) water volume in m$^3$

**$\Delta\Theta$**     is the measured temperature difference:
Heat energy (E1) $\Delta\Theta$ = inlet temperature less outlet temperature
Cooling energy (E3) $\Delta\Theta$ = outlet temperature less inlet temperature

**k**     is the heat coefficient of water, which is calculated according to the formula of EN 1434 and OIML R75-1:2002

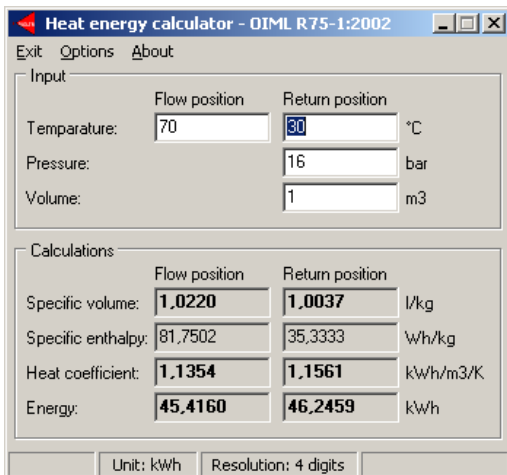Both in the display and during data reading, each energy type is uniquely defined, e.g.

Heat energy: E1 = V1(t1-t2)k          Cooling energy: E3 = V1(t2-t1)k



Kamstrup A/S can supply an energy calculator for check measurement:

# MULTICAL® 803

| | | Calculation | Condition |
|---|---|---|---|
| **Heat energy** (E1, A1, A2) | Inlet | $E1 = m^3 \times (t1-t2)k_{t1}$<br><br>$A1 = m^3 \times (t5-t2)k_{t1}$<br>$A2 = m^3 \times (t2-t5)k_{t1}$ | $t1 > t2$<br>If $t1 = t2$, then E1, A1, A2 = 0<br><br>If $t5-t2 \leq 0$, then A1 = 0<br>If $t2-t5 \leq 0$, then A2 = 0<br>$\theta_{t1} > \theta_{hc}$ *(meter type 6)* |
| | Outlet | $E1 = m^3 \times (t1-t2)k_{t2}$<br><br>$A1 = m^3 \times (t5-t2)k_{t2}$<br>$A2 = m^3 \times (t2-t5)k_{t2}$ | $t1 > t2$<br>If $t1 = t2$, then E1, A1, A2 = 0<br><br>If $t5-t2 \leq 0$, then A1 = 0<br>If $t2-t5 \leq 0$, then A2 = 0<br>$\theta_{t1} > \theta_{hc}$ *(meter type 6)* |
| **Cooling energy** (E3) | Inlet | $E3 = m^3 \times (t2-t1)k_{t1}$ | $t1 < t2$<br>$\theta_{t1} > \theta_{hc}$ *(meter type 6)* |
| | Outlet | $E3 = m^3 \times (t2-t1)k_{t2}$ | $t1 < t2$<br>$\theta_{t1} > \theta_{hc}$ *(meter type 6)* |
| **Inlet/outlet energy** (E8, E9, E10, E11) | | $E8 = V1[m^3] \times t1$<br>$E9 = V1[m^3] \times t2$<br>$E10 = V1[m^3] \times t3$<br>$E11 = V2[m^3] \times t3$ | |

**Note:** In case of error on temperature sensor t1, t2, t3 or t4, the energy calculation and the counting stop in the registers that are influenced by the error. Furthermore, the displayed reading in question will include lines, see the table at the beginning of paragraph 6.

### 7.1.5 Energy calculations and registers E8, E9, E10 and E11

E8 and E9 are used as a basis for calculating the volume-based average temperatures of inlet and outlet, respectively. With every integration, the registers are accumulated by the product of $m^3$ x °C, which makes E8 and E9 a suitable basis for calculation of volume-based average temperatures of inlet and outlet.

E10 and E11 function in the same way as E8 and E9, but are used for the calculation of the average temperature t3 with either V1 or V2.

E8, E9, E10 and E11 can be used for average calculation during any period of time as long as the volume register is read at the same time as the energy registers.
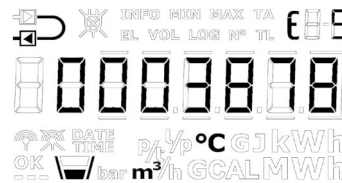
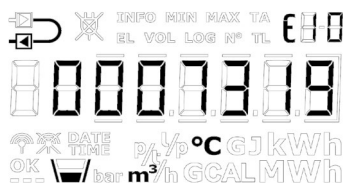$$E8 = V1[m^3] \times t1$$
E8 is increased by the product of $m^3$ for V1 x t1



$$E9 = V1[m^3] \times t2$$
E9 is increased by the product of $m^3$ for V1 x t2
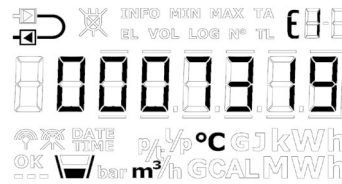


$$E10 = V1[m^3] \times t3$$
E10 is increased by the product of $m^3$ for V1 x t3



$$E11 = V2[m^3] \times t3$$
E11 is increased by the product of $m^3$ for V2 x t3



Resolution of E8, E9, E10 and E11

E8, E9, E10 and E11 depend on the resolution of volume [$m^3$]

| Volume resolution | E8, E9, E10 and E11 resolutions |
|---|---|
| 0000,001 $m^3$ | $m^3$ x °C x 10 |
| 00000,01 $m^3$ | $m^3$ x °C |
| 000000,1 $m^3$ | $m^3$ x °C x 0,1 |
| 0000001 $m^3$ | $m^3$ x °C x 0,01 |

**Example 1:** Within a year, a heating installation has used 250.00 $m^3$ district heating water and the average temperatures have been 95 °C in inlet and 45 °C in outlet. E8 = 23750 and E9 = 11250.

**Example 2:** The average temperatures are to be measured together with the yearly reading. Therefore, E8 and E9 are included in the yearly reading.

| Reading date | Volume | E8 | Average of inlet | E9 | Average of outlet |
|---|---|---|---|---|---|
| 2019.06.01 | 534,26 $m^3$ | 48236 | | 18654 | |
| 2018.06.01 | 236,87 $m^3$ | 20123 | | 7651 | |
| Yearly consumption | 297,39 $m^3$ | 28113 | 28113/297,39 = 94,53 °C | 11003 | 11003/297,39 = 36,99 °C |

*Table 3*

## 7.1.6   Outlet energy registers A1 and A2

The function behind the "Outlet energy registers" is the fact that A1 accumulates heat energy consumed with low outlet temperature for which the customer receives a discount, and A2 accumulates heat energy consumed with high outlet temperature for which the consumer receives an addition.

The energy calculations of a heat meter with flow sensor in outlet are shown below:

$A1 = m^3 \times (t5-t2)k_{t2}$      Heat energy at a discount

$A2 = m^3 \times (t2-t5)k_{t2}$      Heat energy with an addition

**Note:** The energy is calculated only by positive temperature difference.
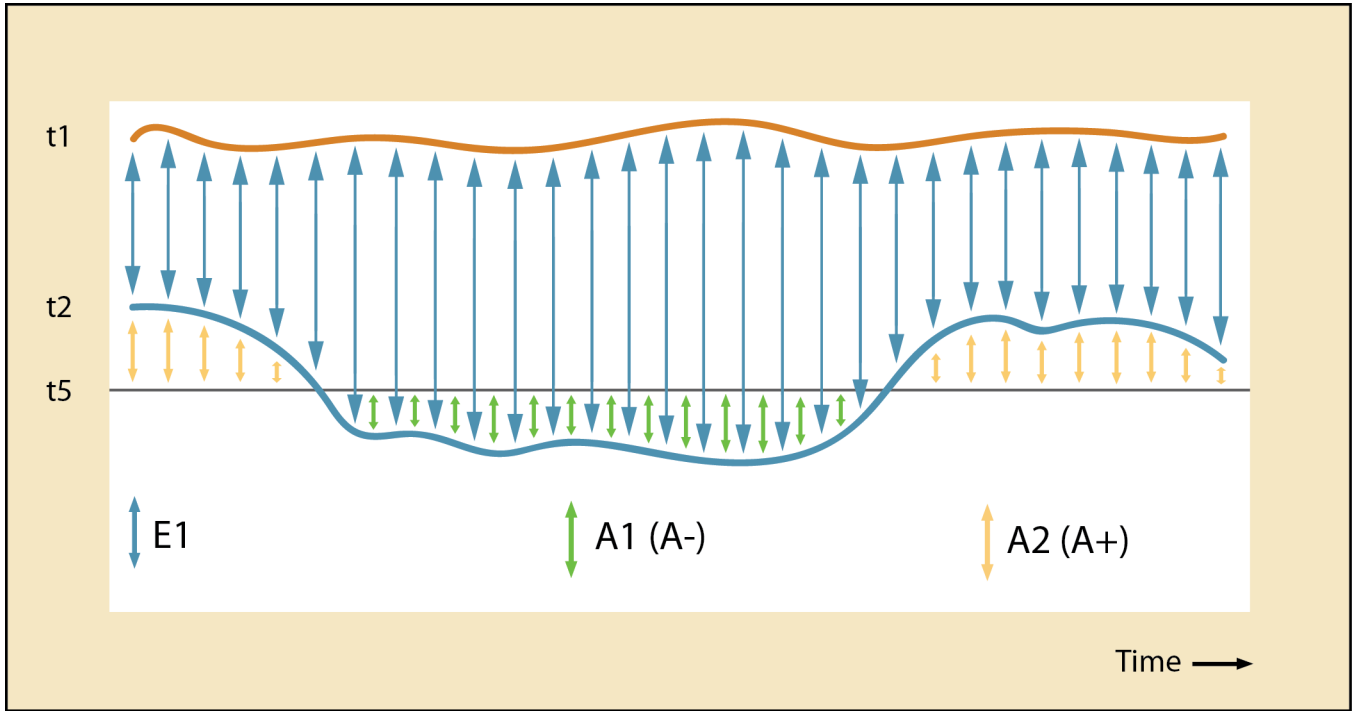


The outlet temperature reference t5 can be factory-configured as required or can be changed via METERTOOL HCW or the "SETUP loop" after delivery. Typical configuration is t5 = 50 °C.

| Symbol | Explanation | Measuring unit |
|--------|-------------|----------------|
| t1 | Inlet temperature | [°C] |
| t2 | Outlet temperature | |
| t5 | Outlet temperature reference | |
| E1 | Total heat energy | [kWh], [MWh], [GJ], [Gcal] |
| A1 | Heat energy at a discount | |
| A2 | Heat energy with an addition | |

As the accuracy of the absolute temperature has direct influence on the accuracy of the outlet energy registers A1 and A2, the zero error of the sensor pair and the influence from the sensors' connection cable ought to be compensated via the offset adjustment of MULTICAL® 803 (see paragraph 7.3).

## 7.2 Measurement of the coefficient of performance of a heat pump

### 7.2.1 Coefficient of Performance (COP)

In houses with heat pumps with one common heat circuit, it is expedient to measure both the released thermal energy and the gained electrical energy, based on which the coefficient of performance (COP or CP) can be calculated. COP is the abbreviation of "Coefficient Of Performance".

The calculation is based on simple proportional numbers between calculated thermal energy (E1) and the electrical energy that is measured via pulse input B1 (In-B1):

$$CP = \frac{Thermal\ energy\ [E1]}{Electrical\ energy\ [Input\ B1]}$$

Electrical energy (In-B1) is registered in kWh or MWh, whereas thermal energy (E1) is either registered in kWh, MWh, Gcal or GJ depending on the selected B code. No matter which unit you choose, the calculator calculates CP correctly. The CP value is displayed with one decimal and is a value in the interval 0.0…19.9.

The CP value can be displayed as a current value, a monthly value or a yearly value (SCOP, Seasonal Coefficient of Performance). In addition, the averaging period of the current CP-value as well as the actual power measured at input B can be displayed.

Current CP is averaged over a number of days and nights selected in the calculator's configuration. The averaging period can be selected in the interval 5…30 days. The averaging period is set to 7 days, unless otherwise stated by the customer.

**Note:** If data of E1 or In-B1 are missing for a logging period, current CP is displayed as 0.0 until the data basis is sufficient.

**CP display readings**

The table below shows the CP readings in the "TECH loop".

| Primary display | Secondary display | Display no. | Display reading |
|---|---|---|---|
| CP (moving average) | | 2-023-00 | 7.3 |
| | Actual power of In-B1 | 2-023-01 | 4 kW |
| | Averaging period of CP | 2-023-02 | 7 |
| | Yearly date | 2-023-03 | 2019.01.01 |
| | Yearly data | 2-023-04 | 3.2 |

| Primary display | Secondary display | Display no. | Display reading |
|---|---|---|---|
| | Monthly date | 2-023-05 | 2019.06.01 |
| | Monthly data | 2-023-06 | 9.7 |

**Reset of CP**

| Situation | Handling |
|---|---|
| Different units and/or resolutions of E1 and In-B1 | Correction for the difference in CP calculation |
| Reconfiguration of unit and/or resolution of E1 (B or CCC code) | Reset of CP calculations [1] |
| Reconfiguration of unit and/or resolution of In-B1 (GG code) | Reset of CP calculations [1] |
| Reconfiguration of presetting of In-B1 | Reset of CP calculations [1] |

[1] *Monthly and yearly CP restart, i.e. CP is calculated over just the remaining period until the next logging. Current CP is set to 0.0 until the daily logger has logged across the configured number of days (if the number of days is, for example, set to 5, the calculator must perform 6 loggings before the calculator can calculate across 5 whole days).*

### 7.2.2    Seasonal Coefficient of Performance (COP)

SCOP is an average measurement of the heat pump efficiency that shows how effective it is on an annual basis. The average yearly value is measured over one year (one season) where the heat pump has experienced both high and low ambient temperatures.

When selecting logger profile (RR code), it is possible to save both yearly and monthly values. Monthly values are calculated as the average of a completed month and yearly values are calculated as the average of a completed year. Month and year are determined by the selected target date.

### 7.2.3    Measurement of the coefficient of performance (CP) of a gas boiler

If the pulse output of a gas meter is connected to the calculator, the coefficient of performance of the gas boiler can be measured, in terms of e.g. kWh/Nm$^3$ gas. A volume resolution that corresponds to the pulse weighting on the gas meter pulse output must then be selected for input B1.

## 7.3 Offset adjustment of temperature sensor measurement

MULTICAL® 803 is available with possible offset adjustment of the temperature sensor measurement, thus increasing the accuracy of the absolute temperature measurement. This is especially relevant in the installation scenario in which the calculator is to be used for tariff billing based on absolute temperatures. In that case, it is an EN 1434 requirement that the accuracy of the calculator's absolute temperature reading must be within ± 1.0 K. Offset adjustment is extremely relevant in district cooling installations too. In district cooling installations, the customer often requires a maximum inlet temperature. Absolute temperature measurement with undesirable inaccuracy can cause the supplier to supply water with a lower inlet temperature than promised, resulting in unnecessary extra costs for the supplier.

The offset adjustment is <u>not</u> programmed at delivery of the calculator as the calculator is not supplied with mounted temperature sensors. The offset must thus be programmed after delivery via the calculator's "SETUP loop" (see paragraph 6.3) or via METERTOOL HCW. See the technical description of METERTOOL HCW (5512-2097).

**Note:** This is only possible if offset adjustment has been selected when placing the order.
Depending on the calculator's configuration, the offset adjustment can be disabled and the menu item in the "SETUP loop" will in that case display "OFF".

If the temperature sensor pair of a calculator with offset adjustment is replaced, it is recommended to correct the offset so that it matches the newly connected sensor pair. Alternatively, offset should be adjusted to 0.00 K, which means that the function is switched off and does not contribute to an undesirable increase of the error of the absolute temperature measurements.

---

**Note that the offset adjustment affects connected temperature sensors on both t1, t2, t3 and t4.**
Due to this, it is recommended to disable the offset adjustment when the meter is installed with four temperature sensors. The offset adjustment is intended for use with sensor pairs and 3-set sensors.

**Note:** The offset adjustment is only active on measured temperatures. If, for example, t3 has been selected for a preset value, the offset adjustment will not influence the preset value.

---

The temperature sensor offset ($t_{r0}$) can be adjusted in the interval -0,99...0,99 K according to the calculator's approval.

---

**Note that the required offset adjustment must be entered, not the error of the temperature sensor pair.**
If the selected temperature sensor pair contributes with an error of -0,20 K, the meter's offset must be set to 0,20 K.

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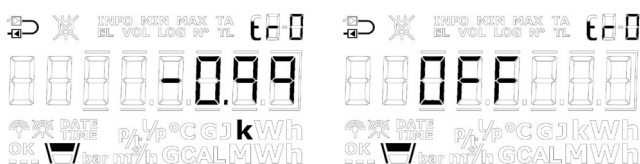
# MULTICAL® 803

## 7.4 Bifunctional heat/cooling metering

MULTICAL® 803 is available as heat meter (meter type 2), cooling meter (meter type 5) or bifunctional heat/cooling meter (meter type 3 and 6).

| Meter type | | |
|---|---|---|
| Heat meter (MID modules B+D) | | 2 |
| Heat/cooling meter (MID modules B+D & TS+DK268) | $\Theta_{hc}$ = OFF | 3 |
| Cooling meter (TS27.02+DK268) | | 5 |
| Heat/cooling meter (MID modules B+D & TS27.02+DK268) | $\Theta_{hc}$ = ON | 6 |
| Country code (language on label, etc.) | | XX |

If MULTICAL® 803 has been supplied as a heat/cooling meter (meter type 3 and 6), heat energy (E1) is measured at a positive temperature difference (t1>t2), whereas cooling energy (E3) is measured at a negative temperature difference (t1<t2). Temperature sensor t1 (marked in red) is mounted in the inlet, whereas t2 (marked in blue) is mounted in the outlet.
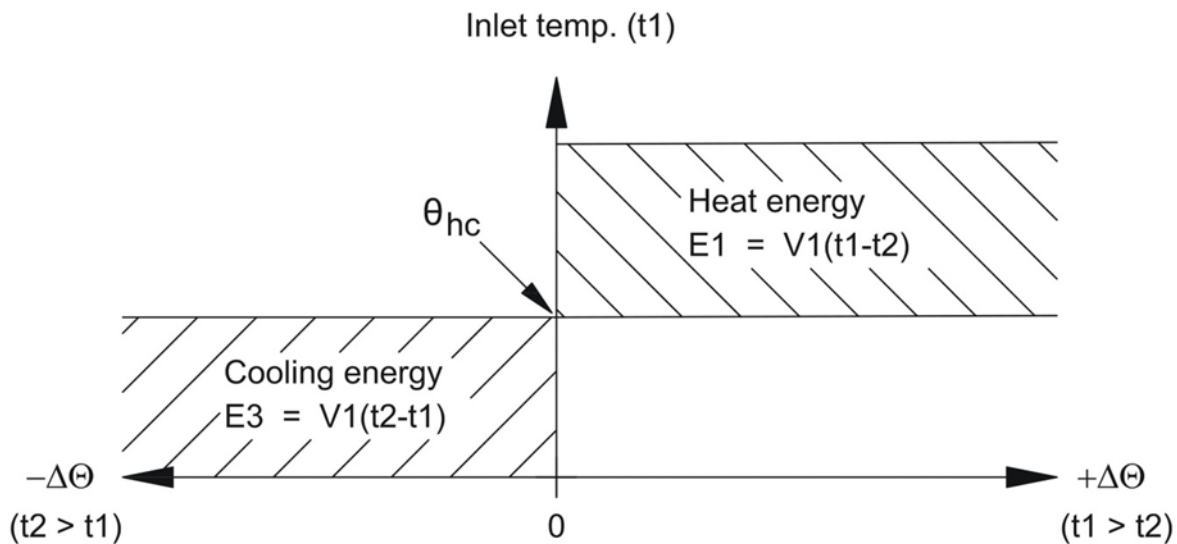


$\theta_{hc}$ acts as a limit value for the measurement of heat/cooling energy. With $\theta_{hc}$ enabled, heat energy is only measured when t1 is greater than or equal to $\theta_{hc}$. Likewise, cooling energy is only measured if the inlet temperature t1 is lower than $\theta_{hc}$.

In heat/cooling meters, the limit value $\theta_{hc}$ should be set to the highest temperature which has appeared in the inlet in connection with cooling, e.g. 25 °C. If the calculator is to be used for billing, $\theta_{hc}$ is a legal value and this appears from the display.

Configuration of the function $\theta_{hc}$ is only possible in meter type 6. Configuration is possible in the interval 0,01..180,00 °C. In order to disable $\theta_{hc}$, this value must be configured to 250,00 °C. In other meter types than meter type 6, $\theta_{hc}$ is permanently "OFF" in the configuration. $\theta_{hc}$ is configured via the "SETUP loop" or METERTOOL HCW. See paragraph 6.3 and the technical description of METERTOOL HCW (5512-2097) for further information.

**Note:** There is no hysteresis in connection with shift between heat and cooling energy measurement ($\Delta\theta_{hc}$= 0,00 K).

## 7.5 Min./max calculations of power (P), flow (Q) and temperature (t)

Just like MULTICAL® 603, MULTICAL® 803 registers minimum and maximum flow and power on both a monthly and yearly basis. It is unique to MULTICAL® 803 that this calculator also has the possibility of registering the minimum and maximum temperatures of t1 and t2 on a monthly and yearly basis. Further, the time-based average temperatures of t1, t2, t3 and t4 are registered on a daily and hourly basis.

| | MULTICAL® 603 | MULTICAL® 803 | Year | Month | Day | Hour |
|---|---|---|---|---|---|---|
| Flow V1 max year date | • | • | • | | | |
| Flow V1 max year | • | • | • | | | |
| Flow V1 min. year date | • | • | • | | | |
| Flow V1 min. year | • | • | • | | | |
| Power max year date | • | • | • | | | |
| Power max year | • | • | • | | | |
| Power min. year date | • | • | • | | | |
| Power min. year | • | • | • | | | |
| Flow V1 max month date | • | • | | • | | |
| Flow V1 max month | • | • | | • | | |
| Flow V1 min. month date | • | • | | • | | |
| Flow V1 min. month | • | • | | • | | |
| Power max month date | • | • | | • | | |
| Power max month | • | • | | • | | |
| Power min. month date | • | • | | • | | |
| Power min. month | • | • | | • | | |
| COP year | • | • | • | | | |
| COP month | • | • | | • | | |
| t1 max year date/time | | • | • | | | |
| t1 max year | | • | • | | | |
| t1 min. year date/time | | • | • | | | |
| t1 min. year | | • | • | | | |
| t2 max year date/time | | • | • | | | |
| t2 max year | | • | • | | | |
| t2 min. year date/time | | • | • | | | |
| t2 min. year | | • | • | | | |
| t1 max month date/time | | • | | • | | |
| t1 max month | | • | | • | | |
| t1 min. month date/time | | • | | • | | |
| t1 min. month | | • | | • | | |
| t2 max month date/time | | • | | • | | |
| t2 max month | | • | | • | | |
| t2 min month date/time | | • | | • | | |
| t2 min month | | • | | • | | |

# MULTICAL® 803

| | MULTICAL® 603 | MULTICAL® 803 | | Year | Month | Day | Hour |
|---|---|---|---|---|---|---|---|
| t1 time average day | • | • | | | | • | |
| t2 time average day | • | • | | | | • | |
| t3 time average day | • | • | | | | • | |
| t4 time average day | | • | | | | • | |
| | | | | | | | |
| t1 time average hour | • | • | | | | | • |
| t2 time average hour | • | • | | | | | • |
| t3 time average hour | • | • | | | | | • |
| t4 time average hour | | • | | | | | • |

The registration can be read in full via data communication. In the display, it is possible to see the current minimum and maximum registration of the current year and month[1]. Furthermore, the two latest yearly registrations and the latest 12 monthly registrations can be read in the "USER loop"[1]. It depends on the selected display code (DDD code) whether these registrations are displayed in the "USER loop". Read more about the DDD code in paragraph 3.4.

The dates on which minimum or maximum values were measured are displayed in the format 20YY.MM.DD[1]. Using serial reading, the time (hh.mm.ss) can be included too. Below you see the complete overview of the registers in the display.

[1] *Applies only to the readings of flow, power and COP while time-based average temperatures are only available via serial communication.*

**Note:** Historical readings (logging values) are not part of the "TECH loop". They are only displayed in the "USER loop" and only if the DDD code in question includes these readings.

**Flow (V1)**

| "USER loop" | |
|---|---|
| 12.1 | Date of max this year |
| 12.2 | Data of max this year |
| 12.3 | Date of max yearly logger |
| 12.4 | Data of max yearly logger |
| 12.5 | Date of max this month |
| 12.6 | Data of max this month |
| 12.7 | Date of max monthly logger |
| 12.8 | Data of max monthly logger |
| 12.9 | Date of min. this year |
| 12.10 | Data of min. this year |
| 12.11 | Date of min. yearly logger |
| 12.12 | Data of min. yearly logger |
| 12.13 | Date of min. this month |
| 12.14 | Data of min. this month |
| 12.15 | Date of min. monthly logger |
| 12.16 | Data of min. monthly logger |

**Thermal power (V1)**

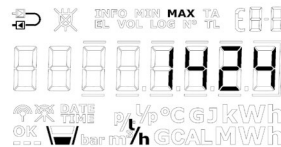| "USER loop" | |
|---|---|
| 14.1 | Date of max this year |
| 14.2 | Data of max this year |
| 14.3 | Date of max yearly logger |
| 14.4 | Data of max yearly logger |
| 14.5 | Date of max this month |
| 14.6 | Data of max this month |
| 14.7 | Date of max monthly logger |
| 14.8 | Data of max monthly logger |
| 14.9 | Date of min. this year |
| 14.10 | Data of min. this year |
| 14.11 | Date of min. yearly logger |
| 14.12 | Data of min. yearly logger |
| 14.13 | Date of min. this month |
| 14.14 | Data of min. this month |
| 14.15 | Date of min. monthly logger |
| 14.16 | Data of min. monthly logger |

Below you see examples of the date and data display readings. The frames around the date indicate whether the date is connected to yearly or monthly data. In data readings of yearly data, the last two digits of the year are marked in frames, whereas the two digits for month are marked for monthly data. Furthermore, the symbols "MIN" and "MAX" are shown to indicate whether the values are minimum or maximum values. The symbol "LOG" is shown for historical readings.

### Examples of yearly date and data (max values) for flow
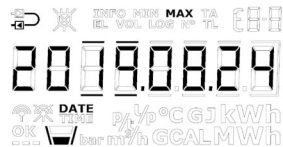
| Date of max this year | Data of max this year |
|---|---|



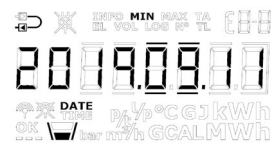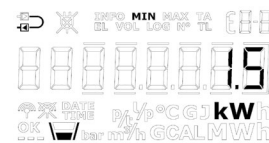| Date of max yearly logger | Data of max yearly logger |
|---|---|
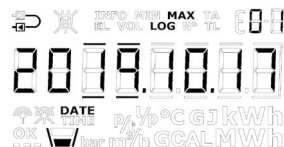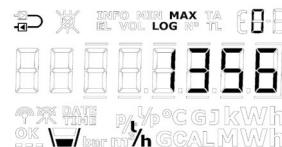


### Examples of monthly date and data (min. values) for power

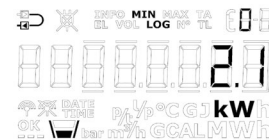| Date of min. this month | Data of min. this month |
|---|---|



| Date of min. monthly logger | Data of min. monthly logger |
|---|---|
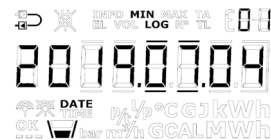


All minimum and maximum values are calculated as the average of a number of current measurements depending on the selected length of the averaging period. All calculated values from the averaging period are used in the calculation of the average. The calculated average value is compared to previous average values, and the new average value is saved as maximum or minimum if it exceeds the previous maximum value or is lower than the previous minimum value. The averaging period used for flow and power can be selected in the range 1…1440 minutes in intervals of 1 minute (1440 minutes = 24 hours). The averaging period and the target dates are stated in the order. Read more about order data in paragraph 3.5. If not otherwise stated in the order, the default averaging period of 60 minutes is used. This value can later be changed via the "SETUP loop" or METERTOOL HCW.

Note the following:

- In the display of logged flow and power, average is shown in the format 20YY.MM.DD, but by serial reading, the time can be stated too, and the format then becomes YY.MM.DD, hh.mm.ss.

- The average is calculated continuously over time, i.e. the average of values is calculated as from now and the length of the averaging period back in time. This means that the min./max calculation is immune to the clock setting and will always move continuously through the time.

## 7.6 Temperature measurement

Inlet and outlet temperatures are measured by means of an accurately matched Pt500 or Pt100 sensor pair. During each temperature measurement, MULTICAL® 803 sends measuring current through each sensor. The current is approx. 0.5 mA for Pt500 and approx. 2.5 mA for Pt100. Two measurements are carried out in order to suppress possible 50 Hz (or 60 Hz) low-frequency noise picked up via the sensor cables. Furthermore, current measurements are made by internal reference resistors in order to secure optimum measuring stability.

The display presents inlet and outlet temperatures in the range 0,00 °C to 185,00 °C. The temperature difference is presented in the area 0,01 K to 185,00 K.

By default, the meter has no cut-off for low temperature and thus measures down to 0,01 °C and 0,01 K. If required, it is possible, when ordering the meter, to program a cut-off for the temperature difference (ΔΘ) in the range 0,01…2,50 K. It is <u>not</u> possible to program this with METERTOOL. If the meter is programmed with a cut-off of 2,50 K, it will not calculate energy and volume at a temperature difference below 2,50 K.

**Note** Cut-off for the temperature difference should be distinguished from $\theta_{hc}$, which functions as a limit value of the heat/cooling energy measurement. See paragraph 7.4.

Inlet or outlet temperatures below 0 °C and above 185 °C are indicated as lines in the display, but serial reading includes 0,00 °C and 185,00 °C, respectively. If one or both temperature sensors are outside the measuring range, the info code is set as shown in paragraph 7.8.

At a negative temperature difference (inlet < outlet), the temperature difference is displayed with a negative sign and cooling energy is calculated. It depends on the selected DDD code whether the temperature difference appears in the display.

**Measuring current and power**

Measuring current is only sent through the temperature sensors during the short duration of the temperature measurement. The effective power that is deposited in the sensor elements is thus very small, and its influence on self-heating of the temperature sensors is typically less than 1/1000 K.

|  | Pt100 | Pt500 |
|---|---|---|
| Measuring current | < 2,5 mA | < 0,5 mA |
| Peak power | < 1,0 mW | < 0,2 mW |
| RMS influence (fast mode) | < 10 µW | < 2 µW |
| RMS influence (normal mode) | < 2 µW | < 0,4 µW |

**Volume-based average temperatures**

MULTICAL® 803 calculates the current average temperature of inlet and outlet (t1, t2 and t3) in full °C and the background calculations E8, E9, E10 and E11 are made for each integration determined by the calculator's integration time (L code). The average calculations are thus volume-weighted and can be used directly for checking purposes.

**Preprogrammed temperatures**

The temperatures t2, t3 and t4 can either be measured or programmed in the calculator's memory while temperature t5 can only be programmed. The temperature input t2 is a legal input, which means that this cannot be programmed on an approved heat meter, cooling meter or bifunctional heat/cooling meter.

See paragraph 7.1 for examples of the use of these extra temperatures.

## 2-wire sensor connection

The temperature sensor inputs of MULTICAL® 803 are designed with 4-wire sensor inputs. Therefore, when using 2-wire sensor pairs, always mount the jumper as shown in *Figure 7* or short-circuit the right and left connection terminals, respectively, in the 4-wire input, as shown in *Figure 8*

For all 2-wire sensor connections, it applies that the cable length and cross section of the two sensors which are used as temperature sensor pair for a heat or cooling meter must always be identical, and the delivered cable length must neither be shortened nor extended.

The limitations connected to the use of 2-wire sensor pairs according to EN 1434-2 appear from the table below. In addition, the table indicates how much error the longer 2-wire cables will cause.

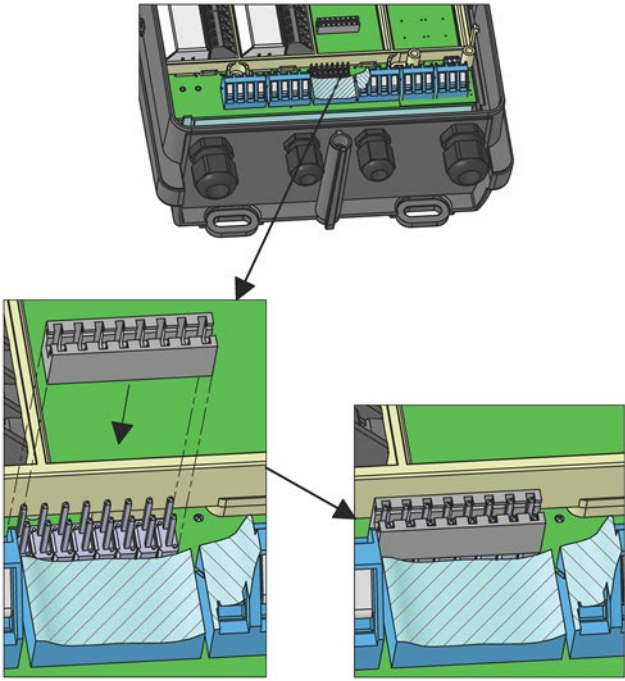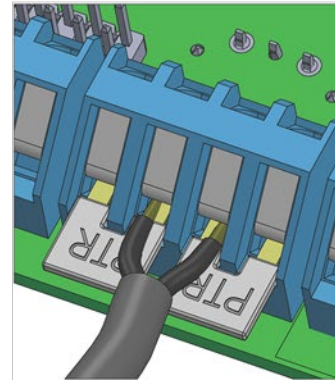Kamstrup delivers Pt500 sensor pairs with up to 10 m cable (2 x 0,25 mm²).



*Figure 7*



*Figure 8*

| Cable cross section [mm²] | Pt100 sensors | | Pt500 sensors | |
|---|---|---|---|---|
| | Max cable length [m] | Error [1] [K/m] | Max cable length [m] | Error [1] [K/m] |
| 0,25 | 2,5 | 0,450 | 12,5 | 0,090 |
| 0,50 | 5,0 | 0,200 | 25,0 | 0,040 |
| 0,75 | 7,5 | 0,133 | 37,5 | 0,027 |

*Table 4*

[1] *The error is calculated for copper cable at 20 °C. At higher cable temperatures, the error will be greater.*

MULTICAL® 803 has a temperature sensor offset function that can be used to reduce the error display, which originates from the cable resistance and zero error of the sensors. Read more about offset adjustment in paragraph 7.3.

**4-wire sensor pair**

For installations requiring longer cables than listed in the table above, it is recommended to use 4-wire sensor pairs. By default, MULTICAL® 803 is prepared for 4-wire connection on all temperature sensor inputs.
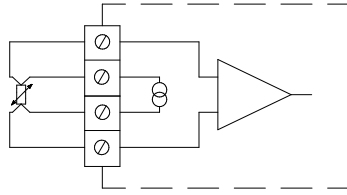


MULTICAL® 803 has a "real" 4-wire measurement, which uses two conductors for measuring current and two conductors for measuring signal, which means that the measurement is in theory uninfluenced by long sensor cables. In practice, cables ought not to be longer than 100 m and it is recommended to use 4 x 0.25 mm$^2$.
As the 4-wire signal inputs have a very high impedance, a disconnected wire could lead to an arbitrary temperature and the information code "Above the measuring range" (sensor disconnected) or "Below the measuring range" (sensor short-circuited) would be displayed

The connection cable ought to have an outer diameter of 5-6 mm in order to obtain optimum tightness of both MULTICAL® 803 and the screw joint for the 4-wire sensor. The isolation material/cover of the cable ought to be selected on the basis of the maximum temperature in the installation. PVC cables are normally used up to 80 °C and for higher temperatures, silicone cables are often used.

**Note:** When presetting temperatures of 4-wire connections, it is important to insert jumpers in the connection terminals of the 4-wire sensor inputs that have preset (e.g. jumper between connection terminals 4-8 and jumper between connection terminals 7-3 at preset of t2) as described in the paragraph above about 2-wire sensors.

## 7.7  Auto Detect Pt100/Pt500

MULTICAL® 803 can be delivered with the possibility of automatic detection of the connected Pt sensor type, either Pt100 or Pt500. However, it is possible to lock the temperature sensor type on the MULTICAL® 803 country code so that the type is locked to either Pt100 or Pt500. For MULTICAL® 803, with the possibility of Auto Detect Pt (Pt100/Pt500), it is also possible to choose via METERTOOL HCW whether the calculator must be set to Pt100, Pt500 or Auto Detect Pt. See the technical description of METERTOOL HCW (5512-2097).

With active Auto Detect Pt in MULTICAL® 803, the registration of the connected Pt sensors takes place when the calculator top and bottom are assembled after separation as is the case of Auto Detect UF (ULTRAFLOW® X4), see paragraph 8.1.1.

Any conversion from one Pt sensor type to another can only be carried out if it is ensured that MULTICAL® 803 has measured absolutely correctly for one of the Pt sensor types and that a clear error has been measured for the other Pt sensor type, see criteria for conversion in the table below.

### Auto Detect Pt criteria for change

| Pt100 | | | | Pt500 | | | | Result |
|---|---|---|---|---|---|---|---|---|
| t1 | t2 | t3 | t4 | t1 | t2 | t3 | t4 | MULTICAL® 803 configuration |
| OK | OK | OK | OK | Error | Error | Error | Error | MULTICAL® 803 is set to Pt100. |
| Error | Error | Error | Error | OK | OK | OK | OK | MULTICAL® 803 is set to Pt500. |

**Note:** Inputs without connected Pt sensors are not included in the Pt type control.

In case of scenarios where the absoluteness is not measured as shown above, MULTICAL® 803 does not change its configuration, but shows an info code that indicates the input of the error connection as well as the type of the error connection, see paragraph 7.8 about information codes.

### Example 1 - Proper connection and change of configuration:

MULTICAL® 803 is fitted with and set to Pt100, the temperature sensor type is replaced by Pt500. Only t1 and t2 are used.

1. Remove the calculator top from the calculator base by loosening the two screws in the calculator top and base.
2. Disassemble the cable connections in the connection terminals for t1 and t2.
3. Loosen the cable connections for the sensor cables for t1 and t2 and remove the cables from the calculator base.
4. Lead the sensor cables of the Pt500 sensor pair through the now empty cable connections and tighten the connections so that they are tight.
5. Mount the cables from the new Pt500 sensor pair correctly in the connection terminals for t1 and t2, respectively, see paragraph 4.4.
6. Mount the calculator top on the calculator base and tighten the two screws in the top and at the bottom.
7. Auto Detect Pt is performed by MULTICAL® 803[2] and the set Pt type can be read on the display.

### Example 2 – Error connection and no change of configuration:

MULTICAL® 803 is fitted with and set to Pt100, the temperature sensor type is replaced by Pt500 on t1. Only t1 and t2 are used.

1. Remove the calculator top from the calculator base by loosening the two screws in the calculator top and base.
2. Disassemble the cable connections in the connection terminals for t1.
3. Loosen the cable connections for the sensor cable for t1 and remove the cables from the calculator base.
4. Lead the sensor cable of the Pt500 sensor through the now empty cable connection and tighten the connection so that it is tight.
5. Mount the cables from the new Pt500 sensor correctly in the connection terminals for t1, see paragraph 4.4.
6. Mount the calculator top on the calculator base and tighten the two screws in the top and at the bottom.
7. Auto Detect Pt is performed by MULTICAL® 803[2] that will show an info code indicating that t1 is disconnected or above the measuring range, which indicates that t1 does not match the set Pt type.

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## Display readings in connection with Auto Detect Pt

| | | |
|---|---|---|
| ① | ⇑ ⇓ | Break the installation seal[1] and separate the calculator top and base |
| ② | | Mount temperature sensors on the temperature sensor inputs on MULTICAL® 803 as specified in paragraph 4.4 |
| ③ | ⇓ ⇑ | Assemble the calculator top and bottom[2] |
| ④ | **SEArCH** <br> *Display duration is typically 5 s* | Observe the flashing display on MULTICAL® 803, which indicates that the mounted Pt type[3] is being searched for |
| ⑤ | **SEArCH** <br> OK <br> *Display duration is 5 s* | Observe the static display on MULTICAL® 803, which indicates that the Pt type has been found and registered[4] |
| ⑥ | **0039.297 MWh** | MULTICAL® 803 automatically switches to the primary energy display in the "USER loop" |

[1] Remember to restore the seal installation after Auto Detect Pt.

[2] Note that MULTICAL® 803 has a built-in engagement delay of up to 20 seconds to ensure that all plug connections between calculator top and base are established before a detection of Pt sensors and/or ULTRAFLOW® X4 is initiated.

[3] If Auto Detect UF for ULTRAFLOW® X4 is switched on, the text in the upper right corner of the display will alternately show **UF** and **Pt**. See more about Auto Detect UF in paragraph 8.1.1.

[4] A config logging is carried out every time MULTICAL® 803 registers a change of Pt type on the temperature sensor inputs.

## 7.8   Information code types

MULTICAL® 803 constantly monitors a number of important functions. If a serious error occurs in the measuring system or installation, a flashing "INFO" appears in the display. The "INFO" field keeps flashing as long as the error is present no matter which reading you choose. The "INFO" field automatically disappears when the reason for the error has been removed.

**Note:** Configuration of "Manual reset of info code" is not possible in MULTICAL® 803.

### 7.8.1   Information code types in display

In MULTICAL® 803, each digit of the info code is dedicated to one of the calculator's inputs. For example, the second digit from the left in the display is always related to information on temperature sensor t1. At the same time, the info code is divided into sections so that a reading from left to right consists of: general information, temperature information (t1, t2, t3, t4), flow information (V1, V2) and information about the pulse inputs A and B (In-A1/A2 and In-B1/B2). See the table below for an overview of the info codes and response times.

**Note:** The temperature inputs t3 and t4 share info codes, which means that it only takes one event on one of the inputs to trigger an info code. If, for example, just one of these two inputs are above the measuring range, the info code will be "000**1**0000".

| Display digit | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| Info | t1 | t2 | t3/ t4 | V1 | V2 | In-A | In-B | Description | Response time for active INFO |
| 1 | | | | | | | | Supply voltage interrupted [1] | - |
| 2 | | | | | | | | The calculator is supplied by the backup battery [4] | < 3 minutes |
| 9 | | | | | | | | External alarm (e.g. via KMP) | < 1 second |
| | 1 | | | | | | | t1 above measuring range or switched off [3] | < 3 minutes |
| | | 1 | | | | | | t2 above measuring range or switched off [3] | < 3 minutes |
| | | | 1 | | | | | t3/t4 above measuring range or switched off [3] | < 3 minutes |
| | 2 | | | | | | | t1 below measuring range or short-circuited [3] | < 3 minutes |
| | | 2 | | | | | | t2 below measuring range or short-circuited [3] | < 3 minutes |
| | | | 2 | | | | | t3/t4 below measuring range or short-circuited [3] | < 3 minutes |
| | 9 | 9 | | | | | | t1-t2 Invalid temperature difference | < 3 minutes |
| | | | | 1 | | | | V1 Communication error | < 1 day |
| | | | | | 1 | | | V2 Communication error | < 1 day |
| | | | | 2 | | | | V1 Wrong pulse figure | < 1 day |
| | | | | | 2 | | | V2 Wrong pulse figure | < 1 day |
| | | | | 3 | | | | V1 Air | < 1 day |
| | | | | | 3 | | | V2 Air | < 1 day |
| | | | | 4 | | | | V1 Wrong flow direction | < 1 day |
| | | | | | 4 | | | V2 Wrong flow direction | < 1 day |
| | | | | 6 | | | | V1 Increased flow (flow1 > qs, for more than 1 hour) | < 1 hour |
| | | | | | 6 | | | V2 Increased flow (flow2 > qs, for more than 1 hour) | < 1 hour |
| | | | | 7 | | | | V1/V2 Burst, water loss (flow1 > flow2) | < 120 seconds |
| | | | | | 7 | | | V1/V2 Burst, water penetration (flow1 < flow2) | < 120 seconds |
| | | | | 8 | | | | V1/V2 Leakage, water loss (M1 > M2) | < 1 day |
| | | | | | 8 | | | V1/V2 Leakage, water penetration (M1 < M2) | < 1 day |
| | | | | | | 7 | | In-A2 Leakage in the system | < 1 day |
| | | | | | | 8 | | In-A1 Leakage in the system | < 1 day |
| | | | | | | 9 | | In-A1/A2 External alarm | < 5 seconds |
| | | | | | | | 7 | In-B2 Leakage in the system [2] | < 1 day |
| | | | | | | | 8 | In-B1 Leakage in the system [2] | < 1 day |
| | | | | | | | 9 | In-B1/B2 External alarm | < 5 seconds |

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[1] *This info code parameter does not appear from the current info code as it is only active when the calculator is without supply. The info code is saved in the info log, and thus it appears from the info log that the calculator has been without power supply and restarted.*

[2] *Info code for leakage on pulse input B must be actively selected.*

[3] *As the 4-wire signal inputs have a very high impedance, a disconnected wire could lead to an arbitrary temperature and the information code "Above measuring range" (sensor disconnected) or "Below measuring range" (sensor short-circuited) would be displayed.*

[4] *This info code indicates that the mains supply is disconnected. However, the calculator is active because of the backup battery.*

**Note:** Info codes are configurable. Therefore, it is not certain that all the above parameters are available in a given MULTICAL® 803. This depends on the selected country code.

## Examples of information codes

### Flashing "INFO"
If the information code is different from "00000000", a flashing "INFO" appears in the calculator's display.
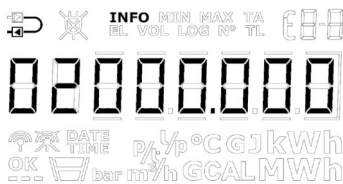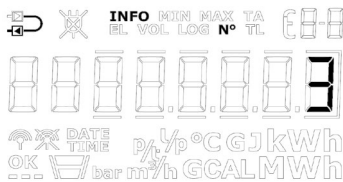
### Current information code
The current info code can be displayed by scrolling to the info code reading using the keys on the calculator front. When the current info code is displayed, "INFO" stops flashing.

*In the example, the current info code indicates that t1 is below the measuring range or short-circuited.*

Current INFO code

### Info event counter
The info event counter is a secondary reading for the info code that shows how many times the info code has been changed.
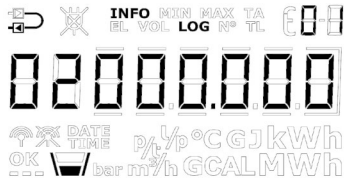The value is increased every time the info code is changed.
The info event counter of a new calculator is 0 as the transport state prevents counting during transportation.

### Info logger
The first display reading states the date of the latest info code change.

The display reading shows the info code of the preshown date. Repeated activations of the front keys alternately induce date and corresponding info code. The data logger saves the latest 280 changes. The latest 50 changes can be displayed. All 50 changes can be read by means of METERTOOL. The whole info log (280 changes) can be displayed via LogView HCW.

**Note:** The info code is saved in the calculator's data logger too for diagnostic purposes.

In case of error, the info code types related to the calculator's different sensors will influence the display readings to which they are tied. In connection with current values for temperatures and power, three horizontal lines appear in the display, and the energy registers, in which counting is dependent on the sensor function, are not accumulated. See paragraphs 6 and 7.7 for further information on sensor errors.

## Temperature sensor error

The error can be due to the sensor being disconnected or short-circuited. An erroneous ΔΘ alone will not be considered a temperature sensor error.

In case of an error in one or more temperature sensors (t1, t2, t3 and t4), the value of the serial communication of the sensor in question will be 0,00 °C (lowest valid temperature) or 185.00 °C (highest valid temperature), respectively, depending on the measurement being below range (sensor short-circuited) or above range (sensor disconnected). The display reading of the sensor in question shows lines in the three digits to the far right in the display, independent of the cause of the error. Decimal points are not included.

The display readings of ΔΘ and actual power also show three lines for errors in one or more temperature sensors. In serial communication, the value is 0,00 K and 0,0 kW.

## Information codes in transport state

The calculator leaves the factory in transport state, i.e. the info codes are only active in the display, not in the calculator's data logger. This prevents info events from being counted and non-relevant data from being saved in the info log during transportation. The first time the calculator registers flow after the installation, the info code automatically becomes active.

## Update of info codes for flow

As shown in the table above, info codes from ULTRAFLOW® X4 are updated once a day. If you want to see the current info code status from ULTRAFLOW® X4, you can perform an update by switching to the display view with the current info code. This view is identified through a constantly lit "INFO" segment on the display. When you have switched to the view with the current info code, the info code from ULTRAFLOW® X4 is updated in the display every 10 seconds.

# MULTICAL® 803

## 7.8.2 Information code types at serial communication

| Bit | Value | Info |
|---|---|---|
| 0 | 1 | Supply voltage interrupted |
| 1 | 2 | The calculator is supplied by the backup battery |
| 2 | 4 | External alarm (e.g. via KMP) |
| 3 | 8 | t1 Above measuring range or switched off |
| 4 | 16 | t2 Above measuring range or switched off |
| 5 | 32 | t1 Below measuring range or short-circuited |
| 6 | 64 | t2 Below measuring range or short-circuited |
| 7 | 128 | Wrong Δt (t1-t2) |
| 8 | 256 | V1 Air |
| 9 | 512 | V1 Wrong flow direction |
| 10 | 1024 | - |
| 11 | 2048 | V1 Increased flow (flow1 > qs, for more than 1 hour) |
| 12 | 4096 | In-A1 Leakage in the system |
| 13 | 8192 | In-B1 Leakage in the system |
| 14 | 16384 | In-A1/A2 External alarm |
| 15 | 32768 | In-B1/B2 External alarm |
| 16 | 65536 | V1 Communication error |
| 17 | 131072 | V1 Wrong pulse figure |
| 18 | 262144 | In-A2 Leakage in the system |
| 19 | 524288 | In-B2 Leakage in the system |
| 20 | 1048576 | t3/t4 above measuring range or switched off |
| 21 | 2097152 | t3/t4 below measuring range or short-circuited |
| 22 | 4194304 | V2 Communication error |
| 23 | 8388608 | V2 Wrong pulse figure |
| 24 | 16777216 | V2 Air |
| 25 | 33554432 | V2 Wrong flow direction |
| 26 | 67108864 | - |
| 27 | 134217728 | V2 Increased flow (flow2 > qs, for more than 1 hour) |
| 28 | 268435456 | V1/V2 Burst, water loss (flow1 > flow2) |
| 29 | 536870912 | V1/V2 Burst, water penetration (flow1 < flow2) |
| 30 | 1073741824 | V1/V2 Leakage, water loss (M1 > M2) |
| 31 | 2147483648 | V1/V2 Leakage, water penetration (M1 < M2) |

## 7.9 Transport state

Before MULTICAL® 803 has detected a flow of 1 % of $q_p$ or larger for the first time, the calculator is in transport state. The transport state includes that:

- No info codes are saved in the calculator's logger and the info event counter is not active.
- A power saving measuring sequence is used.
- The "SETUP loop" is accessible, which enables you to configure the calculator before commissioning.
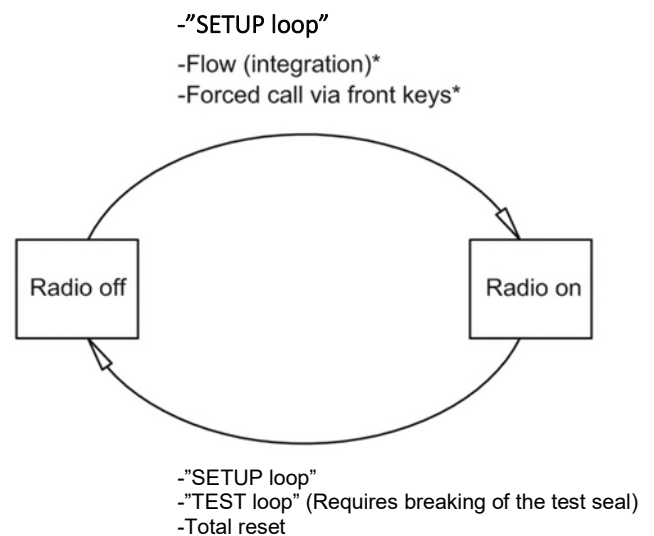  **Note:** In general, the "SETUP loop" is available. It can, however, be limited by the selected country code.

Note that the access to the "SETUP loop" is blocked and the calculator leaves transport state if the configuration in the "SETUP loop" is ended by the function "EndSetup". When the calculator has left the transport state, info codes are logged. The calculator cannot revert to transport state unless a total reset is made. The access to the "SETUP loop" can, however, be opened again by separating the calculator top and base. However, this requires breaking the installation seal, see paragraph 4.8.

-Flow (integration)
-EndSetup

Transport state → Commissioned

-Total reset
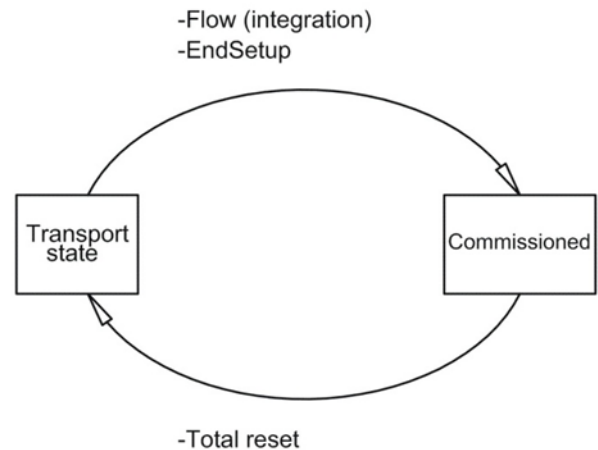
### Radio communication

On delivery, the calculator is in transport state and the calculator's radio communication is deactivated. The radio is activated when the calculator for the first time has detected a flow of 1 % of $q_p$ or greater. In transport state and after commissioning of the calculator, the radio can be enabled either via the "SETUP loop" or by making a forced dial-up (both arrow keys are activated until "CALL" is displayed). Enabling the radio does _not_ cause the calculator to leave transport state. Read more about how to deactivate radio communication in paragraph 6.4 on the "SETUP loop".

-"SETUP loop"
-Flow (integration)*
-Forced call via front keys*

Radio off → Radio on

-"SETUP loop"
-"TEST loop" (Requires breaking of the test seal)
-Total reset

*If the meter is in "TEST loop" the radio remains off at flow (integration) and forced call

### Test mode

Access to the "TEST loop" will disable radio communication. In the "TEST loop", flow measurement will _not_ enable the radio.

**Note:** In order to gain access to the "TEST loop", the test seal (verification seal) must be broken and the calculator must subsequently be reverified.

## 7.10 Info logger

Every time the information code changes, the below registers are logged.

| Register type | Description |
|---|---|
| Date (20YY.MM.DD) | Year, month and day of logging time. |
| Clock (hh.mm.ss) | Time |
| Info | Information code on above date |
| E1 | Heat energy |
| E3 | Cooling energy |
| V1 | Volume |

It is possible to data read the latest 280 changes of the information code as well as the dates the changes were made. When the information code is read from the display, the latest 50 changes including dates can be read. All of the 280 changes can also be read by means of LogView HCW.

### Info event

Every change of a parameter of the info code results in an info event if the selected country code is configured with the parameter. It is therefore not certain that all parameters result in an info event.

An info event results in accumulation of the info event counter as well as logging in the info logger. This does not apply as long as the calculator is in transport state or if the calculator top and base are physically separated.

Reconfiguration of active parameters of the info code will influence future info codes, whereas all logged info codes remain as they were at the time of logging.

## 7.11 Config logger

Every time the configuration is changed, the below register types are logged. It is possible to data read the latest 50 changes of the config log as well as the date the changes were made. The calculator permits only 50 changes unless you break the legal seal and carry out a total reset of the calculator, which also resets the config log.

**Note:** The 50th change of configuration must be carried out on the installation site, i.e. either via the "SETUP loop" or via METERTOOL HCW.

| Register type | Description |
|---|---|
| Date (20YY.MM.DD) | Year, month and date of change are saved. |
| Hour (hh.mm.ss) | Time is saved. |
| Configuration number | The new configuration number is saved. |
| E1, E3 and V1 | Meter counts are saved right after reconfiguration. |
| Hour counter | Hour counter is saved. |
| t offset | The temperature offset value is saved. |
| V1 meter factor | The meter factor of V1 (imp/l or l/imp) is saved. |
| V1 $q_p$ | Nominal flow $q_p$ is saved. |
| Pt type | Pt type (Pt100 or Pt500) is saved. |

The calculator will always carry out a config logging if the user has had access to the "SETUP loop", no matter whether the user has changed the configuration or not.

## 7.12 Summer/winter time adjustment

MULTICAL® 803 is available with configuration for DST (Daylight Saving Time ~ summer/winter time). The calculator's country code determines the DST configuration algorithm, so that it corresponds to the DST regulations of the country for which the calculator is intended. If the calculator is configured with DST and you do not want to use it, the DST-function can be disabled in METERTOOL HCW. The DST function has direct influence on the calculator's internal clock and time-controlled tariff limits. Time stamps for loggings of events and values are saved in standard time together with information on the current DST offset. The current DST offset is imprinted on all logged time stamps when the DST function is active. The imprinted DST offset is removed for time stamps if the DST function is deactivated in the calculator and vice versa if the DST function is reactivated.

**DST and tariffs:** The time-controlled tariff is influenced by the DST offset. For example, the entered tariff limits will be moved an hour forwards in relation to DST start and an hour backwards at the end of DST (DK example). If the DST function is disabled after a period in operation, the time limits will always follow standard time. Accumulated energy in the tariff registers remains unchanged and thus reflects the time limits with enabled DST function. The same applies vice versa if the DST function is reactivated.

**DST and loggers:** The logging time follows normal time. For example, a calculator with enabled DST function will log data at 00.00 during winter time and at 01.00 during summer time (DK example). If the DST function is disabled after delivery and historical logger values are subsequently read, DST offset of previous values will reflect the new configuration and be removed from the time stamp. See the example in the table below. Read logging times will always reflect the current DST status.

| | DST enabled | DST disabled |
|---|---|---|
| Logger target date | Logging time | Logging time |
| 1 January | 00:00 | 00:00 |
| 1 February | 00:00 | 00:00 |
| 1 March | 00:00 | 00:00 |
| 1 April | 01:00 | 00:00 |
| 1 May | 01:00 | 00:00 |
| 1 June | 01:00 | 00:00 |
| 1 July | 01:00 | 00:00 |
| 1 August | 01:00 | 00:00 |
| 1 September | 01:00 | 00:00 |
| 1 October | 01:00 | 00:00 |
| 1 November | 00:00 | 00:00 |
| 1 December | 00:00 | 00:00 |

**DST and max/min. values:** Time stamps on logging of max/min. values follow standard time. If the time stamp of a value is read, it is stated with current DST offset. If the DST function is disabled after delivery, DST offset is removed from the time stamps of historical values as it is done with the loggers.

**DST and reading of logger data:** Data can either be read from a register that includes time in standard time and DST offset as two separate parameters, or alternatively from a register that includes time comprising DST offset as a parameter. If the DST function is disabled after delivery, information on DST offset is removed from time stamps related to the historical values.

## 7.13 Preset and Scheduler functions for temperature inputs

With MULTICAL® 803, it is possible to program (preset) values for the calculator's temperature inputs. The primary demand for programmed values will be in the measurement of hot water energy where the low temperature is programmed because it cannot be measured in practice. Read more about application examples in paragraph 7.1. In addition to program a fixed value (preset), it is also possible to program a variable value that varies over the year (Scheduler). The table below shows which temperature inputs can be programmed in which meter types.

**Note:** The temperature inputs t1 and t2 are the legal inputs, which means that they cannot be programmed on an approved heat meter, cooling meter or bifunctional heat/cooling meter.

By active offset adjustment of the temperature sensor input, the offset adjustment does not influence the preset value of temperature. Read more about offset adjustment in paragraph 7.3.

| | Meter type | Approvals | | Temperature inputs | | | |
|---|---|---|---|---|---|---|---|
| | | | | t1 | t2 | t3 | t4 |
| 1 | Heat meter | MID module B | | - | - | ☑ | ☑ |
| 2 | Heat meter | MID module B+D | | - | - | ☑ | ☑ |
| 3 | Heat/cooling meter | MID module B+D & TS 27.02 | $\Theta_{HC}$ = OFF | - | - | ☑ | ☑ |
| 4 | Heat meter | National approval | | - | ☑ | ☑ | ☑ |
| 5 | Cooling meter | TS 27.02+BEK1178 | | - | - | ☑ | ☑ |
| 6 | Heat/cooling meter | MID module B+D & TS 27.02 | $\Theta_{HC}$ = ON | - | - | ☑ | ☑ |
| 7 | Volume meter | - | | - | ☑ | ☑ | ☑ |
| 9 | Energy meter | - | | - | ☑ | ☑ | ☑ |

## 7.14 Differential energy and volume calculation

MULTICAL® 803 has integrated differential calculation of energy and volume The results of these calculations are stored in the following four registers:

- dE: difference Energy   (E4 - E5 > 0)
- cE: control Energy        (E4 - E5 < 0)
- dV: difference Volume (V1 - V2 > 0)
- cV: control Volume       (V1 - V2 < 0)

All four registers are cumulative registers in which dE and dV count up by a positive difference and cE and cV count up by a negative difference. A reading of both differential and control registers reveal how much is counted with a positive and a negative difference over a given period and it is thus possible to see if the system has been in balance over the selected period.

The calculations follow the integration speed in MULTICAL® 803 and the calculations are thus made with an integration interval of 2 s. All four registers can be displayed in the calculator's "USER loop" and saved in the calculator's loggers. See paragraph 3.4.4 on display setup (DDD codes) and paragraph 3.4.12 on possible logger profiles (RR codes).

Below is a calculation example of the dE and cE registers as well as examples of the display readings.
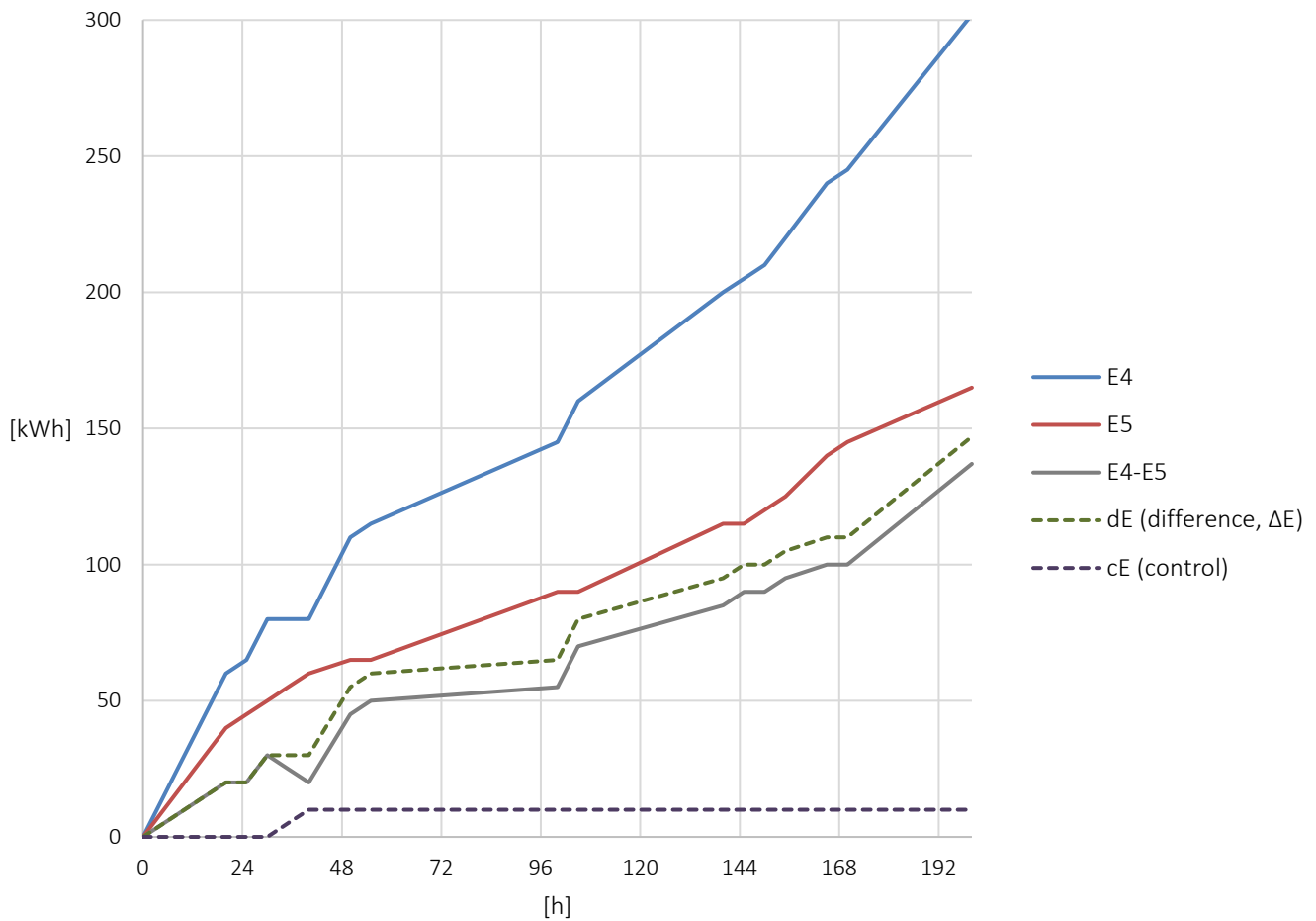


In a scenario where there is no counting in register E4 (supplied energy), e.g. due to air in the flow meter V1, the counting will take place in cE (control energy). In the example above, this is shown between the data points 24 and 48 [h].

| Energy | | Volume | |
|---|---|---|---|
| *Differential energy*<br><br>*dE* |  | *Differential volume*<br><br>*dV* |  |
| *Control energy*<br><br>*cE* |  | *Control volume*<br><br>*cV* |  |

# 8 Flow sensor connection

MULTICAL® 803 has up to 6 pulse inputs for flow sensor connection where V1 and V2 are used for the calculation of energy, while In-A1, In-B1, In-A2 and In-B2 can be used for connecting, for example, cold water meters and electricity meters.

Meter factor and resolution of the V1 and V2 inputs are configured via the CCC code in MULTICAL® 803. If two flow sensors are connected to V1 and V2, , they must be identical as the pulse inputs share their configuration. See paragraph 3.4.3 for an overview of the CCC codes.

Depending on the application type, MULTICAL® 803 can be connected to one or two flow sensors for energy calculation, see paragraph 7.1 for examples of application types. Typically, one flow sensor is used in heat or cooling installations. This flow sensor is always connected to V1, regardless of whether it is placed in inlet or outlet.

The connection board with connection for V1 and V2 can both receive pulses from electronic and mechanical flow sensors. This allows for connection of almost any type of flow sensor with pulse output. For flow sensors with 24 V active pulse outputs see paragraph 8.4.
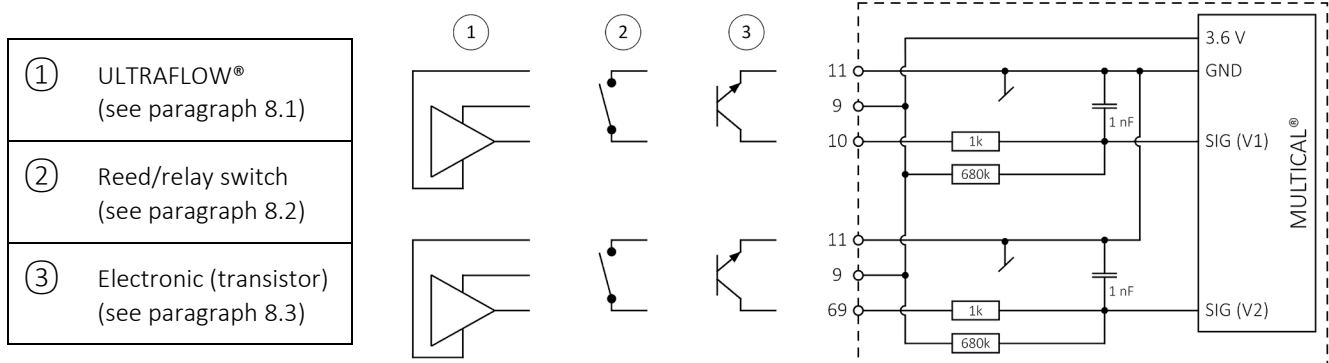


## 8.1 ULTRAFLOW® (Connection type 1-2-7-8)

Kamstrup's ULTRAFLOW® flow sensors are supplied from the calculator and connected according to the table below. The power consumption of ULTRAFLOW® is very low and at the same time, it matches the specified life of the backup battery in MULTICAL® 803, see paragraph 10.2.

| Cable ULTRAFLOW® | Connection terminals V1 | Connection terminals V2 |
|---|---|---|
| Red (3.6 VDC) | 9 | 9 |
| Yellow (Signal) | 10 | 69 |
| Blue (GND) | 11 | 11 |

For ULTRAFLOW®, CCC codes 1xx, 4xx and 5xx are used.

### 8.1.1 Auto Detect UF of ULTRAFLOW® X4

Auto Detect UF enables the exchange of ULTRAFLOW® X4 on MULTICAL® 803 without the need for changing the CCC code.
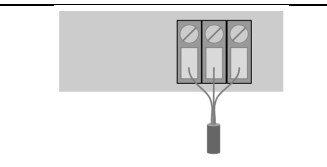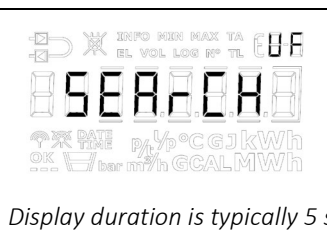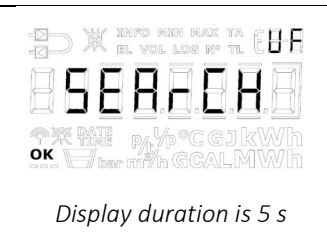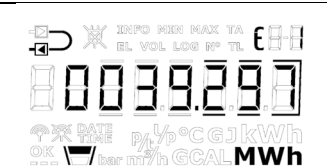
MULTICAL® 803 can automatically adjust the meter factor (imp/l) and the qp value to match the connected ULTRAFLOW® X4 via the function Auto Detect UF. Auto Detect UF is active with the CCC code 8xx.

Auto Detect UF works in such a way that MULTICAL® 803, during startup, automatically collects the correct information about meter factor and qp from the connected ULTRAFLOW® X4 flow sensors. MULTICAL® 803 adapts its configuration to the values that are received from ULTRAFLOW® X4. Auto Detect UF is initiated when the calculator top and base are separated and reassembled.

**Note:** Auto Detect is possible on all ULTRAFLOW® x4, however not on SVM-configured ULTRAFLOW® variants (ULTRAFLOW® SVM country codes 196, 199, 295 and 296).

## 8.1.1.1   Auto Detect UF with one ULTRAFLOW® X4 on V1

To use the Auto Detect UF functionality between MULTICAL® 803 and ULTRAFLOW® X4, use the following procedure.

| ① | | Break the installation seal[1] and separate the calculator top and base. |
|---|---|---|
| ② | | Mount ULTRAFLOW® X4 on the input V1 in MULTICAL® 803 as indicated in the table in paragraph 8.1. |
| ③ | | Assemble the calculator top and bottom.[2] |
| ④ | **SEArCH** *Display duration is typically 5 s* | Observe the flashing display on MULTICAL® 803, which indicates that ULTRAFLOW® X4[3] is being searched for. |
| ⑤ | **SEArCH** *Display duration is 5 s* | Observe the static display on MULTICAL® 803, which indicates that ULTRAFLOW® X4 has been found and registered.[4] |
| ⑥ | **0039.297 MWh** | MULTICAL® 803 automatically switches to the primary energy display in the "USER loop". |

[1] *Remember to restore the seal installation after Auto Detect UF.*

[2] *Note that MULTICAL® 803 has a built-in engagement delay of up to 20 seconds to ensure that all plug connections between calculator top and base are established before a detection of Pt sensors and/or ULTRAFLOW® X4 is initiated.*

[3] *If Auto Detect Pt for the temperature sensors is switched on, the text in the upper right corner of the display will alternately show* **UF** *and* **Pt***. See more about Auto Detect Pt in paragraph 7.7.*

[4] *A config logging is carried out every time MULTICAL® 803 registers a change of qp in ULTRAFLOW® X4 on V1.*

#### 8.1.1.2 Auto Detect UF with two ULTRAFLOW® X4 on V1 and V2

The procedure for Auto Detect UF with two ULTRAFLOW® X4 is identical with the table in paragraph 8.1.1.1, with the exception that in step ②, an identical ULTRAFLOW® X4 connected to input V2 is mounted.

The ULTRAFLOW® X4 flow sensor, which is mounted on V1, will always be determining for meter factor and qp, also in an application with two ULTRAFLOW® X4 flow sensors. This means that a replacement of ULTRAFLOW® X4 on input V2 does not result in a config logging, but just trigger an info code. The info code will be present until ULTRAFLOW® X4 on either input V1 or input V2 is replaced so that both ULTRAFLOW® X4 flow sensors are identical. Replacing ULTRAFLOW® X4 by another meter factor or qp on input V1 always results in a config logging.
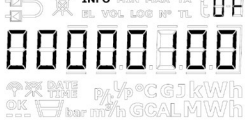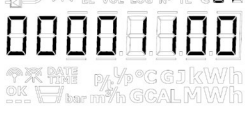
> **In applications with two ULTRAFLOW® X4 flow sensors, both flow sensors must be replaced by the same type, i.e. identical meter factor and qp.**
>
> If the meter factor and qp are not identical, an info code will be triggered.
> See description in paragraph 8.1.1.3.

Note that Auto Detect UF with two ULTRAFLOW® X4 flow sensors requires that the calculator is configured for 2 ULTRAFLOW® flow sensors (Connection type 2 or 8) simultaneously with the choice of CCC = 8xx.

#### 8.1.1.3 Information codes for Auto Detect UF

In case of incorrect ULTRAFLOW® or communication error with ULTRAFLOW® X4, MULTICAL® 803 displays a static info code that describes the given error that has occurred (step ⑤ in the table in paragraph 8.1.1.1). The table below describes the possible info codes and their importance.

| Information code | Description | Remedy |
|---|---|---|
| 00001000 *Display duration of 5 s* | Communication error on input V1. | Separate the calculator and check that ULTRAFLOW® X4 is correctly mounted in the connection terminals of input V1. Then repeat the procedure in paragraph 8.1.1.1 from step ③. |
| 00002000 *Display duration of 5 s* | Incorrect meter factor on input V1. | The config logger is full. It is no longer possible to replace ULTRAFLOW® X4 on input V1 by a different size than the recently logged size for V1. |
| 00000100 *Display duration of 5 s* | Communication error on input V2. | Separate the calculator and check that ULTRAFLOW® X4 is correctly mounted in the connection terminals of input V2. Then repeat the procedure in paragraph 8.1.1.1 from step ③. |
| 00000200 *Display duration of 5 s* | Incorrect meter factor on input V2. | ULTRAFLOW® X4 on input V2 is different from ULTRAFLOW® X4 on input V1. Make sure that the ULTRAFLOW® X4 flow sensors are identical and repeat the procedure in paragraph 8.1.1.1. |
| 00001100 *Display duration of 5 s* | Communication error on both input V1 and input V2. | Separate the calculator and check that ULTRAFLOW® X4 is correctly mounted in the connection terminals of input V1 and input V2. Then repeat the procedure in paragraph 8.1.1.1 from step ③. |

| Information code | Description | Remedy |
|---|---|---|
| *Display duration of 5 s* | Communication error on input V1 as well as incorrect meter factor on input V2. | Separate the calculator and check that ULTRAFLOW® X4 is correctly mounted in the connection terminals of input V1. Check that the ULTRA FLOW® X4 flow sensors are identical. Then repeat the procedure in paragraph 8.1.1.1 from step ③. |
| *Display duration of 5 s* | Incorrect meter factor on input V1 and communication error on input V2. | The config logger is full. It is no longer possible to replace ULTRAFLOW® X4 on either input V1 or input V2 by a different size than the recently logged size for input V1. Separate the calculator and check that ULTRAFLOW® X4 is correctly mounted in the connection terminals of input V2. Check that the ULTRA FLOW® X4 flow sensors are identical. Then repeat the procedure in paragraph 8.1.1.1 from step ③. |
| *Display duration of 5 s* | Incorrect meter factor on both input V1 and input V2. | The config logger is full. It is no longer possible to replace ULTRAFLOW® X4 on either input V1 or input V2 by a different size than the recently logged size for input V1. |

### 8.1.2 Need for longer cables between MULTICAL® 803 and ULTRAFLOW®

In general, cables of up to 10 m can be used between MULTICAL® and ULTRAFLOW®. In case a longer cable is required, Kamstrup can deliver two solutions: Cable Extender Box (6699-036) or Pulse Transmitter (6699-903). With these solutions, the cable length can be extended with up to 30 m or 100 m, respectively. Both solutions have a number of advantages and disadvantages that are outlined in the table below.

| Application options | Cable Extender Box | Pulse Transmitter |
|---|---|---|
| Up to 30 m cable between ULTRAFLOW® and MULTICAL® | Yes | Yes |
| Up to 100 m cable between ULTRAFLOW® and MULTICAL® | No | Yes |
| Info codes and data communication between ULTRAFLOW® and MULTICAL® | Yes | No |
| Galvanic separation between ULTRAFLOW® and MULTICAL® | No | Yes |
| IP class | IP65 | IP67 |

When Pulse Transmitter is used between ULTRAFLOW® and MULTICAL®, the calculator cannot establish data communication with ULTRAFLOW® due to the galvanic separation. In order to avoid incorrect info codes, it is thus necessary to deselect the info codes that are based on data communication between MULTICAL® and ULTRAFLOW® (Info = 16-1024-2048-128-4096-8192-16384-32768).

The above info codes can be deselected by means of METERTOOL HCW, for example by changing from CCC code 4xx to 1xx.

## 8.2 Flow sensor with reed or relay switch output (Connection type L)

The reed switch output is normally mounted as pick-up unit on vane wheel or Woltmann meters where the relay switch output is typically found on magnetic inductive flow sensors. Flow sensors are connected to input V1 on the connection terminals 10 (+) and 11 (-) and input V2 on the connection terminals 10 (+) and 69 (-). Screw terminal 9 is not used in this application.

The leakage current of the switch must not exceed 1 µA in OFF mode and the resistance of the switch set must not exceed 10 kΩ in ON mode.

It must be ensured that MULTICAL® 803 is configured with a CCC code if the meter factor (imp/l or l/imp) matches the connected flow sensors.

Example: The CCC = 011 is used for a calculator with reed pulses with 10 l/imp. and a maximum flow of 1...30 m³/h.

## 8.3 Flow sensor with transistor output (Connection type 7-8-C-J)

Normally, the flow sensor output is designed as an optocoupler with BJT or FET transistor output. Flow sensors are connected to input V1 on the connection terminals 10 (+) and 11 (-) and input V2 on the connection terminals 10 (+) and 69 (-). Connection terminal 9 is not used in this application.

The leakage current of the transistor must not exceed 1 µA in OFF mode and the voltage of the transistor must not exceed 0.4 V in ON mode.

It must be ensured that MULTICAL® 803 is configured with a CCC code if the meter factor (imp/l or l/imp) matches the connected flow sensors.

Example: The CCC = 201 is used for an electronic meter with 1 l/imp. and $q_p$ = 4...150 m³/h.

## 8.4 Flow sensors with active 24 V pulse outputs (Connection type P)

Flow sensors with active 24 V pulse outputs, for example from Siemens, Krohne or ABB, can be connected to MULTICAL® 803 by use of connection board 6699-045, which can either be supplied or is available as an accessory for MULTICAL® 803. The connection is carried out as shown in the figure below. For additional examples, see paragraph 8.5.
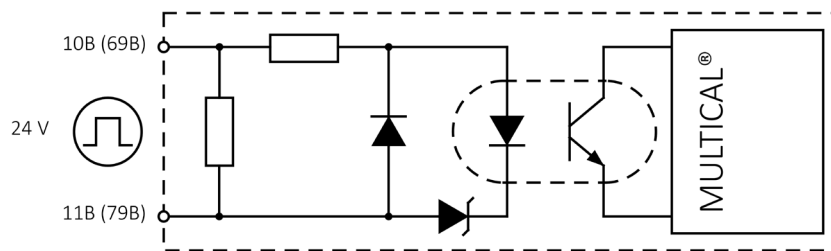


**Technical data:**

| | |
|---|---|
| Pulse input voltage | 12...32 V |
| Pulse current | Max 12 mA at 24 V |
| Pulse frequency | Max 128 Hz |
| Pulse duration | Min. 3 ms |
| Cable length V1 | Max 100 m (drawn with min. 25 cm distance to other cables) |
| Galvanic separation | The inputs V1 and V2 are galvanically separated from MULTICAL® 803 |
| Insulation voltage | 2 kV |
| Mains supply for MULTICAL® | 24 VAC/VDC or 230 VAC |

## 8.5   Connection examples

**Flow sensor with active 24 V pulse output**
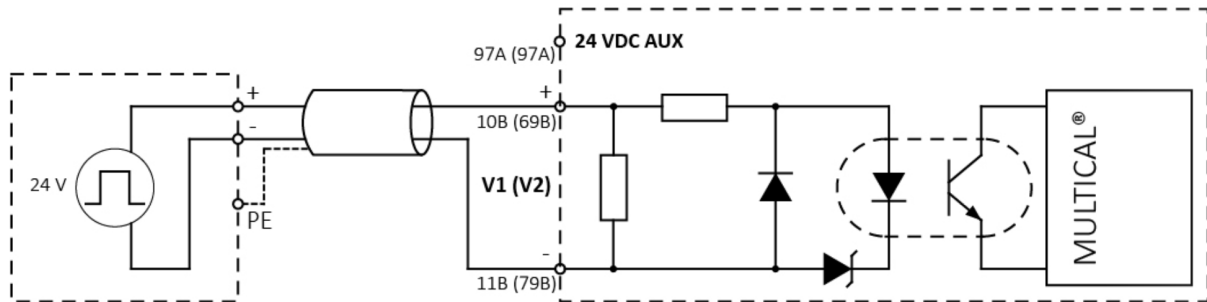


**Flow sensor with NPN transistor output and external 24 VDC supply[1]**
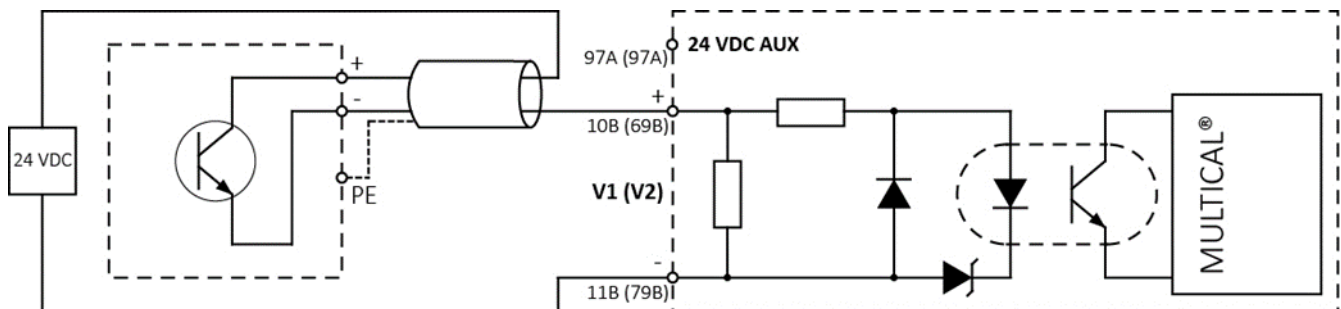


**Flow sensor with NPN transistor output and 24 VDC auxiliary supply[1]**
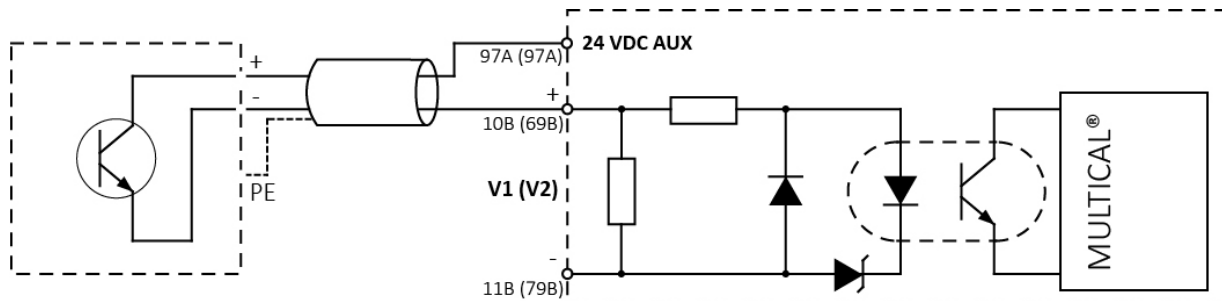


[1] *The transistor output of the flow sensor can be supplied from either an external 24 VDC source or from the internal 24 VDC auxiliary supply on terminal 97A. Note that there is only voltage on terminal 97A if the auxiliary supply module is present in MULTICAL® 803, see paragraph 10.4.*

**Note:** It is recommended to use an external 24 VDC supply if the internal auxiliary supply is already used for the supply of the analog output module via the connectors on the connection board.

## 8.5.1 Connection of flow sensor to own supply voltage

The pulse output from a flow sensor with own supply voltage must always be connected to an opto-isolated pulse input on the calculator. By doing so, a noise-resistant and reliable connection is achieved. The special opto-isolated input circuit of MULTICAL® 803-A further enables the connection of long cables between flow sensor and calculator (up to 100 m cable).
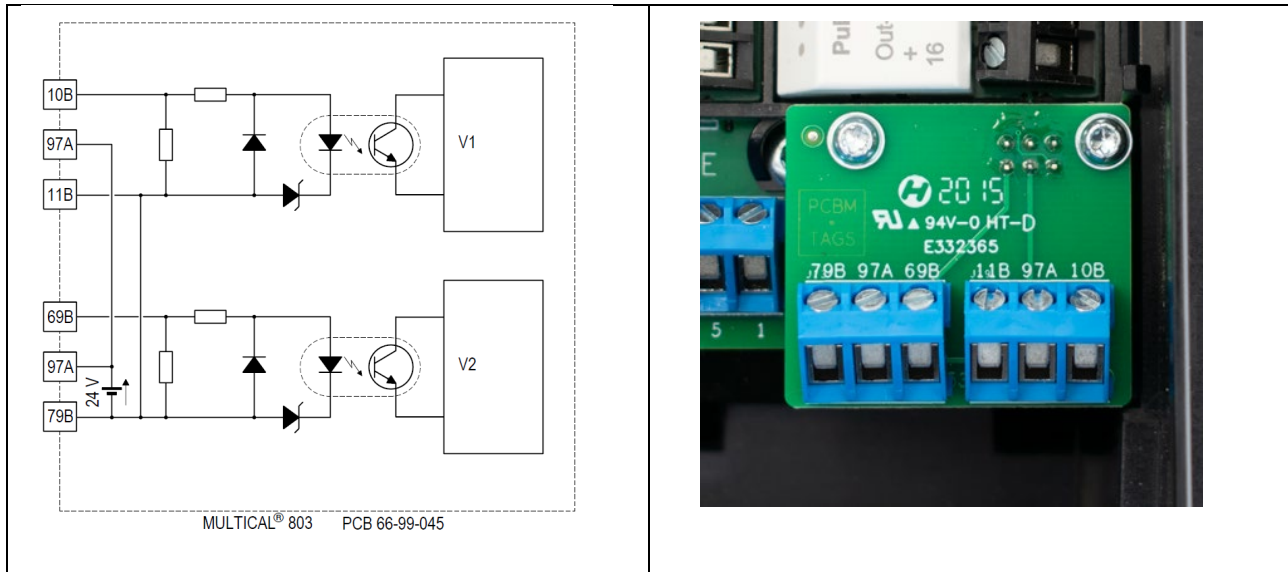


*Figure 9 Opto-isolated pulse inputs (V1 and V2) of MULTICAL® 803-A (PCB 66-99-045).*

**Note:** The integrated 24 VDC supply is only present on type 803-xxxxxxxxC and -d. See paragraph 4.9 for information on the exchange of supply modules. Separate supply modules can be ordered separately (see paragraph 10.4), but should be exchanged/retrofitted by qualified personnel only.

Note that Auto Detect and extended info codes for flow sensors only work with ULTRAFLOW®. See paragraph 7.8 if necessary.

The passive pulse output from a flow sensor with own supply voltage may not be connected directly to pulse input V1 (terminal 11-9-10) and V2 (terminal 11-9-69) of MULTICAL®.

Only flow sensors of the 3 types ①-②-③ below may be connected directly to these pulse inputs.
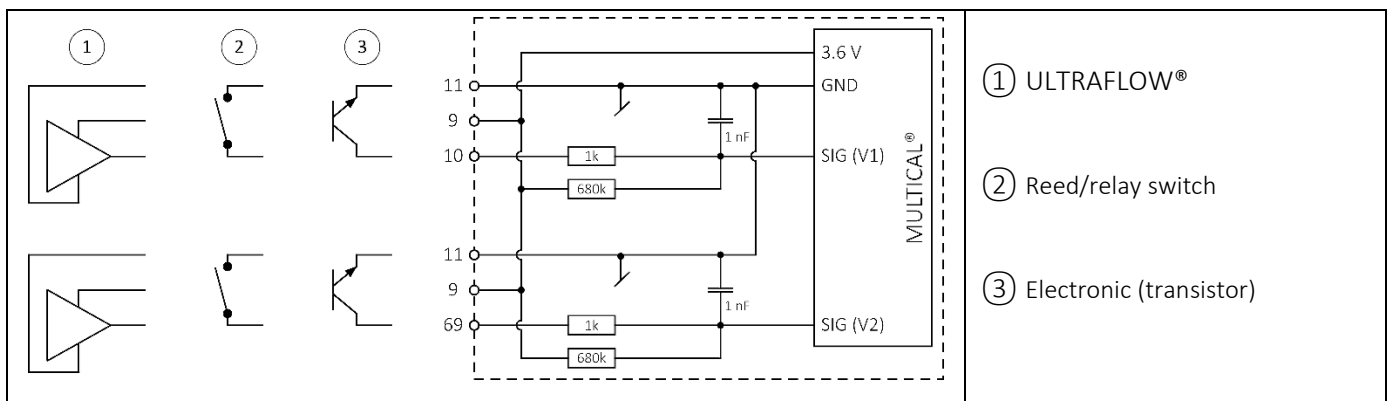
### 8.5.1.1   Kamstrup ULTRAFLOW® with Pulse Transmitter

The cable length between flow sensor and Pulse Transmitter (or between flow sensor and calculator) is approved up to 10 m, or up to 30 m together with Cable Extender Box, type 66-99-036.

The cable length between Pulse Transmitter and calculator is approved up to 100 m.
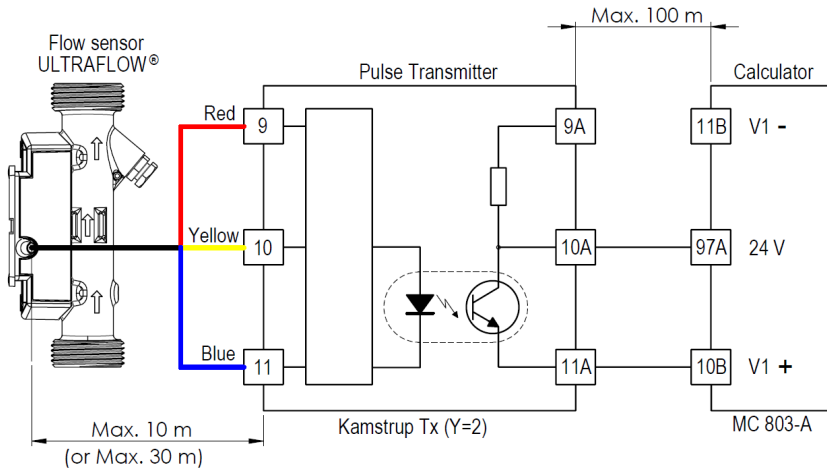


### 8.5.1.2   MAG5000 with 24 V active pulse output
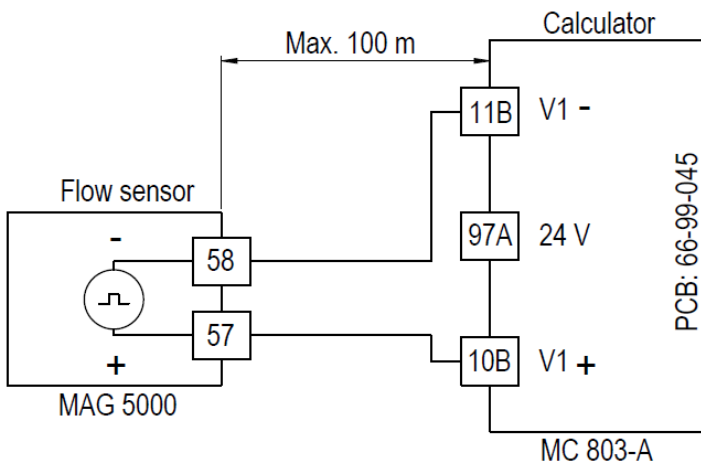


### 8.5.1.3   MAG8000/FUE/FUS with passive pulse output
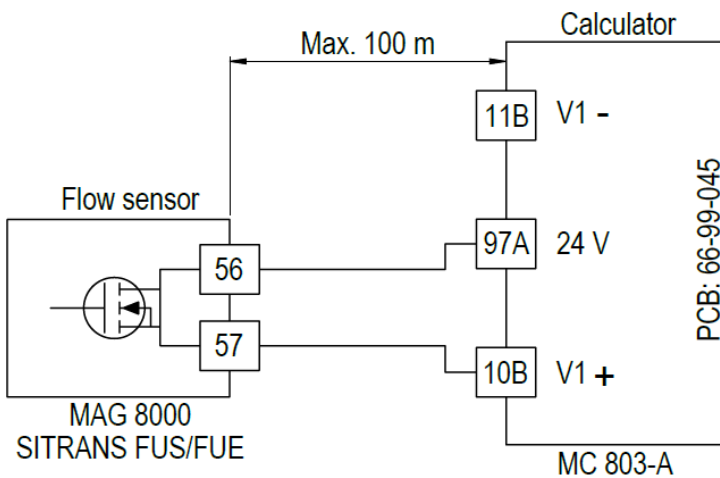
### 8.5.1.4    Krohne flow sensor with passive pulse output
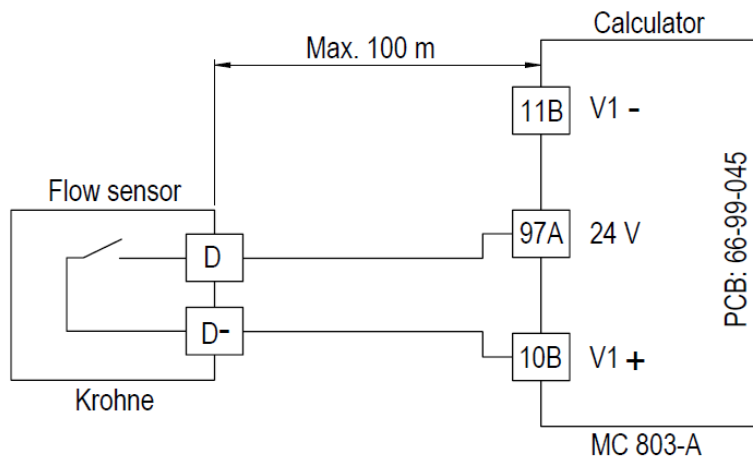


### 8.5.1.5    MAG5000 with active pulse output and directional relay
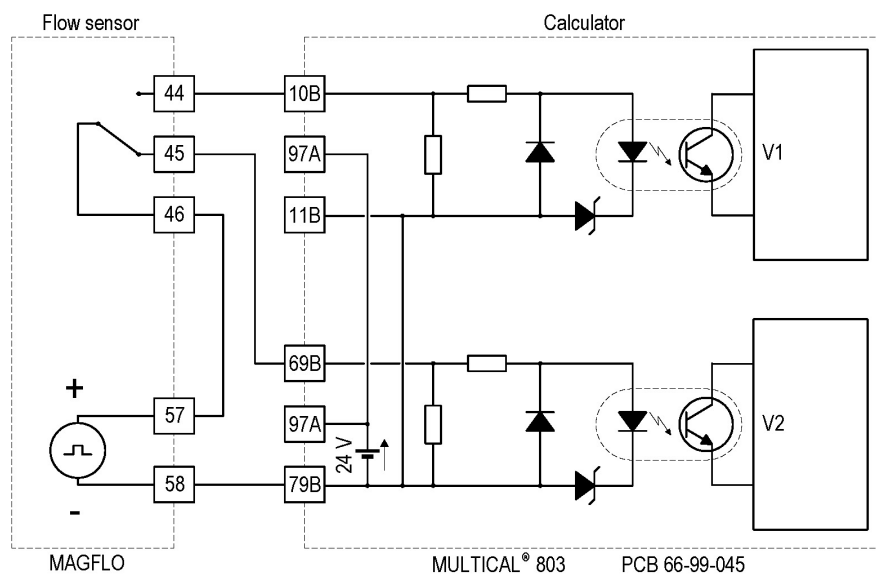
## 8.6 ULTRAFLOW® for bidirectional installations

Two ULTRAFLOW® can be installed "back to back" by which either the one or the other ULTRAFLOW® measures flow depending on the flow direction. When used in an application as shown in the figure, MULTICAL® is configured for inlet (A-code 3).

ULTRAFLOW® is connected to the inputs for V1 and V2 as shown in the figure. This allows up to 10 m cable length between ULTRAFLOW® and MULTICAL® (up to 30 m cable length with Cable Extender Box 6699-036).
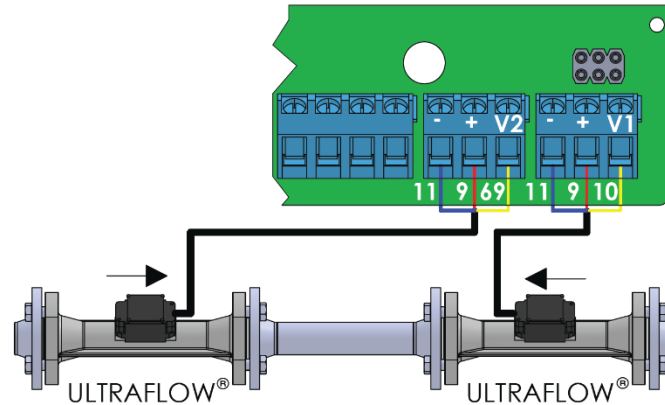


*Figure 10 - Installation of 2 ULTRAFLOW® for MULTICAL® for use for bidirectional flow*

### 8.6.1   Same ΔΘ polarity

In applications in which the polarity of the temperature difference (ΔΘ) does not change when the flow direction is changed so that t1 is always greater than t2 and it is thus only the flow direction that determines whether heating energy or cooling energy is measured, the energy calculations shown in Table 5 can be used.

| Heat energy | Cooling energy |
|---|---|
| $E1 = V1(t1-t2)k_{t1}$ | $E2 = V2(t1-t2)k_{t2}$ |

*Table 5 - Energy calculations for use with the same ΔΘ polarity*

### 8.6.2   Different ΔΘ polarity

In applications in which the polarity of the temperature difference (ΔΘ) changes when the flow direction is changed so that t1 is greater than t2 in one flow direction and t2 is greater than t1 at the other flow direction and it is thus both ΔΘ and the flow direction that determine whether heating energy or cooling energy is measured, the energy calculations shown in Table 6 can be used.

| Heat energy | Cooling energy |
|---|---|
| $E1 = V1(t1-t2)k_{t1}$ | $E12 = V2(t2-t1)k_{t2}$ |

*Table 6 - Energy calculations for use with different ΔΘ polarity*

**Note:** In cases where the energy calculations from the examples above are not correct, it is possible to use other energy calculations from the table in paragraph 7.1. It is important to ensure that the first temperature in the calculation is greater than the other temperature in the calculation and that ULTRAFLOW® is placed at the temperature sensor, which is referred to in the subscripted text after the coefficient k.

**Example:**   $E1 = V1(t1-t2)k_{t1}$    V1 must be placed next to t1

t1 must be greater than t2

## 8.7 MULTICAL® with V1 and V2 of different sizes

The MULTICAL® generation 3 only has one CCC-code shared by flow sensors V1 and V2 and thus only the possibility to utilize two ULTRAFLOW® with the same meter factor (p/l) and the same nominal flow (qp).

When utilizing MULTICAL® connected to two ULTRAFLOW® V1 and V2 in relation to open systems, it may be beneficial to utilize ULTRAFLOW® V2 with a lower nominal flow (qp) than the nominal flow (qp) of the utilized ULTRAFLOW® V1, e.g. in application 7, see paragraph 7.1.3.

It is possible to utilize a V2 smaller than V1 by including a Pulse Divider for V2 to scale down the meter factor of ULTRAFLOW® V2 to match the meter factor of ULTRAFLOW® V1, see Table 7. MULTICAL® is ordered separately* with a CCC-code to fit  ULTRAFLOW® V1. ULTRAFLOW® for both V1 and V2 and the corresponding Pulse Divider are ordered separately.

**Note:** The nominal flow (qp) of ULTRAFLOW® V2 must be lower than the nominal flow (qp) of ULTRAFLOW® V1 when utilizing this method.

| Flow sensor V2 / Flow sensor V1 | qp = 0,6 m³/h (300 p/l) | qp = 1,5 m³/h (100 p/l) | Qp = 2,5 m³/h (60 p/l) | qp = 3,5 m³/h (50 p/l) |
|---|---|---|---|---|
| qp = 2,5 m³/h (60 p/l) | Divisor **5** (116-41-1) | N/A | N/A | N/A |
| qp = 3,5 m³/h (50 p/l) | Divisor **6** (116-51-1) | Divisor **2** (119-51-1) | N/A | N/A |
| qp = 6,0 m³/h (25 p/l) | Divisor **12** (116-12-1) | Divisor **4** (119-12-1) | N/A | Divisor **2** (151-12-1) |
| qp = 10 m³/h (15 p/l) | N/A | N/A | Divisor **4** (198-22-1) | N/A |
| qp = 15 m³/h (10 p/l) | N/A | Divisor **10** (119-32-1) | Divisor **6** (198-32-1) | Divisor **5** (151-32-1) |

*Table 7 – Divisor based on the size difference between V1 and V2 – V1 must be larger than V2. The number in brackets for each possible divisor is the CCC-DD-E configuration of the Pulse Divider for V2*

* MULTICAL® is ordered prepared for flow sensors with fast electronic pulses (Flow sensor connection type C), and the corresponding 1xx CCC-code to match the meter factor (p/l) of the chosen ULTRAFLOW® V1.

## 8.8  Connection of more calculators to one flow sensor

In installations with 2 or more consumers in "series connection", it can be advantageous to use the signal from one flow sensor for more calculators, such as in the setup below.
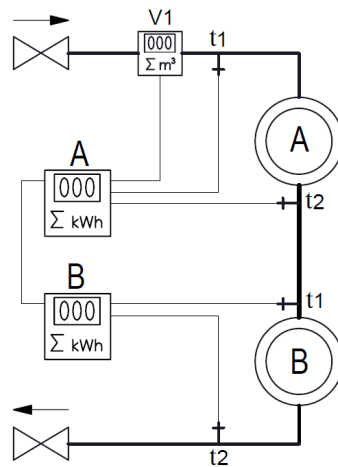


*Figure 11 Heat installation with one flow sensor and 2 calculators.*

When a module with pulse output is connected and the PP-code is set to PP = 82 pulses on the flow sensor, input V1 is repeated on "Out-C" on terminals 16 and 17. Remember to select the flow sensor connection type C and the correct CCC-code on the following calculator.
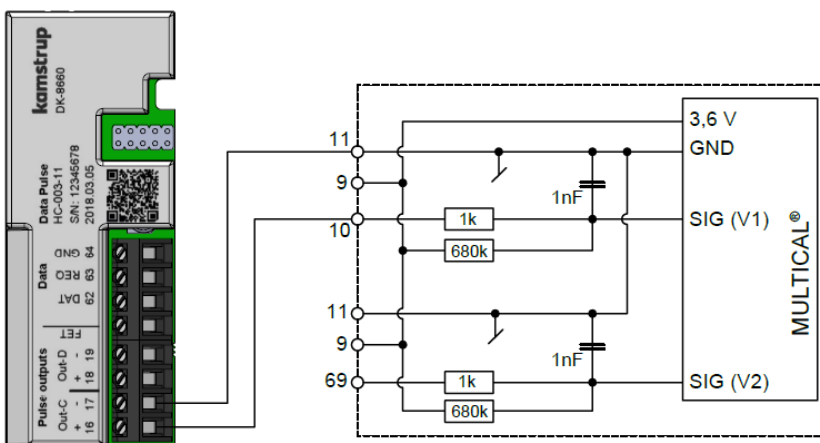


As the pulse output "Out-C" is galvanically separated, a short circuit or other error will not damage the meter in front of it.

| Pulse outputs C and D | PP code |
|---|---|
| Pulse Transmitter/Divider | |
| Out-C: V1/4 (5 ms) | 73 |
| Out-C: V1/1, Out-D: V2/1 (3,9 ms) | 80 |
| Out-C: V1/1 (3,9 ms) | 82 |
| Out-C: V1/4 (22 ms) | 83 |
| Pulse outputs for meter count registers | |
| 10 ms | 94 |
| 32 ms | 95 |
| 100 ms (0,1 s) | 96 |
| 250 ms | 93 |
| Controlled output via data commands | |
| Controlled output | 99 |

# 9 Temperature sensors

A platinum resistance thermometer utilizes that the precious metal platinum has a very well-defined coherence between its resistance and temperature. The coherence between the resistance and the temperature is defined in the standard EN 60751 (DIN/IEC 751), and tables with examples of the coherence are available in paragraph 9.8. On MULTICAL® 803, Pt100 and Pt500 temperature sensors can be used where the nominal resistance at 0 °C is 100 Ω and 500 Ω, respectively.

The coherence between the resistance $R_t$ and the temperature $t$ is defined by:

$$R_t = R_0(1 + At + Bt^2)$$

where $R_0$ indicates the resistance at 0,00 °C, while $A$ and $B$ are constants. The values $R_0$, $A$ and $B$ are determined by the verification of the temperature sensor, which is carried out, cf. EN 1434-5.

On a heat or cooling meter, a temperature sensor pair is used for measuring the temperature difference between inlet and outlet. As each of the two temperature sensors have their own values for $R_0$, $A$ and $B$, the requirement for an approved temperature sensor pair according to EN 1434-1 is that the maximum difference in percentage between the two temperature sensors, $e_t$, in the entire approval area must not exceed:

$$E_t = \pm\left(0,5 + 3\frac{\Delta\theta_{min}}{\Delta\theta}\right)$$

where $\Delta\theta$ is the specific temperature difference and $\Delta\theta_{min}$ is the smallest approved temperature difference, typically 3 K. The values $R_0$, $A$ and $B$ of the individual temperature sensors and $E_t$ appear from the certificate of the temperature sensor pair.

## 9.1 Cable influence and connection of cables

For small and medium-size heat meters, mostly only relatively short temperature sensor cable lengths are needed, which means that 2-wire sensor pairs can be used with advantage. By default, MULTICAL® 803 is prepared for 4-wire connection. The use of 2-wire sensor pairs requires the installation of the short-circuit jumper as shown in the figure below.
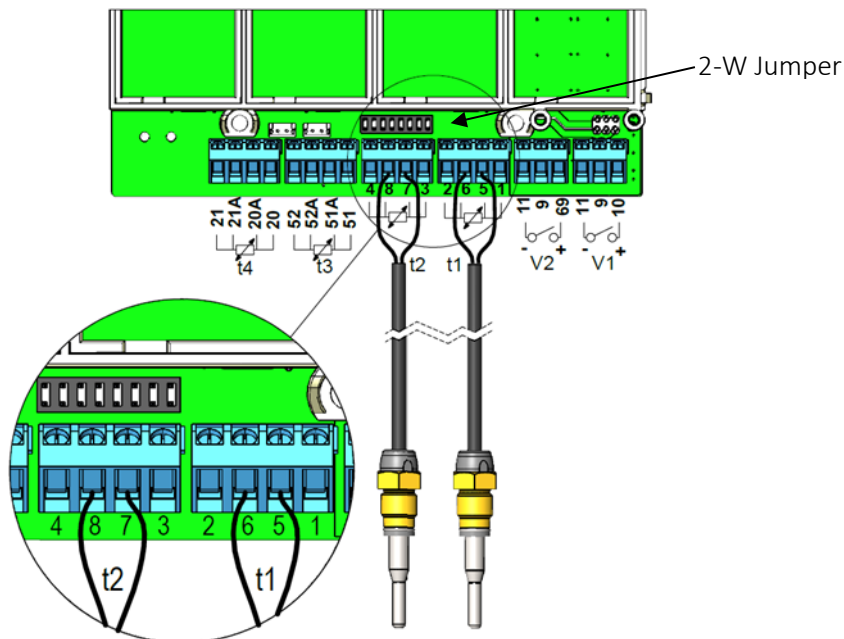


The cable lengths and cross sections of the two sensors, which are used as 2-wire temperature sensor pair for a heat meter, must always be identical, and cable sensors must neither be shortened nor extended.

The limitations connected to the use of 2-wire sensor pairs according to EN 1434-2 appear from the table below.

| Cable cross section [mm$^2$] | Pt100 sensors | | Pt500 sensors | |
|---|---|---|---|---|
| | Max cable length [m]<br><br>Subject to EN 1434-2 | Temperature increase [K/m]<br><br>Copper @ 20 °C | Max cable length [m]<br><br>Subject to EN 1434-2 | Temperature increase [K/m]<br><br>Copper @ 20 °C |
| 0,25 | 2,5 | 0,450 | 12,5 | 0,090 |
| 0,50 | 5,0 | 0,200 | 25,0 | 0,040 |
| 0,75 | 7,5 | 0,133 | 37,5 | 0,027 |
| 1,50 | 15,0 | 0,067 | 75,0 | 0,013 |

*Table 8*

### 4-wire sensor pair

For installations requiring longer cables than listed in the table above, it is recommended to use 4-wire sensor pairs. By default, MULTICAL® 803 is prepared for 4-wire connection on all temperature sensor inputs.
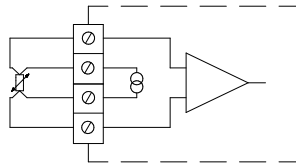


The 4-wire construction uses two conductors for measuring current and two conductors for measuring signal, which means that the construction is in theory uninfluenced by long sensor cables. In practice, cables ought not to be longer than 100 m and it is recommended to use 4 x 0,25 mm$^2$.

The connection cable ought to have an outer diameter of 5-6 mm in order to obtain optimum tightness of both MULTICAL® 803 and the screw joint for the 4-wire sensor. The isolation material/cover of the cable ought to be selected on the basis of the maximum temperature in the installation. PVC cables are normally used up to 80 °C and for higher temperatures, silicone cables are often used.

**Note:** When presetting the temperature value, it is important to insert jumpers in the connection terminals so that the temperature sensor inputs with preset are changed to 2-wire connections. Read more about preset of the temperature value in paragraph 7.13.
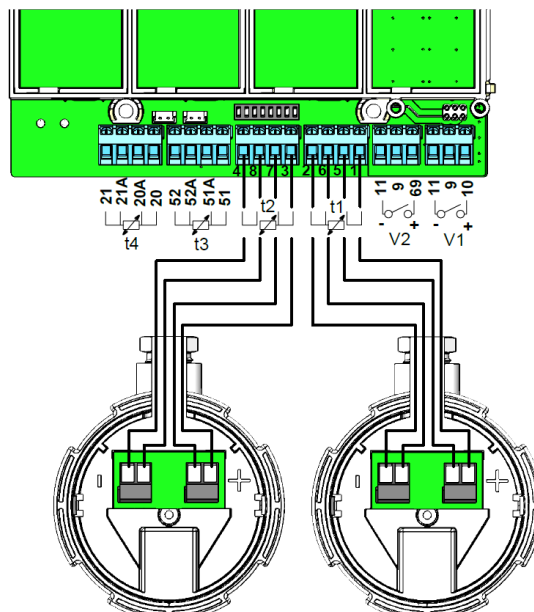
## 9.2   Sensor types

MULTICAL® 803 can be supplied with both Pt100 and Pt500 sensor pairs. The required sensor pair is selected through the calculator's type number. The table below shows the available sensor pairs. See the calculator's complete type number in paragraph 3.1.

For old sensor types, see the document "Conversion to TemperatureSensor 63 & 83" (55122999_EN) at
www.kamstrup.com/en-en/product-centre

| Description | Pt100/Pt500 | Sensor number |
|---|---|---|
| 2 sets of Direct short 27,5 mm, 1,5 m cable | Pt500 | 51 |
| 2 sets of Direct short 27,5 mm, 3 m cable | Pt500 | 52 |
| 3 sets of Direct short 27,5 mm, 1,5 m cable | Pt500 | 55 |
| 3 sets of Direct short 27,5 mm, 3 m cable | Pt500 | 56 |
| 2 sets of Direct short 27,5 mm, 2 m cable | Pt100 | J6 |
| 2 sets of Direct short 38 mm, 1,5 m cable | Pt500 | 21 |
| 2 sets of Direct short 38 mm, 3 m cable | Pt500 | 22 |
| 2 sets of ø5,8 mm pocket sensor, 1,5 m cable | Pt500 | 81 |
| 2 sets of ø5,8 mm pocket sensor, 3 m cable | Pt500 | 82 |
| 2 sets of ø5,8 mm pocket sensor, 5 m cable | Pt500 | 83 |
| 2 sets of ø5,8 mm pocket sensor, 10 m cable | Pt500 | 84 |
| 3 sets of ø5,8 mm pocket sensor, 1,5 m cable | Pt500 | 85 |
| 3 sets of ø5,8 mm pocket sensor, 3 m cable | Pt500 | 86 |
| 3 sets of ø5,8 mm pocket sensor, 5 m cable | Pt500 | 87 |
| 3 sets of ø5,8 mm pocket sensor, 10 m cable | Pt500 | 88 |
| 2 sets of ø6,0 mm pocket sensor, 1,5 m cable | Pt500 | 91 |
| 2 sets of ø6,0 mm pocket sensor, 3 m cable | Pt500 | 92 |
| 2 sets of ø6,0 mm pocket sensor, 5 m cable | Pt500 | 93 |
| 2 sets of ø6,0 mm pocket sensor, 10 m cable | Pt500 | 94 |
| 2 sets of ø6 mm with connection head, length 105 mm | Pt100 | A1 |
| 2 sets of ø6 mm with connection head, length 140 mm | Pt100 | A2 |
| 2 sets of ø6 mm with connection head, length 230 mm | Pt100 | A3 |
| 2 sets of ø6 mm with connection head, length 105 mm | Pt500 | A4 |
| 2 sets of ø6 mm with connection head, length 140 mm | Pt500 | A5 |
| 2 sets of ø6 mm with connection head, length 230 mm | Pt500 | A6 |
| 2 sets of ø5,8 mm pocket sensor in pocket with connection head, length 65 mm | Pt500 | C1 |
| 2 sets of ø5,8 mm pocket sensor in pocket with connection head, length 90 mm | Pt500 | C2 |
| 2 sets of ø5,8 mm pocket sensor in pocket with connection head, length 140 mm | Pt500 | C3 |
| 2 sets of ø5,8 mm pocket sensor in pocket with connection head, length 180 mm | Pt500 | C4 |

## 9.3   Pt500 direct short temperature sensor set
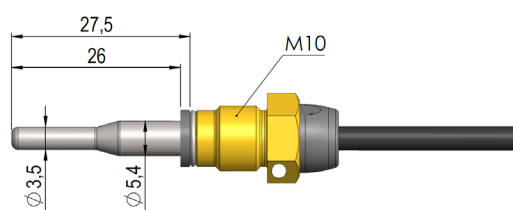


TemperatureSensor 63 direct short DS 27.5 mm temperature sensor is designed according to the European standard for heat energy meters EN 1434-2. The temperature sensor is designed for direct mounting in the measured medium, i.e. without sensor pocket, by which a particularly fast response to temperature changes in, for example, utility water exchangers is obtained. The temperature sensor tube has a diameter of ø3.5 mm, is made of stainless steel and the temperature sensor element itself is placed in the tube. The temperature sensor is approved for both PN16 and PN25 installations, with PS25 as the maximum pressure. The temperature sensor is based on a 2-wire silicone cable and can thus be used with media temperatures up to 150 °C. Furthermore, it can be directly mounted in many of Kamstrup's flow sensor types, which reduces the installation costs. As shown in *Figure 12* and *Figure 13*, the direct short temperature sensor can, for example, also be mounted in a nipple or a ball valve.
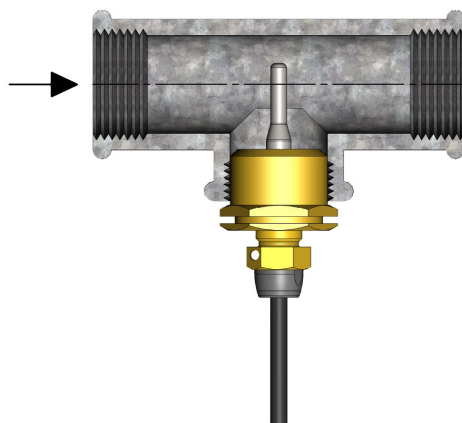


As it appears from *Figure 12*, the direct short temperature sensor DS 27,5 mm can be mounted by means of an R½ or R¾ for M10 nipple in a standard 90° tee.

*Figure 12*

The direct short temperature sensor is also available in a 38 mm version, called DS 38 mm. Further information about this can be found in the TemperatureSensor SP data sheet. The application possibilities of the DS 27.5 mm and DS 38 mm temperature sensors are shown in *Table 9*.

| DN | DS 27,5 mm | DS 38 mm |
|----|------------|----------|
| 15 | X | |
| 20 | X | |
| 25 | X | |
| 32 | | X |
| 40 | | X |

*Table 9: The application possibilities of the DS 27.5 mm and DS 38 mm temperature sensors.*
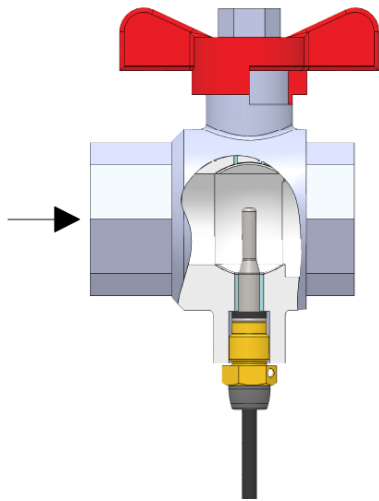
In order to obtain the best possible serviceability during meter replacement, the direct short temperature sensor can be placed in a ball valve with sensor socket, see *Figure 13*.

Ball valves with sensor sockets are available in G½, G¾, G1, all of which fit the DS 27,5 mm sensor, as well as in G1¼ and G1½, both fitting the DS 38 mm sensor.

| Nr. | 6556-570 | 6556-571 | 6556-572 |
|-----|----------|----------|----------|
|     | G½       | G¾       | G1       |

| Nr. | 6556-526 | 6556-527 |
|-----|----------|----------|
|     | G1¼      | G1½      |

*Figure 13*

## 9.4 Pt500 ⌀5.8 mm / ⌀6.0 mm pocket sensor set

TemperatureSensor 63 ⌀5.8 mm / ⌀6.0 mm pocket sensor is a Pt500 wire sensor, designed with a 2-wire silicone cable and completed with a ⌀5.8 mm or ⌀6,0 mm shrinkable stainless steel sleeve that protects the sensor element. The steel sleeve is mounted in a sensor pocket (dip pipe). The sensor pockets for the ⌀5.8 mm temperature sensor is delivered with R½ (conic ½") connection in stainless steel in the lengths 65, 90 and 140 mm. For the ⌀6.0 mm temperature sensor, the sensor pockets are supplied with G½ (straight ½") connection, also in stainless steel, and can be delivered in the lengths 65, 85,120 and 210 mm. For the ⌀6.0 mm temperature sensor, which is designed according to EN1434-2, it is particular that this temperature sensor, in the EU, may be used in all approved pockets for ⌀6 mm temperature sensors that are also designed according to EN1434-2, regardless of the manufacturer. The relevant pockets for ⌀6 mm temperature sensors are characterised by being marked with "EN1434". The sensor design with separate dip pipe enables exchange of sensors without first shutting off the water supply. Furthermore, the wide range of immersion pipe lengths ensures that the sensors can be mounted in all existing pipe dimensions. The stainless steel pockets can be used for mounting in both PN16 and PN25 installations. At flow rates above 3 m/s or in a PN40 installation, it is recommended to use a reinforced stainless steel pocket with a diameter of ⌀10 mm at the tip and that is made of one piece.
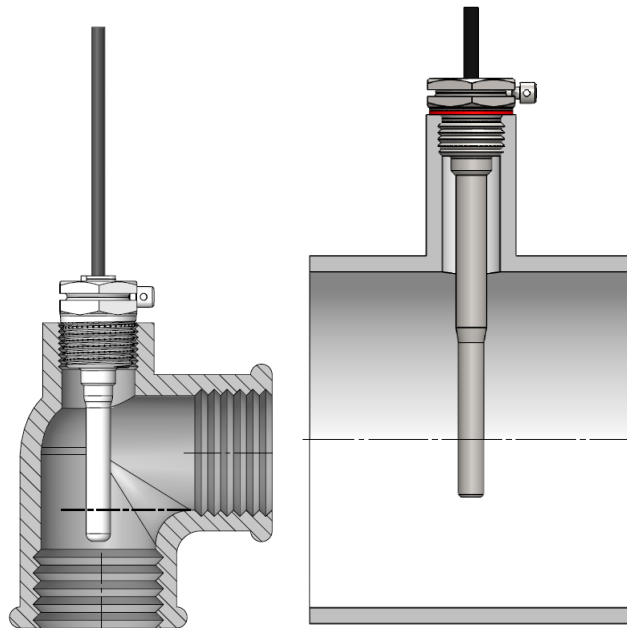


*Figure 14: Examples of installation of sensor pocket for ⌀5.8 mm temperature sensor with R½ thread (to the left) and sensor pocket for ⌀6.0 mm temperature sensor with G½ thread and copper gasket (to the right).*

## 9.5 Identification of inlet and outlet temperature sensors
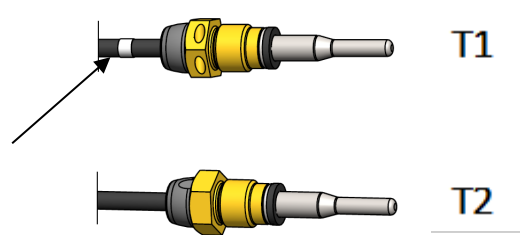


To make it easier to carry out a correct installation of TemperatureSensor 63, the inlet temperature sensor is equipped with additional two white markings on the cable by which you can easily identify which of the two temperature sensors is the inlet temperature sensor or outlet temperature sensor, respectively. One of the white markings is placed right after the temperature sensor itself, see the figure above, which makes it easy to check if the inlet temperature sensor is installed in the inlet pipe. The other white marking is placed at the end of the cable, see the figure below, and can, in connection with reverification, be used for checking that the temperature sensors have subsequently been mounted correctly in the calculator. Identification of inlet and outlet temperature sensors can likewise be seen from the attached sign on the temperature sensors.
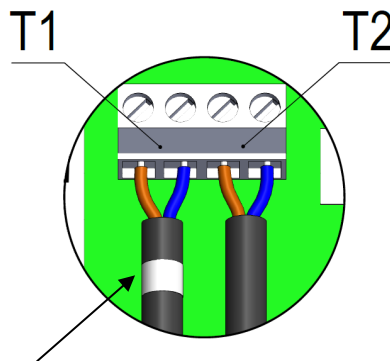


## 9.6 TemperatureSensor 83 – ø5.8 mm pocket sensor with connection head

TemperatureSensor 83 is a ø5.8 mm pocket sensor with connection head consisting of a ø5.8 mm Pt500 temperature sensor, which is connected to a replaceable sensor insert via a 2-wire silicone cable. The sensor insert is mounted in an immersion pocket with mounted connection board, see *Figure 15*. Connection of 4-wire cable takes place by inserting the cable through the PG coupling in the connection head and installing the 4 wires in the screw terminal on the temperature sensor insert.
TemperatureSensor 83 is delivered with R½ (conical ½") connection in stainless steel and in lengths of 65, 90, 140 and 180 mm. The outer diameter of the immersion pocket is ø10 mm at the widest point, which makes it possible to mount TemperatureSensor 83 in a pipe extension. The construction with replaceable sensor insert allows replacement of sensors without having to cut off the water flow. Furthermore, the wide range of immersion pipe lengths ensures that the sensors can be mounted in all existing pipe dimensions. The stainless steel pockets can be used for mounting in both PN16 and PN25 installations.

Figure 15: The ø5.8 mm pocket sensor with connection head can, for example, be mounted in a tee as shown in Figure 16.
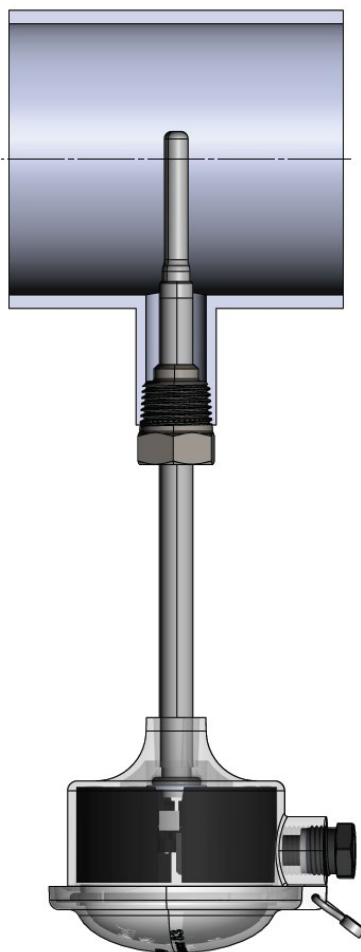
Figure 16

## 9.7   TemperatureSensor SP 4-wire – ø6 mm EN1434 pocket sensor with connection head

TemperatureSensor SP 4-wire is a ø6 mm pocket sensor with connection head designed according to the instructions in EN1434-2. Both the temperature sensor and the matching sensor pocket are shown in *Figure 17*. The temperature sensor has a diameter of 6 mm and at the end of the temperature sensor, a connection head in aluminium of the type DIN Form B is mounted. The temperature sensor can be delivered both as Pt100 and as Pt500 and when mounted in the matching sensor pocket, it is approved for use in the temperature range 0-180 degrees and in both PN16, PN25 and PN 40 installations.

For flow rates up to 3 m/s, a welded stainless steel pocket with a diameter of ø8 mm at the tip is used. At flow rates above 3 m/s or in a PN40 installation, a stainless steel pocket with a diameter of ø10 mm at the tip is used, see *Figure X*, and that is made of one piece. When mounting, a copper gasket is used to ensure the necessary density. The various installation lengths L for the sensor pocket are shown in *Table 10* in which you can also see the matching installation length EL for the temperature sensor.
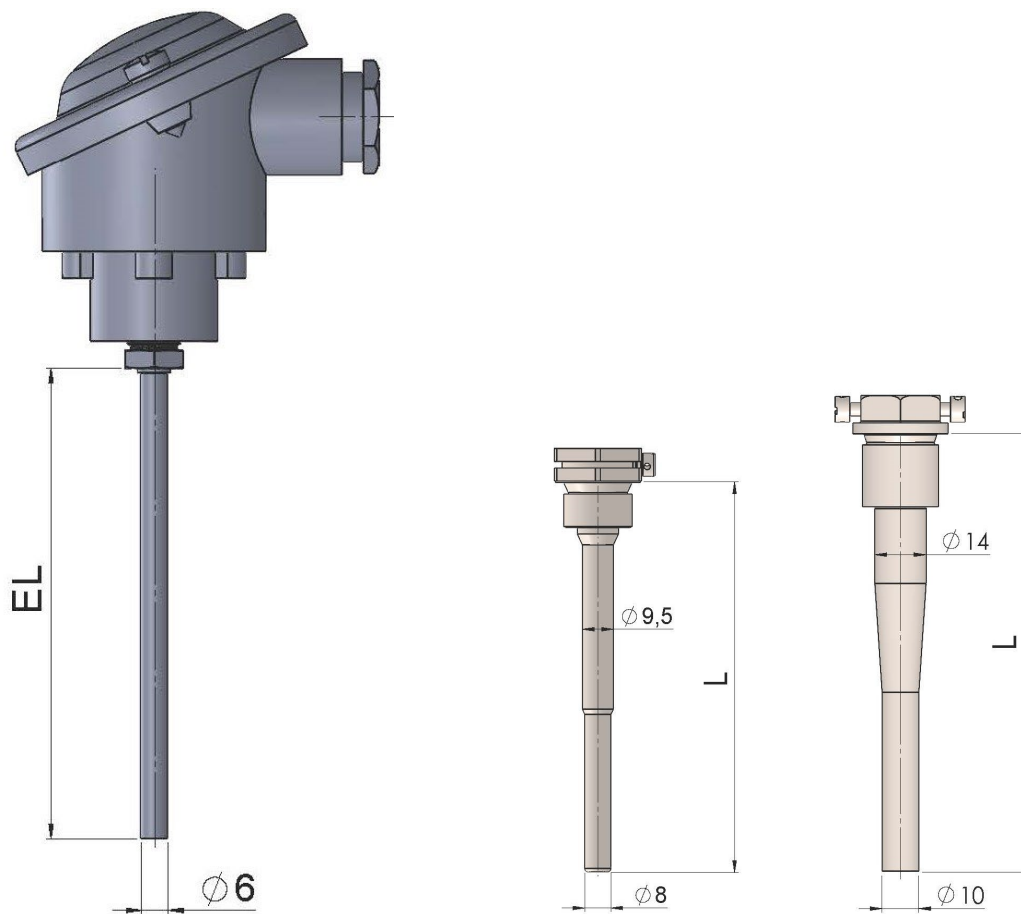


*Figure 17: ø6 mm pocket sensor with connection head and corresponding pockets.*

| Installation length of ø6 mm sensor - EL | Installation length of ø6 mm pocket - L |
|---|---|
| 105 mm | 85 mm |
| 140 mm | 120 mm |
| 230 mm | 210 mm |

*Table 10*

# MULTICAL® 803

## 9.8 Resistance tables

All values of the ohmic resistance are laid down in the international standard EN 60 751, applying to both Pt100 and Pt500 temperature sensors. The value of the ohmic resistance of a Pt500 sensor is five times higher than that of a Pt100 sensor. The tables below show the resistance values in [Ω] for each degree Celsius for Pt100 and Pt500 temperature sensors, respectively:

| Pt100 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| °C | 0 | -1 | -2 | -3 | -4 | -5 | -6 | -7 | -8 | -9 |
| -30 | 88,223 | 87,829 | 87,434 | 87,040 | 86,645 | 86,250 | 85,855 | 85,460 | 85,065 | 84,670 |
| -20 | 92,160 | 91,767 | 91,374 | 90,980 | 90,587 | 90,193 | 89,799 | 89,405 | 89,011 | 88,617 |
| -10 | 96,086 | 95,694 | 95,302 | 94,909 | 94,517 | 94,125 | 93,732 | 93,339 | 92,946 | 92,553 |
| 0 | 100,000 | 99,609 | 99,218 | 98,827 | 98,436 | 98,044 | 97,653 | 97,261 | 96,870 | 96,478 |
| | | | | | | | | | | |
| °C | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 0 | 100,000 | 100,391 | 100,781 | 101,172 | 101,562 | 101,953 | 102,343 | 102,733 | 103,123 | 103,513 |
| 10 | 103,903 | 104,292 | 104,682 | 105,071 | 150,460 | 105,849 | 106,238 | 106,627 | 107,016 | 107,405 |
| 20 | 107,794 | 108,182 | 108,570 | 108,959 | 109,347 | 109,735 | 110,123 | 110,510 | 110,898 | 111,286 |
| 30 | 111,673 | 112,060 | 112,447 | 112,835 | 113,221 | 113,608 | 113,995 | 114,382 | 114,768 | 115,155 |
| 40 | 115,541 | 115,927 | 116,313 | 116,699 | 117,085 | 117,470 | 117,856 | 118,241 | 118,627 | 119,012 |
| 50 | 119,397 | 119,782 | 120,167 | 120,552 | 120,936 | 121,321 | 121,705 | 122,090 | 122,474 | 122,858 |
| 60 | 123,242 | 123,626 | 124,009 | 124,393 | 124,777 | 125,160 | 125,543 | 125,926 | 126,309 | 126,692 |
| 70 | 127,075 | 127,458 | 127,840 | 128,223 | 128,605 | 128,987 | 129,370 | 129,752 | 130,133 | 130,515 |
| 80 | 130,897 | 131,278 | 131,660 | 132,041 | 132,422 | 132,803 | 133,184 | 133,565 | 133,946 | 134,326 |
| 90 | 134,707 | 135,087 | 135,468 | 135,848 | 136,228 | 136,608 | 136,987 | 137,367 | 137,747 | 138,126 |
| 100 | 138,506 | 138,885 | 139,264 | 139,643 | 140,022 | 140,400 | 140,779 | 141,158 | 141,536 | 141,914 |
| 110 | 142,293 | 142,671 | 143,049 | 143,426 | 143,804 | 144,182 | 144,559 | 144,937 | 145,314 | 145,691 |
| 120 | 146,068 | 146,445 | 146,822 | 147,198 | 147,575 | 147,951 | 148,328 | 148,704 | 149,080 | 149,456 |
| 130 | 149,832 | 150,208 | 150,583 | 150,959 | 151,334 | 151,710 | 152,085 | 152,460 | 152,835 | 153,210 |
| 140 | 153,584 | 153,959 | 154,333 | 154,708 | 155,082 | 155,456 | 155,830 | 156,204 | 156,578 | 156,952 |
| 150 | 157,325 | 157,699 | 158,072 | 158,445 | 158,818 | 159,191 | 159,564 | 159,937 | 160,309 | 160,682 |
| 160 | 161,054 | 161,427 | 161,799 | 162,171 | 162,543 | 162,915 | 163,286 | 163,658 | 164,030 | 164,401 |
| 170 | 164,772 | 165,143 | 165,514 | 165,885 | 166,256 | 166,627 | 166,997 | 167,368 | 167,738 | 168,108 |
| 180 | 168,478 | 168,848 | 169,218 | 169,588 | 169,958 | 170,327 | - | - | - | - |

*Pt100, IEC 751 Amendment 2-1995-07*

*Table 11*

| Pt500 | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|
| °C | 0 | -1 | -2 | -3 | -4 | -5 | -6 | -7 | -8 | -9 |
| -30 | 441,116 | 439,144 | 437,172 | 435,199 | 433,225 | 431,251 | 429,276 | 427,301 | 425,325 | 423,349 |
| -20 | 460,802 | 458,836 | 456,869 | 454,902 | 452,934 | 450,966 | 448,997 | 447,027 | 445,057 | 443,087 |
| -10 | 480,430 | 478,469 | 476,509 | 474,547 | 472,585 | 470,623 | 468,660 | 466,696 | 464,732 | 462,767 |
| 0 | 500,000 | 498,046 | 496,091 | 494,135 | 492,179 | 490,222 | 488,265 | 486,307 | 484,348 | 482,389 |
| | | | | | | | | | | |
| °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 |
| 170 | 823,861 | 825,716 | 827,571 | 829,426 | 831,280 | 833,133 | 834,986 | 836,838 | 838,690 | 840,541 |
| 180 | 842,392 | 844,241 | 846,091 | 847,940 | 849,788 | 851,635 | - | - | - | - |

*Pt500, IEC 751 Amendment 2-1995-07*

*Table 12*

# 10 Power supply

MULTICAL® 803 is supplied via the connection terminals to the left in the calculator base. The internal power supply is 3,6 VDC and can be carried out as mains supply with battery backup via a number of different supply modules from Kamstrup A/S. See the below extract from the type number overview in paragraph 3.1.

| Supply | Supply of calculator and modules | Auxiliary supply | Type |
|---|---|---|---|
| 1 x 230 VAC | Calculator and module slots M1+M2 | | A |
| 1 x 24 VAC/VDC | Calculator and module slots M1+M2 | | b |
| 2 x 230 VAC | Calculator and module slots M1+M2+M3+M4 | 1 x 24 VDC | C |
| 2 x 24 VAC/VDC | Calculator and module slots M1+M2+M3+M4 | 1 x 24 VDC | d |

All supply types and modules have been evaluated in connection with the extensive type tests to which MULTICAL® 803 has been subjected, and it is not permissible to use other supply modules than the ones mentioned above. The supply modules are covered by the CE-marking and the factory guarantee of the calculator.

On the display, you can see which module slots are supplied in MULTICAL® 803. When the display of MULTICAL® 803 shows the main display reading, the reading of the supplied module slots is shown by pressing the left arrow key on the calculator front four times, see example below.
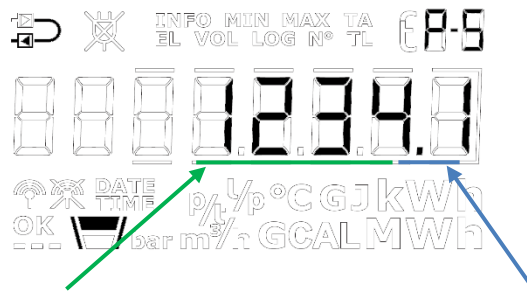


| Supply of the module slots M1, M2, M3 and M4. Note that if the digits are, for example, **1200**.X, it means that there is no supply of the module slots M3 and M4. Read more about supply possibilities in paragraph 10.7. | Backup supply of module slot M1. Note that if the digit is, for example, XXXX.**0**, it means that there is no backup supply of module slot M1. Read more about backup of module slot M1 in paragraph 10.1. |
|---|---|

## 10.1 Backup battery, lithium, 2xA-cells

MULTICAL® 803 is always delivered with 2xA-cell backup battery (Kamstrup type HC-993-10). It requires no tool to install or replace the backup battery when cover and base cover of the calculator are separated.



It is possible to use the backup battery for the operation of the basic meter functionality or basic meter functionality and communication on module slot 1. The supply of module slot 1 during backup requires that the backup battery connection is moved to the connector that is shielded by a label with the battery symbol and the text "Module 1". This connector is placed next to the connector to which the battery is connected on delivery, see figure below.

Each battery cell has a lithium content of approx. 0,9 g, which excepts the backup battery from being subject to regulations for transportation of dangerous goods.
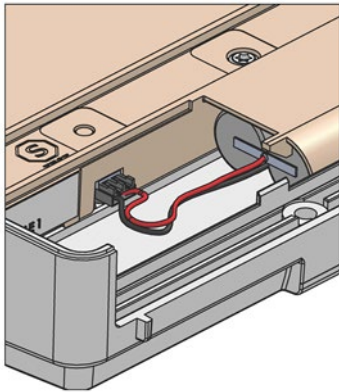


*Figure 18 Battery is mounted at delivery*
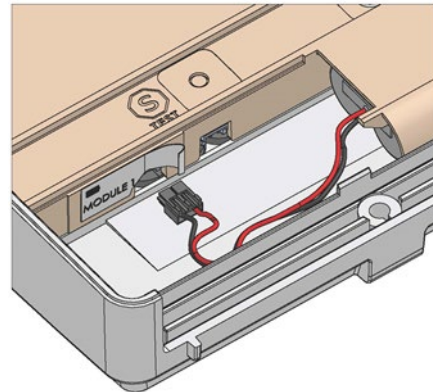


*Figure 19 : Socket is moved for backup operation of module slot M1*

## 10.2 Lifetime of the backup battery

The backup battery lifetime depends on factors like ambient temperature and meter configuration. An indication of the battery lifetime is thus a realistic estimate. In general, the battery lifetime of the backup battery can be considered from two scenarios and in two different applications. Either the calculator is operated by battery only from the day of delivery or the backup battery is used as backup battery in case of mains failure within the 10-year replacement interval. The estimated lifetime of the backup battery in MULTICAL® 803 appears from the table below.

| Function on battery | Battery operation from delivery | Backup operation within the replacement interval (10 years) |
|---|---|---|
| Calculator[1] | Up to 6 years | Up to 2 years |
| Calculator[1] + Module 10 - Data + Pulse inputs | Up to 3 years | Up to 1 years |
| Calculator[1] + Module 20 - M-Bus + Pulse inputs | | |
| Calculator[1] + Module 30[2] - wM-Bus + Pulse inputs | | |

[1] *Basic meter function (V1, V2, t1, t2, t3, t4 and display without backlight)*

[2] *Note that the battery lifetime for wM-Bus depends on the selected datagrams. See "Logger profiles and datagrams, 5512-2245" for more information*

Modules that are not shown in the overview should not be used on module slot 1 during backup operation.


Conditions for above calculations of battery lifetime:

- Wall-mounted calculator (tBAT < 30 °C)

- Data reading: Max one reading per hour

- M-Bus reading: Max one reading every 10 seconds

- Display on (LCD ON), no backlight

- The connected ULTRAFLOW® 54/44 flow sensors have an average flow ≈ qp/4

## 10.3 Supply

### 10.3.1   Input voltage 230 VAC (type no.: HC-993-11)

This module is galvanically separated from the 230 VAC supply, the module is adjusted to direct connection to the electricity network. The module is constructed as a Switch Mode Power Supply that meets the requirements for double-insulation when the calculator top is mounted on the calculator base. There is space for two of this type of module in MULTICAL® 803 in the 230 VAC version, one for supplying the calculator and the module slots M1 and M2, and another for supplying the module slots M3 and M4, if needed.



If connected to 230 VAC, the whole installation must fulfil current national regulations. Connection/disconnection of the module must be carried out by the meter installer. However, note that work on fixed installations and in the electrical panels must be carried out by an authorized electrician.

### 10.3.2   Input voltage 24 VDC/VAC (type no.: HC-993-12)

This module is galvanically separated from the 24 VDC/VAC, the module is adjusted for industrial installations and installations supplied by a separate 230/24 V safety transformer, for example mounted in an electrical panel. The module is constructed as a Switch Mode Power Supply that meets the requirements for double-insulation when the calculator top is mounted on the calculator base. There is space for two of this type of module in MULTICAL® 803 in the 24 VAC/VDC version, one for supplying the calculator and the module slots 1 and 2 and another for supplying the module slots 3 and 4, if needed.



The whole installation must fulfil current national regulations. Connection/disconnection of the module must be carried out by the meter installer, whereas installation of the 230/24 VAC safety transformer in electrical panels as well as other fixed installations must be carried out by an authorized electrician.

## 10.4 Auxiliary supply

### 10.4.1  Input voltage 230 VAC (type no.: HC-993-13)

This module is galvanically separated from the 230 VAC supply and is used for supplying either analog output modules or passive 24 V flow sensors from a third-party supplier, see more in paragraph 8.4. The module is constructed as a Switch Mode Power Supply that meets the requirements for double-insulation when the calculator top is mounted on the calculator base. There is space for one of this type of module in MULTICAL® 803 in the 230 VAC version. The module provides 24 VDC voltage to the connection terminals 97A on the connection board 6699-045 as well as to the two connectors for the supply of analog output modules placed above the connection terminals on the connection board.



If connected to 230 VAC the whole installation must fulfil current national regulations. Connection/disconnection of the module must be carried out by the meter installer. However, note that work on fixed installations and in the electrical panels must be carried out by an authorized electrician.

### 10.4.2  Input voltage 24 VAC/VDC (type no.: HC-993-14)

This module is galvanically separated from the 24 VAC/VDC supply and is used for supplying either analog output modules or passive 24 V flow sensors from third-party suppliers, see more in paragraph 8.4. The module is constructed as a Switch Mode Power Supply that meets the requirements for double-insulation when the calculator top is mounted on the calculator base. There is space for one of this type of module in MULTICAL® 803 in the 24 VAC/VDC version. The module provides 24 VDC voltage to the terminals 97A on connection board 6699-045 as well as to the two connectors for the supply of analog output modules placed above the connection terminals on the connection board.



The whole installation must fulfil current national regulations. Connection/disconnection of the module must be carried out by the meter installer, whereas installation of the 230/24 VAC safety transformer in electrical panels as well as other fixed installations must be carried out by an authorized electrician.

## 10.5 Safety transformer 230/24 VAC

The supply modules for 24 VAC are adjusted for use with a 230/24 VAC safety transformer, e.g. Kamstrup type 6699-404/-405, which is mounted in an electrical panel or another separate capsuling. For power consumption by use of the safety transformer in connection with 24 VAC supply modules, see data sheet 5810-503.



| 6699-404 | 6699-405 |

## 10.6 Supply cables for supply module

Kamstrup A/S can deliver supply cables of the type H03VV-F2[1] 2 x 0,75 mm² to be used for both 24 VAC and 230 VAC as accessory for MULTICAL® 803. The supply cable to the calculator must not be protected by a fuse larger than the one permitted.

In case of doubt, it is recommended to let an authorized electrician assess if the installation in question is performed correctly as regards safety.

*[1] H03VV-F2 is the type designation of the PVC-insulated cable with a rated voltage of 300/300 V and a maximum temperature of 70 °C. During installation, be aware of keeping an adequate distance to hot parts of the installation.*

## 10.7 Retrofitting and replacement of supply modules

Supply modules can be replaced as long as they are of the same voltage specification as the one that MULTICAL® 803 was delivered with. Therefore, it is not permitted to change from 230 VAC to 24 VAC/VDC and vice versa unless the connection board is also replaced. However, you can always add extra supply modules to MULTICAL® 803, which is supplied via a single supply module from Kamstrup A/S (type 803-xxxxxxx-A and B).

Retrofitting requires supply module including supply cables that can be delivered as an accessory from Kamstrup A/S. See paragraph 3.3.
For the installation of supply modules in MULTICAL® 803, see paragraph 4.9.

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**Note:**
PLEASE REMEMBER TO DISCONNECT THE MAINS SUPPLY FROM THE CONNECTION BOARD <u>BEFORE</u> INITIATING THE REPLACEMENT OR EXTENSION OF THE SUPPLY!

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## 10.8 Data backup in case of interruption of supply

As a starting point, MULTICAL® 803 is always equipped with a backup battery, see paragraph 10.1, which ensures the operation of the calculator and the internal clock in case of an interruption of the mains supply. If it is required to replace the backup battery, the calculator will, during the replacement, maintain its clock for one hour so that the replacement of the backup battery can take place without loss of time information. The calculator is also equipped with functionality to store all current register meter counts if the supply is completely disconnected (both backup battery and mains supply). When the supply is reestablished, the calculator continues counting from the value, which was saved when the supply was interrupted.

# 11 Communicationmodules

MULTICAL® 803 has room for four communication modules.
All modules are part of the type approval of the MULTICAL® 803.
Only type-approved modules must be used, as CE-declaration and factory warranty depends hereof.
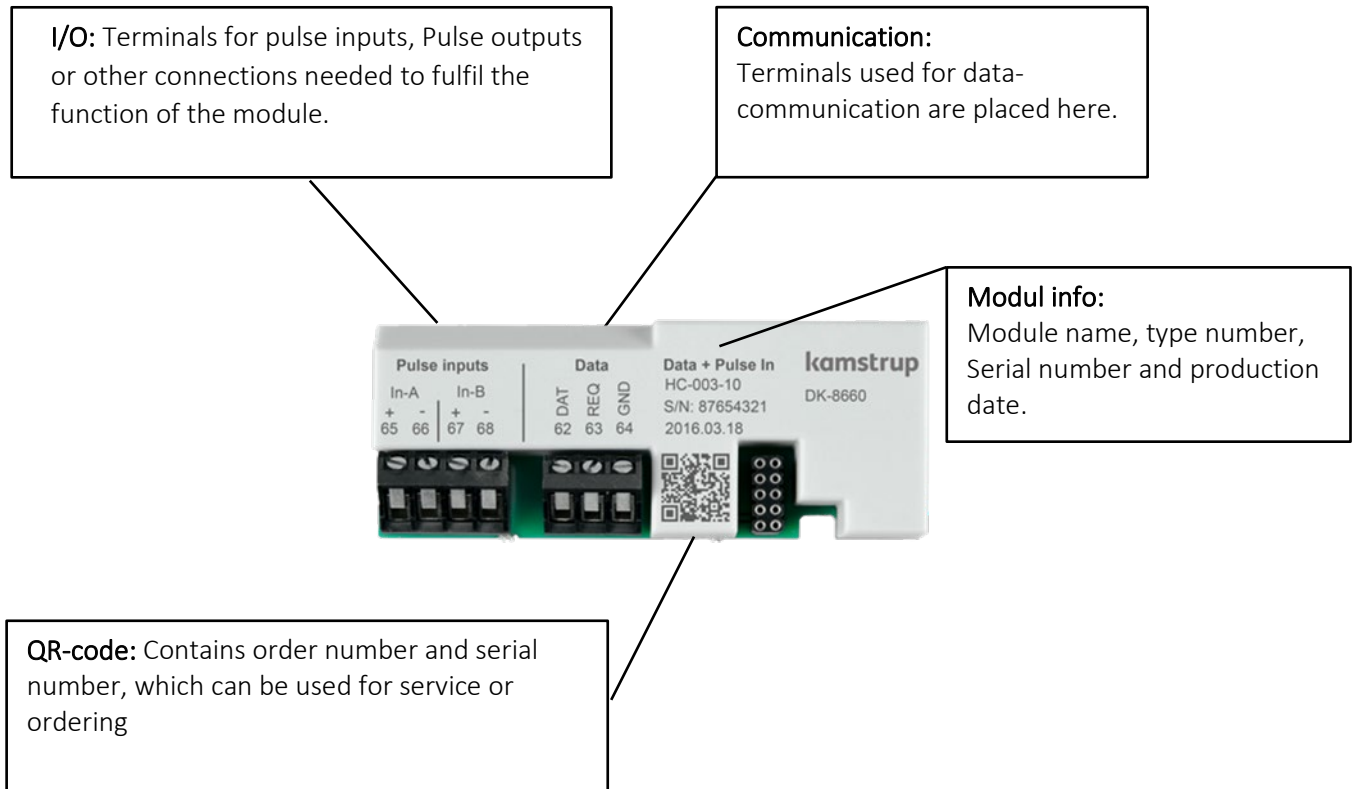The meter automatically detects whether a module has pulse-inputs or pulse-outputs.

| Type number | Module name | Note |
|---|---|---|
| HC-003-**10** | Data Pulse, inputs (In-A, In-B) | |
| HC-003-**11** | Data Pulse, outputs (Out-C, Out-D) | |
| HC-003-**20** | Wired M-Bus, inputs (In-A, In-B) | |
| HC-003-**21** | Wired M-Bus, outputs (Out-C, Out-D) | |
| HC-003-**22** | Wired M-Bus, Thermal Disconnect | ⏻ �🡆 🖳 |
| HC-003-**30** | Wireless M-Bus, inputs (In-A, In-B), 868 MHz | (p) |
| HC-003-**31** | Wireless M-Bus, outputs (Out-C, Out-D), 868 MHz | (p) |
| HC-003-**32** | linkIQ/wM-Bus, inputs (In-A, In-B), EU | (p) |
| HC-003-**33** | linkIQ/wM-Bus, outputs (Out-C, Out-D), EU | (p) |
| HC-003-**34** | wM-Bus, inputs (In-A, In-B),912,5/915/918,5 MHz | (p) |
| HC-003-**40** | Analog outputs 2 x 0/4...20 mA | ⏻ 🡆 |
| HC-003-**41** | Analog inputs 2 x 4...20 mA / 0...10 V | ⏻ 🡆 |
| HC-003-**43** | PQT Controller | ⏻ 🡆 |
| HC-003-**50** | Low Power Radio, inputs (In-A, In-B), 434 MHz | (p) 🖳 |
| HC-003-**51** | Low Power Radio GDPR, inputs (In-A, In-B), 434 MHz | (p) 🖳 |
| HC-003-**56** | NB-IoT, inputs (In-A, In-B) | (p) 🔋⁺ ⚡ |
| HC-003-**60** | LON TP/FT-10, inputs (In-A, In-B) | ⚡ |
| HC-003-**66** | BACnet MS/TP, inputs (In-A, In-B) | ⏻ |
| HC-003-**67** | Modbus RTU, inputs (In-A, In-B) | ⏻ |
| HC-003-**80** | 2G/4G Network, inputs (In-A, In-B) | (p) ⚡ |
| HC-003-**81** | BACnet IP, inputs (In-A,In-B) | ⚡ |
| HC-003-**82** | Modbus/KMP TCP/IP, inputs (In-A, In-B) | ⚡ |
| HC-003-**83** | READy TCP/IP, inputs (In-A, In-B) | ⚡ |
| HC-003-**84** | High Power Radio Router, inputs (In-A, In-B), 444 MHz | (p) ⚡ |
| HC-003-**85** | High Power Radio Router GDPR, inputs (In-A, In-B), 444 MHz | (p) ⚡ |

⏻ The module requires that the meter is mains-supplied.
⚡ The module requires that the meter is mains-supplied with a High Power supply.
🔋⁺ The module requires that the meter is supplied by a High power battery.
🡆 The module requires an external power supply to operate.
🖳 The module requires a specific coding in meter, see the module datasheet for details.
(p) The module requires an internal or external antenna, see chapter **Mounting of antenna.**

# MULTICAL® 803

## 11.1 Marking on communication modules

All module covers are marked, with clear indication on how to connect signal wires, sensors, power supplies etc. to ensure correct function of the module.

I/O: Terminals for pulse inputs, Pulse outputs or other connections needed to fulfil the function of the module.

Communication: Terminals used for data-communication are placed here.

Modul info: Module name, type number, Serial number and production date.

QR-code: Contains order number and serial number, which can be used for service or ordering

Radio communication modules only have the I/O terminals and a connector for antenna.

For further information on the modules, please refer to their respective datasheets.

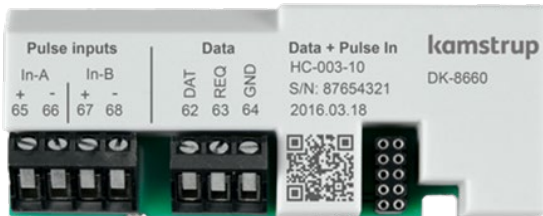For Pulse inputs, see chapter **3.4.7 Pulse inputs A and B >FF-GG<**

For Pulse outputs, see chapter **3.4.11 Pulse outputs C and D >PP<**

## 11.2 Modules

### 11.2.1  HC-003-10: Data Pulse, inputs (In-A, In-B)

Data Pulse module enables direct communication to the meter using the KMP protocol.

The module requires a special Kamstrup adapter cable for either RS-232 or USB to exchange data.



For information about the KMP protocol, see chapter **Data protocol**

### 11.2.2  HC-003-11: Data Pulse, outputs (Out-C, Out-D)

Data Pulse module enables direct communication to the meter using the KMP protocol.

The module requires a special Kamstrup adapter cable for either RS-232 or USB in order to exchange data.



For information about the KMP protocol, see chapter **Data protocol**

### 11.2.3  HC-003-20: Wired M-Bus, inputs (In-A, In-B)

Wired M-Bus enables communication to battery supplied meters, without affecting the battery lifetime.

The Wired M-Bus module supports primary, secondary and enhanced secondary M-Bus addressing. The module supports automatic baud rate selection among 300,2400,9600 and 19200 baud.

A large selection of datagrams for various applications can be configured into the M-Bus module.

### 11.2.4   HC-003-21: Wired M-Bus, outputs (Out-C, Out-D)

Wired M-Bus enables communication to battery supplied meters, without affecting the battery lifetime.

The Wired M-Bus module supports primary, secondary and enhanced secondary M-Bus addressing. The module supports automatic baud rate selection among 300,2400,9600 and 19200 baud.

A large selection of datagrams for various applications can be configured into the M-Bus module.



### 11.2.5   HC-003-22: Wired M-Bus, Thermal Disconnect

Thermal Disconnect enables remote control of flow either for energy-management, or for maintenance purposes. The Thermal Disconnect controls a thermal valve through commands sent via the wired M-bus.

### 11.2.6 HC-003-30: Wireless M-Bus, inputs (In-A, In-B), 868 Mhz

The Wireless M-Bus module has been developed for Wireless M-Bus systems operating within the licence free band of 868 MHz.

Communication is either C-mode or T-mode according to EN13757-4. The Wireless M-Bus module supports individual encryption. Common encryption key is only available upon request.

A large selection of datagrams for various applications can be configured into the Wireless M-Bus module.



⚠  This module is replaced by HC-003-32.

### 11.2.7 HC-003-31: Wireless M-Bus, outputs (Out-C, Out-D), 868 Mhz

The Wireless M-Bus module has been developed for Wireless M-Bus systems operating within the licence free band of 868 MHz.
Communication is either C-mode or T-mode according to EN13757-4. The Wireless M-Bus module supports individual encryption. Common encryption key is only available upon request.
A large selection of datagrams for various applications can be configured into the Wireless M-Bus module.



⚠  This module is replaced by HC-003-33.

# MULTICAL® 803

### 11.2.8   HC-003-32: linkIQ/wM-Bus, inputs (In-A, In-B), EU

This module has been designed with focus on the newest demands for wireless reading. It has an increased transmit power which ensures a better range and still ensures a long battery life. The module can be configured as either wM-Bus (868MHz) or linkIQ (868-870MHz) in both configurations it is still possible to reconfigure the module using C2.



### 11.2.9   HC-003-33: linkIQ/wM-Bus, outputs (Out-C, Out-D), EU

This module has been designed with focus on the newest demands for wireless reading. It has an increased transmit power which ensures a better range and still ensures a long battery life. The module can be configured as either wM-Bus (868MHz) or linkIQ (868-870MHz) in both configurations it is still possible to reconfigure the module using C2.



### 11.2.10 HC-003-34: wM-Bus, inputs (In-A, In-B), 912,5/915/918,5 MHz

This module has been developed for Wireless M-Bus systems operating within the licence free band in the range 912.5...918.5 MHz.
The modules fulfil the requirements of the M-Bus standard EN 13757:2013.
The module can be configured with different datagrams.

## 11.2.11 HC-003-40: Analog outputs 2 x 0/4…20 mA

Analog outputs are often used to pass information to PLC's or similar equipment.

The Analog outputs is based on flow, power or temperatures from the meter. The Analog outputs are individually scale able and configurable as either 0…20 mA or 4…20 mA.



To reduce fluctuations on the analog outputs a larger filtervalue can be selected using METERTOOL. See section **Integration mode > L <**.

The external 24VAC/DC supply is used to supply the analog output circuit.

For MULTICAL®803 the internal 24VDC auxiliary supplies found in MC803xxxxxxxC and MC803xxxxxxxD can be used as well. See chapter **Type number** under Supply.

## 11.2.12 HC-003-41: Analog inputs 2 x 4…20 mA / 0…10 V

The Analog inputs are for reading and collecting external sensor values to be logged or displayed in the meter. The module accepts both 4..20 mA or 0..10 V signals. Each analog input can be configured individually.



The external 24 VAC/DC supply is used to supply the analog input circuit and the attached sensors.

For MULTICAL®803 the internal 24 VDC auxiliary supplies found in MC803xxxxxxxC and MC803xxxxxxxD can be used as well. See chapter **Type number** under Supply.

## 11.2.13 HC-003-43: PQT Controller

The PQT Controller is for application to optimize energy consumption. The PQT Controller reads the flow, power and temperatures from the meter and together with the configured setpoints the PQT Controller steers an attached motorized valve.

### 11.2.14 HC-003-50: Low Power Radio, inputs (In-A, In-B), 434 MHz

The Low Power Radio module enables reading of meters via radio-systems operating in the 434 MHz band.

Low Power Radio is designed for Walk-by/Drive-by but are prepared to participate into a Kamstrup radio mesh-network, facilitating automatic transfer of data to the reading system through the network routers and concentrators.

The reading system decides what data to read in the meter.



### 11.2.15 HC-003-51: Low Power Radio GDPR, inputs (In-A, In-B), 434 MHz

The Low Power Radio module enables reading of meters via radio-systems operating in the 434 MHz band.

Low Power Radio is designed for Walk-by/Drive-by but are prepared to participate into a Kamstrup radio mesh-network, facilitating automatic transfer of data to the reading system through the network routers and concentrators.

The reading system decides what data to read in the meter.

To comply to the GDPR directive, data from the meter are encrypted using individual encryption keys.



### 11.2.16 HC-003-56: NB-IoT, inputs (In-A, In-B)

he NB-IoT (Narrow Band Internet of Things) module is a point-to-point communication module, that transmits data directly from the meter back to meter reading database using the existing mobile NB-IoT infrastructure.

It is very flexible communication platform that can be used for both battery or main supplied meters, as the transmission interval and datagram can be configured/designed according to customer wishes.

Data can be delivered to our own READy reading solution  or to a 3rd party reading solution.
To comply to the GDPR directive, data from the meter are encrypted using individual encryption keys.

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### 11.2.20 HC-003-80: 2G/4G Network, inputs (In-A, In-B)

The 2G/4G Network is a plug-and-play module. Once the meter is commissioned, the module starts sending hourly data on the 2G- or 4G cellular network.

32 actual values are sent to the utility every hour 24/7/365.

The module comes with 8 years of pre-paid data collection



The module includes an eternal 2G/4G antenna.

### 11.2.21 HC-003-81: BACnet IP, inputs (In-A, In-B)

The Module supports BACnet communication via Ethernet.
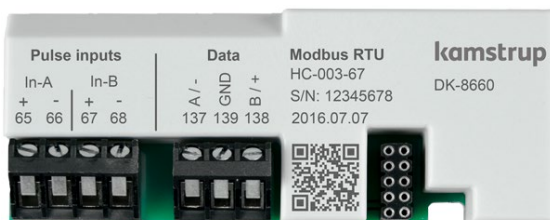
The BACnet IP enables reading of meters by building- and industrial-automation systems.



### 11.2.22 HC-003-82: Modbus/KMP TCP/IP, inputs (In-A, In-B)

The Module supports two communication protocols via Ethernet, Modbus TCP and KMP.

Modbus TCP enables reading of meters by building- and industrial-automation systems.

KMP enables reading of actual and logged values, and configurations.

### 11.2.23 HC-003-83: READy Ethernet, inputs (In-A, In-B)

READy Ethernet module is a plug-and-play module. Once the meter is commissioned, the module starts sending hourly data on the ethernet network.

Actual values are sent to the utility every hour 24/7/365.

### 11.2.24 HC-003-84: High Power Radio Router, inputs (In-A, In-B), 444 MHz

The High Power Radio Router module enables reading of meters via radio-systems operating in the 444 MHz-band. The built-in Router facilitates building of a radio mesh-network between the individual meters and the central concentrator, which manages the radio communication among the meters.

The reading system decides what data to read in the meter.

### 11.2.25 HC-003-85: High Power Radio Router GDPR, inputs (In-A, In-B), 444 MHz

The High Power Radio Router module enables reading of meters via radio-systems operating in the 444 MHz-band. The built-in Router facilitates building of a radio mesh-network between the individual meters and the central concentrator, which manages the radio communication among the meters.

The reading system decides what data to read in the meter.

To comply to the GDPR directive, data from the meter are encrypted using individual encryption keys.

## 11.3 Reading high resolution registers

When data reading energy and volume (E1, E3, V1), it is possible to select the default resolution with up to 8 significant digits like on the calculator display. It is also possible to select a reading with up to 9 significant digits (ExtraDigit), which is a ten times higher resolution than on the calculator display.

Furthermore, it is possible to read the internal high-resolution registers ("HighRes").

Below, E1 is used as an example. The same applies to E3 and V1. E1Extra digit is the same value as E1, with just one digit more in the resolution.

*Example:*

```
E1            =       1.234.567,8 kWh
E1ExtraDigit  =       1.234.567,89 kWh
E1HighRes     =       4.567.890,1 Wh
```

## 11.4 Mounting of antenna

*All radio-based modules must have either an internal or external antenna connected. To achieve best radio-range an external antenna is recommended.*

*When mounting an external antenna please ensure that the antenna cable is arranged as shown, to prevent damage of the cable when the meter is assembled*

*Before opening the meter to mount a module or an antenna, the power supply must be disconnected.*



Wireless M-Bus-module with intern antenna



Wireless M-Bus-module with external antenna

## 11.5 Module retrofitting.

Modules are also sold separately for retrofitting. The modules are preconfigured from the factory and ready to be mounted in the meter. However, some modules might need to be adapted after installation.

This list indicates which changes of module configurations are possible when mounted in the meter. Any changes can be made using METERTOOL HCW and an optical read-out head.

| Type number | Module name | Note |
|---|---|---|
| HC-003-**10** | Data Pulse, inputs (In-A, In-B) | - |
| HC-003-**11** | Data Pulse, outputs (Out-C, Out-D) | - |
| HC-003-**20** | Wired M-Bus, inputs (In-A, In-B) | M+D |
| HC-003-**21** | Wired M-Bus, outputs (Out-C, Out-D) | M+D |
| HC-003-**22** | Wired M-Bus, Thermal Disconnect | M+D |
| HC-003-**30** | Wireless M-Bus, inputs (In-A, In-B), 868 MHz | D |
| HC-003-**31** | Wireless M-Bus, outputs (Out-C, Out-D), 868 MHz | D |
| HC-003-**32** | linkIQ/wM-Bus, inputs (In-A, In-B), EU | D |
| HC-003-**33** | linkIQ/wM-Bus, outputs (Out-C, Out-D), EU | D |
| HC-003-**34** | wM-Bus, inputs (In-A, In-B),912,5/915/918,5 MHz | D |
| HC-003-**40** | Analog outputs 2 x 0/4...20 mA | A |
| HC-003-**41** | Analog inputs 2 x 4...20 mA / 0...10 V | A |
| HC-003-**43** | PQT Controller | A |
| HC-003-**50** | Low Power Radio, inputs (In-A, In-B), 434 MHz | D |
| HC-003-**51** | Low Power Radio GDPR, inputs (In-A, In-B), 434 MHz | D |
| HC-003-**56** | NB-IoT, inputs (In-A, In-B) | A |
| HC-003-**60** | LON TP/FT-10, inputs (In-A, In-B) | - |
| HC-003-**66** | BACnet MS/TP, inputs (In-A, In-B) | A |
| HC-003-**67** | Modbus RTU, inputs (In-A, In-B) | A |
| HC-003-**80** | 2G/4G Network, inputs (In-A, In-B) | - |
| HC-003-**81** | BACnet IP, inputs (In-A, In-B) | A |
| HC-003-**82** | Modbus/KMP TCP/IP, inputs (In-A, In-B) | A |
| HC-003-**83** | READy TCP/IP, inputs (In-A, In-B) | - |
| HC-003-**84** | High Power Radio Router, inputs (In-A, In-B), 444 MHz | - |
| HC-003-**85** | High Power Radio Router GDPR, inputs (In-A, In-B), 444 MHz | - |

M    Bus address/M-Bus Primary and M-Bus secondary addresses.
D    Datagram and module software, only by use of Module Programming cable.
A    All module parameters, datagram and software.
-    Module has no configuration.

**Note:** Pulse value and preset of pulse inputs are part of the meter configuration.
The bus addresses are also stored in the meter configuration, allowing a communication module to be replaced without assigning the bus address to the module.

For further information about METERTOOL HCW see technical documentation (5512-2097)

⚠ *Before opening the meter to mount a module or an antenna, the power supply must be disconnected.*

# 12 MULTICAL® 803 data protocol

The Internal data communication in MULTICAL® 803 is based on the Kamstrup Meter Protocol (KMP) that provides a fast and flexible reading structure and also fulfils future requirements for data reliability.

The KMP protocol is used in all Kamstrup consumption meters launched from 2006 onwards. The protocol is used for the optical read-out head and via plug pins for the module area. Thus, modules with e.g. M-Bus interface use the KMP protocol internally and the M-Bus protocol externally.

**Integrity and authenticity of data**
All data parameters include type, measuring unit, scaling factor and CRC16 check sum.
Every produced meter includes a unique identification number (S/N).

## 12.1 Optical read-out head

The optical read-out head can be used for data communication via the optical interface. The optical read-out head is placed on the front of the calculator just above the IR-diode as shown in the picture below. Note that the optical read-out head includes a very strong magnet, which should be protected by means of an iron disc when not in use.

Various variants of the optical read-out head appear from the list of accessories (see paragraph 3.3).

The optical read-out head is manually fixed when there is a need for brief readings. If you want the optical read-out head to be fixed permanently during the reading, the adhesive metal plate type 6699-042 is used.



**Power savings in connection with the optical read-out head**

In order to limit the power consumption of the circuit around the IR diode, the calculator includes a magnet sensor that switches off the circuit when there is no magnet near it.

## 12.2 Data protocol

Utilities and other relevant companies who want to develop their own communication driver for the KMP protocol can order a demonstration program in C# (.net based) as well as a detailed protocol description (in English language).
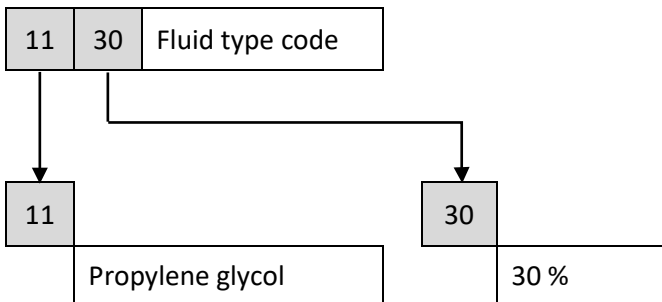
# 13 Mixed fluid

The MULTICAL® 803 calculator variant "M" (Mixed fluid) can operate in sub-zero temperatures, with a temperature range of -40...+140 °C. In applications where sub-zero temperatures can be expected, it is important to select temperature sensors and flow sensors with a suitable temperature range. Mixed fluids have a lower specific heat capacity compared to that of water. Kamstrup's mixed fluid calculator variant can compensate for this and thereby provide precise measurements regardless of the chemical composition in the installation.

The mixed fluid calculator variant can be delivered with the same known meter types, e.g. heat, cooling and heat/cooling, but neither the MID (Measurement Instrument Directive) nor national approvals apply to mixed fluid meters, so these meters are not allowed to be labeled with any approval marking on the meter front. However, the meter is tested in accordance with EN1434 and a calibration certificate is available as well.

MULTICAL® 803 calculator variant "M" is compatible with the most commonly used antifreeze liquids, e.g. ethylene glycol and propylene glycol. The type of antifreeze liquid and the concentration are freely programmable, and thus MULTICAL® 803 can compensate for the unique specific heat capacity in each application, ensuring a high accuracy regardless of the chemical composition of the application. From factory, the calculator is programmed with a 4-digit fluid type code, which states the fluid type and concentration level. The 4-digit fluid type code can be viewed in the calculator's display (reference number 71). New fluid types are added continuously and the complete overview of compatible fluid types can be viewed online at
www.kamstrup.com/en-en/heat-solutions/meters-devices/meters/multical-603/documents



| 11 | 30 | Fluid type code |

| 11 | | 30 |
| Propylene glycol | | 30 % |

## 13.1 Type number

Shown below are the type numbers available for calculator type "M".

| MULTICAL® 803 Mixed fluid type number | | | | | Static data 803-xxxx Written on the meter's front | - | Dynamic data xxxx Can be displayed | - | Dynamic data xxxxxxx Can be displayed |
|---|---|---|---|---|---|---|---|---|---|
| Type 803 - | | | | | □ - □ - □□ | - | □ - □□ | - | □ - □□ □□ □□ □□ |
| **Calculator type** | | | | | | | | | |
| Pt100/Pt500, 2/4-wire | t1, t2, t3, t4 | V1,V2 | Backlit display (Mixed fluid only) | | M | | | | |
| **Meter type** | | | | | | | | | |
| Heat meter | MID module B+D | | | | 2 | | | | |
| Heat/cooling meter | MID module B+D & TS 27.02 | | $\Theta_{HC}$= OFF | | 3 | | | | |
| Cooling meter | TS 27.02+BEK1178 | | | | 5 | | | | |
| Heat/cooling meter | MID module B+D & TS 27.02 | | $\Theta_{HC}$ = ON | | 6 | | | | |
| **Country code** | | | | | | | | | |
| See paragraph 3.5 | | | | | XX | | | | |
| **Flow sensor connection type** | | | | | | | | | |
| Prepared for flow sensors with fast and bounce-free electronic pulses | | | | | C | | | | |
| Prepared for flow sensors with slow and bounce-free electronic pulses | | | | | J | | | | |
| Prepared for flow sensors with slow pulses with bounce | | | | | L | | | | |
| Prepared for flow sensors with 24 V active/passive pulses* | | | | | P | | | | |
| Delivered with one flow sensor (Mixed fluid only) | | | | | G | | | | |

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| | Static data - | Dynamic data - | Dynamic data |
|---|---|---|---|
| **MULTICAL® 803 Mixed fluid type number** | 803-xxxx | xxxx | xxxxxxxx |
| | *Written on the meter's front* | *Can be displayed* | *Can be displayed* |

Type 803 - □ - □ - □□ - □ - □□ - □ - □□ □□ □□ □□

**Temperature sensor pair**

| Delivered without temperature sensors | | | 00 |
|---|---|---|---|
| **2-wire Pt500 temperature sensors** | | | |
| Short direct sensor pair | DS 27,5 mm | L 1,5 m | 51 |
| Short direct sensor pair | DS 27,5 mm | L 3,0 m | 52 |
| Short direct sensor pair (3 pairs) | DS 27,5 mm | L 1,5 m | 55 |
| Short direct sensor pair (3 pairs) | DS 27,5 mm | L 3,0 m | 56 |
| Pocket sensor pair | PL ø5,8 mm | L 1,5 m | 81 |
| Pocket sensor pair | PL ø5,8 mm | L 3,0 m | 82 |
| Pocket sensor pair | PL ø5,8 mm | L 5,0 m | 83 |
| Pocket sensor pair | PL ø5,8 mm | L 10 m | 84 |
| Pocket sensor pair (3 pairs) | PL ø5,8 mm | L 1,5 m | 85 |
| **4-wire Pt500 temperature sensors** | | | |
| Pocket sensor pair with connection head | PL ø5,8 mm | L 65 mm | C1 |
| Pocket sensor pair with connection head | PL ø5,8 mm | L 90 mm | C2 |
| Pocket sensor pair with connection head | PL ø5,8 mm | L 140 mm | C3 |
| Pocket sensor pair with connection head | PL ø5,8 mm | L 180 mm | C4 |

**Supply\*\***

| 1 x 230 VAC | Supply of module slots M1+M2 | | A |
|---|---|---|---|
| 1 x 24 VAC/VDC | Supply of module slots M1+M2 | | b |
| 2 x 230 VAC | Supply of module slots M1+M2+M3+M4 | 1 x 24 VDC auxiliary supply | C |
| 2 x 24 VAC/VDC | Supply of module slots M1+M2+M3+M4 | 1 x 24 VDC auxiliary supply | d |

**Communication module (4 module slots)**

| | M1 | M2 | M3 | M4 |
|---|---|---|---|---|
| No module | 00 | 00 | 00 | 00 |
| Data Pulse, inputs (In-A, In-B) | 10 | 10 | 10 | 10 |
| Data Pulse, outputs (Out-C, Out-D) | 11 | 11 | 11 | 11 |
| Wired M-Bus, inputs (In-A, In-B) | 20 | 20 | 20 | 20 |
| Wired M-Bus, outputs (Out-C, Out-D) | 21 | 21 | 21 | 21 |
| Wired M-Bus, Thermal Disconnect | 22 | 22 | 22 | 22 |
| LinkIQ/wM-Bus, inputs (In-A, In-B), EU | 32 | 32 | - | - |
| LinkIQ/wM-Bus, outputs (Out-C, Out-D), EU | 33 | 33 | - | - |
| wM-Bus, inputs (In-A, In-B), 912,5/915/918,5 MHz | 34 | 34 | - | - |
| Analog outputs 2 x 0/4…20 mA | - | - | 40 | 40 |
| Analog inputs 2 x 4…20 mA / 0…10 V | - | - | 41 | - |
| PQT Controller | - | - | 43 | - |
| LON TP/FT-10, inputs (In-A, In-B) | 60 | 60 | 60 | 60 |
| BACnet MS/TP, inputs (In-A, In-B) | 66 | 66 | 66 | 66 |
| Modbus RTU, inputs (In-A, In-B) | 67 | 67 | 67 | 67 |
| 2G/4G Network, inputs (In-A, In-B) | 80 | 80 | - | - |
| BACnet IP, inputs (In-A, In-B) | 81 | 81 | 81 | 81 |
| Modbus/KMP TCP/IP, inputs (In-A, In-B) | 82 | 82 | 82 | 82 |
| READy Ethernet, inputs (In-A, In-B) | 83 | 83 | 83 | 83 |
| High Power Radio Router, inputs (In-A, In-B), 444 MHz | 84 | 84 | - | - |
| High Power Radio Router GDPR, inputs (In-A, In-B), 444 MHz | 85 | 85 | - | - |

*\* Supplied with connection board for 24 V active/passive pulses*

*\*\* The type numbers A, b, C, d are shown in this way in the display*

# 13.2 Configuration numbers

Shown below are the configuration numbers available for calculator type "M".

**MULTICAL® 803 Mixed fluid configuration number:**

A  -  B  -  C C C  -  DDD  -  EE  -  FF  -  GG  -  L  -  M  -  N  -  PP  -  RR  -  T  -  VVVV

**Flow sensor position**

| | |
|---|---|
| Inlet | 3 |
| Outlet | 4 |

**Measuring unit**

| | |
|---|---|
| GJ | 2 |
| kWh | 3 |
| MWh | 4 |
| Gcal | 5 |

**Static CCC codes**

| | |
|---|---|
| Reed switch (7 digits) | 0 x x |
| Electronic, fast pulse (7 digits) | 1 x x |
| Electronic, fast pulse (8 digits) | 2 x x |
| Electronic, slow pulse (7 digits) | 9 x x |

**Display**

| | |
|---|---|
| Heat meter | 2xx |
| Heat/cooling meter | 3xx |
| Cooling meter | 5xx |

**Tariffs**

| | |
|---|---|
| No active tariff | 00 |
| Power tariff | 11 |
| Flow tariff | 12 |
| t1-t2 tariff | 13 |
| Inlet tariff | 14 |
| Outlet tariff | 15 |
| Time-controlled tariff | 19 |
| Heat/cooling volume tariff | 20 |
| PQ tariff | 21 |

**Pulse inputs A and B**

| | | |
|---|---|---|
| (See paragraph 3.4.7) | FF | GG |

**Integration mode**

| | | |
|---|---|---|
| Fast mode (2 s) | Backlight by push button | 4 |
| Fast mode (2 s) | Backlight always on | 9 |

**Leakage limits (V1/V2)**

| | |
|---|---|
| OFF | 0 |
| 1.0 % of qp + 20 % of q | 1 |
| 1.0 % of qp + 10 % of q | 2 |
| 0.5 % of qp + 20 % of q | 3 |
| 0.5 % of qp + 10 % of q | 4 |

**Leakage limit, Cold water (In-A, In-B)**

| | |
|---|---|
| OFF | 0 |
| 30 minutes without pulses | 1 |
| One hour without pulses | 2 |
| Two hours without pulses | 3 |

**Pulse Transmitter/Divider**

| | | |
|---|---|---|
| Out-C: V1/4 | 5 ms | 73 |
| Out-C: V1/1, Out-D: V2/1 | 3,9 ms | 80 |
| Out-C: V1/1 | 3,9 ms | 82 |
| Out-C: V1/4 | 22 ms | 83 |

**Pulse outputs for count registers**

| | | |
|---|---|---|
| E1 and V1 or E3 and V1 | 10 ms | 94 |
| E1 and V1 or E3 and V1 | 32 ms | 95 |
| E1 and V1 or E3 and V1 | 100 ms (0,1 s) | 96 |

**Controlled output based on data commands**

| | |
|---|---|
| Controlled output | 99 |

| | RR | - | T | - | VVVV |
|---|---|---|---|---|---|
| **Data logger profile** | | | | | |
| Standard data logger profile | 10 | | | | |
| Current values | 11 | | | | |
| Ludwig | 12 | | | | |
| Madrid | 13 | | | | |
| Peter | 14 | | | | |
| Diagnostic | 15 | | | | |
| Kiev | 17 | | | | |
| Information sensitive | 18 | | | | |
| **Encryption level** | | | | | |
| Individual key | | | 3 | | |
| **Customer label** | | | | | |
| See paragraph 3.4.14 | | | | | VVVV |

## 13.3 Tariffs

As the mixed fluid calculator MULTICAL® 803-M has a temperature range that goes below 0 °C, the tariff limits and the corresponding functionality have been adapted to reflect this compared to the rest of the MULTICAL® 803 portfolio.

In the standard meters meant for use with water in which the heat conveying liquid TA4 can be turned off by setting TL4 to 0,00 °C, this will still be the case for the mixed fluid calculators. This means that a tariff limit of 0,00 °C cannot be obtained for TA4/TL4. If required, it must be set to -0,01 °C or 0,01 °C.

Setting up negative temperature limits for the tariffs is done during the order process or in METERTOOL HCW with clear marking of a negative sign in front of the tariff limit value. But as the tariff limits are implemented into the "SETUP loop", it is necessary to indicate positive/negative values in the display. The indication is made with a – in front of the negative values and an _ in front of positive values. The underscore is flashing when setting up the sign, _ will indicate the "cursor"-position in the "SETUP loop". See examples in *Figure 19* and *Figure 20.*



*Figure 20 - Setting up positive TL2 in "SETUP loop", the _ will be flashing when on the sign position but disappears when moving to another decimal.*



*Figure 21 - Setting up negative TL2 in "SETUP loop", the - will be flashing when on the sign position and stays on when moving to another decimal.*

**Note:** The range for t5 and $\theta_{hc}$ remains unchanged in MULTICAL® 803-M in comparison with the existing MULTICAL® 803 portfolio (t5 = 0,01…185,00 °C and $\theta_{hc}$ = 2,00…180,00 °C).

## 13.4 Volume-weighted average temperatures

Since the temperatures in MULTICAL® 803-M can be both positive and negative, the volume-weighted average temperature calculations will not work and thus E8, E9, E10 and E11 will always be fixed at a value set to 0. The same goes for the display average temperatures for month and year (tm and ty).

**Note:** Display codes (DDD), logger profiles and communication datagrams dedicated for the mixed fluid calculators will not contain E8, E9, E10, E11, tm and ty as these registers will be 0 and give no valuable information.

# 14  Test and calibration

MULTICAL® 803 can be tested as a complete energy meter or as a split meter depending on the available equipment.

The high-resolution test registers are read from the display, via serial data reading or via high-resolution pulses.

When testing a split meter, a separate test of the calculator using the Kamstrup calibration equipment for MULTICAL® 803 and METERTOOL HCW can be carried out. Flow sensor and temperature sensors are tested separately too.

The calculator can be set to "TEST loop" when the test seal (verification seal) is broken and the test points are short-circuited, use the short-circuit pen (6699-278). The calculator remains in test mode until the supply (both backup battery and mains supply) is disconnected and the calculator is restarted, or for 9 hours.

When the calculator is in the "TEST loop", an auto-integration can be initiated by using forced dial-up (keep both arrow keys pressed until "CALL" appears in the display).

### Temperature calibration

The temperature measurement is adjusted and calibrated during the production process and it does not require further adjustment in the calculator's lifetime. The temperature circuit can only be adjusted in our factory.
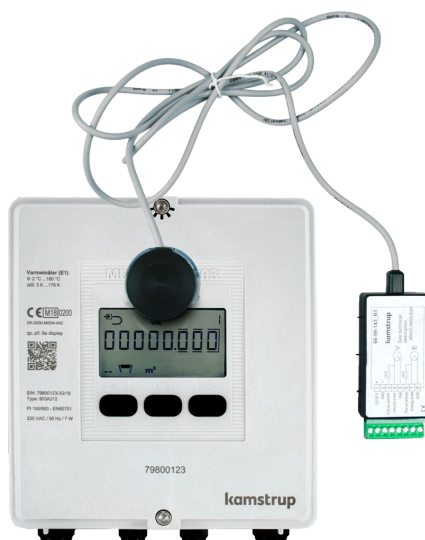
### Pulse interface

During test, either optical read-out head with USB plug (6699-099) for serial reading of the high-resolution energy and volume registers or Pulse Interface (6699-143) with optical read-out head and connection unit for high-resolution pulse outputs is used. Remember that the calculator must be in the "TEST loop".

The high-resolution registers that are provided as output from Pulse Interface always follow the nominal flow size of the flow sensor that MULTICAL® 803 is configured for.

| Flow sensor size | High resolution (pulses) | |
|---|---|---|
| $qp \leq 1,5$ | 0,001 kWh | 0,01 litres |
| $1,5 < qp \leq 15$ | 0,01 kWh | 0,1 litres |
| $15 < qp \leq 150$ | 0,1 kWh | 1 litres |
| $150 < qp \leq 1500$ | 1 kWh | $0,01\ m^3$ |
| $1500 < qp \leq 15000$ | 0,01 MWh | $0,1\ m^3$ |

*Table 8 High resolution for high-resolution meter count registers provides output, depending on the flow sensor size*

# MULTICAL® 803

## Verification pulses
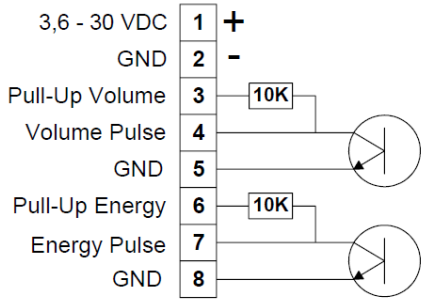
When Pulse Interface type 6699-143 is connected to power supply or battery, the unit is placed on the calculator, and the calculator is in test mode, the following pulses are transmitted:

• High-resolution energy pulses on connection terminals 7 and 8

• High-resolution volume pulses on connection terminals 4 and 5

Pulse Interface 6699-143, technical data

| | |
|---|---|
| Supply voltage | 3,6 – 30 VDC |
| Current consumption | < 15 mA |
| Pulse outputs | < 30 VDC, < 15 mA |
| Pulse duration | 3,9 ms |



## Use of high-resolution pulses

The high-resolution energy/volume pulses can be connected to the test stand used for calibration of the calculator or to Kamstrup Pulse Tester, type 6699-279, as shown in the drawing below.
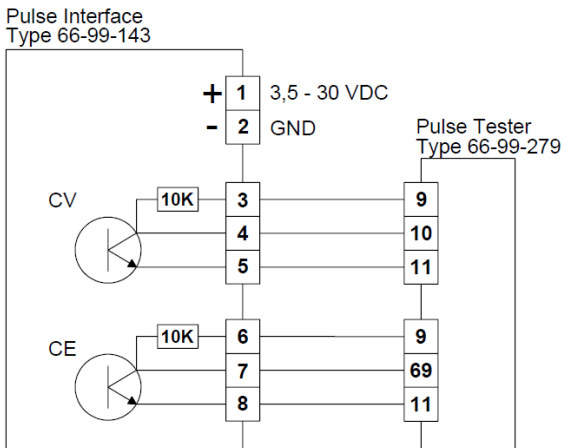


## High-resolution registers for calibration and verification

When the calculator is calibrated or verified on equipment, it is necessary to use a higher resolution of energy and volume than shown in the display to reduce the test time.

These high-resolution registers are described in the KMP data protocol description, which can be requested from Kamstrup A/S.

## True energy calculation

During test and verification, the heat calculator's energy calculation is compared to the "true energy", which is calculated according to the formulas of EN 1434-1:2007, EN 1434-1:2015 and OIML R75:2002.

The below energy calculator can be supplied electronically by Kamstrup A/S.



The true energy at the most frequently used verification points is indicated in the table below:

| t1 [°C] | t2 [°C] | ΔΘ [K] | Inlet [Wh/0,1 m³] | Outlet [Wh/0,1 m³] |
|---|---|---|---|---|
| 42 | 40 | 2 | 230,11 | 230,29 |
| 43 | 40 | 3 | 345,02 | 345,43 |
| 53 | 50 | 3 | 343,62 | 344,11 |
| 50 | 40 | 10 | 1146,70 | 1151,55 |
| 70 | 50 | 20 | 2272,03 | 2295,86 |
| 80 | 60 | 20 | 2261,08 | 2287,57 |
| 160 | 40 | 120 | 12793,12 | 13988,44 |
| 160 | 20 | 140 | 14900,00 | 16390,83 |

# 15  Approvals

## 15.1 Type approvals

MULTICAL® 803 is type-approved as a heat meter (DK-0200-MI004-042) according to MID on the basis of EN 1434-4.

MULTICAL® 803 is type-approved as a cooling meter (TS 27.2 013) in accordance with the Danish announcement (BEK 1178) on the basis of EN 1434-4.

Further, MULTICAL® 803 is available as a bifunctional heat/cooling meter, marked with DK-0200-MI004-042 and TS 27.02 013 as well as the yearly mark of MID.

## 15.2 The Measuring Instruments Directive

MULTICAL® 803 is available with CE-marking according to MID (2014/32/EC). The certificates have the following numbers:

B-Module:    DK-0200-MI004-042

D-Module:    DK-0200-MID-D-001

# 16 Troubleshooting

MULTICAL® 803 has been constructed with a view to quick and simple installation as well as long and reliable operation at the heat consumer. Should you, however, experience an operating problem, the table below can be used for troubleshooting. Should it be necessary to repair the calculator, it is recommended only to replace parts such as backup battery, temperature sensors and communication modules. Alternatively, the whole meter should be replaced. Major repairs must be made by Kamstrup A/S.

Before sending us a meter to be repaired or checked, please use the error detection table below to help you clarify the possible cause of the problem.

| Symptom | Possible reason | Proposal for correction |
|---|---|---|
| No backlight in the display. | Mains supply is interrupted. | Investigate the cause and connect the mains supply. |
| No function on the display (no visible segments in the display). | Backup supply is missing. | Replace the backup battery |
| No function in modules 3 and 4. | MULTICAL® 803 is available in 2 versions. Only one version has supply of all 4 modules. | Please contact your nearest Kamstrup distributor for modification of the meter (see paragraph 4.9) |
| No energy accumulation (e.g. MWh) and volume (m$^3$) | Read "INFO" in the display | Check the error that the info code indicates (see paragraph 7.8) |
| | If "INFO" = 00000000 | Check that the flow direction matches the arrow on the flow sensor |
| | If "INFO" = x<u>X</u>xxxxxx, xx<u>X</u>xxxxx or x<u>XX</u>xxxxx. | See the "INFO" overview (paragraph 7.8) and check the temperature sensors. If defective, replace the sensor pair. |
| Accumulation of volume (m$^3$), but not of energy (e.g. MWh) | Read "INFO" in the display | "INFO" = x<u>99</u>xxxxx indicates invalid differential temperature (t1-t2) |
| | Inlet and outlet sensors have been interchanged in either installation or connection | Mount the sensors correctly |
| | Heat/cooling cut-off $\theta_{hc}$ has been configured at a too low value | Reconfigure $\theta_{hc}$ at a suitable value, or configure $\theta_{hc}$ at 250 °C, thereby disconnecting the cut-off function. |
| Incorrect accumulation of volume (m$^3$) | Incorrect configuration of the meter factor | Check that the meter factor on the flow sensor matches the calculator. |
| Incorrect temperature reading | Defective temperature sensor<br><br>Insufficient installation | Replace sensor pair<br><br>Check the installation |
| Temperature indication a little too low, or accumulation of energy (e.g. MWh) slightly too low | Bad thermal sensor contact<br><br>Heat dissipation<br>Too short sensor pockets | Make sure that the sensors are pushed to the bottom of the sensor pockets<br>Insulate sensor pockets<br>Replace by longer pockets |
| The optical interface is not responding. | Optical interface deactivated<br><br>Optical read-out head positioned incorrectly | See the heart beat and status indications in paragraph 6.<br>Turn the optical read-out head, so that the cable points upwards. |

# 17  Disposal

Kamstrup A/S holds an environmental certification according to ISO 14001, and as part of our environment policy we use materials which can be recovered environmentally correctly to the greatest possible extent.
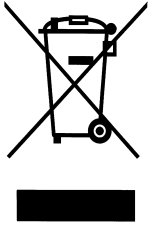
As from August 2005, Kamstrup's heat meters are marked according to EU Directive 2012/19/EU and the standard EN 50419.

The purpose of the marking is to inform our customers that the heat meter cannot be disposed of as ordinary waste.

● Disposal

By prior agreement, Kamstrup A/S offers to receive worn-out MULTICAL® 803 calculators for environmentally correct disposal. The disposal arrangement is free of charge to the customer, except for the cost of transportation to Kamstrup A/S or the nearest disposal system.

The calculators should be disassembled as described below and the separate parts handed in for approved destruction. The batteries must not be exposed to mechanical impact and the lead-in wires must not be short-circuited during transport.

| Item | Material | Recommended disposal |
|---|---|---|
| 2xA-cell lithium | Lithium and thionyl chloride, approx. 2 x 0.9 g lithium | Approved deposit of lithium cells |
| PCBs in MULTICAL® 803 (remove LC-display) | Coppered epoxy laminate, components soldered on | PCB scrap for metal recovery |
| LC-display | Glass and liquid crystals | Approved processing of LC-displays |
| Cables for flow sensor and temperature sensors | Copper with silicone mantle | Cable recovery |
| Top and base covers | PC + 10 % GF | Plastic recycling or combustion |
| Wall bracket | PC + 20 % GF | Plastic recycling or combustion |
| Meter case Clamp plate Transducer/reflector | > 84 % brass or stainless steel material no. 1.408 < 15 % common steel (St 37) < 1 % stainless steel | Metal recovery |
| Packing | Environmental cardboard | Cardboard recycling |
| Packing | Polystyrene | EPS recovery |

Please send any questions you may have regarding environmental matters to:

**Kamstrup A/S**
Att.: Quality and environmental dept.
Fax: +45 89 93 10 01
info@kamstrup.com

# 18  Documents

|  | Danish | English | German |
|---|---|---|---|
| Technical description | 5512-2359 | 5512-2360 | 5512-2361 |
| Data sheet | 5810-1659 | 5810-1662 | 5810-1663 |
| Installation and user guide | 5512-2408 | 5512-24108 | 5512-2408 |

These documents are currently updated. Find the latest edition at:

https://www.kamstrup.com/en-en/heat-solutions/meters-devices/meters/multical-803/documents

MULTICAL® 803