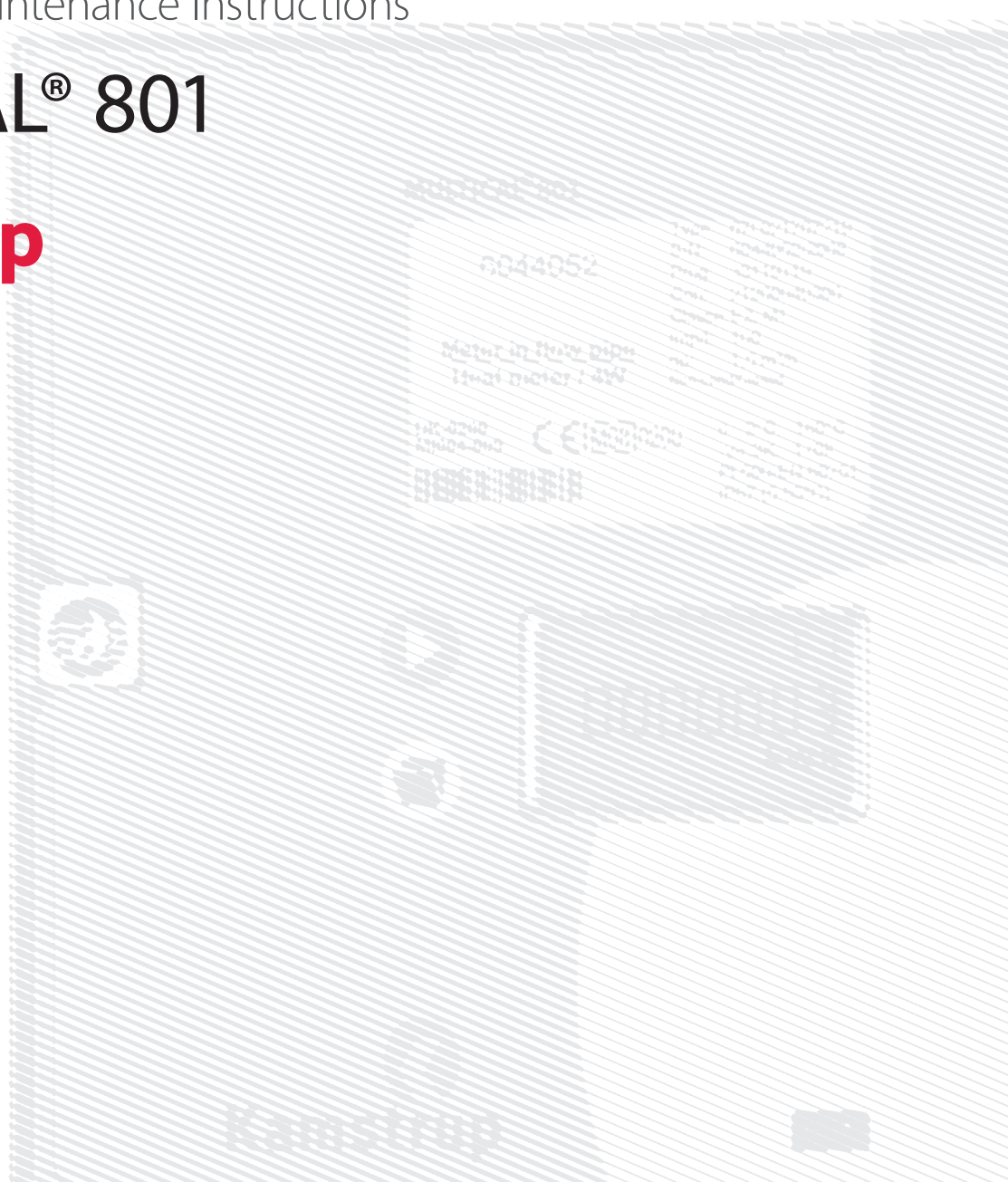Installation & Maintenance Instructions

MULTICAL® 801

kamstrup

MULTICAL® 801

Energy metering

MULTICAL® 801 functions in the following way:

The flow sensor registrates how many m³ (cubic metres) of district heating water are circulating through the heating system.

The temperature sensors, placed in inlet and outlet flow pipes, register cooling, i.e. the difference between the input and output temperatures.

MULTICAL® 801 calculates the consumed amount of energy based on the district heating water volume and cooling.

Readings in the display

When the upper front key ▶ is activated, a new reading appears.

The lower front key ◀ is used to show historical readings and average values.

4 minutes after the front key has been activated reading of consumed energy will automatically appear.

MULTICAL® 801 & ULTRAFLOW®

English

INSTALLATION

Kamstrup

MID designations

Rated operating conditions/measuring ranges:

Calculator	θ: 2 °C...180 °C	$\Delta\Theta$: 3K...170K
Temperature sensor pair	θ: 10 °C...150 °C	$\Delta\Theta$: 3K...140K
Flow sensor	θ: 15 °C...130 °C	

Mechanical environment: M1 (fixed installation with minimum vibration).

Electromagnetic environment: E1 and E2 (Domestic, light industrial and industrial). Signal cables from the meter must be separated by at least 25cm distance to other installations.

Climatic environment: The installation shall be made in non-condensing environments and in closed location (indoor). The ambient temperature must be within 5...55 °C.

Maintenance and repair: The heat supplier is allowed to change communication module, back-up battery, temperature sensor pair and flow sensor. Sensor pair and flow sensor are separately verified and can, therefore, be separated from the calculator. All repairs require a following re-verification in an accredited laboratory.

MULTICAL® 801, type 67-G/L is suitable for temperature sensors type Pt500

MULTICAL® 801, type 67-F/K is suitable for temperature sensors type Pt100

Battery for replacement: Kamstrup type 66-99-619

MULTICAL® 801 can be connected to flow sensor type ULTRAFLOW®, electronic pick-up unit, flow sensor with reed switch output or a flow sensor with 24 V active pulse output.

Irrespective of flow sensor type, "pulses/litres" must be identical in flow sensor and calculator.

Contents

1. General information

⚠ Please read this guide before installing the energy meter. If the meter is installed incorrectly, Kamstrup's guarantee obligations will no longer apply.

Please note that the following installation conditions must be obeyed:

- Pressure stage
  ULTRAFLOW®: PN16/PN25/PN40, see marking. Marking of flow part does not cover included accessories.

- Pressure stage Kamstrup
  sensor set type DS: PN16

- Pressure stage Kamstrup
  stainless steel pockets: PN25/PN40 - depending on type

If the medium temperature exceeds 90 °C we recommend using flange meters.

Please make sure that MULTICAL® 801 is connected to correct voltage, either 230 VAC or 24 VAC, see the marking at terminals 27 and 28 at the bottom left.

MULTICAL® 801 must be sealed with seal and wire or a sealing label after mounting.
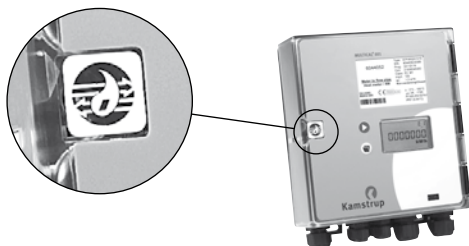
2. Mounting of temperature sensors

Temperature sensors used to measure inlet and outlet temperatures make up a matched pair of sensors and must never be separated. According to EN 1434 or OIML R75 the cable length must not be changed.

Replacement of sensors, if required, must always be made in pairs.

One sensor is marked with a red sign, and must be installed in the inlet pipe.

The other sensor is marked with a blue sign, and must be installed in the outlet pipe.

Note: The sensor cables must not be pulled. Be aware of this in case of binding the cables.

2.1 Pocket sensor pair

Preferably, sensor pockets must be mounted in tee-pieces or in 45 ºC lateral Y-pieces. The tip of the sensor pocket must be placed pointing towards the flow direction and in the middle of the water flow.
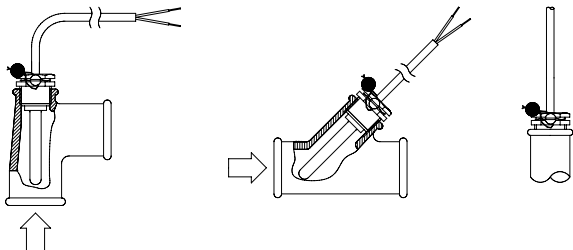
Temperature sensors should be inserted to the bottom of the pockets. If a quick response time is required, "non-hardening" heat conducting paste can be used.

Push the plastic sleeve on the sensor cable into the sensor pocket and secure the cable with the supplied M4 sealing screw. Fasten the screw with your fingers only. Seal the pockets using seal and sealing wire.

2.2   Short direct temperature sensor set

The short direct sensor can be mounted in special ball valves or in special angle tee-pipes, both with threads up to R1 and built-in M10 union for the short direct sensor.

For mounting in existing heating installations with standard angle tees Kamstrup A/S can also supply R½ and R¾ brass nipples which fit the short direct sensors.

The short direct sensor can also be fitted directly into all ULTRAFLOW® variants from Kamstrup A/S with G¾ and G1 thread on the meter case. Fasten the brass unions of the sensors lightly (approx. 4 Nm) by means of a 12 mm face wrench, and seal the sensors with seal and wire.
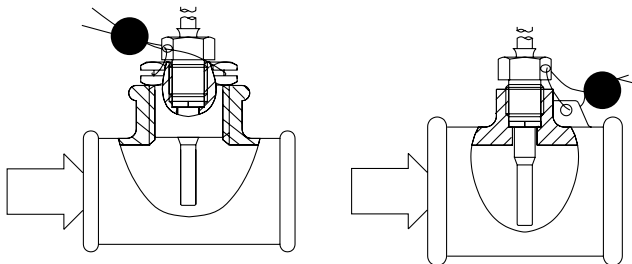
3. Mounting of flow sensor

Prior to installation of the flow sensor, the system should be flushed and protection plugs/plastic diaphragms removed from the flow sensor.

Correct flow sensor position (inlet or outlet pipe) appears from the front label of the ULTRAFLOW®. The flow direction is indicated by an arrow on the side of the flow sensor.

3.1 Mounting of glands and short direct sensor mounted in ULTRAFLOW® flow part

The short direct sensor from Kamstrup can only be mounted in PN16 installations. The blind plug mounted in the MULITCAL® 801 flow part can be used in connection with both PN16 and PN25.

The flow meter can be used in both PN16 and PN25 and can be supplied marked either PN16 or PN25 as desired.

Possibly supplied glands can only be used for PN16. For PN25 installations shall be used suitable PN25 glands.

In connection with G¾x110 mm and G1x110 mm it shall be checked that 10 mm thread run-out is sufficient. See the figure below.

Gasket

Gasket
Tightening approx. 4 Nm

10
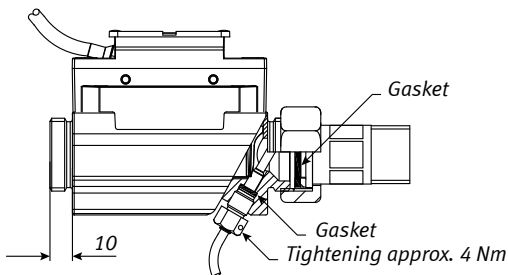
Straight inlet: ULTRAFLOW® requires neither straight inlet nor straight outlet to meet the Measuring Instruments Directive (MID) 2004/22/ EC and prEN 1434:2009. A straight inlet section will only be necessary in case of heavy flow disturbances before the meter. We recommend to follow the guidelines of CEN CR 13582.

3.2 Mounting of ULTRAFLOW® ≤ DN125

ULTRAFLOW® must be mounted vertically, horizontally or at any angle in between.

ULTRAFLOW® may be turned up to ± 45° in relation to the pipe axis.
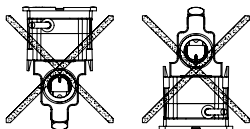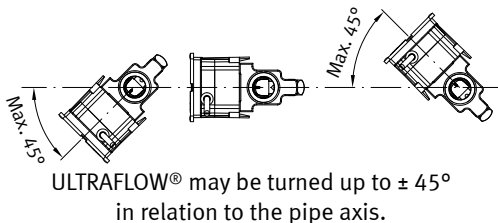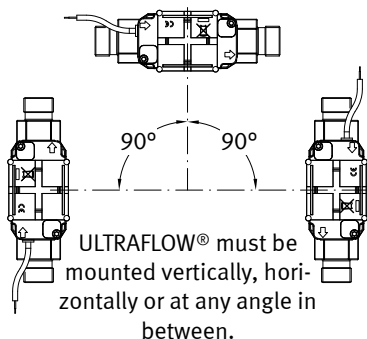
The ULTRAFLOW® housing must not be mounted facing upwards or downwards.

3.2.1 Humidity and condensation

When installed in humid environments ULTRAFLOW® must be turned 45° in relation to the pipe axis as shown below.
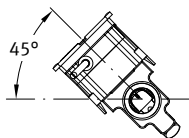
If condensation is likely, e.g. in cooling systems, an ULTRAFLOW® which is protected against condensation must be used.

3.3 Mounting of ULTRAFLOW® 54 ≥ DN150

See installation instructions No. 5512-887.

4. Mounting of calculator

4.1 MULTICAL® 801 front measurements

4.2 MULTICAL® 801 installation measurements

5. Power supply

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

5.1 Backup battery

MULTICAL® 801 includes a backup battery, which ensures that all relevant measurements continue during power failure.

The battery ought to be replaced after 10 years' normal operation, or after 1 year without mains connection.

The type number of the backup battery is 66-99-619

The voltage of a lithium battery is almost constant throughout the whole lifetime of the battery (approx. 3.65 V). Therefore, it is not possible to determine the remaining capacity by measuring the voltage.

The battery cannot and must not be charged and must not be short-circuited. Used batteries must be handed in for approved destruction, e.g. at Kamstrup.

6. Operational check

Carry out an operational check when the energy meter has been fully mounted. Open the thermo-regulators and cocks in order to establish a water flow through the heating system. Activate the upper push button on the MULTICAL® 801 and check that the display values for temperature and water flow are reliable.

7. Electrical connection

4-wire   **2-wire**
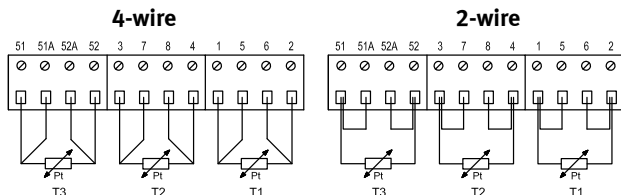
The temperature sensors are mounted in the terminals of the calculator as shown above. Jumpers are used when mounting 2-wire sensors.

In connection with flow sensors V1 and V2, the below-mentioned colours are used for connection of ULTRAFLOW® and electronic pick-up units.

Flow sensors with Reed switch output must be connected to terminals 11-10 and 11-69, respectively.

	V1	V2	
-	11	11	Blue
+	9	9	Red
SIG	10	69	Yellow

	Terminal No.	Standard measurement of heat and cooling	Heat measurement and leak surveillance	Energy measurement in open systems
T1	1−5−6−2	Sensor in inlet pipe (red)	Sensor i inlet pipe (red)	Sensor in inlet pipe (red)
T2	3−7−8−4	Sensor in outlet pipe (blue)	Sensor in outlet pipe (blue)	Sensor in outlet pipe (blue)
V1	11−9−10	Flow sensor in inlet or outlet pipe	Flow sensor in inlet pipe	Flow sensor in inlet pipe
V2	11−9−69	-	Flow sensor in outlet flow pipe	Flow sensor in outlet pipe
T3	51−51A−52A−52	-	Tank/heat exchanger temperature	Reference sensor (grey)

Other makes of flow sensors are usually connected to terminals 10B and 11B.

7.1   Examples of connections
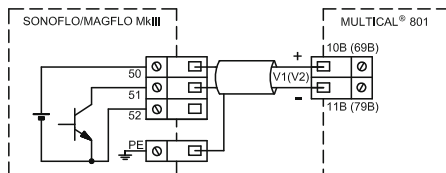
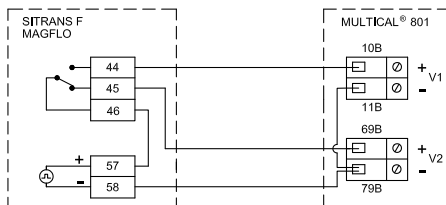*The active pulse output of the flow sensor is connected to the galvanically separated flow sensor input directly. This permits a cable length of up to 100 m between flow sensor and calculator.*
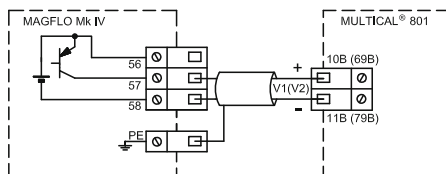
The active pulse output of the flow sensor is connected to the galvanically separated flow sensor input directly. This permits a cable length of up to 100 m between flow sensor and calculator.

	Heat energy	Cooling energy
Same ΔΘ polarity	E2 = V2 (T1-T2)k	E1 = V1 (T1-T2)k
Changed ΔΘ polarity	E2 = V2 (T1-T2)k	E3 = V1 (T2-T1)k

The active pulse output is direct connected to the galvanically separated flow sensor input. This permits a cable length of up to 100 m between flow sensor and calculator.

Auxiliary voltage from E+ and E- is added to the passive contact output P of the flow sensor before the signal is connected to the galvanically separated flow sensor input. This permits a cable length of up to 100 m between flow sensor and calculator.
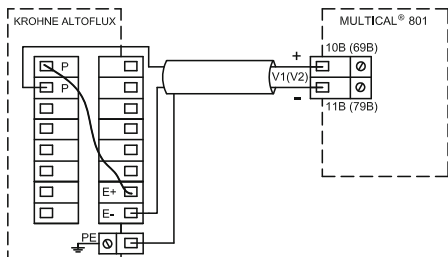

The active pulse output of the flow sensor is connected to the galvanically separated flow sensor input directly. This permits a cable length of up to 100 m between flow sensor and calculator.

The passive contact output of the flow sensor on terminals 56 and 57 is connected directly to the flow sensor input which is not galvanically separated. This permits a cable length of max. 10-20 m between flow meter and calculator.

Auxiliary voltage from terminals 97A and 98A is added to the passive contact output of the flow sensor on terminals 56 and 57 before the signal is connected to the galvanically separated flow sensor input. This permits a cable length of up to 100 m between flow sensor and calculator.
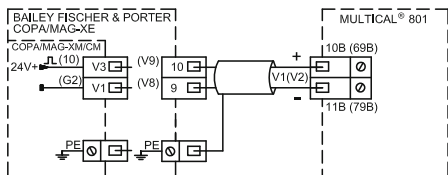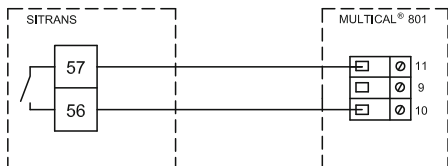

Auxiliary voltage from terminals 97A and 98A is added to the passive contact output on terminals 24 and 25 before the signal is connected to the galvanically separated flow sensor input. This permits a cable length of up to 100 m between flow sensor and calculator.
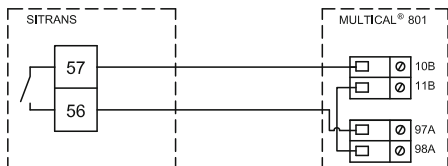

Auxiliary voltage from terminals 97A and 98A is added to the passive contact output on terminals 10A and 11A before the signal is connected to the galvanically separated flow sensor input. This permits a cable length of up to 100 m between flow sensor and calculator.
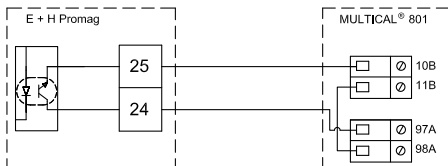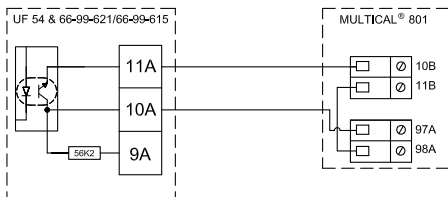
8. Data modules

8.1 GSM/GPRS module (GSM6H), type 67-0Z

The GSM/GPRS module functions as transparent communication path between reading software and MULTICAL® 602 and is used for data reading. The module includes an external dual-band GSM antenna which must always be used. The module itself includes a line of light emitting diodes indicating signal strength which are very useful during installation.

Further details about the GSM/GPRS module appear from data sheet *(DK: 5810627, GB: 5810628, DE: 5810629, SE: 5810630)*.

8.2 3G GSM/GPRS module (GSM8H), type 67-0U

Like GSM6H this module functions as transparent communication path between reading software and MULTICAL® 801 and is used for data reading.

However, this module supports both 2G (GSM/GPRS) and 3G (UMTS) which makes it applicable in areas with 3G coverage only.

The module requires an external Antenna, which covers both 900 MHz, 1800 MHz and 2100 MHz.

The module itself is fitted with a line of light emitting diodes indicating signal strength which are very useful during installation. Furthermore, it is indicated whether the module is connected to a 2G or a 3G network.

Additional details about the 3G module appear from data sheet *(DK: 58101057, GB: 58101058, DE: 58101059, FI: 58101061, SE: 58101060)*.

8.3 Ethernet/IP module (IP201), type 67-0T

The IP module functions as transparent communication between reading software and MULTICAL® 602 and is used for data reading. The module supports both dynamic and static addressing. This is specified in the order or selected during subsequent configuration. The module has no built-in security and must, therefore, always be used in connection with a firewall or NAT.

Further details appear from the data sheet *(DK: 5810541, GB: 5810542, DE: 5810543, SE: 5810544)*.

8.4 M-Bus, type 67-00-20/67-00-27/67-00-29/67-0V/67-0P/ 67-0Q

M-Bus can be mounted in star, ring or bus topology. Depending on the power supply of the M-Bus Master as well as the total cable resistance, up to 250 meters can be connected.
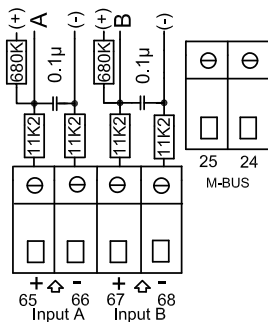
Cable resistance < 29 Ohm
Cable capacity   < 180 nF

The M-Bus network is to be connected to terminals 24 and 25. The polarity is unimportant. M-Bus is supplied with pulse inputs (at module 1 only which is located nearest the terminals).

8.5 Radio + pulse inputs, type 67-00-21/67-0W

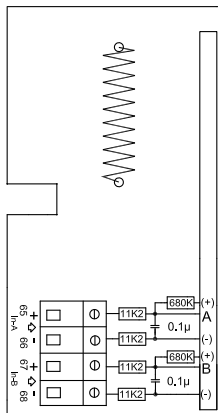The radio module is used for wireless communication via a license-free radio frequency and is available for internal or external antenna.

For further information on radio please refer to *Technical Description for Radio (5512-013)*.

The pulse inputs in this module are identical with the ones described earlier.

8.6 Prog. data logger + RTC + 4...20 mA inputs + pulse inputs, type 67-00-22

The module has connection possibility for two pressure transmitters on terminals 57, 58 and 59 and can be adjusted for current reading or pressure range 6, 10 or 16 bar.

The module is prepared for remote reading, data from meter/module being transferred to the system software via the external GSM/GPRS modem connected on terminals 62, 63 and 64.

Furthermore, the module has two extra pulse inputs, VA and VB.

The module must be powered by 24 VAC.

8.7 Lon Works, type 67-00-24/67-0Y

Re mounting of Lon Works type 67-00-24, see installation guide 5512-396 (DK) or 5512-403 (GB).

8.8 Wireless M-Bus, type 67-00-30/67-00-35

The radio module has been designed to form part of the hand-held Wireless M-Bus Reader systems of Kamstrup A/S at license-free radio frequency (868 MHz).

The module fulfils the C-mode specifications of prEN13757-4 and can thus form part of other systems using Wireless M-Bus C-mode communication.

The radio module comes with internal antenna and external antenna connection as well as two pulse inputs, which are identical with the previously described pulse inputs.

The Wireless M-Bus radio transmitter is switched off on dispatch from the factory. It turns on automatically when one litre of water has run through the meter. The radio transmitter can also be switched on by means of a forced dial-up to the meter (keep both front keys pressed for approx. 5 s. until CALL is displayed).

8.9 ZigBee® + pulse inputs, type 67-00-60

The ZigBee® module is used for wireless communication and can form part of a remote reading system, in which several units can communicate with each other.

The pulse inputs of this module are identical with the previously described pulse inputs.

The ZigBee® module (67-00-60) requires mains supply.

8.10 Metasys N2 + pulse inputs (VA, VB), type 67-00-62

The N2 module is used for data communication between meter and N2 Master in a Johnson Controls System.

The RS485 port is galvanically separated from the meter.

The pulse inputs of this module are identical with the previously described pulse inputs.

The N2 module (67-00-62) requires mains supply.

8.11 SIOX module (Auto detect Baud rate), type 67-00-64/ 67-0M

SIOX is used for data reading of small and medium-sized groups of heat meters via cable, the data readings being presented by the main system, e.g. Mcom, Fix or Telefrang. Further information on these systems can be ordered from the supplier in question. Furthermore, a configuration tool is available from Telefrang.

The two-wire serial SIOX bus connection is optoisolated from the meter and is connected without regard to polarity (i.e. the polarity is unimportant). The module is powered by the SIOX bus. Communication speed between 300 and 19,200 baud. The module automatically uses the highest possible communication speed. The module converts data from KMP protocol to SIOX protocol.

8.12 BACnet®, type 67-00-66

The BACnet® module communicates with BACnet® on MS/TP via RS-485 as a master/slave or slave device.

The BACnet® module transfers a number of both actual data as well as accumulated data.

Furthermore, info codes for general alarm, flow error, temperature, error, water leakage, pipe burst, air in system, and wrong flow direction can be transmitted to the BACnet® Controller.

The two pulse inputs allow connection and reading of two additional meters for e.g. water and electricity with pulse output.

8.13 High Power Radio Router + 2 pulse inputs (VA, VB), type 67-00-84

The High Power RadioRouter module has built-in router functionality and is thus optimized to form part of a Kamstrup radio network, the read data being automatically transferred to system software via the network unit RF Concentrator.

Furthermore, the module can be read by Kamstrup's hand-held reading systems, e.g. USB Meter Reader and MULTITERM Pro.

The RadioRouter module is available for operation in both licence-free and licence demanding frequences permitting a transmitting strength of up to 500 mW. The module is by default fitted with internal antenna, connection for external antenna, and two extra pulse inputs.

8.14 Module overview

MULTICAL® 801 Communication modules #2

| Type No.	Description	Module No.
67-0M	SIOX module (Auto detect baud rate)	5920-193
67-0P	M-Bus module with alternative registers + pulse inputs	5550-997
67-0Q	M-Bus module with MULTICAL® III data package + pulse inputs	5550-1104
67-0T	Ethernet/IP module (IP201)	5550-844
67-0U	3G GSM/GPRS module (GSM8H)	5550-1209
67-0V	M-Bus module	5550-831
67-0W	RadioRouter module	5550-805
67-0Y	LonWorks module, FTT-10A	5550-1128
67-0Z	GSM6H module excl. external antenna	5550-1137

MULTICAL® 801 Communication modules #1

Type No.	Description	Module No.
67-00-20	M-Bus module with pulse inputs - alternative registers	5550-831
67-00-21	RadioRouter module with pulse inputs	5550-805
67-00-22	Prog. data logger + RTC + 4...20mA inputs + pulse inputs	5550-925
67-00-24	LonWorks module, FTT-10A with pulse inputs	5550-1128
67-00-27	M-Bus module with pulse inputs - alternative registers	5550-997
67-00-29	M-Bus module with pulse inputs - MULTICAL® III compatible data	5550-1125
67-00-30	Wireless M-Bus, C1, standard registers, encrypted, 868 MHz, internal and external antenna, pulse inputs	5550-1097
67-00-35	Wireless M-Bus, C1, alternative registers, encrypted, 868 MHz, internal and external antenna, pulse inputs	5550-1200
67-00-60	ZigBee® 2.4 GHz with internal antenna + pulse inputs	5550-992
67-00-62	Metasys N2 (RS-485) + 2 pulse inputs (VA, VB) module	5550-1110
67-00-64	SIOX module (Auto detect baud rate)	5920-193
67-00-66	BACnet® MS/TP (B-ASC) RS485 + 2 pulse inputs	5550-1240
67-00-84	High Power Radio Router + pulse inputs	5550-1221

8.15 Insertion of modules

Data modules are retrofitted by placing the module in the PCB holder in the left side of the meter and "clicking" on the module.
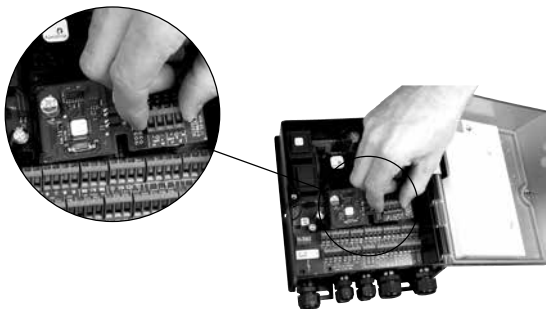
Module and meter are electrically connected using a 6-pole jumper.
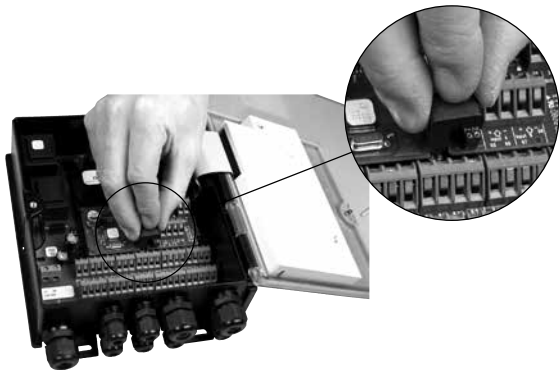
9. Information codes "INFO"

MULTICAL® 801 constantly monitors a series of important functions. If a serious error occurs in the measuring system or in the installation, "INFO" appears in the display and an info code can be read by activating the upper front plate button until the measuring unit shows "INFO" in the display. The info code is only visible while the error exists.

Info code	Description	Response time
0	No irregularities	-
1	Supply voltage has been cut off	-
8	Temperature sensor T1 outside measuring range	1…10 min.
4	Temperature sensor T2 outside measuring range	1…10 min.
32	Temperature sensor T3 outside measuring range	1…10 min.
64	Leak in the cold-water system	24 hours
256	Leak in the heating system	24 hours
512	Burst in the heating system	120 sec.
	ULTRAFLOW® 54 info (if activated CCC=4XX)	
16	Flow sensor V1, Datacomm error	After reset and 1 day (00:00)
1024	Flow sensor V2, Datacomm error	After reset and 1 day (00:00)
2048	Flow sensor V1, Wrong meter factor	After reset and 1 day (00:00)
128	Flow sensor V2, Wrong meter factor	After reset and 1 day (00:00)
4096	Flow sensor V1, Signal too low (Air)	After reset and 1 day (00:00)
8192	Flow sensor V2, Signal too low (Air)	After reset and 1 day (00:00)
16384	Flow sensor V1, Wrong flow direction	After reset and 1 day (00:00)
32768	Flow sensor V2, Wrong flow direction	After reset and 1 day (00:00)

10. Terminal Overview

MULTICAL® 801 has many connection options. The terminals are placed at the bottom of the meter.

97A 98A	16 17 18 19	16B 17B 18B	51 51A 52A 52	3 7 8 4	1 5 6 2
+ 12V –	+ CE – + CV –	UP COM DN	└─┘T3 └─┘	└─┘T2└─┘	└─┘T1└─┘

80 81 82 83 84 85 86 87	62 63 64	69B 79B	11 9 69	10B 11B	11 9 10
+ A1 – + A2 – + A3 – + A4 –	DATA REQ GND	+ V2 –	– + V2	+ V1 –	– + V1
0/4–20 mA Outputs		24V ⌐⌐	Blue Red Yellow	24V ⌐⌐	Blue Red Yellow
Load: 0–500 ohm	Serial DATA	Flow	ULTRAFLOW	Flow	ULTRAFLOW
	KMP Protocol	Meter		Meter	

Consumed energy in kWh, MWh or GJ

E 1
00 15,671
MWh

DATE LOG 0 1
2009.06.01
Latest yearly target date

LOG 0 1
00 12.386
MWh
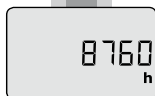Energy consumption count on latest yearly target date, followed by previous yearly target date
Followed by monthly target date data

Consumed district heating water

VOL 1
00324,56
m³

DATE LOG 0 1
2009.06.01
Date of latest yearly target date

LOG 0 1
00 12.386
MWh
District heating water volume count on latest yearly target date, followed by previous yearly target date
Followed by monthly target date data

Number of operating hours

8760
h

Current inlet pipe temperature
(*) Press ⊙ to see yearly and monthly average values

t 1
76,89
°C
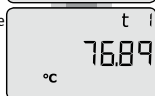
Current outlet pipe temperature
(*) Press ⊙ to see yearly and monthly average values

t 2
34,21
°C

Current temperature difference

t 1-2
42,68
k
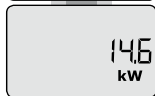
Current water flow
(*) Press ⊙ to see the peak value of the current year and historic yearly and monthly values
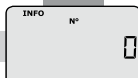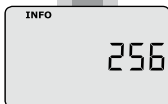
VOL 1
3 16
l/h
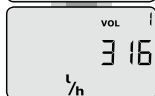
Current heat power
(*) Press ⊙ to see the peak value of the current year and historic yearly and monthly values
Followed by totalized water consumption on input A and B.

14,6
kW

Current information code
(contact the utility if the figure differs from "0")

INFO 256

INFO N° 0

Indication of the number of current and corrected error conditions

DATE 2009.02.14
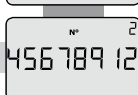
Data logger indicates the date ...

INFO LOG 01
512

... and the INFO code of the latest 36 changes

The first max. 8 digits of the customer number

N° 1
123

N° 2
45678912

The latest 8 digits of the customer number. This example displays customer number 12345678912

DATE 2009.02.14

Current date

TIME 16.25.43

Current time

DATE LOG 06.01

The target date appears in the order of month and day. In this example 1 June

N° 3
6014234

The counter's serial number

N° 4
44119119

The counter's program number. In this example: Installed in outlet flow, MWh and 100 imp/l.
Followed by the calculator's configuration number and software edition.

OK INFO MIN MAX TA TL
DATE ADR LOGN° El VOL
TIME BAUD
88888.8.8.8
bar °C l Gcal kWh
ton /h m³/h GJ MWh

Display segment test

DDD = 213
(*) DDD = 212

Also see interactive user guides at www.kamstrup.com

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