

# MOUNTING AND OPERATING INSTRUCTIONS

## CF 800

### 1. Delivery CF 800

- 1 Calculator
- 1 package with material for sealing, screws, wall plugs
- Mounting and operating instructions

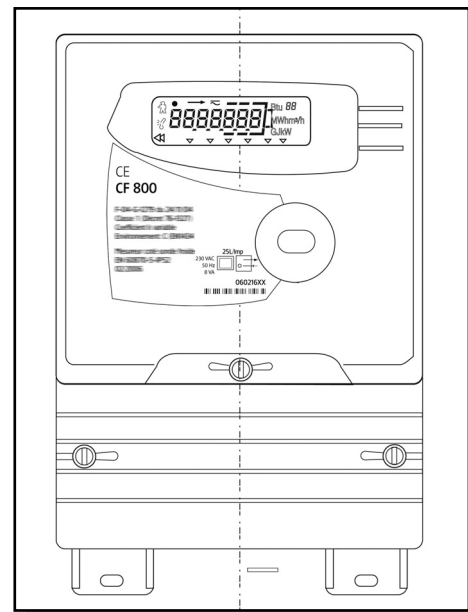
#### Required tools:

- Screwdriver

### 2. General indications

Heat meter CF 800 is a sophisticated electronic measuring instrument.

The following instructions must be carefully observed in order to ensure correct mounting and to fulfill all safety and guarantee conditions.



#### 2.1 Advice concerning safety

Hot water circuits and mains power supplies run under high temperatures and pressures as well as under high voltages. When operated incorrectly, these may cause serious injuries. Due to this, the measuring units may only be installed by qualified and trained personnel. If the calculator casing is submitted to strong shocks, impacts, drops from more than 60 cm height or similar stresses, the calculator must be replaced. Before opening the meter, mains voltage (optional) must be isolated.

#### 2.2 CE marks and protective classes

Metering unit CF 800 fulfills all requirements of EC guidelines and is approved for environmental class E1, M1. (industrial applications) according to DIN EN 1434:

- ambient temperature: +5 °C ... +55 °C (indoors installation)
- storage temperature (without battery): -10 °C ... +60 °C
- relative atmospheric humidity: < 95 %
- absolute altitude: < 2.000 m
- protective class IP 54 according to DIN 40050 (protection against dust and splashing);
- Electrical Safety: 61010-1 (Low voltage regulation)
- EMC protection according to EN61010-1, 61000-6-2 (Immunity industrial environments), 61000-6-3 (Emission for residential, commercial and light-industrial environments).
- double protective insulation  (protective class II according to IEC 60364-4-443)

- Discarded electronic devices or batteries contained within the calculator shall not be disposed with domestic waste. Dispose in accordance to local regulations.
- The metrological class of a complete thermal energy meter, made of subassemblies (flow meter, calculator and temperature sensors pair), assembled and installed according to the manufacturers installations instructions, meets the metrological class that is indicated on the flow meter type plate.



#### 2.3 Further important instructions

Mounting position shall be selected so that the connecting cable of the flow meter and the temperature probe cables will not lie near mains cables or other sources of electromagnetic disturbances (minimum distance 50 cm.).

- Cables must not be installed along pipes reaching temperatures above 55 °C.
- Opening of calibration seals will cause the loss of calibration validation and of guarantee.
- The casing may only be cleaned on the outside with a soft, damp cloth. Do not use detergents.
- Installation must be carried out according to DIN 4713 or DIN EN 1434.
- Some special functions (e.g. when using the tariff and data logger function) requires parameters setting of the calculator through M Bus or optical interface.

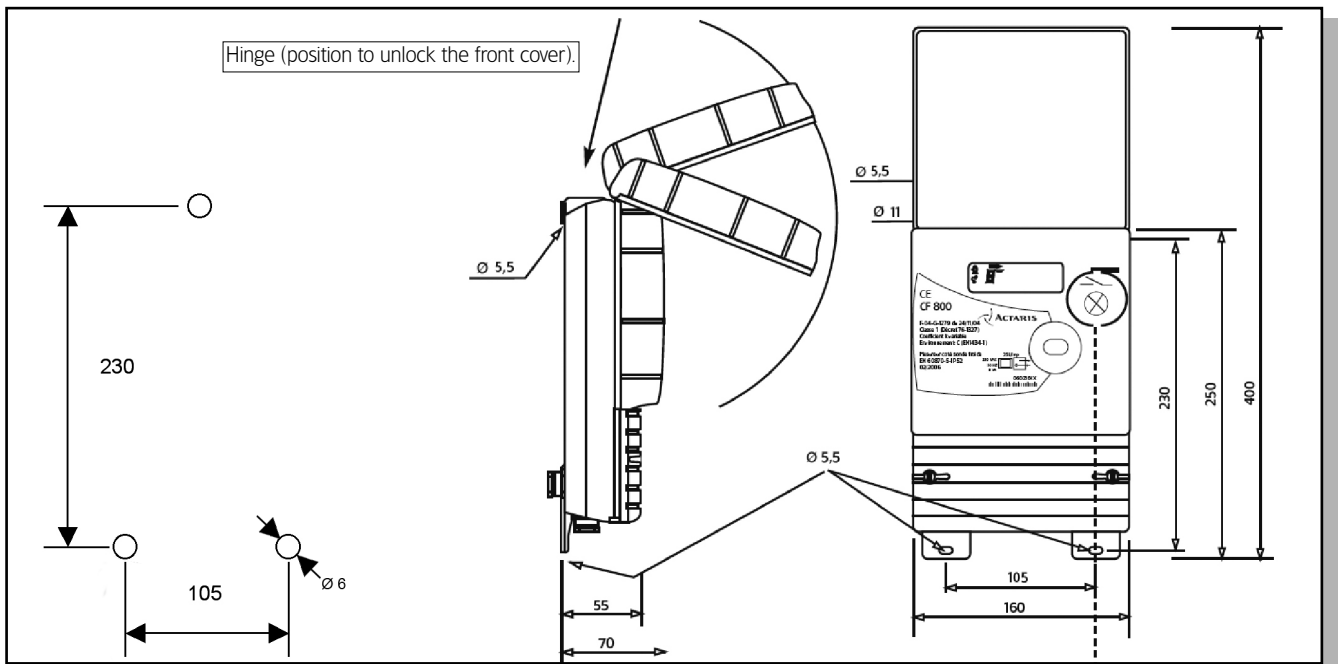
### 3. Mounting the calculator

#### 3.1 Mounting instructions

- Never carry out welding or drilling work near the meter.
- Leave the meter in its original package until all connections, insulating, painting and cleaning tasks have been performed.
- Pulse weight and mounting position (supply and return) of the flow meter must agree with data printed on the nameplate of the CF 800.
- The calculator must be protected against damages caused by shocks or vibrations which may occur at the mounting site.
- Type and basic value of the temperature probes to be connected must agree with the data indicated on the nameplate.


#### 3.2 Mounting on the wall

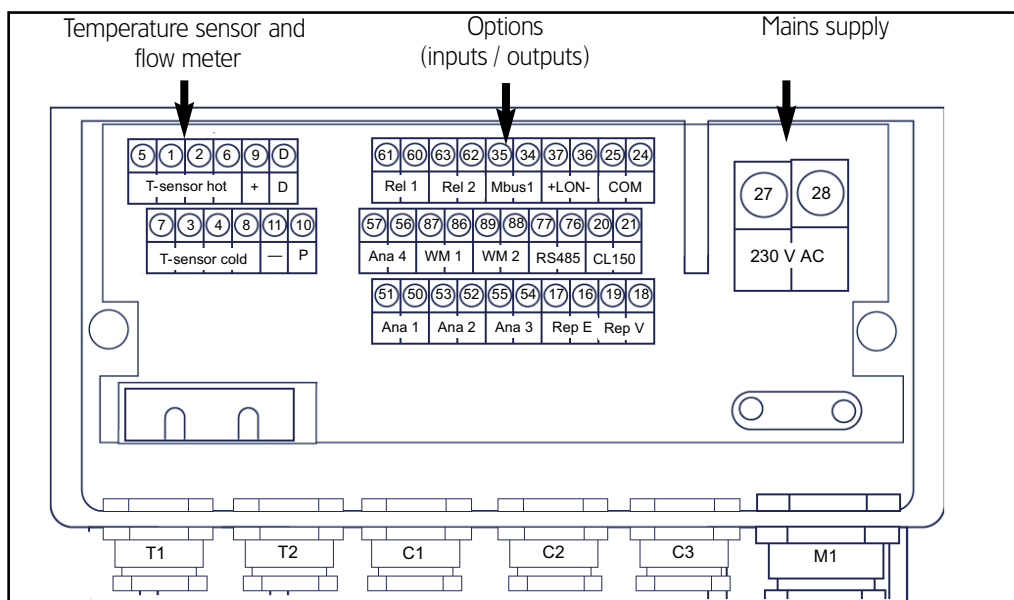
The mounting place should be easy accessible for operating and reading the meter. Please keep some free space for installation of cables. The calculator will be fixed by 3 screws (see drawing for drilling).



### 4 Electrical connection

#### 4.1 Preparation

 Ensure that CF800 is disconnected from mains supply before any kind of electrical connection. Access to the connectors will be given after removing the black lower cover. The connectors are grouped in 3 blocks:



Install all connection cables into lower housing part using the cable entrances and strain relief clamps (where applicable).

The indication of cable entrances is as follows:

- T1, T2: temperature sensors
- C1, C2, C3: options & flow meter
- M1: mains supply

## 4.2 Temperature probes



The integrator requires connection of paired temperature sensors. Probe cables shall not be shortened or lengthened.

Temperature probes specification

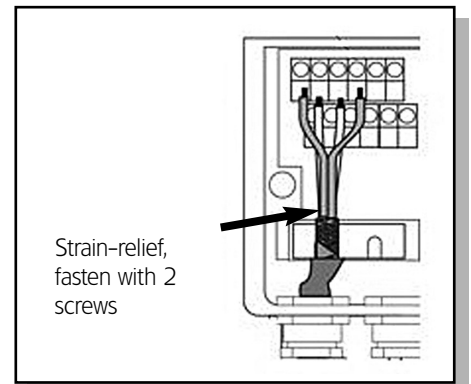
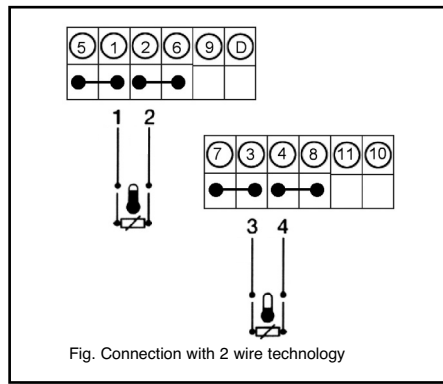
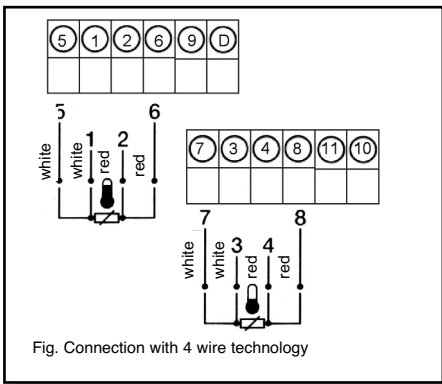
- Connection cable 2 or 4 wire technology
  - Cable diameter 3.5 mm ... 8 mm
  - Wire section 0.2 ... 1.5 mm<sup>2</sup>
  - Type PT100 or PT500 according to DIN EN 60751
- Observe nominal value of calculator – cf. nameplate.

### 4.2.1 Connecting of temperature probes

The following figures and descriptions cover the connection of temperature probes in heating circuits. When connecting temperature probes in cooling circuits or in combined heat-cooling circuits, please observe the following connecting instructions:

	Warm connector 	Cold connector 
Heating-heat flow circuit	supply probe	return probe
Cooling circuit	return probe	supply probe
Combined heating-cooling circuit	heating supply probe	heating return probe

 Warning: when connecting temperature probes in 2 wire technology terminals must be bridged as shown in figure.



In case of shielded wires ensure a good contact between strain-relief and shield.  
In general the shielding must be connected on one side of cable only.

### 4.3 Flow meter

Conventional flow meters with 2 wire connection or US Echo II flow meters with 4 wire connection may be connected to the calculator .

Using US Echo II flow meters allows for the transmission of trouble warning messages to the calculator over a data cable and for power supply of the ultrasound flow meter through the calculator, in addition to the transmission of pulses.

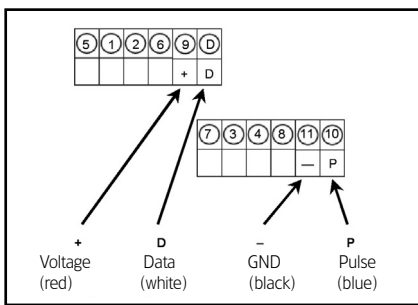
Pulse input specification:

Pulse input:	characteristics according to EN1434-2 – class IB
Pulse generator:	reed contact, open collector , open drain or static relay
Pulse weight:	observe nominal value of calculator
Max. pulse frequency:	128Hz
Resistance on/off:	$\leq 150 \Omega / \geq 2 M\Omega$
Cable diameter:	3,5-8mm
Wire section:	0,2..1,5mm <sup>2</sup>

#### 4.3.1 Connecting US Echo II flow meters with 4 wire connection.

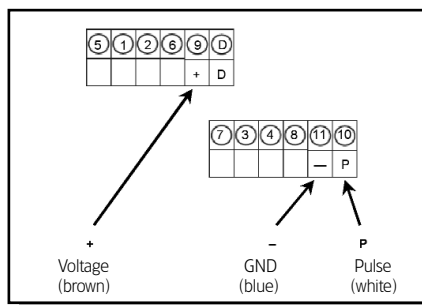
**Remark:** different versions of US Echo II with supplementary Pulse Box are connected to the calculator as described under Point 4.3.2. Please find details in the documents concerning US Echo II.

- Connection of wires according to terminal connection plan:



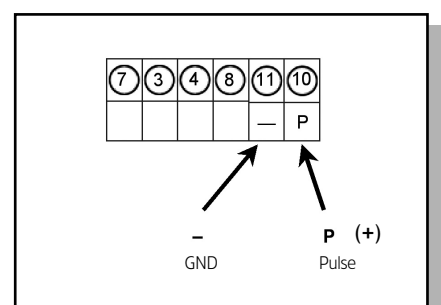
#### 4.3.2 Connecting type US BR 473 flow meters

- Connection of wires according to terminal connection plan (brown last).
- For details refer to the manual US BR 473.



#### 4.3.3 Connecting of conventional flow meters with 2 wire connection.

- When connecting pulse generators based on reed contacts (standard for volume measuring devices with mechanical metering units), polarity must not be observed.
- When connecting electronic pulse generators (e.g. open collector), please observe polarity!
- Connection of wires according to terminal connection plan:



### 4.4 Power supply for calculator CF 800

CF800 is powered by mains which must be connected to 230V AC. An integrated and exchangeable back-up battery ensures heat measurement for at least 1 year without any mains power. Extended options (e.g. analog output) are not working during mains supply failure.



Ensure that mains supply is switched off before any kind of electrical connection.

Heat meters with mains power supply must be connected according to installation instructions. The mains power supply must be protected against voltage failures. Protective systems (circuit breakers) must be used, in order to ensure secure disconnection of the unit from the mains in case of electric trouble (breaking current < 1A).

An emergency circuit breaker should be:

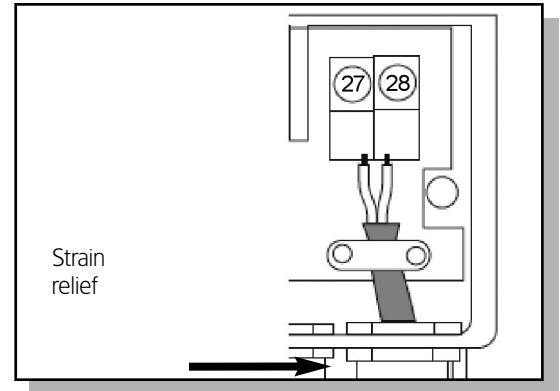
- installed within reach
- clearly recognizable as an emergency breaker
- cut off both wires
- clearly show the on/off position

#### 4.4.1 Mains supply specification

Mains voltage:	230V +10% / -15%
Mains frequency:	50Hz ± 2%,
Max. power requirement:	8VA
Internal fuse:	200mA
Cable type:	2 wires, (no earth)
Cable diameter:	4 ... 10mm
Section of wire:	1,5mm <sup>2</sup> ... 2,5mm <sup>2</sup>

#### 4.4.2 Connection of mains supply cable

- Insert cable using cable gland M1
- Connect wires to terminals no. 27 and 28
- Fasten strain relief



### 5. Connection of options

Ensure that mains supply is switched off before any kind of electrical connection.

In basic version the integrator CF800 is equipped with repetition outputs for energy and volume and an optical interface for meter communication. For extended functions it is possible to get CF800 equipped with two additional option boards.

Optionboard 1: M-Bus /LON / Modem located below, RF located above metrological unit

Optionboard 2: COMIO located right beside the metrological unit.

### 5.1 Available options

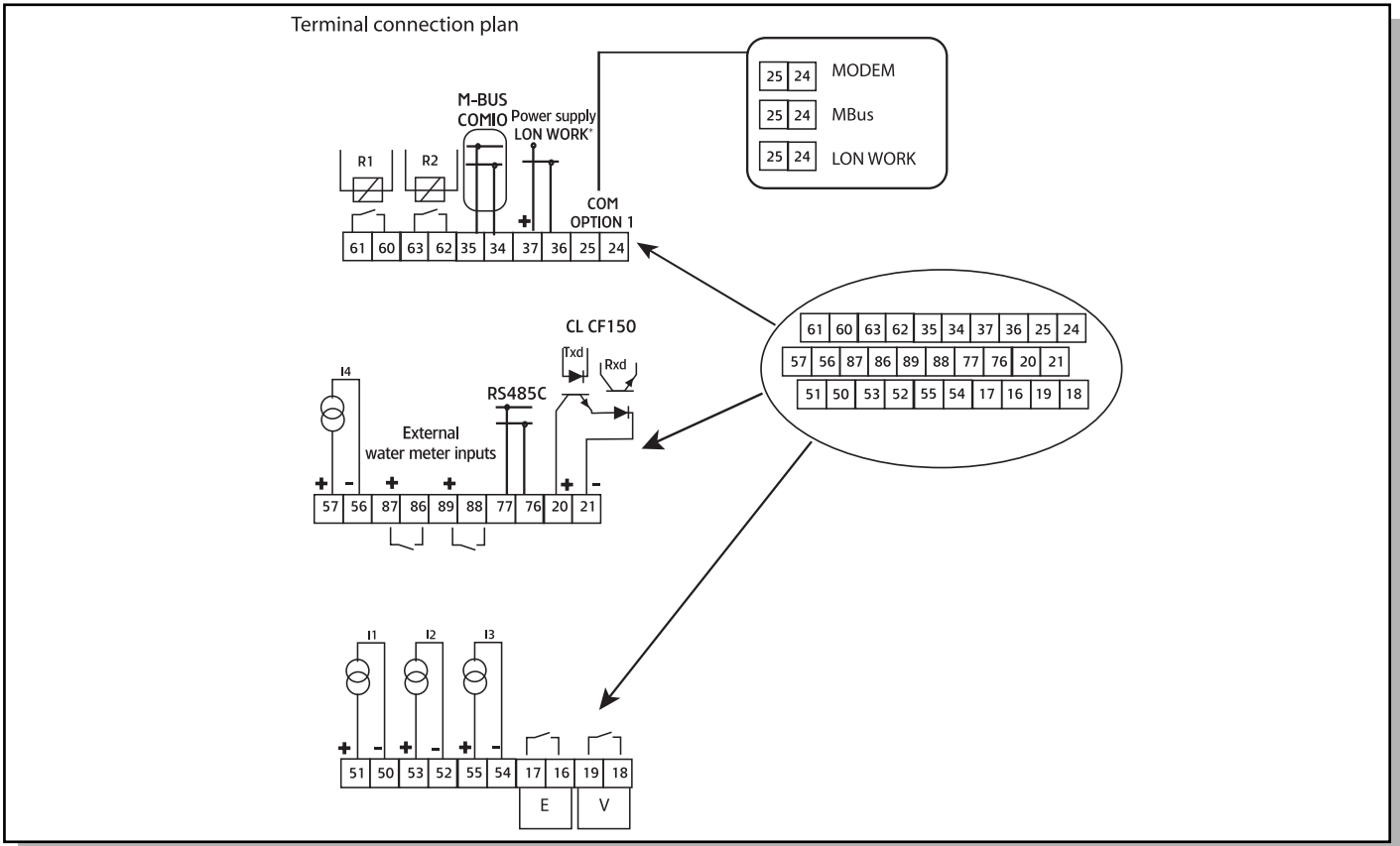
		CF800 Basic	Option 1	Option 2
Pulse output / Relays	Repetition Energy E	X		
	Repetition Volume V	X		
	Replay R1			X <sup>1</sup>
	Replay R2			X <sup>1</sup>
	Pulse input external water meter W1			X <sup>1</sup>
	Pulse input external water meter W2			X <sup>1</sup>
Communication Interfaces	Optical interface EN1434-3 / IEC 870	X		
	LON		X <sup>2</sup>	
	Modem		X <sup>2</sup>	
	Radio Frequency (Actaris RF System)		X <sup>2</sup>	
	M-Bus EN1434-3 / IEC 870		X <sup>2</sup>	X <sup>3</sup>
	RS485C			X <sup>3</sup>
	CL CF150 compatible			X <sup>3</sup>
Analogue-output	Analogue output I1			X
	Analogue output I2			X
	Analogue output I3			X
	Analogue output I4			X

<sup>1</sup>) either relay output or pulse input can be used (programmable by CFCS software)

<sup>2</sup>) one of the listed options available (different versions of option board).

<sup>3</sup>) one of the listed communication options can be used (programmable by CFCS software).

## 5.2 In- / Output of different options



## 5.3 Technical data options

### 5.3.1 Repetition energy and volume:

- Pulse output: passive, characteristics according to EN1434-2 – 71.3 class OA
- Pulse generator: galvanic isolated opto-coupler, passive bi-polar output
- Max. output frequency: 1 Hz (pulse output synchronous to last significant LCD digit of related index)
- Pulse length: 250ms +/- 8%
- Max. resistance Ron: 20 Ω
- Max. permissible voltage: 30V (status OFF)
- Max. current: 20mA (Status ON)
- Cable diameter: 3,5 ... 8mm
- Wire section: 0,2 ... 1,5mm<sup>2</sup>
- Pulse value: depending on flow meter pulse value, typical values see table.
- Galvanic isolation: yes

Product version	Row meter pulse value [L/pulse]	1 / 2,5	10 / 25	100 / 250	1000 / 2500
Output pulse value*	Energy in MWh / pulse	0,001	0,01	0,1	1
	Energy in KWh / pulse	1	-	-	-
	Energy in GJ / pulse	0,01	0,1	1	1
	Volume** in m <sup>3</sup> / pulse	0,01	0,1	1	1

\* typical values. For special designs, pulse weight analog to the smallest part of the corresponding index

\*\* for combined meters with heating and cooling in one circuit this output gives out the cooling energy instead of the volume (Pulse value: see pulse value energy)

### 5.3.2 Pulse input external water meters

- Pulse input active, characteristics according to EN1434-2 – 71.5 Class IB
- Pulse generator reed switch, open collector, open drain or static relay
- Max. voltage 6V
- Max. current 0,1mA
- Max. pulse frequency 5 Hz
- Minimum pulse length 100ms
- Max. resistance Ron 10k  $\Omega$
- Galvanic isolation no
- Cable diameter 3,5 ... 8mm
- Wire section 0,2 ... 1,5mm<sup>2</sup>
- Pulse value 1-250 L/Pulse (programmable, see table)

Pulse input value [L/Imp.]	1	2,5	10	25	100	250
Decimals [m <sup>3</sup> ]	2	2	1	1	0	0

### 5.3.3 M-Bus

- Protocol: M-Bus EN1434-3 / IEC 870
- Cable diameter 3,5 ... 8mm
- Wire section 0,2 ... 1,5mm<sup>2</sup>
- Baud rate, Option 1 300; 1200; 2400
- Baud rate, Option 2 300; 1200; 2400
- Galvanic isolation yes

### 5.3.4 Optical interface

- Protocol: M-Bus EN1434-3 / IEC 870
- Baud rate 300; 2400

### 5.3.5 RS485C

- Protocol\*: M-Bus EN1434-3 / IEC 870
- Cable diameter: 3,5 ... 8mm
- Wire section: 0,2 ... 1,5mm<sup>2</sup>
- Baud rate: 300; 1200; 2400
- Galvanic isolation: yes

\*alternative NRZ / CF150 protocol possible (manufacturer specific protocol – see also 5.3.6).

### 5.3.6 Serial current loop CF150 (manufacturer specific interface)

- Protocol: NRZ / CF150 (manufacturer specific protocol)
- Cable diameter: 3,5 ... 8mm
- Wire section: 0,2 ... 1,5mm<sup>2</sup>
- Baud rate: 110, 300, 1200
- Word length (bit): 7 or 8
- Stop bit: 1 or 2
- Parity: even, odd or none
- Galvanic isolation: yes

### 5.3.7 Analogue output

The set-up of the 4 outputs must be done using CFCS software. For each individual output the software provides possibility to set up requested parameter, output type and range of values.

- Parameter: Tr, Ts, Q, P, dT
- Output: active 0-20mA / 4-20mA
- Max. load: 300 Ohm (per output)
- Tolerance:  $\pm 2\%$  from displayed value
- Resolution:  $\pm 0,5\%$  (0-20mA) /  $\pm 0,65\%$  (4-20mA)
- Cable diameter: 3,5 ... 8mm
- Wire section: 0,2 ... 1,5mm<sup>2</sup>
- Galvanic isolation: no



4 analog outputs: Galvanic isolation must be installed (Pulse Box) when analog outputs are used.

### 5.3.8 Relay output

The set-up of the 2 output must be done using CFCS software. For each individual output the software provides possibility to set up requested parameter, output type, threshold value and switching logic.

- Parameter: Tr, Ts, Q, P, dT, Errorstate, mains supply failure,
- Switching logic\*: in normal condition either open or closed.
- Max. switchable voltage: 50V
- Max. switchable current: 200mA
- Hysteresis:  $\pm 0,5\% \pm$  display resolution
- Cable diameter: 3,5 ... 8mm
- Wire section: 0,2 ... 1,5mm<sup>2</sup>
- Galvanic isolation no

\*during mains supply off both relays will be closed.

### 5.3.9 Modbus

- Operating mode: RS485 RTU
- Cable diameter 3,5...8 mm
- Wire section 0,2...1,5 mm<sup>2</sup>
- Baudrate 2400, 4800, 9600, 19200 bit/s
- Function Function 08 and 03
- Format IEEE 32 bit, MSD, Sequence of Bytes 1, 2, 3, 4
- Galvanic isolation yes

## 6. Start up

- Close all housing parts and fasten the screws.
- Secure screws with user seals (plastic seals or wire seals).
- Switch main power on.,
- Check all functions, especially the correct display of temperatures and volume flow.

## 7. Operating instruction CF 800

A heat meter is a measuring instrument used to record energy released in a heating or cooling system. The partial components consist of a pair of temperature probes, a flow meter and a calculator, each component being subject to compulsory calibration for commercial utilization. The metering unit records the measurement values of the pair of probes and of the flow meter, permitting the display of data over 3 separate display levels.

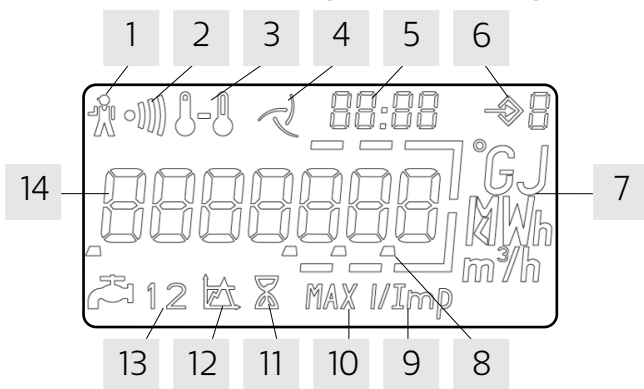
Display level 1: billing level (cumulated energy and volume display)

Display level 2: service level (actual operating data of the heat meter)

Display level 3: due day level (13/24\* monthly values of cumulated energy and volume)

\* Software version 11-21 and higher



### 7.1 LC Display and signification of segments


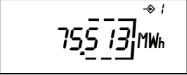



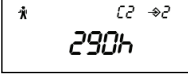

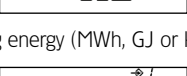

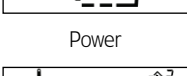

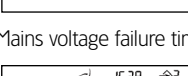

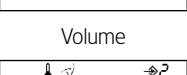

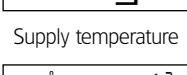
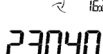
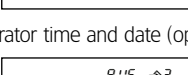

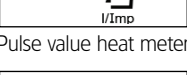
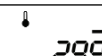
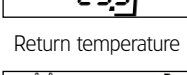
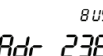
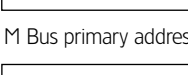
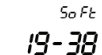


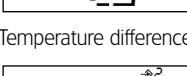

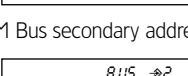

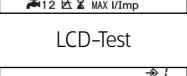
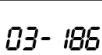
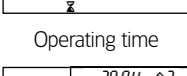


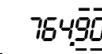
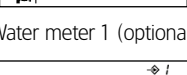

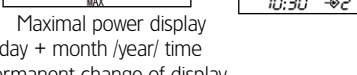
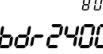
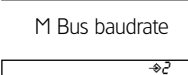
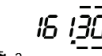
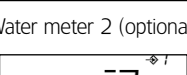
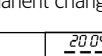
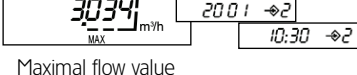

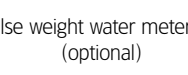

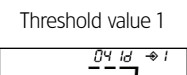
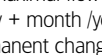
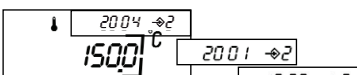

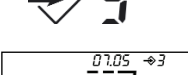
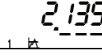
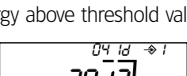
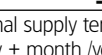
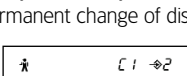
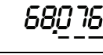
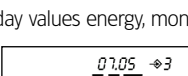
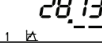

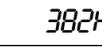
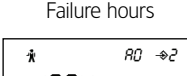
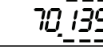
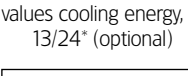
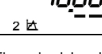
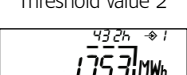
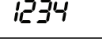
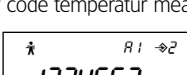
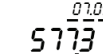
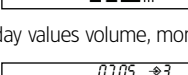
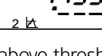
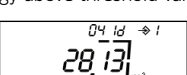
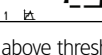



1. Alarm symbol: energy measurement stopped. See 7.3.6
2. "Dirty Transducer warning": energy measurement continued, cleaning of the flow sensor necessary
3. Temperatures: appears for temperature related displays or for displays of cooling energy in case of combined heating/cooling meters.
4. Flow display: permanent symbol: flow is present / flashing symbol: no flow
5. Date & time: representation of date and time indications related to time dependent displays, e.g. due day values and maximum values.
6. Display level: actually selected display level
7. Unit: physical unit
8. Decimal point
9. Pulse weight display: concerns the pulse weight of the metering unit or pulse weight of exterior connected water meters (only when a corresponding optional board is being used)
10. Maximum value: appears when maximum values are displayed
11. Operating time: appears for operating time display
12. Threshold values: display concerns threshold value/tariff function (1 or 2)
13. Water meter 1 or 2: display concerns exterior water meter (1 or 2)
14. Main display area: 7 digits for the display of all values displaying all cumulated and actual values



## 7.2 All display levels and displays in detail

Depending on the type of unit, the actual range of display may differ from the one shown here. Pressing of the push button activates the LC display. Switching of levels is achieved by prolonged pressing for 2 sec. of push button  , change of display through short pressing of push button .

  Energy (MWh, kWh or GJ)	  Flow	  Overload times
  Cooling energy (MWh, GJ or kWh)-optional	  Power	  Mains voltage failure time
  Volume	  Supply temperature	  Integrator time and date (optional)
  Pulse value heat meter	  Return temperature	  M Bus primary address
  Software Version	  Temperature difference	  M Bus secondary address
  LCD-Test	  Operating time	  M Bus secondary address
  Water meter 1 (optional)	  Maximal power display day + month /year/ time -permanent change of display	  M Bus baudrate
  Water meter 2 (optional)	  Maximal flow value day + month /year/ time -permanent change of display	  Pulse weight water meter 1/2 (optional)
  Threshold value 1	  Maximal supply temperature day + month /year/ time permanent change of display	  Due day values energy, month 1 ... 13/24*
  Energy above threshold value 1	  Failure hours	  Due day values cooling energy, month 1 ... 13/24* (optional)
  Volume above threshold value 1	  Error code temperatur measurement	  Due day values volume, month 1 ... 13/24*
  Threshold value 2	  Error code flow measurement (optional)	  Due day values water meter 1/2 month 1 ... 13/24* (optional)
  Energy above threshold value 2		
  Volume above threshold value 2		

\* Software version 11-21 and higher

### 7.3 Indications concerning special display functions (partly optional, depending on type of unit)

#### 7.3.1 Energy and volume index (display levels 1 and 3)

The energy unit is programmed at the factory. As a standard, energy is displayed in MWh, optionally KWh or GJ are possible.

#### 7.3.2 Cooling energy (display level 1)

Display of cumulated cooling energy for energy versions for utilization as combined heating/cooling circuits (please refer to point 9 for more detailed information).

#### 7.3.3 Water meters 1 and 2 (display level 1)

Display of the meter status of connected supplementary water meters with impulse output, using a corresponding option board (please refer to point 5.2 and 5.3.2 for more detailed information).

#### 7.3.4 Threshold value display (display level 1)

Representation of threshold value, energy share, volume and duration in 2 threshold value registers independent from each other (tariff register). The selection of the threshold value parameters, programming of the threshold values and data reset are performed over the M Bus or the optical interface. As soon as the energy or volume value is higher than the selected threshold value, energy and volume shares are recorded in the threshold value registers. The total volume which flowed through the meter during the time the threshold value was exceeded, is summed up in the volume threshold value register. Time of excess is recorded in the same way in the time threshold value register.

Function of the energy threshold value register as a function of the selected threshold value:

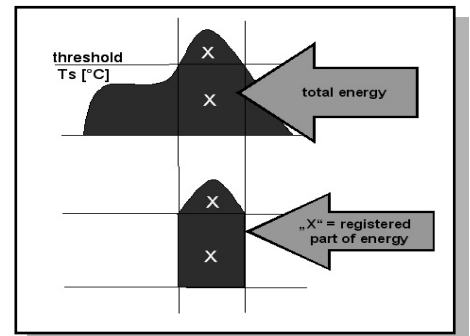
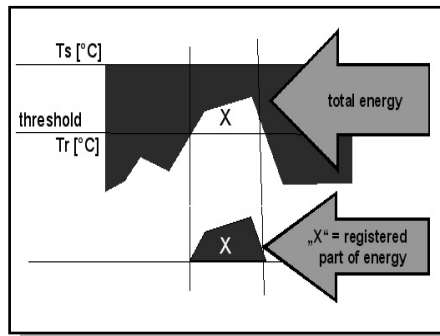
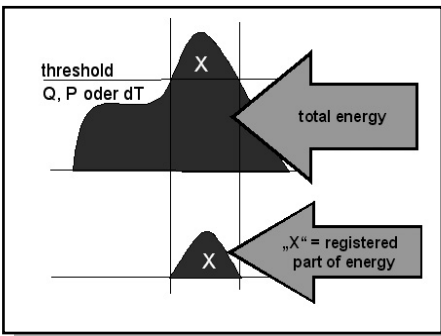
Flow ( $Q > Q_{th}$ )

Power ( $P > P_{th}$ )

Temperature difference ( $dT > dT_c$ )

Return temperature ( $Tr > Tr_{th}$ )

Supply temperature ( $Ts > Ts_{th}$ )




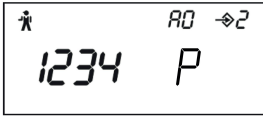
#### 7.3.5 Maximum value display (display level 2)

The actual monthly maximum values for power, output, flow and supply temperature are displayed with the corresponding time stamp. Internally, 13/24\* monthly maximum values are stored for each case, which may be read out over the M Bus or the optical interface. The duration of period to assess the maximum values is 60 minutes. The duration of period may be varied over the M Bus or the optical interface within a range of 1 min – 1440 min (= 1 day).

\* Software version 11-21 and higher

### 7.3.6 Operating trouble alarm (display level 2)

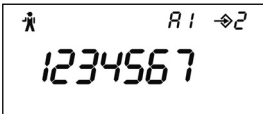
In case of operating trouble, CF 800 displays a symbol . When this trouble alarm appears, maintenance should be called. CF 800 shows detailed information concerning operating troubles in special display levels (cf. description of display).



#### Display level 2<sup>1</sup> operation shut down code

##### A0 = trouble with temperature recording

- 1 = supply temperature probe is not connected, connection cable is interrupted or broken
- 2 = return temperature probe is not connected, connection cable is interrupted or broken
- 3 = negative temperature difference; temperature probes were exchanged (except in case of combined heating/cooling metering)
- 4 = Analog to digital converter is broken (instrument must be replaced)



#### Display level 2<sup>1</sup> operation shut down code (optional)

##### A1 = trouble with flow measurement

- 1 = backflow in meter or in pipe system
- 2 = air in the pipe system, broken ultrasound probe or very strong deposits on the probes (cleaning or inspection required)
- 3 = exceeding the maximum admissible flow  
\* this message is a warning and does not cause measurement shut down.
- 4 = connection cable with flow transponder or connection to the ultrasound probes has been interrupted
- 5 = no flow for > 24 hours, but  $\Delta T > 15$  K
- 6 = no data communication between calculator and flow meter  
(= normal case for 2 wire pulse generators)
- 7 = problem with the optional board

### 7.3.7 M Bus parameters (display level 2)

Representation of characteristic data for remote data readout over M Bus or optical interface.

### 7.3.8 Due day values (display level 3)

Representation of 13/24\* end of the month values of the cumulated values for energy, volume, cooling energy (optional) and volume of the connected water meters, with time stamp and beginning with the value of the previous month.

\* Software version 11-21 and higher

## 8. Integrated data logger

Calculator CF 800 is fitted with an integrated data logger for the field analysis of operating parameters in the cooling and heating systems with the following scope of functions:

- Logger frequency: programmable from 1 minute to 7 days.
- Amount of memory: 1008 memory locations per value.
- Data: 6 selectable registers (cumulated and instantaneous values).
- Supplementary recording of the fault status.
- Programming and reading of the data logger over M Bus or optical interface.

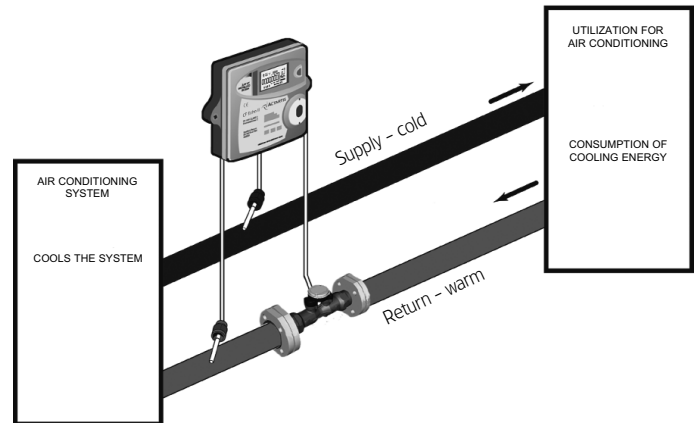
## 9. Special version for use in cooling and combined heating/cooling circuits

### 9.1 Calculator for utilization in cooling circuits

For these product versions, the calculator has been identified and programmed at the factory especially for utilization in cooling systems.

Handling, LC display and utilization of the option boards is essentially in accordance with the heat meter, all energy and power output related display values, M Bus data and remote display impulses being related to cooling energy.

The calculator is programmed for installation of the flow metering unit in the “warm” pipe of the cooling system (= return of the cooling system). A version with programming for the installation of the flow metering in the cold pipe also is available as an option.



### 9.2 Metering unit for utilization in combined heating/cooling circuits

For these product versions, the calculator has been identified and programmed at the factory especially for utilization in air conditioning systems with combined heating and cooling operation.

Handling, LC display and utilization of the option boards is essentially in accordance with the heat meter. The following special characteristics must be taken into account:

Boundary conditions for the metering of heating and cooling energy

- Heating energy is measured as soon as the temperature difference  $\Delta T$  exceeds 0.5 K and supply temperature  $T_s$  exceeds 25 °C ( $\Delta T =$  supply temperature  $T_s$  - return temperature  $T_r$ ).
- Cooling energy is measured as soon as the temperature difference  $\Delta T$  remains below -0.5 K and supply temperature is less than 25 °C.
- A version with switched off  $T_s$  threshold is available as option\*.

LC display

- Display of cooling energy is carried out in a supplementary register in the 1st display level. In order to differentiate from heating energy, a thermometer symbol is displayed simultaneously.
- 13/24\* due day values (end-of-the-month values) for cooling energy may be called up in the 3rd display level.

Repetition output for energy and volume:

- The option outputs are marked “E” (for energy) and “V” (for volume).  
For this type of product, pulses proportional to the cooling energy are output at the volume terminal marked “V”.

This type of product is programmed for installation of the flow meter in the return pipe of the air conditioning system (= cold pipe during operation as heating, warm pipe during operation for cooling). A version with programming for the installation of the flow meter in the supply part also is available as an option.

\* Software version 11-21 and higher

