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Installation and Operating Instructions Compact Heat Meter
Compact Heat/Cooling Meter Compact Cooling Meter
UHC-120 Ultrasonic Meters
DE-16-MI004-PTB025 (MID heat)
DE-16-M-PTB-0097 (national German cooling)
CH-T2-18768-00 (national Swiss cooling)
AV-2485C (Measurement Canada)

APPLICATION AND FUNCTION

The UHC-120 meter is designed for the measurement of the consumed energy in a closed heating, cooling or heating/cooling system.

CONTENTS OF THE PACKAGE

- Heat meter or heat/cooling meter, consisting of a calculator, a flow sensor and two temperature sensors, all permanently connected to each other
- Installation kit (depending on type)
- Declaration of Conformity
- QR code on meter that links to documentation on website

GENERAL INFORMATION

- Valid standards for the application of heat meters: EN 1434, parts 1 – 6; the Measuring Instruments Directive 2014/32/EU, Annexes I and MI-004; and the relevant national verification regulations.
- For the selection, installation, commissioning, monitoring and maintenance of the instrument observe the standard EN 1434 part 6, as well as the verification regulations PTB TR K8 + K9 for Germany (and any relevant national verification regulations in other countries).
- For combined heat/cooling meters the cooling register has no verification. National regulations for the consumption measurement of cooling must be observed.
- The technical regulations for electrical installations must be observed.
- This product fulfils the requirements of the European Council Directive on Electromagnetic Compatibility (EMC Directive) 2014/30/EU.
- ***The identification plate of the instrument and the seals must not be removed or damaged – otherwise the guarantee and the approved application of the instrument are no longer valid!***
- To achieve measurement stability of the meter it is necessary that the water quality meet the requirements of the AGFW-recommendation FW-510 and the document VDI (Association of German Engineers) VDI 2035.
- The heat meter left the factory in conformance with all applicable safety regulations. All maintenance and repair work is to be carried out only by qualified and authorized technical personnel.
- ***Instruments with activated radio function are not allowed on air freight.***
- The correct installation point in the system must be chosen: inlet or outlet flow (see "[Pictograms Installation Point](#)" on [page 4](#)).
- The temperature sensor cables and the cable between the calculator and flow sensor must not be kinked, rolled up, lengthened or shortened.
- To clean the heat meter (only if necessary) use a slightly moist cloth.

- To protect against damage and dirt the heat meter should only be removed from the packaging directly before installation.
- If more than one heat meter is installed in one unit, care must be taken to ensure that all the meters have the same installation conditions.
- All specifications and instructions listed on the data sheet and in the Application Notes must be adhered to.
- Further information can be obtained at www.badgermeter.com.
- The heat meter has a lithium-metal-battery. Do not open the batteries, do not bring the batteries into contact with water or expose them to temperatures above 80 °C. Do not charge them or short-circuit them.
-  Instruments which have been replaced or exchanged must be disposed of according to relevant environmental regulations.
- The display is deactivated and can be activated for two minutes by pushing the button.
- **Unit of energy and installation point (outlet flow / inlet flow) can be set on location, only once, before start of operation by pushing the button or alternatively using the "Device Monitor" software.**

Pictograms Installation Point

On the right side of the meter display in all information loops, one of the following two pictograms displays. The pictogram indicates in which pipe the meter is to be mounted.

	Installation in outlet flow
	Installation in inlet flow

Pictograms Type of Meter (on Type Identification Label)

	Heat meter
	Cooling meter

INSTALLATION

Mounting the Flow Sensor

1. Flush the pipes professionally, taking care not to damage any system components, then close all the shutoff valves.
2. Open the nearest draining valve for pressure release.
3. Drain the closed-off pipe section.
4. Loosen the coupling rings and remove the old heat meter, if there is one.
5. Remove all old gaskets and clean the sealing surfaces. Insert new gaskets.
6. Position the flow sensor correctly, taking into account the direction of flow (arrow on the side of the flow sensor).
7. Tighten the coupling rings.
8. Rotate the calculator to the best position for readout, or detach it and mount it nearby.

NOTE: For the mounting in a heating system with a small quantity of air in the medium, rotate the meter 90° so the display is facing up.

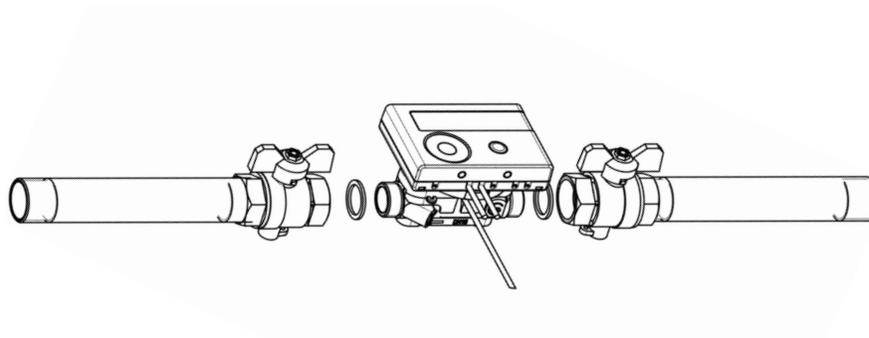


Figure 1: Meter rotated 90°

DETACHABLE CALCULATOR

We also provide meters with detachable calculators, in order to simplify mounting in narrow installation spaces. To release the calculator, pull it carefully up off the flow sensor.

For mounting the calculator on the wall, a wall support is latched onto the adapter of the flow sensor (between calculator and flow sensor). Remove the calculator. Hold the adapter of the flow sensor and rotate the wall mounting support counterclockwise until you can release it. Then attach the wall support at the desired place **with the flat surface towards the wall**.

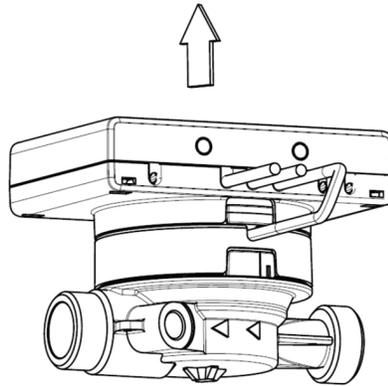


Figure 2: Detachable calculator

We always recommend detaching the calculator from the flow sensor.

However, it is important to note that the calculator must be detached for the Cooling and Heat/Cooling meters.

MOUNTING THE TEMPERATURE SENSORS

When installing the temperature sensors in existing immersion sleeves, the immersion sleeve must be determined and marked. The installer is required by law to provide unmarked immersion sleeves with a clear label. Use the enclosed label for this purpose.

NOTE: When mounting two external temperature sensors (symmetrical), make sure that the (right) temperature sensor with the following drawing is installed in the same heating train as the flow sensor:

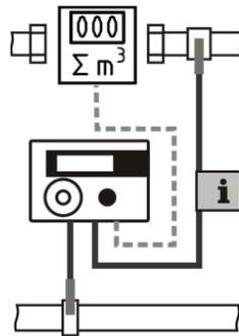


Figure 3: Two external sensors

Push the temperature sensor into the immersion sleeve as far as it will go. The inner diameters of the immersion sleeve and the temperature sensor must match [5.0; 5.2; 6.0 mm].

Direct Mounting (Ball Valve and T-Piece)

The temperature sensor must be installed in the pipeline to provide sufficient immersion depth. The sensor must be immersed at least to the middle of the pipe.

ATTENTION: Direct mounting of 5.0 mm temperature sensors is not permitted with flow sensor Qp10. Only permitted with immersion sleeves.

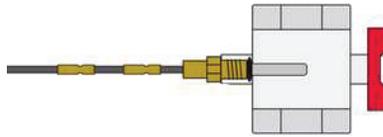


Figure 4: Sensor immersed to middle of pipe

1. Remove the blind screw fitting / old temperature sensor and gasket / old O-ring (without leaving any residue).
2. Slide the O-ring off the temperature sensor and insert it into the threaded opening of the ball valve or the T-piece.
3. Insert the O-ring, if present, into the threaded opening using the assembly aid.
The O-ring must not be seated in any of the corrugations.
The corrugations only connect the sensor sleeve with the cable.



Figure 5: Assembly aid

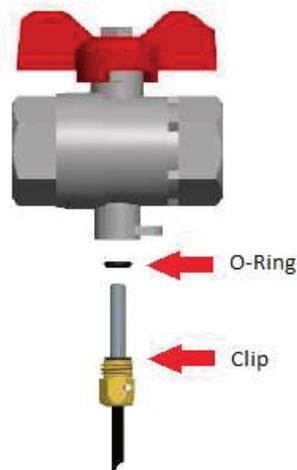


Figure 6: O-ring and clip

4. The locking plastic clip must be engaged in the first crimp (viewed from the sensor tip) and must not be displaced.

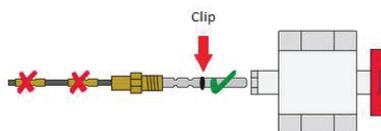


Figure 7: Clip placement

5. Hold the temperature sensor exclusively by the screw and push it into the ball valve or T-piece and screw it tight.
When installing the meters, make sure that the flow and return sensors are installed correctly.

Only the sensor sleeve of the temperature sensor may be immersed in the medium. The locking sleeves, if present, must not extend into the ball valve. If the sensor is inserted too deeply, there is a risk that the temperature sensor will be damaged when the ball valve is shut off.

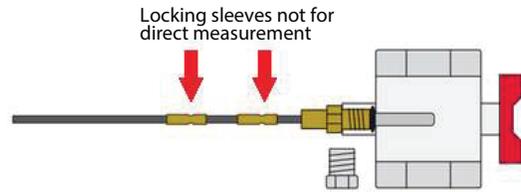


Figure 8: Clip placement

Installation in Short Immersion Sleeves (Smaller than 60 mm)

- MID-compliant immersion sleeves are approved in EU countries (except Germany).
- In Germany, immersion sleeves may not be used in new installations. See attached document for "Immersion sleeve tolerance".
- To insert a temperature sensor into a immersion sleeve, the plastic clip can be adjusted.
- AGFW temperature sensors and needle type temperature sensors may not be installed in immersion sleeves.

START OF OPERATION

NOTE: Check the programming of the units of energy and installation point before starting operation. These parameters cannot be changed after the energy total is >10 kWh.

1. Slowly open the shut-off valves.
2. Check that there are no leaks.
3. Check the following points:
 - a. Are all shut-off valves open?
 - b. Is the meter of the right size?
 - c. Is the heating (heating/cooling) system clear (dirt filters not clogged)?
 - d. Is the temperature sensor installed in the flow sensor correctly sealed to the flow sensor?
 - e. Does the directional arrow on the connection piece / flow sensor match the actual direction of flow?
 - f. Is a flow volume displayed?
 - g. Is a plausible temperature difference displayed?
4. When the meter is functioning properly, attach the seals to the exterior temperature sensors and the flow sensor (required to protect against manipulation).

DISPLAY

The calculator has a liquid crystal display with 8 digits and special characters. The values that can be shown are divided into five display loops. All data is retrieved using the pushbutton next to the display.

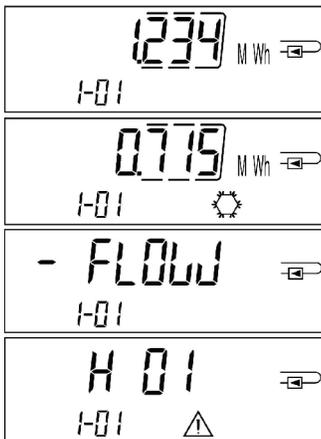
At the start you are automatically in the main loop (1st level).

By pressing the pushbutton longer than 4 seconds you change to the next display loop. Keep the pushbutton pressed until you reach the desired information loop.

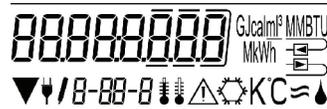
By pressing the pushbutton briefly each time you can scan all the information within a loop. After 2 minutes of non-use of the pushbutton, the display will automatically be deactivated.

Level 1 / Main Loop

1) Total heat energy since start of operation (standard display); alternating display: cooling energy (for heat/cooling meter); when negative flow; information message (if an error was detected)



2) Segment test on / off (all segments triggered simultaneously)



3) Last reading date alternating with heat energy (cooling energy), volume, value tariff register 1, value tariff register 2 at last reading date.¹⁾

(If the meter has 3 pulse inputs, their values follow.²⁾)



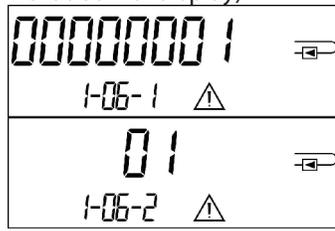
4) Total flow volume in m³



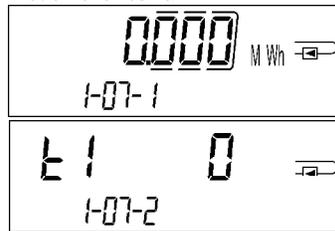
5) Current date alternating with time



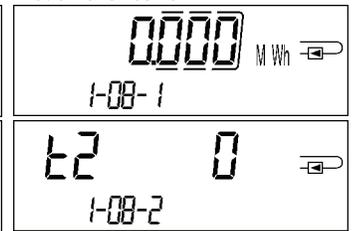
6) Information message (alternating binary and hexadecimal display)



7) Tariff register 1: value alternating with tariff register no. and criteria



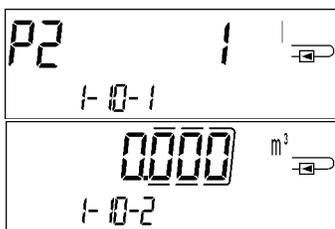
8) Tariff register 2: value alternating with tariff register no. and criteria



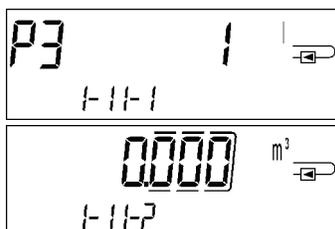
9) Pulse counter 1: pulse value alternating with reading²⁾



10) Pulse counter 2: pulse value alternating with reading²⁾



10) Pulse counter 3: pulse value alternating with reading²⁾

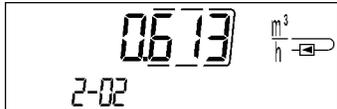
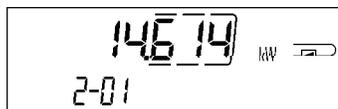


¹⁾ Up to the end of the month / the 15th of the month (for the semimonthly values) the consumption and date will be shown as 0.

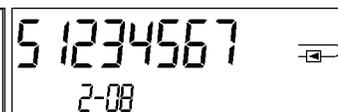
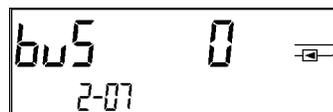
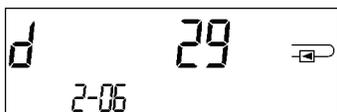
²⁾ Three pulse inputs are an option. They can be set using the software Device Monitor.

Level 2 / Technician's Loop

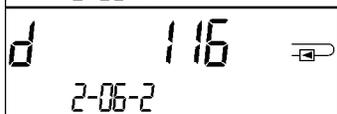
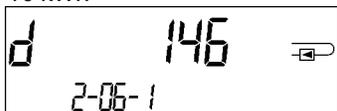
- 1) Current power in kW
- 2) Current flow in m³/h.
(When negative flow, value is displayed negative.)
- 3) Inlet flow temperature in °C
- 4) Outlet flow temperature in °C



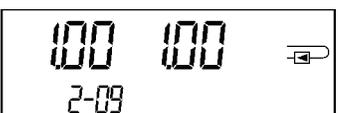
- 5) Temperature difference in K.
(Cooling energy: Value is displayed negative.)
- 6) Before start of operation: days since manufacture
- 7) M-bus address
- 8) Serial number



After start of operation: days since manufacture alternating with days of operation after reaching an energy value > 10 kWh



- 9) Firmware version



Level 3 / Statistics Loop

- 1) – 30) Semimonthly values: date alternating with heat energy, cooling energy, volume, value tariff register 1, value tariff register 2.¹⁾ (If the meter has 3 pulse inputs, their values follow.²⁾)



Level 4 / Maximum Values Loop

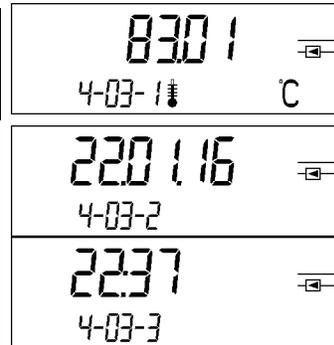
1) Maximum power alternating with date and time



2) Maximum flow alternating with date and time



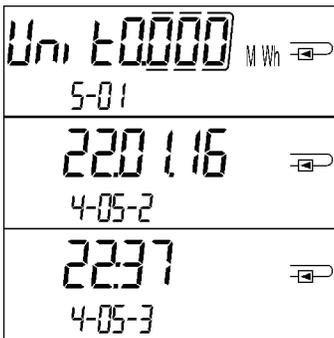
3) Maximum inlet flow temperature alternating with date and time



4) Maximum outlet flow temperature alternating with date and time

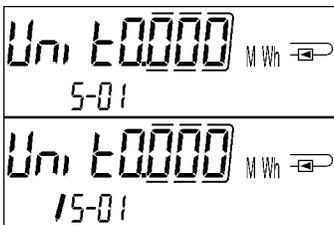


5) Maximum temperature difference alternating with date and time

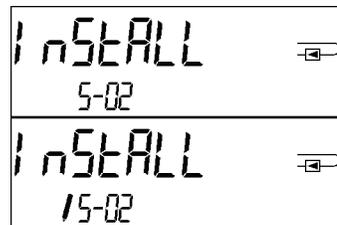


Level 5 / Parameter Loop

1) Parameter unit of energy



2) Parameter installation point



Parameter Loop

The following characteristics of the meters can be set on location, **only once**, by pushing the button or alternatively using the Device Monitor software:

- unit of energy (kWh; MWh; GJ; MMBTU; Gcal)
- installation point (inlet flow; outlet flow).

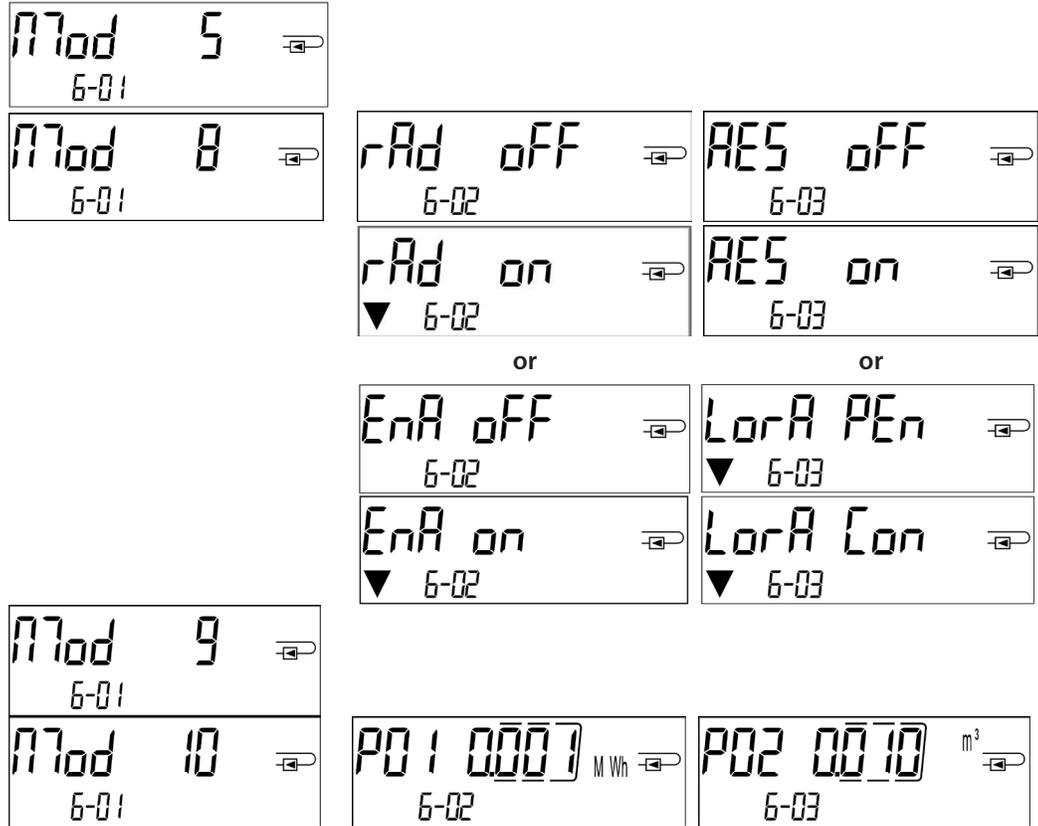
These parameterizing options are only available when the amount of energy is still ≤ 10 kWh. Make sure that these characteristics are set as needed before starting up the system.

Setup by pushing the button: In order to start the editing mode for parameterizing you must select the respective item in the parameterizing loop and then push the button once again for 2-3 seconds. As an aid, after 2 seconds the editing pen will be displayed bottom left in the LCD (see below picture). As soon as it appears you have to let go of the button. Then the current display will start blinking.



By pressing the pushbutton briefly you can switch to the next option. By pressing the pushbutton longer the currently displayed option will be set. If no option is chosen there will be no change and as soon as the LCD goes out the edit mode will end automatically.

Level 6 / Module Loop



- 1) Display of plugged module (alternatively)
- 2) Display depending on plugged module and setup
- 3) Display depending on plugged module and setup

5 = 1 pulse output		
8 = wireless M-Bus + optional 3 pulse inputs	wireless M-Bus (radio) off / wireless M-Bus (radio) on LoRa on / LoRa off	radio encryption (AES) off / radio encryption (AES) on LoRa pending / LoRa connected
9 = M-Bus + optional 3 pulse inputs 9 = Modbus		
10 = 2 pulse outputs	pulse value / pulse output 1	pulse value / pulse output 2

Detection of Flow

As long as the meter detects some flow the following pictogram displays bottom right in the LCD.



APPLICATION CONDITIONS

UHC-120 Meter	
Maximum flow qs/qp	2:1
Mechanical class	M2
Electromagnetic class	E2
Environmental class	C
Protection class flow sensor	IP65
Nominal pressure PN	16 bar
Mounting position	any, if there is no indication on type label
Flow Sensor of UHC-120	
Temperature range medium heat	15...90° C 15...130° C high temperature (150; for maximal 2000 h) (optional)
Temperature range medium cooling	5...50° C (from qp 1,5 to qp 10)
Temperature range medium heat/cooling	15...90° C heat 15...120° C high temperature (optional) 5...50° C cooling
Calculator	
Ambient temperature in the field	5...55° C at 95 % relative humidity
Transport temperature	-25...70° C (for maximal 168 h)
Storage temperature	-25...55° C
Protection class	IP65

INTERFACES AND OPTIONS

Pulse Output

Meters with pulse output may have one or two outputs, depending on the meter options.

Hardware Option	Heat Meter		Cooling Meter		Heat and Cooling Meter
	1 output	2 outputs	1 output	2 outputs	2 outputs
Output 1	Heat	Heat	Cooling energy	Cooling energy	Heat energy
Output 2	Not used	Volume	Not used	Volume	Cooling energy

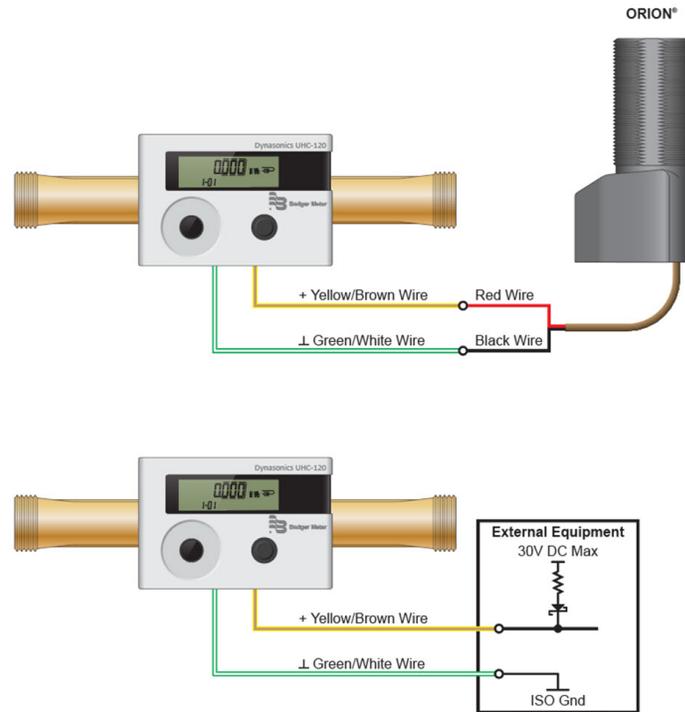


Figure 9: UHC-120 diagrams

		Wire Color	Label
Output 1	Pulse	Yellow	IA1
	ISO Ground	Green	IA1
Output 2	Pulse	Brown	IA2
	ISO Ground	White	IA2

Communication/Output Options

NOTE: Only **ONE** option is supplied with the meter.

- Wired M-Bus
- Modbus RTU EIA-485, baud rate 1200, 2400, 4800, 9600, 1440, 19200, 38400, 56000, 57600, 115200; powered separately with supplied voltage 12...24V DC ± 10 % (SELV power supply only), maximum power consumption 500 mW; not available with Measurement Canada approval
- Pulse 1 (or 2 for heating/cooling) open collector outputs: 30 V DC; width 100 ms; 2nd output for cooling only or heating only for volume; 2nd output for heating/cooling is cooling energy

One Pulse Output for Energy

	Display in kWh / MWh	Display in Gcal	Display in GJ	Display in MMBTU
qp 1,5 m ³ /h	1 kWh/Imp	1 Mcal/Imp	10 MJ/Imp	10 MMBTU/Imp
qp 2,5 m ³ /h	1 kWh/Imp	1 Mcal/Imp	10 MJ/Imp	10 MMBTU/Imp
qp 3,5 m ³ /h	10 kWh/Imp	10 Mcal/Imp	10 MJ/Imp	10 MMBTU/Imp
qp 6 m ³ /h	10 kWh/Imp	10 Mcal/Imp	10 MJ/Imp	10 MMBTU/Imp
qp 10 m ³ /h	10 kWh/Imp	10 Mcal/Imp	10 MJ/Imp	10 MMBTU/Imp

Two Pulse Output for Energy

The pulse value for the energy always applies: 1 kWh/pulse, 0.001 MWh/pulse, 0.001 GJ, 1 Mcal/pulse, 10 MMBTU/pulse

Pulse Output for Volume

For one pulse output, the pulse value for the volume always applies: Display in m³ -> pulse value: 100 l/pulse (0.1 m³/pulse).

For two pulse output, the pulse value for the volume always applies. 10 l/pulse (0.01 m³/pulse).

For communication with the optical interface an optocoupler and the Device Monitor software are necessary. The optocoupler and Device Monitor are available as accessory equipment.

The optical infrared interface will be activated by automatically sending a header (according to EN 13757-3).

Baud rate: 2400 baud.

Then you can communicate with the meter for 4 seconds. After every valid communication the meter is open for another 4 seconds. Afterwards the display is deactivated.

The number of read-outs per day via the optical interface is limited. During daily read-out at least 4 communications are possible. If read-outs are carried out more rarely, the possible number of communications will increase.

Retrofitting with an Additional Communication Interface (Optional)

We also offer a retrofittable meter to which communication interfaces can be added later.

To retrofit such a meter with an additional communication interface, the calculator's adhesive seal has to be destroyed and the device's calculator opened. **When the calculator is open, observe the ESD requirements according to EN 61340-5-1.**

1. Use a screwdriver with a wide tip (4...5 mm) and carefully press in the two round predetermined breaking points above the cable feedthroughs (see [Figure 10](#)).

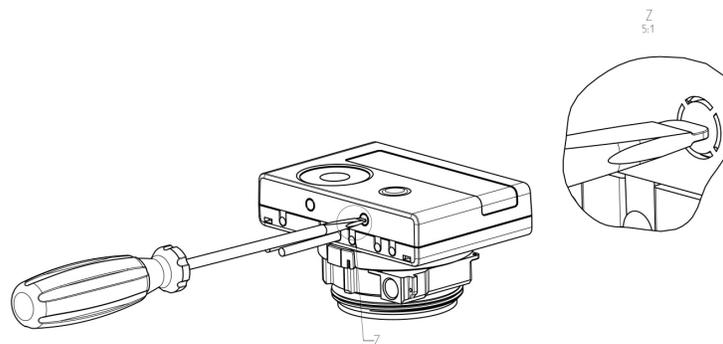


Figure 10: Press breaking points

2. Then insert the screwdriver into one of the two openings at an angle of approximately 45° and carefully lift the handle up to approximately 90° (see [Figure 11](#)). The upper housing piece of the calculator is then no longer latched on this side.

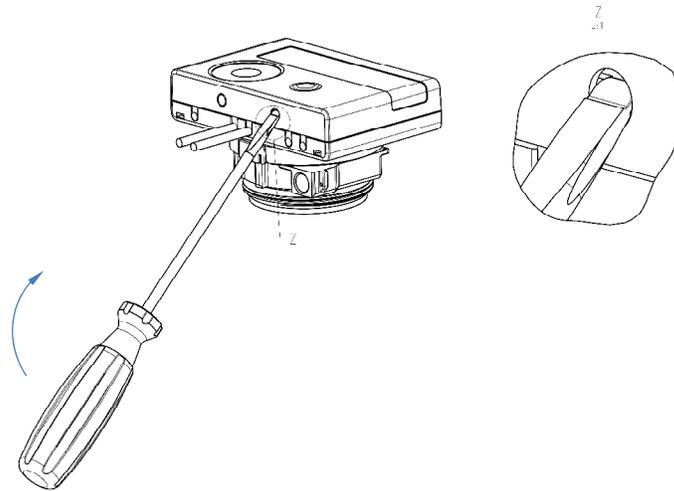


Figure 11: Lift handle

3. Repeat this with the other opening. Now the upper housing piece can be taken off.
4. Plug the interface module on the right side of the PC board (see [Figure 12](#)). The cables are to be fed through the rightmost cable feedthroughs into the calculator after removing the blind grommets. Close the calculator.

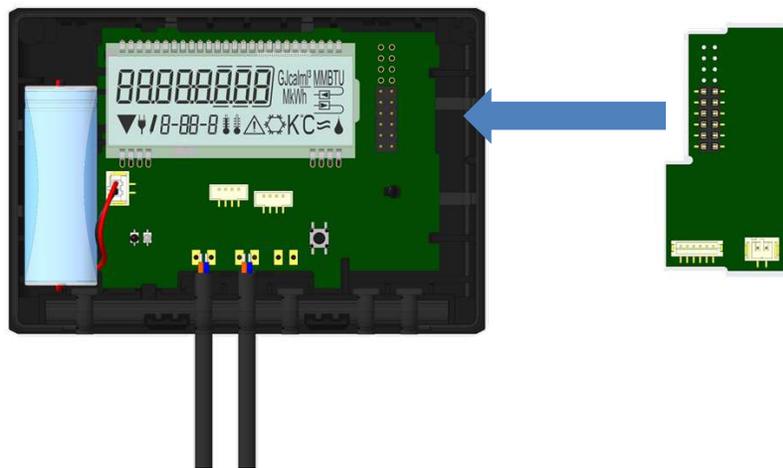


Figure 12: Plug in interface module

5. Protect the calculator against unauthorized opening using one of the numbered adhesive seals enclosed to the modules (stick it upon the seal destroyed). The added bar code label can be used for the purpose of documentation.

Replacing the Battery

Only authorized technical personnel may replace the battery. Dispose of replaced batteries according to relevant environmental regulations.

1. To replace the battery, open the meter's calculator as described in "[Retrofitting with an Additional Communication Interface \(Optional\)](#)" on page 15.
2. Afterwards protect the calculator against unauthorized opening using one of the numbered adhesive seals enclosed to the batteries (stick it upon the seal destroyed). The added bar code label can be used for the purpose of documentation.

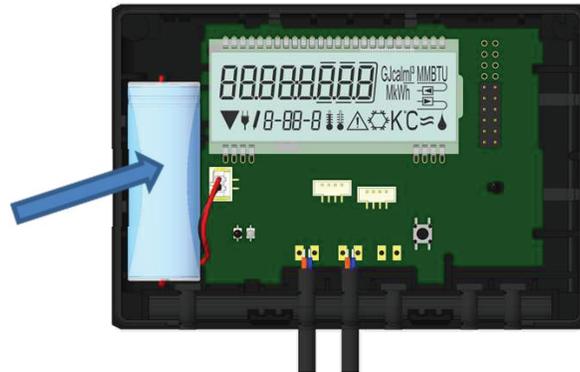


Figure 13: Battery location

Mounting a Power Pack

If an external power supply is needed, only the power pack designed for our heat meter may be used.

To connect the power pack:

1. Open the meter's calculator as described above in 10.2. Then r
2. Remove the battery from the calculator and plug it into the battery connector in the power pack. Protect the power pack against unauthorized opening using one of the numbered adhesive seals enclosed. The added bar code label can be used for the purpose of documentation. (The battery is a backup in case of a power outage.)

The power pack cable (A) has two connectors:

3. Plug the one connector onto the contact fingers on the left side of the PC board.
4. Feed the cable through the meter's leftmost cable feedthrough (viewed from the front) after removing the blind grommet.
5. Plug the other connector into the female connector on the PC board.

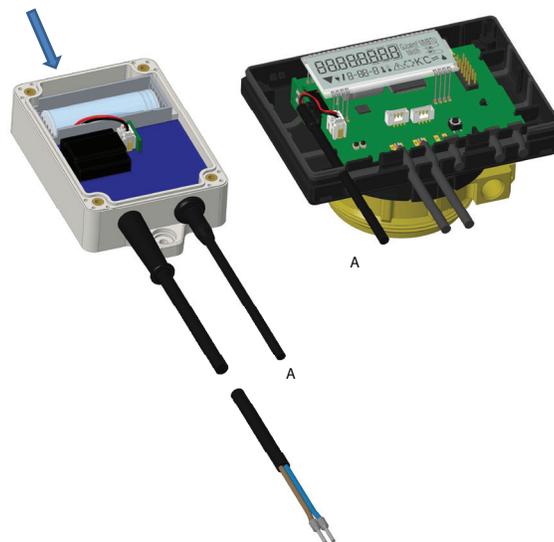


Figure 14: Power pack

Only authorized technical personnel may connect the power pack to the 230 V mains supply and check it. When the meter detects external power supply, the pictogram of a mains plug appears in the display lower left. Close the calculator.



Protect the calculator against unauthorized opening using one of the numbered adhesive seals enclosed to the power pack (stick it upon the seal destroyed). The added bar code label can be used for the purpose of documentation.

INFORMATION MESSAGES

When the instrument has detected an information message, the message symbol is displayed:

The specific message can be found at menu item 6 'Information message' in level 1 / main loop (see section 8, Display). The message code is displayed alternately in binary and hexadecimal form.

The instrument recognizes eight message causes, which can also occur in combination with each other.

Hexadecimal Display	Description	Binary Display
H 80	Low battery	1 at first place
H 40	Instrument has been reset	1 at second place
H 20	Electronics defective	1 at third place
H 10	Error in flow measurement system	1 at fourth place
H 08	Temperature sensor 2 short circuit	1 at fifth place
H 04	Temperature sensor 2 cable break	1 at sixth place
H 02	Temperature sensor 1 short circuit	1 at seventh place
H 01	Temperature sensor 1 cable break	1 at eighth place

Temperature sensor 1 is the right temperature sensor (viewed from the front).

Example: Temperature sensor 1 cable break

Message	Low battery	Reset	Electronics defective	Error in flow measurement system	Temperature sensor 2 short circuit	Temperature sensor 2 cable break	Temperature sensor 1 short circuit	Temperature sensor 1 cable break	Alternating hexadecimal message displayed (LCD)
Bit	7	6	5	4	3	2	1	0	
Display location	1	2	3	4	5	6	7	8	
Alternating binary message displayed (LCD)									

When a message  appears in the standard display (total heat energy), with the exception of the messages:

- Low battery (H 80)
- Reset (H 40)
- Error in flow measurement system (H 10; in the case of air in the ultrasonic measuring tube), the instrument must be exchanged and sent to the supplier for examination

Message Descriptions

Display	Message	Effect	Possible Cause
H 80	Low battery	No influence on the calculation	Adverse environmental conditions; long operating time
H 40	Reset	No influence on the calculation	EMC, electromagnetic interference
H 20	Electronics defective	No energy calculations are carried out. The register for energy is not being updated (no new data is being stored).	Component failure on the calculator PC board
H 10	Error in flow measurement system	No calculations are carried out. The registers for volume and energy are not being updated (no new data is being stored).	Connecting cable between the calculator housing and flow sensor damaged <u>Ultrasonic flow sensor:</u> Air in the system; contaminated flow sensor
H 08	Temperature sensor 2 short circuit	No energy calculations. The register for energy is not being updated (no new data is being stored).	Sensor cable damaged
H 04	Temperature sensor 2 cable break	No energy calculations. The register for energy is not being updated (no new data is being stored).	Sensor cable damaged
H 02	Temperature sensor 1 short circuit	No energy calculations. The register for energy is not being updated (no new data is being stored).	Sensor cable damaged
H 01	Temperature sensor 1 cable break	No energy calculations. The register for energy is not being updated (no new data is being stored).	Sensor cable damaged

