

## 1 General information

The meter has left the factory in a technically safe condition. Further technical support is provided by the manufacturer on request. The meter's calibration-relevant security symbols must not be damaged or removed. Otherwise, the warranty and calibration validity of the meter will be invalidated.

- Keep the packaging in a safe place so that you can transport the meter in its original packaging after the calibration validity has expired.
- Lay all cables at a minimum distance of 500 mm from power and high-frequency cables.
- A relative humidity of < 93 % at 25°C is permissible (non-condensing).
- Avoid overpressure cavitation throughout the system, i.e. at least 1 bar for qp and approx. 3 bar for qs (applies for approx. 80 °C).
- The control line must not be cut, shortened or extended.
- In the case of a **heat meter** or combined heat/cooling meter, the cold side installation location corresponds to the return  and the warm side installation location corresponds to the supply .
- In the case of a **cooling meter** , the warm side installation location corresponds to the return  and the cold side installation location to the supply .

## 2 Safety instructions

 **Caution**  
The meters may only be used in building installations and only for the applications described.

 **Caution**  
The local regulations (installation, etc.) must be observed.

 **Caution**  
The operating conditions on the nameplate must be observed during use. Failure to comply with these regulations can cause dangerous situations and voids all claims arising from liability for defects as well as liability on the basis of any expressly granted guarantees.

 **Caution**  
Comply with the requirements for circulation water (CEN / TR 16911:2016).

 **Caution**  
The meter is only suitable for circulation water in heating systems.

 **Caution**  
The meter is not suitable for drinking water.

 **Caution**  
Do not lift the meter on the calculator.

 **Caution**  
Pay attention to sharp edges on threads, flanges and the measuring tube.

 **Caution**  
Only personnel trained in the installation and operation of meters in heating/cooling systems may install and remove the meter.

 **Caution**  
Only install or remove the meter on an unpressurised system.

 **Caution**  
After installing the meter, check the leak tightness of the system.

 **Caution**  
Breaking the safety marks relevant for calibration voids the warranty and the validity of the calibration.

 **Caution**  
Avoid contact of the meter housing with silicone oils or substances containing silicone oil.

 **Caution**  
Only clean the meter from the outside with a soft, slightly moistened cloth. Do not use spirits or cleaning agents.

 **Warning**  
If the medium temperature is higher than 60 °C, shield the volume measuring part from unintentional contact.

 **Warning**  
The meter must not be energised until it has been fully assembled. Otherwise there is a risk of electric shock on the terminals. A defective or obviously damaged device must be disconnected from the power supply immediately and replaced.

**Warning**

The meter is valid for disposal as waste electronic equipment within the meaning of the European Directive 2012/19/EU (WEEE) and must not be disposed of as household waste. The corresponding national and legal regulations must be observed and the device must be disposed of via the channels provided for this purpose. The local and currently valid legislation must be observed.



**Warning**

The meter contains lithium batteries. Do not dispose of the meter and batteries as household waste. Observe local regulations and laws regarding disposal.



**Warning**

After lithium batteries have been used, you can return them to the manufacturer for proper disposal. When shipping batteries please observe legal regulations which among other things govern the labelling and packaging of hazardous goods.



**Warning**

Do not open the batteries. Do not bring batteries into contact with water or expose to temperatures exceeding 80°C.



**Warning**

The meter has no lightning protection. Ensure lightning protection via the house installation.



**3 Operating elements**

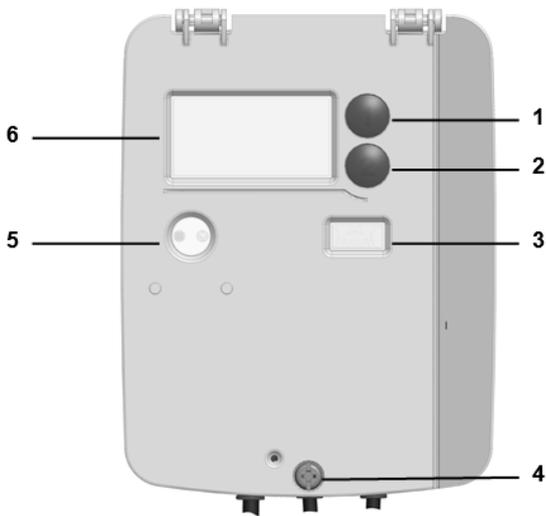


Figure 1: Meter, closed

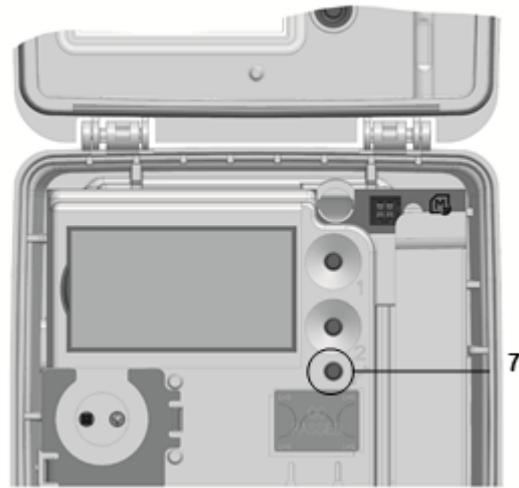


Figure 2: Meter, open

Number	Description
1	Button 1
2	Button 2
3	Security stamp
4	Screw
5	Optical interface
6	LCD
7	Service button

**4 Installation**

**Note**

For a **heat meter** or combined heat/cooling meter, the cold side installation location corresponds to the return and the warm side installation location to the supply .

**Note**

In the case of a **cooling meter** , the warm side installation location corresponds to the return and the cold side installation location to the supply .

Proceed as follows to install the meter:

1. Compare the installation location with the symbol on the LCD ( or ) to determine the installation location. If necessary, adjust the installation location of the meter to match the conditions (see chapter "Changing the installation location").
2. Note the dimensions of the meter and check whether there is sufficient free space.
3. Flush the system thoroughly before installing the meter.
4. Install the meter vertically or horizontally between two gate valves so that the arrow on the body matches the flow direction. Please note the following installation examples.

5. Install the temperature sensors in the same circuit as the meter.
6. Seal temperature sensors and screw connections to prevent manipulation.
7. Remove the rubber band from the volume measuring part. During operation, the temperature sensor cable and control line should not be in direct contact with the volume measuring part.
8. If you install the meter as a cooling meter, follow the corresponding instructions.  
Recommendation: If you install several meters, the same installation conditions should apply to all meters.

#### 4.1 Changing the installation location

##### Note



The installation location can be changed in the field if this function has been enabled at the factory. This function locks after 5 changes and can then no longer be used. The entries can be checked via the LCD loop "LE".

##### Note



Alternatively, you can change the installation location using UltraAssist.

##### Note



If the "PoS" symbol is not displayed, this function is not available.

For meters with an adjustable installation location, the installation location can be determined manually. Proceed as follows:

- Press and hold the Service button (for more than 3 seconds) until "Para" appears on the LCD.
- Press button 2 briefly until "F8" appears on the LCD.
- Press button 1 briefly several times until "PoS" appears on the LCD.
- Briefly press button 2 to display the current installation location. Depending on the installation location, "PoS Cold" or "PoS Hot" is displayed.
- To change the installation location, press button 1. The display changes.
- Press button 2 briefly until \* appears on the LCD.
- To complete the parameterisation, briefly press button 1 several times until "nb----" appears on the LCD.
- Press button 2 briefly to complete the change.
- The change can be checked using the symbols (←) or (→) on the LCD.
- If necessary, adjust the temperature sensors according to the installation requirements.

#### 4.2 Installation recommendations

- During installation, make sure that water cannot enter into the calculator during operation.
- Inlet or outlet sections are not necessary but are recommended.
- If you install the meter in the common return of two circuits, select an installation location with a minimum distance of 10 × DN from the T-piece.
- The temperature sensor ends should reach at least into the middle of the pipe cross-section.

#### 4.3 Installation examples

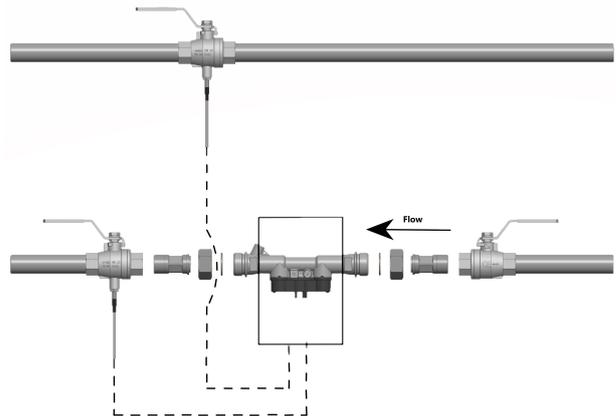


Figure 3: Integration with ball valve (recommended up to and including DN 25)

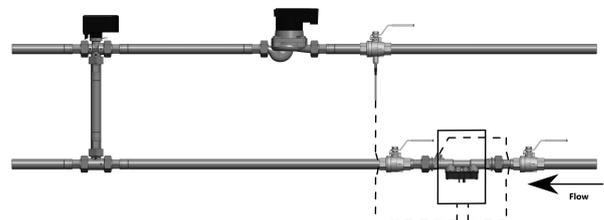


Figure 4: Integration for circuit with admixture; placement of the temperature sensors

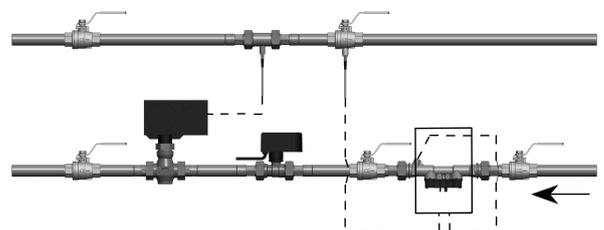
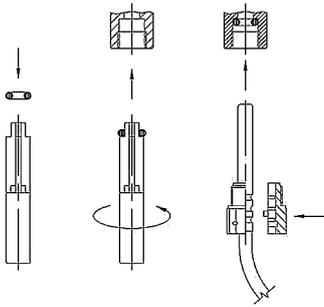


Figure 5: Integration for circuit with throttle circuit, for example (flow sensor in flow direction before the control valve/differential pressure regulator)

#### 4.4 Installation instructions for the adapter set (direct immersion temperature sensor)

An installation set is included for meters with a  $\varnothing 5.2 \times 45$  mm temperature sensor. This allows you to immerse the temperature sensor directly in an installation piece or a ball valve, for example.



**Figure 6: Installation adapter set**

1. Install the O-ring into the installation point using the enclosed mounting aid/pin.
2. Place both halves of the plastic fitting around the 3 recesses on the temperature sensor.
3. Press the screw connection together and screw the screw connection into the installation point as far as it will go (tightening torque 3 ... 5 Nm).

#### 4.5 Torques

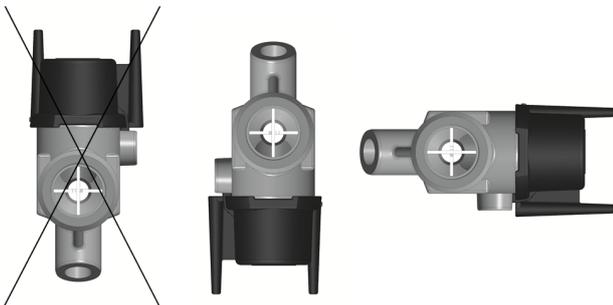
Please note the following torques for tightening the screws and nuts on the meter:

- Screw on the device cover (Fig.1, No. 4): min. 1 Nm
- All other screws: Hand-tightened to approx. 0.5 Nm

#### 4.6 Installation of cooling meters and combined heat/cooling meters

To prevent condensation from forming, observe the following installation instructions:

- Install the cooling meter so that the black cover on the measuring tube faces to the side or downwards.
- Install the calculator separately from the volume measuring part, e.g. on the wall.
- Create a downwards loop with the connected lines.
- Install the thermowells in such a way that the temperature sensors are horizontal or vertical.



**Figure 7: Recommended installation position of cooling meters and combined heat/cooling meters**

## 5 Calculator

The ambient temperature of the calculator must not exceed 55 °C. Avoid direct sunlight. For water temperatures between 10 °C and 90 °C, you can install the calculator on the volume measuring unit or on the wall.

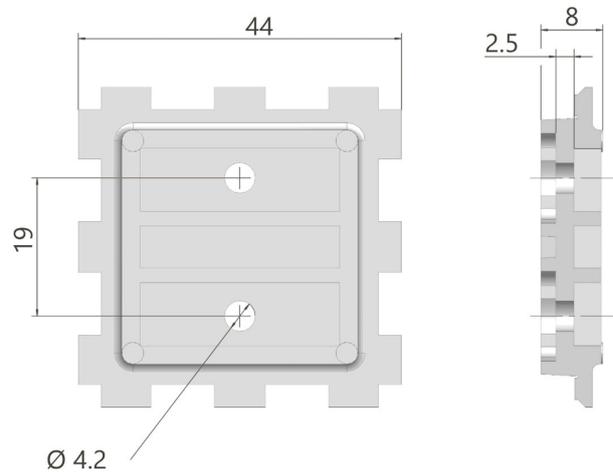
### 5.1 Align the calculator

Proceed as follows to align the calculator:

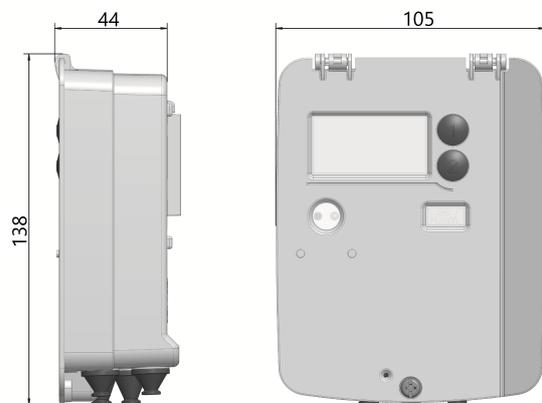
1. Slide the housing upwards and remove it.
2. Turn the calculator so that you can easily read the display.
3. Slide the calculator onto the adapter plate in this position until it clicks into place.

### 5.2 Wall mounting (split mounting)

Install the calculator on the wall if the water temperature is below 10°C or above 90°C.



**Figure 8: Plan view and cross-section of the adapter plate**



**Figure 9: Calculator dimensions**

Proceed as follows when mounting the calculator on the wall:

1. Remove the calculator from the adapter plate.
2. Unscrew the adapter plate from the volume measuring part.
3. Attach the adapter plate to the wall.
4. Slide the calculator onto the adapter plate until it clicks into place.

## 6 Power supply

### Caution



Do not open the batteries. Do not bring batteries into contact with water or expose to temperatures exceeding 80°C. Dispose of used batteries at suitable collection points.

### 6.1 Changing the battery

#### Note



Only batteries approved by the manufacturer may be installed.

#### Note



When replacing the battery, ensure that the battery service life is longer than the planned life cycle of the meter.

#### Note



After lithium batteries have been used, you can return them to the manufacturer for proper disposal. When shipping batteries please observe legal regulations which among other things govern the labelling and packaging of hazardous goods.

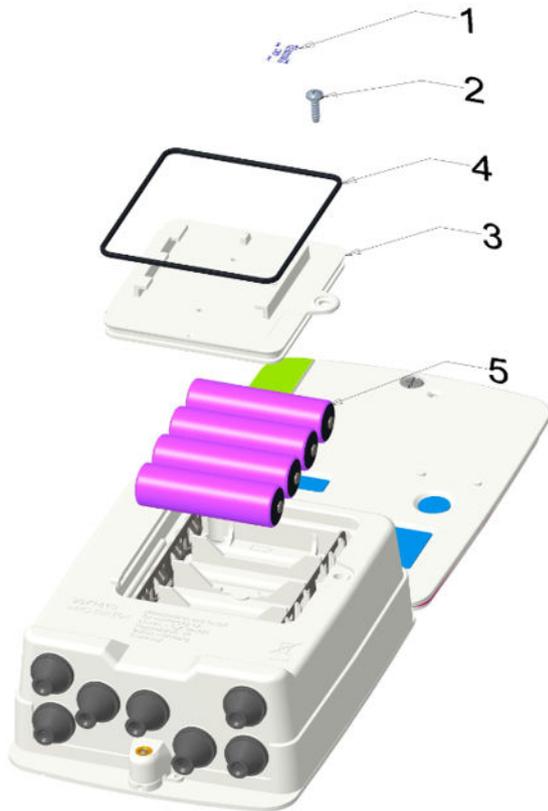


Figure 10: Battery compartment

Number	Description
1	User protection
2	Battery compartment cover screw
3	Battery compartment cover

Number	Description
4	Seal
5	Battery

Proceed as follows to change the battery:

- If necessary, open the battery compartment cover by loosening the screw.
- To loosen the screw, use a PH1 Phillips screwdriver. Make sure that the contact pressure is firm.
- Remove the old batteries from the battery compartment.
- Insert the battery into the battery compartment according to the polarity mark. Observe the connection sequence. Always start with the labelled battery position 1.
- Close the battery cover by tightening the screw.

#### Note



We recommend using the UltraAssist service software to parameterise the battery change.

### 6.2 Calculator interfaces

The meters are equipped as standard with an optical interface as per EN 62056-21:2002 and two water meter pulse inputs.

You can also use one of the following communication modules for remote reading:

- Pulse output module
- M-Bus module
- Radio module

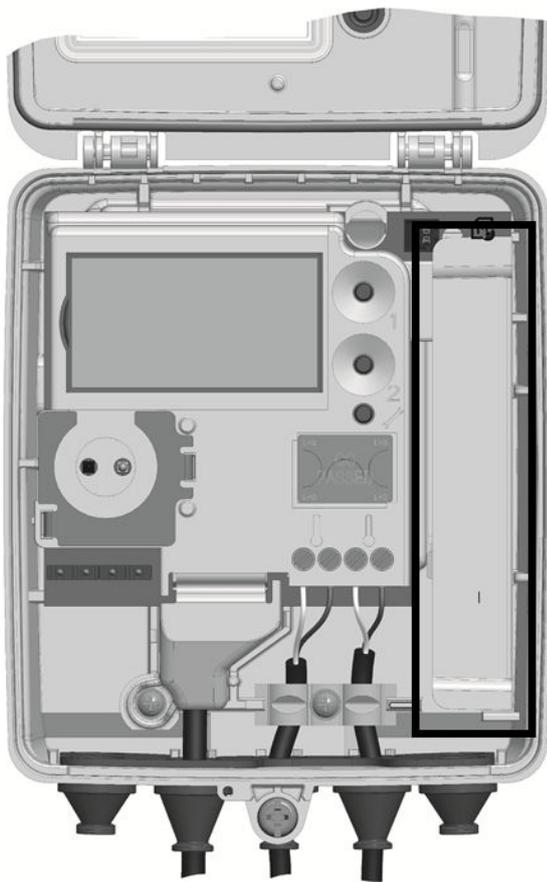
These modules have no effect on consumption recording. You can retrofit the modules at any time without violating the security tag.

## 7 Communication modules

#### Note



Observe the necessary ESD protection measures when installing modules.



**Figure 11: Communication module slot**

### 7.1 Installing the communication module

The communication modules are connected via a non-reactive plug to enable installation or conversion at any time.

**Note**  
Only ever touch the module on its plastic holder.

**Note**  
To connect an external cable, open the cable sleeves so that they tightly enclose the cable.

Proceed as follows to install a communication module:

- If necessary, open the housing cover by loosening the screw.
- For M-Bus and pulse output modules, also note the following points:
- Run the cable from the outside through the grommet.
  - Strip and connect the cable.
  - Secure the cable with the strain relief clamp.
  - Connect the cables to the module's terminals.
  - Pull the cables out through the housing while inserting the module.
  - First attach the contact surfaces of the module to the module slot.
  - Gently push the module in.

Depending on the design of the housing, please also observe the following points:

- For IP 68 versions of the housing, tighten the cable gland.
- For the IP 54 version of the housing, make sure that the grommet is seated correctly.
- Close the housing cover by tightening the screw (see chapter Torque) and press the housing cover tightly into place.

**Note**  
You can find the technical details and data about the communication modules in their documentation.

**Note**  
No later than 60 seconds after installation, the meter

**Note**  
automatically  detects the inserted modules and is ready for communication or pulse output.

### 7.2 Terminal blocks

2-pin or 4-pin terminals are used to connect the external lines to the modules.

- Stripping length 6 mm
- Connection capability
  - rigid or flexible, 0.14 ... 1.5 mm<sup>2</sup>
  - flexible with wire end ferrule with plastic sleeve, 0.25 ... 1.5 mm<sup>2</sup>
  - flexible with wire end ferrule without plastic sleeve, 0.25 ... 1.0 mm<sup>2</sup>
  - Conductor sizes 26 ... 14 AWG
- Recommended screwdriver:
  - 0.6 × 3.5 mm
- Tightening torque: 0.35 ... 0.4 Nm

### 8 Non-detachable temperature sensors

**Note**  
The cables must not be detached, shortened or extended for factory-fitted, non-detachable temperature sensors.

- Insert the temperature sensors into the immersion sleeves, ball valves or T-pieces. The temperature sensor must sit on the bottom of the thermowell.
- Seal the temperature sensors to prevent manipulation.

### 9 Detachable temperature sensor

**Note**  
If detachable temperature sensors are used, they must have their own calibration or certificate of conformity.

**Note**

**Note**  
The temperature sensor type Pt100  or

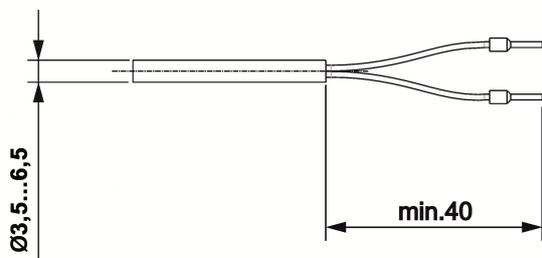
**Note**

Pt500  set in the electronics can be checked in the Loop1 display ID 144.

**Note**

The maximum cable length of the temperature sensors is 10 m. An extension is not permitted.

- If necessary, open the housing cover by loosening the screw.
- Run the warm side temperature sensor cable from the outside through the 4th grommet from the left and the cold side temperature sensor of the through the 5th grommet from the left.
- Strip both cables as shown in the illustration.



**Figure 12: Temperature sensor connection**

- Connect the wires according to the printed wiring diagram. The connection is made to terminals 5/6 (warm side temperature sensor) and 7/8 (cold side temperature sensor).
- Insert the temperature sensors into the thermowells, ball valves or T-pieces. The temperature sensor must sit on the bottom of the thermowell.
- Seal the temperature sensors to prevent manipulation.
- Close the housing cover by tightening the screw (see chapter Torque) and press the housing cover tightly into place.

If the LCD displays , you can reset this error message via the parameterisation menu. Please refer to the service manual.

## 10 Commissioning

Proceed as follows when carrying out the commissioning:

- Close the housing cover by tightening the screw (see chapter Torque) and press the housing cover tightly into place.
  - Slowly open the gate valves.
  - Check the system for leaks and vent it carefully. The message F0 disappears after 100 s at the latest.
  - Check the flow and temperature indicators for plausibility.
  - Vent the system until the flow display [ID 000] is stable.
  - Attach user guards to the calculator and temperature sensors.
  - Document the meter readings.
- Recommendation: Reset the maximums and the absence time. More details can be found in the T450 service manual.

## 11 Error messages due to incorrect installation

**Note**

When the system is at a standstill, these messages can also be displayed without incorrect installation

	<b>Error "Incorrect flow direction (negative)"</b> Check whether the flow direction arrows on the volume meter correspond to the flow direction of the system. If the directions do not match, rotate the volume meter 180°.
	<b>Error "negative temperature difference"</b> Check whether the temperature sensors are correctly installed. If the temperature sensors are not correctly installed, swap the installation location of the temperature sensors.
	<b>Heat meter:</b> Temperature sensor in the flow pipe - pipe with higher temperatures; Temperature sensor in the return pipe - pipe with lower temperatures
	<b>Cooling meter:</b> Temperature sensor in the flow pipe - pipe with lower temperatures; Temperature sensor in the return pipe - pipe with higher temperatures

## 12 Display

The functions of the LCD are described in detail in the operating manual included.

## 13 Error messages

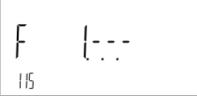
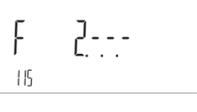
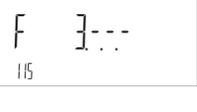
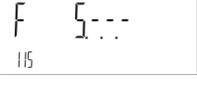
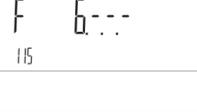
**Note**

Reset the message F8 in parameterisation mode manually or with UltraAssist. All other error messages are automatically deleted after the error has been corrected.

The meter regularly performs a self-diagnosis and can recognise and display various  errors and error messages.

**Table 1:**

Error code	Error	Information for Service
	Wrong flow direction	Check flow and installation direction and correct as necessary
<b>Possibly alternating with:</b>		

Error code	Error	Information for Service
	Negative temperature difference	Check installed position of temperature sensor; change if necessary
<b>Possibly alternating with:</b>		
	No flow measurable	Air in measuring part/tube, bleed the line (status at delivery)
	Temperature sensor warm side interruption	Check warm side of temperature sensor, replace if necessary
	Temperature sensor cold side interruption	Check temperature sensor cold side, replace if necessary
	PCB for temperature evaluation defective	Change the device
	Battery empty; power supply problem	Replace battery; check connection
	Short-circuit temperature sensor warm side	Check warm side of temperature sensor, replace if necessary
	Short-circuit temperature sensor cold side	Check temperature sensor cold side, replace if necessary

Error code	Error	Information for Service
	Error in internal memory	Change the device. The measurements of the meter may no longer be used for legally calibrated billing.
or		
		
	F2, F3, F5 or F6 persisting for more than 8 hours, attempted manipulation detected (here: F1 longer than 8 hours).	The action depends on the error code. This F8 error message must be reset by the Service Department.
	Error in the printed circuit board	Change the device

#### 14 Notes

In Germany, the following applies for MID-compliant devices: For new installations in pipelines smaller than/equal to DN 25, only direct immersion is permitted when installing short sensors.

