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Installation and Operating Instructions

Thermal Energy Meter (Compact Heat Meter, Combined Heat/Cooling Energy Meter)

microCLIMA/SENSOSTAR®2/2+ MSH

Model MSH DE-07-MI004-PTB001 (MID heat)
Model QStar DE-08-MI004-PTB005 (MID heat)

1 Application and Function

Thermal energy meter designed for the measurement of the consumed thermal energy in a closed heating system or heating / cooling system.

2 Contents of the Package

- Thermal energy meter consisting of a calculator, a flow sensor and two temperature sensors, connected permanently
- Installation kit MSH-SStar, -VStar, -MStar, -AStar or QStar (depending on type)
- Depending on type of the flow sensor (label):
  - EAS identification “EN14154” (IST)
  - EAS identification “EN14154”(TE1)
  - EAS identification “EN14154” (M60)
  - EAS identification “EN14154”(A1)
- Installation and Operating Instructions

3 General Information

- Valid standards for the application of heat meters: EN 1434, parts 1 – 6; the Measuring Instruments Directive 2004/22/EC, 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 Annex 22 of the verification regulations (for Germany).
- 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) 2004/108/EC.
- 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the seals must not be removed or damaged – otherwise the guarantee and the approved application of the instrument are no longer valid!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 meets 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.
- The instrument must be stored and transported at temperatures above-freezing.
- **Instruments with activated radio function are not allowed on air freight.**
- The correct installation point in the system must be chosen: forward or return flow, as stated on the type identification label.
- 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.engelmann.de.
- 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 one minute by pushing the button (except calculator without additional interfaces).

3.1 Definition of pictograms on type identification label

	Installation in return flow
	Installation in forward flow

4 Mounting the Flow Sensor

4.1 Installation of *SENSOSTAR® 2/2+* type MSH-SStar in a single pipe connection piece (EAS)

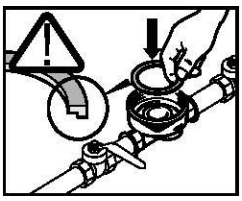
The multi-jet flow sensor type MSH-SStar has a 2“ connection as described in EN 14154 (IST) and must be installed without an adapter in a single pipe connection piece (EAS) compatible to EN 14154 (IST). These EASs are pipe connections which have no metrological influence on the measurement accuracy.

Important

Before installing the flow meter check if the EAS has the identification EN14154 (IST). If not, the label provided with the meter must be applied clearly to the EAS.

Mounting

- Flush the pipes according to the generally acknowledged rules of technology. Then close all the shut-off valves. Open the nearest draining valve for pressure release.
- Drain the closed-off pipe section.
- Take into account the direction of flow (connection piece)!
- Remove the overflow flange or the old heat meter from the connection piece using a wrench.
- Remove all old gaskets. Check sealing surfaces and threads for imperfections or dirt. If necessary, deburr or clean with a suitable cleaning liquid.
- Place the new profile gasket into the connection piece with the flat surface facing up.
- Lubricate the external thread of the flow sensor with a thin layer of food safe silicon grease.
- Check that the O-ring on the outlet of the flow sensor is in the correct position.
- Screw in the heat meter tightly by hand and then tighten additionally with a suitable wrench to the mechanical end stop (metal-to-metal).
- Detach the calculator and mount it, or rotate it to the best position for read-out.



4.2 Installation of *SENSOSTAR® 2+* type MSH-VStar in a single pipe connection piece (ASS)

The multi-jet flow sensor type MSH-VStar has an external thread M62x2 connection as described in EN 14154 (TE1) and must be installed without an adapter in a single pipe connection piece (ASS) compatible to EN 14154 (TE1). These ASSs are pipe connections which have no metrological influence on the measurement accuracy.

Important

Before installing the flow meter check if the ASS has the identification EN14154 (TE1). If not, the label provided with the meter must be applied clearly to the ASS.

Mounting

- Flush the pipes according to the generally acknowledged rules of technology. Then close all the shut-off valves.
- Open the nearest draining valve for pressure release.
- Drain the closed-off pipe section.
- Take into account the direction of flow (connection piece)!
- Remove the overflow flange or the old heat meter from the connection piece using a wrench.
- Remove all old gaskets. Check sealing surfaces and threads for imperfections or dirt. If necessary, deburr or clean with a suitable cleaning liquid.
- Lubricate the external thread of the flow sensor with a thin layer of food safe silicon grease.
- Check that the O-ring on the outlet of the flow sensor is in the correct position.

- Screw in the heat meter tightly by hand and then tighten additionally with a suitable wrench to the mechanical end stop (metal-to-metal).
- Detach the calculator and mount it, or rotate it to the best position for read-out.

4.3 Installation of *SENSOSTAR® 2+* type MSH-MStar in a single pipe connection piece (thread M60x1,5)

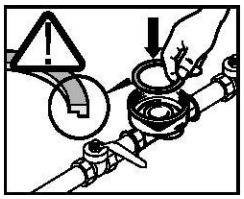
The multi-jet flow sensor type MSH-VStar has an external thread M60x1,5 connection as described in EN 14154 (M60) and must be installed without an adapter in a single pipe connection piece compatible to EN 14154 (M60). These pipe connections have no metrological influence on the measurement accuracy.

Important

Before installing the flow meter check if the connection piece has the identification EN14154 (M60). If not, the label provided with the meter must be applied clearly to the connection piece.

Mounting:

- Flush the pipes according to the generally acknowledged rules of technology. Then close all the shut-off valves. Open the nearest draining valve for pressure release.
- Drain the closed-off pipe section.
- Take into account the direction of flow (connection piece)!
- Remove the overflow flange or the old heat meter from the connection piece using a wrench.
- Remove all old gaskets. Check sealing surfaces and threads for imperfections or dirt. If necessary, deburr or clean with a suitable cleaning liquid.
- Place the new profile gasket into the connection piece with the flat surface facing up.
- Lubricate the external thread of the flow sensor with a thin layer of food safe silicon grease.
- Check that the O-ring on the outlet of the flow sensor is in the correct position.
- Screw in the heat meter tightly by hand and then tighten additionally with a suitable wrench to the mechanical end stop (metal-to-metal).
- Detach the calculator and mount it, or rotate it to the best position for read-out.



4.4 Installation of *SENSOSTAR® 2+* type MSH-AStar in a single pipe connection piece (EAT M77x1,5)

The multi-jet flow sensor type MSH-AStar has an external thread M77x1,5 connection as described in EN 14154 (A1) and must be installed without an adapter in a single pipe connection piece (EAT) compatible to EN 14154 (A1). These pipe connections have no metrological influence on the measurement accuracy.

Important

Before installing the flow meter check if the connection piece has the identification EN14154 (A1). If not, the label provided with the meter must be applied clearly to the connection piece

Mounting

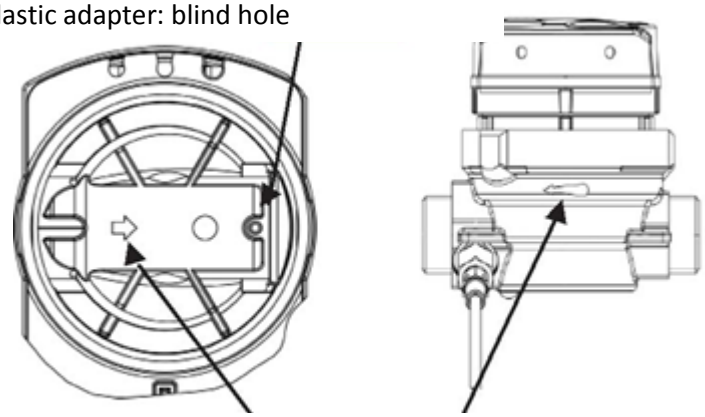
- Flush the pipes according to the generally acknowledged rules of technology. Then close all the shut-off valves.
- Open the nearest draining valve for pressure release.
- Drain the closed-off pipe section.
- Take into account the direction of flow (connection piece)!
- Remove the overflow flange or the old heat meter from the connection piece using a wrench.
- If a plastic adapter was mounted together with the old meter, it is to remove, too.
- Check sealing surfaces and threads for imperfections or dirt. If necessary, deburr or clean with a suitable cleaning liquid.
- Lubricate the external thread (M77x1,5) of the flow sensor and the O-ring (66,35x2,62) with a thin layer of food safe silicon grease.
- Screw in the heat meter tightly by hand and then tighten additionally with a suitable wrench to the mechanical end stop (metal-to-metal).
- Detach the calculator and mount it, or rotate it to the best position for read-out.

Attention

When installing, ensure correct positioning regarding the flow by paying attention to the directional arrows on the outer surface of the EAT and on the bottom of the plastic adapter.

Also, please pay attention that the blind hole in the plastic adapter is properly lined up with the metal pin in the inside bottom of the EAT on the flow outlet (in rare cases, this pin may not be present: in this case, it is not necessary for installation.)

Plastic adapter: blind hole



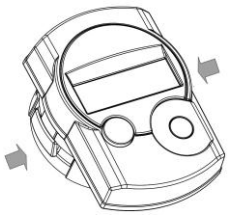
Directional arrows

4.5 Mounting of *SENSOSTAR® 2/2+* type MSH-QStar

- Flush the pipes according to the generally acknowledged rules of technology. Then close all the shut-off valves.
- Open the nearest draining valve for pressure release.
- Drain the closed-off pipe section.
- Loosen the coupling rings and remove the old heat meter.
- Remove all old gaskets.
- Clean the sealing surfaces.
- Insert new gaskets.
- Position the flow sensor correctly, taking into account the direction of flow (arrow on the side of the flow sensor)!
- Tighten the coupling rings.
- Detach the calculator and mount it, or rotate it to the best position for read-out.

Note (valid for all types of flow sensors)

In order to simplify mounting in narrow installation spaces the compact meter`s calculator can be detached from the flow sensor.



To release the calculator pull it carefully up off the flow sensor.

For heat meter versions it is recommended to detach the calculator.
For heat/cooling meters the calculator must be detached from the flow sensor.

5 Mounting the Temperature Sensors

For pipes of sizes < DN25 in new installations (whether new construction or refurbishment) it is required to install the temperature sensors directly immersed in the flow (without temperature pockets).

Note
During installation of the meter make sure that the temperature sensors are mounted according to their marking.

5.1 Direct mounting (ball valve and T-piece)

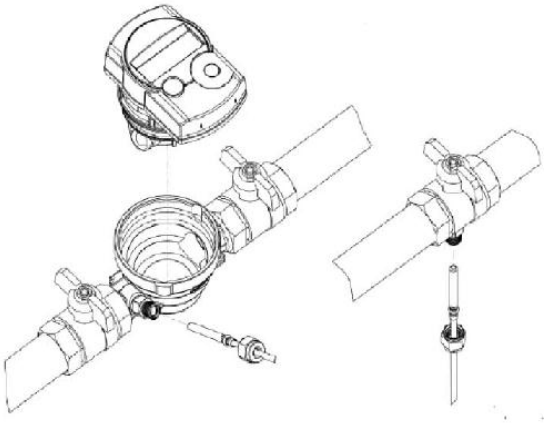
- Remove the blind plug/old temperature sensor and gasket/old O-ring. Clean connection surfaces.
- Slide the O-ring off the temperature sensor and insert it to the bottom of the threaded opening of the ball valve or the T-piece.
- Insert the temperature sensor to at least 15mm, preferably the middle of the ball valve or T-piece (or a little further) and screw tightly. It is important to pay attention that the tip of the temperature sensor does not touch the bottom (the other side) of the ball valve or T-piece.

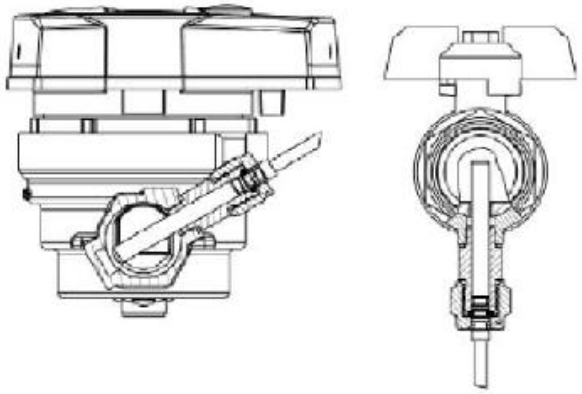
5.2 Mounting the temperature sensors 6 mm of the MSH-AStar

5.2.1 Direct-mounting the temperature sensors of the MSH-AStar

Important notes

- Close the shut-off valves and make sure that no hot water can escape upon removal of the blind plug or the old temperature sensor!
- Prepare both temperature sensors: Push the O-ring into the middle groove.
- Insert the temperature sensors into the measuring point of EAT and ball valve or T-piece and tighten using the coupling nuts.
- Reopen all ball valves and check installation points for leakage.
- Protect the installation points (meter and temperature sensors) against manipulation by securing with the seals and sealing wires.





6 Start of Operation

- Slowly open the shut-off valves.
- Check that there are no leaks.

Check the following points:

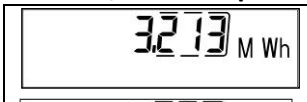
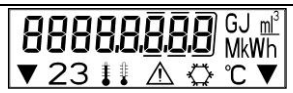
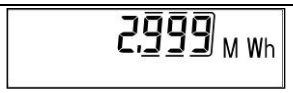
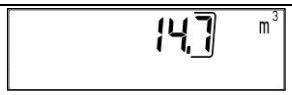
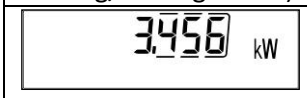
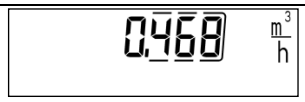
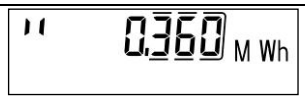
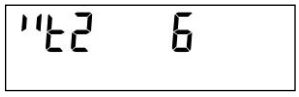
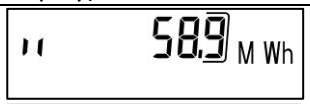
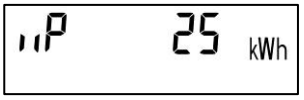
- Are all shut-off valves open?
- Is the meter of the right size?
- Is the heating (heating/cooling) system clear (dirt filters not clogged)?
- Are the temperature sensors and the flow sensor sealed (against manipulation)?
- Is a flow volume displayed?
- Is a plausible temperature difference displayed?

When the meter is functioning properly, attach the seals to the temperature sensors and the flow sensor (required to protect against manipulation).

7 Display

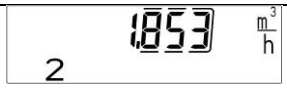
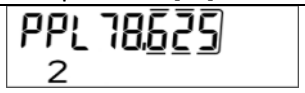
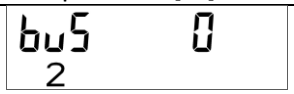
The calculator has a liquid crystal display with 8 digits and special characters. The values that can be shown are divided into three display loops. All data is retrieved using the push button next to the display.
At the start you are automatically in the main loop (1st level). By pressing the push-button longer than 4 seconds you change to the next display loop. Keep the push-button pressed until you reach the desired information loop.
By pressing the push-button briefly you can scan all the information within a loop. After 1 minute of non-use of the push-button, the display automatically returns to the main loop.

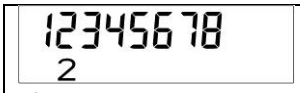
Level 1 / Main loop

<table>
<tr>
<td> 
 
1) Standard display: total heat energy; alternating display: total cooling energy (for heating/cooling meter)</td>
<td> 
2) Segment test, all segments triggered simultaneously</td>
<td> 
 
3) Heat energy at last reading date alternating with last reading date[1]</td>
<td> 
4) Total flow volume [m³]</td>
</tr>
<tr>
<td> 
5) Current power [kW]</td>
<td> 
6) Current flow [m³/h]</td>
<td> 
7) Current date</td>
<td> 
 
8) Hint flag (alternating binary and hexadecimal display)</td>
</tr>
<tr>
<td> 
 
 
 
9) Tariff register 1: values alternating with tariff register no. and criteria[2]</td>
<td> 
 
 
10) Tariff register 2: values alternating with tariff register no. and criteria[2]</td>
<td> 
 
11) Momentary reading of the pulse counter 1 alternating with the pulse value[2]</td>
<td> 
 
12) Momentary reading of the pulse counter 2 alternating with the pulse value[2]</td>
</tr>
</table>

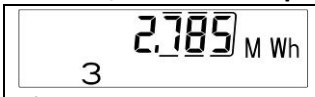
Tariff register and 2 pulse counters are options ex factory.

Level 2 / Technician's loop

<table>
<tr>
<td> 
1) Maximum power [kW]</td>
<td> 
2) Maximum flow [m³/h]</td>
<td> 
3) Forward flow temperature [°C]</td>
<td> 
4) Return flow temperature [°C]</td>
</tr>
<tr>
<td> 
5) Temperature difference [K]</td>
<td> 
6) Days in operation since calibration</td>
<td> 
7) Pulse value [pulses per litre]</td>
<td> 
8) M-Bus address</td>
</tr>
</table>

 9) Serial number	 10) Firmware version		

Level 3 / Statistics loop

 1) Previous reading date alternating with its value. Alternatively, the total volume or tariff values can be displayed[1]	 2.-16) Monthly values: dates alternating with their values. Alternatively, the total volume or tariff values can be displayed[1]

[1] Up to the end of the month the consumption and reading date for that month will be shown as 0.
[2] Can be set using the software "Device Monitor". A dedicated meter password is necessary. The password is available from the manufacturer.

8 Technical Data

Approval Data (the data on the type label are valid)		**SStar / VStar / MStar / AStar**	**QStar**
EC-type examination certificate		DE-07-MI004-PTB001	DE-07-MI004-PTB005
Accuracy class (EN 1434-1:2007)		class 2/3	
Minimum flow qi/qp	horizontal	standard: 1:50	
	vertical		
Maximum flow qs/qp		2:1	
Mechanical class		M1	
Electromagnetic class		E1	
Protection class of flow sensor		IP54	
Flow disturbance class		UO	

Flow Sensor MSH: SStar / VStar / MStar / AStar / QStar					
Nominal flow qp		m^3/h	0.6	1.5	2.5
Maximum flow qs		m^3/h	1.2	3.0	5.0
Pressure drop Δp at qp		mbar	120	225	240
Nominal pressure PN		bar	16		
Maximum pressure MAP		bar	25		
Low flow threshold	horizontal	l/h	2.5	3.5	4
	vertical		3	5	6
Temperature range		°C	15 – 90		
Mounting position			horizontal; vertical		
Point of installation			return flow (standard version) forward flow (optional version)		
Installation Dimensions Flow Sensor QStar					
Nominal flow qp		m^3/h	0.6	1.5	2.5
Installation length		mm	110	110	130
Connection thread		inch	G3/4B	G3/4B	G1B

Calculator		
Ambient temperature	°C	5 - 55; see "Influencing_factors_battery_lifetime"
Temperature range	°C	1 - 150 (1 - 105; option wireless M-Bus / wireless M-Bus 2IE)
Temperature difference	K	3 - 100
Protection class		IP54

Power supply		3 V lithium battery
Battery lifetime, estimated	years	Standard: 10 years; 6 years + 1 with pulse output: see “Influencing_factors_battery_lifetime”.
Data storage		E^2PROM; daily
Display		8 digits + special characters
Interfaces	standard	Infrared
	optional	M-Bus galvanically isolated; M-Bus galvanically isolated + 2 pulse inputs; wireless M-Bus; wireless M-Bus + 2 pulse inputs; pulse output

Temperature Sensors		
Sensor type		platinum precision resistor Pt500
Connection type		2-wire system
Diameter	mm	5 (optional 5.2 or 6)
Length of cables	m	1.5 (optional 3)

9 Interfaces and Options

9.1 Optical (infrared) interface

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

Baud rate: 2400 baud

The optical (infrared) interface is activated by pressing the push-button.

If within 60 seconds neither a valid telegram is received nor the push-button pressed again, the interface is deactivated. The number of read-outs via the optical interface is limited to 300 times per day.

9.2 M-Bus (optional)

The M-Bus is a galvanically isolated interface for the transmission of meter data (absolute values).

9.3 General information about the M-Bus interface

It is important to note that the acknowledged state of the art technology rules and the relevant legal restraints (international and local; see 9.3.1 “Relevant norms, standards and literature”) are to be observed.

The installation has to be performed by authorized, skilled persons.

If the regulations and the information in the installation and operating instruction manuals are not strictly followed, or if the installation is shown to be faulty, any resulting expenses will be charged to the company responsible for the installation.

Recommended type of cable: telephone cable J-Y(ST)Y 2x2x0.8mm².

It is important to make sure that the topology of the M-Bus network (cable lengths and cross-sections) is suitable for the baud rate (2400 Bd) of the end instruments.

Further information can be found in the detailed ‘Application Note M-Bus’ at www.engelmann.de.

9.3.1 Relevant norms, standards and literature on the M-Bus

IEC 60364-4-41 (2005-12)	Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock
IEC 60364-4-44 (2007-08)	Low-voltage electrical installations - Part 4-44: Protection for safety - Protection against voltage disturbances and electromagnetic disturbances
IEC 60364-5-51 (2005-04)	Electrical installations of buildings - Part 5-51: Selection and erection of electrical equipment - Common rules
IEC 60364-5-54 (2011-03)	Low-voltage electrical installations - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements and protective conductors
EN 50310 (2010)	Application of equipotential bonding and earthing in buildings with information technology equipment

EN 13757-1_2002, -2_2004, -3_2004	Communication systems for meters and remote reading of meters
The M-Bus	A Documentation, Version 4.8, M-Bus User group
TI Technical Journal	Texas Instruments Technical Journal Vol. 8, 1991 M-Bus

9.3.2 Additional technical specifications

The installation has to fulfil the requirements of the relevant norms, standards and literature (see paragraph 9.3.1) and the specifications as follows:

Maximum voltage M-Bus	42 V
Minimum voltage M-Bus	24 V
Maximum ripple voltage	200 mV; EN 13757-2_2004; 4.3.3.6
Maximum voltage potential differences	2 V

9.3.3 Technical data M-Bus

Primary address	0 (factory setting); 1 – 250 (configurable)
Baud rate	2400; 300 (configurable)
Connecting cable length	1 m

9.3.4 Number of read-outs

The number of possible read-outs (2400 Bd) depends on the number of devices in the M-Bus network.

Number of devices in the network	Read-outs per day primary address	Read-outs per day secondary address (without using SND NKE)
3	655	275
20	485	170
60	300	90
120	190	52
250	105	27

Values for standard baud rate 2400 Bd.

If fewer read-outs are carried out, the unused ‚credit' is stored in the instrument and can be used later.

During M-Bus communication with an end instrument the other interfaces (push-button, optical interface) of this instrument cannot be used.

9.4 Radio interface wireless M-Bus EN 13757-3, -4 (optional)

The radio interface is for the transmission of meter data (absolute values).

General information about the radio interface

Installation of radio components between or behind heating pipes, or the presence of other bulky obstacles directly over or in front of the housing must be avoided.

The transmission quality (range, telegram processing) of radio components can be negatively influenced by instruments or equipment with electromagnetic emissions, such as telephones (particularly LTE mobile radio standard), Wi-Fi routers, baby monitors, remote control units, electric motors, etc.

In addition, the construction of the building has a strong influence on the transmission range and coverage. Furthermore, when using installation boxes (substations) they must be equipped with non-metallic covers or doors.

The factory-setting of the clock in the meter is standard (winter) Central European Time (GMT +1). There is no automatic changeover to daylight savings (summer) time.

The radio function is not activated upon delivery (factory-setting). See section 'Activation of the radio interface'.

9.4.1 Technical data radio

Frequency	868 MHz
Transmission power	up to 12 dBm
Protocol	wireless M-Bus based on EN 13757-3
Selectable modes	S1 / T1 / C1
Telegrams	- short telegram in conformity to AMR (OMS-Spec_Vol2_Primary_v301): energy (heat/cooling energy, pulse input 1, pulse input 2), total volume, flow, power, hint flag, return flow temperature, temperature difference - long telegram for walk-by read-out: energy (heat/cooling energy, pulse input 1, pulse input 2), total volume, hint flag, 15 monthly values
Encryption	AES: Advanced Encryption Standard; key length: 128 bits

9.4.2 Radio configuration*

Parameter	**Possible settings**	**Factory settings** (Battery lifetime, estimated: 6 years + 1)
Mode	S1 / T1 / C1; unidirectional	T1 (unidirectional)
Transmission period	00:00 - 24:00; any time period in the day	7:00 am - 7:00 pm
Transmission interval	120 seconds - 240 minutes	120 seconds (heat meters)
Weekdays	Monday – Sunday (any weekday)	Monday - Friday
Weeks in a month	1 – 4 (4: uninterrupted, incl. a possible 5th week)	1 – 4 (4: uninterrupted)
Months	1 - 12	1 - 12
Radio activation date	01.01. - 31.12. (day. month)	not set

AES-128-encryption	- not encrypted;
	- encrypted:
	  - Master Key;
	  - random key per instrument
		Master Key

Type of telegram	- short telegram in conformity to AMR (OMS-Spec_Vol2_Primary_v301) - long telegram for walk-by read-out	long telegram (walk-by)

*Factory settings may vary from the above.

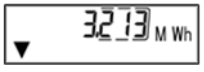
9.4.3 Activation of the radio interface

The radio interface **leaves the factory not activated**. It can be activated as follows:

a. Without using additional software the radio function can be activated by pressing the push-button for more than 3 seconds while at the display item ‘M-Bus address’, second level, item 8 (see section 7. Display, Level 2 / Technician’s loop) is displayed. The standard factory-settings will be activated.

b. The radio function can also be activated using the software ‘Device Monitor’. This software can be ordered separately as an option. The exact procedure for activating the radio function using this software is described in the accompanying handbook.

After successful activation of the radio function a triangle will appear permanently in the lower left corner of the display.



If using the compact mode, for one hour after activation the meter transmits in installation mode. This means that format telegrams and compact telegrams are sent alternately.

During installation mode at least one meter of the version being installed (forward or return flow, heat or heat/cooling, pulse inputs, display units) must be read out with the Engelmann Read-out Software. The format of the telegram will be stored locally in the PC in an .xml file.

After completion of the installation mode only compact telegrams will be transmitted.

9.5 Two additional pulse inputs (optional; only in conjunction with M-Bus or radio)

With this option, additional instruments with pulse outputs can be read out via M-Bus or radio.

General information about pulse inputs

It is important to note that the acknowledged state of the art technology rules and the relevant legal restraints (international and local; see par. 9.5.1 “Relevant norms, standards and literature on the pulse inputs”) are to be observed.

The installation has to be performed by authorized, skilled persons. If the regulations and the information in the installation and operating instruction manuals are not strictly followed, or if the installation is shown to be faulty, any resulting expenses will be charged to the company responsible for the installation.

9.5.1 Relevant norms, standards and literature on the pulse inputs

IEC 60364-4-41 (2005-12)	Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock
IEC 60364-4-44 (2007-08)	Low-voltage electrical installations - Part 4-44: Protection for safety - Protection against voltage disturbances and electromagnetic disturbances
IEC 60364-5-51 (2005-04)	Electrical installations of buildings - Part 5-51: Selection and erection of electrical equipment - Common rules
IEC 60364-5-54 (2011-03)	Low-voltage electrical installations - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements and protective conductors
EN 50310 (2010)	Application of equipotential bonding and earthing in buildings with information technology equipment
EN 1434-2 2007	Heat Meters — Part 2: Constructional requirements

9.5.2 Technical data pulse inputs

Pulse input class	CMOS; IB according to EN 1434-2:2007
Internal pull-up voltage	+ 3 V DC
Internal pull-up resistance	2 MΩ
Current	= 1.5 µA
High-level threshold	U ≥ 2 V
Low-level threshold	U ≤ 0.5 V
Length of connecting cable	1 m

9.5.3 Electrical requirements on the pulse output of the instrument to be connected (e.g. flow meter)

Pulse output class	(passive) output OA (reed contact / electronic switch) or OC (open collector) according to EN 1434-2:2007
Pulse length "on"	≥ 100 ms
Pulse length "off"	≥ 100 ms
Current	= 1.5 µA
Resistance "contact open"	≥ 6 MΩ
Resistance "contact closed"	≤ 3 kΩ

9.5.4 Setting up the two additional pulse inputs

The optional pulse inputs 1 + 2 for external meters can be set up using the ‘Device Monitor’ configuration software.

The input pulse value, the units and the starting values of the external meters can be configured.

9.5.5 Set-up possibilities

Pulse value	**Units**
1	litres / kWh / pulse without unit
2,5	litres / kWh / pulse without unit
10	litres / kWh / pulse without unit
25	litres / kWh / pulse without unit
100	litres / kWh / pulse without unit
250	litres / kWh / pulse without unit

1000	litres / kWh / pulse without unit

Installation notes for the pulse inputs

It is important that the pulse cables not be affected by (or exposed to) the M-Bus voltage!

Check the polarity of pulse generators with 'open collector' outputs.

The cable wires must not touch each other during installation, otherwise pulses will be counted in the instrument.

When setting up the meter it may be necessary to adjust the meter reading of the instruments connected and the pulse value using the 'Device Monitor' software.

9.5.6 Pin assignments 6-wire cable (only in conjunction with M-Bus)

Pin	Colour	Connection
1	White	IE1+
2	Brown	IE1⊥
3	Green	IE2⊥
4	Yellow	IE2+
5	Grey	M-Bus
6	Pink	M-Bus

9.5.7 Pin assignments 4-wire cable (only in conjunction with radio)

Pin	Colour	Connection
1	Yellow	IE1+
2	Green	IE1⊥
3	Brown	IE2⊥
4	White	IE2+

9.6 Potential-free pulse output (optional)

The potential-free pulse output is an electronic switch that outputs counting pulses of the meter which can be used for any purpose.

The pulse output closes, corresponding to the pulse value shown on the type identification label on the instrument.

9.6.1 Technical data pulse output

Pulse output class	OA (electronic switch) according to EN 1434-2:2007
Pulse value heat energy	1 kWh/pulse
Pulse value volume (optional)	100 l/pulse
Peak switching current	300 mA ~/-
Switching voltage, maximum	35 V ~/-
Switching power, maximum	300 mW
Contact isolation	> 10^9 Ohm
Contact resistance (on)	max. 25 Ohm
Contact capacity	1.5 pF
Maximum current	120 mA
Withstand voltage (open contact)	350 V ~/-
Closure time	125 ms
Interval between pulses	125 ms

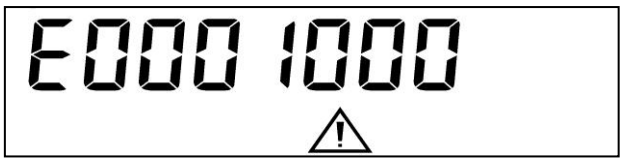
10 Hint flags

When the instrument has detected a hint flag, the hint symbol is displayed: ⚠

The specific hint flag can be found at the menu item 8 'Hint flag' in level 1 / Main loop (see section 7. Display). The instrument recognizes seven hint causes, which can also occur in combination with each other. The flags are shown on the display. The hint flag is displayed alternately in binary and hexadecimal form.

Binary display	Description	Hexadecimal display
1 at first place	Check sum error	E 40
1 at second place	E^2PROM defective	E 20
1 at third place	Instrument has been reset	E 10
1 at fourth place	Scanning coil defective	E 08
1 at fifth place	Reference sensor defective	E 04
1 at sixth place	Return flow sensor defective	E 02 / E 82
1 at seventh place	Forward flow sensor defective	E 01 / E 81

Example: scanning coil fault

Hint	Check sum fault	E^2PROM fault	Reset	Scanning coil fault	Reference sensor fault	Return flow sensor fault	Forward flow sensor fault	
Hint bit	6	5	4	3	2	1	0	
Display location	1	2	3	4	5	6	7	Alternating hexadecimal hint displayed (LCD)
Alternating binary hint displayed (LCD)								

When a hint appears in the standard display (total heat, or alternating total heat and cooling energy), with the exception of the hint 'reset' (10), the instrument must be exchanged and sent to the supplier for examination.

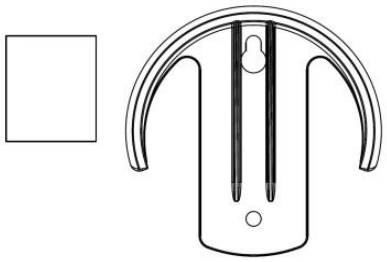
10.1 Hint description / error description

Hint / Error	Effect	Possible cause
Forward flow sensor fault	No calculations are carried out. The register for energy is not being updated (no new data is being stored).	Sensor cable severed; sensor cable shorted.
Return flow sensor fault	No calculations are carried out. The register for energy is not being updated (no new data is being stored).	Sensor cable severed; sensor cable shorted.
Reference sensor fault	No calculations are carried out. The register for energy is not being updated (no new data is being stored).	A defect on the calculator circuit board.
Coil fault (the scanning is not functioning properly)	No calculations are carried out. The registers for flow and energy are not being updated (no new data is being stored).	Coil shorted; connecting cable between calculator housing and flow sensor damaged.

Reset	The measurements since the last storage of data in the E^2PROM are lost (max. one day).	EMC
E^2PROM fault	After a reset, the instrument is without function.	Defective component
Check sum fault	No calculations are carried out. The registers for flow and energy are not being updated (no new data is being stored).	Defective component

11 Mounting with Wall Support

For mounting the calculator on the wall, a sticker pad and a wall mounting support are available. They must be ordered separately. The adhesive surfaces must be clean and free of grease.



12 MID Declaration of Conformity

For the product described in this document we confirm, as the manufacturer, that it meets the fundamental requirements of the following directives:

- Directive 2004/22/EC of 31 March 2004 on measuring instruments, in particular those in Annex MI-004
- Directive 2004/108/EC on EMC
- Directive 2006/95/EC on low voltage
- Directive 1999/5/EC (R&TTE)

The complete signed declaration can be found at **www.engelmann.de**.

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Subject to technical change without prior notice.