



SENSOSTAR® 2/2+

Multi-jet compact heat meter

Type MSH-... DE-07-MI004-PTB001

Type QStar DE-08-MI004-PTB005

Installation and Operating Instructions

1 Application and Function

This multi-jet compact heat meter SENSOSTAR® 2/2+ type MSH is designed for measurement of the consumed heat energy in a closed heating system.

2 Content of the Package

- Heat meter, consisting of a calculator, flow sensor and two temperature sensors, all permanently connected to each other.
- Installation kit MSH-SStar/-iStar, -VStar, -MStar, -AStar and QStar (depending on type)
- Depending on type of the EAS (label):
 - EAS identification „EN14154“ (IST)
 - EAS identification „EN14154 (TE1)
 - EAS identification „EN14154“ (M60)
 - EAS identification „EN14154“ (A1)
- Installation kit wall support (only separable version)
- Installation and Operating Instructions

3 General Information

- The valid standards for the application of heat meters are EN 1434, parts 1 + 6, the Directive 2004/22/EC ('MID'), in particular annex MI-004, and the relevant national verification regulations.
- The regulations for electrical installations are to be observed.
- The product meets the requirements relating to emissions in the European Council Directive EMC 2004/108/EC.
- The measurement stability of the heat meters is only guaranteed when the quality of the water meets the conditions as specified in the AGFW Recommendation FW-510.
- The instrument identification and the seals must not be damaged or removed – otherwise the guarantee and the approved application of the instrument no longer apply!
- 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 direct-mounted temperature sensor or the plug on the temperature sensor installation point may not be altered in any way, in particular the sealing wire must not be removed.
- The instrument must be stored and transported at above-freezing temperatures. **Important: Instruments with activated radio function are not allowed on air freight!**
- To protect against damage and dirt the heat meter should only be removed from the packaging directly before installation.
- All details and specifications listed on the data sheet of the heat meter must be adhered to.
- Instruments with a return-flow temperature sensor mounted directly in the flow sensor may only be mounted in the return flow.

- All electrical connections must be laid at a **minimum distance of 50 cm** to sources of electromagnetic interference (switches, controllers, pumps, etc.). All instrument connections must be laid at a **minimum distance of 10 cm** to other current-carrying wires.
- The temperature sensor cables must not be kinked, rolled up, lengthened or shortened.
- To clean the heat meter (only if necessary) use a slightly moist (not dripping wet!) cloth.
- In the case of instruments with a temperature sensor mounted in the flow sensor (non-symmetrical installation) the limitation of the **minimal flow ($q \geq 24 \text{ l/h}$ or $q \geq 50 \text{ l/h}$)** indicated on the identification plate must be observed.
- Categorically, all temperature sensors which are not mounted in the flow sensor must be direct-mounted in the pipe.
- 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.
- Pay attention to the installation point of the heat meter: standard: in the return flow pipe optional: in the forward flow pipe (state when ordering)
- Make sure that the EAS connection piece used corresponds to the appropriate list:
 - Installation of SENSOSTAR® 2/2+ type MSH-SStar or MSH-iStar,
 - Installation of SENSOSTAR® 2/2+ type MSH-VStar,
 - Installation of SENSOSTAR® 2/2+ type MSH-MStar;
 - Installation of SENSOSTAR® 2/2+ type MSH-AStar.

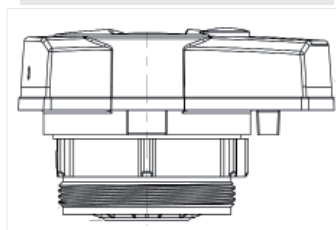
4 Installation of SENSOSTAR® 2/2+

4.1 Installation of SENSOSTAR® 2/2+ type MSH-SStar or MSH-iStar in single pipe connection pieces

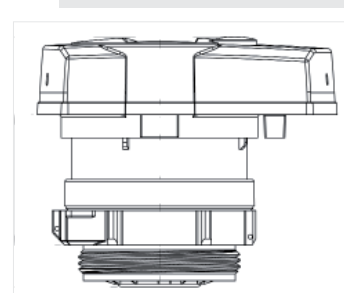
The multi-jet flow sensor type MSH-SStar or MSH-iStar in this heat meter has a 2" connection as described in EN 14154 (IST) and must be installed without an adapter in the following EASs or a single pipe connection piece that is metrologically completely identical. These EASs are pipe connections which have no metrological influence on the measurement accuracy:

English description as in EAS installation instructions	Corresponding DN	Total length mm
Internal thread EAS R _p 1/2	15	94
EAS R _p 3/4	20	100
EAS with ball valve R _p 3/4	20	147
EAS with ball valve R _p 1	25	159
EAS Universal R _p 3/4	20	105
EAS Universal R _p 1	25	105
External thread EAS G 3/4	15	80
	15	110
External thread EAS G 1	20	105
	20	130
	20	190

side view MSH-SStar



side view MSH-iStar



Mounting the flow sensor type MSH-SStar or MSH-iStar in single pipe connection pieces

Important:

Before installing the flow meter check if the EAS:

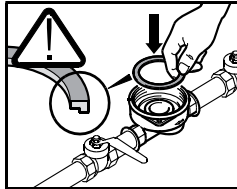
1. corresponds to the table „Installation of SENSOSTAR® 2/2+ type MSH-SStar or MSH-iStar in single pipe connection pieces (EAS)“
2. has the identification EN14154 (IST).

If 1. is fulfilled but the EAS does not has the identification as in 2. the label provided with the meter **must** be applied clearly to the EAS.

If 1. is not fulfilled, the EAS **must** be exchanged.

Mounting SENSOSTAR® 2/2+ MSH-SStar or MSH-iStar in an EAS

- Flush the pipes according to DIN/EN.
- Close the shut-off valves. Drain the closed-off length of pipe.
- Demount the temperature sensor(s).
- **Take into account the direction of flow (EAS)**
- Remove the overflow flange or the old heat meter from the EAS using a wrench.
- Remove all old gaskets.
- Check sealing surfaces and threads for imperfections or dirt. If necessary, debur or clean with a suitable cleansing liquid.
- Place the new profile gasket in the EAS 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).
- Rotate the calculator into the correct reading position.



4.2 Installation of SENSOSTAR® 2/2+ type MSH-VStar in single pipe connection pieces

The multi-jet flow sensor type MSH-VStar in this heat meter has an external thread M62x2 connection as described in EN 14154 (TE1) and must be installed without an adapter in the following EASs or a single pipe connection piece that is metrologically completely identical. These EASs are pipe connections which have no metrological influence on the measurement accuracy:

Description of single pipe connection pieces	With integrated sensor seat	Corresponding DN	Total length (mm)	Nominal size up to q_p (q_n) m^3/h
105 mm / Rp ½	no	10	105	1,5
105 mm / Rp ¾	no	15	105	1,5
105 mm / Rp 1	yes	20	105	2,5
105 mm / L18	no	10	105	1,5
105 mm / L22	no	15	105	1,5
105 mm / L28	yes	20	105	2,5
110 mm / G¾B	yes	15	110	1,5
130 mm / G1B	yes	20	130	2,5
105 mm / G1B	yes	20	105	2,5

Mounting the flow sensor type MSH-VStar in single pipe connection pieces

Important:

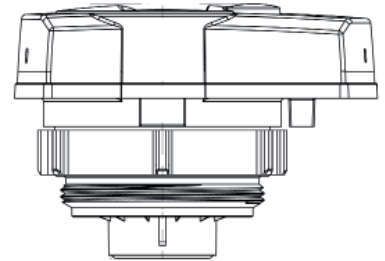
Before installing the flow meter check if the EAS:

1. corresponds to the table „Installation of SENSOSTAR® 2/2+ type MSH-VStar in a single pipe connection pieces (EAS)“
2. has the identification EN14154 (TE1).

If 1. is fulfilled but the EAS does not has the identification as in 2. the label (EN14154 (TE1)) provided with the meter **must** be applied clearly to the EAS.

If 1. is not fulfilled, the EAS **must** be exchanged.

side view
MSH-VStar



Mounting SENSOSTAR® 2/2+ type MSH-VStar

- Flush the pipes according to DIN/EN.
- Close the shut-off valves. Drain the closed-off length of pipe.
- Demount the temperature sensor(s).
- **Take into account the direction of flow (EAS)!**
- Remove the overflow flange or the old heat meter from the EAS using a wrench.
- Clean the sealing surfaces of the flow sensor.
- Remove all old gaskets. Check sealing surfaces and threads for imperfections or dirt. If necessary, debur or clean with a suitable cleansing liquid.
- Lubricate the external thread of the flow sensor and the sealing surfaces 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).
- Rotate the calculator into the correct reading position.

4.3 Installation of SENSOSTAR® 2/2+ type MSH-MStar in single pipe connection pieces

The multi-jet flow sensor type MSH-VStar in this heat meter has an external thread M60x1.5 connection as described in EN 14154 (M60) and must be installed without an adapter in the following EASs or a single pipe connection piece that is metrologically completely identical. These EASs are pipe connections which have no metrological influence on the measurement accuracy:

Description of single pipe connection pieces	With integrated sensor seat	Corresponding DN	Total length mm	Nominal size up to q_p (q_n) m^3/h
EAS G¾B	no	15	110	1,5
EAS G1B	no	20	130	2,5
EAS Rp ½	no	15	110	1,5
EAS Rp¾	no	20	110	2,5

Mounting the flow sensor type MSH-MStar in single pipe connection pieces, external thread M60x1,5

Important:

Before installing the flow meter check if the EAS:

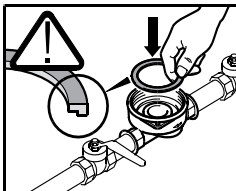
1. corresponds to the table „Installation of SENSOSTAR® 2/2+ type MSH-MStar in a single pipe connection pieces (EAS)“
2. has the identification EN14154 (M60).

If 1. is fulfilled but the EAS does not has the identification as in 2. the label (EN14154 (M60)) provided with the meter **must** be applied clearly to the EAS.

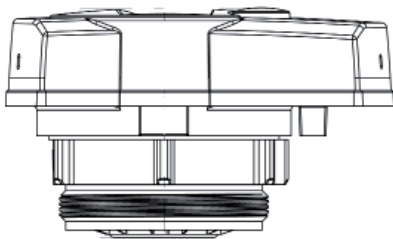
If 1. is not fulfilled, the EAS **must** be exchanged.

Mounting SENSOSTAR® 2/2+ MSH-MStar in an EAS

- Flush the pipes according to DIN/EN.
- Close the shut-off valves. Drain the closed-off length of pipe.
- Demount the temperature sensor(s).
- **Take into account the direction of flow (EAS)**
- Remove the overflow flange or the old heat meter from the EAS using a wrench.
- Remove all old gaskets.
- Check sealing surfaces and threads for imperfections or dirt. If necessary, debur or clean with a suitable cleansing liquid.
- Place the new profile gasket in the EAS 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).
- Rotate the calculator into the correct reading position.



side view
MSH-MStar



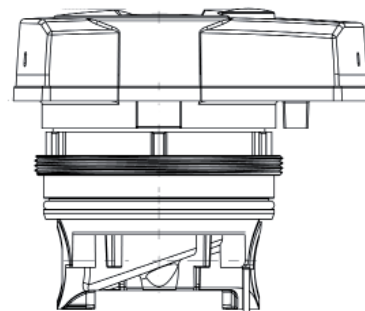
- Check sealing surfaces and threads for imperfections or dirt.
- If necessary, debur or clean with a suitable cleansing liquid.
- Lubricate the external thread (M77x1,5) and and O-ring (66,35x2,62) of the flow sensor with a thin layer of food safe silicon grease.
- Replacement the heat meter.
- Screw in the heat meter tightly by hand and then tighten additionally to the mechanical end stop (metal-to-metal).
- Use the black sealing piece to seal the EAT by inserting the seal in one of the two designated spots.

Note:

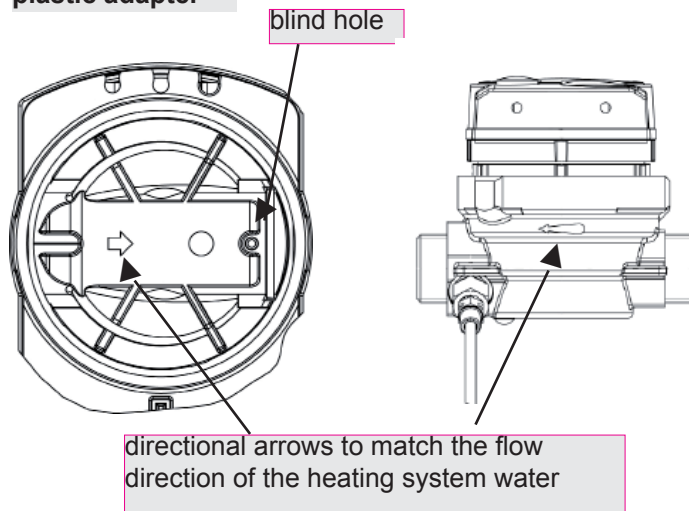
When installing, ensure correct positioning regarding the flow by paying attention to the directional arrows on the outer surface of the EAT and on the bottom of the plastic adapter.

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.)

side view
MSH-AStar



plastic adapter



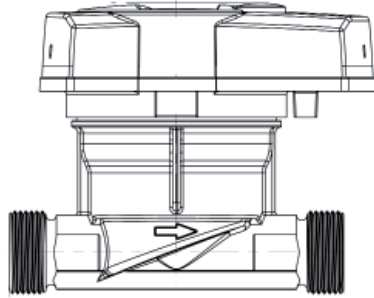
4.4 Installation of SENSOSTAR® 2/2+ type MSH-AStar in single pipe connection pieces, external thread M77x1,5

- Check the connection pieces (label A1)
- Flush the pipes according to DIN/EN.
- Close the shut-off valves.
- Drain the closed-off length of pipe.
- **Take into account the direction of flow (EAS)!**
- Remove the overflow flange or the old heat meter from the EAT using a wrench.
- Remove all old flow meter or heat meter.
- Remove adaptation if it is built-in.
- Remove all old gasket.

4.5 Mounting SENSOSTAR®2/2+ type MSH QStar

- Flush the pipes according to DIN/EN
- Close the shut-off valves
- Open the nearest draining valve for pressure release and drain the closed-off pipe section.
- Loosen the coupling ring 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
- Rotate the calculator into the correct reading position.

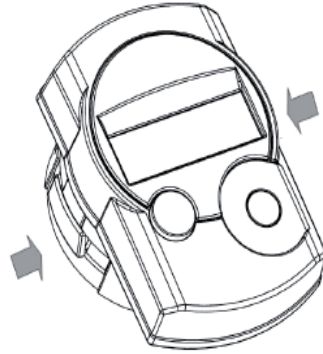
side view
QStar



Note:

In order to simplify mounting in narrow installation spaces the calculator can be detached from the flow sensor (only detached version).

To detach the calculator press on the side surfaces (as shown in the illustration above) and carefully lift off the top part of the housing.



5 Mounting the Temperature Sensors

For pipe systems of size \leq DN25 the MID regulations require direct mounting of the temperature sensors for new installations (new construction, or retrofitted heating systems).

Note:

During installation be sure that the return flow sensor (blue label) is mounted in the „colder pipe“ and the forward flow sensor (red label) in the „warmer pipe“.

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.
- Set the required mounting depth of the tip of the temperature sensor by tightening the cross-head screw in the correct beading on the sheath.
- The temperature sensor must not touch the bottom of the ball valve or T-piece.
- Insert the temperature sensor into the ball valve or the T-piece and tighten the screw nut to the stop.



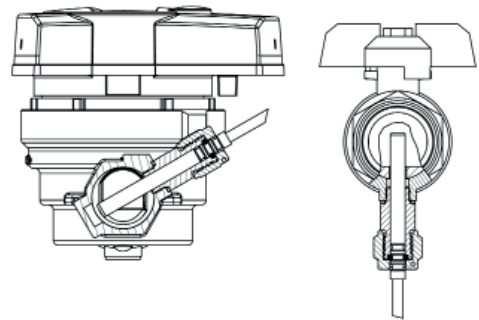
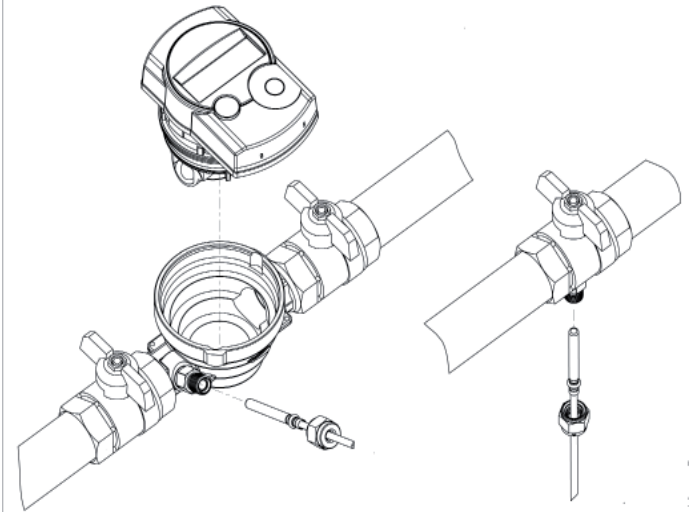
5.2 Mounting temperature sensor in MSH-AStar

5.2.1 Direct-mounting of the temperature sensor

Important Notes:

- **Close the shut-off valves and make sure that no hot water can escape upon removal of the temperature pockets!**
- Close the ball valves.
- Remove the old meter including both temperature sensors (forward and return flow).
- Remove the old gasket and thoroughly clean the sealing surfaces.
- Insert the SENSOSTAR®2 meter into the installation point.
- **(Important! Pay attention to the flow direction).** Screw in the meter by hand as tight as possible and then finish by using a hook wrench to tighten the brass ring to the stop.
- Prepare both temperature sensors: Push the O-ring into the middle groove.
- Insert the temperature sensors into the brass screw at the installation point and at the ball valve and tighten using the coupling nut.
- 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.

Direct-mounting of the temperature sensor



5.2.2 Mounting MSH-AStar in temperature pockets

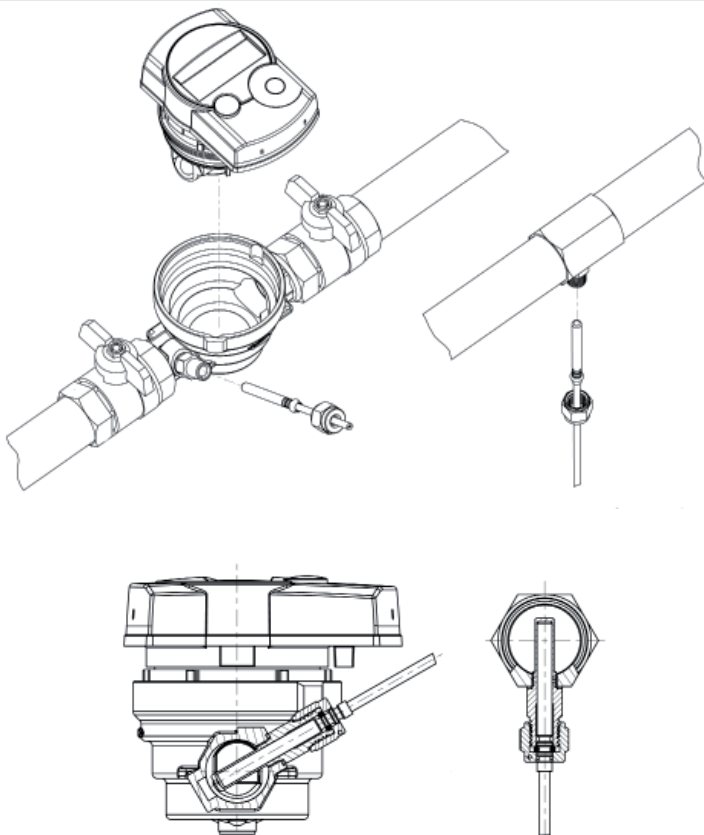
Important Notes:

- **Close the shut-off valves and make sure that no hot water can escape upon removal of the temperature pockets!**
- Close the ball valves
- Remove the old meter including both temperature sensors (forward and return flow).
- Insert the *SENSOSTAR*[®] 2 meter into the installation point.
- (**Important!** Pay attention to the flow direction). Screw in the meter by hand as tight as possible and then finish by using a hook wrench to tighten the brass ring to the stop.
- Prepare both temperature sensors: Push the O-ring into the middle groove.
- Insert the temperature sensors into the temperature pockets at the installation point and at the adapter and tighten using the coupling nut.
- 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.

Note:

In compliance with our toleration of temperature pockets!

Mounting MSH-AStar in temperature pockets



6 Start of Operation

- Slowly open the shut-off valves
- Check that the meter is functioning properly and that there are no leaks

After confirming that the heat meter is functioning properly, insert and tighten the sealing wires for the temperature sensors and the flow sensor itself.

When replacing a meter at the end of a verification period note the meter readings and the serial numbers of the old and new meters.

Check the following points:

- Is the heat meter of the right size?
- Are the shut-off valves open?
- Is the heating system clear (dirt filters not clogged?)
- Are the temperature sensors and the flow sensor sealed (against manipulation)?
- Is the directional arrow on the flow sensor in the correct direction?
- Is a flow volume displayed?
- Is a plausible temperature difference displayed?
- For instruments with two external temperature sensors, is the forward flow sensor (red) in the forward flow and the return flow sensor (blue) in return flow pipe?
- For instruments with an integrated return flow temperature sensor, check the flow sensor is installed in the return flow.

Note:

National restrictions may apply when using temperature pockets. In Germany, only combinations of temperature sensor pairs and temperature pockets which have been approved by the PTB may be used.

7 Technical Data

7.1 Technical Data MSH-... MID

Data Approval MSH- ... MID		
EC examination certificate	DE-07-MI004-PTB001	
Accuracy class ¹⁾	EN 1434-1:2007, class 2 / 3	
Minimal flow ¹⁾ q_i/q_p	horizontal/ vertical	Standard: 1:50
Maximum flow q_s/q_p	2:1	
Mechanical class	M1	
Electromagnetic class	E1	
Protection class	IP54	
Flow disturbance class	U0	
¹⁾ Accuracy class and minimal flow rate depend on the model.		

7.1.1 Details flow sensor MSH-...

Nominal flow q_p	m ³ /h	0.6	1.5	2.5	
Max. flow q_s	m ³ /h	1.2	3.0	5.0	
Pressure drop Δp at q_p	mbar	120	225	240	
Pressure drop MAP	bar	25			
Max. pressure PN	bar	16			
Low flow threshold	horizontal	l/h	2.5	3.5	4.0
	vertical		3.0	5.0	6.0
Temperature range	°C	15 ... 90			
External thread MSH-SSStar/MSH-iStar ²⁾		2"			
Installation length MSH-SSStar/MSH-iStar	see table 4.1 "Installation of <i>SENSOSTAR</i> [®] 2/2+ type MSH-SSStar/MSH-iStar in single pipe connection pieces (EAS)"				
External thread MSH-VStar ³⁾		M62x2			
Installation length MSH-VStar	See table 4.2 "Installation of <i>SENSOSTAR</i> [®] 2/2+ type MSH-VStar in single pipe connection pieces (EAS)"				
External thread MSH-MStar ⁴⁾		M60x1,5			
Installation length MSH-MStar	See table 4.3 "Installation of <i>SENSOSTAR</i> [®] 2/2+ type MSH-MStar in single pipe connection pieces (EAS)"				
External thread MSH-AStar		M77x1,5			
Mounting position		horizontal; vertical			
Color plastic ring (<i>SENSOSTAR</i> [®] 2+)		blue	red	black	
Color plastic ring MSH-iStar		black			

²⁾Connection compatibility MSH-SSStar or MSH-iStar:

See table 4.1 "Installation of *SENSOSTAR*[®] 2/2+ type MSH-SSStar/MSH-iStar in single pipe connection pieces (EAS)"

³⁾Connection compatibility MSH-VStar:

See table 4.2 "Installation of *SENSOSTAR*[®] 2/2+ type MSH-VStar in single pipe connection pieces (EAS)"

⁴⁾Connection compatibility MSH-MStar:

See table 4.3 "Installation of *SENSOSTAR*[®] 2/2+ type MSH-MStar in single pipe connection pieces (EAS)"

7.2 Technical Data QStar

Data Approval		
EC examination certificate	DE-08-MI004-PTB005	
Accuracy class ¹⁾	EN 1434-1:2007, class 2 o. 3	
Minimal flow ¹⁾ q_i/q_p	horizontal/ vertical	1:100/1:50/1:25
Maximum flow q_s/q_p	2:1	
Mechanical class	M1	
Electromagnetic class	E1	
Protection rating	IP54	
Flow disturbance class	U0	

¹⁾Accuracy class and minimal flow rate depend on the model.

7.2.1 Details flow sensor QStar

Nominal flow q_p	m ³ /h	0.6	1.5	2.5
Max. flow q_s	m ³ /h	1.2	3.0	5.0
Pressure drop Δp at q_p	mbar	120	225	240
Nominal pressure PN	bar	16		
Maximum pressure MAP	bar	25		
Low flow threshold	l/h	2.5	3.0	5.0
Installation length	mm	110		130
External connection thread		G3/4B		G1B
Temp. range of medium	°C	15 ... 90		
Mounting position		horizontal; vertical		
Color code (<i>SensoStar</i> 2+)		blue	red	black

7.3 Technical Data Calculator

Ambient temperature	°C	5 ... 55		
Temperature range	°C	1 ... 150		
Temperature range radio 868 MHz	°C	1 ... 105		
Temperature difference	K	3 ... 100		
Power supply	standard	3V, lithium		
	optional	3V, lithium + supply via M-bus		
Lifetime of battery		6 + 1 year		
Data storage		E ² PROM / daily		
Display		8-digits + special characters		
Interfaces	standard	infrared		
	optional	M-bus, M-bus (VS), Mini-bus, pulse output, 2 pulse inputs and radio 868 MHz		

7.4 Details Temperature Sensors

Typ PT500		platinum precision resistor
Connection		2 wire technique
Diameter	mm	5.0 (optional 5.2 or 6.0)
Length of connecting cables	m	1.5 (optional 3.0)

8 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 pushbutton next to the display.

The standard display is the total heat energy consumed since the meter was put into operation.

At the start you are automatically in the main loop (1st level). By pressing the key longer than 4 seconds you change to the next display loop. Keep the key pressed until you reach the desired information loop. By pressing the key briefly you can scan all the information within a loop.

After one minute of non-use of the pushbutton, the display automatically returns to the main loop.

1. Level / Main Loop

1.) Total heat energy in MWh – standard display –

2.) Segment test, all segments triggered simultaneously

3.) Heat energy at last billing date alternating with last billing date¹⁾

4.) Total volume in m³

5.) Current power in kW

6.) Current flow in m³/h

7.) Current date

8.) Error message (alternating binary and hexadecimal display)

View only for instruments with 2 pulse inputs!

9.) Tariff register1: Values alternating with tariff register and criteria²⁾

10.) Tariff register2: Values alternating with tariff register and criteria²⁾

11.) Momentary reading of the pulse counter1 alternating with the pulse value.²⁾

12.) Momentary reading of the pulse counter2 alternating with the pulse value.²⁾

2. Level / Technician`s Loop

1.) Maximum power in kW

2.) Maximum flow in m³/h

3.) Forward flow temperature in °C

4.) Return flow temperature in °C

5.) Temperature difference

6.) Days in operation since verification

7.) Pulse value; pulses per liter

8.) M-Bus address

9.) Serial number of the heat meter

10.) Firmware/Software version

3. Level / Statistics Loop

1.) Previous billing date alternating with its value. Alternatively, the total volume, tariff values, or values of individual instruments connected to the optional pulse inputs can be displayed, if so set.¹⁾

2. - 16.) Monthly values: Dates alternating with their value. Alternatively, the total volume, tariff values, or the values of individual pulse counters can be displayed, if so set.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 „Engelmann® Monitor“. A dedicated meter password is necessary. Password available from manufacturer.

9 Interfaces and Options

9.1 Optical (infrared) interface

In order for a PC to be able to communicate with a *SENSOSTAR*[®] 2/2+ instrument, it is necessary to connect an optocoupler to the serial or USB interface of the PC. The optocoupler and the necessary software „Engelmann[®]Monitor“ are available as options.

Baudrate (2400 Bd)

The optical infrared interface is activated with the key.

If within 60 seconds neither a valid telegram is received nor the key pressed again, then the interface is deactivated.

9.2 M-bus (optional)

9.2.1 M-bus with power supply (M-bus VS)

For increased communication, *SENSOSTAR*[®] 2/2+ can be supplied with power via the M-bus interface.

This protective M-bus interface (M-bus VS) is not galvanically separated. This version M-bus interface allows for an unlimited number of read-outs per instrument.

9.2.2 M-bus without power supply (M-bus)

With the option 'M-bus without power supply' the protective interface is galvanically separated. This means that additional power supply cannot be obtained using the M-bus network.

In a maximum-sized M-bus network of 250 meters, 24 read-outs per day are possible for each meter. If fewer read-outs are carried out and/or fewer heat meters are installed in the network (connected to the M-bus system), the unused amount of available read-outs is stored in the instrument to be used when needed.

9.2.3 General M-bus information

- The optical interface is powered via the battery, however. For this reason the number of read-outs via the optical interface is limited.
- During communication on the M-bus with an addressed instrument via the M-bus it is not possible to use the other interfaces on the instrument (pushbutton, optical interface) and vice versa.
- The valid standards for the M-bus protocol are EN 13757-2, EN 13757-3 and EN 1434-3 and the M-bus Recommendation (version 4.8 from Nov. 1997) with the basic standard IEC 870 parts 1,2 and 4.
- Each meter on the M-bus is only protected against high voltage up to the maximal allowed bus voltage ($\pm 50V$). Additional protective measures must be provided by the level converter.
- The installation of an instrument in an M-bus network may only be carried out by authorized, qualified technical personnel.
- Attention must be paid to ensure that the cable lengths and cable cross-sections in the bus network are appropriate for the **baud rate of the connected meters (2400 baud)**.

Recommended cable type:

Telephone cable J-Y(ST) Y2 x 2 x 0.8 mm²

9.3 Mini-bus

The factory-installed option mini-bus (state when ordering) is a protective interface (cannot be affected by external signals). This interface is a two-wire connection with point-to-point communication, as per EN 1434-3, to an external inductive interface with a maximum distance of 50 meters.

Baudrate: 2400 baud (Then also the same baud rate for the optical interface for this meter.)

9.4 Pulse output (potential-free)

The potential-free pulse output available as a built-in option (state when ordering) of the *SENSOSTAR*[®] 2/2+ is an electronic switch for flexible use (class OA according to EN1434), which outputs the counting pulses of the heat meter.

The pulse output closes corresponding to the pulse value (see the identification plate on the instrument). As long as the nominal and boundary values of the contact are taken into consideration, the user is free to define his contact data within a wide range. A wide variety of data acquisition instruments can be connected to the contact outputs. The pulse value is indicated on the instrument.

Pulse value:

Heat: 1kWh/Imp or optional

Volume: 100 L/Imp

Pulse output:

Max. switching current (peak)	300 mA ~/-
Max. switching voltage	35 V ~/-
Max. switching power	300 mW
Insulation resistance	$> 10^{09}$ Ohm
Contact resistance	max. 25 Ohm
Contact capacity	1.5 pF
Maximum current	120 mA
Dielectric strength (open contact)	350 V ~/-
Pulse length	125 ms
Min. pulse interval	125 ms

9.5 Radio Transmission

As a customer option, *SENSOSTAR*[®]2+ meters can be equipped at the factory with a radio interface based on the European standard EN 13757-4 for wireless M-bus. This option must be stated when ordering.

Operating frequency: 868 MHz

Transmission power: up to 25 mW

Protocol: wireless M-bus based on EN 13757-4, optional mode of operation T1, S1, T2, S2

Short telegram for stationary read-out

Long telegram for walk-by read-out

The time setting in the meter at the factory is standard time (GMT + 1). Please note the following points:

Reference switch on time: 7 a.m.

Reference switch off time: 7 p.m.

Setting during standard time:

Switch on time: 7 a.m.

Switch out time: 7 p.m.

Setting during daylight-saving time / summer time:

Switch on time: 8 a.m.

Switch out time: 8 p.m.

9.5.1 Radio configuration

Radio is always deactivated upon delivery (factory setting) (see 9.5.2 Activation of the radio interface)

Parameter	Possible setting	Standard setting
Mode	S1 / T1: unidirectional	T1 (unidirectional)
	S2 / T2: bidirectional	
Transmission period	0:00 - 24:00	7 a.m - 7 p.m.
Transmission interval	120 seconds - 240 minutes; special setting: once per month	120 seconds
Weekdays	Monday - Sunday	Monday - Friday
Calendar weeks	1 - 4	1 - 4
Months	1 - 12	1 - 12
Switch-on date	01. Jan. - 31. Dec.	not set
AES-Encoding	activated / not activated; same key per customer or order / random key per meter	activated; random key per meter
Telegram type	short telegram / long telegram (monthly values)	long telegram (monthly values)

9.5.2 Activation of the radio interface

When leaving the factory the radio interface is **deactivated**. It can be activated as follows:

- a) Without using additional software the radio function can be activated by pressing the Engelmann pushbutton longer than 3 seconds in the menu item "M-bus address" in level 2 (Technician's loop). See section 8: "Display Information". The standard factory settings will be loaded:

bus 4
2

- b) Using separate software Engelmann[®]Monitor. The software are available as options.

The exact procedure for activating the radio function via the separate software is described in the operating instructions.

9.5.3 Checking whether radio is activated

After the radio function has been successfully activated a triangle will appear permanently in the lower left corner of the display.

bus 4
▼ 2

Note:

Radio-activated heat meters should not be installed between or behind heating system pipes. This can negatively affect the range of the radio signal.

In addition, the range of the *SENSOSTAR*[®]2+ with radio function (as well as any heat meter with radio) can possibly be affected by other instruments nearby with radio interfaces, such as WLAN routers, baby phones, remote controls, etc.

A third important aspect which can influence the radio range is the type of construction of the building in which the meter is installed.

9.6 Setting of the 2 additional pulse inputs (only in connection with the M-bus or radio)

With this setting the external instruments can be read out via the M-bus.

The optional pulse inputs 1+2 for external meters can be set using the configuration software Engelmann® Monitor. The settings are the input pulse value and the units in which the external meter counts. For invoicing, the meter readings of the instruments connected to the pulse inputs must be included in the calculation.

- Class IB according to classification of pulse input devices EN1434-2:2007
- Pulse length: ≥ 100 ms
- Pulse frequency: ≤ 5 Hz
- Current source: $\leq 0,1$ mA

Setting:

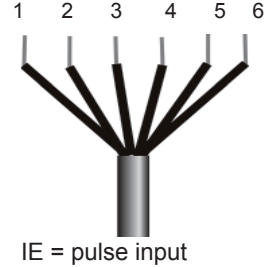
Input pulse value	Units	
1	liter/kWh/no units	per pulse
2,5	liter/kWh/no units	per pulse
10	liter/kWh/no units	per pulse
25	liter/kWh/no units	per pulse
100	liter/kWh/no units	per pulse
250	liter/kWh/no units	per pulse
1000	liter/kWh/no units	per pulse

Pay attention to the following important points on installation of pulse inputs

1. Do not switch the polarity of the pulse cables.
2. The wires must not touch each other during installation, otherwise pulses will be detected in the instrument.
3. During setup of the meter, the readings and pulse values of the connected instruments have to be matched using the Engelmann® Monitor software.

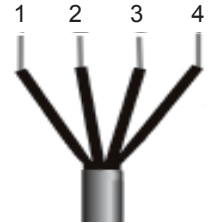
9.6.1 Pin connections for 6-wire cable (cable length 1m) (only in connection with the M-bus)

PIN	color	
1	white	IE1 +
2	brown	IE1 ⊥
3	green	IE2 ⊥
4	yellow	IE2 +
5	grey	M-Bus
6	pink	M-Bus



9.6.2 Pin connections for 4-wire cable (cable length 1m) (only in connection with the wireless M-bus (radio))

PIN	color	
1	yellow	IE1+
2	green	IE1⊥
3	brown	IE2⊥
4	white	IE2+



9.6.3 Setting of the 2 additional tariff registers (only in connection with 2 additional pulse inputs)

There are 2 tariff registers, which add up the energy or time, depending on certain criteria. The registers can be individually set using the Engelmann® Monitor software and can be read via the display or using the read-out software.

	Display examples	Description of example in tariff register 1 (either the energy or the time can be measured)
0	'E1 0	Not defined.
1	' 0683 MWh 'E1 1 ' 18:00 ' 06:00	The energy (0.683 MWh) in the time period from 18.00 (6 pm) to 6.00 am (the time can be set in 10-minute steps) is being measured.
2	' 0683 MWh 'E1 2 ' 2000 kW	The energy (0.683 MWh) above a power of ≥ 2000 kW
3	' 0683 MWh 'E1 3 ' 2000 kW	The energy (0.683 MWh) up to a power of ≤ 2000 kW
4	' 0683 MWh 'E1 4 ' 0600 m³/h	The energy (0.683 MWh) above a flow of ≥ 0.600 m³/h
5	' 0683 MWh 'E1 5 ' 0600 m³/h	The energy (0.683 MWh) up to a flow of ≤ 0.600 m³/h
6	' 11 h 'E1 6 ' 6500 °C	The time (11 h) above a temperature in the forward flow of ≥ 65.00 °C (in steps of 0.01°C)
7	' 11 h 'E1 7 ' 6500 °C	The time (11h) up to a temperature in the forward flow of ≤ 65.00 °C (steps of 0.01°C)
8	' 11 h 'E1 8 ' 3600 °C	The time (11 h) above a temperature in the return flow of ≥ 36.00 °C (steps of 0.01°C)
9	' 11 h 'E1 9 ' 3600 °C	The time (11 h) up to a temperature in the return flow of ≤ 36.00 °C (steps of 0.01°C)
10	' 0683 MWh 'E1 10 ' 1000 °C	The energy (0,683 MWh) above a temperature difference of ≥ 10.00 °C (steps of 0.01 K)
11	' 11 h 'E1 11 ' 1000 °C	The time (11 h) up to a temperature difference of ≤ 10.00 °C (steps of 0.01 K)

9.7 Settings of the Datalogger

The datalogger is an optional additional function for meters and calculators which must be specified in the original order (instruments cannot be retrofitted).

The Engelmann datalogger makes it possible to record consumption data and the individual meter values in the internal storage module in freely selectable time intervals. The recorded data can be stored in various data formats, for example for analysis of peak values in order to optimize cost-effective supply of heat.

The datalogger can be read out either via the optical interface or via M-bus, so that the data can be used for individual analysis. The Engelmann datalogger is a ring buffer. The current values are always stored; this means that when the memory is full, the oldest values are written over by each new piece of data.

The storage capacity is up to 10,589 values.

The software "Engelmann Datalogger" reads out only one meter at a time, which is addressed using the set primary address. If only one meter is at hand, the address 254 can be used.

The following parameters can be individually set for recording, singly or jointly, using the software "Engelmann Datalogger":

- time (is always stored)
- heat energy
- cooling energy
- volume
- power
- flow
- forward flow temperature
- return flow temperature
- temperature difference

The meters values can be measured at the following freely selectable time intervals:

- 1 minute
- 10 minutes
- 15 minutes
- 30 minutes
- 60 minutes
- 3 hours
- 6 hours
- 12 hours
- 24 hours

Depending on the configuration, the datalogger can store between 2117 and 10,589 sets of data.

Note:

All previous stored values are lost (deleted) upon reparameterization!

10 Error Codes



When the instrument detects an error, the error symbol and number are displayed.

The error can also be displayed by selecting the menu item 8) 'error display' in the first level / main loop (see no. 8. Display).

There are seven possible causes of error, and they can appear in combination with each other, depending on the situation. The description of the faults can you see over the display.

Display binär	Description	Display hexadecimal
1 at 1st position	check sum fault	error 40
1 at 2nd position	E ² PROM fault	error 20
1 at 3rd position	Reset	error 10
1 at 4th position	scanning coil fault	error 08
1 at 5th position	REF-sensor fault	error 04
1 at 6th position	RF-sensor fault	error 02
1 at 7th position	FF-sensor fault	error 01

Example: scanning coil fault

Error	check sum fault	E ² PROM fault	reset	scanning coil fault	reference sensor fault	return flow sensor fault	forward flow sensor fault	Errorcode hexadecimal (LCD)
	1	2	3	4	5	6	7	
Binary display LCD	E000 1000							08

When an error occurs in the **standard display** (total heat energy), with the exception of the „reset“ error, the instrument must be exchanged and sent to the manufacturer for examination.

Error Description

Error	Effect	Possible cause
ff-sensor fault	No calculations are carried out. The registers for flow and energy are not being updated (no new data is being stored).	Sensor cable severed; sensor cable shorted out.
rf-sensor fault	No calculations are carried out. The registers for flow and energy are not being updated (no new data is being stored).	Sensor cable severed; sensor cable shorted out.
ref-sensor fault	No calculations are carried out. The registers for flow and energy are 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 out; connecting cable between calculator housing and flow sensor damaged.
reset	The measurements since the last storage of data in the E ² PROM are lost (max. one day)	EMC
E ² PROM fault	After a reset, the instrument is without function.	Defective component.
check sum fault	No calculations are carried out. The registers of flow and energy are not being updated.	Defective component.

11 MID Declaration of Conformity

For the product described in this document we confirm, as the manufacturer, that it meets the fundamental requirements according to the

- Council Directive 2004/22/EC of 31 March 2004 on the approximation of the laws of the member states relating to measurement instruments, in particular those in annex MI-004, as well as
- the requirements relating to emissions in the European Council Directive on EMC 2004/108/EC, and the requirements according to the Council Low Voltage Directive 2006/95/EC, as well as
- R&TTE Directive (1999/5/EC)

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

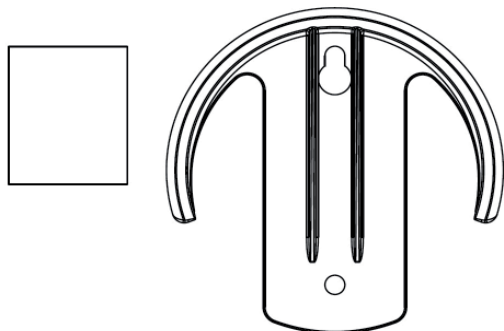
Important:

Mounting only for instruments with detachable calculators *SENSOSTAR®2+!*

12 Mounting with wall support

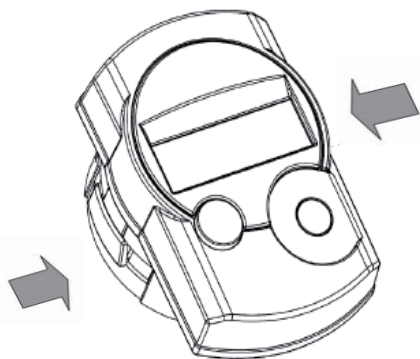
When the calculator is detached from the flow sensor it can be mounted on the wall using the mounting support. If possible, place the wall mounting support above the flow sensor. The display must remain accessible and able to be read out without auxiliary tools.

The wall mounting support and the sticker pad are included in delivery for *SENSOSTAR®2+* separable version.



A. Mounting

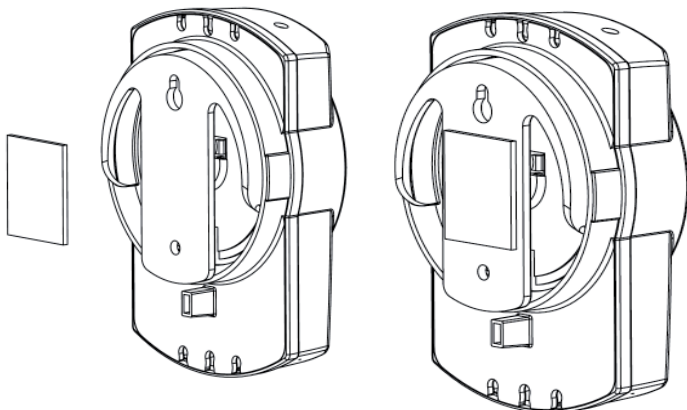
Press the locking positions on the side of the adapter lightly with one hand while pulling up the calculator housing with the other hand.



You have the alternative to put the wall mounting support with with sticker pad or with dowels and screws at the wall.

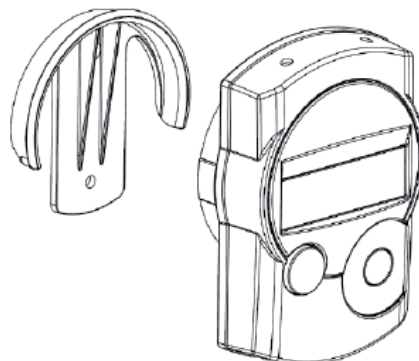
The sticker pad is included.

Latch the wall mounting support onto instrument.



B. Removing the heat meter from the mounting support

Pull the instrument upwards and away from the wall.



13 Manufacturer

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Subject to technical change!

Return shipment of the lithium batteries must be carried out appropriately.