

Ultrasonic Thermal Energy Meter

1. Overview

This is designed for the measurement of the consumed energy in a closed heating, cooling or heating / cooling system.

- Detection of back flow and air
- High temperature resistant for district heating
- Measuring cycle temperature, dynamic: 2 / 60 s
- Detachable calculator unit: 85 cm pulse cable length
- Communication interfaces: M-Bus;
Modbus RTU



2. Contents of the Package

- Heat meter or heat/cooling meter, consisting of a calculator, a flow sensor and two temperature sensors, all permanently connected to each other.
- Installation and Operating Instructions
- Operating Instructions for Communication Interfaces S3 (with meters with an optional interface)
- Declaration of Conformity

Safety Instructions

Please read instructions carefully and use the product as specified in this manual. Be sure to keep this manual nearby for quick reference.

Restrictions on Use

This product was developed, designed, and manufactured for general air conditioning use.

Do not use the product in a situation where human life may be at risk or for nuclear applications in radiation-controlled areas. If you wish to use the product in a radiation-controlled area, please contact Azbil Corporation.

Particularly when the product is used in applications like the following where safety is especially required, implementation of fail-safe design, redundant design, regular maintenance, etc., should receive appropriate consideration so that the product can be used safely and reliably.

- Safety devices for protecting the human body
- Start/stop control devices for transportation machines
- Aeronautical/aerospace machines

For system design, application design, instructions for use, or product applications, please contact Azbil Corporation. Azbil Corporation bears no responsibility for any result, or lack of result, deriving from the customer's use of the product.

Recommended Design Life (Recommended Period of Use)

It is recommended that this product be used within its design life. The design life is the period during which you can use the product safely and reliably based on the design specifications. If the product is used beyond this period, its failure ratio may increase due to time-related deterioration of parts, etc. The design life during which the product can operate reliably with the lowest failure ratio and least deterioration over time is estimated scientifically based on acceleration tests, endurance tests, etc., taking into consideration the operating environment, conditions, and frequency of use as basic parameters.

The design life of this product is 10 years.

Cautions for Transporting



Lithium batteries are used in this product.

When this product, which uses lithium batteries, is transported by air or sea, ship it in accordance with IATA-DGR/IMDG-Code regulations.





Please inform your shipping company that lithium batteries are included in the product, and follow the necessary procedures according to the company's instructions.




If the product is shipped by air or sea without the necessary labels, etc., specified by the ordinances, you may be in violation of aviation or maritime safety laws and be subject to punishment.















Warnings and Cautions

 WARNING	Alerts users that improper handling may cause death or serious injury.
 CAUTION	Alerts users that improper handling may cause minor injury or material loss.

Symbols

	Notifies users that specific actions are prohibited to prevent possible danger. The symbol inside  graphically indicates the prohibited action. (For example, the sign on the left notifies that disassembly is prohibited.)
	Instructs users to carry out a specific obligatory action to prevent possible danger. The symbol inside  graphically indicates the actual action to be carried out. (For example, the sign on the left indicates general instructions.)

 WARNING	
	To prevent combustion of the circuit board and components, install a power supply circuit breaker at the power source.
	Before wiring, turn off the power to this product. Failure to do so may result in electric shock or device failure.

 CAUTION	
	Install and use this product according to the specifications stated in this manual. Failure to do so may cause device failure.
	Take anti-lightning surge measures based on regional and building characteristics. Lightning may cause fire or critical damage to this product if protective measures are not taken.
	Do not ground the product in outdoor installations or locations where it is subject to direct sunlight.
	Installation and wiring must be performed by personnel qualified to do instrumentation and electrical work. Mistakes in installation or wiring may cause fire or electric shock.
	Do not apply tools to the window of the product (LCD display part in the computational unit). Doing so may result in injury due to damage.
	Do not use beyond the recommended design life.
	All wiring must comply with applicable codes and ordinances. Otherwise there is a danger of fire.
	After installation, make sure no fluid leaks from the valve-pipe connections. Improper piping may cause fluid leakage outside of the valve.
	After wiring, reconfirm the polarity. Incorrect polarity may damage the equipment.
	The product has a lithium-metal-battery. Do not open the batteries, do not bring the batteries into contact with water or expose them to temperatures above 80 °C. Do not charge them or short-circuit them.
	Do not put a load or weight on this product. Doing so may damage the product.
	When removing the product, ensure that there is no residual liquid or pressure inside the piping and volumetric measuring device. Failure to do so may result in injury.
	Keep the device free from detergents and organic solvents to prevent fire or malfunction.

■ Model Numbers

● MODBUS (module installed)

Azbil Family No.	Model Number (Azbil Brand)			Description									
				Nominal size qp	Length [mm]	DN	Connection	Temp. sensor Ø [mm]	Symetric Asymetric	cable length [m]	display unit	supply / return side	heat / cooling / hybrid
GY1	BD	AA	140211	0.6	110	15	G3/4B	5.2	Asymetric	1.5	MWh	return flow	heat
	BD	AB	140212	1.5	110	15	G3/4B	5.2	Asymetric	1.5	MWh	return flow	cooling
	BD	BB	140213	1.5	130	20	G1B	5.2	Asymetric	1.5	MWh	return flow	cooling
	BD	BC	140214	2.5	130	20	G1B	5.2	Asymetric	1.5	MWh	return flow	cooling
	BD	ED	140215	3.5	150	25	G1 1/4B	5.2	Asymetric	1.5	MWh	return flow	cooling
	BD	GD	140216	3.5	260	25	G1 1/4B	5.2	Asymetric	1.5	MWh	return flow	cooling
	BD	EE	140217	6.0	150	25	G1 1/4B	5.2	Asymetric	3	MWh	return flow	cooling
	BD	GE	140218	6.0	260	25	G1 1/4B	5.2	Asymetric	3	MWh	return flow	cooling
	BD	HF	140219	10.0	200	40	G2B	6.0	Asymetric	3	MWh	return flow	cooling
	BD	IF	140220	10.0	300	40	G2B	6.0	Asymetric	3	MWh	return flow	cooling

● M-Bus (module installed)

Azbil Family No.	Model Number (Azbil Brand)			Description									
				Nominal size qp	Length [mm]	DN	Connection	Temp. sensor Ø [mm]	Symetric Asymetric	cable length [m]	display unit	supply / return side	heat / cooling / hybrid
GY1	BD	AA	140221	0.6	110	15	G3/4B	5.2	Asymetric	1.5	MWh	return flow	heat
	BD	AB	140222	1.5	110	15	G3/4B	5.2	Asymetric	1.5	MWh	return flow	cooling
	BD	BB	140223	1.5	130	20	G1B	5.2	Asymetric	1.5	MWh	return flow	cooling
	BD	BC	140224	2.5	130	20	G1B	5.2	Asymetric	1.5	MWh	return flow	cooling
	BD	ED	140225	3.5	150	25	G1 1/4B	5.2	Asymetric	1.5	MWh	return flow	cooling
	BD	GD	140226	3.5	260	25	G1 1/4B	5.2	Asymetric	1.5	MWh	return flow	cooling
	BD	EE	140227	6.0	150	25	G1 1/4B	5.2	Asymetric	3	MWh	return flow	cooling
	BD	GE	140228	6.0	260	25	G1 1/4B	5.2	Asymetric	3	MWh	return flow	cooling
	BD	HF	140229	10.0	200	40	G2B	6	Asymetric	3	MWh	return flow	cooling
	BD	IF	140230	10.0	300	40	G2B	6	Asymetric	3	MWh	return flow	cooling

■ Specifications

● Flow sensor

Item		Specification							
Measuring method		ultrasonic; time-of-flight							
Sizes	Nominal flow q_p	m ³ /h	0.6	1.5	1.5	2.5	3.5	6.0	10.0
	Low flow threshold	l/h	6	6	6	12	14	30	50
	Minimum flow q_i	l/h	12	12	12	25	28	60	100
	Maximum flow q_s	m ³ /h	1.2	3.0	3.0	5.0	7.0	12.0	20
Pressure drop Δp at q_p		bar	0.03	0.21	0.04	0.12	0.21	0.20	0.11
Pressure drop Δp at q_s		bar	0.13	0.85	0.17	0.46	0.89	0.80	0.43
Nominal diameter		mm	DN 15	DN15	DN20	DN 20	DN 25	DN 25	DN 40
Thread		inch	G3/4B	G3/4B	G1B	G1B	G1 1/4B	G1 1/4B	G2B
Length		mm	110	110	130	130	150; 260	150; 260	200; 300
Dynamic range q_i/q_p		-	1:50	1:125	1:125	1:100	1:125	1:100	1:100
Accuracy class (MID)			class 2						
Nominal pressure PN		bar	16						
Temperature range medium heat		°C	15 – 90						
Temperature range medium cooling (from q_p 1.5 to q_p 10)		°C	5 – 50						
Temperature range medium heat / cooling		°C	15 – 90 heat 5– 50 cooling						
Point of installation			outlet flow and inlet flow; can be set when the amount of energy is still \leq 10 kWh						
Mounting position			any position						
Protection class			IP65						

● **Calculator unit**

Item	Unit	Description
Temperature range medium	°C	0 – 150 heat 0 – 50 cooling (from qp 1.5 to qp 10)
Ambient temperature in the field	°C	5 – 55 at 95 % relative humidity
Transport temperature	°C	-25 – 70 (for maximal 168 h)
Storage temperature	°C	-25 – 55
Temperature difference range $\Delta\Theta$ heat	K	3 – 100
Temperature difference range $\Delta\Theta$ cooling	K	-3 – -50
Minimum temp. difference $\Delta\Theta$ heat	K	> 0.05
Minimum temperature difference $\Delta\Theta$ cooling	K	< -0.05
Minimum temperature difference $\Delta\Theta$ HC heat / cooling	K	> 0.5 / < -0.5
Resolution temperature	°C	0.01
Measuring cycle temperature; dynamic	s	2 / 60; using a power pack: 2 s permanent
Measuring cycle flow	s	2
Display		LCD - 8 digits + special characters
Decimal places		up to 3 after comma
Units		MWh, kW, m ³ , m ³ /h (kWh, GJ, MMBTU, Gcal); unit of energy can be set when the amount of energy is still ≤ 10 kWh
Interfaces		M-Bus; Modbus RTU
Power supply		3 V lithium battery (non-exchangeable, Lifespan of approx. 10 years)
Data storage		nonvolatile memory
Reading dates		selectable yearly reading date; 15 monthly and semimonthly values: via display or wireless M-Bus (compact mode); 24 monthly and semimonthly values: via optical interface or M-Bus
2 tariff registers		can be set individually; adding up energy or time
Storage of maximum values		flow, power and temperatures (inlet, outlet, $\Delta\Theta$), plus the respective maximum values of the last 15 months
Protection class		IP65
CE		yes
EMC		EN 1434

● **Temperature sensors (2-wire technique)**

Item	Unit	Description
Platinum precision resistor		Pt 1000
Diameter	mm	5.2; 6
Length of cable	m	1.5; 3
Installation		asymmetrical

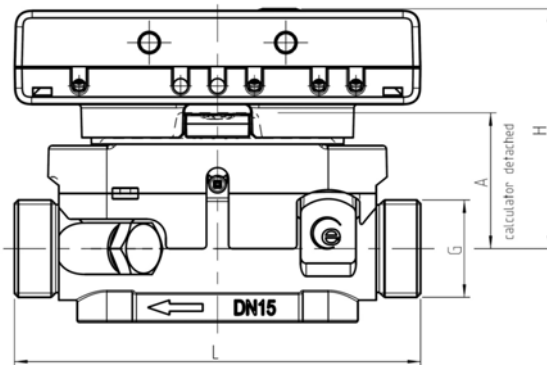
■ Dimensions

● Calculator unit

Item	Unit	Description
Calculator housing (H x W x D)	mm	75 x 110 x 34.5

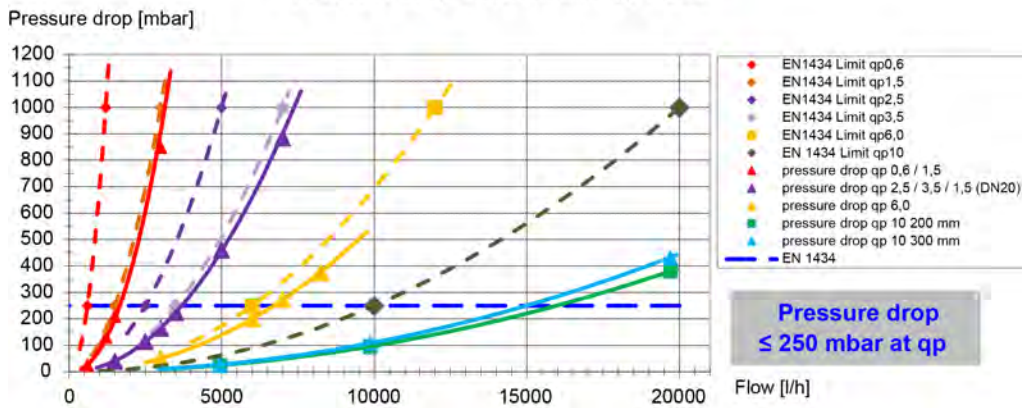
● Meter

Qp (m³/h)	Nominal diameter	G (")	L (mm)	H (mm)	A (mm)	Weight (basic version in kg)
0.6	DN 15	G3/4B	110	65	38.5	0.600
1.5	DN 15	G3/4B	110	65	38.5	0.600
1.5	DN 20	G1B	130	66	39.5	0.680
2.5	DN 20	G1B	130	66	39.5	0.680
3.5	DN 25	G1 1/4B	150	66	39.5	0.820
3.5	DN 25	G1 1/4B	260	66	39.5	1.080
6.0	DN 25	G1 1/4B	150	68.5	42	0.820
6.0	DN 25	G1 1/4B	260	68.5	42	1.080
10.0	DN 40	G2B	200	73	46.5	1.530
10.0	DN 40	G2B	300	73	46.5	1.970










■ Pressure Drop




Pressure drop Thermal Energy Meter









■ Installation

 CAUTION	
	After installation, make sure no fluid leaks from the valve-pipe connections. Improper piping may cause fluid leakage outside of the valve.
	Do not ground the product in outdoor installations or locations where it is subject to direct sunlight.
	Install and use this product according to the specifications stated in this manual. Failure to do so may cause device failure.
	Installation and wiring must be performed by personnel qualified to do instrumentation and electrical work. Mistakes in installation or wiring may cause fire or electric shock.
	Do not apply tools to the window of the product (LCD display part in the computational unit). Doing so may result in injury due to damage.
	Do not put a load or weight on this product. Doing so may damage the product.

■ Wiring

 WARNING	
	To prevent combustion of the circuit board and components, install a power supply circuit breaker at the power source.
	Before wiring, turn off the power to this product. Failure to do so may result in electric shock or device failure.

 CAUTION	
	Take anti-lightning surge measures based on regional and building characteristics. Lightning may cause fire or critical damage to this product if protective measures are not taken.
	Installation and wiring must be performed by personnel qualified to do instrumentation and electrical work. Mistakes in installation or wiring may cause fire or electric shock.
	All wiring must comply with applicable codes and ordinances. Otherwise there is a danger of fire.
	Do not apply tools to the window of the product (LCD display part in the computational unit). Doing so may result in injury due to damage.
	After wiring, please the polarity. Incorrect polarity may damage the equipment .

■ Disposal

When this product is no longer needed, dispose of it as industrial waste in accordance with local regulations. Do not reuse all or part of this product.



3. General Information

- Valid standards for the application of Energy meters: EN 1434, parts 1–6; the Measuring Instruments Directive 2014/32/EU, Annexes I and MI-004; and the relevant national verification regulations.
- For the selection, installation, commissioning, monitoring and maintenance of the instrument observe the standard EN 1434 part 6, as well as the verification regulations PTB TR K8 + K9 for Germany (and any relevant national verification regulations in other countries).
- **For combined heat/cooling meters the cooling register has no verification. National regulations for the consumption measurement of cooling must be observed.**
- The technical regulations for electrical installations must be observed.
- This product fulfils the requirements of the European Council Directive on Electromagnetic Compatibility (EMC Directive) 2014/30/EU.
- The identification plate of the instrument and the seals must not be removed or damaged – otherwise the guarantee and the approved application of the instrument are no longer valid!
- To achieve measurement stability of the meter it is necessary that the water quality meet the requirements of the AGFW-recommendation FW-510 and the document VDI (Association of German Engineers) VDI 2035.
- The Energy meter left the factory in conformance with all applicable safety regulations. All maintenance and repair work is to be carried out only by qualified and authorized technical personnel.
- **Instruments with activated radio function are not allowed on air freight.**
- The correct installation point in the system must be chosen: inlet or outlet flow (see item 3.1 'Pictograms installation point').
- 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 Energy meter (only if necessary) use a slightly moist cloth.
- To protect against damage and dirt the Energy meter should only be removed from the packaging directly before installation.
- If more than one Energy 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.
- The Energy meter has a lithium-metal-battery. Do not open the batteries, do not bring the batteries into contact with water or expose them to temperatures above 80 °C. Do not charge them or short-circuit them.
- Instruments which have been replaced or exchanged must be disposed of according to relevant environmental regulations.
- The display is deactivated and can be activated for two minutes by pushing the button.
- **Unit of energy and installation point (outlet flow / inlet flow) can be set on location, only once, before start of operation by pushing the button or alternatively using the „Device Monitor“ software.**
- **Type and concentration of glycol in the medium of those mechanical meter types designed to be used with glycol can be set on location at any time using the „Device Monitor“ software (see item 8.1 for details).**





3.1 Pictograms installation point

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

	Installation in outlet flow
	Installation in inlet flow

3.2 Pictograms type of meter (on type identification label)

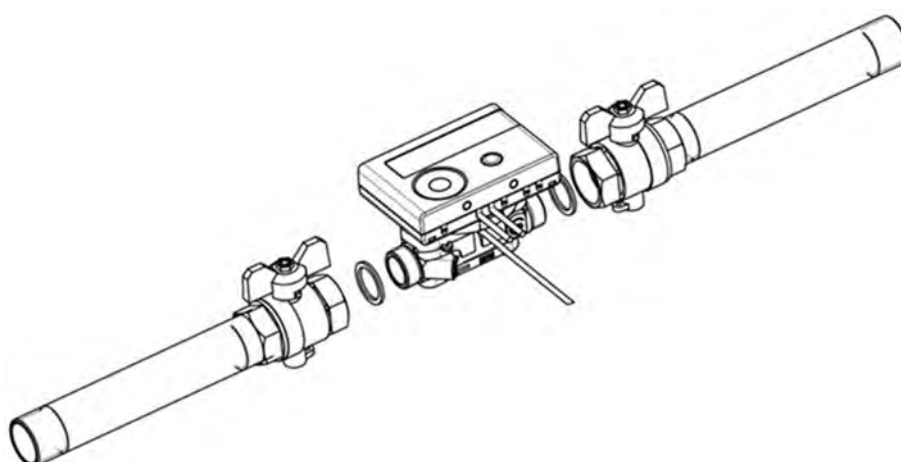
	Heat meter
	Cooling meter

4. Mounting the Flow Sensor

4.1 Mounting of Ultrasonic Thermal Energy Meter

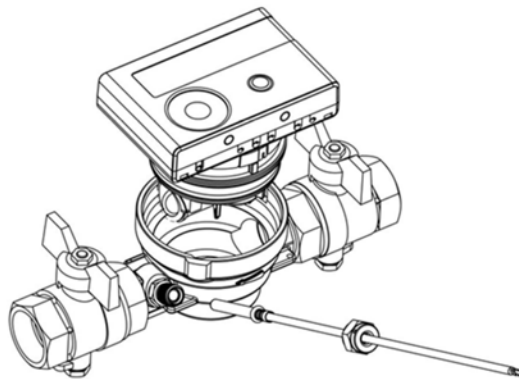
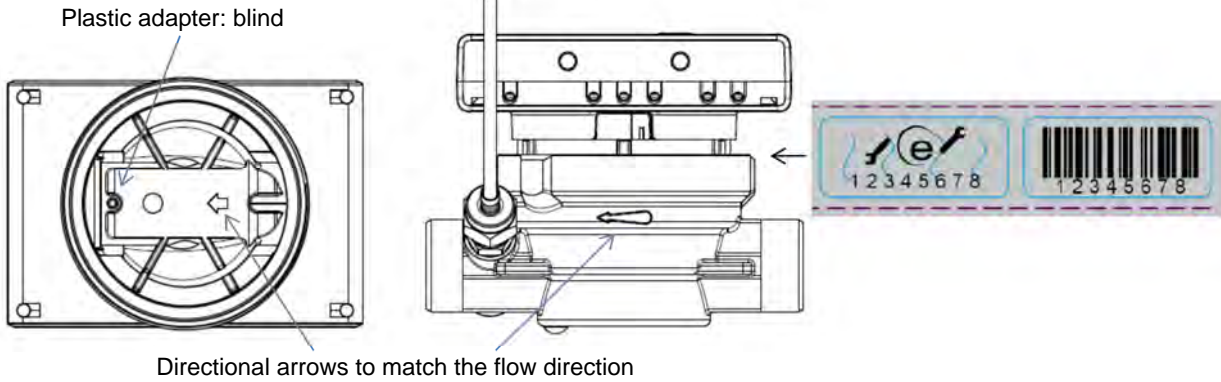
- Flush the pipes professionally, taking care not to damage any system components. Then close all the shutoff valves.
- Open the nearest draining valve for pressure release.
- Drain the closed-off pipe section.
- Loosen the coupling rings and remove the old Energy meter.
- Remove all old gaskets and 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 to the best position for read-out, or detach it and mount it nearby.

Note concerning **Thermal Energy Meter**: For the mounting in a heating system with a small quantity of air in the medium we recommend to overturn the meter through 90°.



Attention!

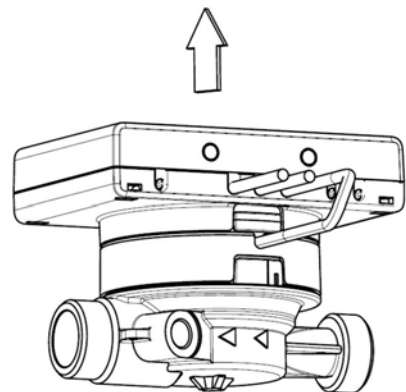
When installing, ensure correct positioning regarding the flow by paying attention to the directional arrows on the connection piece and on the bottom of the plastic adapter. Also, make sure that the blind hole in the plastic adapter is properly lined up with the metal pin in the inside bottom of the connection piece on the flow outlet. (In rare cases, this pin may not be present: In this case, it is not necessary for installation.)



5. Detachable Calculator

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

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



We always recommend detaching the calculator from the flow sensor.

However, it is important to note that the calculator must be detached for the following versions:

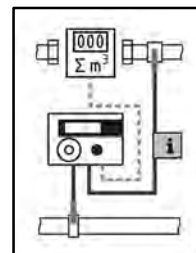
- **Cooling and heat/cooling meters**

6. Mounting the Temperature Sensors

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

Note on installation of symmetrical temperature sensors:

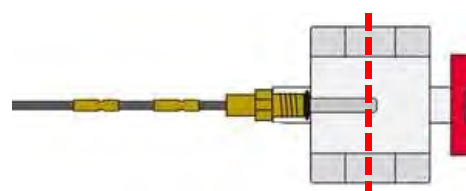
When mounting two external temperature sensors (symmetrical), make sure that the (right) temperature sensor with the following drawing is installed in the same heating train as the flow sensor:



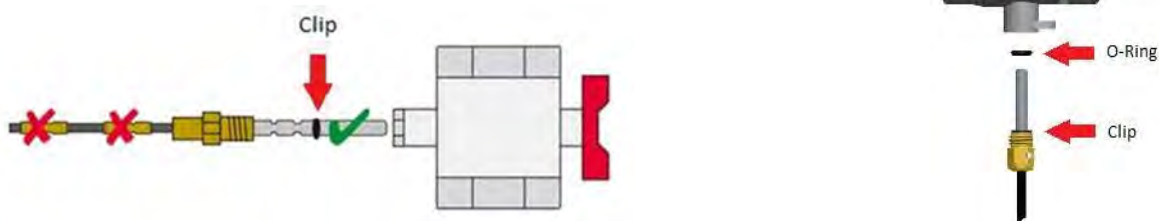
Push the temperature sensor into the immersion sleeve as far as it will go. The inner diameters of the immersion sleeve and the temperature sensor must match [5.0; 5.2; 6.0 mm]. For accurate measuring of flow temperature, thermal insulation is required. If the heat insulation is inappropriate, accuracy of flow rate measurement and temperature measurement may degrade.

6.1 Direct mounting (ball valve and T-piece)

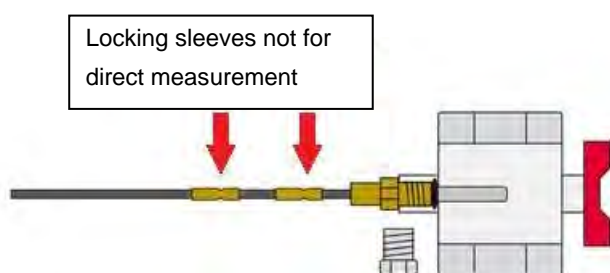
- The temperature sensor must be installed in the pipeline in such a way that sufficient immersion depth is ensured. The sensor must be immersed at least to the middle of the pipe.
- **ATTENTION: Direct mounting of 5.0 mm temperature sensors is not permitted with flow sensor Qp10 → only permitted with immersion sleeves.**



- Remove blind screw fitting / old temperature sensor and gasket / old O-ring (without leaving any residue).
- **Slide the O-ring off the temperature sensor and insert it into the threaded opening of the ball valve or the T-piece.**
- If present, insert the O-ring into the threaded opening using the assembly aid.
- The O-ring must not be seated in any of the corrugations. The corrugations only connect the sensor sleeve with the cable.
- **The locking plastic clip must be engaged in the first crimp (viewed from the sensor tip) and must not be displaced.**



- Hold the temperature sensor exclusively by the screw and push it into the ball valve or T-piece and screw it tight.
- When installing the meters, make sure that the flow and return sensors are installed correctly.
- Only the sensor sleeve of the temperature sensor may be immersed in the medium. The locking sleeves, if present, must not extend into the ball valve. If the sensor is inserted too deeply, there is a risk that the temperature sensor will be damaged when the ball valve is shut off.



6.2 Installation in short immersion sleeves (smaller than 60 mm)

- MID-compliant immersion sleeves are approved in EU countries (except Germany).
- To insert a temperature sensor into a immersion sleeve, the plastic clip can be adjusted.
- AGFW temperature sensors and needle type temperature sensors may not be installed in immersion sleeves.

7. 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)?
- Is the temperature sensor installed in the flow sensor correctly sealed to the flow sensor?
- Does the directional arrow on the connection piece / flow sensor match the actual direction of flow?
- Is a flow volume displayed?
- Is a plausible temperature difference displayed?

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

8. Display

The calculator has a liquid crystal display with 8 digits and special characters. The values that can be shown are divided into five display loops. All data is retrieved using the 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 each time you can scan all the information within a loop. After 2 minutes of non-use of the push-button, the display will automatically be deactivated.

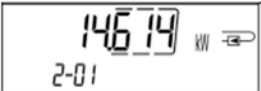
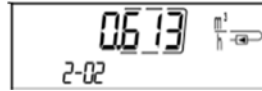



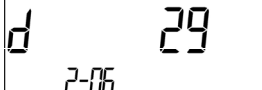

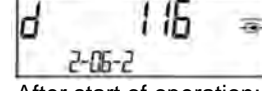



Level 1 / Main Loop:

<p>1) Total heat energy since start of operation (standard display); alternating display: cooling energy (for heat/cooling meter); when negative flow; information message (if an error was detected)</p>	<p>2) Segment test on / off (all segments triggered simultaneously)</p>	<p>3) Last reading date alternating with heat energy (cooling energy), volume, value tariff register 1, value tariff register 2 at last reading date.¹⁾ (If the meter has 3 pulse inputs, their values follow.²⁾)</p>	<p>4) Total flow volume in m³</p>
<p>5) Current date alternating with time</p>	<p>6) Information message (alternating binary and hexadecimal display)</p>	<p>7) Tariff register 1: value alternating with tariff register no. and criteria</p>	<p>8) Tariff register 2: value alternating with tariff register no. and criteria</p>
<p>9) Pulse counter 1: pulse value alternating with reading²⁾</p>	<p>10) Pulse counter 2: pulse value alternating with reading²⁾</p>	<p>11) Pulse counter 3: pulse value alternating with reading²⁾</p>	

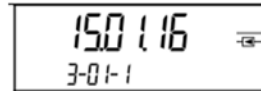

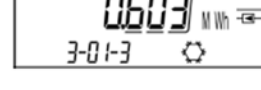


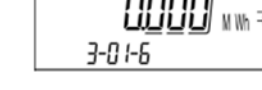
¹⁾ Up to the end of the month / the 15th of the month (for the semimonthly values) the consumption and date will be shown as 0.

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

Level 2 / Technician's Loop:

 <p>1) Current power in kW</p>	 <p>2) Current flow in m³/h. (When negative flow, value is displayed negative.)</p>	 <p>3) Inlet flow temperature in °C</p>	 <p>4) Outlet flow temperature in °C</p>
 <p>5) Temperature difference in K. (Cooling energy: Value is displayed negative.)</p>	 <p>6) Before start of operation: days since manufacture</p>   <p>After start of operation: days since manufacture alternating with days of operation after reaching an energy value > 10 kWh</p>	 <p>7) M-Bus address</p>	 <p>8) Serial number</p>
 <p>9) Firmware version</p>			

Level 3 / Statistics Loop:

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

Level 4 / Maximum Values Loop:

<p>1) Maximum power alternating with date and time</p>	<p>2) Maximum flow alternating with date and time</p>	<p>3) Maximum inlet flow temperature alternating with date and time</p>	<p>4) Maximum outlet flow temperature alternating with date and time</p>
<p>5) Maximum temperature difference alternating with date and time</p>			

Level 5 / Parametrizing Loop:

<p>1) Parametrizing „unit of energy“</p>	<p>2) Parametrizing „installation point“</p>		

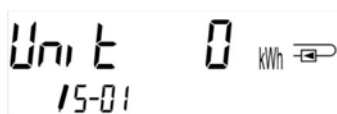
8.1 Parametrizing loop

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

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

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

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



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

b) The following characteristic of those mechanical meter types designed to be used with glycol can be set on location **at any time** using the „Device Monitor“ software:

- **type and concentration of glycol in the medium** (propylene glycol; ethylene glycol; 20 %; 30 %; 40 %; 50 %).

8.2 Detection of flow


As long as the meter detects some flow the following pictogram will be displayed bottom right in the LCD.

	flow detected
---	---------------

9. Application Conditions

Thermal Energy Meter		
Maximum flow qs/qp		2:1
Mechanical class		M2
Electromagnetic class		E2
Environmental class		C
Protection class flow sensor		IP65
Nominal pressure PN	bar	16
Mounting position		any, if there is no indication on type label
Flow sensor		
Temperature range medium heat	°C	15 – 90
Temperature range medium cooling	°C	5 – 50 (from qp 1.5 to qp 10)
Temperature range medium heat/cooling	°C	15 – 90 heat 5 – 50 cooling
Calculator		
Ambient temperature in the field	°C	5 – 55 at 95 % relative humidity
Transport temperature	°C	-25 – 70 (for maximal 168 h)
Storage temperature	°C	-25 – 55
Protection class		IP65

10. Information Messages

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



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

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

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

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

Example: Temperature sensor 1 cable break

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

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

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

10.1 Message description

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

11. Manufacturer

Engelmann Sensor GmbH
 Rudolf-Diesel-Str. 24-28
 69168 Wiesloch-Baiertal
 Germany

12. Contact

Azbil Corporation
 Building Systems Company

13. Operating Instructions for Communication Interfaces S3

13.1 Interfaces and Options

13.1.1 M-Bus (optional)

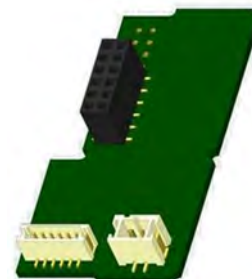
The M-Bus is a galvanically isolated interface for the transmission of meter data (absolute values).

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 “Relevant Norms / Standards / Literature M-Bus”) 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.

13.1.1.1 Relevant norms / standards / literature 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 (2011)	Application of equipotential bonding and earthing in buildings with information technology equipment
EN 13757-1_2015, -2_2004, -3_2013	Communication systems for meters and remote reading of meters
The M-Bus	A Documentation, Version 4.8, M-Bus User group

13.1.1.2 Additional technical specifications

The installation has to fulfill the requirements of the relevant norms / standards 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

13.1.1.3 Technical data M-Bus

Primary address	0 (factory setting); 1 - 250 (configurable)
Baud rate	2400; 300
Connecting cable length	1 m
Number of possible read-outs	unlimited
Refresh of data	120 s; using a power pack: 2 s

13.1.2 Modbus RTU (optional)

The Modbus RTU Module is a galvanically isolated interface for the transmission of meter data (absolute values). It is designed for use with S3 Energy meter to connect them to Modbus RTU network using EIA-485 channel.

13.1.2.1 Technical data Modbus

Connector A	PowerSupply 12 V – 24V DC ± 10% (SELV power supply only)
Connector B	Modbus Network
Maximum power consumption	500 mW
Communication protocol	Modbus RTU
Channel	EIA-485 (galvanically isolated)
Baud rate	1200, 2400, 4800, 9600, 14400, 19200, 38400, 56000, 57600, 115200

13.1.2.2 Default factory settings

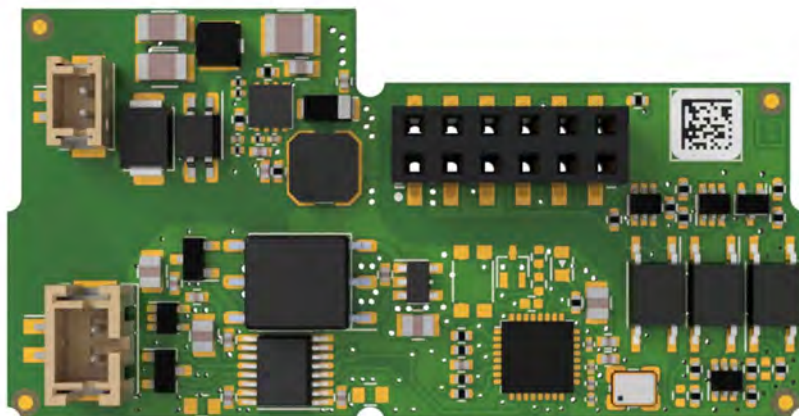
Communication parameters	9600 bps, 8N1 data format (8 data bits, none parity, 1 stop bit)
Update Rate Data from Meter	600 s
Modbus Slave ID*	1
Automatic Slave ID**	0 (deactivated)

* Acceptable values: 1 ... 247.

** If the automatic Slave ID is activated (set to = 1), the M-Bus address which is set in the meter is used for communication.

14. EN-MBRTU Modbus RTU Module

For Energy meter



The Modbus RTU Module is designed for use with Energy meter by Azbil to connect them to Modbus RTU network using EIA-485 channel.

14.1 Power supply

Connectors	CN100 (see section "External connectors")
Supply voltage	12V – 24V DC \pm 10 % (SELV power supply only)
Polarity	Independent
Maximum power consumption	500 mW

14.2 Communication interface

Connectors	CN101 (see section "External connectors")	
Communication protocol	Modbus RTU	
Channel	EIA-485 (galvanically isolated)	
Baud rate (bits per second)	1200, 2400, 4800, 9600, 14400, 19200, 38400, 56000, 57600, 115200	
Data format	Data bits	8
	Parity bit	even, odd, none
	Stop bits	1, 2

14.3 Environmental conditions

Ambient operating temperature	0–55 °C
Recommended storage temperature	-25–70 °C

14.4 Default factory settings

Communication parameters	9600 bps, 8N1 data format (8 data bits, none parity, 1 stop bit)
Modbus Slave ID	1
Update Rate Data from Meter	600 s
Automatic Slave ID	0

14.5 External connectors

Power Supply	CN100:	Polarity independent
EIA-458	CN101:	B (+) and A (-)




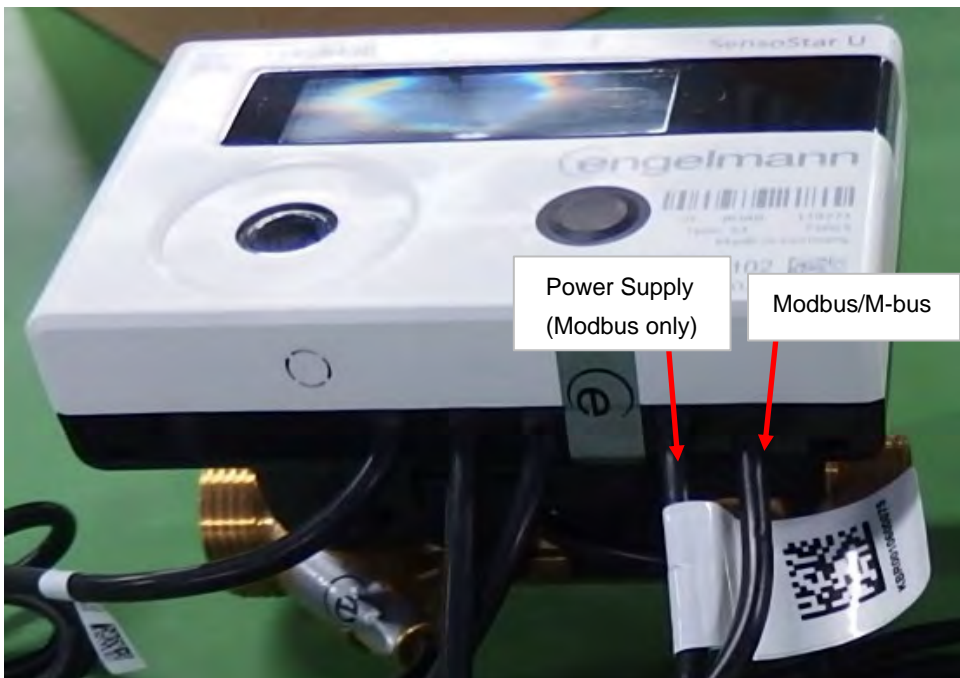
CN100	+/-	+/-	B (+)	A (-)	CN101
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M-Bus interface

Destination of the cable	Marking of the cable	Color of the wire	Destination of the wire
M-Bus interface		White	Line
		Brown	Line

Modbus RTU interface (EIA-485)

Destination of the cable	Marking of the cable	Color of the wire	Destination of the wire
Modbus RTU (EIA-485)		White	B (+)
		Brown	A (-)
Power Supply 12V–24VDC±10% (SELV power supply only)		White	PWR DC +
		Brown	PWR GND ↓



14.6 Modbus data register list

Designation	Modbus Register	Modbus Register Type	Modbus Address	Data Value Range	Unit	Read only (RO) Read/write (R/W)
Energy	30001 or 40001	Input or Holding	0	int32	1	RO
Energy (Unit factor)	30003 or 40003	Input or Holding	2	uint16	-	RO
Energy (Unit)	30004 or 40004	Input or Holding	3	4 char ASCII	-	RO
Energy (Float)	30006 or 40006	Input or Holding	5	IEEE754	1	RO
Cooling Energy	30008 or 40008	Input or Holding	7	int32	1	RO
Cooling Energy (Unit factor)	30010 or 40010	Input or Holding	9	uint16	-	RO
Cooling Energy (Unit)	30011 or 40011	Input or Holding	10	4 char ASCII	-	RO
Cooling Energy (Float)	30013 or 40013	Input or Holding	12	IEEE754	1	RO
Tariff 1 Energy	30015 or 40015	Input or Holding	14	int32	1	RO
Tariff 1 Energy (Unit factor)	30017 or 40017	Input or Holding	16	uint16	-	RO
Tariff 1 Energy (Unit)	30018 or 40018	Input or Holding	17	4 char ASCII	-	RO
Tariff 1 Energy (Float)	30020 or 40020	Input or Holding	19	IEEE754	1	RO
Tariff 2 Energy	30022 or 40022	Input or Holding	21	int32	1	RO
Tariff 2 Energy (Unit factor)	30024 or 40024	Input or Holding	23	uint16	-	RO
Tariff 2 Energy (Unit)	30025 or 40025	Input or Holding	24	4 char ASCII	-	RO
Tariff 2 Energy (Float)	30027 or 40027	Input or Holding	26	IEEE754	1	RO
Volume	30029 or 40029	Input or Holding	28	int32	2	RO
Volume (Unit factor)	30031 or 40031	Input or Holding	30	uint16	-	RO
Volume (Unit)	30032 or 40032	Input or Holding	31	4 char ASCII	-	RO
Volume (Float)	30034 or 40034	Input or Holding	33	IEEE754	l	RO
Power	30050 or 40050	Input or Holding	49	int32	-	RO
Power (Unit factor)	30052 or 40052	Input or Holding	51	uint16	-	RO
Power (Unit)	30053 or 40053	Input or Holding	52	4 char ASCII	-	RO
Power (Float)	30055 or 40055	Input or Holding	54	IEEE754	W	RO
Flow	30057 or 40057	Input or Holding	56	int32	-	RO
Flow (Unit factor)	30059 or 40059	Input or Holding	58	uint16	-	RO
Flow (Unit)	30060 or 40060	Input or Holding	59	4 char ASCII	-	RO
Flow (Float)	30062 or 40062	Input or Holding	61	IEEE754	l/h	RO
Forward temperature (Fixed)	30064 or 40064	Input or Holding	63	int16	1 °C	RO
Forward temperature (Float)	30066 or 40066	Input or Holding	65	IEEE754	°C	RO
Return temperature (Fixed)	30068 or 40068	Input or Holding	67	int16	1 °C	RO
Return temperature (Float)	30070 or 40070	Input or Holding	69	IEEE754	°C	RO
Temperature difference (Fixed)	30072 or 40072	Input or Holding	71	int16	0.01 °K	RO
Temperature difference (Float)	30074 or 40074	Input or Holding	73	IEEE754	°K	RO
Heat Meter Serial Number (Fixed)	30076 or 40076	Input or Holding	75	uint32	-	RO
Heat Meter Serial Number (ASCII)	30078 or 40078	Input or Holding	77	8 char ASCII	-	RO
Error Code	30082 or 40082	Input or Holding	81	uint32	-	RO
Modbus Slave ID ⁴	41001	Holding	1000	uint16	-	R/W
Update Rate Data from Meter	41002	Holding	1001	uint16	1 s	R/W
Baud Rate ⁵	41003	Holding	1002	uint32	-	R/W
Data Bits ⁵	41005	Holding	1004	uint16	-	R/W
Parity ^{5, 6}	41006	Holding	1005	uint16	-	R/W
Stop Bits ⁵	41007	Holding	1006	uint16	-	R/W
Automatic Slave ID ⁷	41008	Holding	1007	uint16	-	R/W
Module Serial Number	32001	Input	2000	uint64	-	RO
Module Model Number	32005	Input	2004	uint32	-	RO
Firmware Version ³	32007	Input	2006	uint16	-	RO
Firmware Revision	32008	Input	2007	uint32	-	RO

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- 1 Specified registers can hold data present energy in different units. Data unit is visible in (Unit) register. Available units for the register are MWh, MBTU, GJ or Gcal.
- 2 Specified registers can hold data present volume in different units. Data unit is visible in (Unit) register. Available units for the register are ml, l or m³.
- 3 Higher byte of the register is major number of firmware version (0x##00). Lower byte of the register is minor number of firmware version (0x00##).
- 4 This register is Modbus address of the module in the range 1–247 (01–F7 hex).
- 5 Only the values corresponding to the data format of the serial EIA-485 interface should be set in the registers (see section “Communication interface”).
- 6 This register is set by the ASCII char value – ‘E’ for Even parity (69 dec, 45 hex), ‘O’ for Odd parity (79 dec, 4F hex) and ‘N’ for None parity (78 dec, 4E hex).
- 7 This register with value 1 enable setting Modbus Slave ID based on heat meter primary M-Bus address. To disable set value 0.

14.7 Error codes

Error Bit	Error Description	Trigger for Error	Effect
0	Temperature Sensor 1: Cable Break	-	No calculation of energy value.
1	Temperature Sensor 1: Short Circuit		
2	Temperature Sensor 2: Cable Break		
3	Temperature Sensor 2: Short Circuit		
4	Error at Flow Measurement System	Depends on used Measurement System: <ul style="list-style-type: none"> • Coil Error • No Water 	No calculation of volume and energy values.
5	Electronic Defect	Checksum in FRAM has an unexpected value.	-
6	Reset	Restart of Device has been done: <ul style="list-style-type: none"> • by watchdog (only on FW or HW error) • by power off / power on 	-
7	Low Battery	Battery voltage is equal or lower as 2.5 Volts: <ul style="list-style-type: none"> • voltage level is detected on every day change 	-
8–15	Reserved	-	-
16	No readout from heat meter	Communication with the meter is not possible.	Delivered data on the Modbus is not updated with last data from meter and therefore invalid.
17–31	Reserved	-	-

Meaning of the error bit state:

- If error bit is set to 1, the corresponding error is active.
- If error bit is set to 0, the corresponding error is not active.

Reserved error bits are always 0.

14.8 Meter Compatibility

The Modbus Module is compatible with heat meters with a compatible firmware version. The table below shows the minimum firmware versions required.

The meter’s firmware version can be shown in the meter’s display, for further information please refer to the meter’s manual.

Meter	Minimum firmware version
Energy meter	1.03/0.14

EG-Konformitätserklärung EC-Declaration of Conformity

Für das Produkt *For the product*

Kompaktkältezähler
Compact Cooling Meter

S3

bestätigen wir als Hersteller
we confirm as the manufacturer

Engelmann Sensor GmbH, Rudolf-Diesel-Straße 24-28, D-69168 Wiesloch-Baiertal

dass das Produkt die Anforderungen erfüllt, die in den folgenden Richtlinien der Europäischen Gemeinschaft genannt werden, soweit diese Anwendung auf das Produkt finden:

that the product meets the requirements according to the following directives of the European Parliament as far as these are applied on the product:

RoHS-Richtlinie 2011/65/EU vom 08.06.2011 (ABl. L 174/88 1.7.2011)

RoHS Directive 2011/65/EU

EMV-Richtlinie 2014/30/EU vom 26.02.2014 (ABl. L 96/79 29.3.2014)

EMC Directive 2014/30/EU

Zusätzlich für Geräte mit Funk: *Additionally for devices with radio communication:*

Funkanlagen-Richtlinie 2014/53/EU vom 16.04.2014 (ABl. L 153/62 22.5.2014)

Radio Equipment Directive 2014/53/EC

Weiterhin entspricht das Produkt den folgenden harmonisierten Normen, normativen Dokumenten, Technischen Richtlinien und sonstigen Rechtsvorschriften, soweit diese Anwendung auf das Produkt finden:

Furthermore, the product complies with the following harmonised standards, normative documents, technical guidelines and other regulations as far as these are applied on the product:

DIN EN 1434 (2015)

EN 300220-2 V3.1.1 (2017-02)

EN 61000-4-3 (2006+A1:2008+A2:2010)

DIN EN ISO 4064 (2014)

EN 13757-2, -3 (2005)

EN 61000-4-4 (2004+A1:2010)

OIML R75 (2002/2006)

EN 60751 (2009)

EN 61000-4-6 (2014)

EN 301489-1 V2.2.3 (2019-11)

EN 62479 (2010)

EN 61000-4-8 (2010-11)

EN 301489-3 V2.1.1 (2019-03)

DIN EN 60529 (2000)

PTB-Richtlinie K 7.1, K7.2 (2006)

Der Hersteller trägt die alleinige Verantwortung für die Ausstellung der Konformitätserklärung.

The manufacturer is solely responsible for issuance of the declaration of conformity.

Wiesloch-Baiertal, 01.12.2022
Engelmann Sensor GmbH



R. Tischler / CE-Beauftragter *CE Manager*

Konformitätserklärung

für Geräte, die nicht europäischen Vorschriften unterliegen

Für das Produkt

Kompaktkältezähler

S3

Baumusterprüfbescheinigung

DE-16-M-PTB-0097

Metrologiekennzeichnung

DE-M XX 0102 XX = Jahreszahl

Benannte Stelle, Modul, Zertifikat

0102, Physikalisch-Technische Bundesanstalt, D-38116 Braunschweig, Modul D, DE-M-AQ-PTB015

bestätigen wir als Hersteller

Engelmann Sensor GmbH, Rudolf-Diesel-Straße 24-28, D-69168 Wiesloch-Baiertal

dass das Produkt die Anforderungen erfüllt, die im Mess- und Eichgesetz (MessEG vom 25.07.2013 (BGBl. I S. 2722)), zuletzt geändert durch Artikel 1 des Gesetzes vom 09.06.2021 (BGBl. I S. 1663) sowie in der sich darauf stützenden Mess- und Eichverordnung (MessEV vom 11.12.2014 (BGBl. I S. 2010)), zuletzt geändert durch die dritte Verordnung zur Änderung der Mess- und Eichverordnung vom 26. Oktober 2021 (BGBl. I S. 4742), genannt werden.

Weiterhin entspricht das Produkt den folgenden harmonisierten Normen, normativen Dokumenten, Technischen Richtlinien und sonstigen Rechtsvorschriften, soweit diese Anwendung auf das Produkt finden:

DIN EN 1434 (2015)

OIML R75 (2002/2006)

PTB-Richtlinie K 7.1, K7.2 (2006)

DIN EN ISO 4064 (2014)

EN 60751 (2009)

Der Hersteller trägt die alleinige Verantwortung für die Ausstellung der Konformitätserklärung.

Wiesloch-Baiertal, 01.12.2022
Engelmann Sensor GmbH



R. Tischler / Metrologie-Beauftragter

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azbil

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