DESCRIPTION

EM303

Ultrasonic thermal energy meter for heating and cooling applications certified according to MID directive (Measurement Instruments Directive 2014/32/EU). Composed by:

- ***An ultrasonic flow meter (flow sensor):*** it allows to measure with high accuracy and reliability the flow rate circulating through the device. Rated PN25 and proved up to temperature of 130°C. Available only in the threaded version (from ¾" to 1");
- ***An electronic display unit (calculator):*** it allows to set a series of characteristic parameters of the device and view and consult the data logs saved by the instrument. It houses the working and calculating electronic of the device. It can be positioned on the wall, by using the dedicated support included with the product, or on the flow sensor;
- ***A set of PT500 temperature probes:*** they allow to measure the temperature differential between flow and return and thus determine the thermal energy consumption. Available only in the direct immersion version.

Based on the requirements, the device can be equipped with one communication protocol selectable between ***M-bus*** or ***M-bus Wireless*** and only with ***integrated battery*** power supply (16 years lifetime). Equipped with an optical interface for local reading.

SIZES AND SELECTION

The size of the meter is distinguished by the nominal flow rate of the device q_P. In addition to this value, each meter is characterized by three other characteristic flow rate values q_c, q_i and q_s (cut-off flow rate, minimum flow rate and maximum flow rate respectively). Once the design flow rate q has been defined, the most suitable size of meter must be selected in such a way that this value is between the minimum and the nominal one ($q_i < q < q_P$). The different available sizes of EM303 thermal energy meter with their respective characteristic flow values are collected in the following table:

Article	Flow rate				Dynamic range	Flow sensor length	Flow sensor connection*
	Cut-off q_c [l/h]	Minimum q_i [l/h]	Nominal q_p [m³/h]	Maximum q_s [m³/h]			
EM303	3	6	0,6	1,2	100:1	110 mm	¾"
EM303	3	15	1,5	3	100:1	110 mm	¾"
EM303	5	25	2,5	5	100:1	130 mm	1"

*Thread according to EN ISO 228-1.

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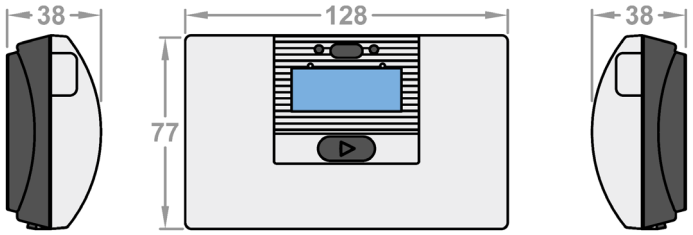
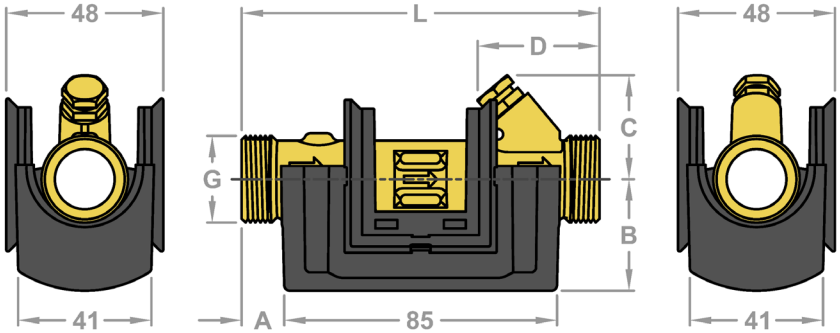
DIMENSIONS

The characteristic dimensions of the different elements making up the EM303 thermal energy meter are shown below (unit of measurement **mm**):

CALCULATOR



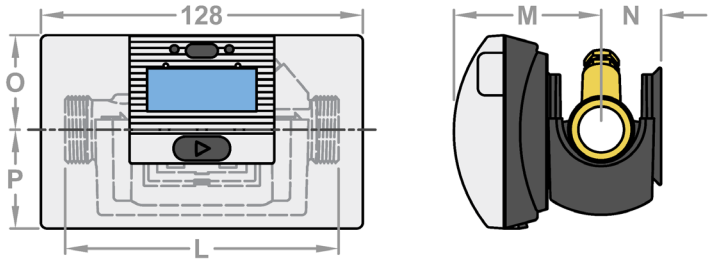
FLOW SENSOR



Article	Size	G*	L	A	B	C	D	Weight [g]
EM303	0,6 m³/h	¾"	110	13	34	31	37	~450
EM303	1,5 m³/h	¾"	110	13	34	31	37	~450
EM303	2,5 m³/h	1"	130	22	38	34	47	~550

*Thread according to EN ISO 228-1.

MOUNTING ON THE FLOW SENSOR



Article	Size	L	M	N	O	P	Weight [g]*
EM303	0,6 m³/h	110	58	24	38	39	~650
EM303	1,5 m³/h	110	58	24	38	39	~650
EM303	2,5 m³/h	130	58	24	38	39	~750

*The weight indicated includes the flow sensor, the calculator and the temperature probes.

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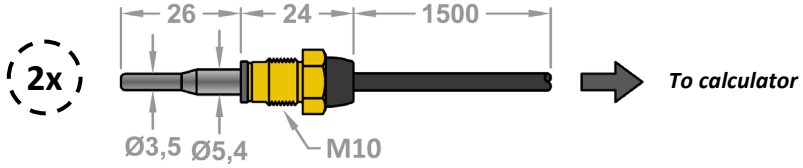
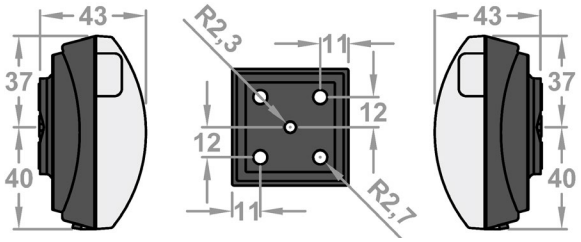
DIMENSIONS

The characteristic dimensions of the different elements making up the EM303 thermal energy meter are shown below (unit of measurement **mm**):

DIRECT IMMERSION TEMPERATURE PROBE



SUPPORT FOR WALL MOUNTING



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MATERIALS

The materials of the different elements making up the EM303 thermal energy meter are shown below:

CALCULATOR

- Front shell — Polycarbonate filled with 10% glass fiber (PC 10% GF) with thermoplastic elastomers (TPE)
- Rear shell — Polycarbonate filled with 10% glass fiber (PC 10% GF)

CABLES

- Flow sensor - Calculator — Silicon cable 3 x 0,25 mm^2
- Temperature probes — Silicon cable 2 x 0,22 mm^2
- Communication protocol — PVC cable 2 x 0,22 mm^2

SUPPORTS FOR MOUNTING

- Wall support — Polycarbonate filled with 20% glass fiber (PC 20% GF)

TEMPERATURE PROBES

- Immersion type — Stainless steel W. nr. 1-4404

FLOW SENSOR

- Flow sensor casing — Antidezincification brass CW602N
- Transducer — Stainless steel W. nr. 1-4404
- O-rings — EPDM
- Measuring tube — Polyethersulfone filled with 30% glass fiber (PES 30% GF)
- Reflectors — Stainless steel W. nr. 1-4436 or 1-4350
- Reflectors base — Polyethersulfone filled with 30% glass fiber (PES 30% GF)
- Protection cover — Polycarbonate filled with 20% glass fiber (PC 20% GF)

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OPERATING CONDITIONS

The EM303 thermal energy meter is suitable for indoors installation without the possibility of condensation forming. Outdoor installation is not permitted. It must be used in closed hydronic systems and is supplied by default for installation on the return pipe. If installation on the supply pipe is necessary, it is possible to change the setting on the meter.

The main characteristics and operating conditions of the device are collected in the following table:

TECHNICAL FEATURES	
IP protection (calculator)	IP65
IP protection (flow sensor)	IP68
Type of medium	Water
Nominal pressure (flow sensor)	25 bar
Room temperature range	5÷55 °C
Medium temperature range	2÷130 °C
Storage temperature range	-25÷60 °C
Calculator mounting	On the flow sensor or on the wall

APPROVALS

The different directives and regulations according to which the EM303 thermal energy meter is certified, with the related certificates where present, are shown below:

CERTIFICATIONS

- MID directive (Measurement Instruments Directive 2014/23/EU) ➔ Certificate DK-0200-MI004-045
- DK-BEK 1178 regulation (Danish cooling regulation) ➔ Certificate TS 27.02.015

Heating (MID)		Cooling (DK-BEK 1178)	
Temperature range θ	**Differential range $\Delta\theta$**	**Temperature range θ**	**Differential range $\Delta\theta$**
2 °C…180 °C	3 K…178 K	2 °C…180 °C	3 K…178 K
Mechanical environment: class M1 and M2 – *Electromagnetic environment:* class E1			

EUROPEAN DIRECTIVES AND REGULATIONS

- MID directive (Measurement Instruments Directive 2014/23/EU)
- EMCD directive (ElectroMagnetic Compatibility Directive)
- LVD directive (Low Voltage Directive)
- RED directive (Radio Equipment Directive)
- PED directive (Pressure Equipment Directive)
- RoHS directive (Restriction of Hazardous Substances)
- EN 1434:2007/AC:2007 regulation
- EN 1434:2015 + A1:2018 regulation
- EN 1434:2022 regulation

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CALCULATOR DATA

The calculator of the EM303 thermal energy meter is equipped with an LCD display through which it is possible to view the different recordings made by the device and the settings with which it is configured. Navigation between the different menus and modification of the related parameters can be achieved through the use of the two central buttons.

The main characteristics of the calculator of the EM303 thermal energy meter are collected in the following table:

TECHNICAL FEATURES	
Type of display	LCD with 7 or 8 digits
Display resolution	Depending on the data, up to a maximum of 3 decimal digits
Energy measurement units	Can be set between MWh, kwh or GJ
Type of memory	EEPROM (data stored are never lost)
Data logging frequency*	Yearly, monthly, daily, hourly, minute 1 (15'), minute 2 (1')
Data logging depth**	20 year, 36 months, 460 days, 72 hours, 1440 minutes, 360 minutes
Daylight saving time (DST)	Programmable
Clock accuracy (without external adjustment)	Less than 15 min/year
Clock accuracy (with external adjustment)	Less than 7 sec from daylight saving time
Data communication	Through optical head and communication module
Length of connection cable to flow sensor	1,5 m (can't be removed)
Length of connection cable to the temperature probes	1,5 m (can't be removed)

*In the case of yearly and monthly frequencies, the yearly and monthly date on which the EM303 thermal energy meter records the parameter can be directly set by the end user. **The logging depth, namely the number of years, months, days, hours or minutes for which it is possible to navigate within the device's memory, varies according to the logging frequency considered and increases as this latter decreases.

MOUNTING OF THE CALCULATOR

Depending on the installation needs, positioning of the calculator box can be carried out in two different ways:

- *Mounting on the flow sensor* (the calculator can be installed with any possible orientation);
- *Mounting on the wall* (in this case it is necessary to consider the maximum length of the connection cable between the calculator and the flow sensor of 1,5 m. The support for mounting is included with the product).

If the installation takes place in humid environments or environments subject to the formation of condensation, it is recommended to position the calculator on the wall in a way that it stays above the flow sensor and not below.

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INSTALLING POSITION

In order to guarantee correct functioning, it is necessary to take into account some installation constraints regarding the positioning of the device within the system such as:

1. Do not place the flow sensor at the highest point of the pipe (***Fig.1***);
2. Do not place the flow sensor immediately after a butterfly valve or a regulating control valve. However, previous installation is permitted (***Fig.2***);
3. Do not place the flow sensor immediately before or after a circulation pump (***Fig.3***);
4. Do not place the flow sensor immediately after a double curve oriented on two different planes (***Fig.4***);

For cases 2, 3 and 4, if you want to proceed with the installation, provide a straight section of pipe between the two elements with a minimum length equal to ten times the nominal diameter of the device. For any other cases not listed, straight pipe sections are not necessary either before or after the installation point.

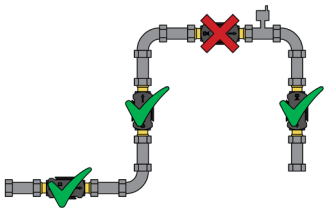

Fig.1

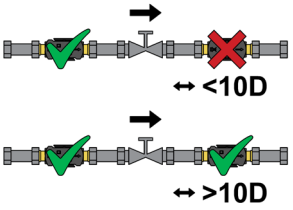

Fig.2

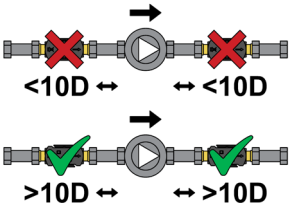

Fig.3

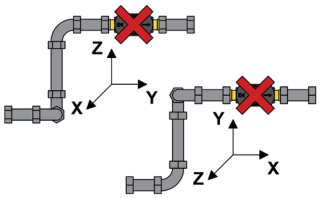

Fig.4

MOUNTING OF THE FLOW SENSOR

The mounting of the flow sensor of the EM303 thermal energy meter must be carried out in accordance with the following two conditions:

1. The direction of flow must agree with the direction of the arrows shown on the device's body;
2. The installation position inside the circuit must agree with the one set on the calculator (supply or return).

The EM303 thermal energy meter is equipped with an advanced integrated diagnostic system. If the installation direction is not consistent with the set flow direction, the meter generates a specific alarm message.

FLOW SENSOR ORIENTATION

The flow sensor can be oriented in any position: horizontal, vertical or inclined (***Fig.5***). In particular, if the installation is vertical, compatibly with the available space, the flow sensor can be rotated 360° around its axis. If the installation is of the horizontal type, however, the flow sensor can be oriented with inclinations between 0° and -90°. In particular, orientation with an angle between -45° and -90° is permitted if the absence of impurities and dirt inside the heat transfer fluid has been verified (***Fig.6***). What has been analyzed so far is to be applied in the case of heating systems. In the case of cooling or mixed applications, it is recommended to orient the flow sensor with an angle equal to 0° (***Fig.7***).

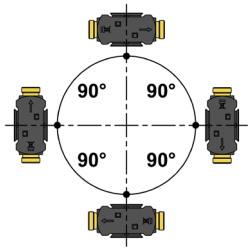

Fig.5

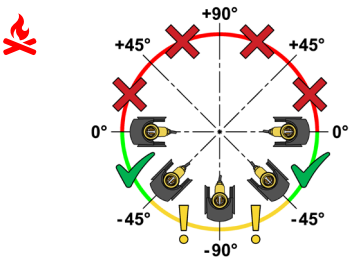

Fig.6

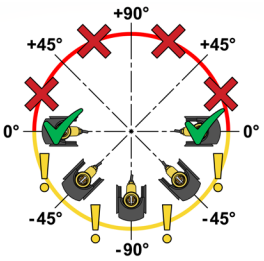

Fig.7

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TEMPERATURE PROBES

The EM303 thermal energy meter is equipped with two direct immersion PT500 temperature probes, one for the supply (T1 probe) and one for the return (T2 probe). The T2 probe is directly inserted into the flow sensor while the T1 probe is loose and must be installed in a dedicated probe holder (***Fig.8***). Hydraulic sealing is provided by compression of the end gasket (the probe does not need to be fully tightened against the stop). In the case of heating applications, the probe can be oriented in any position: horizontal, vertical or inclined (***Fig.9***). In the case of cooling or mixed applications, however, orienting the probe with an angle between 0° and -90° is recommended (***Fig.10***). Installation at angles greater than 0° requires the probe to be suitably thermally insulated.

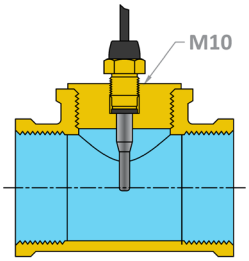


Fig.8

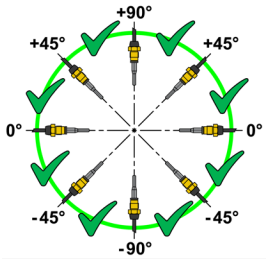


Fig.9

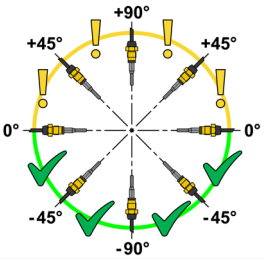
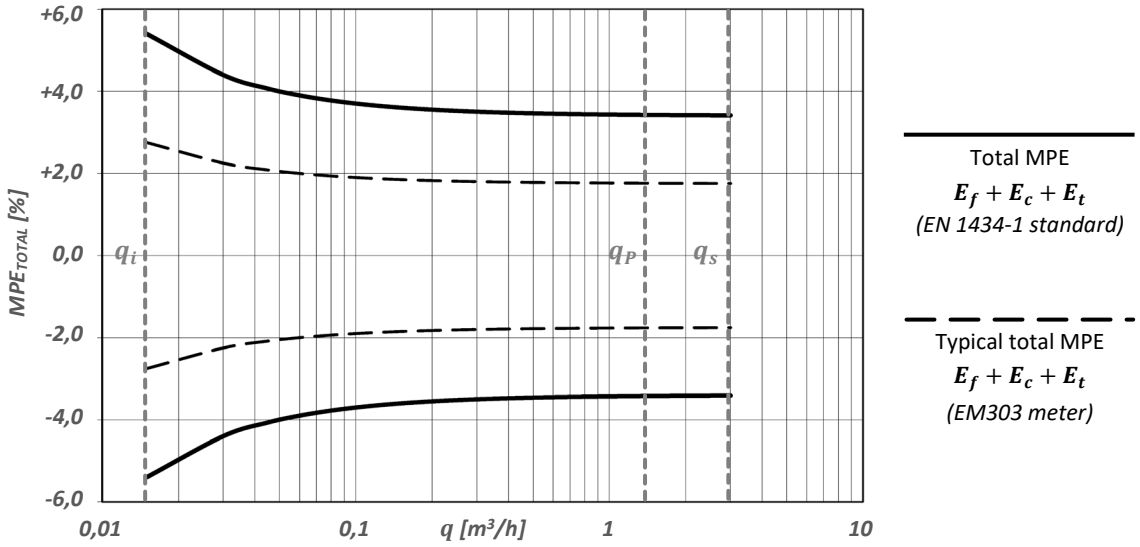


Fig.10

MEASURING ACCURACY

The measurement accuracy of the EM303 thermal energy meter complies with the minimum requirements indicated in the EN 1434-1 standard. As an example, consider the graph below which represents the typical measurement accuracy (MPE) of the EM303 thermal energy meter ($q_p = 1{,}5\ m^3/h$, $\Delta\Theta = 30\ K$) compared to the limits imposed by EN 1343-1 standard.



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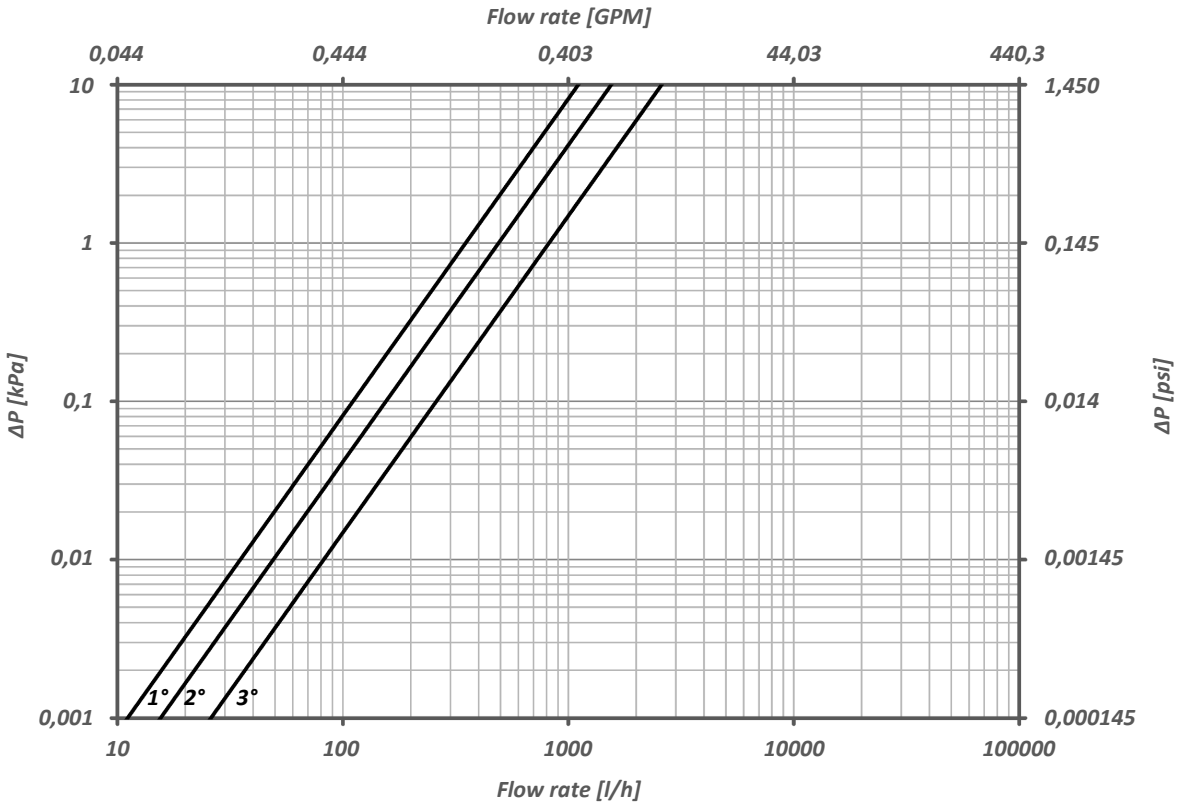
PRESSURE DROP DIAGRAM

The flow coefficients of the different meter sizes available are shown below:



Size [m³/h]	0,6	1,5	2,5
Kv	3,5	4,9	8,2
Cv	4	5,7	9,5
PN	25	25	25
Curve	*1°*	*2°*	*3°*

FLOW RATE MEASUREMENT

The flow sensor inside the EM303 thermal energy meter is of the ultrasonic type. Thanks to the absence of moving parts, this technology minimizes the need for maintenance of the device, thus maximizing its reliability and measurement precision over time.

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COMMUNICATION PROTOCOL

The EM303 thermal energy meter has an optical interface on the front body that can be used for local reading of the device using an appropriate optical probe. At the same time, based on communication needs, the device can be equipped with one communication protocol. The different communication protocols with which the EM303 thermal energy meter can be supplied are collected in the following table:

Protocol	Communication standard	Transmission speed / Transmission frequency
M-Bus	EN13757:2013	300÷2400 baud (automatic detection)
M-Bus Wireless	EN13757-4	868 MHz

POWER SUPPLY

The EM303 thermal energy meter can be supplied only with a lithium integrated battery 3,65V DC (lifetime up to 16 years in conditions of $T_{BATTERY}$ < 30°C).

COMPONENTS REPLACEMENT

The EM303 thermal energy meter is compact, meaning that it must not be opened once received. In order to prevent tampering, the device body has two dedicated security seals. Breaking these seals as a result of operations not permitted on the device will result in the loss of validity of the product warranty. Outside of the issues covered by the warranty, if it is necessary to repair a single component, the entire device must be replaced.

GENERAL NOTES

For further technical and installation information, please refer to the dedicated literature or directly contact Pettinaroli technical support.

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