

# ISONRG™

## ML 311



HEAT METER

**MI-004 APPROVED**  
in accordance with the Directive 2004/22/EC

Warranty conditions are available on this website:  
[www.isomag.eu](http://www.isomag.eu) only in English version

**ISOIL**   
INDUSTRIA  
*The solutions that count*

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## SYSTEM DESCRIPTION

ML 311 is an energy meter designed for heating, cooling or combined heating/cooling carried by a thermal fluid; typically the thermal fluid is water, though a special features allow to calculate the energy even for water and glycol ethylene or polypropylene at several concentration. The calculator contains all the necessary circuits for calculating energy value according to the standard EN1434; the thermal energy calculation is based on the following calculation :

$$Q = \int_{t_0}^{t_1} q_m \Delta h dt$$

Where :

- $Q$  : amount of heat (energy) transferred or absorbed
- $q_m$  : mass flow rate of the vector fluid /kg s<sup>-1</sup>
- $\Delta h$  :  $\Delta$  of specific enthalpy between in-let and out-let pipe line /J kg<sup>-1</sup>
- $t$  : time /s

### FLOW MEASUREMENT

The calculator can calculate the flow rate throughout two channel :

- Analogic : it acquire the 4-20mA signal from a flow meter
- or
- Factorized pulses: it calculate the flow rate throughout factorized pulses coming from the flow meter

### TEMPERATURE MEASUREMENT

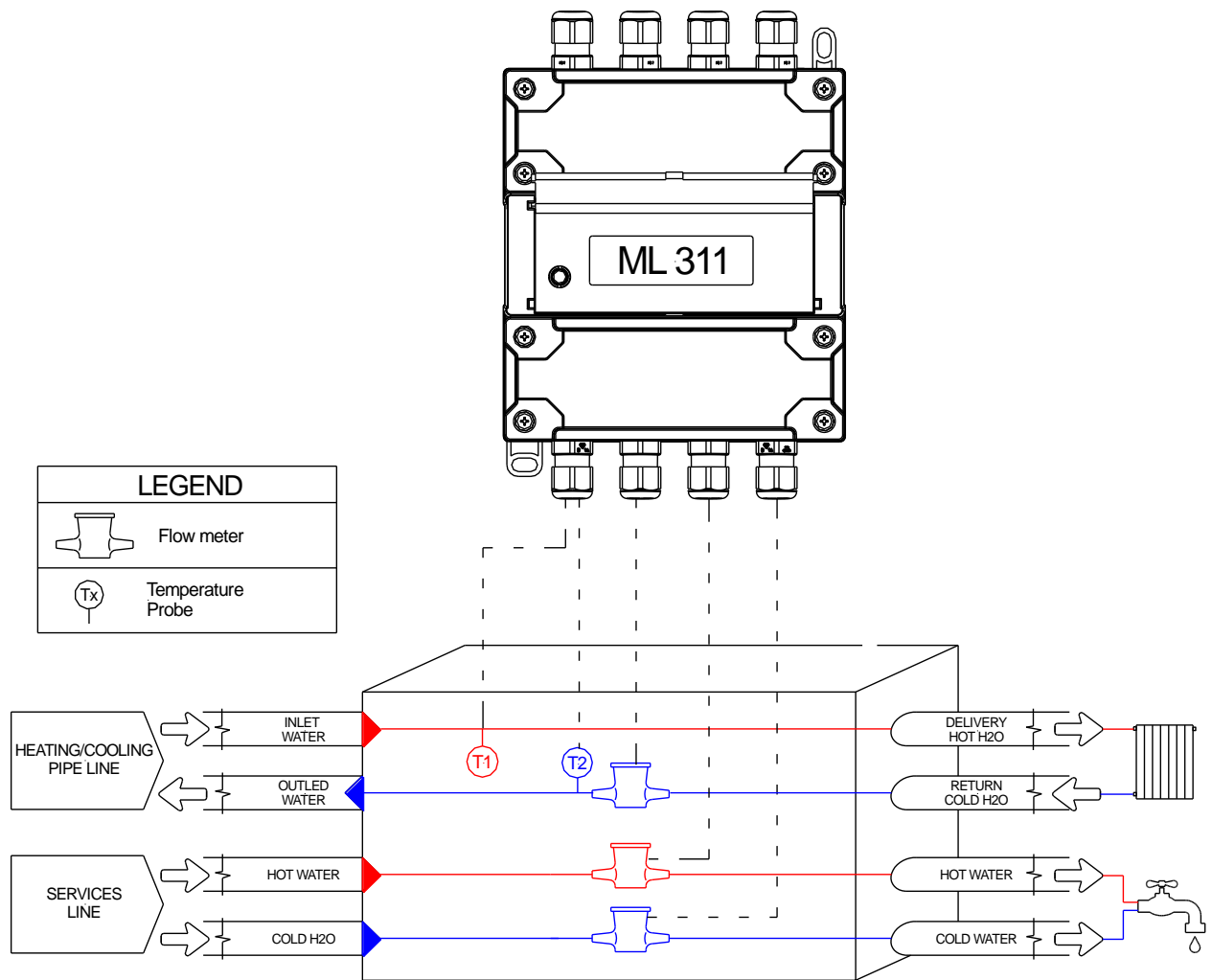
The instrument measures the temperature by RTD (PT type), in a 4-wires configuration; the PT values, can be selected via software; the allowed model are:

- PT100
- PT500
- PT1000

### TIME

By a highly accurate internal reference system and an appropriate electronic switch network, the temperatures are measured by highly accurate ADC (Analog to Digital Converter).

The diagram below is a schematic of the principle: in addition to the thermal energy meter function, the ML 311 allows to totalize the hot and cold water volume used for service lines; in some cases this solution can be helpful for a quick reference of the measures and the possibility to transfer them to other systems using several fieldbus which the instrument has built-in.



## TECHNICAL DATA

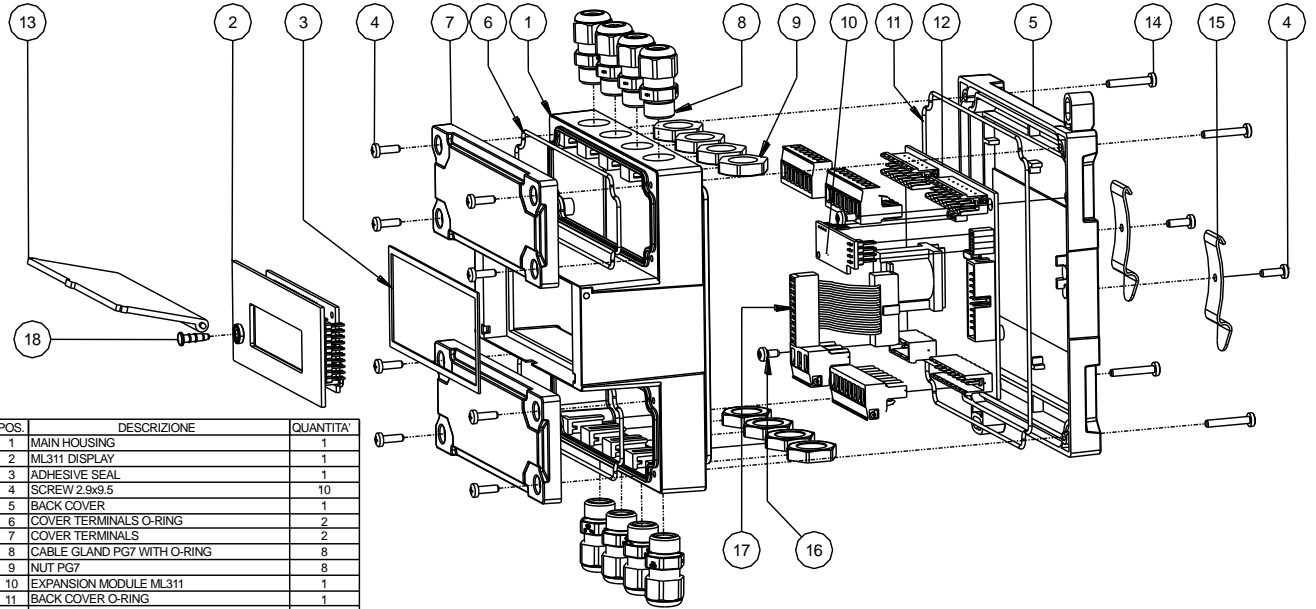
<i>OVERALL FEATURES</i>	
Maximum Thermal Power	<input type="checkbox"/> $P_s = 99999 \text{ GW}$
Hot/Cold Switching	<input type="checkbox"/> Automatic through assignment of the +/- sign (possibility of congruence control from remote input)
Measure Units Available	<input type="checkbox"/> kW/MJ
Installation	<input type="checkbox"/> Any orientation - DIN rail
Altitude	<input type="checkbox"/> From -200m to 4000m (from -656 to 13120 feet)
Environmental Temperature	<input type="checkbox"/> +5... +55°C (+41...+131°F)
Temperature Range(Measure)	<input type="checkbox"/> -15... +200 (+5...+392°F) <input type="checkbox"/> -15... +150 (+5...+302°F) for MID instrument
Protection Rate	<input type="checkbox"/> IP65

<i>STANDARD FEATURES</i>	
Housing Material	<input type="checkbox"/> PC/ABS self-extinguishing
Power Supply/Power Consumption	<input type="checkbox"/> 15-45V $\overline{\text{---}}$ (6W); 15-45V $\sim$ – 45-66Hz (12 VA)
Pulses Outputs	<input type="checkbox"/> N° 2 output 1250Hz, 100mA, 40Vdc
Available Protocols	<input type="checkbox"/> ETP
Digital Input	<input type="checkbox"/> N° 1 multifunction (reset totalizer, cooling /heating)
Analog Input For Flow Meter	<input type="checkbox"/> N°1 4..20mA range for measure fluid flow rate
Pulses Inputs	<input type="checkbox"/> N° 3 inputs (frequency max. 1kHz, min. 0.003 Hz): <ul style="list-style-type: none"> <li>▪ Vector Fluid volume</li> <li>▪ Cold water volume</li> <li>▪ Hot water volume</li> </ul>
Inputs For Sensor Temperature	<input type="checkbox"/> N° 2 (one for the delivery and one for the return)
Digital Outputs	<input type="checkbox"/> N° 2 programmable for alarms or pulses for energy/volume
Programming Plug In	<input type="checkbox"/> Protected plug in for the connection to PC
Galvanic Isolation	<input type="checkbox"/> All the inputs/outputs are galvanically isolated from power supply up to 500 V
Diagnostic Function	<input type="checkbox"/> Yes
CE Certification	<input type="checkbox"/> Yes

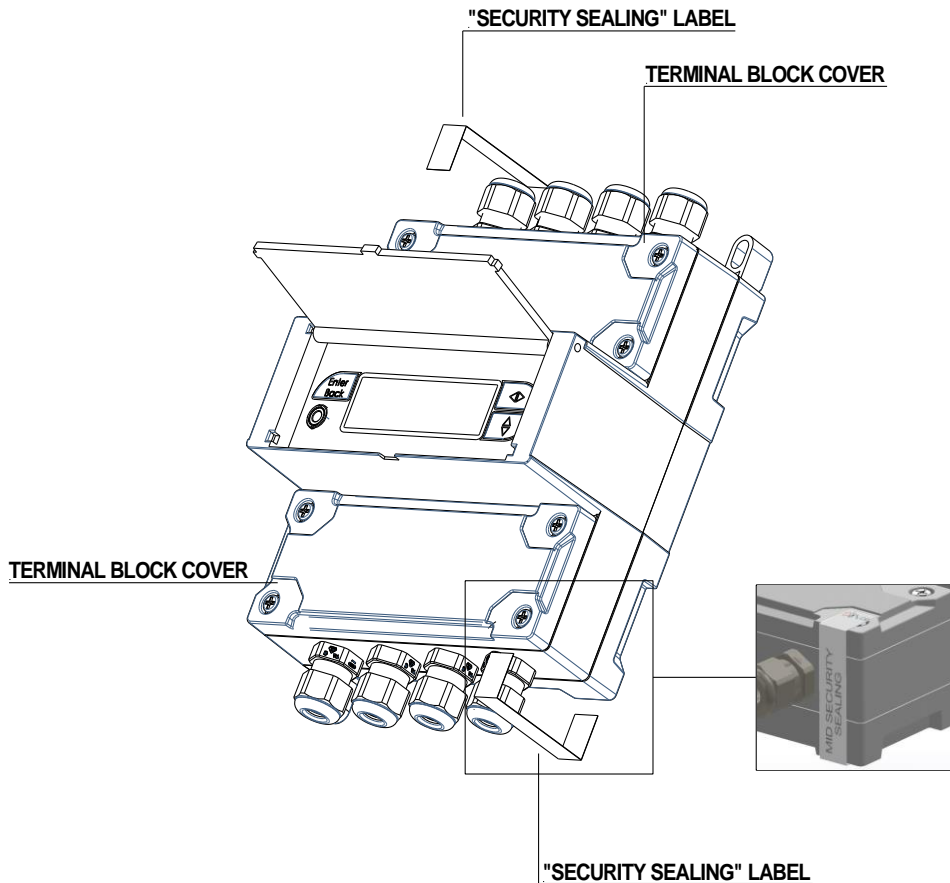
<b>OPTIONAL FEATURES</b> <i>(CHECK FOR MORE DETAILS 'HOW TO ORDER' ON LAST PAGE)</i>	
<b>LCD Display</b>	<input type="checkbox"/> <b>Graphic display 122 x 32 pixels back light; characters height 6,8 mm</b> <input type="checkbox"/> <b>3 membrane keys</b>
<b>Current Output</b>	<input type="checkbox"/> <b>N° 1 0/4...20mA selectable alternatively for flow, energy, temperature T1, T2 or delta T</b>
<b>Temperature Sensor</b>	<input type="checkbox"/> <b>Thermal probes PT 100/PT500/PT1000 (2/3/4 wires)</b>
<b>Communication Port</b>	<input type="checkbox"/> <b>RS 485/MBus</b>
<b>Available Protocols</b>	<input type="checkbox"/> <b>Modbus over RS485/N2/BACnet over RS485/Mbus</b>
<b>Data Storage</b>	<input type="checkbox"/> <b>F-RAM: permanent data storage in power failure case</b>
<b>MID Certification</b>	<input type="checkbox"/> <b>MI-004</b>

<b>MEASUREMENT</b>	
<b>Temperature Measuring Range</b>	<input type="checkbox"/> <b><math>\vartheta_{min} -15\text{ °C } (+5\text{ °F}), \vartheta_{max} 200\text{ °C } (392\text{ °F})</math></b>
<b>Delta Temperature (<math>\Delta\vartheta</math>)</b>	<input type="checkbox"/> <b><math>\Delta\vartheta_{min} 2\text{ °C } (35.6\text{ °F}), \Delta\vartheta_{max} 150\text{ °C } (392\text{ °F})</math></b> <input type="checkbox"/> <b><math>\Delta\vartheta_{min} 0,1\text{ °C } (32.18\text{ °F}) \Delta\vartheta_{max} 200\text{ °C } (392\text{ °F})</math> – for instruments without MID certificate</b>
<b>Measurement Accuracy</b>	<input type="checkbox"/> <b>System: <math>\pm 0.20\text{ % } (0.18 + \Delta\vartheta_{min}/\Delta\vartheta)</math></b>

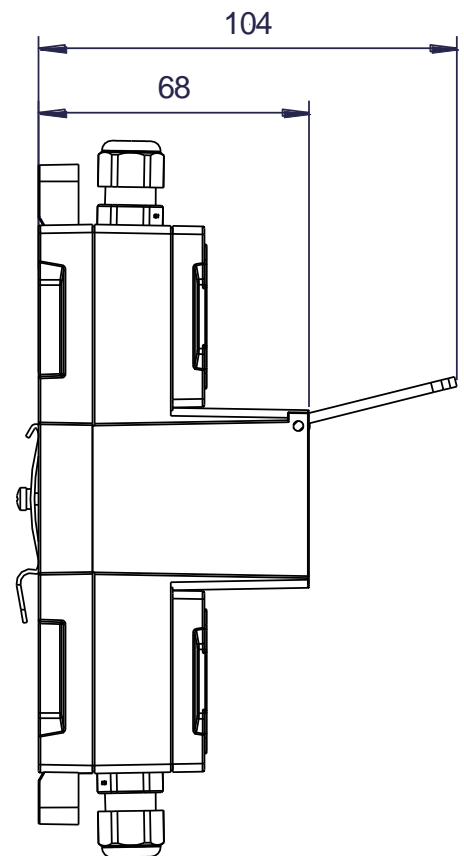
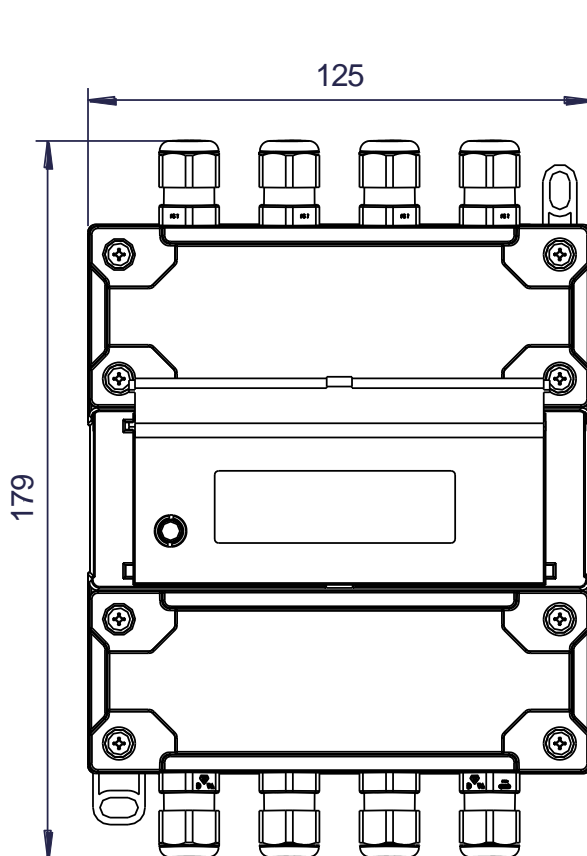
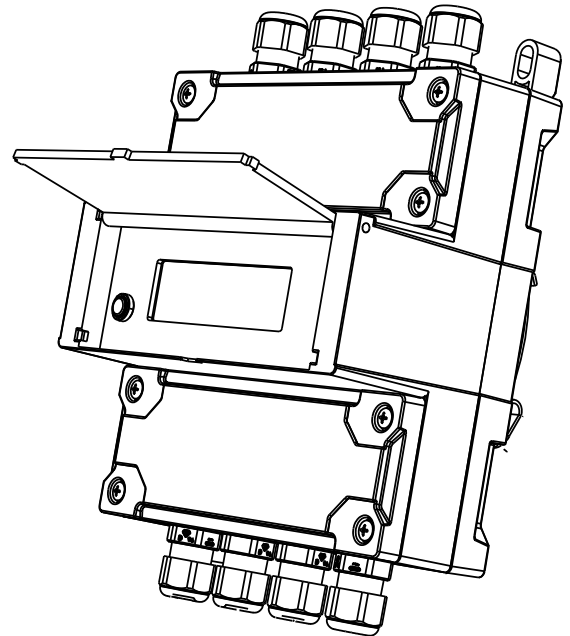
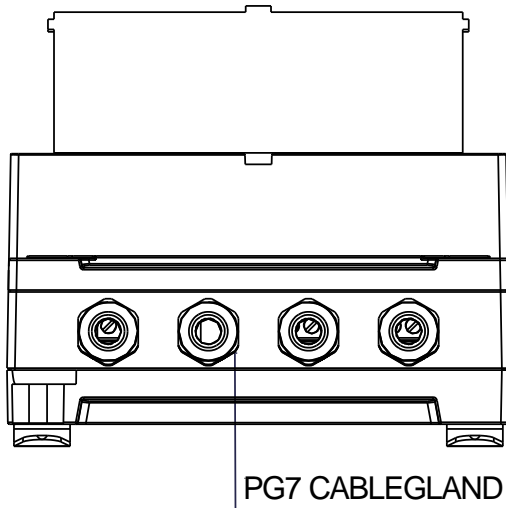
# EXPLODED LAYOUT



POS.	DESCRIZIONE	QUANTITA
1	MAIN HOUSING	1
2	ML311 DISPLAY	1
3	ADHESIVE SEAL	1
4	SCREW 2.9x9.5	10
5	BACK COVER	1
6	COVER TERMINALS O-RING	2
7	COVER TERMINALS	2
8	CABLE GLAND PG7 WITH O-RING	8
9	NUT PG7	8
10	EXPANSION MODULE ML311	1
11	BACK COVER O-RING	1
12	ML311 PCB	1
13	PROTECTION GLASS	1
14	SCREW 2.9x19	4
15	DIN RAIL BRACKETS	2
16	SCREW 2.9x6	2
17	20 POLES FLAT CABLE	1
18	DUST PROTECTION CAP JACK 3.5	1

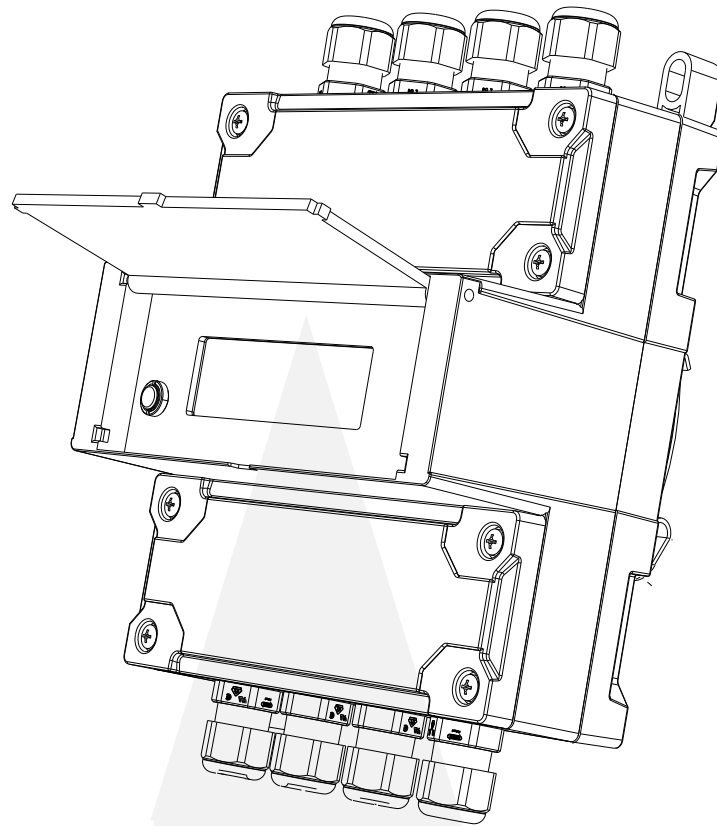


## OVERALL DIMENSIONS





## VISUALIZATION PAGES



**TEMPERATURES**  
 TD °C 0.08  
 T1 °C 21.21  
 T2 °C 21.14



**VECTOR FLUID**  
 M<sup>3</sup> .000  
 M<sup>3</sup> .000



**HOT WATER**  
 M<sup>3</sup> .000  
 M<sup>3</sup> .000



**COLD WATER**  
 M<sup>3</sup> .000  
 M<sup>3</sup> .000



**POWER & FLOW**  
 kW 0.0000  
 dm<sup>3</sup> /s 0.0000



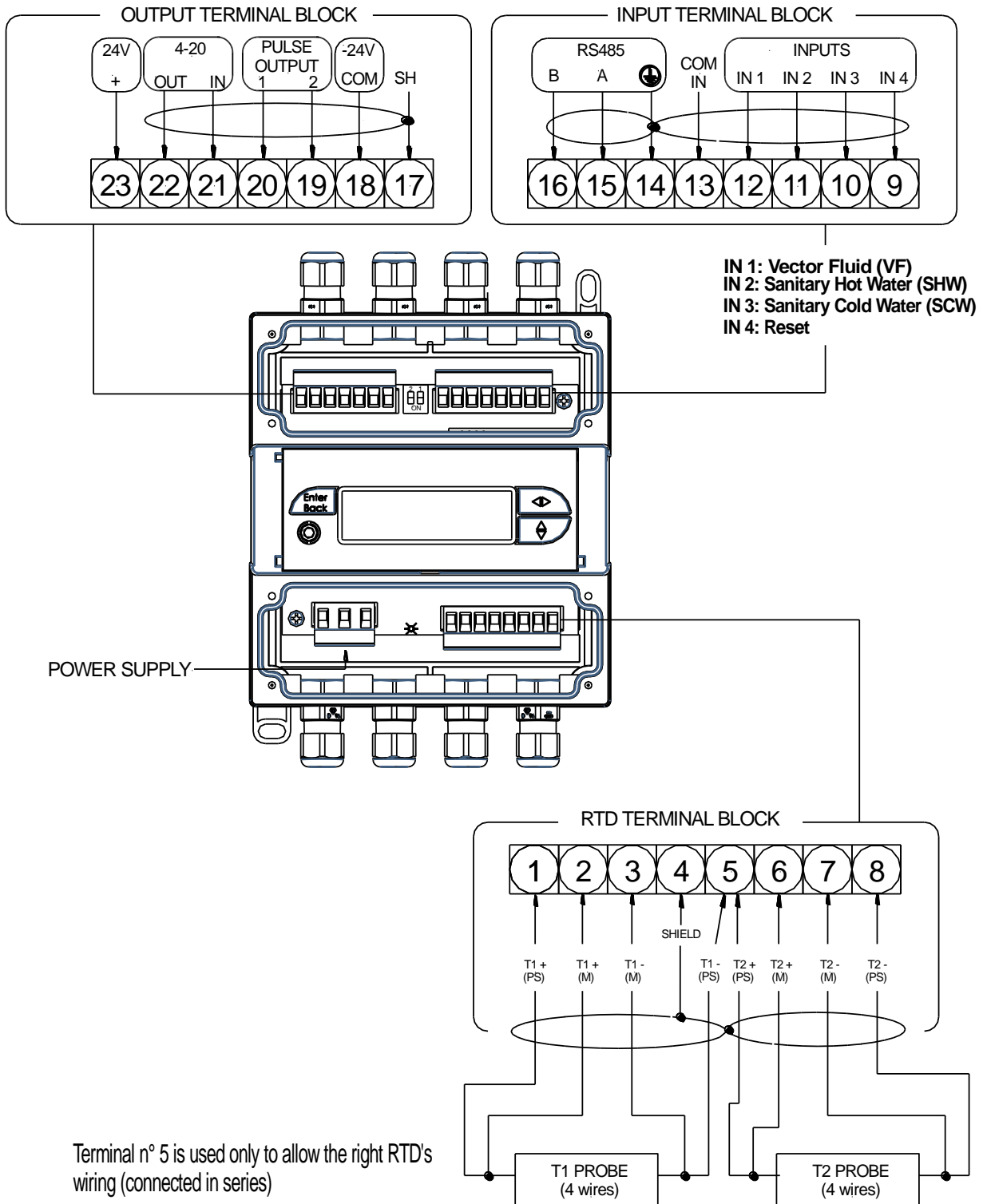
**HEATING ENERGY**  
 kWh .000  
 kWh .000



**COOLING ENERGY**  
 kWh .000  
 kWh .000

**Different visualization possibilities by simply pressing of a key**

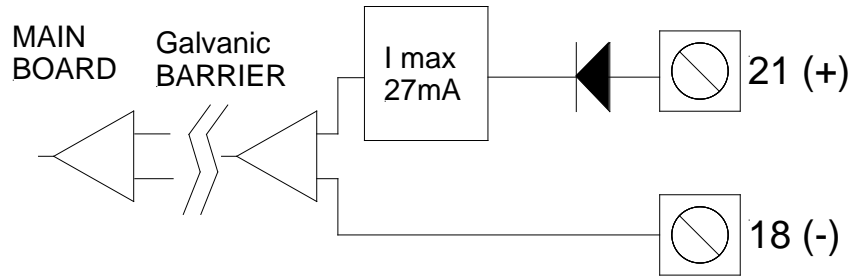
## ELECTRICAL CONNECTIONS



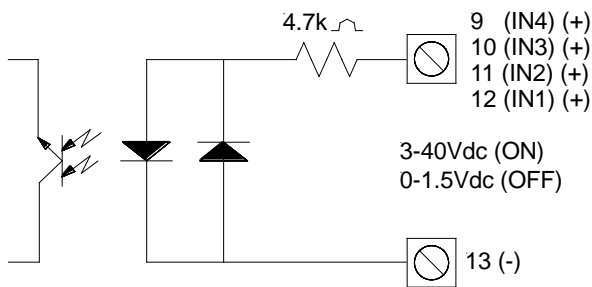
To connect 2 wire probe:  
 T1: connect the probe to terminal block 2 and 3, bridge on 1-2 and 3-5  
 T2: connect the probe to terminal block 6 and 7, bridge on 5-6 and 7-8

# INPUTS/OUTPUTS

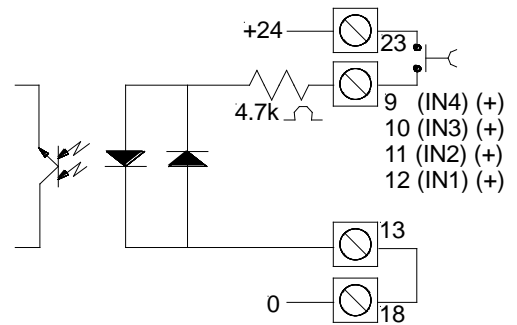
## 4-20mA INPUT



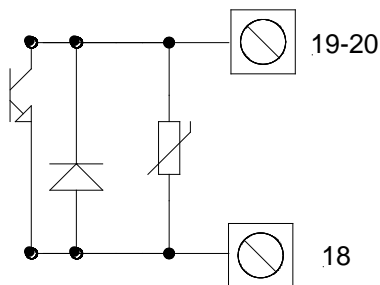
## DIGITAL INPUT EXTERNALLY POWERED



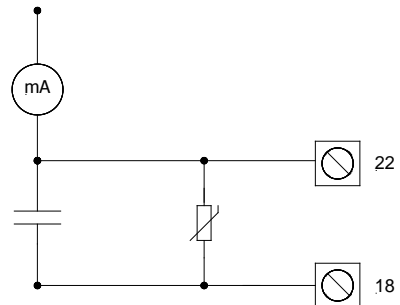
## DIGITAL INPUT INTERNALLY POWERED



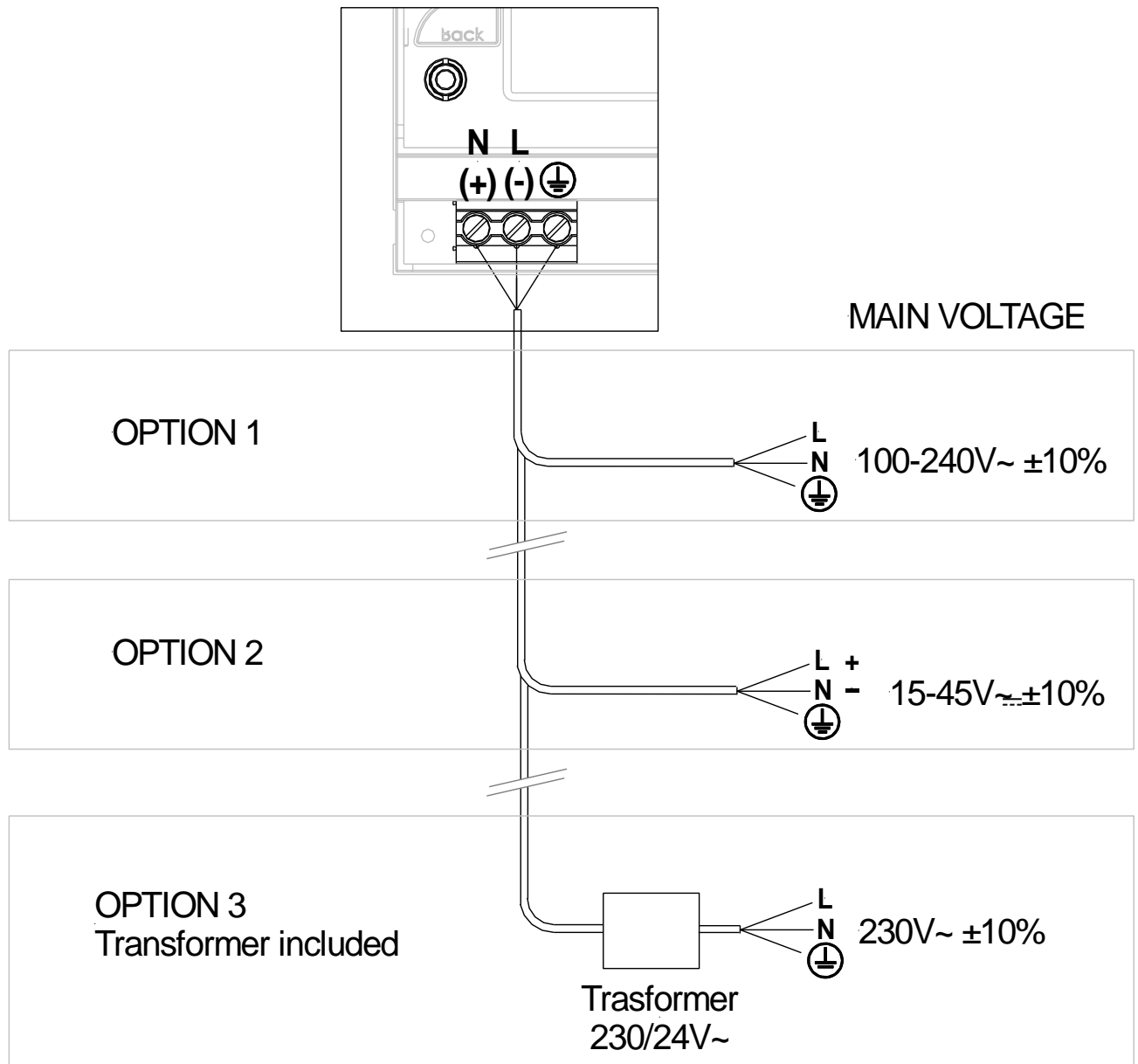
## ON/OFF 1250Hz OUTPUT



## 4-20mA OUTPUT



## POWER SUPPLY



## FUNCTIONS

```

MAIN MENU
1-Scales
2 Y-SCALES
3 Fr=dm³/s 10.0000
4 Pwr=kW 10.0000
5 Temp. ut.= C
6 Energy=kWh 1.000
7 Vol.vf=m³ 1.000
8 Vol.hw=m³ 1.000
9 Vol.cw=m³ 1.000
10 Ipl1=dm³ 1.00000
    Ipl2=dm³ 1.00000
    Ipl3=dm³ 1.00000
    Opl1=dm³ 1.00000
    Opl2=kWh 1.00000
    Top1=ms 0030.40
    Top2=ms 0050.00
    Fs DT =°C 025
    Fs T1T2 =°C 100
    PresT1=bar 02.0
    PresT2=bar 02.0

```

- 1.1\* Flow rate full scale value
- 1.2\* Thermal power full scale value
- 1.3 Temperature measure unit
- 1.4\* Energy totalizers measure unit value
- 1.5\* Vector fluid volume totalizers measure unit value
- 1.6\* Hot water volume totalizers measure unit value
- 1.7\* Cold water volume totalizers measure unit value
- 1.8\* Input 1 pulse value (VF)
- 1.9\* Input 2 pulse value (SHW)
- 1.10\* Input 3 pulse value (SCW)
- 1.11\* Output 1 pulse value (Vector Fluid)
- 1.12\* Output 2 pulse value (Energy)
- 1.13\* Output 1 pulse time (Vector Fluid)
- 1.14\* Output 2 pulse time (Energy)
- 1.15 Temperature delta T full scale
- 1.16 Temperature T1 and T2 full scale
- 1.17\* Pressure value measured at T1 point
- 1.18\* Pressure value measured at T2 point

```

MAIN MENU
1-Scales
2-Measure
3 ALARMS
4 2-MEASURE
5 Cut-off =% 00.1
6 DT min =%C 00.0
7 Meas. side = 12
8 Flw. r. src = PLS1
9 Tmax Pls 1= 20
10 Tmax Pls 2= 20
    Tmax Pls 12= 20
    Tmax Pls 13= 20
    Ctrl tupe = AIT
    K-factor = ON
    Gluc. type = PROP
    Concentr. % = 0

```

- 2.1\* Measure filter cut-off threshold
- 2.2\* Minimum Delta T
- 2.3\* Flow rate calculation side
- 2.4\* Flow rate source measure
- 2.5\* maximum waiting time between two pulse on input 1 (VF)
- 2.6\* Maximum pulse number on input 1 (VF)
- 2.7\* maximum waiting time between two pulse on input 2 (SHW)
- 2.8\* Maximum pulse number on input 2 (SHW)
- 2.9\* maximum waiting time between two pulse on input 3 (SCW)
- 2.10\* Maximum pulse number on input 3 (SCW)
- 2.11\* Control type
- 2.12\* Enable substance additive
- 2.13\* Glycole type
- 2.14\* Substance concentration

```

MAIN MENU
1-Scales
2-Measure
3-ALARMS
4-Inputs
5 3-ALARMS
6 Flr. max=% 000
7 Flr. min=% 000
8 Pwr. max=% 000
9 Pwr. min=% 000
10 DT max=% 000
    DT min=% 000
    T1 max=% 000
    T1 min=% 000
    T2 max=% 000
    T2 min=% 000
    Hyst.=% 00
    mA vfault=% 010

```

- 3.1 Positive rate maximum flow alarm. Express in full scale %. Value =0: alarm disabled
- 3.2 Positive rate minimum flow alarm. Express in full scale %. Value =0: alarm disabled
- 3.3 Maximum thermal power alarm. Express in full scale %. Value =0: alarm disabled
- 3.4 Minimum thermal power alarm. Express in full scale %. Value =0: alarm disabled
- 3.5 Maximum delta temperature alarm. Value =0: alarm disabled
- 3.6 Minimum delta temperature alarm. Value =0: alarm disabled
- 3.7 Maximum temperature on temperature point T1 Value =0: alarm disabled
- 3.8 Minimum temperature on temperature point T1. Value =0: alarm disabled
- 3.9 Maximum temperature on temperature point T2. Value =0: alarm disabled
- 3.10 Minimum temperature on temperature point T2. Value =0: alarm disabled
- 3.11 Hysteresis thresholds alarm
- 3.12\* Output current alarm condition value

```

MAIN MENU
1-Scales
2-Measure
3-ALARMS
4-Inputs
5 4-INPUTS
6 Flow r.->0= OFF
7 Hot w.->0= OFF
8 Cold w.->0= OFF
9 Heat e.->0= OFF
10 Cool e.->0= OFF
    Count lock= OFF

```

- 4.1\* Flow rate partial volume totalizer enable reset
- 4.2\* Hot water partial volume totalizer enable reset
- 4.3\* Cold water partial volume totalizer enable reset
- 4.4\* Heat energy partial totalizer enable reset
- 4.5\* Cool energy partial totalizer enable reset
- 4.6\* Input totalizers counting lock enable

```

MAIN MENU
1-Scales
2-Measure
3-alarms
4-Inputs
5-Outputs
6-Communicat.
7-Display
8-Data logger
9-Diagnostic
10-Intern. data
5-OUTPUTS
  Out1= FLOW PLS 5.1* Output 1 function
  Out2= NRG PLS 5.2* Output 2 function
  Out MA= 4:22 5.3* Current output scale
  Out mA= FLOW 5.4* Current output function

```

```

4-Inputs
5-Outputs
6-Communicat.
7-Display
8-Data logger
9-Diagnostic
10-Intern. data
6-COMMUNICAT.
  IF2 prot.= DPP 6.1 IF2 protocol type
  Address= 001 6.2 Device address (range 0 - 255)
  Speed= 2400 6.3 RS485 speed
  Protocol=BACNet 6.4 RS485 protocol type
  Parity= NO2SB 6.5 RS485 parity
  Delay= OFF 6.6 Answer delay

```

```

5-Outputs
6-Communicat.
7-Display
8-Data logger
9-Diagnostic
10-Intern. data
7-DISPLAY
  Language= EN 7.1 Choice of the language: EN=English, IT=Italian, FR=French, SP=Spanish, DE=German
  Quick start= ON 7.2 Quick start menu enable
  Displ. lock=OFF 7.3 Display lock enable
  Flow r.->0 7.4 Flow rate volume totalizer partial reset
  Hot w.->0 7.5 Hot water volume totalizer partial reset
  Cold w.->0 7.6 Cold water volume totalizer partial reset
  Heat e.->0 7.7 Heat energy partial totalizer reset
  Cool e.->0 7.8 Cool energy partial totalizer reset

```

```

6-Communicat.
7-Display
8-Data logger
9-Diagnostic
10-Intern. data
8-DATA LOGGER
  92/01/02 00:00 8.1* Date and time set
  Disp. events 8.2* Stored events read
  Disp. min/max 8.3 Minimum and maximum visualization of: flow rate, thermal power, DT, T1, T2
  Clear data log 8.5 Reset all events stored: hourly, daily, monthly the datalogger
  Clear events 8.5 Reset all events stored
  Reset min/max 8.4 Reset all minimum and maximum values

```

```

7-Display
8-Data logger
9-Diagnostic
10-Intern. data
9-DIAGNOSTIC
  Self test 9.1* Converter autotest
  Simulation= OFF 9.2* Measure simulation enable

```

## HOW TO ORDER

CODE EXAMPLE	<i>Certification</i>	
0	0	WITHOUT MID-004
	M	CE M CERTIFICATION: MID-004
<b>Display</b>		
A	A	Blind version (without display)
	B	4 LINES X 15 CHARACTER DISPLAY
<b>Housing material / Protection rate</b>		
	0	PPO Housing sealable
	1	PPO Housing sealable - ET version
	2	PC/ABS housing sealable
	3	PC/ABS housing sealable - ET version
<b>FLOW RATE SOURCE (THERMAL FLUID)</b>		
A	A	Pulses
	B	4/20 mA
<b>Power supply</b>		
1	1	Power supply :100 ... 240 V AC 45/66 Hz
	2	Power supply : 15-45 VAC/DC
	3	Power supply : 15-45 VAC/DC + TRANSFORMER 230/24 VAC
<b>Analogue output</b>		
A	A	without analog out
	B	Analogue output 0/4...20/22 mA
<b>Serial Interface</b>		
0	0	None
	2	RS485 Serial Interface
	3	Modbus protocol over RS 485 interface
	4	N2 protocol over RS 485 interface
	5	Mbus protocol
	6	BACnet protocol over RS 485 interface
<b>Additional module</b>		
A	A	None
	B	PT 100
	C	PT 500
	D	PT 1000
<b>Special Features</b>		
0	0	NONE

ML311-0A2A1A0A0 (Example of order code)

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