

# Energy Management Energy Analyzer Type EM111

CARLO GAVAZZI



- Digital input (for tariff management)
- Easy connection or wrong current direction detection
- Certified according to MID Directive (option PF only): see "how to order" below

- Single phase energy analyzer
- Class 1 (kWh) according to EN62053-21
- Class B (kWh) according to EN50470-3
- Accuracy  $\pm 0.5\%$  RDG (current/voltage)
- Direct current measurement up to 32 AAC
- Backlit LCD display with integrated touch key-pad
- Energy readout on display: 7 digit
- Variable readout on display: 4 digit
- Energy measurement: kWh and kvarh (imported/exported); kWh+ by 2 tariffs
- System variables, kW, kvar, V, A, PF, Hz, kWdmd, kWdmd peak
- Self power supply
- Dimensions: 1-DIN module
- Protection degree (front): IP51
- Pulse output (optional, by open collector PNP)
- RS485 Modbus port (optional)
- M-bus port (optional)

## Product description

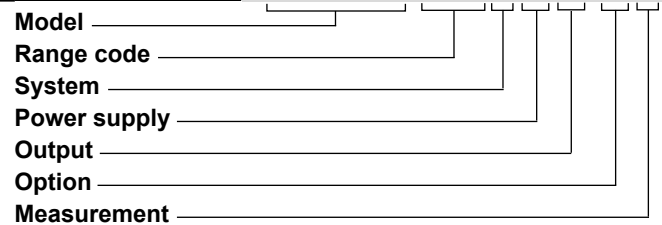
Single-phase energy analyzer with backlit LCD display with integrated touch keypad. Particularly indicated for active energy metering and for cost allocation in applications up to 32 A (direct connection), with dual tariff management availability. It can measure imported and exported energy or be programmed to consider only

the imported one. Housing for DIN-rail mounting, with IP51 front degree protection. The meter is optionally provided with pulse output proportional to the active energy being

measured, RS485 Modbus port or M-bus port.

**MID** Certified according to MID Directive, Module B and Module D of Annex II, for legal metrology relevant to active electrical energy meters (see Annex V, MI003, of MID). Can be used for fiscal (legal) metrology.

## How to order EM111-DIN AV8 1 X O1 PF B



## Type Selection

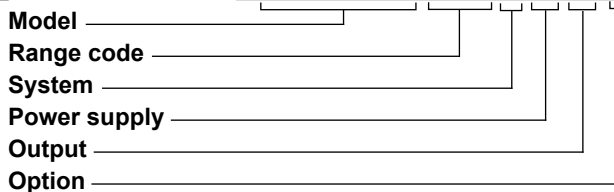
Range code	System	Power supply	Output
<b>AV8:</b> 230VLN AC - 5(45)A (Direct connection up to 32 A)	<b>1:</b> 1-phase 2-wire	<b>X:</b> Self power supply -30% +20% of the rated measuring input voltage, 50Hz	<b>O1:</b> pulse output <b>S1:</b> RS485 Modbus port <b>M1:</b> M-bus port
<b>AV7:</b> 120VLN AC - 5(45)A (Direct connection up to 32 A)			
Option			
<b>PF:</b> Certified according to MID Directive. Can be used for fiscal(legal) metrology.			
	Measurement		
	<b>A:</b> The power is always integrated (both in case of positive imported and negative exported power) and the total energy meter is certified according to MID.		
	<b>B:</b> Only the total positive energy meter is certified according to MID.		



**STANDARD**

Not certified according to MID Directive. Cannot be used for fiscal (legal) metrology.

**How to order EM111-DIN AV8 1 X O1 X**



**Type Selection**

Range code	System	Power supply	Output
<b>AV8:</b> 230VLN AC - 5(45)A (Direct connection up to 32 A)	<b>1:</b> 1-phase 2-wire	<b>X:</b> Self power supply -30% +20% of the rated measuring input voltage, 45 to 65Hz	<b>O1:</b> pulse output <b>S1:</b> RS485 Modbus port <b>M1:</b> M-bus port
<b>AV7:</b> 120VLN AC - 5(45)A (Direct connection up to 32 A)			

**Option**

**X:** none

## Input specifications

<b>Rated Inputs</b>		<b>Max. and Min. indication</b>	Max. 999 999.9 Min. 0.0
Current type	1-phase loads, direct connection up to 32 A	<b>Memory energy storage</b>	Energy
Nominal current range	5(45)A Ib 5 A Imax 45 A	Programming parameters	10 <sup>10</sup> cycles. Energy value is saved every time the less significant digit increases. 10 <sup>10</sup> cycles. When a parameter is modified, only the relevant memory cell is overwritten
Nominal voltage	230VLN AC (AV8 option), 120 VLN (AV7 option)		
<b>Accuracy</b> (@25°C ±5°C, R.H. ≤60%, 45 to 65 Hz)		<b>LEDs</b>	Flashing red light pulses according to EN50470-3, EN62052-11, 1000 imp./kWh (min. period: 90ms, max. frequency: 11 Hz) Fix orange light: wrong current direction only with PFB option or with "B" measurement selection in case of X option
AV7	Imin=0.25A; Ib: 5A, Imax: 45A; Un: 120VLN -30% +30%		
AV8	Imin=0.25A; Ib: 5A, Imax: 45A; Un: 230VLN -30% +20%		
Energies		<b>Current overloads</b>	
Active energy	Class 1 according to EN62053-21 Class B (Class B (kWh) according to EN50470-3)	Continuous	45A, @ 50Hz
Reactive energy	Class 2 according to EN62053-23	For 10ms	1350 A
Start-up current:	20mA (AV7, AV8), -20mA (AV7, AV8) positive or negative	<b>Voltage Overloads</b>	
Start-up voltage	Self-consumption is not measured. 84VLN (AV7), 161VLN (AV8)	Continuous	1.2 Un
		For 500ms	2 Un
<b>Resolution</b>	Display/serial communication	<b>Input impedance</b>	
Current	0.1/0.001 A	Voltage input 230VL-N	1.2 Mohm
Voltage	0.1/0.1 V	Voltage input 120VL-N	1.2 Mohm
Power	0.01 kW or kVar/ 0.1 W or var	Current inputs: 5(45) A	< 0.5 VA
Frequency	0.1 Hz/0.1Hz		
PF	0.01/ 0.001		
Energies (positive)	0.01 kWh or kvarh / 0.1 kWh or kvarh		
Energies (negative)	0.01 kWh or kvarh / 0.1 kWh or kvarh		
<b>Energy additional errors</b>			
Influence quantities	According to EN62053-21		
<b>Temperature drift</b>	≤200ppm/°C		
<b>Sampling rate</b>	4096 samples/s @ 50Hz 4096 samples/s @ 60Hz		
<b>Display and touch key-pad</b>			
Type	Backlit LCD, 7-digit, h 6 mm		
Read-out	Energy: 7 digit. Variables: 4 digit		
Touch key	2 (Enter and UP).		

## Digital input specifications

<b>Digital inputs</b>	Free of voltage contact	Overload	In case a voltage is erroneously applied to the digital input, the input is not damaged up to 30 VAC/DC.
Function	Tariff management (switch between t1-t2)		
Number of inputs	1		
Contact measurement voltage	5 V		
Contact impedance	1kohm		
Contact resistance	1kohm, close contact 100kohm, open contact		

## Output specifications

<b>RS485 serial port</b>	RS485 by screw connection.	Other	Available functions: wild card, header, initialisation SND_NKE, and req_udr management. Management of primary address modification via M-bus and reset of partial energy via M-bus available. VIF, VIFE, DIF and DIFE: see protocol
Function	For communication of measured data, programming parameters		
Protocol	ModBus RTU (slave function)		
Baud rate	9.6, 19.2, 38.4, 57.6, 115.2 kbaud, even or no parity, 1 to 247 (default: 01)		
Address	1/8 unit load. Maximum 247 transceivers on the same bus.	<b>Static output</b>	
Driver input capability	1sec	Purpose	For pulse output proportional to the active energy (kWh)
Data refresh time	50 words available in 1 read command	Pulse rate	Selectable in multiple of 100
Read command	Rx segment on display is shown when a valid Modbus command is sent to that specific meter	Pulse ON duration	Max 1000 or 3000 kWh according to pulse ON duration
Rx/Tx indication	Tx segment on display is shown when a valid Modbus reply is sent back to the master	Output type	Selectable: 30ms or 100 ms according to EN62052-31
<b>M-bus port</b>	M-bus by screw connection.	Load	open collector PNP $V_{ON}$ 1 VDC max. 100mA $V_{OFF}$ 80 VDC max.
Function	For communication of measured data		
Protocol	M-bus according to EN13757-1		
Baud rate	0.3, 2.4, 9.6 kbaud		
Meters in the M-bus network	250		
Primary address	Selectable		
Secondary address	Univocally defined in each unit		
Secondary address	from 5000 0000 to 6999 9999		

## General specifications

<b>Operating temperature</b>	-25 to +65 °C, indoor, (R.H. from 0 to 90% non- condensing @ 40°C)	<b>Standard compliance</b>	EN62052-11 EN62053-21, EN50470-3
<b>Storage temperature</b>	-30°C to +80°C (R.H. < 90% noncondensing @ 40°C)	<b>Approvals</b>	CE, MID (PF option only), cULus (AV7 option only)
<b>Overvoltage category</b>	Cat. III	<b>Connections</b>	
<b>Insulation (for 1 minute)</b>	4000 VAC RMS between measuring inputs and digital/serial output (see table) 4000 VAC RMS	Cable cross-section area	Measuring inputs: max. 6 mm <sup>2</sup> with/without metallic cable ferrule; Max. screw tightening torque: 1.1 Nm
<b>Dielectric strength</b>	4000 VAC RMS for 1 minute	Other terminals	1.5 mm <sup>2</sup> , Min./Max. screws tightening torque: 0.4 Nm
<b>EMC</b>	According to EN62052-11	<b>Housing</b>	
Electrostatic discharges	15kV air discharge;	Dimensions (WxDxH)	17,5 x 63 x 91,5 mm
Immunity to irradiated electromagnetic fields	Test with current: 10V/m from 80 to 2000MHz; Test without any current: 30V/m from 80 to 2000MHz;	Material	Noryl, self-extinguishing: UL 94 V-0
Burst	On current and voltage measuring inputs circuit: 4kV	Sealing covers	Included
Immunity to conducted disturbances	10V/m from 150KHz to 80MHz	<b>Mounting</b>	DIN-rail
Surge	On current and voltage measuring inputs circuit: 4kV;	<b>Protection degree</b>	
Radio frequency	According to CISPR 22	Front	IP51
		Screw terminals (cable inputs)	IP20
		<b>Weight</b>	Approx. 80 g (packing included)

## Power supply specifications

<b>Self power supply</b>		<b>Power consumption</b>	≤ 1.0W, ≤ 8VA
AV8	230VAC VL-N, -30% +20% 45 to 65 Hz		
AV7	120VAC VL-N, -30% +30% 45 to 65 Hz		

## Insulation (for 1 minute) between inputs and outputs

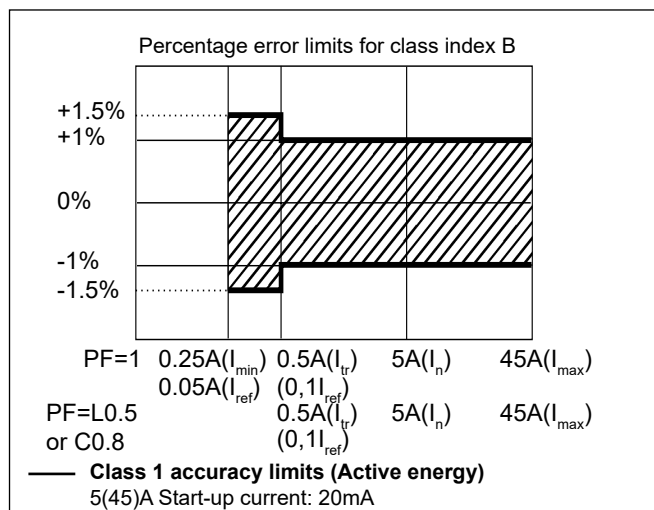
	Measuring input	Digital or serial output	Digital input
Measuring input	-	4 kV	4 kV
Digital or serial output	4 kV	-	-
Digital input	4 kV	-	-

## MID compliance (PF option only)

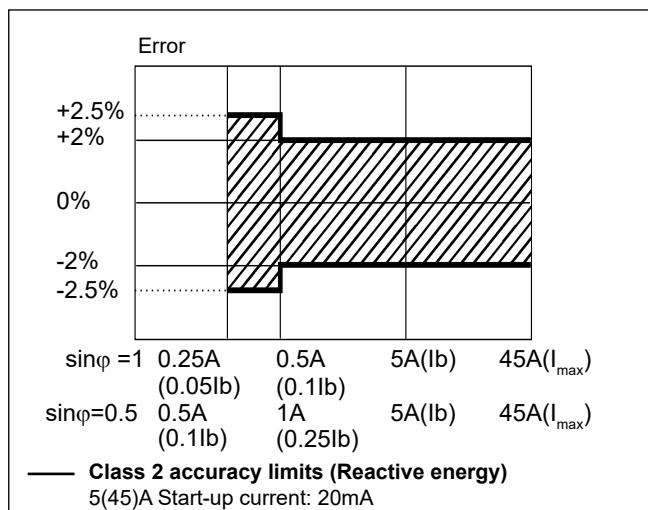
<b>Accuracy</b>	0.9 $U_n \leq U \leq 1.1 U_n$ ; 0.98 $f_n \leq f \leq 1.02 f_n$ ; $f_n$ : 50 Hz; cos $\phi$ : 0.5 inductive to 0.8 capacitive. Class B Considering listed $I_b$ or $I_n$ values
<b>Operating temperature</b>	-25 to +55°C (-13°F to 131°F) (R.H. from 0 to 90% non-condensing @ 40°C)
<b>EMC compliance</b>	E2
<b>Mechanical compliance</b>	M2

## Accuracy (according to EN50470-3 and EN62053-23)

kWh, accuracy (RDG) depending on the current



kvarh, accuracy (RDG) depending on the current



## Display pages

No	Variable	“Full” mode	“Easy” mode	Note
0	kWh+ (imported)	X	X	In PF version (MID) this is the only certified energy meter. In PFA version and in X version with Measurement menu set to “A”, this is considering the total energy without considering the current direction.
1	kWh- (exported)	X	X	In PFB version and in X version with Measurement menu set to “B”
2	kW	X	X	
3	V	X	X	
4	A	X	X	
5	PF	X		
6	Hz	X		
7	kvarh+ (imported)	X		In PFA version and in X version with Measurement menu set to “A”, this is considering the total positive reactive energy without considering the current direction.
8	kvarh- (exported)	X		In PFB version and in X version with Measurement menu set to “B”
9	kvar	X		
10	kW dmd	X		
11	kW dmd peak	X		
12	kWh (t1)	X	X	Only relevant to kWh+, with Tariff menu set to ON
13	kWh (t2)	X	X	Only relevant to kWh+, with Tariff menu set to ON

X= available

## List of available menus

Menu name and description		Range	Default setting
PASS	Password request	From 0000 to 9999	0000
nPASS	New password	From 0000 to 9999	0000
Measure	Measurement type (A=easy connection; B=bidirectional, imported and exported energy). Not available in PFA and PFB versions (MID)	A; b	A
P int	Integration time for Wdmd calculation	1 to 30 min	1
Mode	Selection of complete or simplified set of variables on display	Full or Easy	Full
Tariff	Tariff enabling	Yes/No	No
PULSE (O1 option)	Selection of pulse ON duration	30 or 100 ms	30
	Selection of the pulse rate	100 to 1000 (if duration is 100ms) or to 3000 (if 30 ms)	100
Address (S1 option)	Modbus serial address	1 to 247	01
Baud (S1)	Modbus baud rate	9.6; 19.2; 38.4; 57.6, 115.2 kbps	9.6
Parity (S1)	Modbus parity	No/even	No
PrI Add (M1 option)	M-bus primary address	1 to 250	1
Baud (M1)	M-bus baud rate	0.3; 2.4; 9.6 kbps	2.4
RESEt	Allow the reset of tariff meters and W dmd peak and of the kWh/kvarh partial meter available only via serial communication	Yes/No	No
End	Exit to measuring mode		

**Note:** after the confirmation of a new parameter value, the value is stored in the memory without the need to exit the programming mode.

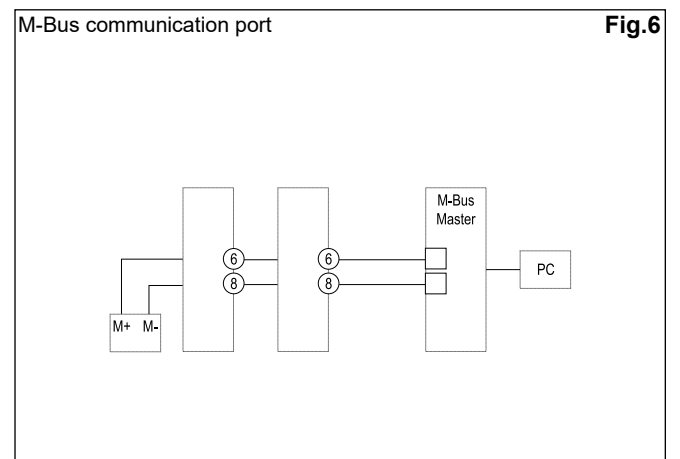
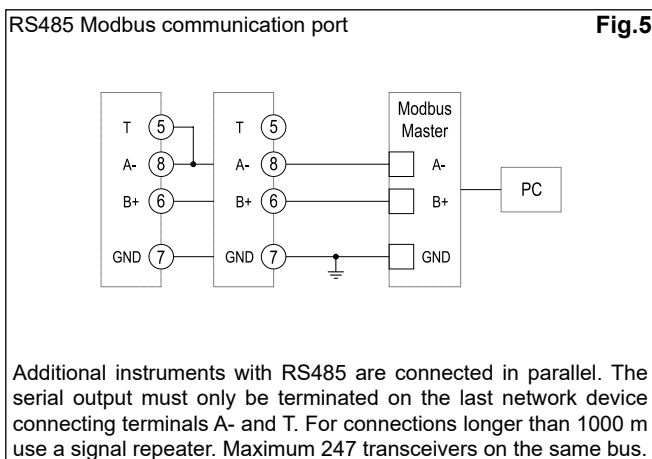
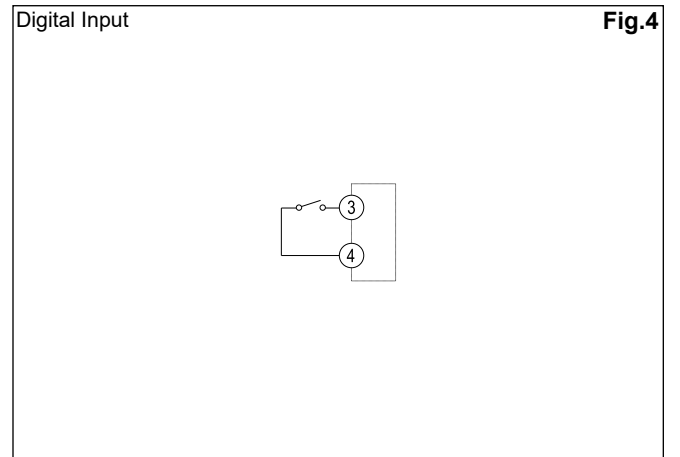
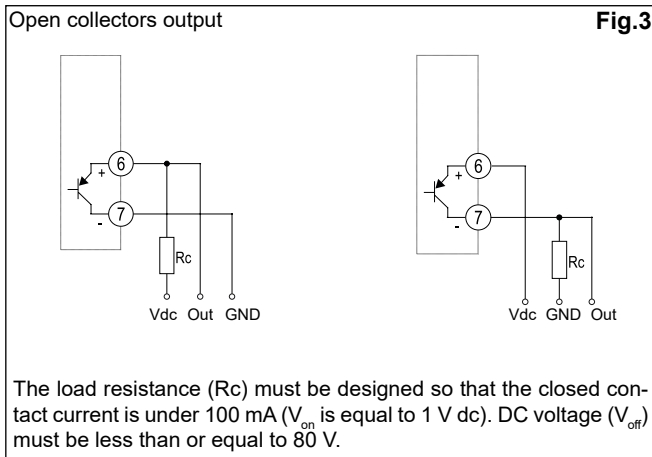
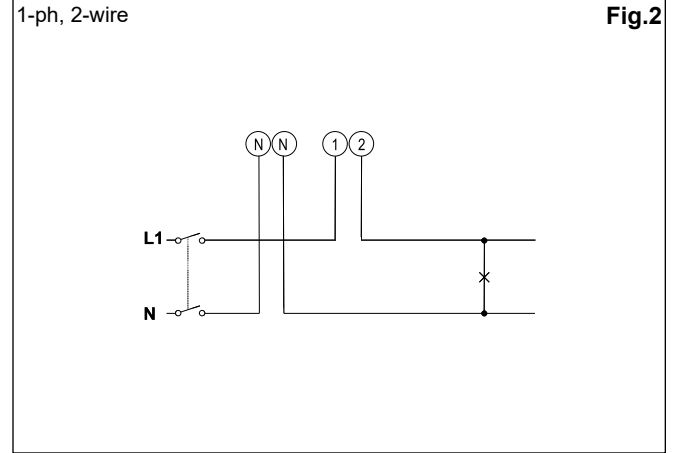
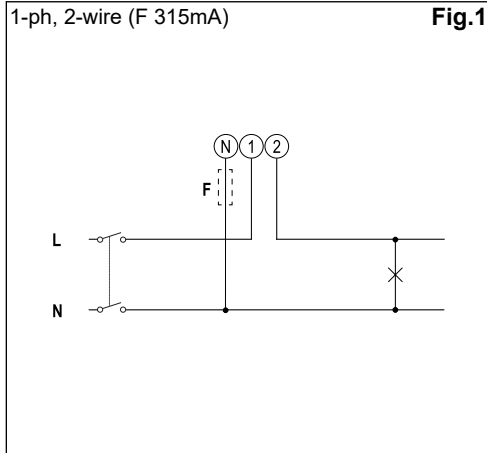
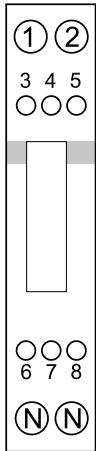
## Additional available information on the display (\*)

Type	Description	Note
Info page 1	YEA <sub>r</sub> (2013)	Year of production
Info page 2	SE <sub>R</sub> I <sub>A</sub> L (dddnnnA)	Serial number (ddd= day of the year; nnn=progressive number; A= production line, internal use only)
Info page 3	rEV (A.01)	Firmware revision
Info page 4	MEAS <sub>u</sub> rE	Measurement type
Info page 5	P int	Integration time for Wdmd calculation
Info page 6	ModE	Set of variables on display
Info page 7	tArI <sub>F</sub> F	Tariff enabling
Info page 8 (O1)	PULSE	Pulse ON duration
		Pulse rate
Info page 8 (S1)	AddrESS	Modbus serial address
Info page 9 (S1)	bAud	Modbus baud rate
Info page 10 (S1)	PARtY	Modbus parity
Info page 8 (M1)	PrI Add	M-bus primary address
Info page 9 (M1)	bAud	M-bus baud rate

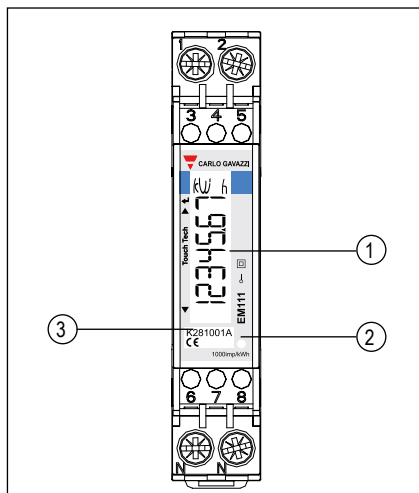
(\*) can be reached by pressing simultaneously the 2 touch keys



## Wiring diagrams

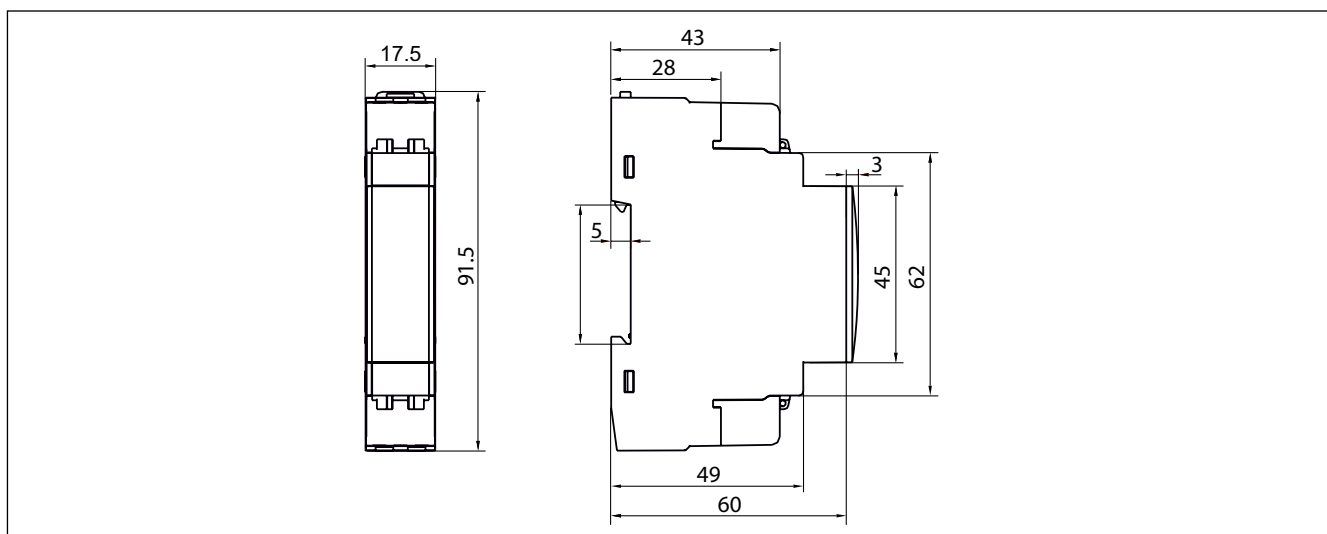


## Front panel description



1. **Display**  
Backlit LCD display with touch key-pad.  
Upper part: enter
2. **LED**  
LED proportional to kWh reading
3. **Serial number and MID data**  
Area reserved to serial number and MID-relevant data in PF versions

## Dimensions (mm)



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