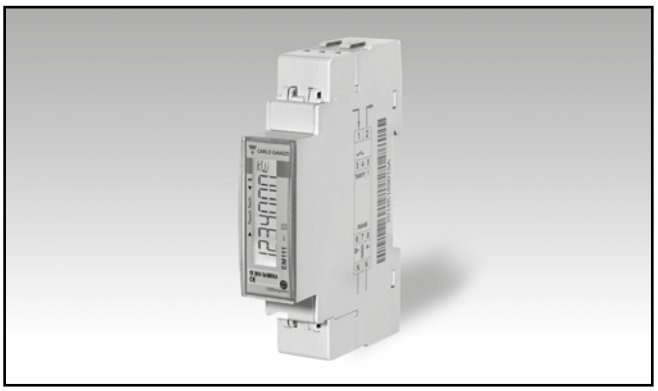
Energy Management
Energy Analyzer
Type EM111

CARLO GAVAZZI



- **Single phase energy analyzer**
- **Class 1 (kWh) according to EN62053-21**
- **Class B (kWh) according to EN50470-3**
- **Accuracy ±0.5% RDG (current/voltage)**
- **Direct current measurement up to 45AAC**
- **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)**
- **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**

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 45 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, Annex "B" + Annex "D" or Annex "B" + Annex "F" for legal metrology relevant to active electrical energy meters (see Annex MI-003 of MID). Can be used for fiscal (legal) metrology.

How to order

EM111-DIN AV8 1 X O1 PF B

- **Model**
- **Range code**
- **System**
- **Power supply**
- **Output**
- **Option**
- **Measurement**

Type Selection

Range code

AV8: 230VLN AC - 5(45)A (Direct connection)

AV7: 120VLN AC - 5(45)A (Direct connection)

System

1: 1-phase 2-wire

Power supply

X: Self power supply -30% +20% of the rated measuring input voltage, 50Hz

Output

O1: pulse output

S1: RS485 Modbus port

M1: M-bus port

Option

PF: Certified according to MID Directive, Annex"B" + Annex "D" for legal metrology relevant to active electrical energy meters (see Annex MI-003 of MID). Can be used for fiscal(legal) metrology.

Measurement

A: 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: Only the total positive energy meter is certified according to MID.

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STANDARD

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

How to order

EM111-DIN AV8 1 X O1 X

- **Model**
- **Range code**
- **System**
- **Power supply**
- **Output**
- **Option**

Type Selection

Range code

- **AV8:** 230VLN AC - 5(45)A (Direct connection)
- **AV7:** 120VLN AC - 5(45)A (Direct connection)

System

- **1:** 1-phase 2-wire

Power supply

- **X:** Self power supply -30% +20% of the rated measuring input voltage, 45 to 65Hz

Output

- **O1:** pulse output
- **S1:** RS485 Modbus port
- **M1:** M-bus port

Option

- **X:** none

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Input specifications

Rated Inputs	
Current type	1-phase loads, direct connection
Current range	5(45)A
Nominal voltage	230VLN AC (AV8 option), 120 VLN (AV7 option)
Accuracy (@25°C ±5°C, R.H. ≤60%, 45 to 65 Hz)	
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	
Active energy	Class 1 according to EN62053-21, and MID Annex MI-003 Class B (Class B (kWh) according to EN50470-3)
Reactive energy	Class 2 according to EN62053-23
Start-up current:	20mA (AV7, AV8), -20mA (AV7, AV8) positive or negative Self-consumption is not measured.
Start-up voltage	84VLN (AV7), 161VLN (AV8)
Resolution	Display/serial communication
Current	0.1/0.001 A
Voltage	0.1/0.1 V
Power	0.01 kW or kVar/ 0.1 W or var
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
Energy additional errors	
Influence quantities	According to EN62053-21
Temperature drift	≤200ppm/°C
Sampling rate	4096 samples/s @ 50Hz 4096 samples/s @ 60Hz
Display and touch key-pad	
Type	Backlit LCD, 7-digit, h 6 mm
Read-out	Energy: 7 digit. Variables: 4 digit
Touch key	2 (Enter and UP).
Max. and Min. indication	Max. 999 999.9 Min. 0.0
Memory energy storage	
Energy	10^10 cycles. Energy value is saved every time the less significant digit increases.
Programming parameters	10^10 cycles. When a parameter is modified, only the relevant memory cell is overwritten
LEDs	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
Current overloads	
Continuous	45A, @ 50Hz
For 10ms	1350 A
Voltage Overloads	
Continuous	1.2 Un
For 500ms	2 Un
Input impedance	
Voltage input 230VL-N	1.2 Mohm
Voltage input 120VL-N	1.2 Mohm
Current inputs: 5(45) A	< 0.5 VA

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Digital input specifications

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

Output specifications

RS485 serial port	RS485 by screw connection.
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,
Address	1 to 247 (default: 01)
Driver input capability	1/8 unit load. Maximum 247 transceivers on the same bus.
Data refresh time	1sec
Read command	50 words available in 1 read command
Rx/Tx indication	Rx segment on display is shown when a valid Modbus command is sent to that specific meter Tx segment on display is shown when a valid Modbus reply is sent back to the master
M-bus port	M-bus by screw connection.
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
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
Static output	
Purpose	For pulse output proportional to the active energy (kWh)
Pulse rate	Selectable in multiple of 100 Max 1000 or 3000 kWh according to pulse ON duration
Pulse ON duration	Selectable: 30ms or 100 ms according to EN62052-31
Output type	open collector PNP
Load	V_{ON} 1 VDC max. 100mA V_{OFF} 80 VDC max.

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General specifications

Operating temperature	-25 to +65 °C, indoor, (R.H. from 0 to 90% non-condensing @ 40°C)
Storage temperature	-30°C to +80°C (R.H. < 90% noncondensing @ 40°C)
Overvoltage category	Cat. III
Insulation (for 1 minute)	4000 VAC RMS between measuring inputs and digital/serial output (see table) 4000 VAC RMS
Dielectric strength	4000 VAC RMS for 1 minute
EMC	According to EN62052-11
Electrostatic discharges	15kV air discharge;
Immunity to irradiated electromagnetic fields	Test with current: 10V/m from 80 to 2000MHz; Test without any current: 30V/m from 80 to 2000MHz;
Burst	On current and voltage measuring inputs circuit: 4kV
Immunity to conducted disturbances	10V/m from 150KHz to 80MHz
Surge	On current and voltage measuring inputs circuit: 4kV;
Radio frequency	According to CISPR 22

Standard compliance	
Safety	EN62052-11
Metrology	EN62053-21, EN50470-3
Approvals	CE, MID (PF option only), cULus (AV7 option only)
Connections	
Cable cross-section area	Measuring inputs: max. 6 mm^2 with/without metallic cable ferrule; Max. screw tightening torque: 1.1 Nm
Other terminals	1.5 mm^2, Min./Max. screws tightening torque: 0.4 Nm
Housing	
Dimensions (WxDxH)	17,5 x 63 x 91,5 mm
Material	Noryl, self-extinguishing: UL 94 V-0
Sealing covers	Included
Mounting	DIN-rail
Protection degree	
Front	IP51
Screw terminals (cable inputs)	IP20
Weight	Approx. 80 g (packing included)

Power supply specifications

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

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Insulation (for 1 minute) between inputs and outputs

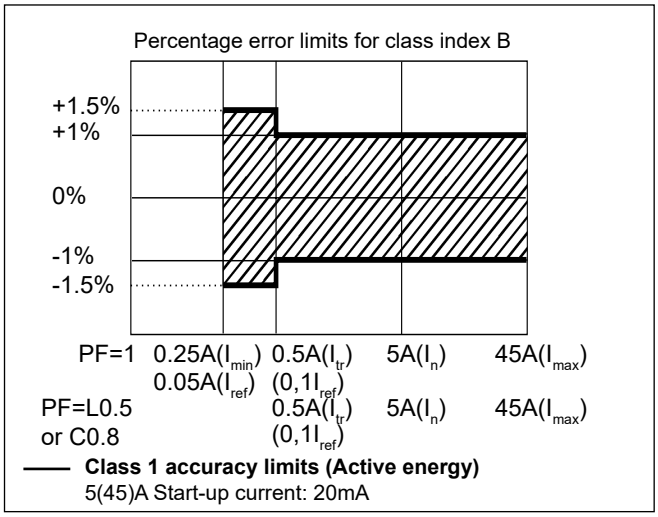
	Measuring input	Digital or serial output	Digital input
Measuring input	-	4 kV	4 kV
Digital or serial output	4 kV	-	-
Digital input	4 kV	-	-

MID "Annex MI-003" compliance (PF option only)

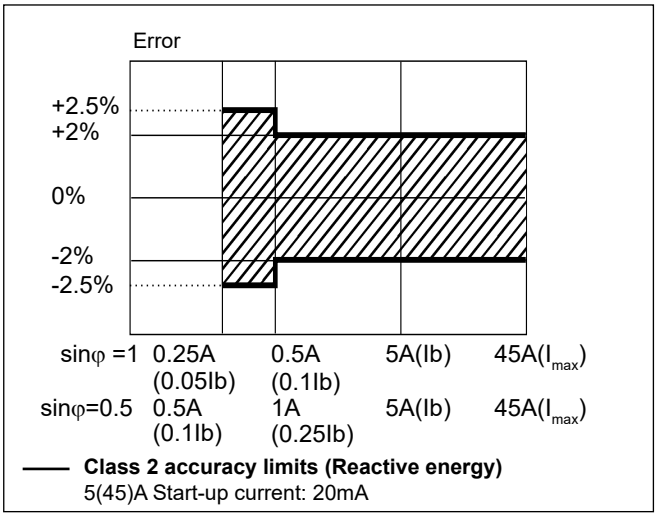
Accuracy	0.9 Un ≤ U ≤ 1.1 Un; 0.98 fn ≤ f ≤ 1.02 fn; fn: 50 Hz; cosφ: 0.5 inductive to 0.8 capacitive. Class B Considering listed Ib or In values
Operating temperature	-25 to +55°C (-13°F to 131°F) (R.H. from 0 to 90% non-condensing @ 40°C)
EMC compliance	E2
Mechanical compliance	M2

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

kWh, accuracy (RDG) depending on the current



kvarh, accuracy (RDG) depending on the current



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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

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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
Prl 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	YEAr (2013)	Year of production
Info page 2	SErIAL (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	MEASurE	Measurement type
Info page 5	P int	Integration time for Wdmd calculation
Info page 6	ModE	Set of variables on display
Info page 7	tArIFF	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)	PArItY	Modbus parity
Info page 8 (M1)	Prl Add	M-bus primary address
Info page 9 (M1)	bAud	M-bus baud rate

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

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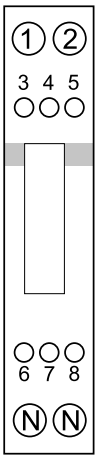
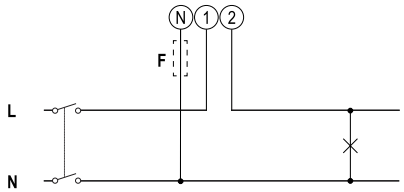
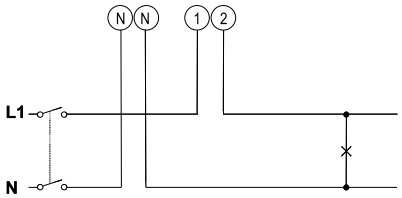
Wiring diagrams



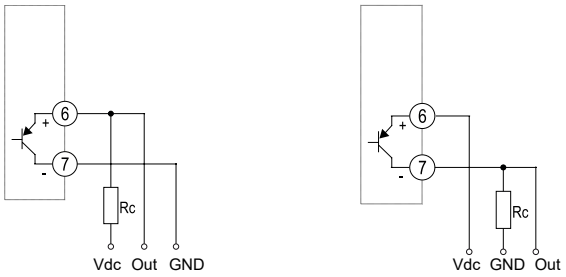
1-ph, 2-wire (F 315mA) **Fig.1**



1-ph, 2-wire **Fig.2**

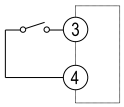


Open collectors output **Fig.3**

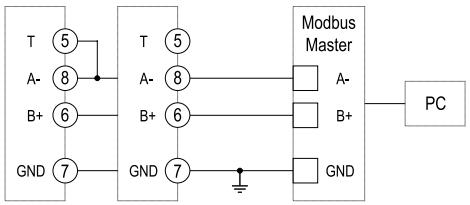


The load resistance (Rc) must be designed so that the closed contact current is under 100 mA (V_{on} is equal to 1 V dc). DC voltage (V_{off}) must be less than or equal to 80 V.

Digital Input **Fig.4**

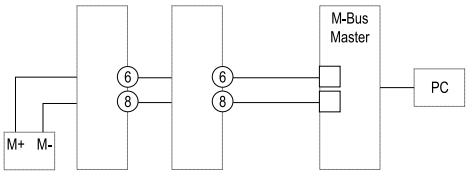


RS485 Modbus communication port **Fig.5**

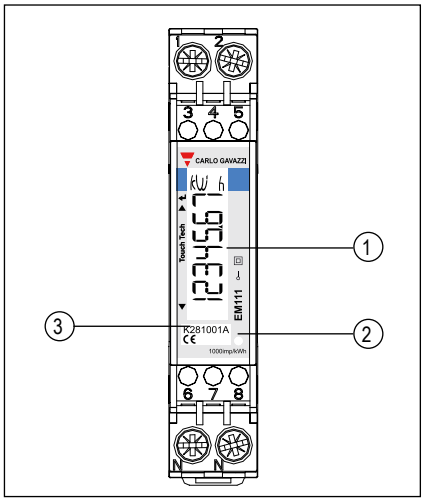


Additional instruments with RS485 are connected in parallel. The serial output must only be terminated on the last network device connecting terminals A- and T. For connections longer than 1000 m use a signal repeater. Maximum 247 transceivers on the same bus.

M-Bus communication port **Fig.6**

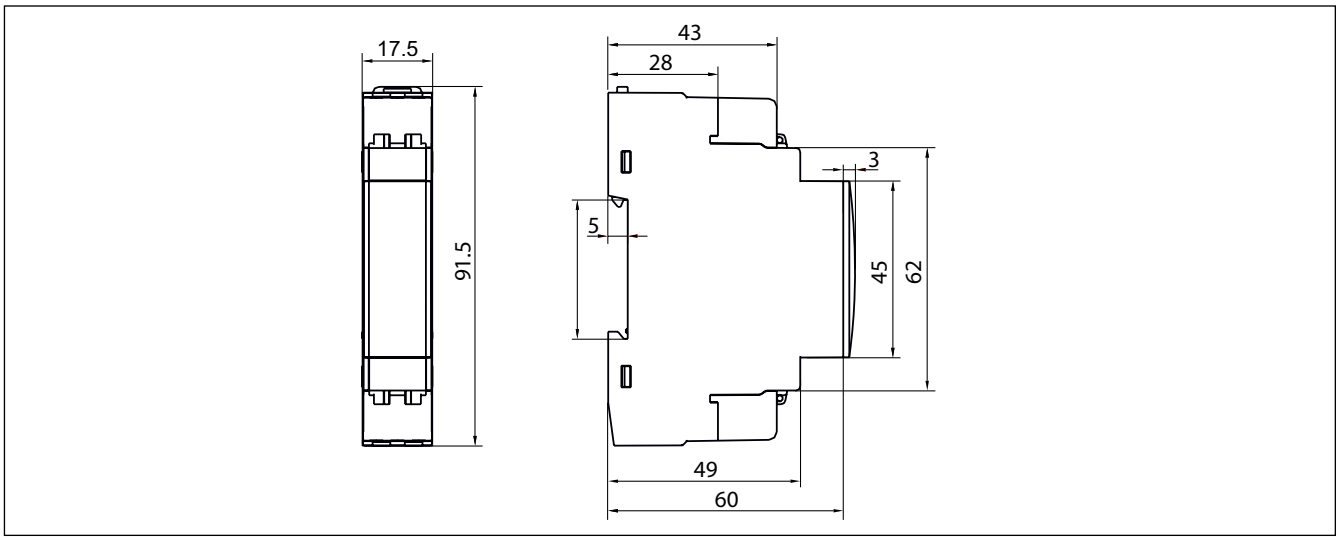


Front panel description



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)