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 ±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)
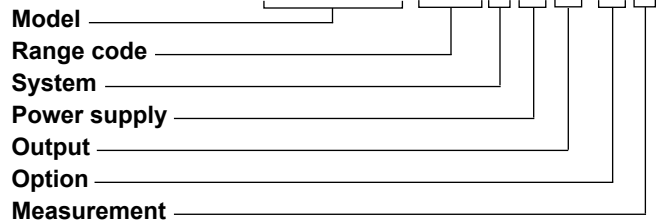
Product description

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

Model
Range code
System
Power supply
Output
Option
Measurement

Type Selection

Range code		System		Power supply		Output	
AV8:	230VLN AC - 5(45)A (Direct connection up to 32 A)	**1:**	1-phase 2-wire	**X:**	Self power supply -30% +20% of the rated measuring input voltage, 50Hz	**O1:**	pulse output
AV7:	120VLN AC - 5(45)A (Direct connection up to 32 A)					**S1:**	RS485 Modbus port
						M1:	M-bus port

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.

Option

PF: Certified according to MID Directive. Can be used for fiscal(legal) metrology.

CARLO GAVAZZI

How to order   EM111-DIN AV8 1 X O1 X

Model ───────────
Range code ───────────
System ───────────
Power supply ───────────
Output ───────────
Option ───────────

Type Selection

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

Option

X:	none

Input specifications

Rated Inputs	
Current type	1-phase loads, direct connection up to 32 A
Nominal current range	5(45)A
	Ib 5 A
	Imax 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 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

CARLO GAVAZZI

Digital input specifications

Digital inputs	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		
Input impedance	1kohm		
Contact resistance	1kohm, close contact 100kohm, open contact		

Output specifications

RS485 serial port	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,		
Address	1 to 247 (default: 01)	**Static output**	
Driver input capability	1/8 unit load. Maximum 247 transceivers on the same bus.	Purpose	For pulse output proportional to the active energy (kWh)
Data refresh time	1sec	Pulse rate	Selectable in multiple of 100
Read command	50 words available in 1 read command		Max 1000 or 3000 kWh according to pulse ON duration
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	Pulse ON duration	Selectable: 30ms or 100 ms according to EN62052-31
		Output type	open collector PNP
M-bus port	M-bus by screw connection.	Load	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		

CARLO GAVAZZI

General specifications

Operating temperature	-25 to +65 °C, indoor, (R.H. from 0 to 90% non-condensing @ 40°C)	**Standard compliance** Safety Metrology	 EN62052-11 EN62053-21, EN50470-3
Storage temperature	-30°C to +80°C (R.H. < 90% noncondensing @ 40°C)	**Approvals**	CE, MID (PF option only), cULus (AV7 option only)
Overvoltage category	Cat. III	**Connections** Cable cross-section area	 Measuring inputs: max. 6 mm^2 with/without metallic cable ferrule; Max. screw tightening torque: 1.1 Nm 1.5 mm², Min./Max. screws tightening torque: 0.4 Nm
Insulation (for 1 minute)	4000 VAC RMS between measuring inputs and digital/serial output (see table) 4000 VAC RMS	Other terminals	
Dielectric strength	4000 VAC RMS for 1 minute	**Housing** Dimensions (WxDxH) Material	 17,5 x 63 x 91,5 mm Noryl, self-extinguishing: UL 94 V-0
EMC Electrostatic discharges Immunity to irradiated electromagnetic fields	According to EN62052-11 15kV air discharge; Test with current: 10V/m from 80 to 2000MHz; Test without any current: 30V/m from 80 to 2000MHz;	Sealing covers	Included
		Mounting	DIN-rail
		Protection degree Front	 IP51
Burst	On current and voltage measuring inputs circuit: 4kV	Screw terminals (cable inputs)	IP20
		Weight	Approx. 80 g (packing included)
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		

Power supply specifications

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

CARLO GAVAZZI

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)

Accuracy	$0.9\,U_n \le U \le 1.1\,U_n$; $0.98\,f_n \le f \le 1.02\,f_n$; fn: 50 Hz; cos$\varphi$: 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

Specification are subject to change without notice EM111 DS 020518
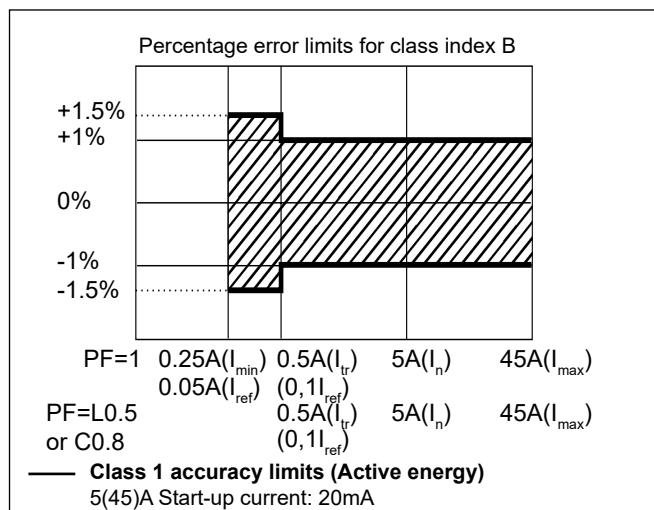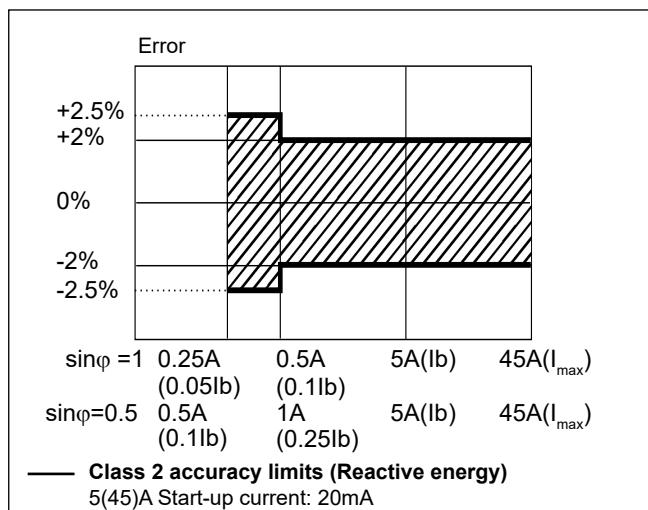
Display pages

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

CARLO GAVAZZI

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.
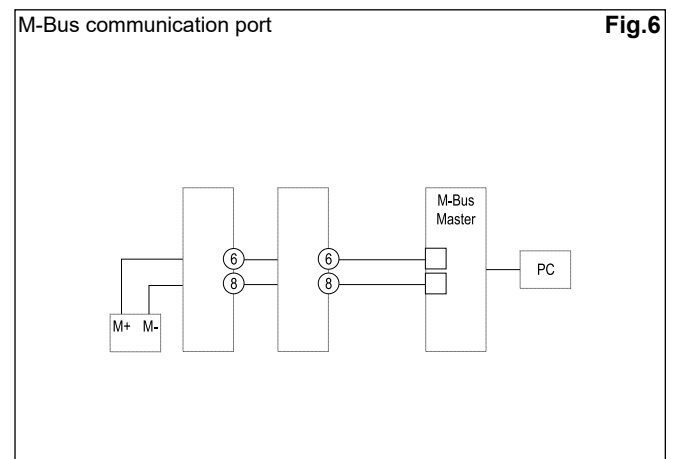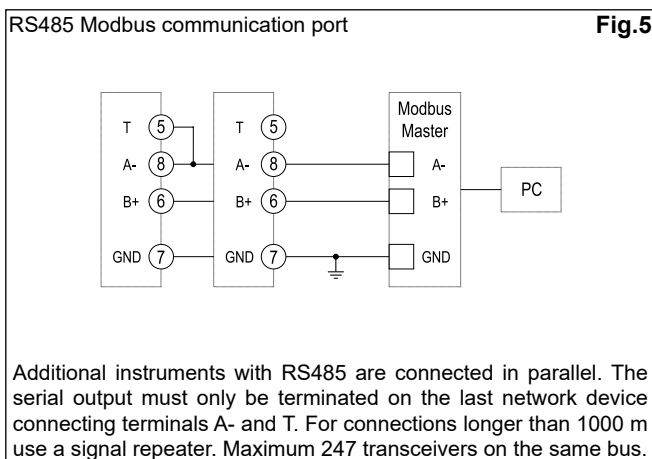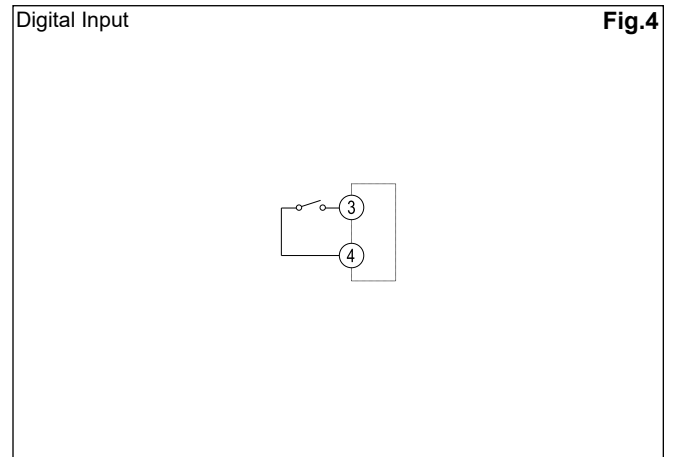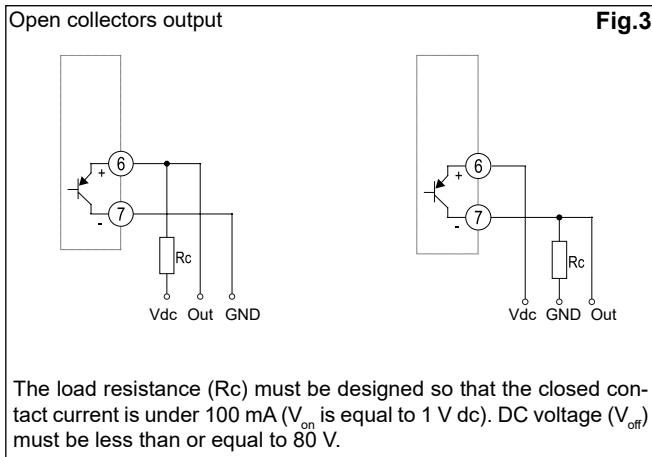
Additional available information on the display (*)

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

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**

CARLO GAVAZZI

Front panel description
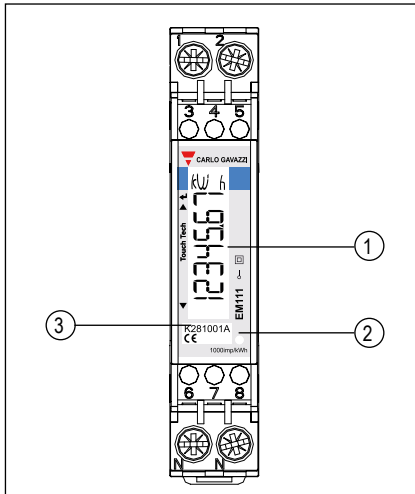
1. **Display**
   Backlit LCD display with touch key-pad.
   Upper part: enter

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)