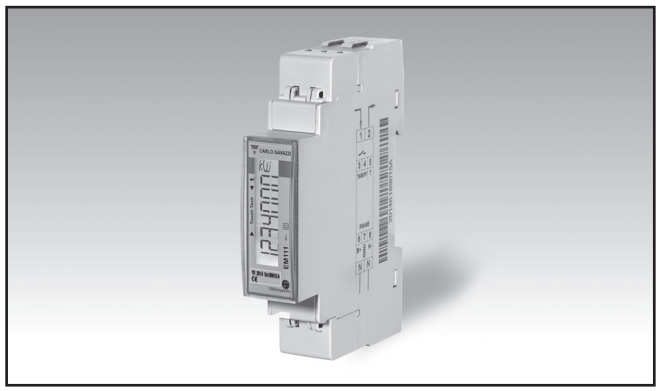
Energy Management
Energy Analyzer
Type EM111

CARLO GAVAZZI



- **Easy connection or wrong current direction detection**
- **Compliant with the international accuracy standard IEC/EN62053-21, and the IEC/EN61557-12 performance requirements (active power and active energy).**
- **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)**
- **Current measurement via 333 mV current sensor up to 600 A (MV5)**
- **Current measurement via CT up to 300 A (AV5)**
- **Rated primary current: 32 A (AV7, AV8)**
- **Max primary current: 45 A (AV7, AV8)**
- **Max cable cross section: 6 mm²**
- **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 (by open collector PNP)**
- **RS485 Modbus port**
- **M-Bus port**
- **Digital input (for tariff management)**

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) or up to 300 A (CT connection) or up to 600 A (333 mV current sensor), with dual tariff management availability. It can measure imported and exported energy or be programmed to sum them into an unique totalizer. Housing for DIN-rail mounting, with IP51 front degree protection. The meter is 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

AV8: 230VLN AC - 5(45)A (Direct connection up to 32 A)

System

1: 1-phase 2-wire

Power supply

X: Self power supply

Output

O1: pulse output
S1: RS485 Modbus port
M1: M-Bus port

Option

PF: Certified according to MID Directive. 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. Operating temperature: from –25 to +55°C/from –13 to +131°F

B: Only the total positive energy meter is certified according to MID. Operating temperature: from –25 to +55°C/from –13 to +131°F

A70: 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. Operating temperature: from –25 to +70°C/from –13 to +158°F

B70: Only the total positive energy meter is certified according to MID. Operating temperature: from –25 to +70°C/from –13 to +158°F

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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 up to 32 A)
- **AV7:** 120VLN ac - 5(45) A (Direct connection up to 32 A). Available on request (MOQ 100 pcs)
- **AV5:** 230VLN ac - 5(6)A (CT connection), **S1** output only
- **MV5:** 230VLN ac - 333 mV (current sensor connection), **S1** output only

System

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

Power supply

- **X:** Self power supply

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		
	AV7, AV8	1-phase loads, direct connection up to 32 A
	AV5	1-phase loads, CT connection (5A) Note: max CT ratio = 60 (300 A)
	MV5	1-phase loads, current sensor connection (333 mV) Note: max primary current = 600 A
Nominal current range		
	AV7, AV8	5(45)A, Ib 5 A, Imax 45 A, Imin 0.25 A
	AV5	5 (6) A, In 5A, Imax 6 A, Imin 0.25 A.
	MV5	333 mV (400 mV max)
Nominal voltage		
	AV5, AV8	230 VLN -30% +20 %
	AV7	120 VLN -20% +20%
	MV5	230 VLN -30% +20 %
Note		EM111 with direct connection (AV7, AV8) can be used up to 45 A if a 6 mm2 section wire complies with local regulations and/ or installation needs.
Accuracy (@25°C ±5°C, R.H. ≤60%, 45 to 65 Hz)		
Energies		
Active energy		Class 1 according to EN62053-21 Class B (kWh) according to EN50470-3 (option PF only)
Reactive energy		Class 2 according to EN62053-23
Start-up current		
	AV7, AV8	20 mA, positive or negative
	AV5	10 mA, positive or negative Self-consumption is not measured.
	MV5	0.666 mV
Start-up voltage		
	AV5, AV8	161 VLN
	AV7	96 VLN
	MV5	161 VLN
Resolution		Display
Current		0.1 A
Voltage		0.1 V
Power		0.01 kW or kVar
Frequency		0.1 Hz
PF		0.01
Energies (positive)		0.01 kWh or kvarh
Energies (negative)		0.01 kWh or kvarh
		Serial communication
Current		0.001 A
Voltage		0.1 V
Power		0.1 kW or kvar
Frequency		0.1Hz
PF		0.001
Energies (positive)		0.1 or 0.001 kWh or kvarh
Energies (negative)		0.1 or 0.001 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/DOWN and UP).
Max. and Min. indication		Max. 9 999 999 Min. 0.00
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
Pulse weight	AV7, AV8	1000 pulses/kWh (max. frequency: 11 Hz)
	AV5	Depending on CT ratio: CT ≤ 25: 1000 pulse/kWh 25 < CT < 60: 100 pulses/kWh
	MV5	Depending on primary current: Primary current ≤ 125 : 1000 pulses/kWh Primary current >125: 100 pulses/kWh
Note		Fix orange light: wrong current direction only with PFB option or with “B” measurement selection in case of X option
Current overloads		
Continuous	AV7, AV8	45 A
	AV5	6 A
	MV5	400 mV
For 10ms	AV7, AV8	1350 A
	AV5	120 A
Voltage Overloads		
Continuous		1.2 Un
For 500ms		2 Un
Input impedance		
Voltage input		2.8 Mohm
Current input	AV7, AV8	< 0.5 VA
	AV5	<0.05 VA
	MV5	1 kohm

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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 V ac/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,
parity control	even or no parity,
Address	1 to 247 (default: 1)
Driver input capability	1/8 unit load. Maximum 247 transceivers on the same bus.
Data refresh time	1 s
Read command	50 words available in 1 read command
M-Bus port	M-Bus by screw connection.
Function	For communication of measured data
Protocol	M-Bus according to EN13757-3
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 50000000 to 69999999
Other	Available functions: wild card, header, initialisation SND_NKE, and req_udr management. Management of primary address modification via M-Bus. VIF, VIFE, DIF and DIFE: see protocol
Note	not available with AV5 and MV5 range code
Static output	
Purpose	For pulse output proportional to the active energy (kWh)
Pulse rate	Selectable in multiple of 100 Max 1000 or 3000 pulses/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.
Note	not available with AV5 and MV5 range code

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General specifications

Operating temperature	
PF option (standard or with suffixes from 01 to 60)	From –25 to +55°C/from –13 to +131°F
PF option (with suffixes from 61 to 99)	From –25 to +70°C/from –13 to +158°F
X option	From –25 to +65°C/from –13 to +149°F indoor, (R.H. from 0 to 90% non-condensing @ 40°C)
Storage temperature	-30°C to +80°C (R.H. < 90% non-condensing @ 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 (X option) According to EN50470-1 (PF option)
Standard compliance	
Safety	EN62052-11 (X option) EN50470-1 (PF option)
Metrology	EN62053-21, EN62053-23, EN50470-3 (PF option only) IEC/EN61557-12 (active power and active energy, MID models only)
Approvals	CE, UKCA, 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	PBT, 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

Power supply	self power supply
Power consumption	≤ 1.0W, ≤ 8VA

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Insulation (for 1 minute) between inputs and outputs

AV7, AV8 model	Measuring input	Digital or serial output	Digital input
Measuring input	-	4 kV	4 kV
Digital or serial output	4 kV	-	-
Digital input	4 kV	-	-

AV5 model	CT input (5 A)	Voltage input	Serial output	Digital input
CT input (5 A)	-	2 kV	4 kV	4 kV
Voltage input	2 kV	-	4 kV	4 kV
Serial output	4 kV	4 kV	-	4 kV
Digital input	4 kV	4 kV	4 kV	-

MV5 model	CT input (333 mV)	Voltage input	Serial output	Digital input
CT input (333 mV)	-	2 kV	4 kV	4 kV
Voltage input	2 kV	-	4 kV	4 kV
Serial output	4 kV	4 kV	-	4 kV
Digital input	4 kV	4 kV	4 kV	-

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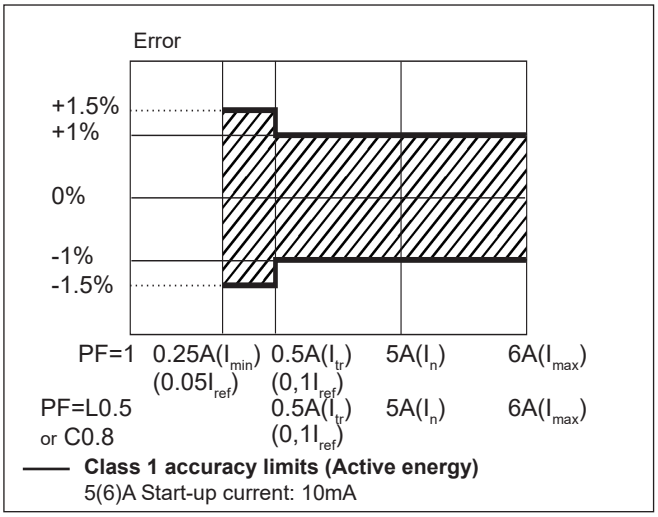
MID compliance (PF option only)

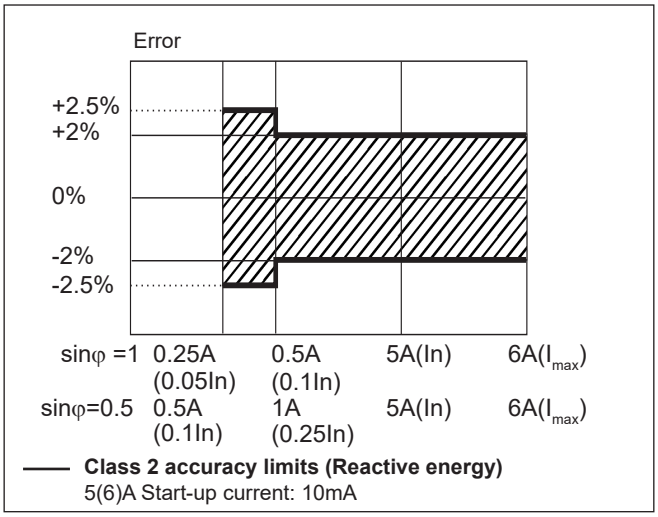
Accuracy	0.9 Un ≤ U ≤ 1.1 Un; 0.98 fn ≤ f ≤ 1.02 fn; fn: 50 Hz; cosφ: 0.5 inductive to 0.8 capacitive. Class B Considering listed Ib or In values
Operating temperature	PF option (standard or with suffixes from 01 to 60): from –25 to +55°C/from –13 to +131°F PF option (with suffixes from 61 to 99): from –25 to +70°C/from –13 to +158°F X option: from –25 to +65°C/from –13 to +149°F indoor (R.H. from 0 to 90% non-condensing @ 40°C)
EMC compliance	E2
Mechanical compliance	M2

Accuracy (according to EN62053-21 and EN62053-23) - AV5 model

kWh, accuracy (RDG) depending on the current



kvarh, accuracy (RDG) depending on the current



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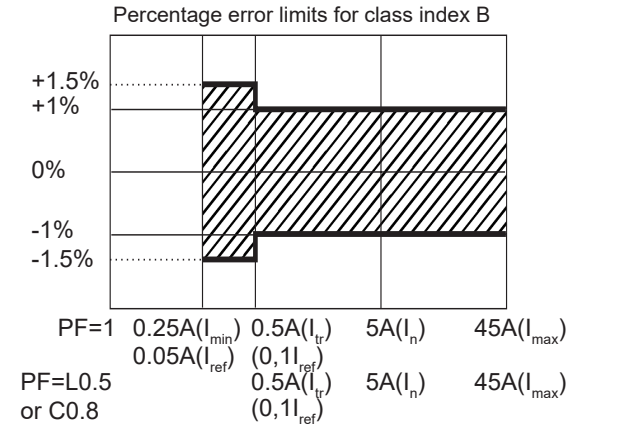
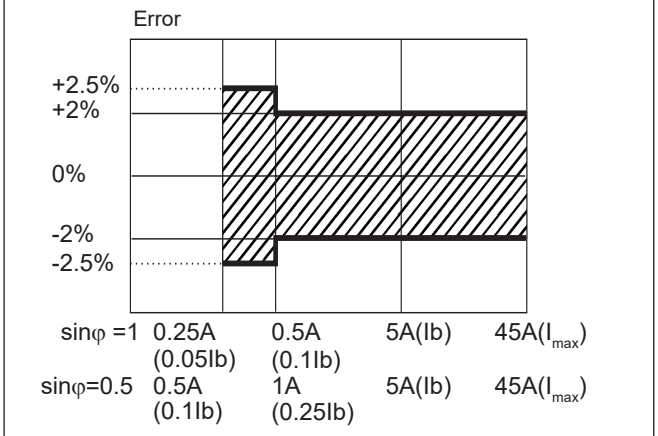
Accuracy (according to EN50470-3 and EN62053-23) - AV7/AV8 model

kWh, accuracy (RDG) depending on the current



kvarh, accuracy (RDG) depending on the current



Measurement accuracy according to IEC/EN61557-12 (MID versions)

Active power	Performance class 1	**Active energy**	Performance class 2

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
Ct RatIo (AV5)	Current transformer ratio	From 1 to 60	20
PrI Curr (MV5)	Primary current	From 1 to 600	100
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 weight (multiplies of 100 pulses/kWh)	100 to 1000 (if duration is 100ms) 100 to 3000 (if 30 ms)	1000
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	0
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 (kWh/kvarh partial meter reset 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.

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Additional available information on the display (*)

Type	Page	Description
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	Ct RatIo (AV5)	Current transformer ratio
Info page 5	Prl Curr (MV5)	Primary current
Info page 6	MEASurE	Measurement type
Info page 7	P int	Integration time for Wdmd calculation
Info page 8	ModE	Set of variables on display
Info page 9	tArIFF	Tariff enabling
Info page 10 (O1)	PULSE	Pulse ON duration
		Pulse weight
Info page 10 (S1)	AddrESS	Modbus serial address
Info page 11 (S1)	bAud	Modbus baud rate
Info page 12 (S1)	PArItY	Modbus parity
Info page 10 (M1)	Prl Add	M-Bus primary address
Info page 11 (M1)	bAud	M-Bus baud rate
Info page 13	ChECk_S	FW checksum

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

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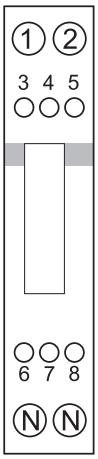
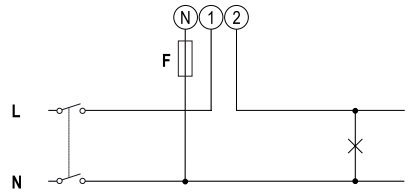
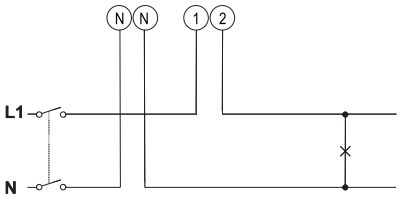
AV7, AV8 wiring diagrams



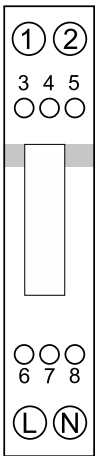
1-ph, 2-wire (F 315mA) **Fig.1**



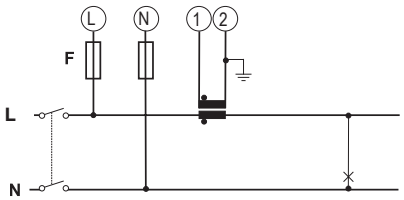
1-ph, 2-wire **Fig.2**



AV5 wiring diagrams

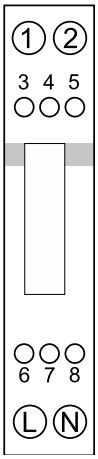


1-ph, 2-wire (F=315 mA) **Fig.3**

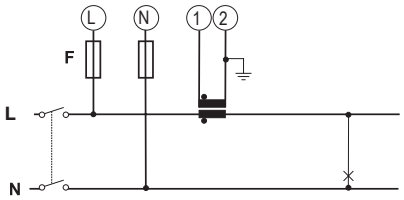


1-CT connection

MV5 wiring diagrams



1-ph, 2-wire (F=315 mA) **Fig.4**



1-current sensor connection

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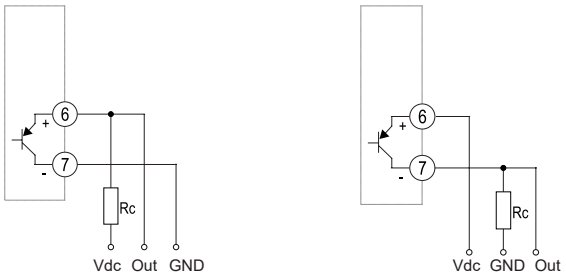
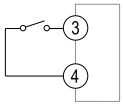
Input/output communication

Open collectors output **Fig.4**

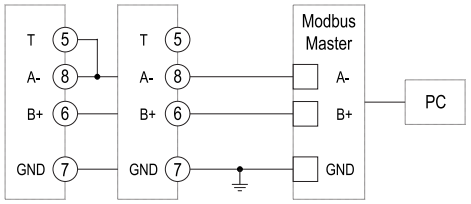


The load resistance (Rc) must be designed so that the closed contact current is under 100 mA (V_{on} is equal to 1 V dc). DC voltage (V_{off}) must be less than or equal to 80 V.

Digital Input **Fig.5**

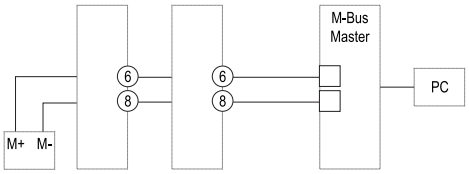


RS485 Modbus communication port **Fig.6**

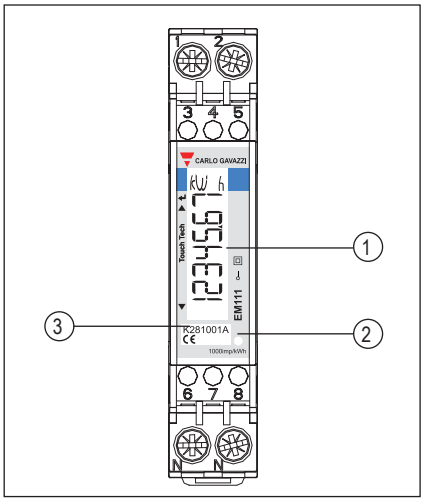


Additional instruments with RS485 are connected in parallel. The serial output must only be terminated on the last network device connecting terminals A- and T. For connections longer than 1000 m use a signal repeater. Maximum 247 transceivers on the same bus.

M-Bus communication port **Fig.7**



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)