

# Energy Management Energy Analyzer Type EM11 DIN



- Class 1 (kWh) according to EN62053-21
- Class 2 (kvarh) according to EN62053-23
- Accuracy  $\pm 0.5$  RDG (current/voltage)
- Energy analyzer
- Instantaneous variables readout: 4 DGT
- Energies: 5+1 DGT
- Instantaneous variables: V, A, W, Wdmd, Wdmd max, var, PF, Hz
- Single phase variables: VLL, VLN, A, VA, W, var, PF
- Energy measurements: total kWh and kvarh
- TRMS measurements of distorted sine waves (voltages/currents)
- Self power supply
- Dimensions: 1-DIN module
- Protection degree (front): IP40
- 1 pulse output on request
- 1 alarm output on request
- MID "annex MI-003" (Measuring Instruments Directive) compliant

## Product Description

One-phase energy analyzer with built-in configuration push button and LCD data displaying; particularly indicated for active and reactive energy metering and for cost allocation. Housing for DIN-rail mounting, IP40 (front) protection degree. Direct

connection up to 32A. Moreover the meter can be provided with either pulse output proportional to the active energy being measured or alarm control on the available instantaneous variables.

## How to order **EM11 DIN AV8 1 X O1 X**



## Type Selection

Range code	System	Power supply	Output
<b>AV7:</b> 120V <sub>LN</sub> AC - 5(32)A (**) (direct connection)	<b>1:</b> 1-phase	<b>X:</b> Self power supply (from 48 to 62Hz). The instrument works on the range from -20% to +20% of the measuring input nominal voltage.	<b>XX:</b> None (**) <b>O1:</b> Pulse type (open collector output) (*) <b>R1:</b> Alarm type (relay output) (*) <b>B1:</b> Buzzer output (**)
<b>AV8:</b> 230V <sub>LN</sub> AC - 5(32)A (*) (direct connection)	<b>Option</b>		
(*) as standard. (**) on request.	<b>X:</b> None (*)		

## Input specifications

<b>Rated inputs</b> Current range (by shunt) Voltage range	System: 1 AV7 and AV8: 5(32)A AV7: 120 VLN AC AV8: 230 VLL AC	Active power Reactive power Active energy	$\pm(1\%RDG + 2DGT)$ $\pm(2\%RDG + 2DGT)$ Class 1 according to EN62053-21 and MID Annex MI-003 Class B.
<b>Accuracy (Display)</b> (@25°C $\pm 5^\circ C$ , R.H. $\leq 60\%$ , 48 to 62Hz)	lb: 5A, Imax: 32A; Un: 120VLN (-20% +20%) AV8 model lb: 5A, Imax: 32A; Un: 230VLN (-20% +20%)	Reactive energy	Class 2 according to EN62053-23.
Current		Reference values	lb: 5A, Imax: 32A, 0.1 lb: 0.5A 20mA
Voltage	From 0.04lb to 0.2lb: $\pm(0.5\% RDG + 3DGT)$ From 0.2lb to Imax: $\pm(0.5\% RDG + 1DGT)$ .	Start up current:	
Frequency	In the Un range: $\pm(0.5\% RDG + 2DGT)$ $\pm 0.1Hz$ (48 to 62Hz)	<b>Energy additional errors</b> Influence quantities	According to EN62053-21, EN62053-23
		<b>Temperature drift</b>	$\leq 200ppm/^\circ C$
		<b>Sampling rate</b>	1600 samples/s @ 50Hz 1900 samples/s @ 60Hz

## Input specifications

<b>Display</b>	1 line (max: 5+1 DGT)	<b>Crest factor</b>	1b 5A ≤4 (45A max. peak)
Type	LCD, h 7mm	<b>Current Overload</b>	
Instantaneous variables read-out	4 DGT (V and A) 3 DGT (W, var, Wdmd, Wdmd max, Hz, PF)	Continuous	32A, @ 50Hz
Min. Max. indication	Max. 9 999; Min. 0 (0.0)	For 10ms	960A, @ 50Hz
Energies	Total: 5+1 DGT	<b>Voltage Overload</b>	
<b>LEDs</b>	Red LED (Energy consumption), 1000 pulses/kWh (Max Frequency 16 Hz) according to EN62053-11	Continuous	1.2 Un
<b>Measurements</b>	See "Measuring variables and Min. Max. indications"	For 500ms	2 Un
Method	TRMS measurements of distorted wave forms	<b>Input impedance</b>	
Coupling type	Direct	120VL-N (AV7)	>720KΩ
		230VL-N (AV8)	>720KΩ
		5(32) A (AV7-AV8)	< 0.5VA
		<b>Frequency</b>	48 to 62 Hz
		<b>Key-pad</b>	1 push-button for variable selection and programming of the instrument working parameters

## Output specifications

<b>Digital output</b>	(on request)		
Number of outputs	1	On-time delay	"Measuring variables and Min. Max. indications") 0 to 9999s (166min)
Type	Open collector, programmable from 0.001 to 1 kWh for each pulse.	Off-time delay	0 to 9999s (166min)
Signal	V <sub>ON</sub> 1.2 VDC/ max. 100 mA V <sub>OFF</sub> 30 VDC max.	Min. response time	≤ 1s, set-point on-time delay: "0 s"
Pulse duration	≥100ms < 120msec (ON), ≥120ms (OFF), according to EN62052-31	Insulation	4000 VRMS output to measuring inputs
Insulation	By means of optocouplers, 4000 VRMS output to measuring inputs	<b>Buzzer</b>	(on request)
<b>Alarm output</b>	(on request)	Type	It sounds when the alarm is ON
Number of outputs	1	Alarm modes	Beep type 70dB
Type	Reed Relay, SPST type AC 1-5A @ 250VAC DC 12-5A @ 24VDC AC 15-1.5A @ 250VAC DC 13-1.5A @ 24VDC	Controlled variables	Up alarm or down alarm kW, kWdmd, kvar, PF, A, V, Hz
Alarm modes	Up alarm or down alarm	Set-point adjustment	Programmable on all the measuring range (see "Measuring variables and Min. Max. indications")
Controlled variables	kW, kWdmd, kvar, PF, A, V, Hz	Hysteresis	programmable on all the measuring range (see "Measuring variables and Min. Max. indications")
Set-point adjustment	Programmable on all the measuring range (see "Measuring variables and Min. Max. indications")	On-time delay	0 to 9999s (166min)
Hysteresis	programmable on all the measuring range (see "Measuring variables and Min. Max. indications")	Off-time delay	0 to 9999s (166min)
		Min. response time	≤ 1s, set-point on-time delay: "0 s"

## Software functions

<b>Password</b>	Numeric code of max. 4 digits; 2 protection levels of the programming data: Password "0", no protection; Password from 1 to 9999, all data are protected	<b>Displaying</b>	1 variable per page (See «Measuring variables and Min. Max. indications»)
1st level		<b>Reset</b>	By means of the front key-pad: - W dmd max; - energies: kWh, kvarh
2nd level			

## General specifications

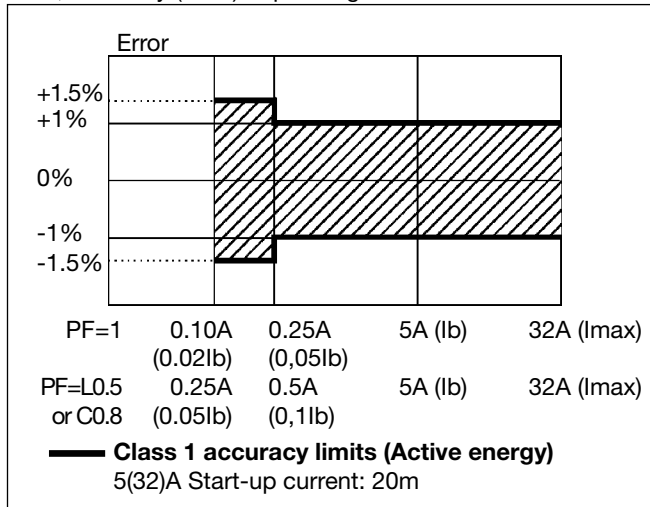
<b>Operating temperature</b>	-25°C to +55°C (13°F to 131°F) (R.H. from 0 to 90% non-condensing @ 40°C) according to EN62053-21 and EN62053-23	<b>Surge</b>	On current and voltage measuring input circuits: 4kV;
<b>Storage temperature</b>	-30°C to +70°C (22°F to 140°F) (R.H. < 90% non-condensing @ 40°C) according to EN62053-21 and EN62053-23	<b>Radio frequency suppression</b>	According to CISPR 22
<b>Installation category</b>	Cat. III (IEC60664, EN60664)	<b>Standard compliance</b>	
<b>Insulation (for 1 minute)</b>	4000 VRMS between measuring inputs and digital output (O1 and R1).	<b>Safety</b>	IEC60664, IEC61010-1 EN60664, EN61010-1 EN62052-11
<b>Dielectric strength</b>	4000 VRMS for 1 minute	<b>Metrology</b>	EN62053-21, EN62053-23. MID "annex MI-003"
<b>CMRR Noise rejection</b>	100 dB, 48 to 62 Hz	<b>Pulse output Approvals</b>	DIN43864, IEC62053-31 CE, PTB (Revenue Approvals)
<b>EMC</b>	According to EN62052-11	<b>Connections</b>	Screw-type
Electrostatic discharges	8kV air discharge;	<b>Cable cross-section area</b>	Min. 2.5 mm <sup>2</sup> , Max. 10 mm <sup>2</sup> (measuring inputs);
Immunity to irradiated electromagnetic fields	Test with applied current: 10V/m from 80 to 2000MHz; Test without any applied current: 30V/m from 80 to 2000MHz;		Other terminals: 1.5 mm <sup>2</sup> Min./Max. screws tightening torque: 1 Nm / 4 Nm
Burst	On current and voltage measuring input circuits: 4kV	<b>DIN Housing</b>	
Immunity to conducted disturbances	10V/m from 150KHz to 80MHz	<b>Dimensions (WxHxD)</b>	17.5 (+0.5 -0) x 90 x 67.5 mm
		<b>Material</b>	Nylon PA66, self-extinguishing: UL 94 V-0
		<b>Mounting</b>	DIN-rail
		<b>Protection degree</b>	
		<b>Front</b>	IP40
		<b>Screw terminals</b>	IP20
		<b>Weight</b>	Approx. 100 g (packing included)

## Power supply specifications

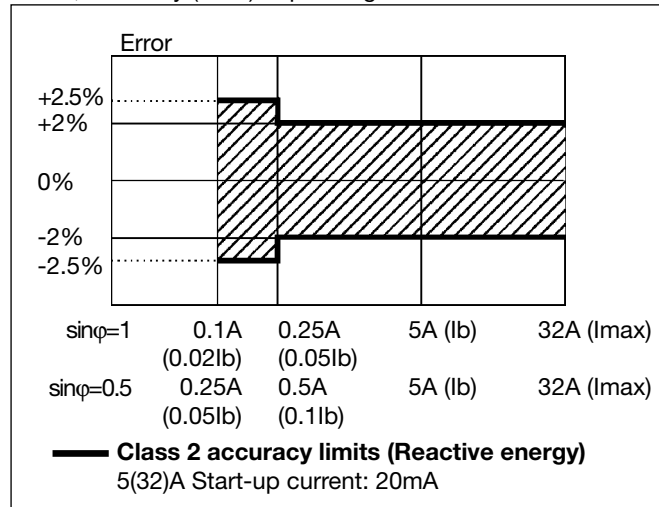
<b>Self supplied version</b>	120VLN, 230 VLN (-20% +20%) 48-62Hz	<b>Power consumption</b>	≤ 3VA
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## Accuracy

kWh, accuracy (RDG) depending on the current



kvarh, accuracy (RDG) depending on the current



## MID "Annex MI-003" compliance

### Accuracy

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 or 60Hz;  
 $\cos\phi$ : 0.5 inductive to 0.8  
capacitive.  
Class B  
 $I_{st}$ : 0.025A;  
 $I_{min}$ : 0.32A;  
 $I_{tr}$ : 0.64A;  
 $I_{max}$ : 32A.

### Operating temperature

-25°C to +55°C (13°F to  
131°F) (R.H. from 0 to 90%  
non-condensing @ 40°C)

### EMC compliance

E2

## Used calculation formulas

### Phase variables

Instantaneous effective voltage

$$V_{IN} = \sqrt{\frac{1}{n} \cdot \sum_1^n (V_{IN})_i^2}$$

Instantaneous active power

$$W_1 = \frac{1}{n} \cdot \sum_1^n (V_{IN})_i \cdot (A_1)_i$$

Instantaneous power factor

$$\cos\phi_1 = \frac{W_1}{VA_1}$$

Instantaneous effective current

$$A_1 = \sqrt{\frac{1}{n} \cdot \sum_1^n (A_1)_i^2}$$

Instantaneous apparent power

$$VA_1 = V_{IN} \cdot A_1$$

Instantaneous reactive power

$$\text{var}_1 = \sqrt{(VA_1)^2 - (W_1)^2}$$

### Energy metering

$$kWh_i = \int_{t_1}^{t_2} P_i(t) dt \cong \Delta t \sum_{n_1}^{n_2} P_{nj}$$

$$kvarh_i = \int_{t_1}^{t_2} Q_i(t) dt \cong \Delta t \sum_{n_1}^{n_2} Q_{nj}$$

Where:

**i**= considered phase (L1)

**P**= active power;

**Q**= reactive power;

**t<sub>1</sub>, t<sub>2</sub>**=starting and ending time points  
of consumption recording;

**n**= time unit;

**Δt**= time interval between two

successive power consumptions;

**n<sub>1</sub>, n<sub>2</sub>** = starting and ending discrete

time points of consumption recording

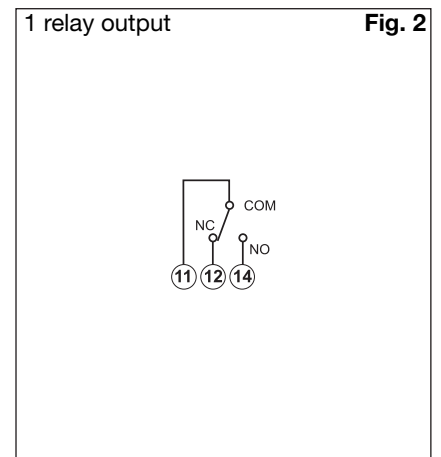
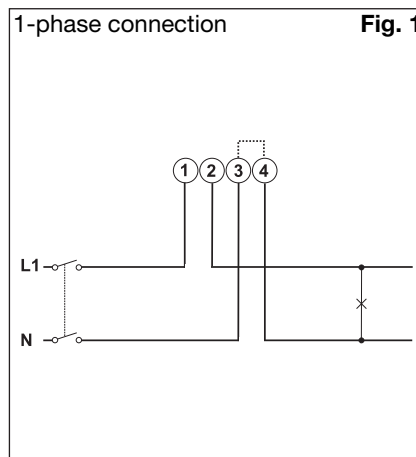
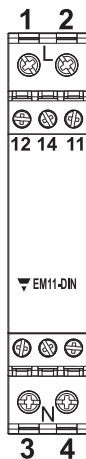
## Measuring variables and Min. Max. indications

Page number	Variable	Min. Max. Indication	Notes
1	kWh	from 0.0 to 99999.9	Total (only consumed energy)
2	kvarh	from 0.0 to 99999.9	Total (only consumed energy)
3	kW	from 0.00 to 9.99	
4	kW dmd	from 0.00 to 9.99	Integration time programmable from 1 to 30 minutes
5	kW dmd max	from 0.00 to 9.99	Max value with data storage (in EEPROM)
6	V	from 0.0 to 999.9	
7	A	from 0.0 to 32.00	
8	Hz	from 48.0 to 62.0	
9	PF (cosφ)	from L/C. 00 to L/C. 99	
10	kvar	from 0.00 to 9.99	

## Insulation between inputs and outputs

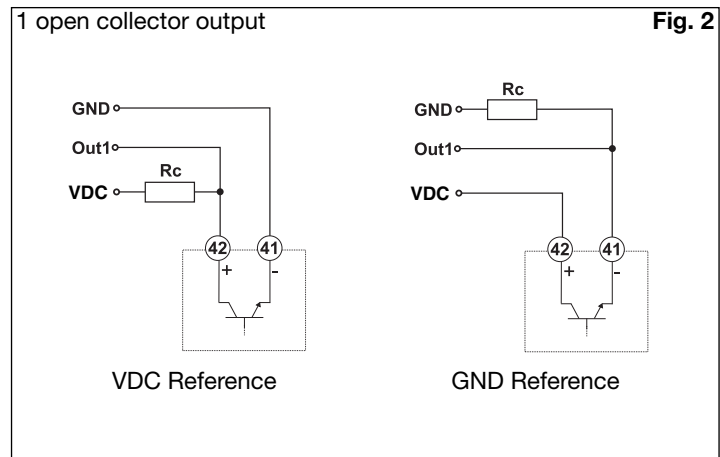
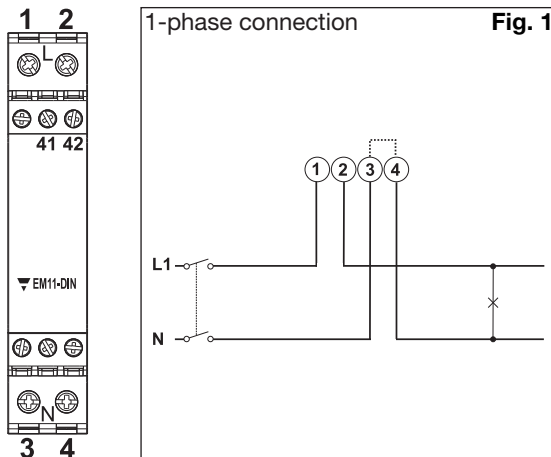
	Measuring inputs	Relay output	Open collector output	AC self-power supply
Measuring inputs	-	4kV	4kV	0kV
Relay output	4kV	-	4kV	4kV
Open collector output	4kV	4kV	-	4kV
AC self-power supply	0kV	4kV	4kV	-

## Wiring diagrams and relay output (R1)



**NOTE:** The 3 and 4 terminals, in the instrument, are wired together

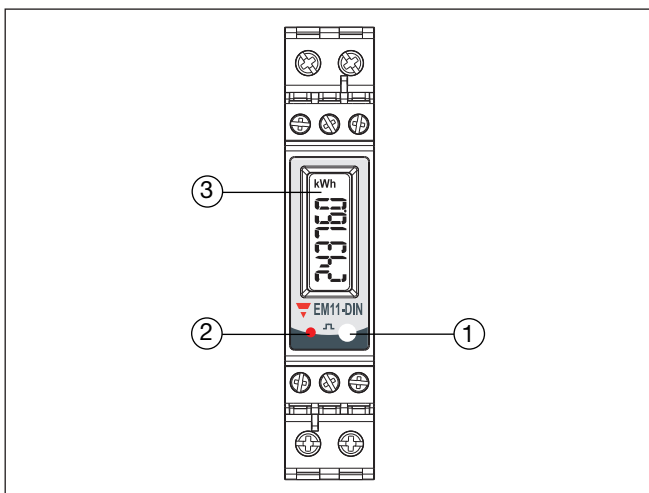
## Wiring diagrams and open collector output (O1)



**NOTE:** The 3 and 4 terminals, in the instrument, are wired together

The load resistances (Rc) must be designed so that the close contact current is lower than 100mA; the VDC voltage must be lower than or equal to 30VDC.

## Frontal panel description



- 1. Push button**  
To program the configuration parameters and the display of the variables.
- 2. LED**  
Red LED to show the consumed energy.
- 3. Display**  
LCD-type with alphanumeric indication to:
  - display configuration parameters;
  - display all the measured variables.

## Dimensions and panel cut-out

