# Energy Management
# Energy Meter
# Type EM23 DIN

- **Certified according to MID Directive (option PF only): see "how to order" below**
- **Other version available (not certified, option X): see "how to order" on the next page**

- **Class 1 (kWh) according to EN62053-21**
- **Class B (kWh) according to EN50470-3**
- **Class 2 (kvarh) according to EN62053-23**
- **Accuracy ±0.5 RDG (current/voltage)**
- **Energy meter**
- **Instantaneous variables readout: 3 DGT**
- **Energies readout: 7 DGT**
- **System variables: W, var, Phase-sequence.**
- **Single phase variables: A**
- **Energy measurements: total kWh and kvarh**
- **TRMS measurements of distorted sine waves (voltages/currents)**
- **Self power supply**
- **1 pulsating output (optional)**
- **RS485 serial communication port (MODBUS-RTU) optional**
- **Dimensions: 4-DIN modules**
- **Protection degree (front): IP50**
- **Easy connections management**

## Product Description

Three-phase energy meter with built-in configuration joystick and LCD data displaying; particularly indicated for active and reactive energy metering and for cost allocation. Housing for DIN-rail mounting with IP50 (front) protection degree. Direct connection up to 65A. Moreover the meter is provided with either one pulsating output proportional to the active energy being measured or a serial commonication port.

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

## How to order

**EM23 DIN AV9 3 X O1 PF A**

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

## Type Selection

**Range codes**

**AV2:** 400$V_{LL}$AC 10(65)A (direct connection) $V_{LN}$: 113V to 265$V_{LN}$ $V_{LL}$: 196V to 460$V_{LL}$

**AV9:** 400$V_{LL}$ AC - 10(65)A (direct connection) $V_{LN}$: 184V to 276$V_{LN}$ $V_{LL}$: 318V to 480$V_{LL}$

**System**

**3:** Balanced and unbalanced load: 3-phase, 4-wire

**Output**

**O1:** Open collector type (single pulse output)

**S1:** RS485 port

**Power supply**

**X:** Self power supply

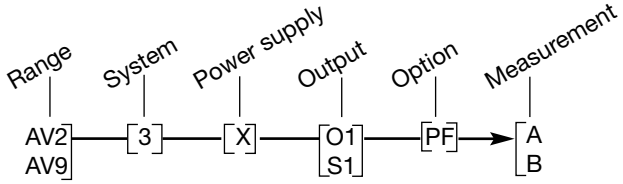
**Measurement**

**A:** The power is always integrated -both in case of positive (imported) and negative (exported) power

**B:** only the positive (imported) power is integrated - no integration in case of negative (exported) power

**Options**

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




**NOTE: please check the availability of the needed code on the verification path diagram on left before order .**

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## STANDARD

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

## How to order

**EM23 DIN AV9 3 X O1 X**

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

## Type Selection

**Range codes**

**AV2:** 400$V_{LL}$AC 10(65)A (direct connection)
$V_{LN}$: 113V to 265$V_{LN}$
$V_{LL}$: 196V to 460$V_{LL}$

**AV9:** 400$V_{LL}$ AC - 10(65)A (direct connection)
$V_{LN}$: 184V to 276$V_{LN}$
$V_{LL}$: 318V to 480$V_{LL}$

**System**

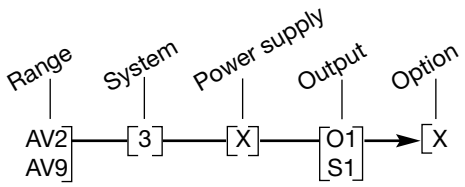
**3:** Balanced and unbalanced load: 3-phase, 4-wire; 3-phase, 3-wire;

**Output**

**O1:** Open collector type (single pulse output)
**S1:** RS485 port

**Power supply**

**X:** Self power supply -15% +20% of the rated measuring input voltage, 45 to 65 Hz




**NOTE: please check the availability of the needed code on the verification path diagram on left before order .**

**Options**

**X:** none

## Input specifications

| | |
|---|---|
| **Rated inputs** | System type: 3 |
| Current type | By direct connection |
| Voltage | AV2: 133/230 $V_{LN}$ AC<br>230/400 $V_{LL}$ AC<br>AV9: 230 $V_{LN}$/400 $V_{LL}$ AC |
| Current range (direct) | AV2 and AV9: 10 (65)AAC |
| **Accuracy** (Display) (@25°C ±5°C, R.H. ≤60%, 48 to 62Hz) | Ib: see below, Un: see below |
| AV2 model | Ib: 10A, Imax: 65A; Un: 113 to 265$V_{LN}$ (196 to 460$V_{LL}$) |
| AV9 model | Ib: 10A, Imax: 65A; Un: 184 to 276$V_{LN}$ (318 to 480$V_{LL}$) |
| Current (AV2, AV9) | From 0.004Ib to 0.2Ib: ±(0.5% RDG +3DGT).<br>From 0.2Ib to Imax: ±(0.5% RDG +1DGT). |
| Phase-neutral voltage | In the range Un: ±(0,5% RDG +1DGT) |
| Phase-phase voltage | In the range Un: ±(1% RDG +1DGT) |
| Active power | ±(1%RDG +2DGT) |
| Reactive power | ±(2%RDG +2DGT) |
| Active energy | Class 1 according to EN62053-21 and Class B according to EN50470-3 |
| Reactive energy | Class 2 according to EN62053-23 |
| AV2, AV9 models | Ib: 10A, Imax: 65A;<br>0.1 Ib: 1A,<br>Start up current: 40mA |
| **Energy additional errors** | |
| Influence quantities | According to EN62053-21, EN62053-23 and EN50470-1-2 |
| **Temperature drift** | ≤200ppm/°C |
| **Sampling rate** | 1600 samples/s @ 50Hz<br>1900 samples/s @ 60Hz |
| **Display refresh time** | 750 msec. |
| **Display** | 2 lines (1 x 7 DGT; 1 x 3DGT) |
| Type | LCD, h 9mm |
| Instantaneous variables read-out | 3 DGT |
| Energies (imported) | Autorange<br>5+2, 6+1 or 7 DGT |
| Overload status | EEE indication when the value being measured is exceeding the "Continuous inputs overload" (maximum measurement capacity) |
| Max. and Min. indication | Max. instantaneous variables: 999; energies: 9 999 999. Min. instantaneous variables: 0; energies 0.00 |
| **LEDs** | Red LED (Energy consumption),<br>0.001 kWh by pulse<br>Max frequency: 16Hz<br>according to EN50470-1 |
| **Measurements** | See "List of the variables that can be connected to:" |
| Method | TRMS measurements of distorted wave forms. |
| Coupling type | Direct |
| **Crest factor** | Ib 10A ≤4 (91A max. peak) |
| **Current Overloads** | |
| Continuous | 65A, @ 50Hz |
| For 10ms | 1920A max, @ 50Hz |
| **Voltage Overloads** | |
| Continuous | 1.2 Un |
| For 500ms | 2 Un |
| **Input impedance** | |
| Voltage (AV2, AV9) | Refer to "Power Consumption" |
| Current (AV2, AV9) | < 4VA |
| **Frequency** | 45 to 65 Hz |
| **Joystick** | For variable selection. |

## Output specifications

| | |
|---|---|
| **Digital outputs** | |
| Pulse type | |
| Number of outputs | 100 pulses per kWh (0.01kWh/pulse). |
| Type | Output connected to the active energy (kWh) |
| Pulse duration | ≥100ms < 120msec (ON), ≥120ms (OFF), according to EN62052-31 |
| **Static output** | |
| Purpose | For pulse output |
| Signal | $V_{ON}$ 1.2 VDC/ max. 100 mA<br>$V_{OFF}$ 30 VDC max. |
| Insulation | By means of optocouplers, 4000 VRMS between output to measuring inputs. |

## RS485 communication port

| | |
|---|---|
| Type | Multidrop, bidirectional (static and dynamic variables) |
| Connections | 2-wire<br>max. distance 1000m |
| Addresses | 247, selectable by means of the front joystick |
| Protocol | MODBUS/JBUS (RTU) |
| Data (bidirectional) | |
| Dynamic (reading only) | System and phase variables: see table “List of variables...” |
| Static (reading and writing) | Communication address and baud-rate parameters. |
| Static (reading only) | Serial number, year of production and firmware revision |
| Data format | 1 start bit, 8 data bit, no parity,1 stop bit |
| Baud-rate | 4800, 9600 bits/s |
| Driver input capability | 1/5 unit load. Maximum 160 transceivers on the same bus. |
| Insulation | By means of optocouplers, 4000 VRMS output to measuring input |

## Software functions

| | |
|---|---|
| **System selection** | |
| System 3-Phase unbalanced load | 3-phase (4-wire);<br>3-phase (3-wire) X option only. |
| **Displaying** | Up to 3 variables per page |
| **Easy connection function** | Automatic phase sequence detection with current and voltage synchronisation. |
| X and PFA options | Both energy and power measurements are independent from the current direction. The total energy is displayed as “imported”. |
| PFB option | Both energy and power measurements are dependent on the current direction. The displayed energy is only the “imported” one, the “exported” energy is not measured nor displayed. |

## General specifications

| | |
|---|---|
| **Operating temperature** | -25°C to +55°C (-13°F to 131°F) (R.H. from 0 to 90% non-condensing @ 40°C) according to EN62053-21, EN62053-23 and EN50470-1 |
| **Storage temperature** | -30°C to +70°C (-22°F to 158°F) (R.H. < 90% non-condensing @ 40°C) according to EN62053-21, EN62053-23 and EN50470-1 |
| **Installation category** | Cat. III (IEC60664, EN60664) |
| **Insulation (for 1 minute)** | 4000 VRMS between measuring inputs and digital output |
| **Dielectric strength** | 4000 VRMS for 1 minute |
| **Noise rejection CMRR** | 100 dB, 48 to 62 Hz |
| **EMC** | According to EN62052-11 |
| Electrostatic discharges | 15kV air discharge; |
| Immunity to irradiated Electromagnetic fields | Test with current: 10V/m from 80 to 2000MHz;<br>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 suppression | According to CISPR 22 |
| **Standard compliance** | |
| Safety | IEC60664, IEC61010-1<br>EN60664, EN61010-1 |
| Metrology | EN62052-11, EN50470-1<br>EN62053-21, EN62053-23, EN50470-3. MID “Annex MI-003” |
| Pulse output | DIN43864, IEC62053-31 |
| Approvals | CE, MID (PF option only) |
| **Connections** | Screw-type |
| Cable cross-section area | measuring inputs terminals max. 16 $mm^2$; min. 2.5 $mm^2$ (by cable lug)<br>Min./Max. screws tightening torque: 1.7 Nm / 3 Nm<br>Output terminals: 1.5 $mm^2$<br>Screws tightening torque: 0.5 Nm |

## General specifications (cont.)

| | |
|---|---|
| **Housing DIN** | |
| Dimensions (WxHxD) | 71 x 90 x 64.5 mm |
| Material | Nylon PA66, self-extinguishing: UL 94 V-0 |
| Mounting | DIN-rail |

| | |
|---|---|
| **Protection degree** | |
| Front | IP50 |
| Screw terminals | IP20 |
| **Weight** | Approx. 400 g (packing included) |

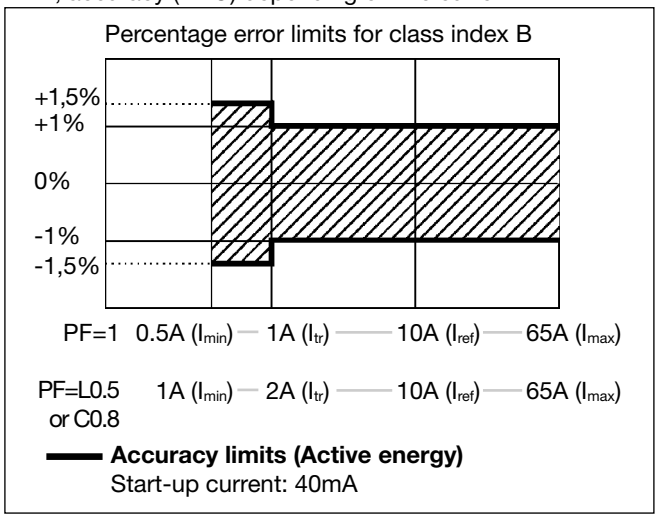
## Power supply specifications

| | |
|---|---|
| **Self supplied version** | |
| AV2 model | -15% +15% of Un, 45-65Hz. |
| AV9 model | -15% +20% of Un, 45-65Hz. |
| **Note** | S1 option only: -15% +10% of Un, 45-65Hz. The instrument provided with "S1" option will work only if all the voltage inputs are connected (3-phase and neutral); if a 1-phase connection has to be performed, the L1 and L2 voltage inputs have to be short circuited. The instrument working in a 3-phase system with neutral may work also if one or two phases are missing. |

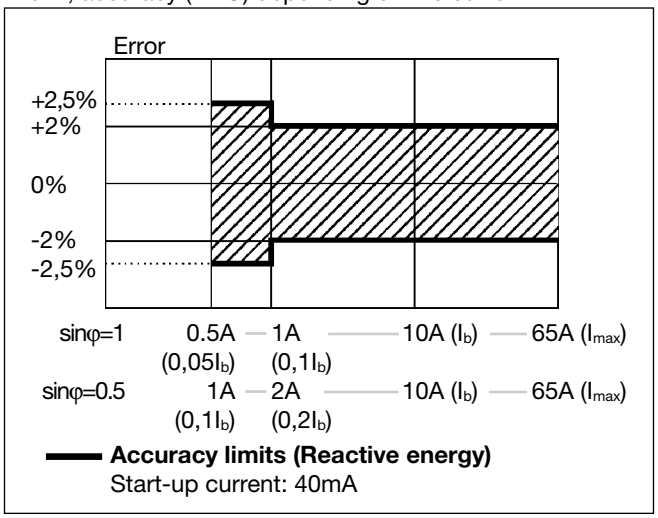
| | |
|---|---|
| **Power consumption** | |
| AV2-AV9 models | ≤20VA/1W |
| AV2-AV9 models (S1 option only) | ≤12VA/2W |

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

**kWh**, accuracy (RDG) depending on the current




**kvarh**, accuracy (RDG) depending on the current




## 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 or 60Hz; cosφ: 0.5 inductive to 0.8 capacitive. Class B I st: 0.04A; I min: 0.5A; I tr: 1A; I max: 65A. |
| **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 |
| **Mechanical compliance** | M2 |
| **Protection degree** | in order to achieve the protection against dust and water required by the norms harmonized to MID, the meter must be used only installed in IP51 (or better) cabinets. |

## List of the available variables

| No | Variable | 3-ph. 4-wire bal. system | 3-ph. 4-wire unbal. system | 3 ph. 3-wire bal. system | 3 ph. 3-wire unbal. system | Notes |
|---|---|---|---|---|---|---|
| 1 | A L1 | x | x | x | x | |
| 2 | A L2 | x | x | x | x | |
| 3 | A L3 | x | x | x | x | |
| 4 | var sys | x | x | x | x | sys=system |
| 5 | W sys | x | x | x | x | sys=system |
| 6 | Phase seq. | x | x | x | x | |
| 7 | kWh | x | x | x | x | Total |
| 8 | kvarh | x | x | x | x | Total |

(x) = available

## Display pages

Display variables in 3-phase systems with or without neutral

| No | 1st line | 2nd line | Phase Sequence | Notes |
|---|---|---|---|---|
| 1 | Total kWh | kW sys | Warning triangle if reverse sequence | Joystick position: up |
| 2 | Total kvarh | kvar sys | Warning triangle if reverse sequence | Joystick position: left |
| 3 | AL1 - AL2 | AL3 | Warning triangle if reverse sequence | Joystick position: down |
| 4 | Information | Information | | Joystick position: right |

Note: whatever page the user has selected, after 60s it goes back to page 1.

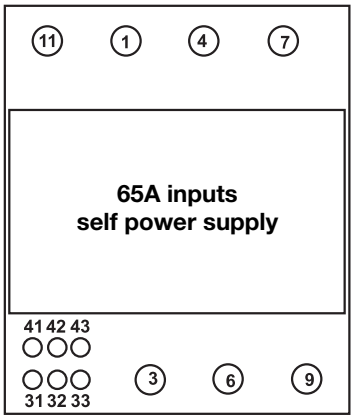
## Additional available information on the display (only for S1 version)

| Type | 1st line | 2nd line | Note |
|---|---|---|---|
| Meter information 1 | Secondary address (1234567) | Sn (text) | For M-bus connection via VMU-B Available also via RS485 |
| Meter information 2 | Year of production (Yr 2009) | Firmware revision (A.00) | Available also via e RS485 |
| Meter information 3 | Serial communication Address (Adr 1) | Communication speed (4.8 or 9.6) | Available also via RS485 |

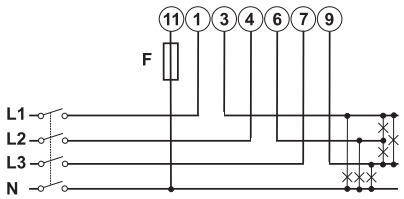
## Insulation between inputs and outputs

| | Measuring Inputs | Open collector outputs or serial port | Self power supply |
|---|---|---|---|
| **Measuring Inputs** | - | 4kV | 0kV |
| **Open collector outputs or serial port** | 4kV | - | 4kV |
| **Self power supply** | 0kV | 4kV | - |

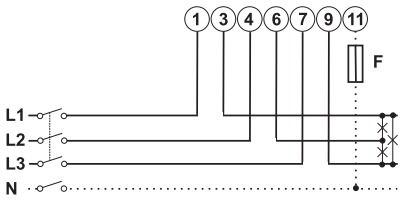
## Wiring diagrams




3-ph, 4-wire, unbal./bal. load **Fig.1**



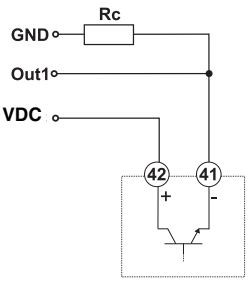

3-ph, 3-wire, unbal./bal. load **Fig. 2**




**NOTE**: on AV9 version the N connection is mandatory

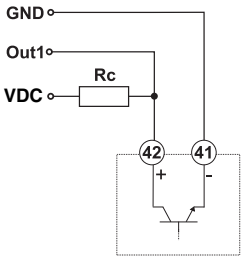
## Open collector output and RS485 wiring diagrams

Open Collector **Fig. 1**



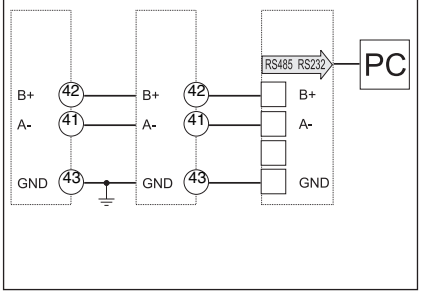

GND reference

Open Collector **Fig. 2**



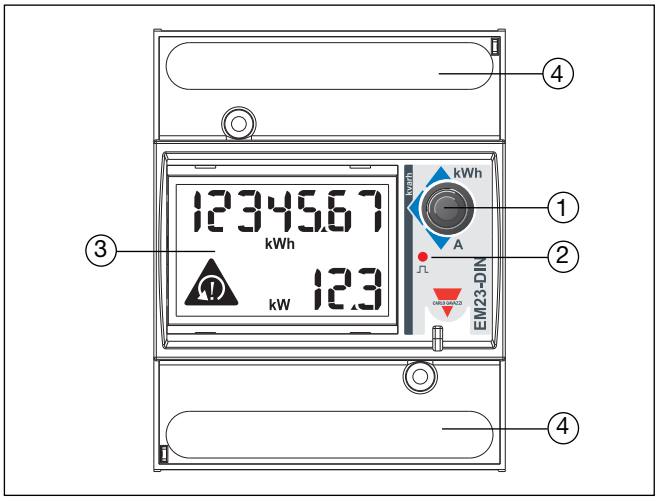

VDC reference

RS485 port **Fig. 3**




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.

## Front panel description




1. **Joystick**
   To scroll the variables on the display.
2. **LED**
   Red LED blinking proportional to the energy being measured.
3. **Display**
   LCD-type with alphanumeric indications to display all the measured variables.
4. **Connections**
   Screw terminal blocks for instrument wiring.

## Dimensions