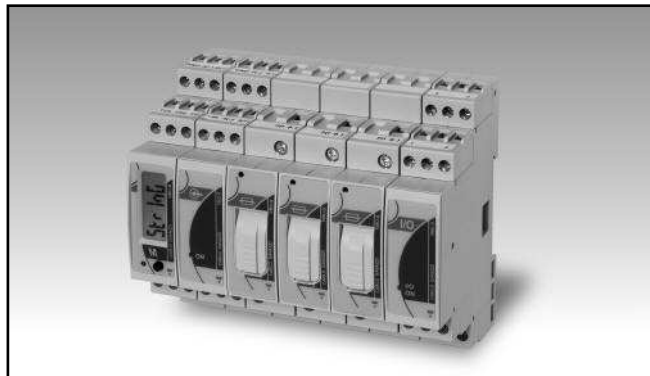


# Energy Management Control solution for solar PV applications Type Eos-Array

CARLO GAVAZZI



- Modular local control system for PV plants
- Up to 17 DIN modules configuration equivalent to 280mm width
- Eos-ArraySoft freeware software for easy product configuration
- Eos-Array can be formed by maximum 17 units
- Eos-Array can manage in addition to VMU-M master unit up to:
  - 1 VMU-P unit;
  - max 15 VMU-S units;
  - max 7 VMU-O units;
  - max 1 VMU-1.

## VMU-M, master module and data logger



- Master communication capability
- RS485 communication port (Modbus)
- Local communication bus management up to 15 mixed VMU-S, VMU-P and VMU-O units
- Two digital inputs
- Two temperature inputs: Pt100 or Pt1000
- Single virtual or real alarm set-point connectable to any available variable
- Data and event stamping system
- Display readout: 6 DGTs
- 12 to 28 VDC power supply
- Dimensions: 1-DIN module
- Protection degree (front): IP40

## Product Description

Eos-Array is a combination of modules which performs a complete control of a photovoltaic plant. The core unit is VMU-M which performs the local bus management of VMU-S, VMU-P both measuring units and VMU-O I/O unit. VMU-M assigns the proper local unit address automatically (up to 15 units) and gathers all the local measurements coming from VMU-S and VMU-P measuring units. VMU-M can pro-

vide by means of VMU-O modules two relay outputs so to manage alarms or/and external loads (like a lighting system, a module washing system and so on) and two temperature inputs. These latter two measuring inputs can become, according to the programmed function, also two digital inputs. Housing for DIN-rail mounting, IP40 (front) protection degree.

## How to order

**VMU-M 4 A S1 T2 X**

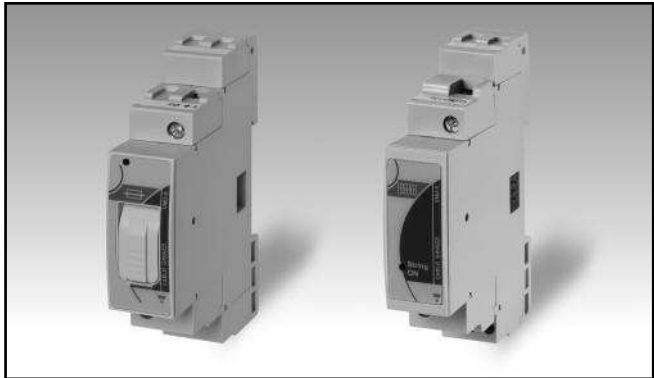
Model \_\_\_\_\_  
 Function \_\_\_\_\_  
 Power supply \_\_\_\_\_  
 Communication \_\_\_\_\_  
 Inputs \_\_\_\_\_  
 Option \_\_\_\_\_

## Type Selection

Function	Power supply	Communication	Inputs
<b>4:</b> Data storage 4Mbyte (*)	<b>A:</b> From 12 to 28VDC (*)	<b>S1:</b> RS485 Modbus (*)	<b>T2:</b> two temperature inputs or two digital inputs for free of voltage reading contacts (*)
<b>Option</b>	(*) as standard.		
<b>X:</b> none			



VMU-S, string measuring unit



- Direct DC voltage measurement up to 1000V
  - Energy measurements: kWh
  - Direct DC current measurement up to 16A or up to 30A without fuse
  - Instantaneous variables data format: 4 DGTs
  - Energies data format: 6 DGT
  - Instantaneous variables: V, A, W.
  - Accuracy: Class 1 (kWh)  $\pm 0.5$  RDG (current/voltage)
  - Auxiliary power supply from VMU-M unit
- Integrated 10.3x38mm fuse holder for string protection
  - Dimensions: 1-DIN module
  - Protection degree (front): IP40
- String alarm management by means of VMU-M unit only
  - Fuse blow detection by means of VMU-M unit only
  - PV module connection control by means of VMU-M unit only

Product Description

Variables measuring unit with built-in protection fuse-holder (the fuse is not provided); particularly indicated for DC current, voltage, power and energy metering in PV solar applications. The current inputs/outputs and also the voltage inputs are made so to simplify the string common connections. Direct connection up to 16A

or 30A depending on the model. Moreover the unit is provided with an auxiliary serial communication bus. Alarms, fuse blow detection, PV module connection and serial communication are managed by means of VMU-M module. Housing for DIN-rail mounting, IP40 (front) protection degree.

How to order VMU-S AV10 X S FX

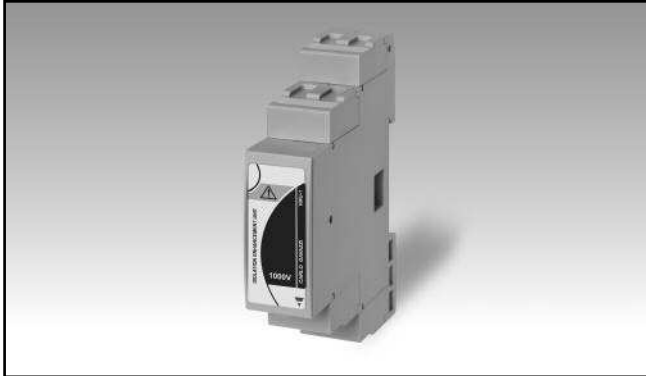


Type Selection

Range	Power supply	Communication	Option
<b>AV10:</b> 1000V DC, 16A (Direct connection) (*)	<b>X:</b> from 12 to 28VDC, self-power supply from VMU-M unit	<b>S:</b> auxiliary communication bus, compatible only to VMU-M module (*)	<b>XX:</b> none (no fuse holder)
<b>AV30:</b> 1000V DC, 30A (Direct connection) (**). In this case the "Option" is "XX".			<b>FX:</b> with fuse holder

(\*) as standard.  
(\*\*) on request.

## VMU-1, isolation enhancement unit



- Isolation enhancement of voltage measuring inputs to earth of VMU-S: from 800VDC (without VMU-1) to 1000VDC max.
- Dimensions: 1-DIN module
- Protection degree (front): IP40

### Product Description

Isolation enhancement unit suitable to be used in combination with VMU modules. VMU-1 allows to enhance the isolation of the voltage measuring input to earth from 800VDC to 1000VDC.

The module is to be mounted between the first VMU-S and all the other VMU modules. Housing for DIN-rail mounting, IP40 (front) protection degree.

### How to order

**VMU-1 1000**

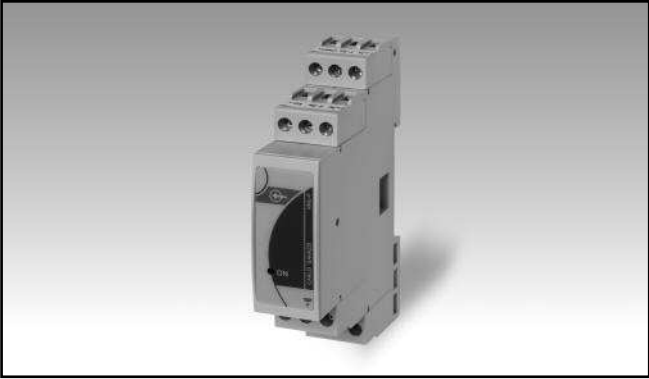
Standard model

### Type Selection

#### Standard model

**Isolation voltage 1000V:** isolation enhancement on VMU-S voltage measuring input to earth from 800VDC (without module) to 1000VDC.  
Note: only one VMU-1 is needed per Eos-Array

VMU-P, environment variable unit



- Measurements: PV module temperature, air temperature, sun irradiation, wind speed
- Two temperature inputs: Pt100 or Pt1000
- One 120mV or 20mA DC input with scaling capability for irradiation measurement
- One pulse input for wind speed measurement
- Auxiliary communication bus to VMU-M unit
- Auxiliary power supply from VMU-M unit
- Dimensions: 1-DIN module
- Protection degree (front): IP40

Product Description

Environment variable measurement unit particularly indicated for PV module temperature, air temperature, sun irradiation, wind speed metering in PV solar applications. Moreover the unit is provided with a specific serial communication bus which is managed by means of the additional VMU-M module. Housing for DIN-rail mounting, IP40 (front) protection degree.

How to order

VMU-P 2TIW X S X

Model

Range

Power supply

Communication

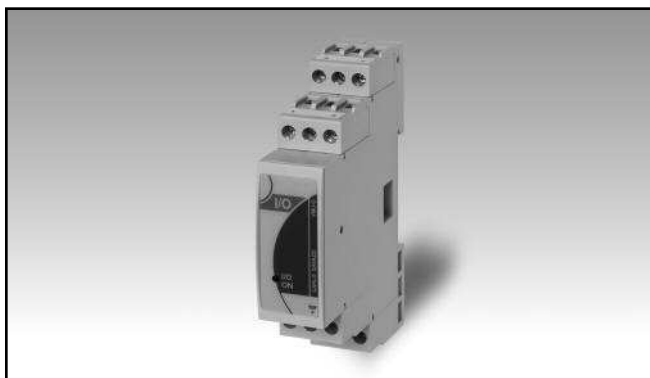
Option

Type Selection

Range	Power supply	Communication	Option
2TIW: Two “Pt” temperature type probes, mV sun irradiation and wind speed measuring inputs (*)	X: from 12 to 28VDC, self-power supply from VMU-M unit	S: auxiliary communication bus, compatible only to VMU-M module (*)	X: none
2TCW: Two “Pt” temperature type probes, mA sun irradiation and wind speed measuring inputs (*)			

(\*) as standard.

## VMU-O, inputs/outputs unit



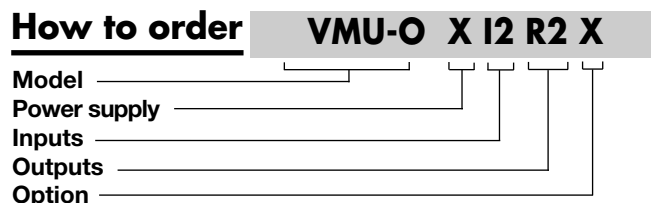
- Expansion I/O module (digital inputs and outputs)
- Two relay outputs managed by the VMU-M module
- Two digital inputs managed by the VMU-M module
- Auxiliary power supply from VMU-M module
- Dimensions: 1-DIN module
- Protection degree (front): IP40

### Product Description

I/O unit suitable to be used in combination with VMU-M modules. VMU-O allows to add, for every single unit, two digital inputs and two

relay outputs to a VMU-M based system. Housing for DIN-rail mounting, IP40 (front) protection degree.

### How to order



### Type Selection (Standard model)

Power supply	Inputs	Outputs	Option
<b>X:</b> from 12 to 28VDC, self-power supply from VMU-M unit	<b>I2:</b> two digital inputs (*)	<b>R2:</b> two relay output (*)	<b>X:</b> none

### Type Selection (Antitheft model)

Power supply	Inputs	Outputs	Option
<b>X:</b> from 12 to 28VDC, self-power supply from VMU-M unit	<b>I3:</b> three digital inputs (*)	<b>R1:</b> one relay outputs (*)	<b>AT:</b> antitheft compability

**Note:** in case of “Antitheft application” every single Eos-Array can manage the combination of one VMU-O.X.I3.R1.AT module and up to three VMU-O.X.I2.R2.X modules.

(\*) as standard.



VMU-AT, Antitheft sensor for VMU-O with "AT" option



- Plastic fibre optic sensor
- Sensing distance up to 200m
- Static output compatible with VMU-O "AT" option
- Auxiliary power supply from VMU-O "AT" option
- Dimensions: 14 x 31 x 73 mm housing
- Protection degree (front): IP50

Product Description

Antitheft plastic fibre optic sensor to be used in combination with VMU-O "AT" I/O unit, suitable to carry out an antitheft control on PV modules which are passed by 2.2 mm plastic fibre optic.

The maximum loop distance which can be covered by the sensor is 200m. Housing for DIN-rail mounting, IP50 (front) protection degree.

How to order

VMU-AT X P M C X

Model

Power supply

Plastic fibre

200m sensing distance

Output

Option

Type Selection

Power supply	Fibre optic	Sensing distance	Output
X: from 12 to 28VDC, self-power supply from VMU-O "AT" option unit	P: plastic (*)	M: 200m (*)	C: open collector
			Option
			X: none

(\*) as standard.

Product Description

PFO22-1000 is a specific plastic fibre optic cable which is made for VMU-AT sensor and is supplied in a

quantity of 1000m. The working temperature is -55 to 70°C.

How to order

PFO22 1000

Model

Fibre optic cable length: 1000m

## VMU-M Display and LED specification

<b>Display</b> Type Information read-out	1 line (max: 6-DGT) LCD, h 7mm From 4 to 6-DGT depending on the information.	Green blinking light: the communication on the RS485 bus is working. Red: alarm detected (any). In case of alarm/communication condition the LED alternates its colour from red (alarm) to green. The blinking time is approx. 1 second.
<b>LED</b> Type Status and colour	Dual colour Green steady light: the module is power supplied and there is no communication on the RS485 bus.	

## VMU-S LED specification

<b>LED</b> Type Status	Multicolor ON steady light: the module is power supplied and there is no alarm. Green: the power supply is ON, there is a string current up to 1A; Yellow: there is a string current from 1.1 to 3A; Light orange: there is a string current from 3.1 to 6A; Orange: there is a string current from 6.1 to 8A; Dark orange: there is a string current from 8.1 to 10A; Red: there is a string current higher than 10A; White: the unit is enabled by VMU-M module for data reading and displaying. Green ⇒ OFF: module not acknowledged in the Eos-Array. Cycling from blue to any other colour listed above (from yellow to red): string alarm. Cycling from blue to green: blown fuse. Cycling from blue to violet: inverted string polarity. Cycling from white to any other colour: the unit is enabled by VMU-M module for data reading and displaying and shows the status of the module according to the	Colour AV30 range code	colour list above. The cycling time is approx. 1 second. Green: the power supply is ON, there is a string current up to 1A; Yellow: there is a string current from 1.1 to 6A; Light orange: there is a string current from 6.1 to 12A; Orange: there is a string current from 12.1 to 16A; Dark orange: there is a string current from 16.1 to 20A; Red: there is a string current higher than 20A; White: the unit is enabled by VMU-M module for data reading and displaying. Green ⇒ OFF: module not acknowledged in the Eos-Array. Cycling from blue to any other colour listed above (from yellow to red): string alarm. Cycling from blue to violet: inverted string polarity. Cycling from white to any other colour: the unit is enabled by VMU-M module for data reading and displaying and shows the status of the module according to the colour list above. The cycling time is approx. 1 second.
Colour AV10 range code			

## VMU-P LED specification

<b>LED</b> Type Status and colour	Multicolor Green: the power supply is ON.	White: the unit is enabled by VMU-M module for data reading and displaying.
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## VMU-O LED specification

<b>LED</b>		
Type	Multicolor	one or both digital outputs are activated. Cycling from one colour to any other one: the unit shows the status of the module according to the colour list above.
Status and colour	Green: the power supply is ON. White: the unit is enabled by VMU-M module for data reading and displaying. Red: one or both digital inputs are activated. Blue:	The cycling time is approx. 1 second.

## VMU-AT LED specification

<b>LED</b>			
Power supply status	Green: the power supply is ON	Loop status	Red: the optical loop is closed

## VMU-M input specifications

<b>Digital inputs</b>		<b>Insulation</b>	See the table "Insulation between inputs and outputs"
Number of inputs	2	<b>Temperature inputs</b>	
Working mode	First input: detection of ON/OFF status Second input: counting of pulses coming from an energy meter	Number of inputs	2
Purpose	- First input: trip of protection detection, the status is transmitted only by means of the communication port. - Second input: trip counter, interfacing with an energy meter (-kWh) so to measure the total efficiency of the system.	Temperature probe	Pt100, Pt1000
Input frequency	20Hz max, duty cycle 50%	Number of wires	2 or 3-wire connection
Pre-scaler adjustment	From 0.001 to 10.000 kWh/pulse (only for the second input)	Wire compensation	Up to 10Ω.
Contact measuring voltage	3.3VDC	Accuracy (Display + RS485)	See "Temperature input characteristics"
Contact measuring current	<1mA	Temperature drift	±150ppm/°C
Contact resistance	≤1kΩ closed contact; ≥20kΩ open contact	Engineering unit	Selectable °C or °F
		Insulation	See the table "Insulation between inputs and outputs"
		<b>Key-pad</b>	1 push-button for variable scrolling and programming. Full programming can be carried out only using Eos-ArraySoft.

## VMU-S input specifications

<b>Rated inputs</b>			AV30 range: 1000V DC
Current type	1 (shunt)	<b>Accuracy</b>	(@25°C ±5°C, R.H. ≤60%)
Current range	AV10 range: 16A DC @ 40°C, 15A @ 50°C, 14A @ 55°C, 12A @ 60°C, 10A @ 65°C AV30 range: 30A DC @ 55°C, 25A DC @ 60°C, 20A DC @ 65°C AV10 range: 1000V DC	AV10 range code	
		Current	±(0.5%RDG+2 DGT) from 0.05A to 16A
		Voltage	±(0.5%RDG+2 DGT) from 20V to 1000V
		Power	±(1% RDG+ 2DGT)
		Energy	±(1% RDG)
Voltage			



## VMU-S input specifications (cont.)

Start up current	0.05A	AV30 range code	power has not to exceed 2W
Start up voltage	10V	Voltage	> 2.5M
AV30 range code		Current	< 0.003Ω @ 0.5 Nm (screw terminal torque).
Current	±(0.5%RDG+2 DGT) from 0.2A to 30A	<b>Voltage Overloads</b>	
Voltage	±(0.5%RDG+2 DGT) from 20V to 1000V	Continuous	1100V
Power	±(1% RDG+ 2DGT)	For 500ms	1600V
Energy	±(1% RDG)	To earth	800V (extended to 1000V in case of combined use of VMU-1.1000V unit)
Start up current	0.2A	<b>Current Overloads</b>	
Start up voltage	10V	Continuous	AV10 range: 16A
<b>Temperature drift</b>	≤200ppm/°C	For 1s	AV30 range: 30A
<b>Measurement sampling time</b>	2 sec.	<b>Protection</b>	
Variables format		Fuse holder	Integrated into the module gPV
Instantaneous variables	4-DGT (A, W), 5-DGT (V)	Fuse type	10x38mm (IEC60269-1-6)
Resolution	0.1V; 0.01A; 0.01kW	Fuse size	Fuse NOT provided.
Energies	Total: 5+1 DGT (0.1KWh)	Fuse current	Note: the fuse rated current has to be ≥1.4 Isc at 45°C ambient temperature. See fuse manufacturer specifications for further details including de-rating caused by higher ambient temperature.
<b>Max. and Min. data format</b>	See "Stored set of variables coming from ..."		
<b>Input impedance</b>			
AV10 range code			
Voltage	> 2.5MΩ		
Current	< 0.006Ω(+ fuse impedance) @ 0.5 Nm (screw terminal torque). For current input of 16A the fuse has therefore a nominal current of 32A AC. The maximum dissipation		

## VMU-P input specifications

<b>Temperature drift</b>	≤200ppm/°C		±(0.1%RDG+1DGT)
<b>Variables format</b>			25% to 120% FS.
Instantaneous variables	4 DGT (Temperature, solar irradiation and wind speed)	Temperature drift	±150ppm/°C
Resolution	0.1°C/0.1°F; 1W/m², 1W/ft²; 0.1m/s, 0.1ft/s	Scaling factor	
<b>Max. and Min. data format</b>	See "Stored set of variables coming from ..."	Operating mode	
<b>Temperature probe inputs</b>			
Number of inputs	2 (Input 1: PV module; Input 2: air)		
Temperature probe	Pt100 or Pt1000		
Number of wires	Up to 3-wire connection	Decimal point position	
Wire compensation	Up to 10Ω.	Impedance	
Accuracy (Display + RS485)	See table "Temperature input characteristics"	Overload	
Temperature drift	±150ppm/°C	Continuous	
Engineering unit	Selectable °C or °F		
Insulation	See the table "Insulation between inputs and communication bus"	For 1s	
<b>Irradiation sensor inputs (range code: 2TIW)</b>		Insulation	
Number of inputs	1		
Range	0 to 120mVDC	<b>Irradiation sensor input (range code: 2TCW)</b>	
Accuracy (Display + RS485) (@25°C ±5°C, R.H. ≤60%)	±(0.2%RDG+1DGT) 0% to 25% FS;	Number of inputs	1
		Range	0 to 20mADC
		Accuracy (Display + RS485) (@25°C ±5°C, R.H. ≤60%)	±(0.2%RDG+1DGT) 0% to 25% FS;

## VMU-P input specifications (cont.)

Temperature drift	$\pm(0.1\%RDG+1DGT)$ 25% to 120% FS.	Accuracy (@25°C $\pm 5^\circ\text{C}$ , R.H. $\leq 60\%$ )	$\pm(0.02\%RDG+1DGT)$ 0% to 25% FS;
Scaling factor	$\pm 150\text{ppm}/^\circ\text{C}$	(Display + RS485)	$\pm(0.01\%RDG+1DGT)$ 25% to 110% FS.
Operating mode	Dual scale: - Input: programmable range from 0 to 25.0 (mADC) - Display Data format: programmable range from 0 to 9999 (kW/m <sup>2</sup> , kW/ft <sup>2</sup> )	Temperature drift	$\pm 150\text{ppm}/^\circ\text{C}$
Decimal point position	Fixed $\leq 23\Omega$	Scaling factor	Dual scale: - Input: programmable range from 0 to 999.9 (Hz) - Display: programmable range from 0 to 299.9 (m/s, ft/s)
Impedance		Operating mode	Fixed and depending on the input/display scale.
Overload	50mADC (measurement available up to 25mA on both display and communication bus)	Decimal point position	680 $\Omega$
Continuous	150mADC	Impedance	2.5V <sub>peak</sub> to 9V <sub>peak</sub> /5mA <sub>peak</sub> to 35mA <sub>peak</sub> , duty cycle 50%
For 1s	See the table "Insulation between inputs and communication bus"	Operating input	220 $\Omega$
Insulation		Impedance	7V <sub>RMS</sub> /25mA <sub>RMS</sub> (AC/DC)
		Overload	14V <sub>RMS</sub> /50mA <sub>RMS</sub> (AC/DC)
		Continuous	See the table "Insulation between inputs and communication bus"
		For 1s	
		Insulation	
<b>Wind speed sensor inputs</b>			
Number of inputs	1		
Range	0 to 1000Hz max, duty cycle 50%		

## VMU-M Output specifications

<b>RS485</b>			
Type	Multidrop, bidirectional (static and dynamic variables)	<b>Auxiliary communication bus</b>	between inputs and outputs"
Connections	2-wire. Max. distance 1000m		This is the communication bus to the VMU-S, VMU-P and VMU-O units where VMU-M performs the master function in this network. VMU-M unit can gather the following information from the bus:
Addresses	247, selectable by means of the front push-button		- All variables available on the bus;
Protocol	MODBUS/JBUS (RTU)		- Blown protection fuse;
Data (bidirectional)			- PV reverse voltage and current polarity.
Dynamic (reading only)	All variables, see table "Measured variables, data format and messages" in the VMU-S document		The local address in both the VMU-S, VMU-P and VMU-O units is automatically assigned by VMU-M master unit based on their positions. It can manage up to 15 different addresses (units).
Static (writing only)	All the configuration parameters.		See the table "Insulation between inputs and outputs"
Data format	1 start bit, 8 data bit, no parity, 1 stop bit		
Baud-rate	Selectable: 9600, 19200, 38400, 115200 bits/s		
Driver input capability	Parity: none 1/5 unit load. Maximum 160 transceivers on the same bus.		
Special functions	None	Insulation	
Insulation	See the table "Insulation between inputs and communication bus"		

## VMU-O Input/Output specifications

<b>Maximum number of modules managed by every single VMU-M module</b>	Up to 7	<b>Digital output</b> Number of outputs Purpose	2 Alarm notification as a String alarm or as a digital input status changing (OR function); activation of a lighting system (by means of the internal clock or as a remote control); activation of a module washing system (by means of the internal clock, as a remote control or as a changing of efficiency of the PV panels). Relay, SPST type AC 1-5A @ 250VAC AC 15-1A @ 250VAC Available by means of VMU-O module only See the table "Insulation between inputs and outputs"
<b>Digital inputs</b> Number of inputs Working mode  Purpose	2 Detection of OPEN/CLOSED contact status Trip of protection detection, the status is transmitted only by means of the communication port.	Type	
Input frequency Contact reading voltage Contact reading current Contact resistance	2Hz max, duty cycle 50% 3.3VDC <2mA ≤300Ω closed contact; ≥10kΩ open contact	Insulation	
Insulation	See the table "Insulation between inputs and outputs"		

## VMU-M and VMU-P Temperature input characteristics

Probe	Range	Accuracy	Min Indication	Max Indication
Pt100	-50°C to +200.0°C	±(0.5%RDG +5DGT)	-50.0	+200.0
Pt100	-58°F to +392°F	±(0.5%RDG +5DGT)	-58.0	+392.0
Pt1000	-50°C to +200.0°C	±(0.5%RDG +5DGT)	-50.0	+200.0
Pt1000	-58°F to +392°F	±(0.5%RDG +5DGT)	-58.0	+392.0

## VMU-O with "AT" option, Input/Output specifications

<b>Maximum number of module managed by every single VMU-M module</b>	Up to 1	<b>Digital output</b> Number of outputs Purpose	between inputs and outputs"
<b>Digital inputs</b> Number of inputs Working mode Purpose	3 Detection of ON/OFF status Detection of the output status of up to 3 VMU-AT units, the same inputs can be used also to detect standard free of voltage contacts of other devices.		1 Antitheft notification in case of function enabling (EosArraySoft) or alarm notification as a String alarm or as a digital input status changing (OR function); activation of a lighting system (by means of the internal clock or as a remote control); activation of a module washing system (by means of the internal clock, as a remote control or as a changing of efficiency of the PV modules). Relay, SPST type AC1 - 5A @ 250VAC AC15 - 1A @ 250VAC See the table "Insulation between inputs and outputs"
Working logic	The inputs in case of Antitheft purpose selection work as an OR logic (EosArraySoft), if this function is not enabled every input works independently from each other.	Type	
Input frequency Contact reading voltage Contact reading current Contact resistance	2Hz max, duty cycle 50% 3.3VDC <2mA ≤300Ω closed contact; ≥10kΩ open contact	Insulation	
Insulation	See the table "Insulation between inputs and outputs"		

## VMU-AT Antitheft sensor specifications

<b>Maximum number of sensors managed by every single VMU-O "AT" module</b>	Up to 3	Compatible model	PGU-CD1001-22
		Working temperature	-55 to +70°C
<b>Optical sensing</b>		<b>Digital output</b>	
Maximum operational distance	200m (loop)	Number of outputs	1
Sensitivity	Automatic adjusted	Type	Open collector
Light source	GaAIAs, LED 660 nm	Insulation	Operational insulation only (50VACRMS)
Light type	Red modulated		
Operating frequency	1Khz	<b>Power Supply</b>	12 to 28 VDC
Response time on fibre breaking	0.5 seconds	<b>Connection</b>	
<b>Fibre Optic</b>		Cable	Length: 0.5m, black colour, PVC material
Material	Plastic		
Diameter	2.2 mm		

## Main Function

<b>Displaying</b>	1 parameter per page		2 protection levels of the programming data:
Own VMU-M module	See "Stored set of variables from ..." and "Alarm and diagnostics messages"	1st level	Password "0", no protection;
		2nd level	Password from 1 to 9999, all data are protected
When a VMU-S module is selected	All the information related to the status of the string being selected by means of the front key (see "Variable" in the table "List of the variables that can be...").	<b>Reset</b>	By means of the front push-button when the relevant VMU-S is selected
When a VMU-P module is selected	All the information related to the status of the environment probes being selected by means of the front key (see "Variable" in the table "List of the variables that can be...").	<b>Alarms</b>	
		Number of alarms	One, independent for every single available variable (see the table "List of the variables that can be...")
When a VMU-O module is selected	All the information related to the status of the inputs/outputs being selected by means of the front key (see "Variable" in the table "List of the variables that can be...").	Alarm types	Virtual alarm or real alarm
		Alarm modes	Up alarm, down alarm (see the table "List of the variables that can be connected to ...")
		Set-point adjustment	From 0 to 100% of the display scale
		Hysteresis	From 0 to full scale
		On-time delay	0 to 3600s
		Output status	Selectable; normally de-energized or normally energized
		Min. response time	≤ 700ms, set-point on-time delay: "0 s"
<b>Password</b>	Numeric code of max. 4 digits;		

## Main Function (Cont.)

<b>Clock</b>		<b>Event logging</b>	
Functions	Universal clock and calendar.	Data displaying	The data are not available on the display but they can be both checked and downloaded using RS485 communication port in combination with Eos-ArraySoft software. Activation: NO/YES
Daylight-saving enabling	Activation: NO/YES	Function enabling Type of stored events	
Time format	Hour:minutes with selectable 24 hours or AM/PM		
Date format	Month-Day, where the month is displayed in a three letter format (e.g.: JAN-FEB-MAR) and the date as a number. Year is displayed in a two digit format.		
Battery life	10 years		VMU-O digital input/output status change (real and virtual alarms), string alarms (see “String control”), VMU-M 1st digital input status change. The events are recorded as soon as they occur. For more information about the type and stored data, see “List of the variables that can be connected to ....” Max. 10 000. The reset can be carried out only using Eos-ArraySoft. Event, date (dd:mm:yy) and time (hh:mm:ss) Circular FIFO Flash 10 years
<b>Data logging</b>			
Data	The data are not available on the display but they can be both checked and downloaded using RS485 communication port in combination with Eos-ArraySoft software.	Number of events	The reset can be carried out only using Eos-ArraySoft. Event, date (dd:mm:yy) and time (hh:mm:ss) Circular FIFO Flash 10 years
Function enabling	Activation: NO/YES	Data reset	
Function description	All the events gathered from both VMU-S, VMU-O and VMU-P modules are stored individually into the internal memory.	Data format	
Stored data type	Variables: V, A, W, Wh, PV module temperature, ambient temperature, irradiation, wind speed, string efficiency and BOS efficiency.	Storage method Memory type Memory retention time	
Storage interval	Selectable: 1-5-10-15-30-60 minutes	<b>String control</b>	
Sampling management	The sample stored within the selected time interval results from the continuous average calculation of the measured values. The average is calculated with an interval within two following measurements of approx. 2s.	Function enabling Function selection	Activation: NO/YES Match max. control or median control Match max. control: this function is helpful only if there are at least two string controls (VMU-S units). The highest value of the measured string power among those available is used as a reference value. The alarm set-point is a value which can be set by the user as a percentage of the reference value below which there is the alarm condition. - Median control: the measurement of the string power is performed by the local VMU-S module individually. Within the VMU-M system all values coming at the same instant from
Storage duration	Before overwriting: depending on the storage interval, see “Historical data storing time table”	Function description	
Data format	Variables, date (dd:mm:yy) and time (hh:mm:ss)		
Storage method	Circular FIFO		
Memory type	Flash		
Memory retention time	10 years		

## Main Function (Cont.)

String window alarm	every VMU-S module are used to calculate the “median” value which becomes the reference value to which the dynamic window set-point (in percentage set by the user) is linked. The abnormal condition is detected when the measured instantaneous string power is out of the set window alarm. The alarm activates, with reference to the failed string, either a relay output (only in case of “VMU-O” connection) or/and a message which is transmitted by means of the RS485 communication port to an acquisition system. The alarm is set as the string power control, the value is programmable in percentage (of the measured string value) from 0.1 to 199.9.	Control type “1”	The VMU-P module is present and both PV module temperature and irradiation are measured to calculate the reference value for the efficiency calculation.
		Control type “2”	The VMU-P module is present and both ambient temperature and irradiation are measured to calculate the reference value for the efficiency calculation.
	Other alarms	<b>BOS efficiency measurement</b>	The total efficiency measurement is based on the comparison between the generated energy and the exported energy supplied to the grid. The grid supplied energy is measured by means of a “S0” output coming from an energy meter like EM21-72, EM24-DIN, EM26-96 where the pulsating output (-kWh) is connected to the second digital input of VMU-M.
	<b>“PV string” efficiency measurement</b> Function enabling	<b>Fuse blow detection</b> (only AV10 range code)	Warning message transmission through the local port to the VMU-M unit.
Control type “0”	Activation: NO/YES Three type of controls are available The VMU-P unit is not available therefore the single strings are used to calculate the reference value for the efficiency calculation.	<b>Wrong PV string connection</b>	Warning message transmission through the local port to the VMU-M unit.

**Note:** the “String control”, the “PV string efficiency” and the “BOS efficiency” can be carried out only in case a minimum system is available like a VMU-M, plus a VMU-S, plus a VMU-P and an energy meter with pulsating output.



## Insulation between inputs and outputs

Module		Any	VMU-M			VMU-P			VMU-O		VMU-S		
	Type of input/output	Local bus	DC Power supply	Temperature or digital inputs: Ch1, Ch2	RS485	Temperature: Ch1, Ch2	Solar irradiation	Wind speed	Digital inputs: Ch1, Ch2, Ch3	Relay outputs: Ch1, Ch2	Input string (V-)	Input string (A+)	Output string (A+)
Any	Local bus	-	0kV	0kV	0kV	0kV	0kV	0kV	4kV	4kV	4kV	4kV	4kV
VMU-M	DC Power supply	0kV	-	0kV	0kV	0kV	0kV	0kV	4kV	4kV	4kV	4kV	4kV
	Temperature or digital inputs: Ch1, Ch2	0kV	0kV	-	0kV	0kV	0kV	0kV	4kV	4kV	4kV	4kV	4kV
	RS485	0kV	0kV	0kV	-	0kV	0kV	0kV	4kV	4kV	4kV	4kV	4kV
VMU-P	Temperature: Ch1, Ch2	0kV	0kV	0kV	0kV	-	0kV	0kV	4kV	4kV	4kV	4kV	4kV
	Solar irradiation	0kV	0kV	0kV	0kV	0kV	-	0kV	4kV	4kV	4kV	4kV	4kV
	Wind speed	0kV	0kV	0kV	0kV	0kV	0kV	-	4kV	4kV	4kV	4kV	4kV
VMU-O	Digital inputs: Ch1, Ch2, Ch3	0kV	0kV	0kV	0kV	0kV	0kV	0kV	-	4kV	4kV	4kV	4kV
	Relay outputs: Ch1, Ch2	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	-	4kV	4kV	4kV
VMU-S	Input string (V-)	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	-	4kV	>5MΩ
	Input string (A+)	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	-	4kV
	Output string (A+)	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	>5MΩ	4kV	-

**Note:** The isolation between the two relay outputs is 4kV.

0kV	Inputs / outputs are not insulated. Use insulated probes and free of voltage contacts inputs.
4kVrms	EN61010-1, IEC60664-1 - Over-voltage category III, Pollution degree 2, double insulation on systems with max. 300Vrms to ground
4kVrms	IEC60664-1 - Using protection device with clamping voltage ≤4kV (surge suppressor) the system insulation can be considered as reinforced for string output voltage up to 1000V (800V to earth). IEC60664-1, IEC61730-2 application class B: impulse withstand voltage 1,2/50μsec: 6000V.
4kV	Only if the fuse is not present. The fuse is only for over-current protection (it has not to be considered as a disconnecting device).

## General specifications

<b>Operating temperature</b>	See table "String current vs. operating temperature".	<b>EMC (Immunity)</b> Electrostatic discharges	According to EN61000-6-2 EN61000-4-2: 8kV air discharge, 4kV contact;  EN61000-4-3 : 10V/m from 80 to 3000MHz; EN61000-4-4: 4kV on power lines, 2kV on single lines;  EN61000-4-6: 10V from 150KHz to 80MHz; EN61000-4-5: 500V on power supply; 4kV on string inputs.
<b>Storage temperature</b>	-30 to +70°C (-22°F to 158°F) (R.H. < 90% non-condensing @ 40°C)	Immunity to irradiated Electromagnetic fields	
<b>Over voltage category</b>	Cat. III (IEC 60664, EN60664) For inputs from string: equivalent to Cat. I, reinforced insulation.	Immunity to Burst	
<b>Insulation</b> (for 1 minute)	See table "Insulation between inputs and outputs"	Immunity to conducted disturbances	
<b>Dielectric strength</b>	4000 VAC RMS for 1 minute	Surge	
<b>Noise rejection</b> CMRR	65 dB, 45 to 65 Hz	<b>EMC (Emission)</b> Radio frequency suppression	According to EN61000-6-3 According to CISPR 22

## General specifications (cont.)

<b>Standard compliance</b> Safety	IEC60664, IEC61010-1 EN60664, EN61010-1	<b>Material</b>	Noryl, self-extinguishing: UL 94 V-0
<b>Approvals</b>	CE, cULus Listed	<b>Mounting</b>	DIN-rail
<b>Housing</b> Dimensions (WxHxD)	17.5 x 90 x 67 mm	<b>Protection degree</b> Front Screw terminals	IP40 IP20

## Connections

<b>VMU-M</b> Connections Cable cross-section area	Screw-type 1.5 mm <sup>2</sup> max, Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm	Screw terminal purposes 16 mm <sup>2</sup>	1+1 screw terminals: 1 positive for string input and 1 positive for string output (to the Inverter)
Screw terminal purposes 1.5 mm <sup>2</sup>	3+3 screw terminals used for two temperature inputs 3 screw terminals used for RS485 communication 2 screw terminals used for power supply	1.5 mm <sup>2</sup>	3 screw terminals: not power input, only for negative voltage signal measurement
<b>VMU-S AV10</b> Connections Cable cross-section area Current (+)	Screw-type  Min. 2.5 mm <sup>2</sup> , max 6 mm <sup>2</sup> in case of flexible wire, Max. 10 mm <sup>2</sup> in case of rigid wire. Min./Max. screws tightening torque: 0.5 Nm / 1.1 Nm	Screw terminal purposes 1.5 mm <sup>2</sup>	Screw-type 1.5 mm <sup>2</sup> max. Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm
Voltage (-)	Max 1.5 mm <sup>2</sup> , Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm		3+3 screw terminals used for two temperature probes 2 screw terminals used for wind speed sensor, 2 screw terminals used for solar irradiation sensor
Screw terminal purposes 10 mm <sup>2</sup>	1+1 screw terminals: 1 positive for string input and 1 positive for string output (to the Inverter)	<b>VMU-O</b> Connections Cable cross-section area Relay outputs and digital inputs	Screw-type
1.5 mm <sup>2</sup>	3 screw terminals: not power input, only for negative voltage signal measurement	"X" type Screw terminal purposes 1.5 mm <sup>2</sup>	Max 1.5 mm <sup>2</sup> Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm
<b>VMU-S AV30</b> Connections Cable cross-section area Current (+)	Screw-type  Min. 2.5 mm <sup>2</sup> , max 10 mm <sup>2</sup> in case of flexible wire, Max. 16 mm <sup>2</sup> in case of rigid wire. Min./Max. Hole dimension: 7.2x5.1mm, screws tightening torque: 0.5 Nm / 1.1 Nm	"AT" type Screw terminal purposes 1.5 mm <sup>2</sup>	2+2 screw terminals: two for 1 <sup>st</sup> relay output and two for 2 <sup>nd</sup> relay output (SPST type) 2+2 screw terminals: two for 1 <sup>st</sup> digital input and two for 2 <sup>nd</sup> digital input
Voltage (-)	Max 1.5 mm <sup>2</sup> , Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm		2 screw terminals for relay output (SPST type) 2+2+2 screw terminals: two for 1 <sup>st</sup> digital input, two for 2 <sup>nd</sup> digital input and two for 3 <sup>rd</sup> digital input
		<b>Weight (all modules)</b>	Approx. 100 g (packing included)

## Power supply specifications

<b>VMU-M</b> Power supply Power consumption	12 to 28 VDC ≤1W	<b>VMU-S-P-O</b> Power supply	Self-power supplied through the communication bus
		Power consumption	≤0.7W



## String current vs. operating temperature

VMU-S AV10 Input current	VMU-O Max. contact current	Other modules	Operating temperature	
10A DC max.	2.5A	VMU-M, VMU-P	-25 to + 65°C	-13°F to 149°F
12A DC max.	3.0A	VMU-M, VMU-P	-25 to + 60°C	-13°F to 140°F
14A DC max.	3.5A	VMU-M, VMU-P	-25 to + 55°C	-13°F to 131°F
15A DC max.	4.0A	VMU-M, VMU-P	-25 to + 50°C	-13°F to 122°F
16A DC max.	5.0A	VMU-M, VMU-P	-25 to + 40°C	-13°F to 104°F
VMU-S AV30 Input current				
20A DC max.	2.5A	VMU-M, VMU-P	-25 to + 65°C	-13°F to 149°F
25A DC max.	3.0A	VMU-M, VMU-P	-25 to + 60°C	-13°F to 140°F
30A DC max.	3.5A	VMU-M, VMU-P	-25 to + 55°C	-13°F to 131°F

R.H. < 90% non condensing @ 40°C (104°F)

## Sizing of Carlo Gavazzi DC power supply without antitheft functionality

VMU-S units	VMU-O units	VMU-P units	Consumption	Start up current	Power supply part number
From 1 to 3	None	None	PS <sub>W</sub> : 2.5W <sub>typ</sub>	1.5A for 1s	SPD 24 18 1B or SPM3 24 1
From 1 to 3	Up to 1	Up to 1	PS <sub>W</sub> : 5W <sub>typ</sub>	1.5A for 1s	SPD 24 18 1B or SPM3 24 1
From 4 to 10	From 2 to 4	Up to 1	PS <sub>W</sub> : 11W <sub>typ</sub>	1.5A for 1s	SPD 24 30 1B or SPM3 24 1
From 11 to 14	Up to 1	Up to 1	PS <sub>W</sub> : 10W <sub>typ</sub>	1.5A for 1s	SPD 24 30 1B or SPM3 24 1
Max. 14	Max. 7	Max. 1			Note: VMU-P as 1.8W includes also the CG (part number DWS-V) wind sensor consumption.

**Note:** the consumption above includes already one VMU-M unit without any antitheft management. For different units combination not mentioned above the consumption calculation is the following:  $PS_W < 1W + n_{VMU-S} * 0.5W + n_{VMU-O} * 0.7W + n_{VMU-P} * 1.8W$ . Where “n” is number of power supplied units.

## Sizing of Carlo Gavazzi DC power supply with antitheft functionality

VMU-S units	VMU-O.X units	VMU-O AT units	VMU-AT units	VMU-P units	Consumption	Start up current	Power supply part number
10 to 14	None	Up to 1	Up to 3	None	PS <sub>W</sub> : 12W <sub>typ</sub>	1.5A for 1s	SPD 24 30 1B or SPM3 24 1
10 to 13	Up to 1	Up to 1	Up to 3	Up to 1	PS <sub>W</sub> : 13W <sub>typ</sub>	1.5A for 1s	SPD 24 30 1B or SPM3 24 1
10 to 12	Up to 2	Up to 1	Up to 3	Up to 1	PS <sub>W</sub> : 14W <sub>typ</sub>	1.5A for 1s	SPD 24 30 1B or SPM3 24 1
10	Up to 3	Up to 1	Up to 3	Up to 1	PS <sub>W</sub> : 14W <sub>typ</sub>	1.5A for 1s	SPD 24 30 1B or SPM3 24 1
Max. 14	Max. 3	Max. 1	Max. 3	Max. 1			Note: VMU-P as 1.8W includes also the CG (part number DWS-V) wind sensor consumption.

**Nota:** in order to carry out, in the Eos-Array, the proper antitheft functionality, one VMU-O.X.I3.R1.AT unit and up to three VMU-AT.X.P.M,C,X sensors have to be added, in this case the maximum equivalent added consumed power is 4W. For different units combination not mentioned above the consumption calculation is the following:  $PS_W < 1W + n_{VMU-S} * 0.5W + n_{VMU-O.X} * 0.7W + n_{VMU-O.AT} * 0.7W + n_{VMU-AT} * 1.1W + n_{VMU-P} * 1.8W$ . Where “n” is number of power supplied units.

## Stored set of variables in the VMU-M module

No.	Variable	Data format	Notes
1	Temperature 1	-60.0 to 400.0	The range is extended so to cover both °C and °F indication
2	Temperature 2	-60.0 to 400.0	The range is extended so to cover both °C and °F indication
3	BOS efficiency	0.0 to 999.9	“Total efficiency” result in percentage
4	AC energy value	0.0 to 99999.9	The value is in kWh and is the result of the totalized pulses coming from external energy meter

## Stored set of variables coming from every single VMU-S module

No.	Variable	Data format	Sub-address	Notes
1	V	0.0 to 1250.0	From 1 to 15	
2	A	0.0 to 20.00	From 1 to 15	
3	kW	0.0 to 99.99	From 1 to 15	
4	kWh	0.0 to 99999.9	From 1 to 15	
5	String efficiency	0.0 to 999.9		"PV string" efficiency result in percentage. Every string in the network has its own data.

## Stored set of variables coming from every single VMU-P module

No.	Variable	Data format	Sub-address	Notes
1	Temperature 1 (PV module)	-60.0 to 400.0	From 1 to 15	PV module temperature (°C/°F). The range is extended so to cover both °C and °F indication
2	Temperature 2 (Environment)	-60.0 to 400.0	From 1 to 15	Ambient temperature (°C/°F). The range is extended so to cover both °C and °F indication
3	Solar irradiation	0.0 to 9.999	From 1 to 15	Irradiation kW/m <sup>2</sup> (kW/feet <sup>2</sup> ). (e.g. in: 0 to 1kW/m <sup>2</sup> (1kW/feet <sup>2</sup> ), out: 0 to 100mV)
4	Wind speed	0.0 to 299.9	From 1 to 15	Wind speed (m/s) or feet/s

## Alarm and diagnostics messages

No.	Message	Notes
1	Conn.CY (AV10 only)	Fuse blow detection. The status of each fuse is indicated by the colour change of the relevant LED on the VMU-S module.
2	StrinG	String failure warning: the "String control" function has detected a failure. The STRING information is given in combination with the LED alarm on VMU-M and the LED colour code on every single string.
3	Conn.PY	The string is wrongly connected (reverse polarity)
4	SYStEM	Power-up self-test error
5	buS	Auxiliary bus communication error
6	ALArM	Variables alarm (any)
7	tHEFt	Theft warning: removal of the PV modules in the fibre optic loop controlled by the relevant VMU-AT sensor. The THEFT information is given in combination with the LED alarm on VMU-M and the LED colour code on the relevant VMU-O.AT module.

## Historical data storing time table

Time interval (minutes) (1)	From 1 to 15 strings			
	Data storing time			
	Min. days	Min. weeks	Min. months	Note
1	6	0	0	(2), (3), (4)
5	34	4	1	(2), (3), (4)
10	69	9	2	(2), (3), (4)
15	104	14	3	(2), (3), (4)
30	208	29	7	(2), (3), (4)
60	416	59	14	(2), (3), (4)

(1) Every value stored in the memory, is the result of the average calculation, in the selected time interval of the variable being measured and sampled every 2 seconds. (2) A maximum of 10 000 variable sets can be stored into the memory independently from the type and quantity of managed modules (for a maximum of 15). (3) The stored variables are coming from the VMU-P module and are: PV module temperature, ambient temperature, irradiation and wind speed. (4) The stored variables are relevant to both String efficiency and BOS efficiency.

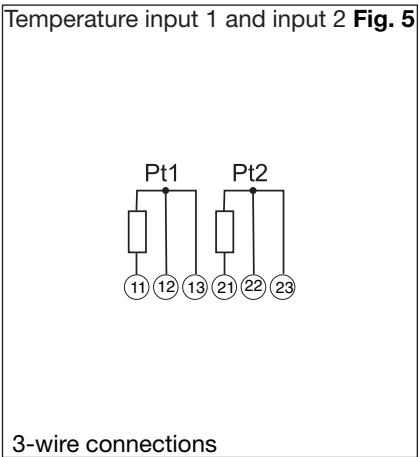
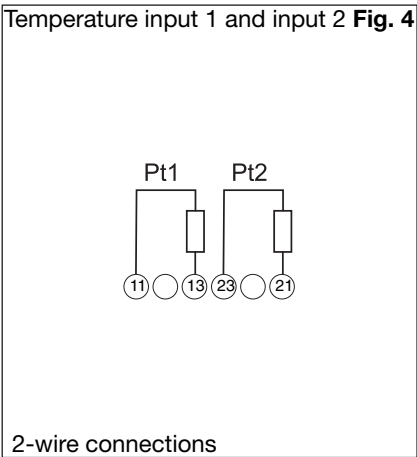
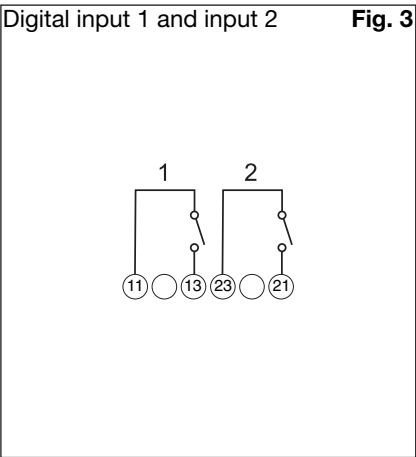
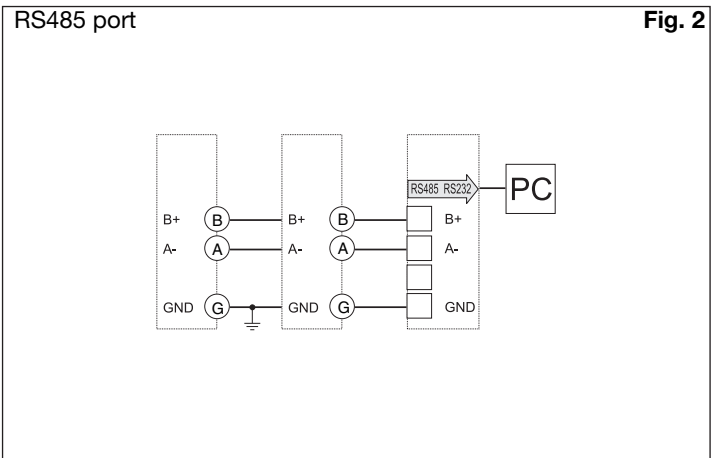
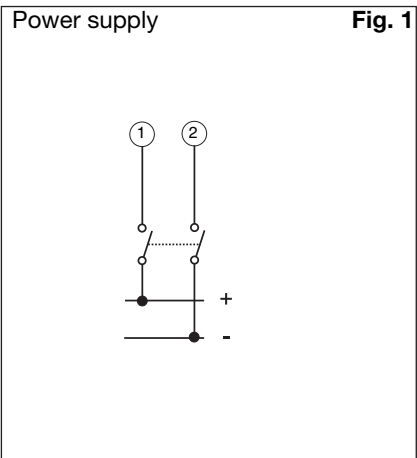
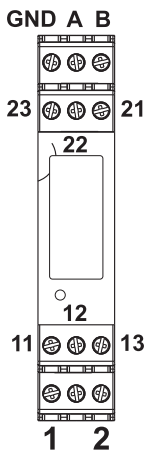
## List of the variables that can be displayed and connected to ...

- RS485 communication port
- Real and virtual alarms and events
- Data-logging

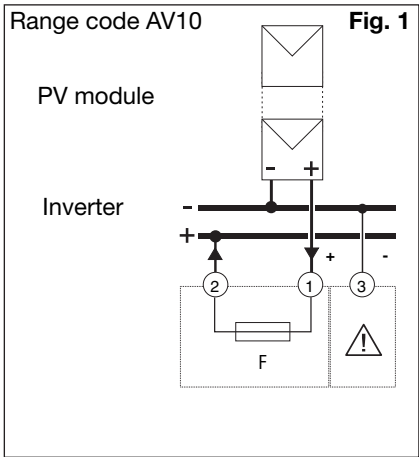
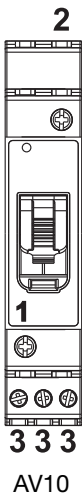
No	Variable	Event-logging	Data-logging	Alarm output	Module (from)	Notes
1	°C (°F) (input 1 )	Yes	Yes	Yes	VMU-M	As alternative of status detection (4)
2	°C (°F) (input 2 )	Yes	Yes	Yes	VMU-M	As alternative of variable (5)
3	% BOS efficiency	Yes	Yes	Yes	VMU-M	BOS efficiency calculation of the PV plant (in case of one VMU-M unit only). In all other cases the calculation is made by the software.
4	ON / OFF status (input 1)	Yes	Yes	No	VMU-M	As alternative of variable (1)
5	kWh (input 2)	Yes	Yes	No	VMU-M	Counting of pulses coming from an energy meter, as alternative of variable (2)
6	Reset kWh (input 2)	No	No	No	VMU-M	Resetting of totalized pulses from AC energy meter
7	Error: 1	Yes	No	Yes (a)	VMU-M	Local bus communication problems
8	Error: 2	Yes	No	Yes (a)	VMU-M	Changed system modules configuration
9	Error: 3	Yes	No	Yes (a)	VMU-M	Incoherent programming parameters
10	Error: 4	Yes	No	Yes (a)	VMU-M	More than one VMU-P unit connected to the bus
11	Error: 5	Yes	No	Yes (b)	VMU-M	Short circuit on probe input 1
12	Error: 6	Yes	No	Yes (b)	VMU-M	Open circuit on probe input 1
13	Error: 7	Yes	No	Yes (b)	VMU-M	Short circuit on probe input 2
14	Error: 8	Yes	No	Yes (b)	VMU-M	Open circuit on probe input 2
15	Status: 1	Yes	No	No	VMU-M	Local programming access
16	Status: 2	Yes	No	No	VMU-M	Power ON/OFF
17	V	Yes	Yes	Yes	VMU-S	Available from every string
18	A	Yes	Yes	Yes	VMU-S	Available from every string
19	kW	Yes	Yes	Yes	VMU-S	Available from every string
20	kWh	Yes	Yes	No	VMU-S	Available from every string
21	Reset string kWh	No	No	No	VMU-S	Resetting DC string energy meter
22	Reset all strings kWh	No	No	No	VMU-S	Resetting all DC string energy meters
23	% string efficiency	Yes	Yes	Yes	VMU-S	String efficiency
24	Status: 1	Yes	No	Yes	VMU-S	Incoherent programming parameters
25	Status: 2	Yes	No	Yes	VMU-S	Fuse blow detection
26	Status: 3	Yes	No	Yes	VMU-S	Reverse string current or voltage
27	Status: 4	Yes	No	Yes	VMU-S	High temperature inside VMU-S unit
28	String control	Yes	Yes	Yes	VMU-S	
29	°C (°F) input 1	Yes	Yes	Yes	VMU-P	PV module temperature
30	°C (°F) input 2	Yes	Yes	Yes	VMU-P	Air temperature
31	kWp/m <sup>2</sup> (kWp/ft <sup>2</sup> )	Yes	Yes	Yes	VMU-P	Solar irradiation
32	m/s (ft/s)	Yes	Yes	Yes	VMU-P	Wind speed
33	Error: 1	Yes	No	Yes	VMU-P	Incoherent programming parameters
34	Error: 2	Yes	No	Yes (c)	VMU-P	Short circuit on probe input 1
35	Error: 3	Yes	No	Yes (c)	VMU-P	Open circuit on probe input 1
36	Error: 4	Yes	No	Yes (c)	VMU-P	Short circuit on probe input 2
37	Error: 5	Yes	No	Yes (c)	VMU-P	Open circuit on probe input 2
38	Status: input 1	Yes	No	No	VMU-O	ON /OFF status detection
39	Status: input 2	Yes	No	No	VMU-O	ON /OFF status detection
40	Status: output 1	Yes	No	No	VMU-O	ON /OFF status detection
41	Status: output 2	Yes	No	No	VMU-O	ON /OFF status detection
42	Error: 1	Yes	No	Yes	VMU-O	Incoherent programming parameters

**Note about “Alarm output”:** YES (a), YES (b) and YES (c) are according to the relevant letter “OR” logic alarms.

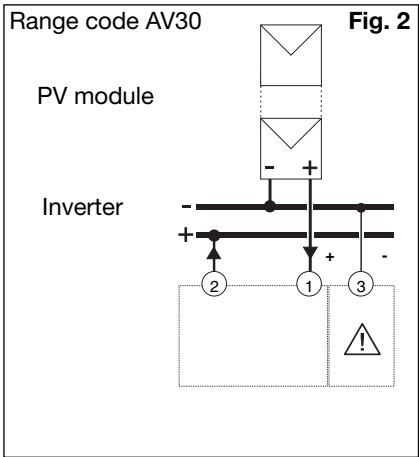
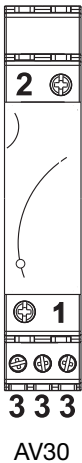
VMU-M connections



VMU-S (AV10 and AV30) connections

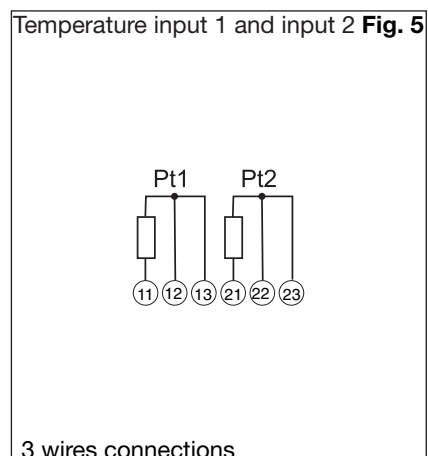
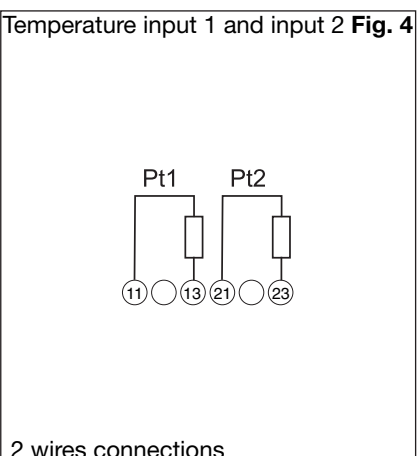
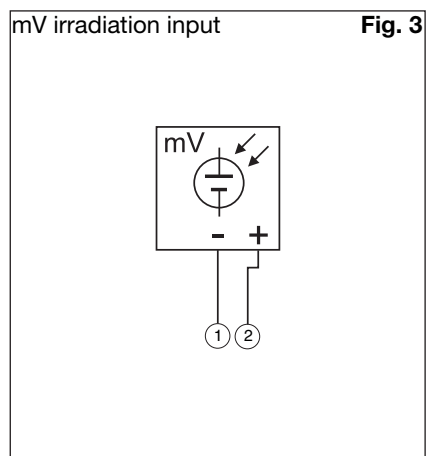
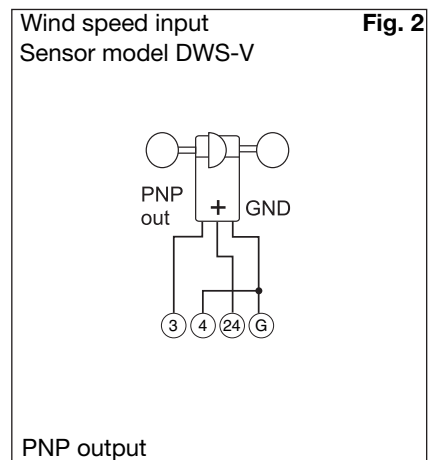
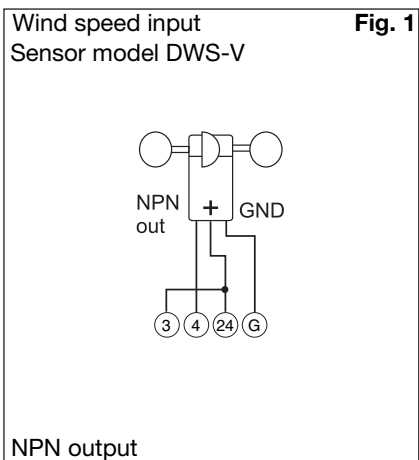
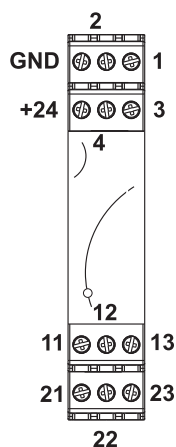


F= 10.3x38mm (IEC269-2-1) 1.25 Isc DC

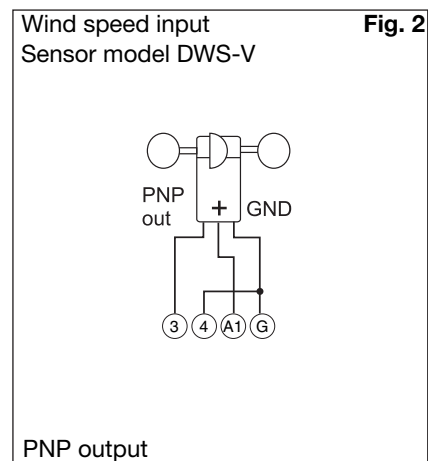
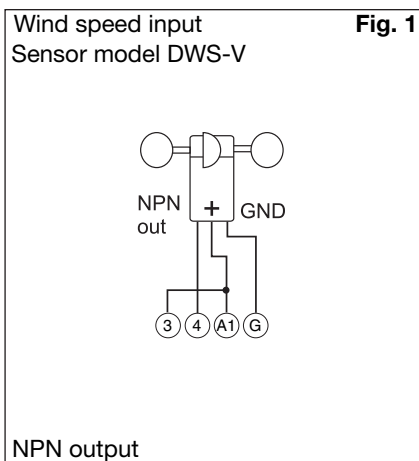
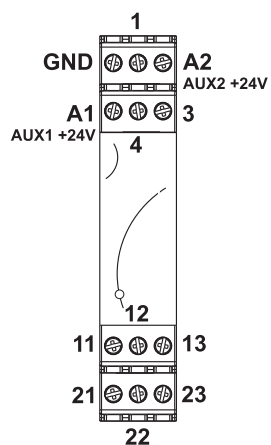


⚠ = Not power input, only for voltage signal measurement.

## VMU-P (2TIW) connections

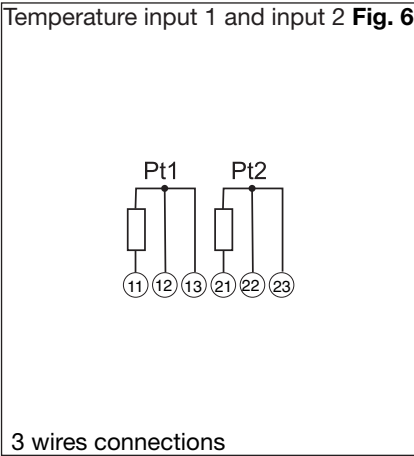
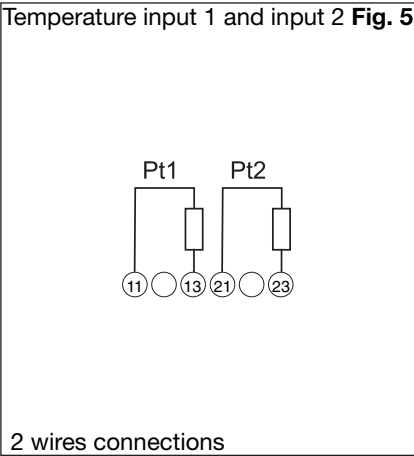
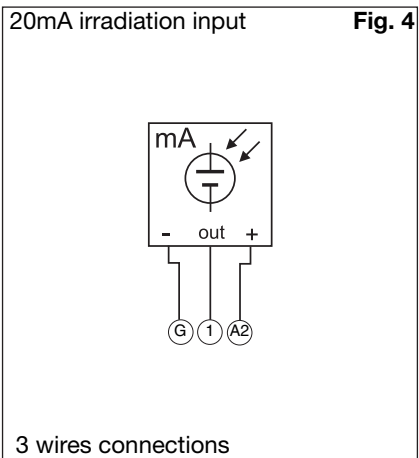
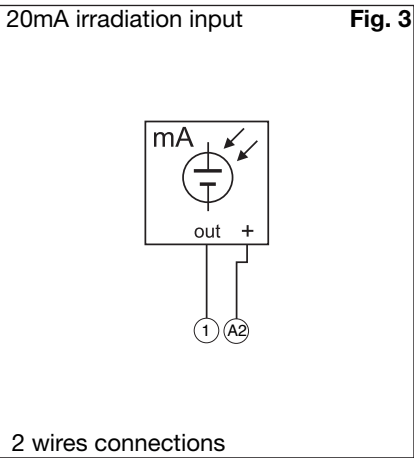
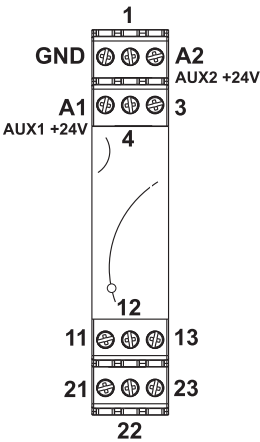


## VMU-P (2TCW) connections

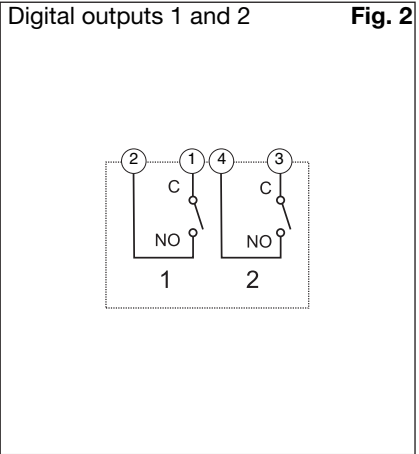
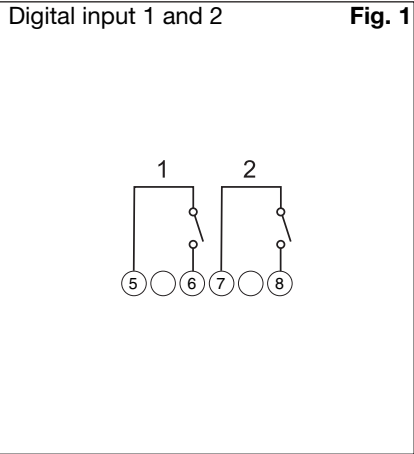
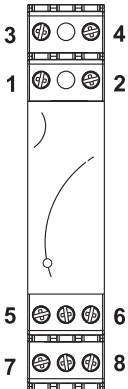




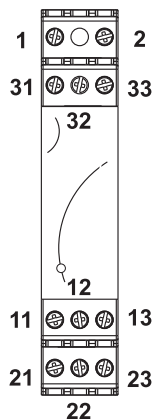
VMU-P (2TCW) connections (cont.)



VMU-O connections

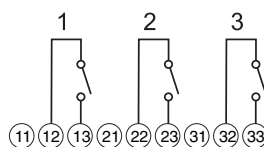


## VMU-O "AT" option connections



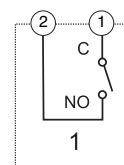
Digital input 1, 2 and 3

Fig. 1

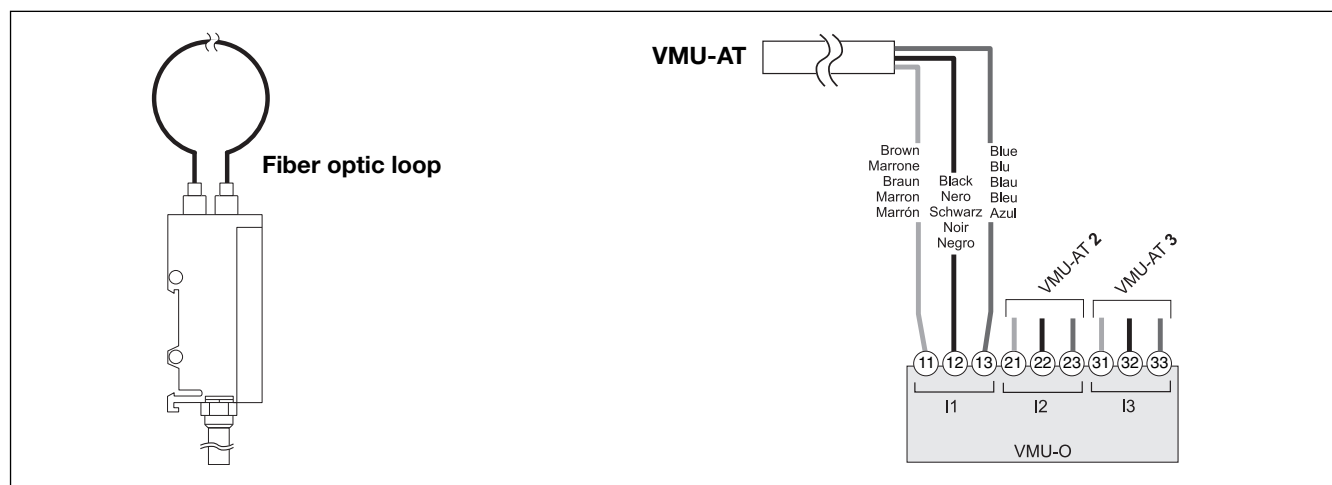


Digital output

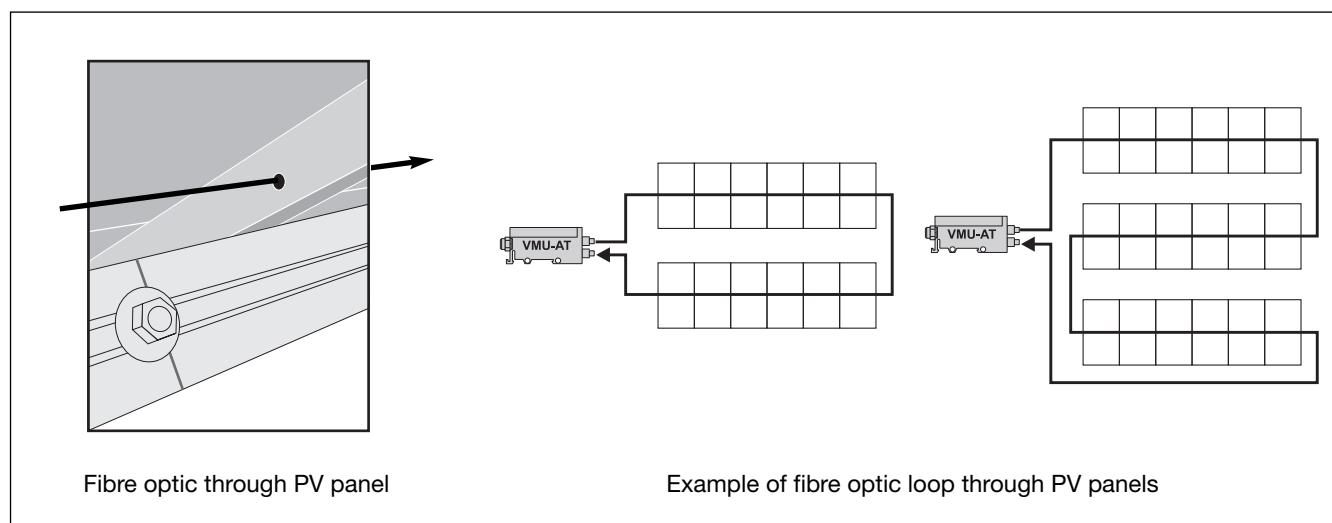
Fig. 2



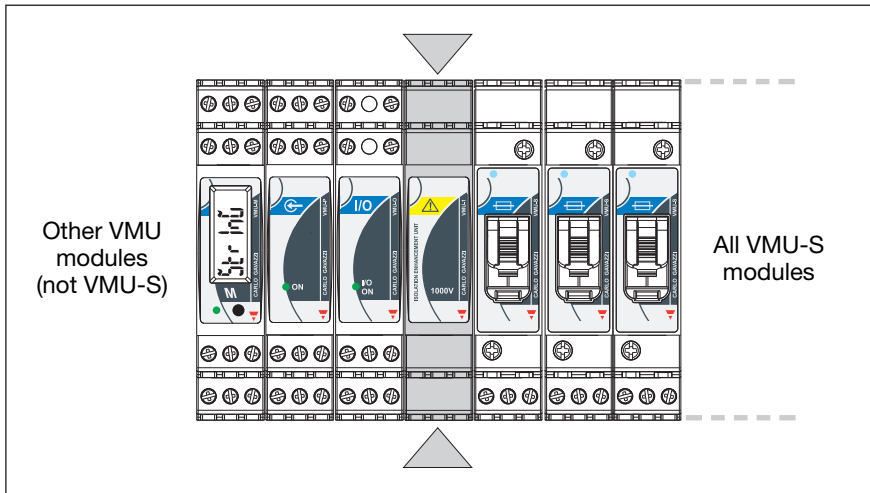
## VMU-AT connections



## VMU-AT mounting and use



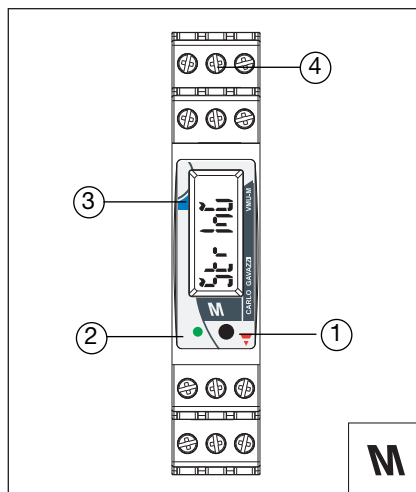
## VMU-1 mounting and positioning



The VMU-1 has to be mounted between the group of VMU-S and all the other modules as shown in the example picture on the left.

Every Eos-Array has to be equipped only with one VMU-1.

## VMU-M Front panel description



### 1. Push button.

To program the configuration parameters and to scroll the variables. One key function: short time pushbutton click: variable scroll or parameter increasing. Long time pushbutton click: programming procedure entering, parameter selection confirmation.

### 2. LED.

Green steady light: the module is power supplied and there is no communication on the RS485 bus. Green blinking light: the communication on the RS485 bus is working. Red: alarm detected (any). In case of alarm/communication condition the LED alternates its colour from red (alarm) to green. The blinking time is approx. 1 second.

### 3. Display.

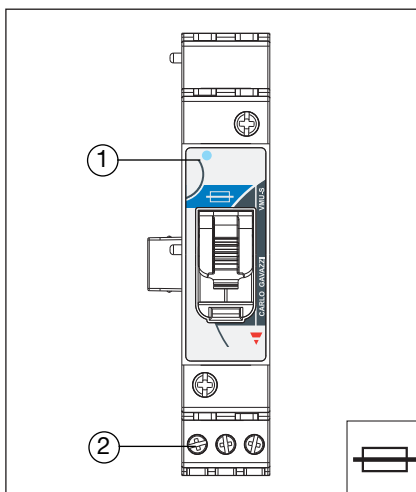
LCD-type with alphanumeric indications to:

- display some configuration parameters;
- display some measured variables.

### 4. Screw terminals.

For power supply, bus and digital inputs/output connections

## VMU-S Front panel description (AV10 range code: 16A)



### 1. LED

Green: the power supply is ON, there is a string current up to 1A;

Yellow: there is a string current from 1.1 to 3A;

Light orange: there is a string current from 3.1 to 6A;

Orange: there is a string current from 6.1 to 8A;

Dark orange: there is a string current from 8.1 to 10A;

Red: there is a string current higher than 10A;

White: the unit is enabled by VMU-M module for data reading and displaying.

Cycling from blue to any other colour listed above (from yellow to red): string alarm

Cycling from blue to green: blown fuse.

Cycling from blue to violet: inverted string polarity.

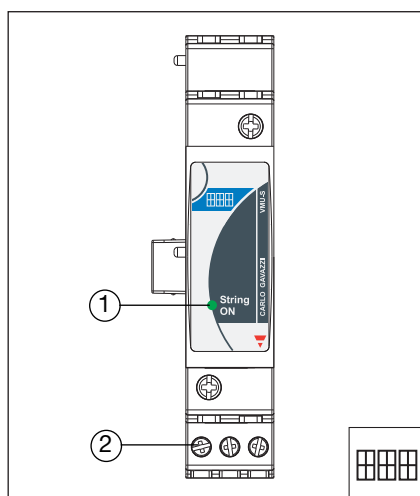
Cycling from white to any other colour: the unit is enabled by VMU-M module for data reading and displaying and shows the status of the module according to the colour list above.

### 2. Screw terminals

For string connections



## VMU-S Front panel description (AV30 range code: 30A)



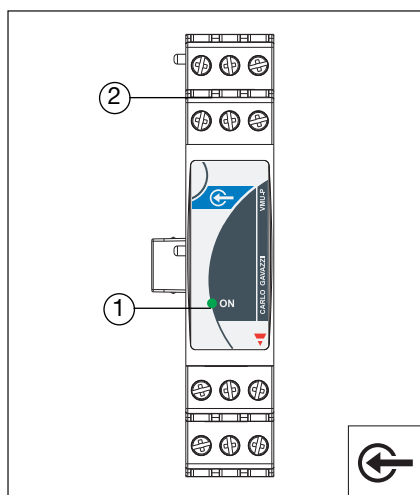
### 1. LED

Green: the power supply is ON, there is a string current up to 1A;  
 Yellow: there is a string current from 1.1 to 6A;  
 Light orange: there is a string current from 6.1 to 12A;  
 Orange: there is a string current from 12.1 to 16A;  
 Dark orange: there is a string current from 16.1 to 20A;  
 Red: there is a string current higher than 20A;  
 White: the unit is enabled by VMU-M module for data reading and displaying.  
 Cycling from blue to any other colour listed above (from yellow to red): string alarm  
 Cycling from blue to violet: inverted string polarity.  
 Cycling from white to any other colour: the unit is enabled by VMU-M module for data reading and displaying and shows the status of the module according to the colour list above.

### 2. Screw terminals

For string connections

## VMU-P Front panel description



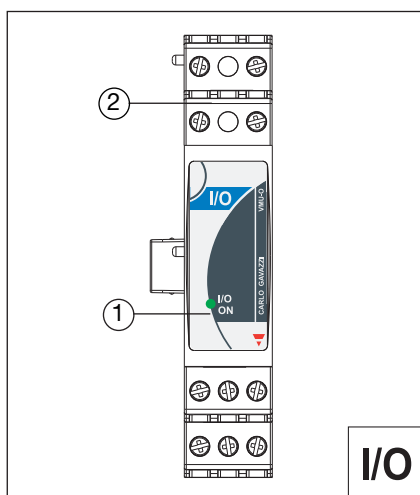
### 1. LED

ON steady light: the module is power supplied.  
 Green: the power supply is ON.  
 White: the unit is enabled by VMU-M module for data reading and displaying

### 2. Screw terminals

For measuring input connections

## VMU-O/VMU-O AT Front panel description



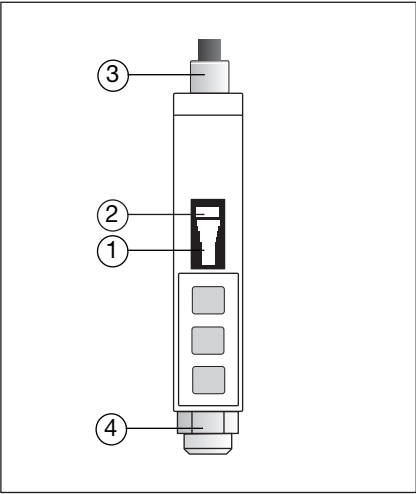
### 1. LED

ON steady light: the module is power supplied.  
 Green: the power supply is ON  
 White: the unit is enabled by VMU-M module for data reading and displaying.  
 Red: one or up to three digital inputs are activated  
 Blue: one or both digital outputs are activated  
 Cycling from one colour to any other one: the unit shows the status of the module according to the colour list above.  
 The cycling time is approx. 1 second.

### 2. Screw terminals

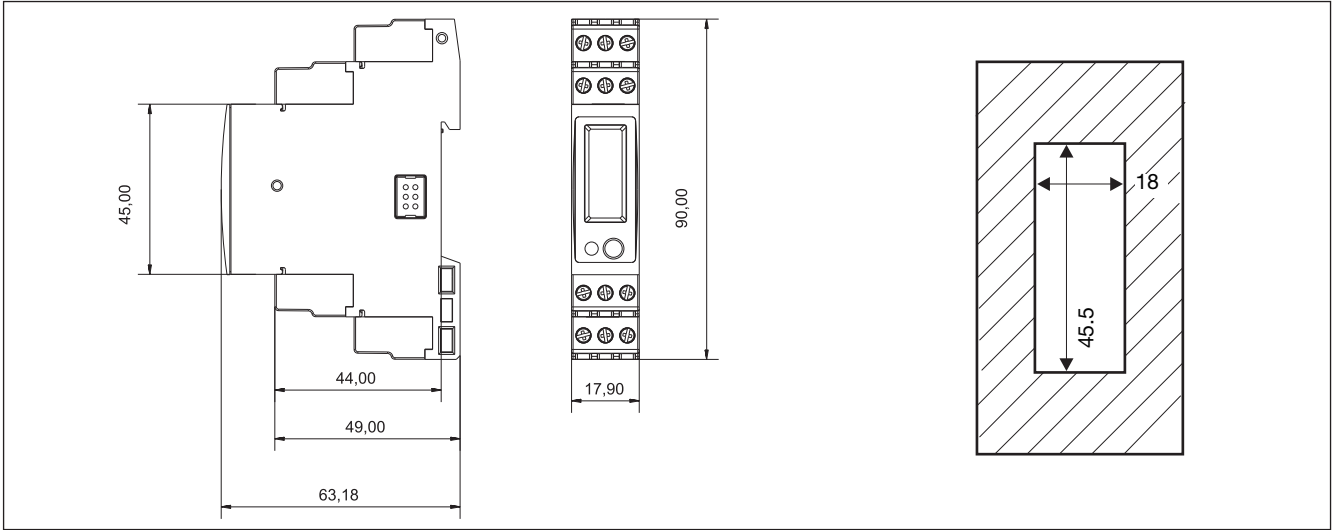
For digital inputs and outputs connections

VMU-AT Front panel description

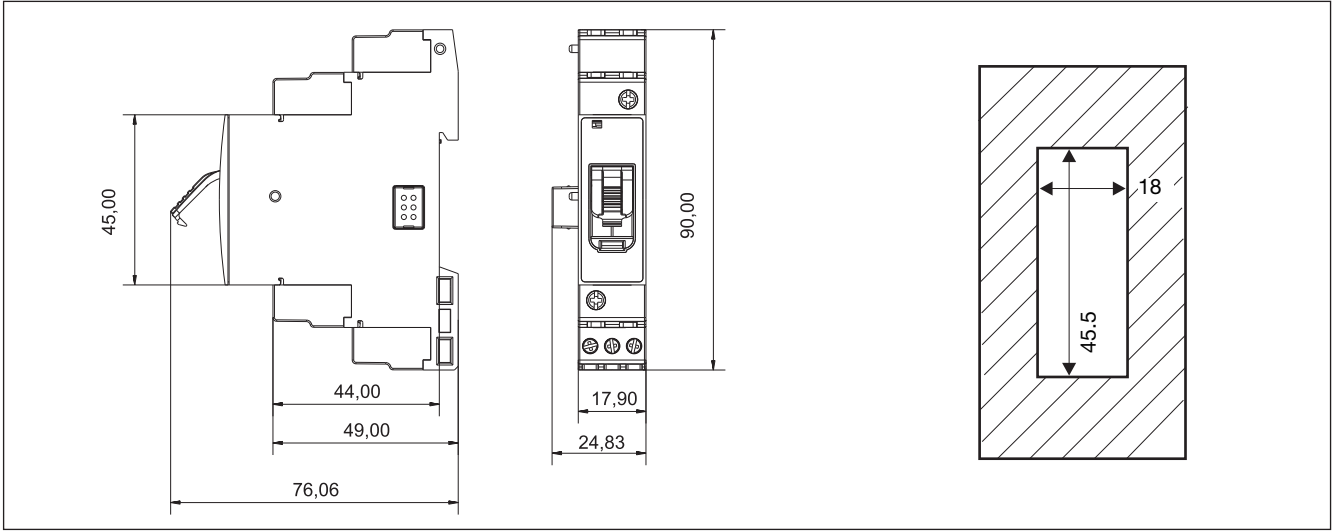


- 1. **Green LED**  
The power supply is ON
- 2. **Red LED**  
The optical signal loop is working
- 3. **Optical fibre connectors**  
One RX and one TX optical fibre connector
- 4. **One cable**  
Cable for power supply and signal output.

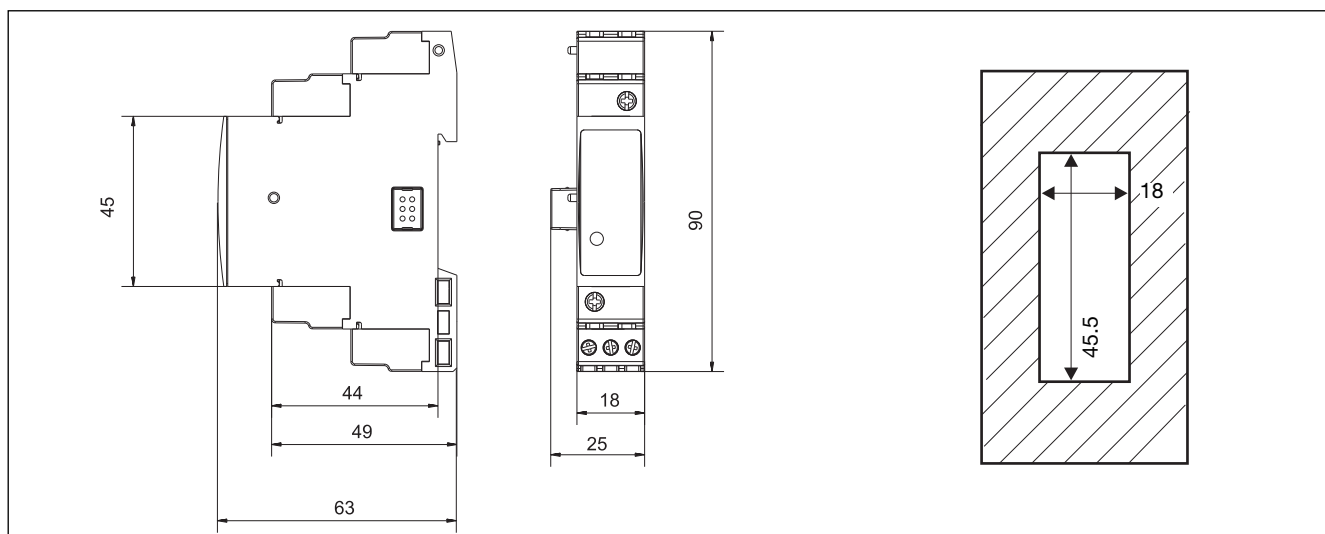
VMU-M Dimensions and panel cut-out (mm)



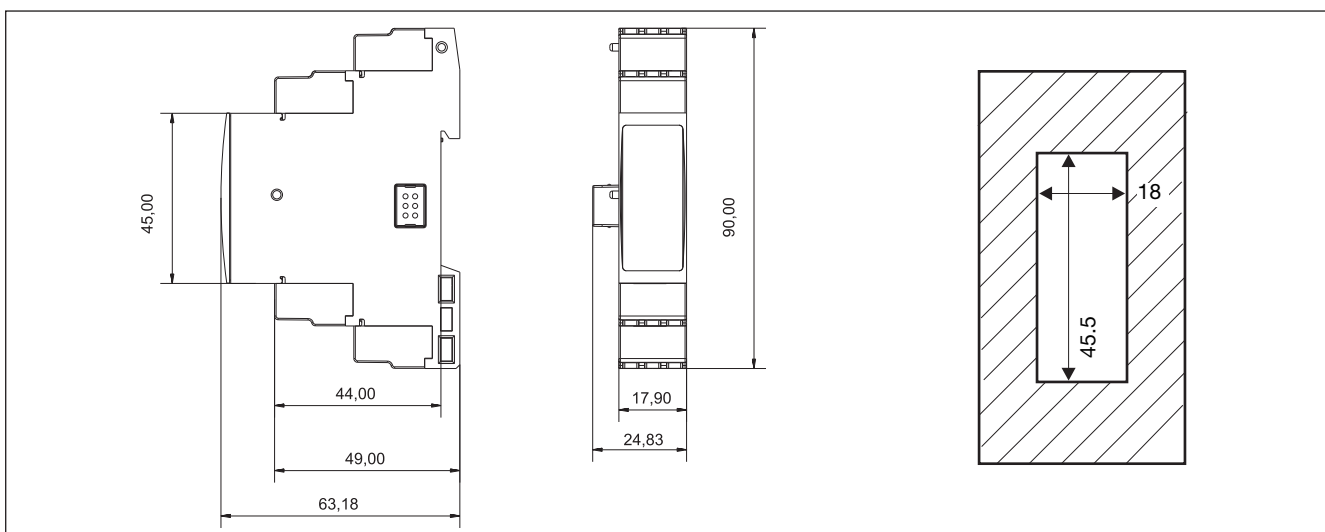
VMU-S (AV10) Dimensions and panel cut-out (mm)



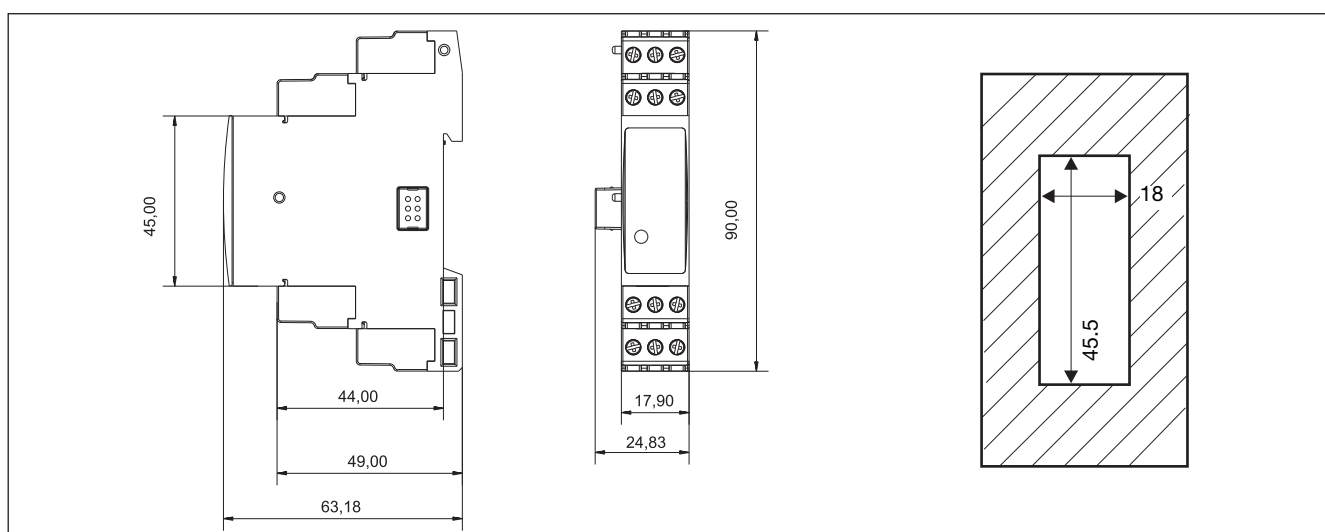
### VMU-S (AV30) Dimensions and panel cut-out (mm)



### VMU-1 Dimensions and panel cut-out (mm)

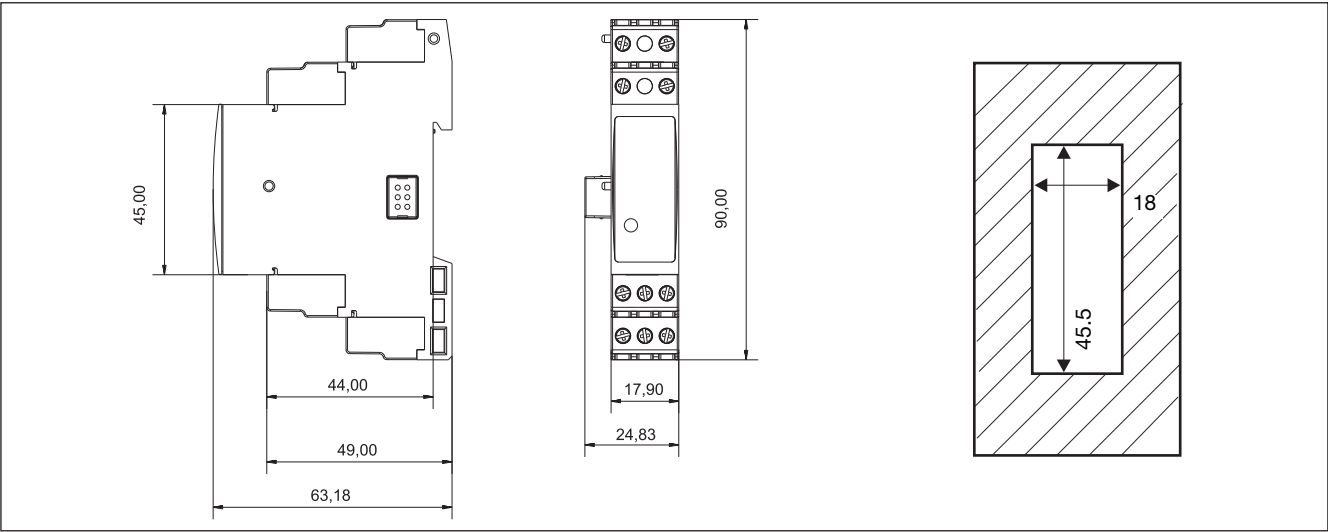


### VMU-P Dimensions and panel cut-out (mm)

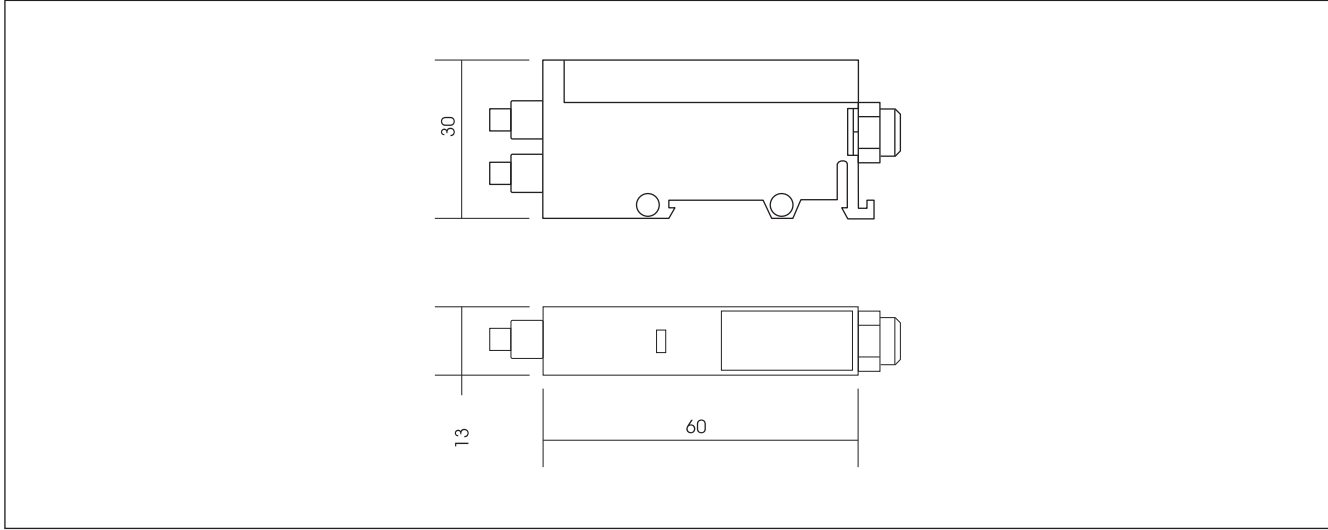




**VMU-O/VMU-O AT Dimensions and panel cut-out (mm)**



**VMU-AT Dimensions (mm)**



## Mean time to failure (MTTF)

Model	MTTF/MTBF - Years	Test conditions	Standard
VMU-M	24.2	gf, 50° C	MIL-HDBK-217F
VMU-S	35.4	gf, 50° C	MIL-HDBK-217F
VMU-P	65.4	gf, 50° C	MIL-HDBK-217F
VMU-O	31.7	gf, 50° C	MIL-HDBK-217F

gf: ground, fixed.

## Eos-ArraySoft parameter programming and variable reading software

### Eos-ArraySoft

#### Application

Multi-language software (Italian, English, French, German, Spanish) for variable reading and parameters programming. The program runs under Windows XP/Vista/7.

Up to two different applications can be selected:

- Solar: a management of a limited network where Eos-ArraySoft manages basically one VMU-M unit with relevant VMU-S, VMU-P and VMU-O modules and maybe an energy meter connected to the VMU-M digital input;
- Solar extended: a management of a complex network where Eos-ArraySoft manages many VMU-M modules and relevant sub networks (VMU-S, VMU-P and VMU-O units) and maybe an energy meter (EM21-72D, EM24-DIN, EM26-96) connected to the same RS485 bus.

#### Configuration mode

#### Data storing

#### Data download

#### Data displaying

#### Alarm set-up

#### Modem management

There are two configuration levels:

- the RS485 communication network which can include either one or more VMU-M units;
- the auxiliary network with all the parameters relevant to the following modules: VMU-M, VMU-S, VMU-P, VMU-O.

In pre-formatted XLS files (Excel data base).

Manual or automatic at programmable intervals.

The following matrix is available:

- String 1: V-A-kW-kWh;
  - String 2: V-A-kW-kWh;
  - String n: V-A-kW-kWh.
  - Main: PV module temperature, air temperature, irradiation and wind speed. Alarm parameters.
- GSM/GPRS modem configuration (connected to the PC) SMS messages.