EOS

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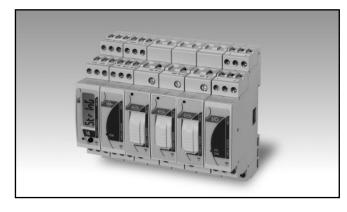
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Energy Management Control solution for solar PV applications Type Eos-Array

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



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 provide 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.

VMU-S, VMU-P and VMU-O units

 Master communication capability RS485 communication port (Modbus)

- Two digital inputs
- Two temperature inputs: Pt100 or Pt1000
- Single virtual or real alarm set-point connectable to any available variable

Local communication bus management up to 15 mixed

- Data and event stamping system
- Display readout: 6 DGTs
- 12 to 28 VDC power supply
 Dimensions: 1-DIN module
- Protection degree (front): IP40

How to order VMU-M 4 A S1 T2 X

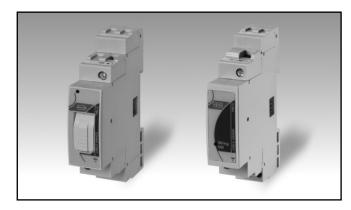
Model	-
Function	
Power supply	
Communication	
Inputs —	
Option	

Type Selection

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



VMU-S, string measuring unit



- Integrated 10.3x38mm fuse holder for string protection
- Dimensions: 1-DIN module
- Protection degree (front): IP40

- 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) ±0.5 RDG (current/voltage)
- Auxiliary power supply from VMU-M unit
- 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 fuseholder (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

Model	-	
Range ———		
Power supply		
Communication		 _
Option		

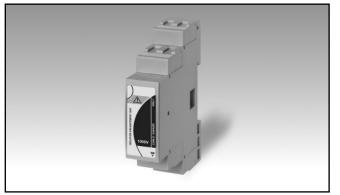
Type Selection

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

VMU-1 1000

Standard model

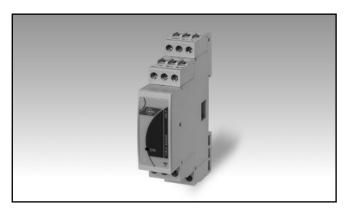
Type Selection

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		

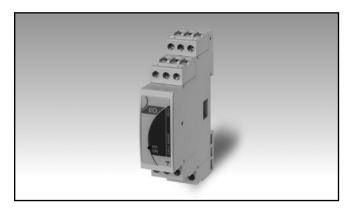
Type Selection

Range	Power supply		Com	Communication		Option	
 2TIW: Two "Pt" temperature type probes, mV sun irradiation and wind speed measuring inputs (*) 2TCW: Two "Pt" temperature type probes, mA sun irradiation and wind speed measuring inputs (*) 	<u></u> Х:	from 12 to 28VDC, self-power supply from VMU-M unit	S:	auxiliary communica- tion bus, compatible only to VMU-M module (*)	X:	none	

- -



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	VMU-O	X 12 R2 X
Model		$\Box = \Box =$
Power supply Inputs		
Outputs		
Option		

Type Selection (Standard model)

Pow	er supply	Inpu	ts	Outp	uts	Optio	on
X :	from 12 to 28VDC, self-power supply from VMU-M unit	12:	two digital inputs (*)	R2:	two relay output (*)	X:	none

Type Selection (Antitheft model)

Power supply		Inputs		Outputs		Option	
X:	from 12 to 28VDC, self-power supply from VMU-M unit	13:	three digital inputs (*)	R1:	one relay outputs (*)	AT:	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	ΧP	MCX
Model Power supply Plastic fibre			
200m sensing distance Output Option	e —		

Type Selection

Pow	er supply	Fibre	e optic	Sens	sing distance	Outp	out
X :	from 12 to 28VDC, self-power supply from VMU-O "AT" option unit	P:	plastic (*)	<u>M</u> :	200m (*)	C: Opti	open collector
(*) 20	standard.					X:	none

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.

Model	
Fibre optic cable lengtl	h: 1000m

DE022 1000

How to order



VMU-M Display and LED specification

Display Type Information read-out	1 line (max: 6-DGT) LCD, h 7mm From 4 to 6-DGT depend- ing on the information.
LED Type Status and colour	Dual colour Green steady light: the module is power supplied and there is no communi-

cation 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.

VMU-S LED specification

LED Type Status	Multicolor ON steady light: the module is power sup- plied and there is no alarm.	Colour AV30 range code	colour list above. The cycling time is approx. 1 second. Green: the power supply is
Colour AV10 range code	Green: the power supply is ON, there is a string cur- rent 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		ON, there is a string cur- rent 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 mod- ule 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 mod- ule 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.

VMU-P LED specification

LED

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.



VMU-O LED specification

LED 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. Red: one or both 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.

VMU-AT LED specification

LED

Power supply status

Green: the power supply is ON

Loop status

Red: the optical loop is closed

VMU-M input specifications

Digital inputs Number of inputs Working mode Purpose Input frequency Pre-scaler adjustment Contact measuring voltage Contact measuring current Contact resistance	2 First input: detection of ON/OFF status Second input: counting of pulses coming from an energy meter - First input: trip of protec- tion 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. 20Hz max, duty cycle 50% From 0.001 to 10.000 kWh/pulse (only for the second input) 3.3VDC <1mA $\leq 1k\Omega$ closed contact; $\geq 20k\Omega$ open contact	Insulation Temperature inputs Number of inputs Temperature probe Number of wires Wire compensation Accuracy (Display + RS485) Temperature drift Engineering unit Insulation Key-pad	See the table "Insulation between inputs and out- puts" 2 Pt100, Pt1000 2 or 3-wire connection Up to 10Ω. See "Temperature input characteristics" ±150ppm/°C Selectable °C or °F See the table "Insulation between inputs and out- puts" 1 push-button for variable scrolling and programming. Full programming can be carried out only using Eos-ArraySoft.
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VMU-S input specifications

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



VMU-S input specifications (cont.)

Start up current Start up voltage AV30 range code Current	0.05A 10V ±(0.5%RDG+2 DGT)
Voltage	from 0.2A to 30A ±(0.5%RDG+2 DGT) from 20V to 1000V
Power	±(1% RDG+ 2DGT) ±(1% RDG)
Energy Start up current Start up voltage	0.2A 10V
Temperature drift	≤200ppm/°C
Measurement sampling time Variables format Instantaneous variables Resolution Energies	2 sec. 4-DGT (A, W), 5-DGT (V) 0.1V; 0.01A; 0.01kW Total: 5+1 DGT (0.1KWh)
Max. and Min. data format	See "Stored set of vari- ables coming from
Input impedance AV10 range code Voltage Current	> $2.5M\Omega$ < $0.006\Omega(+$ 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

AV30 range code	power has not to exceed 2W
Voltage	> 2.5M
Current	< 0.003Ω @ 0.5 Nm (screw
	terminal torque).
Voltage Overloads	
Continuous	1100V
For 500ms	1600V
To earth	800V (extended to 1000V
	in case of combined use of
	VMU-1.1000V unit)
Current Overloads	
Continuous	AV10 range: 16A
	AV30 range: 30A
For 1s	AV10 range: 100A max
	AV30 range: 150A max
Protection	
Fuse holder	Integrated into the module
Fuse type	gPV
Fuse size	10x38mm (IEC60269-1-6)
Fuse current	Fuse NOT provided.
	Note: the fuse rated cur-
	rent has to be ≥1.4 lsc at
	45°C ambient temperature.
	See fuse manufacturer
	specifications for further
	details including de-rating
	caused by higher ambient
	temperature.

VMU-P input specifications

Temperature drift	≤200ppm/°C		±(0.1%RDG+1DGT)
Variables format	4 DGT (Temperature, solar	Temperature drift	25% to 120% FS. ±150ppm/°C
Resolution	irradiation and wind speed) 0.1°C/0.1°F; 1W/m ² , 1W/ft ² ; 0.1m/s, 0.1ft/s	Scaling factor Operating mode	Dual scale: - Input: programmable
Max. and Min. data format	See "Stored set of vari- ables coming from		range from 0 to 150.0 (mVDC)
Temperature probe inputs Number of inputs Temperature probe Number of wires Wire compensation Accuracy (Display + RS485) Temperature drift	2 (Input 1: PV module; Input 2: air) Pt100 or Pt1000 Up to 3-wire connection Up to 10Ω . See table "Temperature input characteristics" $\pm 150ppm/°C$	Decimal point position Impedance Overload Continuous	 Display: programmable range from 0 to 9999 (kW/m², kW/ft²) Fixed. > 30KΩ 10VDC (measurement available up to 150mV on both display and communi- cation bus)
Engineering unit Insulation	Selectable °C or °F See the table "Insulation between inputs and com- munication bus"	For 1s Insulation	20VDC See the table "Insulation between inputs and com- munication bus"
Irradiation sensor inputs (range code: 2TIW) Number of inputs Range Accuracy (Display + RS485) (@25°C ±5°C, R.H. ≤60%)	1 0 to 120mVDC ±(0.2%RDG+1DGT) 0% to 25% FS;	Irradiation sensor input (range code: 2TCW Number of inputs Range Accuracy (Display + RS485) (@25°C ±5°C, R.H. ≤60%)	1 0 to 20mADC ±(0.2%RDG+1DGT) 0% to 25% FS;



VMU-P input specifications (cont.)

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

VMU-M Output specifications

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

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Maximum number of modul managed by every single VMU-M module	-	Digital output Number of outputs	2 Alarm notification as a
Digital inputs Number of inputs Working mode	Up to 7 2 Detection of OPEN/CLOSED contact status	Purpose	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
Purpose	Trip of protection detec- tion, the status is transmit- ted only by means of the communication port.		remote control); activation of a module washing sys- tem (by means of the inter- nal clock, as a remote con- trol or as a changing of effi-
Input frequency Contact reading voltage Contact reading current Contact resistance	2Hz max, duty cycle 50% 3.3VDC <2mA \leq 300 Ω closed contact; \geq 10k Ω open contact	Туре	ciency of the PV panels). Relay, SPST type AC 1-5A @ 250VAC AC 15-1A @ 250VAC Available by means of
Insulation	See the table "Insulation between inputs and outputs"	Insulation	VMU-O module only See the table "Insulation between inputs and out- puts"

VMU-O Input/Output specifications

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

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



VMU-AT Antitheft sensor specifications

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

Main Function

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

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Main Function (Cont.)

· · ·	•		
Clock		Event logging	
Functions	Universal clock and calen-	Data displaying	The data are not available
	dar.		on the display but they can
Daylight-saving enabling	Activation: NO/YES		be both checked and
Time format	Houre:minutes with		downloaded using RS485
	selectable 24 hours or		communication port in
	AM/PM		combination with Eos-
Date format	Month-Day, where the		ArraySoft software.
	month is displayed in a	Function enabling	Activation: NO/YES
	three letter format (e.g.:	Type of stored events	VMU-O digital input/output
	JAN-FEB-MAR) and the	31	status change (real and vir-
	date as a number. Year is		tual alarms), string alarms
	displayed in a two digit for-		(see "String control"),
	mat.		VMU-M 1st digital input
Battery life	10 years		status change. The events
Data logging	,		are recorded as soon as
Data	The data are not available		they occur. For more infor-
Dala	on the display but they can		mation about the type and
	be both checked and		stored data, see "List of
	downloaded using RS485		the variables that can be
	communication port in		connected to"
	combination with Eos-	Number of events	Max. 10 000.
	ArraySoft software.	Data reset	The reset can be carried
Function enabling	Activation: NO/YES		out only using Eos-
Function description	All the events gathered		ArraySoft.
runction description	from both VMU-S, VMU-O	Data format	Event, date (dd:mm:yy) and
	and VMU-P modules are		time (hh:mm:ss)
	stored individually into the	Storage method	Circular FIFO
	internal memory.	Memory type	Flash
Stored data type	Variables: V, A, W, Wh, PV	Memory retention time	10 years
	module temperature, ambi-	String control	
	ent temperature, irradia-	Function enabling	Activation: NO/YES
	tion, wind speed, string	Function selection	Match max. control or
	efficiency and BOS effi-		median control
	ciency.	Function description	Match max. control: this
Storage interval	Selectable: 1-5-10-15-30-		function is helpful only if
5	60 minutes		there are at least two string
Sampling management	The sample stored within		controls (VMU-S units). The
	the selected time interval		highest value of the mea-
	results from the continuous		sured string power among
	average calculation of the		those available is used as a
	measured values. The		reference value. The alarm
	average is calculated with		set-point is a value which
	an interval within two fol-		can be set by the user as a
	lowing measurements of		percentage of the refer-
	approx. 2s.		ence value below which
Storage duration	Before overwriting:		there is the alarm condi-
C C	depending on the storage		tion.
	interval, see "Historical		- Median control: the mea-
	data storing time table"		surement of the string
Data format	Variables, date (dd:mm:yy)		power is performed by the
	and time (hh:mm:ss)		local VMU-S module indi-
Storage method	Circular FIFO		vidually. Within the VMU-M
Memory type	Flash		system all values coming
Memory retention time	10 years		at the same instant from
-			



Main Function (Cont.)

	every VMU-S module are used to calculate the "median" value which becomes the reference val- ue to which the dynamic window set-point (in per- centage set by the user) is linked. The abnormal con- dition is detected when the measured instantaneous string power is out of the set window alarm. The	Control type "1" Control type "2"	The VMU-P module is pre- sent and both PV module temperature and irradiation are measured to calculate the reference value for the efficiency calculation. The VMU-P module is pre- sent and both ambient temperature and irradiation are measured to calculate the reference value for the efficiency calculation.
	alarm activates, with refer-	BOS efficiency	
	ence to the failed string,	-	The total officiancy man
	either a relay output (only	measurement	The total efficiency mea- surement is based on the
	in case of "VMU-O" con-		comparison between the
	nection) or/and a message		generated energy and the
	which is transmitted by		exported energy supplied
	means of the RS485 com-		to the grid. The grid sup-
	munication port to an		plied energy is measured
	acquisition system.		by means of a "S0" output
String window alarm	The alarm is set as the		coming from an energy
	string power control, the		meter like EM21-72, EM24-
	value is programmable in percentage (of the mea-		DIN, EM26-96 where the
	sured string value) from 0.1		pulsating output (-kWh) is
	to 199.9.		connected to the second
Other alarms	The alarms can be con-		digital input of VMU-M.
	nected also to: A and V.	Fuse blow detection	
"PV string" efficiency		(only AV10 range code)	Warning message trans- mission through the local
measurement			port to the VMU-M unit.
Function enabling	Activation: NO/YES	Wrong DV string connection	
Ŭ	Three type of controls are available	Wrong PV string connection	Warning message trans- mission through the local
Control type "0"	The VMU-P unit is not		port to the VMU-M unit.
	available therefore the sin-		
	gle strings are used to cal-		
	culate the reference value		
	for the efficiency calcula-		
	tion.		

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-0		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 strimg (A+)
Any	Local bus	-	0kV	0kV	0kV	0kV	0kV	0kV	4kV	4kV	4kV	4kV	4kV
	DC Power supply	0kV	-	0kV	0kV	0kV	0kV	0kV	4kV	4kV	4kV	4kV	4kV
VMU-M	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
	Temperature: Ch1, Ch2	0kV	0kV	0kV	0kV	-	0kV	0kV	4kV	4kV	4kV	4kV	4kV
VMU-P	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
	Digital inputs: Ch1, Ch2, Ch3	0kV	0kV	0kV	0kV	0kV	0kV	0kV	-	4kV	4kV	4kV	4kV
VMU-0	Relay outputs: Ch1, Ch2	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	-	4kV	4kV	4kV
	Input string (V-)	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	-	4kV	>5MΩ
VMU-S	Input string (A+)	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	-	4kV
	Output strimg (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 dis- connecting device).

General specifications

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



General specifications (cont.)

Standard compliance Safety Approvals Housing Dimensions (WxHxD)	IEC60664, IEC61010-1 EN60664, EN61010-1 CE, cULus Listed 17.5 x 90 x 67 mm	Material Mounting Protection degree Front Screw terminals	Noryl, self-extinguishing: UL 94 V-0 DIN-rail IP40 IP20	
Connections				
VMU-M Connections Cable cross-section area Screw terminal purposes 1.5 mm ²	Screw-type 1.5 mm2 max, Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm 3+3 screw terminals used for two temperature inputs 3 screw terminals used for PC105 communication	Screw terminal purposes 16 mm2 1.5 mm²	1+1 screw terminals: 1 posi- tive for string input and 1 positive for string output (to the Inverter) 3 screw terminals: not power input, only for nega- tive voltage signal mea- surement	
VMU-S AV10	RS485 communication 2 screw terminals used for power supply	VMU-P Connections Cable cross-section area	Screw-type 1.5 mm ² max. Min./Max. screws tightening torque:	
Connections Cable cross-section area Current (+)	Screw-type Min. 2.5 mm ² , max 6 mm ² in case of flexible wire, Max. 10 mm ² in case of rigid wire. Min./Max. screws tightening torque: 0.5 Nm / 1.1 Nm	Screw terminal purposes 1.5 mm ²	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	
Voltage (-) Screw terminal purposes 10 mm²	Max 1.5 mm ² , Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm 1+1 screw terminals: 1 posi- tive for string input and 1 positive for string output (to	VMU-O Connections Cable cross-section area Relay outputs and digital inputs	Screw-type Max 1.5 mm ² Min./Max. screws tightening torque:	
1.5 mm²	the Inverter) 3 screw terminals: not power input, only for nega- tive voltage signal mea- surement	"X" type Screw terminal purposes 1.5 mm ²	0.4 Nm / 0.8 Nm 2+2 screw terminals: two for 1 st relay output and two for 2 nd relay output (SPST	
VMU-S AV30 Connections Cable cross-section area Current (+)	Screw-type Min. 2.5 mm ² , max 10 mm ² in case of flexible wire, Max. 16 mm ² 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 mm²	2+2 screw terminals: two for 1 st digital input and two for 2 nd digital input 2 screw terminals for relay output (SPST type) 2+2+2 screw terminals: two for 1 st digital input, two for 2 nd digital input and two for 3 rd digital input	
Voltage (-)	Max 1.5 mm ² , Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm	Weight (all modules)	Approx. 100 g (packing included)	

Power supply specifications

VMU-M Power supply Power consumption

12 to 28 VDC ≤1W VMU-S-P-O Power supply

Self-power supplied through the communication bus ≤0.7W

Power consumption

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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

String current vs. operating temperature

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 _w : 2.5W _{typ}	1.5A for 1s	SPD 24 18 1B or SPM3 24 1
From 1 to 3	Up to 1	Up to 1	PS _w : 5W _{typ}	1.5A for 1s	SPD 24 18 1B or SPM3 24 1
From 4 to 10	From 2 to 4	Up to 1	PS _w : 11W _{typ}	1.5A for 1s	SPD 24 30 1B or SPM3 24 1
From 11 to 14	Up to 1	Up to 1	PS _w : 10W _{typ}	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 _w : 12W _{typ}	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 _w : 13W _{typ}	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 _w :14W _{typ}	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 _w :14W _{typ}	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: $PS_W:<1W+n_{VMU-S}*0.5W+n_{VMU-O,X}*0.7W+n_{VMU-O,T}*1.1+n_{VMU-P}*1.8W.$ 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
-	4 AC energy value 0.0 to 9		external energy meter



Eos-Array

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" effinciency 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	-60.0 to 400.0	From 1 to 15	PV module temperature (°C/°F).
1	(PV module)	-00.0 10 400.0	1101111013	The range is extended so to cover both °C and °F indication
2	Temperature 2	-60.0 to 400.0	From 1 to 15	Ambient temperature (°C/°F).
2	(Environment)	-00.0 10 400.0	1101111013	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 ² (kW/feet ²).
3	Solar Inaciation	0.0 10 9.999		(e.g. in: 0 to 1kW/m ² (1kW/feet ²), 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 rel- evant 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)		From 1 to	15 strings					
Time interval (minutes)	Data storing time							
(1)	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

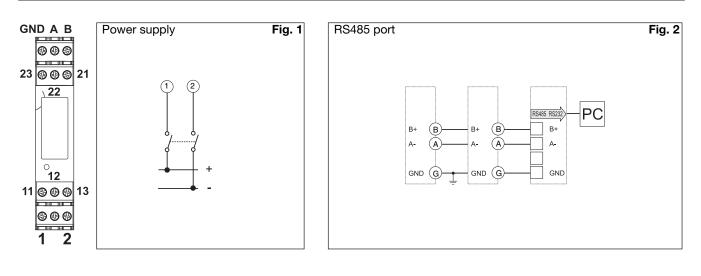
• Data-logging

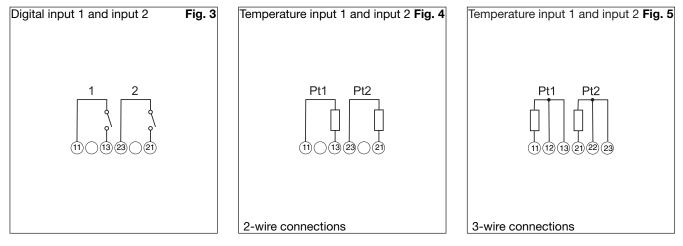
No	Variable	Event- logging	Data- logging	Alarm output	Module (from)	Notes
1	°C (°F) (input 1)	Yes	Yes	Yes	VMU-M	As alternative of status detection (4)
2	°C (°F) (input 2)	Yes	Yes	Yes	VMU-M	As alternative of variable (5)
3	% BOS efficiency	Yes	Yes	Yes	VMU-M	BOS efficiency calculation of the PV plant (in case of one VMU-M unit only). In all othre cases the calculaion 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 alter- native 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 ² (kWp/ft ²)	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-0	ON /OFF status detection
39	Status: input 2	Yes	No	No	VMU-0	ON /OFF status detection
40	Status: output 1	Yes	No	No	VMU-0	ON /OFF status detection
41	Status: output 2	Yes	No	No	VMU-0	ON /OFF status detection
42	Error: 1	Yes	No	Yes	VMU-0	Incoherent programming parameters

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

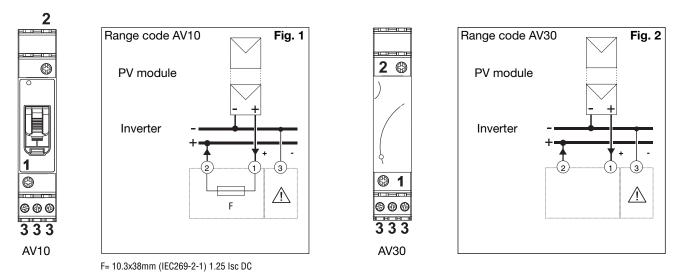


VMU-M connections





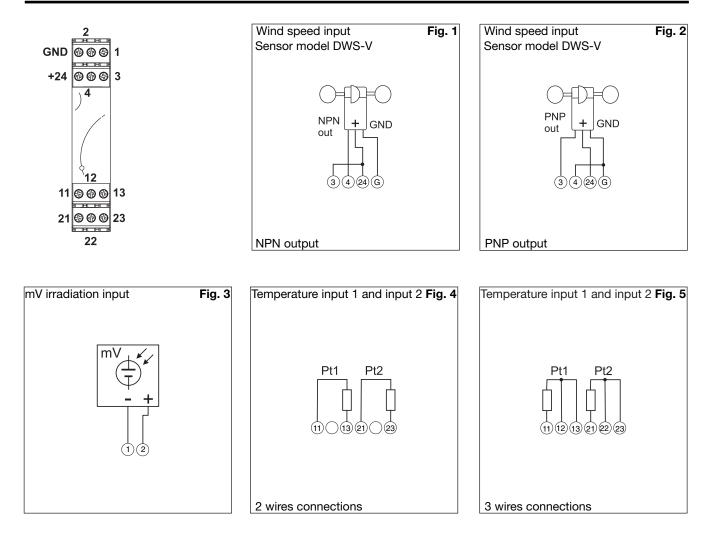
VMU-S (AV10 and AV30) connections



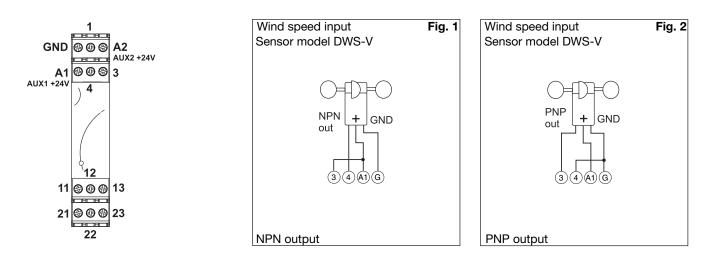
🕂 = Not power input, only for voltage signal measurement.

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VMU-P (2TIW) connections

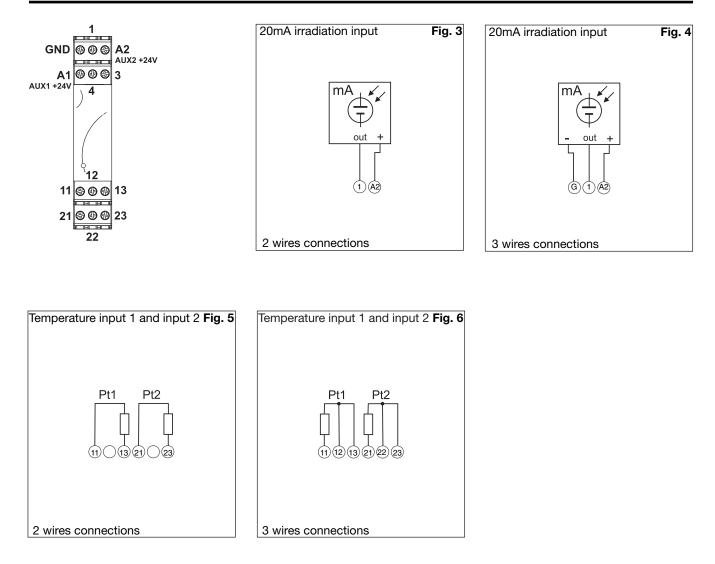


VMU-P (2TCW) connections

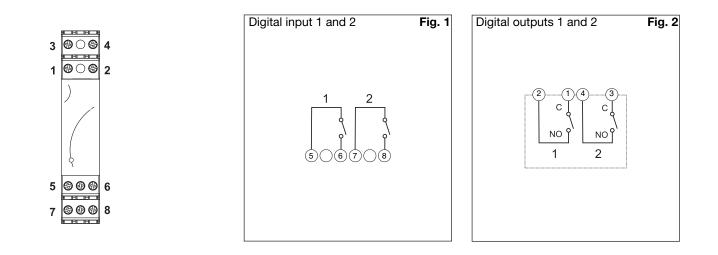




VMU-P (2TCW) connections (cont.)

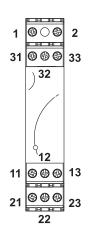


VMU-O connections

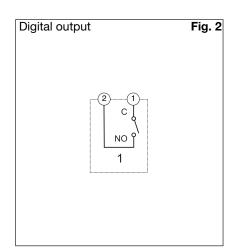




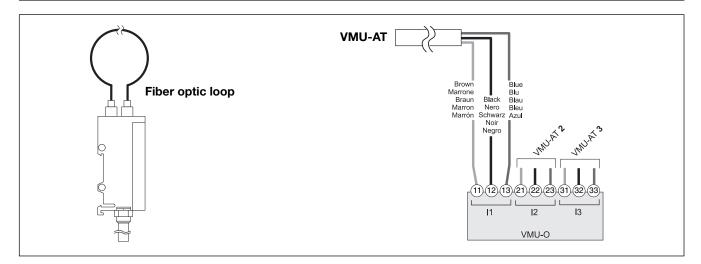
VMU-O "AT" option connections



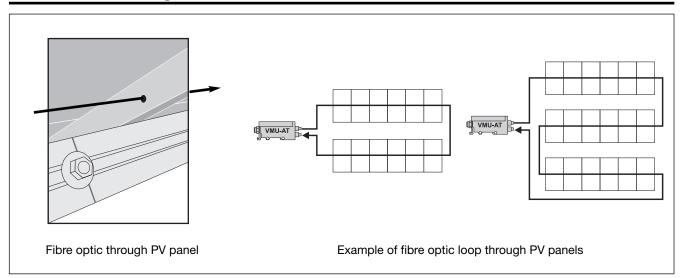
Digital input 1, 2 and 3 Fig. 1



VMU-AT connections

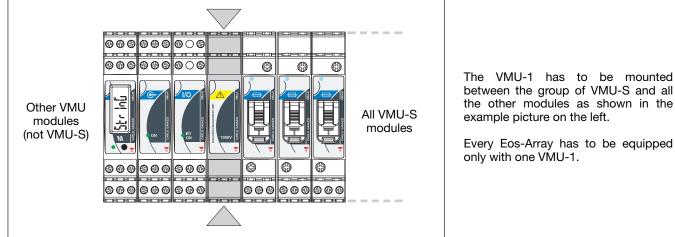


VMU-AT mounting and use

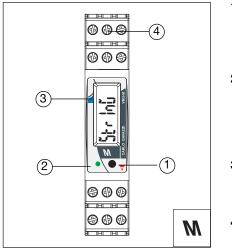




VMU-1 mounting and positioning



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.

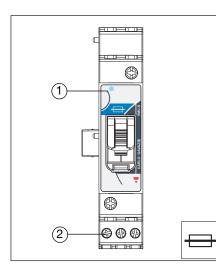
3. Display.

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)

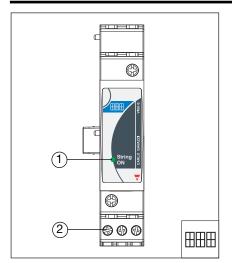


1. LED Green: the power supply is ON, there is a string current up to 1A; Yellow: there is a string current from 1.1 to 3A; Light orange: there is a string current from 3.1 to 6A; Orange: there is a string current from 6.1 to 8A; Dark orange: there is a string current from 8.1 to 10A; Red: there is a 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)

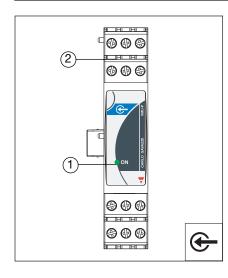


1. LED

- 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



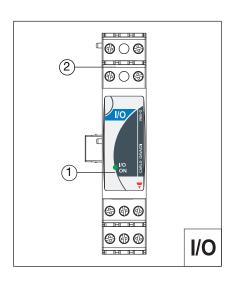
1. LED

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

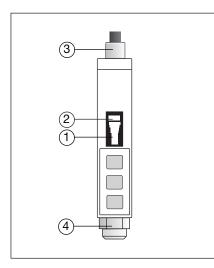
ON steady light: the module is power supplied. Green: the power supply is ON White: the unit is enabled by VMU-M module for data reading and displaying. Red: one or up to three digital inputs are activated Blue: one or both digital outputs are activated Cycling from one colour to any other one: the unit 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

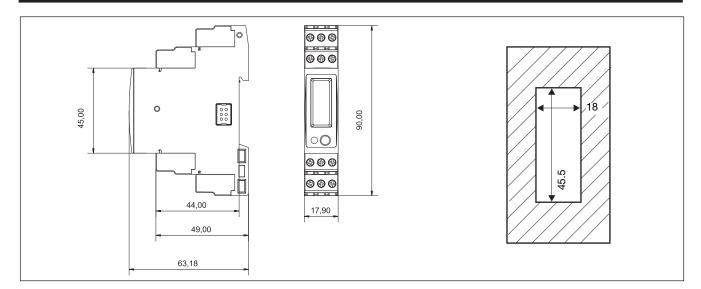


VMU-AT Front panel description

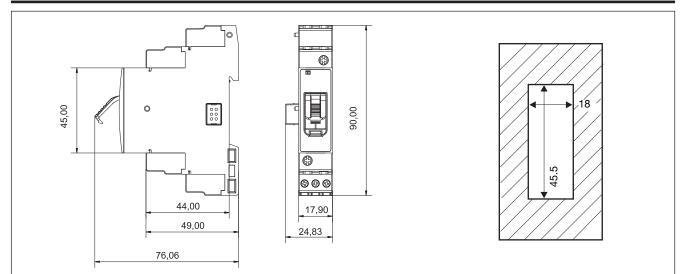


- 1. Green LED
 - The power supply is ON
- 2. Red LED
- The optical signal loop is working **3. Optical fibre connectors**
- One RX and one TX optical fibre connector
- 4. One cable
- Cable for power supply and signal output.

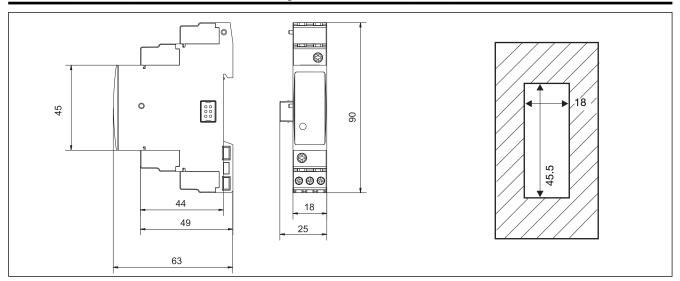
VMU-M Dimensions and panel cut-out (mm)



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

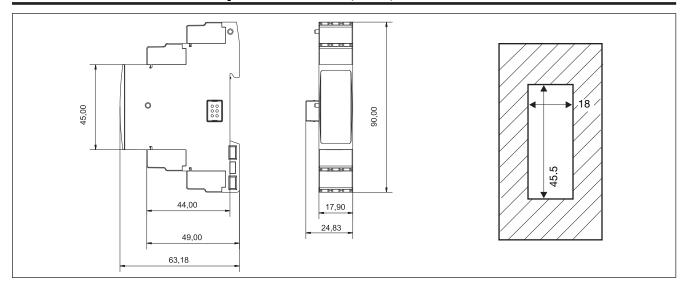


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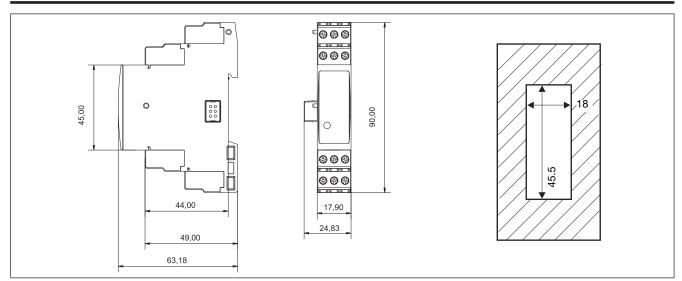


VMU-S (AV30) Dimensions and panel cut-out (mm)

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

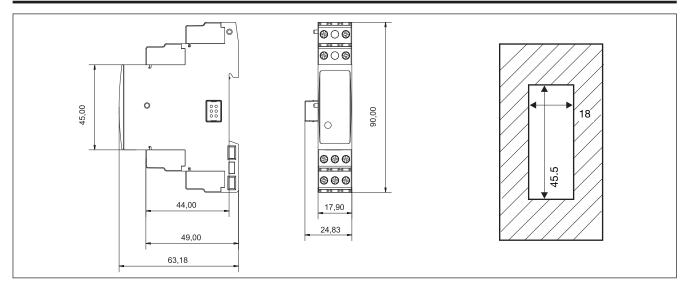


VMU-P Dimensions and panel cut-out (mm)

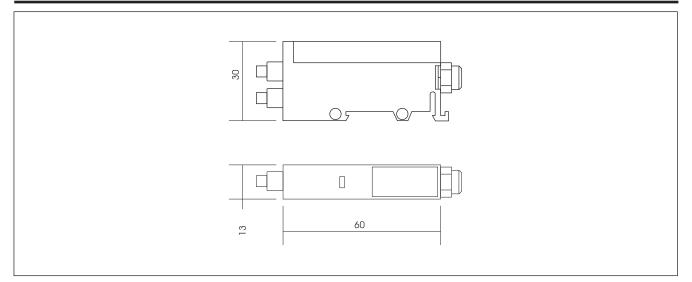




VMU-O/VMU-O AT Dimensions and panel cut-out (mm)



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

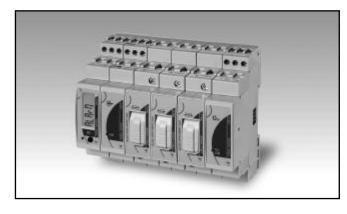
gf: ground, fixed.

Eos-ArraySoft parameter programming and variable reading software

Eos-ArraySoft Application	Multi-language software (Italian, English, French, German, Spanish) for vari- able reading and parame- ters programming. The program runs under Win- dows XP/Vista/7. Up to two different applica- tions can be selected:	Configuration mode	There are two configuration levels: - the RS485 communica- tion network which can include either one or more VMU-M units; - the auxiliary network with all the parameters relevant to the following modules:
	- Solar: a management of a		VMU-M, VMU-S, VMU-P,
	limited network where Eos-ArraySoft manages basically one VMU-M unit	Data storing	VMU-O. In pre-formatted XLS files (Excel data base).
	with relevant VMU-S, VMU-P and VMU-O mod-	Data download	Manual or automatic at programmable intervals.
	ules and maybe an energy meter connected to the VMU-M digital input; - Solar extended: a man- agement of a complex net- work 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	Data displaying Alarm set-up Modem management	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 tem- perature, air temperature, irradiation and wind speed. Alarm parameters. GSM/GPRS modem con- figuration (connected to the PC) SMS messages.
	same RS485 bus.		

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

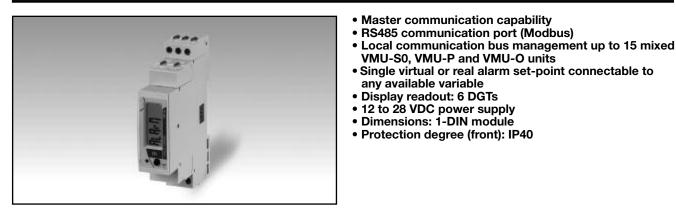
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Modular local control system for PV plants • Up to 17 DIN modules configuration equivalent to 280mm width

- Eos-ArrayLSoft freeware software for easy product configuration
- Eos-Array can be formed by maximum 17 units
- Eos-Array can manage in addition to VMU-ML master unit up to:
 - max 1 VMU-P unit;
 - max 15 VMU-S0 units;
 - max 1 VMU-O units.
 - max 1 VMU-1

VMU-ML, master unit



Product Description

Eos-Array Lite is a combination of modules which performs mainly a current and voltage control of a photovoltaic plant. The core unit is VMU-ML which performs the local bus management of VMU-S0, VMU-P both measuring units and VMU-O output unit. VMU-ML assigns the proper local unit address

automatically (up to 15 units) and gathers all the local measurements coming from VMU-S0 and VMU-P measuring units. VMU-ML can provide by means of VMU-O modules one relay output so to manage up to 1 real alarm. Housing for DIN-rail mounting, IP40 (front) protection degree.

How to order VMU-M LAS1 XX X

VMU-S0, VMU-P and VMU-O units

any available variable

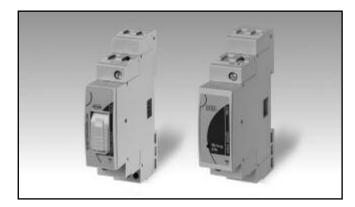
	-	-	
Model			
Power supply Communication			
Inputs			
Option			

Type Selection

Function	Power supply	Communication	Inputs
L: Lite (*)	A: From 12 to 28VDC (*)	S1: RS485 Modbus (*)	XX: none (*)
Option	(*) as standard.		



VMU-SO, string measuring unit



- Direct DC voltage measurement up to 1000V
- Direct DC current measurement up to 16A or up to 30A without fuse
- Instantaneous variables data format: 4 DGTs
- Instantaneous variables: V, A.
- Accuracy: ±0.5 RDG (current/voltage)
- Auxiliary power supply from VMU-ML unit
- String alarm management by means of VMU-ML unit
- Integrated 10.3x38mm fuse holder for string protection
- Fuse blow detection by means of VMU-ML unit only
- Dimensions: 1-DIN module
- Protection degree (front): IP40

Product Description

Variables measuring unit with built-in protection fuseholder (the fuse is not provided), particularly indicated for DC current, voltage, 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. Moreover the unit is provided with an auxiliary serial communication bus. Alarms, fuse blow detection, and serial communication are managed by means of VMU-ML module. Housing for DIN-rail mounting, IP40 (front) protection degree.

How to order	VMU-S0	AV10	X S FX
Model			$\Box \Box $
Range			
Power supply			
Communication —			
Option			

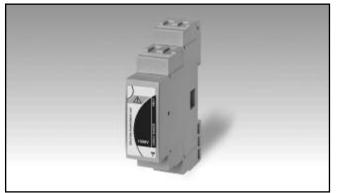
Type Selection

Range	Pow	er supply	Com	munication	Optio	n
AV10: 1000V DC, 16A (Direct connection) (*) AV30: 1000V DC, 30A (Direct connection) (**) In this case the "Option" is "XX".	X :	from 12 to 28VDC, self-power supply from VMU-ML unit	S:	auxiliary communica- tion bus, compatible only to VMU-ML mod- ule (*)	XX: FX:	none (no fuse holder) with fuse holder (*)

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



VMU-1, isolation enhancement unit



- Isolation enhancement of voltage measuring inputs to earth of VMU-S0: 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-S0 and all the other VMU modules. Housing for DIN-rail mounting, IP40 (front) protection degree.

How to order

VMU-1 1000

Standard model

_____L

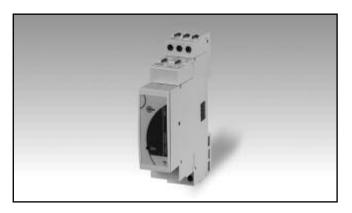
Type Selection

Standard model

Isolation voltage 1000V: isolation enhancement on VMU-S0 voltage measuring input to earth from 800VDC (without module) to 1000VDC. Note: only one VMU-1 is needed per Eos-Array.



VMU-P, environment variables unit



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

Product Description

Environment variables measurement unit particularly indicated for PV module temperature or air temperature and sun irradiation, 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-ML module. Housing for DIN-rail mounting, IP40 (front) protection degree.

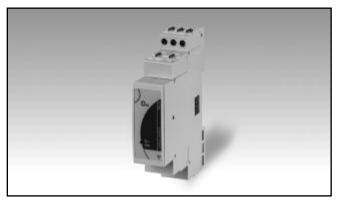
How to order	VMU-P	1TI	XSX
Model Range Power supply Communication Option			

Type Selection

Range		Power supply		Communication		Option	
1TI: 1TC:	One "Pt" temperature type probe, mV sun irradiation input (*) One "Pt" temperature type	X :	from 12 to 28VDC, self-power supply from VMU-ML unit	S:	auxiliary communica- tion bus, compatible only to VMU-ML mod- ule (*)	X:	none
	probe, mA sun irradiation input (*)						



VMU-O, relay outputs unit



- One relay output managed by the VMU-ML module
- Auxiliary power supply from VMU-ML unit
- Dimensions: 1-DIN module
- Protection degree (front): IP40

VMU-O Product Description

Relay output unit suitable to be used in combination with VMU-ML module. VMU-O allows to add one relay output to a VMU-ML based system so to manage local alarms. Housing for DIN-rail mounting, IP40 (front) protection degree.

How	to o	rder
-----	------	------

VMU-O X XX R1 X

Model —	
Power supply ——	
Inputs	
Outputs	
Option	

Type Selection

Power supply		Inputs	Outputs	Option	
X :	from 12 to 28VDC, self-power supply from VMU-ML unit (*)	XX: none	R1: one relay output (*)	X: none	

(*) as standard.



Green blinking light: the

communication on the

RS485 bus is working. Red: alarm detected (any).

In case of alarm/communi-

cation condition the LED

alternates its colour from

red (alarm) to green. The

blinking time is approx. 1

White: the unit is enabled by VMU-ML module for

data reading and display-

second.

ing.

VMU-ML Display and LED specifications

Display

Type Information read-out LED Type

Status and colour

1 line (max: 6-DGT) LCD, h 7mm 4-DGT

Dual colour Green steady light: the module is power supplied and there is no communication on the RS485 bus.

VMU-P LED specifications

LED Type Status and colour

Multicolor Green: the power supply is ON.

VMU-O LED specifications

LED Type Status and colour

Multicolor Green: the power supply is ON. White: the unit is enabled by VMU-ML module for data reading and displaying. Blue: digital output is 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.

VMU-ML input specifications

Key-pad

1 push-button for variable scrolling and for some parameters programming.

Full programming can be carried out only using Eos-ArrayLSoft.

VMU-SO input specifications

Rated inputs Current type	1 (shunt)	Start up current Start up voltage	0.05A 10V
Current range	AV10 range: 16A DC @ 40°C, 15A @ 50°C, 14A @	AV30 range code Current	±(0.5%RDG+2 DGT)
	55°C, 12A @ 60°C, 10A @ 65°C AV30 range: 30A DC @	Voltage	from 0.2A to 30A ±(0.5%RDG+2 DGT) from 20V to 1000V
Voltage	55°C, 25A DC @ 60°C, 20A DC @ 65°C AV10 range: 1000V DC	Start up current Start up voltage	0.2A 10V
voltage	AV10 range: 1000V DC AV30 range: 1000V DC	Temperature drift	≤200ppm/°C
Accuracy	(@25°C ±5°C, R.H. ≤60%)	Measurement sampling time	2 sec.
AV10 range code	· · · · · ·	Variables format	
Current	±(0.5%RDG+2 DGT)	Instantaneous variables	4-DGT (A), 5-DGT (V)
Voltage	from 0.05A to 16A ±(0.5%RDG+2 DGT) from 20V to 1000V	Resolution	0.1V; 0.01A.



VMU-SO input specifications (cont.)

Max. and Min. data format Input impedance AV10 range code Voltage Current	See "Variables format" > 2.5M Ω < 0.006 Ω (+ fuse impedance) @ 0.5 Nm	Current Overloads Continuous For 1s	AV10 range: 16A AV30 range: 30A AV10 range: 100A max AV30 range: 150A max
AV30 range code Voltage Current	(screw terminal torque). The maximum dissipation power has not to exceed 2W. > 2.5M $< 0.003\Omega @ 0.5 Nm (screwterminal torque)$	Protection Fuse holder Fuse type Fuse size Fuse current	Integrated into the module gPV 10x38mm (IEC60269-1-6) Fuse NOT provided. Note: the fuse rated cur- rent has to be \geq 1.4 lsc at 45°C ambient temperature. See fuse manufacturer
Voltage Overloads Continuous For 500ms To earth	1100V 1600V 800V (extended to 1000V in case of combined use of VMU-1.1000V unit)		specifications for further details including de-rating caused by higher ambient temperature.

VMU-P input specifications

Temperature drift	≤200ppm/°C	Desired resiret resition	Fired
Variables format		Decimal point position Impedance	Fixed. $> 30 K\Omega$
Instantaneous variables	4 DGT (Temperature, solar	Overload	
	irradiation)	Continuous	10VDC (measurement
Resolution	0.1°C/0.1°F; 1W/m²,		available up to 1V on both
	1W/ft²;		display and communica-
Max. and Min. data format	See "Variables format"	For 1s	tion bus) 20VDC
Temperature probe input		Insulation	See the table "Insulation
Number of inputs	1		between inputs and com-
Temperature probe	Pt100 or Pt1000		munication bus"
Number of wires	Up to 3-wire connection	Irradiation sensor inputs	
Wire compensation	Up to 10Ω.	(range code: 1TC)	
Accuracy (@25°C ±5°C, R.H. ≤60%)		Number of inputs	1
(Display + RS485)	See table "Temperature	Range	0 to 20mA DC
	input characteristics"	Accuracy (Display + RS485)	
Temperature drift	±150ppm /°C	(@25°C ±5°C, R.H. ≤60%)	±(0.2%RDG+1DGT)
Engineering unit	Selectable °C or °F		0% to 25% FS; ±(0.1%RDG+1DGT)
Insulation	See the table "Insulation		25% to 120% FS.
	between inputs and com-	Temperature drift	±150ppm /°C
	munication bus"	Scaling factor	
Irradiation sensor inputs		Operating mode	Dual scale:
(range code: 1TI)			- Input: programmable
Number of inputs Range	1 0 to 120mVDC		range from 0 to 25.0
Accuracy (Display + RS485)	01012011000		(mADC)
(@25°C ±5°C, R.H. ≤60%)	±(0.2%RDG+1DGT)		- Display: programmable range from 0 to 9999
(020 0 20 0, 1 20070)	0% to 25% FS;		(kW/m ² , kW/ft ²)
	±(0.1%RDG+1DGT)	Decimal point position	Fixed.
	25% to 120% FS.	Impedance	≤ 2 3Ω
Temperature drift	±150ppm /°C	Overload	
Scaling factor	Dual appla	Continuous	50mADC (measurement
Operating mode	Dual scale: - Input: programmable		available up to 25mA on
	range from 0 to 150.0		both display and communi-
	(mVDC)	For 1s	cation bus) 150mADC
	- Display: programmable	Insulation	See the table "Insulation
	range from 0 to 9999	induction	between inputs and com-
	(kW/m², kW/ft²)		munication bus"



VMU-P Temperature input characteristics

Probe	Range	Accuracy (@25°C ±5°C, R.H. ≤60%)	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-ML Output specifications

RS485	Slave function	Auxiliary communication bus	This is the communication
Туре	Multidrop, bidirectional		bus to the VMU-S0, VMU-
	(static and dynamic vari-		P and VMU-O units where
	ables)		VMU-ML performs the
Connections	2-wire. Max. distance		master function in this net-
	1000m		work. VMU-ML unit can
Addresses	247, selectable by means		gather the following infor-
	of the front push-button		mation from the bus:
Protocol	MODBUS/JBUS (RTU)		- All variables available on
Data (bidirectional)			the bus;
Dynamic (reading only)	All variables, see "List of		- Antitheft status:
	the variables that can be"		- PV reverse voltage and
Static (writing only)	All the configuration		current polarity;
Otatio (whiting only)	parameters.		- PV module status.
Data format	1 start bit, 8 data bit, no		The local address in the
Bata format	parity,1 stop bit		VMU-S0, VMU-P and
Baud-rate	Selectable: 9600, 19200,		VMU-O units is automati-
Daud-late	38400, 115200 bits/s		cally assigned by VMU-ML
	Parity: none		master unit based on their
Driver input conchility	1/5 unit load. Maximum		positions. It can manage
Driver input capability	160 transceivers on the		up to 15 different address-
			•
One shiel from stilling a	same bus.	Insulation	es (units). See the table "Insulation
Special functions	None	Insulation	
Insulation	See the table "Insulation		between inputs and out-
	between inputs and out-		puts"
	puts"		

VMU-O Output specifications

Maximum number of modules managed by every single VMU-ML module	Up to 1	Туре	Relay, SPST type AC 1-5A @ 250VAC AC 15-1A @ 250VAC
Digital output Number of outputs Purpose	1 Alarm notification as a String alarm and other alarms (see "List of the variables that can be con- nected to"	Insulation	Available by means of VMU-O module only See the table "Insulation between inputs and out- puts"

Main Function



Displaying	1 parameter per page		there are at least two string
VMU-ML module	"Alarm and diagnostics		controls (VMU-S0 units).
	messages"		The highest value of the
When a VMU-S0 module			measured string current
is selected	All the information related		among those available is used as a reference value.
	to the status of the string being selected by means		The alarm set-point is a
	of the front key (see		value that can be set by
	the table "List of the vari-		the user as a percentage of
	ables that can be").		the reference value below
When a VMU-P module			which there is the alarm
is selected	All the information related		condition. - Median control: the mea-
	to the status of the envi- ronment probes being		surement of the string
	selected by means of the		power is performed by the
	front key (see the table		local VMU-S0 module indi-
	"List of the variables that		vidually. Within the VMU-
	can be").		ML system all values com-
When a VMU-O module is selected	All the information related		ing at the same instant from every VMU-S0 mod-
IS SELECTED	to the status of the output		ule are used to calculate
	being selected by means		the "median" value which
	of the front key (see the		becomes the reference val-
	table "List of the		ue to which the dynamic
	variables that can be").		window set-point (in per-
Password	Numeric code of max. 4		centage set by the user) is linked. The abnormal con-
	digits; 2 protection levels of the		dition is detected when the
	programming data:		measured instantaneous
1 st level	Password "0", no protec-		string current is out of the
	tion;		set window alarm. The
2 nd level	Password from 1 to 9999,		alarm activates, with refer- ence to the failed string,
	all data are protected		either a relay output (only
Alarms	A A A A A		in case of "VMU-O" con-
Number of alarms	One, independent for every single available variable		nection) or/and a message
	(see the table "List of the		which is transmitted by
	variables that can be")		means of the RS485 com-
Alarm types	Virtual alarm or real alarm		munication port to an acquisition system.
Alarm modes	Up alarm, down alarm (see	String window alarm	The alarm is set as the
	the table "List of the vari-	5	string power control, the
	ables that can be connect- ed to")		value is programmable in
Set-point adjustment	From 0 to 100% of the dis-		percentage (of the mea-
	play scale		sured string value) from 0.1 to 199.9.
Hysteresis	From 0 to full scale	Other variable alarms	The alarms can be con-
On-time delay	0 to 3600s		nected also to the string
Output status	Selectable; normally de-		voltage.
	energized or normally ener- gized	Fuse blow detection	
Min. response time	≤ 700ms, set-point on-	(only AV10 range code)	Warning message trans-
	time delay: "0 s"		mission through the local
String control			port to the VMU-ML unit.
Function enabling	Activation: NO/YES	Wrong PV module connection	Warning message trans- mission through the local
Function selection	Match max. control or		port to the VMUML unit.
Function description	median control Match max. control: this		
	function is helpful only if		



Insulation between inputs and outputs

Module		Any	VMU	I-ML	VM	U-P	VMU-0		VMU-SO	
	Type of input/output	Local bus	DC Power supply	RS485	Temperature: Ch1	Solar irradiation	Relay outputs: Ch1	String input (V-)	String input (A+)	String output (A+)
Any	Local bus	-	0kV	0kV	0kV	0kV	4kV	4kV	4kV	4kV
VMU-ML	DC Power supply	0kV	-	0kV	0kV	0kV	4kV	4kV	4kV	4kV
VIVIO-IVIL	RS485	0kV	0kV	-	0kV	0kV	4kV	4kV	4kV	4kV
VMU-P	Temperature: Ch1	0kV	0kV	0kV	-	0kV	4kV	4kV	4kV	4kV
VIVIU-P	Solar irradiation	0kV	0kV	0kV	0kV	-	4kV	4kV	4kV	4kV
VMU-0	Relay outputs: Ch1	4kV	4kV	4kV	4kV	4kV	-	4kV	4kV	4kV
	String input (V-)	4kV	4kV	4kV	4kV	4kV	4kV	-	4kV	>5MΩ
VMU-SO	String input (A+)	4kV	4kV	4kV	4kV	4kV	4kV	4kV	-	4kV
	String output (A+)	4kV	4kV	4kV	4kV	4kV	4kV	>5MΩ	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. Remove the fuse only when the disconnecting breaker is switched off. The fuse is only for over-current protection (it has not to be considered as a disconnecting device).



General specifications

Operating temperature	See table "String current	Immunity to conducted	
	vs. operating temperature".	disturbances	EN61000-4-6: 10V from
Storage temperature	-30 to +70°C (-22°F to		150KHz to 80MHz;
	158°F) (R.H. < 90% non-	Surge	EN61000-4-5: 500V on
	condensing @ 40°C)		power supply; 4kV on
Over voltage category	Cat. III (IEC 60664,		string inputs.
	EN60664)	EMC (Emission)	According to EN61000-6-3
	For inputs from string:	Radio frequency suppression	According to CISPR 22
	equivalent to Cat. I, rein-	Standard compliance	
	forced insulation.	Safety	IEC60664, IEC61010-1
Insulation (for 1 minute)	See table "Insulation		EN60664, EN61010-1
	between inputs and out-	Approvals	CE, cULus Listed
	puts"	Housing	
Dielectric strength	4000 VAC RMS for 1	Dimensions (WxHxD)	17.5 x 90 x 67 mm
_	minute	Material	Noryl, self-extinguishing:
Noise rejection			UL 94 V-0
CMRR	>65 dB, 45 to 65 Hz	Mounting	DIN-rail
EMC (Immunity)	According to EN61000-6-2	Protection degree	
Electrostatic discharges	EN61000-4-2: 8kV air dis-	Front	IP40
	charge, 4kV contact;	Screw terminals	IP20
Immunity to irradiated			
electromagnetic fields	EN61000-4-3: 10V/m from		
	80 to 3000MHz;		
Immunity to Burst	EN61000-4-4: 4kV on		
	power supply lines, 2kV on		
	single lines;		

Connections

VMU-ML Connections	Screw-type	1.5 mm ²	3 screw terminals: not power input, only for nega-
Cable cross-section area	1.5 mm ² max, Min./Max. screws tightening torque:		tive voltage signal mea- surement
Screw terminal purposes 1.5 mm ²	0.4 Nm / 0.8 Nm 3 screw terminals used for RS485 communication	VMU-S0 AV30 Connections Cable cross-section area Current (+)	Screw-type Min. 2.5 mm ² , max 10 mm ² in case of flexible wire,
	2 screw terminals used for power supply		Max. 16 mm ² in case of rigid wire. Min./Max. Hole dimension: 7.2x5.1mm.
VMU-S0 AV10			screws tightening torque:
Connections	Screw-type		0.5 Nm / 1.1 Nm
Cable cross-section area		Voltage (-)	Max 1.5 mm ² , Min./Max.
Current (+)	Min. 2.5 mm ² , max 6 mm ² in case of flexible wire,	Screw terminal purposes	screws tightening torque: 0.4 Nm / 0.8 Nm
	Max. 10 mm ² in case of rigid wire. Min./Max. screws tightening torque: 0.5 Nm / 1.1 Nm	16 mm2	1+1 screw terminals: 1 posi- tive for string input and 1 positive for string output (to the Inverter)
Voltage (-)	Max 1.5 mm ² , Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm	1.5 mm ²	3 screw terminals: not power input, only for nega- tive voltage signal mea- surement
Screw terminal purposes		VMU-P	
10 mm ²	1+1 screw terminals: 1 (+) for string input and 1 (+) for string output (to the Inverter)	Connections Cable cross-section area	Screw-type 1.5 mm ² max. Min./Max. screws tightening torque:



Connections (cont.)

Screw terminal purposes 1.5 mm ²	0.4 Nm / 0.8 Nm 3 screw terminals used for	Screw terminal purposes 1.5 mm ²	2 screw terminals: for relay output (SPST type)
	temperature probe 2 screw terminals used for solar irradiation sensor	Weight (all model)	Approx. 100 g (packing included)
VMU-O			
Connections	Screw-type		
Cable cross-section area	Max 1.5 mm ² Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm		

Power supply specifications

VMU-ML Power supply Power consumption

12 to 28 VDC ≤1W VMU-S0-P-O Power supply

Power consumption

Self-power supplied through the communication bus ≤0.7W

Sizing of Carlo Gavazzi DC power supply

VMU-S0 units	VMU-O units	VMU-P units	Consumption	Start-up current	Power supply part number
From 1 to 3	None	None	PS _W : 2.5W _{typ}	1.5A for 1s	SPD 24 18 1B or SPM3 24 1
From 1 to 3	Up to 1	Up to 1	PS _w : 5W _{typ}	1.5A for 1s	SPD 24 18 1B or SPM3 24 1
From 4 to 10	From 2 to 4	Up to 1	PS _w : 11W _{typ}	1.5A for 1s	SPD 24 30 1B or SPM3 24 1
From 11 to 14	Up to 1	Up to 1	PS _w : 10W _{typ}	1.5A for 1s	SPD 24 30 1B or SPM3 24 1
Max. 14	Max. 7	Max. 1			

Note: the consumption above includes already one VMU-U unit. For different combinations not mentioned above the consumption calculation is the following: PS_W :<1W+ n_{VMU-S0} *0.5W+ n_{VMU-O} *0.7W+ n_{VMU-P} *1.8W. where "n" is number of power supplied units.

Variables format

No.	Module	Variable	Data format	Notes
1	VMU-S0	V	0.0 to 1250.0	
2	VMU-S0	A	0.0 to 50.0	
3	VMU-P	Temperature	-60 to 400.0	Temperature (°C/°F). The range is extended to cover both °C and °F indications
4	VMU-P	Solar irradiation (IRR)	0.0 to 9.999	Irradiation kW/m2 (kW/feet2) (e.g. in: 0 to 1kW/m2 (1kW/feet2), out: 0 to 100mV)



No.	Message	Notes	
1	Conn.CY (AV10 only)	Fuse blow detection.	
2	StrinG	String failure warning: the "String control" function has detected a failure.	
3	Conn.PY	Reverse string current or voltage	
4	SYSteM	Power-up self-test error	
5	buS	Auxiliary bus communication error	
6	ALArM	Variables alarm (any)	

Alarm and diagnostics messages

String current vs. operating temperature

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

R.H. < 90% non condensing @ $40^{\circ}C$ ($104^{\circ}F$)

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

• RS485 communication port

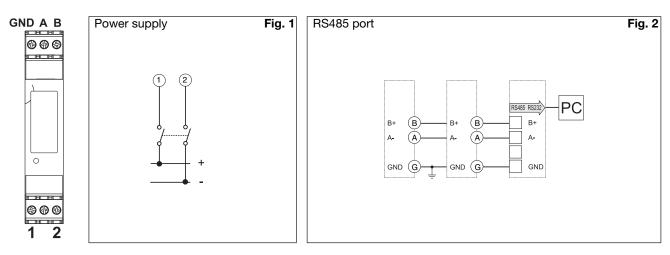
Real and virtual alarms and events

No	Variable	Event- logging	Data- logging	Alarm output	Module (from)	Notes
1	Error: 1	Yes	No	Yes (a)	VMU-ML	Local bus communication problems
2	Error: 2	Yes	No	Yes (a)	VMU-ML	Changed system modules configuration
3	Error: 3	Yes	No	Yes (a)	VMU-ML	Incoherent programming parameters
4	Error: 4	Yes	No	Yes (a)	VMU-ML	More than one VMU-P unit connected to the bus
5	Status: 1	Yes	No	No	VMU-ML	Local programming access
6	Status: 2	Yes	No	No	VMU-ML	Power ON/OFF
7	V	Yes	Yes	Yes	VMU-S0	Available from every string
8	A	Yes	Yes	Yes	VMU-S0	Available from every string
9	Status: 1	Yes	No	Yes	VMU-S0	Incoherent programming parameters
10	Status: 2	Yes	No	Yes	VMU-S0	Fuse blow detection
11	Status: 3	Yes	No	Yes	VMU-S0	Reverse string current or voltage
12	Status: 4	Yes	No	Yes	VMU-S0	High temperature inside VMU-S0 unit
13	String control	Yes	Yes	Yes	VMU-S0	
14	°C (°F) input	Yes	Yes	Yes	VMU-P	PV module temperature
15	kWp/m ² (kWp/ft ²)	Yes	Yes	Yes	VMU-P	Solar irradiation
16	Error: 1	Yes	No	Yes	VMU-P	Incoherent programming parameters
17	Error: 2	Yes	No	Yes (c)	VMU-P	Short circuit on probe input
18	Error: 3	Yes	No	Yes (c)	VMU-P	Open circuit on probe input
19	Status: input 1	Yes	No	No	VMU-0	ON /OFF status detection
20	Error: 1	Yes	No	Yes	VMU-0	Incoherent programming parameters

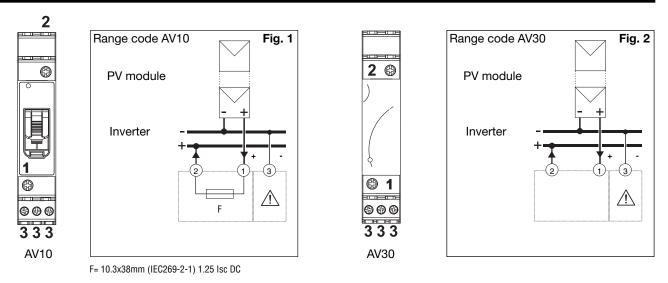
Note about "Alarm output": YES (a), YES (b) and YES (c) are according to the relevant letter "OR" logic alarms.

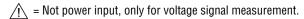


VMU-ML connections

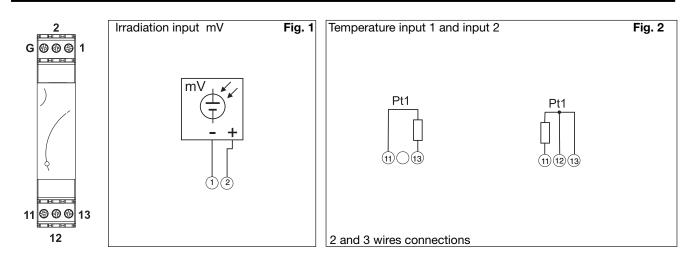


VMU-SO (AV10 and AV30) connections



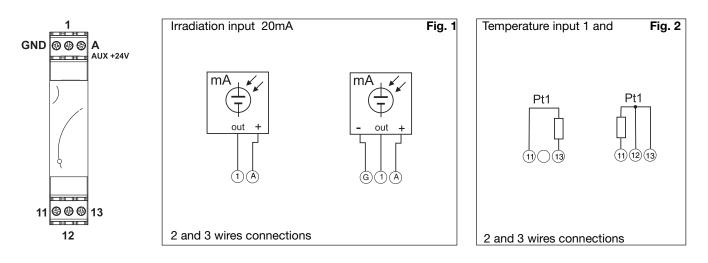


VMU-P (1TI) connections

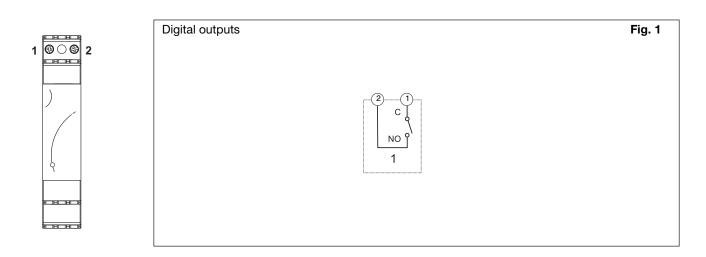


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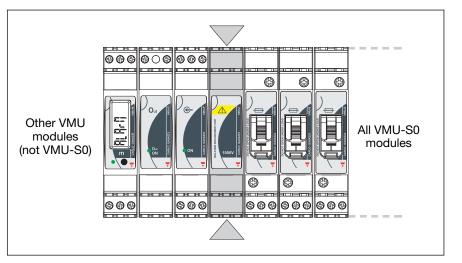
VMU-P (1TC) connections



VMU-O connections



VMU-1 mounting and positioning

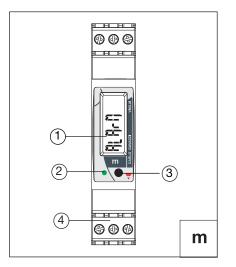


The VMU-1 has to be mounted between the group of VMU-S0 and all the other modules as shown in the example picture on the left.

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



VMU-ML Front panel description



1. Display.

LCD-type with alphanumeric indications to:

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

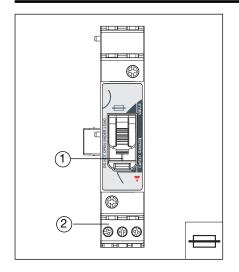
3. Push button.

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.

4. Screw terminals.

For power supply, bus and digital inputs/output connections

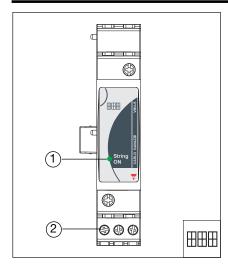
VMU-S0 Front panel description (AV10 range code: 16A)



1. Fuse holder cover For fuse holding and protection.

2. Screw terminals For string connections

VMU-S0 Front panel description (AV30 range code: 30A)

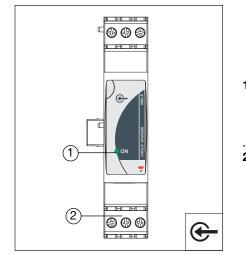


1. LED

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

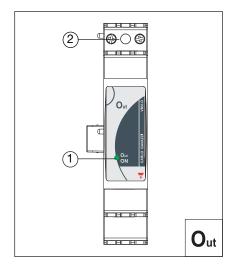


LED ON steady light: the module is power supplied. Green: the power supply is ON. White: the unit is enabled by VMU-ML module for data reading and displaying . Screw terminals

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For measuring input connections

VMU-O Front panel description



1. LED

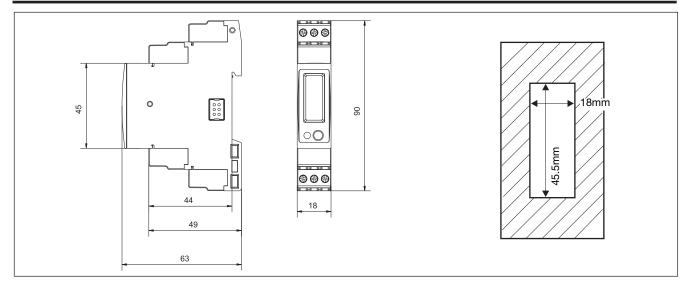
Green: the power supply is ON White: the unit is enabled by VMU-ML module for data reading and displaying. Red: one or both digital inputs are activated Blue: one or both digital outputs are activated Cycling from one colour to any other one: the unit shows the status of the module according to the colour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

2. Screw terminals

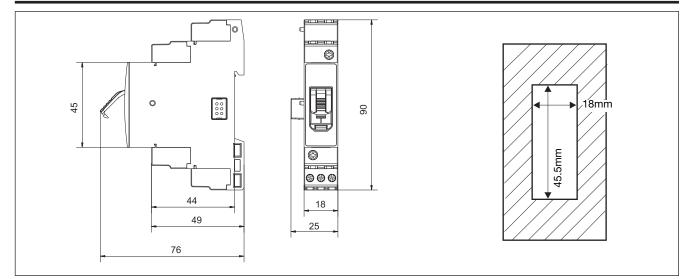
For digital inputs and outputs connections



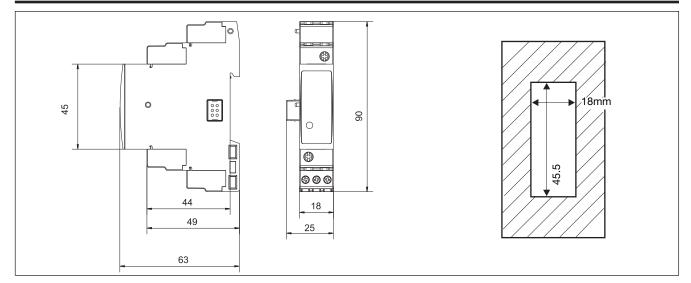
VMU-ML Dimensions and panel cut-out (mm)



VMU-S0 (AV10) Dimensions and panel cut-out (mm)

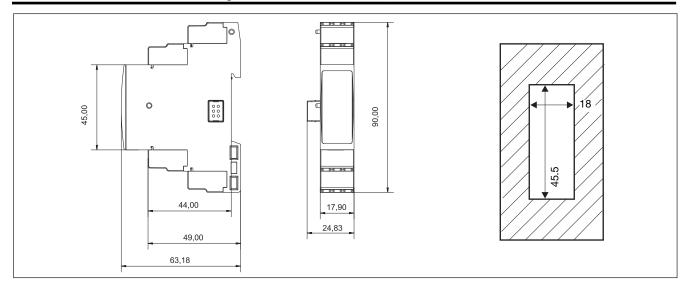


VMU-SO (AV30) Dimensions and panel cut-out (mm)

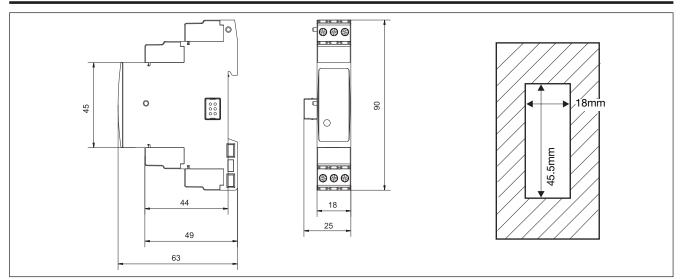




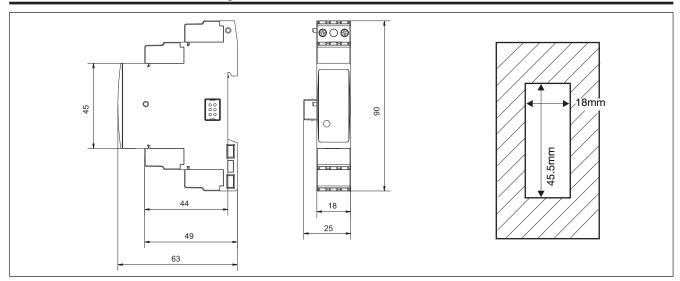
VMU-1 Dimensions and panel cut-out (mm)



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



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





Mean time to failure (MTTF)

Model	el MTTF/MTBF - Years Test conditions		Standard
VMU-ML	VMU-ML 24.2 gf, 50° C		MIL-HDBK-217F
VMU-S0	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-ArrayLSoft parameter programming and variable reading software

Eos-ArrayLSoft	Multi-language software (Italian, English, French, German, Spanish) for vari- able reading and parame- ters programming. The program runs under Win- dows XP/Vista	Configuration mode	There are two configuration levels: - the RS485 communica- tion network which can include either one or more VMU-ML units; - the auxiliary network with
Application	One / three different appli- cations can be selected: - Solar: a management of a limited network where Eos-ArrayLSoft manages basically one VMU-ML unit with relevant VMU-S0, VMU-P and VMU-O mod- ules and maybe an energy meter connected to the VMU-ML digital input; - Solar extended: a man- agement of a complex net- work where Eos-ArrayL- Soft manages many VMU- ML modules and relevant sub networks (VMU-S0, VMU-P and VMU-O units) and maybe an energy meter (EM21-72D, EM24- DIN, EM26-96) connected to the same RS485 bus.	Data displaying	all the parameters relevant to the following modules: VMU-ML, VMU-S0, VMU-P, VMU-O. The following matrix are available: - String 1: V-A - String 2: V-A - String n: V-A - Main: temperature, irra- diation and AC energy. - Plant alarms and errors alarm - Relay output status.

Energy Management Control solution for Solar PV applications Type Eos-Box





- 100 to 240VAC power supply
- Dimensions(WxHxD): 225 x 225 x 45 mm
- Protection degree (front): IP20

- Fan-less embedded PC with Web-server capability Windows XP embedded operating system
- Managed information: V, A, kW, kWh, sun-irradiation, cell-temperature, air- temperature, wind speed on the DC part of the photovoltaic park and V, A, kW, kWh on the AC part and from both inverters and energy meters.
- Efficiency calculation and control on three different levels: string, BOS and total
- · Variables shown as graphs and numbers in formatted tables
- Alarms control and automatic e-mailing and SMS management in case of GPRS modem external connection
- All data exports on XLS format
- Data storage up to 15 years in a 8GB DOM Memory
- Four RS485 communication ports (Modbus)
- One Ethernet port

Product description

Eos-Box is a fan-less embedded PC with Web-server capability suitable to gather photovoltaic plant information from Eos-Array, inverters, energy meters and interface protection. Eos-Box provides information in a quick and automatic fashion via the internet using a standard browser, so the data is available wherever you are. Eos-Box shows information such as: V, A, kW, kWh, sun-irradiation, cell-temperature, airtemperature, wind speed on the DC part of the photovoltaic park and V, A, kW, kWh on the AC part coming from both inverters and energy meters. All data are available as graphs and numbers in forHow

How to order	Eos-Box D XX X
Model	
Power supply	
Option	
Special features	

matted tables. Eos-Box performs alarms control managing also automatic e-mailing and SMS when proper GPRS modem is connected. All available data can be exported as spread sheets for further analysis.

Type Selection

Power supply		Option		Special features		
D:	from 100 to 240VAC (*)	XX:	none (*)	X :	none (*)	(*) as standard.

Hardware

Type Operating system Operation Processor Chipset	Embedded PC Windows XP embedded Fan-less AMD LX800 500 MHz AMD LX+CS5536+ITE8888G	Communication ports RS485	3 ports for Eos-Array bus management 1 port for Inverter, Interface protection and Energy meters
BIOS	Phoenix-Award 4Mbit with RPL/PXE LAN Boot ROM. SmartView and customer CMOS backup	Ethernet	1 for internet/LAN connection 1 for local access
Memory DDR DOM Back-up Industrial CompactFlash™	256MB SODIMM 8GB 8GB Type II (on request)	USB	3, for local access and ser- vice



Hardware (cont.)

LED Status and colour	Green for power-on Orange for DOM memory access	Ethernet USB	RJ-45 connector (10/100Base-T) High speed USB 2.0
Connections RS485	3 pole detachable screw terminal block per port		

RS485 communications ports

Connections

Туре

Addresses Protocol Data (bidirectional) Data format Master function, Multidrop, bidirectional (static and dynamic variables) 2-wire. Max. distance 1000m 247 MODBUS/JBUS (RTU) All variables Selectable: 1 start bit, 7/8 data bit, no/odd/even/

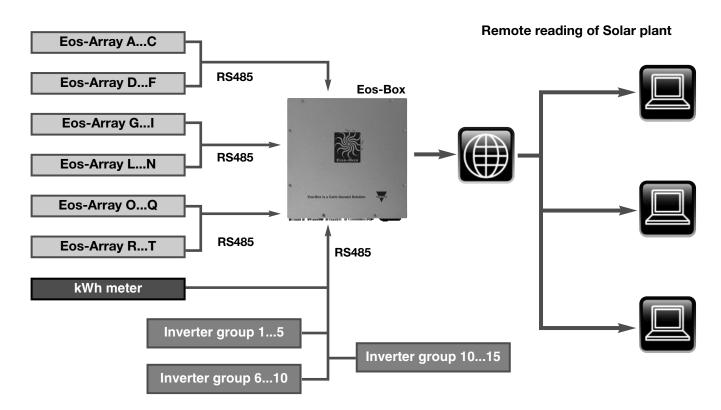
Baud-rate

Driver input capability

Insulation

mark/space parity,1/1.5/2 stop bit Selectable: 9600, 19200, 38400, 115200 bits/s 1/5 unit load. Maximum 160 transceivers on the same bus. See the table "Insulation between inputs and outputs"

Example of communication architecture



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	Max. number of Eos-Array systems which can be managed by one Eos-Box					
Every Eos-Array is equipped with 15 VMU-S			Max. number of Eos-Array which can be connected to one port at the given communication speed			
Data logger time interval (minutes)	Total number of Eos-Array	Total number of VMU-S	0.00000000000000000000000000000000000			@ 115200 bits/s
1	18	270	13	18	18	18
5	84	1260	65	84	84	84
10	168	2520	130	168	168	168
15	247	3705	195	247	247	247
30	494	7410	247	247	247	247
60	741	11115	247	247	247	247
	RS485 communication ports: 2-3-4					

Eos-Box Management capability

• All the details of the daily logged data will be available and therefore displayable as graphs from 6 months (in case of 1 minute time interval) to 10 years (in case of 30 minutes time interval) for "Day" selection. The single day data will be available and displayable as graphs for 10 years (either "Month" or "Year" selection).

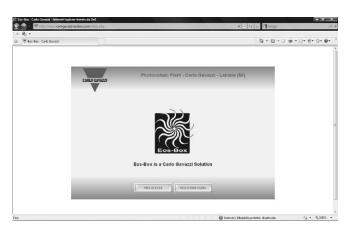
• 6 months and 10 years are worst conditions, they consider, according to the time interval, the maximum number of managed Eos-Array, if those latter ones decrease, the single data time availability will increase proportionally.

Max. number of In	Max. number of Inverters and energy meters which can be managed by one Eos-Box					
Max. number of inverters	Maximum number of energy me	ters to be connected to one Eos-Box				
30	10 (with RS485 communication port) (with pulse output and only from one VM as kWh)					
 All inverters have to be connected on "COM1". The refresh time of the data depends on the inverter's communication speed. The data (power, energy, AC and DC) are stored with a time interval of 15 minutes. Those data will be available for graph displaying for maximum 10 years. 	 The information acquired from every sin and where possible also the active powerters is mainly due to the maximum nur During the set-up of Eos-Box only one energy meter. All the details of the daily logged data graphs from 6 months (in case of 1 m 	gle energy meter is the metered active energy wer. The limit of number of connected energy nber of inverters connected to the same port. • energy meter can be selected as main yield will be available and therefore displayable as inute time interval) to 10 years (in case of 30 The single day data will be available and dis- Month" or "Year" selection).				
Inverter, Energy me	ters and interface protection use the same	RS485 communication port 1				

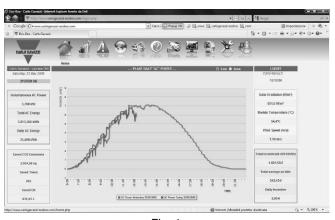
Max. number of sensors which can be managed by one Eos-Box					
Max. number of irradiation and wind speed sensors	Maximum number of temperature sensors				
Depending on the number of VMU-P units available in the network	2 (VMU-M) + 2 (VMU-P)				
 The irradiation and wind speed sensors can be as much as the number VMU-P units managed in the same network. All the details of the daily logged data will be available and therefore displayable as graphs from 6 months (in case of 1 minute time interval) to 10 years (in case of 30 minutes time interval) "Day" selection. The single day data will be available and displayable as graphs for 10 years (either "Month or "Year" selection). Only one irradiation sensor within one Eos-Box has to be used as a reference for the efficiency calculation. 	 VMU-P (being 2 channel inputs available per unit) + VMU-M (being 2 channel inputs available per unit). All the details of the daily logged data will be available and therefore displayable as graphs from 6 months (in case of 1 minute time interval) to 10 years (in case of 30 minutes time interval) "Day" selection. The single day data will be available and displayable as graphs for 10 years (either 				



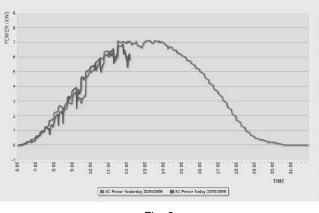
Access page of Eos-Box



Home page







This page has a double access:

- "Free access": there is access at one web page which has been formerly selected by the "Administrator".
- "Registered users": the access is with "User name" and "Password" and has different privileges according to the type of user:
- As "User": in this case the user has access to the "Home" page and all the other graphs and tables pages.
- As an "Administrator": in this case the user has access to all pages as per "User" above but in addition also to all "Settings" and to the "Account" management.

The page is divided in four areas:

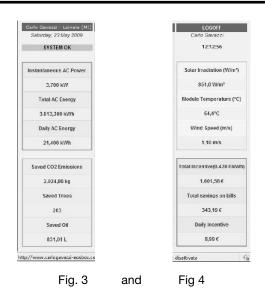
1 On the top. 11 icons are available to have direct access to different functionalities like (Fig.1):

- Home page: Plant daily AC power;
- Plant page: Detailed graphs and data table of all available variables;
- Alarms page: alarms, warning, events, commands list;
- Map page: alarms localisation on the photovoltaic park;
- Economy page: economical parameters of the installation;
- Information page: plant description with relevant technical data, financial highlights, energy production data source;
- IP cam page: live images from the photovoltaic park;
- Monitor page: combination of main graphs for accurate plant analysis;
- Export page: data base export in Excel spreadsheet;
- Setting page: access to the configuration of all parameters of Eos-Box;
- Account page: access to LAN and Internet configuration.
- 2 On the middle (Fig.2). The plant daily power graph which allows to compare the actual AC power vs. the day before AC power. The graph is available as either a line or an area graph. The showed power may come directly either from the inverters or from the energy meters (selectable).

Fig. 2

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WEB-server displaying and control functionalities (cont.)



Plant pages

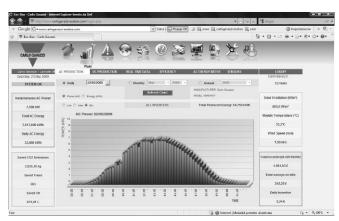
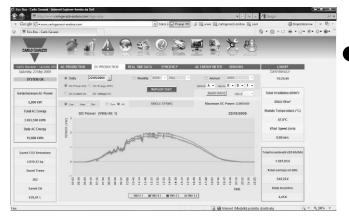


Fig. 5





3 On the left hands (Fig.3). Power and Savings information such as:

- Instantaneous AC power (kW);
- Total AC energy (kWh);
- Daily AC energy (kWh);
- · Saved CO2 emissions (kg);
- Saved trees (qty.);
- Saved oil (l/gallons).

4 On the right hands (Fig.4). Environment and Economic information such as:

- Solar irradiation (W/m2, W/ft2);
- Module temperature (°C/°F);
- Wind speed (m/s, ft/s);
- Total incentive (currency/kWh);
- Total savings on bills (currency);
- Daily incentive (currency)

The page has access to 6 different and specialised menus like:

AC production and then the following selections (Fig.5):

- All inverter, with the possibility to display AC kW, DC kW and AC kWh.
- Single inverters, with the possibility to display AC kW, DC, kW and AC kWh.

2 DC production and then the following selections (Fig.6):

- All strings, with the possibility to display DC kW, DC A and DC kWh.
- Single strings, with the possibility to display DC kW, DC A, DC V and DC kWh. The measurements are available either as single graphs where, by group, they appear all at the same time with different colours so to allow an easy comparison of the different strings or as a sum of kW, A and kWh. A specific tool (see fig.7) allows to select the requested string for proper analysis.

3 Real time data and then the following selections (Fig.8):

- Inverter: a table with one line per inverter with the following information will appear: inverter name (label), V AC, A AC, kW AC, V DC, A DC, kW DC, AC kWh from energy meter and the inverter status.
- Eos-Array: a table with one line per string (VMU-S) with the following information will appear: VMU-S position (label), V DC, A DC, kW DC and VMU-S status. A specific tool (see fig.7) allows to select the requested string for proper analysis.
- AC energy meter: a table with one line per energy meter with the following information will appear: Name, Type (label), AC kW, AC kWh.











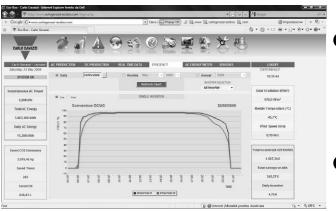


Fig. 9

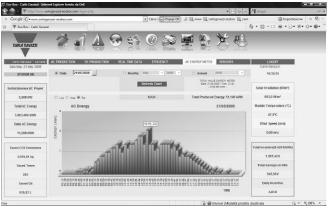


Fig. 10

4 Efficiency and then the following selections (Fig.9):

- Total: this graph shows the efficiency of the whole photovoltaic park under control (DC and AC part);
- Eos-Array: these combinations of graphs show the efficiencies of the DC part of the installation. The selection can be either "All strings" or "Single strings" and allows to analyse in case of "Total String" selection the behaviour of the efficiency of all strings together. In case of "Single string" selection a group of single strings will be shown with its own efficiency. This graph will allow the user to analyse the behaviour of the photovoltaic park. A specific tool (see fig.7) allows to select the requested string for proper analysis.
- Inverter: these combinations of graphs show the efficiencies of the DC to AC conversion inside the inverters. The selection can be either "All inverters" or "Single inverters" and allows to analyse in case of "Total inverters" selection the behaviour of the efficiency of all inverters together. In case of "Single inverter" selection a group of single inverter will be shown with its own efficiency. It is possible to select with a proper tool all the inverters in the network.
- BOS: this graph shows the efficiency of the AC part photovoltaic park under control.

5 AC energy meter and then the following selections (Fig.10):

- Main: the graph shows the total AC energy production to grid.
- Partial: the graph shows the partial (when the photovoltaic park is split in several parts) AC energy production to grid.

6 Sensors and then the following selections (Fig.11):

- Solar irradiation: the graph shows the solar irradiation which also used to calculate the string efficiency.
- Temperature: there is the possibility to select and to show many different graphs of temperature depending on the VMU-M and VMU-P settings, example: cell temperature, air temperature, string box temperature and so on.
- Wind speed: the graph shows the wind speed.





Fig. 11

Alarms page

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Fig. 12



Fig. 13

Every single page has the possibility to show, according to the kind of variable, the graphs in three different ways: line, area, bar. The user has access to the database based on daily graph, with 24 hours time interval. The needed day is selectable by means of a calendar functionality. The same database can be displayed as "Month" (31 days) with "Month" and "Year" selection or "Year" graph (12 months) with "Year" selection.

The page has access to the list of all available anomalies not yet disappeared and not yet acknowledged such as:

- Alarms: alarms set by the user as high priority types;
- Warning: alarms set by the user as low priority types;
- Events: any kind of event recorded by Eos-Array;
- Commands: closing/opening contact detected by Eos-Array.

The page is split in two main parts which are then sub-split in some columns:

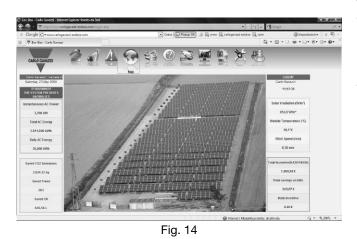
- Device type, Label, Alarm type, Start date, Start time, End date, End time: these information are all details relevant to the recorded alarm. Every line is a new alarm.
- Address, Group (VMU-M), Position, Channel: these are the information of the same line above but relevant to the device which has generated the alarm.
- All alarms according the privilege of the user can be hidden.

One box (Fig.13) on the left hands upper corner shows at a glance the status of the photovoltaic park. Two type of messages may appear:

- STATUS OK (green): there are no alarms or low priority alarms;
- ALARM with message (red): there are high priority alarms.



Map page



Economy page

This page shows to the user :

- the ROI (Return of Investment) status, current vs. expected;
- the delay in "days" of the investment payback;
- the total invested capital and the capital interests;
- the daily capital earnings;
- the total capital earnings;
- the feed-in tariff parameters.

Information page



Fig. 15

IP cam page

This page shows to the user live images of the photovoltaic park. There are two possible selections:

- "Select IP cam" where the user can chose to which IP cam to connect and upload the image;
- "Mosaic" where the user can see four IP cams simultaneously.

Eos-Box is capable to manage any kind of IP cam, it is independent from the type, as long as it is an IP type. Also DVR IP cams can be managed and those with remote position control.

This page shows, based on a map picture (JPG) loaded by the user the status of alarms on the photovoltaic park. The status is shown with:

Green LED: no anomalies;

Red LED: high priority alarms detected by the local Eos-Array systems.

Clicking with the mouse on the LED there is a direct access on the string managed by Eos-Array. If the LED is red the access is to Alarm list page (Fig.12), if the LED is green the access is to the relevant String (VMU-S) graph.

This page shows to the user:

- the plant description such as: plant name, plant location, plant property, installer, PV module installation date and Eos-Box installation date;
- the technical data such as: plant type, total area of PV modules, number of inverters, number of strings, peak power of plant;
- the financial highlights such as: energy system, incentive paid per kWh, kWh purchasing price, % of sold energy vs. total produced energy, price per sold kWh;
- the energy production data source: inverter or energy meter which has been selected in settings.



Monitor page

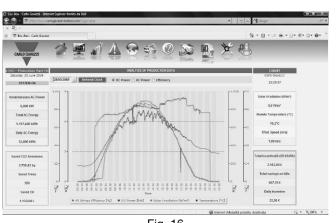


Fig. 16

This page shows to the user:

Three combinations of variables which will let the user to understand how the photovoltaic park behaves and if there are problems such low efficiencies.

- DC Power as a combination of 4 graphs: all strings efficiency, DC power, Solar irradiation, Cell or air temperature (depending on the selection made by the user). The time interval of the graphs is depending on settings of Eos-Array system;
- AC Power as a combination of 4 graphs: Total efficiency, AC power (three sources are selectable: inverter, energy meter, inverter + energy meter), Solar irradiation, Cell or air temperature (depending on the selection made by the user). The time interval of the graphs is 30 minutes;
- Efficiency as a combination of 3 graphs: all strings efficiency, BOS efficiency and Total efficiency.

Export page



Fig. 17

The database of the whole photovoltaic park managed by the Eos-Box can be downloaded as an Excel spreadsheet and is available according to the following selection:

Daily: 24 hours time interval with the selection of the needed "Day" using a calendar tool;

Monthly: max. 31 days with the selection of the needed "Month" and "Year";

Annual: 12 months with the selection of the needed "Year".

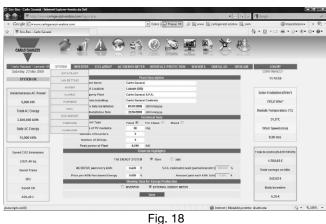
In order to help the user to focus on the desired information a further criteria is available:

- Alarms
- Eos-Array
- Temperature
- Solar irradiation
- Wind speed
- Inverters
- Energy meter



Configuration

Setting page



System



Fig. 19



Fig. 20

This main configuration menu allows the user to access to all parameters relevant to the Eos-Box such as:

- System: all main parameters of Eos-Box;
- Inverter: all communication parameters of the connected inverters.
- · Eos-Array: all communication parameters of the connected Eos-Arrays;
- AC energy meter: all communication parameters of the connected energy meters;
- Interface protection: all communication parameters of the connected interface protection device;
- · Sensors: all information of the used sensors;
- Digital I/O: all information of the used I/Os;
- IP cam: all communication parameters of the connected IP cams.

Most of the listed settings are provided with sub-menus as explained in the next figures.

This first menu allows the user to configure the following sub-menus:

- Data plant: the setting of all parameters as already explained at the figure 15 above.
- LAN setting: the Eos-Box label and the Network settings like: automatic IP address (DHCP) or manual: IP address, subnet mask, default gateway; automatic DNS server address or manual DNS server address (preferred and alternative DNS server).
- Modem (Fig.19 and Fig.20): this sub-menu allows not only to configure the connected wireless modem but also to check if it works. The following parameters can be set: No modem; GPRS/EDGE/UMTS/HSDPA modem with internet connection and/or SMS; IP router based GPRS/EDGE/UMTS/HSDPA with internet connection and/or SMS, and IP router address; configuration of Internet connection selecting also the provider.
- Alarms: this sub-menu is used to configure the management of all alarms, the labels to be displayed at the figure 12 and the link of variable versus type of anomaly: high priority alarm (alarm), low priority alarm (warning), events and commands.
- Planning: this-sub-menu is used to enable the automatic e-mailing based on daily, weekly and monthly shipments with pre-set time, the list of the e-mail addresses and the relevant attachments. The enabling of alarms, the setting of the relevant messages and attachments.
- Mail: this sub-menu allows to configure the classical email parameters to manage the communication.
- Eos-Server: this sub menu is used to configure the communication to an Eos-Server which is a machine capable to gather data from several Eos-Boxes also in different locations so to work out a global service.
- Firmware: this particular sub-menu allows the service people to upgrade the firmware running into the Eos-Box.



Configuration (cont.)

Inverter

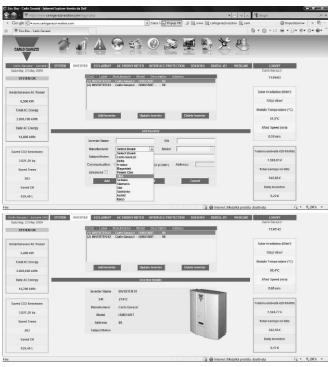


Fig. 21 and Fig. 22

Eos-Array

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Fig. 23

This sub-menu allows the user to:

- "Add" a new inverter to the network managed by Eos-Box;
- "Update" the parameters of an existing inverter;
- "Delete" an already configured inverter.

The main parameters which can be configured are:

- Inverter name as a label;
- Serial number of the inverter being connected;
- Manufacturer, selectable among the following brands: Carlo Gavazzi, Delta, Fronius, Magnetek, Power-one, SMA, Schuko, Siemens, Siel, Elettronica Santerno, Astrid, Kaco. Other brands will be added in the future.
- Model shown in accordance to the selected manufacturer. Other models will be added in the future.
- Subject/notes: a text which can be typed in by the user;
- Communication type: RS485 (COM1) or RS232 (COM1) and relevant address;
- Some advanced communication functionalities like: baud rate, data bit number, parity, stop bit number.

This sub-menu is split in several other menus such as:

- Auto-setting, Set-up and Update, see details below;VMU-M: it is possible to label the device and read all
- vonfigured parameters;
 vMU-S: it is possible to label the device and also to link it
- to the relevant inverter, moreover the page shows all the
- VMU-S configured parameters;
- VMU-P it is possible to label the device and read all configured parameters;
- VMU-O it is possible to label the device and read all configured parameters;

For security reasons the Eos-Array parameters can be set only locally and by using its configuration software Eos-ArraySoft. The only parameters which can be changed from Eos-Box are the alarm set-points, which can be adjusted for installation fine tuning.

Auto-setting: the "Set-up" menu allows the user to configure all the communication parameters of Eos-Arrays being connected to the network. The page is split in three parts:

- "Communication port setup" where it is possible to select for each group A-B-C (corresponding to each communication port) the communication port enable, the baud rate and the parity. This represents the first step.
- "Search Eos-Array" where it is possible to start the relevant search, this is the second step.
- "Download Eos-Array parameters" as auto-setting start.



AC Energy Meter	
	As for the inverters also here it is possible to "Add", "Update" and "Delete a device which is
	in this case an energy meter. The main parameters which can be configured are:
	Meter name as a label;
	,
	Serial number of the meter being connected; Manufacturer, coloritable, among the following, brande: Carlo, Cavazzi, others, Other
	 Manufacturer, selectable among the following brands: Carlo Gavazzi, others. Other brands will be added in the future.
	 Model shown in accordance to the selected manufacturer. Other models will be added in the future.
	 Subject/notes: a text which can be typed in by the user;
	Meter reference for BOS and Total efficiency calculation;
	Communication type: RS485 (COM1) and relevant address or pulses coming from VMU-M;
	 Energy metering as exported or imported energy;
	 Energy offset;
	 Some advanced communication functionalities like: baud rate, data bit number, parity,
	stop bit number.
Interface protection	
	This sub-menu allows to configure:
	Device name as a label;
	Serial number of the device being connected;
	• Manufacturer, selectable among the following brands: Carlo Gavazzi, others. Other
	brands will be added in the future.
	Model shown in accordance to the selected manufacturer. Other models will be added in
	the future.
	 Subject/notes: a text which can be typed in by the user;
	Communication type: RS485 (COM1) and relevant address.
Sensors	
	This sub-menu allows to configure the type of sensor in the Eos-Array system such as:
	 Solar irradiation;
	• Temperature;
	Wind speed.
	For every single sensor it is possible to configure the following parameters:
	Device name as a label;
	Sensor state: enabled/disabled;
	Reference device for efficiency calculation.
Digital I/O	
	This sub-menu allows to configure the "Name" as a label of every single device in the Eos-
	Array system.
IP cam	
	This sub-menu allows to configure the
	 "Name" as a label of every single IP cam in the network;
	 Management parameters of the IP cam;
	• Network settings like: automatic IP address (DHCP) or manual: IP address, subnet mask,
	default gateway; automatic DNS server address or manual DNS server address (pre-
	ferred and alternative DNS server).



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Insulation between inputs and outputs

Type of input/output	Ac Power supply	RS485 port 1 (Inverter, energy meters and interface protection)	RS485 port 2 (Eos-Array)	RS485 port 3 (Eos-Array)	RS485 port 4 (Eos-Array)	Ethernet port 1 (LAN/Internet)	Ethernet port 2 (Service)	USB ports (Service)
Ac Power supply	-	4kV	4kV	4kV	4kV	4kV	4kV	4kV
RS485 port 1 (Inverter, energy meters and inter- face protection)	4kV	-	0kV	0kV	0kV	4kV	4kV	4kV
RS485 port 2 (Eos-Array)	4kV	0kV	-	0kV	0kV	4kV	4kV	4kV
RS485 port 3 (Eos-Array)	4kV	0kV	0kV	-	0kV	4kV	4kV	4kV
RS485 port 4 (Eos-Array)	4kV	0kV	0kV	0kV	-	4kV	4kV	4kV
Ethernet port 1 (LAN/Internet)	4kV	4kV	4kV	4kV	4kV	-	4kV	4kV
Ethernet port 2 (Service)	4kV	4kV	4kV	4kV	4kV	4kV	-	4kV
USB ports (Service)	4kV	4kV	4kV	4kV	4kV	4kV	4kV	-

0kV	Inputs / outputs are not insulated.
4kVrms	EN61010-1, IEC60664-1 - Over-voltage category III, Pollution degree 2, double insulation on systems with max. 300Vrms to ground

General specifications

Operating temperature	-20 to +50°C (-4°F to	PI-Q	1.0 (Quality Level II)
	122°F) (R.H. from 0 to <90%	Failure rate	12 567.29 FITs (Failure In
	non-condensing @ 40°C)		Time)
	See also "VMU-S input	Environment condition 1	Grounded, fixed, uncon-
	specifications"		trolled GF (PI-E = 2.0)
Storage temperature	-20 to +80°C (-4°F to	Test temperature	60°C
0	176°F) (R.H. < 90% non-	MTBF @ PI-E = 2.0	79 571 hours (Mean Time
	condensing @ 40°C)		Between Failures)
Approvala	CE	Environment condition 2	Grounded, fixed, controlled
Approvals			GB (PI-E = 1.0)
Housing		Test temperature	40°C
Dimensions (WxHxD)	225 x 225 x 45 mm	MTBF @ PI-E = 1.0	195 710 hours (Mean Time
Material	Aluminium and Heavy-duty		Between Failures)
	steel	Brotaction degree	
Mounting	Wall and DIN-rail with addi-	Protection degree Front	IP20
meaning	tional bracket	Screw terminals	IP20
Vibration endurance	2G RMS W/CF 5-500Hz, X-	Weight	2.15Kg
	Y-Z direction		
Failure tests			
Electrical stress condition	50%		



Power supply specifications

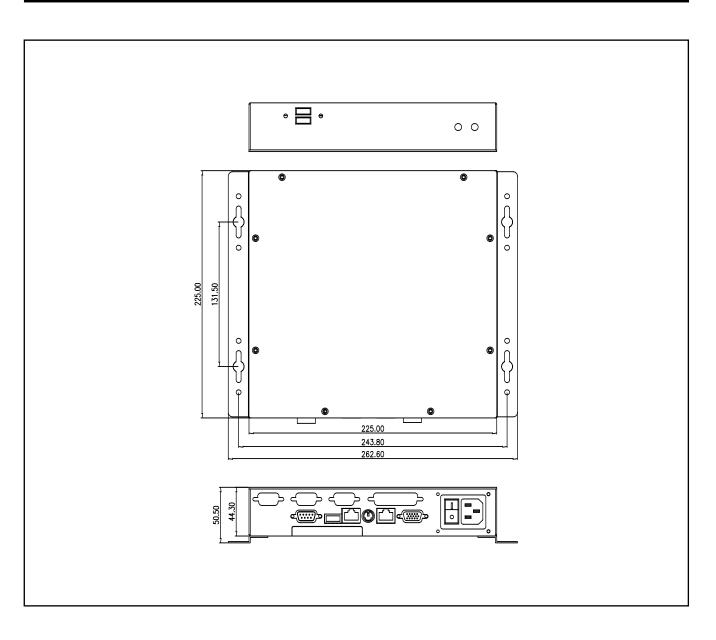
Power supply

100 to 240VAC

Power consumption

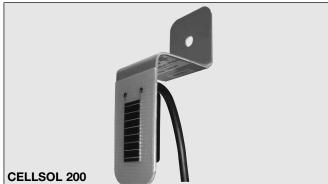
70W

Overall dimensions



Irradiation Sensor Model CELLSOL 200





- · Solar irradiation measure
- Output ~75mV @ 1000W/m²
- Light and strong device with an easy installation
- Two wire cable, UV proof, length 3m



Product Description

CELLSOL 200 is a silicon sensor for the measurement of the solar irradiation. The device provides a voltage output in mV, proportional to the standard irradiation of 1000W/m².

Every sensor brings in plate the value calibrated in mV related to the full scale. Normally used for controlling the efficiency of the photovoltaic plants.





Model

General Specification

Range	from 0 to 1500W/m ²
Accuracy	±5%, annual average
Output	Approx. 75mV @ 1000W/m ² (true value is reported on the label)

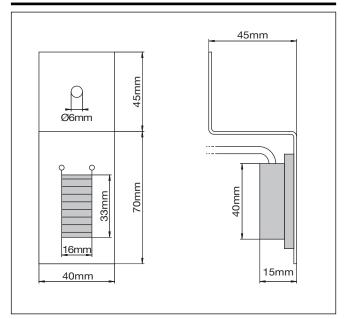
Sensor Characteristics

Sensor type	Mono-crystalline cell
Mounting	Novaflon and EVA sheet
Cell dimension	6 x 33mm

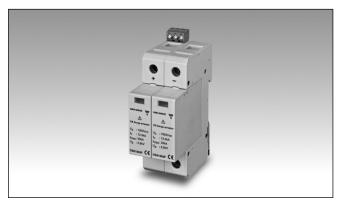
Mechanical Specification

Main structure	Anodized aluminium
Cable dimension	110 x 40 x 40mm UV proof 3m
Fixing	1 hole Ø6mm
Weight	~200g (with cable)
Warranty	2 years

Dimensions



Monitoring Relays Surge Arresters for PV system Type DSF D



• Type 2 (class C) according to EN61643-11 (VDE 0675, part 6-11) • Approved UL1449 3rd Edition

- Complies with IEC-61643-1, VTE C 61-740-51
- Do not require backup fuse up to 200kArms (UL 1449 3rd Ed.)
- Innovative tecnology to prevent dangerous failures in case of temporary overvoltages

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- Suitable for unstable networks where sustainend overvoltages may persist for some minutes or longer
- **Plug-in cartridges**
- Optical indication of exhausted cartridges (red window)
- Voltage-free contact, for remote function monitoring
- Including thermal and dynamic separating device •
- Assembled unit ready for mounting
- Marked connections
- For DIN-rail mounting

Product Description

DSF D is a Type 2 (Class C) surge arrester according to EN 61643-11 (VDE 0675, part 6-11) and UL1449 3rd edition suitable for protecting DC systems from transient overvoltage due to both indirect atmospheric discharges and switching actions.

It is available both in 2-pole or 3-pole configurations, allowing both differential and common mode protection.

The control windows (no/red indication) and the contact allow both a local and a remote monitoring of the

status of the plug-in cartridges, warning the operator about the need to promptly replace the cartridges themselves.

In installation without external LPS (Lightning Protection System) or where the distance between the LPS elements and the solar panel frames is >50cm, DSF can be used in the DC side of photovoltaic generation plants, and can be installed on a DIN-rail in every commercially available distribution box.

Ordering Key DSF 53 C D 1200 PV

Description	Code	
Mounting		
DIN-rail	D	
Function		
Surge arresters	S	
Туре		
Type 2 (class C) "Fuseless"	F	
Cartridge dimens	sions	
17.5 mm	5	
Configuration		
2-pole	2	
3-pole	3	
Contact		
None	Х	
1 (relay)	С	
Network		
DC	D	
Range		<u>⊢</u> .
600 VDC	600	
1000 VDC	1000	
1200 VDC	1200	
Application		ll
Photovoltaic	PV	
system		

Type Selection

Code	Description	Max. cont. operating voltage	Output relay	Cartridge
DSF52CD600PV	2-pole surge arrester for PV installations	600 VDC	SPDT	2x DS0600F
DSF52XD1000PV	2-pole surge arrester for PV installations	1000 VDC	NO	2x DS1000F
DSF52CD1000PV	2-pole surge arrester for PV installations	1000 VDC	SPDT	2x DS1000F
DSF53XD1200PV	3-pole (Y) surge arrester for PV installations	1200 VDC	NO	3x DS0600F
DSF53CD1200PV	3-pole (Y) surge arrester for PV installations	1200 VDC	SPDT	3x DS0600F



Product specifications

Max. continuous operating		Voltage protection level	Up
voltage DC	Uc	DSF52CD600PV	< 2.2 kV
DSF52CD600PV	600 VDC	DSF52xD1000PV	< 2.8 kV
DSF52xD1000PV	1000 VDC	DSF53xD1200PV	< 4.4 kV
DSF53xD1200PV	1200 VDC	Response time	t _A
SPD (Surge Protection Device)		DSF5xxDxxxx	< 25 ns
according to EN 61643-11		Protection fuse size	
DSF5xCDxxxxPV	Туре 2	(UL 1449 3rd Ed.)	
SPD (Surge Protection Device)		DSF5xxDxxxx	Not required up to 200 kA rms
according to IEC 61643-1		Follow current	· · ·
DSF5xCDxxxxPV	Class II	DSF5xxDxxxx	No
LPZ (Lightning Protection Zone)		Short-circuit withstand current	
DSF5xCDxxxxPV	1> 2	(data for AC applications	
Nominal discharge surge		according to EN 61643-11)	25kA/50Hz
current (8/20)	In	Front window	
	+ or - to PE	DSF5xxDxxxx	No indication: working
DSF52CD600PV	20 kA		cartridge.
DSF52xD1000PV	12.5 kA		Red: exhausted cartridge
DSF53xD1200PV	20 kA		(to be replaced)
	+ and - to PE	Operating temperature	(
DSF52CD600PV	40 kA	DSF5xxDxxxx	-40 to +80 °C
DSF52xD1000PV	25 kA		
DSF53xD1200PV	20 kA		
Max. discharge surge			
current (8/20)	Imax		
. ,	+ or - to PE		
DSF52CD600PV	40 kA		
DSF52xD1000PV	25 kA		
DSF53xD1200PV	40 kA		
	+ and - to PE		
DSF52CD600PV	80 kA		
DSF52xD1000PV	50 kA		
DSF53xD1200PV	40 kA		

Output Specifications

Output

DSF5xCDxxxxPV Rating SPDT AC: 250V/0.5A 125V/3A Cable cross-section area Terminal torque max 1.5 mm² 0.25 Nm max

General Specifications

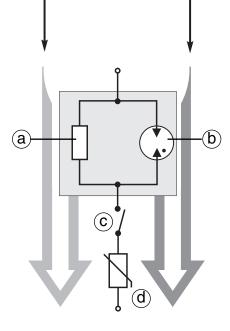
Protection degree	IP 20		degree UL 94 V-0
Dimensions		Approvals	CE, UL1449 3 rd Edition
DSF52CD600PV	36 x 90 x 72 mm		
DSF52xD1000PV	36 x 90 x 72 mm		
DSF53xD1200PV	54 x 90 x 72 mm		
Screw terminals			
Cable cross-section area	25 mm ² (stranded)		
	35 mm ² (solid)		
Terminal torque	4.5 Nm max		
Housing material	Thermoplastic, extinguishing		
-			



No backup-fuse tecnology

Long duration overvoltage path

The arrester is activated in the event of electric power system failure. The voltages are much lower than transient voltages but substantially more destructive. The system is composed of a current limiter and a varistor. In the event of increased voltage level the current limiter circuit limits the current through the varistor. When the normal condition is re-established (rated line voltage), the surge arrester continues to perform its normal function.



Transient (short duration) overvoltage path

The arrester is activated at the occurence of instantaneous high voltage surges lasting only a few microseconds. Such condition states are experienced at switching operations and atmospheric discharges. The system is composed of a gas tube surge arrester and a varistor. Both components have a very short response time which is reflected in a low protective residual voltage level. This provides an efficient protection of sensitive electronic devices.

a) Current limiter b) Gas tube c) Thermal disconnector d) Varistor

Installation notes

Protection distance

• If DSF is installed less than 10 m from the device to be protected, the distance can be ignored.

• If DSF and its connection wires have a total protection level $U_{p/f}$ (U_{prot}) <0.5 U_w , where U_w is the breaking voltage of the device to be

protected, the distance can be neglected.

• If the protection distance is longer than 10 m, the real protection distance ℓ_{po} can be calculated by the following formula:

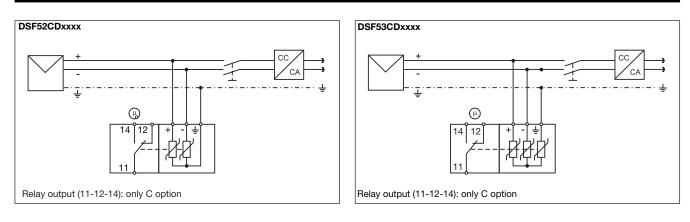
 $\ell_{po} = (U_w - U_{p/f}) / K [m]$ with K = 25 V/m.

Protection against overcurrents and indirect contacts

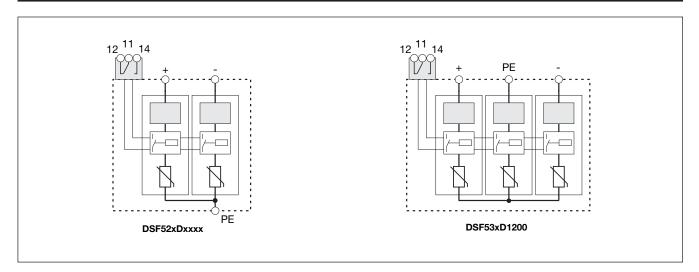
DSF can be installed without further integrative protections even if a general circuit breaker/fuses with nominal current >125 kA is installed and if in the DSF installation point the short circuit current is >25 kA (but <200kArms). No protection fuses are needed for backup protection.



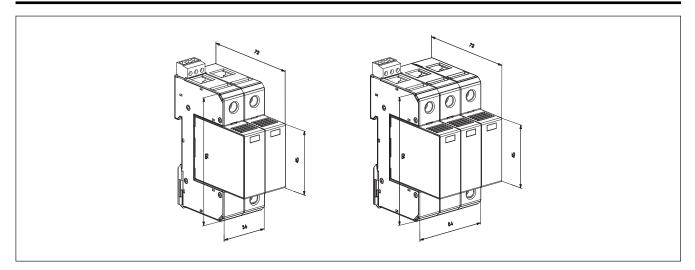
Wiring Diagrams



Connection Diagrams

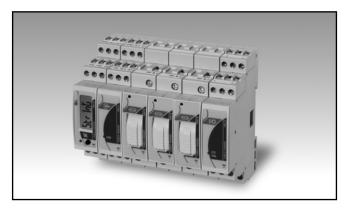


Dimensions



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

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- 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:

• Local communication bus management up to 15 mixed VMU-

· Single virtual or real alarm set-point connectable to any

Note: The device contains metal-ion batteries. For the sending, you must comply with the relevant packaging and

- 1 VMU-P unit;
- max 15 VMU-S units;

Master communication capability
 RS485 communication port (Modbus)

Data and event stamping system
Display readout: 6 DGTs
12 to 28 VDC power supply
Dimensions: 1-DIN module
Protection degree (front): IP40

Two temperature inputs: Pt100 or Pt1000

• 1 Metal-ion non-replaceable battery; 0.04 g.

S, VMU-P and VMU-O units

Two digital inputs

available variable

- max 7 VMU-O units;
- max 1 VMU-1.

VMU-M, master module and data logger



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 provide 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

labeling regulation.

Model	$ \longrightarrow $
Function ———	
Power supply	
Communication	
Inputs	
Option	

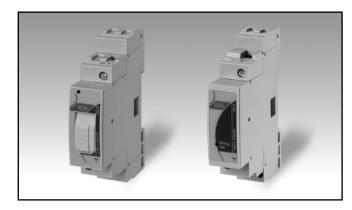
Type Selection

Function		Pow	Power supply		Communication		Inputs	
4:	Data storage 4Mbyte (*)	A:	From 12 to 28VDC (*)	S1:	RS485 Modbus (*)	T2:	two temperature inputs or two digi- tal inputs for free of voltage reading contacts (*)	
Opti	on						contacts ()	
		— (*) a	is standard.					

X: none



VMU-S, string measuring unit



- Integrated 10.3x38mm fuse holder for string protection
- Dimensions: 1-DIN module
- Protection degree (front): IP40

- 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) ±0.5 RDG (current/voltage)
- Auxiliary power supply from VMU-M unit
- 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 fuseholder (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
Model —	
Range ———	
Power supply —	
Communication —	
Option	

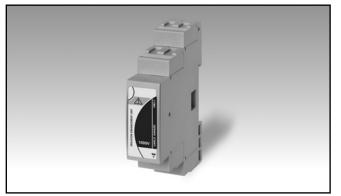
Type Selection

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

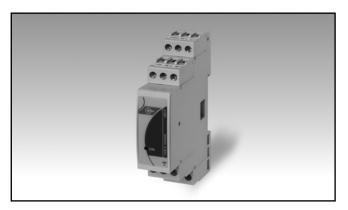
Type Selection

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		
-		

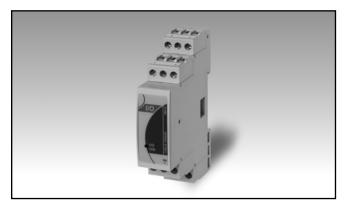
Type Selection

Range	Pow	ver supply	Com	munication	Opti	on
2TIW: Two "Pt" temperature type probes, mV sun irradiation and wind speed measuring inputs (*) 2TCW: Two "Pt" temperature type probes, mA sun irradiation and wind speed measuring inputs (*)	X :	from 12 to 28VDC, self-power supply from VMU-M unit	S:	auxiliary communica- tion bus, compatible only to VMU-M module (*)	X :	none

- -



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	VMU-O	X I2 R2 X
Model		
Power supply		
Inputs		
Outputs		
Option		
-		

Type Selection (Standard model)

Pow	er supply	Inpu	ts	Outp	uts	Optio	on
X :	from 12 to 28VDC, self-power supply from VMU-M unit	12:	two digital inputs (*)	R2:	two relay output (*)	X:	none

Type Selection (Antitheft model)

Pow	er supply	Inpu	ts	Outp	uts	Optic	n
X :	from 12 to 28VDC, self-power supply from VMU-M unit	13:	three digital inputs (*)	R1:	one relay outputs (*)	AT:	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	ХР	MCX
Model			$\Box \Box $
Power supply ———			
Plastic fibre ———			
200m sensing distance	э ———		
Output			
Option			

Type Selection

	r supply	Fibro	e optic	Sens	sing distance	Outp	out
X:	from 12 to 28VDC, self-power supply from VMU-O "AT" option unit	P:	plastic (*)	<u>M:</u>	200m (*)	C: Opti	open collector
(4)	standard.					 X:	none

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

Display Type Information read-out	1 line (max: 6-DGT) LCD, h 7mm From 4 to 6-DGT de ing on the informatio
LED Type Status and colour	Dual colour Green steady light: 1

7mm to 6-DGT dependthe information. olour 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.

VMU-S LED specification

LED Type Status	Multicolor ON steady light: the module is power sup- plied and there is no alarm.	Colour AV30 range code	the colour list above.The cycling time is approx. 1 second. Green: the power supply is ON, there is a string cur-
Colour AV10 range code	Green: the power supply is ON, there is a string cur- rent 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		rent 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 ena- bled by VMU-M module for data reading and display- ing. 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.

VMU-P LED specification

LED

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.



VMU-O LED specification

LED

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. Red: one or both 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.

VMU-AT LED specification

LED

Power supply status

Green: the power supply is ON

Loop status

Red: the optical loop is closed

1 second.

VMU-M input specifications

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

Rated inputs 1 (shunt) Current type 1 (shunt) Current range AV10 range: 16A D 40°C, 15A @ 50°C, 55°C, 12A @ 60°C, 55°C, 12A @ 60°C, 65°C AV30 range: 30A DC 55°C, 25A DC @ 60 DC @ 65°C AV10 range: 1000V	, 14A @ Current , 10A @ Voltage C @ Power Energy	AV30 range: 1000V DC (@25°C ±5°C, R.H. ≤60%) ±(0.5%RDG+2 DGT) from 0.05A to 16A ±(0.5%RDG+2 DGT) from 20V to 1000V ±(1% RDG+ 2DGT) ±(1% RDG)
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VMU-S input specifications (cont.)

Start up current	0.05A 10V	$\Lambda V/20$ range code	2W
Start up voltage	100	AV30 range code	> 2.5M
AV30 range code		Voltage Current	
Current	±(0.5%RDG+2 DGT)	Current	$< 0.003\Omega$ @ 0.5 Nm (screw
	from 0.2A to 30A		terminal torque).
Voltage	±(0.5%RDG+2 DGT)	Voltage Overloads	
	from 20V to 1000V	Continuous	1100V
Power	±(1% RDG+ 2DGT)	For 500ms	1600V
Energy	±(1% RDG)	To earth	800V (extended to 1000V
Start up current	0.2A		in case of combined use of
Start up voltage	10V		VMU-1.1000V unit)
Temperature drift	≤200ppm/°C	Current Overloads	
Measurement sampling time	2 sec.	Continuous	AV10 range: 16A
Variables format			AV30 range: 30A
Instantaneous variables	4-DGT (A, W), 5-DGT (V)	For 1s	AV10 range: 100A max
Resolution	0.1V; 0.01A; 0.01kW		AV30 range: 150A max
Energies	Total: 5+1 DGT (0.1KWh)	Protection	
Max. and Min. data format	See "Stored set of vari-	Fuse holder Fuse type	Integrated into the module aPV
	ables coming from	Fuse size	10x38mm (IEC60269-1-6)
Input impedance		Fuse current	Fuse NOT provided.
AV10 range code		Tuse current	Note: the fuse rated cur-
Voltage	> 2.5MΩ		rent has to be ≥ 1.4 lsc at
Current	$< 0.006 \Omega$ (+ fuse imped-		45°C ambient temperature.
	ance) @ 0.5 Nm (screw		See fuse manufacturer
	terminal torque).		specifications for further
	For current input of 16A		
	the fuse has therefore a		details including de-rating
	nominal current of 32A AC.		caused by higher ambient
	The maximum dissipation		temperature.
	power has not to exceed		

VMU-P input specifications

Temperature drift	≤200ppm/°C		±(0.1%RDG+1DGT)
Variables format Instantaneous variables Resolution	4 DGT (Temperature, solar irradiation and wind speed) 0.1°C/0.1°F; 1W/m ² , 1W/ ft ² ; 0.1m/s, 0.1ft/s	Temperature drift Scaling factor Operating mode	25% to 120% FS. ±150ppm/°C Dual scale: - Input: programmable
Max. and Min. data format	See "Stored set of vari- ables coming from		range from 3 to 150.0 (mVDC)
Temperature probe inputs Number of inputs Temperature probe Number of wires Wire compensation Accuracy (Display + RS485) Temperature drift Engineering unit Insulation	2 (Input 1: PV module; Input 2: air) Pt100 or Pt1000 Up to 3-wire connection Up to 10Ω . See table "Temperature input characteristics" ± 150 ppm/°C Selectable °C or °F See the table "Insulation between inputs and com- munication bus"	Decimal point position Impedance Overload Continuous For 1s Insulation	 Display: programmable range from 0 to 9999 (kW/ m², kW/ft²) Fixed. 30KΩ 10VDC (measurement available up to 150mV on both display and communi- cation bus) 20VDC See the table "Insulation between inputs and com- munication bus"
Irradiation sensor inputs (range code: 2TIW) Number of inputs Range Accuracy (Display + RS485) (@25°C ±5°C, R.H. ≤60%)	1 3 to 120mVDC ±(0.2%RDG+1DGT) 0% to 25% FS;	Irradiation sensor input (range code: 2TCW Number of inputs Range Accuracy (Display + RS485) (@25°C ±5°C, R.H. ≤60%)	1 0 to 20mADC ±(0.2%RDG+1DGT) 0% to 25% FS;



VMU-P input specifications (cont.)

Temperature drift Scaling factor Operating mode Decimal point position Impedance Overload Continuous	\pm (0.1%RDG+1DGT) 25% to 120% FS. ±150ppm/°C Dual scale: - Input: programmable range from 0 to 25.0 (mADC) - Display Data format: pro- grammable range from 0 to 9999 (kW/m ² , kW/ft ²) Fixed ≤23Ω 50mADC (measurement available up to 25mA on both display and communi- cation bus)	(@25°C ±5°C, R.H. ≤60%) (Display + RS485) Temperature drift Scaling factor Operating mode Decimal point position Impedance Operating input	$\begin{array}{l} \pm (0.02\% RDG+1DGT) \\ 0\% \ to \ 25\% \ FS; \\ \pm (0.01\% RDG+1DGT) \\ 25\% \ to \ 110\% \ FS. \\ \pm 150 ppm/°C \\ \hline \\ \hline \\ Dual \ scale: \\ - \ lnput: \ programmable \\ range \ from \ 0 \ to \ 999.9 \ (Hz) \\ - \ Display: \ programmable \\ range \ from \ 0 \ to \ 299.9 \ (m/s, \ ft/s) \\ Fixed \ and \ depend- \\ ing \ on \ the \ input/display \\ scale. \\ 680\Omega \\ 2.5V_{peak} \ to \ 9V_{peak}/5mA_{peak} \ to \ 35mA_{peak}, \ duty \ cycle \ 50\% \\ 220\Omega \\ \end{array}$
For 1s Insulation	cation bus) 150mADC See the table "Insulation between inputs and com-	Impedence Overload Continuous For 1s	22003 7V _{RMS} /25mA _{RMS} (AC/DC) 14V _{RMS} /50mA _{RMS} (AC/DC)
Wind speed sensor inputs	munication bus"	Insulation	See the table "Insulation between inputs and com-
Number of inputs	1		munication bus"
Range	0 to 1000Hz max,		
Accuracy	duty cycle 50%		
Accuracy			

VMU-M Output specifications

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

Maximum number of modules managed by every single VMU-M module	Up to 7	Number of outputs Purpose	2 Alarm notification as a String alarm or as a digital			
Digital inputs Number of inputs Working mode	2 Detection of OPEN/ CLOSED contact status		input status changing (OR function); activation of a lighting system (by means of the internal clock or as			
Purpose	Trip of protection detec- tion, the status is transmit- ted only by means of the communication port.		a remote control); activa- tion of a module washing system (by means of the internal clock, as a remote control or as a changing of			
Input frequency Contact reading voltage	2Hz max, duty cycle 50% 3.3VDC	_	efficiency of the PV pan- els).			
Contact reading current Contact resistance	<2mA ≤300Ω closed contact; ≥10kΩ open contact	Туре	Relay, SPST type AC1: 5A @ 250VAC AC15: 1A @ 250VAC			
Insulation	See the table "Insulation between inputs and out- puts"	Insulation	Available by means of VMU-O module only See the table "Insulation			
Digital output			between inputs and out- puts"			

VMU-O Input/Output specifications

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

Maximum number of module managed by every single VMU-M module	Up to 1	Digital output	between inputs and out- puts"
Digital inputs		Number of outputs	1
Number of inputs	3	Purpose	Antitheft notification in
Working mode	Detection of ON/OFF status		case of function enabling
Purpose	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.		(EosArraySoft) or alarm notification as a String alarm or as a digital input status changing (OR func- tion); activation of a light- ing system (by means of
Working logic	The inputs in case of Antitheft purpose selec- tion work as an OR logic (EosArraySoft), if this func- tion is not enabled every input works independently from each other.		the internal clock or as a remote control); activa- tion of a module washing system (by means of the internal clock, as a remote control or as a changing of efficiency of the PV mod-
Input frequency	2Hz max, duty cycle 50%		ules).
Contact reading voltage	3.3VDC	Туре	Relay, SPST type
Contact reading current	<2mA		AC1: 5A @ 250VAC
Contact resistance	≤300Ω closed contact; ≥10kΩ open contact	Insulation	AC15: 1A @ 250VAC See the table "Insulation
Insulation	See the table "Insulation		between inputs and out- puts"



VMU-AT Antitheft sensor specifications

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

Main Function

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

Main Function (Cont.)

Clock		Event logging	
Functions	Universal clock and calen-dar.	Data displaying	The data are not available
Daylight-saving enabling Time format	Activation: NO/YES Houre:minutes with selectable 24 hours or AM/PM		on the display but they can be both checked and downloaded using RS485
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	Function enabling Type of stored events	communication port in combination with Eos- ArraySoft software. Activation: NO/YES VMU-O digital input/output
Battery	format. Life: 10 years	Type of stored events	status change (real and vir- tual alarms), string alarms (see "String control"), VMU-M 1st digital input status change. The events are recorded as soon as they occur. For more infor-
Data logging			mation about the type and
Data	The data are not available on the display but they can be both checked and	Number of events	stored data, see "List of the variables that can be connected to" Max. 10 000.
	downloaded using RS485 communication port in combination with Eos- ArraySoft software.	Data reset	The reset can be carried out only using Eos-Array- Soft.
Function enabling	Activation: NO/YES	Data format	Event, date (dd:mm:yy) and time (hh:mm:ss)
Function description	All the events gathered from both VMU-S, VMU-O and VMU-P modules are	Storage method Memory type Memory retention time	Circular FIFO Flash 10 years
	stored individually into the internal memory.	String control	
Stored data type	Variables: V, A, W, Wh, PV module temperature, ambient temperature, irra- diation, wind speed, string	Function enabling Function selection Function description	Activation: NO/YES Match max. control or median control Match max. control: this
	efficiency and BOS effi- ciency.	·	function is helpful only if there are at least two string
Storage interval	Selectable: 1-5-10-15-30- 60 minutes		controls (VMU-S units). The highest value of the meas-
Sampling management	The sample stored within the selected time interval results from the continu- ous average calculation of the measured values. The average is calculated with an interval within two fol- lowing measurements of approx. 2s.		ured 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 refer- ence value below which there is the alarm condi- tion.
Storage duration	Before overwriting: depending on the storage interval, see "Historical data storing time table"		- Median control: the measurement of the string power is performed by the local VMU-S module
Data format	Variables, date (dd:mm:yy) and time (hh:mm:ss)		individually. Within the VMU-M system all values
Storage method	Circular FIFO		coming at the same instant
Memory type Memory retention time	Flash 10 years		

Main Function (Cont.)

	from every VMU-S mod- ule are used to calculate the "median" value which becomes the reference value to which the dynamic window set-point (in per- centage set by the user) is linked. The abnormal condition is detected when the measured instantane- ous string power is out of the set window alarm.	Control type "1" Control type "2"	The VMU-P module is pre- sent and both PV module temperature and irradiation are measured to calculate the reference value for the efficiency calculation. The VMU-P module is present and both ambient temperature and irradiation are measured to calculate the reference value for the efficiency calculation.
String 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 mes- sage 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 meas- ured string value) from 0.1 to 199.9.	BOS efficiency measurement	The total efficiency meas- urement is based on the comparison between the generated energy and the exported energy supplied to the grid. The grid sup- plied 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.
Other alarms	The alarms can be con- nected also to: A and V.	Fuse blow detection (only AV10 range code)	Warning message trans-
"PV string" efficiency measurement			mission through the local port to the VMU-M unit.
Function enabling Control type "0"	Activation: NO/YES Three type of controls are available The VMU-P unit is not	Wrong PV string connection	Warning message trans- mission through the local port to the VMU-M unit.
	available therefore the sin- gle strings are used to cal- culate the reference value for the efficiency calcula- tion.		

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		VM	U-0		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 strimg (A+)
Any	Local bus	-	0kV	0kV	0kV	0kV	0kV	0kV	4kV	4kV	4kV	4kV	4kV
	DC Power supply	0kV	-	0kV	0kV	0kV	0kV	0kV	4kV	4kV	4kV	4kV	4kV
VMU-M	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
	Temperature: Ch1, Ch2	0kV	0kV	0kV	0kV	-	0kV	0kV	4kV	4kV	4kV	4kV	4kV
VMU-P	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
	Digital inputs: Ch1, Ch2, Ch3	0kV	0kV	0kV	0kV	0kV	0kV	0kV	-	4kV	4kV	4kV	4kV
VMU-O	Relay outputs: Ch1, Ch2	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	-	4kV	4kV	4kV
	Input string (V-)	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	-	4kV	>5MΩ
VMU-S	Input string (A+)	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	4kV	-	4kV
	Output strimg (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 dis- connecting device).

General specifications

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



General specifications (cont.)

Standard compliance Safety Approvals Housing Dimensions (WxHxD)	IEC60664, IEC61010-1 EN60664, EN61010-1 CE, cULus Listed 17.5 x 90 x 67 mm	Material Mounting Protection degree Front Screw terminals	Noryl, self-extinguishing: UL 94 V-0 DIN-rail IP40 IP20
Connections			
VMU-M Connections Cable cross-section area Screw terminal purposes 1.5 mm ²	Screw-type 1.5 mm2 max, Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm 3+3 screw terminals used for two temperature inputs 3 screw terminals used for	Screw terminal purposes 16 mm ² 1.5 mm ²	1+1 screw terminals: 1 posi- tive for string input and 1 positive for string output (to the Inverter) 3 screw terminals: not power input, only for nega- tive voltage signal meas- urement
VMU-S AV10 Connections Cable cross-section area	RS485 communication 2 screw terminals used for power supply Screw-type	VMU-P Connections Cable cross-section area	Screw-type 1.5 mm ² max. Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm
Current (+)	Min. 2.5 mm ² , max 6 mm ² in case of flexible wire, Max. 10 mm ² in case of rigid wire. Screws tightening torque: Max 1.1 Nm	1.5 mm ²	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
Voltage (-) Screw terminal purposes 10 mm ²	Max 1.5 mm ² . Screws tightening torque: Max 0.5 Nm 1+1 screw terminals: 1 posi- tive for string input and 1 positive for string output (to	VMU-O Connections Cable cross-section area Relay outputs and digital inputs	Screw-type Max 1.5 mm ² Min./Max. screws tightening torque:
1.5 mm²	3 screw terminals: not power input, only for nega- tive voltage signal meas- urement	"X" type Screw terminal purposes 1.5 mm ²	0.4 Nm / 0.8 Nm 2+2 screw terminals: two for 1 st relay output and two for 2 nd relay output (SPST
VMU-S AV30 Connections Cable cross-section area Current (+) Voltage (-)	Screw-type Min. 2.5 mm ² , max 10 mm ² in case of flexible wire, Max. 16 mm ² in case of rigid wire. Hole dimension: 7.2x5.1mm. Screws tight- ening torque: Max 0.7 Nm Max 1.5 mm ² .	"AT" type Screw terminal purposes 1.5 mm²	2 screw terminals for relay output (SPST type) 2+2+2 screw terminals: two for 1 st digital input, two for 2 nd digital input and two
	Screws tightening torque: Max 0.5 Nm	Weight (all modules)	for 3 rd digital input Approx. 100 g (packing included)

Power supply specifications

VMU-M Power supply Power consumption VMU-S-P-O

12 to 28 VDC ≤1W Power supply

Self-power supplied through the communication bus ≤0.7W

Power consumption

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

String current vs. operating temperature

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 _w : 2.5W _{typ}	1.5A for 1s	SPD 24 18 1B or SPM3 24 1
From 1 to 3	Up to 1	Up to 1	PS _w : 5W _{typ}	1.5A for 1s	SPD 24 18 1B or SPM3 24 1
From 4 to 10	From 2 to 4	Up to 1	PS _w : 11W _{typ}	1.5A for 1s	SPD 24 30 1B or SPM3 24 1
From 11 to 14	Up to 1	Up to 1	PS _w : 10W _{typ}	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 _w : 12W _{typ}	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 _w : 13W _{typ}	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 _w :14W _{typ}	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 _w :14W _{typ}	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: $PS_W:<1W+n_{VMU-S}*0.5W+n_{VMU-O,X}*0.7W+n_{VMU-O,AT}*0.7W+n_{VMU-AT}*1.1+n_{VMU-P}*1.8W.$ 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		0.0 to 99999.9	The value is in kWh and is the result of the totalized pulses coming from
4	AC energy value	0.0 10 99999.9	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" effinciency 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 ² (kW/feet ²). (e.g. in: 0 to 1kW/m ² (1kW/feet ²), 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 a lister and (as is set as)	From 1 to 15 strings						
Time interval (minutes)	Data storing time						
(1)	Min. days	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 portReal and virtual alarms and events

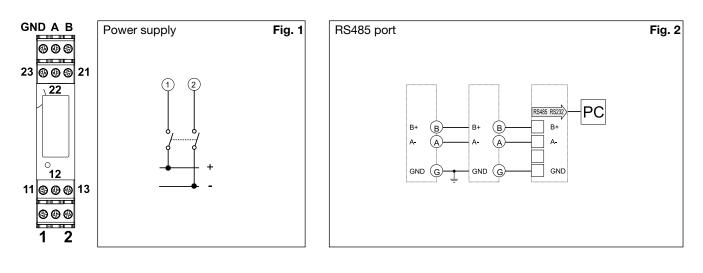
Data-logging

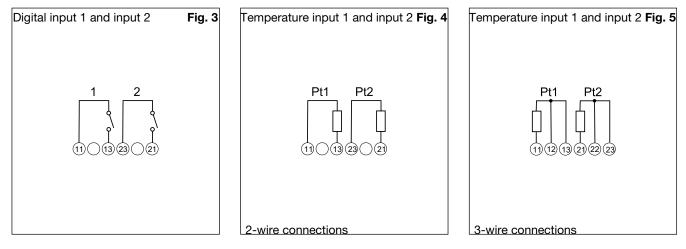
No	Variable	Event- logging	Data- logging	Alarm output	Module (from)	Notes
1	°C (°F) (input 1)	Yes	Yes	Yes	VMU-M	As alternative of status detection (4)
2	°C (°F) (input 2)	Yes	Yes	Yes	VMU-M	As alternative of variable (5)
3	% BOS efficiency	Yes	Yes	Yes	VMU-M	BOS efficiency calculation of the PV plant (in case of one VMU- M unit only). In all othre 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 ² (kWp/ft ²)	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.

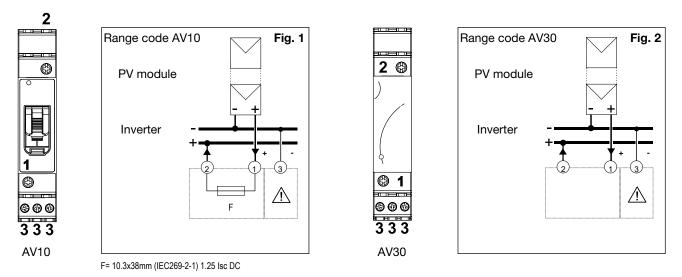


VMU-M connections



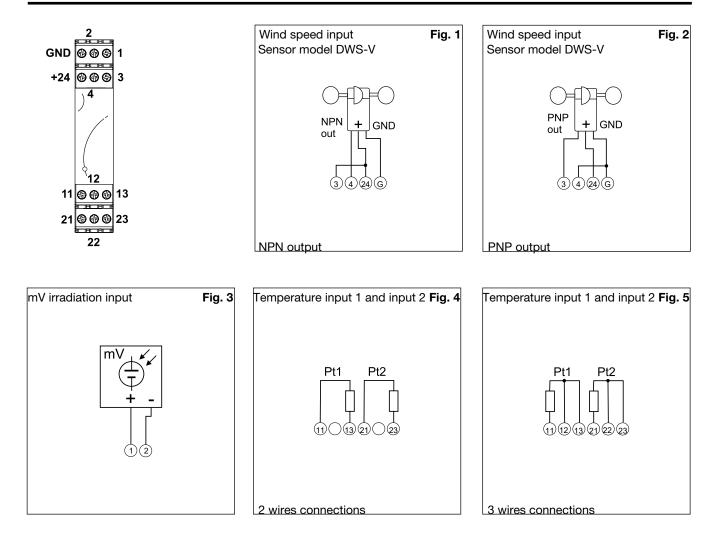


VMU-S (AV10 and AV30) connections

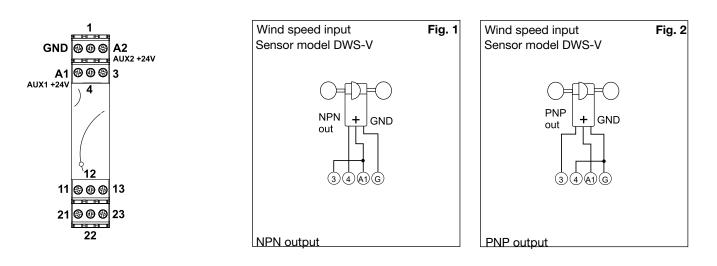


A = Not power input, only for voltage signal measurement.

VMU-P (2TIW) connections

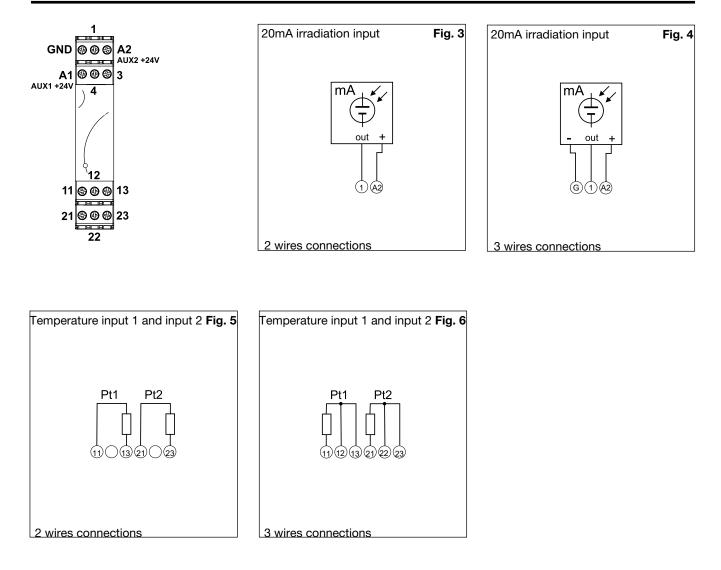


VMU-P (2TCW) connections

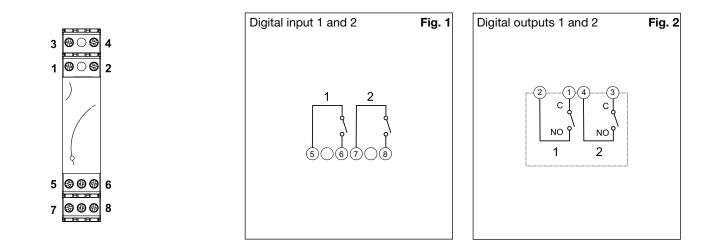




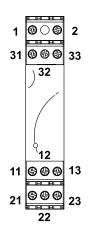
VMU-P (2TCW) connections (cont.)



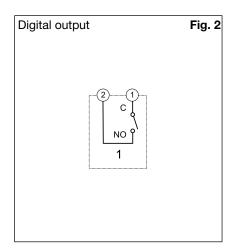
VMU-O connections



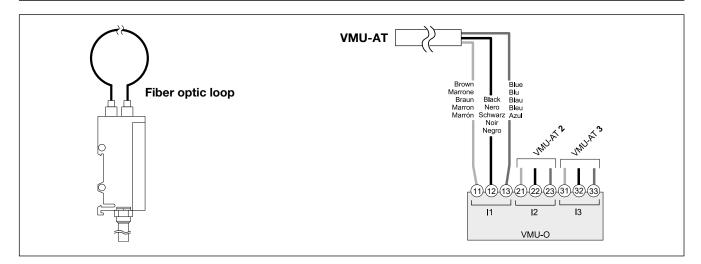
VMU-O "AT" option connections



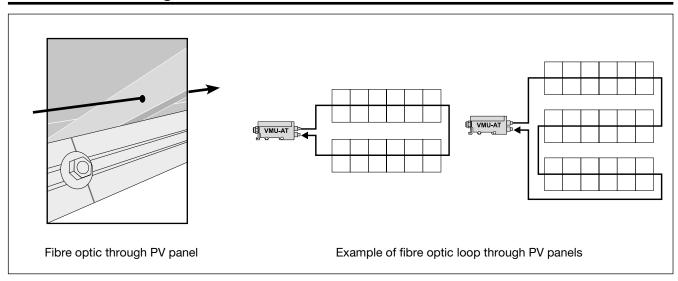
Digital input 1, 2 and 3 Fig. 1



VMU-AT connections



VMU-AT mounting and use



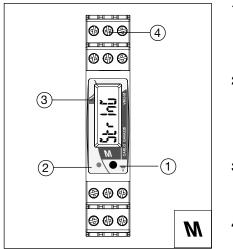


VMU-1 mounting and positioning 000000000 000000 ••• 0 0 0 3 Other VMU All VMU-S modules modules (not VMU-S) 00000000000 Ð Ø æ 600600600 600600600

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.

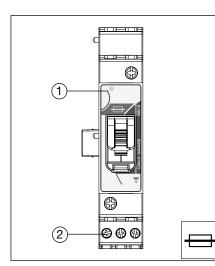
2. LED.

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

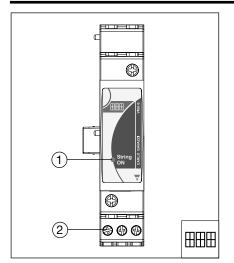
VMU-S Front panel description (AV10 range code: 16A)



- 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)

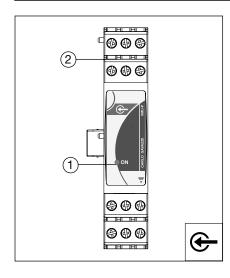


1. LED

- 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



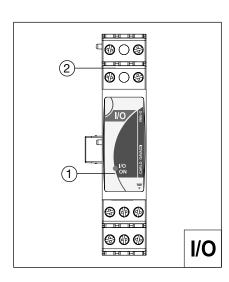
1. LED

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

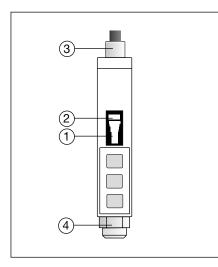
ON steady light: the module is power supplied. Green: the power supply is ON White: the unit is enabled by VMU-M module for data reading and displaying. Red: one or up to three digital inputs are activated Blue: one or both digital outputs are activated Cycling from one colour to any other one: the unit 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

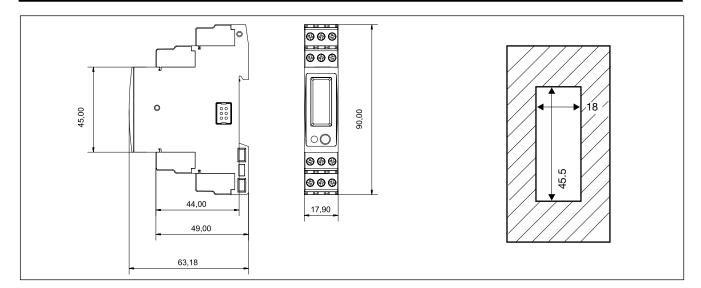


VMU-AT Front panel description

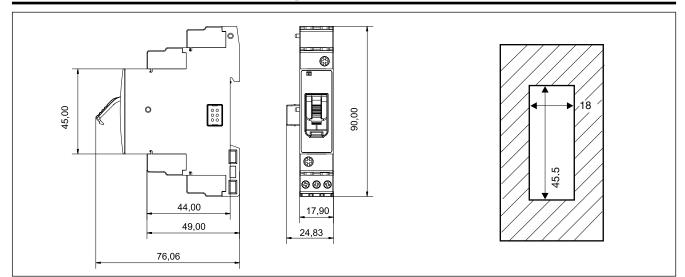


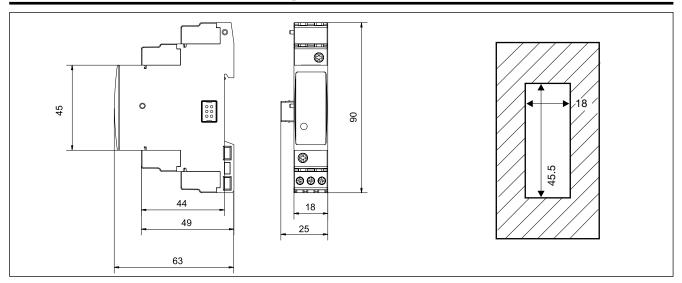
- 1. Green LED
 - The power supply is ON
- 2. Red LED
- The optical signal loop is working
- 3. Optical fibre connectors One RX and one TX optical fibre connector
- 4. One cable
- Cable for power supply and signal output.

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



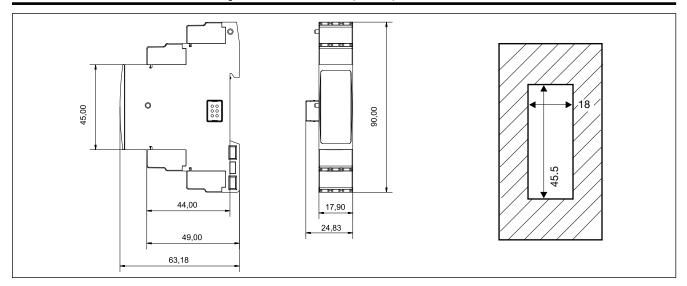
VMU-S (AV10) Dimensions and panel cut-out (mm)



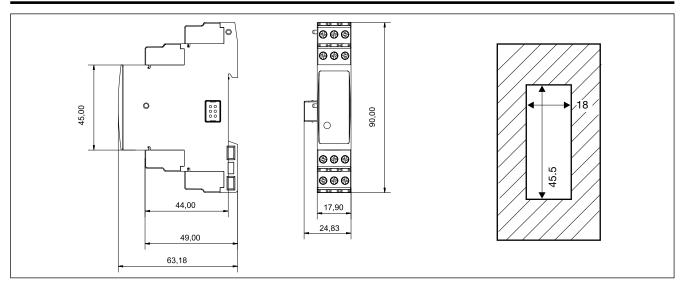


VMU-S (AV30) Dimensions and panel cut-out (mm)

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

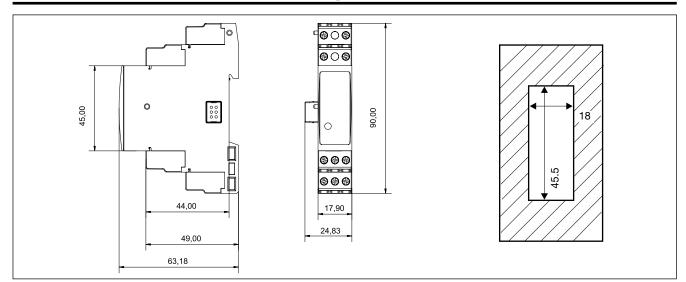


VMU-P Dimensions and panel cut-out (mm)

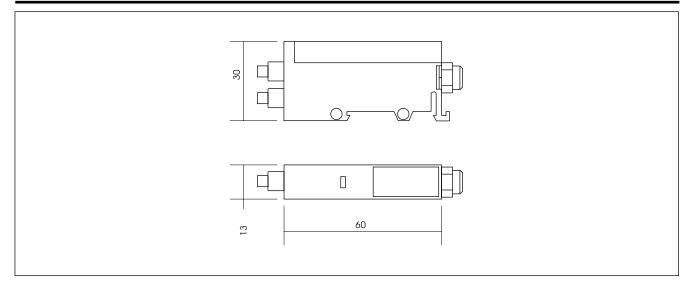




VMU-O/VMU-O AT Dimensions and panel cut-out (mm)



VMU-AT Dimensions (mm)





Mean time to failure (MTTF)

Model	MTTF/MTBF - Years	Test conditions	Standard
VMU-M	VMU-M 24.2		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

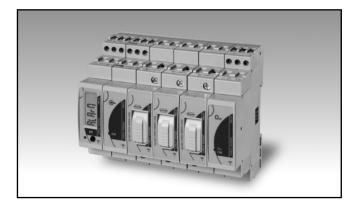
gf: ground, fixed.

Eos-ArraySoft parameter programming and variable reading software

Eos-ArraySoft	Multi-language software (Italian, English, French, German, Spanish) for varia- ble reading and parameters programming. The program runs under Windows XP/ Vista/7.		levels: - the RS485 communica- tion network which can include either one or more VMU-M units; - the auxiliary network with all the parameters relevant
Application	Up to two different applica- tions 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 mod- ules and maybe an energy meter connected to the VMU-M digital input; - Solar extended: a man- agement of a complex net- work 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.	Data storing Data download Data displaying Alarm set-up Modem management	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 tem- perature, air temperature, irradiation and wind speed. Alarm parameters. GSM/GPRS modem con- figuration (connected to the PC) SMS messages.
Configuration mode	There are two configuration		

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

CARLO GAVAZZI



· Modular local control system for PV plants

- Up to 17 DIN modules configuration equivalent to 280mm width
- · Eos-ArrayLSoft freeware software for easy product configuration
- Eos-Array can be formed by maximum 17 units
 Eos-Array can manage in addition to VMU-ML master unit up to:
 - max 1 VMU-P unit;
 - max 15 VMU-S0 units;
- max 1 VMU-O units.
- max 1 VMU-1

VMU-ML, master unit



Master communication capability

- RS485 communication port (Modbus) · Local communication bus management up to 15 mixed VMU-S0, VMU-P and VMU-O units
- · Single virtual or real alarm set-point connectable to any available variable
- Display readout: 6 DGTs
- 12 to 28 VDC power supply
- Dimensions: 1-DIN module
- Protection degree (front): IP40

Product Description

Eos-Array Lite is a combination of modules which performs mainly a current and voltage control of a photovoltaic plant. The core unit measuring units. VMU-ML is VMU-ML which performs the local bus management of VMU-S0, VMU-P both measuring units and VMU-O output unit. VMU-ML assigns the proper local unit

address automatically (up to 15 units) and gathers all the local measurements coming from VMU-S0 and VMU-P can provide by means of VMU-O modules one relay output so to manage up to 1 real alarm. Housing for DINrail mounting, IP40 (front) protection degree.

How to order

How to order	VMU-M	L A S1 XX X
Model Function Power supply Communication Inputs Option		

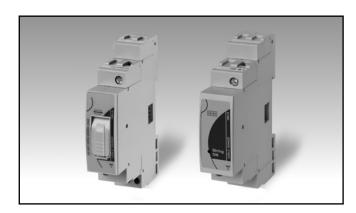
Type Selection

Function	Power supply	Communication	Inputs
L: Lite (*)	A: From 12 to 28VDC (*)	S1 : RS485 Modbus (*)	XX: none (*)
Option	(*) as standard.		

X: none



VMU-S0, string measuring unit



- Direct DC voltage measurement up to 1000V
- Direct DC current measurement up to 16A or up to 30A without fuse
- Instantaneous variables data format: 4 DGTs
- Instantaneous variables: V, A.
- Accuracy: ±0.5 RDG (current/voltage)
- Auxiliary power supply from VMU-ML unit
- String alarm management by means of VMU-ML unit
- Integrated 10.3x38mm fuse holder for string protection
- · Fuse blow detection by means of VMU-ML unit only
- Dimensions: 1-DIN module
- Protection degree (front): IP40

Product Description

Variables measuring unit with built-in protection fuseholder (the fuse is not provided), particularly indicated for DC current, voltage, 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. Moreover the unit is provided with an auxiliary serial communication bus. Alarms, fuse blow detection, and serial communication are managed by means of VMU-ML module. Housing for DIN-rail mounting, IP40 (front) protection degree.

How to order	VMU-S0 AV10 X S FX
Model	
Range	
Power supply	
Communication —	
Option	

Type Selection

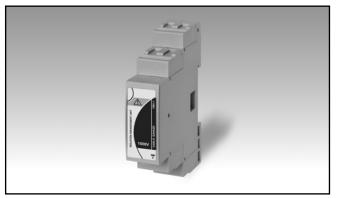
Range	Power supply		Communication		Option	
AV10: 1000V DC, 16A (Direct connection) (*) AV30: 1000V DC, 30A (Direct connection) (**) In this case the "Option" is "XX".	X :	from 12 to 28VDC, self-power supply from VMU-ML unit	S:	auxiliary communica- tion bus, compatible only to VMU-ML mod- ule (*)	XX: FX:	none (no fuse hold- er) with fuse holder (*)

(*) as standard.

(**) on request.



VMU-1, isolation enhancement unit



- Isolation enhancement of voltage measuring inputs to earth of VMU-S0: 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-S0 and all the other VMU modules. Housing for DIN-rail mounting, IP40 (front) protection degree. How to order

VMU-1 1000

Standard model

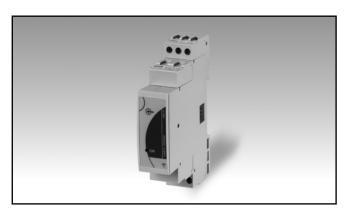
Type Selection

Standard model

Isolation voltage 1000V: isolation enhancement on VMU-S0 voltage measuring input to earth from 800VDC (without module) to 1000VDC. Note: only one VMU-1 is needed per Eos-Array.



VMU-P, environment variables unit



Product Description

Environment variables measurement unit particu-larly indicated for PV module temperature or air temperature and sun irradiation, 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-ML module. Housing for DIN-rail mounting, IP40 (front) protection degree.

· Measurements: PV module temperature or	
air temperature, sun irradiation	

- One temperature input: Pt100 or Pt1000 type
- One 120mV or 20mA DC input with scaling capability for irradiation measurement
- Auxiliary communication bus to VMU-ML unit
- Auxiliary power supply from VMU-ML unit
- Dimensions: 1-DIN module
 Protection degree (front): IP40

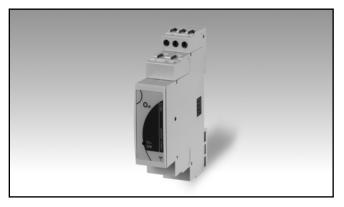
How to order	VMU-P 1TI XSX
Model ————————————————————————————————————	
Power supply	
Communication	
Option	

Type Selection

Range		Powe	er supply	Com	nunication	Optio	n
1TI: 1TC:	One "Pt" temperature type probe, mV sun irradiation input (*) One "Pt" temperature type probe, mA sun irradiation input (*)	x :	from 12 to 28VDC, self-power supply from VMU-ML unit	S:	auxiliary communica- tion bus, compatible only to VMU-ML mod- ule (*)	X :	none



VMU-O, relay outputs unit



- One relay output managed by the VMU-ML module
- Auxiliary power supply from VMU-ML unit
 Dimensions: 1-DIN module
- Protection degree (front): IP40

VMU-O Product Description

Relay output unit suitable to be used in combination with VMU-ML module. VMU-O allows to add one relay output to a VMU-ML based

system so to manage local alarms. Housing for DIN-rail mounting, IP40 (front) protection degree.

How to order	VMU-O X XX R1 X
Model — Power supply = Power supply	

Type Selection

Powe	r supply	Inputs	Outputs	Option
X :	from 12 to 28VDC, self-power supply from VMU-ML unit (*)	XX: none	R1: one relay output (*)	X: none

(*) as standard.



the communication on the

Red: alarm detected (any). In case of alarm/commu-

nication condition the LED

alternates its colour from

red (alarm) to green. The

blinking time is approx. 1

White: the unit is enabled by VMU-ML module for

data reading and display-

second.

ing.

RS485 bus is working.

VMU-ML Display and LED specifications

Display

Type Information read-out LED Type

Status and colour

1 line (max: 6-DGT) LCD, h 7mm 4-DGT

Dual colour Green steady light: the module is power supplied and there is no communication on the RS485 bus. Green blinking light:

VMU-P LED specifications

LED Type Status and colour

Multicolor Green: the power supply is ON.

VMU-O LED specifications

LED

Type Status and colour Multicolor Green: the power supply is ON. White: the unit is enabled by VMU-ML module for data reading and displaying. Blue: digital output is 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.

VMU-ML input specifications

Key-pad

1 push-button for variable scrolling and for some parameters programming.

Full programming can be carried out only using Eos-ArrayLSoft.

VMU-S0 input specifications

Rated inputs		Start up current	0.05A
Current type	1 (shunt)	Start up voltage	10V
Current range	AV10 range: 16A DC @	AV30 range code	
	40°C, 15A @ 50°C, 14A @	Current	±(0.5%RDG+2 DGT)
	55°C, 12A @ 60°C, 10A @ 65°C		from 0.2A to 30A
	AV30 range: 30A DC @	Voltage	±(0.5%RDG+2 DGT)
	55°C, 25A DC @ 60°C, 20A		from 20V to 1000V
	DC @ 65°C	Start up current	0.2A
Voltage	AV10 range: 1000V DC	Start up voltage	10V
Vollage	AV30 range: 1000V DC	Temperature drift	≤200ppm/°C
Accuracy	(@25°C ±5°C, R.H. ≤60%)	Measurement sampling time	2 sec.
AV10 range code	()	Variables format	
Current	±(0.5%RDG+2 DGT)	Instantaneous variables	4-DGT (A), 5-DGT (V)
	from 0.05A to 16A	Resolution	0.1V; 0.01A.
Voltage	±(0.5%RDG+2 DGT)		
	from 20V to 1000V		

VMU-S0 input specifications (cont.)

Input impedanceAV10 range codeVoltageVoltageCurrent< 0.	See "Variables format" > 2.5M Ω < 0.006 Ω (+ fuse imped-	Current Overloads Continuous For 1s	AV10 range: 16A AV30 range: 30A AV10 range: 100A max AV30 range: 150A max
AV30 range code Voltage Current	 ance) @ 0.5 Nm (screw terminal torque). The maximum dissipation power has not to exceed 2W. > 2.5M < 0.003Ω @ 0.5 Nm (screw terminal torque) 	Protection Fuse holder Fuse type Fuse size Fuse current	Integrated into the module gPV 10x38mm (IEC60269-1-6) Fuse NOT provided. Note: the fuse rated current has to be ≥1.4 lsc at 45°C ambient temperature. See fuse manufacturer speci-
Voltage Overloads Continuous For 500ms To earth	1100V 1600V 800V (extended to 1000V in case of combined use of VMU-1.1000V unit)		fications for further details including de-rating caused by higher ambient tempera- ture.

VMU-P input specifications

Temperature drift	≤200ppm/°C	Impedance	> 30KQ
Variables format		Overload	2 301(32
Instantaneous variables	4 DGT (Temperature, solar	Continuous	10VDC (measurement
Resolution	irradiation) 0.1°C/0.1°F; 1W/m², 1W/ft²;		available up to 1V on both display and communication
Max. and Min. data format	See "Variables format"		bus)
		For 1s	20VDC
Temperature probe input Number of inputs	1	Insulation	See the table "Insulation
Temperature probe	Pt100 or Pt1000		between inputs and com-
Number of wires	Up to 3-wire connection		munication bus"
Wire compensation	Up to 10Ω .	Irradiation sensor inputs	
Accuracy	op to	(range code: 1TC)	
(@25°C ±5°C, R.H. ≤60%)		Number of inputs	1 0 to 20mA DC
(Display + RS485)	See table "Temperature	Range Accuracy (Display + RS485)	U LO ZUMA DC
	input characteristics"	(@25°C ±5°C, R.H. ≤60%)	±(0.2%RDG+1DGT)
Temperature drift	±150ppm /°C	(@25 C ±5 C, R.H. ±00 %)	0% to 25% FS;
Engineering unit	Selectable °C or °F		±(0.1%RDG+1DGT)
Insulation	See the table "Insulation		25% to 120% FS.
	between inputs and com- munication bus"	Temperature drift	±150ppm /°C
	munication bus	Scaling factor	
Irradiation sensor inputs (range code: 1TI)		Operating mode	Dual scale:
Number of inputs	1		- Input: programmable
Range	0 to 120mVDC		range from 0 to 25.0
Accuracy (Display + RS485)	0 10 120111200		(mADC) - Display: programmable
(@25°C ±5°C, R.H. ≤60%)	±(0.2%RDG+1DGT)		range from 0 to 9999 (kW/
	0% to 25% FS;		m^2 , kW/ft ²)
	±(0.1%RDG+1DGT)	Decimal point position	Fixed.
	25% to 120% FS.	Impedance	≤23Ω
Temperature drift	±150ppm /°C	Overload	
Scaling factor	Dual scale:	Continuous	50mADC (measurement
Operating mode	- Input: programmable		available up to 25mA on
	range from 0 to 150.0		both display and communi-
	(mVDC)	For 1s	cation bus) 150mADC
	- Display: programmable	Insulation	See the table "Insulation
	range from 0 to 9999 (kW/	moulauon	between inputs and com-
	m², kW/ft²)		munication bus"
Decimal point position	Fixed.		



VMU-P Temperature input characteristics

Probe	Range	Accuracy (@25°C ±5°C, R.H. ≤60%)	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-ML Output specifications

RS485	Slave function		puts"
Туре	Multidrop, bidirectional	Auxiliary communication bus	This is the communica-
	(static and dynamic vari-	· · · · · · · · · · · · · · · · · · ·	tion bus to the VMU-S0.
	ables)		VMU-P and VMU-O units
			where VMU-ML performs
Connections	2-wire. Max. distance		the master function in this
	1000m		network. VMU-ML unit can
Addresses	247, selectable by means		gather the following infor-
	of the front push-button		mation from the bus:
Protocol	MODBUS/JBUS (RTU)		- All variables available on
Data (bidirectional)			the bus;
Dynamic (reading only)	All variables, see "List of		- Antitheft status;
	the variables that can be "		- PV reverse voltage and
Static (writing only)	All the configuration param-		current polarity;
	eters.		- PV module status.
Data format	1 start bit, 8 data bit, no		The local address in the
	parity,1 stop bit		VMU-S0, VMU-P and
Baud-rate	Selectable: 9600, 19200,		VMU-O units is automati-
	38400, 115200 bits/s		cally assigned by VMU-ML
	Parity: none		master unit based on their
Driver input capability	1/5 unit load. Maximum 160		positions. It can manage up
	transceivers on the same		to 15 different addresses
	bus.		(units).
Special functions	None	Insulation	See the table "Insulation
Insulation	See the table "Insulation		between inputs and out-
	between inputs and out-		puts"

VMU-O Output specifications

Maximum number of modules managed by every single VMU-ML module	Up to 1	Туре	Relay, SPST type AC 1-5A @ 250VAC AC 15-1A @ 250VAC
Digital output Number of outputs Purpose	1 Alarm notification as a String alarm and other alarms (see "List of the variables that can be con- nected to"	Insulation	Available by means of VMU-O module only See the table "Insulation between inputs and out- puts"

Main Function

CARLO GAVAZZI

Displaying	1 parameter per page		controls (VMU-S0 units).
VMU-ML module	"Alarm and diagnostics		The highest value of the
	messages"		measured string current
When a VMU-S0 module			among those available is
is selected	All the information related		used as a reference value.
	to the status of the string		The alarm set-point is a
	being selected by means of		value that can be set by
	the front key (see		the user as a percentage of
	the table "List of the vari-		the reference value below
	ables that can be").		which there is the alarm
When a VMU-P module			condition.
is selected	All the information related		- Median control: the meas-
	to the status of the environ-		urement of the string power
	ment probes being selected		is performed by the local VMU-S0 module individu-
	by means of the front key		ally. Within the VMU-ML
	(see the table "List of the		system all values coming
When a VMU-O module	variables that can be").		at the same instant from
is selected	All the information related		every VMU-S0 module are
15 50100104	to the status of the output		used to calculate the "medi-
	being selected by means of		an" value which becomes
	the front key (see the table		the reference value to
	"List of the		which the dynamic window
	variables that can be").		set-point (in percentage
Password	Numeric code of max. 4		set by the user) is linked.
	digits;		The abnormal condition is
	2 protection levels of the		detected when the meas-
	programming data:		ured instantaneous string
1 st level	Password "0", no protec-		current is out of the set
	tion;		window alarm. The alarm
2 nd level	Password from 1 to 9999,		activates, with reference
	all data are protected		to the failed string, either a
Alarms			relay output (only in case of "VMU-O" connection)
Number of alarms	One, independent for every		or/and a message which
	single available variable		is transmitted by means
	(see the table "List of the		of the RS485 communica-
	variables that can be…")		tion port to an acquisition
Alarm types	Virtual alarm or real alarm		system.
Alarm modes	Up alarm, down alarm (see	String window alarm	The alarm is set as the
	the table "List of the varia-	3	string power control, the
	bles that can be connected		value is programmable in
Cat paint adjustment	to …") From 0 to 100% of the dis-		percentage (of the meas-
Set-point adjustment			ured string value) from 0.1
Hystorosis	play scale From 0 to full scale		to 199.9.
Hysteresis On-time delay	0 to 3600s	Other variable alarms	The alarms can be con-
Output status	Selectable; normally de-		nected also to the string
Oulput status	energized or normally ener-		voltage.
	gized	Fuse blow detection	
Min. response time	≤ 700ms, set-point on-time	(only AV10 range code)	Warning message trans-
I I	delay: "0 s"		mission through the local
String control	,		port to the VMU-ML unit.
Function enabling	Activation: NO/YES	Wrong PV module connection	Warning message trans-
Function selection	Match max. control or		mission through the local
	median control		port to the VMUML unit.
Function description	Match max. control: this		
-	function is helpful only if		
	there are at least two string		



Insulation between inputs and outputs

Module		Any	VML	J-ML	VM	U-P	VMU-O		VMU-S0	
	Type of input/output	Local bus	DC Power supply	RS485	Temperature: Ch1	Solar irradiation	Relay outputs: Ch1	String input (V-)	String input (A+)	String output (A+)
Any	Local bus	-	0kV	0kV	0kV	0kV	4kV	4kV	4kV	4kV
VMU-ML	DC Power supply	0kV	-	0kV	0kV	0kV	4kV	4kV	4kV	4kV
VIVIO-IVIL	RS485	0kV	0kV	-	0kV	0kV	4kV	4kV	4kV	4kV
VMU-P	Temperature: Ch1	0kV	0kV	0kV	-	0kV	4kV	4kV	4kV	4kV
VIVIO-P	Solar irradiation	0kV	0kV	0kV	0kV	-	4kV	4kV	4kV	4kV
VMU-O	Relay outputs: Ch1	4kV	4kV	4kV	4kV	4kV	-	4kV	4kV	4kV
	String input (V-)	4kV	4kV	4kV	4kV	4kV	4kV	-	4kV	>5MΩ
VMU-S0	String input (A+)	4kV	4kV	4kV	4kV	4kV	4kV	4kV	-	4kV
	String output (A+)	4kV	4kV	4kV	4kV	4kV	4kV	>5MΩ	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. Remove the fuse only when the disconnecting breaker is switched off. The fuse is only for over-current protection (it has not to be considered as a disconnecting device).



General specifications

Operating temperature	See table "String current vs. operating temperature".	Immunity to conducted disturbances	EN61000-4-6: 10V from	
Storage temperature	-30 to +70°C (-22°F to 158°F) (R.H. < 90% non- condensing @ 40°C)	Surge	150KHz to 80MHz; EN61000-4-5: 500V on power supply; 4kV on string inputs.	
Over voltage category	Cat. III (IEC 60664, EN60664) For inputs from string:	EMC (Emission) Radio frequency suppression	According to EN61000-6-3 According to CISPR 22	
	equivalent to Cat. I, rein- forced insulation.	Standard compliance Safety	IEC60664, IEC61010-1 EN60664, EN61010-1	
Insulation (for 1 minute)	See table "Insulation between inputs and out-	Approvals	CE, cULus Listed	
Dielectric strength	puts" 4000 VAC RMS for 1 min- ute	Housing Dimensions (WxHxD) Material	17.5 x 90 x 67 mm Noryl, self-extinguishing:	
Noise rejection CMRR	>65 dB, 45 to 65 Hz	Mounting	UL 94 V-0 DIN-rail	
EMC (Immunity) Electrostatic discharges Immunity to irradiated electromagnetic fields Immunity to Burst	According to EN61000-6-2 EN61000-4-2: 8kV air dis- charge, 4kV contact; EN61000-4-3: 10V/m from 80 to 3000MHz; EN61000-4-4: 4kV on power supply lines, 2kV on single lines;	Protection degree Front Screw terminals	IP40 IP20	

Connections

VMU-ML Connections Cable cross-section area	Screw-type 1.5 mm² max, Min./Max.		er input, only for negative voltage signal measure- ment
Screw terminal purposes 1.5 mm²	screws tightening torque: 0.4 Nm / 0.8 Nm 3 screw terminals used for RS485 communication 2 screw terminals used for power supply	VMU-S0 AV30 Connections Cable cross-section area Current (+)	Screw-type Min. 2.5 mm ² , max 10 mm ² in case of flexible wire, Max. 16 mm ² in case of rigid wire. Hole dimension: 7.2x5.1mm.
VMU-S0 AV10 Connections Cable cross-section area	Screw-type	Voltage (-)	Screws tightening torque: Max 0.7 Nm Max 1.5 mm ² . Screws tight- ening torque: Max 0.5 Nm
Current (+)	Min. 2.5 mm ² , max 6 mm ² in case of flexible wire, Max. 10 mm ² in case of rigid wire.	Screw terminal purposes 16 mm²	1+1 screw terminals: 1 posi- tive for string input and 1 positive for string output (to the Inverter)
Voltage (-)	Screws tightening torque: Max 1.1 Nm Max 1.5 mm ² . Screws tight-	1.5 mm²	3 screw terminals: not pow- er input, only for negative voltage signal measure- ment
Screw terminal purposes	ening torque: Max 0.5 Nm	VMU-P	
10 mm ²	1+1 screw terminals: 1 (+) for string input and 1 (+) for string output (to the Inverter)	Connections Cable cross-section area	Screw-type 1.5 mm ² max. Min./Max. screws tightening torque:
1.5 mm ²	3 screw terminals: not pow-		0.4 Nm / 0.8 Nm

Connections (cont.)

Screw terminal purposes 1.5 mm ²	3 screw terminals used for temperature probe 2 screw terminals used for	1.5 mm² Weight (all model)	2 screw terminals: for relay output (SPST type) Approx. 100 g (packing
	solar irradiation sensor		included)
VMU-O			
Connections	Screw-type		
Cable cross-section area	Max 1.5 mm ² Min./Max. screws tightening torque:		
Screw terminal purposes	0.4 Nm / 0.8 Nm		

Power supply specifications

VMU-ML Power supply Power consumption

12 to 28 VDC ≤1W VMU-S0-P-O Power supply

Power consumption

Self-power supplied through the communication bus ≤0.7W

Sizing of Carlo Gavazzi DC power supply

VMU-S0 units	VMU-O units	VMU-P units	Consumption	Start-up current	Power supply part number
From 1 to 3	None	None	PS _W : 2.5W _{typ}	1.5A for 1s	SPD 24 18 1B or SPM3 24 1
From 1 to 3	Up to 1	Up to 1	PS _W : 5W _{typ}	1.5A for 1s	SPD 24 18 1B or SPM3 24 1
From 4 to 10	From 2 to 4	Up to 1	PS _w : 11W _{typ}	1.5A for 1s	SPD 24 30 1B or SPM3 24 1
From 11 to 14	Up to 1	Up to 1	PS _w : 10W _{typ}	1.5A for 1s	SPD 24 30 1B or SPM3 24 1
Max. 14	Max. 7	Max. 1			

Note: the consumption above includes already one VMU-U unit. For different combinations not mentioned above the consumption calculation is the following: PS_W :<1W+ n_{VMU-S0} *0.5W+ n_{VMU-O} *0.7W+ n_{VMU-P} *1.8W. where "n" is number of power supplied units.

Variables format

No.	Module	Variable	Data format	Notes
1	VMU-S0	V	0.0 to 1250.0	
2	VMU-S0	A	0.0 to 50.0	
3	VMU-P	Temperature	-60 to 400.0	Temperature (°C/°F). The range is extended to cover both °C and °F indications
4	VMU-P	Solar irradiation (IRR)	0.0 to 9.999	Irradiation kW/m2 (kW/feet2) (e.g. in: 0 to 1kW/m2 (1kW/feet2), out: 0 to 100mV)

No.	Message	Notes
1	Conn.CY (AV10 only)	Fuse blow detection.
2	StrinG	String failure warning: the "String control" function has detected a failure.
3	Conn.PY	Reverse string current or voltage
4	SYSteM	Power-up self-test error
5	buS	Auxiliary bus communication error
6	ALArM	Variables alarm (any)

Alarm and diagnostics messages

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-ML, VMU-P	-25 to + 65°C	-13°F to 149°F
12A DC max.	3.0A	VMU-ML, VMU-P	-25 to + 60°C	-13°F to 140°F
14A DC max.	3.5A	VMU-ML, VMU-P	-25 to + 55°C	-13°F to 131°F
15A DC max.	4.0A	VMU-ML, VMU-P	-25 to + 50°C	-13°F to 122°F
16A DC max.	5.0A	VMU-ML, VMU-P	-25 to + 40°C	-13°F to 104°F
VMU-S AV30 Input current				
20A DC max.	2.5A	VMU-ML, VMU-P	-25 to + 65°C	-13°F to 149°F
25A DC max.	3.0A	VMU-ML, VMU-P	-25 to + 60°C	-13°F to 140°F
30A DC max.	3.5A	VMU-ML, VMU-P	-25 to + 55°C	-13°F to 131°F

R.H. < 90% non condensing @ $40^{\circ}C$ ($104^{\circ}F$)

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

RS485 communication port

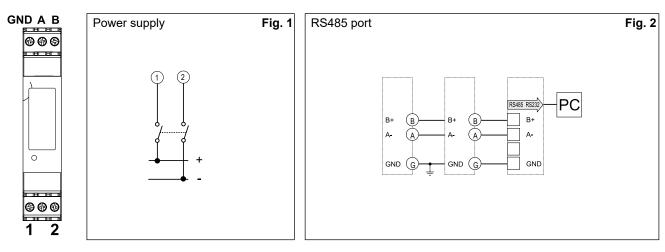
· Real and virtual alarms and events

No	Variable	Event- logging	Data- logging	Alarm output	Module (from)	Notes
1	Error: 1	Yes	No	Yes (a)	VMU-ML	Local bus communication problems
2	Error: 2	Yes	No	Yes (a)	VMU-ML	Changed system modules configuration
3	Error: 3	Yes	No	Yes (a)	VMU-ML	Incoherent programming parameters
4	Error: 4	Yes	No	Yes (a)	VMU-ML	More than one VMU-P unit connected to the bus
5	Status: 1	Yes	No	No	VMU-ML	Local programming access
6	Status: 2	Yes	No	No	VMU-ML	Power ON/OFF
7	V	Yes	Yes	Yes	VMU-S0	Available from every string
8	А	Yes	Yes	Yes	VMU-S0	Available from every string
9	Status: 1	Yes	No	Yes	VMU-S0	Incoherent programming parameters
10	Status: 2	Yes	No	Yes	VMU-S0	Fuse blow detection
11	Status: 3	Yes	No	Yes	VMU-S0	Reverse string current or voltage
12	Status: 4	Yes	No	Yes	VMU-S0	High temperature inside VMU-S0 unit
13	String control	Yes	Yes	Yes	VMU-S0	
14	°C (°F) input	Yes	Yes	Yes	VMU-P	PV module temperature
15	kWp/m ² (kWp/ft ²)	Yes	Yes	Yes	VMU-P	Solar irradiation
16	Error: 1	Yes	No	Yes	VMU-P	Incoherent programming parameters
17	Error: 2	Yes	No	Yes (c)	VMU-P	Short circuit on probe input
18	Error: 3	Yes	No	Yes (c)	VMU-P	Open circuit on probe input
19	Status: input 1	Yes	No	No	VMU-O	ON /OFF status detection
20	Error: 1	Yes	No	Yes	VMU-O	Incoherent programming parameters

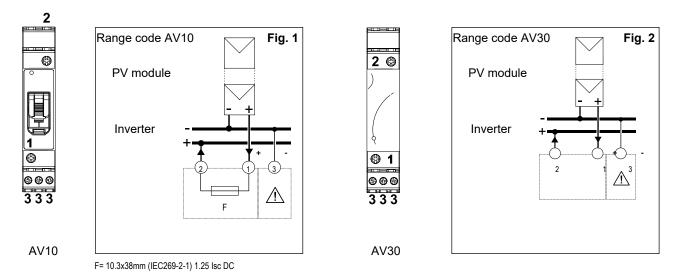
Note about "Alarm output": YES (a), YES (b) and YES (c) are according to the relevant letter "OR" logic alarms.

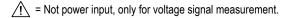


VMU-ML connections

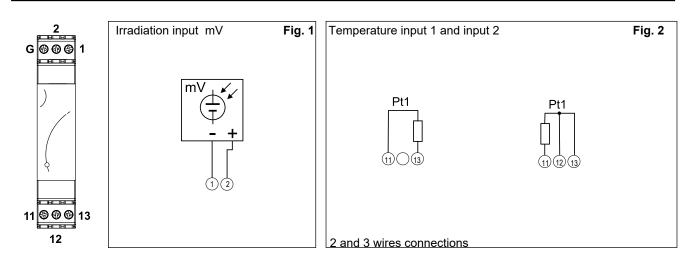


VMU-S0 (AV10 and AV30) connections

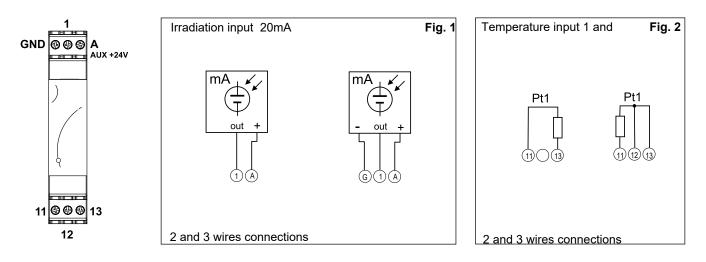




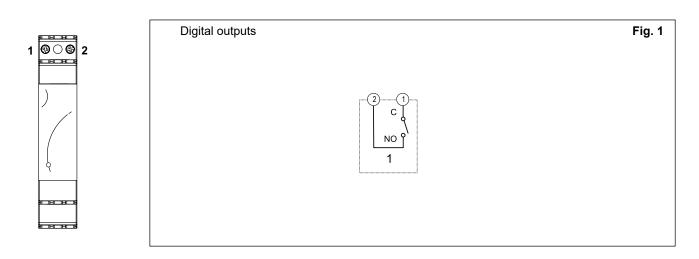
VMU-P (1TI) connections



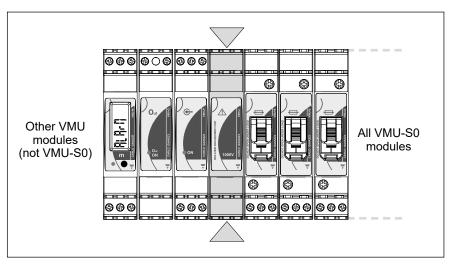
VMU-P (1TC) connections



VMU-O connections



VMU-1 mounting and positioning

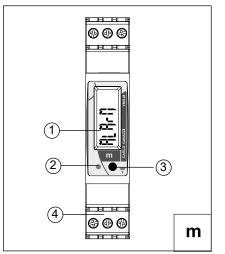


The VMU-1 has to be mounted between the group of VMU-S0 and all the other modules as shown in the example picture on the left.

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



VMU-ML Front panel description



1. Display.

LCD-type with alphanumeric indications to:

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

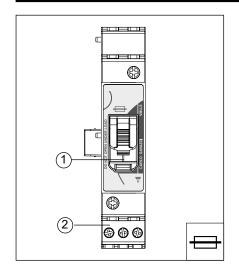
3. Push button.

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.

4. Screw terminals.

For power supply, bus and digital inputs/output connections

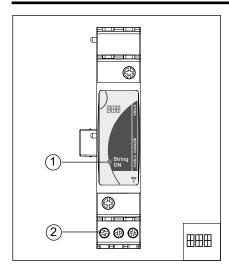
VMU-S0 Front panel description (AV10 range code: 16A)



1. Fuse holder cover For fuse holding and protection.

2. Screw terminals For string connections

VMU-S0 Front panel description (AV30 range code: 30A)

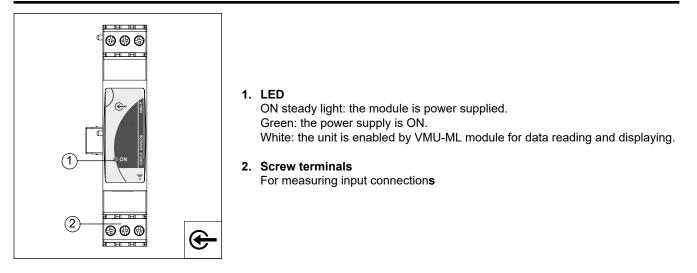


1. LED

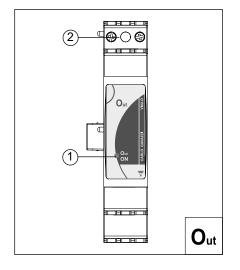
Green: the power supply is ON, there is a string current up to 1A; Yellow: there is a string current from 1.1 to 6A: Light orange: there is a string current from 6.1 to 12A; Orange: there is a string current from 12.1 to 16A; Dark orange: there is a string current from 16.1 to 20A; Red: there is a string 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



VMU-O Front panel description



1. LED

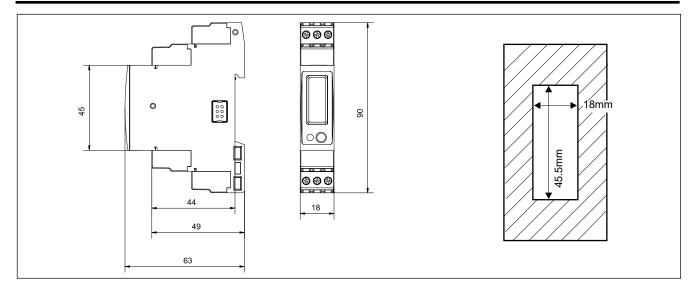
Green: the power supply is ON White: the unit is enabled by VMU-ML module for data reading and displaying. Red: one or both digital inputs are activated Blue: one or both digital outputs are activated Cycling from one colour to any other one: the unit shows the status of the module according to the colour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

2. Screw terminals

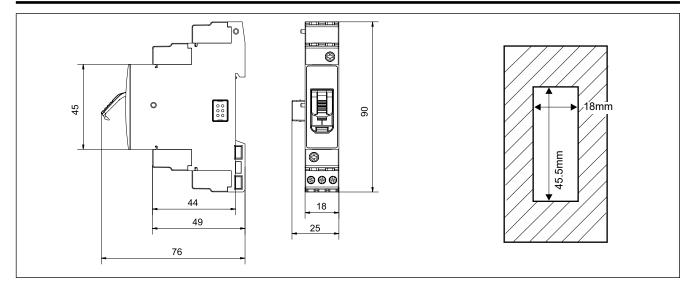
For digital inputs and outputs connections



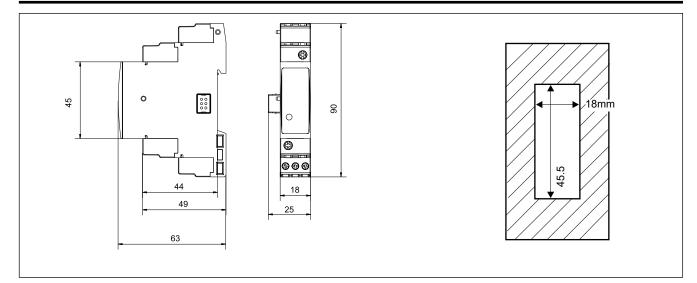
VMU-ML Dimensions and panel cut-out (mm)



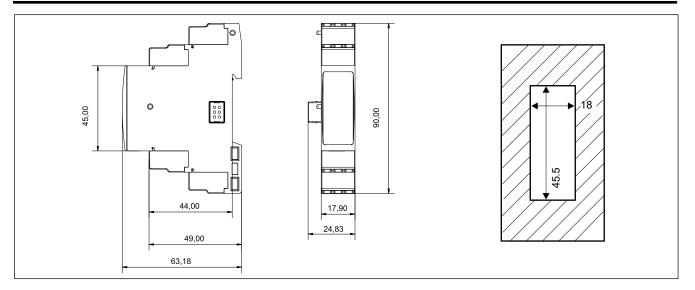
VMU-S0 (AV10) Dimensions and panel cut-out (mm)



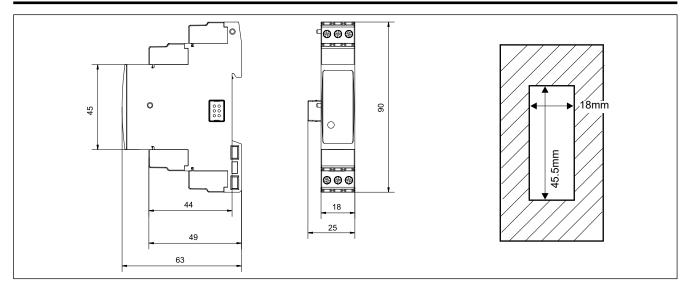
VMU-S0 (AV30) Dimensions and panel cut-out (mm)



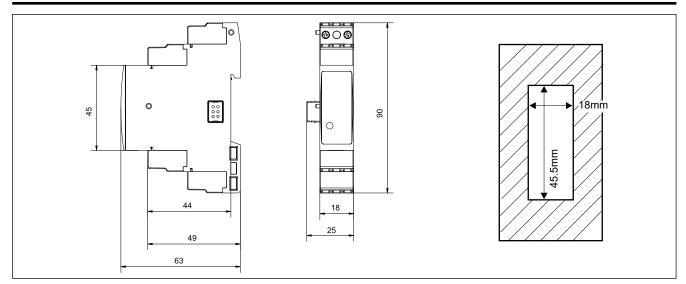
VMU-1 Dimensions and panel cut-out (mm)



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



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





Mean time to failure (MTTF)

Model	MTTF/MTBF - Years	Test conditions	Standard
VMU-ML	24.2	gf, 50° C	MIL-HDBK-217F
VMU-S0	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-ArrayLSoft parameter programming and variable reading software

Eos-ArrayLSoft	Multi-language software (Italian, English, French, German, Spanish) for vari- able reading and param- eters programming. The program runs under Win- dows XP/Vista	Configuration mode	There are two configuration levels: - the RS485 communica- tion network which can include either one or more VMU-ML units; - the auxiliary network with
Application	One / three different appli- cations can be selected: - Solar: a management of a limited network where Eos- ArrayLSoft manages basi- cally one VMU-ML unit with relevant VMU-S0, VMU-P and VMU-O modules and maybe an energy meter connected to the VMU-ML digital input; - Solar extended: a man- agement of a complex net- work where Eos-ArrayL- Soft manages many VMU- ML modules and relevant sub networks (VMU-S0, VMU-P and VMU-O units) and maybe an energy meter (EM21-72D, EM24- DIN, EM26-96) connected to the same RS485 bus.	Data displaying	all the parameters relevant to the following modules: VMU-ML, VMU-S0, VMU- P, VMU-O. The following matrix are available: - String 1: V-A - String 2: V-A - String n: V-A - Main: temperature, irra- diation and AC energy. - Plant alarms and errors alarm - Relay output status.

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