Energy Management
Integrated WEB based solution for Energy Management
Type VMU-C EM

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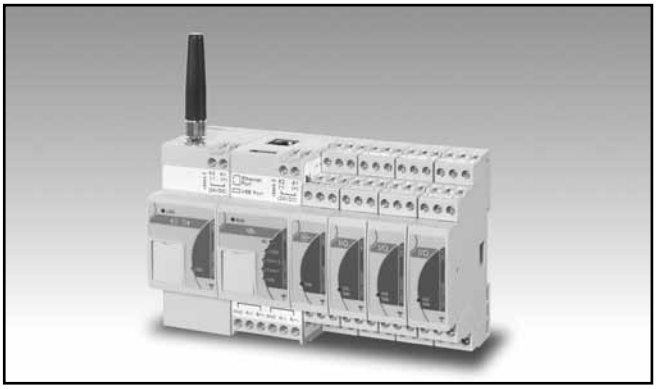

- **Integrated modular local monitoring system for Energy Management plants based on Web-server and FTP/push capability**
- **Up to 8 DIN modules configuration equivalent to 140mm width**
- **VMU-C EM can manage on RS485 bus up to 32 Energy Meters or Power Analyzers**
- **VMU-C EM can manage on local bus 1 VMU-W modem unit**
- **VMU-C EM can manage on local bus up to 4 VMU units and up to 10 VMU-M based arrays on RS485 bus**
- **Any VMU-M based arrays can manage up to:**
  - max 1 VMU-P unit;
  - max 3 VMU-O unit

Product description

VMU-C is a combination of modules which performs the monitoring of an Energy Management installation. The core unit is VMU-C gathering data from up to 32 energy meters; the meters can be both AC or DC meters. In addition to the data-logging, it performs also the management of local or remote (via VMU-M) VMU-O “I/O unit” and/or VMU-P “Environment variable unit”, and provides an FTP push functionality.
VMU-C can also provide, by means of the VMU-O modules, relay alarm contacts, digital inputs (e.g. for status indication, to sense the tripping of an automatic switch). The VMU-W unit has the task to transmit, with wireless modem technology, all the data when a wired LAN or Internet access is not available. Housing for DIN-rail mounting, IP40 (front) protection degree.
The FTP push function enables a FTP based communication from VMU-C to an external FTP server (owned by the end-user), so to transmit in a simple and standard way a predefined set of data (using CVS format). In this case data are gathered and logged by VMU-C from the energy meters and VMU modules in the field and, following a schedule or a trigger, are grouped into a file and uploaded to the defined FTP server; the upload action is repeted in case of failure. In addition to the protocol, VMU-C can communicate data in M2M (machine to machine) scenario also via HTTP protocol.

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VMU-C EM: WEB server and FTP master unit

- Two RS485 communication ports (Modbus)
- One Ethernet port
- Two multi purpose USB 2.0 ports
- 12 to 28 VDC power supply
- Dimensions: 2-DIN modules
- Protection degree (front): IP40

- Micro PC with Web-server
- Push of CSV or XML file in FTP servers
- Linux embedded operating system
- Up to 32 Energy meters and Power analysers management
- AC measurements: V, A, Hz, kW/var/VA
- DC measurement: V, A, W, kWh
- Environment variables: temperature, analogue values, pulse rate variables
- Other variables: utility meters (by EM24 or EM26 energy meters), digital status
- Variables shown as graphs and numbers in formatted tables
- Alarms control with automatic e-mailing and SMS management (with VMU-W only)
- All data exports on HTML format compatible with Excel or other spread sheets
- Internal data storage up to 30 years in a 4GB memory
- Optional automatic data back-up on micro SD or micro SDHC memories (not supplied)

Product description

VMU-C EM is a micro PC with Web-server and FTP push capability suitable to gather electrical variables information from up to 32 energy meters (or power analysers), and up to 11 arrays of optional VMU modules. VMU-C EM provides information in a quick and automatic glance via the internet using a standard browser, so the data is available from anywhere. VMU-C EM shows information on the electrical plant such as: V, A, kW, kWh, kvar, kvarh, Hz, PF, etc. and additional information such as temperature or analogue signals.

All data are available as graphs and numbers in formatted tables. VMU-C performs alarms control, managing also automatic e-mailing and SMS when combined with VMU-W. All available data can be exported in an xls-compatible format so to be imported in standard spread sheets for further analysis.

How to order

VMU-C EM A WS S U X

- **Model**
- **Application**
- **Power supply**
- **Function**
- **Serial port**
- **USB port**
- **Option**

Type Selection

Application		Power supply		Function		Serial port	
EM:	Energy Management	**A:**	from 12 to 28VDC	**WS:**	Web-Server with FTP push capability	**S:**	two RS485 Modbus

USB port		Option	
U:	two USB 2.0	**X:**	none

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VMU-W: Universal mobile modem for data communication

- **Internet access point when regular wired network is not available**
- **Compatibility with quad-band GSM-GPRS-EDGE standards**
- **Compatibility with dual-band UMTS-HSPA standards**
- **SIM (25 x 15mm) for data communication (M2M SIM type only)**
- **Three available versions: one for Europe, Africa and Asia, one for America and one for Australia**
- **12 to 28 VDC power supply**
- **Dimensions: 2-DIN module**
- **Protection degree (front): IP40**

Product description

Modem based on “UMM” (Universal Mobile Modem) communication technology for data communication when wired Internet is not available. This unit is suitable to be used in combination with VMU-C only.
VMU-C EM (VMU-W + VMU-C) can manage a plant control based on SMS alert received by maintenance personnel on mobile phones, who might decide, based on the relevant message to go straight on site or to access to the proper plant domain for further details. Housing for DIN-rail mounting, IP40 (front) protection degree.

How to order

VMU-W A UMM 1 X

Model
Power supply
Comm. Technology
Area compatibility
Option

Type Selection

Power supply	Function	Serial port	Option
A: from 12 to 28VDC	**UMM:** universal mobile modem compatible with quad-band GSM-GPRS-EDGE standards; dual-band UMTS-HSPA. The supply includes already a stub antenna to be screwed on the RP-SMA connector.	**1:** Europe (EU27)	**X:** none

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VMU-M EM, master module and data logger

- **Master communication capability**
- **RS485 communication port (Modbus)**
- **Local communication bus management up to 1 VMU-P and 3 VMU-O units**
- **Two digital inputs**
- **Two temperature inputs: Pt100 or Pt1000**
- **Display readout: 6 DGTs**
- **12 to 28 VDC power supply**
- **Dimensions: 1-DIN module**
- **Protection degree (front): IP40**

Product description

VMU-M performs the local bus management of VMU-P (environmental variable unit) and VMU-O (I/O unit). VMU-M assigns the proper local unit address automatically and gathers all the local measurements coming from VMU-P. VMU-M can provide by means of VMU-O modules two relay outputs so to manage alarms and/or external loads and two temperature inputs (only for local management). 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 EM

- **Model**
- **Function**
- **Power supply**
- **Communication**
- **Inputs**
- **Option**

Type Selection

Function

4: data storage 4 MB

Power supply

A: from 12 to 28VDC

Communication

S1: RS485

Inputs

T2: two temperature inputs or two digital inputs for free of voltage reading contacts

Option

EM: energy Management version

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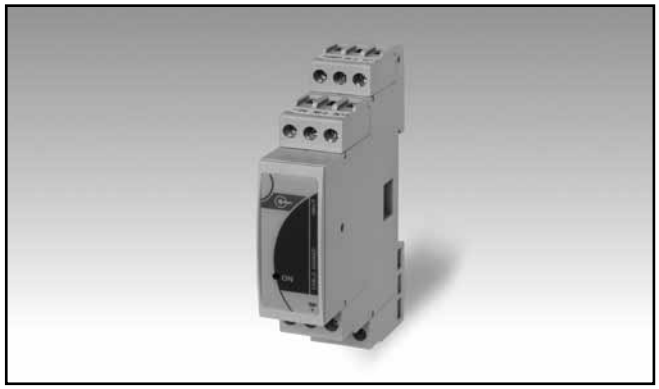
VMU-P EM, enviroment variables module



- **Measurements: 2 temperatures, 1 analogue input, 1 pulse rate input**
- **Two temperature inputs: Pt100-Pt1000 type**
- **One 120mV or 20mA analogue input with scaling capability**
- **One pulse rate input for general speed/flow measurements**
- **Auxiliary communication bus to VMU-C unit or VMU-M unit depending on which bus it belongs to**
- **Auxiliary power supply from VMU-C or VMU-M unit depending on which bus it belongs to**
- **Dimensions: 1-DIN module**
- **Protection degree (front): IP40**

Product description

Additional variables measurement unit particularly indicated for temperature, analogue and pulse/speed metering. Moreover the unit is provided with a specific serial communication bus which is managed by means of the additional VMU-C or VMU-M module. Housing for DIN-rail mounting, IP40 (front) protection degree

How to order

VMU-P 2TIW X S EM

Model
Range
Power supply
Communication
Option

Type Selection

Range		Power supply		Communication		Option	
2TIW:	Two “Pt” temperature type probes, 120mV analogue and pulse speed measuring inputs	**X:**	self-power supply from VMU-C or VMU-M unit	**S:**	auxiliary communication bus, compatible only to VMU-C or VMU-M unit	**EM:**	energy Management version
2TCW:	Two “Pt” temperature type probes, 20mA analogue and pulse speed measuring inputs						

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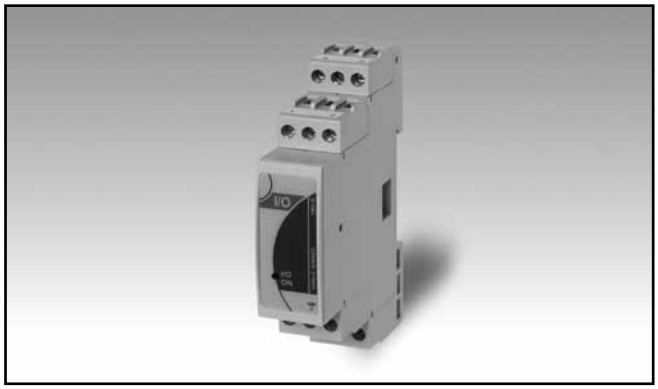
VMU-O EM: I/O unit



- **Expansion I/O module (digital inputs and outputs)**
- **VMU-O: two digital inputs and two relay outputs managed by the VMU-C or VMU-M unit**
- **Auxiliary communication bus to VMU-C unit or VMU-M unit**
- **Auxiliary power supply from VMU-C or VMU-M unit depending on which bus it belongs to**
- **Dimensions: 1-DIN module**
- **Protection degree (front): IP40**

Product description

I/O unit suitable to be used in combination with a VMU-C or a VMU-M module. VMU-O allows to add, depending on the unit, two digital inputs and two relay outputs for a standard application. Housing for DIN-rail mounting, IP40 (front) protection degree.

How to order

VMU-O X I2 R2 EM

Model
Power supply
Inputs
Outputs
Option

Type Selection

Power supply		Inputs		Outputs		Option	
X:	self-power supply from VMU-C or VMU-M unit	**I2:**	two digital inputs	**R2:**	two relay outputs	**EM:**	energy Management version

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VMU-C EM EM; VMU optional modules and energy meters combinations

VMU modules: units compatibility		VMU-C Main Master unit		
Module	**Description**	**On local bus**	**VMU modules combination connected to the RS485 port**	**Total VMU units**
VMU-W	Mobile communication unit	Max1	None	1
VMU-M	Local master unit	None	10 (1)	10
VMU-O	I/O unit	Max 3	Max 3 per VMU-M	33
VMU-P	Environment variables measuring unit	Max1	Max 1 per VMU-M	11
EMxx or WMxx	Energy meters or Power Analysers	None	Max 32 (2)	

Note (1): the VMU-C-EM solution can manage up to 10 external VMU modules arrays by means of VMU-M master module to be connected to RS485 port (com 1).
(2) Note: the energy meters and power analysers are to be connected to RS485 port (com 2).

VMU-C EM Main hardware characteristics

Memory	
Flash (data)	4 GB
RAM	128 MB (internal)
Back-up Memory	Up to 2 GB in case of micro SD type and from 4 to 16 GB in case of micro SDHC type (removable, not supplied), industrial type (-25°C to 85°C) suggested
File system	External micro SD or USB memory stick only: FAT32 (VFAT)
Communication ports	
RS485	2 ports
Ethernet	According to ISO9847
Auxiliary bus	
Right side	Compatible with VMU modules units
Left side	Compatible with VMU-W (modem Unit)
Other ports	
Mini USB	1, “D” device function only for firmware upgrade purpose
USB	, “H” host function (not available when VMU-W is connected)
Connections	
Ethernet	RJ-45 connector (10/100Base-T)
USB	High speed USB 2.0
RS485	3 screw terminals per port
Cable cross-section area	1.5 mm2 max
	Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm
Power supply	2 screw terminals
	1.5 mm2 max
	Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm
Weight	< 600 g

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VMU-C EM RS485 communications ports

Number of ports	2	Data format	Selectable: 1 start bit, 7/8 data bit, no/odd/even parity,1/2 stop bit
Purpose	COM1: for external VMU-M, VMU-P and VMU-O management. COM2: energy meters (EM21, EM23, EM24, EM26, EM33, WM30 and WM40, VMU-E	Baud-rate	Selectable: 9600, 19200, 38400, 115200, bits/s
		Driver input capability	1/8 unit load. Up to 256 nodes on a network.
Type	Multidrop, bidirectional (static and dynamic variables)	Insulation	See the table “Insulation between inputs and outputs”
Addresses	247		
Protocol	MODBUS/JBUS (RTU)		
Data (bidirectional)	All data		

VMU-C EM Modbus TCP communication

Modbus TCP function	Slave	Instantaneous variable format	Floating point IEEE754
Devices	Any meter (AC and DC) can be independently selected to be available via Modbus TCP	Energy/counters format	INT 64 with 0.1 kWh (or other, e.g. m3) resolution
		Modbus TCP address	Selectable
		Modbus TCP map	Available as a file (in either PDF or XML format)
Variables	Any variable of any meter can be independently selected to be available via Modbus TCP		

VMU-C EM USB ports

Type	High speed 2.0 (max. 250mA)		following functions: - service port for firmware upgrading Note: this port cannot be used when VMU-W is already connected. Note: both USB and mini USB ports are working in parallel, so relevant port functions can work simultaneously. The Mini USB is a virtual Ethernet port and works as a real Ethernet port performing all the functions of the main Ethernet port.
Connections	“A” type as “Host” function on the top of the housing “Mini A” type as “Device” function on the front of the housing protected by front cover		
Host function (USB)	Available on the “H” USB port only, can be used to perform the following functions: - downloading and uploading of plant file based on measurement data and events on a memory stick; Note: this port cannot be used when VMU-W is already connected.	Working type Communication speed	Hot swap 60MB/s (480Mbits/s)
Device function (mini USB)	Available on the “D” USB port only, can be connected to a PC to perform the		

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Memory management

Function	Micro-SD (SDHC)	USB (H)	USB (D)
Download (from VMU-C to micro-SD/USB)			
Plant configuration	YES	YES	YES
Database and events export	YES (*)	YES (*)	YES (*)
Upload (from micro SD/USB to VMU-C)			
XML driver (energy meters and power analyzers)	NO (*)	YES	YES
Plant configuration	YES	YES	YES
Firmware upgrade	NO (*)	NO	YES
Database and events export	YES (*)	YES (*)	NO

Note: both USB (D and H) and micro-SD storing are equivalent, if both are available than the priority is on the micro-SD.

(*) The data base export is based on HTML format compatible with Excel or other equivalent spreadsheet of the last full month.

VMU-C EM Ethernet port

Protocol	HTTP	Client connections	Max 20 simultaneously (one administrator by time)
IP configuration	Static IP / Netmask / Default gateway	Connections	RJ45 10/100 BaseTX Max. distance: 100m
DNS	Primary and secondary DNS as a static or dynamic management (using DHCP server if configured)	Insulation	See “Insulation between inputs and outputs” table
Port	Fixed		

VMU-C EM memory format and data occupancy

Description	Used memory	Information format and time resolution		
Total available memory for database and events	3.5 GB	**Data resolution**	**Graph resolution**	**Graph format**
6 months database at the minimun 5 minutes time interval **(*)**	1.0 GB	From 5 to 60 minutes	Minutes, days, month	Day, month, year
Yearly grouped data	6.0 MB	24 hours	Day, month	Month, year
Single event	350 bytes	Text	NO	NO

Notes:
(*) From current instant the data are available with the selected time interval for 6 months back. Afterwards keeping the 6 months rolling time period, all old data are compressed to a one day resolution.

- All the used memory is relevant to the worst case which means using 11 VMU module array, 32 energy meters, and all enabled external measuring probes.
- The memory format above allows VMU-C to store data and events for more than 30 years.
- The memory used data are relevant to the internal VMU-C memory only.

The external (removable) back-up memory saves data in excel compatible format therefore memory occupancy is more demanding than the internal database.

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VMU-W "Modem" Main hardware characteristics

Radio modem	
Communication technology	GSM, GPRS, EDGE standards. Quad band: 850MHz, 900MHz, 1800MHz, 1900MHz. UMTS and HSPA standards. Dual band: Europa, Africa and Asia (EUD): 900MHz, 2100MHz; America (NAD): 850MHz, 1900MHz; Australia (AUD): 850MHz, 2100MHz.
Output power	Class 4 (2W, 33dBm) @ GSM 850/900MHz Class 1 (1W, 30dBm) @ GSM 1800/1900MHz Class E2 (0.5W, 27dBm) @ EDGE 850/900MHz Class E2 (0.4W, 26dBm) @ EDGE 1800/1900MHz Class 3 (0.25W, 24dBm) @ UMTS
Modem configuration	By means of the PC browser: - access point name (APN); - connection number
Communication	
Purpose	- Access to the Web-Server (VMU-C) and all its functionalities if the wired network is not available; - To send SMS.
SIM	
Type	SIM (25 x 15mm) for data communication (M2M SIM type only)
Holder	On the front with protection cover
GPRS-EDGE connectivity	
Multi-slot	12 class
Mobile-station	B class
Downlink speed	GPRS: up to 107 kb/s EDGE: up to 296 kb/s
Uplink speed	GPRS: up to 85.6 kb/s EDGE: up to 236.8 kb/s
CSD (Circuit Switch Data)	Downlink/Uplink: up to 14.4 kb/s
UMTS-HSPA connectivity	
Downlink speed	HSDPA 7.2 Mb/s (Category 8)
Uplink speed	HSUPA 5.76 Mb/s (Category 6)
W-CDMA (Wideband Code Division Multiple Access)	Downlink/Uplink: up to 384 kb/s
Auxiliary port	
Type and connections	Compatible with VMU-C unit only
Connections	
Antenna	RP-SMA female
Power supply	2 screw terminals 1.5mm^2 max. Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm

VMU-W "Modem" Main functions

SMS Configuration	
Phone book	Set of phone number Managed as groups and phone numbers belonging to each group. Every group can manage alarm SMS
Alarm management and messaging	
Actions	Alarms as working status of the plant. Anomalies as working status of the monitoring system. Events as low priority status change of monitoring system.
Data download	
Features and working mode	It is the same of VMU-C being VMU-W only an alternative access point to the regular wired network.

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Max. n. of energy meters which can be managed by one VMU-C EM

Maximum number of energy meters	Up to 32
RS485 communication port	• The information acquired from every single energy meter complies to the “Stored set of variables coming from every energy meter” table. • During the set-up of VMU-C only one energy meter can be selected as main energy meter. • All the details of the daily logged data will be available and therefore displayable as graphs for 6 months back at the selected resolution (from 5 to 60 minutes), if there is the need to move back for data analysis beyond 6 months than data will be available according to the selected graph with a minimum time interval of one day. The single day data will be available and displayable as graphs for more than 30 years (either “Month” or “Year” selection).

Max. number of sensors which can be managed by one VMU-C EM

Max. number of temperature, analogue inputs and Pulse rate inputs	Up to 11 VMU-P units available in the network
Every single VMU-P can manage up to:	two temperature measurements; one analogue input; one pulse rate input. All the details of the daily logged data will be available and therefore displayable as graphs for 6 months back at the selected resolution (from 5 to 60 minutes), if there is the need to move back for data analysis beyond 6 months than data will be available according to the selected graph with a minimum time interval of one day. The single day data will be available and displayable as graphs for more than 30 years (either “Month” or “Year” selection).

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VMU-C EM TCP/IP networking

Inbound TCP/IP communication		
TCP/IP port number	**TCP/IP port description**	**Porpuse**
80	HTTP	Access to the internal web-server
52325	SSH	Remote service (reserved to support personnel)

Outbound TCP/IP communication		
TCP/IP port number	**TCP/IP port description**	**Porpuse**
53	DNS	Domain name resolution
37	NTP	Network time services access
21	FTP	Data upload to FTP server
25	SMTP	Email message dispatching

Modbus TCP communication		
TCP/IP port number	**TCP/IP port description**	**Porpuse**
502	Modbus (TCP)	Modbus TCP data communication

Inbound TCP/IP communication				
Feature	**Information**	**Protocol**	**Data Format**	**Description**
Schedule FTP push	Alarms, Measured variables	FTP upload at fixed intervals (from 10 minutes to 24 hours)	CVS file (fixed format)	Data are uploaded from VMU-C the remote FTP server
On request FTP push	Alarms, Measured variables, device list	FTP upload at fixed intervals (from 10 minutes to 24 hours)	CVS file (fixed format)	Data are uploaded from VMU-C the remote FTP server following an HTTP query
On request HTTP pull	Alarms, measured variables, device list	HTTP respose to HTTP query	CVS formatted response (fixed format)	An HTTP query is sent from the remote server to the VMU-C; an immediate response is expected

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VMU-C EM LED specifications

Type	Single colour
Status	Changing according to the function
Controlled functions	Internal communication bus, communication port COM1 and COM2, USB ports, alarms, power supply
Colour code and working mode	
Power on	Green Steady ON: power supply is on; Blinking: writing cycle on micro SD card.
Bus (internal)	Yellow Steady OFF: no communication; Blinking: regular communication; Steady ON: error on communication
COM1	Yellow Steady OFF: no communication; irregular blinking: no answer to Modbus request (time-out); regular blinking: regular communication
COM2	Yellow Steady OFF: no communication; irregular blinking: no answer to Modbus request (time-out); regular blinking: regular communication
USB	- Bleu Steady ON: acknowledged device, no writing in progress, device can be removed; Steady OFF: neither acknowledged device nor connected device; Blinking: acknowledged device and writing cycle in progress, device cannot be removed.
Alarm	Red Steady ON: alarm in progress. Steady OFF: no alarms Note: the LED is ON either for one alarm or for more alarms.

VMU-W LED specifications

Type	Single colour
Status	Changing according to the function
Colour and status	
Power supply	Green: steady ON
Communication	Blue: - Steady OFF: the unit is OFF. - Fast blinking: net search / not registered / turning off. - Slow blinking: registered full service. - Steady ON: a call is active.

VMU-P EM LED specifications

Type	Multicolour
Colour and status	Green: the power supply is ON. White: no communication on auxiliary bus to VMU-C or being part of a VMU-M bus the unit is enabled by VMU-M module for data reading and displaying

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VMU-O EM LED specifications

Type	Multicolour
Colour and status	Green: the power supply is ON White: no communication on auxiliary bus to VMU-C or being part of a VMU-M bus 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-M EM Input specifications

Inputs	
Working mode	The inputs can be selected as either two digital inputs, or two temperature inputs (only for local display and local setpoint management)
Digital inputs	
Number of inputs	2
Purpose	Detection of ON/OFF status (e.g. trip of protection detection, remote input disable), the status is transmitted only by means of the communication port.
ON/OFF status detection change	≥500ms
Contact measuring voltage	3.3V
Contact measuring current	<1mA
Contact resistance	≤1kΩ closed contact; ≥20kΩ open contact
Insulation	See the table “Insulation between inputs and outputs”
Temperature inputs	
Number of inputs	2
Temperature probe	Pt100 or Pt1000
Number of wires	2 or 3-wire connection
Wire compensation	Up to 10Ω
Accuracy (Display + RS485)	See “Temperature input characteristics”
Temperature drift	±150ppm/°C
Engineering unit	Selectable °C or °F
Insulation	See the table “Insulation between inputs and outputs”
Key-pad	1 push-button for variable scrolling and for some parameters programming. Full programming can be carried out only using the main master unit VMU-C.

VMU-P EM Input specifications

Temperature drift	≤200ppm/°C
Variables format	
Instantaneous variables	4-DGT (Temperature, Analogue input and Pulse rate input)
Resolution	0.1°C/0.1°F; 0.1 [generic engineering unit]
Max. and Min. data format	See “Stored set of variables coming from …”
Temperature probe inputs	
Number of inputs	2
Temperature probe	Pt100, Pt1000
Number of wires	2 or 3-wire connection
Wire compensation	Up to 10Ω
Accuracy (@25°C ±5°C, R.H. ≤60%) (Display + RS485)	See table “Temperature input characteristics”
Engineering unit	Selectable °C or °F
Insulation	See the table “Insulation between inputs and communication bus”
Analogue input (range code: 2TIW)	
Number of inputs	1
Range	3 to 120mVDC
Accuracy (@25°C ±5°C, R.H. ≤60%)	±(0.2%RDG+1DGT) 0% to

VMU-P EM Input specifications (cont.)

	25% FS;
(Display + RS485)	±(0.1%RDG+1DGT) 25% to 120% FS.
Temperature drift	±150ppm/°C
Scaling factor	
Operating mode	Dual scale: - Input: programmable range from 3 to 150.0mV - Display Data format: programmable range from 0 to 9999 (the decimal point is displayed and programmable in VMU-C only).
Impedance	> 30KΩ
Overload	
Continuous	10VDC (measurement available up to 150mV on both display and communication bus)
For 1s	20VDC
Insulation	See the table “Insulation between inputs and communication bus”
Analogue input (range code: 2TCW)	
Number of inputs	1
Range	0 to 20mADC
Accuracy	
(@25°C ±5°C, R.H. ≤60%)	±(0.2%RDG+1DGT) 0% to 25% FS;
(Display + RS485)	±(0.1%RDG+1DGT) 25% to 120% FS
Temperature drift	±150ppm/°C
Scaling factor	
Operating mode	Dual scale: - Input: programmable range from 0 to 25.0 (mADC) - Display Data format: programmable range from 0 to 9999 (the decimal point is displayed and programmable in VMU-C only).
Impedance	≤22Ω
Overload	
Continuous	50mADC (measurement available up to 25mA on both display and communication bus)
For 1s	150mADC
Insulation	See the table “Insulation between inputs and communication bus”
Pulse rate input	
Number of inputs	1
Range	0 to 1000Hz max, duty cycle 50%
Accuracy	
(@25°C ±5°C, R.H. ≤60%)	±(0.02%RDG+1DGT) 0% to 25% FS;
(Display + RS485)	±(0.01%RDG+1DGT) 25% to 110% FS
Temperature drift	±150ppm/°C
Scaling factor	
Operating mode	Dual scale: - Input: programmable range from 0 to 999.9 (Hz) - Display: programmable range from 0 to 9999 (the decimal point is displayed and programmable in VMU-C only).
Operating input	2.5Vpeak to 9Vpeak/5mApeak to 35mApeak, duty cycle 50%
Impedance	220Ω
Overload	
Continuous	7VRMS/25mARMS (AC/DC)
For 1s	14VRMS/50mARMS (AC/DC)
Insulation	See the table “Insulation between inputs and communication bus”

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

PROBE	RANGE	ACCURACY	MIN.	MAX.
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

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VMU-O EM Input/Output specifications

Maximum number of modules managed by VMU-C unit on local bus	Up to 3
Digital inputs	
Number of inputs	2 per unit
Working mode	Detection of ON/OFF status
Function	Status detection, transmitted only by means of the communication port.
ON/OFF status detection change	≥500ms
Contact reading voltage	3.3VDC
Contact reading current	<2mA
Contact resistance	≤300Ω closed contact; ≥10kΩ open contact
Insulation	See the table “Insulation between inputs and outputs”

VMU-M EM Output specifications

RS485	Slave function
Type	Multidrop, bidirectional (static and dynamic variables)
Connections	2-wire. Max. distance 1000m
Addresses	247, selectable by means of the front push-button
Protocol	MODBUS/JBUS (RTU)
Data (bidirectional)	
Dynamic (reading only)	All variables, see table “List of the variables that can be displayed and connected to …”
Static (writing only)	All the configuration parameters.
Data format	1 start bit, 8 data bit, no parity,1 stop bit
Baud-rate	Selectable: 9.600, 19.200, 38.400, 115.200 bits/s. Parity: none
Insulation	See the table “Insulation between inputs and outputs”
Auxiliary communication bus	This is the communication bus to the VMU-P and VMU-O units where VMU-M performs the single master function in the VMU module array system.
Insulation	See the table “Insulation between inputs and outputs”

VMU-C EM based insulations between inputs and outputs

Type of input / output	DC Power supply	RS485 - COM 1	RS485 - COM 2	Ethernet	USB port “H” (Host)	USB port “D” (Service)	VMU-W
DC Power supply	-	2kV	2kV	0.5kV	0kV	0kV	0kV
RS485 - COM 1 (VMU I/O modules)	2kV	-	0.5kV	2kV	2kV	2kV	2kV
RS485 - COM 2 (energy meter)	2kV	0.5kV	-	2kV	2kV	2kV	2kV
Ethernet (LAN/Internet)	0.5kV	2kV	2kV	-	0.5kV	0.5kV	0.5kV
USB port “H” (Host)	0kV	2kV	2kV	0.5kV	-	0kV	0kV
USB port “D” (Service)	0kV	2kV	2kV	0.5kV	0kV	-	0kV
VMU-W	0kV	2kV	2kV	0.5kV	0kV	0kV	-

0kV: Inputs / outputs are not insulated
2kVrms: EN61010-1, IEC60664-1 - Over-voltage category III, Pollution degree 2, double insulation on systems with max. 300Vrms to ground
0.5kVrms: the insulation is functional type

VMU-C EM based insulations between inputs and outputs

Module		Any	VMU-M			VMU-P			VMU-O	
	Type of input / output	Local bus	DC Power supply	Temperature or digital Inputs: Ch1, Ch2	RS485	Temperature: Ch1, Ch2	Analogue input	Pulse rate input	Digital inputs: Ch1, Ch2, Ch3	Relay outputs: Ch.1, Ch2
Any	Local bus	-	0kV	0kV	0kV	0kV	0kV	0kV	0kV	4kV
VMU-M	DC Power supply	0kV	-	0kV	0kV	0kV	0kV	0kV	0kV	4kV
	Temperature or digital Inputs: Ch1, Ch2	0kV	0kV	-	0kV	0kV	0kV	0kV	0kV	4kV
	RS485	0kV	0kV	0kV	-	0kV	0kV	0kV	0kV	4kV
VMU-P	Temperature: Ch1, Ch2	0kV	0kV	0kV	0kV	-	0kV	0kV	0kV	4kV
	Analogue input	0kV	0kV	0kV	0kV	0kV	-	0kV	0kV	4kV
	Pulse rate input	0kV	0kV	0kV	0kV	0kV	0kV	-	0kV	4kV
VMU-O	Digital inputs: Ch1, Ch2, Ch3	0kV	0kV	0kV	0kV	0kV	0kV	0kV	-	4kV
	Relay outputs: Ch.1, Ch2	4kV	4kV	4kV	4kV	4kV	4kV	4kV	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).

VMU-C EM, VMU-M EM, VMU-W EM, VMU-P EM and VMU-O EM General specifications

Operating temperature	See table "String current vs. operating temperature"
Storage temperature	-30 to +70°C (-22°F to 158°F) (R.H. < 90% non-condensing @ 40°C)
Over voltage category	Cat. III (IEC 60664, EN60664) For inputs from string: equivalent to Cat. I, reinforced insulation.
Insulation (for 1 minute)	See table "Insulation between inputs and outputs"
Dielectric strength	4000 VAC RMS for 1 minute
Noise rejection	
CMRR	>65dB, 45 to 65 Hz
EMC (Immunity)	According to EN61000-6-2
Electrostatic discharges	EN61000-4-2: 8kV air discharge, 4kV contact;
Immunity to irradiated electromagnetic fields	EN61000-4-3: 10V/m from 80 to 3000MHz;
Immunity to Burst	EN61000-4-4: 4kV on power lines, 2kV on signal lines;
Immunity to conducted disturbances	EN61000-4-6: 10V from 150KHz to 80MHz;
Surge	EN61000-4-5: 500V on power supply; 4kV on string inputs.
EMC (Emission)	
Radio frequency suppression	According to EN61000-6-3, CISPR 22, class B
Standard compliance (all units)	
Safety	IEC60664, IEC61010-1 EN60664, EN61010-1
Standard compliance (VMU-W only)	
Health and Safety	EN 60950
EMC	EN301 489-1, EN301 489-7
RF spectrum efficiency	EN301 511

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VMU-C EM, VMU-M EM, VMU-W EM, VMU-P EM and VMU-O EM General specifications (cont.)

Approvals	All units: CE, cULus Listed VMU-W only: R&TTE 99/5/CE
Housing	
Dimensions (WxHxD)	VMU-P, VMU-O modules: 17.5 (+0.5 -0) x 90 x 67 mm. VMU-C, VMU-W modules: 35.5 (+0.5 -0) x 90 x 67 mm
Material	Noryl, self-extinguishing: UL 94 V-0
Mounting	DIN-rail
Protection degree	
Front	IP40
Screw terminals	IP20

Max current vs. operating temperature

VMU-O Max. contact current	Operating temperature	
2.5A	-25 to +65°C	-13°F to 149°F
3.0A	-25 to +60°C	-13°F to 140°F
3.5A	-25 to +55°C	-13°F to 131°F
4.0A	-25 to +50°C	-13°F to 122°F
5.0A	-25 to +40°C	-13°F to 104°F

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

Mean time to failure (MTTF)

Model	MTTF/MTBF - Years	Test conditions	Standard
VMU-C	12.0	gf (ground, fixed), 50°C	MIL-HDBK-217F
VMU-W	26.0	gf (ground, fixed), 50°C	MIL-HDBK-217F
VMU-M	24.2	gf (ground, fixed), 50°C	MIL-HDBK-217F
VMU-P	31.7	gf (ground, fixed), 50°C	MIL-HDBK-217F
VMU-O	65.4	gf (ground, fixed), 50°C	MIL-HDBK-217F

Power supply specifications

VMU-C and VMU-M	
Power supply	12 to 28 VDC
Power consumption	VMU-C:≤5W; VMU-M:≤1W
VMU-W	
Power supply	12 to 28 VDC
Consumption	≤5W
VMU-P and VMU-O	
Power supply	Self-power supplied through the communication bus.
VMU-P power consumption	≤1.8W (pulse rate sensor included).
VMU-O power consumption	≤0.7W

Sizing of Carlo Gavazzi DC power supply for VMU-M EM

VMU-O units	VMU-P unit	Consumption	Start-up current	Power supply part number
None	None	PSW: 2.5W	1.5A for 1s	SPM3 24 1 (30W) or SPD 24 18 1B (18W)
Up to 1	Up to 1	PSW: 5W	1.5A for 1s	SPM3 24 1 (30W) or SPD 24 18 1B (18W)
From 2 to 3	Up to 1	PSW: 10.6W	1.5A for 1s	SPM3 24 1 (30W) or SPD 24 30 1B (30W)
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.

Sizing of Carlo Gavazzi DC power supply with one VMU-C EM, and one VMU-W

VMU-O units	VMU-P unit	VMU-W unit	Consumption	Start-up current	Power supply part number
None	None	None	PSW: 6.5W	4.5 A for 1s	SPM3 24 1 (30W) or SPD 24 18 1B (18W)
Up to 1	Up to 1	None	PSW: 9W	6A for 1s	SPM3 24 1 (30W) or SPD 24 18 1B (18W)
From 2 to 3	Up to 1	1	PSW: 18.9W	13A for 1s	SPM4 24 1 (60W) or SPD 24 60 1B (60W)
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-C unit.

Connections

VMU-M	Screw-type
Cable cross-section area	1.5 mm² max Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm
Screw terminal purposes	
1.5 mm²	3+3 screw terminals used for two temperature inputs 3 screw terminals used for RS485 communication 2 screw terminals used for power supply
Weight	Approx. 100 g (packing included)
VMU-P	Screw-type
Cable cross-section area	1.5 mm² max Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm
Screw terminal purposes	
1.5 mm²	3+3 screw terminals used for two temperature probes 2 screw terminals used for pulse rate input sensor 2 screw terminals used for analogue input sensor
Weight	Approx. 100 g (packing included)
VMU-O	Screw-type
Cable cross-section area	1.5 mm² max Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm
Screw terminal purposes	
1.5 mm²	2+2 screw terminals: two for 1st relay output and two for 2nd relay output (SPST type) 2+2 screw terminals: two for 1st digital input and two for 2nd digital input
Weight	Approx. 100 g (packing included)

VMU-C EM Main functions

Configuration	The configuration and the programming of all parameter of VMU-C and all other VMU modules connected to either the same local bus or to the managed RS485 ports can be carried out using the Web-Server capability of VMU-C (Ethernet port). No specific configuration software is needed.
Clock	
Functions	Universal clock and calendar with automatic synchronisation enabling through internet connection.
Daylight-saving enabling	Activation: automatic.
Time format	Hour:minutes with automatic 24 hours or AM/PM selection.
Date format	Month-Day, where the month is displayed in a three letter format (e.g.: JAN-FEB-MAR) and the date as a number. Year is displayed in a two digit format.
Battery life	10 years
Alarms (virtual or real)	
Number of alarms	Two for every single available variable (see the table “List of the variables that can be displayed and connected to …”)
Alarm types	Virtual alarm or real alarm
Alarm modes	Up alarm, down alarm (see the table “List of the variables that can be connected to …”)
Set-point adjustment	From 0 to 100% of the display scale
Hysteresis	From 0 to full scale
On-time delay	0 to 3600s
Output status (only real)	Selectable; normally de-energized or normally energized
Min. response time	≤700ms, set-point on-time delay: “0 s”

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VMU-C EM Main functions

Alarm management and messaging	
E-mails	
Configuration	Set of recipient addresses and relevant subject, sender address, sender name, SMTP server, username of SMTP server and password of SMTP server.
Actions	Mail sent in case of: - alarms as working status of the monitored plant; - anomalies as working status of the monitoring system; - events as working status devices connected through digital inputs.
Planning	Enabling of 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.
SMS (with VMU-W only)	
Configuration	Set of phone number
Actions	- alarms as working status of the monitored plant; - anomalies as working status of the monitoring system; - events as working status devices connected through digital inputs.
Data logging	
Data	The data are accessible and downloadable using either Ethernet communication port or configuration USB “H” port, see “Memory Management” table.
Function enabling	Activation: NO/YES
Function description	All the variables gathered from VMU-P modules are stored individually into the internal memory.
Stored data type	Variables: electric variables from energy meters and environmental variables from VMU-P.
Storage interval	Selectable: 5-10-15-30-60 minutes
Sampling management	The sample stored within the selected time interval results from the continuous average calculation of the measured values. The average is calculated with an interval within two following measurements of approx. 2s.
Storage duration	Before overwriting: depending on the storage interval, see “Historical data storing time table”
Number of variables	See “Stored set of variables …” and “Historical data storing”
Data format	Variables, date (dd:mm:yy) and time (hh:mm:ss)
Storage method	Circular FIFO
Memory type	Flash and Micro SD (Industrial type suggested, not supplied)
Memory size	4 GB
Memory retention time	10 years
Events logging	
Events	The data are accessible and downloadable using either Ethernet communication port or Micro SD, see “Memory Management” table.
Function enabling	Activation: NO/YES
Function description	All the events gathered from both VMU-P and VMU-O modules are stored individually into the internal memory.
Type of stored events	VMU-O digital input/output status change (real and virtual alarms), VMU-M 1st digital input status change. The events are recorded as soon as they occur. For more information about the type and stored data, see “List of the variables that can be displayed and connected to ….”.
Number of events	Till memory is full
Data reset	The reset can be carried out through the proper command in the Web-Server screen.
Data format	Event, date (dd:mm:yy) and time (hh:mm:ss).
Memory type	Flash and Micro SD (Industrial type suggested, not supplied).
Memory retention time	10 years

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

No	Variables	Data Format	Notes
1	Temperature 1	-50.0 to 200.0°C -60.0 to 400.0°F	Temperature (°C/°F). The range is extended to cover both °C and °F indications
2	Temperature 1	-50.0 to 200.0°C -60.0 to 400.0°F	Temperature (°C/°F). The range is extended to cover both °C and °F indications
3	Analogue input	0 to 9999, with selectable decimal point position	Generic variable (e.g. pressure, position, weight, etc.)
4	Pulse rate input	0 to 9999, with selectable decimal point position	Generic variable (e.g. pressure, position, weight, etc.)

VMU-C EM Alarm and diagnostics messages

No	Message	Notes
1	System error	Power-up self-test error (see note 1 below)
2	Bus error	Auxiliary bus communication error (see note 2 below)
3	Alarm	Variables alarm (any)
4	Missing communication on COM1	In case of missing of communication on COM1 for more than 30 seconds a proper alarm will be managed
5	Missing communication on COM2	In case of missing of communication on COM2 for more than 30 seconds a proper alarm will be managed

Stored set of variables coming from every AC energy meter

No	AC	Data Format	Notes
1	kWh+	UINT32 (1 decimal point resolution)	Three-phase type
	VLNSYS	INT16 (1 dec. point)	Three-phase type
3	VL1N	INT16 (1 dec. point)	Three-phase type
4	VL2N	INT16 (1 dec. point)	Three-phase type
5	VL3N	INT16 (1 dec. point)	Three-phase type
6	VLLSYS	INT16 (1 dec. point)	Three-phase type
7	VL12	INT16 (1 dec. point)	Three-phase type
8	VL23	INT16 (1 dec. point)	Three-phase type
9	VL31	INT16 (1 dec. point)	Three-phase type
10	AL1	INT16 (3 dec. point)	Three-phase type
11	AL2	INT16 (3 dec. point)	Three-phase type
12	AL3	INT16 (3 dec. point)	Three-phase type
13	KWSYS	INT16 (1 dec. point)	Three-phase type
14	KWL1	INT16 (1 dec. point)	Three-phase type
15	KWL2	INT16 (1 dec. point)	Three-phase type
16	KWL3	INT16 (1 dec. point)	Three-phase type

Stored set of variables coming from every external AC energy meter

17	KvarSYS	INT16 (1 dec. point)	Three-phase type
18	KvarL1	INT16 (1 dec. point)	Three-phase type
19	KvarL2	INT16 (1 dec. point)	Three-phase type
20	KvarL3	INT16 (1 dec. point)	Three-phase type
21	KVASYS	INT16 (1 dec. point)	Three-phase type
22	KVAL1	INT16 (1 dec. point)	Three-phase type
23	KVAL2	INT16 (1 dec. point)	Three-phase type
24	KVAL3	INT16 (1 dec. point)	Three-phase type
25	PF sys	INT16 (3 dec. point)	Three-phase type
26	PF L1	INT16 (3 dec. point)	Three-phase type
27	PF L2	INT16 (3 dec. point)	Three-phase type
28	PF L3	INT16 (3 dec. point)	Three-phase type
29	Phase sequence	INT16 (0 dec. point)	Three-phase type
30	Hz	INT16 (1 dec. point)	Three-phase type
31	THD A	INT16 (1 dec. point)	Three-phase type
32	THDA1	INT16 (1 dec. point)	Three-phase type
33	THDA2	INT16 (1 dec. point)	Three-phase type
34	THDA3	INT16 (1 dec. point)	Three-phase type
35	THD VLN	INT16 (1 dec. point)	Three-phase type
36	THDV1N	INT16 (1 dec. point)	Three-phase type
37	THDV2N	INT16 (1 dec. point)	Three-phase type
38	THDV3N	INT16 (1 dec. point)	Three-phase type
39	Wdmd	INT16 (1 dec. point)	Three-phase type. Calculated by VMU-C using the instantaneous kWSYS variables.
40	Wdmdmax	INT16 (1 dec. point)	
41	kWh per tariff	INT16 (1 dec. point)	(calculated by VMU-C according to the dual tariff management, if used)
42	kWh per tariff	INT16 (1 dec. point)	(calculated by VMU-C according to the dual tariff management, if used)
43	Kvarh (+, -, C, L according to the meter type)	INT16 (1 dec. point)	
44	Kvarh per tariff	INT16 (1 dec. point)	(calculated by VMU-C according to the dual tariff management, if used)
45	Kvarh per tariff	INT16 (1 dec. point)	(calculated by VMU-C according to the dual tariff management, if used)
46	kWh_1, kWh_2, kWh_3,	UINT32 (1 decimal point resolution)	Single kWh meters in case of system 3x1-phase (application D, multi-domestic) in EM24 or EM26.45a and 45b are in alternative
47	Gas, hot and cold water	UINT32 (1 decimal point resolution)	Utility meters by pule inputs (application C, F, G, H) in EM24 or EM26, WM30 45a and 45b are in alternative

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Working mode of all AC energy meters

Source	Metered energy	Use	Type	Function
Meter	Consumed	Total kWh AC	Virtual, Real	R, T
Meter	Consumed	Partial kWh AC	Real	Y, N

R: Reference energy meter in the system, there can be only one in the system (real main meter).
T: Totalizer function, there can be only one in the system (virtual main meter).
Y: Yes, contribution to total energy calculation of the virtual meter.
N: No contribution to total energy metering of the virtual meter.

Stored set of variables coming from every DC energy meter

No	AC	Data Format	Notes
1	kWh	UINT32 (1 decimal point resolution)	
2	V	INT16 (1 dec. point)	
3	A	INT16 (1 dec. point)	
4	MW	INT16 (1 dec. point)	

Working mode of all DC energy meters

Source	Metered energy	Use	Type	Function
Meter	Consumed	Total kWh DC	Virtual, Real	R, T
Meter	Consumed	Partial kWh DC	Real	Y, N

R: Reference energy meter in the system, there can be only one in the system (real main meter).
T: Totalizer function, there can be only one in the system (virtual main meter).
Y: Yes, contribution to total energy calculation of the virtual meter.
N: No contribution to total energy metering of the virtual meter.

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

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

No	Variable	Data-logging	Alarm output	Event-logging	Module	Notes
1	All instantaneous and energy data from energy meters	Yes	Yes	Yes	VMU-C	
6	COM1 alarm	No	Yes	Yes	VMU-C	Missing communication for more than 30s
7	COM2 alarm	No	Yes	Yes	VMU-C	Missing communication for more than 30s
8	Error: 1	No	Yes	Yes	VMU-C/M	Local bus communication problems
9	Error: 2	No	Yes	Yes	VMU-C/M	Changed system modules configuration
10	Error: 3	No	Yes	Yes	VMU-C/M	Incoherent programming parameters
11	Error: 4	No	Yes	Yes	VMU-C/M	More than one VMU-P unit connected to the AUX bus
12	Status: 1	No	No	Yes	VMU-C/M	Local programming access
13	Status: 2	No	No	Yes	VMU-C/M	Power OFF/ON
14a	°C (°F) (input 1)	Yes	Yes	Yes	VMU-M	As alternative of status detection No 15
14b	°C (°F) (input 2)	Yes	Yes	Yes	VMU-M	Other temperature
15	ON/OFF status (input 1)	Yes	No	Yes	VMU-M	As alternative of variable No 14a
16	°C (°F) (input 1)	Yes	Yes	Yes	VMU-P	Temperature 1
17	°C (°F) (input 2)	Yes	Yes	Yes	VMU-P	Temperature 2
18	Analogue input	Yes	Yes	Yes	VMU-P	Analogue input
19	Pulse rate input	Yes	Yes	Yes	VMU-P	Pulse rate input
20	Error: 1	No	Yes	Yes	VMU-P	Incoherent programming parameters
21	Error: 2	No	Yes	Yes	VMU-P	Short circuit on probe input 1
22	Error: 3	No	Yes	Yes	VMU-P	Open circuit on probe input 1
23	Error: 4	No	Yes	Yes	VMU-P	Short circuit on probe input 2
24	Error: 5	No	Yes	Yes	VMU-P	Open circuit on probe input 2
26	Status: input 1	No	No	Yes	VMU-O	ON/OFF status detection
27	Status: input 2	No	No	Yes	VMU-O	ON/OFF status detection
28	Status: input 3	No	No	Yes	VMU-O	ON/OFF status detection
29	Status: output 1	No	No	Yes	VMU-O	ON/OFF status detection
30	Status: output 2	No	No	Yes	VMU-O	ON/OFF status detection
31	Error: 1	No	Yes	Yes	VMU-O	Incoherent programming parameters

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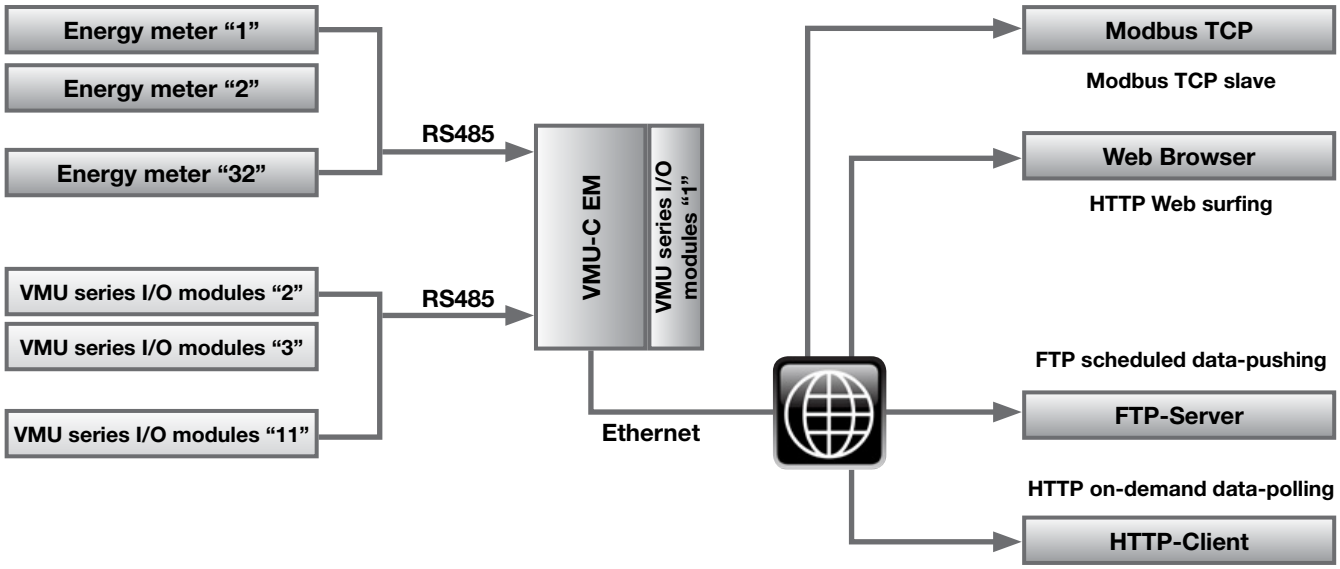
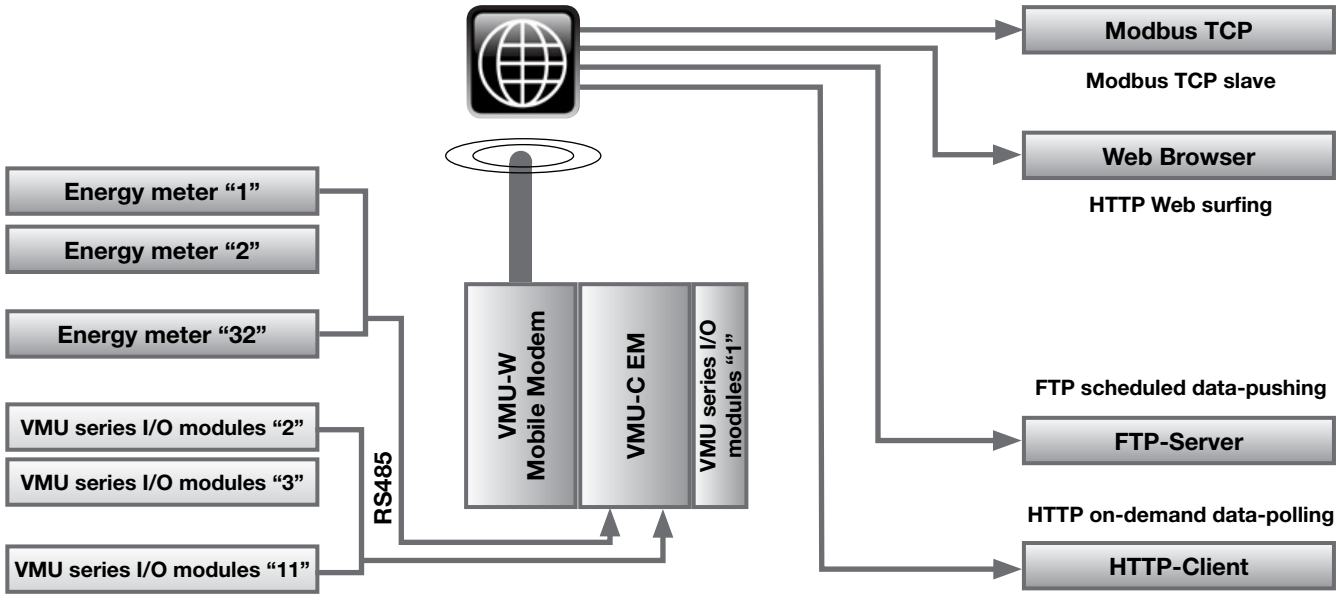
Alarms Management and VMU-O EM outputs link

Variable or function	Alarm origin device	Local alarm	Global alarm	Type of alarm
Temperature input 1	VMU-M	YES	NO	Single
Temperature input 2	VMU-M	YES	NO	Single
Missing communication on COM1 and COM2	VMU-M (VMU-C)	YES	NO	OR (a)
Local bus communication problems	VMU-M	YES	NO	OR (a)
Changed system modules configuration	VMU-M	YES	NO	OR (a)
Incoherent programming parameters	VMU-M	YES	NO	OR (a)
More than one VMU-P unit connected to the bus	VMU-M	YES	NO	OR (a)
Temperature input 1	VMU-P	YES	NO	Single
Temperature input 2	VMU-P	YES	NO	Single
Analogue input	VMU-P	YES	NO	Single
Pulse rate input	VMU-P	YES	NO	Single
Any instantaneous variables from any EM	VMU-C	YES	NO	Single
Incoherent programming parameters	VMU-P	YES	NO	OR (c)
Short circuit on probe input 1	VMU-P	YES	NO	OR (c)
Open circuit on probe input 1	VMU-P	YES	NO	OR (c)
Short circuit on probe input 2	VMU-P	YES	NO	OR (c)
Open circuit on probe input 2	VMU-P	YES	NO	OR (c)
Incoherent programming parameters	VMU-O	YES	NO	OR (d)

Example of comm. architecture with FTP push function capability



Example of comm. architecture with FTP push function capability



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FTP push function: available files

The following files are available to be pushed by FTP protocol:

File	Description	Format
VAR_custom	Variables logged in the last user defined period	FMT_V01
ALARM_custom	Alarms logged in the last user defined period	FMT_A01
DEV_custom	List of the connected devices	FMT_D01

FTP push function: file format definition FMT_V01

Section	Sub-Section	Format
HEADER	Record-Type	AC avg (AC meter average value) AC min (AC meter minimum value) AC max (AC meter maximum value) DC avg (DC meter average value) DC min (DC meter minimum value) DC max (DC meter maximum value) EN (Environmental units) IO (I/O modules VMUO)
	Product-Type	Example: VIRTUAL_AC_METER, EM21, etc
	Item-S/N	(void when not managed)
	Item-label	Item label
	COM PORT	1 or 2
	MODBUS ADDRESS	Device's Modbus address
Timestamp	Timestamp-absolute	UTC based timestamp (YYYY-MM-DD-hh:mm:ss)
	Timestamp-local	Local time-zone timestamp (YYYY-MM-DD-hh:mm:ss)
Data	Variable values list	See next table

Note: field separator is ";". Filename= [VMU-C S/N] _ [Timestamp(YYYY-MM-DD-hh-mm-ss)]_[S/T].csv where S=scheduled and T=triggered. Files are variable length (and variable number of fields).

POSITION	AC	DC	EN	IO
1	kWh+	KWh	Temperature 1	Input 1 status
2	kWh-	V	Temperature 2	Input 2 Status
3	VLNSYS	A	Analogue input	Output 1 status
4	VL1N	KW	Pulse rate input	Output 2 status
5	VL2N			
6	VL3N			
7	VLLSYS			
8	VL12			
9	VL23			
10	VL31			

FTP push function: file format definition FMT_V01

11	AL1			
12	AL2			
13	AL3			
14	KWSYS			
15	KWL1			
16	KWL2			
17	KWL3			
18	KvarSYS			
19	KvarL1			
20	KvarL2			
21	KvarL3			
22	KVASYS			
23	KVAL1			
24	KVAL2			
25	KVAL3			
26	PF sys			
27	PF L1			
28	PF L2			
29	PF L3			
30	Phase sequence			
31	Hz			
32	THDA1			
33	THDA2			
34	THDA3			
35	THD VLN			
36	THDV1N			
37	THDV2N			
38	THDV3N			
39	Wdmd			
40	Wdmdmax			
41	Counter 1, 2, 3			

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FTP push function: FMT_A01

File format for alarm/event/anomaly transmission

Section	Sub-Section	Format
HEADER	Record-Type	ALARM ANOMALY EVENT COMMAND
	Product-Type	Example: VIRTUAL_AC_METER, EM21, etc.
	Item-S/N	(void when not managed)
	Item label	Item label
Timestamp	Timestamp (opened)	UTC
	Timestamp	Local timezone
Data	Status	
	Description	
Timestamp_alarm_close	Timestamp	UTC
	Timestamp	Local time zone

Note: only opened alarms for scheduled upload

FTP push function: FMT_D0

File format for device list transmission

Section	Sub-Section	Format
HEADER	Record-Type	DEVICE_LIST
Timestamp	Timestamp	UTC
	Timestamp	Local time zone
Data	Variable values list	See next table

POSITION	DEVICE_LIST
1	DEVICE_TYPE
2	MODEL
3	S/N
4	COM_PORt
5	MODBUS_ADDR
6	LABEL
7	
8	
9	
10	SUBMODULE1
11	SUBMODULE2
…	
30	SUBMODULE20

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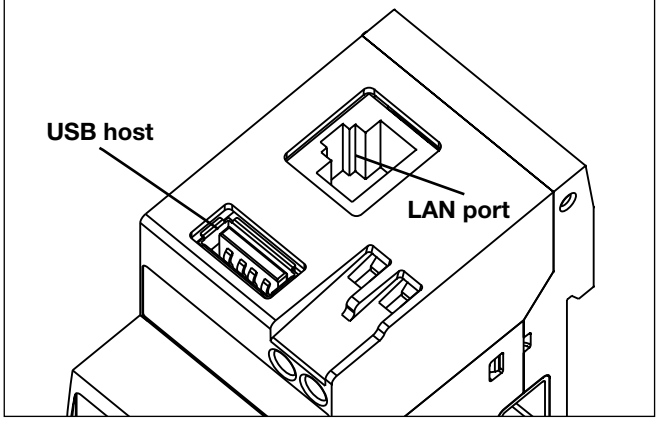
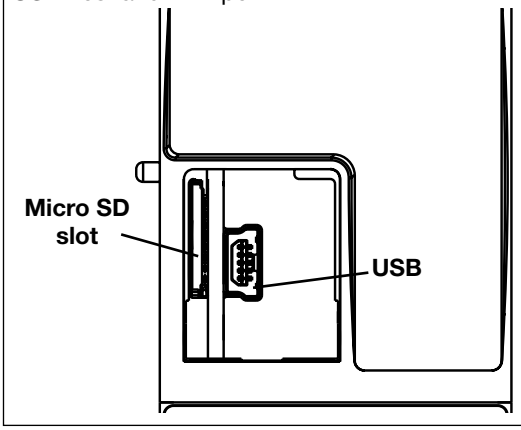
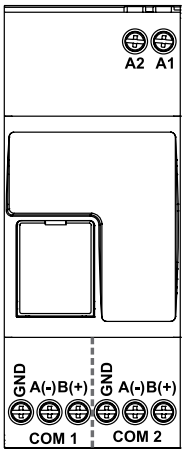
VMU-C EM connections

USB host and LAN port **Fig.1**

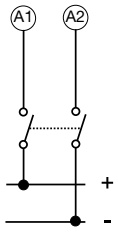


USB host and LAN port **Fig.2**

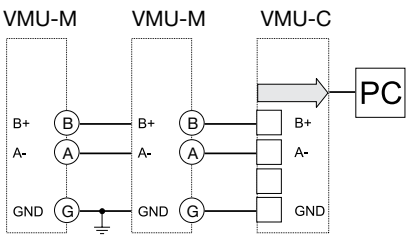




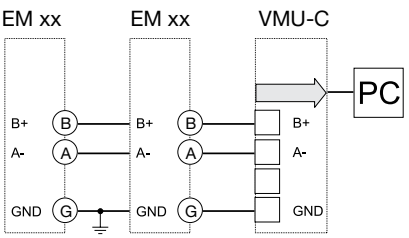
Power Supply **Fig.3**



RS485 COM1 (to VMU-M modules) **Fig.4**



RS485 COM2 (to Energy Meter) **Fig.5**



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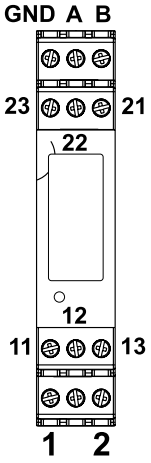
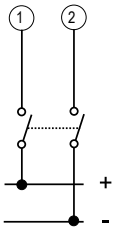
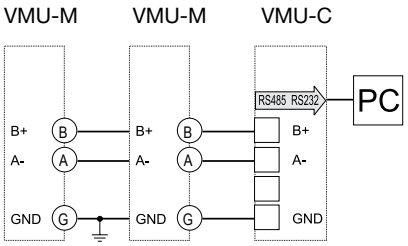
VMU-M EM connections



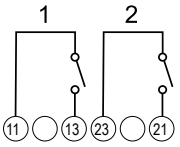
Power Supply **Fig.1**



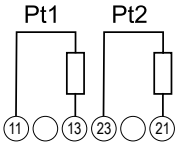
RS485 port **Fig.2**



Digital input 1 and 2 **Fig.3**

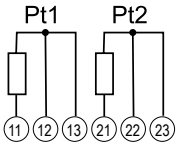


Temperature input 1 and input 2 **Fig.4**



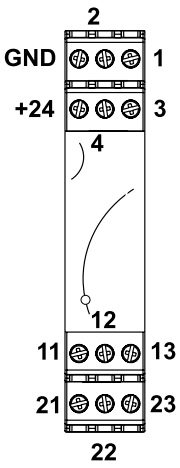
2-wire connection

Temperature input 1 and input 2 **Fig.5**

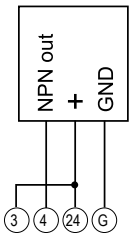


3-wire connections

VMU-P EM (2TIW) connections

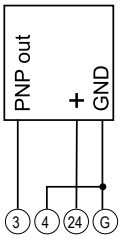


Pulse rate **Fig.1**



NPN output

Pulse rate **Fig.2**



PNP output

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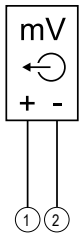
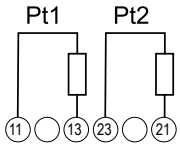
VMU-P EM (2TIW) connections (cont)

Analogue input **Fig.3**



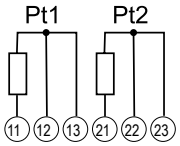
mV

Temperature input 1 and input 2 **Fig.4**



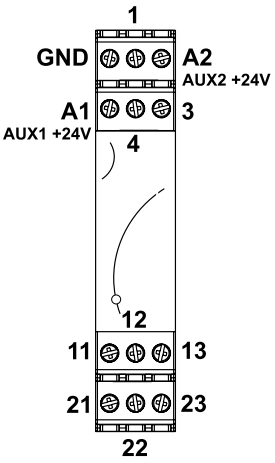
2-wire connection

Temperature input 1 and input 2 **Fig.5**

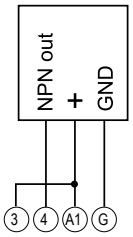


3-wire connections

VMU-P EM (2TCW) connections

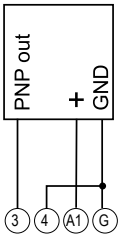


Pulse rate **Fig.1**



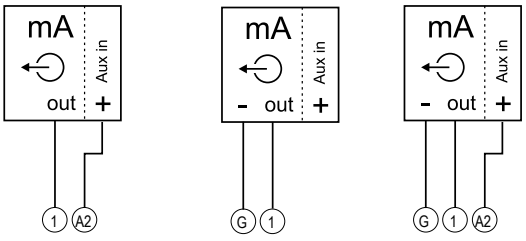
NPN output

Pulse rate **Fig.2**



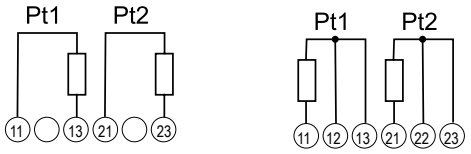
PNP output

Analogue input **Fig.3**



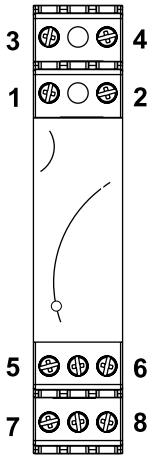
mA (2 and 3 wire connections)

Temperature input 1 and input 2 **Fig.4**

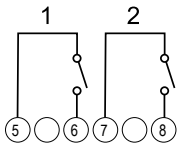


2 and 3 wire connection

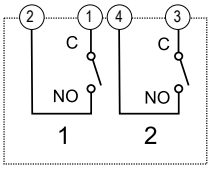
VMU-O EM connections



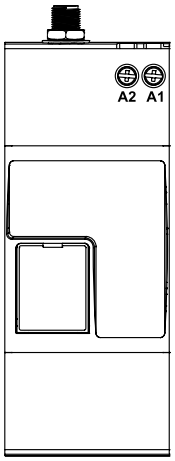
Digital input 1 and 2 Fig.1



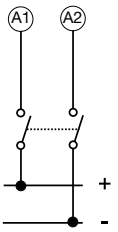
Digital outputs 1 and 2 Fig.2



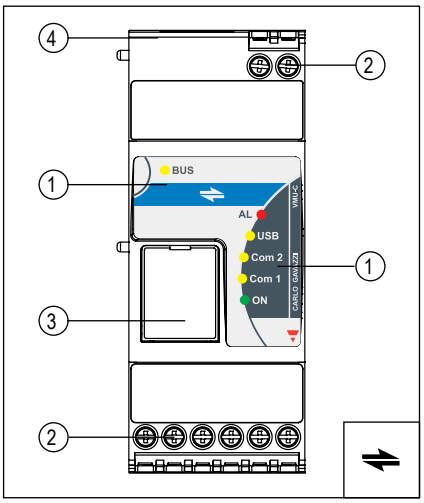
VMU-W EM connections



Power Supply Fig.1

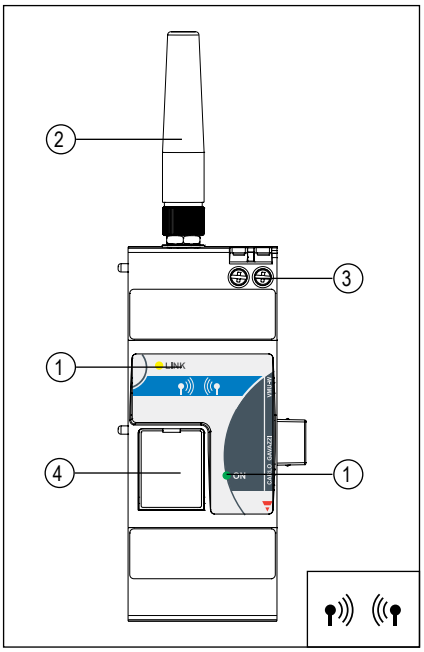


VMU-C EM Front panel description



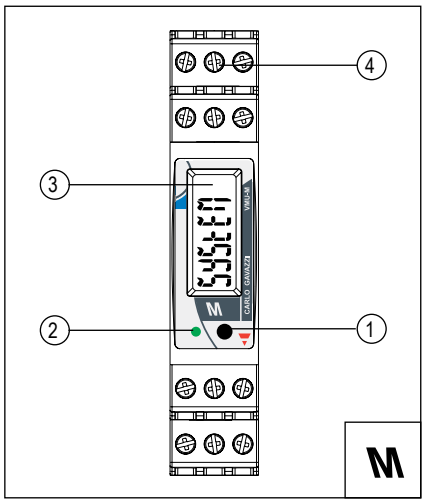
1. **LED**
   • Power ON (Green)
   Steady ON: power supply is on;
   Blinking: writing cycle on micro SD card
   • Bus (internal) (Yellow)
   Steady OFF: no communication; blinking: regular communication
   Steady ON: error on communication.
   • COM1 (Yellow)
   Steady OFF: no communication;
   Slow blinking: no answer to Modbus request (time-out);
   Blinking: regular communication.
   • COM2 (Yellow)
   Steady OFF: no communication;
   Slow blinking: no answer to Modbus request (time-out);
   Blinking: regular communication.
   • USB (Blue)
   Steady ON: acknowledged device, no writing in progress;
   Steady OFF: neither acknowledged device nor connected device;
   Blinking: acknowledged device and writing cycle in progress.
   • Alarm (Red)
   Steady on: alarm in progress;
   Steady OFF: no alarms.
2. **Screw terminals**
   For power supply and bus connections.
3. **Micro SD holder**
   Slot to plug-in the proper micro SD or micro SDHC memory and mini USB connector.
4. **USB and RJ connector**
   USB “A” type connector and RJ45 10/100 BaseTX connector for Ethernet communication.

VMU-W Front panel description



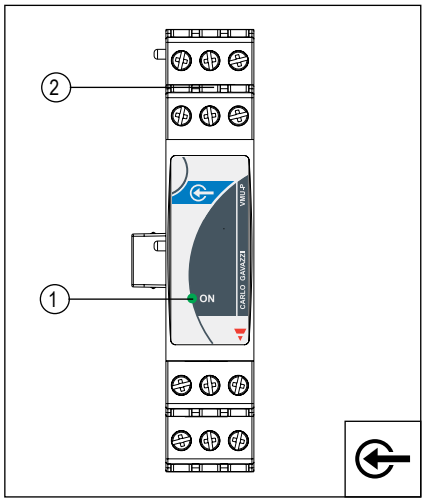
1. **LED.**
   • Power supply (Green):
   Steady ON
   • Link (Blue):
   Steady OFF: the unit is OFF.
   Fast blinking: net search / not registered / turning off.
   Slow blinking: registered full service.
   Steady ON: a call is active.
2. **Antenna.**
3. **Power supply.**
   For power supply connections
4. **Sim card holder.**
   Proper slot for SIM card with protection cover

VMU-M EM Front panel description



1. **Push button.**
   To program the configuration parameters and to scroll the variables. One key function: short time push button click: variable scroll or parameter increasing. Long time push button 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

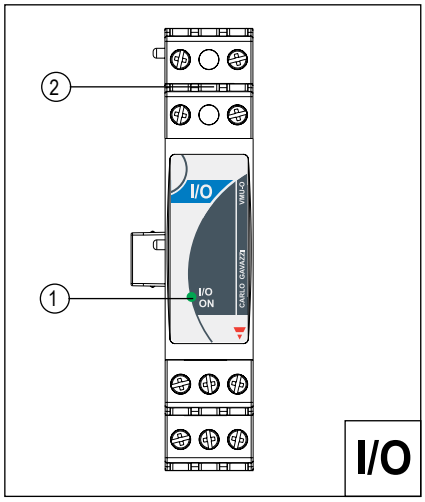
VMU-P EM Front panel description



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

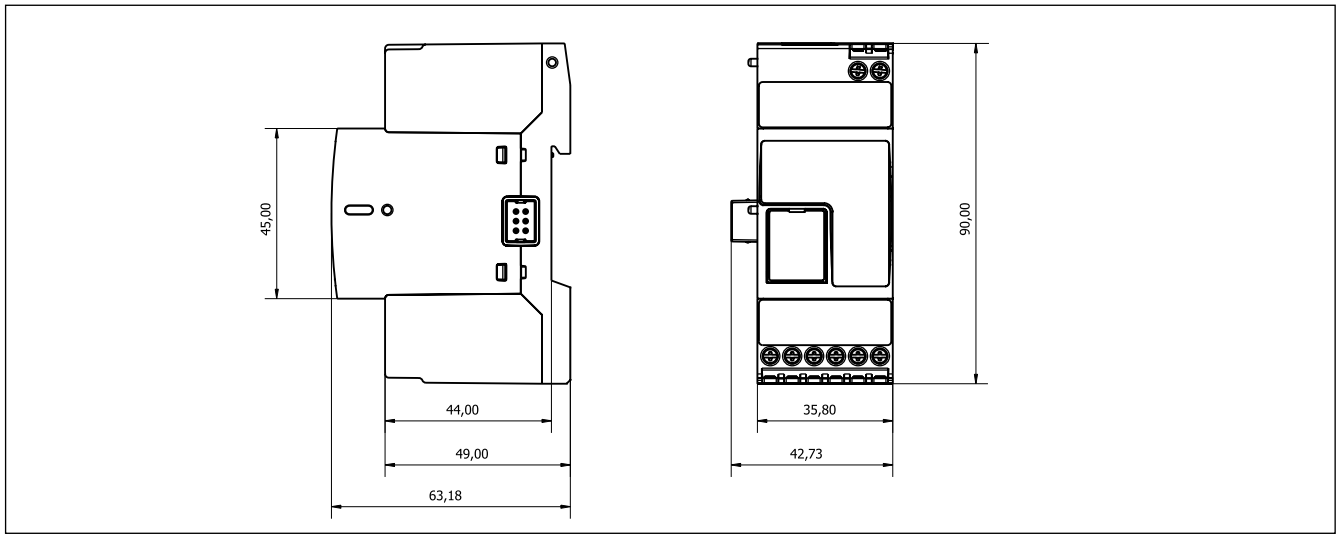
VMU-O EM Front panel description



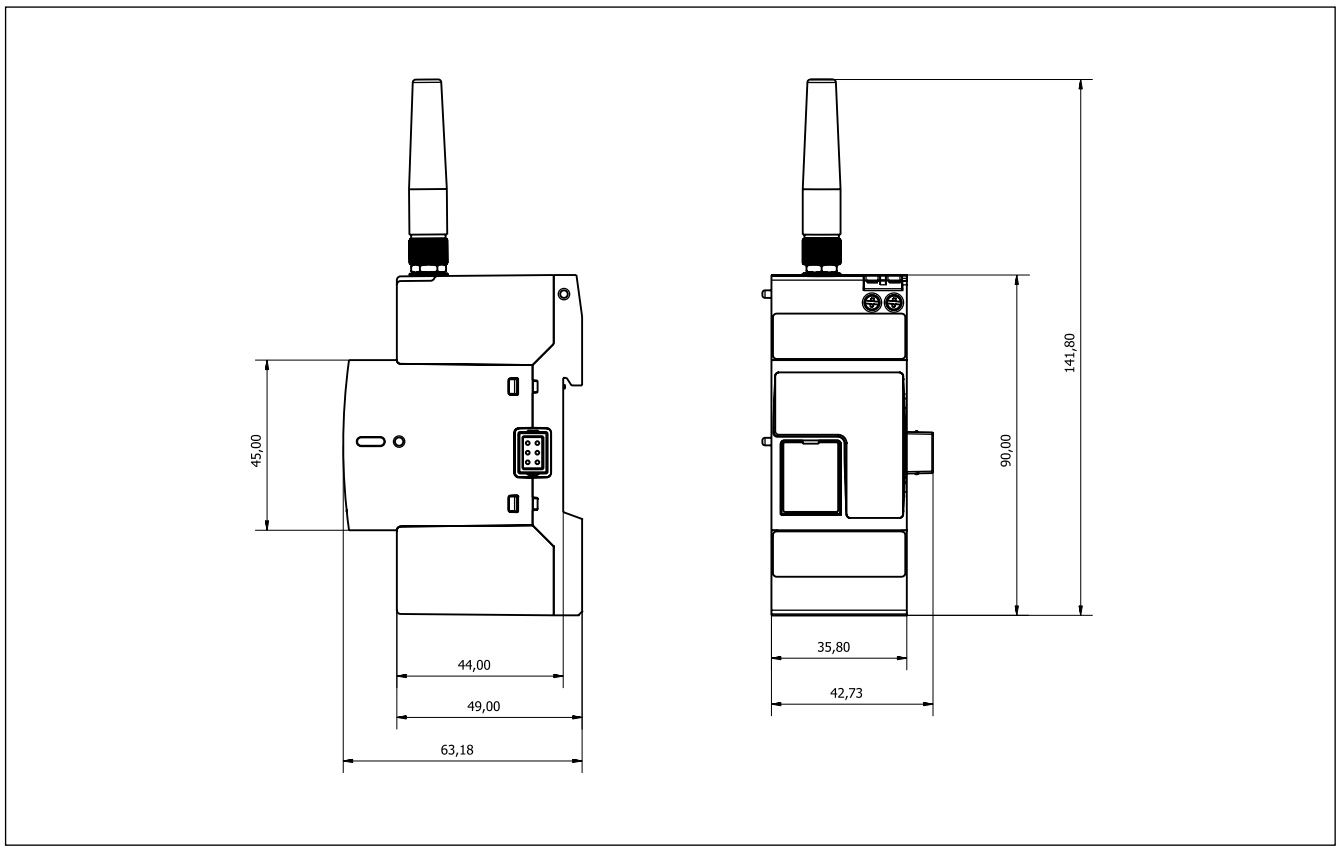
1. **LED.**
   ON steady light: the module is power supplied.
   Green: the power supply is ON
   White: the unit is enabled by VMU-M module for data reading and displaying.
   Red: one or up to three digital inputs are activated
   Blue: one or both digital outputs are activated
   Cycling from one 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-C EM dimensions (mm)



VMU-W dimensions (mm)



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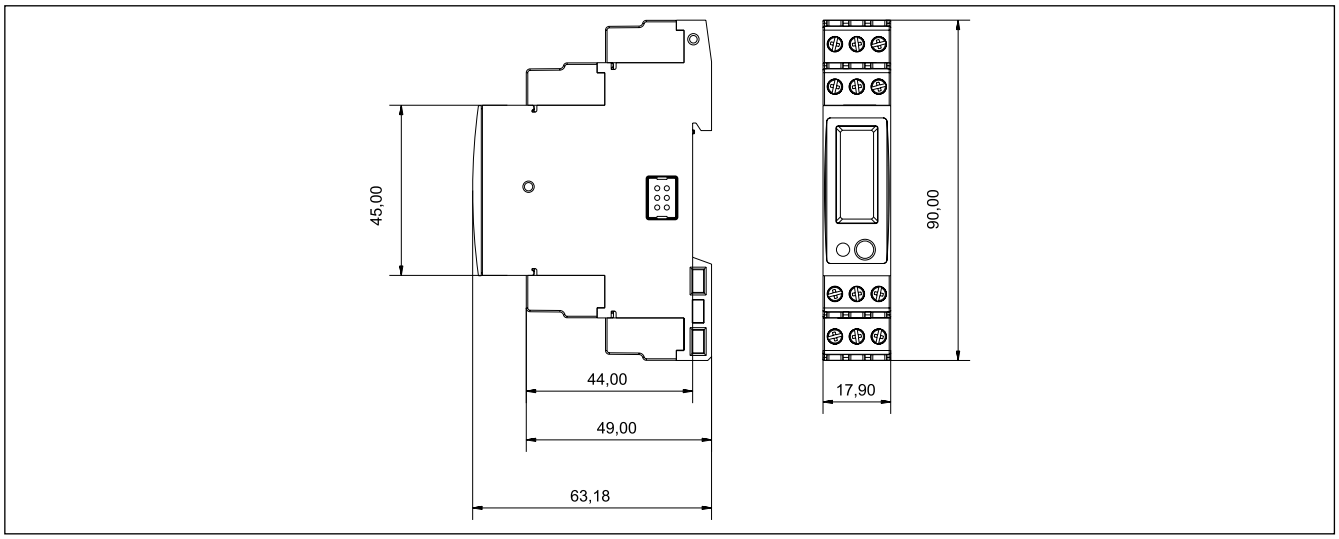
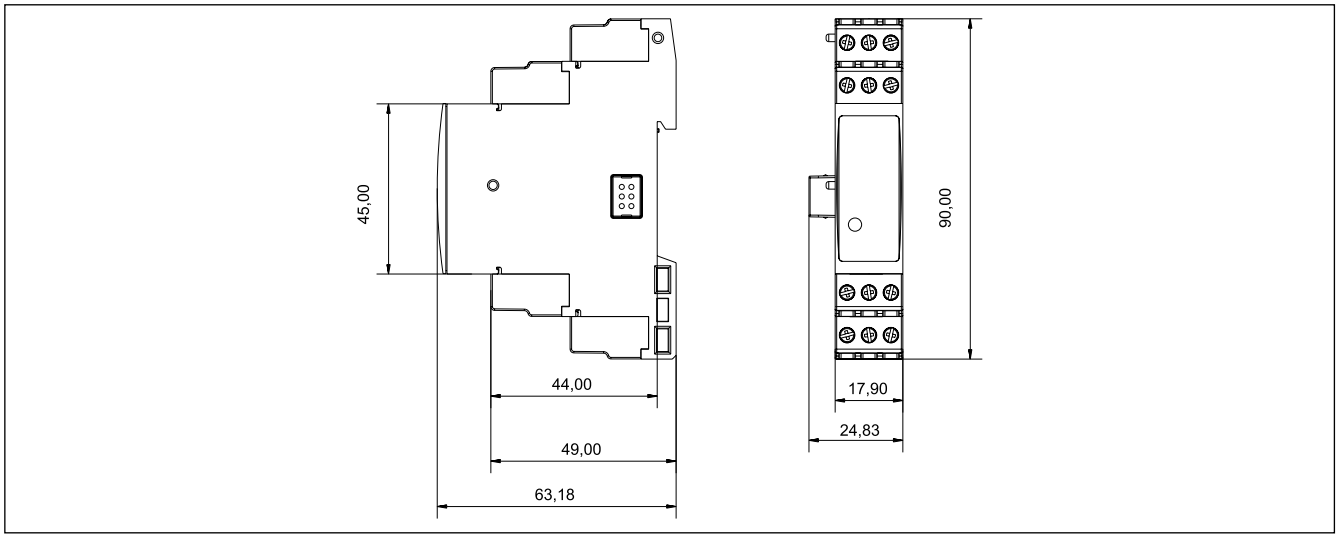
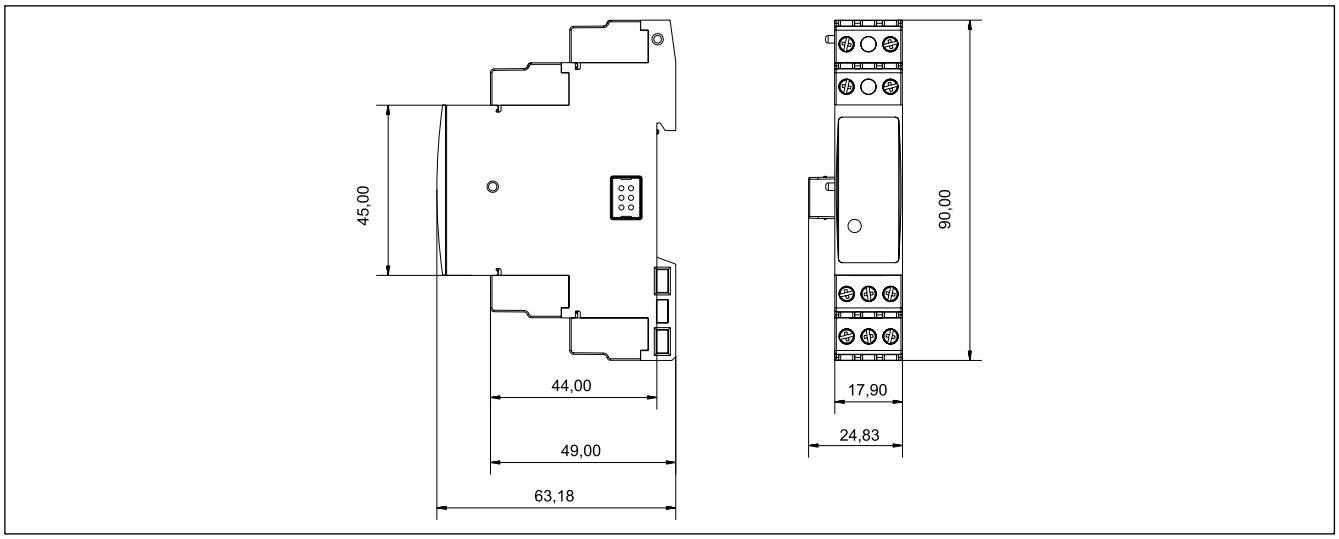
VMU-M EM dimensions (mm)



VMU-P EM dimensions (mm)



VMU-O EM dimensions (mm)



WEB-server

Home page with is the main one and let following information available at a glance:
- electrical plant information such as total power, daily and total energy consumption;
- CO_2, equivalent emissions;
- instantaneous variables of the plant, such as voltages and currents;

The main graph shows the actual total energy consumption of the plant vs. the previous day.

The consumption of each single energy meter can be analysed on daily, monthly or annual basis.
In the same section also the utility meters (gas, water or remote heating meters info acquired by pulses) and the analogue and environmental variables acquired by the VMU modules can be displayed and analysed.

The logged instantaneous variables relevant to the main meter, so to the whole electrical installation, can be analysed on daily, monthly or annual basis.
The variables can be monitored by specific setpoints. In case of problems or faults, it is possible to analyse the plant history before the event, so to understand the relevant reasons.

All the real-time variables of any meter can be displayed in the web-brower. This is equivalent to the on-site and read look directly at any meter display: the whole plant is completely under your control.

The database including all the history of the plant can be queried to get a set of data in a defined time period. The data are then available in Excel compatible format for further analysis by the user.