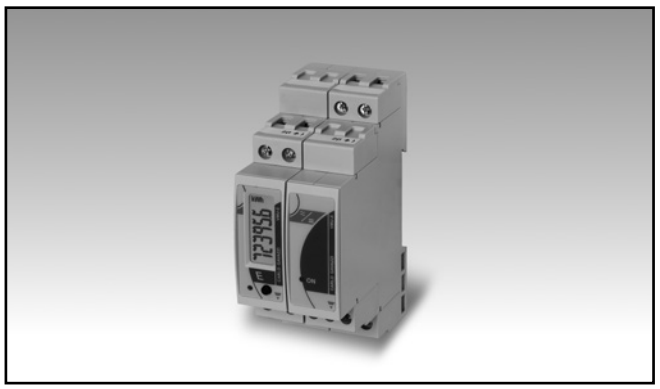
Energy Management
Modular DC Energy analyzer
Type VMU-E and VMU-X



- **Modular solution based on the combination of two units:**
- **VMU-E analysis unit and VMU-X universal power supply and RS485 communication unit.**

VMU-E, DC energy analysis unit

- **Instantaneous variables: V, A, W**
- **Instantaneous variables data format: 4-DGTs**
- **Energy measurements: kWh**
- **Energies data format: 6 DGT**
- **Accuracy: class 1 (kWh), ±0.5 RDG (current/voltage)**
- **Direct DC current measurement up to 20A**
- **External shunt DC current measurement up to 1000A**
- **External 10V DC current sensor measurement up to 1000 A**
- **Direct DC voltage measurement up to 400V**
- **Auxiliary power supply from VMU-X unit**
- **Dimensions: 1-DIN module**
- **Protection degree (front): IP40**

VMU-E Product Description

DC energy analyzer unit with built-in 6 digit display and programming push-button, particularly indicated for DC current, voltage, power and energy metering. Direct connection up to 20A and with external shunt or current sensor (e.g. Hall effect), with 10 V output) up to 1000A. Moreover the unit is provided with an auxiliary serial communication bus which is connected to the VMU-X unit so to provide an RS485 communication port. Housing for DIN-rail mounting, IP40 (front) protection degree.

How to order

VMU-E AV00 XX X X

Model
Range code
Power supply
Internal bus
Option

Type Selection

Range code		Power supply		Internal bus		Option	
AV00:	400V DC - 20A (Direct connection) or external shunt input for currents up 1000A	**XX:**	self-power supply from VMU-X unit	**X:**	internal bus compatible only to VMU-X module	**X:**	none
AV10:	400V DC - External 10V DC current sensor for currents up 1000A						

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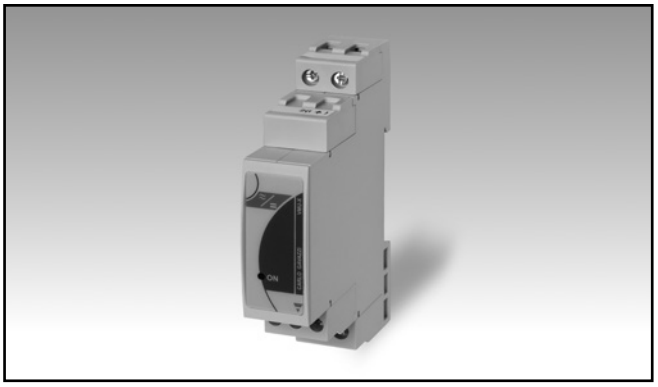
VMU-X, universal power supply and RS485 communication unit or static digital output



- **Power supply module for VMU-E unit**
- **RS485 communication port (Modbus)**
- **One digital output for pulse retransmission proportional to the energy being measured or for alarm control**
- **38 to 265 VAC/DC power supply input**
- **Dimensions: 1-DIN module**
- **Protection degree (front): IP40**

VMU-X Product Description

Universal power supply module suitable to be used in combination to VMU-E unit. In order to improve the communication capability of VMU-E unit, VMU-X can be provided with either an RS485 communication port or with a static output. Housing for DIN-rail mounting, IP40 (front) protection degree.

How to order

VMU-X U S1 X

Model
Power supply
Communication
Option

Type Selection

Power supply		Communication		Option	
U:	from 38 to 265VAC/DC **(*)**	**S1:**	RS485 Modbus **(*)**	**X:**	none
		D1:	static digital output for pulse retransmission or alarm control **(*)**		

(*) as standard.

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VMU-E Display and LED specifications

Display	1 line (max: 6-DGT)
Type	LCD, h 7mm
Information read-out	From 4 to 6-DGT depending on the information.
LED	
Type	Dual colour
Status and colour	Red blinking light: energy consumption; 1000 pulses/kWh (Max Frequency 16 Hz). Red steady light: alarm detected (it has the priority on any other condition: energy consumption or communication). Green blinking light: the communication on the RS485 bus is working. Note: in case of energy counting or communication condition, the LED alternates its colour from red to green.

VMU-X LED specification

LED			
Type	Single colour	Colour	Green: the power supply is ON.

VMU-E input specifications

Rated inputs	
Current input	1 (internal shunt)
Current direct conn. range	From 0 to 20A DC
Current external shunt conn. range	From 0 to 120mV DC
DC current external sensor connection	From 0 to 12V DC
Voltage range	From 0 to 400V DC
Accuracy	(@25°C ±5°C, R.H. ≤60%)
Current direct conn. range	±(0.5%RDG+2 DGT) from 0.05A to 20A DC
Start up current	50mA DC
Current external shunt conn.	±(0.5%RDG+2 DGT) from 0.1mV to 120mV DC
Start up current	0.1mV DC
DC current external sensor range:	+/-(0.5%RDG + 2DGT) from 0.01V to 12VDC
Start up current:	equivalent to 0.01V
Voltage	±(0.5%RDG+2 DGT) from 10V to 400V DC
Start up voltage	10V DC
Power	±(1% RDG+ 2DGT)
Energy	±(1% RDG)
Temperature drift	≤200ppm/°C
Measurement sampling time	≤150 ms
Key-pad	1 push-button for variable scrolling and programming of the instrument working parameters.

Display read-out	
Instantaneous variables	4-DGT (V, A, W)
Resolution	0.1V; 0.01A; 0.01kW (for more details see “VMU-E set of variables)
Energy	Total: 6-DGT (0.1KWh)
Max. and Min. indication	See “VMU-E set of variables”
Input impedance	
Voltage	= 5MΩ
Current direct connection	< 0.006Ω+ @ 0.5 Nm (screw terminal torque).
Current external shunt conn.	> 30kΩ
DC current external sensor connection:	> 300 kohm
Voltage Overloads	
Continuous	500V
For 1s	800V
Current Overloads	
Direct connection	
Continuous	20A DC
For 1s	100A DC max
External shunt connection	
Continuous	10V DC
For 1s	20V DC max
DC current external sensor connection	
Continuous	50 V DC
For 1s	100 V DC max

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VMU-X Output specifications

RS485

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: 9600, 19200, 38400, 115200 bits/s Parity: none
Driver input capability	1/5 unit load. Maximum 160 transceivers on the same bus.
Special functions	None
Insulation	See the table “Insulation between inputs and outputs”

Digital output

Number of outputs	1
Purpose	Selectable either for pulse transmission proportional to the energy being measured or for alarm control on selected variable.
Type	Static: opto-mosfet;
Load	V_{ON} 2.5 VAC/DC max. 70 mA, V_{OFF} 260 VAC/DC max.
Pulse output	
Pulse duration	≥100ms < 120msec (ON), ≥120ms (OFF)
Alarm output	
Operating mode	With digital output: real alarm; with RS485: virtual alarm.
Alarm modes	Up alarm or down alarm
Controlled variables	W, V, A (see the table “List of the variables that can be displayed and connected to …”)
Set-point adjustment	Programmable on all the measuring range (see “VMU-E set of variables”)
Hysteresis	Programmable on all the measuring range (see “VMU-E set of variables”)
On-time delay	0 to 9999s (166min)
Off-time delay	0 to 9999s (166min)
Min. response time	≤ 1s, set-point on-time delay: “0 s”
Insulation	See the table “Insulation between inputs and outputs”

Main functions

Displaying	1 variable per page. See ("VMU-E set of variables")
Password	Numeric code of max. 4 digits; 2 protection levels of the programming data:
1st level	Password "0", no protection;
2nd level	Password from 1 to 9999, all data are protected
Energy reset	By means of the front push-button

Scaling of external shunt current input	
Input scale	Programmable from 0 to 120mV DC
Display scale	Programmable from 0 to 1000A DC

Insulation between inputs and outputs

Module		VMU-E	VMU-X		
	Type of input/output	Measuring input	Power Supply	RS485 port	Static output
VMU-E	Measuring input	-	4kV	4kV	4kV
VMU-X	Power Supply	4kV	-	4kV	4kV
	RS485 port	4kV	4kV	-	4kV
	Static output	4kV	4kV	4kV	-

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General specifications

Operating temperature	-25 to +55°C (-13°F to 131°F) (R.H. from 0 to 90% non-condensing @ 40°C)
Storage temperature	-30 to +70°C (-22°F to 158°F) (R.H. < 90% non-condensing @ 40°C)
Installation category	Cat. III (IEC 60664, EN60664)
Insulation (for 1 minute)	See table "Insulation between inputs and outputs"
Dielectric strength	4000 VAC RMS for 1 minute
Noise rejection	
CMRR	>65 dB, 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 single lines;
Immunity to conducted disturbances	EN61000-4-6: 10V from 150KHz to 80MHz;
Surge	EN61000-4-5: 2kV on power supply; 4kV on current inputs.
EMC (Emission)	According to EN61000-6-3
Radio frequency suppression	According to CISPR 22
Standard compliance	
Safety	IEC60664, IEC61010-1 EN60664, EN61010-1
Approvals	CE
Housing	
Dimensions (WxHxD)	17.5 x 90 x 67 mm
Material	Noryl, self-extinguishing: UL 94 V-0
Mounting	DIN-rail
Protection degree	
Front	IP40
Screw terminals	IP20

VMU-E connections

Connections	Screw-type
Cable cross-section area	
Current, voltage	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
Current shunt	Max 1.5 mm^2, Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm
Screw terminal purposes	
6/10 mm^2	4 screw terminals: 1 for current input, 1 for current output 2 voltage reference
1.5 mm^2	2 screw terminals: external shunt or DC current sensor input
Weight	Approx. 100 g (packing included)

VMU-X connections

Connections	Screw-type
Cable cross-section area	1.5 mm^2 max. Min./Max. screws tightening torque: 0.4 Nm / 0.8 Nm
Screw terminal purposes	
1.5 mm^2	3 screw terminals used for RS485 port. 2 screw terminals used for static output, 2 screw terminals used for power supply
Weight	Approx. 100 g (packing included)

VMU-E power supply specifications

Power supply	Self-power supplied		through the VMU-X unit

VMU-X power supply specifications

Power supply	38 to 265 VAC/DC	**Power consumption**	1.5W, 3VA (VMU-X + VMU-E)

VMU-E set of variables

No.	Variables	Display read-out	Notes
1	V	0.0 to 999.9	
2	A	0.0 to 20.00	In case of external shunt input: 0.0 to 999.9
3	kW	0.0 to 99.99	In case of external shunt input: 0.0 to 999.9
4	kWh	0.0 to 99999.9	In case of external shunt input: 0.0 to 999999

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

- RS485 communication port
- Alarms

No	Variable	Display	RS485	Alarm	Reset	Notes
1	V	Yes	Yes	Yes	No	
2	V min	No	Yes	No	Yes	The value is saved into E^2PROM
3	V max	No	Yes	No	Yes	The value is saved into E^2PROM
4	A	Yes	Yes	Yes	No	
5	A min	No	Yes	No	Yes	The value is saved into E^2PROM
6	A max	No	Yes	No	Yes	The value is saved into E^2PROM
7	kW	Yes	Yes	Yes	No	
8	kW min	No	Yes	No	Yes	The value is saved into E^2PROM
9	kW max	No	Yes	No	Yes	The value is saved into E^2PROM
10	kWh	Yes	Yes	No	Yes	The value is saved into E^2PROM
11	Alarm	No	Yes	Yes	No	There is only one alarm which can be linked to the availale instantaneous variables

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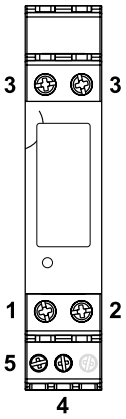
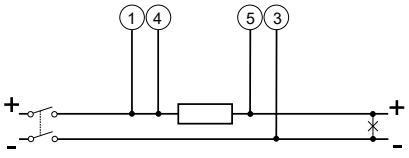
VMU-E connections

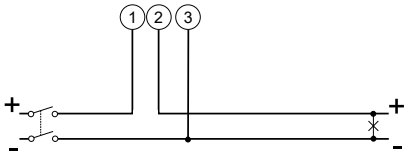


Measuring input (AV00) **Fig. 1**



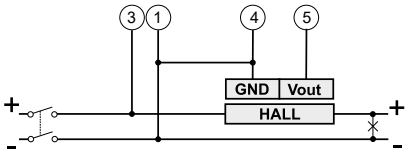
External SHUNT connection

Measuring input (AV00) **Fig. 2**



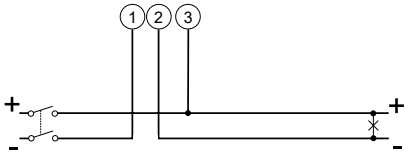
DIRECT connection (20 ADC)

Measuring input (AV10) **Fig. 3**



External SENSOR connection (12 V dc)

Measuring input (AV10) **Fig. 4**



DIRECT connection (20 A dc)

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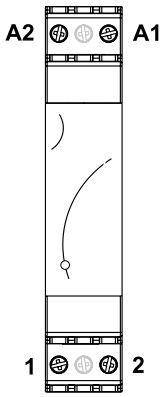
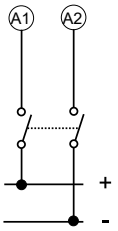
VMU-X connections



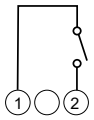
VMU-X **D1**

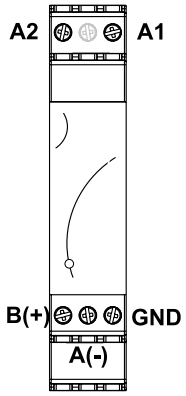
Power supply **Fig. 1**



38 to 265 VAC/DC

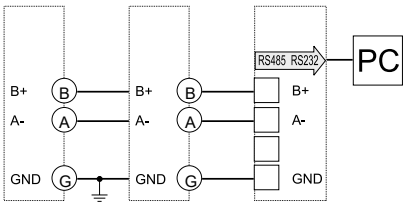
Digital output **Fig. 2**



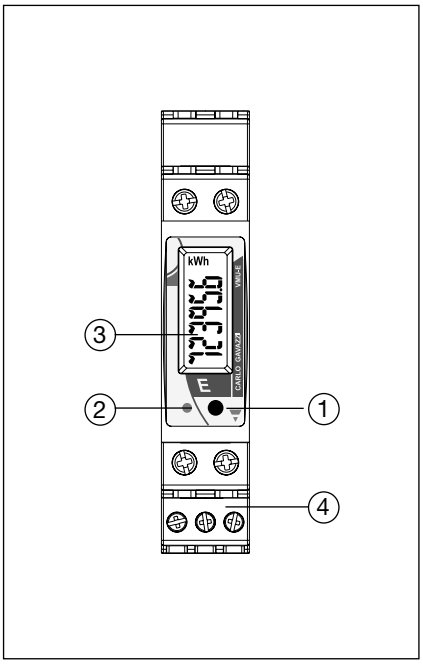


VMU-X **S1**

RS485 port **Fig. 3**



VMU-E Frontal panel description



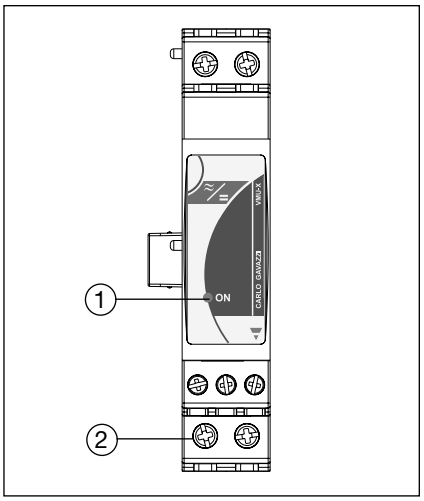
1. **Push button.**
   To program the configuration parameters and to scroll the variables. One key function: short time pushbutton click: variable scroll or parameter increasing. Long time pushbutton click: programming procedure entering, parameter selection confirmation.

2. **LED.**
   Red blinking light: energy consumption; 1000 pulses/kWh (Max Frequency 16 Hz). Red steady light: alarm detected (it has the priority on any other condition: energy consumption or communication). Green blinking light: the communication on the RS485 bus is working. Note: in case of energy counting or communication condition, the LED alternates its colour from red to green.

3. **Display.**
   LCD-type with alphanumeric indications to:
   - display the configuration parameters;
   - display some measured variables.

4. **Screw terminals.**
   For measuring input connections.

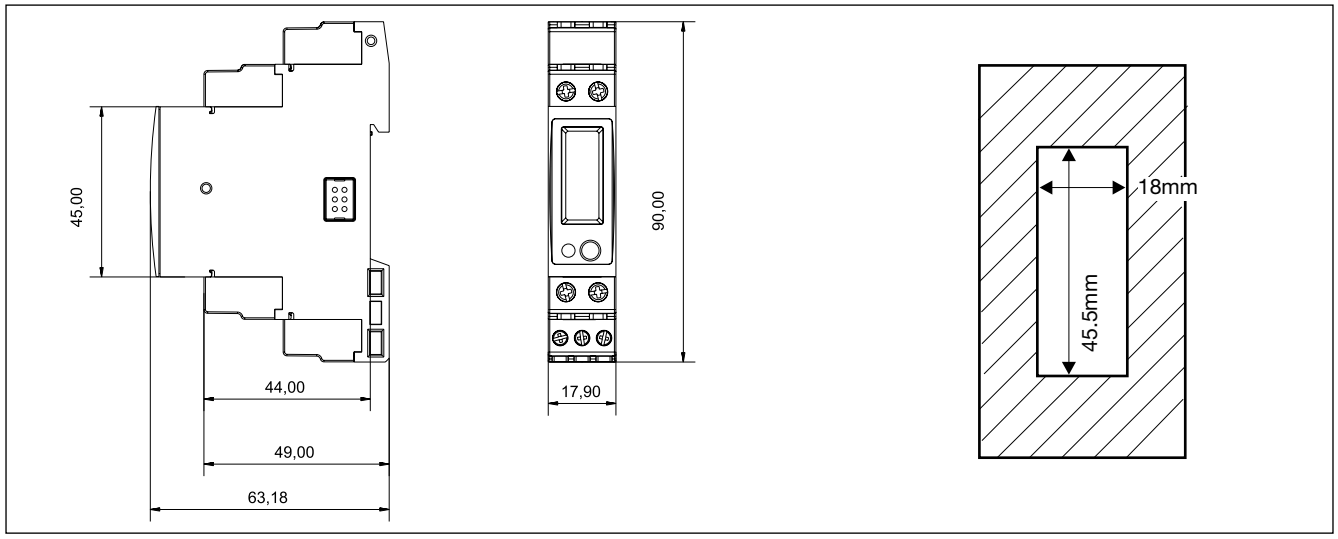
VMU-X Frontal panel description



1. **LED**
   Green: the power supply is ON.

2. **Screw terminals**
   For power supply and either digital output or communication port connections.

VMU-E Dimensions and panel cut-out



VMU-X Dimensions and panel cut-out