Web-Server VMU-C

Web-Server solution for low to medium peak power photovoltaic applications (< 1MW)

Instruction manual

Firmware release A7

SUMMARY

1 INSTALLATION

1.1 INTRODUCTION

This manual provides a comprehensive guide to VMUC (WebServer) installation, configuration and commissioning; it is addressed to technical staff members having an average knowledge of IT and of TCP/IP networking basic principles.

VMUC is a web server and provides a comprehensive system allowing to monitor the devices installed in a Photovoltaic System, like inverters, electrical energy meters, environmental sensors and string controls (Eos-Array).
The software and all the components needed for panel operation require no installation of additional software components.

1.2 PACKAGE CONTENT

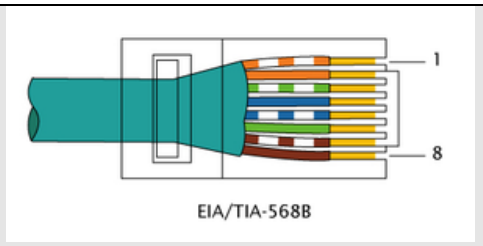
VMUC is supplied in a package including the following components:

- VMUC

1.3 TECHNICAL CHARACTERISTICS

VMUC is micro PC, totally fanless and without any moving components, providing WebServer functions; thanks to the use of industrial hardware, to its extremely small size, to its low energy consumption and to the low noise level it is ideal for monitoring applications requiring features like sturdiness and reliability along time; it can be installed in both technical and inhabited environments, without requiring any special caution during installation, usage and maintenance.

The following table provides a summary list of the product characteristics:

<table>
<tr><td>Ports and connections</td><td>
1 X 12 to 28Vdc power supply (A1+ and A2-)
2 X RS-485 (COM1 and COM2) :
<table>
<tr><td rowspan="3">COM1</td><td>Data – (A-)</td></tr>
<tr><td>Data + (B+)</td></tr>
<tr><td>GND</td></tr>
<tr><td rowspan="3">COM2</td><td>Data – (A-)</td></tr>
<tr><td>Data + (B+)</td></tr>
<tr><td>GND</td></tr>
</table>
1 X RJ-45 connector for 10/100 Base-T Ethernet [Communication]
[Communication port – Default IP: 192.168.1.110]
<table>
<tr><td> 
</td><td>Pin 1 TX+
Pin 2 TX-
Pin 3 Rx+
Pin 6 Rx-</td></tr>
</table>
1 X standard USB
1 X mini USB (through a dedicated driver it allows to access the system through the IP address 192.168.254.254)
1 X slot for micro SD or SDHC memory card
</td></tr>
<tr><td>Absorption</td><td>5W Max.</td></tr>
<tr><td>Operating conditions</td><td>-25°C to 40°C</td></tr>
<tr><td>COM port termination</td><td>Both COM ports are internally terminated with a value of 150Ω and polarised with two 511Ω resistors (from “B+” to +5V and from “A-“ to GND). As a consequence no other external connection is required.</td></tr>
</table>

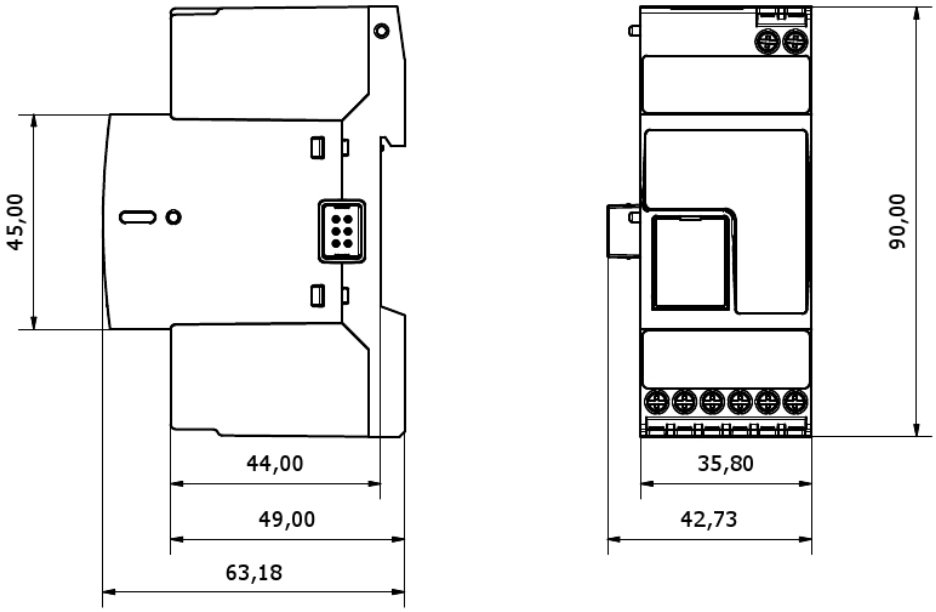


Fig 1 – Eos-Box dimensions

1.4 INSTALLATION AND CONNECTIONS

To install the VMU-C you need to perform the following steps:

- Connect the DC 24Vdc power supply (12Vdc to 28Vdc) through an appropriately sized feeder (recommended feeder: SPM3-241)
- Connect the inverters and the electric energy counters (if any) to the RS-485 (COM2) port. The different “paralleled” devices may communicate at different baud rates (communication speeds) and use different communication protocols.
- Connect the Eos-Arrays to the RS-485 (COM1) ports

  You can connect up to 10 Eos-Array systems (VMU-M along with the relevant modules).

  All the Eos-Arrays connected to the COM1 port shall be configured with the same baud rate and the same sampling time.

  The log data recorded throughout the day shall be available to be shown in graphical form for 6 months. The daily data, that is the summary values of each day shall be available to be shown in graphical form for 10 years.

- Connect the system to the data network through a standard Ethernet cable, using the LAN communication port configured with the default static IP address 192.168.1.110
- (Optional) Connect the GPRS/EDGE/UMTS/HSDPA modem by means of the VMU-W module through inner bus.

When switching on the VMU-C, the following LEDs will light up on the front panel: green “ON” LED (indicating the machine is powered), orange “BUS” LED (indicating LAN door activity), orange “COM1” and COM2 LEDs (indicating COM door activity), blue “USB” LED (indicating the presence of an USB device) and red “AL” LED (indicating the presence of any alarm condition); when connecting the network cable, the Ethernet port LEDS will light up as well.

After connecting and powering the VMU-C, access its configuration Web pages as described in the next chapter.

2 GENERAL OVERVIEW

2.1 ABOUT VMU-C

VMU-C is a photovoltaic plant monitoring Web server based on Web technology. Once properly set up, the VMU-C software can be used through the net – both LAN and Internet – through any PC or device equipped with a common Internet browser.
As VMU-C is based on the Web technology, it can be accessed and browsed as a common Web site; the data and status display function for the devices installed in the plant (inverters, strings, environmental sensors) is based on the innovative AJAX technology, allowing to send and receive information without having to reload the graphical pages.

2.2 ACCESSING THE SYSTEM

To access the system, you first need to establish a network connection between your PC and VMU-C, using the LAN port existing on the device; you have two options:

- Directly connect the two machines (VMU-C and PC) through network cable
- Connect both machines (VMU-C and PC) to your local network
- Directly connect the two machines (VMU-C and PC) through a USB/mini-USB cable.

The VMU-C default address is **192.168.1.110** ; in both connection configurations, this implies that, in order to be able to communicate with VMU-C your PC must belong to the same sub-network; that means its IP address must be "192.168.1.x", where "x" must be a number not equal to 100 and ranging between 1 and 254.
A backup unchangeable IP address is provided on the same Ethernet port: 192.168.253.254.
If using a mini-USB cable to connect the devices, the address must be 192.168.254.254.
If your network configuration is different (the first 3 number are not the prescribed ones) you need to temporarily modify your network configuration as specified above; then, as described below, after accessing the software you can modify the VMU-C network parameters, to make it compatible with your network, and finally restore your original network configuration.

After configuring your IP address, open an Internet browser and type the following address: http://192.168.1.110

Note that a secondary backup IP address is available in the case of a misconfiguration of the primary address: http://192.168.253.254

The system will display the following access page:

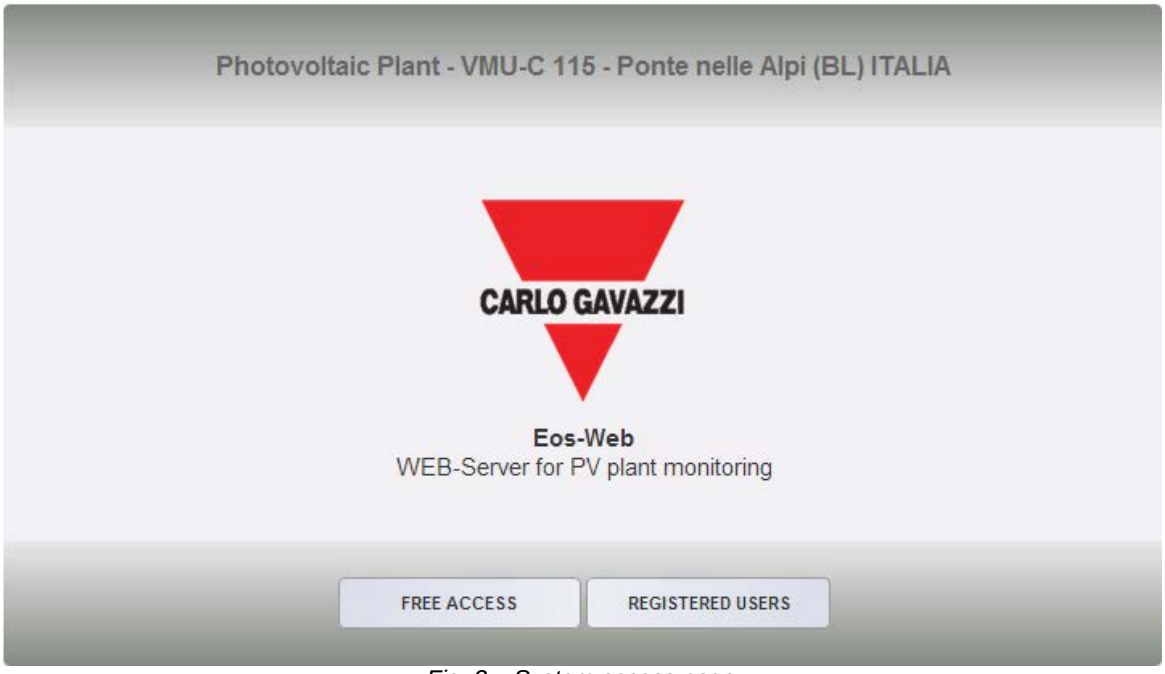


Fig. 3 – System access page

Clicking the "REGISTERED USERS" button will access the Login page:

Fig. 4 – Login page

The following are the default username and password:

Username	Password	Username
admin	admin	Administrator

It is essential that you modify the default password, as otherwise unwanted users might be able to access the system, above all when using an Internet connection.

2.3 THE MAIN SCREEN

The figure below shows the VMU-C home page:

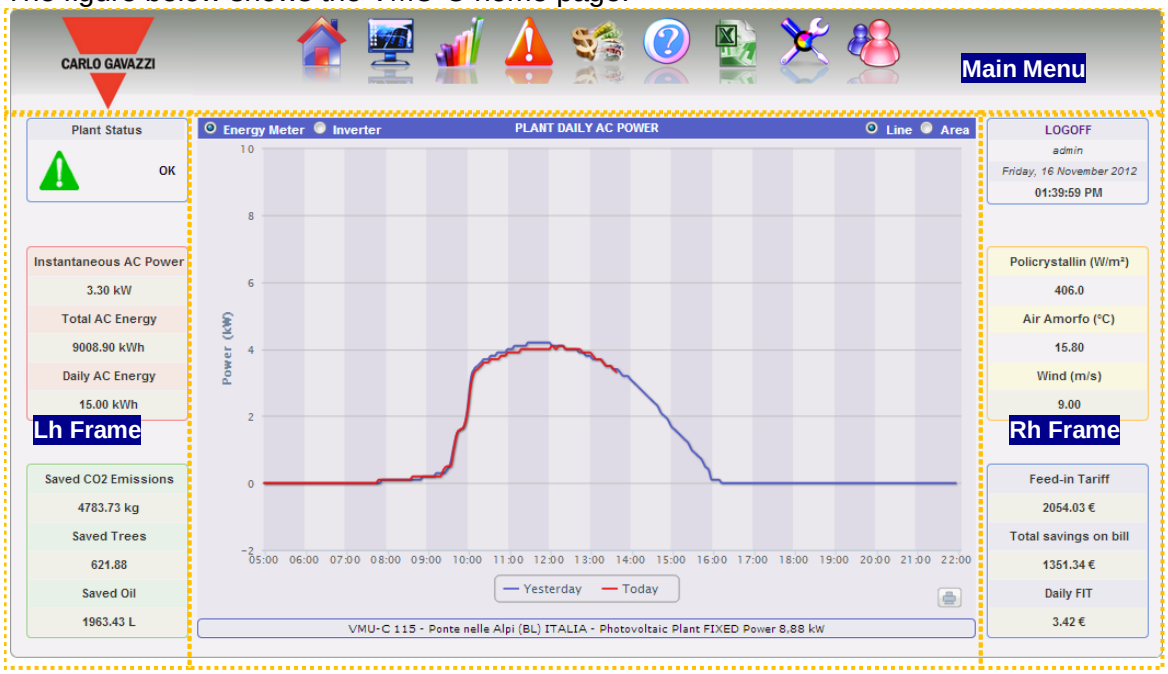


Fig. 5 – Home Page

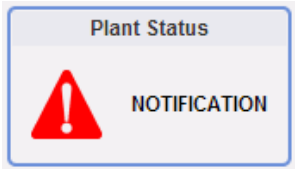
In particular, we have highlighted the following items, which are always available while using the software:

a) *Main Menu:* It includes the Navigation Menu (Para. 2.3.1)

b) *Lh Frame:* Starting from the top we have:

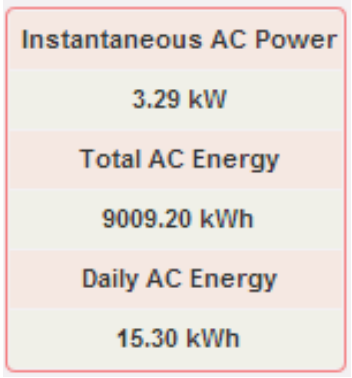
- Date.
- System status. Two messages may be displayed:
  1) OK – There are NO active Alarms or Faults

2) PRESENCE OF NOTIFICATIONS – There are some active Alarms or Faults. The inner triangle will be displayed in one of the following colours: red (top priority), orange, grey or green (minimum priority).



Clicking on a message will display the history of all the alarms that have occurred in the system, sorted chronologically in descending order. If any alarms/warnings are yet to be closed ("End date" is not shown), the system status message will be the one shown in 2). As described below you can mask the alarms/faults, thus preventing them from generating message 2).

1) Production data. (Automatic data update)



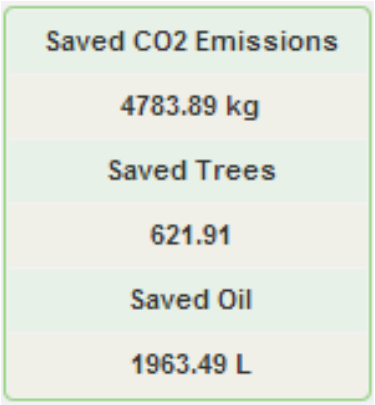
1) Instant AC power – Instant power (kW) generated by the plant. Data is collected from the reference energy meter, according to the settings indicated in section "Energy meter configuration".

2) Total AC energy – Total energy delivered by the plant since its switch-on. Data is collected from the reference energy meter, according to the settings indicated in section "Energy meter configuration".

3) Daily AC energy – Energy delivered by the plant since the beginning of the day. Data is collected from the reference energy meter, according to the settings indicated in section "Energy meter configuration".

Note: should the plant include no energy meters, VMU-C will create a virtual one, representing the sum of the data (kWh and kW) provided by the inverters.

2) Environmental data. (Automatic data update)



1) Saved CO_2 emissions – The calculation refers to the Total AC Energy generated by the plant (see 'Total AC Energy' in "Production data") Measuring unit: kilogram (kg).

Calculation:

A kWh used by the final user, produced by a thermoelectric plant, corresponds to an emission into air of about 0.53kg of CO_2. We can thus state that a kWh produced by a photovoltaic plant prevents the emission into air of 531g of CO_2.

We'll thus have: *Saved CO_2* emissions = 0.531 x Total AC Energy (kWh)

2) Equivalent trees - The calculation refers to the Total AC Energy produced by the plant [see 'Total AC Energy' in "Production data"].

Calculation:

Equivalent Trees = Saved CO_2 Emissions x 0.13

3) Saved Oil - The calculation refers to the Total AC Energy produced by the plant [see 'Total AC Energy' in "Production data"]. Measuring unit: Litres (L).

Calculation:

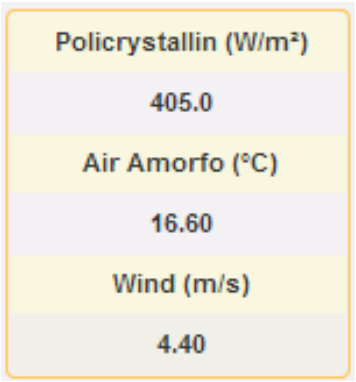
Saved Oil = TOE x *7.33* x *159*

TOE = [0.187 x Total AC Energy (kWh)]/1000

1 TOE (Tonne of Oil Equivalent)= 7.33 oil drums
1 oil drum = 159 litres of oil

c) ***Rh Frame**:* Starting from the top we have:

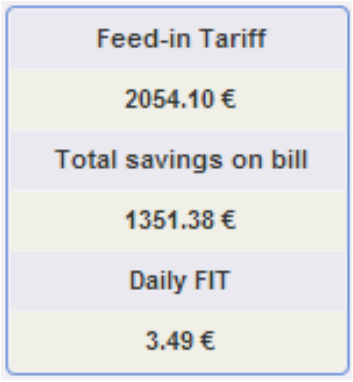
3) Log-off button. When clicking this button you will log off from VMU-C and return to the access page.
4) Username
5) PC's time.
6) Environmental sensor data. (Automatic data update)



1) Solar Radiation (W/m^2) hitting the reference Solar radiation sensor.
2) Module Temperature – Temperature (°C) read by the reference temperature probe.
3) Wind Speed – Wind Speed (m/s) read by the reference sensor.

N.A. = Data is not available. This occurs when: the sensor is not installed; data is incorrect; there is no communication from the sensor.

7) Economic Data. (Automatic data update)



1) Total Incentive – Total Amount (€) received as an Incentive. (*x* €/kWh), *x* Amount paid for each kWh of produced energy.

Calculation:

Total Incentive = Total AC Energy x Incentive

2) Total Saving on bill / Total Amount of Sold Energy (€) – this depends on the settings made in "System Data" → "Economic Data" Self-consumption / Sale

Calculation:

Total Saving on bill = Total AC Energy x Cost of 1 kWh of Energy

Total Sold Energy Amount = Total AC Energy x Amount paid for the sale of 1 kWh of Energy

3) Saving on bill for the current day/ Amount of Sold Energy (in the current day) (€) – this depends on the settings made in: "System Data" → "Economic Data" Self-consumption / Sale

Calculation:

Daily incentive (saving on bill) = AC Energy of the current day x Cost of 1 kWh of Energy

Total Sold Energy Amount = Total AC Energy of the current day x Amount paid for the sale of 1 kWh of Energy

d) *Main Frame:* It displays the relevant Navigation menu pages. In the bottom section it also displays a text band containing the main system data: name, location, plant type (fixed/tracker/mixed), peak power. It also includes a selection allowing to indicate the source of the data shown in the subsequent chart (from Inverter or from Meter).

2.3.1 NAVIGATION MENU

Hover your mouse over the icons to display their meaning in text form in the bottom section. Click on the icon to access the relevant section which will be displayed in the Main Frame.

Home

It allows to return to the main page.

Monitor

It allows to display the production data in graphical form, comparing Solar Radiation, Temperature, Powers and Efficiencies.

Plant

It allows to display in graphical form all the acquired system data.

Alarms

It allows to display the alarms that have been raised in the plant.

Money

It allows to display in graphical form the equivalent monetary value of incentives, sales and savings.

Information

A tab displaying the plant characteristics.

Export

It allows to stored data to xls format.

Configuration (Only available for Administrator users)

It allows to access the system configuration menu.

Account (Only available for Administrator users)

It allows to access the Account management question.

3 CONFIGURATION

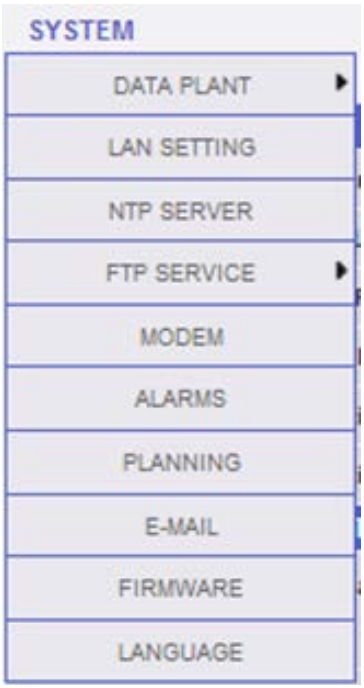
Clicking on the “Configuration” icon in the Navigation Menu (Fig. 6) will grant access to the whole system Configuration section.

Fig. 6 – System Configuration

The software will display three main configuration menus (*SYSTEM, PLANT and SENSORS*):

3.1 “SYSTEM” CONFIGURATION

Clicking on the “SYSTEM” menu will display the following sub-menus:



3.1.1 PLANT DATA SETTING

The "*PLANT DATA*" menu allows to access the plant description page and the project page:

3.1.1.1 "DESCRIPTION" SETTING

Clicking on the "DESCRIPTION" menu will display the main page providing a plant description:

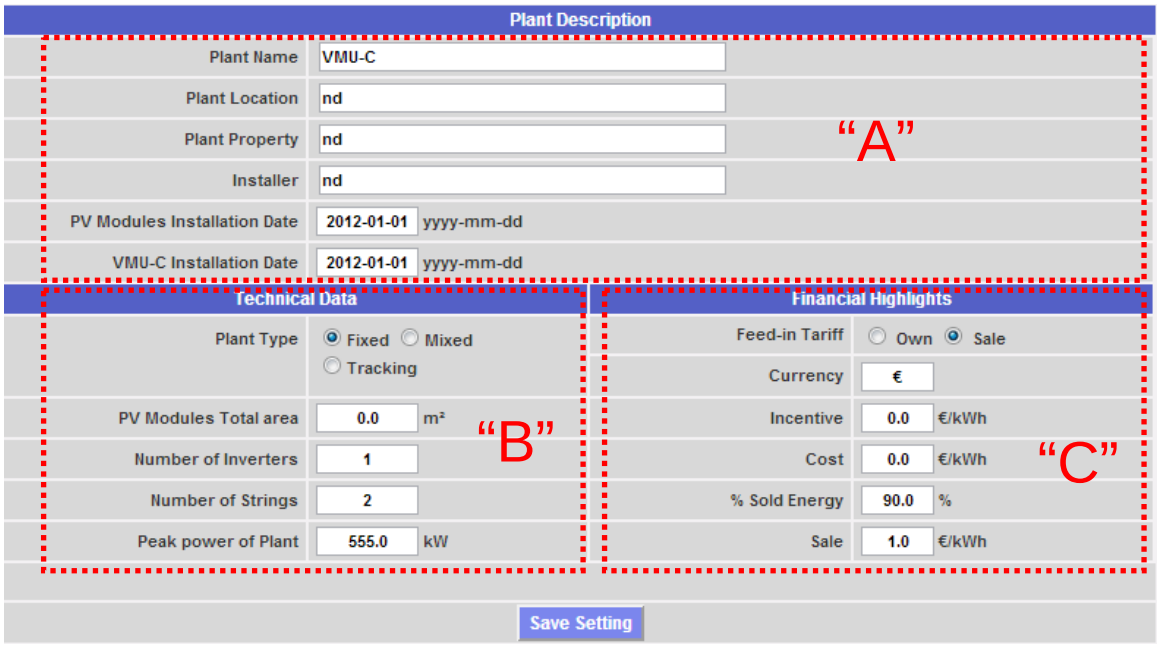


Fig. 13 - Plant Data Configuration

The "***Plant description***" section (see the dotted area "A") allows the insertion of the general data of the plant to make the plant management easier.

The "***Technical data***" section (see the dotted area "B") displays the most technical data (surface, amount of inverters and strings, plant rated power). These data cannot be edited; the relevant fields are populated by the software referring to the system configuration data (see chapter "Configuring the areas" and "Configuration of VMU-S modules"). "Total area of PV modules" indicates the product between the surface of each photovoltaic module and the total number of modules installed in the system.

Note: If the VMU-S modules were not configured in the system, the field "Peak Power Plant" can be configured directly by entering the two values previously calculated by the user

The "***Economic data***" section (see the dotted area "C") allows to choose between two options: "*Self-consumption*" and "*Sale*". Choosing "*Sale*" will also enable two more fields: "SALE", specifying the amount paid for each sold kWh and *"Sold Energy % Estimate"* (in case of partial transfer). The latter parameter ranges between 0-100% and modifies the equivalent monetary value obtained from the sale of energy.
By default production data are acquired from the energy meters and displayed as the sum of the individual values. The selection affects the subsequent calculation of economic counter-values, the data shown in "LH frame" and "RH frame" and the total efficiency calculated.

Press "Save setting" to store data.

Note: All decimal numbers must be separated by a point.

3.1.1.2 "PROJECT " SETTING

Clicking on the "PROJECT" menu will display the main page providing a plant description:

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Monthly Planned Yield index (kWh/kWp)

PV Modules Installation Date 2012-01-01

	First Installation Value	Annual Corrected Value		First Installation Value	Annual Corrected Value
January	0.0 kWh/kWp	0.0	July	0.0 kWh/kWp	0.0
February	0.0 kWh/kWp	0.0	August	0.0 kWh/kWp	0.0
March	0.0 kWh/kWp	0.0	September	0.0 kWh/kWp	0.0
April	0.0 kWh/kWp	0.0	October	0.0 kWh/kWp	0.0
May	0.0 kWh/kWp	0.0	November	0.0 kWh/kWp	0.0
June	0.0 kWh/kWp	0.0	December	0.0 kWh/kWp	0.0

Annual Yeld Corrective Factor 0.0 %

Expected Energy on Current Year 0 kWh/kWp

Save

Fig. 7 – Data Project configuration

In this configuration page the user shall specify the "YIELD" (kWh/kWp) data expected of the plant in question for each month. He shall also indicate the "Annual Decay Factor" of installed panel performance. VMU-C will automatically calculate the "Correct Annual Value", which will take into account the installed value and the decay due to panel ageing, for each month. VMU-C will also automatically provide the "Expected Energy for the current year".

3.1.2 NETWORK CONFIGURATION

Clicking on “NETWORK CONFIGURATION” will grant access to the page shown in Fig. 8.

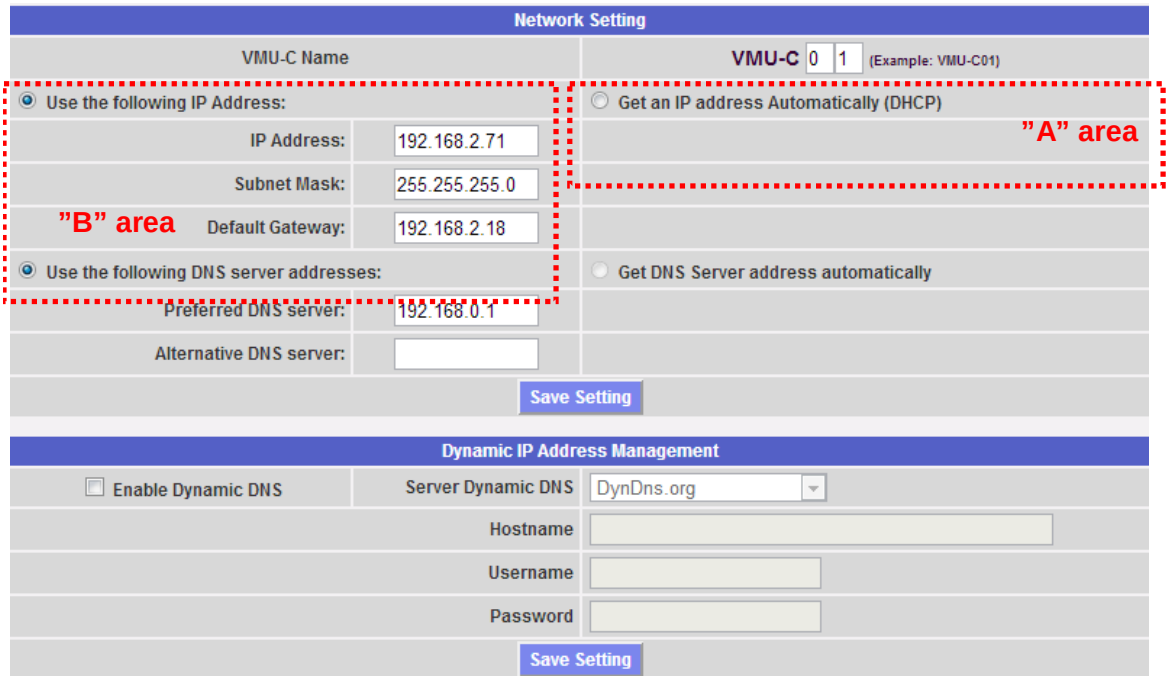


Fig. 8 – Network configuration

This page consists of three sections:

1) *Network configuration*

To configure the LAN port, you can choose between two options:

- *Obtain an IP address automatically (DHCP*) (see “A” area) : the address is automatically acquired when switching on the VMU-C from a DHCP server, which must exist inside the network the port is connected to. The IP address will be dynamic and not known in advance. In this case you can reach VMU-C from within the same network by typing on the browser the Machine Name assigned to it (e.g. VMU-C01).

- *Use the following IP address (Static routing) (see “B” area):* you need to manually specify an IP address along with a network mask and a default gateway.

  In the absence of a network administrator who can provide the correct network parameters, assign an address belonging to the same class as those of the other existing devices (e.g.: ADSL router), and indicate “255.255.255.0” as the network mask.
  The default gateway is only mandatory if you plan to access VMU-C through the Internet using the LAN connection; in this case, indicate in this field the IP address of the ADSL router

Finally, you can manually specify the addresses of the primary and secondary DNS servers to be used to access the Internet (*Use the following DNS server*

addresses)*;* as an alternative, if the LAN port is set to DHCP mode, you can allow VMU-C to acquire the DNS servers from the DHCP server *(Obtain DNS server address Automatically).*
Press the “Save configuration” button to store the network configuration. To apply the new settings, VMU-C needs to be automatically restarted; wait until the count-down is over; then you'll routed back to the home page.

The system requires to have access to the Internet for the following services:

- *To send e-mails to the configured SMTP server.*
- *To synchronise the date and time settings through the NTP service (if configured).*

Note: to make VMU-C accessible from the outside through a LAN connection you need to adopt the typical re-routing policies on the ADSL router modem (NAT- Port forwarding) to which it is connected. **The ports to be re-routed** are**: 80, 22**.

2) *Dynamic public IP address management*

Should you not have at your disposal a static public IP address allowing to reach the VMU-C from the Internet, but should you have to use any public IP addresses dynamically assigned by your ISP (Internet Service Provider), you may resort to DNS server managers keeping the dynamic public IP address constantly synchronised with a domain name. The managers used by VMU-C are *DynDns.org*, *DynDns.it* and *No-ip.com*. To access the service you need to connect to http://www.dyndns.org/ (or http://www.dyndns.it/ or http://www.No-ip.com/), register by creating an account and finally create a new “Dynamic DNS host”. The term "Dynamic DNS host" indicates a domain address which shall then be typed into the browser's address bar to reach VMU-C. (E.g. VMUC.No-ip.com). When registering to DynDNS.org (or to an equivalent site) you shall provide a Username and a Password that VMU-C will use to authenticate with the server.

To enable the management of the dynamic public IP address you need to:

- Check “Enable dynamic DNS”.
- Type the name of the chosen Dynamic DNS host.
- Type the Username and Password provided during account registration.
- Click on “Save settings”

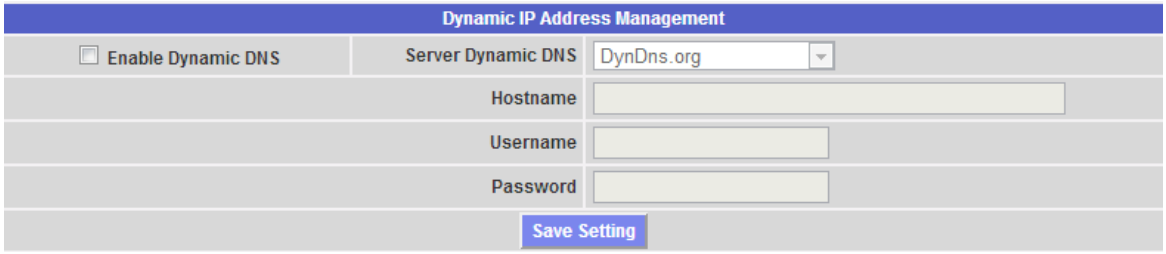


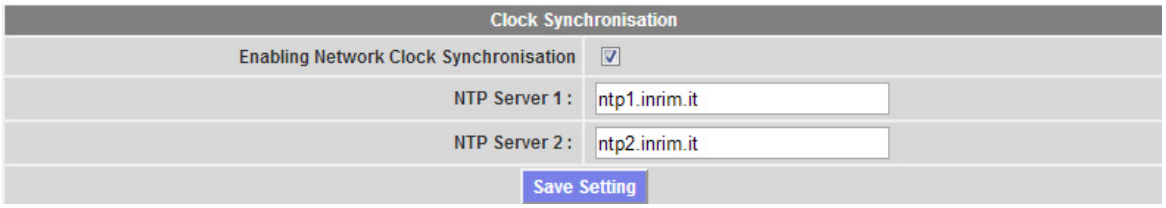
Fig. 9 – Dynamic public IP address management

The service will be available after about 6 minutes.

Note: Resorting to this service is often necessary when the Internet connection is established through a GPRS/UMTS modem or when you don't have any static IP address on your ADSL line. Mobile telephony operators, in fact, are unlikely to provide a static IP address.

3.1.3 CONFIGURING THE NTP SERVER

Clicking on “NTP SERVER” will grant access to the page shown in Fig. 10.



Best regards/Distinti saluti
Alessio Costantini
International Product Manager
****
Carlo Gavazzi Controls S.p.A.
Via Safforze, 8
32100 BELLUNO - ITALY
Phone: 0039 0437 355811
FAX: 0039 0437 355880
Mobile: 0039 331 1917224
Visit our site: www.gavazziautomation.com
****
Please consider the environment before printing this e-mail

Fig. 10 – NTP SERVER

You can set up to two NTP servers. Enabling this server type allows to constantly synchronise the DATE and TIME data; this service also allows the VMU-C to know in which geographic area it has been installed.

3.1.4 FTP SERVICE CONFIGURATION

By clicking on “FTP SERVICE” the following 3 sub-menu are presented:

3.1.4.1 SETTING

By clicking on “SETTING” it is possible to configure the parameters needed to enable data communication from VMU-C to the customer’s server:

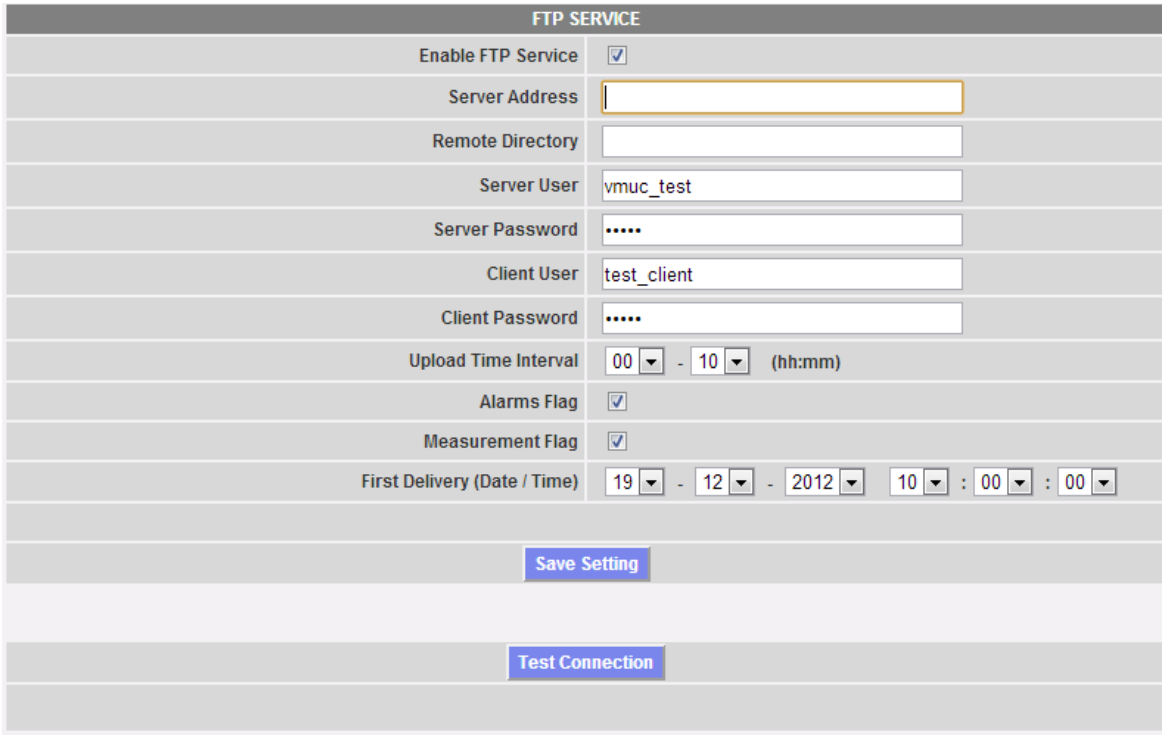


Fig. 11 – FTP Service

The relevant fields must be completed according to the following guideline:

- “Enable FTP Service”: to be checked to enable data communication (both by FTP-push and HTTP-pull); both HTTP-pull and FTP-push are available at the same time.

In the case FTP communication is needed, the following fields must be completed:

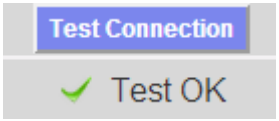
- “Server Address”: it is the Internet address of the FTP server to which VMU-C will upload data
- “Remote directory”: the remote FTP server’s directory to which data will be uploaded
- “Server user”: the user name authorized to access the remote FTP server’s directory
- “Server password”: the password to be used together with the “Server user” to access the remote directory
- “Upload time interval” (hh:mm) : the interval time between two successive FTP upload actions (in the range 10 minutes – 24 hours)
- “Alarms Flag”: to be checked to enable the VMU-C’s alarms upload to the FTP server

- “Measurements Flag”: to be checked to enable the VMU-C’s measurement upload to the FTP server
- “First Delivery” (date/time): date and time of the first upload action to the FTP server

In the case it is needed to exchange data using HTTP-pull, the VMU-C will send its response to an HTTP query sent by the remote system (automated HTTP client); for security reasons an authentication is needed to poll data, and the following fields must be completed prior to be able to perform HTTP requests:

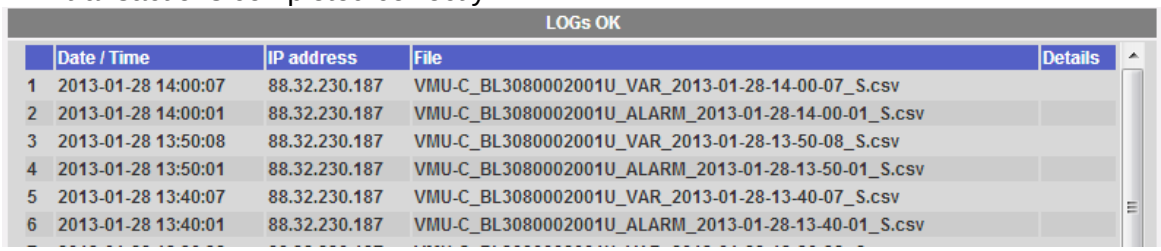
- “Client User”: user name to authenticate on VMU-C while executing a query
- “Client Password”: password to authenticate on VMU-C while executing a query

Press “Save Configuration” to confirm configuration changes.
After having completed the relevant fields for FTP communication it is suggested to push “Test connection” so as to check that everything is working correctly; in the case the configuration is correct, this is the VMU-C’s output:



3.1.4.2 LOGs OK

By clicking on the “LOGs OK” item, the following screenshot will appear, reporting all the FTP transactions completed correctly

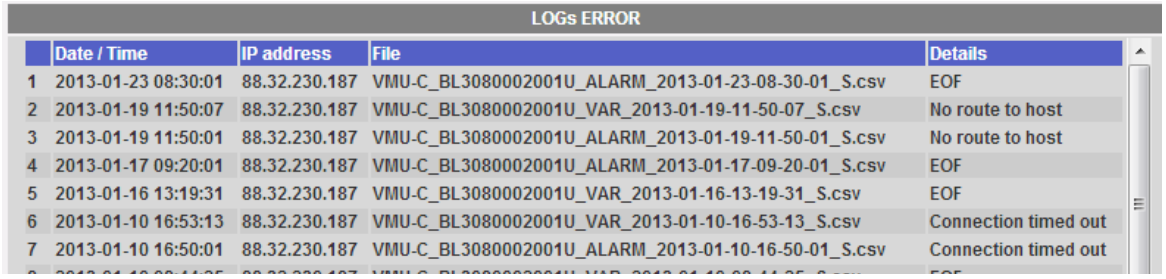


LOGs OK

	Date / Time	IP address	File	Details
1	2013-01-28 14:00:07	88.32.230.187	VMU-C_BL3080002001U_VAR_2013-01-28-14-00-07_S.csv	
2	2013-01-28 14:00:01	88.32.230.187	VMU-C_BL3080002001U_ALARM_2013-01-28-14-00-01_S.csv	
3	2013-01-28 13:50:08	88.32.230.187	VMU-C_BL3080002001U_VAR_2013-01-28-13-50-08_S.csv	
4	2013-01-28 13:50:01	88.32.230.187	VMU-C_BL3080002001U_ALARM_2013-01-28-13-50-01_S.csv	
5	2013-01-28 13:40:07	88.32.230.187	VMU-C_BL3080002001U_VAR_2013-01-28-13-40-07_S.csv	
6	2013-01-28 13:40:01	88.32.230.187	VMU-C_BL3080002001U_ALARM_2013-01-28-13-40-01_S.csv	

3.1.4.3 LOGs ERROR

By clicking on the “LOGs ERROR” item, the following screenshot will appear, reporting all the FTP transactions not completed correctly



LOGs ERROR

	Date / Time	IP address	File	Details
1	2013-01-23 08:30:01	88.32.230.187	VMU-C_BL3080002001U_ALARM_2013-01-23-08-30-01_S.csv	EOF
2	2013-01-19 11:50:07	88.32.230.187	VMU-C_BL3080002001U_VAR_2013-01-19-11-50-07_S.csv	No route to host
3	2013-01-19 11:50:01	88.32.230.187	VMU-C_BL3080002001U_ALARM_2013-01-19-11-50-01_S.csv	No route to host
4	2013-01-17 09:20:01	88.32.230.187	VMU-C_BL3080002001U_ALARM_2013-01-17-09-20-01_S.csv	EOF
5	2013-01-16 13:19:31	88.32.230.187	VMU-C_BL3080002001U_VAR_2013-01-16-13-19-31_S.csv	EOF
6	2013-01-10 16:53:13	88.32.230.187	VMU-C_BL3080002001U_VAR_2013-01-10-16-53-13_S.csv	Connection timed out
7	2013-01-10 16:50:01	88.32.230.187	VMU-C_BL3080002001U_ALARM_2013-01-10-16-50-01_S.csv	Connection timed out

Note: both the FTP and HTTP based communication protocols, the file format and the HTTP query parameters are available on request as Developer’s technical manual.

3.1.5 INSTALLING AND CONFIGURING THE VMU-W MODEM

Connecting the VMU-W module

To connect the Modem (VMU-W) to VMU-C you will have to perform the following steps:

- Make sure the VMU-C and the VMU-W are not powered.
- Connect the VMU-W to the VMU-C through the auxiliary bus on the left side of the VMU-C.
- Make sure the **SIM is not protected by a PIN code** (should that be the case, disable the protection).
- Insert the SIM into the VMU-W modem through the special slot.
- Connect the antenna and put it in a place assuring proper signal reception.
- Restore the power supply of both devices (VMU-C and VMU-W).
- Make sure that both devices are located in a dry place, protected against rain and dust.

On the front side of VMU-W there are two LEDs, whose meaning is the following:

1) Green LED: *Steadily on* => the equipment is powered.
2) Blue LED: *Off* => no power supply. *Fast blinking* => searching for the cover signal / not registered / switching off. *Slow blinking* => Service is registered and signal is available. *Steadily on* => communication under way.

Fig. 9/b – VMU-W

By clicking on “MODEM” it is possible to access the configuration of the parameters which allow VMU-W based communication. It is needed to complete all the fields from the following form:

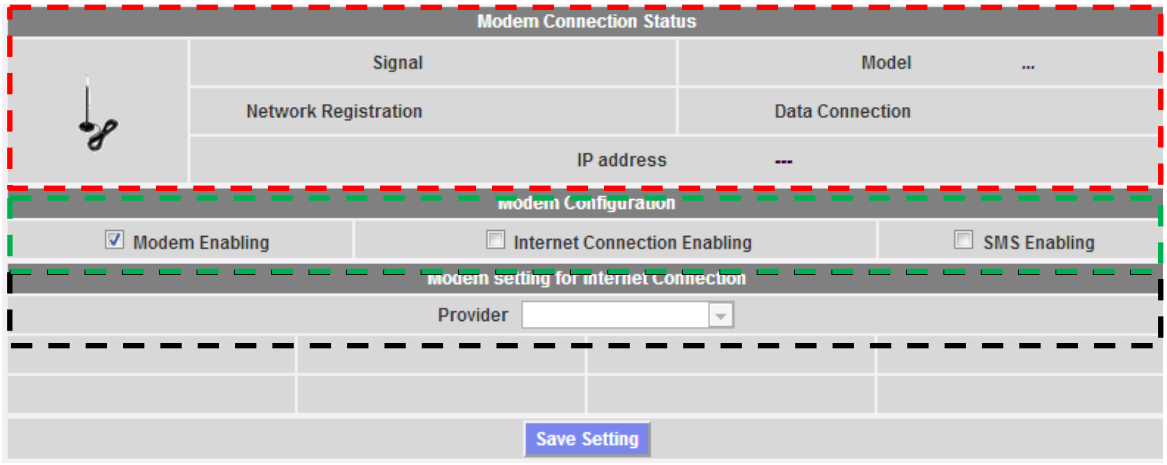


Fig. 12 –Modem Configuration

The area surrounded by the red dashed line shows information relevant to the communication status:

- Signal = Modem's signal level (RX)
- Model = full Modem's part number
- Network registration = Mobile network to which the modem is connected
- Data connection = connection status
- IP address = IP address assigned to the device by the mobile network

The area surrounded by the green dashed line shows the functions to be enabled:

- Modem Enabling = to be checked to enable the VMU-W modem
- Internet Connection Enabling= to be checked to enable data communication over Internet
- SMS Enabling= to be checked to enable SMS alarm dispatching

The area surrounded by the black dashed line includes the mobile operator selection box

3.1.6 ALARM SENDING CONFIGURATION

Clicking on the “ALARMS” item will grant access to the page shown in Fig. 11.

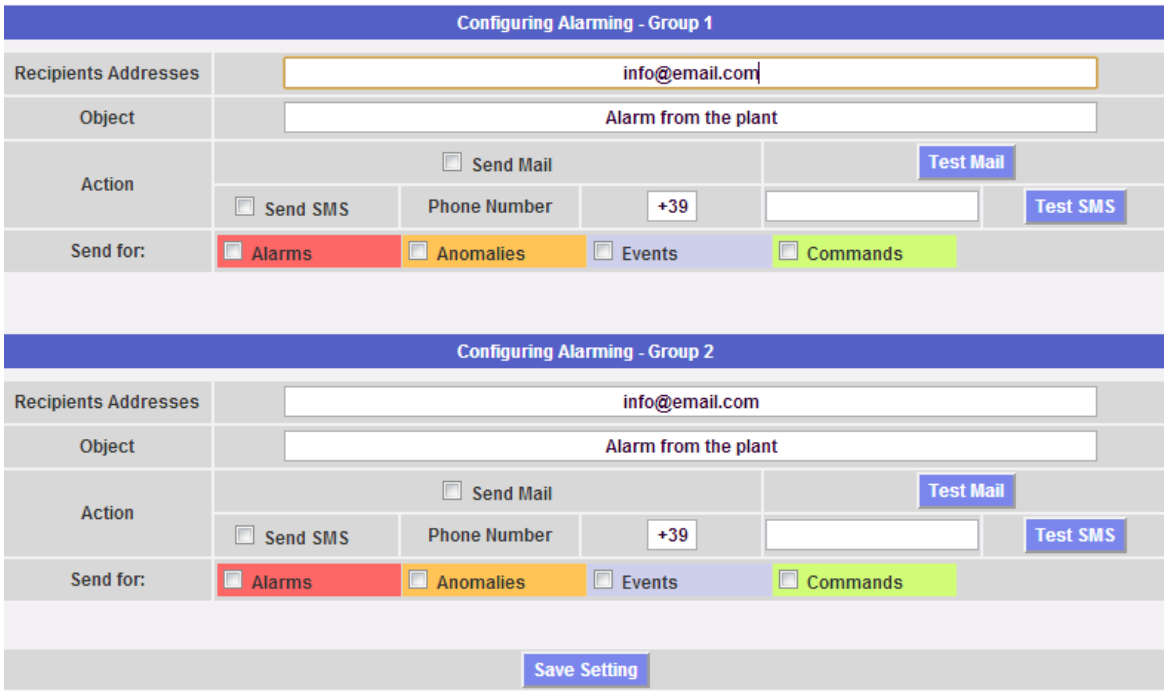


Fig. 13 – Outgoing mail address configuration mask

VMU_C can send an alarm email or SMS to more receivers at the same time and according to pre-set rules. This page contains two separate configuration screens, in order to create two separate users groups to send communications to. In “Send for” selection field, alarm messages can be filtered to be sent to the relevant receivers.

Fill in the fields in both screens according to the following specifications:

“*Receivers' addresses*”: Email addresses of receivers the alarm messages are sent to.

Note: Addresses must be separated by semicolon (;) with no space.

“*Phone number*”: the full telephone number (including international code) to which SMS will be sent

“*Re*”: Subject of email to be sent. (Ex. *Alarm from PV plant*).

“*Action*”:

- “*Send email*”: Check to enable email sending.

Note: To be able to send any mails, the outgoing mail server must be appropriately configured in the system. (See paragraph “*EMAIL*”)

- “*Test Mail*”: Press this key to receive a test email at the email addresses specified in “Receivers' addresses” field.
- “*Test SMS*”: Press this key to receive an SMS test message to the phone number specified in “Phone Number” field.

Note: If the email is not received, check outgoing mail server settings, receiver's address, VMU-C reachability from Internet.

Note: If the SMS is not received, check the phone number and the international prefix code

"*Send in case of*": the selections allows to choose and filter the alarm type to be notified by e-mail and/or SMS. If not sent, the alarm is anyway stored and visible on monitor from Alarms list. Details of alarm types:

- "*Alarms*": High-priority alarms.
- "*Warning*": Low-Medium priority alarms.
- "*Events*": Opening/Closing of digital inputs and outputs
- "*Commands*": Variation of parameters on Eos-Array

For further details on alarm types, refer to "Alarm display" paragraph.
Press "Save setting" key to store settings.

3.1.7 SCHEDULE CONFIGURATION

Clicking on the “SCHEDULE” item will grant access to the page shown in Fig. 12.

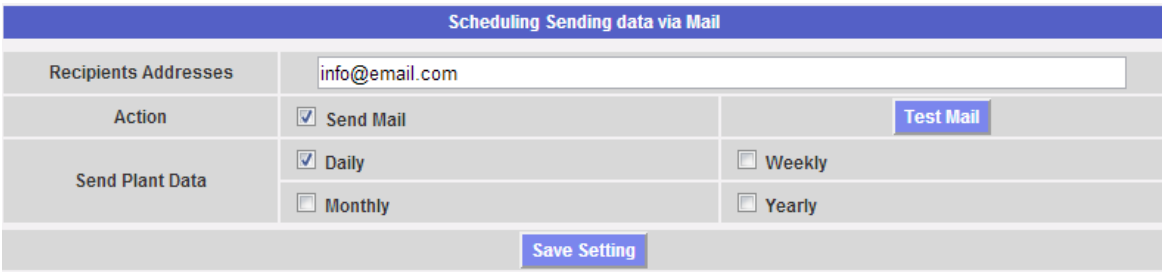


Fig. 14 - Schedule configuration

- *Scheduling Sending data via Mail*

  VMU-C allows scheduling an email sending with a .xls file attached, containing the system production data for the period selected in "Send Data Plant".
  The email can be sent to more receivers at the same time.

Note: To be able to send any mails, the outgoing mail server must be appropriately configured in the system. (See paragraph 3.1.6)

  Fill in the fields in both screens according to the following specifications:

  “*Receivers' addresses*”: Email addresses of receivers the production data are sent to.

Note: Addresses must be separated by semicolon (;) with no space.

  “*Action*”: Enable/disable schedule:

  - “*Send email*”: Check to enable email sending.

Note: To be able to send any mails, the outgoing mail server must be appropriately configured in the system. (See the previous paragraph)

  - “*Test Mail*”: Press this key to receive a test email at the email addresses specified in “Receivers' addresses” field.

Note: If the email is not received, check outgoing mail server settings, receiver's address, VMU-C reachability from Internet.

  “*Send Data Plant*”: Check email sending period.

  - “*Daily*”: every day at 11.59 p.m., a .xls file is sent with daily production data. The file will have the following structure:

Date 2012-07-16	AC Energy on period (read from inverters) (kWh)	AC Instantaneous Power (read from inverters) (kW)	Energy on period (read from energy meters) (kWh)	Instantaneous Power (read from energy meters) (kW)	Solar Irradiation (W/m2)
11:15	0.40	4.5	0.60	6.60	764.00
11:20	0.40	4.6	0.50	6.60	774.00
11:25	0.40	4.6	0.60	6.70	782.00
11:30	0.40	4.7	0.60	6.80	791.00

"Daily" file format

- "*Weekly*": an .xls file containing the production data of each day of the week that just ended is sent at 11:59 p.m. of each Sunday. The file will have the following structure:

Date 2012-07-01	AC Energy on period (read from inverters) (kWh)	AC Instantaneous Power (read from inverters) (kW)	Energy on period (read from energy meters) (kWh)	Instantaneous Power (read from energy meters) (kW)	Solar Irradiation (W/m2)
09:45	0.30	3.0	0.30	4.20	470.00
09:50	0.20	3.0	0.40	4.30	486.00
09:55	0.30	3.1	0.40	4.50	502.00
10:00	0.20	3.2	0.30	4.60	519.00
.....	.....	.....	.....	.....	.....
22:00	0.00	0.0	0.00	0.00	0.00
Date 2012-06-30	AC Energy on period (read from inverters) (kWh)	AC Instantaneous Power (read from inverters) (kW)	Energy on period (read from energy meters) (kWh)	Instantaneous Power (read from energy meters) (kW)	Solar Irradiation (W/m2)
.....	.....	.....	.....	.....	.....
09:35	0.20	2.8	0.30	4.00	438.00
09:40	0.40	2.9	0.30	4.10	450.00
09:45	0.20	2.9	0.40	4.10	458.00
09:50	0.20	3.0	0.30	4.20	470.00
.....	.....	.....	.....	.....	.....
22:00	0.00	0.0	0.00	0.00	0.00
Date 2012-06-29	AC Energy on period (read from inverters) (kWh)	AC Instantaneous Power (read from inverters) (kW)	Energy on period (read from energy meters) (kWh)	Instantaneous Power (read from energy meters) (kW)	Solar Irradiation (W/m2)
.....	.....	.....	.....	.....	.....
09:20	0.20	2.7	0.30	3.90	398.00
09:25	0.20	2.8	0.30	4.00	438.00
09:30	0.30	2.9	0.40	4.10	456.00
09:35	0.30	3.0	0.30	4.30	470.00
09:40	0.20	3.1	0.40	4.40	484.00
.....	.....	.....	.....	.....	.....
22:00	0.00	0.0	0.00	0.00	0.00
Date 2012-06-28	AC Energy on period (read from inverters) (kWh)	AC Instantaneous Power (read from inverters) (kW)	Energy on period (read from energy meters) (kWh)	Instantaneous Power (read from energy meters) (kW)	Solar Irradiation (W/m2)
05:00	0.00	0.0	0.00	0.00	0.00

"Weekly" file format

- "*Monthly*": on the last day of the month at 11.59 p.m., a .xls file is sent with summarized (daily total production) and detailed production data for every day of the month. The file will have the following structure:

Date	AC Energy on period (read from inverters) (kWh)	AC Instantaneous Power (read from inverters) (kW)	Energy on period (read from energy meters) (kWh)	Instantaneous Power (read from energy meters) (kW)	Solar Irradiation (W/m2)
01-06-2012	23.70	5.6	33.80	8.10	290.79
02-06-2012	15.10	4.9	21.30	7.00	211.61
03-06-2012	10.90	5.3	15.40	7.70	134.34
04-06-2012	5.90	1.1	7.90	1.60	64.10
05-06-2012	30.90	6.0	44.50	8.70	361.53
06-06-2012	12.80	3.4	17.90	4.80	163.46
07-06-2012	18.30	5.5	26.20	7.80	241.81
08-06-2012	18.20	5.1	24.20	7.30	201.54

"Monthly" format file

- "*Yearly* ": on December 31st at 11:59 p.m., a .xls file is sent with summarized (daily total production) production data for all months of the year.

Date	AC Energy on period (read from inverters) (kWh)	AC Instantaneous Power (read from inverters) (kW)	Energy on period (read from energy meters) (kWh)	Instantaneous Power (read from energy meters) (kW)	Solar Irradiation (W/m2)
gen-12	348,0	4.7	504,0	6.90	429.35
feb-12	298,0	5.1	433,0	7.50	461.95
mar-12	332,0	4.7	479,0	6.90	266.35
apr-12	331,0	4.9	478,0	7.10	375.32
mag-12	334,0	4.5	482,0	6.60	432.25
giu-12	273,0	4.7	395,0	6.80	323.22
lug-12	316,0	4.9	457,0	7.10	381.43

"*Yearly" format file*

3.1.8 E-MAIL CONFIGURATION (OUTGOING MAIL SERVER)

Clicking on the "E-MAIL" item will grant access to the page shown in Fig. 15.

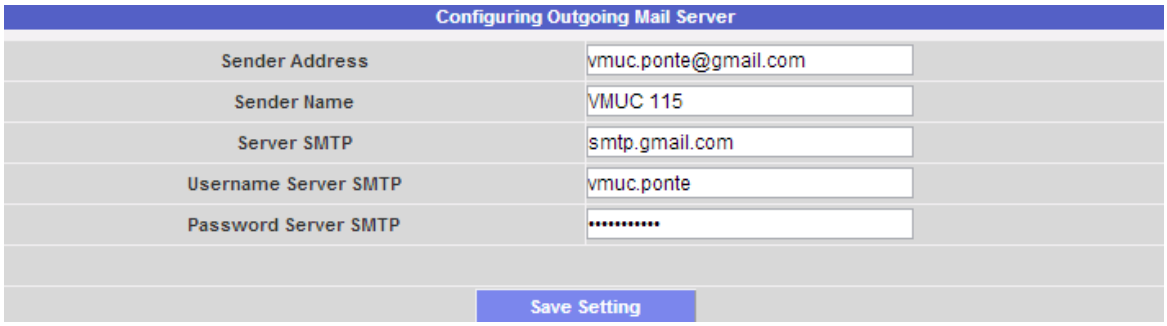


Fig. 15 – Outgoing mail server configuration screen

The outgoing mail server configuration is necessary to send alarms or production data emails. If configuration is incomplete or incorrect, VMU-C cannot send communication by email.

Fill in the fields according to the following specifications:

- "*Sender's address*": E-mail address associated with VMU-C. If the address is not a valid address the e-mail sent by VMU-C might be considered as SPAM.
- "*Sender's name*": Name appearing on email. (Da/ From)
- "*SMTP server"*: Address of SMTP server for outgoing mail.
- "*SMTP server username"*: Username for access authentication to SMTP server.
- "*Password Server SMTP"*: Password for access authentication to SMTP server.

Press "Save setting" key to store settings.

Note: To ensure proper operation of email message sending, refer to "Alarm configuration" paragraph.

Note: Should you use a mail server not requiring the configuration of the "UserName" and "Password" fields, when configuring VMU-C don't fill in the two fields in question.

3.1.9 UPDATING THE VMU-C FIRMWARE

Clicking on the “FIRMWARE” item will grant access to the page shown in Fig. 14.

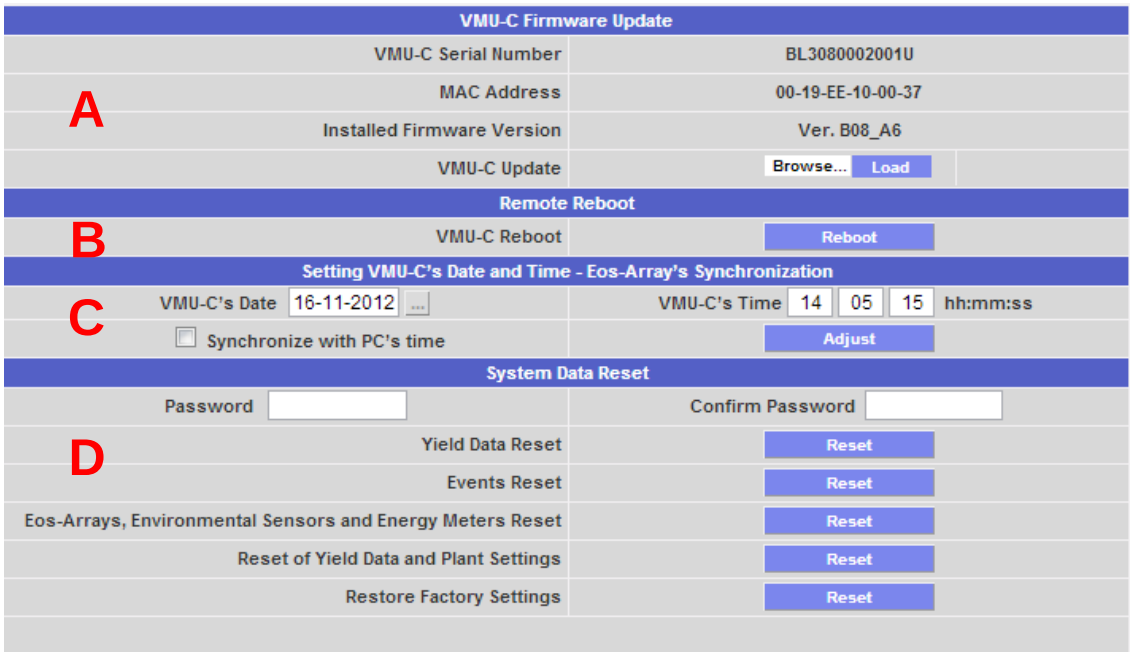


Fig. 16 - Firmware update

The page includes four masks: an update one (see area “A”), a restart one (see area “B”), one allowing to configure the Date and Time in VMU-C and synchronise all the connected devices (see area “C”) and a final mask allowing to manage the RESET commands (see area “D”).

- *Updating the VMU-C firmware (A)*

  The field *Installed Firmware Version* displays the firmware version installed on VMU-C. Pressing the “Browse” button will open a window allowing to specify where the firmware update file has been saved; as soon as you select the file, VMU-C will display the above window again, replacing the “Browse” caption with “OK” (the update file must be obtained from the Carlo Gavazzi technical support department).

  Pressing the “Load” button will open a window prompting you to confirm the firmware update operation. As soon as the update operation is confirmed, the system will prompt you to confirm the operation under way (Fig. 17):

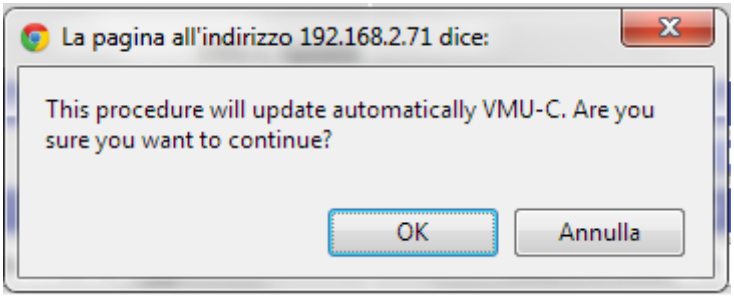


Fig. 17 – Firmware update confirmation

As soon as you give your OK to proceed with the firmware update operation the system will display the screen shown below:

Wait for a couple of minutes until VMU-C is restarted and the new version is installed.

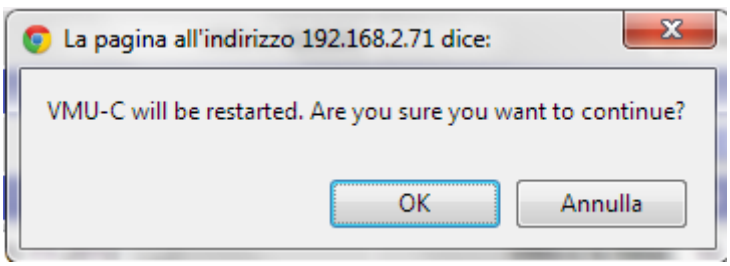
Note: the time necessary to the system for loading the update depends on the speed of the Internet/LAN connection between the PC and VMU-C and could last for several minutes, particularly in connection with cellular modem. Wait for the report to confirm the successful download.

Notes: **updating operation cannot be interrupted after launching the Update command. Do not launch a new update before the system has completed the first one.**

- *Restarting VMU-C (B)*

VMU-C can be restarted through the “RESTART” button.

After issuing the command you will be prompted to confirm that you wish to proceed,



then a countdown will displayed. When it is completed, you will be addressed back to the home page (Fig. 18).

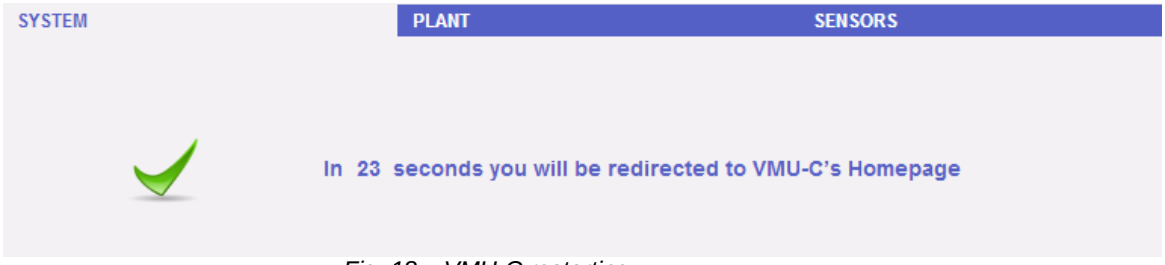


Fig. 18 – VMU-C restarting

Note: during update and restart, web pages can show error messages as VMU-C cannot be temporarily reached.
Wait for a few seconds before restoring connection.

- *Date and Time configuration and Eos-Array device synchronisation (C)*

  By pressing the "***Set***" button you can set the VMU-C internal date and time on all the VMU-M devices connected to VMU-C. If you select the "Synchronise with …" function the date and time sent to the VMU-C and as a consequence to the VMU-M devices connected to it will be those of the PC in use (Fig. 19).

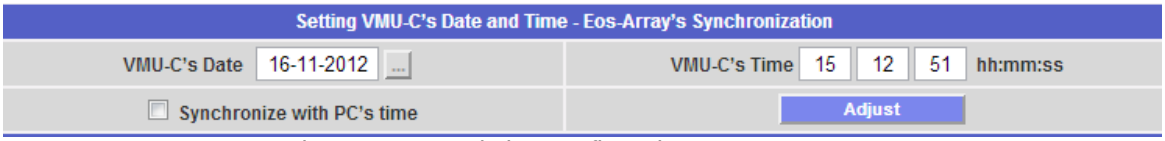


Fig. 19 – Date and Time configuration

- *Resetting system data (D)*

  VMU-C provides 5 different Reset commands (Fig. 20):

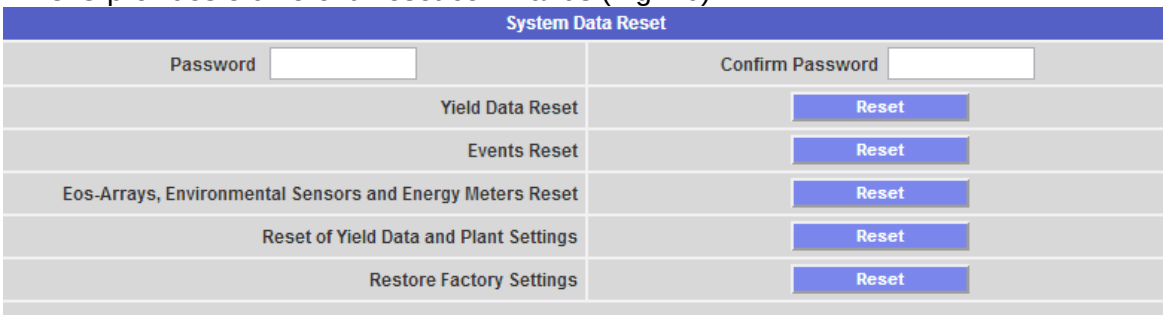


Fig. 20 – Resetting system data

1) Production data reset: it will reset all the production data stored in the internal memory of VMU-C and in the VMU-M devices connected to it (if a memory card has been installed in VMU-C, it is not affected by the Reset command).
2) Event reset: it will reset all the events stored in VMU-C and in the VMU-M devices connected to it (if a memory card has been installed in VMU-C, it is not affected by the Reset command).
3) Eos-Array, environmental sensor and meter reset: it will reset all the environmental sensor data recorded in VMU-C and in the VMU-M devices connected to it (temperatures, radiance and wind speed), as well as the values of the plant kWh meters (if a memory card has been installed in VMU-C, it is not affected by the Reset command).
4) Production data and system setting reset: It combines the three Reset commands described above; it also resets the plant configuration (it doesn't

reset the data concerning the IP address, the SMTP mail server data and all the previously input e-mail addresses).

5) *Restore Factory Settings*: it performs the reset operations described at point 4; it also resets all the settings like IP address, SMTP server and alarm management by e-mail (if a memory card has been installed in VMU-C, it is not affected by the Reset command). Default data (factory settings) will be restored.

Note: to be able to execute any of the reset commands described above , you first need to enter the Administrator "Password" data.

3.1.10 LANGUAGE SETTING

Place the mouse on "SYSTEM", a drop-down menu appears; click on "LANGUAGE"; the relevant section will be displayed, as shown in Fig. 21. From the drop-down menu select the desired language. The system will also display the currently set engineering units.

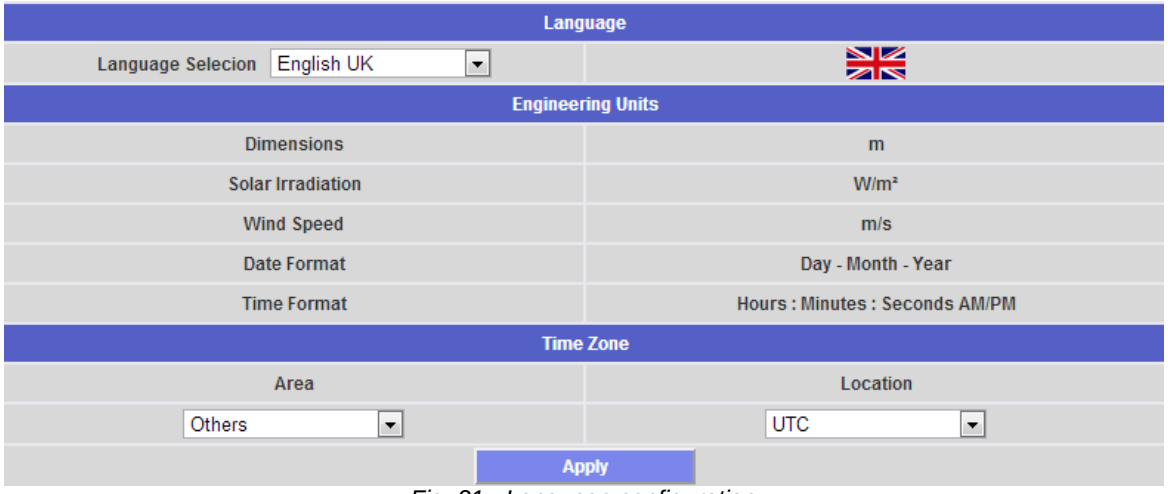


Fig. 21 - Language configuration

You will also have to define the following information:

- Geographic area
- City

This information is required for time management inside VMU-C.

4 INSTALLING THE "PLANT"

Hovering the mouse over "PLANT" will display a drop-down menu consisting of three items: "CONFIGURE COM" , "DRIVER" and "CONFIGURATION" (Fig. 20).

Fig. 22 - Plant Configuration

4.1 CONFIGURE COM

Hovering the mouse over "CONFIGURE COM" will grant access to the page shown in Fig. 23.
The configuration of the "COM 2" port must be carried out during the configuration of the energy meters / inverters connected to VMU-C.

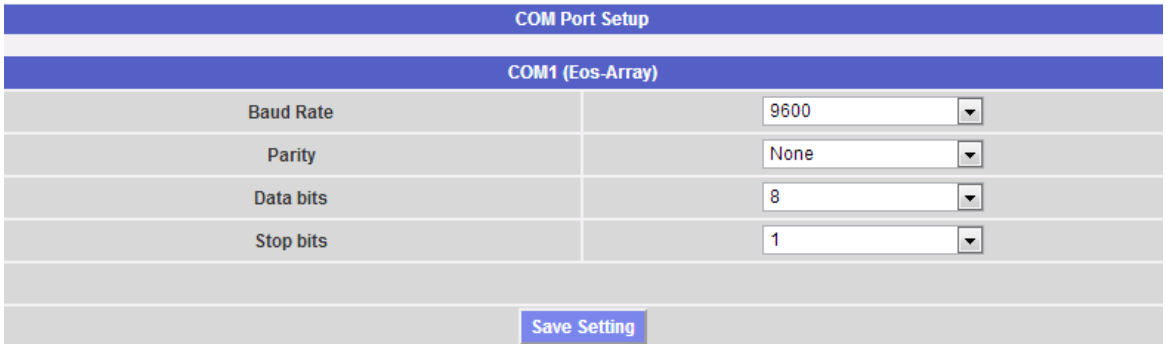


Fig. 23 - Plant Configuration

Note: The communication port RS485 (COM 1) is specifically designed for the communication with the VMU-M belonging to the system and controlled by VMU-C.

Press "Save setting" to store data.

4.2 DRIVERS

When hovering the mouse over “DRIVERS”, the system will display the two items LIST and IMPORT.

- Clicking on the LIST item will grant access to the page shown in Fig. 24, showing (in alphabetical order) all the drivers (Energy Meters and Inverters) available in VMU-C.

Available driver list			
Brand	**Driver**	**Version**	**Instrument**
AEG	I_AEG_PROTECT_MODBUS	2.2	Inverter
AEG	I_AEG_PROTECT_PV10	2.2	Inverter
Ablerex	I_ABLEREX-HELIOS	2.2	Inverter
ELETTRONICA SANTERNO	I_1-PHASE_SUNWAY-M-PLUS	1.0	Inverter
ELETTRONICA SANTERNO	I_1-PHASE_SUNWAY-M-XS	1.0	Inverter
ELETTRONICA SANTERNO	I_3-Phase-TG-TG-TE	2.3	Inverter
Fagor	I_FAGOR_FSI100	2.2	Inverter
Fronius	I_1-Phase-IG	2.1	Inverter
Fronius	I_3-Phase-IG-CL	2.1	Inverter
Gavazzi	E_EM21	2.0	Energy Meter
Gavazzi	E_EM21_PF	2.0	Energy Meter
Gavazzi	E_EM24_AV0	2.0	Energy Meter
Gavazzi	E_EM24_AV5	2.0	Energy Meter
Gavazzi	E_EM24_AV5_PF	2.0	Energy Meter

Fig. 24 – Driver list

- Clicking on the "IMPORT" item will grant access to the page shown in Fig. 25, allowing to import any new drivers made available by “Carlo Gavazzi Controls” along time. Once the new driver(s) loading procedure is completed, press the “Activate” button to actually enable the driver.

Driver Import Procedure	
Select the file using the "Browse" button	Browse...
Press the "Load Driver" key to load the selected driver	Load Driver
Confirm New Driver Activation	Activate

Fig. 25 – Driver import

Note: due to the complexity of the implemented functions, some driver require that some low-level firmware functions are enabled at the same time. In this case you may have to update the whole VMU-C firmware.

4.3 CONFIGURATION

When hovering the mouse over “CONFIGURATION”, the system will display the two items WIZARD and DOWNLOAD (Fig. 26) .

Fig. 26 - VMU-C Configuration

- If the VMU-C configuration has already been completed, clicking on the DOWNLOAD item will allow to export it to a FILE with “DB” extension (Fig. 25) and to same it to one's PC, to import it into VMU-C or into a new machine at a later time.

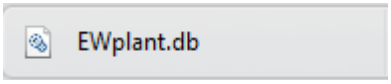


Fig. 27 – VMU-C configuration file

- Clicking on the WIZARD item will grant access to the page shown in Fig. 27, displaying four new sub-menus:
  - Detect Connected Instruments
  - Manual configuration
  - Restore Configuration
  - Import

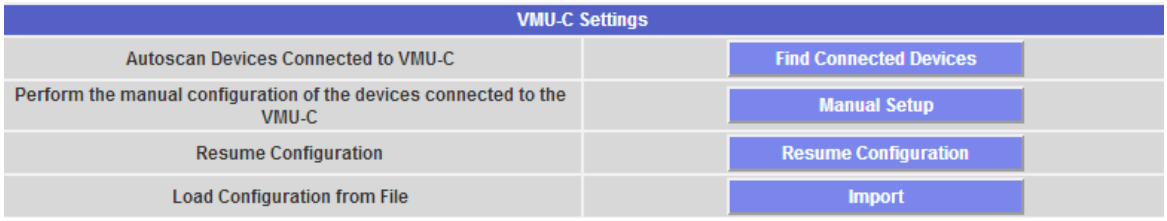


Fig. 28- VMU-C Configuration

- Clicking on the “*Detect Connected Instruments*” item will grant access to the page shown in Fig. 29; through the “Start Scanning” command, it allows to launch the procedure of “self-detection” of the modules connected to the auxiliary bus of VMU-C and of the devices connected to the COM1 communication port (VMU-M and relevant modules).

Note: before starting the configuration procedure described below, the relevant Mod-BUS address (Mod-BUS node number) must have been assigned for all the VMU-M modules. There must be no two devices having the same node number on the same communication bus.

Note: the scanning operation can only detect the devices which are properly connected and powered. The self-detection operation only refers to the COM1 communication bus. Any devices existing on COM2 shall be input and configured manually.

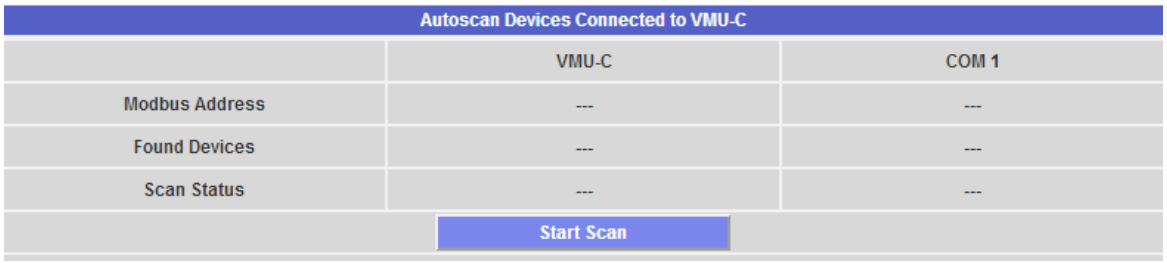


Fig. 29 - VMU-C Configuration

Once the connected device automatic detection procedure has been completed, the system will display the page shown in Fig. 30, indicating the amount of devices identified for each individual COM. Should you see that all the devices connected to the COM ports have been recognised, you can stop the automatic scanning.

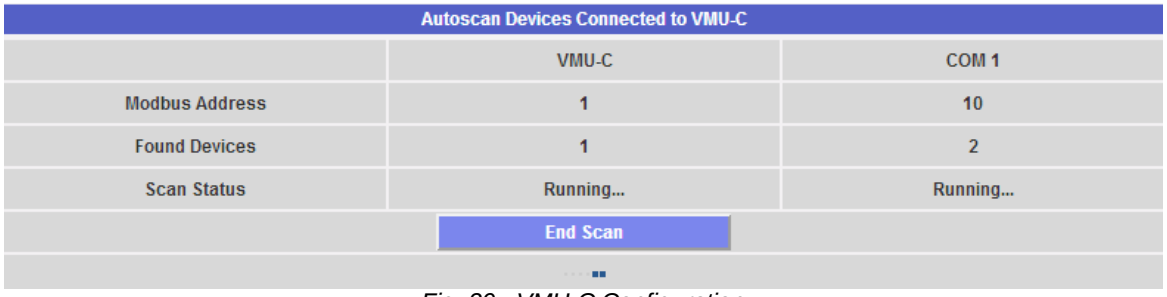


Fig. 30 - VMU-C Configuration

Once the scanning procedure has been completed, if you think it has been successful, by clicking on the "Save Detected Configuration" button (Fig. 29) you can save the information in question.

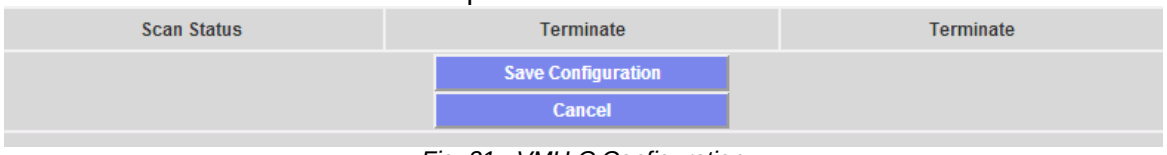


Fig. 31 - VMU-C Configuration

- Clicking on the "*SaveDetected Configuration*" item will grant access to the page shown in Fig. 32.
  It should be noted that clicking on the "*Manual Configuration*" item (Fig. 28) will grant access to the manual configuration section. From now on the ARRAY system configuration will start.
  It should be noted that you still can ADD, MODIFY or REMOVE any VMU-M devices even after they have been self-recognised.

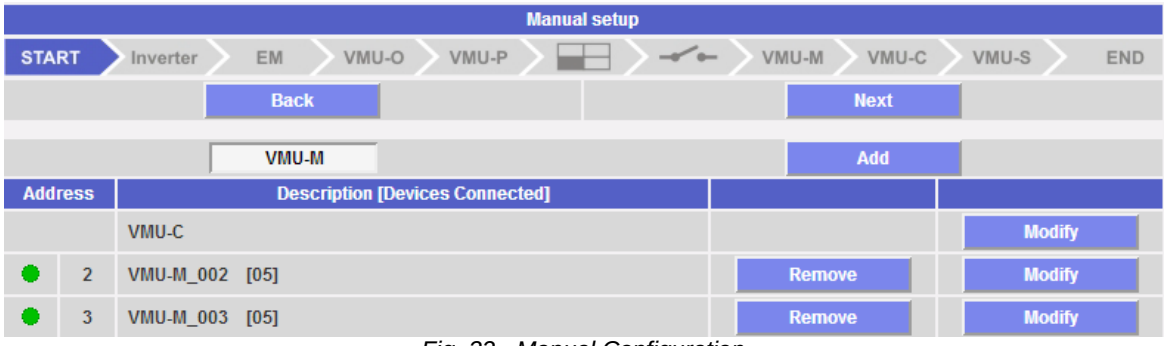


Fig. 32 - Manual Configuration

Note: The two green LEDS shown in figure 32 can switch to 3 different colours, having three different meanings:

- **GREEN :** Configuration OK and serial communication enabled
- **YELLOW :** Configuration OK but serial communication **not** enabled.
- **RED :** Configuration data error. Communication with the relevant module will be impossible

- Clicking on the "Edit" button you can display and modify the structure of each individual VMU-M (Fig. 33), adding or removing any VMU- modules.
- You can modify the serial communication address of the specific VMU-M module.
- You can assign a specific group description (this way it might be easier to identify the box during monitoring)
- You can also associate a further descriptive note with the specific VMU-M module.
- The command "Enable VMU-M module communication in COM1 network" basically enables the communication between the VMU-C master and the relevant box. Otherwise during the scanning of all the connected boxes the VMU-C master shall not enquire this specific VMU-M.

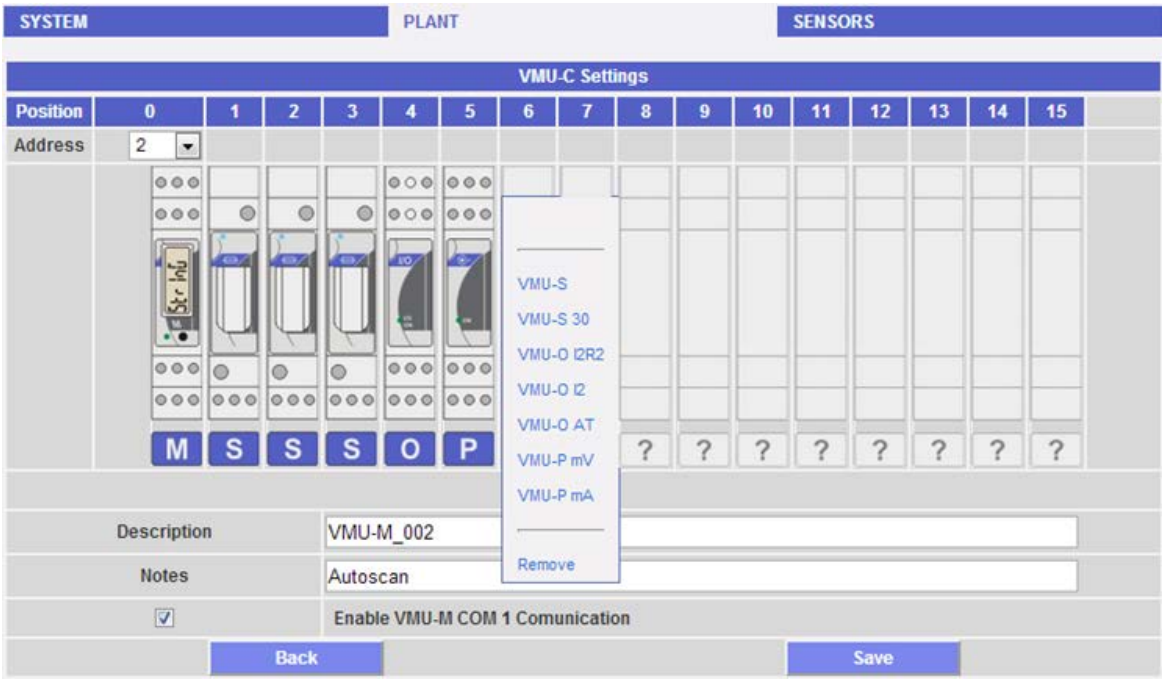


Fig. 33 - VMU-C Configuration

- Clicking on the "Next" button from the "Manual Configuration" page (Fig. 32) will grant access to the configuration of the individual devices, like Inverters, Energy meters and VMU modules.

5 INVERTER CONFIGURATION

Clicking on the “Next” button from the “Manual Configuration” page (Fig. 32) will grant access to the inverter configuration page (Fig. 34)

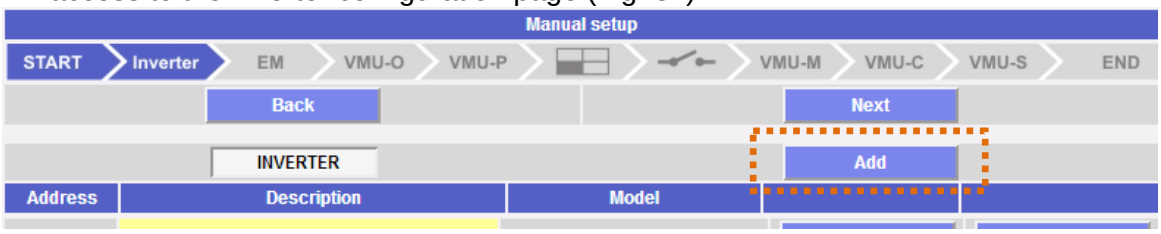


Fig. 34 - Manual Configuration

5.1 ADDING AN INVERTER

Clicking on the “***Add***” button (see orange frame) will display the mask allowing to select the model and the relevant configuration (Fig. 35). Click on the “Edit” button to access the detailed Inverter configuration (Fig. 36)

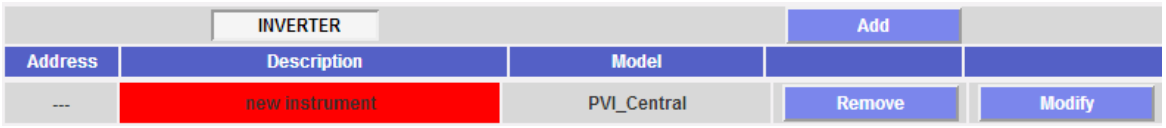


Fig. 35 - Inverter Configuration

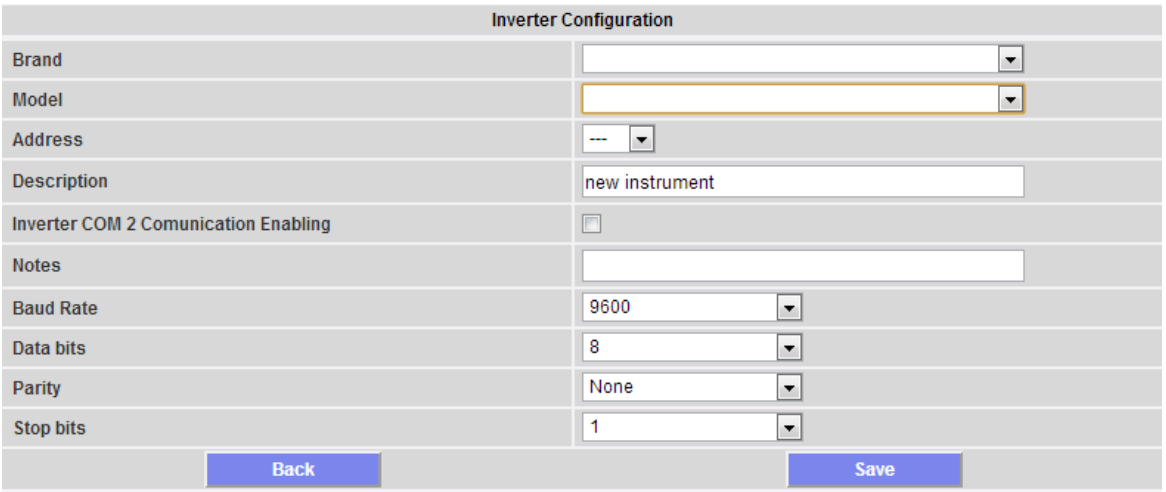


Fig. 36 - Inverter Configuration

Through the drop-down menu of the “Brand” field select the name of the inverter manufacturer (Fig. 37)

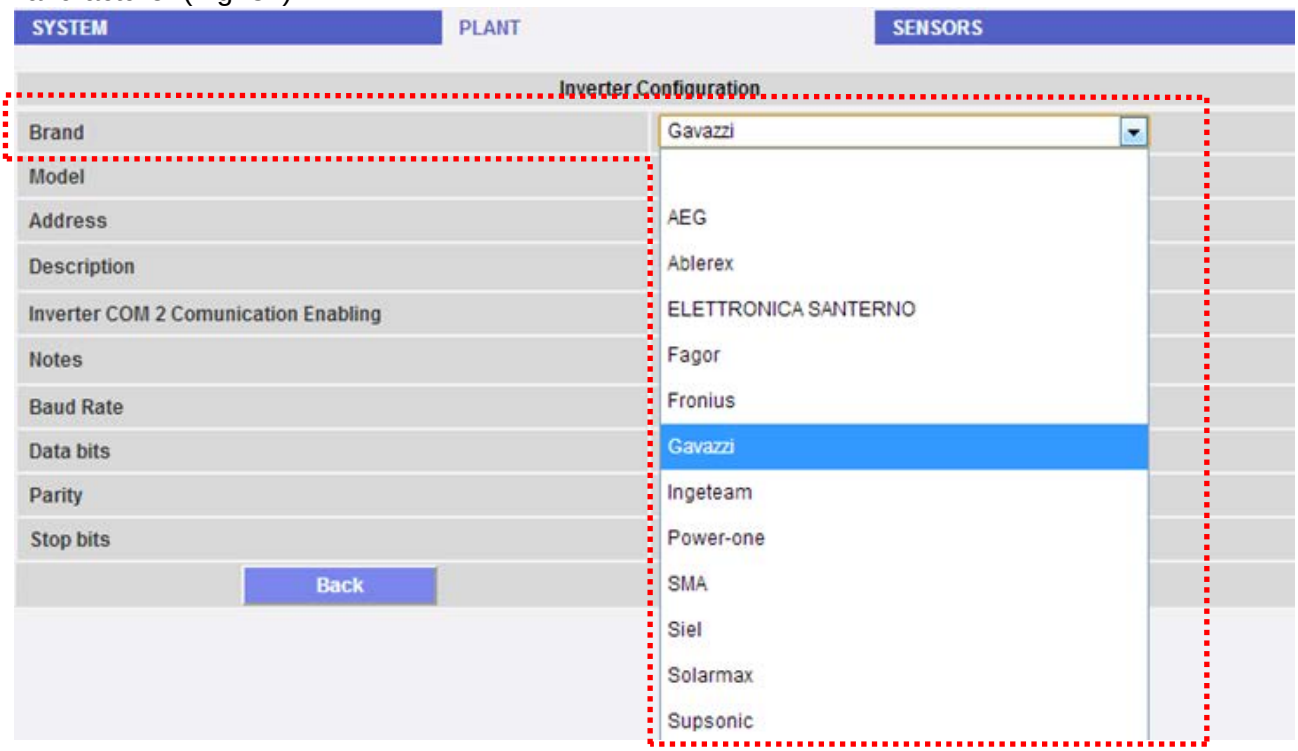


Fig. 37 – Compatible inverter list

Through the drop-down menu of the “Model” field select the specific model of the inverter you are configuring (Fig. 38)

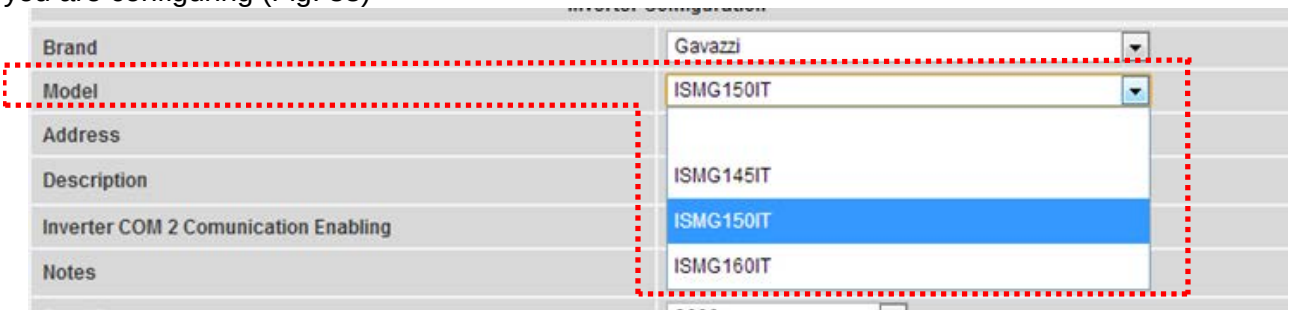


Fig. 38 – Compatible model list

The inverter configuration shall be completed by configuring the following fields:

a) Modbus Address: Specify the address configured on inverter.

> *Note*: Two inverters (or other devices) with the same address cannot exist within the same RS-485 chain. Two or more inverters with the same address prevent their communication.

b) Description: label to be assigned to the inverter. We recommend that you name inverters in progressive order to easily identify them during data or alarm search.

> *Note*: We recommend that you never assign the same “Description” to two different inverters.

c) Enable inverter communication in the COM2 network : Clicking on the relevant box will enable the serial communication of the inverter with VMU-C
d) Notes: Notes field.
e) Communication rate (bps)
f) Data bits
g) Parity
h) Stop bits

When pressing the “Save” button the inverter is inserted and added to the list as shown in Fig. 39.

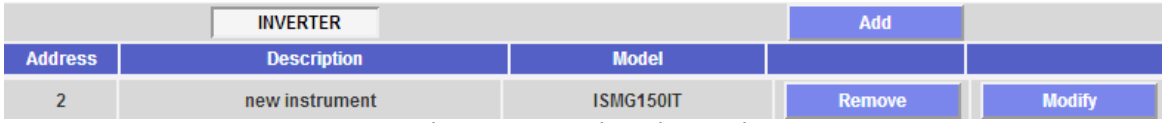


Fig. 39 - Inverter insertion mask

Note: **The “Description” field box** in figure 26 can be displayed in 3 different colours, having as many different meanings:
- **GREY :** Configuration OK and serial communication enabled
- **YELLOW :** Configuration OK but serial communication **not** enabled.
- **RED :** Configuration data error. Communication with the relevant module will be impossible

Click again on the “***Add***” button (Fig. 39) to add other inverters.

5.2 INVERTER DELETION

Press the “Remove” (Fig. 40) to remove an inverter from the configured inverter list.

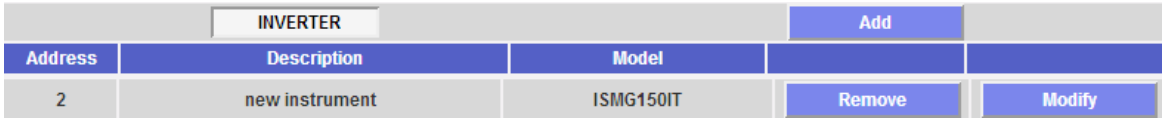


Fig. 40 - Inverter insertion/removal mask

A confirmation message will be displayed (Fig. 41).

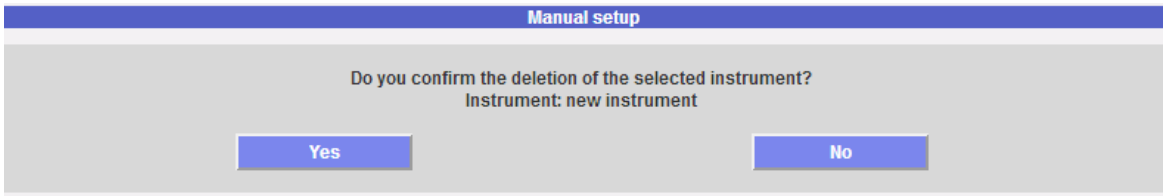


Fig. 41 - Inverter deletion mask

Press ‘YES’ to confirm deletion or “NO” to cancel. When pressing “YES” the inverter is removed from the Inserted Inverter list. All data acquired from VMU-C up to that moment on the deleted inverter are definitely eliminated.

Note: insertions, changes and cancellations of the Inverter will take effect only after the new configuration has been sent to the system through a control. It is not necessary to restart your pc.

6 ENERGY METER CONFIGURATION

Clicking on the “Next” button again from the “Manual Configuration” page will grant access to the Energy Meter configuration page (Fig. 42)

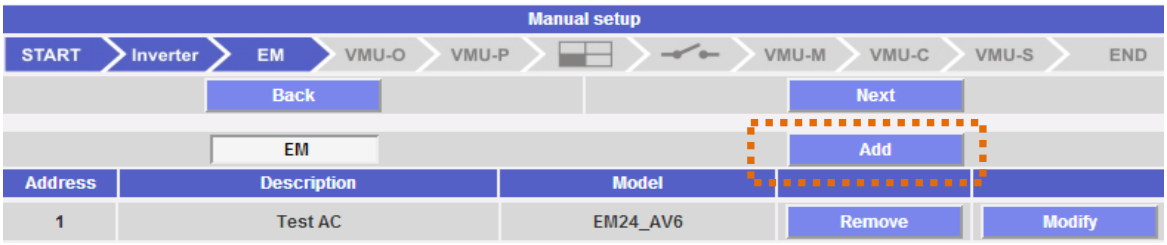


Fig. 42 - Manual Configuration

6.1 INSERTING ENERGY METERS

Clicking on the “***Add***” button (see orange frame) will display the mask allowing to select the model and the relevant configuration (Fig. 43).

Fig. 43 - Manual Configuration

Click on the “Edit” button to access the detailed Energy Meter configuration (Fig. 44)

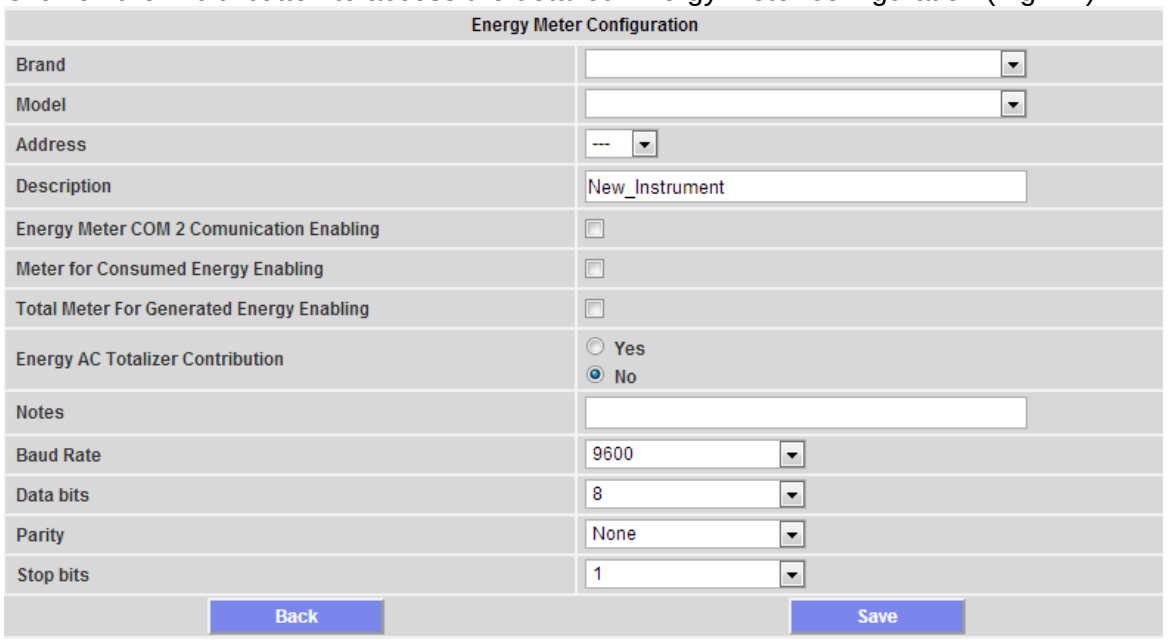


Fig. 44 – Energy Meter configuration

Through the drop-down menu of the “Brand” field select the name of the Energy Meter manufacturer (Fig. 45)

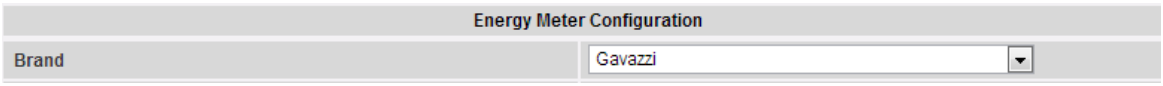


Fig. 45 – List of compatible Energy Meters

> *Note*: Only the Energy Meters manufactured by Carlo Gavazzi are currently compatible with the VMU-C system.

Through the drop-down menu of the “Model” field select the specific model of the Energy Meter you are configuring (Fig. 46)

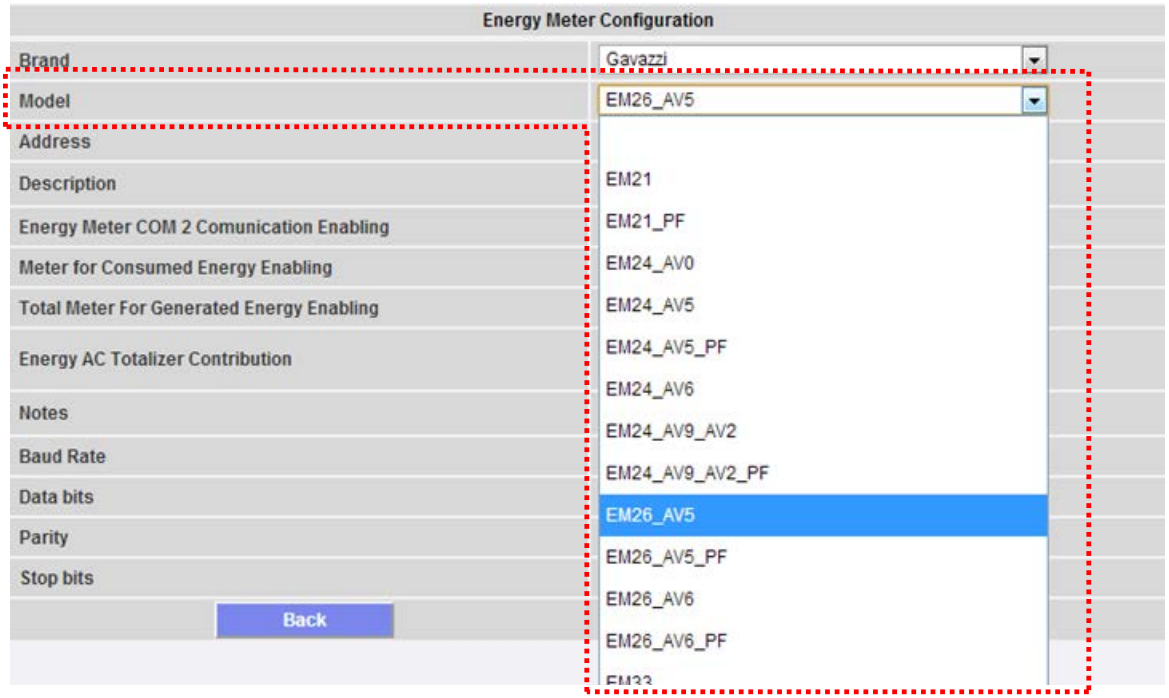


Fig. 46 – Compatible model list

The Energy Meter configuration shall be completed by configuring the following fields:

a) Modbus address: Specify the address configured on the Energy Meter.

> *Note*: Two Energy Meters (or other devices) with the same address cannot exist within the same RS-485 chain. The presence of two or more inverters with the same address prevents any communication with them.

b) Description: Label to be assigned to the Energy Meter. We recommend that you name instruments in progressive order to easily identify them during data or alarm search.

> *Note*: We recommend that you never assign the same “Description” to two different instruments.

c) Enable energy meter communication in the COM2 network : Clicking on the relevant box will enable the serial communication of the instrument with VMU-C

d) Enable the energy consumption measuring instrument: the energy measured by this instrument shall be considered as having been consumed. This value shall not be used for the calculation of efficiency (Total and/or BOS).
e) Total meter for generated energy enabling: Click on the relevant box if there is only 1 Energy Meter installed for generated energy metering (don't click on this box when multiple meters are installed).
f) Energy AC totalizer contribution: If there are 2 or more Energy Meters, you can define whether the energy metered by the instrument in question must be summed to the energy produced by the other instruments (to obtain the total produced energy) or if for some reason the specific meter shall not be considered.
g) Notes: Notes field.
h) Communication rate (bps)
i) Data bits
j) Parity
k) Stop bits

When pressing the "Save" button the Energy Meter is inserted and added to the list as shown in Fig. 47.

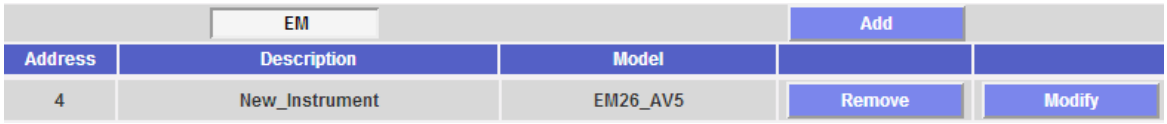


Fig. 47 - Inverter insertion mask

Note: **The "Description" field box** in figure 47 can be displayed in 3 different colours, having as many different meanings:
- **GREY :** Configuration OK and serial communication enabled
- **YELLOW :** Configuration OK but serial communication **not** enabled.
- **RED :** Configuration data error. Communication with the relevant module will be impossible

Click again on the "***Add***" button (Fig. 47) to add other Energy Meters.

6.2 DELETING ENERGY METERS

Press the "Remove" (Fig. 48) to remove an instrument from the list of the configured Energy Meters.

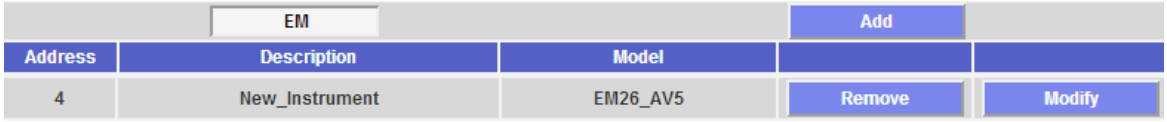


Fig. 48 – Energy Meter insertion/removal mask

A confirmation message will be displayed (Fig. 49).

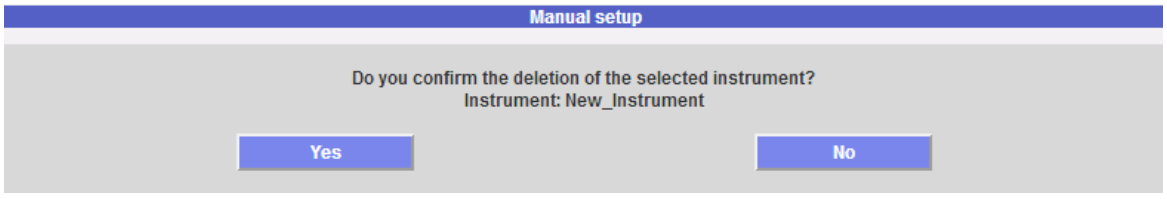


Fig. 49 – Energy Meter deletion mask

Press ‘YES’ to confirm deletion or “NO” to cancel. If you press “YES” the Energy Meter is removed from the Inserted Meter list. All data acquired from VMU-C up to that moment on the deleted Energy Meter are definitely eliminated.

Note: insertions, changes and cancellations of the Energy Meters will take effect only after the new configuration has been sent to the system through a control. It is not necessary to restart your pc.

7 CONFIGURATION OF VMU-O MODULES

If during the “device auto-detection” stage one or more VMU-O modules have been identified (there may be up to 3 VMU-O modules for each group), the system will display the screen shown in Fig. 50.
The Eos-Array auto-detection procedure operates in ‘self-teaching’ mode; that means it scans all the devices existing on the COM1 port, records their location and displays the current configuration.

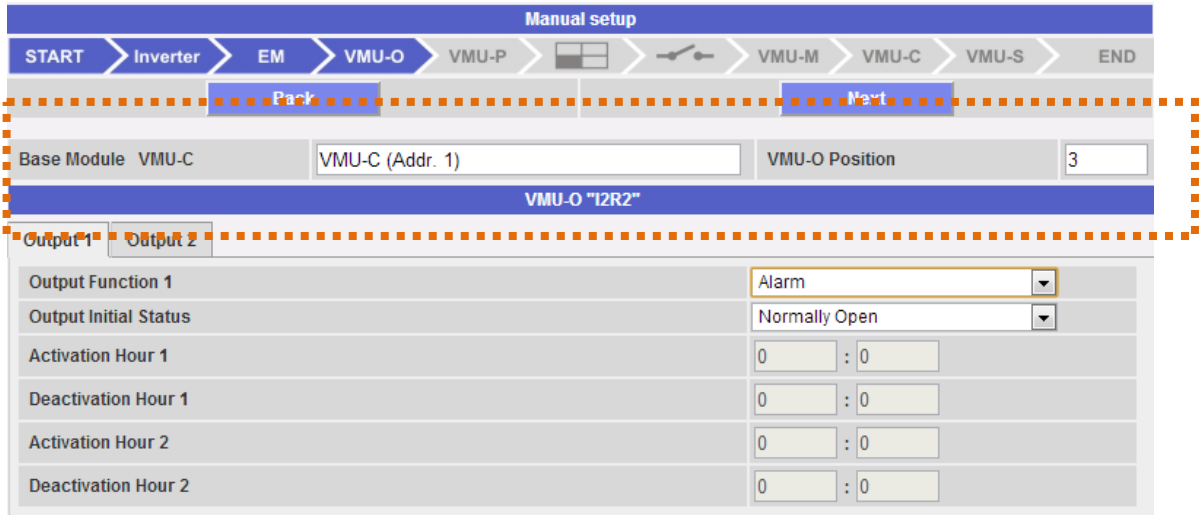


Fig. 50 – VMU-O module configuration mask

In the area marked by the orange dots the system will automatically display the information concerning the source base module (VMU-C or VMU-M) and the location of the VMU-O module within the Array system.

Indicate for each of the two outputs (Output1 and Output2) the function to be applied (Remote, Alarm, Clock): see Fig. 51:

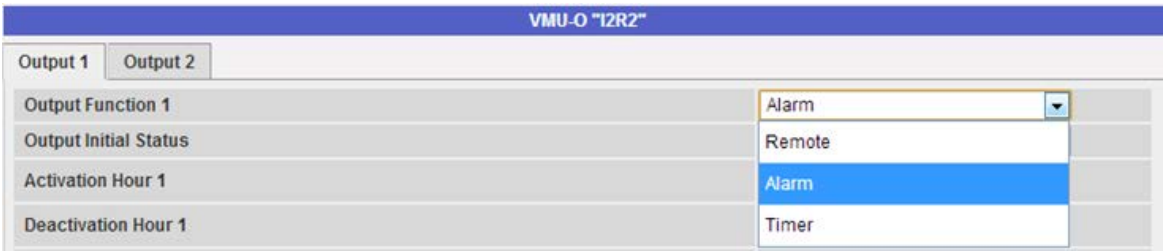


Fig. 51 – VMU-O usage mode configuration mask

- *Remote*: Activation and deactivation are performed through a special command sent by the operator through VMU-C.
- *Alarm*: The output is associated with an alarm condition. This selection also allows to define the initial state of the relay (Normally closed or Normally open).
- *Clock*: Activation and deactivation are carried out at the time set in VMU-C.

8 CONFIGURATION OF VMU-P MODULES

If during the “device auto-detection” stage one or more VMU-P modules have been identified the system will display the screen shown in Fig. 52 (for each ARRAY group there may be at most 1 VMU-P module; VMU-C can manage up to 11 groups).
The Eos-Array auto-detection procedure operates in ‘self-teaching’ mode; that means it scans all the devices existing on the COM1 port, records their location and displays the current configuration.

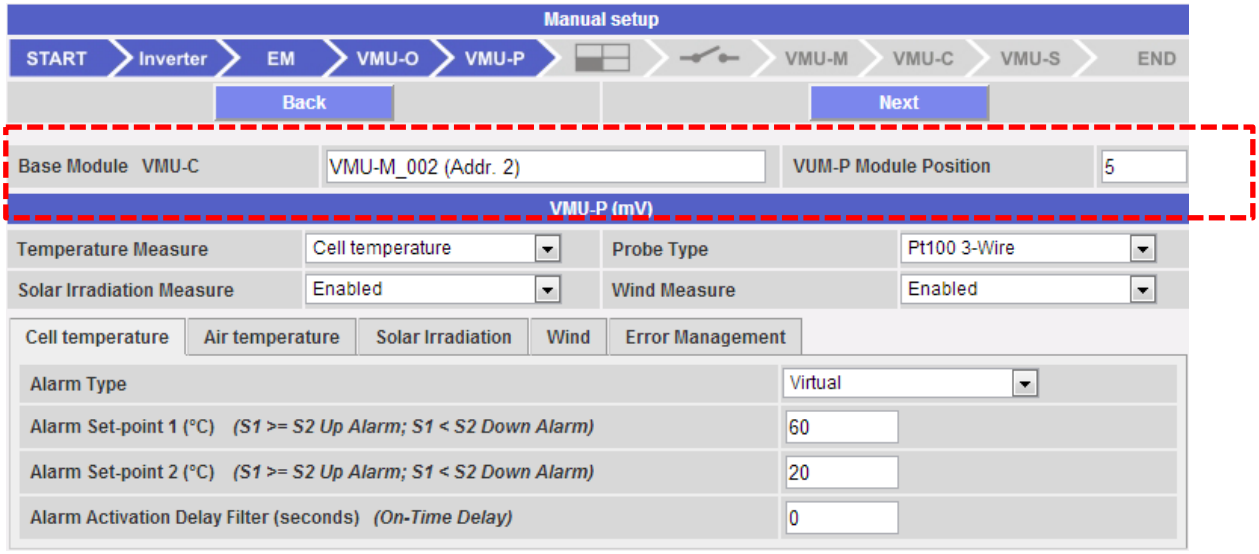


Fig. 52 – VMU-P module configuration mask

In the area marked by the orange dots the system will automatically display the information concerning the source base module (VMU-C or VMU-M) and the location of the VMU-P module within the Array system.

Indicate for each module which temperature measurements shall be monitored (Air/cell temperature or both) and with which type of sensor (you can choose between Pt100 or Pt1000 probes, with 3 or 2 wires).

For each module you can also enable (or disable) the radiance and wind speed measurements.

8.1 CONFIGURING ALARMS ON VMU-P MODULES

Each VMU-P module can manage specific alarms for each of the managed dimensions (Fig. 53):

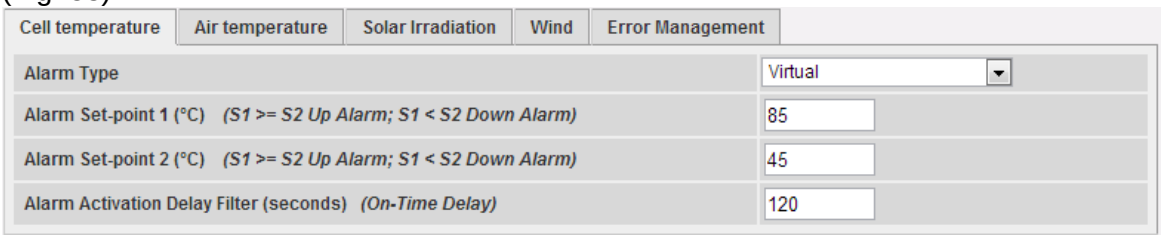


Fig. 53 – VMU-P alarm configuration mask

- *Cell temperature*
- *Air temperature*
- *Radiance*
- Wind speed

For each alarm you can define the activation thresholds and the relevant usage mode:

- Up alarm: Treshold1 equal to or higher than Threshold2
- Down alarm: Threshold1 lower than Threshold2

Each individual alarm can remain disabled, or be enabled as a Virtual Alarm, ore you can link each individual alarm to a digital output (Fig. 54)

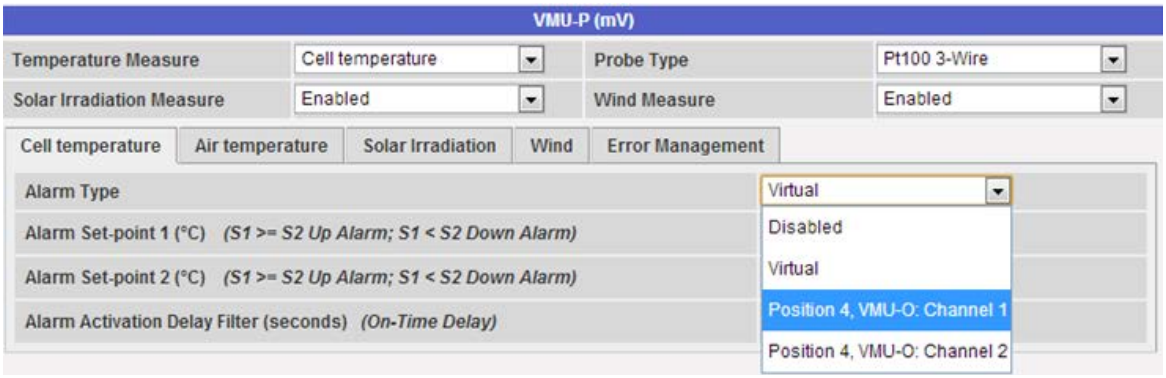


Fig. 54 – VMU-P alarm configuration mask

Each alarm can be associated with a different “Delay on activation” value (a value expressed in seconds, which can range between 0 and 3600).

For the configuration of the radiance and wind speed alarm, besides the alarm thresholds Threshold1 and Threshold2, you need to set the data referring to the specific installed sensor:

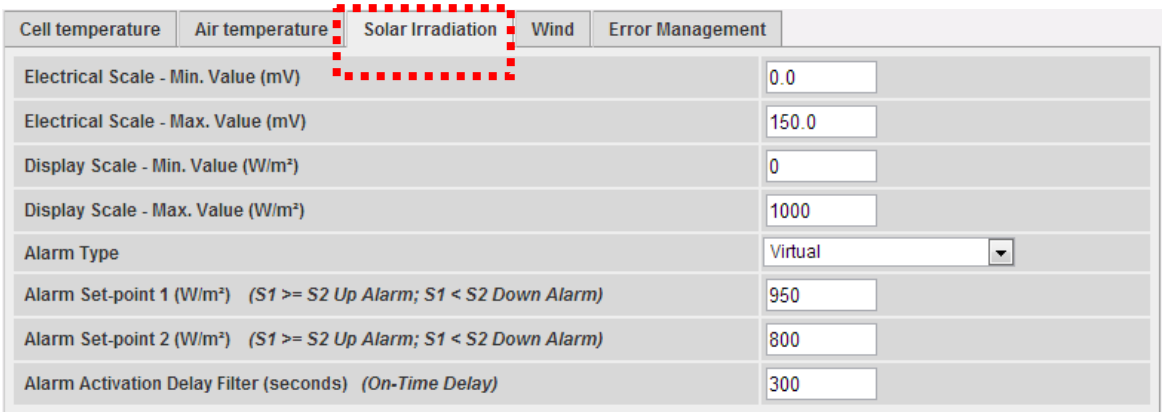


Fig. 55 – Radiance alarm configuration mask

- Electric Scale – Minimum Value (mV): conversion parameter allowing to obtain the radiance measurements (minimum value of the input signal).
- Electric Scale – Maximum Value (mV): conversion parameter allowing to obtain the radiance measurements (maximum value of the input signal).
- Displayed Scale – Minimum Value (W/m2): Minimum value (in W/m2) to be displayed at the minimum input value (mV).
- Displayed Scale – Maximum Value (W/m2): Maximum value (in W/m2) to be displayed at the maximum input value (mV).

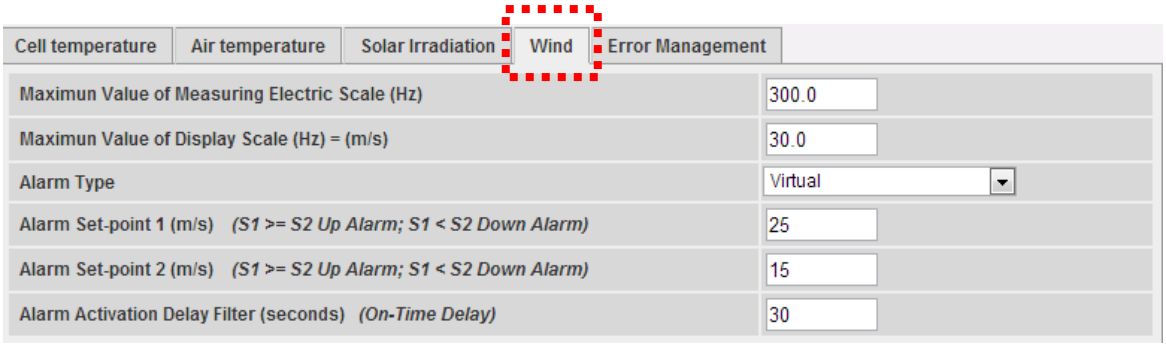


Fig. 56 – Wind speed alarm configuration mask

- Electric scale measurement maximum value (Hz): conversion parameter allowing to obtain the wind speed measurements (maximum frequency value the sensor can generate).
- Maximum displayed scale value (m/s): Wind speed value at the maximum frequency signal value.

You can also set the activation of an alarm in case of errors in the operation of the module itself. Each alarm is associated with one or more error conditions on the module. You can associate the managed errors with an output to be activated. The list allowing to select the Output associated with the alarm shall include the output of the VMU-O modules existing in the group with the Alarm setting (Fig. 57).

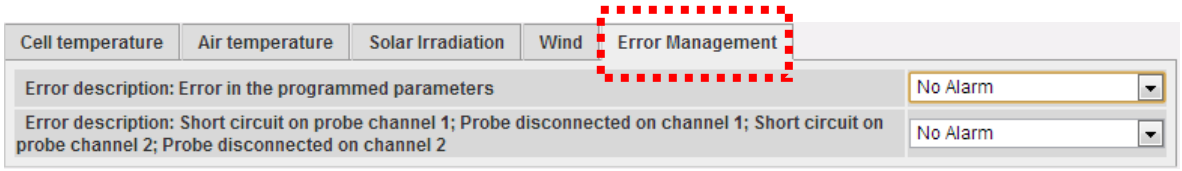


Fig. 57 – Configuration mask for alarm triggering in case of error

9 CONFIGURING THE AREAS

The VMU-C monitoring system allows to manage multiple AREAS inside the same system. The term AREAS indicates different zones inside the same photovoltaic field which due to their exposure or to the technology in use are expected to behave differently. You can set up to 11 different areas. Each area must be associated with a VMU-P module.

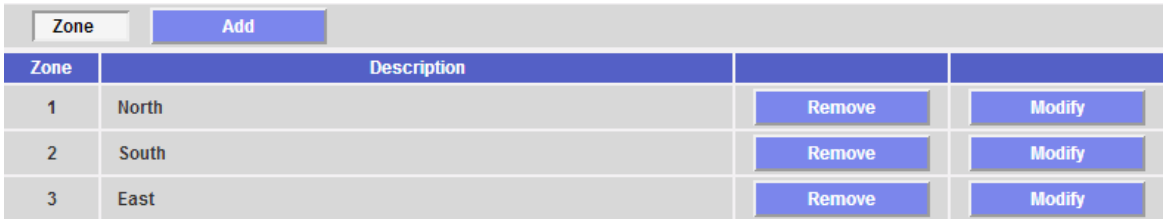


Fig. 58 – AREA configuration mask

Pressing the "Edit" button grants access to the area configuration page (Fig. 59):

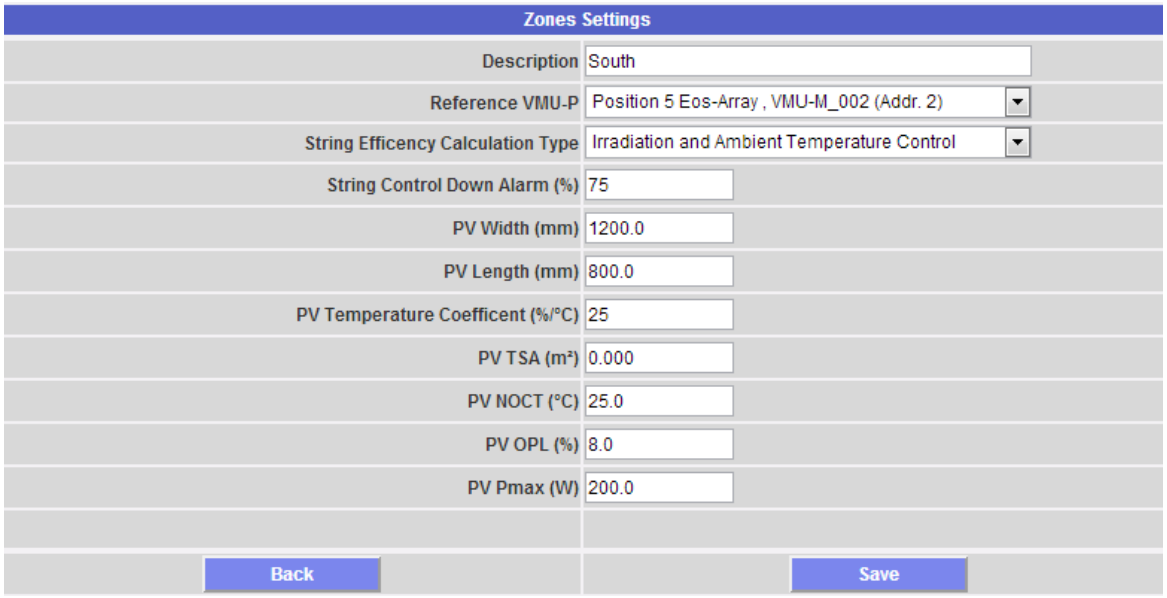


Fig. 59 – Individual AREA configuration mask

The parameters to be entered are described below:

- *Description*: Descriptive field
- *Reference VMU-P module*: each area must have a reference VMU-P module. The radiance and temperature data obtained through the relevant VMU-P module shall be used to calculate the efficiency of the individual area.
- *String efficiency calculation type*: the system provides 3 different efficiency calculation methods: a) No radiance/temperature measurement but comparison between strings. b) Through the measurement of radiance and cell temperature. c) Through the measurement of radiance and air temperature.
- *Down alarm string control (%)*: Set the value (%) for the string control. The set value refers to the string power value calculated as median or Match Max (Fig. 68). In the example shown above, should a string show a power value lower than 50% of the power value calculated according to the median of the individual strings, the relevant alarm shall be triggered.

- Photovoltaic module width (mm): module dimension (please refer to the technical data sheet of the panels in use).
- Photovoltaic module length (mm): module dimension (please refer to the technical data sheet of the panels in use).
- Photovoltaic module temperature coefficient (%/°C): reduction value of the photovoltaic module Max power as a function of the module temperature (please refer to the technical data sheet of the panels in use).
- Photovoltaic module TSA (sq m): Total String Area. Specific AREA value in sq m (the value is calculated automatically).
- Photovoltaic module NOCT (°C): Nominal operating cell temperature (please refer to the technical data sheet of the panels in use).
- Photovoltaic module OPL (mm): Other Power Loss (please refer to the technical data sheet of the panels in use).
- Photovoltaic module Pmax (W): Maximum nominal power of the photovoltaic panel (please refer to the technical data sheet of the panels in use).

Press the “Previous” button to return to the previous mask without saving any changes to the set data. If you press the “Save” button, the input data shall be confirmed and ready to be transferred into VMU-C.

Repeat the operation described above for each individual AREA.

9.1 ASSOCIATING THE AREAS

Pressing the “NEXT” button again will grant access to the screen allowing to associate the individual groups (VMU-M or the VMUC itself) with the relevant area (Fig. 60).

Zones - VMU-M link

MODULE	DESCRIPTION	ZONE
VMU-C	VMU-C	North
VMU-M	VMU-M_002	South
VMU-M	VMU-M_003	East

Fig. 60 – Individual AREA configuration mask

Clicking on the drop-down menu (see “AREA” column) will display all previously created areas. Select the relevant source area for each VMU-M or VMUC device (Fig. 61).

Zones - VMU-M link

MODULE	DESCRIPTION	ZONE
VMU-C	VMU-C	North
VMU-M	VMU-M_002	No Zone
VMU-M	VMU-M_003	North
		South
		East

Fig. 61 – Individual AREA configuration mask

If you press the “NEXT” button, the newly defined configuration shall be saved and you shall access the next screen.

10 CONFIGURING THE MANUAL COMMANDS FOR THE OUTPUTS OF THE VMU-O MODULES

Pressing the “NEXT” button again will grant access to the screen allowing to configure the manual commands of the relay outputs on the VMU-O modules (Fig. 62).
Through this function, by using a manual command, you'll be able to remotely activate or deactivate (through the Internet) the digital outputs of the VMU-O modules installed on-field.

Note: To be able to use this function, the outputs on the VMU-O modules must be set to REMOTE control.

Note: You can create up to 20 manual commands.

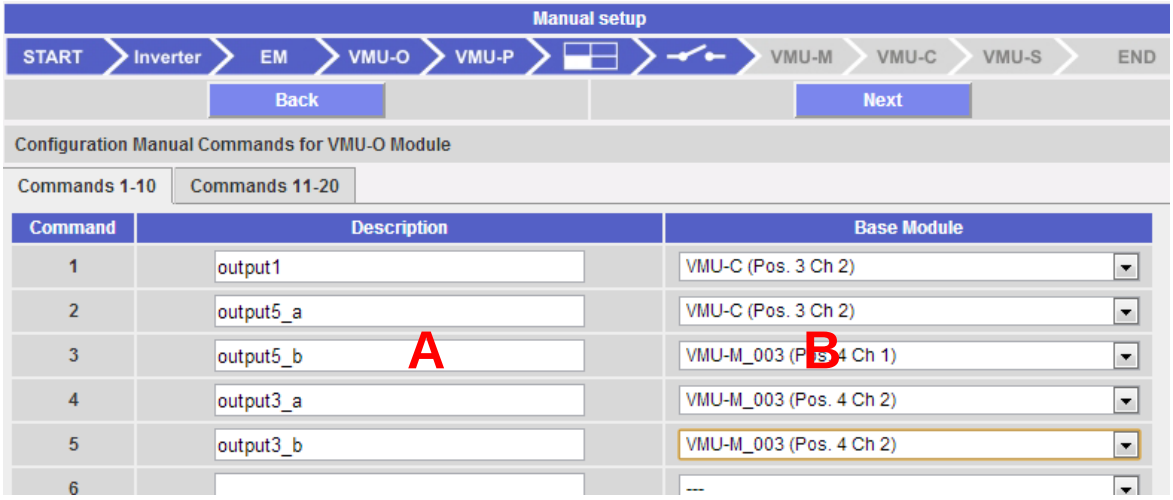


Fig. 62 – VMU-O output manual command configuration mask

- In the “A” column you can associate each command with a label you can use to easily identify the function the command in question will activate (for example “Outdoor lighting switch-on”).
- The “B” column allows to associate the descriptive label (see the above paragraph) with the digital output defined for the purpose. Opening the drop-down menu will display the list of all the outputs previously set to REMOTE control (Fig. 63).

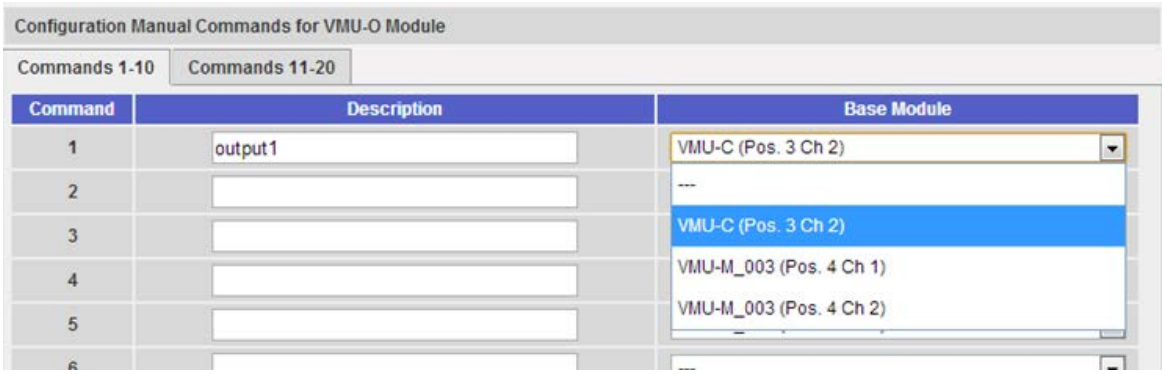


Fig. 63 – VMU-O output manual command configuration mask

11 CONFIGURING THE VMU-M MODULES

Pressing the "NEXT" button again will grant access to the screen allowing to configure the VMU-M modules connected to VMU-C (Fig. 61).

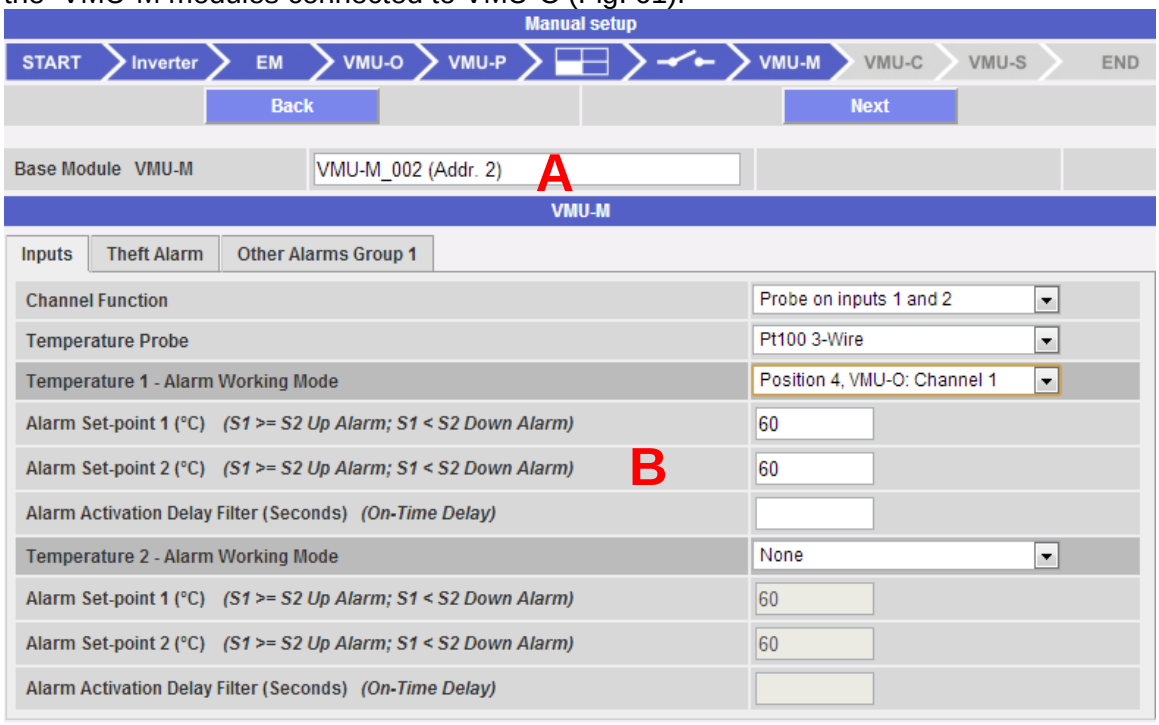


Fig. 64 – VMU-M module configuration mask

- The box marked with "A" above displays the previously defined label (Fig. 33) and the ModBus address of the specific VMU-M module.
- Section "B" is used for the configuration of the digital or temperature inputs, for the "Anti-theft" alarms (if any) and for other general alarms. The paragraphs below will describe the three pages:
  A. **Inputs**:
  In this section you have to define the use of the inputs on the VMU-M module:
  - ⇨ NONE: The module inputs will have no use.
  - ⇨ For TEMPERATURE reading (on one or two channels; probe type: Pt100 or Pt1000, 2 or 3 wires).
  - ⇨ DIGITAL: Digital input "1" shall be used to read the status (Open/Closed) of a digital contact (for example to detect whether

the DC protection has tripped or not). Digital input “2” : it cannot be used.

Note: When in puts are used for temperature reading you also have to define whether you wish to manage the ALARM function for each channel. In this case you have to set the values of “Threshold 1” and of “Threshold 2” (for values of “T1” exceeding or equal to those of “T2” you will get a MAXIMUM alarm; for values of “T1” lower than those of “T2” you will get an alarm with MINIMUM operation). You also have to define whether the alarm must be VIRTUAL or REAL (associated with a relay output of VMU-O) (Fig. 65).

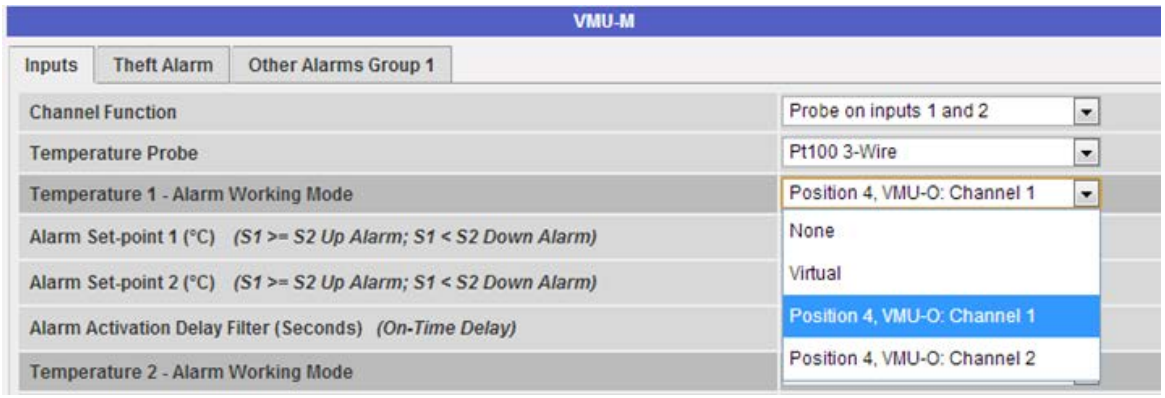


Fig. 65 – Mask for alarm configuration on VMU-M module

B. **Theft alarm**:
In this section you have to define the use of the THEFT ALARM function (Fig. 66):

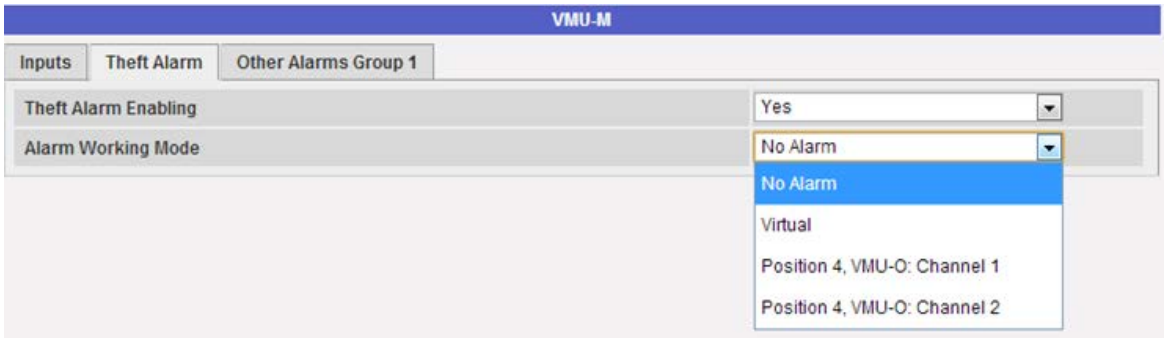


Fig. 66 – THEFT alarm configuration mask

Note: This function can only be activated if the VMU-O AT module is installed

Note: When the function is enabled, you need to define whether the alarm must be VIRTUAL or REAL (associated with a relay output) (Fig. 57).

C. **Other group alarms**:
In this section you have to define the use of further alarms managed by VMU-M (Fig. 67):

Fig. 67 – Other alarm configuration mask

Note: Should VMU-C detect that the VMU-M programming is inconsistent with the modules connected to it, you can choose whether the error shall not be managed or whether an alarm shall be triggered on a physical output.

***Note**:* Repeat the **VMU-M MODULE CONFIGURATION** procedure for each of the VMU-M modules connected to the VMU-C.

12 CONFIGURING THE VMU-C MODULES

Pressing the “NEXT” button again will grant access to the screen allowing to fully configure the VMU-C module (Fig. 68):

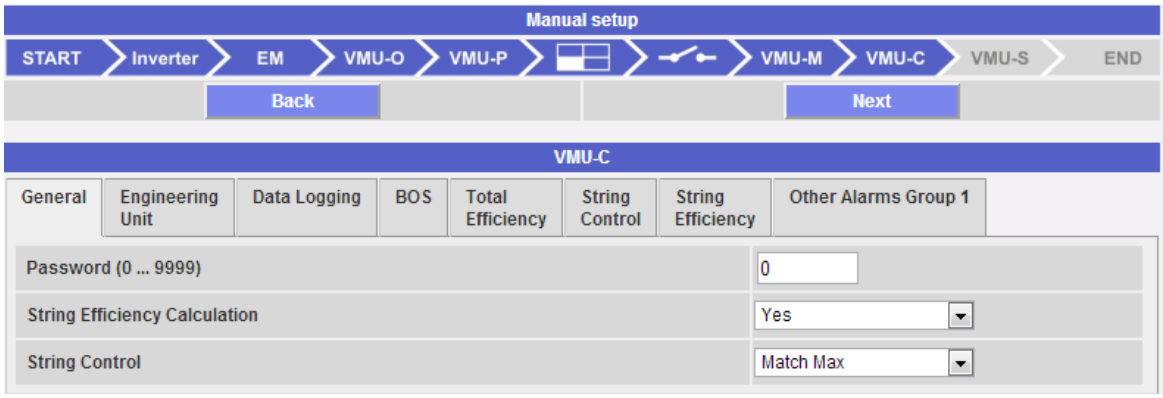


Fig. 68 - VMU-C configuration mask

The paragraphs below describe the individual pages allowing to configure the available functions:

- **GENERAL**: it allows to set a password whose function is protecting the devices against unwanted configuration changes or reset commands.
  In this page you also have to define whether String Efficiency calculation should be enabled or not (YES / NO).
  Also in this page you have to configure the calculation method for the *String Control* function; you can choose between the following three options:
  - **Disabled:** String control is not enabled.
  - **Median:** this function can only be used if there are at least two strings (VMU-S modules). This calculation method is recommended for large size plants. The reference power value is the result of the median, calculated by the VMU-C module, between all the VMU-S modules. The alarm condition occurs when one of the powers measured for each string exceeds the set percentage limit with respect to the reference (see Fig. 59). Note: the median indicates the number occupying the central position in a set of numbers; that means one half of the numbers has a value which is higher than the median, while the other half has a lower value. For example, the median of 2, 3, 3, 5, 7 and 10 is 4.
  - **Coinciding with the maximum value:** this function can only be used if there are at least two strings (VMU-S modules). This calculation method is recommended for small size plants. The reference power value is the highest values measured between the different strings. The alarm condition occurs when one of the powers measured for each string exceeds the set percentage limit with respect to the reference.

Note: The tripping threshold for this alarm is defined in the AREA configuration page, under *“Down alarm string control (%)”* and is common to the whole system (see Fig. 59).

- **MEASURING UNITS**: it allows to set the engineering units for the *Temperature* (°C or °F), *Dimension* (m or ft) and Radiance (W/m2 or W/ft2) measurements

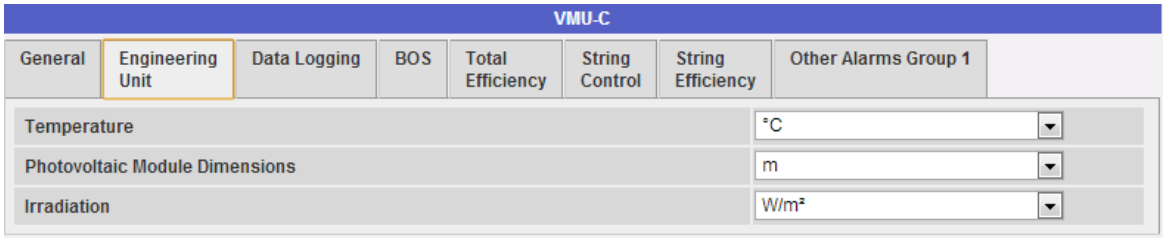


Fig. 69 – Engineering unit configuration mask

- **DATA LOGGING**: It allows to activate the Data Logging function and to define the relevant storage interval (Fig. 70).

Note: The storage interval can be set between a minimum of 5 min. and a maximum of 60 min. The available values are: 5min – 10min – 15min – 30min – 60 min.

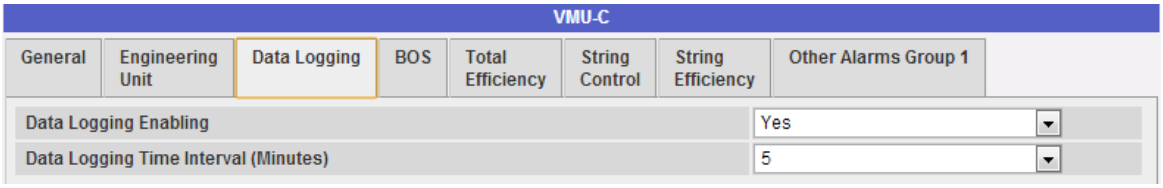


Fig. 70 – Data logging time configuration mask

- **BOS**: it allows to activate an alarm associated with the calculation of the BOS (Balance Of System) Efficiency. The operating modes of the alarm are: *Disabled*, activated as a *virtual alarm*, activated and *associated with a physical output* (Fig. 71).

Note: You will have to set the "Threshold 1" and "Threshold 2" values (for values of "T1" exceeding or equal to those of "T2" you will get a MAXIMUM alarm; for values of "T1" lower than those of "T2" you will get an alarm with MINIMUM operation). You can also set a delay for alarm triggering (the value is expressed in "hours", from a minimum of 0 to a maximum of 24. The value shall be increased or decreased using the "+" and "-" buttons).

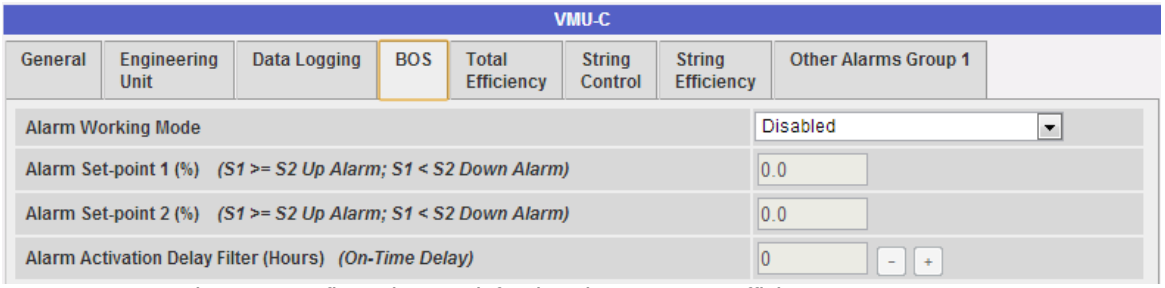


Fig. 71 – Configuration mask for the Alarm on BOS Efficiency measurement

Note: To be able to associate the BOS alarm with a physical output, the VMU-O module must belong to the VMU-C group.

- **TOTAL EFFICIENCY**: it allows to activate an alarm associated with the calculation of the Total Efficiency. The operating modes of the alarm are: *Disabled*, activated as a *virtual alarm*, activated and *associated with a physical output* (Fig. 72).

Note: You will have to set the "Threshold 1" and "Threshold 2" values (for values of "T1" exceeding or equal to those of "T2" you will get a MAXIMUM alarm; for values of "T1" lower than those of "T2" you will get an alarm with MINIMUM operation). You can also set a delay for alarm triggering (the value is expressed in "hours", from a minimum of 0 to a maximum of 24. The value shall be increased or decreased using the "+" and "-" buttons).

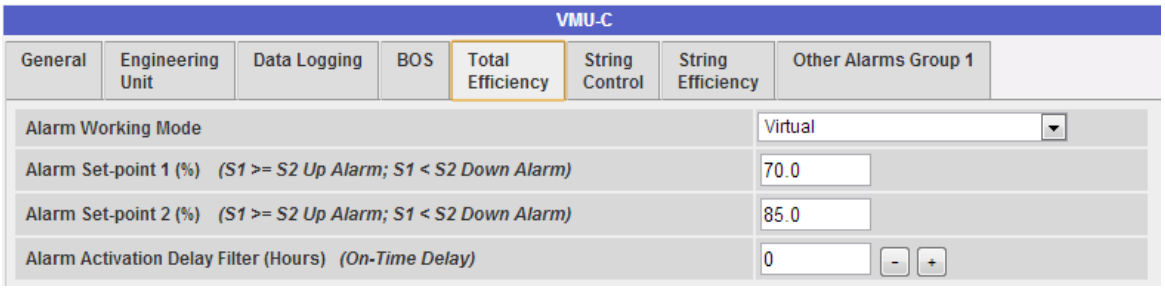


Fig. 72 – Configuration mask for the Alarm on Total Efficiency measurement

Note: To be able to associate the Total Efficiency alarm with a physical output, the VMU-O module must belong to the VMU-C group.

- **STRING CONTROL**: it allows to select the operating mode of the alarm associated with the *String Control* function (see Fig. 68). The operating modes of the alarm are: *Disabled*, activated as a *virtual alarm*, activated and *associated with a physical output* (Fig. 73).

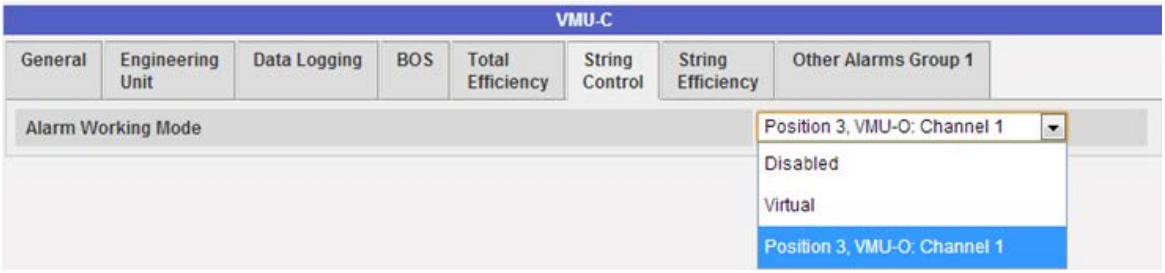


Fig. 73 – String control configuration mask

Note: If enabled, the alarm shall operate according to the mode selected in the *GENERAL* configuration page (see Fig. 68).

Note: To be able to associate the *String Control* alarm with a physical output, the VMU-O module must belong to the VMU-C group.

Note: The tripping threshold for this alarm is defined in the AREA configuration page, under *"Down alarm string control (%)"* (see Fig. 59) and is common to the whole system.

- **STRING EFFICIENCY**: it allows to enable the single string efficiency alarm. The operating modes of the alarm are: *Disabled*, activated as a *virtual alarm*, activated and *associated with a physical output* (Fig. 74).

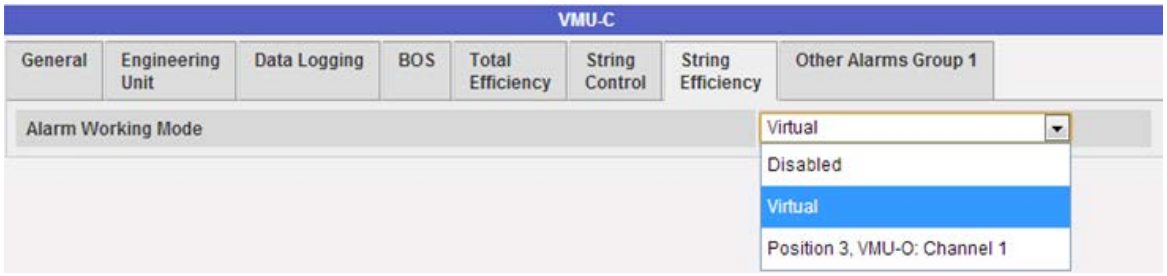


Fig. 74 – String efficiency alarm configuration mask

Note: If enabled, the alarm shall operate according to the mode selected in the AREA configuration page under *"String efficiency calculation type"* (see Fig. 56) and is common to the whole system.

Note: To be able to associate the *String Efficiency alarm* with a physical output, the VMU-O module must belong to the VMU-C group.

Note: For each string you can set a different *String Alarm threshold.* The tripping mode for this alarm has to be set in the configuration page of the individual VMU-S modules (see Fig. 78).

- **OTHER GROUP 1 (VMU-C) ALARMS**: This section allows to configure *Other Alarms* of general type (Fig. 75):
  - *COM1 and/or COM2 port communication alarm:* should a device connected to the COM1 and/or COM2 communication ports stop working (communicating) for more than 30 sec. (if configured) the system will trigger the alarm.
  - *Inverter event alarm:* should the VMU-C receive an alarm notification from the Inverters connected to it (through the COM2 communication door), if the function has been configured the system will trigger the alarm.

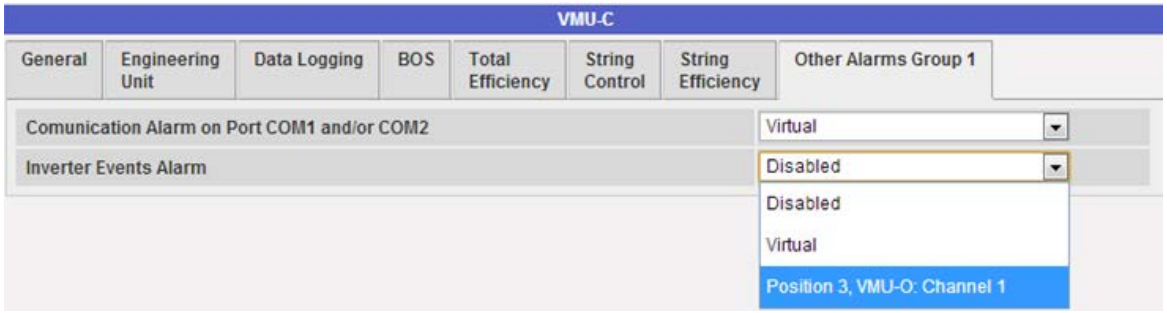


Fig. 75 – Other alarm configuration mask

Note: To be able to associate these *Other alarms* with a physical output, the VMU-O module must belong to the VMU-C group.

13 CONFIGURING THE VMU-S MODULES

Pressing the "NEXT" button again will grant access to the screen allowing to fully configure the VMU-S modules (Fig. 76):

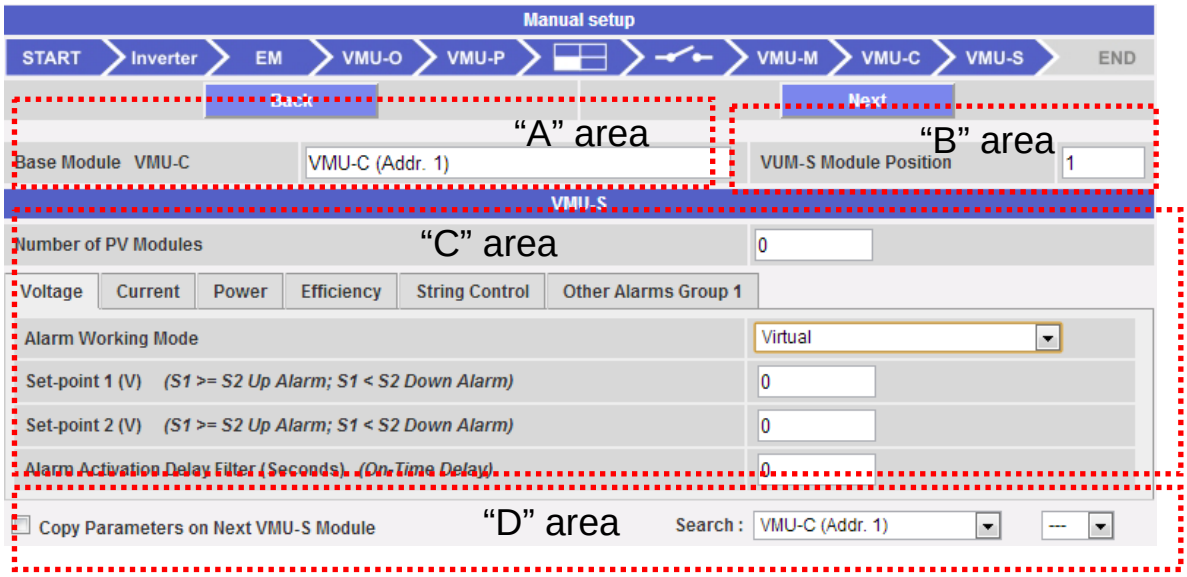


Fig. 76 – VMU-S module configuration mask

The paragraph below describe the four main areas highlighted above:

- **BASE MODULE** ("A" areas): It indicates to which "master" module (VMU-C or VMU-M) the specific VMU-S module is connected. The master module communication address on RS485 bus is indicated in brackets.
- **VMU-S MODULE POSITION** ("B" area): It indicates the position of the specific VMU-S module within the group it belongs to.
- **ALARM MANAGEMENT for each individual VMU-S module** ("C" area): For each individual VMU-S module you can define an alarm for each one of the following variables: *Voltage, Current, Power, Efficiency, String Control and Other Alarms*.
    - ***Voltage, Current, Power:*** Alarm setting for these variables follows the same rules: You have to set the "Threshold 1" and "Threshold 2" values. For values of "T1" exceeding or equal to those of "T2" you will get a MAXIMUM alarm; for values of "T1" lower than those of "T2" you will get an alarm with MINIMUM operation. You can also set a delay for alarm triggering (the value is expressed in "hours", from a minimum of 0 to a maximum of 3600). The operating modes of the alarm are: *Disabled*, activated as a *virtual alarm*, activated and *associated with a physical output* (Fig. 77).

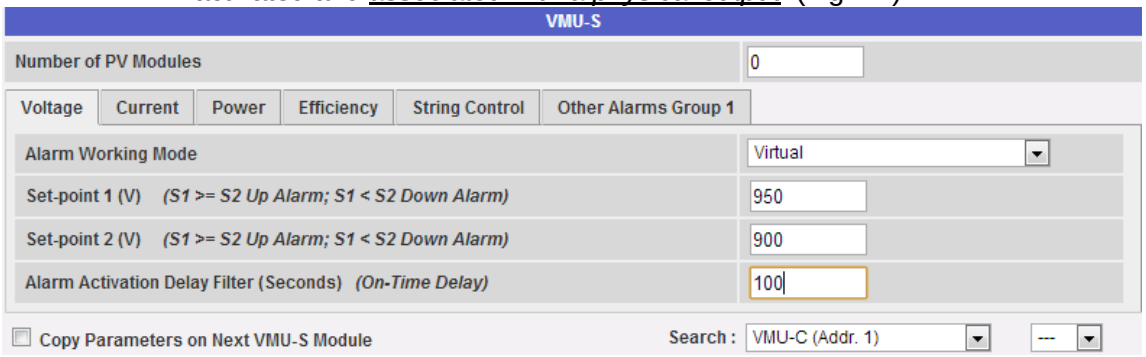


Fig. 77 – Mask for voltage alarm configuration on VMU-S

- ***Efficiency:*** Alarm setting for these variables must comply with the following provisions: Select whether this alarm shall be activated or not, then set the "Threshold 1" and "Threshold 2" values. For values of "T1" exceeding or equal to those of "T2" you will get a MAXIMUM alarm; for values of "T1" lower than those of "T2" you will get an alarm with MINIMUM operation. You can also set a delay for alarm triggering (the value is expressed in "minutes", from a minimum of 0 to a maximum of 60. (See Fig. 78).

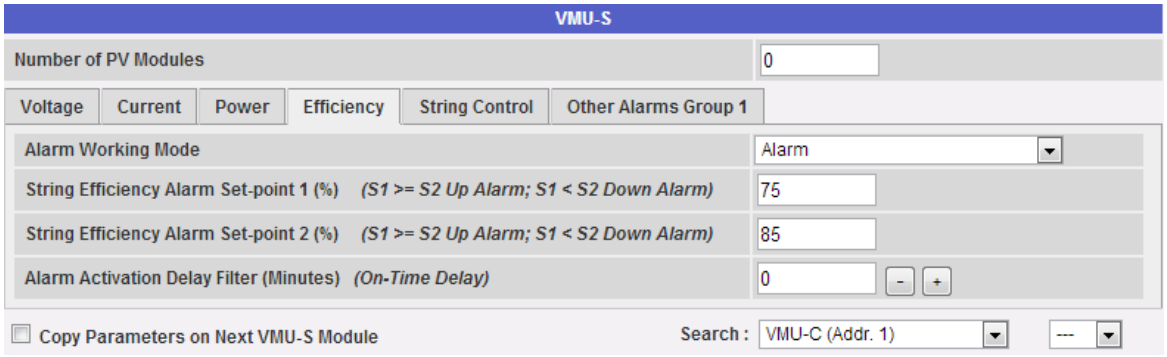


Fig. 78 – Mask for efficiency alarm configuration on VMU-S

- ***String Control***: The Alarm setting (Fig. 79) in this page results in the activation of the "String Control" function for the string in question: all the powers of each string shall be compared with each other, according to the alarm activation value and to the set calculation method (Median or with reference to the Maximum value); should the power value of a string fall outside the acceptability window, the "String Control" alarm shall be triggered.
  You can also set a delay for alarm triggering (the value is expressed in "minutes", from a minimum of 0 to a maximum of 60.

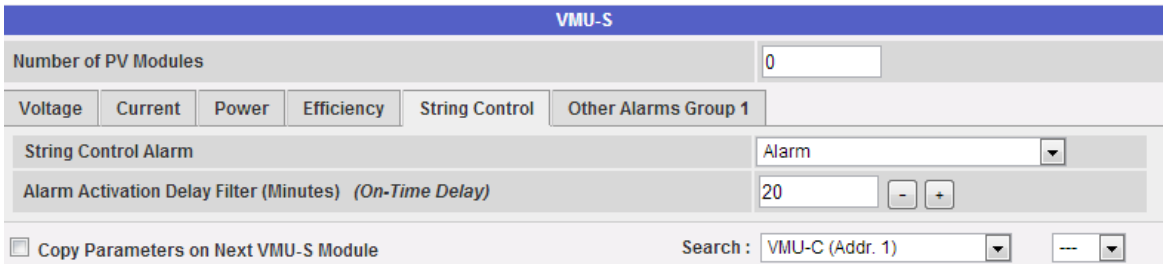


Fig. 79 – Configuration mask for string control on VMU-S

Note: To be able to associate this alarm with a physical output, the VMU-O module must belong to the VMU-C group.

Note: The calculation of the *String Efficiency* and the management of the *String Control* function are integrated into the VMU-C module.

- ***Other Group Alarms***: This page allows to enable or disable the following alarms:
  - *Inconsistent programming parameters*
  - *String not connected*
  - *Negative current or voltage in the string*
  - *High temperature inside the VMUS module*

Fig. 80 – Mask for Other Alarms configuration on VMU-S

Note: To be able to activate one or more of the alarms listed above, there must be at least a VMU-O module in the same group. If there is no I/O module the alarms cannot be activated.

- **Copy Parameters ….** (“D” area): By clicking on the box “Copy parameters to next VMU-S module” (Fig. 81) you can copy all the newly entered configuration data to all the VMU-S modules following the current one. This function is particularly useful when all the VMU-S modules existing in the installation have to be configured in the same way. With a single command, the newly set VMU-S module configuration will be copied and transferred to all the subsequent VMU-S modules.
  Through the “***Search***” function you can quickly switch to a VMU-S module which is not exactly adjacent to the newly configured module (you first have to select the source group (VMU-M or VMU-C) and then the position of the VMU-S module inside the group.

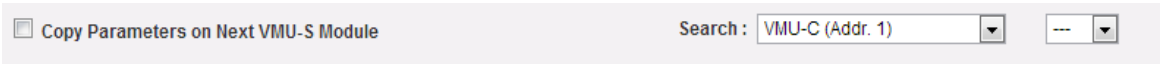


Fig. 81 Copy parameters to next VMU-S module

14 SENDING THE SYSTEM CONFIGURATION

Once the last VMU-S module has been configured, the system will display the configuration end screen (Fig. 82); all the data are ready to be loaded into the MASTER VMU-C module. Data will only become operational after you have issued the “Send system data” command.

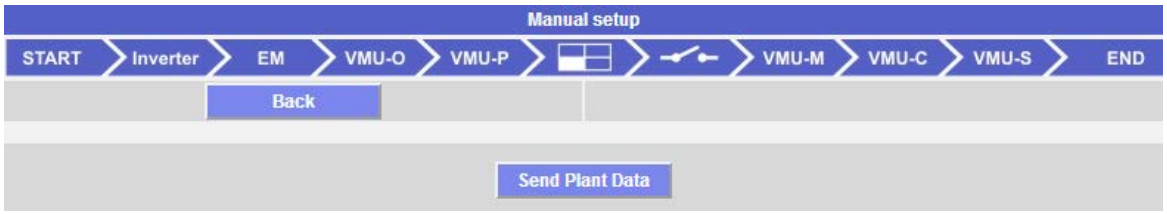


Fig. 82 – Configuration has been completed and is ready to be sent to VMU-C

Once data transfer is completed the system will display again the main screen granting access to the VMU-C configuration (Fig. 83).

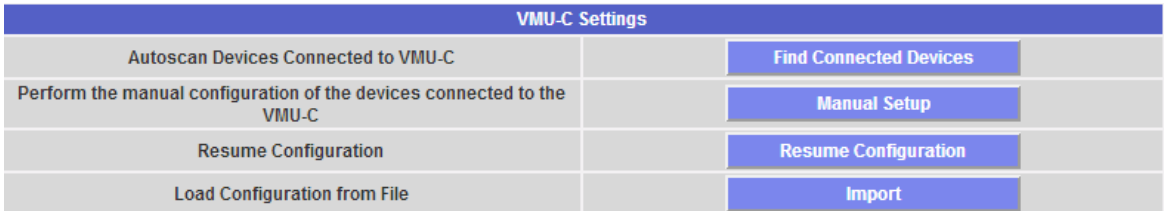


Fig. 83 – Configuration has been successfully completed

14.1 RESUME CONFIGURATION(OF THE SYSTEM)

If for any reason you should exit the “*VMU-C Configuration*” procedure during system configuration, pressing the “Resume Configuration” button (Fig. 84) you will directly return to the point where the configuration procedure had been interrupted.

Fig. 84 – Resume configuration

14.2 IMPORT (SYSTEM CONFIGURATION)

If a plant configuration had previously been exported using the “*DOWNLOAD*” command (Fig. 85), (also see chapter 4.3),

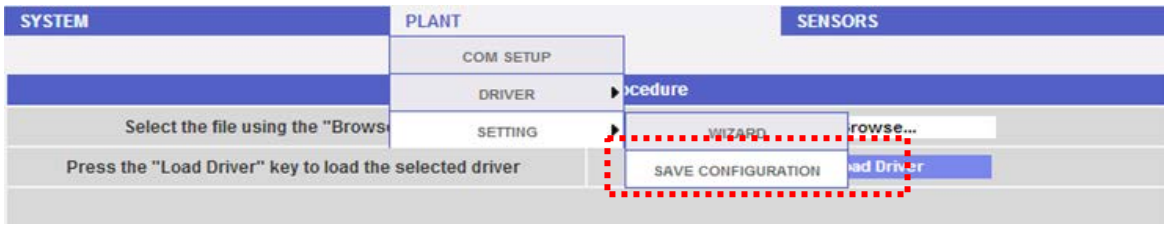


Fig. 85 – Configuration export command

now using the "*IMPORT*" command (Fig. 86) the configuration can be loaded again into the same system or into a new one, does avoiding having to re-enter all the configuration data.

Fig. 86 – Configuration has been successfully completed

15 INSTALLING THE "SENSORS"

When you hover the mouse over "SENSORS" the system will display a drop-down menu showing the list of the sensors VMU-C can manage: "SOLAR RADIATION" , "(VMUP) CHANNEL1 TEMPERATURE", "(VMUP) CHANNEL2 TEMPERATURE" and "WIND SPEED" (Fig. 87).

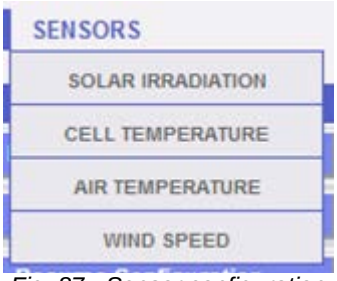


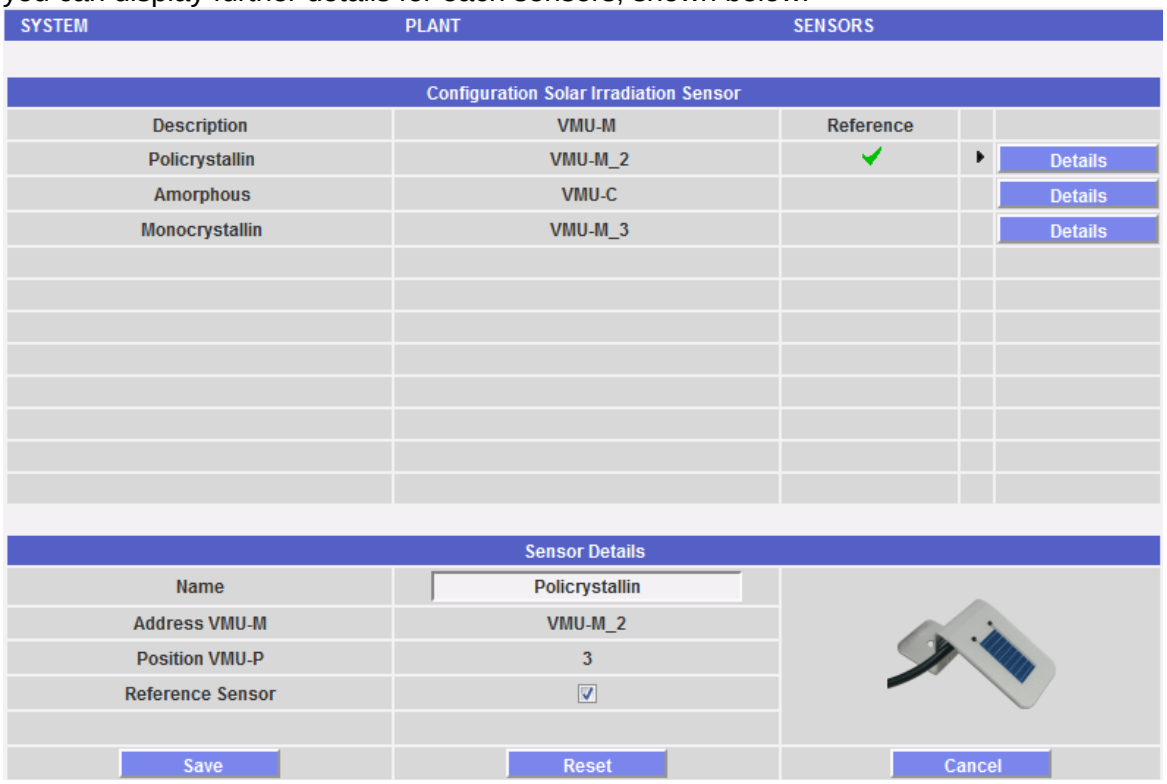
Fig. 87 - Sensor configuration

VMU-C can manage three different types of environmental sensors:

- Solar radiance sensors (PVS1V)
- Temperature sensors (TEMPSOL, ...)
- Sensors measuring the wind speed (DWS-V-DAC13)

15.1 CONFIGURING THE ENVIRONMENTAL DATA SENSORS

Clicking on one of the buttons associated with the individual types of managed sensors, you can display further details for each sensors, shown below:



This section allows to configure each sensors which has previously been configured (and enabled) in the VMU-M and VMUP modules installed in the system.
Besides assigning a name to the sensors, in this section you can define which of the sensors must be considered as a reference.

Note: Only the data from the sensors defined as "*reference*" are displayed in the yellow frame showing the environmental data (Fig. 88).

Note: Should multiple temperature. radiance or wind speed measuring sensors be installed in the plant, you'll be able to define as "*reference*" only one sensor for each type.

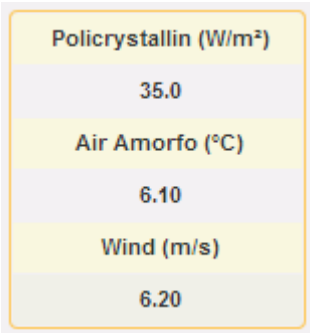


Fig. 88 – Environmental data frame

For each sensor, you can display the details listed below:

- *Name*: in this space (see the dotted area "A") you can enter a name or description allowing to easily identify the sensor;
- *VMU-M address* (or VMU-C address): ModBus address of the VMU-M or VMU-C module the sensor is connected to;
- *VMU-P position:* It indicates the position of the VMU-P module within the group;
- *Reference sensor:* If this box is enabled, the relevant sensor becomes the "reference sensor".

- Solar irradiance sensor

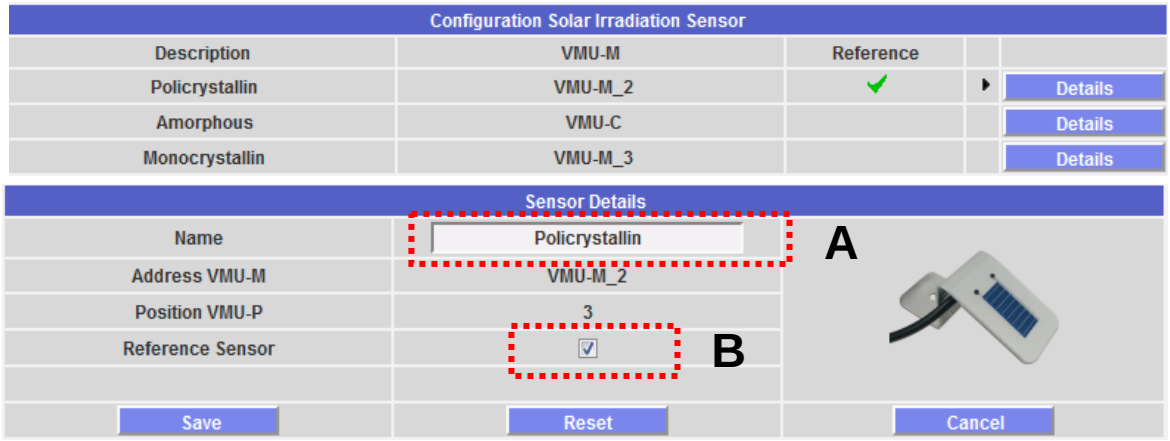


Fig. 89 irradiance sensor configuration

- Temperature sensor.

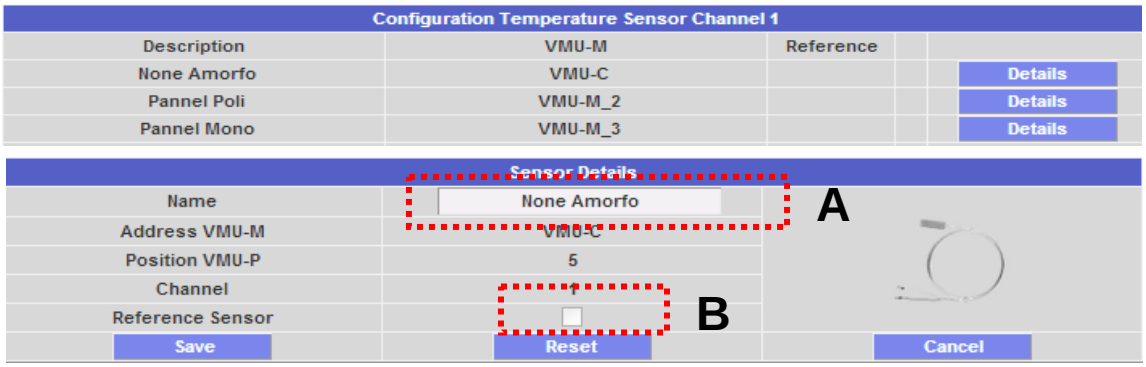


Fig. 90 Temperature sensor configuration

- Wind-speed sensor.

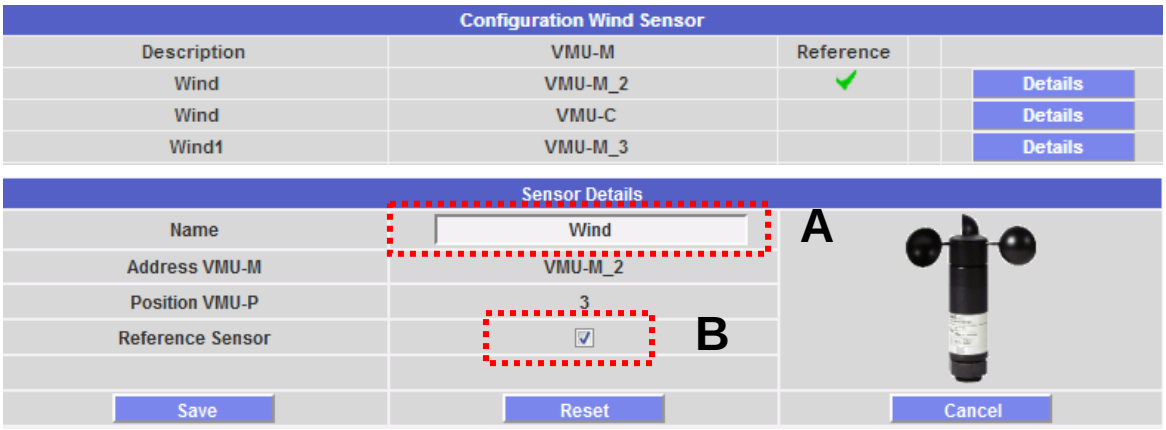


Fig. 91 Wind-speed sensor configuration

Press the "***Reset***" button to cancel the newly entered changes; you can also press "***Cancel***" to cancel the newly entered changes; unlike the "***Reset***" command, when choosing this operation the user shall exit the "Sensor details page". Press "Save" key to save the newly entered sensor settings.

16 HOME PAGE

Click on "Home" icon in the Navigation menu to access the content shown in Fig. 89 (dotted area), displaying the trend of the power delivered by the plant during the current day and during the previous one, with a sample resolution of 5 minutes.

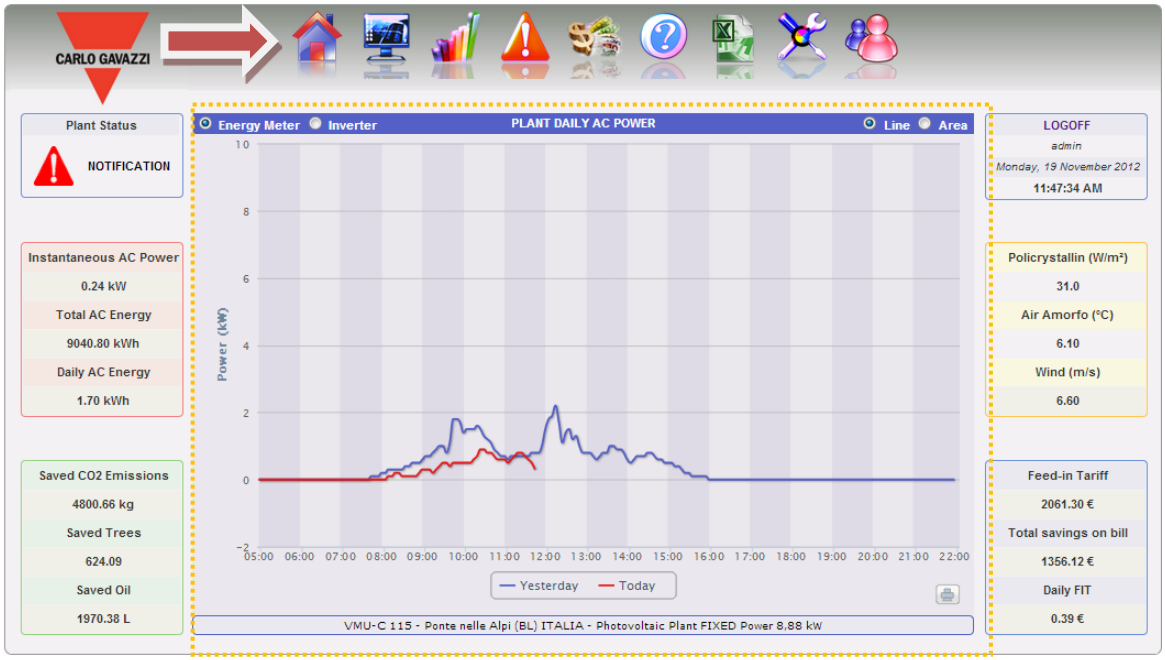


Fig. 93 – System daily "AC" power

The chart can be displayed in "Line" or "Area" mode (Fig. 90 and 91) by selecting the relevant button located in the top right.

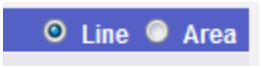
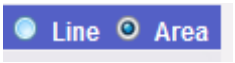


Fig. 93 – System daily "AC" power; graphic mode: Area



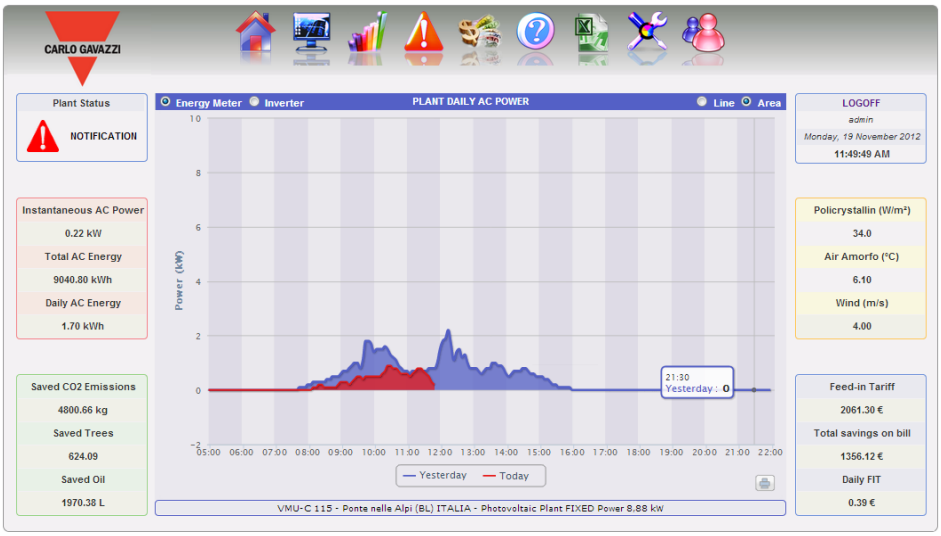


Fig. 94 – System daily "AC" power; graphic mode: Area

On the abscissa axis the chart displays the hours of the day from 5:00 to 22:00, while on the ordinate axis it displays the power in kW; the maximum ordinate value is sized according to the plant peak power. The chart is automatically updated every 5 minutes. Hover the mouse over the chart area to show the relevant power value as shown in Fig. 95 and 96.

You can also indicate the source of the data shown in the chart: Inverter or Meter (Fig. 95).

Fig. 95 – Selecting "Inverter" or "Meter"

- *Print chart*

  Clicking on the "print" button located in the bottom right of the chart area (Fig. 96), you can specify which printer shall be used to print the chart.

Fig. 96 – "Print" key

17 ANALYSING THE PRODUCTION DATA

This section is dedicated to production data analysis. With the help of chart comparisons on such data as power, solar irradiation, temperatures and efficiencies, the system allows to analyse the relationships between the typical productivity elements of a photovoltaic system. Click on "Monitor" icon in the Navigation menu to access the content shown in Fig. 94 (red dotted area).

Fig. 97 – Production data analysis

The system is monitored in its two parts:

a) direct current part - monitored by VMU-S string controls
b) alternating current - monitored by production meter or, if not available, directly from inverters.

The analysis consists of five different types of data analysis, accessible through top bar buttons (Fig. 98):

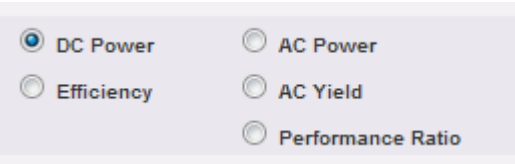


Fig. 98 – Analysis type

1. *"DC power"* - the direct current part upstream of VMU-Ss is analysed (string control).
2. *"Efficiency"* – the different efficiencies are compared.

3. *"Yield" (kWh/kWp)* – the analysis compares the produced energy value (kWh) with the maximum design power value (kWp).
4. *"AC power"* - the alternating current part is analysed.
5. *"Performance" – The system displays* the ratio between the produced energy (AC) and the energy which can be produced (AC).

a) *Graphic functions*

Charts consist of an X-axis, showing day hours from 05:00 a.m. to 10:00 p.m., and of as many Y-axes as the number of dimensions to be drawn. Each Y axis has its own full scale appropriately sized for the dimension it refers to. To enable or disable a curve, simply click on the name of the variable the curve refers to, located below the X axis. The curve is immediately displayed or removed without any page refresh.
Hovering the mouse over the chart area will show a window displaying the relevant value of each variable.

- *Print chart*

Clicking on the "print" button located in the bottom right of the chart area you can specify which printer shall be used to print the chart (Fig. 96).

Fig. 99 - Data export from chart

b) *Data searching and graphic display*

Data stored in a file are searched for and displayed by using the calendar. Press the key close to the date field, on top bar, to view the calendar shown in Fig. 100.

Fig. 100 – Data searching by date

Select the desired day and press "Refresh chart" button.

Note: the date field cannot be edited; date can only be selected through the relevant calendar.

Note: If chart is not drawn and a white area appears with "No data to display" writing, it means that no data is available for the selected day.

17.1 "DC POWER" CHART

Fig. 101 - Production data analysis in DC chart

The chart displays 4 dimensions:

a) *Total efficiency*": the total string efficiency is a percentage value derived from the ratio between a theoretical production value and the value really measured by VMU-S string control.
To calculate the theoretical production value, temperature and solar irradiation are necessary; if these environmental sensors are not available, the theoretical value considered is the max string power value among the read ones (calculation by comparison).
VMU-C can calculate string efficiency in three different ways, according to its configuration.

- Calculation with solar irradiation and temperature sensor located on module.
- Calculation with solar irradiation and room temperature sensor.
- Calculation without solar irradiation and temperature sensor.

Note: String efficiency calculated can exceed 100 under low solar irradiation condition, thus power delivered by modules. The value higher than 100 must be understood like an error due to measure resolution or solar irradiation sensor position.

Note: temperature and solar irradiation sensors used to calculate string efficiency must be configured like reference sensors.

b) "*DC power*" : The direct current power is expressed in kW and is the result of the sum of all the power values read by the INVERTERS.

c) "*Solar irradiation*": The solar irradiation is expressed in W/m^2 and acquired by reference solar irradiation sensor.

d) "*Temperature"*: The temperature is expressed in °C and acquired by reference temperature sensor.

Note: The chart sampling frequency (irradiation, temperature and power), depends on the storage interval set on the VMU-C. It can be: 5,10,15,30,60 minutes. For the Efficiency chart calculation is averaged every 60 minutes.

Note: **all the data displayed in graphic form on VMU-C are calculated as an average of all the samples acquired by the system in the storage interval.**

17.2 "EFFICIENCY" CHART

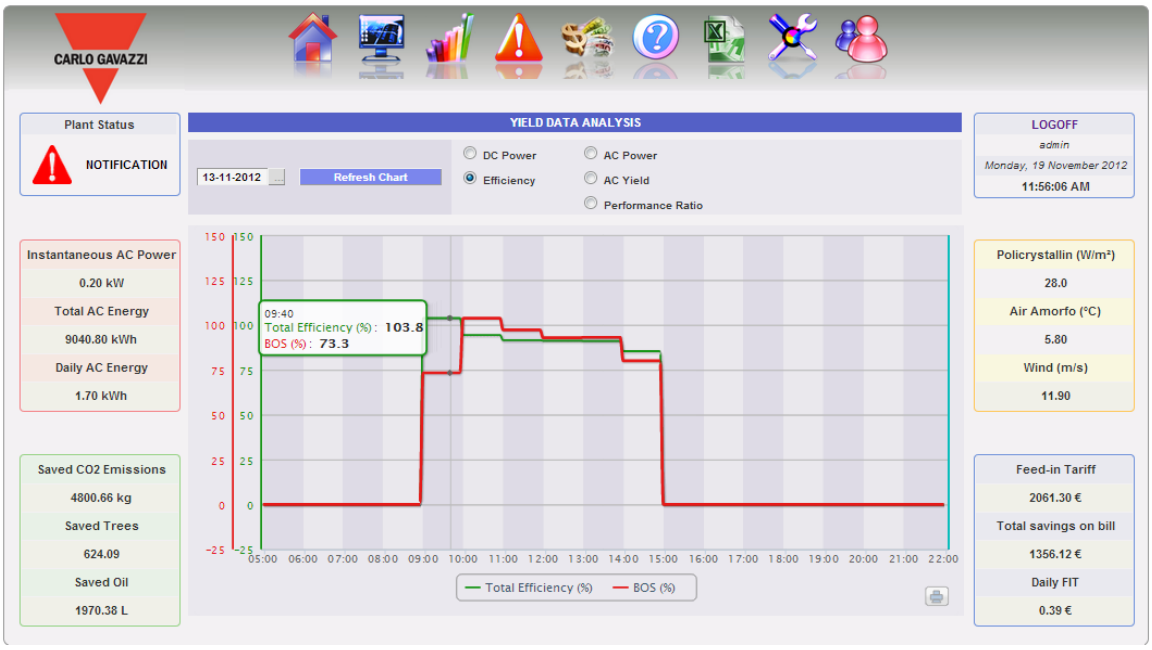


Fig. 102 – Efficiency analysis chart

The chart compares 2 dimensions:

a. "*Total efficiency*": This is the value shown in the "*DC power*" chart (Fig. 98).

b. *BOS efficiency*": BOS (Balance of system) is calculated by comparing two energy values within the same time interval: value of AC energy acquired from reference production meter and DC energy value acquired by VMU-S string control.

The time interval between samples on the chart is 60 minutes.

Note: "*BOS efficiency*" can only be calculated if a main reference energy meter is inserted into VMU-C.

17.3 "AC YIELD" CHART

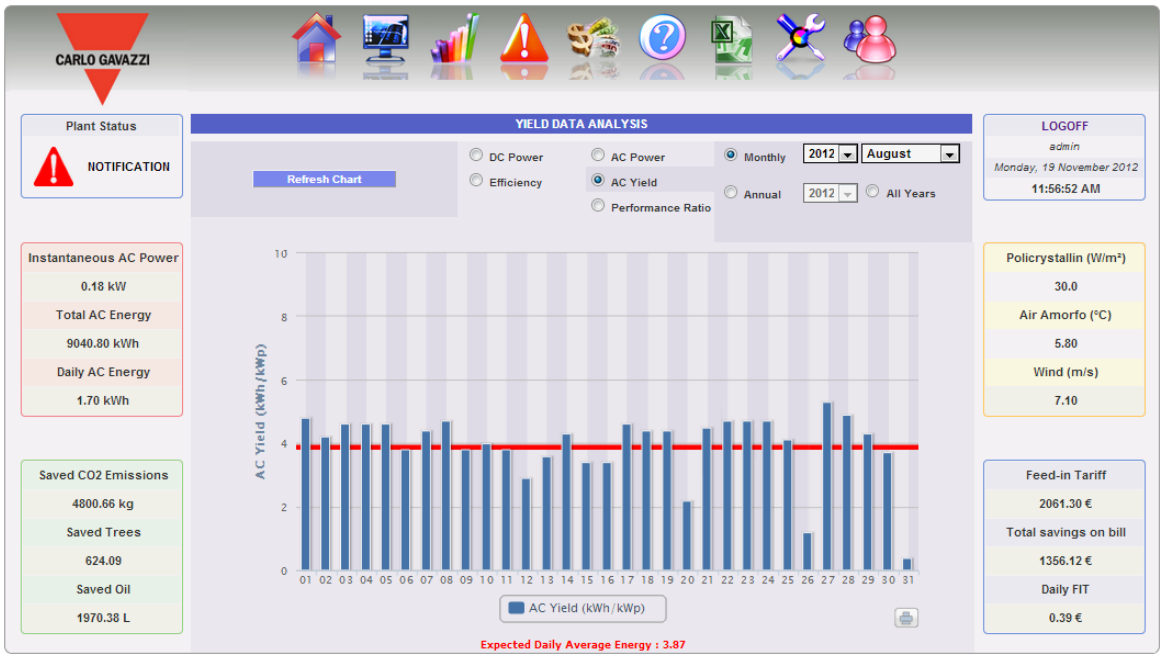


Fig. 103 – Monthly yield chart (kWh/kWp)

The chart allows to compare 2 dimensions:

a. "*Daily yield (kWh/kWp)":* Each histogram (in light blue) represents the yield of the relevant day. The term "Yield" indicates the ratio between the AC energy (kWh) produced in the day being analysed and the rated power (kWp) of the plant itself. The order of magnitude of this piece of data (in a sunny day) will typically range between 4 and 6. (Fig. 103).

b. "*Expected daily yield (kWh/kWp)*": The red line shows the average monthly yield expected for the relevant plant (the estimated value is also shown in the chart section under "Estimated average daily energy: x,xx". This value is fixed for all the days belonging to the same months.

You can also choose display on a yearly basis (Fig. 104) where each histogram will represent the yield in the specified month. Even in this case the term "Yield" indicates the ratio between the AC energy (kWh) produced in the month being analysed and the rated power (kWp) of the plant itself.

In this case the data represented by the red line (expected yield) are data set during configuration in the "Project" page.

Fig. 104 – Yearly yield chart (kWh/kWp)

Also available is a further display scale, in which each individual histogram represents the yield of the year in question.

Note: The calculation of "AC Yield" is available only if an AC meter is connected as main AC energy reference to VMU-C

17.4 "AC POWER" CHART

Fig. 105 – AC production data analysis chart

The chart displays 4 dimensions:

a. "*Total efficiency(%)*": the total efficiency is a percentage value derived from the ratio between a theoretical production value and the value which is really measured by AC production meter or inverters.
The system uses the values from the meter or from the inverters.
To calculate the theoretical production value, temperature and solar irradiation are necessary; **if these environmental sensors are not available, the total efficiency cannot be provided for.**

Note: Total efficiency calculated can exceed 100 under low solar irradiation condition, thus power delivered by modules. The value higher than 100 must be understood like an error due to measure resolution or solar irradiation sensor position.

Note: temperature and solar irradiation sensors used to calculate string efficiency must be configured like reference sensors.

b. "*AC power*" : Power in alternating current expressed in kW. Through the menu shown in Fig. 106 you can set the data source. The AC power data can be read from:
   - Main energy meter (set up like a reference meter in configuration phase)
   - Inverter
   - Main energy meter +Inverter (with two distinct curves)

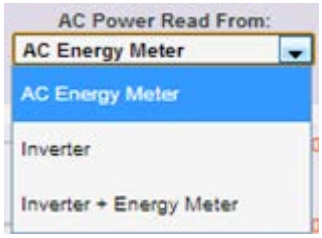


Fig. 106 – AC power display selection menu

c. "*Irradiation*": The solar irradiation is expressed in W/m^2 and acquired by reference solar irradiation sensor.

d. "*Temperature"*: The temperature is expressed in °C and acquired by reference temperature sensor.

Note: The chart sampling frequency (irradiation, temperature and power), depends on the storage interval set on the VMU-C. It can be: 5,10,15,30,60 minutes. For the Efficiency chart calculation is averaged every 60 minutes.

17.5 "PERFORMANCE" CHART

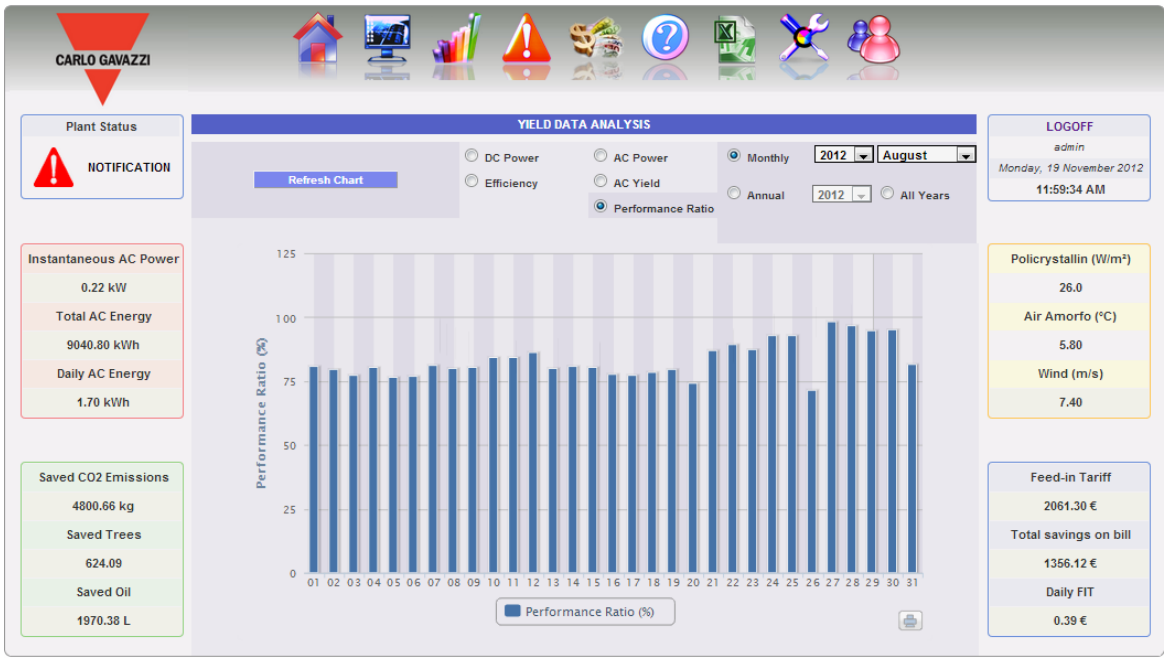


Fig. 107 – Monthly performance chart (Produced energy / Expected energy)(%)

The chart allows to display the performance index for each individual day of the selected month.

Each histogram represents the daily performance of the specified day. The "Performance" value (also called "Performance Ratio") defines the ratio between the actual energy yield (actually produced AC energy) and the possible theoretical

yield (Energy which can potentially be produced in the same period). This value (theoretically always equal to 100%) will indicate the quality of the plant operation. This doesn't depend on the installed power value, nor from the panel orientation, nor from different irradiation values. For this reason, through this parameter you can compare photovoltaic plants connected to the network and located in different parts of the world.

You can also choose the display on a yearly basis, where each individual histogram will represent the yield of the specified month (Fig. 108).

Fig. 108 – Yearly performance chart (%)

Also available is a further display scale, in which each individual histogram represents the performance of the year in question.

Note: "Performance ratio" is available only if there is a main reference AC meter connected to VMU-C and at the same time DC energy is provided by the VMU-S modules

18 PRODUCTION DATA CHARTS

In this section the system displays in graphical form all the data acquired by VMU-C read from the different devices. Click on "Plant" icon in the Navigation menu for access to page shown in Fig. 109.

Fig. 109 – Production data charts

A menu at the top of the page (Fig. 110) grants access to the following sections:

Fig. 110 – Production data chart menu

1. "*AC PRODUCTION*": For Inverters and Energy Meters (EM).
2. "*DC PRODUCTION*": Dedicated to VMU-S string control.
3. "*EFFICIENCY*": Dedicated to efficiencies: Total, Eos-Array, Inverter, BOS.
4. "*SENSORS*": Dedicated to environmental sensors.

18.1 AC PRODUCTION

When hovering the mouse over “AC PRODUCTION” the system will display the following items; “ALL INVERTERS”, “SINGLE INVERTER” , “TOTAL EM” and “PARTIAL EM” (Fig. 108).

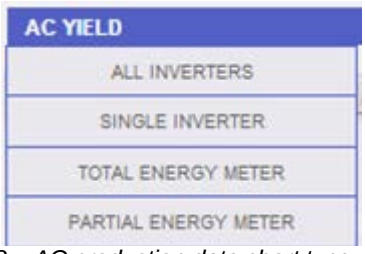


Fig. 108 – AC production data chart type

18.1.1 ALL INVERTERS

The power/energy curve (Fig. 109) represents the sum of all contributions from inverters monitored on the system, within the time interval selected. When building this curve, obviously, the system will only consider the inverters whose field “AC energy totaliser contribution” is set to “YES” (see configuration page).

Fig. 112 - AC PRODUCTION - ALL INVERTERS chart

This page consists of two sections:

A. Search and selection sections (in page top)
   Buttons to select the display type are shown in dark grey:

- Daily: it shows the daily trend of power or energy on the selected day. (To choose the day use the special calender which can be accessed through the button next to the date field)
- Monthly: it shows the average daily power or the total produced energy, for each day of the selected month. (To choose the month and year use the special selection menus next to the field)
- Yearly: it shows the average daily power or the total produced energy, for each month of the selected year. (To choose the year use the special selection menu next to the field)

After selecting the display type press the “Refresh Chart” button.

On the left, displayed in light grey, there are:

i. The keys to select the type of dimensions to be drawn, Power or Energy.
ii. The check box enabling the display in the chart of the DC power measured by the inverter. (only available if the information exists in the inverter itself).

B. Chart section.
On the abscissa axis (X) the chart displays time; the dimension (hours, days, months) depends on the selected display type (daily, monthly, yearly). On the ordinate axis (Y) the chart displays power in kW or energy in kWh, with a full scale appropriately sized according to the plant peak power.
In the top left of this section there is a menu allowing to select the graphical display mode: Line, Area, Bar.

Note: we recommend that you use the “Line” or “Area” display for the daily Power data and the Bar display (for histograms) for the monthly and yearly energy data.

Note: The sampling frequency depends on the storage interval set on VMU-C. It can be: 5,10,15,30,60 minutes.

- *Graphic display of value*

Hovering the mouse over the chart area will show a window displaying the relevant value of the variable (Fig. 113).

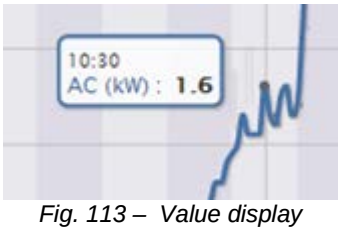


Fig. 113 – Value display

- *Print chart*

  Clicking on the "*Print*" button located in the bottom right of the chart area you can specify which printer shall be used to print the chart (Fig. 114).

Fig. 114 – Chart printing command

18.1.2 SINGLE INVERTER

When hovering the mouse over "AC PRODUCTION" and selecting the "SINGLE INVERTER" item, you will access to the content shown in Fig. 115.
As you access the page, the system will display the daily trend of the power delivered by each individual inverter monitored by the system in the specific plant. Each curve has a different colour and can be identified by legend on chart bottom. Use the "INVERTER NAME" menu to display the production curve of every single inverter, as well.

Fig. 115 - AC PRODUCTION - SINGLE INVERTERS chart

This page consists of two sections:

A. "Section A" for search and selection (at the page top)

Buttons to select the display type are shown in dark grey:

- Daily: it shows the daily trend of power or energy on the selected day. (To choose the day use the special calender which can be accessed through the button next to the date field)
- Monthly: it shows the average daily power or the total produced energy, for each day of the selected month. (To choose the month and year use the special selection menus next to the field)

- Yearly: it shows the average daily power or the total produced energy, for each month of the selected year. (To choose the year use the special selection menu next to the field)

After selecting the display type press the “Refresh Chart” button.

On the left, displayed in light grey, there are:

I. The buttons allowing to choose the type of data to be displayed in the chart: Power or Energy.
II. The check box enabling the display in the chart of the DC power measured by the inverter. (only available if the information exists in the inverter itself).

The inverter selection menu is on right-hand side, in light grey. The list contains:

- The list of all the names assigned to the inverters included in VMU-C; when selecting an individual inverter, only the relevant curve will be displayed.
- The “ALL” item, allowing to simultaneously display all the inverters existing in the plant.

Note: Comparing production trends of various inverters allows to easily identify any production abnormalities on the system.

Note: all keys and selections outside the dark grey area do not need “Update chart” function. After a few seconds the chart will update automatically.

B. “Section B” contains the chart(s).

On the abscissa axis (X) the chart displays time; the dimension (hours, days, months) depends on the selected display type (daily, monthly, yearly). On the ordinate axis (Y) the chart displays power in kW or energy in kWh, with a full scale appropriately sized according to the plant peak power.
In the top left of this section there is a menu allowing to select the graphical display mode: Line, Area, Bar.

Note: we recommend that you use the “Line” or “Area” display for the daily Power data and the Bar display (for histograms) for the monthly and yearly energy data.

Note: The sampling frequency depends on the storage interval set on VMU-C. It can be: 5, 10, 15, 30, 60 minutes.

18.1.3 TOTAL ENERGY METER (TOTAL EM)

When hovering the mouse over “AC PRODUCTION” and selecting the "TOTAL EM" item, you will access to the content shown in Fig. 113.
As you access the page, the system will display the daily trend of the power measured by the TOTAL meter or by the virtual meter representing the sum of all the values read by the partial meters installed in the specific plant. When building this curve, obviously, the system will only consider the energy meters whose field “AC energy totaliser contribution” is set to “YES” (see configuration page).

Fig. 116 - AC PRODUCTION - TOTAL EM

This page consists of two sections:

A. Search and selection sections (in page top)
   Buttons to select the display type are shown in dark grey:

   - Daily: it shows the daily trend of power or energy on the selected day. (To choose the day use the special calender which can be accessed through the button next to the date field)
   - Monthly: it shows the average daily power or the total produced energy, for each day of the selected month. (To choose the month and year use the special selection menus next to the field)
   - Yearly: it shows the average daily power or the total produced energy, for each month of the selected year. (To choose the year use the special selection menu next to the field)

   After selecting the display type press the “Refresh Chart” button.

   On the left, displayed in light grey, there are the buttons allowing to select the type of magnitudes to be included in the chart: *Power or Energy*.

B. Chart section.
On the abscissa axis (X) the chart displays time; the dimension (hours, days, months) depends on the selected display type (daily, monthly, yearly). On the ordinate axis (Y) the chart displays power in kW or energy in kWh, with a full scale appropriately sized according to the plant peak power.
In the top left of this section there is a menu allowing to select the graphical display mode: Line, Area, Bar.

Note: we recommend that you use the "Line" or "Area" display for the daily Power data and the Bar display (for histograms) for the monthly and yearly energy data.

Note: The sampling frequency depends on the storage interval set on VMU-C. It can be: 5, 10, 15, 30, 60 minutes.

- *Graphic display of value*

  Hovering the mouse over the chart area will show a window displaying the relevant value of the variable (Fig. 117).

Fig. 117 – Value display

- *Print chart*

  Clicking on the "*Print*" button located in the bottom right of the chart area you can specify which printer shall be used to print the chart .

18.1.4 PARTIAL ENERGY METERS (PARTIAL EM)

When hovering the mouse over “AC PRODUCTION” and selecting the "PARTIAL EM" item, you will access to the content shown in Fig. 118.
As you access the page, the system will display the daily trend of the power measured by each individual energy meter monitored by the system in the specific plant. Each curve has a different colour and can be identified by legend on chart bottom. Use the “Energy meter name” menu to display the production curve of a specific instrument, as well.

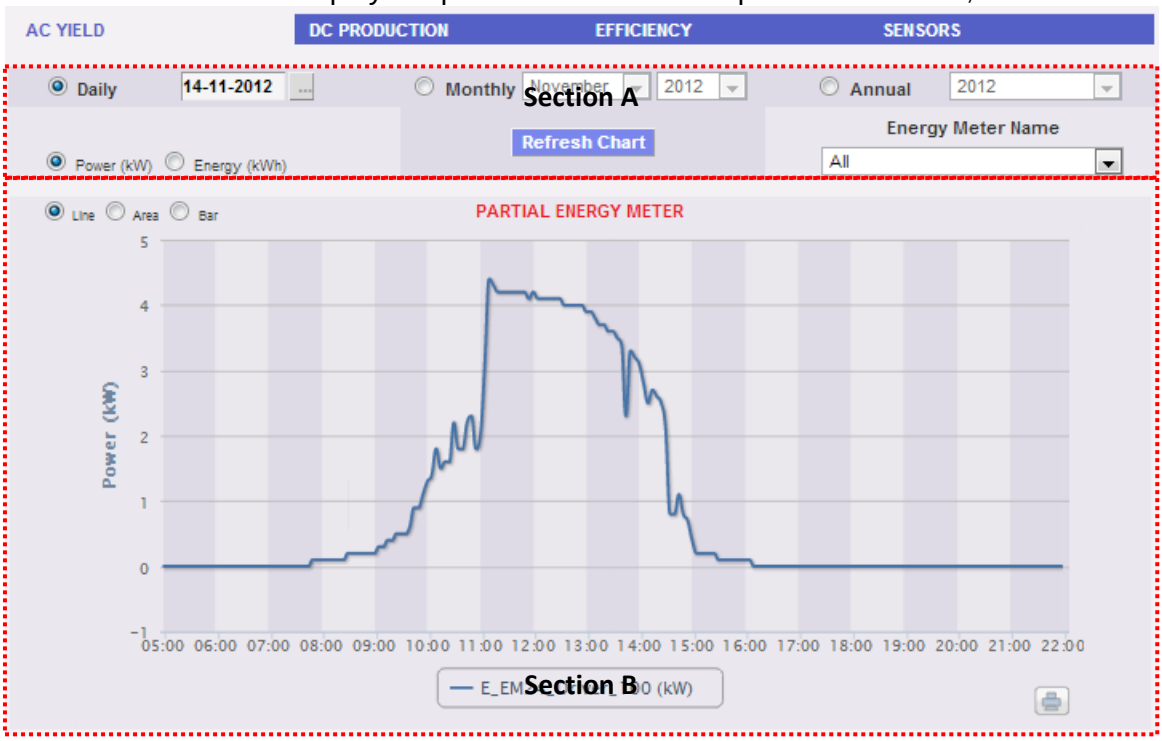


Fig. 118 - AC PRODUCTION - PARTIAL EM

This page consists of two sections:

C. "Section A" for search and selection (at the page top)

Buttons to select the display type are shown in dark grey:

- Daily: it shows the daily trend of power or energy on the selected day. (To choose the day use the special calender which can be accessed through the button next to the date field)
- Monthly: it shows the average daily power or the total produced energy, for each day of the selected month. (To choose the month and year use the special selection menus next to the field)
- Yearly: it shows the average daily power or the total produced energy, for each month of the selected year. (To choose the year use the special selection menu next to the field)

After selecting the display type press the “Refresh Chart” button.

On the left, displayed in light grey, there are the buttons allowing to select the type of dimensions to be included in the chart: Power or Energy.

The energy meter selection menu is on right-hand side, in light grey. The list contains:

- The list of all the names assigned to the energy meters included in VMU-C; when selecting an individual meter, only the relevant curve will be displayed.

- The “ALL” item, allowing to simultaneously display all the energy meters configured and existing in the plant.

Note: Comparing the measurement trends of the different energy meters allows to easily identify any production abnormalities on the system.

Note: all keys and selections outside the dark grey area do not need “Update chart” function. After a few seconds the chart will update automatically.

D. “Section B” contains the chart(s).

On the abscissa axis (X) the chart displays time; the dimension (hours, days, months) depends on the selected display type (daily, monthly, yearly). On the ordinate axis (Y) the chart displays power in kW or energy in kWh, with a full scale appropriately sized according to the plant peak power.
In the top left of this section there is a menu allowing to select the graphical display mode: Line, Area, Bar.

Note: we recommend that you use the “Line” or “Area” display for the daily Power data and the Bar display (for histograms) for the monthly and yearly energy data.

Note: The sampling frequency depends on the storage interval set on VMU-C. It can be: 5, 10, 15, 30, 60 minutes.

18.2 DC PRODUCTION

Hovering the mouse over “DC PRODUCTION” will display the items allowing to select the string graphical data display mode: “ALL STRINGS” or “SINGLE STRING” (Fig. 119).

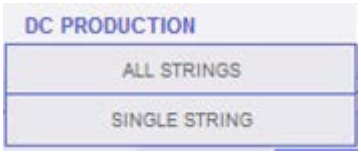


Fig. 119 – Display type selection: “ALL STRINGS” or “SINGLE STRING”

18.2.1 ALL STRINGS

When hovering the mouse over “DC PRODUCTION” and selecting the "ALL STRINGS" item, you will access the content shown in Fig. 120.
The power/energy curve represents the sum of all contributions from the individual strings monitored in the system, within the selected time interval.

Fig. 120 - DC PRODUCTION - ALL STRINGS chart

This page consists of two sections:

A. "Section A" for search and selection (at the page top)
Buttons to select the display type are shown in dark grey:

- Daily: it shows the daily trend of DC power or DC energy or DC current on the selected day. (To choose the day use the special calender which can be accessed through the button next to the date field)
- Monthly: it displays the maximum DC power, the maximum DC current or the total DC energy produced for each day of the selected month. (To choose the month and year use the special selection menus next to the field)
- Yearly: it shows the maximum DC power, maximum DC current or total DC energy produced for every month of the selected year. (To choose the year use the special selection menu next to the field)

After selecting the display type press the “Refresh Chart” button.

On the left, displayed in light grey, there are:

1. The buttons allowing to select the type of dimension to be included in the chart: DC power, DC energy and DC current.

B. Chart section.

On the abscissa axis (X) the chart displays time; the dimension (hours, days, months) depends on the selected display type (daily, monthly, yearly). Y-axis shows power in kW or energy in kWh or current in A with a properly-dimensioned scale end.
In the top left of this section there is a menu allowing to select the graphical display mode: Line, Area, Bar.

Note: it is recommended to use “Line” or “Area” display for daily data and Bar display for monthly and yearly data.

Note: The time interval between a chart sample and the other one depends on storing time interval set up on VMU-C. It can account for 5,10,15,30,60 minutes.

18.2.2 SINGLE STRING

When hovering the mouse over “DC PRODUCTION” and selecting the "SINGLE STRING" item, you will access the content shown in Fig. 121.
As you access the page, the system displays the daily trend of the power delivered by each individual string of a specific group (EosArray) monitored by the system. Each curve has a different colour and can be identified by legend on chart bottom. Through the “STRING MODULE” menu you can display the specific string production curve.

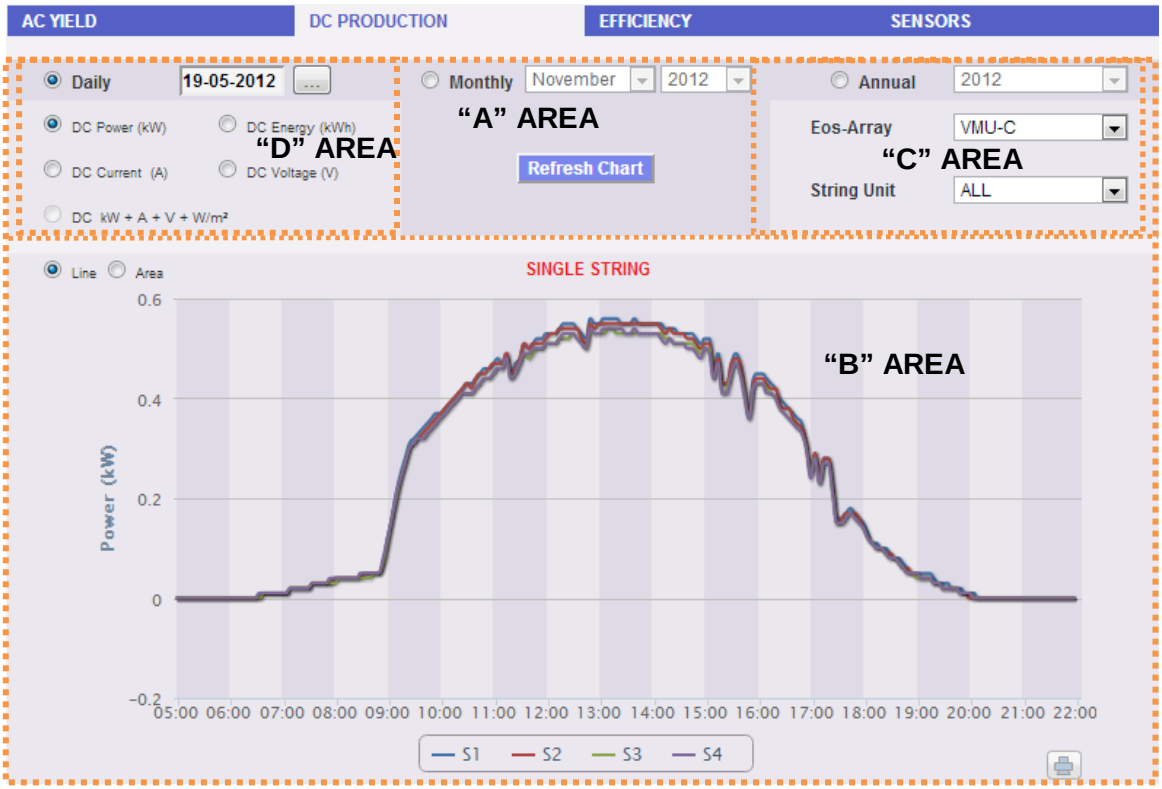


Fig. 121 - DC PRODUCTION - SINGLE STRING chart

In this page you can watch the trend of the electric values (kW, kWh, A and V) of the individual strings controlled by the on-field VMU-S modules. In particular, two display types exist:

1. Chart with aggregated data from multiple VMU-S string controls (belonging to the same EosArray group).
2. Chart with data from a single VMU-S string control (single VMU-S module).

- *Chart with data coming from several VMU-S string controls.*

  This section displays data from all VMU-Ss under the VMU-C or a specific VMU-M (to be selected through the special menu shown in Fig.. 121 - **AREA** “**C”**). Data can be displayed by:

  a) (All) - Several curves, one for each VMU-S selected, displayed at the same time.
  b) (Single string) - A single curve built using the data from the individual VMU-S specified through the menu shown in Fig. 121 - **AREA** “**C”**.

"All" is the default mode and it shows all the curves of VMU-Ss under the VMU-C or the selected VMU-M at the same time. Comparing various curves allows to easily identify any production abnormalities on a specific string. The bottom legend allows finding the relevant VMU-S.

Follow the sequence of operations below to search and graphically view the electric dimension required:

1. *Selection of the VMU-C or of the VMU-M connected to it*

   Through the special menu shown in Fig. 121 - **AREA** "**C**", you can select the VMU-C or the VMU-M you are interested in. The VMU-C or the VMU-M must be selected to identify all VMU-Ss under it, to be monitored and compared.

2. *Selection of date/month/year of display*

   At the top of the **AREA** "**A**" sections there are the buttons allowing to select the display interval:

   - Daily: it shows the daily trend of DC power or DC energy or DC current on the selected day. (To choose the day use the special calender which can be accessed through the button next to the date field)
   - Monthly: it displays the maximum DC power, the maximum DC current or the total DC energy produced for each day of the selected month. (To choose the month and year use the special selection menus next to the field)
   - Yearly: it shows the maximum DC power, maximum DC current or total DC energy produced for every month of the selected year. (To choose the year use the special selection menu next to the field)

3. *Selection of electric dimension required*

   Through the special menu shown in **AREA** "**D**" in the above figure and reproduced again below (Fig. 122), you can select the desired electric dimension.

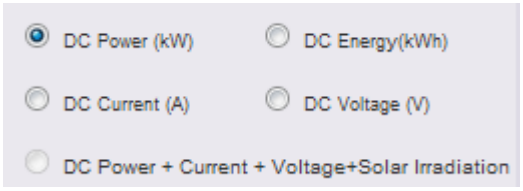


Fig. 122 – Electric dimension selection

Note: "DC Power+Current+Voltage+Solar Irradiation" selection is disabled for the display of aggregated data from more VMU-S string controls. It will only be enabled for charts with data from a single VMU-S string control.

the electric dimensions which can be selected are:

- *"DC Power (kW)*" : chart shows the trend of power in kW within the time interval chosen.

- *"DC Energy (kWh)*: chart shows the trend of delivered energy (kWh) within the time interval chosen.

- *"DC Current (A)*: chart shows the trend of current in A within the time interval chosen.
- *"DC Voltage (V)*: chart shows the trend of voltage in V within the time interval chosen.

4. *Display of the desired chart*

   Press "Refresh chart" to view the desired chart.

- *<u>Charts with data coming from a single VMU-S string control.</u>*

To draw chart of a specific VMU-S string control, follow the sequence below:

1. *Selection of the VMU-C or of the VMU-M connected to it*

   Through the special menu shown in Fig. 121 - C area you can select the VMU-C or the VMU-M you are interested in. VMU-M must be selected to identify all VMU-Ss under it, to be monitored and compared.

2. *Selection of date/month/year of display*

   Buttons to select the display interval are shown in Section A top side:

   - Daily: it shows the daily trend of the selected electrical dimension, in the selected day. (To choose the day use the special calender which can be accessed through the button next to the date field)
   - Monthly: it shows the maximum DC power, maximum DC current, maximum DC voltage or total DC energy produced for every day of the selected month. (To choose the month and year use the special selection menus next to the field)
   - Yearly: it shows the maximum DC power, maximum DC current, maximum DC voltage or total DC energy produced for every month of the selected year. (To choose the year use the special selection menu next to the field)

3. *Searching for the desired VMU-S*

   Through the "String module" menu shown in Fig 123, select the VMU-S module you wish to analyse. The "DC Power+Current+Voltage +Solar Irradiation" selection becomes active.

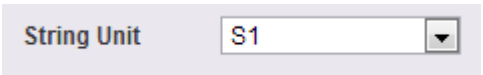


Fig. 123 - Search button for a specific VMU-S module

Note: The list contains some numbers corresponding to the position of the VMU-S in the chain of the devices under the VMU-C or VMU-M. If the "VMU-S" list is empty that means under the VMU-M selected at point 1 there is no VMU-S.

4. *Selection of electric dimension required*

Through the special menu shown in Fig. 124, you can select the desired electric dimension to be included in the chart.

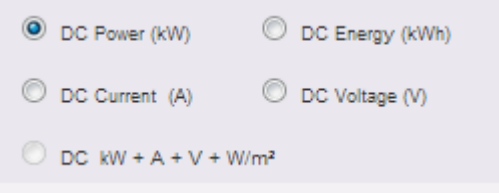


Fig. 124 – Electric variable selection buttons

Selection keys available are the following:

- *"DC Power (kW)*" : chart shows the trend of power in kW within the time interval chosen.
- *"DC Energy (kWh)*: chart shows the trend of delivered energy (kWh) within the time interval chosen.
- *"DC Current (A)*: chart shows the trend of current in A within the time interval chosen.
- *"DC Voltage (V)*: chart shows the trend of voltage in V within the time interval chosen.
- *"DC Power+Current+Voltage+Solar Irradiation*": chart shows the four dimensions at the same time, within the chosen time interval. Chart type for this selection is as shown in Fig. 125.

Fig. 125 – VMU-S Power+Current+Voltage+Solar Irradiation chart

As already mentioned above, this type of chart allows to show or hide curves by clicking on the legend located at the bottom of the relevant axis.

To display another VMU-S among those available with the same criteria, click again “String Modules” and select the desired item from the VMU-S list. On the contrary, to change the electric dimension type, repeat the sequence starting from point 3.

- *Graphic mode selection*

To change the graphic display mode, use the relevant selection menu on top left side of Section B and shown in Fig. 126.

Fig. 126 – Graphic mode selection

Area and bar keys are disabled if the search type does not allow for representation.

Note: it is recommended to use “Line” or “Area” display for daily data and Bar display for monthly and yearly data.

- *Time distance between two following samples*

The time interval between a chart sample and the other one depends on storing time interval set up on VMU-C. It can account for 5,10,15,30,60 minutes.

- *Graphic display of value*

Place the mouse above the chart area to show the relevant frame showing the type of dimension, date it refers to, relevant value expressed in the measure unit shown on Y-axis.

- *Chart printing*

  Clicking on the "*Print*" button located in the bottom right of the chart area you can specify which printer shall be used to print the chart (Fig. 127).

Fig. 127 – Chart printing

18.3 SYSTEM EFFICIENCIES

When you hover the mouse over “EFFICIENCY” the system will display a menu (Fig. 125) allowing to select the desired type among the following:

1. “TOTAL”:
2. “EOS-ARRAY”
3. “INVERTER”
4. “BOS”

Fig. 128 – Efficiency menu

Some charts might not be available in case some components are not configured in VMU-C; these include:

- temperature and solar irradiation
- the main energy meter
- Inverter

.

The following functions are common to all charts in "EFFICIENCY" section.

- *Graphic display of value*

  Place the mouse above the chart area to show the relevant frame showing the type of dimension, date it refers to, relevant value expressed in the measure unit shown on Y-axis.

- *Print chart*

  Clicking on the “*Print*” button located in the bottom right of the chart area you can specify which printer shall be used to print the chart (Fig. 129).

Fig. 129 – Chart printing

18.3.1 TOTAL EFFICIENCY

The total efficiency is the result derived from the ratio between a theoretical production value and the value which is really measured by AC production meter or inverters. The system uses the values from the meter or from the inverters according to the setting made in the plant configuration menu.
To calculate the theoretical production value, temperature and solar irradiation are necessary; **if these environmental sensors are not available, the total efficiency cannot be provided for.**

Note: temperature and solar irradiation sensors used to calculate total efficiency must be configured like reference sensors.

From the “EFFICIENCY” menu, click on the "TOTAL" item; the system will display the page shown in Fig. 130. As soon as you access this page, the chart shows total efficiency trend for the current day; select another date or a time interval such as monthly or yearly, use the dark grey section on top and press “Refresh chart” key.

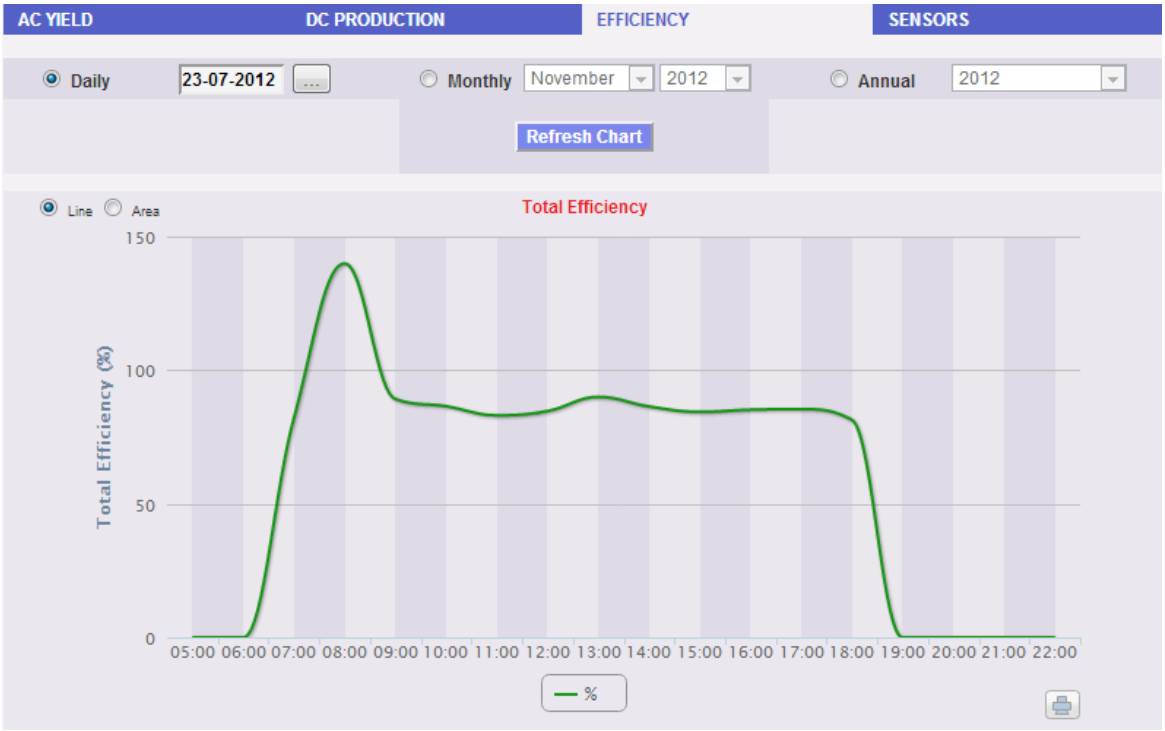


Fig. 130 Total Efficiency

On left-hand top side of the chart, a selection menu exists for graphic display mode (Line or Area).

Note: The sampling frequency is fixed to 60 minutes and cannot be modified.

18.3.2 EOS-ARRAY EFFICIENCY - ALL STRINGS

String total efficiency derives from ratio between production technical value and direct current power value really measured by VMU-S string controls. To calculate theoretical production value, temperature and solar irradiation are necessary; **if these environmental sensors are not available, the string total efficiency cannot be provided for.**

Note: temperature and solar irradiation sensors used to calculate total efficiency must be configured like reference sensors.

Note: String total efficiency calculated can exceed 100 under low solar irradiation condition, thus power delivered by modules. The value higher than 100 must be understood like an error due to measure resolution or solar irradiation sensor position.

From “EOS-ARRAY→EFFICIENCY” menu, click on "ALL STRINGS" item; the system will display the page shown in Fig. 131.
As soon as you access this page, the chart shows total efficiency trend for the current day; select another date or a time interval such as monthly or yearly, use the dark grey section on top and press “Refresh chart” key.

Fig. 131 String total efficiency

In the top left of the chart there is a menu allowing to select the graphic display mode.

Note: The time interval between a chart sample and the other one depends on storing time interval set up on VMU-C. It can be: 5,10,15,30,60 minutes.

18.3.3 EOS-ARRAY EFFICIENCY - SINGLE STRING

The string efficiency derives from ratio between production technical value and direct current power value really measured by VMU-S string control selected. To calculate the theoretical production value, temperature and solar irradiation are necessary; **if these environmental sensors are not available, the string efficiency cannot be provided for.**

Note: temperature and solar irradiation sensors used to calculate total efficiency must be configured like reference sensors.

Note: String total efficiency calculated can exceed 100 under low solar irradiation condition, thus low power delivered by modules. The value higher than 100 must be understood like an error due to measure resolution or solar irradiation sensor position.

From “EOS-ARRAY EFFICIENCY→” menu, click on "SINGLE STRING" item; the system will display the content shown in Fig. 129.
As you access the page, the chart display the efficiency curves of all the VMU-S string controls under the VMU-C (or under one of the VMU-M connected to it) selected in the “**A**” menu shown in Fig. 129; curves can be identified through the bottom legend. To select another date or a time interval such as monthly or yearly, use the dark grey section on top and press “Refresh chart” key.

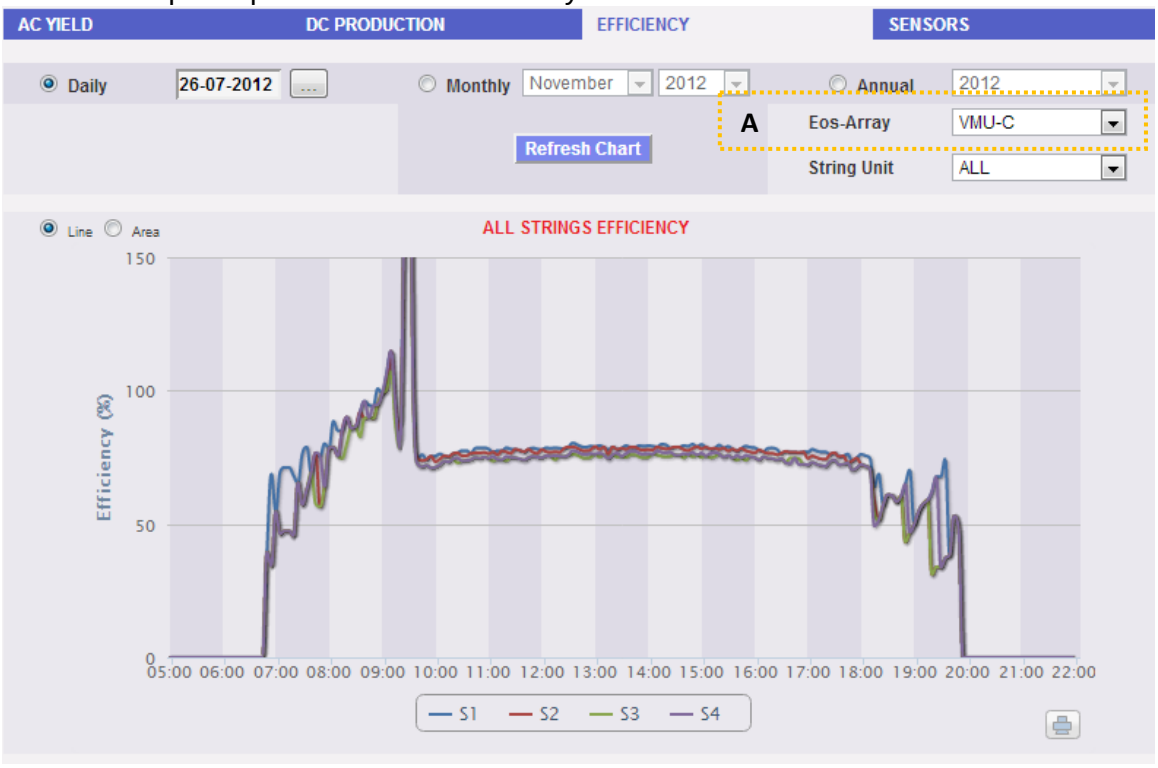


Fig. 132 - Single String efficiency

To display the efficiency of a single string, follow the sequence below:

1. *Selection of the VMU-C or of the relevant VMU-M*

   Through the special menu shown in Fig. 132 - menu “**A**”, you can select the VMU-C or one of the VMU-M connected to the VMU-C for which you wish to conduct a more in-depth analysis. VMU-M must be selected to identify all VMU-Ss under it, to be monitored and compared.

2. *Selection of date/month/year of display*

   Buttons to select the display interval are shown in Section A top side:

   - Daily: it shows the daily trend of VMU-S efficiency on the selected day. (To choose the day use the special calendar which can be accessed through the button next to the date field)
   - Monthly: it shows the maximum efficiency of the selected VMU-S, for each day of the selected month. (To choose the month and year use the special selection menus next to the field)

- Yearly: it shows the maximum efficiency of the chosen VMU-S, for every month of the selected year. (To choose the year use the special selection menu next to the field)

3. *Searching for the desired VMU-S*

Through the “String module” menu shown in Fig 133→, select the VMU-S module you are interested in.
The list contains some numbers corresponding to the position of the VMU-S in the chain of the devices under the VMU-C or one of the VMU-M connected to it.
Select the desired VMU-S → VMU-C will process the chart, which will be displayed on-screen after a few seconds.

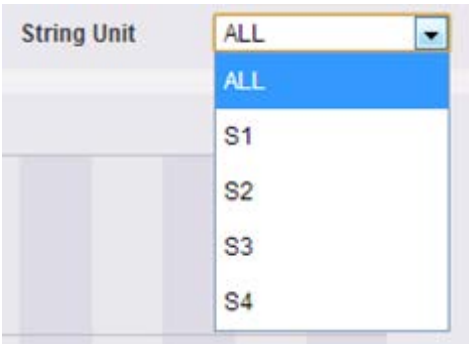


Fig. 133 – VMU-S search button

Note: If the "VMU-S" list has no items, it means there is no VMU-S under the VMU-C or under one of the VMU-M connected to it.

4. *Select the desired graphic mode among the available ones: "Line, Area".*

Note: The chart is displayed automatically without having to click on the “Refresh Chart” button.

If you wish to display an other VMU-S among the available ones with the same criteria, click again on the “String module” menu and select the desired item in the VMU-S list.

18.3.4 INVERTER EFFICIENCY

The inverter efficiency **is not calculated by VMU-C**, but it's the VMU-C itself which expects **to receive this piece of data from the inverter**.

Note: Should the efficiency datum not be available, VMU-C will show a flat chart (with all the values set to "0").

From the "EFFICIENCY" menu, click on the "INVERTER" item; the system will display the content shown in Fig. 134.
As soon as you access this page, the chart shows the efficiency curve of the individual inverters for the current day. To select another date or a time interval such as monthly or yearly, use the dark grey section on top and press "Refresh chart" key.

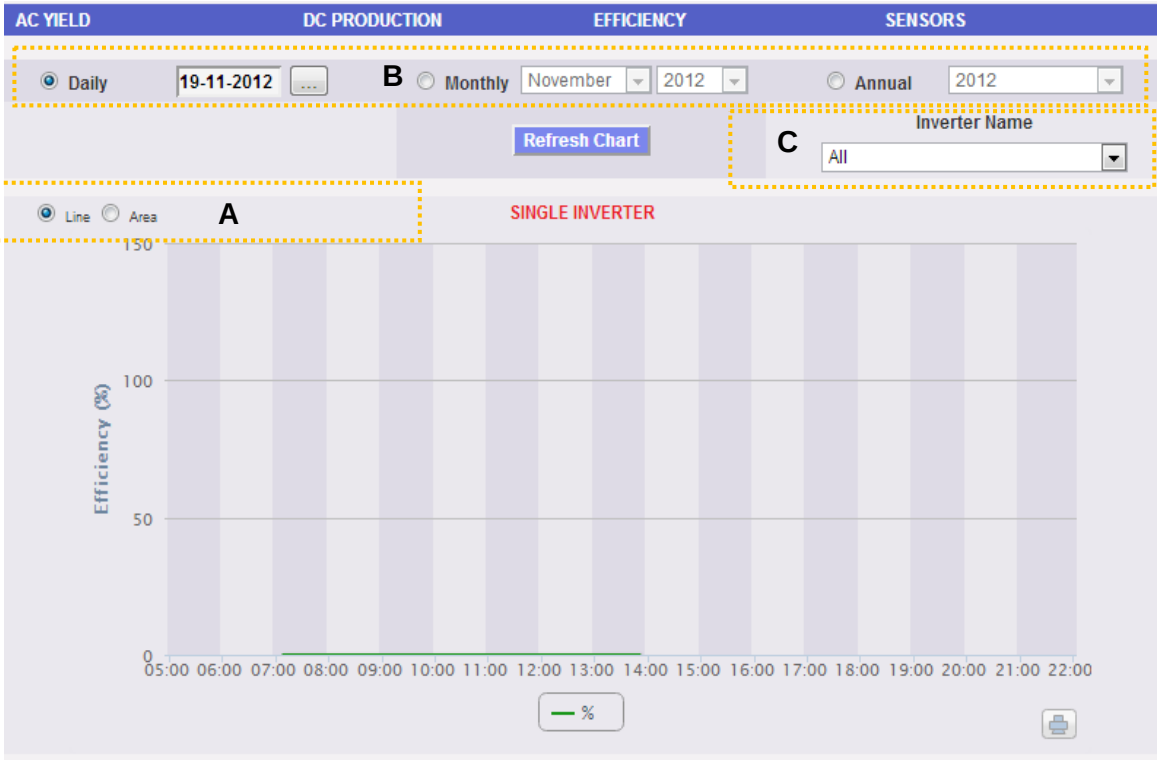


Fig. 134 - All inverter efficiency

In the top left (dotted area "A") of the chart there is a menu allowing to select the graphic display mode: display by ***LINE*** or by ***AREA.***

Note: The time interval between a chart sample and the other one depends on storing time interval set up on VMU-C. It can be: 5,10,15,30,60 minutes.

As you access the page, the chart displays the efficiency curves of all the inverters connected to the VMU-C. The curves can be identified through the bottom legend. To select another date or a time interval such as monthly or yearly, use the dark grey section on top and press "Refresh chart" key (dotted area "B").

To display the efficiency of a single inverter, follow the sequence below:

1. *INVERTER selection*

   Through the special menu shown in Fig. 134 - "**Inverter name**" menu (dotted area "C"), you can select the individual Inverter whose efficiency you wish to analyse.

2. *Selection of date/month/year of display*

   To select another date or a time interval such as monthly or yearly, use the dark grey section on top and press "Refresh chart" key.

   Buttons to select the display interval are shown in Section B top side:

   - Daily: it shows the daily trend of VMU-S efficiency on the selected day. (To choose the day use the special calender which can be accessed through the button next to the date field)
   - Monthly: it shows the maximum efficiency of the selected VMU-S, for each day of the selected month. (To choose the month and year use the special selection menus next to the field)
   - Yearly: it shows the maximum efficiency of the chosen VMU-S, for every month of the selected year. (To choose the year use the special selection menu next to the field)

   Note: if the "Inverter name" list is empty that means no inverter is configured in the VMU-C module.

3. *Select the desired graphic mode among the available ones: "Line, Area".*

   Note: The chart is displayed automatically without having to click on the "Refresh Chart" button.

   If you wish to display an other Inverter among the available ones, click again on the "Inverter Name" menu and select the desired item from the list.

Note: The time interval between a chart sample and the other one depends on storing time interval set up on VMU-C. It can be: 5,10,15,30,60 minutes.

18.3.5 BOS EFFICIENCY

BOS (Balance of System) efficiency is calculated as the ratio between:
the AC energy measured by the reference energy meter and the total DC energy produced by the photovoltaic field measured by the VMU-S string controls; obviously the two energies are measured in the same time interval.
BOS efficiency cannot be calculated without a reference energy meter.

From the “EFFICIENCY” menu, click on the "BOS" item; the system will display the content shown in Fig. 135.

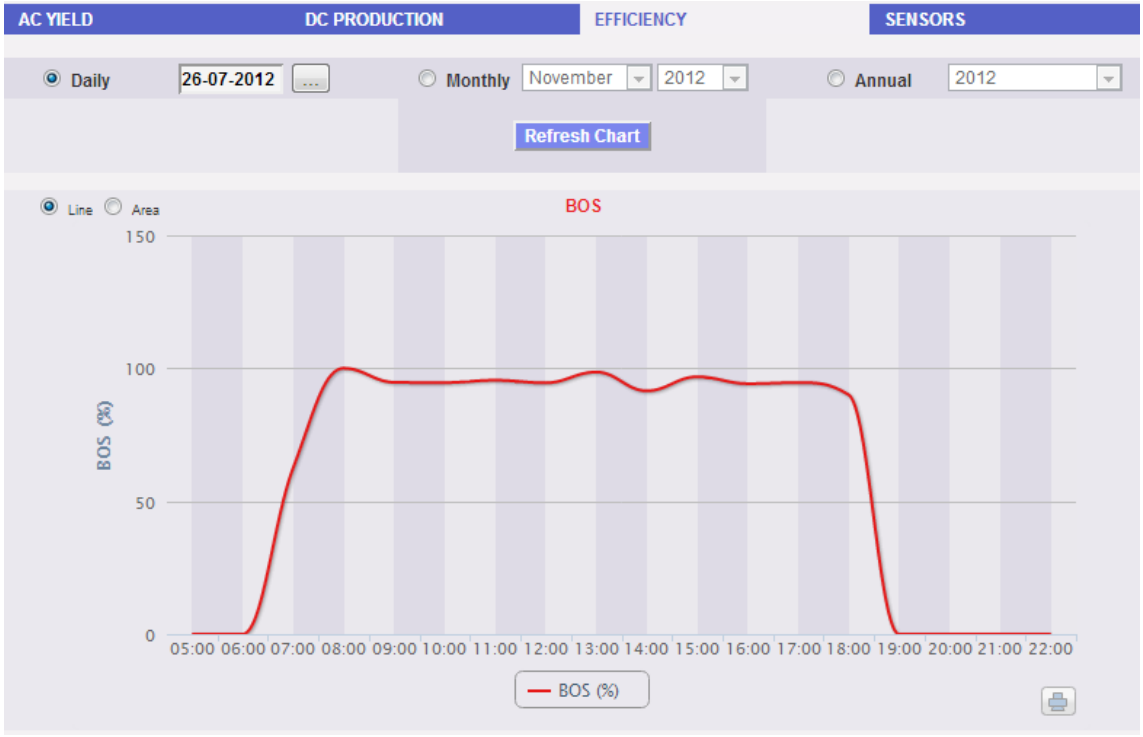


Fig. 135 - BOS efficiency

As soon as you access this page, the chart shows the BOS efficiency curve for the current day. To select another date or a time interval such as monthly or yearly, use the dark grey section on top and press “Refresh chart” key.

In the top left of the chart there is a menu allowing to select the graphic display mode.

Note: Interval between samples in "daily" view is 60 minutes.

18.4 ENVIRONMENTAL SENSORS

When you hover the mouse over the “SENSORS” item the system will display a menu (Fig. 136) allowing to select the desired sensor among the following:

1. "SOLAR IRRADIATION".
2. “TEMPERATURE”.
3. “WIND SPEED”.

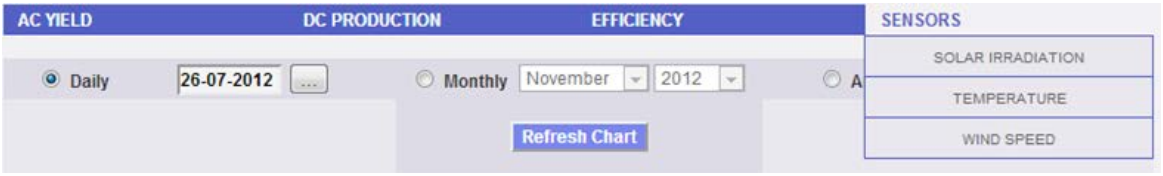


Fig. 136 - Environmental sensors

The following functions are common to all charts in "SENSORS" section.

- *Graphic display of value*

  Place the mouse above the chart area to show the relevant frame showing the type of dimension, date it refers to, relevant value expressed in the measure unit shown on Y-axis.

- *Print chart*

  Clicking on the “*Print*” button located in the bottom right of the chart area you can specify which printer shall be used to print the chart .

18.4.1 SOLAR IRRADIATION SENSORS

The curve is only available if at least one solar irradiation sensor exists. Otherwise, "SENSOR NOT AVAILABLE" message is displayed.

From the "SENSORS" menu click on the "SOLAR IRRADIATION" item; the system will display the content shown in Fig. 137.

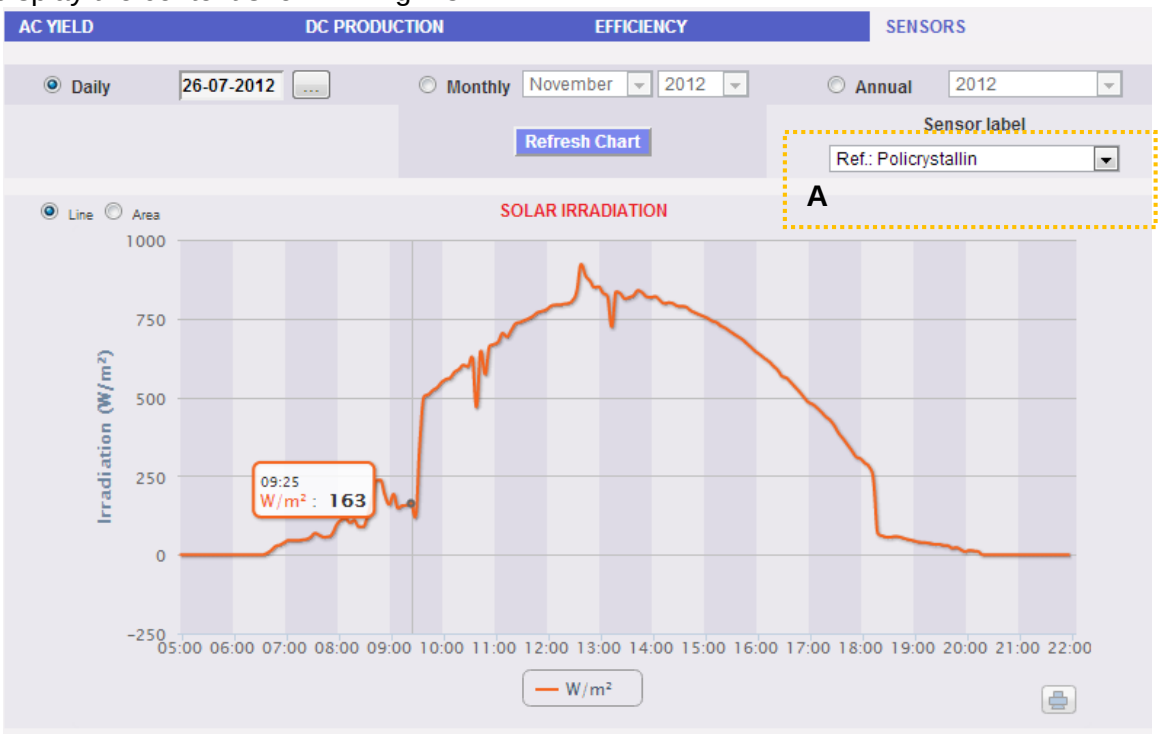


Fig. 137 - Solar irradiation trend

As soon as you access this page, the chart shows the solar irradiation in W/m^2 as measured by reference sensor, for the current day. To select another date or a time interval such as monthly or yearly, use the dark grey section on top and press "Refresh chart" key.
On left-hand top side of the chart, a selection menu exists for graphic display mode (Line or Area).

Note: The time interval between a chart sample and the other one in "daily" display mode depends on storing time interval set up on VMU-C. It can be: 5,10,15,30,60 minutes.

Should the plant include multiple solar irradiation sensors, use the selection menu shown in Fig. 137 (see dotted frame – "**A**" area).

18.4.2 TEMPERATURE SENSORS

The curve is only available if at least one temperature sensor exists. Otherwise, "SENSOR NOT AVAILABLE" message is displayed.

From the "SENSORS" menu, click on the "TEMPERATURE" item; the system will display the content shown in Fig. 138.

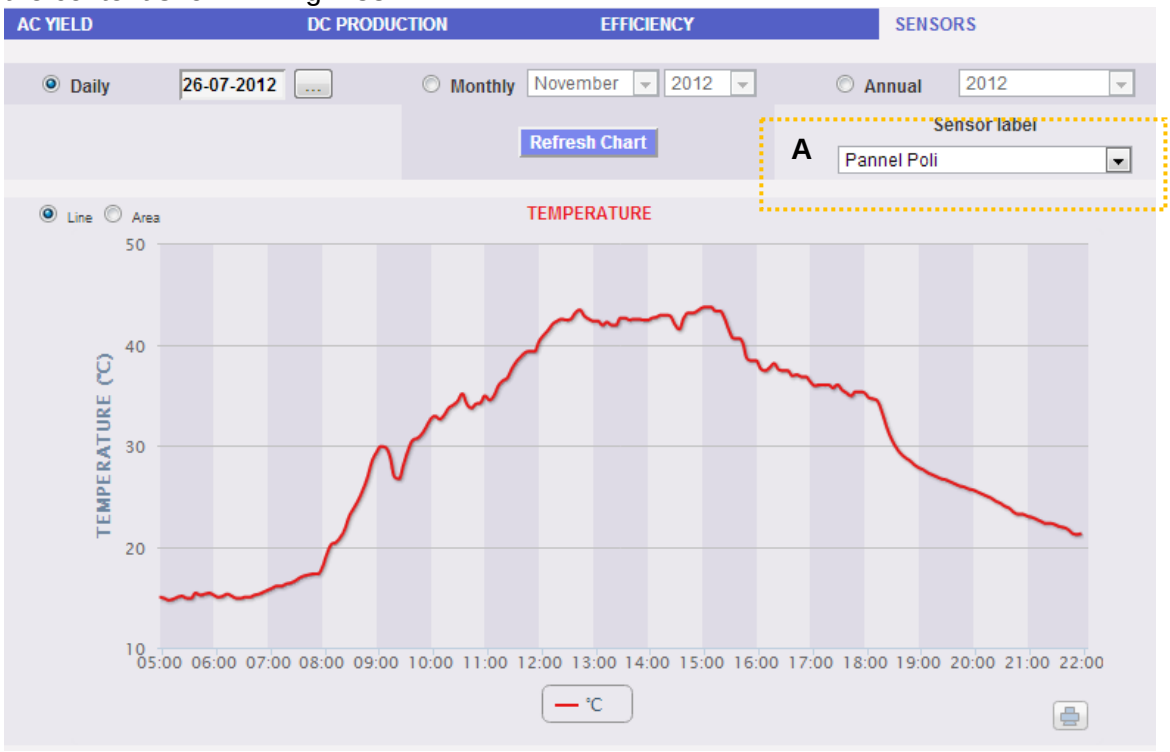


Fig. 138 - Trend of temperature

As soon as you access this page, the chart shows the temperature in °C as measured by reference sensor, for the current day. To select another date or a time interval such as monthly or yearly, use the dark grey section on top and press "Refresh chart" key.
On left-hand top side of the chart, a selection menu exists for graphic display mode (Line or Area).

Note: The time interval between a chart sample and the other one in "daily" display mode depends on storing time interval set up on VMU-C. It can be: 5,10,15,30,60 minutes.

Should the plant include multiple temperature sensors, use the selection menu shown in Fig. 138 (see dotted frame – "**A**" area).

18.4.3 WIND SPEED SENSORS

The curve is only available if at least one wind speed sensor exists. Otherwise, "SENSOR NOT AVAILABLE" message is displayed.

From the "SENSORS" menu, click on the "WIND SPEED" item; the system will display the content shown in Fig. 139.

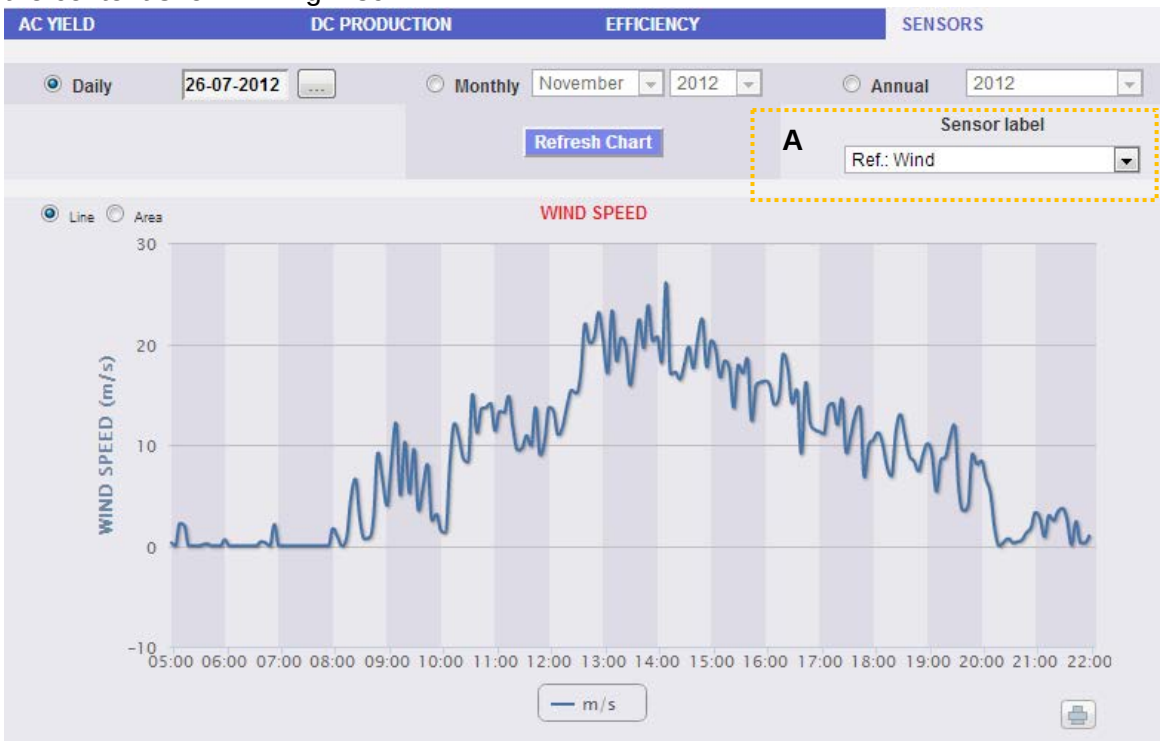


Fig. 139 - Trend of wind speed

As soon as you access this page, the chart shows the wind speed in m/s as measured by reference sensor, for the current day. To select another date or a time interval such as monthly or yearly, use the dark grey section on top and press "Refresh chart" key.
In the top left of the chart there is a menu allowing to select the graphic display mode.

Note: The time interval between a chart sample and the other one in "daily" display mode depends on storing time interval set up on VMU-C. It can be: 5,10,15,30,60 minutes.

Should the plant include multiple wind speed sensors, use the selection menu shown in Fig. 139 (see dotted frame – "**A**" area).

19 ZOOM FUNCTION

You can use the ZOOM function in any Chart display page, it allows you to zoom a particular area of the graph for further analysis.

The ZOOM function is fast and easy. The picture below shows the sequence of operations to perform:

Example of a graph that you want to further analyze. In particular, we want to analyze the area highlighted with the orange dotted area:

Move your mouse pointer " " to point "A" and using the mouse hold down the left mouse button drag the pointer to point "B" (Fig. 140).

Fig. 140 - Zoom function

As soon as the left mouse button is released, the zoomed area is highlighted (Fig. 140) the performance of the charts can be further analyzed.

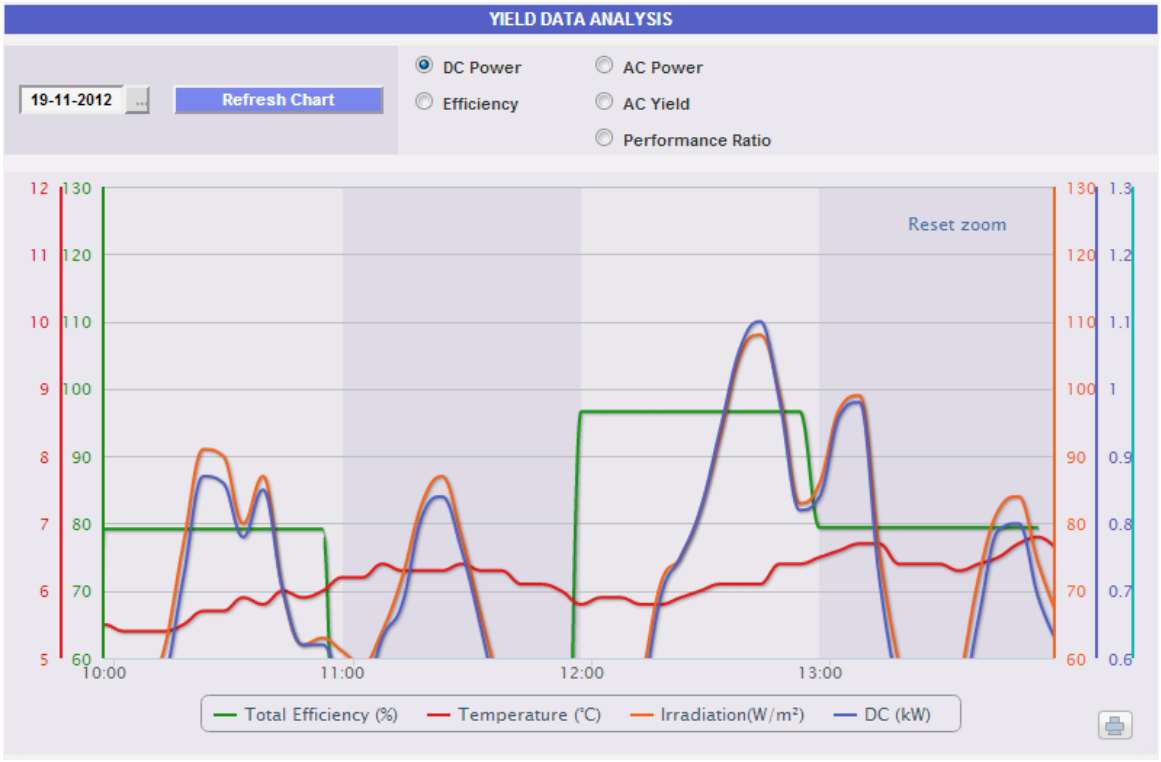


Fig. 141 - Zoomed area

The zoom function is available for all chart types (histogram and area charts).

20 ALARMS

This section is dedicated to alarm management and display occurred on a system. Click on "Alarms" icon in the Navigation menu to access the content shown in Fig. 142 (pink dotted area).

Fig. 139 - Plant alarms

This table shows the list of alarms stored in VMU-C in chronological order from the most recent.

Note: alarm classification cannot be changed by user.

Alarms are divided into four categories, each one with a different colour assigned.

Alarms	All problems provoking lack of energy production to the system or indicating a serious malfunction on devices monitored are classified like “Alarms”.
Anomalies	All statuses arising from devices controlled and warning improper operation are classified like “Warning”. They can be a problem in short/medium/long period. The analysis of the notified abnormality is the responsibility of the user.
Events	All status changes in digital inputs and outputs on Eos-Array are classified as "Event".
Commands	All parameter changing operations performed inside Eos-Array through Eos-Array Soft are classified as "Command".

- *Filter application on alarm table view*

  Using the menu shown in Fig. 142 – "**A**" area you can restrict display to some alarm categories only. Select categories required by checking the relevant case aside.

- *Navigation buttons*

  Table bottom shows navigation buttons shown in Fig. 143.

Fig. 143 – Navigation buttons in table

  Click on the two end buttons to display the first or the last page. Internal arrows allow displaying previous or following page.
  Alternatively, access directly to a specific position by writing the page number required on left field and press send.

- *Fields of Alarms table*

  The Alarms table shows the following fields:

  1. "*ID*": Event identification number (Alarm or Abnormality or Event or Command). This meter is only reset when all existing messages have been deleted.
  2. "Message": Alarm description.
  3. "Description": Name/Label assigned to the device during configuration.
  4. "Module": Address of the primary device (VMU-C or relevant VMU-M) and position of the secondary device (VMU-S or VMU-P or VMU-O) which raised the alarm in the Eos-Array chain.
  5. "*Start date*": Date when alarm occurred.
  6. "*Start time*": Time when alarm occurred.
  7. "*End date*": Date when alarm finished. If alarm still exists, the field is blank.
  8. "*End time*": Time when alarm has finished. If alarm still exists, the field is blank.
  9. "*Area*": Indication of the alarm source area (if specified).
  10. "Hide": If flagged, the alarm line will be automatically hidden.

Note: To view all alarms, including the hidden ones, check "Show all" on top right side. If selected, a hidden alarm can be viewed again by simply removing the relevant check from "Hide".

21 ECONOMIC ANALYSIS

This section is dedicated to the economic analysis of photovoltaic system. Economic countervalues of sold and saved energy are calculated, together with any incentives. Click on "Economy" icon in the Navigation menu to access the content shown in Fig. 144 (red dotted area).

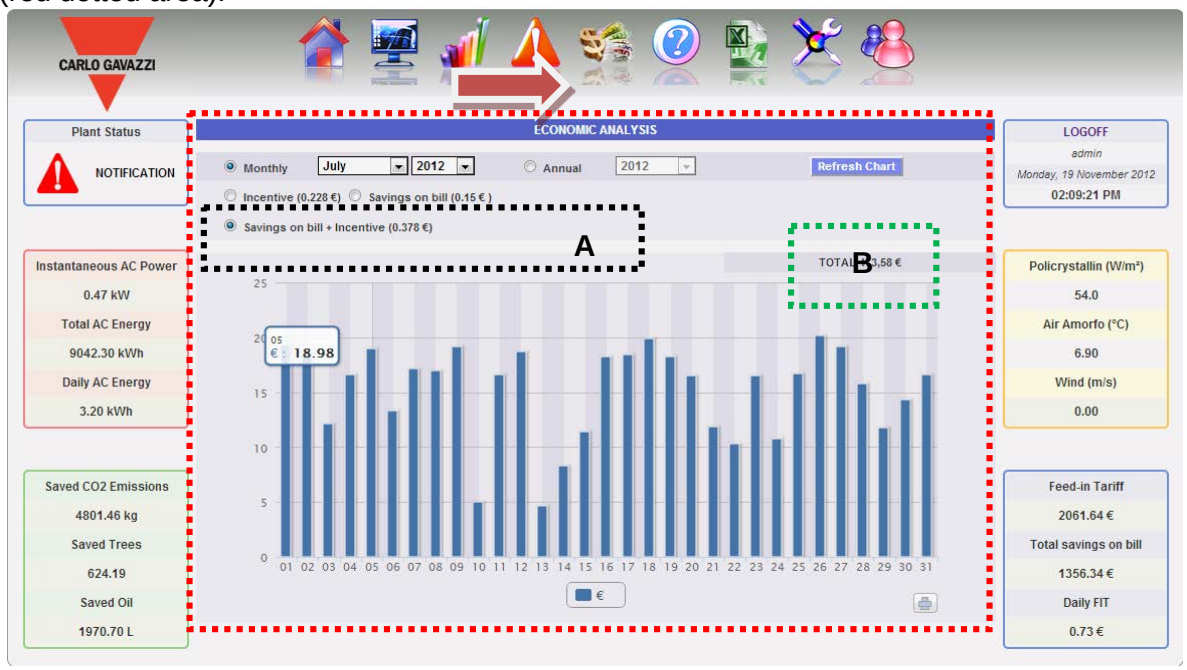


Fig. 144 - Economic analysis

As soon as you access this page, the chart shows the total countervalue in € ("Saving on bill +Incentive") for all days of the current month. To select another month or a yearly time interval, use the dark grey section on top and press "Refresh chart" key.
The available selections shown in Fig. 144 - "**A**" area, depend on the settings you made during configuration in the "Economic Data" section.

If during configuration you set "**Self-consumption**" as plant type, available items will be:

1. "*Incentive (…€)*": Click on "*Incentive*" to automatically view the chart with economic countervalues obtained from incentives. Values specified are calculated and stored by the system every day at 11:59 p.m., considering the amount paid for each kWh (set up in "Economic data" section in system data configuration and total value of energy produced during the day in kWh.
2. *Savings on bill (… €)*": Click to automatically view the chart with economic countervalues obtained from energy not purchased but self-produced. Values specified are calculated and stored by the system every day at 11:59 p.m., considering the "Price per kWh of energy purchased", set up in "Economic data" and total value of energy produced during the day in kWh.
3. *Savings on bill + Incentive (… €)*": Click to automatically view the chart with economic countervalues resulting from the sum of incentive and Savings on bill described in paragraphs 1 and 2.

If during configuration you selected "**Sale**" as a plant type, the available selection buttons will be the same as those of the self-consumption scheme, plus the following:

1. "*Sold energy (.. €)*": Click to automatically view the chart with economic countervalues obtained from energy sales. Values specified are calculated and stored by the system every day at 11:59 p.m., considering the "AMOUNT paid for each kWh sold", set up in "Economic data" and total value of energy produced during the day in kWh.
2. *Sold en. (..€)* + *Incentive*": Click to automatically view the chart with economic countervalues resulting from the sum of incentive and energy sold described in the above paragraphs.

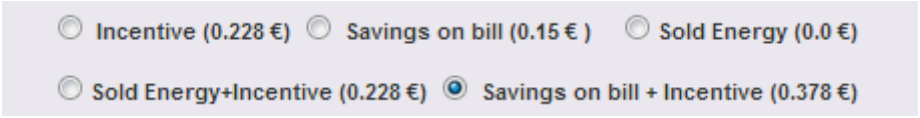


Fig. 145 – With SALE scheme selection

On top right side (green dotted area), the total value (in €) of selection set up is given, as paid/saved in the selected month/year.

If the time interval selected is "Yearly" type, values shown are calculated at the end of each month like the addition of all relevant daily values.

Note: Total daily energy produced (kWh) is considered in calculations. Data can come from the reference external energy meter or from the Inverters, if no energy meter exists.

22 PLANT DATA

This section shows the data and characteristics of the monitored photovoltaic system. Click on the "Information" icon in the Navigation menu to access the content shown in Fig. 146.

Fig. 146 - Plant Data

This page consists of four sections:

1. *Description*": Plant characteristics are specified here.
2. *Technical data*": Technical data of photovoltaic plant is specified here.
3. *Financial highlights*": Economic values are specified here.
4. "*Monthly energy production index estimated during the design stage (kWh/kWp)*": It indicates the expected monthly production index for the current year. This calculation takes into account the "*decay*" index set in the configuration page. The "*Expected energy for the year*" line also includes the value resulting from the sum of the production index of each individual month.

23 DATA EXPORT

This section allows to export the data stored in VMU-C in xls format.
Click on the "Export" icon in the Navigation menu to access the content shown in Fig. 147.

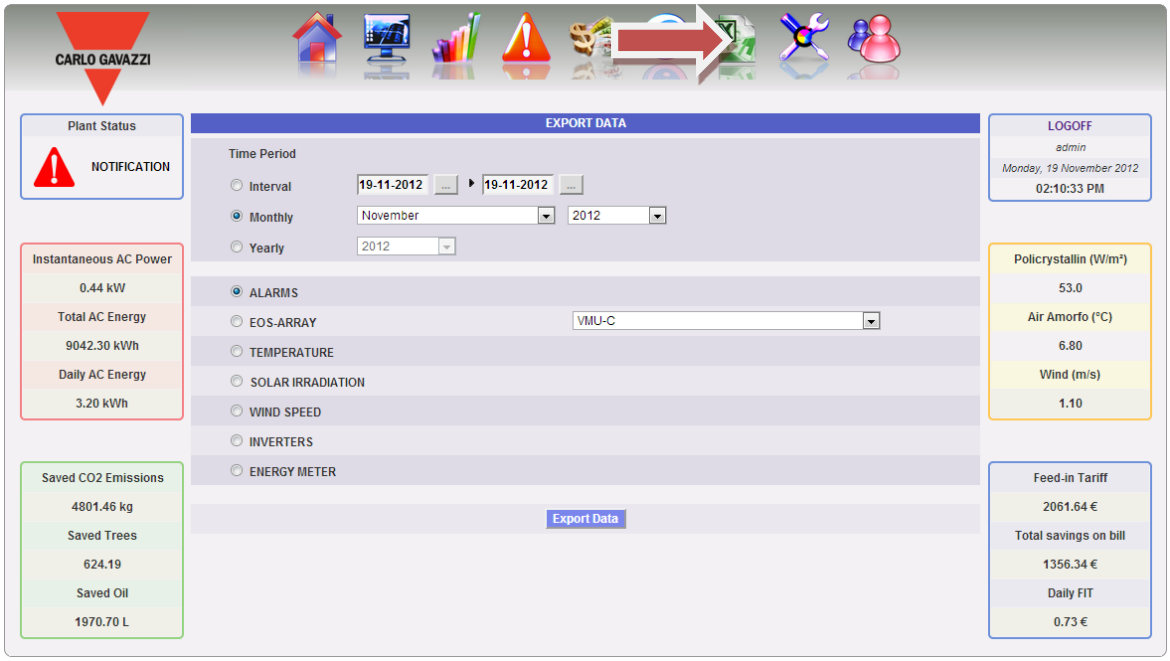


Fig. 147 - Exporting stored data

In this area, the type of datum to be exported and the relevant period can be chosen. Generate file by pressing the "*Export data*" button.
File can be open or saved on one's own PC.

You can export the following data types:

- *Alarms*": A .xls file is generated, containing the chronology of all alarms occurred in the system and organized according to the same graphic layout as "Alarms" web section. The saved file name will be of the following type: "ALARMS_dd_mm_yyyy.xls"
- *Eos-Array*": This selection allows to export the electric values acquired by string control(s) of one or all VMU-Ss under the VMU-C or by the VMU-M selected through the menu shown in Fig. 148.

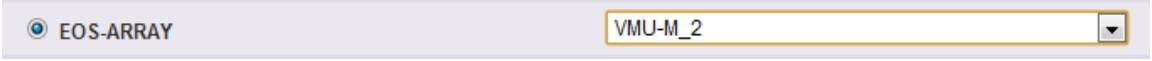


Fig. 148 - Exporting Eos-Array data

- *Data export for all VMU-S string controls under the VMU-C or a specific VMU-M*

  The generated xls file contains the values of all VMU-S under the VMU-C or the selected VMU, divided by electric dimension type. The first two columns show date and time, followed by groups of "n" columns containing Power (kW), Energy (kWh), Voltage (V) and Current (A). Select the address of the desired VMU-M (or directly the VMU-C) through the selection menu shown in Fig 148.

The number following the VMU-M_" indication specifies the RS-485 address assigned to the VMU-M' during programming. The saved file name will be of the following type: "VMU-M_dd_mm_yyyy.xls" Click on "Export data". xls file is generated containing data of the selected day (Fig. 149).

Date 2012-11-18	AC Energy on period (read from inverters) (kWh)	AC Instantaneous Power (read from inverters) (kW)	Energy on period (read from energy meters) (kWh)	Instantaneous Power (read from energy meters) (kW)	Solar Irradiation (W/m2)
10:15	0.10	1.0	0.10	1.50	146.00
10:20	0.10	1.1	0.10	1.60	157.00
10:25	0.10	1.1	0.10	1.50	150.00
10:30	0.00	0.9	0.20	1.30	136.00
10:35	0.20	0.9	0.10	1.20	126.00
10:40	0.00	0.7	0.00	1.10	111.00
10:45	0.00	0.6	0.10	0.90	96.00

Fig. 149 - Table of Eos-Array export data

- "***Temperature***": The selection allows to export the temperature values of all the sensors configured as active ("Enable") in VMU-C. The generated xls file will contain two columns specifying the date and time, followed by as many columns as the number of the temperature sensors (for each individual logging interval, the file will indicate the average, maximum and minimum value for each probe).
- "***Solar irradiation***": The selection allows to export the solar irradiation values of all the sensors configured in VMU-C. The generated xls file will contain two columns specifying the date and time, followed by as many columns as the number of the solar irradiation sensors, each containing the relevant values in $W*m^2$ (for each individual logging interval, the file will indicate the average, maximum and minimum value for each probe).
- "***Wind speed***": The selection allows to export the wind speed values of all the sensors configured in VMU-C. The generated xls file will contain two columns specifying the date and time, followed by as many columns as the number of the wind speed sensors, each containing the relevant values in m/s (for each individual logging interval, the file will indicate the average, maximum and minimum value for each probe).

- "***Inverters***": The selection allows to export the electric values acquired by the Inverters monitored by VMU-C. The generated xls file contains the values divided by electric dimension type. The first two columns show date and time, followed by groups of "n" columns (equivalent to the number of inverters) containing all the electric dimensions made available by the inverters themselves:

- "***Meters***": The selection allows to export the progressive energy values counted by all the meters configured in VMU-C. The generated xls file will contain two columns specifying the date and time, followed by as many columns as the number of the monitored meters, containing the relevant values in kWh.

24 ACCOUNT

Clicking on the “Account” icon in the Navigation menu will grant access to the Account Configuration section (Fig. 150) allowing to manage users for access to the system.

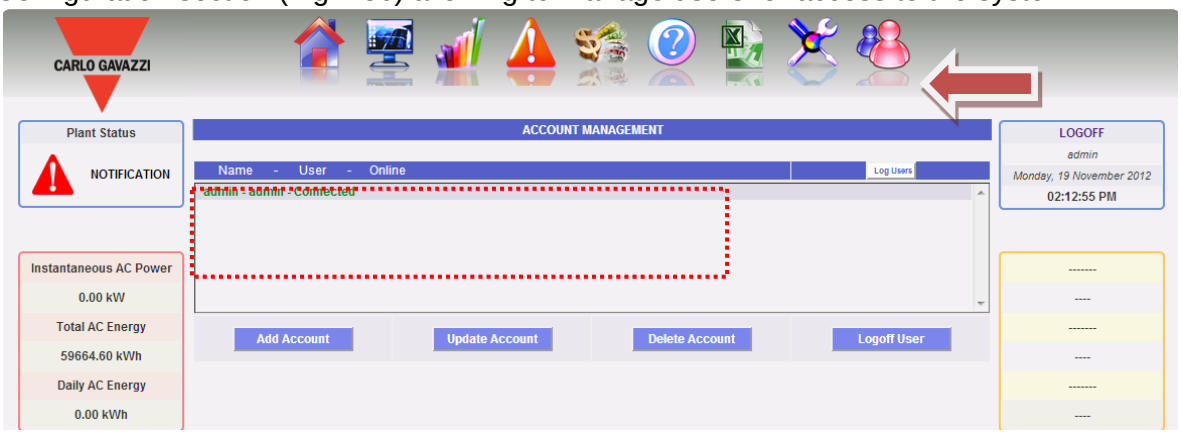


Fig. 150 - Account management

24.1 ACCOUNT MANAGEMENT

System accesses are managed by creating two user types with different privileges.

A. “*Administrator*” type user – Administrator user has access to all software areas: System configuration, Account configuration, Data display.

B. “*User*” type user – "User" user has only access to Data display area.

The system has a default Administrator type, with these characteristics:

Username	Password	Username
admin	admin	Administrator

It is recommended to modify the default user during the first configuration.

Note: An Administrator type user must always exist in the system, otherwise access to System configuration and Account configuration areas is not allowed any more. To restore Administrator user, contact Carlo Gavazzi technical assistance.

Two know which users are online just refer to the list displayed in the dotted area in Fig. 150. Logged-in users are shown in green and are marked with “Logged-in”; other users are shown in red and are marked with “Not logged-in”.

24.2 NEW ACCOUNT INSERTION

Press the "*Add account*" button. In the bottom section of the page the system will display the content shown in Fig. 151.

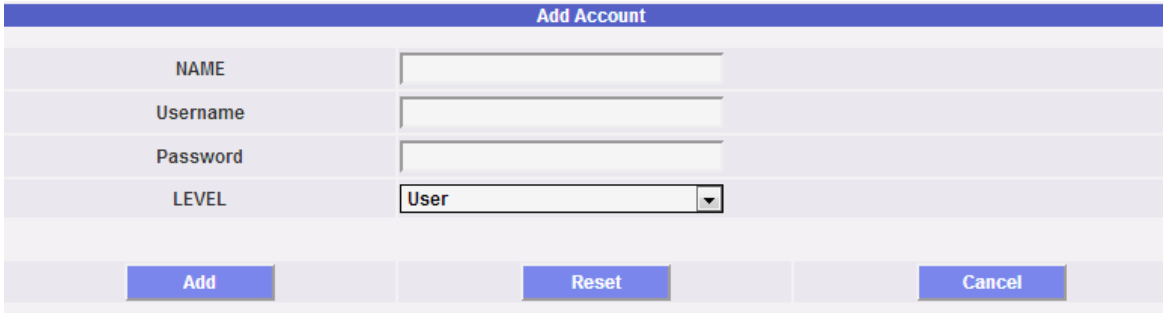


Fig. 151 - Account insertion mask

Fill in the fields according to the following specifications:

- "*Name*": Username.

  Note: It is recommended to never assign the same "Name" to two different users.

- "*USERNAME*": Username for system access.

  Note: Two users with the same "Username" cannot be entered.

- "*PASSWORD*": Password for system access.

- "*LEVEL*": User level: User/Administrator.

Press "Reset" key to delete the contents of various fields; "Cancel" to cancel operation. Press "Add" key to enter account and add it to the list.

24.3 MODIFY ACCOUNT

Select the account to be modified from the Inserted accounts list (Fig. 150). Press the "*Modify*" button. In the bottom section of the page the system will display the content shown in Fig. 152.

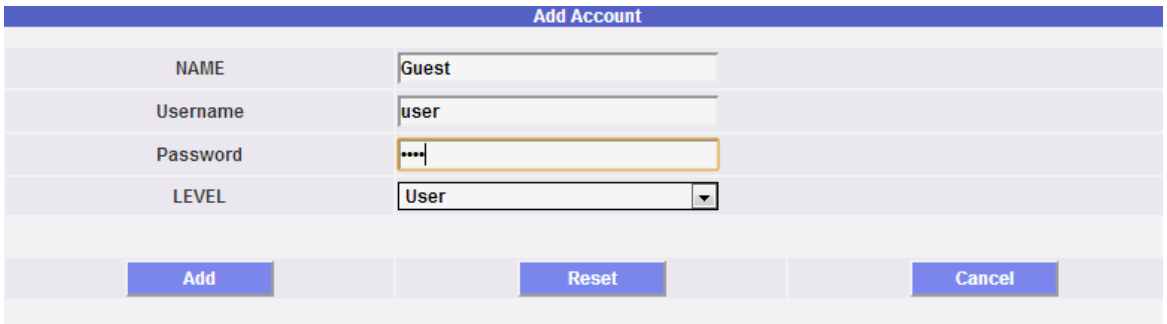


Fig. 152 - Account Modification mask

Modify as already described in the previous section (New account insertion) and considering that Username field cannot be changed. Press the "Reset" button to cancel

the modifications; “Cancel” to cancel the operation. Press the “Update” button to modify the account.

24.4 ACCOUNT DELETION

Select the account to be deleted from the list shown in Fig. 150. Press the “*Delete account*” button. The confirmation message appears on the centre of the page. Press “OK” key to confirm deletion or “Cancel operation” to cancel.

24.5 ACCOUNT LOG-OFF

The administrator user can disconnect a user in the list by a forced log-off operation. The user in question is displayed in green in the list with the "Connected" word aside. Select the account to be disconnected from the list shown in Fig. 150. Press the “*User Log-off*” button. All the users connected with that Username are disconnected and re-addressed to the home page.

24.6 CHRONOLOGY OF SYSTEM ACCESSES

Clicking on the “Log Users“ button (Fig. 150) will open a window containing the chronology of the accesses to VMU-C complete with date and time (Fig. 153). Lines in green show the users online at the moment.

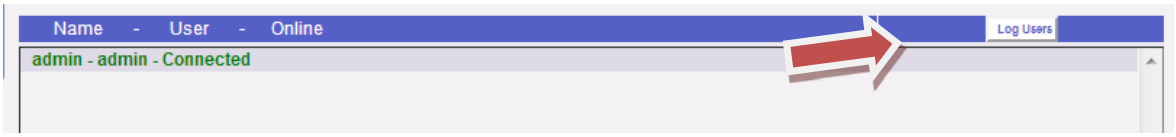


Fig. 150 - System accesses list button

The chronology keeps access data for a week; date and time refer to login phase.

User	Logged	IP	Last Login
admin	Connected	192.168.2.166	19-11-2012
admin	Connected	192.168.2.166	16-11-2012
admin	Connected	192.168.3.104	15-11-2012
admin	Connected	192.168.2.166	14-11-2012
admin	Connected	192.168.2.166	13-11-2012
admin	Connected	192.168.2.166	26-10-2012
admin	Connected	192.168.2.167	22-10-2012
admin	Connected	192.168.2.77	19-10-2012
admin	Connected	192.168.2.166	18-10-2012
admin	Connected	192.168.2.184	18-10-2012
admin	Connected	192.168.2.166	17-10-2012
admin	Not Connected	192.168.2.166	17-10-2012

Fig. 153 - System accesses list

Click on IP address captured to find the user's origin area.

25 BACK-UP OF DATA

- *Data backup on external memory (optional)*

  With the help of a “Micro SD” or “SDHC” memory card appropriately inserted into the relevant slot (Fig. 154) or directly using a PenDrive connected to the USB port (Fig. 155), you can backup the data existing in the VMU-C database.

  Note: **the Micro SD card is not included in VMU-C. the maximum capacity of the Micro SD card or of the PenDrive is of 16GB.**

  - *Micro SD installation*

    1. Open the flap located on the VMU-C front panel. Identify the slot specifically designed for the insertion of the “Micro SD” memory cards (fig. 151).

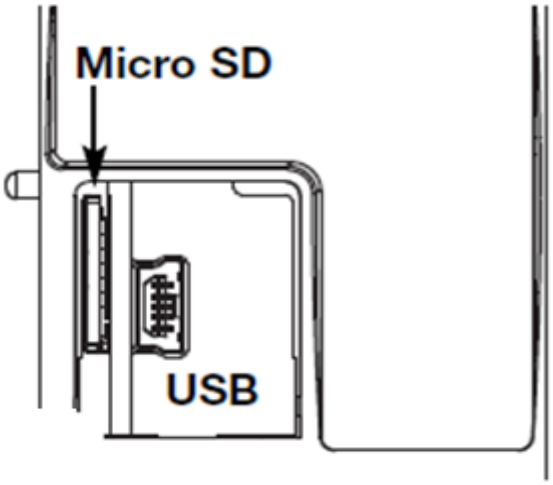


Fig. 154 – Slot for Micro SD memory card and mini-USB port

    2. Insert the Micro SD card, making sure it is not write-protected and it is properly formatted (FAT32).
    3. Close the flap back. Warning: if the flap is not properly closed VMU-C will not enable any writing or reading operation (flap closing is controlled by a micro switch located under the flap.
    4. As soon as the flap is closed, VMU-C will install the newly inserted memory card and transfer the BACK-UP data. As long as the installation and writing operations are under way, the front “ON” LED (green) will blink. Warning: opening the flap during the writing stage will stop the data transfer process and may potentially damage the Micro SD memory.

  - *Pen-drive installation*

    1. Identify the USB port specifically designed for the insertion of the “Pen Drive” memory (Fig. 155).

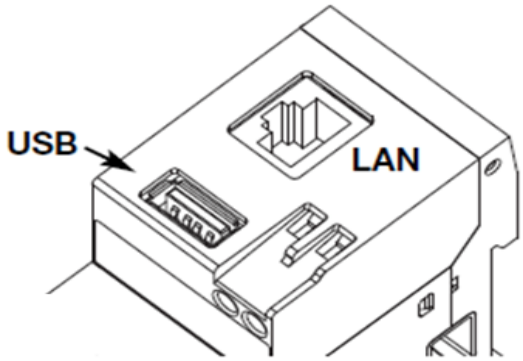


Fig. 155 – USB Slot for Pen Drive

2. Insert the Pen-drive, making sure it is not write-protected and it is properly formatted (FAT32).
3. As soon as you have inserted the Pen-drive, VMU-C will install the newly inserted memory and transfer the BACK-UP data. As long as the installation and writing operations are under way, the front "USB" LED (blue) will blink. Warning: disconnecting the Pen-drive during the writing stage will stop the data transfer process and may potentially damage the Micro SD memory.

The Back-up operation starts as soon as the memory device (micro SD or Pen Drive) is inserted. At the end of the operation, the memory device will contain a folder named VMUC_"VMU-C name" (fig. 156) whose content is described below:

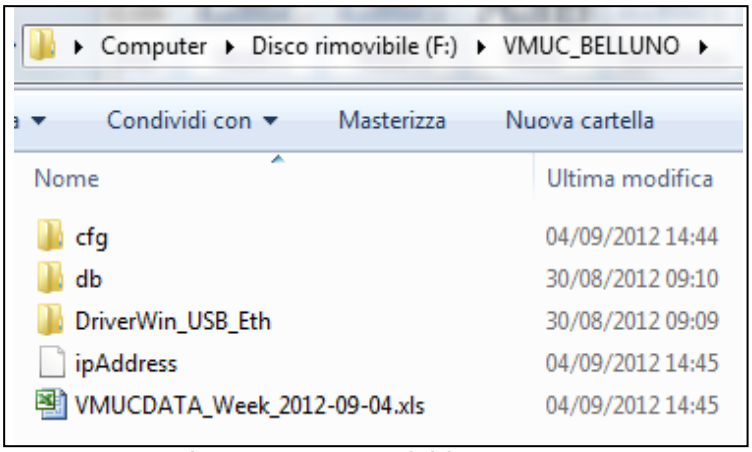


Fig. 156 – VMUC folder content

Note: The name of the folder VMU-C automatically creates at switch-on (or when the memory device is inserted) consists of a fixed part "VMUC, automatically followed by the name assigned to the VMUC itself (For example the folder name might be something like VMUC_BELLUNO). This operation, which VMUC performs automatically, will prevent the databases of different VMUC from being overwritten.

- *Folder "**cfg**"*
- *Folder "**db**"*

- *Folder "**DriverWin_USB_Eth**"*
- *File "**ipAddress**"*
- *EXCEL file "**VMUCDATA week_.....**"*

The ***"cfg" folder*** *contains two files:*

1) *EWgeneral.db: it contains the general system configuration, like the IP address, the planned operations, the e-mail addresses for the sending of scheduled messages or in case of alarm, etc.*
2) *EWplant.db: it contains the plant configuration (the system configuration, like installed modules, RS485 network addresses, threshold settings, etc.).*

"db" folder *It contains the whole VMU-C database. This folder contains all the data stored in VMU-C and updated up to 12:00 p.m. of the previous day. Should the VMU-C get damaged and have to be replaced, this folder allows to move the whole Database and the relevant configuration from the damaged instrument to the new one through a "**Disaster-Recovery**"-type function*

"DriverWin_USB_Eth" folder *it contains a Windows driver allowing to connect the VMU-C to the PC through the mini USB communication port. In this case the reference address (fixed and not editable) is 192.168.254.254. To access the VMU-C through the mini USB port use a USB => mini USB cable and type through the browser in use the address 192.168.254.254;* the log-in page will be displayed again.

"ipAddress" file: *it contains the IP addresses of the connected devices.*

Note: *We recommend that you use "Notepad" to display this file.*

EXCEL file "VMUCDATA week_.....": Excel file containing all the data logged by VMU-C in the last 7 days. The file (Fig. 157) will contain the following variables:

- *AC energy for the period (read from Inverters) kWh*
- *Average power for the period (read from Inverters) kW*
- *AC energy for the period (read from Energy Meter) kWh*
- *Average power for the period (read from Energy Meter) kWh*
- *Average solar irradiation for the period W/m^2*

Note: *For all the variables mentioned above, the period corresponds to the logging interval set on VMU-C. This interval can* be of: 5,10,15,30,60 minutes.

	A	B	C	D	E	F
1	Date 2012-07-29	AC Energy on period (read from inverters) (kWh)	AC Instantaneous Power (read from inverters) (kW)	Energy on period (read from energy meters) (kWh)	Instantaneous Power (read from energy meters) (kW)	Solar Irradiation (W/m2)
86	12:00	0.40	4.5	0.50	6.50	776.00
87	12:05	0.40	4.5	0.60	6.60	784.00
88	12:10	0.40	4.6	0.50	6.60	789.00
89	12:15	0.40	4.6	0.60	6.70	805.00
90	12:20	0.40	4.7	0.50	6.80	812.00
91	12:25	0.40	4.7	0.60	6.80	810.00
92	12:30	0.40	4.6	0.60	6.70	799.00
93	12:35	0.40	4.6	0.50	6.60	790.00
94	12:40	0.30	4.7	0.60	6.80	815.00
95	12:45	0.40	4.8	0.60	6.90	831.00
96	12:50	0.40	4.8	0.50	7.00	845.00
97	12:55	0.40	4.8	0.60	7.10	852.00
98	13:00	0.40	4.8	0.60	7.00	841.00

Fig. 157 – Content of the back-up Excel file

If the memory device (micro SD or Pen Drive) is left inserted into VMU-C, at 12:00 p.m. o'clock, on a daily basis VMU-C adds a new file (fig. 158) containing the data of the just expired day (same formatting as the previous file).

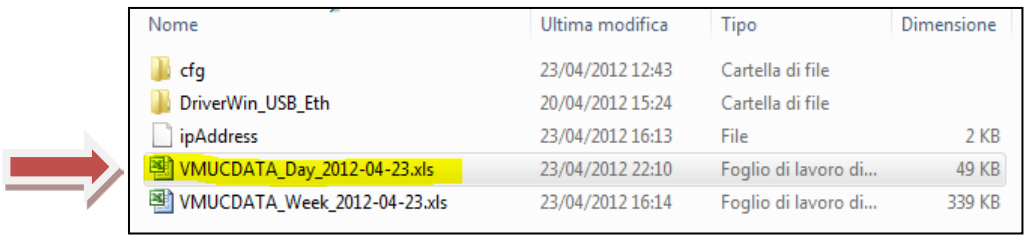


Fig. 158 – New daily back-up file

25.1 RESTORATION OF THE CONFIGURATION FROM BACKUP (FROM FILE)

If the VMU-C configuration has previously been saved on a PC, it can be re-imported by simply following the procedure described below:

- Click on the "*SETUP*" icon => Click on the "*PLANT*" button => Click on the "*CONFIGURATION*" button => Click on the "*WIZARD*" button => Click on the "*IMPORT*" button

The system will then display a "Configuration import from file …" mask (Fig. 159).

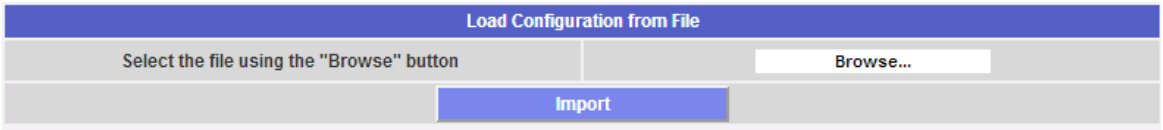


Fig. 159 – Configuration import from FILE

Through the "***Browse***" button specify the path of the location where the configuration file had been previously saved on the PC.
As soon as the relevant file has been selected (Fig. 160), you'll be able to issue the "***Import***" command.

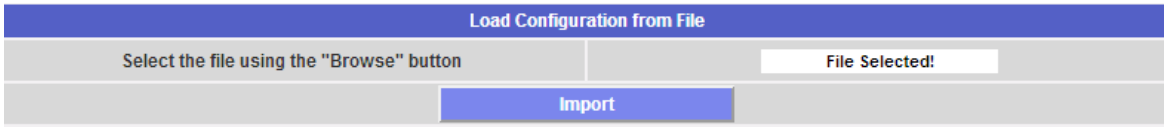


Fig. 160 – Configuration import from USB or micro-SD

25.2 RESTORATION OF THE DATABASE FROM BACKUP (DISASTER RECOVERY)

If a memory pen or a micro SD memory card is inserted in VMU-C the following screen will be displayed:

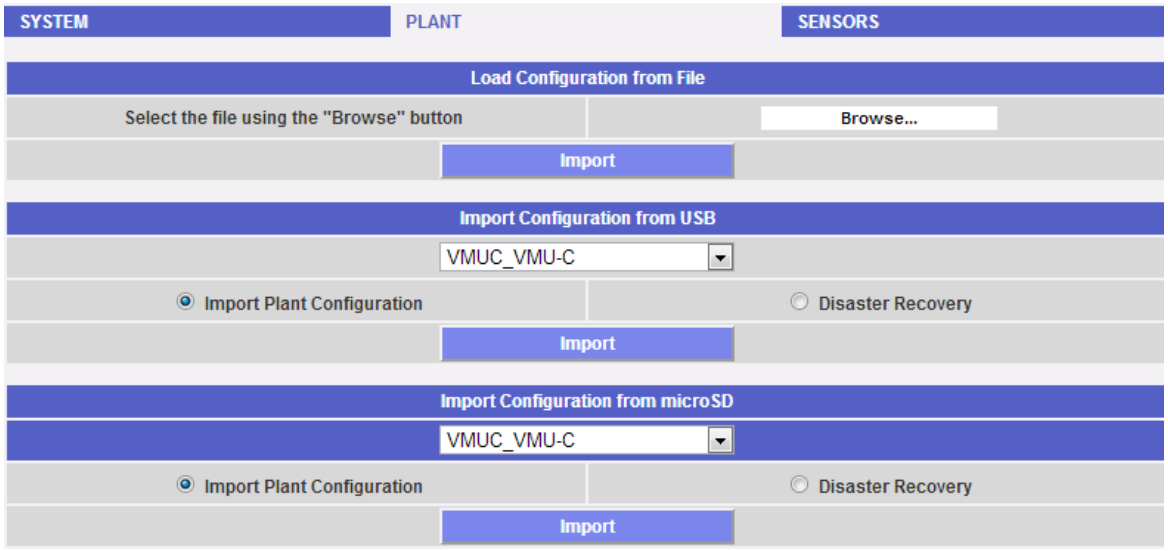


Fig. 161 – Configuration and/or Database import (Disaster Recovery function)

The screen in question (Fig. 161) allows to access two distinct operations:

- Plant Configuration Import
- Disaster Recovery

25.3 IMPORT OF THE PLANT CONFIGURATION

This operation is exactly equivalent to the “Configuration restoration from Back-Up” described at point 3.1. Whenever an external memory device (Pen-drive or micro-SD) is inserted into VMU-C, a copy of the system configuration (Arrays, Inverters, Energy Meters) will be automatically created; the copy in question can then be imported through a special command.

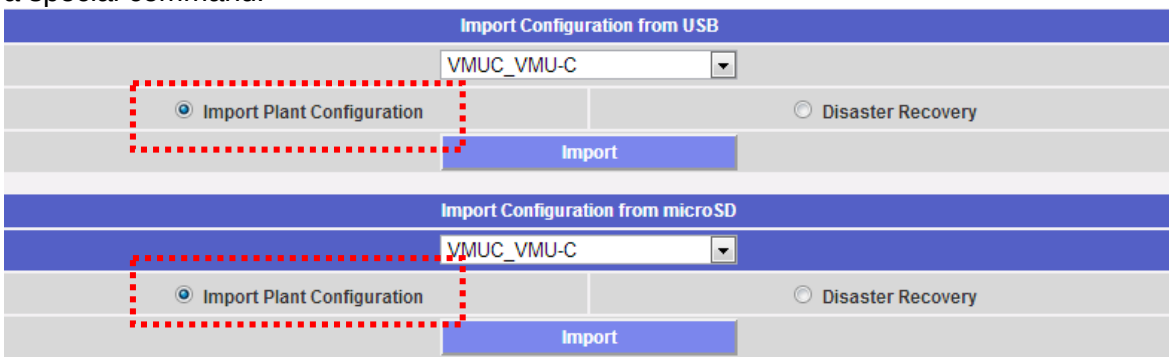


Fig. 162 – Configuration import from USB or micro-SD

25.4 IMPORT OF THE DATABASE (DISASTER RECOVERY)

This operation allows to import into a VMU-C the Database of an other VMU-C (this function can be very useful in case the machine should have to be replaced as a consequence of a failure). The “Disaster Recovery” function imports into the new machine all the previously saved data (data-logger + events) on the failed VMU-C.
Obviously this function is only available if the back-up memory device (Pen-drive or micro SD) is left constantly inserted into the VMU-C.

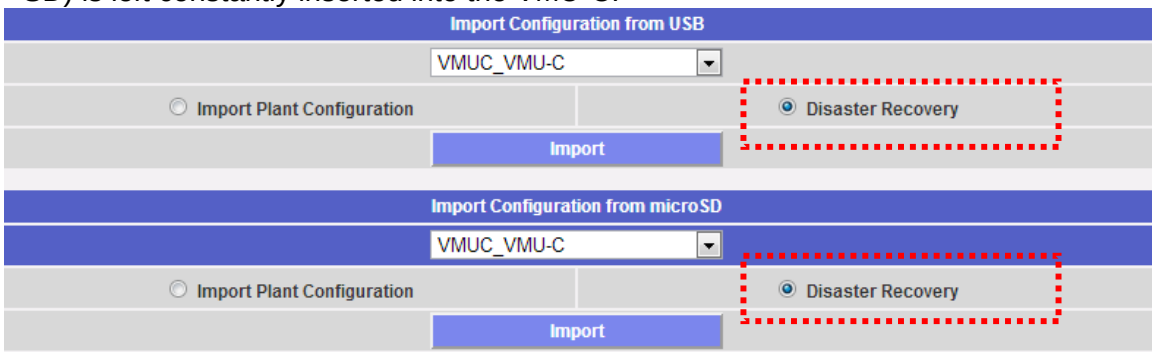


Fig. 163 – Database import from USB or micro-SD