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# Eos-Box

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## Web-Server solution for photovoltaic applications

Instruction Manual  
Vers. 1.0.0

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# 1. INSTALLATION

## 1.1 INTRODUCTION

This manual is the complete guide for installation, configuration and commissioning of Eos-Box; it is aimed at technical personnel with an average knowledge of Informatics and of basic principles of networking on TCP/IP.

Eos-Box is a complete system of monitoring of the devices on a photovoltaic plant like inverter, energy meters, environmental sensors and string control (Eos-Array).

The software and all the components necessary for operation panel don't require the installation of any additional software component.

## 1.2 PACKAGE CONTENTS

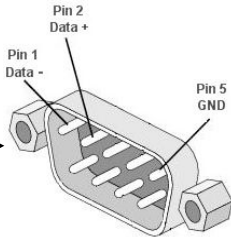
Eos-Box is supplied with the following components:

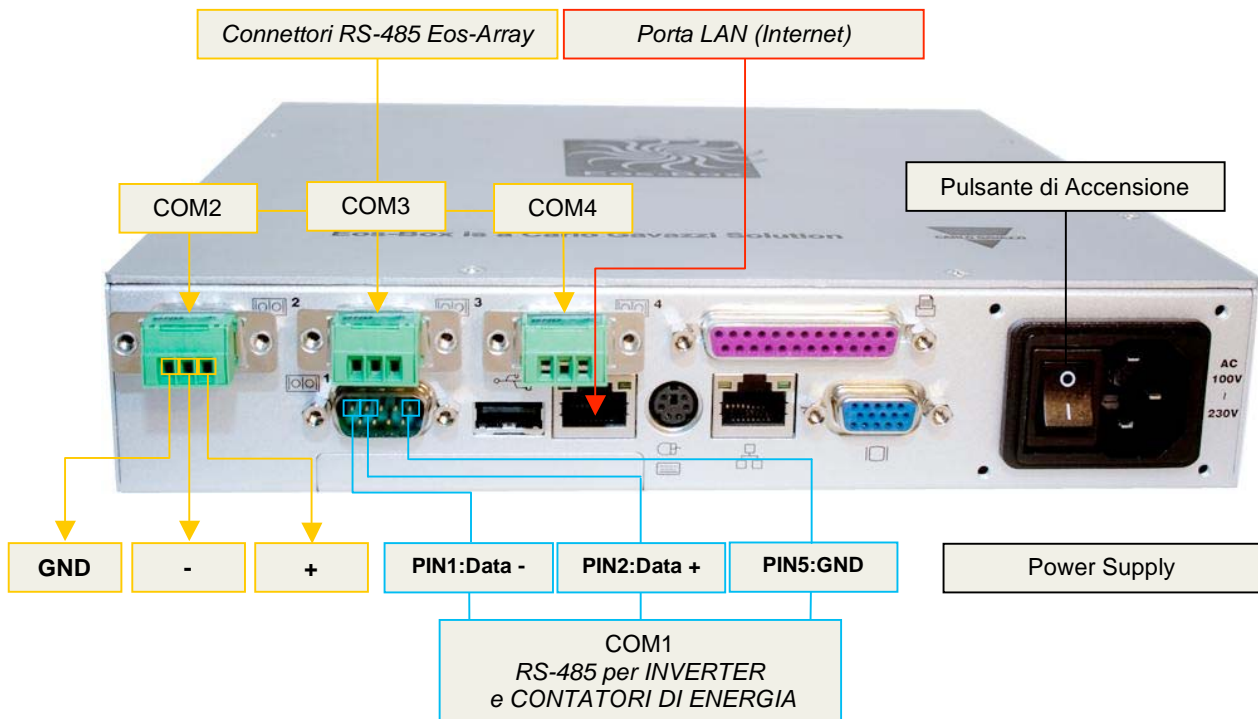
- ∞ Eos-Box
- ∞ Power cable for connection to the power grid.
- ∞ N° 3 Connectors for connection to the network RS-485
- ∞ Kit for DIN rail mounting
- ∞ Kit for mounting on a flat surface
- ∞ This printed manual
- ∞ Instruction Manuals on CD-ROM in English-Spanish-Italian-German and French.

## 1.3 TECHNICAL FEATURES

Eos-Box is an embedded controller completely fanless and with no moving parts; the industry hardware, its small size, the minimum electrical input and the absolute silence make it ideal for monitoring applications that require features such as robustness and reliability over time, to fit both in technical environments and inhabited environments, without requiring any special device for mounting, use and maintenance.

The following table provides a summary of product characteristics:

<p>Ports and connections</p>	<p>1 X Power supply 100 to 230VCA                  1 X RS-485 (COM1) - 9 pin D-sub:</p> <table border="1"> <tr> <td>pin 1</td> <td>Data -</td> </tr> <tr> <td>pin 2</td> <td>Data +</td> </tr> <tr> <td>pin 5</td> <td>GND</td> </tr> </table>  <p>3 X RS-485 (Three-pole Connector)                  1 X RJ-45 connector for 10/100 Base-T Ethernet [Communication] [Communication port – default IP: 192.168.1.110]                  1 X RJ-45 connector for 10/100 Base-T Ethernet (with Logo ) [Service port – IP unmodifiable: 192.168.1.100]                  3 X USB                  1 X DB25 D-Sub connector [Not Enabled]                  1 X VGA [Not Enabled]                  1 X PS/2 connector [Not Enabled]</p>	pin 1	Data -	pin 2	Data +	pin 5	GND
pin 1	Data -						
pin 2	Data +						
pin 5	GND						
<p>Consumption</p>	<p>70W Max.</p>						
<p>Operating conditions</p>	<p>-20°C to 50°C</p>						



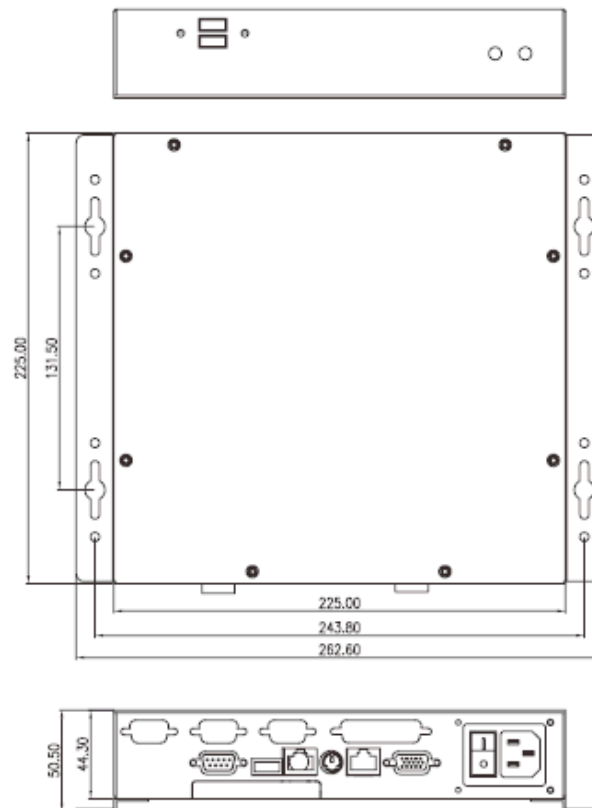


Fig 1 –Eos-Box Dimensions

## 1.4 INSTALLATIONS AND CONNECTIONS

The mounting of Eos-Box requires the following steps:

- ∞ Connection to AC 220V using the supplied cable
- ∞ Inverters and energy meter (if any) connection to RS-485 port (COM1 - 9 pin D-sub). The RS-485 networks through which various devices communicate, need to be connected in parallel and connected to Eos-Box according to the following specifications:

<i>pinout COM1</i>	
pin 1	Data -
pin 2	Data +
pin 5	GND

The various “slave” devices can communicate at different baud rates (communication speed) and use different communication protocols.

- ∞ Connection to RS-485 ports (COM2-COM3-COM4 three-pole connectors) of Eos-Array according to the following specifications:

<i>pinout COM2/3/4</i>	
pin -	Data -
pin +	Data +
pin <b>GND</b>	GND

It is possible to connect one or more Eos-Array to each port depending on the communication speed and to data sampling time.


All Eos-Array connected to the same port must be configured with the same baud rate and the same sampling time.

Use the table below (Fig. 2) respecting the imposed constraints.

Every Eos-Array includes 15 VMU-S			Max Number of Eos-array connected to a port				
		Max Number of connectable Eos-Array	Max number of manageable VMU-S	@ 9600 b/s	@ 19200 b/s	@ 38400 b/s	@ 115200 b/s
Sampling Rate (minutes)	1	18	270	13	18	18	18
	5	84	1260	65	84	84	84
	10	168	2520	130	168	168	168
	15	247	3705	195	247	247	247
	30	494	7410	247	247	247	247
	60	741	11115	247	247	247	247

The "Log" data within the will remain available and can be graphically displayed for 6 Months in the case of sampling interval of 1 minute to 10 Years in case of sampling interval of 30 minutes.  
 The daily Data as synthetic value of a day will remain available and can be graphically displayed for 10 Years.

Fig 2 Max Number of Eos-Array connectable on Eos-Box

- ∞ Connection to data network by standard Ethernet cable, using the communication port LAN WITHOUT Logo (  ) configured with static IP default address 192.168.1.110
- ∞ (Optional) GPRS/EDGE/UMTS/HSDPA Modem Connection by USB supplied cable to any available USB port on Eos-Box.

Move to "1" the power button next to the power connector, the frontal LEDs light up, Green and Orange, indicating the presence of power and disk activity; furthermore, after the connection of the network cable, the LEDs light up in correspondence with the relevant Ethernet port. Once connected and powered Eos-Box, to get access to its configuration web page as specified in the next chapter.

## 2. GENERAL OVERVIEW

### 2.1 WHAT IS EOS-BOX

Eos-Box is a web server for monitoring of photovoltaic plants based on web technology. Once properly configured, the Eos-Box software can be used through the network – both LAN and Internet – by means of any PC or device with a common Internet browser. Since Eos-Box is based on web technology, its use follows the same features of a common website; the display of data and of the status of the devices installed in the plant (inverter, strings, environmental sensors) is based on the innovative AJAX technology, that allows you to send and receive information without graphic pages reload.

### 2.2 ACCESS TO THE SYSTEM

To access the system, you must establish a network connection between your PC and Eos-Box **using the LAN without logo**; you can proceed in two ways:

- ∞ Directly connect the two machines via a crossover network cable (“cross over”)
- ∞ Connect both machines to their own network

The default address of Eos-Box is **192.168.1.110**; in both connection configurations, this implies that in order to communicate with Eos-Box, your PC must belong to the same sub-network, or it must have an IP address “192.168.1.x”, where “x” must be a number between 1 and 254, other than 110.

If your network configuration is different (the first 3 numbers are different from those shown) you must temporarily change your network configuration as mentioned above; at this point, as shown below, once you are in the software, you can change the network parameters of Eos-Box, to make it compatible with your network, and finally restore the original network configuration.

Once you have configured your IP address, open an Internet browser and type the following address:

<http://192.168.1.110>

It will be proposed at the next login page:





Fig. 3 – System access Page

By selecting “REGISTERED USERS” you will go to the Login page:

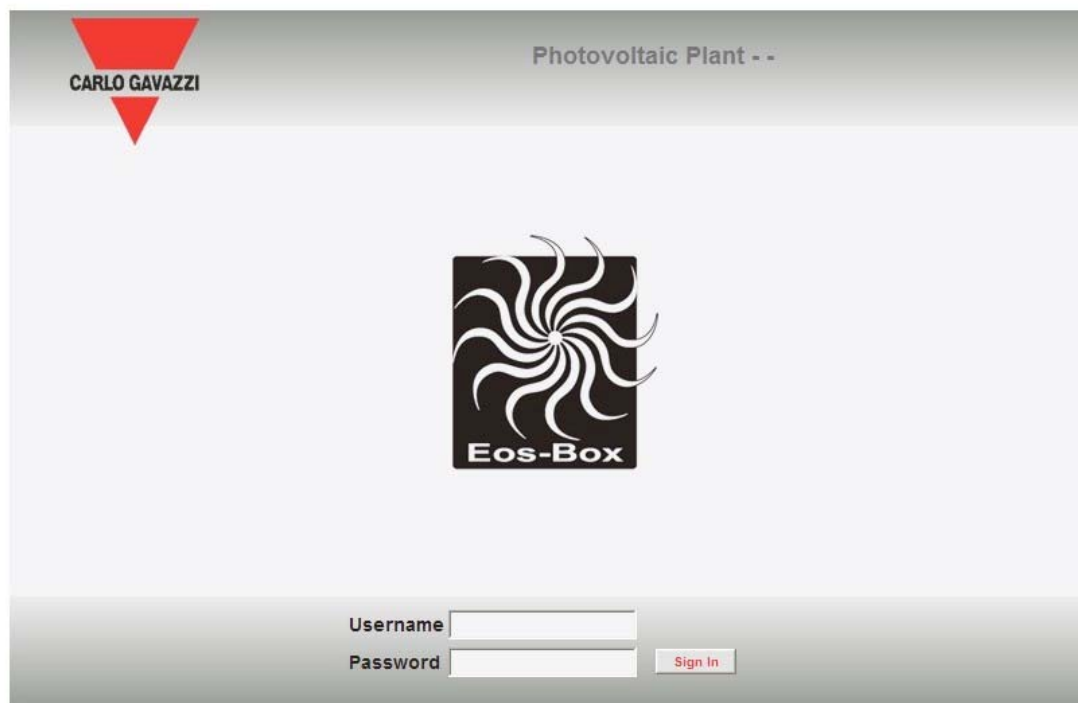


Fig. 4 – Login Page

The following is the default user and relative password:

Username	Password	Username
admin	admin	Administrator

It is crucial to change the default password, otherwise it would open a potential access route to the system, especially in case of Internet connectivity.

## 2.3 MAIN SCREEN

The following figure shows the Home Page of Eos-Box:

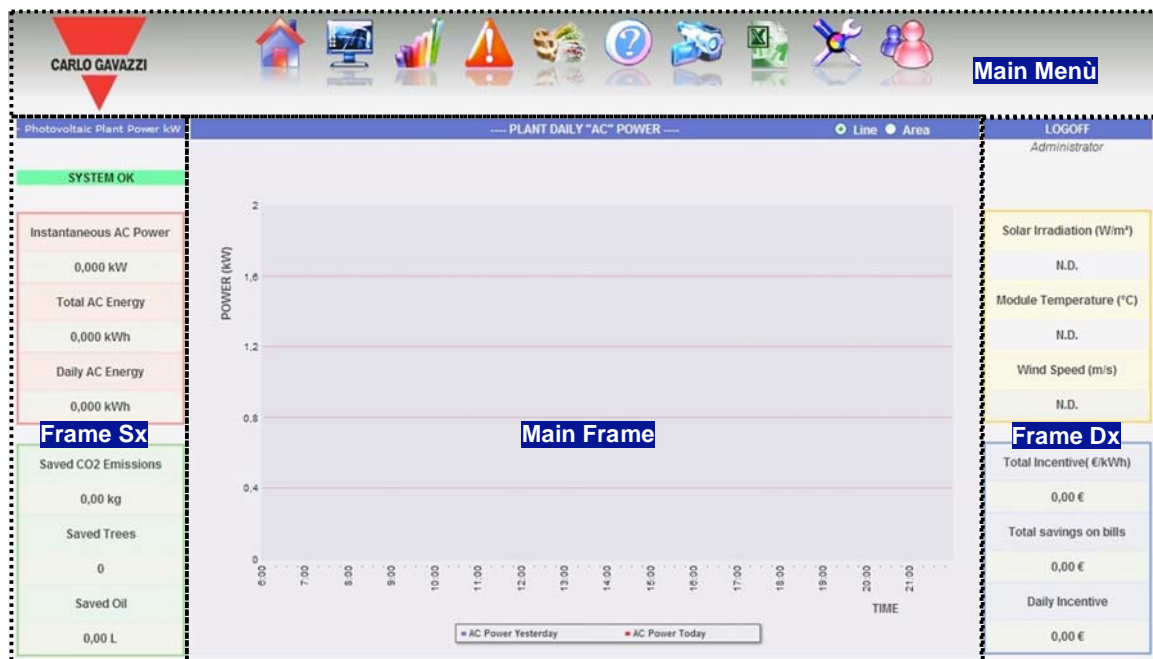


Fig. 5 – Home Page

In particular, the following elements are highlighted, their are always available while using the software:

1. Main Menu: It contains the navigation menu (Par. 2.3.1)
2. Frame Sx: Starting from the top:
  - ∞ Band with scrolling text related to the main data of the plant: name, place, plant type (fixed/tracking/mixed), and peak power.
  - ∞ Date.
  - ∞ System Status. There are two possible messages:
    - 1) SYSTEM OK – The system has no alarms or Anomalies
    - 2) !!! WARNING !!! The system has ANOMALIES – There are Alarms or Anomalies.

Clicking on the message, it will be showed a list in the Main Frame where it is shown the history of all alarms that occurred in the plant in descending

chronological order. If One or more Alarms/Warnings are "not closed" (it is not present "End Date"), Message System Status will be those displayed in 2). As described below, you can hide the Alarms / Warnings prevent them from generating the message 2).

∞ Production data. (Automatic data update)

Instantaneous AC Power
0,000 kW
Total AC Energy
0,000 kWh
Daily AC Energy
0,000 kWh

1) Instantaneous AC power – Instantaneous power (kW) produced by the plant. The data comes from the inverter or the reference counter depending on the settings shown on "Plant Data"

2) Total AC Energy – Total Energy produced by the plant from its start. The data comes from the inverter or the reference counter depending on the settings shown on "Plant Data".

3) Daily AC Energy – Energy produced by the plant from the beginning of the day. The data comes from the inverter or the reference counter depending on the settings shown on "Plant Data".

∞ Ecological data. (Automatic data update)

Saved CO <sub>2</sub> Emissions
0,00 kg
Saved Trees
0
Saved Oil
0,00 L

1) Saved CO<sub>2</sub> Emissions – The calculation refers to the total AC energy produced by the plant (see 'Total AC Energy in "Production Data") Unit of Measurement kilogram (kg).

Calculation:

A kWh used by the last user produced by a thermal power plant, equivalent to an emission of about 0.53kg of CO<sub>2</sub>. We can assert that a kWh produced by a photovoltaic plant saves such as 530g of CO<sub>2</sub> emission.

The result is:  $Saved\ CO_2\ Emissions = 0.531 \times Total\ CA\ Energy(kWh)$

2) Equivalent Trees - The calculation refers to the total AC energy produced by the plant [see 'Total AC Energy in "Production Data"]].

Calculation:

$Equivalent\ Trees = Saved\ CO_2\ Emissions \times 0.13$

3) Saved Oil - The calculation refers to the total AC energy produced by the plant [see 'Total AC Energy in "Production Data"]]. Unit of Measurement Litres (L).

Calculation:

$Saved\ Oil = TOE \times 7.33 \times 159$

$$\text{TOE} = [0.187 \times \text{Total AC Energy (kWh)}] / 1000$$

1 TOE (The tonne of oil equivalent) = 7,33 oil barrels

1 oil barrel = 159 oil litres

3. Frame Dx: Starting from the top:

- ∞ Logoff Button. Clicking you will be disconnected from Eos-Box and returned to the login page.
- ∞ User Name.
- ∞ Time of your PC.
- ∞ Environmental Sensors Data. (Automatic data update)

Solar Irradiation (W/m <sup>2</sup> )
N.D.
Module Temperature (°C)
N.D.
Wind Speed (m/s)
N.D.

1) Solar Irradiation – Solar Irradiation (W/m<sup>2</sup>) affecting the reference Solar Radiation Sensor.

2) Module Temperature – Temperature (°C) acquired by the reference temperature probe.

3) Wind speed – Wind speed (m/s) acquired by the reference sensor.

N.A. = Data not available. It occurs in the following cases: the sensor is not installed; the data is not correct; the sensor is not communicating.

- ∞ Economic Data. (Automatic data update)

Total Incentive( €/kWh)
0,00 €
Total savings on bills
0,00 €
Daily Incentive
0,00 €

1) Total Incentive – Total Amount (€) received as incentive. (x €/kWh), x Amount paid per kWh of produced energy.

Calculation:

$$\text{Total Incentive} = \text{Total AC Energy} \times \text{Incentive}$$

2) Total savings on bills / Total Amount of Sold Energy (€) – depending on the set economic system: Internal consumption / Sale

Calculation:

$$\text{Total Savings on Bills} = \text{Total AC Energy} \times 1 \text{ Energy kWh cost}$$

$$\text{Total amount of sold energy} = \text{Total AC Energy} \times \text{Amount paid for the sale of 1 kWh of energy}$$

- 3) Daily Incentive – Equivalent received as incentive depending on the energy production of the day in progress.

4. Main Frame: The relevant pages of the navigation menu are showed.

## 2.3.1 NAVIGATION MENU

Moving the mouse over the icons, it will be shown below its meaning. Click the icon to access the relevant section, which will be shown on the Main Frame.



### Home

You can go back to the homepage.



### Monitor

It allows the graphical display of production data comparing solar irradiation, temperature, power and efficiency.



### Plant

It allows the graphical display of all collected plant data.



### Alarms

It allows the graphical display of the alarms occurred in the plant.



### Economy

It allows the graphical display of the equivalent value from incentive, sales and savings



### Information

File containing the characteristics of the plant.



### IP Cam

It allows the display of IP Cam of the plant



### Export

It allows exporting the stored data in xls format.



### Configuration (Available only for administrator)

It allows accessing the configuration menu.



### Account (Available only for administrator)

It allows accessing the account management section.

## 3. CONFIGURATION

Clicking on the "Configuration" in the navigation menu you access the system configuration shown in Fig.6

Fig. 6 – System Configuration

### 3.1 LANGUAGE SETTING


Moving the mouse on "SYSTEM" it will appear a pull down menu; clicking on "LANGUAGE" it will appear the relative section as shown in Fig. 7. Select the language from the pull down menu.

Fig. 7 – Language Configuration

## 3.2 NETWORK CONFIGURATION

Moving the mouse on “SYSTEM” it will appear a pull down menu; clicking on “NETWORK” you will access the page shown on Fig. 8.

Fig. 8 – Network Configuration

**Note:** All network settings described below refer to the LAN port without logo. The service LAN port with logo (  ) can't be modified by the user, and cannot be used to connect Eos-Box on network.

The page consists of three sections:

### Machine Name Configuration

It allows you to assign a name to Eos-Box as: eosboxYW, where Y and W can only be numbers or letters. This feature allows you to reach Eos-Box from the inside LAN network to which it belongs, just typing the assigned machine name in the address bar of your browser. If the network configuration is set in DHCP it is the only way to achieve Eos-Box.

**Note:** Two or more Eos-Box belonging to the same LAN must have different machine names. By default, the machine name is: eosbox

Press "Save Configuration" to store the machine name. To apply the new settings, Eos-Box requires an automatic restart; await the end of the countdown, after which you will be redirected to the homepage.

∞

∞ Network Configuration

The LAN port without logo, can be configured in two ways:

- *Obtain an IP address automatically (DHCP):* the address is acquired automatically with Eos-Box power up from a DHCP server, must be present in the network to which the port is connected. The IP address is dynamic and not known a priori. In this case you can reach Eos-Box from the inside of the same network just typing the assigned machine name on the browser.
- *Use the following IP address (Static addressing):* you must manually specify an IP address together with a netmask and a default gateway.

If there is not a network administrator providing the correct network parameters, assign an address in the same class of other devices (es: router ADSL), and indicate "255.255.255.0" as netmask.

The default gateway is necessary only if you plan to access Eos-Box through Internet using the LAN connection; In this case, indicate in this field the IP address of ADSL router.

If you use the Internet connection via Cellular Modem to reach Eos-Box from outside indicate the same default gateway IP address of Eos-Box.

Finally, you can manually specify the primary and secondary DNS server addresses to be used for the Internet access (*Use the following server DNS addresses*) or, if the LAN port is configured in DHCP mode, Eos-Box can acquire the DNS server from DHCP server (*Obtain DNS server address automatically*).

Press "Save setting" key to store network settings.


Network Setting	
<input type="radio"/>	Obtain an IP address Automatically (DHCP)
<input checked="" type="radio"/>	Use the following IP Address:
Ip address:	<input type="text" value="10.1.1.28"/>
Subnet Mask:	<input type="text" value="255.255.255.0"/>
Default Gateway:	<input type="text" value="10.1.1.1"/>
<input type="radio"/>	Obtain DNS server address automatically
<input checked="" type="radio"/>	Use the following DNS server addresses:
Preferred DNS server:	<input type="text" value="151.99.125.2"/>
Alternate DNS server:	<input type="text" value="151.99.125.3"/>
 <input type="button" value="Save Setting"/>	

Fig. 8b – Saving network settings

After saving settings, message in Fig. 8c appears with countdown inside.





Fig. 8c – Network setting countdown

**Note:** to apply new settings, Eos-Box needs an automatic reboot, to store the configuration setup; time necessary for operation is about 130 seconds.

Wait for countdown to be completed, then you will be re-addressed to homepage if your PC network settings belong to the same category as set up on Eos-Box.

**Note: Do not interrupt power supply to Eos-Box:**

**1. Until countdown is completed.**

**2. Before connecting to Eos-Box by the new address through PC used in configuration.**

**ANY INTERRUPTION IN POWER SUPPLY DURING THIS PHASE CAN DAMAGE THE MACHINE**

If connection to Eos-Box with new parameters is not possible, after network configuration, try to access with previous parameters and repeat configuration.

**Note:** If network address set up on Eos-Box is not known, connect by service LAN port (with logo) using this address: 192.168.1.100. Now, you can view the address set up in the relevant section and change it, if necessary. Changing network parameters only affects LAN port without logo.

**Note:** to access Eos-Box from outside through LAN it is necessary redirect the ADSL Modem Router (NAT- Port forwarding) to which it is connected. **The gates to be "redirect" are: 80, 3306, 3389, and 5900.** You cannot use proxy server.

#### ∞ Dynamic public IP address Management

If you don't have a static public IP address to reach Eos-Box from Internet and you have to use public IP addresses assigned dynamically by your ISP (Internet Service Provider) you can use DNS server operators maintaining the dynamic public IP address constantly synchronized to a domain name. The operator used by Eos-Box DynDNS.com. To use the service you must connect to: <http://www.dyndns.com/>, subscribe, create an account and then create a new "Dynamic DNS host". Dynamic DNS host is an address domain that will be the same to type in the address bar of your browser to reach Eos-Box. (Ex. eosbox.homeip.net).

During the subscribing to DynDNS.com you have to provide Username and Password for the server authentication by Eos-Box.

To enable the dynamic public IP address management it is necessary:

- Check "Enable DynDns".
- Enter the name of the chosen Dynamic DNS host.
- Enter Username and Password provided during the account subscribing.
- Click on "Save Settings"

Dynamic IP Address Management	
<input checked="" type="checkbox"/> Enable DynDns	Server DynDns <input type="text" value="DynDns.org"/>
Hostname	<input type="text" value="eosbox.homeip.net"/>
Username	<input type="text" value="nameaccount"/>
Password	<input type="password" value="....."/>
<input type="button" value="Save Setting"/>	

Fig. 9 – Configuration of dynamic public IP management

The service will be active after about 6 minutes.

Note: The use of this service is often essential if the Internet connection is via cellular Modem: a static IP address is unlikely made available from mobile operators.

**The synchronization time between the domain name (Dynamic DNS host) and the assigned IP address is estimated to be about 1 minute. Assigning a new IP to Eos-Box from ISP can occur several times a day; it may make Eos-Box temporarily unavailable from the Internet.**

## 3.3 MODEM INSTALLATION AND CONFIGURATION

### ∞ Modem Connection

To connect the modem to Eos-Box you should follow the following steps:

- Check if the **SIM card is PIN protected**.
- Insert the SIM into the modem using the appropriate slot.
- Connect the antenna and place it in a sufficiently high signal reception area.
- Connect the power cable into the Modem and insert the adapter into a 220VAC output.
- Connect the USB cable to the modem into any available USB port on Eos-Box. (There are two doors in the front and one in the back)
- Place the Modem in a dry place and protected from rain and dust.

Note: It is not possible to connect more than 1 modem on Eos-Box.

∞ Modem configuration

Place the mouse on “SYSTEM”, a drop-down menu appears; click on “MODEM” for access to the page shown in Fig. 10.

Fig. 10 - Modem configuration

To enable modem use, check *GPRS/EDGE/UMTS/HSDPA Modem*. The modem can be used for:

- Internet connection (check “Internet connection”)

To configure the connection, select the telephone provider of SIM inside the modem. In “Configuring Internet Connection for Modem GPRS/EDGE/UMTS/HSDPA” section, open “Telephone provider” drop-down menu and select your provider among the available ones. If not available, select “OTHER”. Form shown in Fig. 11 is displayed.

Fig. 11 - Telephone provider configuration

Enter Username and Password only if the operator requires an authentication process for connection, otherwise leave the field blank.  
 Enter operator's APN (Access Point Name or APN is the name of an access point for GPRS).  
 Enter the telephone number for connection. (Ex. \*99\*\*\*1#)

*Note:* find all information on one's own Telephone provider before configuring this section. Ensure that Telephone provider assigns IP addresses so that both incoming and outgoing traffic is allowed on port 80.

- Sending SMS (check "Send SMS")

If enabled, it allows sending SMSs in case of System alarms according to policies set up on Alarms section.

Press "Save configuration" button to store settings entered.

Wait for a few seconds and check the modem connection status in the area shown in Fig. 12 in page top side.



Fig. 12 - Modem configuration status

The quality signal ranges between 0 to 100%. A good signal level is above 50%. If "N.A." is displayed, the modem does not communicate with Eos-Box

The connection status is represented by a two-colour led:

Red = Modem NOT connected to Internet.

Green = Modem connected to Internet

*Notes:* if, after modem configuration, the signal quality remains "N.A." ensure that connections are correct and modem is powered. (See Sect. *Modem connection* Par. 3.3).

If the signal quality is acceptable and connection status is "NOT connected" (red led):

- Ensure SIM is properly inserted and PIN is removed
- Ensure connection parameters are properly entered (Fig. 11)

If the telephone provider gives a public dynamic IP address, refer to "*How to manage the public dynamic IP address*" section Par. 3.2.

***Note:* Eos-Box is a Web-Server, thus it must always be connected to Internet to be reached from outside. Internet connection via cellular modem will always be active (24h).**

***Note:* If Eos-Box uses cellular modem for Internet connection, during the SMS sending phase the system must disconnect from internet to process message sending and connect again. This process makes the machine temporarily not reachable. Estimated service downtime is about 3 minutes.**

### 3.4 SYSTEM DATA CONFIGURATION

Place the mouse on “SYSTEM”, a drop-down menu appears; click on “DATA PLANT” for access to the page shown in Fig. 13.

SYSTEM	INVERTER	EOS-ARRAY	AC ENERGY METER	INTERFACE PROTECTION	SENSORS	DIGITAL I/O	WEBCAM
DATA PLANT							
LAN SETTING	<b>Plant Description</b>						
MODEM	Plant Name	<input type="text"/>					
ALARMS	Plant Location	<input type="text"/>					
PLANNING	Property Plant	<input type="text"/>					
MAIL	Rate Installing	<input type="text"/>					
FIRMWARE	Installation Date	<input type="text"/>	dd/mm/yyyy				
LANGUAGE	Installation Date	<input type="text"/>	dd/mm/yyyy				
	<b>Technical Data</b>						
	Plant Type	Fixed <input type="radio"/>	For Chase <input type="radio"/>	Mixed <input type="radio"/>			
	Total area of PV modules	<input type="text"/>	m <sup>2</sup>				
	Number of Inverters	<input type="text"/>					
	Number of Strings	<input type="text"/>					
	Peak power of Plant	<input type="text"/>	kW				
	<b>Financial Highlights</b>						
	THE ENERGY SYSTEM		<input type="radio"/> Own	<input type="radio"/> Sale			
	INCENTIVE paid every kWh	<input type="text"/>	€	% En. estimated sold (partial transfer)	<input type="text"/>	%	
	Price per kWh Purchased Energy	<input type="text"/>	€	Amount paid each kWh Sold	<input type="text"/>	€	
	<b>Viewing Data for Energy Production</b>						
	<input checked="" type="radio"/> INVERTER	<input type="radio"/> EXTERNAL ENERGY METER					
	<b>Save Setting</b>						

Fig. 13 - System data configuration

Fill in “Plant description”, “Technical data” sections, carefully checking date format and measuring units. “Total area of PV modules” indicates the product between plate data of photovoltaic module and the total number of modules installed in the system.

“Financial Highlights” section consists of two options: “Own” and “Sale”. If “Sale” is selected, the following forms are enabled: “INCENTIVE paid each kWh” and “% En. estimated sold (partial transfer)”. The last parameter varies between 0-100% and modifies the economic counter-value obtained from the sale of energy.

In “Viewing Data for Energy Production” the system production data origin can be selected. If a reference production meter is configured on Eos-Box, data can be directly acquired from it.

The production data is acquired by inverters by default and shown like an addition of all inverters. The selection affects the future calculation of economic counter-values, data shown in “LH frame” and “RH frame” and in total efficiency calculated.

Press “Save setting” to store data.

**Note: all decimal numbers entered must be separated by point.**

## 3.5 INVERTER CONFIGURATION

Place the mouse on "INVERTER", "SETTING" item appears; click for access to the page shown in Fig. 14.



Fig. 14 - Inverter configuration

### 3.5.1 INVERTER INSERTION

Press "Add Inverter" key. The content of Fig. 15 is shown in page bottom.

Fig. 15 - Inverter insertion screen

Fill in the fields according to the following specifications:

- "Inverter name": Label to be assigned to inverter. It is recommended to name inverters in progressive order to easily identify them during data or alarm search. (Ex. INVERTER01 – INVERTER02...)

Note: Never assign the same "Inverter name" to two different inverters.

- "S/N": Inverter serial number found on inverter plate.
- "Manufacturer": Select inverter brand.
- "Model": Select inverter model or family.
- "Subject/Notes": Notes field.
- "Communication": Select the communication port type necessary to inverters.

*Note:* COM1 communication port on Eos-Box is RS-485 type. If RS-232 port is necessary for communicating with inverters, a proper external RS-485 →RS-232 converter must be set in cascade.

- “Address”: Specify the address configured on inverter.

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

- “Advanced”: When Advanced option is checked, you have access to the configuration screen of communication parameters shown in Fig.16.

Fig. 16 - Communication parameter screen

Select parameters required for communication on various drop-down menus.

*Note:* The configuration parameters shows are default parameters for the inverter model selected. So no changes are required unless setting on inverters is different from factory setting.

Press “Reset” key to delete the contents of various fields; “Cancel” to cancel operation. Press “Add” key to insert and add the inverter to the list as shown in Fig.17; the addition screen is shown again on bottom.

Fig. 17 - Inserted inverters list

### 3.5.2 INVERTER MODIFICATION

Select the inverter to be modified from the Inserted inverters list (Fig. 17). Press “Update Inverter” key. The content of Fig. 18 is shown in page bottom.

Fig. 18 - Inverter modification screen

Modify as already described in the previous section (Inverter insertion). Press “Reset” key to delete modifications; “Cancel” to cancel operation. Press “Save” key to modify the inverter; “Inverter details” screen is shown on bottom.

### 3.5.3 INVERTER DELETION

Select the inverter to be deleted from the Inserted inverters list (Fig. 17). Press “Delete Inverter” key. The confirmation message appears on the centre of the page. Press “OK” key confirm deletion or “Cancel operation” to cancel. Press “OK” to remove inverter from Inserted inverters list. All data acquired from Eos-Box up to that moment on the deleted inverter are definitely eliminated.

Note: Inverter insertions, modifications and deletions are effective after a few seconds, without restarting the machine.

### 3.5.4 INVERTER DETAILS

When an inverter is selected from the Inserted inverters list (Fig. 17), a data sheet is shown below with its most significant data (Fig. 19). To display the other data, simply follow the “Modify inverter” procedure and cancel operation.

Inverter Details	
Inverter Name	INVERTER01
S/N	12345678910
Manufacturer	Carlo Gavazzi
Model	ISMG160IT
Address	1
Subject/Notes	Note...

Fig. 19 - Inverter details



### 3.6 EOS-ARRAY CONFIGURATION

Place the mouse on “EOS-ARRAY”, “AUTOSETTING”→“SET-UP” item appears; click for access to the page shown in Fig. 19.

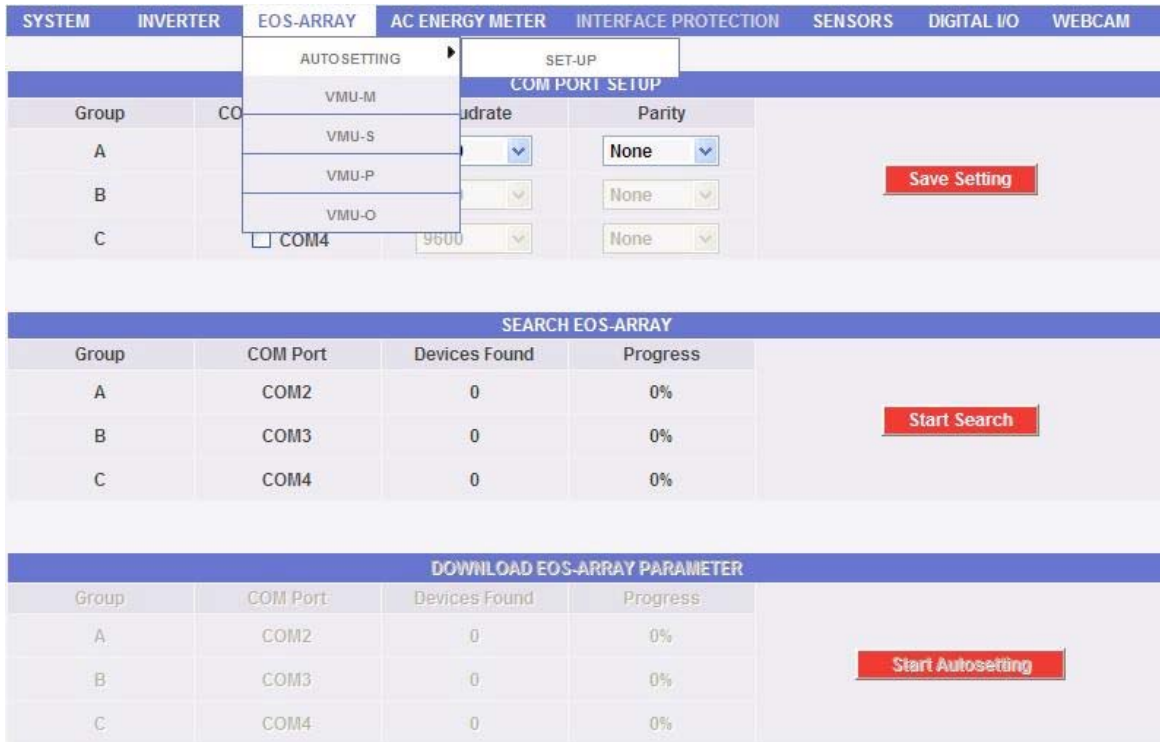


Fig. 19 - Eos-Array configuration screen

Eos-Array configuration procedure works in ‘self-learning’ i.e. it scans all devices located on COM ports enabled in “COM PORT SETUP” screen, stores and automatically configures them on Eos-Box. Please follow this procedure step by step.

**Note:** This procedure could last for a few minutes.

1. COM port setup

It enables ports used for connection to Eos-Array by checking in “COM Port Enable” (Fig. 20) column.

Select the communication speed (Baudrate) and parity (“Parity”) set up on all Eos-Arrays connected to the relevant door.

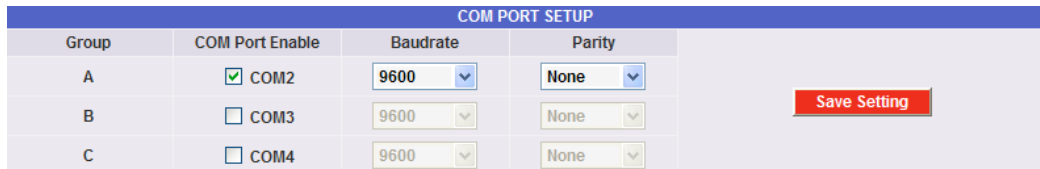


Fig. 20 - COM door enabling screen

Press “Save setting” to store settings.

**Note:** On a chain of Eos-Array RS-485 connected to the same port, settings of baudrate, parity and data sampling frequency must be the same. Any Eos-Array with different parameters is not found.

## 2. Search Eos-Array

In “SEARCH EOS-ARRAY” (Fig. 21) screen, press “Start search” key. The confirmation message appears on the centre of the page. Press “OK” to continue or “Cancel” to stop operation.

SEARCH EOS-ARRAY			
Group	COM Port	Devices Found	Progress
A	COM2	0	0%
B	COM3	0	0%
C	COM4	0	0%

**Start Search**

Fig. 21 - Eos-Array searching screen

Press “OK” key to disable “COM PORT SETUP” and “DOWNLOAD EOS-ARRAY PARAMETERS” screens; the system starts searching for enabled ports. “Devices found” column shows in real time the number of Eos-Arrays reached in their relevant ports, while the “Completed” column shows the searching progression in percentage. The searching time can last for a few minutes.

*Note:* Ports enabled are scanned simultaneously.

To stop searching operation, press “Stop searching” key. “COM PORT SETUP” and “DOWNLOAD EOS-ARRAY PARAMETERS” screens are enabled and a new search can be performed.

***Note:* Do not download Eos-Array parameters until all Eos-Arrays have been surely found.**

The searching process is completed when 100% progression is reached and “COM PORT SETUP” and “DOWNLOAD EOS-ARRAY PARAMETERS” screens are enabled. Now, parameters can be downloaded. (See the following par.)

*Note:* Transition times between a command and the expected effect are not instant, wait for a few seconds.

## 3. Acquisition of Eos-Array parameters

In “SEARCH EOS-ARRAY” (Fig. 22) screen, press “Start autsetting” key. The confirmation message appears on the centre of the page. Press “OK” to continue or “Cancel” to stop operation.

*Note:* “DOWNLOAD EOS-ARRAY PARAMETERS” screen is disabled until Eos-Array searching is performed.

DOWNLOAD EOS-ARRAY PARAMETER			
Group	COM Port	Devices Found	Progress
A	COM2	0	0%
B	COM3	0	0%
C	COM4	0	0%

**Start Autsetting**

Fig. 22 - Acquire Eos-Array parameters screen

Press “OK” key to start the acquisition procedure of parameters set on previously-found Eos-Arrays.

“COM PORT SETTING” and “SEARCH EOS-ARRAY” screens are disabled. “Devices found” column shows in real time the number of Eos-Arrays processed in their relevant ports, while the “Completed” column shows the searching progression in percentage.

The searching time can last for a few minutes.

**Note: If repeated afterwards, this operation shall definitely delete all Eos-Arrays and the relevant data acquired on Eos-Box up to that moment.**

To stop searching operation, press “Stop autosetting” key. All screens are enabled and acquisition can be restarted.

The parameter acquisition process is completed when 100% progression is reached and all screens are enabled.

Now, Eos-Box starts acquiring data and alarms stored on Eos-Arrays and is ready to show charts.

**Note: The transfer of data and alarms stored on Eos-Array, can require for a few hours according to the quantity to be imported. No real-time data shall be available up to that moment. The setting procedure shall finish when data is available on “DC PRODUCTION” chart.**

### 3.6.1 VMU-M PARAMETERS

Place the mouse on “EOS-ARRAY” to display “VMU-M” item; click for access to the page shown in Fig. 23. The page shows VMU-Ms on field and the quantities of VMU-S, VMU-P and VMU-O for each group.

**Note: Group A corresponds to all devices connected to COM2 port. Group B corresponds to all devices connected to COM3 port. Group C corresponds to all devices connected to COM4 port.**

SYSTEM	INVERTER	EOS-ARRAY	AC ENERGY METER	INTERFACE PROTECTION	SENSORS	DIGITAL I/O	WEBCAM
<b>Group A</b>							
VMU-M Addr: 1 - Label: All Strings - VMU-S: 4 - VMU-P: 1 - VMU-O: 2				Total Number of VMU-M	1		
				Total Number of VMU-S	4		
				Total Number of VMU-P	1		
				Total Number of VMU-O	2		
<b>Group B</b>							
				Total Number of VMU-M	0		
				Total Number of VMU-S	0		
				Total Number of VMU-P	0		
				Total Number of VMU-O	0		
<b>Group C</b>							
				Total Number of VMU-M	0		
				Total Number of VMU-S	0		
				Total Number of VMU-P	0		
				Total Number of VMU-O	0		

Fig. 23 – VMU-M screen

Click on a VMU-M inside the lists shown in the hatched areas in Fig. 23 to open a window containing the relevant VMU-M parameters acquired in self-configuration phase (Fig. 24). The only parameter to be possibly assigned is VMU-M label. This label is used in Alarms section to more easily find the device. Press “Save” key for storing.

Program Parameters VMU-M: 1 Group: A					
Label	All Strings	Data and Event logger Enabling	1	Tempertaure ch 1: Delay	0
COM	2	Data logger Time Interval	0	Tempertaure ch 2: Alarm Link	0
Maximum Power	0	RS485 Address	1	Tempertaure ch 2: Set Point 1	0
Digital Input Type	1	RS485 Baud Rate	3	Tempertaure ch 2: Set Point 2	0
Digital Input 2 prescaler	1	RS485 Parity	0	Tempertaure ch 2: Delay	0
Temperature Enginnering Unit	1	Clock Time Format	0	DC/AC Efficiency: Alarm Link	0
PV parameters Enginnering unit	0	Clock Daylight-saving	1	DC/AC Efficiency: Set Point 1	0
PV parameters Reference Power	133	Year Acquisition Parameter	2009	DC/AC Efficiency: Set Point 2	0
PV parameters Total String Area	69	Month Acquisition Parameter	4	DC/AC Efficiency: Delay	0
PV parameters Power Temperature coefficient	65106	Day Acquisition Parameter	8	Daylight Saving Month to increase hour	3
PV parameters NOCT	480	Hour Acquisition Parameter	16	Daylight Saving Number of Sunday to increase hour	0
PV parameters OPL	80	Minutes Acquisition Parameter	21	Daylight Saving Hour to increase hour	2
PV module efficiency mesasurement Enabling	1	Seconds Acquisition Parameter	59	Daylight Saving Month to decrease hour	10
PV module efficiency calculation type	1	Tempertaure ch 1: Alarm Link	1	Daylight Saving Number of sunday to decrease hour	0
String control Enabling	1	Tempertaure ch 1: Set Point 1	0	Daylight Saving Hour to decrease hour	3
String window Alarm	100	Tempertaure ch 1: Set Point 2	0	AC energy Counter	0

**Save**

Fig. 24 – VMU-M parameters screen

### 3.6.2 VMU-S PARAMETERS

Place the mouse on “EOS-ARRAY”, “VMU-S” item appears; click for access to the content shown in Fig. 25. To display VMU-Ss under a specific VMU-M, it is sufficient to set up the VMU-M group and address through selection menu (A) shown in Fig 25. “VMU-M address” indicates the RS-485 address assigned to VMU-M in programming phase. The address range is between 001 and 247. Press “Search VMU-S” key to display aside all VMU-Ss under the selected VMU-M. If the list is empty, the selected VMU-M is not available or there are no VMU-S under it.

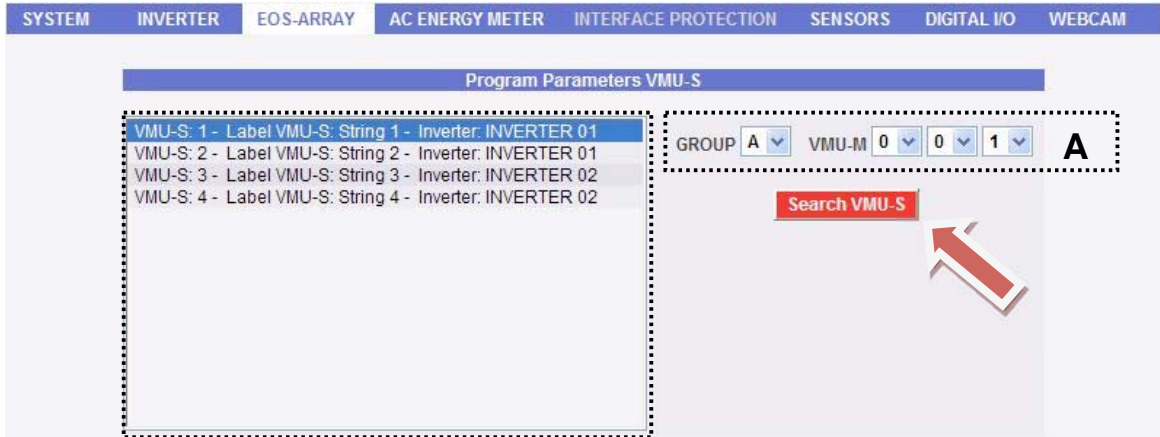


Fig. 25 – VMU-S screen

Click on a VMU-M inside the list to open a window containing the relevant parameters acquired in self-configuration phase (Fig. 26). Parameters to be set are “Label” and “Inverter References”. Label is used in Alarms section to better find the device. Inverter References is the inverter the VMU-S-controlled string is connected to. If Inverters are neither available nor inserted yet, “Inverter References” menu is blank. Press “Save” for storing. The window automatically closes and VMU-S list is updated.

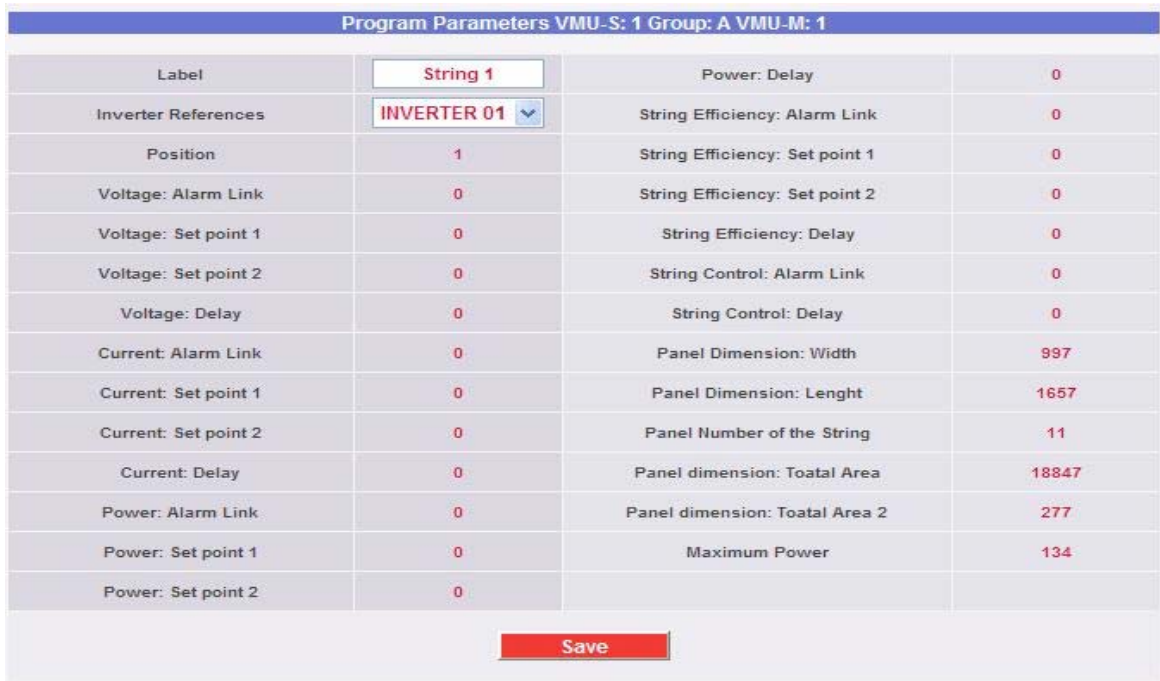


Fig. 26 – VMU-S parameters screen

### 3.6.3 VMU-P PARAMETERS

Place the mouse on “EOS-ARRAY”, “VMU-P” item appears; click for access to the content shown in Fig. 27. The list displays all VMU-Ps available in the system.



Fig. 27 – VMU-P screen

Click on a VMU-P inside the list to open a window containing the relevant VMU-P parameters acquired in self-configuration phase (Fig. 28). The only parameter to be possibly assigned is VMU-P label. This label is used in Alarms section to more easily find the device. Press “Save” key for storing. The window automatically closes and VMU-P list is updated.

Program Parameters VMU-P: 7 Group: A VMU-M: 1			
Label	REFERENCE	Temperature Channel 1: Delay	0
Temperature Engineering Unit: °C/°F	0	Temperature Channel 2: Alarm Link	0
Temperature Probe P	3	Temperature Channel 2: Set point 1	0
Irradiation input Engineering Unit	0	Temperature Channel 2: Set point 2	0
Irradiation: input Electrical Scale LOW	0	Temperature Channel 2: Delay	0
Irradiation: input Electrical Scale HIGH	741	Solar Irradiation: Alarm Link	0
Irradiation: input Display scale LOW	0	Solar Irradiation: Set point 1	0
Irradiation: input Display scale HIGH	1000	Solar Irradiation: Set point 2	0
Wind Speed signal Input	1500	Solar Irradiation: Delay	0
Wind Speed scale input	150	Wind Speed: Alarm Link	0
Temperature Channel 1: Alarm Link	0	Wind Speed: Set point 1	0
Temperature Channel 1: Set Point 1	0	Wind Speed: Set point 2	0
Temperature Channel 1: Set Point 2	0	Wind Speed: Delay	0

**Save**

Fig. 26 – VMU-P parameters screen

### 3.6.3 VMU-O PARAMETERS

Place the mouse on “EOS-ARRAY”, “VMU-O” item appears; click for access to the content shown in Fig. 29. The list displays all VMU-Os available in the system.

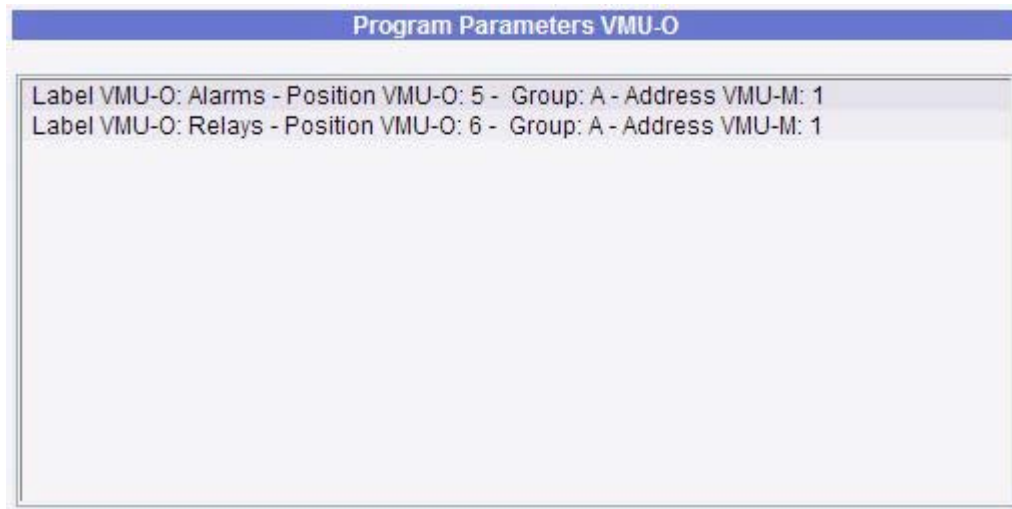


Fig. 27 – VMU-O screen

Click on a VMU-O inside the list to open a window containing the relevant VMU-O parameters acquired in self-configuration phase (Fig. 30). The only parameter to be possibly assigned is VMU-O label. This label is used in Alarms section to more easily find the device. Press “Save” key for storing. The window automatically closes and VMU-O list is updated.

Program Parameters VMU-O: 5 Group: A VMU-M: 1			
Label	Alarms	Digital Output channel 2: Enabling	1
Digital Output channel 1: Enabling	1	Digital Output channel 2: Output Status	0
Digital Output channel 1: Output Status	0	Digital Output channel 2: Time activation hour	12
Digital Output channel 1: Time activation hour	12	Digital Output channel 2: Time activation minutes	0
Digital Output channel 1: Time activation minutes	0	Digital Output channel 2: Time deactivation hour	12
Digital Output channel 1: Time deactivation hour	12	Digital Output channel 2: Time deactivation minutes	0
Digital Output channel 1: Time deactivation minutes	0		
<input type="button" value="Save"/>			

Fig. 30 – VMU-O parameters screen

## 3.7 ENERGY METER CONFIGURATION

Place the mouse on “AC METERS”, “SETTING” item appears; click for access to the page shown in Fig. 31.

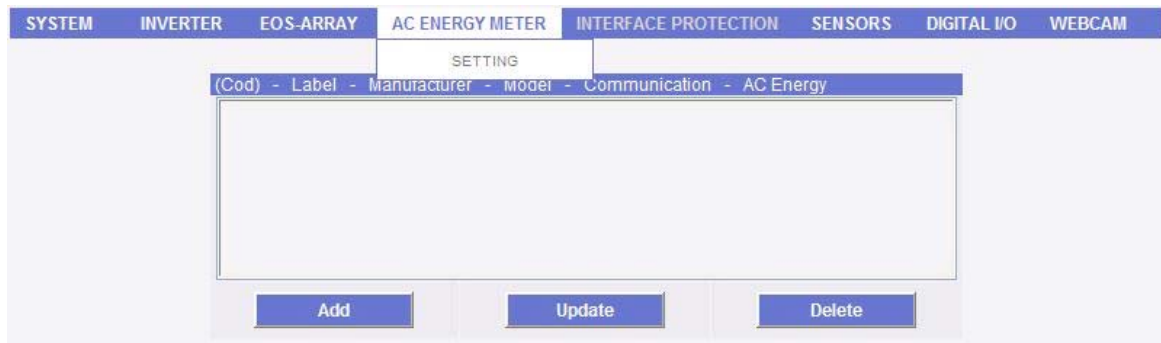


Fig. 31 - Energy meters configuration

### 3.7.1 METER INSERTION

Press “Add” key. The content of Fig. 32 is shown in page bottom.

Fig. 32 - Meter insertion screen

Fill in the fields according to the following specifications:

- “Name”: Label to be assigned to meter. (Ex. Main AC Energy Meter...)
- Note:* Never assign the same “Inverter name” to two different inverters.
- “S/N”: Meter serial number found on inverter plate.
  - “Manufacturer”: Select meter brand. If “OTHER” is selected, the meter must have a pulse output (See “Pulse-type communication”).
  - “Model”: Select model.
  - “Subject/Notes”: Notes field.
  - “Reference meter”: Check if the production meter is involved



- “Communication”: Select meter communication via RS-485 or by pulse output (Pulse (VMU-M)). In the former, it is connected to Eos-Box COM1, in the latter to a VMU-M.

A. RS-485 meter communication

“Address” and “Advanced” fields are enabled.

- “Address”: Specify the address set on inverter.

*Note:* In COM1 communication port on Eos-Box, both Inverters and one or more meters can co-exist. Simply connect them properly in parallel. Two devices (meters or inverters) with the same address cannot exist within the same RS-485 chain. Two or more devices with the same address prevent their communication.

- “Advanced”: When Advanced option is checked, you have access to the configuration screen of communication parameters shown in Fig.33.

Fig. 33 - Meter communication parameter screen

Select parameters required for communication on various drop-down menus.

*Note:* The configuration parameters shows are default parameters for the meter model selected. So no changes are required unless setting on meters is different from factory setting.

B. Pulse-type communication

A screen opens at the bottom to select the VMU-M the meter is connected to (Fig. 34); “Address” and “Advanced” are disabled.

Name	Main AC Energy Meter	S/N	1234567890
Manufacturer	OTHER	Model	Select
Subject/Notes	Note...	<input checked="" type="checkbox"/> Reference Energy Meter	
Communication:	<input type="radio"/> RS-485 (COM1) <input checked="" type="radio"/> Pulse (VMU-M)		
Advanced <input checked="" type="checkbox"/>	Energy : <input checked="" type="radio"/> Exported <input type="radio"/> Imported	Offset (kW)	0.00
Select VMU-M	GROUP A VMU-M 0 0 1 A		
Channel :	2	Peso Impulso :	0.100 kW
Add		Reset	
		Cancel	

Fig. 34 – VMU-M selection for meter screen

- “*Select VMU-M*”: Set up the VMU-M group and address through selection menu (A) shown in Fig 34. “Address VMU-M” indicates the RS-485 address assigned to VMU-M in programming phase. The address range is between 001 and 247.
- “*Channel*”: Default channel for connection on VMU-M is 2.
- “*Pulse weight*”: Set up weight in kW for each pulse emitted by the meter.
- “*Energy*”: Select if energy counted by the meter is exported to the grid (“Exported”) or imported from the grid (“Imported”).

*Note:* If two bi-directional meters are installed on RS-485, to acquire both exported and imported energy, it is sufficient to insert two separate meters with different names but the same address. In this case, “Exported” is selected on the former, “Imported” on the latter. Eos-Box processes them as if they were two separate meters.

- ∞ “*Offset*”: Offset is a value in kWh which aligns the system production datum with datum in Eos-Box. It is entered when a quantity of energy not counted by the monitored meter is to be considered. Using the offset is necessary to replace the meter or for a pulse-output meter not connected to Eos-Array from the beginning of its counting.

Press “Reset” key to delete the contents of various fields; “Cancel” to cancel operation. Press “Add” key to insert and add the inverter to the list as shown in Fig.17; the addition screen is shown again on bottom.



Fig. 35 - Inserted meters list

### 3.7.2 METER MODIFICATION

Select the meter to be modified from the Inserted meters list (Fig. 35). Press “Update” key. The content of Fig. 36 is shown in page bottom.

Fig. 36 - Meter modification screen

Modify as already described in the previous section (Meter insertion). Press “Reset” key to delete modifications; “Cancel” to cancel operation. Press “Save” key to modify the meter; “Meter details” screen is shown on bottom.

### 3.7.3 METER DELETION

Select the meter to be deleted from the Inserted meters list (Fig. 35). Press “Delete” key. The confirmation message appears on the centre of the page. Press “OK” key to confirm deletion or “Cancel operation” to cancel. Press “OK” to remove meter from Inserted meters list. All data acquired from Eos-Box up to that moment on the deleted meter are definitely eliminated.

Note: Meter insertions, modifications and deletions are effective after a few seconds, without restarting the machine.

### 3.7.4 METER DETAILS

When a meter is selected from the Inserted meters list (Fig. 35), a data sheet is shown below with its most significant data (Fig. 37). To display the other data, simply follow the “Modify meter” procedure and cancel operation.

Energy Meter Details	
Name	Main AC Energy Meter
Manufacturer	Carlo Gavazzi
Model	EM24 DIN
Subject/Notes	
Energy	Exported
Communication	RS485
Address	1



Fig. 37 - Meter details screen

## 3.8 ENVIRONMENTAL SENSORS

Environmental sensors monitored by Eos-Box are the following:

1. Solar radiation sensor
2. Temperature sensors
3. Wind-speed sensor

*Note:* Environmental sensors can only be configured after configuring Eos-Arrays (See Par. 3.6) and must be properly connected to VMU-P/M modules.

### 3.8.1 SOLAR IRRADIATION SENSOR

Place the mouse on “SENSORS”, “SOLAR IRRADIATION” item appears; click for access to the page shown in Fig. 38.

SYSTEM	INVERTER	EOS-ARRAY	AC ENERGY METER	INTERFACE PROTECTION	SENSORS	DIGITAL I/O	WEBCAM
<b>SET-UP SOLAR IRRADIATION SENSOR</b>						SOLAR IRRADIATION	
						TEMPERATURE	
						WIND SPEED	
Label Sensor - Group - Address VMU-M - Position VMU-P - Sensor State							
Sensore 1 - Group: A - Address VMU-M: 1 - Position VMU-P: 7 - ENABLED - REFERENCE							

Fig. 38 – Inputs list for solar irradiation sensor screen

The list shows all available VMU-Ps in a system able to house the sensor. If more VMU-Ps and a single sensor exist, only enable the VMU-P housing it according to the following procedure.

∞ Solar irradiation sensor configuration

Select the sensor from the list shown in Fig. 38. The content of Fig. 39 is shown in page bottom.

Sensor Details			
Name	Sensore 1		
Group	A	Address VMU-M	1
Position VMU-P	7		
Sensor State	<input checked="" type="radio"/> ENABLED <input type="radio"/> DISABLED		
<input checked="" type="checkbox"/> Reference Sensor			
Save		Reset	
Cancel			

Fig. 39 – Solar irradiation sensor configuration screen

*Note:* “Group”, “Address VMU-M” and “Position VMU-P” fields cannot be modified as automatically acquired by Eos-Box.

“Name”: Enter a name to be assigned to the sensor; it is necessary for searching in chart display phase. Specify the label if only sensor is effectively connected onto VMU-P, otherwise leave the field blank and disable the channel.

“Group”: Group the VMU-M controlling VMU-P belongs to.

“Address VMU-M”: Address of VMU-M controlling VMU-P where the sensor is connected.

“Position VMU-P”: Position of VMU-P in VMU chain under VMU-M.

“Sensor state”: To be enabled if sensor is really connected on this VMU-P, otherwise to be disabled.

“Reference sensor”: check this case if the sensor connected is the reference sensor for calculating efficiencies.

**Note: A single reference can be specified; in addition to use for calculating system efficiencies, it is used by Eos-Box to show its real-time values on “RH frame” in environmental sensors. (See par. 2. 3 - RH frame)**

Press “Reset” key to delete modifications; “Cancel” to cancel operation. Press “Save” key to change sensor settings.

## 3.8.2 TEMPERATURE SENSOR

Place the mouse on “SENSORS”, “TEMPERATURE” item appears; click for access to the page shown in Fig. 40.

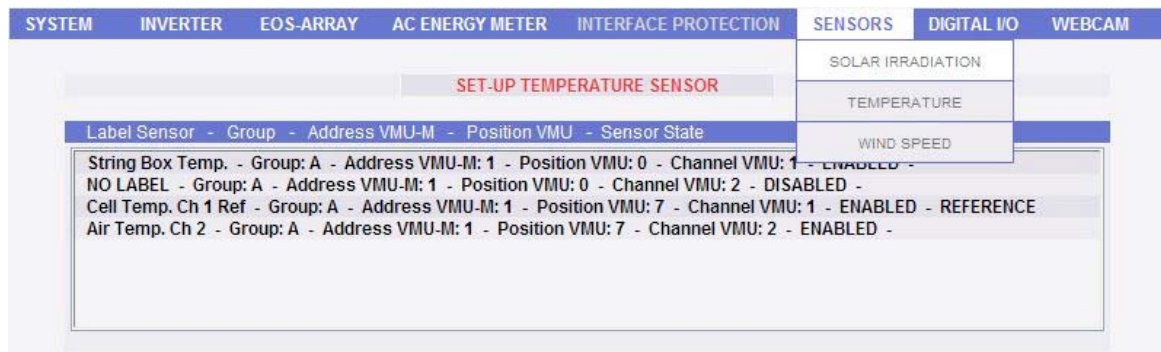


Fig. 40 – Inputs list for temperature sensors screen

The list shows all available VMU-PMs and VMU-PMs in a system able to house the sensor. If the number of existing inputs is higher than sensors really installed on the system, only enable inputs connected according to the following procedure.

### ∞ Set-up temperature sensor

Select the sensor from the list shown in Fig. 40. The content of Fig. 41 is shown in page bottom.

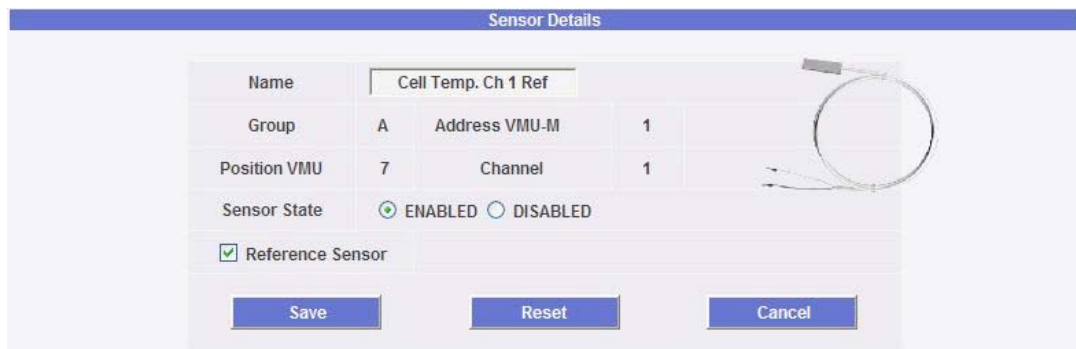


Fig. 41 – Set-up temperature sensor screen

**Note:** “Group”, “Address VMU-M” and “Position VMU-P” fields cannot be modified as automatically acquired by Eos-Box.

“Name”: Enter a name to be assigned to the sensor; it is necessary for searching in chart display phase. Specify the label if only sensor is effectively connected onto VMU-M/P, otherwise leave the field blank and disable the channel.

“Group”: Group the VMU-M controlling VMU-P belongs to.

“Address VMU-M”: Address of VMU-M controlling VMU-P where the sensor is connected.

“Position VMU”: Position of VMU-P/M in VMU chain. If sensor is connected onto a VMU-M, the position is always 0.

“Sensor state”: To be enabled if sensor is really connected on this VMU-P/M, otherwise to be disabled.

“Reference sensor”: check this case if the sensor connected is the reference sensor for calculating efficiencies.

**Note: A single reference can be specified; in addition to use for calculating system efficiencies, it is used by Eos-Box to show its real-time values on “RH frame” in environmental sensors. (See par. 2. 3 - RH frame)**

Press “Reset” key to delete modifications; “Cancel” to cancel operation. Press “Save” key to change sensor settings.

### 3.8.3 WIND SPEED SENSOR

Place the mouse on “SENSORS”, “WIND SPEED” item appears; click for access to the page shown in Fig. 42.

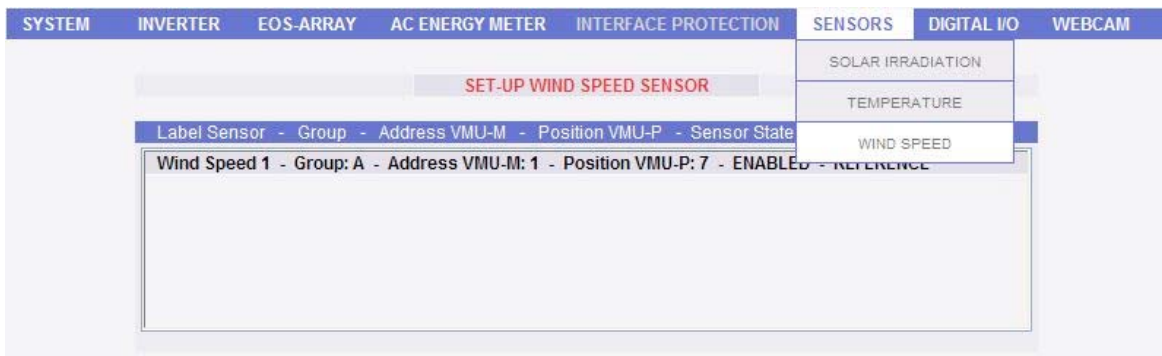


Fig. 42 – Inputs list for wind speed sensor screen

The list shows all available VMU-Ps in a system able to house the sensor. If more VMU-Ps and a single sensor exist, only enable the VMU-P housing it according to the following procedure.

∞ Set-up Wind-speed sensor

Select the sensor from the list shown in Fig. 42. The content of Fig. 44 is shown in page bottom.

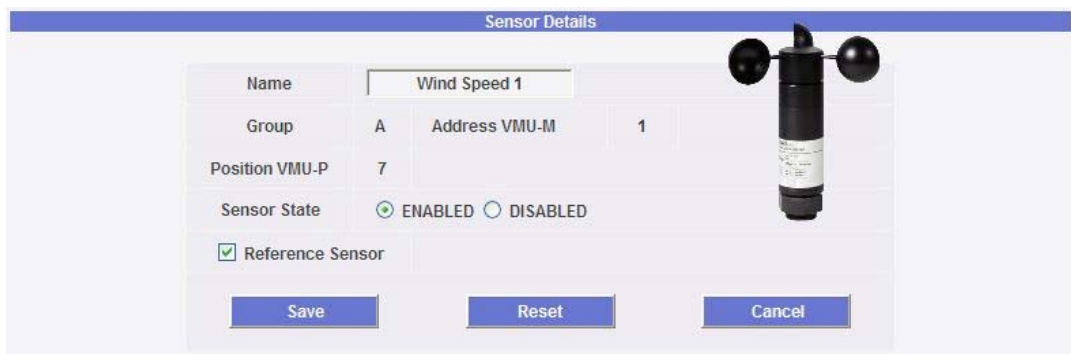


Fig. 44 – Set-up Wind-speed sensor screen

**Note: “Group”, “Address VMU-M” and “Position VMU-P” fields cannot be modified as automatically acquired by Eos-Box.**

“Name”: Enter a name to be assigned to the sensor; it is necessary for searching in chart display phase. Specify the label if only sensor is effectively connected onto VMU-P, otherwise leave the field blank and disable the channel.

“Group”: Group the VMU-M controlling VMU-P belongs to.

“Address VMU-M”: Address of VMU-M controlling VMU-P where the sensor is connected.

“Position VMU-P”: Position of VMU-P in VMU chain under VMU-M.

“Sensor state”: To be enabled if sensor is really connected on this VMU-P, otherwise to be disabled.

“Reference sensor”: check this case if the sensor connected is the reference sensor.

**Note: A single reference can be specified; it is used by Eos-Box to show its real-time values on “RH frame” in environmental sensors. (See par. 2. 3 - RH frame)**

Press “Reset” key to delete modifications; “Cancel” to cancel operation. Press “Save” key to change sensor settings.

### 3.9 DIGITAL INPUTS AND OUTPUTS

Digital inputs and outputs are present on Eos-Box for displaying the status value only; Open/Close in Alarms section. Control functions are assigned to VMU-M.

*Note:* Digital inputs and outputs can only be configured after configuring Eos-Arrays (See Par. 3.6) and be properly connected to VMU-P modules.

#### 3.9.1 DIGITAL INPUTS

Place the mouse on “DIGITAL I/O” to display “DIGITAL INPUT” item; click for access to the page shown in Fig. 45. Digital inputs can be located on both VMU-Ms and VMU-Os. The list specifies the VMU the input refers to when controlling “Position VMU”; position 0 → VMU-M, position 1-15 → VMU-O.

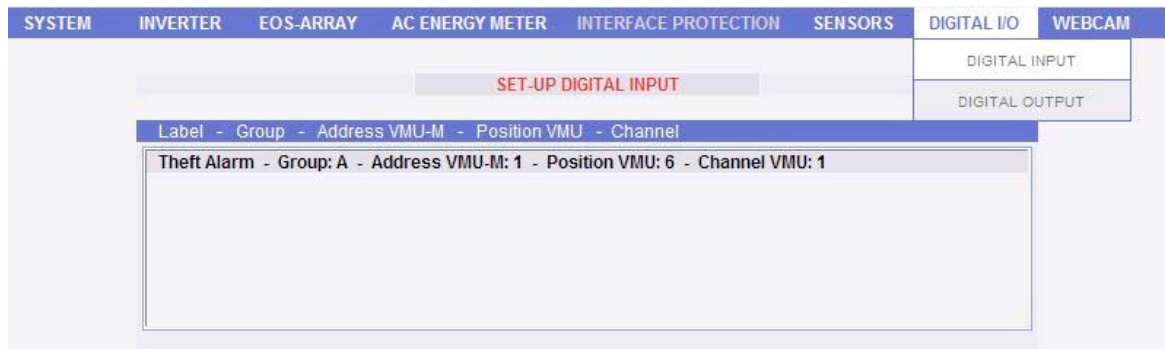


Fig. 45 - Digital inputs list screen



∞ Set-up Digital input

Select the input from the list shown in Fig. 45. The content of Fig. 46 is shown in page bottom.



Fig. 46 - Set-up Digital input screen

*Note:* “Group”, “Address VMU-M” and “Position VMU” fields cannot be modified as automatically acquired by Eos-Box.

“Name”: Enter a name to be assigned to the input; it is necessary for an easier identification from Alarms list.

“Group”: Group the VMU-M controlling VMU-O belongs to.

“Address VMU-M”: Address of VMU-M controlling VMU-O.

“Position VMU”: Position of VMU chain. If sensor is connected onto a VMU-M, the position is always 0.

“Channel”: input channel.

Press “Reset” key to delete modifications; “Cancel” to cancel operation. Press “Save” key to change input name.

### 3.9.2 DIGITAL OUTPUTS

Place the mouse on “DIGITAL I/O”, “DIGITAL OUTPUT” item appears; click for access to the page shown in Fig. 47. Digital inputs can only appear on VMU-Os.

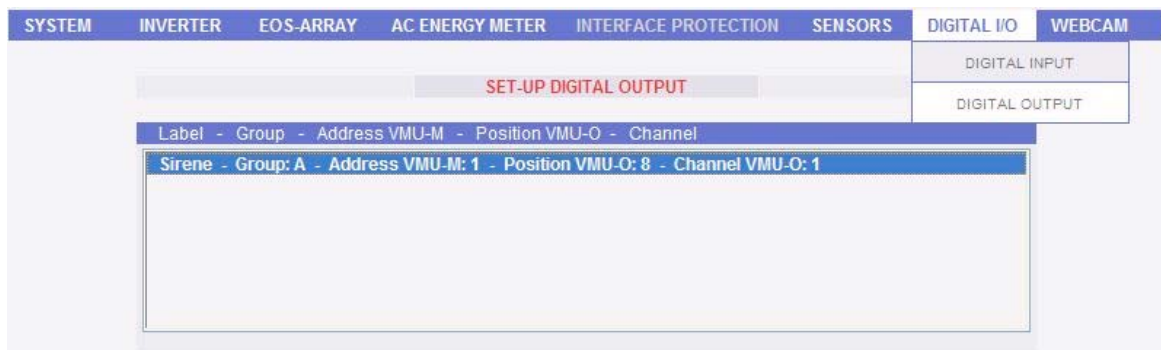


Fig. 47 - Digital outputs list screen

∞ Set-up Digital output

Select the output from the list shown in Fig. 47. The content of Fig. 48 is shown in page bottom.

Fig. 48 - Set-up Digital outputs screen

*Note:* “Group”, “Address VMU-M” and “Position VMU” fields cannot be modified as automatically acquired by Eos-Box.

“Name”: Enter a name to be assigned to the output; it is necessary for an easier identification from Alarms list.

“Group”: Group the VMU-M controlling VMU-O belongs to.

“Address VMU-M”: Address of VMU-M controlling VMU-O.

“Position VMU”: Position of VMU-O chain.

“Channel”: output channel.

Press “Reset” key to delete modifications; “Cancel” to cancel operation. Press “Save” key to change input name.

### 3.10 IP CAM CONFIGURATION

Eos-Box can internally display the images from IP, TV cameras, Server Video or DVR (digital video-recorders). This operation provides for re-addressing of web pages they provide inside IP Cam section.

Place the mouse on “IP CAM”, “SETTING” item appears; click for access to the page shown in Fig. 49.

Fig. 49 - IP Cams list screen

### 3.10.1 IP CAM INSERTION

Press “Add” key. The content of Fig. 50 is shown in page bottom.



Fig. 50 - Add IP Cam screen

Fill in the fields according to the following specifications:

- “Name”: Name to be assigned to TV-camera.
- “Address”: IP address of IP Cam, Server Video or DVR.

**Note: IP address must be a static public address, not an internal grid address.**

Press “Reset” key to clean form; “Cancel” to cancel operation. Press “Add” key to enter IP Cam name in the list shown in Fig. 51.

### 3.10.2 IP CAM MODIFICATION

Select the IP Cam to be modified from the IP Cams list shown in Fig. 51. Press “Modify” key. The content of Fig. 52 is shown in page bottom.



Fig. 51 - Inserted IP Cams list



The screenshot shows a web interface titled "Update IP Cam". It features a light blue header bar with the text "Update IP Cam". Below the header, there is a form with two input fields: "Name" containing "Camera East" and "Address" containing "http://ip\_address.com". At the bottom of the form are three buttons: "Save", "Reset", and "Cancel".

Fig. 52 - IP Cam modification screen

Modify as already described in the previous section (IP Cam insertion). Press "Reset" key to delete modifications; "Cancel" to cancel operation. Press "Save" key to change configuration.

### 3.10.3 IP CAM DELETION

Select the element to be deleted from the Inserted IP Cams list (Fig. 51). Press "Delete" key. The confirmation message appears on the centre of the page. Press "OK" key confirm deletion or "Cancel" to cancel. Press "OK" to remove element from the list shown in Fig. 51.

### 3.11 OUTGOING MAIL SERVER OUTPUT (SMTP)

Place the mouse on “SYSTEM”, “MAIL” item appears; click for access to the page shown in Fig. 53.

Fig. 53 – 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, Eos-Box cannot send communication by email.

Fill in the fields according to the following specifications:

- “*Sender address*”: Email address associated to Eos-Box. If the address is not valid, emails sent by Eos-Box could be considered as SPAM.
- “*Sender name*”: Name appearing on email. (From:)
- “*Server SMTP*”: Address of SMTP server for outgoing mail.
- “*Username Server SMTP*”: 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.

## 3.12 ALARM SENDING CONFIGURATION

Place the mouse on “SYSTEM”, “ALARMS” item appears; click for access to the page shown in Fig. 54.

The screenshot displays the 'Setup Send Alarms' configuration interface. At the top, a navigation bar includes 'SYSTEM', 'INVERTER', 'EOS-ARRAY', 'AC ENERGY METER', 'INTERFACE PROTECTION', 'SENSORS', 'DIGITAL I/O', and 'IP CAM'. The main content is divided into two sections: 'Setup Send Alarms 1' and 'Setup Send Alarms 2'. Each section contains the following fields:

- Recipients Addresses:** A text input field containing 'address1@domain.com;address2@domain.com;address3@domain.com' for the first screen and 'address4@domain.com;address5@domain.com;' for the second.
- Object:** A text input field containing 'Alarms from name\_plant' in both screens.
- Action:** Includes checkboxes for 'Send Mail' and 'Send SMS', and buttons for 'Test Mail' and 'Test SMS'. A 'Phone Number' field is present next to the 'Send SMS' checkbox, containing '+39 1234567890' in the first screen and '+39 9876543210' in the second.
- Send for:** A row of colored buttons with checkboxes: 'Alarms' (red, checked), 'Warning' (yellow, checked in the first screen, unchecked in the second), 'Event' (blue, checked), and 'Command' (green, unchecked).

A 'Save Setting' button is located at the bottom center of the configuration area.

Fig. 54 - Alarms configuration screen

Eos-Box can send an alarm email or SMS to more receivers at the same time and according to preset 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:

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

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

“*Object*”: Subject of email to be sent. (Ex. Alarm from platform room system in Lainate (MI)).

“*Action*”: Check what Eos-Box is supposed to do when an alarm appears.

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

*Note:* To send emails, the outgoing mail server must be properly configured on the system. (See the previous paragraph)

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

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

- “*Send SMS*”: Check to enable SMS sending to the number entered aside.
- “*Phone number*”: Telephone number the SMS is to be sent to. The number consists of a first part where the international phone code is specified (Ex. +39) and a second part where the telephone number is entered.

*Note:* If no modem has been configured in Eos-Box for SMS sending, “Send SMS” selection and “Telephone number” field are disabled. (See Installation and configuration modem - Par. 3.3)

- “*Test SMS*”: Press this key to receive a SMS to the number entered.

*Notes:* if the message is not received, ensure that number is correct and signal quality is acceptable. (See Installation and configuration modem - Par. 3.3)

***Note:* If Eos-Box uses cellular modem for Internet connection, during the SMS sending phase the system must disconnect from internet to process message sending and connect again. This process makes the machine temporarily not reachable. Estimated service downtime is about 3 minutes.**

“*Send for*”: Selections allow selecting and filtering the alarm type the email or SMS is to be sent for. 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.
- “*Event*”: Opening/Closing of digital inputs and outputs
- “*Command*”: Variation of parameters on Eos-Array

Press “Save setting” key to store settings.

**For further details on alarm types, refer to chapter 8, “Alarms”.**

### 3.13 PLANNING SETTING

Place the mouse on “SYSTEM”, “PLANNING” item appears; click for access to the page shown in Fig. 55.

∞ Scheduling Sending data via Mail

Eos-Box allows scheduling an email sending with a .xls file attached, containing the system production data for the period selected in “Send plant data”. The email can be sent to more receivers at the same time.

Note: To send emails, the outgoing mail server must be properly configured on the system. (See paragraph 3.11)

Fig. 55 - Schedule configuration

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

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

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

“*Action*”: Enable/disable schedule:

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

Note: To send emails, the outgoing mail server must be properly configured on the system. (See the previous paragraph)

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

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

“*Send plant data*”: Check email sending period.

- “*Daily*”: every day at 11.59 p.m., a .xls file is sent with daily production data.



- “*Weekly*”: every Sunday at 11.59 p.m., a .xls file is sent with summarized (daily total production) and detailed production data for every day of the week
- “*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.
- “*Yearly*”: on December 31st at 11.59 p.m., a .xls file is sent with summarized (daily total production) production data for every day of the year.

### ∞ Backup Data on External Memory (optional)

Scheduled backup operations for all data contained in Eos-Box database can be activated by CompactFlash (CF)..

**Note: the CompactFlash is not included in Eos-Box. Install an 8GB industrial-type Compact Flash.**

- *Compact Flash installation*
  1. Turn Eos-Box upside down and find the cover fastened onto the plate by two screws.
  2. Untighten screws and remove the cover.
  3. Insert the CompactFlash ensuring that it is formatted and not protected in writing.
  4. Re-place the cover.
- *Scheduled backup operation*

Select the option according to the backup frequency desired:

“*No backup*”: Schedule disabled.

“*Daily*”: backup is performed every day at 11:59 p.m.

“*Weekly*”: backup is performed on Sunday evening at 11:59 p.m.

“*Monthly*”: backup is performed on the last day of the month at 11:59 p.m.

“*Yearly*”: backup is performed on December 31st at 11:59 p.m.

Press “Save setting” key to store all settings entered.

## 3.14 Eos-Box UPDATE AND REBOOT

Place the mouse on “SYSTEM”, "FIRMWARE" item appears; click for access to the page shown in Fig. 56.

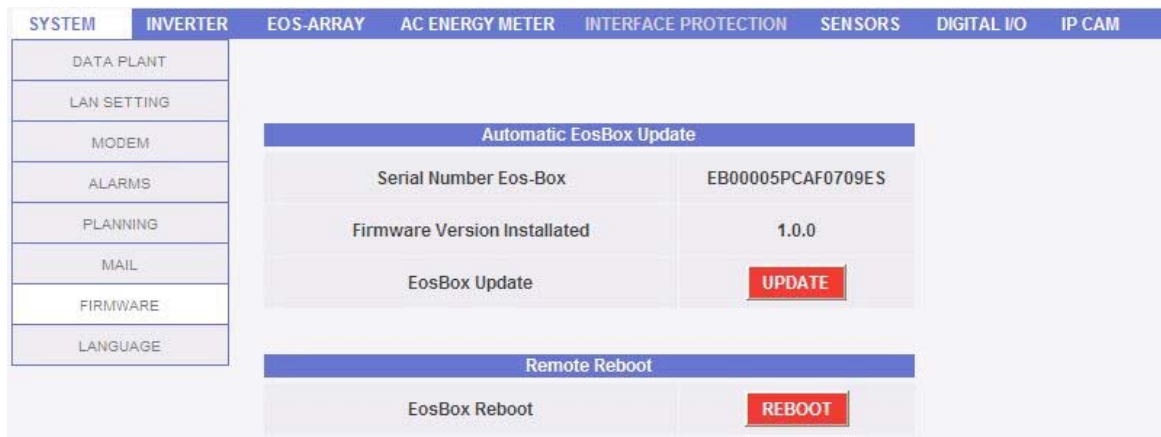


Fig. 56 - Firmware update

The page contains two screens: an update screen and a reboot screen.

∞ Automatic Eos-Box update

The serial number of Eos-Box is specified aside of the first field, as shown on label under the device.

Currently-installed firmware version is given below.

*Note:* The system does not ensure if installation on machine is the last one available. Update operation is performed in any case.

Press “Update” key to view an operation confirmation message. Press “OK” to continue or “Cancel” to stop. Press “OK” to open a new window as shown in Fig. 56c.



Fig. 56c – Download Firmware

The system starts downloading last firmware version available on server. The dimension of file to be downloaded is shown on left top side. A progressive bar appears in the central part to indicate the real download trend in progress, with the relevant percentage under the bar.

*Note:* If server is not reachable, the update operation cannot be performed. Check Eos-Box internet connection.

If connection to server is not available, N.A. appears close to "File size" and "Access to server impossible" is shown in red above the progression bar.

"Abort Download" appears on bottom; click to stop updating and close the window. To repeat system upgrade, press "Update" system as shown in Fig. 56.

**Note:** "Abort Download" button is disabled when download phase is completed and system is completing update operation.

**Note:** if Internet connection is interrupted during download, the progression bar stops and (if Eos-Box connection to PC still exists) "Access to server impossible" appears in red above it. To repeat update, release the system by "Abort Download" key.

Download operation is completed when the 100% percentage is reached and the "Download completed successfully" appears in green. **Wait for machine restart... DO NOT SWITCH OFF Eos-Box. The system will be reachable again in a few minutes**".

In this phase it is **important not to switch the machine off** and **wait for a few minutes until the machine can be reached again at its address**.

**Note:** The time necessary to the system for downloading the update depends on internet connection speed and could last for several minutes, particularly in connection with cellular modem.

**Note:** If more update operations are launched at the same time, the system will only take care of the first one and the update status windows (Fig 56c) only show its progress.

### ∞ Eos-Box reboot

Eos-Box can be restarted by "REBOOT" key. After this command, a countdown is displayed. When it is completed, you are addressed back to the home page (Fig. 57).

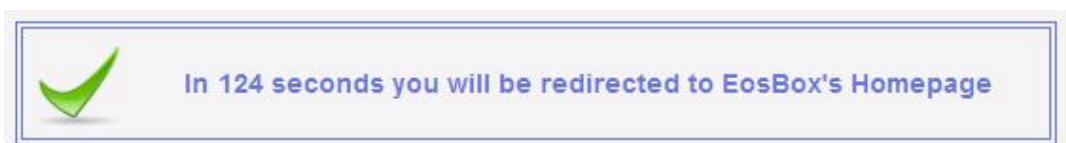


Fig. 57 - Rebooting Eos-Array

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

## 4. ACCOUNT



Click on “Account” icon in Navigation menu for access to Account configuration section (Fig. 58) dedicated to users management for access to system.

Fig. 58 - Account management

### 4.1 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 anymore. To restore Administrator user, contact Carlo Gavazzi technical assistance.

To know online users, refer to the list shown in the hatched area in Fig. 58. The connected users are shown in green, with “Connected” word, while the others are displayed in red with “Non connected” saying.

### 4.1.1 NEW ACCOUNT INSERTION

Press “Add account” key. The content of Fig. 59 is shown in page bottom.

Fig. 59 - Account insertion screen

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.

### 4.1.2 ACCOUNT MODIFICATION

Select the account to be modified from the Inserted accounts list (Fig. 58). Press “Update” key. The content of Fig. 60 is shown in page bottom.

Fig. 60 - Account modification screen

Modify as already described in the previous section (New account insertion) and considering that Username field cannot be changed. Press “Reset” key to delete modifications; “Cancel” to cancel operation. Press “Save” key to change account.

### 4.1.3 ACCOUNT DELETION

Select the account to be deleted from the list in Fig. 58. Press “Delete account” key. The confirmation message appears on the centre of the page. Press “OK” key to confirm deletion or “Cancel operation” to cancel.

### 4.1.4 ACCOUNT LOGOFF

The administrator user can disconnect a user in the list by a forced logoff operation. This user is displayed in green in the list with the “Connected” word aside. Select the account to be disconnected from the list in Fig. 58. Press “User logoff” key. All the users connected with that Username are disconnected and re-addressed to the home page.

## 4.2 CHRONOLOGY OF SYSTEM ACCESSES

Click on a “Log Users” button (Fig. 61) to open a window containing the chronology of accesses to Eos-Box, including date and time (Fig. 62). Lines in green show the users online at the moment.

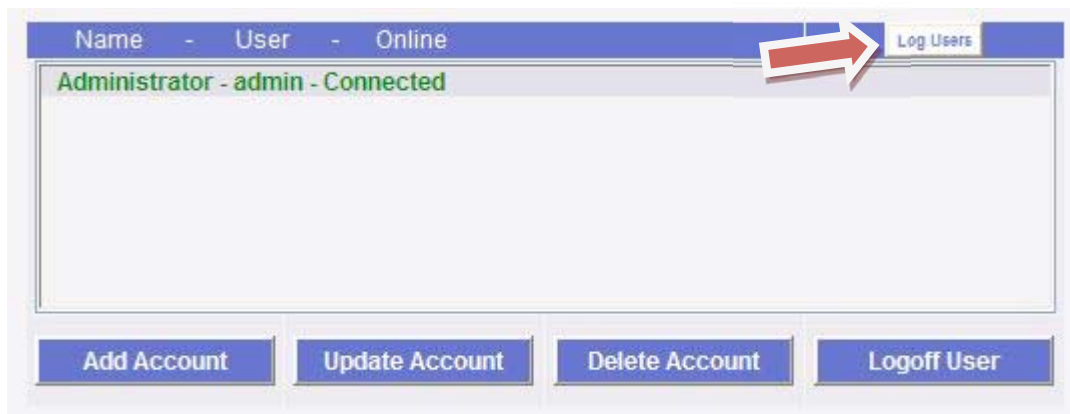


Fig. 61 - System accesses list button

The chronology keeps access data for a week; date and time refer to login phase (Fig. 4).

User	Logged	IP	Last Login
Administrator	Connected	127.0.0.1	0000-00-00 00:00:00
Administrator	Not Connected	127.0.0.1	0000-00-00 00:00:00
Administrator	Not Connected	127.0.0.1	0000-00-00 00:00:00

Fig. 62 - System accesses list

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



## 5. HOME PAGE

Click on “Home” icon in Navigation menu for access to the content in Fig. 63 (hatched area), showing the trend of power emitted from the system during the current and the previous days, with 1-minute sample resolution.

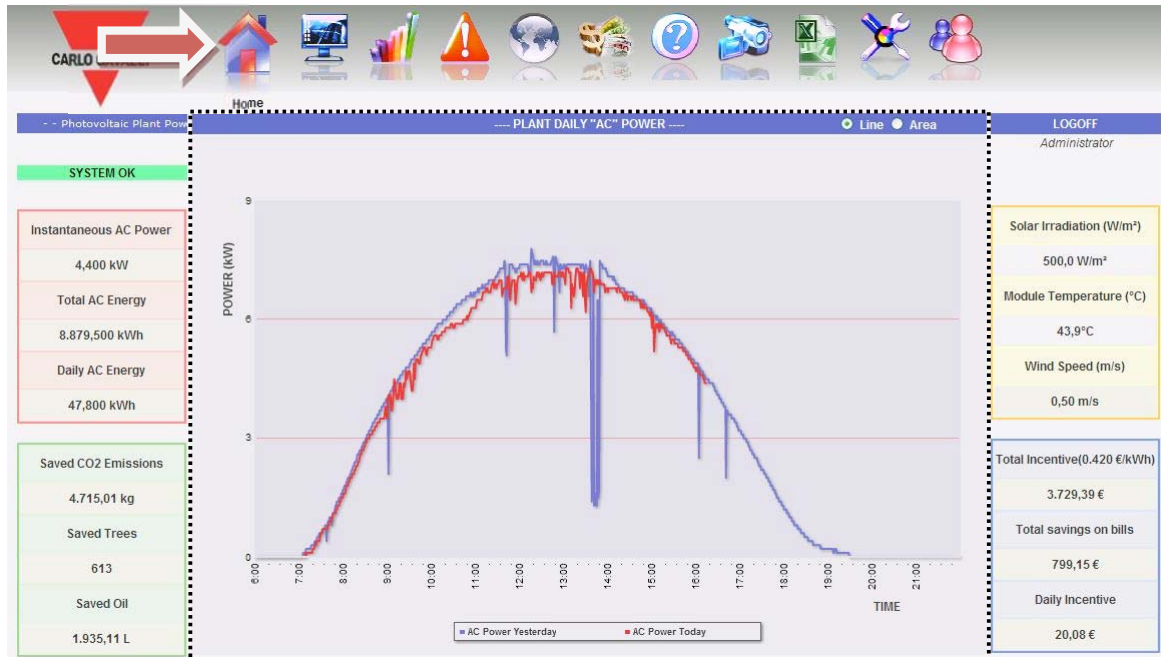


Fig. 63 – System daily “AC” power

The chart can be displayed in “Line” or “Area” mode (Fig. 64) by selecting the keys on top right side.

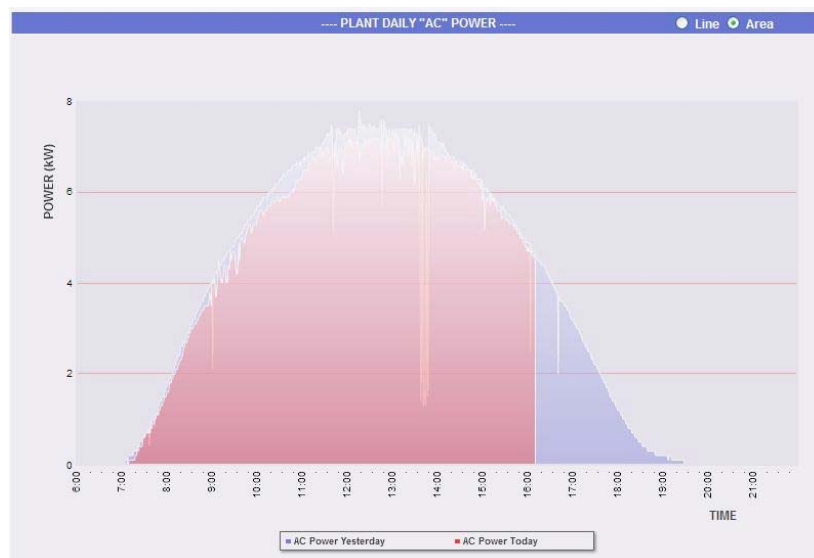


Fig. 64 – System daily “AC” power; graphic mode: Area

In chart X-axis, day time is shown from 6:00 a.m. to 10:00 p.m., while Y-axis shows power in kW; the Y-axis max value is dimensioned according to system peak power. The chart is automatically updated every minute. Place the mouse above the chart line to show the relevant power value as shown in Fig. 65.

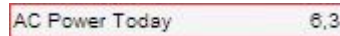


Fig. 65

∞ Data export from chart

Right-click inside the chart area to open the drop-down menu displayed in the hatched area in Fig. 66.

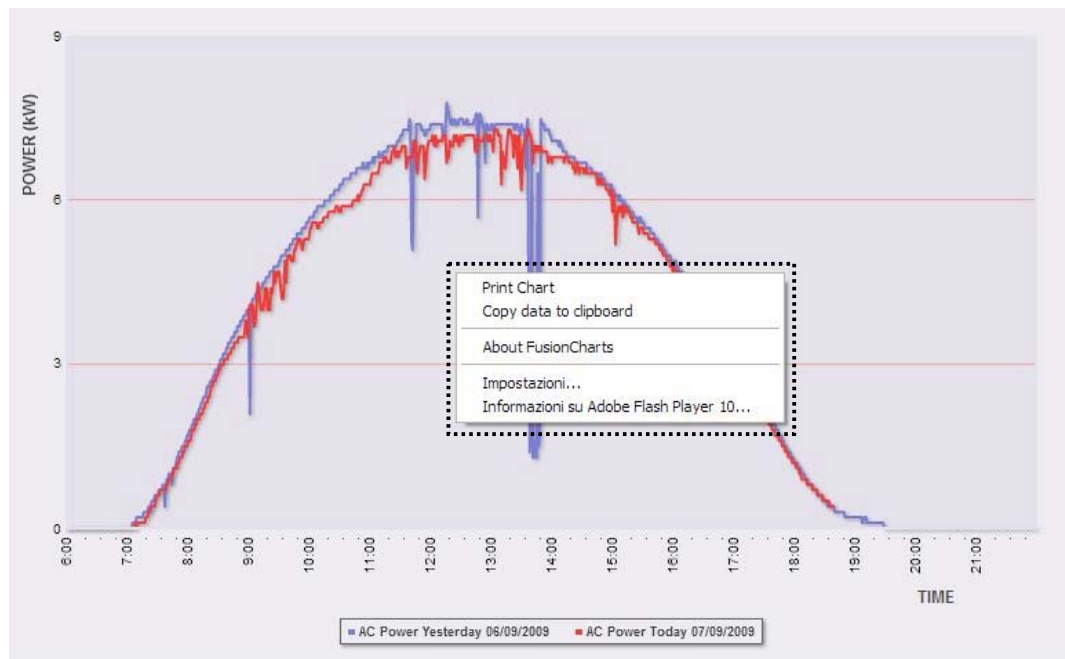


Fig. 66 - Data export from chart

Left-click on “Copy data to clipboard”. Open any spreadsheet and paste data.

∞ Print chart

Right-click inside the chart area to open the drop-down menu displayed in the hatched area in Fig. 66. Left-click on “Print Chart”; select the printer and press “Print” key.





## 6. PRODUCTION DATA ANALYSIS

This section is dedicated to production data analysis. Helped by chart comparisons on dimensions such as power, solar irradiation, temperatures and efficiencies, the typical productivity elements of a photovoltaic system are associated. Click on "Monitor" icon in the Navigation menu for access to the content of Fig. 67 (hatched area).

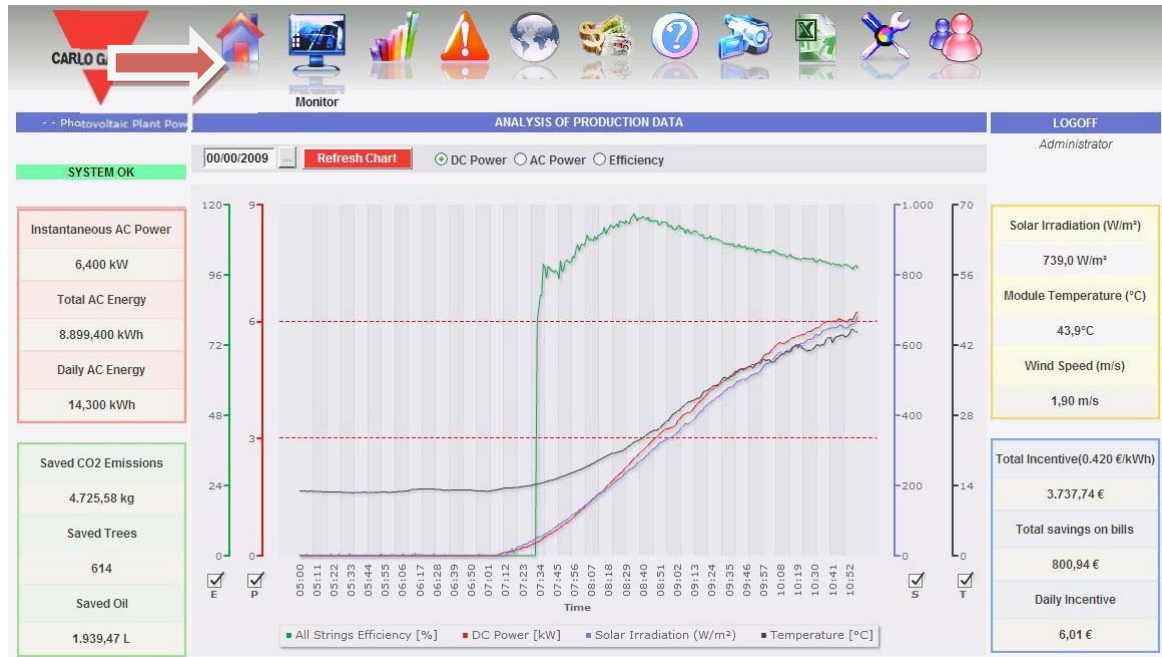


Fig. 67 - Production data analysis

The system is monitored in its two parts:

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

The analysis consists of three different types of data analysis, accessible through top bar buttons (Area A - Fig. 67):

- "DC power" - the direct current part upstream of VMU-Ss is analysed (string control).
- "AC power" - the alternating current part is analysed.
- "Efficiency" - various efficiencies are compared

### a. Graphic functions

Charts consist of X-axis, showing day hours from 05.00 a.m and so many Y-axis as the number of dimensions to be drawn. Each Y-axis has a scale end properly dimensioned to the dimension it refers to and can be moved from outside to inside by mouse-clicking on it; colours of Y-axis comply with legend words. To enable or disable a curve, simply use the check control located on Y-axis bottom side. The curve is immediately displayed or removed without any page refresh.

Place the mouse above a chart line to show the relevant value. If access to the value is complex due to the several curves overlapping, it is recommended to eliminate the others by isolating the interesting curves only.

- *Data export from chart*

Right-click inside the chart area to open the drop-down menu displayed in Fig. 68.



Fig. 68 - Data export from chart

Left-click on "Copy data to clipboard". Open any spreadsheet and paste data.

- *Print chart*

Right-click inside the chart area to open the drop-down menu displayed in Fig. 68. Left-click on "Print Chart"; select the printer and press "Print" key.

### 1. 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. 69.

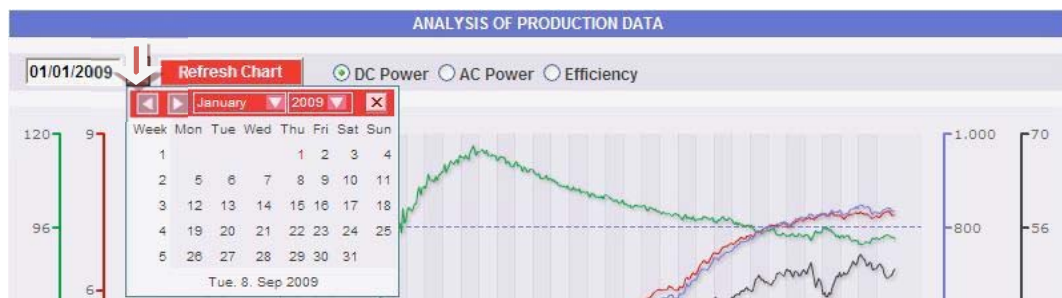


Fig. 69 - Data searching

Select the day desired and press "Refresh Chart" key.

*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.

## 2. "DC power" chart



Fig. 70 - Production data analysis in DC chart

The chart displays 4 dimensions:

1. "String efficiency": the 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.

Eos-Box can calculate string efficiency in three different ways, according to its configuration way in VMU-M with the bottom address, connected to COM2 port.

- 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. (Chap. 3.8)

2. "DC power": The direct current power is expressed in kW and is the final addition of all power values read by VMU-Ss.

3. “*Solar Irradiation*”: The solar irradiation is expressed in  $W/m^2$  and acquired by reference solar irradiation sensor.
4. “*Temperature*”: The temperature is expressed in  $^{\circ}C$  and acquired by reference temperature sensor.

*Note:* The time interval between a chart sample and the other one depends on storing time interval set up on VMU-Ms. It can account for 1,5,10,15,30,60 minutes.

**Note:** all data graphically shown on Eos-Box, except for instant values, are calculated like an average value of all samples acquired by the system within the storing time interval.

### 3. “AC power” chart

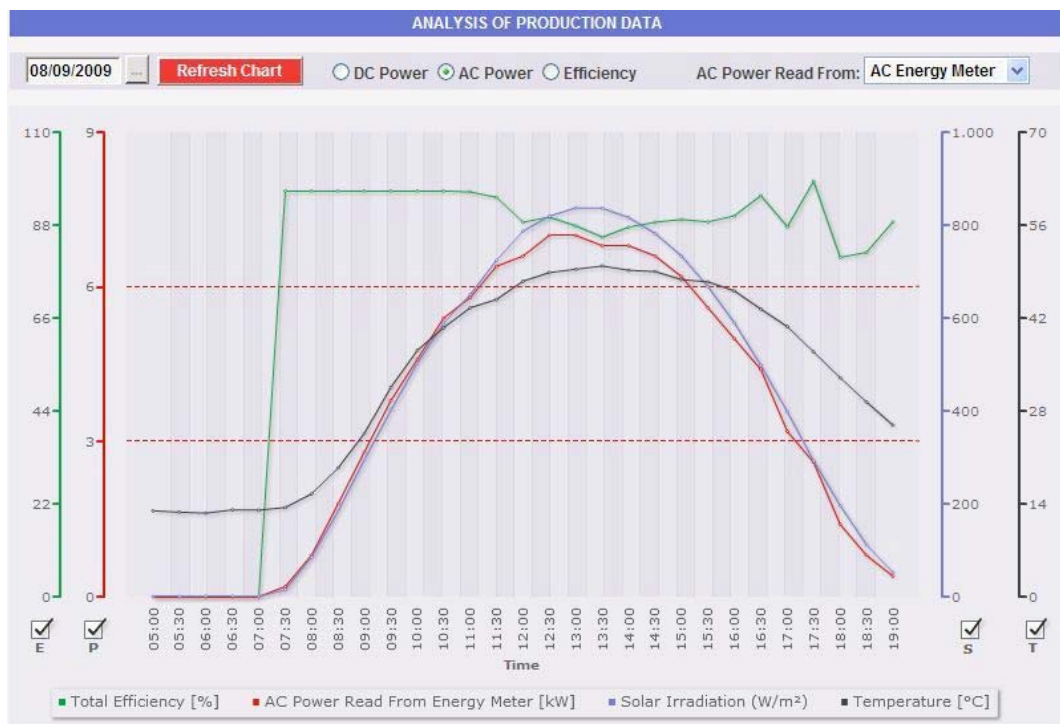


Fig. 71 - Production data analysis in AC chart

The chart displays 4 dimensions:

1. “*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 values from meter or inverters as selected on “*Energy production data display*” screen in “*System data configuration*” (Chap.3.4). 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.**

Eos-Box can calculate total efficiency in two different ways, according to its configuration way in VMU-M with the bottom address, connected to COM2 port:

- Calculation with solar irradiation and temperature sensor located on module.
- Calculation with solar irradiation and room temperature sensor.

*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. (Chap. 3.8)

2. “AC power” : Power in alternating current expressed in kW. Through the menu shown in Fig.72, power can be displayed coming from :
  - Main energy meter (set up like a reference meter in configuration phase)
  - Inverter – (Reference Y-axis: red-coloured “P”)
  - Main energy meter + inverter

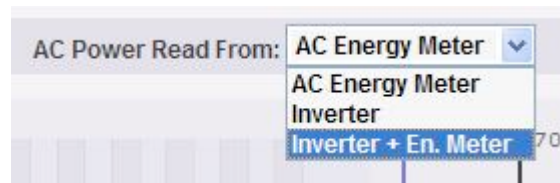


Fig. 72 – Selection menu to display AC power

3. “Solar irradiation”: The solar irradiation is expressed in  $W/m^2$  and acquired by reference solar irradiation sensor.
4. “Temperature”: The temperature is expressed in  $^{\circ}C$  and acquired by reference temperature sensor.

Time interval between samples on the chart is 30 minutes.

***Note:* To calculate efficiencies, refer to Eos-Array manual. Eos-Box acquires all necessary parameters directly from VMU-M with bottom address, connected to COM2 port.**

## 4. "Efficiencies" chart



Fig. 73 – Efficiency analysis screen

The chart compares 3 dimensions:

1. "String efficiency": See point 1 "DC power chart".
2. "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.
3. "Total efficiency": See point 1 "AC power chart".

To reach proper efficiency values, time interval between samples on the chart is 30 minutes.

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



## 7. PRODUCTION DATA CHARTS

This section is dedicated to graphic display of all data acquired by Eos-Box and real-time display of values, read from various devices. Click on "Plant" icon in the Navigation menu for access to page shown in Fig. 74.

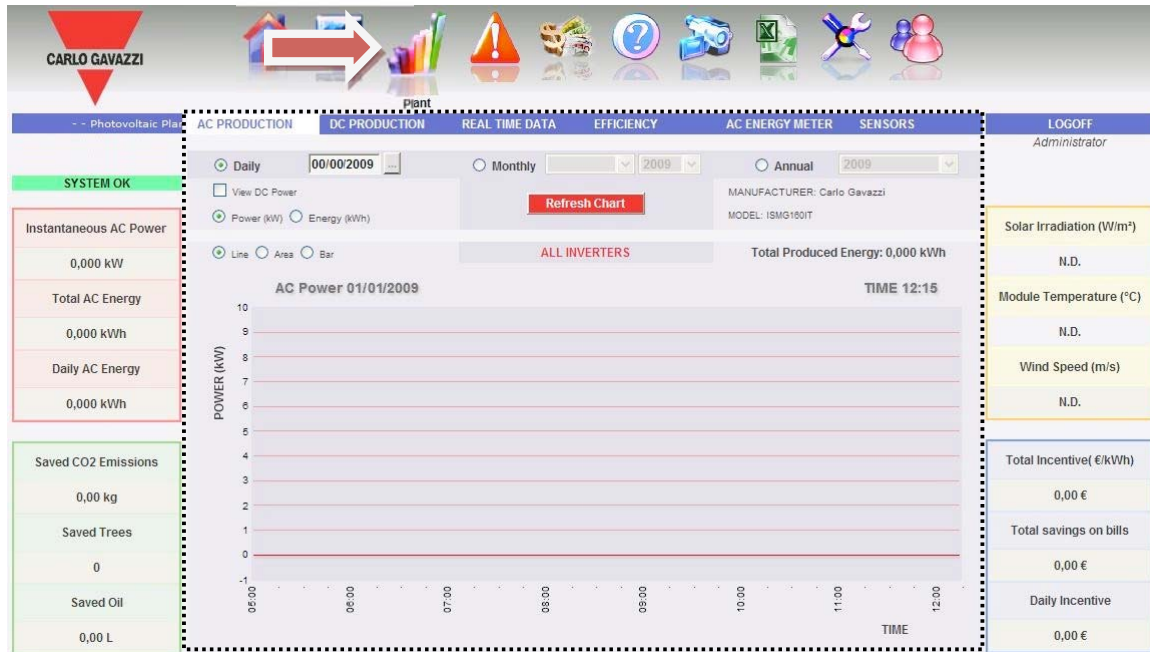


Fig. 74 - Production data charts

An access menu (Fig. 74) to the following sections is located on page top:

1. "AC PRODUCTION": Dedicated to Inverters.
2. "DC PRODUCTION": Dedicated to VMU-S string control.
3. "REAL-TIME DATA": It provides for real-time data from Inverters, VMU-Ss and AC meters.
4. "EFFICIENCY": Dedicated to efficiencies: Total, Eos-Array, Inverter, BOS.
5. "AC METERS": Dedicated to Energy meters monitored on the system.
6. "SENSORS": Dedicated to environmental sensors.



Fig. 75 - Production data charts menu

### 7.1.1 AC PRODUCTION – ALL INVERTERS

Place the mouse on "AC PRODUCTION", "ALL INVERTERS" item appears; click for access to the content of Fig. 76.

Power/energy curves represent the addition of all contributions from inverters monitored on the system, within the time interval selected.

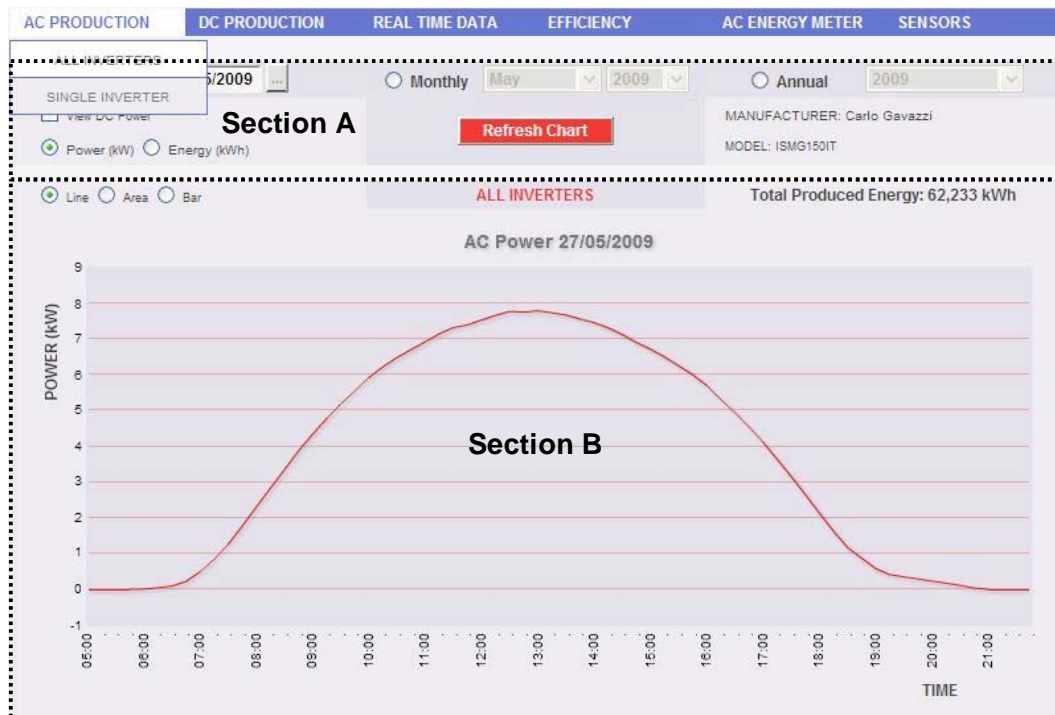


Fig. 76 - AC PRODUCTION - ALL INVERTERS chart

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 select the day, use the relevant calendar accessible through the key on date field side)
- Monthly: it shows the average daily power or total energy produced for every day of the selected month. (To select month and year, use the relevant selection menus aside)
- Yearly: it shows the power daily power or total energy produced for every month of the selected year. (To select the year, use the relevant selection menu aside)

After selecting the display type, press “Refresh Chart” key.

On left-hand side, in clear grey, there are:

1. the keys to select the type of dimensions to be drawn, Power or Energy.
2. The check enabling the graphic display of power or energy in direct current as measured from inverter upstream. (available if delivered by inverter).

Inverter brand and model are on right-hand side, in clear grey.



**B. Section containing the chart.**

X-axis shows time; according to the display type chosen (daily, monthly, yearly), we will have the relevant dimension (hours, days, months). Y-axis shows power in kW or energy in kWh with a properly-dimensioned scale end according to system peak power.

On left-hand top side of this section, a selection menu exists for graphic 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.

Right-hand top side shows the total energy produced by the system in the selected time interval.

*Note:* Time interval between samples on the chart is 15 minutes.

- *Graphic display of value*

Place the mouse above the chart line 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.

- *Data export from chart*

Right-click inside the chart area to open the drop-down menu displayed in Fig. 77.



*Fig. 77 - Data export from chart*

Left-click on "Copy data to clipboard". Open any spreadsheet and paste data.

- *Print chart*

Right-click inside the chart area to open the drop-down menu displayed in Fig. 77. Left-click on "Print Chart"; select the printer and press "Print" key.

## 7.1.2 AC PRODUCTION – SINGLE INVERTER

Place the mouse on “AC PRODUCTION”, “SINGLE INVERTER” item appears; click for access to the content of Fig. 78.

As soon as access is provided for, the page shows the daily trend of power delivered by every single inverter monitored on the system. Each curve has a different colour and can be identified by legend on chart bottom. Use “SELECT INVERTER” menu to display the production curve of every single inverter, as well.



Fig. 78 - AC PRODUCTION - SINGLE 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 select the day, use the relevant calendar accessible through the key on date field side)
- Monthly: it shows the average daily power or total energy produced for every day of the selected month. (To select month and year, use the relevant selection menus aside)
- Yearly: it shows the power daily power or total energy produced for every month of the selected year. (To select the year, use the relevant selection menu aside)

After selecting the display type, press “Refresh Chart” key.

On left-hand side, in clear grey, there are:

3. The keys to select the type of dimensions to be drawn, Power or Energy.
4. The check enabling the graphic display of power or energy in direct current as measured from inverter upstream. (available if delivered by inverter).

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

- Names assigned to inverters inserted into Eos-Box
- "ALL INVERTERS" item.

When an inverter name is selected, the relevant curve is shown; select "ALL INVERTERS" and the chart displays all inverter curves in a system at the same time. The graphic mode selected is Line.

*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 "Refresh Chart" function. The chart automatically updates after a few seconds.

### B. Section containing the chart.

X-axis shows time; according to the display type chosen (daily, monthly, yearly), we will have the relevant dimension (hours, days, months). Y-axis shows power in kW or energy in kWh with a properly-dimensioned scale end according to system peak power.

On left-hand top side of this section, when the production trend of a single inverter is displayed, a selection menu exists for graphic 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.

Right-hand top side shows the total energy produced - in the selected time interval - by the selected inverter or the whole system, if "ALL INVERTERS" is selected.

*Note:* Interval between samples on the chart is 15 minutes.

## 7.2.1 DC PRODUCTION –ALL STRINGS

Place the mouse on “DC PRODUCTION”, "ALL STRINGS" item appears; click for access to the content of Fig. 79.

Curves represent the addition of all contributions from VMU-S string controls monitored on the system, within the time interval selected.

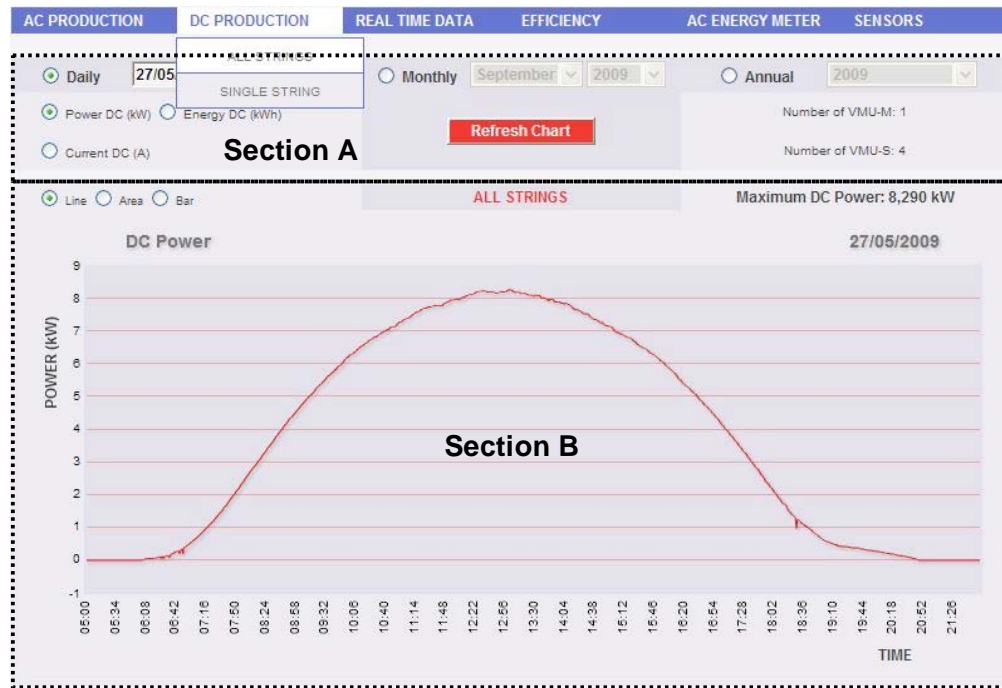


Fig. 79 - DC PRODUCTION - ALL STRINGS chart

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 DC power or DC energy OR DC current on the selected day. (To select the day, use the relevant calendar accessible through the key on date field side)
- Monthly: it shows the maximum DC power, maximum DC current or total DC energy produced for every day of the selected month. (To select month and year, use the relevant selection menus aside)
- Yearly: it shows the maximum DC power, maximum DC current or total DC energy produced for every month of the selected year. (To select the year, use the relevant selection menu aside)

After selecting the display type, press “Refresh Chart” key.

On left-hand side, in clear grey, there are:

5. The keys to select the type of dimensions to be drawn, DC Power, DC Energy or DC Voltage.

The number of VMU-Ms and VMU-Ss on the field is on right-hand side, in clear grey.

B. Section containing the chart.

X-axis shows time; according to the display type chosen (daily, monthly, yearly), we will have the relevant dimension (hours, days, months). Y-axis shows power in kW or energy in kWh or current in A with a properly-dimensioned scale end.

On left-hand top side of this section, a selection menu exists for graphic 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.

Right-hand top side shows the total DC energy produced in the selected time interval.

*Note:* The time interval between a chart sample and the other one depends on storing time interval set up on VMU-Ms. It can account for 1,5,10,15,30,60 minutes.

**Note:** The same datum storing time is to be set up on all VMU-Ms in the system. For configuration, see Eos-Array manual.

## 7.2.2 DC PRODUCTION – SINGLE STRING

Place the mouse on “DC PRODUCTION”, "SINGLE STRING" item appears; click for access to the content of Fig. 80.

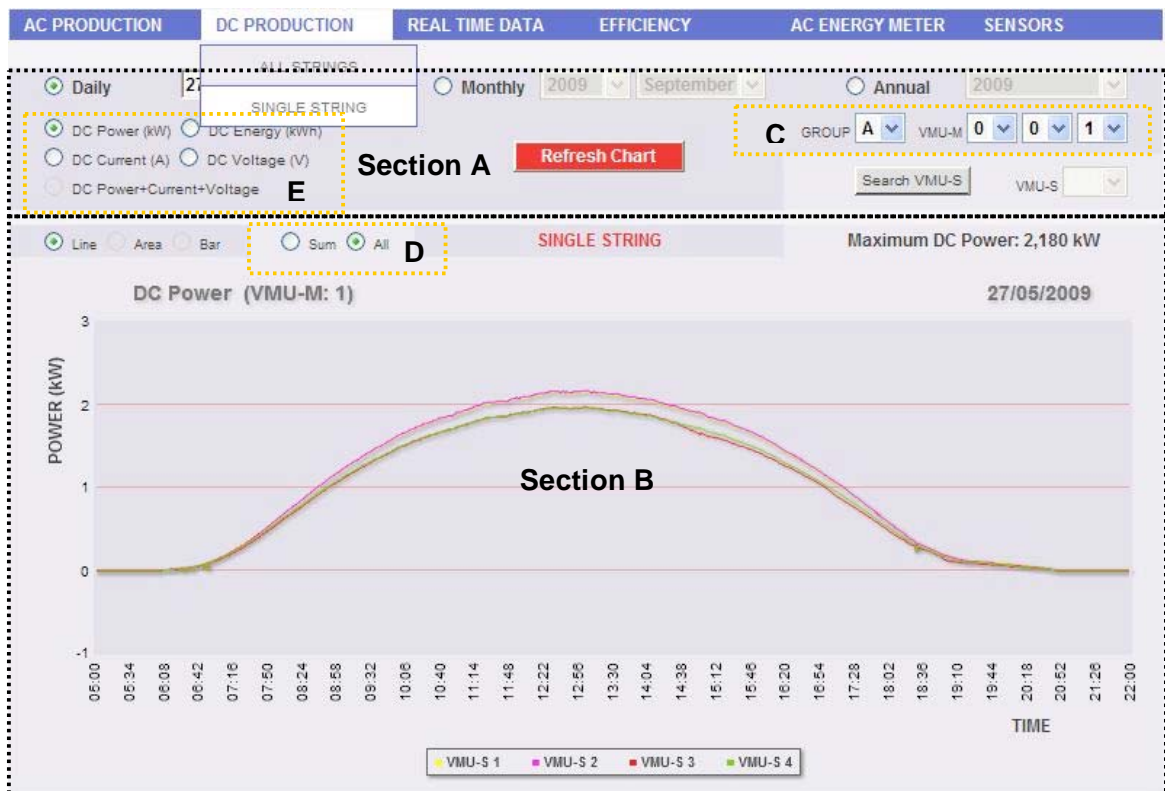


Fig. 80 - DC PRODUCTION - SINGLE STRING chart

This page shows trend of all electric values of strings controlled by VMU-Ss on the field. In particular, two display types exist:

1. Chart with aggregated data coming from several VMU-S string controls.
2. Chart with data coming from a single VMU-S string control.

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

Data from all VMU-Ss under a specific VMU-M (to be selected by proper menu viewed in Fig. 80 - Area C) are shown here. Data can be displayed by:

- a) (All) - Several curves, one for each VMU-S selected, displayed at the same time.
- b) (Addition) - A single curve consisting of the addition of all curves of VMU-Ss selected.

To select "All" or "Addition" mode, use the menu shown in the hatched area "D" in Fig. 80.

**"All" is the default mode** and it shows curves of VMU-Ss under 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.

"Addition" mode shows a single curve, being the result of contributions from different VMU-Ss.

Note: the "Addition" mode does not allow for DC Voltage to be selected as the addition of more string voltages would be useless.

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

1. *VMU-M selection*

Use proper menu in Fig. 80 - Area C to select the relevant VMU-M. VMU-M must be selected to identify all VMU-Ss under it, to be monitored and compared.

"GROUP" field represents Eos-Box communication port used to communicate with VMU-M: Group A = COM2, B=COM3, C=COM4.

"VMU-M address" indicates the RS-485 address assigned to VMU-M in programming phase. The address range is between 001 and 247.

Note: if the VMU-M selected does not exist in the system, the chart shows "No data to Display" writing on a white background.

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 DC power or DC energy or DC current on the selected day. (To select the day, use the relevant calendar accessible through the key on date field side)
- Monthly: it shows the maximum DC power, maximum DC current or total DC energy produced for every day of the selected month. (To select month and year, use the relevant selection menus aside)
- Yearly: it shows the maximum DC power, maximum DC current or total DC energy produced for every month of the selected year. (To select the year, use the relevant selection menu aside)

### 3. Selection of electric dimension required

Use proper menu in Fig. 80 - Area E and shown below to select the electric dimension required.

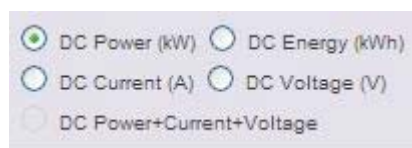


Fig. 81 – Selection of electric dimension buttons

*Note:* “DC Power+Current+Voltage” selection is disabled for the display of aggregated data from more VMU-S string controls. It only activates for chart with data from a single VMU-S string control.

*Note:* the “Addition” mode does not allow for Voltage (V) to be selected as the addition of more string voltages would be useless.

Selection keys available are the following:

- “DC Power (kW)” : [Default selection]; chart shows the trend of power in kW within the time interval.
- “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. (Only enabled in All mode)

### 4. View of chart required

Press “Refresh Chart” key to view the chart required.

*Note:* To shift from "All" mode to "Addition" mode, use the menu shown in Fig. 80 - Area D. The chart automatically updates without using “Refresh Chart”.

∞ Charts with data coming from a single VMU-S string control.

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

1. *VMU-M selection*

Use proper menu in Fig. 80 - Area C to select the relevant VMU-M. VMU-M must be selected to identify all VMU-Ss under it, to be monitored and compared. "GROUP" field represents Eos-Box communication port used to communicate with VMU-M: Group A = COM2, B=COM3, C=COM4. "VMU-M address" indicates the RS-485 address assigned to VMU-M in programming phase. The address range is between 001 and 247.

*Note:* if the VMU-M selected does not exist in the system, the chart shows "No data to Display" writing on a white background.

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 electric dimension chosen on the selected day. (To select the day, use the relevant calendar accessible through the key on date field side)
- 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 select month and year, use the relevant selection menus aside)
- 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 select the year, use the relevant selection menu aside)

3. *Searching for the VMU-S required*

Press "Search VMU-S" key shown in Fig 82. → "Refresh Chart" key disappears, "DC Power+Current+Voltage" selection can be selected, VMU-S selection menu is activated.

*Note:* Do not select any VMU-S from VMU-S menu before choosing the electric dimension required.



Fig. 82 – VMU-S search button



#### 4. Selection of electric dimension required

Use proper menu in Fig. 82 to select the electric dimension to be drawn.

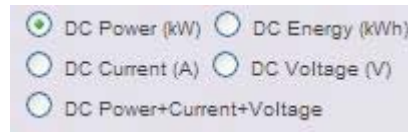


Fig. 83 – Selection of electric dimension buttons

Selection keys available are the following:

- “DC Power (kW)” : [Default selection]; chart shows the trend of power in kW within the time interval.
- “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”: chart shows the three dimensions at the same time, within the time interval chosen. Chart type for this selection is as shown in Fig. 84.



Fig. 84 – VMU-S Power+Current+Voltage chart

As already described in Chap. 6, this type of chart allows showing or hiding curves by checking at the bottom of the relevant axis.

#### 5. Selection of VMU-S required and graphic display

Open “VMU-S” drop-down menu shown in Fig. 82 to display the list of VMU-Ss under the VMU-M selected in point 1.

*Note:* If the "VMU-S" list has no items, it means there is no VMU-S under the selected VMU-M in point 1.

The list contains numbers matching VMU-S position in the chain of devices under VMU-M.

Select VMU-S required → Eos-Box processes the selected chart, viewed in section B after a few seconds.

*Note:* Chart is automatically displayed without using “Refresh Chart” key. It is only used to generate charts with data coming from several VMU-S string controls.

To display another VMU-S among those available with the same criteria, click again “Search VMU-S” and select the item required from 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. 85.



Fig. 85 – Graphic mode selection

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

*Note:* to update chart following Line/Area/Bar mode selected, press “Refresh Chart” key (aggregated data) or “Search VMU-S” → Select “VMU-S” (single VMU-S data).

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

#### ∞ Max or total values

For electric dimensions such as Power, Current and Voltage, the relevant Max value reached on drawn charts is shown on chart right top side. On the contrary, if energy is shown, the total delivered in kWh will be viewed within the time interval chosen. (Area A - Fig. 86)

∞ 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-Ms. It can account for 1,5,10,15,30,60 minutes.

Note: Time interval between samples on the Energy chart is never lower than 15 minutes. It is recommended to display in Bar graphic mode.

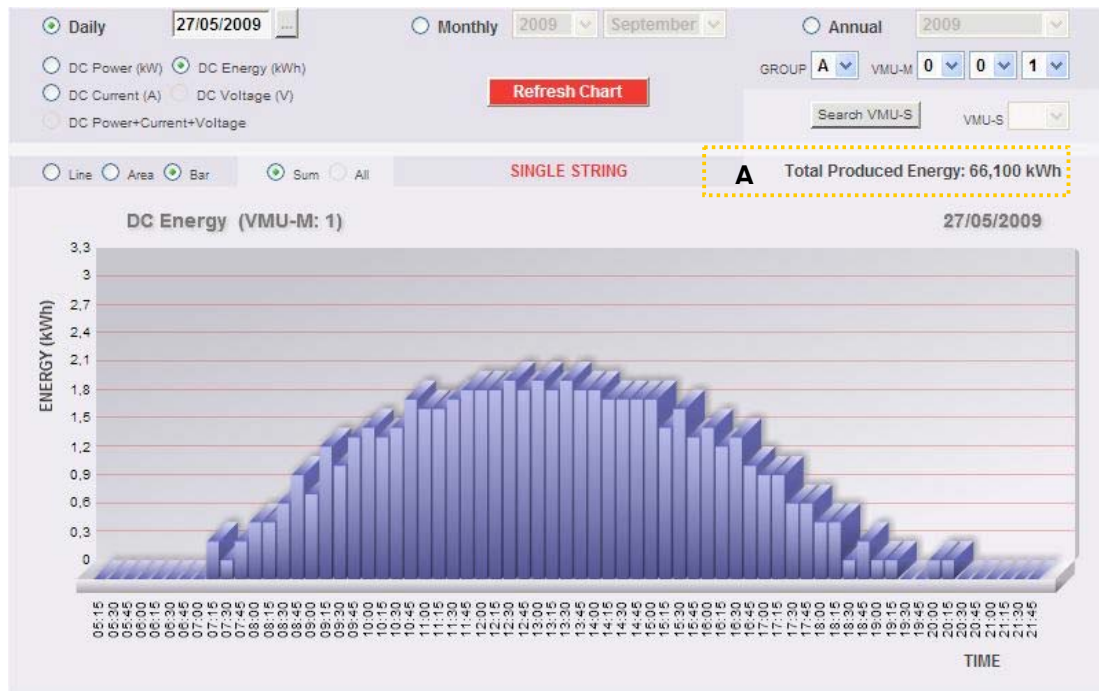


Fig. 86 – Example of chart showing DC energy delivered by strings controlled under VMU-M: 1

∞ Graphic display of value

Place the mouse above the chart line 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.

∞ Data export from chart

Right-click inside the chart area to open the drop-down menu displayed in Fig. 87.

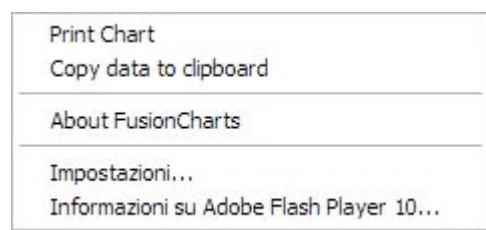


Fig. 87 - Data export from chart

Left-click on “Copy data to clipboard”. Open any spreadsheet and paste data.

∞ *Print chart*

Right-click inside the chart area to open the drop-down menu displayed in Fig. 87. Left-click on "Print Chart"; select the printer and press "Print" key.

## 7.3 REAL-TIME DATA

Place the mouse on "REAL-TIME DATA", a menu opens with three links: INVERTERS, EOS-ARRAYS, AC METERS as shown in Fig. 88.

These three links allow access to real-time display of the relevant data.

AC PRODUCTION			DC PRODUCTION			REAL TIME DATA	EFFICIENCY	AC ENERGY METER		SENSORS	
			LAST VAL			INVERTER	ROM INVERTER - TIME 16:46:15				
INVERTER NAME	Voltage AC (V)	Current AC (A)				DC (V)	Current DC (A)	Power DC (W)	AC Energy Meter (kWh)	Status	
INVERTER 01									1239		
INVERTER 02									2339		

Fig. 88 - Real-time data

### 7.3.1 INVERTER - REAL-TIME DATA

**Note: The list of Inverter models Eos-Box can communicate with is constantly updated. In order to enjoy new compatibilities on one's own system, it is recommended to update Firmware as described in chapter 3.14. For further information on inverter compatibility list refer to Carlo Gavazzi technical assistance.**

For access to real-time data display **as read by inverters** click on "INVERTER" from the menu shown in Fig. 88.

The table shown (Fig. 89) has so many lines as the number of inverters configured in Eos-Box. Each line has the following fields inside:

1. Inverter name - Assigned in configuration phase.
2. AC Voltage (V) – Measured on inverter output.
3. AC Current (A) – Measured on inverter output.
4. AC Power (W) – Measured on inverter output.
5. DC Voltage (V) – Measured on inverter input.
6. DC Current (A) – Measured on inverter input.
7. DC Power (W) – Measured on inverter input.
8. AC counter (kWh): Total Energy delivered by inverter at first switching-on.
9. Status – Inverter status. If neither alarms nor abnormalities exist, "OK" or "No error" are shown in green. Otherwise, the error description is shown in red **according to specifications in the inverter manual**. Error messages are always in English

Not: Data is continuously and automatically updated without page refresh thanks to Ajax technology.

Update time of a single datum depends on length of RS-485 chain of devices to be enquired. According to estimations, on a 30-device chain (inverters/energy meters), datum is updated every 90 seconds.

**Note: It is recommended not to connect more than 30 Inverters/Energy meters on RS-485 chain connected to Eos-Box COM1 port.**

For three-phase inverters, AC current and voltage values are shown through the three phases separated by semicolon (";").

**Note: Data could be unavailable on some inverter models; if so, fields are left blank.**

LAST VALUES - DATE: 13/09/2009 FROM INVERTER - TIME 17:57:17								
INVERTER NAME	Voltage AC (V)	Current AC (A)	Power AC (W)	Voltage DC (V)	Current DC (A)	Power DC (W)	AC Energy Meter (kWh)	Status
INVERTER 01							1239	
INVERTER 02							2339	

Fig. 89 - Inverter- Real-time data table

Table top part shows in red date and time of last sample acquisition.

### 7.3.2 Eos-ARRAY - REAL-TIME DATA

For access to real-time data display of VMU-S string controls click on “EOS-ARRAY” from the menu shown in Fig. 88.

The table (Fig. 90) shown in this page has so many lines as the number of VMU-S string control under VMU-M selected from menu A in Fig. 90.

AC PRODUCTION	DC PRODUCTION	REAL TIME DATA	EFFICIENCY	AC ENERGY METER	SENSORS
LAST VALUES - DATE: 2009-09-14 - TIME 09:31:36					
<span style="border: 1px dashed yellow; padding: 2px;"> <b>A</b> GROUP <span style="border: 1px solid gray; padding: 0 5px;">A</span> VMU-M <span style="border: 1px solid gray; padding: 0 5px;">0</span> <span style="border: 1px solid gray; padding: 0 5px;">0</span> <span style="border: 1px solid gray; padding: 0 5px;">1</span> </span>					
VMU-S POSITION	DC VOLTAGE (V)	DC CURRENT (A)	DC POWER (kW)	STATUS	
1	302.50	0.33	0.09	OK	
2	302.10	0.33	0.09	OK	
3	260.20	0.34	0.08	OK	
4	271.30	0.34	0.09	OK	

Fig. 90 - Eos-Array - Real-time data table

Default VMU-M is Group: A address: 1.

Each line has the following fields inside:

1. “VMU-S POSITION”: Position of VMU-S in the chain under VMU-M selected.
2. “DC VOLTAGE (V)”: DC string voltage

3. "DC CURRENT (A)": DC string current
4. "DC POWER (Kw)": DC string power
5. "STATUS": If no alarms exist, "OK" writing is shown in green, otherwise the alarm description appears in red in the language set up on Eos-Box.

Not: Data is continuously and automatically updated without page refresh thanks to Ajax technology.

∞ VMU-M selection

Use proper menu in Fig. 90 - Area A to select the relevant VMU-M. VMU-M must be selected to identify all VMU-Ss under it, to be monitored.

"GROUP" field represents Eos-Box communication port used to communicate with VMU-M: Group A = COM2, B=COM3, C=COM4.

"VMU-M" indicates the RS-485 address assigned to VMU-M in programming phase. The address range is between 001 and 247.

*Note:* if the VMU-M selected does not exist in the system or has no VMU-S modules under it, no item exists in the table and "VMU-M NOT AVAILABLE" writing appears in red. Otherwise, date and time of last sample acquisition appears.

After selecting VMU-M, wait for a few seconds until data is loaded in the table. This operation is performed without page refresh.

*Note:* The real-time data update frequency depends on the number of VMU-Ms in RS-485 series the selected VMU-M belongs to. This time can vary between a few seconds and several minutes.

*Note:* During Eos-Box installation phase, the system must align data contained inside the VMU-Ms monitored. This operation can require for several hours; until it is completed, real-time data of Eos-Array is not available.

### 7.3.3 ENERGY METERS - REAL-TIME DATA

For access to real-time data display of meters, click on "AC METERS" from the menu shown in Fig. 88.

The table shown (Fig. 91) in this page has so many lines as the number of meters configured in Eos-Box.

Each line has the following fields inside:

1. "NAME": Name of meter assigned in configuration phase.
2. "TYPE": Type field can be "exported" or "imported" and refers to energy counting direction. (see Chap. 3.7 - Energy selection field)
3. "POWER (kW)": Instant value of power read in kW.
4. "LAST VALUE (kWh)": Energy counted from the first switching-on in kWh.

Not: Data is continuously and automatically updated without page refresh thanks to Ajax technology.

Note: If no meter has been configured in Eos-Box, "NO METERS" writing appears in red on the table. Otherwise, date and time of last sample acquisition appear.

AC PRODUCTION	DC PRODUCTION	REAL TIME DATA	EFFICIENCY	AC ENERGY METER	SENSORS
LAST VALUES - DATE: 2009-09-14 - TIME 12:06					
NAME	TYPE	POWER (kW)	LAST VALUE (kWh)		
Main AC Energy Meter	Generated	1.400	9139.200		

Fig. 91 - Energy meters - Real-time data table

Update time of a single datum depends on length of RS-485 chain of devices to be enquired. According to estimations, on a 30-device chain (inverters/energy meters), datum is updated every 90 seconds.

## 7.4 PLANT EFFICIENCY

Place the mouse on "EFFICIENCY", a menu item appears (Fig. 92) where the type desired can be selected among the following available:

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

AC PRODUCTION	DC PRODUCTION	REAL TIME DATA	EFFICIENCY	AC ENERGY METER	SENSORS
			TOTAL		
			EOS-ARRAY ▶		
			INVERTER ▶		
			BOS		

Fig. 92 – Efficiency menu

Some charts could be unavailable if temperature and solar irradiation sensors, as well as main energy meter, are not configured in Eos-Box.

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

### ∞ Graphic display of value

Place the mouse above the chart line 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.

### ∞ *Data export from chart*

Right-click inside the chart area to open the drop-down menu displayed in Fig. 93.



Fig. 93 - Data export from chart

Left-click on “Copy data to clipboard”. Open any spreadsheet and paste data.

### ∞ *Print chart*

Right-click inside the chart area to open the drop-down menu displayed in Fig. 93. Left-click on "Print Chart"; select the printer and press "Print" key.

## 7.4.1 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 values from meter or inverters as selected on “*Energy production data display*” screen in “System data configuration” (Chap.3.4).

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. (Chap. 3.8)

From “EFFICIENCY” menu, click on “TOTAL” item; page in Fig. 94 appears. 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. 94 Total efficiency

On left-hand top side of the chart, a selection menu exists for graphic display mode.

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

The maximum efficiency value reached in the chart is specified on top right side.

*Note:* Interval between samples is 30 minutes.

## 7.4.2 EFFICIENCY OF EOS-ARRAY - 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. (Chap. 3.8)

*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; page shown in Fig. 95 appears. →

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. 95 String total efficiency

On left-hand top side of the chart, a selection menu exists for graphic display mode.

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

The maximum efficiency value reached in the chart is specified on top right side.

*Note:* Interval between samples is 30 minutes.

### 7.4.3 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. (Chap. 3.8)

*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 content shown in Fig. 96 appears. →

As soon as you access the page, the chart shows efficiency curves of all VMU-S string controls under VMU-M selected from menu A displayed in Fig. 96; curves can be identified by legend on the bottom. 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.

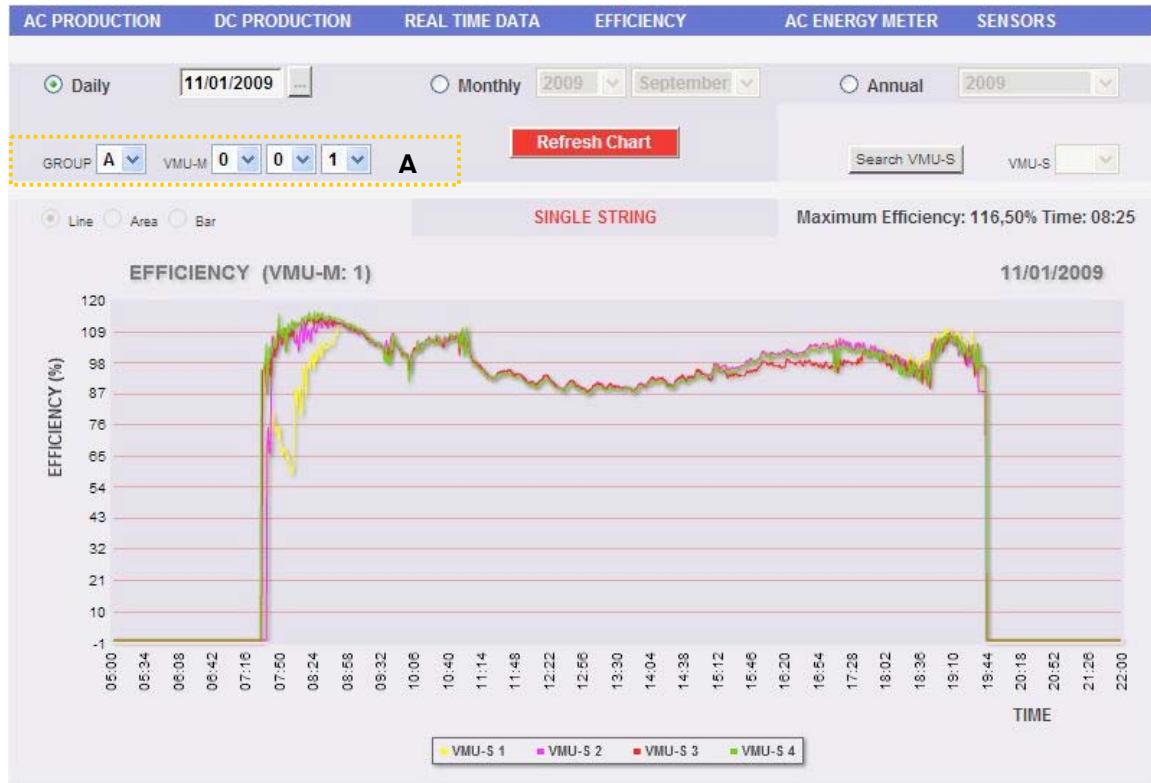


Fig. 96 - String total efficiency

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

### 1. VMU-M selection

Use proper menu in Fig. 96 - Area A to select the relevant VMU-M. VMU-M must be selected to identify all VMU-Ss under it, to be monitored and compared.

"GROUP" field represents Eos-Box communication port used to communicate with VMU-M: Group A = COM2, B=COM3, C=COM4.

"VMU-M address" indicates the RS-485 address assigned to VMU-M in programming phase. The address range is between 001 and 247.

*Note:* if the VMU-M selected does not exist in the system, the chart shows "No data to Display" writing on a white background.

### 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 select the day, use the relevant calendar accessible through the key on date field side)

- Monthly: it shows the maximum efficiency of VMU-S chosen for every day of the selected month. (To select month and year, use the relevant selection menus aside)
- Yearly: it shows the maximum efficiency of VMU-S chosen for every month of the selected year. (To select the year, use the relevant selection menu aside)

### 3. Searching for the VMU-S required

Press "Search VMU-S" key shown in Fig 97. → "Refresh chart" key disappears →, "Line, Area, Bar " selection menu is activated.



Fig. 97 – VMU-S search button

### 4. Select the graphic mode required among the available "Line, Area, Bar".

### 5. Selection of VMU-S required and graphic display

Open "VMU-S" drop-down menu shown in Fig. 97 to display the list of VMU-Ss under the VMU-M selected in point 1.

**Note:** If the "VMU-S" list has no items, it means there is no VMU-S under the selected VMU-M in point 1.

The list contains numbers matching VMU-S position in the chain of devices under VMU-M.

Select VMU-S required → Eos-Box processes the chart, viewed on the video after a few seconds.

**Note:** Chart is automatically displayed without using "Refresh chart" key. It is only used to generate charts with data coming from several VMU-S string controls.

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

## 7.4.4 INVERTER EFFICIENCY – ALL INVERTERS

Inverter efficiency is calculated like a ratio between AC power output from inverter and DC power input. **Measure values used for calculation are directly read by inverters.**

*Note:* If AC and DC power data is not provided for by inverter, efficiency calculation is not available.

From “INVERTER →EFFICIENCY” menu, click on "ALL INVERTERS" item; the content shown in Fig. 98 appears.

As soon as you access this page, the chart shows the inverter average efficiency chart 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. 98 - All inverters efficiency

On left-hand top side of the chart, a selection menu exists for graphic display mode.

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

The maximum efficiency value reached in the chart is specified on top right side.

*Note:* Interval between samples in "daily" view is 15 minutes.

## 7.4.5 INVERTER EFFICIENCY – SINGLE INVERTER

The section allows comparing the efficiency curves of more inverters by showing them in a single chart or individually. The comparison allows to immediately find any malfunction in DC/AC conversion. Inverter efficiency is calculated like a ratio between AC power output from inverter and DC power input. **Measure values used for calculation are directly read by inverters.**

*Note:* If AC and DC power data is not provided for by inverter, efficiency calculation is not available.

From “INVERTER →EFFICIENCY” menu, click on “SINGLE INVERTER” item; the content shown in Fig. 99 appears.

As soon as you access this page, the chart shows all inverter efficiency charts monitored by Eos-Box 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.

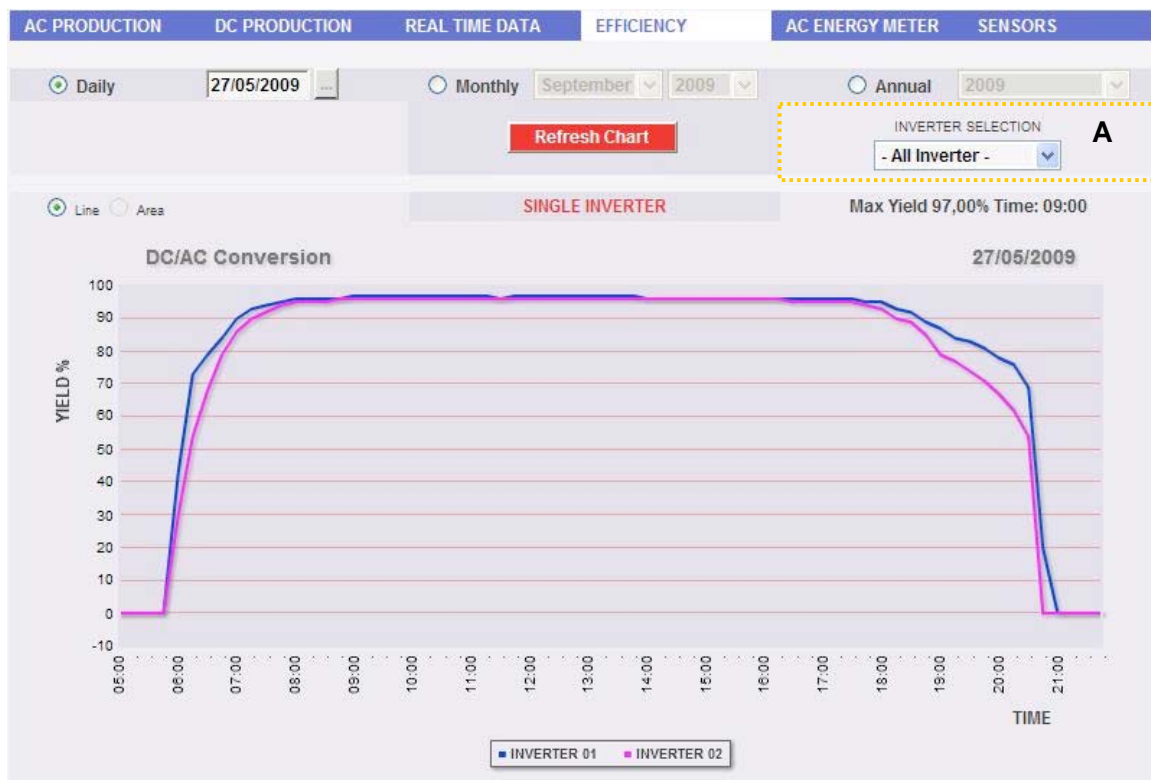


Fig. 99 - Single inverter efficiency

### ∞ Single inverter chart

Use menu in Fig. 99 - Area A to draw the efficiency chart of a single inverter. Open the drop-down menu to view the list of monitored inverters. Select the element desired and wait for chart update.

∞ All inverters chart

Select "ALL INVERTERS" from menu in Fig. 99. The chart simultaneously shows all efficiency curves of inverters. The reference to each curve can be identified by legend on chart bottom.

On left-hand top side of the chart, a selection menu exists for graphic display mode.

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

The maximum efficiency value reached in the chart is specified on top right side.

*Note:* Interval between samples in "daily" view is 15 minutes.

## 7.4.6 Bos EFFICIENCY

BOS (Balance of System) efficiency is calculated like a ratio between: total DC energy produced by photovoltaic field and measured by VMU-S string controls and AC energy measured by reference energy meter in the same time interval.

**BOS efficiency cannot be calculated without a reference energy meter.**

From "EFFICIENCY" menu, click on "BOS" item; the content shown in Fig. 100 appears.



Fig. 100 - 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.

On left-hand top side of the chart, a selection menu exists for graphic display mode.

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

The maximum efficiency value reached in the chart is specified on top right side.

*Note:* Interval between samples in "daily" view is 30 minutes.

## 7.5.1 MAIN METER

This section shows the trend of system energy production measured from the reference AC energy meter.

**The curve is only available if a reference energy meter exists.**

From “AC METER” menu, click on "MAIN" item; the content shown in Fig. 101 appears.

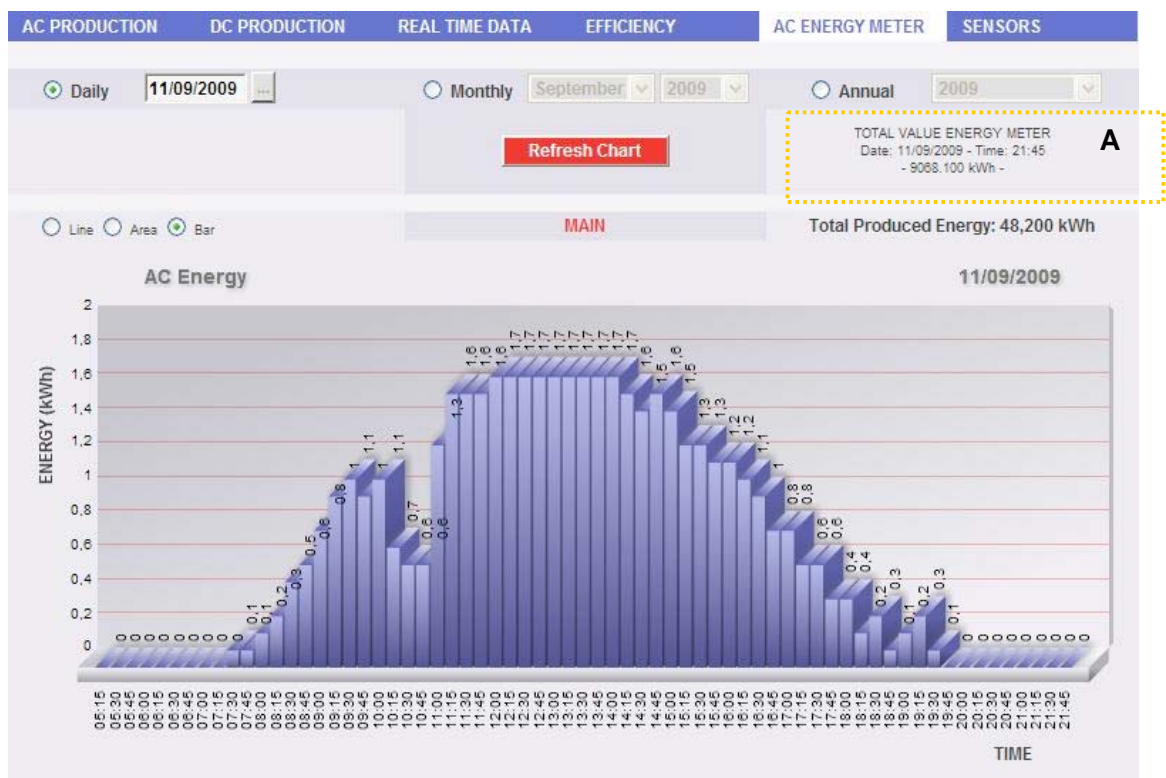


Fig. 101 - Trend of reference meter energy

As soon as you access this page, the chart shows the energy 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.

On left-hand top side of the chart, a selection menu exists for graphic display mode.

*Note:* it is recommended to use “Line” or “Area” display for daily data and Bar display for monthly and yearly data. On top of each bar, the sample value is specified in kWh.



On top right side, the total energy value is given as produced in the selected day/month/year.

*Note:* Interval between samples in "daily" view depends on storage time of datum set up on VMU-Ms and, anyway, is not lower than 15 minutes.

To know the total energy value measured by the meter in a day different from the current day, follow this procedure:

1. Select the date using the relevant calendar.
2. Click on "Refresh chart".
3. On top right side, the energy value given is measured at the end of the day by the meter, as shown in Fig. 101 Area A.

## 7.5.2 PARTIAL METERS

This section shows the trend of system energy production measured from the non-reference AC energy meters.

**The curve is only available if other NON-reference energy meters exist.**

From "AC METER" menu, click on "PARTIAL" item; the content shown in Fig. 102 appears.

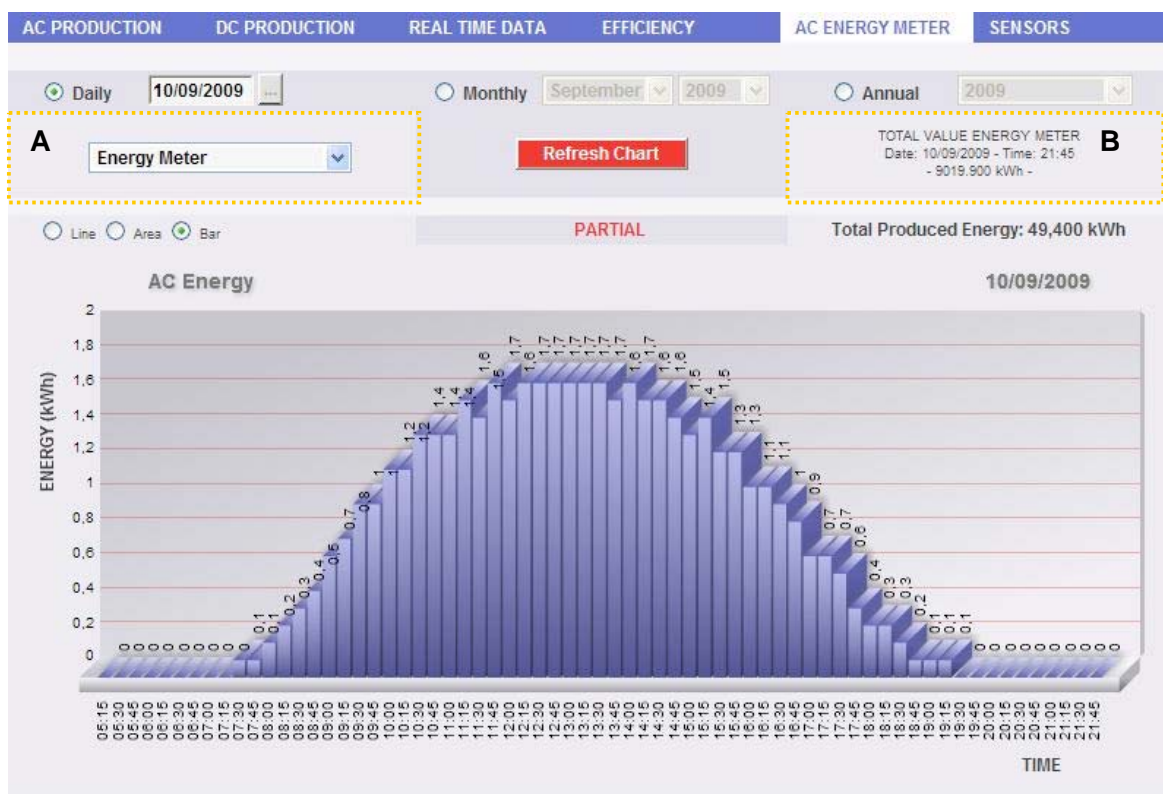


Fig. 102 - Trend of partial meter energy

As soon as you access this page, no chart appears. Select the relevant meter through menu show in Fig. 102 - Area A. After selecting, wait for a few seconds until the energy curve appears 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.

*Note:* it is recommended to use "Line" or "Area" display for daily data and Bar display for monthly and yearly data. On top of each bar, the sample value is specified in kWh.

On top right side, the total energy value is given as produced in the selected day/month/year.

*Note:* Interval between samples in "daily" view is 15 minutes.

To know the total energy value measured by the meter in a day different from the current day, follow this procedure:

4. Select the date using the relevant calendar.
5. Click on "Refresh chart".
6. On top right side, the energy value given is measured at the end of the day by the meter, as shown in Fig. 102 Area B.

## 7.6 ENVIRONMENTAL SENSORS

Place the mouse on "SENSORS", a menu item appears (Fig. 103) where the sensor desired can be selected among the following available:

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



Fig. 103 - Environmental sensors

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

∞ *Graphic display of value*

Place the mouse above the chart line 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.

∞ *Data export from chart*

Right-click inside the chart area to open the drop-down menu displayed in Fig. 104.



Fig. 104 - Data export from chart

Left-click on "Copy data to clipboard". Open any spreadsheet and paste data.

### ∞ Print chart

Right-click inside the chart area to open the drop-down menu displayed in Fig. 104. Left-click on "Print Chart"; select the printer and press "Print" key.

## 7.6.1 SOLAR IRRADIATION SENSORS

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

From "SENSORS" menu, click on "SOLAR IRRADIATION" item; the content shown in Fig. 105 appears.



Fig. 105 - Trend of solar irradiation

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.

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

On top right side, the maximum value reached in the selected day/month/year appears.

*Note:* Interval between samples in "daily" view depends on storage time of datum set up on VMU-Ms.

If more solar irradiation sensors exist on the system, use the selection menu shown in Fig. 105 - Area A.

## 7.6.2 TEMPERATURE SENSORS

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

From “SENSORS” menu, click on "TEMPERATURE" item; the content shown in Fig. 106 appears.



Fig. 106 - 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.

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

On top right side, the maximum value reached in the selected day/month/year appears.

*Note:* Interval between samples in "daily" view depends on storage time of datum set up on VMU-MS.

If more temperature sensors exist on the system, use the selection menu shown in Fig. 106 - Area A.

### 7.6.3 WIND SPEED SENSORS

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

From “SENSORS” menu, click on "WIND SPEED" item; the content shown in Fig. 107 appears.

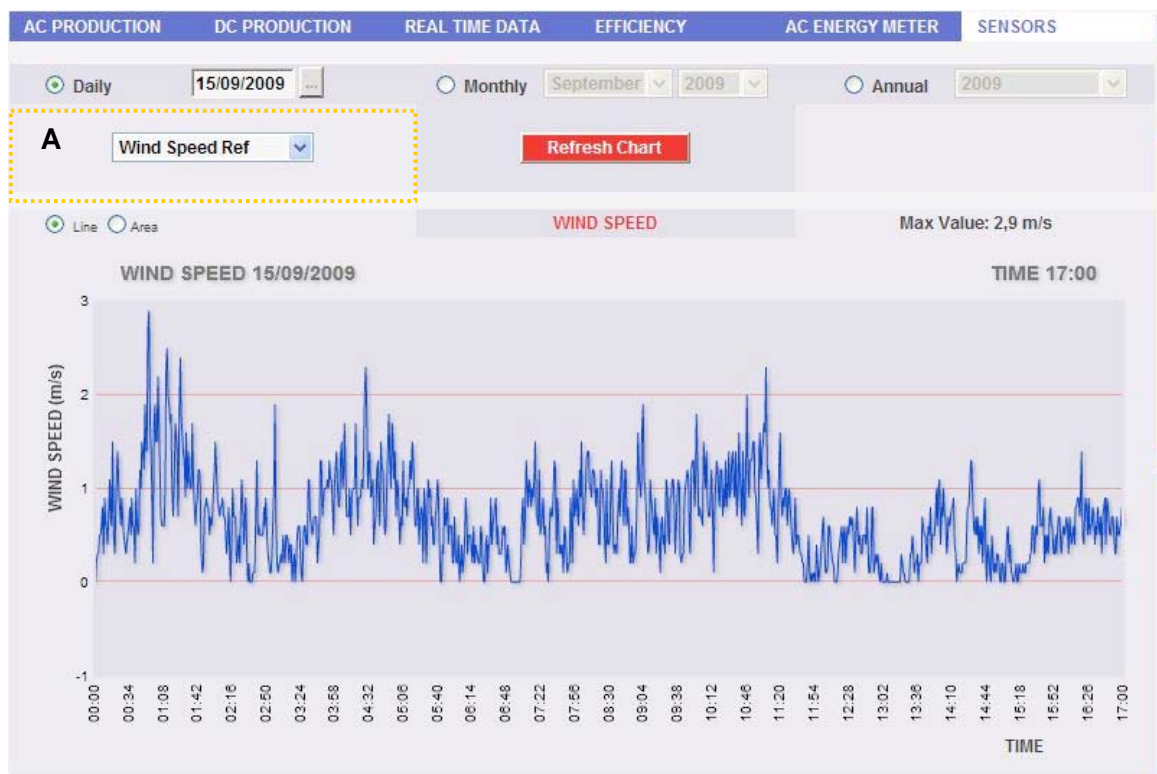


Fig. 107 - Trend of wind speed

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.

On left-hand top side of the chart, a selection menu exists for graphic display mode.

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

On top right side, the maximum value reached in the selected day/month/year appears.

*Note:* Interval between samples in "daily" view depends on storage time of datum set up on VMU-Ms.

If more wind speed sensors exist on the system, use the selection menu shown in Fig. 107 - Area A.



## 8. ALARMS

This section is dedicated to alarm management and display occurred on a system. Click on "Alarm" icon in the Navigation menu for access to the content of Fig. 107 (hatched area).

Device Type	Label	Alarm Type	Start Date	Start Time	End Date	End Time	Address	Group (VMU-M)	Position	Channel	Hide
INVERTER	inverterSMG150IT	No Energy Production	17/09/2009	09:00:10			2				<input type="checkbox"/>
INVERTER	inverterSMG150IT	No Energy Production	17/09/2009	09:00:10			1				<input type="checkbox"/>
VMU-M	String 3	Solar string is not Connected	17/09/2009	06:57:29	17/09/2009	06:57:38	1	A	3		<input type="checkbox"/>
VMU-M	String 1	Solar string is not Connected	16/09/2009	22:11:54	17/09/2009	06:42:08	1	A	1		<input type="checkbox"/>
VMU-M	String 4	Solar string is not Connected	15/09/2009	20:07:34	16/09/2009	06:40:29	1	A	4		<input type="checkbox"/>
VMU-M	String 1	Solar string is not Connected	15/09/2009	20:07:30	17/09/2009	06:42:08	1	A	1		<input type="checkbox"/>
VMU-M	String 3	Solar string is not Connected	15/09/2009	20:07:17	17/09/2009	06:57:38	1	A	3		<input type="checkbox"/>
INVERTER	inverterSMG150IT	No Energy Production	15/09/2009	16:00:10			2				<input type="checkbox"/>
INVERTER	inverterSMG150IT	No Energy Production	15/09/2009	16:00:05			1				<input type="checkbox"/>
VMU-M	String 1	Solar string is not Connected	14/09/2009	20:15:40	17/09/2009	06:42:08	1	A	1		<input type="checkbox"/>
VMU-M	String 3	Solar string is not Connected	14/09/2009	20:15:30	17/09/2009	06:57:38	1	A	3		<input type="checkbox"/>
VMU-M	String 4	Solar string is not Connected	14/09/2009	20:15:27	16/09/2009	06:40:29	1	A	4		<input type="checkbox"/>
VMU-M	String 3	Solar string is not Connected	14/09/2009	19:59:24	17/09/2009	06:57:38	1	A	3		<input type="checkbox"/>
INVERTER	inverterSMG150IT	No Energy Production	14/09/2009	11:30:10			2				<input type="checkbox"/>
INVERTER	inverterSMG150IT	No Energy Production	14/09/2009	11:30:07			1				<input type="checkbox"/>
VMU-M	String 2	Solar string is not Connected	14/09/2009	03:06:23	14/09/2009	06:39:22	1	A	2		<input type="checkbox"/>
VMU-M	String 1	Solar string is not Connected	14/09/2009	03:06:22	17/09/2009	06:42:08	1	A	1		<input type="checkbox"/>
VMU-M	String 1	Solar string is not Connected	14/09/2009	02:48:37	17/09/2009	06:42:08	1	A	1		<input type="checkbox"/>

Fig. 107 - Plant alarms

This table shows the list of alarms stored in Eos-Box 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.



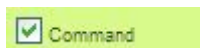
All problems provoking lack of energy production to the system or indicating a serious malfunction on devices monitored are classified like "Alarms".



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 abnormality warned is to be interpreted by the user.



All status changes in digital inputs and outputs on Eos-Array are classified like "Event".



All parameter changing operations performed inside Eos-Array through Eos-Array Soft are classified like "Command".

**Note: Eos-Box uses solar irradiation sensor to decide whether or not the system must produce energy, according to outside light conditions. No production alarm is warned and sent after no production status has lasted for more than 15 minutes. The solar irradiation threshold established, below which no signal is provided for and no no-energy-production alarm is sent, accounts for 100 W/m<sup>2</sup>. If a solar irradiation sensor is not available, warning and sending for no-energy-production alarm are active inside the timeband between 10:00 a.m. to 03:00 p.m.**

∞ Filter application on alarm table view

Use menu in Fig. 107 - Area A to only view specific alarm categories. Select categories required by checking the relevant case aside.

∞ Navigation buttons

Table bottom shows navigation buttons shown in Fig. 108.



Fig. 108 – Navigation buttons in table

Click two keys on end 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. “*Device type*”: Device which generated alarm: VMU-M, VMU-S, INVERTER etc. If device type is Eos-Array, click on it to view the relevant chart on the day when alarm occurred.
2. “*Label*”: Name/Label assigned to device in configuration phase.
3. “*Alarm type*”: Alarm description.
4. “*Start date*”: Date when alarm occurred.
5. “*Start time*”: Time when alarm occurred.
6. “*End date*”: Date when alarm finished. If alarm still exists, the field is blank.
7. “*End time*”: Time when alarm finished. If alarm still exists, the field is blank.
8. “*Address*”: Device address (if available).
9. “*Group (VMU-M)*”: Group the device belongs to. (Existing value, for Eos-Array only).
10. “*Position*”: Position of alarm device in Eos-Array chain. (Existing value, for Eos-Array only).
11. “*Channel*”: Channel of alarm device in Eos-Array chain. (Existing value, for Eos-Array only).



12. "Channel": Channel of alarm-generating device. (Existing value, for Eos-Array only).
13. "Hide": This key allows hiding the relevant alarm view. (.)

*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".  
Attention, this function is available for "Administrator" log-in only.

## 9. 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 for access to the content of Fig. 109 (hatched area).

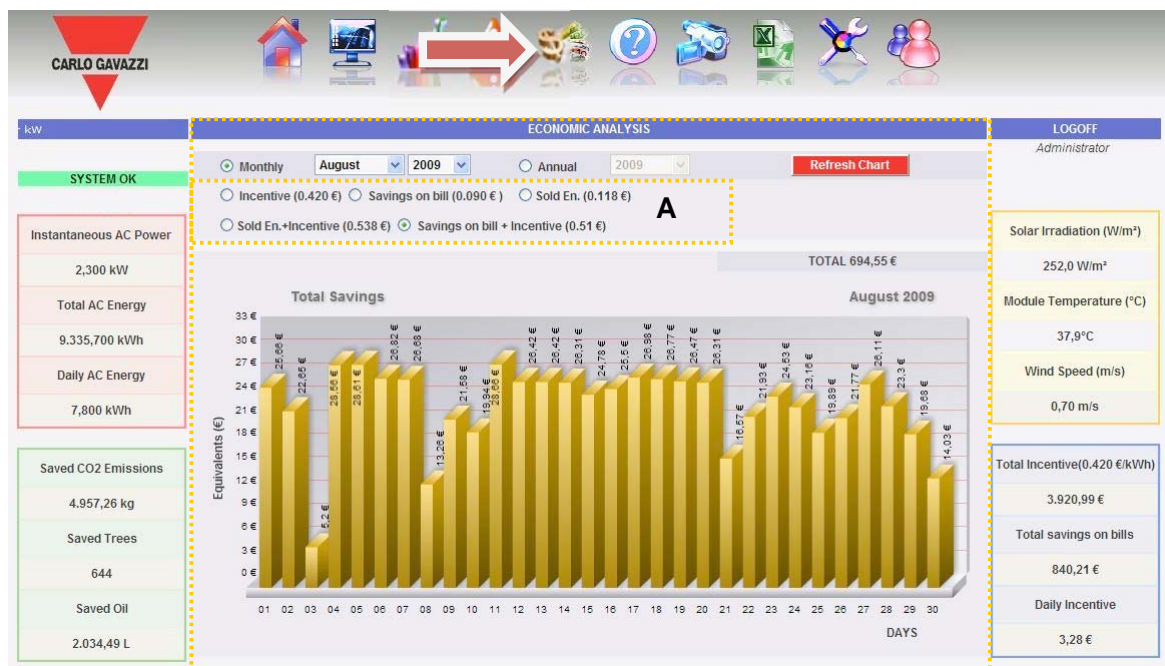


Fig. 109 - Economic analysis

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. Selections available shown in Fig. 109-Area A depend on the scheme set up in configuration phase in "Economic data" section (See Chap. 3.4).

If the scheme set up is "Self-consumption" type, we have:

1. "Incentive (...€)": Click 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 (Chap 3.4) 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 being the addition of incentive and Savings on bill described in paragraphs 1 and 2.

If the scheme set up is "Sales" type, we have the same selection buttons as self-consumption scheme, together with the following:

4. "Sold En. (...€)": 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.
5. "AMOUNT corresponding to each kWh sold": Click to automatically view the chart with economic countervalues being the addition of incentive and energy sold described in paragraphs 1 and 4.

On top right side, 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. This datum can come from inverters or external reference energy meter. Value origin is selected as set up in "Energy production data display" section in "System data configuration", Chap.3.4.



# 10. PLANT CHARACTERISTICS

This section shows data and characteristics of monitored photovoltaic system. Click on "Information" icon in the Navigation menu for access to the content of Fig. 110.

The screenshot displays the 'PLANT CHARACTERISTICS' page for a photovoltaic system. The interface includes a navigation bar at the top with the 'CARLO GAVAZZI' logo and several icons. The main content area is divided into several sections:

- SYSTEM OK**: A green status indicator.
- Instantaneous AC Power**: 0,000 kW
- Total AC Energy**: 0,000 kWh
- Daily AC Energy**: 0,000 kWh
- Saved CO2 Emissions**: 0,00 kg
- Saved Trees**: 0
- Saved Oil**: 0,00 L
- Description**:
 

Description	
Plant Name	Carlo Gavazzi
Plant Location	Lainate (MI)
Property Plant	Carlo Gavazzi S.P.A.
Corporate Installing	Carlo Gavazzi Controls
PV Modules Data Installation	01/01/2009 dd/mm/yyyy
Eos-Box Installation Date	22/04/2009 dd/mm/yyyy
- Technical Data**:
 

Technical Data	
Plant Type	FIXED
Total area of PV modules	80 mq
Number of Inverters	3
Number of Strings	4
Peak power of Plant	8.240 kW
- Financial Highlights**:
 

Financial Highlights	
THE ENERGY SYSTEM:	OWN
INCENTIVE paid every kWh	0.420 €
Price per kWh Purchased Energy	0.090 €
% En. estimated sold (partial transfer)	100.000 %
Amount paid each kWh Sold	0.000 €
- Viewing Data for Energy Production**:
 

DATA COMING FROM EXTERNAL ENERGY METER
- Solar Irradiation (W/m²)**: No Data
- Module Temperature (°C)**: N.D.
- Wind Speed (m/s)**: N.D.
- Total Incentive (0.420 €/kWh)**: 0,00 €
- Total savings on bills**: 0,00 €
- Daily Incentive**: 0,00 €

Fig. 110 - Plant characteristics

This page consists of three 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. In "Viewing data for energy production": The device type global production data is acquired from is specified here.



# 11. VIEWING IP CAM

This section shows video flows from IP Cam, Videosever or DVR (Digital Video Recording) configured on Eos-Box (see Chap. 3.10). Click on "IP Cam" icon in the Navigation menu for access to the content of Fig. 111.

The screenshot shows the Eos-Box interface. At the top, there is a navigation bar with icons for home, monitor, charts, warning, arrows, camera, checkmark, wrench, and people. Below this, the main content area is divided into several sections. On the left, there is a 'SYSTEM OK' status indicator and a table of energy and emissions data. On the right, there is a 'LOGOFF' section and a table of environmental and financial data. In the center, there is a dropdown menu labeled 'A' with the text 'Select View from IP Cam' and 'Select IP Cam'.

Instantaneous AC Power
0,000 kW
Total AC Energy
0,000 kWh
Daily AC Energy
0,000 kWh

Solar Irradiation (W/m <sup>2</sup> )
No Data
Module Temperature (°C)
N.D.
Wind Speed (m/s)
N.D.

Total Incentive(0.420 €/kWh)
0,00 €
Total savings on bills
0,00 €
Daily Incentive
0,00 €

Fig. 111 – IP Cam selection

Use menu in Fig. 111 - Area A to view the source required. This menu lists all IP Cams controlled. Select the element desired to have the single video (Fig. 112).

The screenshot shows the Eos-Box interface with a video feed selected. The main content area now displays a live video feed of a solar panel array on a roof. The dropdown menu 'A' now shows 'Camera 1' selected. The data panels on the left and right remain the same as in Fig. 111.

Instantaneous AC Power
0,000 kW
Total AC Energy
0,000 kWh
Daily AC Energy
0,000 kWh

Solar Irradiation (W/m <sup>2</sup> )
No Data
Module Temperature (°C)
N.D.
Wind Speed (m/s)
N.D.

Total Incentive(0.420 €/kWh)
0,00 €
Total savings on bills
0,00 €
Daily Incentive
0,00 €

Fig. 112 - Viewing IP Cam single video

Click on “Mosaic” to view the grid of first four IP Cams connected. (Fig 113)

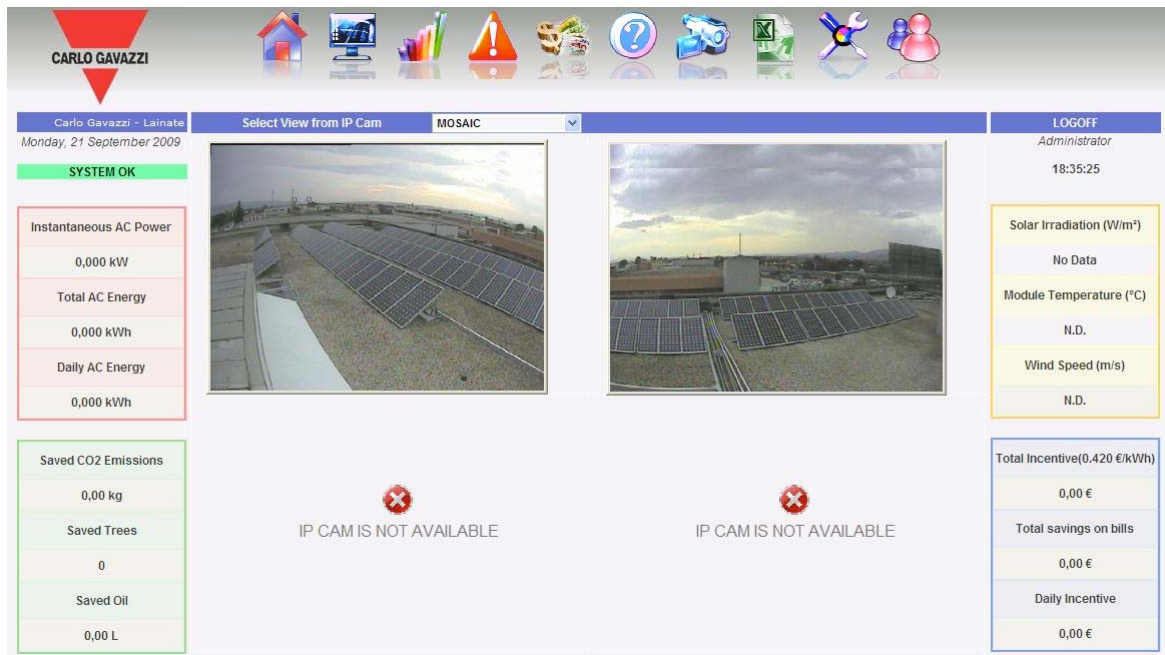


Fig. 112 – Viewing Mosaic mode

**Note:** It is recommended to install video management devices on IP (IP Cam, Videoserver DVR) providing for video flows cleaned from any side frame or management menu to directly obtain the video, exclusively, through the relevant IP address.



## 12. EXPORT DATA

This section allows exporting data stored in Eos-Box xls format.

Click on "Export" icon in the Navigation menu for access to the content of Fig. 113.

Fig. 113 - Exporting stored data

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

The following data can be exported:

1. "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"
2. "Eos-Array": This selection allows exporting electric values acquired by string control(s) of one or all VMU-Ss under the VMU-M selected through menu shown in Fig. 114.



Fig. 114 - Eos-Array export

∞ Data export for all VMU-S string controls under a specific VMU-M

xls file generated contains values of all VMU-S under VMU-M selected, 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). Set up the group they belong to and the VMU-M address required through the selection menu (A) shown in Fig. 114.

"VMU-M address" indicates the RS-485 address assigned to VMU-M in programming phase. The address range is between 001 and 247. Do not press "Search VMU-S" key. Click on "Export data". xls file is generated containing data of the selected day (Fig. 115).

A	B	C	D	E	F	G	H	I	J
Time	Time	Power VMU-S 1 (kW)	Power VMU-S 2 (kW)	Energy VMU-S 1 (kWh)	Energy VMU-S 2 (kWh)	Voltage VMU-S 1 (V)	Voltage VMU-S 2 (V)	Current VMU-S 1 (A)	Current VMU-S 2 (A)
152	2208020000	7.23	0.03	200.0	200.0	237.9	244.1	0.10	0.10
154	2208020000	7.24	0.03	200.0	200.0	238.7	224.8	0.10	0.10
156	2208020000	7.20	0.03	200.0	200.0	237.1	233.8	0.10	0.10
158	2208020000	7.26	0.03	200.0	200.0	238.5	242.6	0.10	0.10
159	2208020000	7.27	0.04	200.0	200.0	237.5	277.6	0.10	0.10
160	2208020000	7.28	0.04	200.0	200.0	273.4	269.8	0.10	0.10
161	2208020000	7.29	0.04	200.0	200.0	270.6	239.8	0.10	0.10
162	2208020000	7.26	0.04	200.0	200.0	237.4	248.0	0.2	0.10
163	2208020000	7.21	0.05	200.0	200.0	236.1	257.4	0.10	0.2
164	2208020000	7.22	0.05	200.0	200.0	237.1	271.1	0.22	0.2
165	2208020000	7.23	0.05	200.0	200.0	237.4	255.2	0.2	0.22
166	2208020000	7.24	0.05	200.0	200.0	236.3	263.3	0.23	0.21
167	2208020000	7.25	0.05	200.0	200.0	236.0	266.4	0.22	0.23
168	2208020000	7.26	0.05	200.0	200.0	237.1	249.4	0.23	0.22
169	2208020000	7.27	0.05	200.0	200.0	236.0	251.5	0.25	0.25
170	2208020000	7.28	0.05	200.0	200.0	235.0	244.8	0.24	0.24
171	2208020000	7.28	0.05	200.0	200.0	237.0	233.3	0.25	0.24
172	2208020000	7.29	0.05	200.0	200.0	237.9	238.7	0.25	0.25
173	2208020000	7.31	0.07	200.0	200.0	237.8	237.8	0.25	0.25
174	2208020000	7.32	0.07	200.0	200.0	237.9	235.4	0.27	0.26
175	2208020000	7.33	0.07	200.0	200.0	237.4	237.6	0.28	0.28
176	2208020000	7.34	0.07	200.0	200.0	235.0	235.9	0.28	0.28
177	2208020000	7.35	0.07	200.0	200.0	236.4	238.8	0.2	0.29
178	2208020000	7.36	0.08	200.0	200.0	234.0	237.1	0.2	0.31
179	2208020000	7.37	0.08	200.0	200.0	235.0	238.0	0.28	0.3
180	2208020000	7.38	0.08	200.0	200.0	235.0	239.0	0.27	0.31
181	2208020000	7.39	0.08	200.0	200.0	234.2	234.2	0.29	0.32
182	2208020000	7.40	0.09	200.0	200.0	234.2	237.9	0.29	0.32
183	2208020000	7.41	0.1	200.0	200.0	237.7	233.8	0.27	0.32
184	2208020000	7.42	0.1	200.0	200.0	237.7	235.0	0.26	0.32
185	2208020000	7.43	0.1	200.0	200.0	236.2	235.0	0.26	0.32
186	2208020000	7.44	0.1	200.0	200.0	235.1	233.0	0.28	0.29
187	2208020000	7.45	0.1	200.0	200.0	235.0	237.0	0.29	0.28
188	2208020000	7.46	0.1	200.0	200.0	236.7	239.0	0.29	0.28
189	2208020000	7.47	0.1	200.0	200.0	234.0	235.7	0.27	0.27

Fig. 115 - Table of Eos-Array export data

∞ Data export for a VMU-S string control under a specific VMU-M

xls file generated contains electric values of VMU-S selected as follows: the first two columns show date and time, followed by Power (kW), Energy (kWh), Voltage (V) and Current (A).

Set up the group they belong to and the VMU-M address required through the selection menu (A) shown in Fig. 114.

Press “Search VMU-S” key; the list aside shows all VMU-Ss under VMU-M selected. If the list is empty, the selected VMU-M is not available or there are no VMU-Ss under it.

Set up the element desired and click on "Export data". xls file is generated containing data of the selected day. The saved file name will be of the following type: “VMUM1\_VMUS2\_dd\_mm\_yyyy.xls”

3. “Temperature”: The selection allows exporting temperature values of all sensors configured like active (“Enable”) in Eos-Box. xls file generated will show date and time in the first two columns, followed by so many columns as the temperature sensors with the relevant values °C inside.
4. “Solar irradiation”: The selection allows exporting solar irradiation values of all sensors configured in Eos-Box. xls file generated will show date and time in the first two columns, followed by so many columns as the solar irradiation sensors with the relevant values in W/m<sup>2</sup> inside.
5. “Wind speed”: The selection allows exporting wind speed values of all sensors configured in Eos-Box. xls file generated will show date and time in the first two

columns, followed by so many columns as the wind speed sensors with the relevant values m/s inside.

6. "*Inverters*": The selection allows exporting electric values acquired by inverters monitored by Eos-Box. xls file generated contains values divided by type of electric dimension. The first two columns show date and time, followed by groups of "n" columns (equivalent to the number of inverters) containing:  
AC Energy (kWh), AC Power (kW), AC Voltage (V), AC Current (A), DC Energy (kWh), DC Power (kW), DC Voltage (V), DC Current (A), Inverter performance (%).
7. "*Meters*": The selection allows exporting progressive energy values counted by all meters configured in Eos-Box. xls file generated will show date and time in the first two columns, followed by so many columns as the monitored meters, with the relevant values kWh inside.

Note: when exporting data from devices non configured in Eos-Box, xls file is generated in any case, with the following saying in the first case: "Device not available".