

Operating manual

ZIGOR

# SATURNO 60A



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## Index

<b>1</b>	<b>PRECAUTIONS</b> .....	<b>1</b>
1.1	General precautions .....	1
1.2	Environmental precautions .....	3
1.3	Precautions during the transport of the material .....	3
1.4	Precautions on receiving the unit .....	3
1.5	Storage precautions .....	4
<b>2</b>	<b>GENERAL DESCRIPTION</b> .....	<b>5</b>
2.1	Introduction .....	5
2.1.1	<i>General Features</i> .....	5
2.2	What is MPPT (Maximum Power Point Tracking)? .....	6
2.3	Physical description of the regulator .....	6
2.3.1	<i>Power connections</i> .....	7
2.3.2	<i>Control connections</i> .....	7
2.3.3	<i>Control panel</i> .....	8
<b>3</b>	<b>USER INTERFACE DESCRIPTION</b> .....	<b>9</b>
3.1	Control panel .....	9
3.2	Main Screen .....	9
3.3	Battery configuration mode .....	10
3.4	LCD configuration screen .....	11
3.5	Auxiliary output configuration screen .....	11
3.6	MPPT configuration screen .....	12
<b>4</b>	<b>START-UP AND OPERATION</b> .....	<b>13</b>
4.1	Description of operation .....	13
4.2	Protection against deep discharges .....	13
4.3	Protection against overload .....	13
4.4	Temperature compensation .....	13
<b>5</b>	<b>COMMUNICATIONS</b> .....	<b>14</b>
<b>6</b>	<b>TECHNICAL FEATURES</b> .....	<b>15</b>
<b>7</b>	<b>STANDARD</b> .....	<b>16</b>
<b>8</b>	<b>WARRANTY</b> .....	<b>17</b>

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*The contents of this manual are exact at the time it was printed. However, with the intention of complying with our aim of continuous development and improvement, the manufacturer reserves the right to modify product specifications, its operation or the contents of the Operation Manual without prior warning.*



# 1 PRECAUTIONS

## 1.1 General precautions

**For your own safety and that of the unit, you must read and understand the instructions contained in this document before starting work.**

**Keep these instructions in a place accessible to all the personnel who work with the unit so that these can be consulted.**

**Only expert and duly authorised personnel may operate our units.**



**Danger warnings.** When handling the system, current conducting parts may be live. Be especially aware of terminals, relay contacts, etc. Before handling the system, disconnect all poles (both alternating and direct) from mains and wait at least five minutes for the internal condensers to discharge.

**Arbitrary modifications are forbidden.** The unit must not be subjected to any modification regarding its construction or safety without ZIGOR's express consent. Any modification shall free ZIGOR of any responsibility for any damage caused as a result of the modification. In particular, all repair work, soldering of printed circuit boards and replacing of components, modules and printed circuit boards, without the express authorisation of ZIGOR, is forbidden. Should spare parts be used, only ZIGOR original parts shall be utilised.

ZIGOR shall not accept any responsibility for any inadequate, negligent or incorrect installation of the equipment.

Use the unit for the purpose for which it was designed. The system supplied must be used only for the purpose for which it was designed. Any other use is strictly forbidden. ZIGOR cannot accept responsibility for any damage that might result from its use for any other purpose. In such cases, the user shall assume exclusive responsibility for any risk. The use for which the unit was designed is defined in the documentation. The system shall be exposed only to admissible environmental conditions. These are defined in the technical details provided for the equipment.



WARNING

This supply equipment contains a lethal voltage. Comply with the instructions set out in this manual to avoid any risk of electrical shock.

**Please follow the indications set out below to operate under conditions of complete safety:**

- The System must be checked once the installation has been completed by a qualified technician and before being put into operation. Should these indications not be adhered to, the warranty shall be considered null and void.
- Do not power up the device before a technician has checked it.
- The unit does not contain any user repairable parts. In the case of any malfunction or problems operating the unit, please contact ZIGOR.
- Do not place the SATURNO 60 near power magnets as this might cause a malfunction.
- Do not block or cover the ventilation grills in the SATURNO 60 regulator housing.
- Should you have any problems with the contents of this manual, you must ask ZIGOR for assistance.
- The SATURNO 60 regulator is designed in accordance with current Spanish legislation. Compare these standards with the corresponding standards in the country where the unit is to be installed.
- The SATURNO 60 regulator operates completely autonomously.
- Before touching any live parts, you must check that the unit is not powered up.

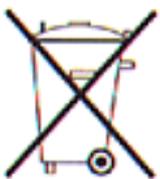
- This system has been designed for industrial use and/or for domestic-commercial use.
- If any liquid is spilt accidentally on any component of the SATURNO 60 regulator, disconnect this and consult ZIGOR personnel.
- During assembly work, start-up or maintenance, wear goggles to avoid any damage to your eyes due to accidental electric arcing. Pay special attention to the battery and panels connections.

**Environmental indications** *A number of system subassemblies may be recyclable products. In order to protect the environment, manage these in accordance with current environmental regulations and requirements in force in each country or community. If you are in any doubt please consult the manufacturer.*

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**The contents of this manual.** *The contents of this manual were accurate at the time of printing. However, in order to comply with our policy of continuous improvement and development, we reserve the right to change the specifications or operation of the product or the contents of the operation manual without warning.*

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*The drawing of a crossed out wheeled container on the product or in the documentation or packaging means that the electrical-electronic components and batteries must be disposed of separately at the end of their service life. This requirement is applied in the European Union and in those locations where individual disposal systems are available. Do not dispose of these components in the form of unsorted municipal waste*

## 1.2 Environmental precautions

*ZIGOR, in accordance with the exceptions detailed in the First Additional Provision of Law 11/1997 on commercial or industrial containers, declares that the end user, being responsible for container waste and used containers, must deliver these in appropriate condition for reuse to an authorised recovery or recycling entity or valuer.*

## 1.3 Precautions during the transport of the material

ZIGOR's SATURNO 60 regulators must be handled carefully, otherwise damage may be caused incurring a loss of the warranty. SATURNO 60 regulators must not be subjected to knocks or blows. All ZIGOR's SATURNO 60 systems shall be subject to this standard.

SATURNO 60 regulators contain internal components which are very sensitive to impacts.

**Inadequate handling of the equipment may cause damage not covered by the warranty.**

## 1.4 Precautions on receiving the unit

Make a visual check that the storage location is appropriate. Check the characteristics of the location (clean, without drips and well-ventilated).

### Checking the material

On receiving the material, a visual inspection should be made in order to detect any anomalies that may have occurred during transport.

List and check all the items indicated on the delivery note. Should any component be missing, notify the forwarding agent within the established deadline.

Extract all parts from the packaging and examine the unit for any damage caused during transport.

Report any damage to the forwarding agent and ZIGOR.

Check that the material delivered corresponds to the delivery note. This is done by checking the manufacturer's label placed at the rear or on one side of the unit.

Responsibility for the loss or damage of Products shall transfer to the Customer from the moment ZIGOR places these at his disposal in the place indicated by the Customer.

**AS OF THIS MOMENT, THE CUSTOMER WILL HAVE 24 HOURS TO MAKE ANY CLAIM UNDER GUARANTEE FOR ANY ANOMALY IN THE AMOUNT OR QUALITY OF THE PRODUCTS RECEIVED, PROVIDING DETAILS OF THE MATERIAL RECEIVED IN BAD CONDITION AFTER REPORTING THIS CIRCUMSTANCE ON THE FORWARDING AGENT'S DELIVERY NOTE ON RECEPTION.**

**SHOULD THE CUSTOMER NOT REPORT ANY DEFECT WITHIN 24 HOURS, IT WILL BE UNDERSTOOD THAT HE HAS ACCEPTED DELIVERY OF THE UNIT.**

## 1.5 Storage precautions

*The store where the material is kept must protect the material from the elements, risk of flooding or contact with water.*

*The material shall be protected from any risk of overheating due to exposure to direct sunlight or through windows.*

*The recommended storage temperature is from 15°C to 25°C. The recommended relative humidity is from 30% to 90%.*

*Do not stack the packages to avoid the risk of mechanical shock. These will be placed in accordance with the silkscreen printed details on the boxes used for packaging.*

*When installed for periods of more than three months, maintenance work must be carried out on the batteries in order to ensure their perfect condition. Should this maintenance work not be done, the warranty shall be rendered null and void. If in doubt, please contact ZIGOR Corporación.*



**ANY FAILURE TO RESPECT THESE PRECAUTIONS MAY RENDER THE  
PRODUCT WARRANTY NULL AND VOID**

## 2 GENERAL DESCRIPTION

### 2.1 Introduction

You have just purchased a SATURNO 60 regulator, an MPPT Load Solar Regulator unit.

You have purchased one of the most powerful, compact and reliable units of its type. Please read the operating instructions carefully before using the unit.

#### 2.1.1 General Features

The most important functional characteristics of the SATURNO 60 regulator are as follows:

- **MPPT** load algorithm (maximum power point tracking).
- Automatic voltage recognition system for battery (36V / 48V).
- Wide range of solar voltage input from 65V to 140V.
- 4-line LCD display.
- Deep discharge protection by auxiliary connection.
- Protection against overload and overvoltage.
- Correction of temperature-dependent load parameters (temperature probe).
- Protection against excess temperature and overcurrent; totally electronic protection against inverse polarity of PV system.
- Detection of connected battery.
- DC load disconnection auxiliary output.
- Optional: Possibility of saving the record on an SD memory card.
- Optional: Remote control with screen.
- Optional: Communications RS232/RS485



*Fig. 2-1 General view*

## 2.2 What is MPPT (Maximum Power Point Tracking)?

MPPT is an algorithm that optimises the power from the PV panel under different environmental conditions. Its full potential becomes clear if we compare it with traditional systems.

The easiest explanation is to give an example.

The power of PV panels is the result of multiplying the voltage on the panel terminals and the current it generates under specific conditions. Starting, for example, with an 85Wp and 17V panel under maximum power, if we connect this panel to a 12 V battery, we force the panel to work at a less than the optimum rate. The following figure shows that the current value has not increased at the same rate as the voltage has gone down. Therefore, when calculating the power value at this time, a value much lower than the panel's nominal value is obtained.

$$12V \times 4.9A = 58.8W$$

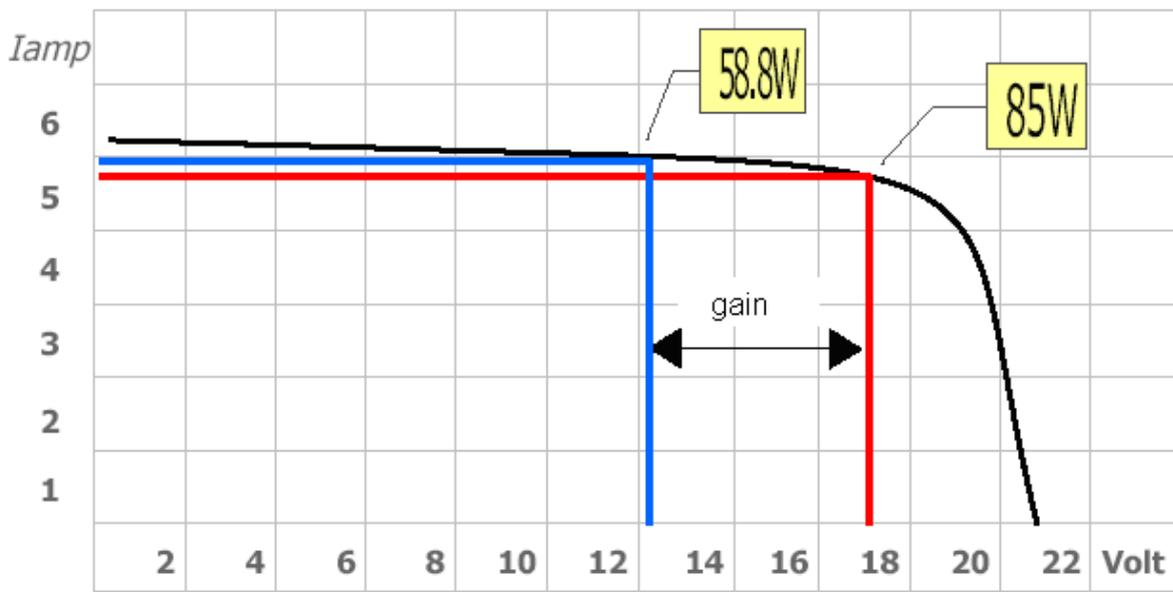


Fig. 2-2 V-I curve

MPPT regulators (Maximum Power Point Tracker) eliminate the direct connection between the PV panel and battery, allowing the panel to work at the maximum power point, whatever the weather conditions (radiation, temperature, etc.). The maximum gain with this type of regulator can be obtained on cloudy days, which is precisely when it is most difficult to capture the rays of the sun and, normally, more energy is required.

MPPT regulators carry out energy converting functions, achieving energy gains of around 30 ~ 35% compared to traditional systems, especially on rainy and cloudy days.

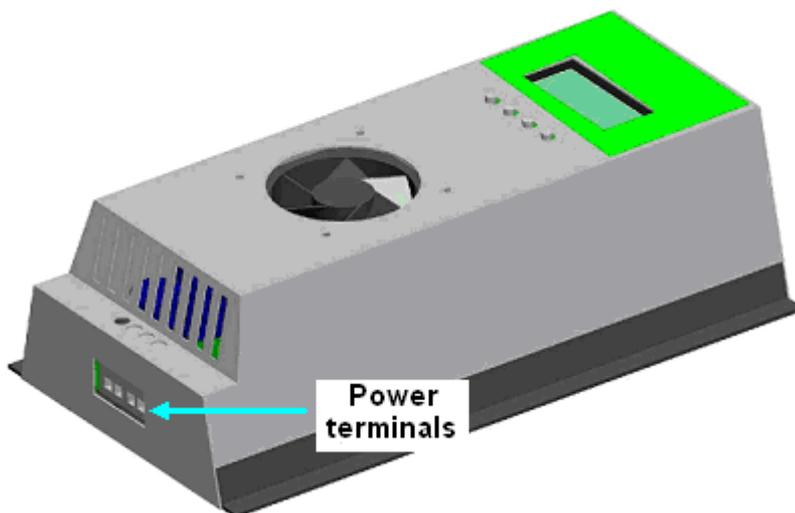
## 2.3 Physical description of the regulator

The SATURNO 60 regulator is a system designed with the following characteristics:

- Wall mounted, with four anchoring bolts.
- Natural refrigeration in radiator and electronics.
- Forced refrigeration in electronics.
- Power connections at the bottom of the unit.
  - PV input
  - Battery output.
- Control connections at the top of the unit.
  - Auxiliary output.
  - Temperature probe.
  - Remote control communications.

**2.3.1 Power connections**

The power connections consist of four screw terminals for 16mm<sup>2</sup> cables. There are two terminals for the PV panel input and two for the battery output.



*Fig. 2-3 Detail of Power Terminals*

The signaling of terminals is as follows:



*Fig. 2-4 Terminal Plug of PV and Battery*

The PV panels input is connected to the first two on the left with the polarity indicated and the battery output is connected to the terminals on the right, maintaining the polarity indicated.

**2.3.2 Control connections**

The auxiliary connections comprise three connections.

- Jack → Temperature probe supplied with the system.
- RJ 12 → Remote control communications.
- Terminal Plug → Auxiliary output.

The auxiliary output has been designed to control a battery isolating switch, for example. The voltage level of the output is 12VDC. This output provides a maximum current of 15mA.

These connections are located on top of the regulator.



Figure 2-5 Connections Detail control.



Figure 2-6 Detail control connections

### 2.3.3 Control panel

The SATURNO 60 regulator has a 4-line LCD screen and four push buttons for the control and handling of the regulator.



Fig. 2-7 Display - Push-button Panel Detail .

The function of each button is printed next to it.

### 3 USER INTERFACE DESCRIPTION

#### 3.1 Control panel

In SATURNO 60 regulators, the control panel is located on the front, upper part of the regulator. This consists of a 4-line alphanumeric display, which is used to provide the user with information on the regulator operating variables and status, and four push buttons to navigate through the menus and control of the system.

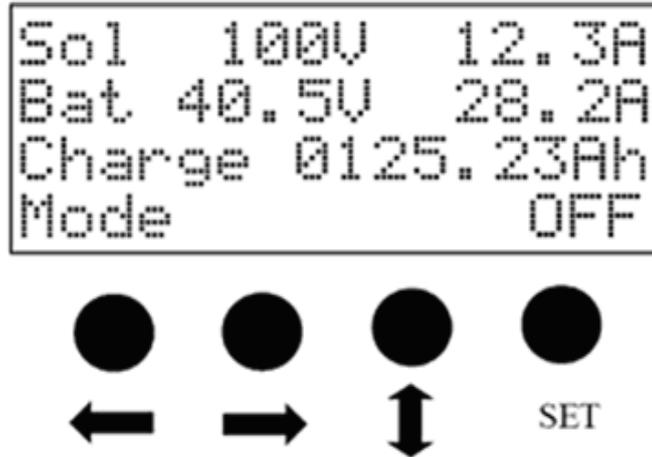


Fig. 3-1 Control panel

The buttons have the followings functions:

- **Left-hand arrow**, change screen or reduce a value.
- **Right-hand arrow**, change screen or increase a value.
- **Up/Down Arrow**, change screen.
- **SET button**, edit value or change screen type.

#### 3.2 Main Screen

On the main screen of the SATURNO 60 regulator, you can display the main parameters of the current status of the regulator.

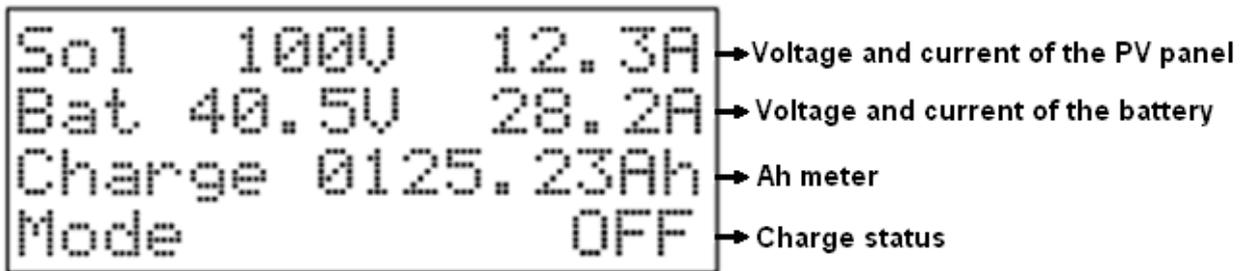


Fig. 3-2 Main screen.

**FV panel voltage and current:** are the instantaneous voltage and current values provided by the photovoltaic panels.

**Battery voltage and current:** are the instantaneous voltage and current values provided to the battery.

**Ah meter:** amps/hour provided by the photovoltaic system to the battery.

**Charging status:** current status of the battery charging cycle.

- **OFF** → No load.
- **Current** → Constant current mode.
- **Voltage** → Constant voltage mode.

- **MPPT** → Maximum power point tracking mode.

### 3.3 Battery configuration mode

The parameters that affect the battery can be adjusted on the battery configuration screen of the SATURNO 60 regulator. This configuration consists of two screens, which are described below:

#### First screen:



Fig. 3-3 Battery 1<sup>st</sup> screen.

**Nominal value of Battery Voltage:** This type of regulator can control batteries with a nominal voltage value of 36 or 48 VDC. This value is selected automatically at start-up, by connecting the battery before the panels.

If the battery is not detected adequately, this can be modified manually.

**Maximum Battery Current value:** In order to manage the battery charge correctly, the maximum battery charge current value can be changed. The maximum value is 60A.

#### Second screen:

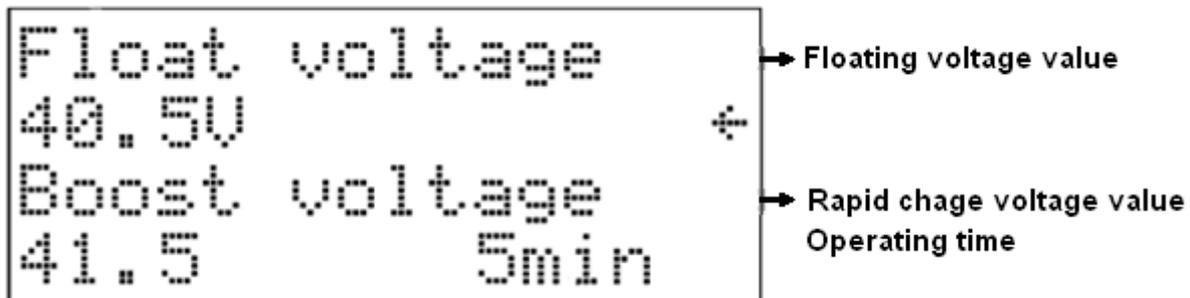


Fig. 3-4 Battery 2 screen.

**Floating Voltage Value:** This is the normal load voltage value. The regulator will try to reach this load value provided that it is not limited by current.

**Rapid Charge Value:** This is the rapid charge voltage value, used to recover the battery after deep discharges. The regulator will try to reach this load value provided that it is not limited by current.

**Rapid Charge Operating Time:** This is the time while regulator maintains the Rapid Charge voltage value on the battery.

### 3.4 LCD configuration screen

The parameters affect the LCD can be adjusted on the LCD configuration screen of the SATURNO 60 regulator.

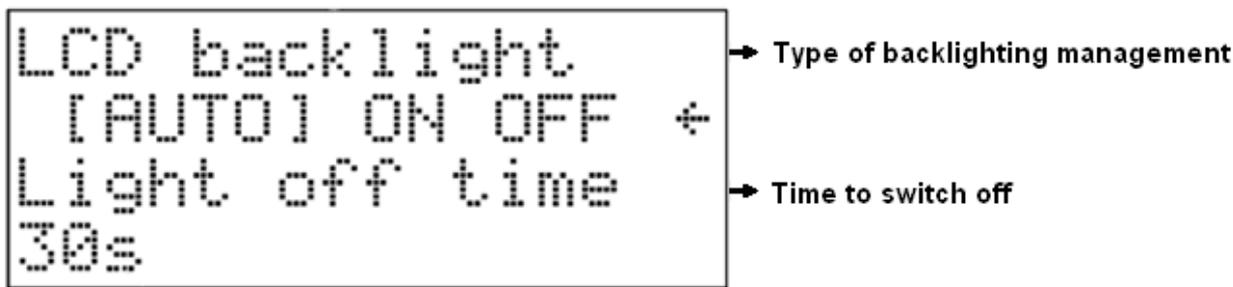


Fig. 3-5 LCD screen.

Type of feedback management: A different operating mode can be selected in accordance with the user’s preferences.

- **AUTO** → The back-lighting turns off when the buttons are not pressed for the pre-established time.
- **ON** → The back-lighting is permanently on.
- **ON** → The back-lighting is permanently off.

Shutdown time: dwell time to turn off the back-lighting in AUTO type management.

### 3.5 Auxiliary output configuration screen

The parameters affect the AUX output of the regulator can be adjusted on the SATURNO 60 regulator auxiliary output configuration screen.



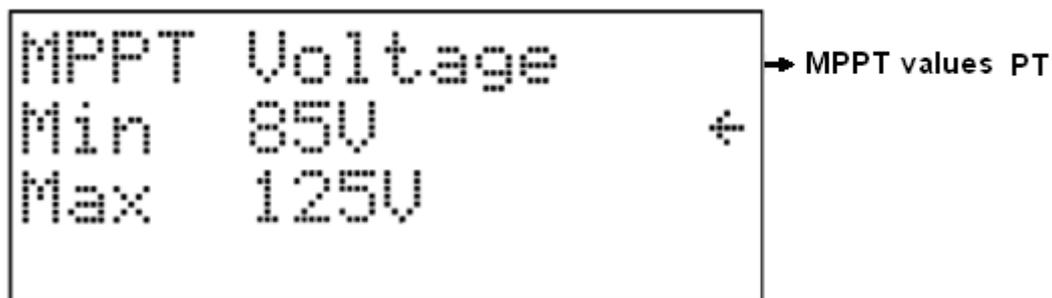
Fig. 3-6 AUX Output Screen.

The auxiliary output is:

- **Activated** → When the value of the battery voltage is higher than indicated on the ON line.
- **Deactivated** → When the value of the battery voltage is higher than indicated on the OFF line.

### 3.6 MPPT configuration screen

The PV voltage values for the MPPT monitoring of the SATURNO 60 regulator are set on the MPPT configuration screen.



*Fig. 3-7 MPPT screen.*

**MPPT values:** These are the maximum and minimum photovoltaic voltage values between which the regulator carries out its MPPT monitoring function.

The absolute minimum value is 60 VDC

The absolute maximum value is 145 VDC

## 4 START-UP AND OPERATION

### 4.1 Description of operation

The charge algorithm of the **MPPT** (maximum power point tracking) allows you to make maximum use of the power generated by your solar modules. The most efficient operating point of solar modules is affected by a number of different factors, such as module temperature, radiation, module type, etc. This operating point is supervised on a permanent basis by the internal microcontroller and, should it be necessary, is controlled in such a way that it is possible to attain the optimum performance of the solar module and the batteries are charged with the maximum current available. Photovoltaic systems are normally fitted with lead-acid batteries, maintenance-free lead-acid, lead-gel and open lead batteries for storing energy. Lead batteries require protection against deep discharge and overload. The internal microcontroller controls with precision the switching thresholds for overload, deep discharge and voltage restoration (with temperature compensation).

### 4.2 Protection against deep discharges

Lead batteries require protection against deep discharge as otherwise their cells might be damaged. The MPPT solar charge controller offers reliable protection for batteries against deep discharge by activating the auxiliary output to disconnect the load as soon as the deep discharge voltage of the battery is reached. As soon as the solar module has recharged the battery sufficiently, the auxiliary output is deactivated.

### 4.3 Protection against overload

When the battery charge voltage is too high, the battery begins to produce gases. The intensive production of gases causes a loss of electrolyte in the battery. Moreover, the hydrogen generated creates a highly explosive compound when mixed with the oxygen in the air. If certain parts of the battery plates are not covered with electrolyte due to the loss of liquid, the battery could be damaged. If an intensive production of gases is observed, look for the cause (consult the troubleshooting table) and check the acid level. The amount of gas generated in the batteries depends on the temperature. The external temperature sensor adjusts the maximum charge voltage automatically in accordance with the atmospheric temperature.

For open-lead batteries you don't have to consider the previous point.

### 4.4 Temperature compensation

The external temperature sensor adjusts and regulates the battery charge voltage and helps to make longer the life of the battery. For this reason, the charge controller must be installed on the same room as the batteries and the external probe must be placed next to the battery housing. Likewise, there is additional protection against high external temperatures. The unit allows a maximum charge current of up to 40°C and at temperatures of between 40 and 60°C this will be gradually reduced to 66%.

### 4.5 Polarity

SATURNO 60 has not inverse polarity protection for batteries, so that, is extremely important to connect correctly wires with their correct polarity. Any damage caused because a bad connection will cancel the warranty conditions.

## 5 COMMUNICATIONS

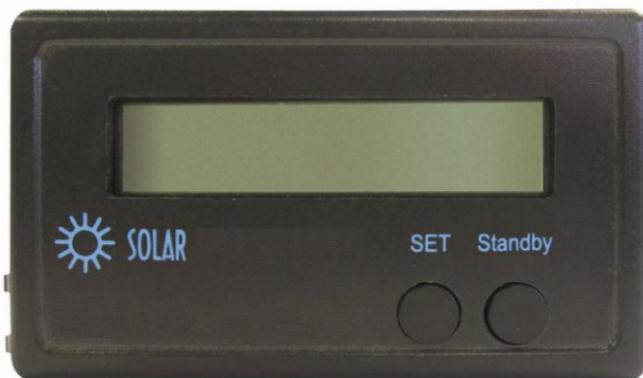
Through the regulator's communication port RJ12 may optionally connect the following devices:

➤ **Remote Display:**

This option allows connect to RJ12 port a remote display by wiring, in order to display data from the equipment in other place with better accessibility.

The main features of the display are:

- Easy operation.
- Display of solar parameters.
- Display of charge parameters.
- Integrated real time clock.
- Display of date.
- Remote control of the main module.
- SD card function for PC evaluation.
- Plug & Play function.



*Fig 5.1 Remote Display*

➤ **Conversion device RS232 ó RS485**

This adapter allows a remote connection via RS232 or RS485 to control and remote monitoring, in case you wish to integrate this device contact to ZIGOR.

## 6 TECHNICAL FEATURES

CHARACTERISTICS	SATURNO 60
MPPT Voltage Range	65 VDC ~ 140 VDC
Maximum FV Voltage	140 VDC
Battery Voltage	36 VDC or 48 VDC (automatic selection)
Charge Current	Configurable between 10ADC and 60ADC
Maximum Output Current	60 ADC*
Maximum Performance	> 93.5%
Typical Consumption in Dwell Mode	< 1W
Temperature Sensor	External
END OF CHARGE VOLTAGE	
Floating Charge	40.3 V / 54.6 V**
Rapid Charge	41.3 V / 56.4 V**
Temperature compensation	-4 mV/°C/cell
OTHERS	
User Interface	LCD display Navigation buttons
Integration Interface	RS232 or RS485 (optional)
Auxiliary output	12VDC
Audible noise (dB)	<45
Type of Protection	IP20
Temperature Range	-25°C ~ +60°C
Relative humidity	0-95% without condensation
Dimensions (WidthxHeightxDPTH) (mm)	190 x 335 x 100
Weight (Kg)	3 Kg

\*: Until PV voltage 120 Vdc. Maximum Voltage is gradually reduced from 120Vdc to Maximum PV Voltage de 140 Vdc.

\*\* : Configurable.

## 7 STANDARD

**SATURNO** models comply with the following European standards:

- European Directive on Low Power (73/23/CEE-93/68/CEE).  
General regulations and safety regulations.  
Standard: EN 60950
- European directive on electromagnetic compatibility. (89/336/CEE)  
Regulations for the electromagnetic compatibility of systems.  
Standard: EN 61000-6-3, EN 61000-6-1, EN 55022



## 8 WARRANTY

ZIGOR guarantees that equipment leave the factory in perfect working order and free of any defects for a period of 24 months to be counted as of the date of sale of the apparatus, shown in the delivery note and/or invoice.

ZIGOR guarantees correct operation against manufacturing and/or workmanship defects. No servicing and/or travelling is included, this being at the expense of the buyer.

When required, parts will be replaced with other new or repaired parts and the parts replaced shall become the property of ZIGOR.

Any defect that may arise due to an accident, disaster or inadequate use, mistreatment, non authorised modifications or causes of a similar nature, as well as those deriving from the use of accessories not purchased from or installed by ZIGOR or any of this company's sales outlets or authorised services is excluded.

The batteries are charged when they leave the factory. In this way, they can be stored for up to two years, provided that they are charged at least every six months during storage. Should these indications not be followed, the warranty shall be considered null and void.

*The installation of elements inside the unit, not carried out by personnel authorised by ZIGOR, shall render the warranty null and void. ZIGOR shall not take responsibility for the repair of the equipment should any of the seals installed for internal checks be broken.*

The Spanish Standardisation and Certification Association (**AENOR**) certifies that the “Quality Assurance ” and “Environmental Management Systems” adopted by **ZIGOR Corporación, S.A.** for the design, development, production and after sales service for electronic equipment for the conversion of direct and alternating current as well as electronic projections, communications systems, telemanagement applications and electrical and electronic turnkey projects, is an agreement with the requirements of the Spanish Standards **UNE-EN ISO 9001:2008** and **UNE-EN ISO 14001:2004** respectively.



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