

# Advanced Hybrid Wind / Solar Charge Controller

## User Manual





## **Safety**

1. Please read the instructions carefully prior to product use or installation and refer back to them throughout the installation.
2. This product should be installed by qualified personnel, in strict accordance with local regulations and the installation instructions provided in this user manual.
3. Never install this product in areas exposed to direct sunlight, corrosive/ flammable/ explosive gases, moisture, excessive dust, vibration, or strong electromagnetic interference.
5. Do not attempt to disassemble or repair this product.

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## I. Product Overview

This controller is specifically designed for Wind/Solar hybrid systems with a range of configurable settings for all types of applications; from basic hybrid systems to more complex setups, with programmable settings and timers for lighting.

This controller features independent charging circuits for wind or solar input. This allows the controller to function either as a hybrid solar/wind controller, as a solar controller using only solar power or as a wind controller using only wind power. (Advanced lighting settings are not available when using wind turbines alone).

The wind charging circuit of this controller features advanced MPPT boost charging technology to extract the maximum possible power from the wind turbine in low wind speeds. In excessive wind speeds which could potentially damage the battery and load, the controller will automatically activate the dump load function (see Section II) where excess energy is redirected in order to protect the system components.

The solar charging circuit of this controller uses MOS tube PWM technology, which minimises the power consumption of the controller and makes the system more stable.

The controller features a range of working modes and control functions which can be programmed according to specific user requirements.

The extensive range of inbuilt safety protection features include: lightning protection, reverse current backflow protection, over-voltage automatic braking, battery reverse polarity, battery open circuit protection, etc.

The user-friendly interface includes an LCD display and four easy to use buttons for simple and convenient operation.

## II. Technical Notes

In off-grid systems, the wind turbine / solar panel can generate power which is either above or below the level required for normal charging of the battery and operation of the connected load. This controller is equipped to handle either of these two scenarios, as detailed below:

*Scenario 1) The battery is full and first requires discharge to power the load normally and avoid permanent damage to system components*

A dump load function is incorporated to resolve the issue presented in situation 1), when the battery has become fully charged and excess energy must be diverted elsewhere. In this case, the energy generated by the wind turbine will be diverted directly to the dump load resistor; connected to the dump load terminals of the controller. It is absolutely essential that the dump load resistor is enabled in areas of high wind speeds, such as coastal regions or areas of high ground. Even in areas of low to moderate wind speeds, it is still strongly recommended that the dump load resistor is configured.

*Scenario 2) The energy produced is not sufficient enough to support the requirements of the load. In this case, power generation capacity must be improved.*

The MPPT boost charging function is designed for when the wind power is not at a high enough level to support battery charging. When wind conditions are less than the rated wind speed of the generator, and the resulting voltage and power do not reach the level required for charging, the controller will use real-time monitoring to acknowledge this and will boost the circuit voltage and current to meet system requirements. The MPPT algorithm ensures that the maximum possible power is extracted from the wind generator.

This hybrid controller uses simple and efficient PWM technology for the solar array, whilst a combination of MPPT boost charging and dump load functions are employed for the wind array.

### III. Key features and Protection Functions

#### a) Key Features:

- Dump load function ensures optimum safety of system components
- High efficiency MPPT charging technology used for the wind power array
- Optional boost charge function increases charging efficiency in low wind speeds
- Extensive range of safety protection functions
- Advanced digital LCD display to show various charging parameters
- Optional programmable charging parameters
- Easy to use function keys allow the user to adjust various settings
- Long lasting, compact design

#### b) Protection Functions:

Function	Description
<b>Solar reverse charge protection</b>	At night or in poor light conditions, the controller will prevent current from flowing back to the solar cells from the battery.
<b>Battery reverse charge protection</b>	The controller will automatically disconnect the battery circuit during high transient currents to protect the battery, device and load.
<b>Battery open circuit protection</b>	After long term use, or due to poor connections, battery open circuit may occur. In this case, the controller itself will be protected from any damage. Connections should be checked regularly to avoid this.

Figure 1.1 Controller Protection Functions

This charge controller also features the additional safety functions:

- Battery reverse polarity connection
- Battery open circuit protection
- High wind speed protection
- Over voltage protection
- Lightning protection\*

\*Please note: for lightning prone areas, additional necessary safety precautions must be taken and specialist protection equipment may still be required.

## IV. Installation

Installation should only be carried out by qualified personnel with the appropriate electrical knowledge and experience, in strict accordance with the information provided in this user manual. Relevant safety precautions must be taken.

### a) Installation Considerations:

When choosing a location to install this controller and the dump load resistor, please observe the following requirements:

1. The controller and dump load resistor should be installed in a clean, dry, well ventilated environment
2. Avoid positioning in direct sunlight, rain, and humid environments.
3. Avoid dusty environments
4. The battery should be located at least 0.5m away from the controller
5. Never install the controller and dump load resistor in environments exposed to flammable or explosive gases
6. Ambient temperature should be within the range of  $-25^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ .
7. Relative air humidity must be under 85% ( $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ ).

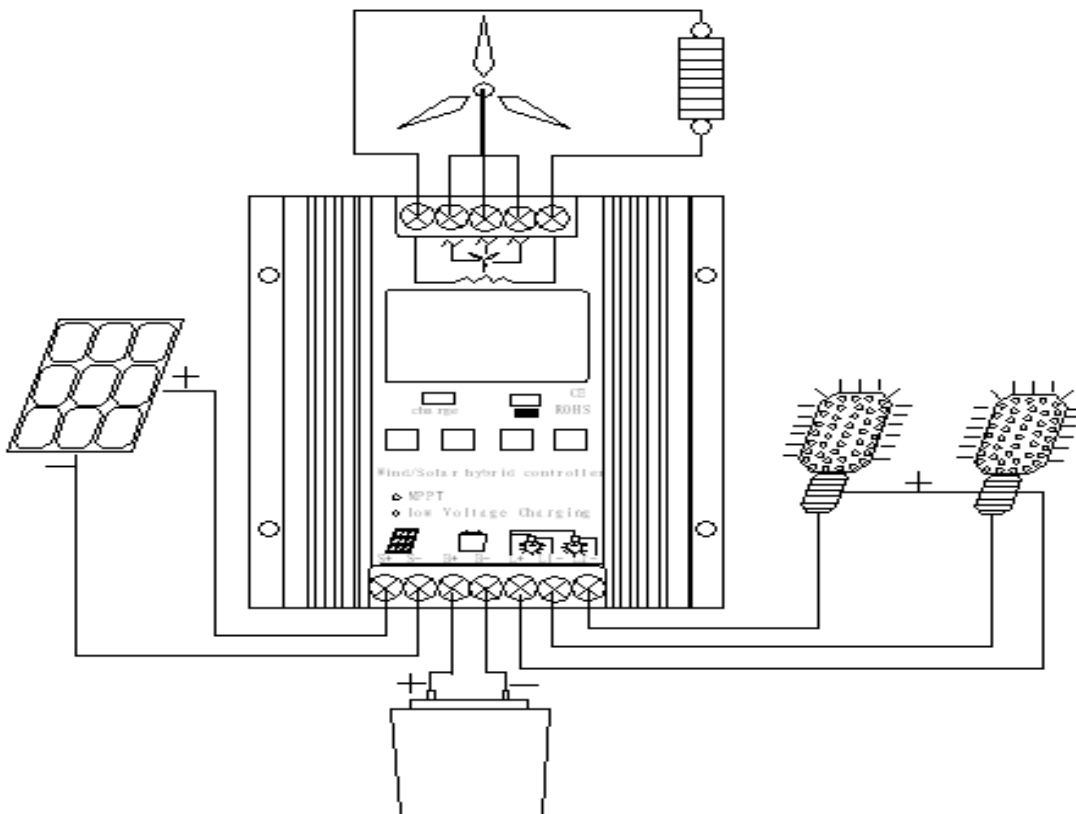


Figure 2.1 System wiring diagram

## **b) Installation Procedure :**

1. Open the package to confirm that all parts are present and undamaged.
2. Install the controller and dump load resistor in an appropriate location (see *Installation Considerations*) with adequate space and airflow around both the controller and dump load resistor to ensure normal heat dissipation. Do not install the controller or resistor in an enclosed space or location with an ambient temperature which exceeds the working temperature range for this controller.
3. For installation, please use insulated multi-strand copper wires. First, determine the appropriate wire lengths to ensure that power losses are kept to a minimum.
4. Connect your battery to the battery terminals of the wind charge controller, using copper core cable less than 1m in length with a minimum thickness of 4mm<sup>2</sup>. Paying close attention to the positive and negative polarity, connect one end of the cable to the “B+” terminal of the controller, and the other end to the positive terminal of the battery. Next, using a wire of the same length, connect one end to the “B-” terminal of the controller, and the other to the negative terminal of the battery. If the positive and negative terminals are connected incorrectly, disconnect all cables immediately and reconnect them correctly in the above order. The controller has reverse polarity protection which should prevent the controller from potential damage.
5. After connecting the battery as instructed, the controller will automatically switch on. The two charging lights will start flashing, and the LCD display will illuminate. If the controller does not switch on, check that the battery polarity is correct and that the battery voltage is at least 8V. If both of these checks are successful, reconnect the battery following the instructions provided in step number 4.
6. Using appropriately sized copper core cable, connect the load to the load terminals of the controller, paying close attention to the positive and negative polarity. Any connection errors may result in permanent damage to the load, as these are not necessarily protected against reverse polarity. If desired, two loads may be connected to the controller. To do this, screw the two positive wires from both loads into the “L+” terminal of the controller and connect each of the negative wires into the “L1” and “L2” terminals of the controller. After connection, check that the load is working normally. If the load is not operating as expected, check whether the ‘OUT’ light on the controller is flashing – if so, this indicates battery under-voltage which means that the battery requires further charging first.
7. Using appropriately sized copper core cable, connect the solar panel(s) to the solar terminals of the controller, paying close attention to the positive and negative polarity. Connect the positive wire from the solar panel to the “S+” terminal of the controller. Connect the negative wire from the solar panel to the “S-” terminal of the controller. If connected incorrectly, the charge controller has reverse connection protection to prevent any damage (provided that the battery and load have been connected correctly as instructed). Once the solar panel is connected correctly, the ‘Charge’ light will turn on (provided that the panels are exposed to daylight).
8. Using appropriately sized copper core cable, connect the dump load resistor to the dump load resistor terminals of the controller. There is no positive or negative distinction.
9. Using appropriately sized copper core cable, connect the wind turbine to the wind turbine terminals of the controller. For three-phase wind turbines, there is no positive or negative distinction. For DC wind turbines, the turbine can be connected using any two of the three

terminals available on the controller. Always install the wind turbine in low wind speeds to avoid safety risks.

## V. LCD Interface and Settings

### a) LED Status Indicators:



LED	Status	Indication
CHARGE 	ON	Charging
	OFF	Not charging
OUT 	ON	Normal Voltage
	OFF	Over Voltage
	FLASHING	Under Voltage

Figure 3.1 LED indicators

### b) Function Keys:

Figure 3.2 Function keys

As shown in figure 3.2:

- **Button (1)** – Press this button to enter the Setup interface or to switch between Setup programs.
- **Button (2)** – Press this button to scroll down in page views, or to reduce parameter values by increments of 0.1 in the Setup interface.
- **Button (3)** – Press this button to scroll up in page views, or to increase parameter values by increments of 0.1 in the Setup interface.
- **Button (4)** – Press this button to exit the setup interface and to save the selected parameters.

### c) LCD Display Icons

The default interface shown on the LCD display will appear similar to figure 3.3 shown below, depending on the individual system:

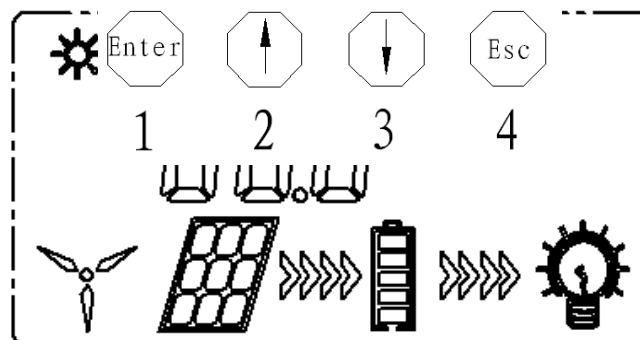





Figure 3.3 Default LCD interface

 Displays a digital real-time battery voltage reading below


 Daytime detected

 Night time detected


 2 x icons to represent Charging and Discharging:

- During charging, the icon will become animated. When there is no charging or charging current is very low, the icon will disappear.
- During discharge, when the battery is in a state of under-voltage, the icon will flash. When the battery voltage is within the normal range, the icon will remain static, indicating that it is able to power a load. When load current draw is detected, the icon will become animated.

 Solar panel connected

 Battery connected. The number of lines displayed represents the battery capacity.

 Load connected

 Wind turbine connected. Icon will become animated when wind is detected.

#### d) Parameter Browsing Menu

To browse charging parameters, press the down key to view the wind turbine charging current (“Ifan”) and once more to view the solar charging current (“I<sub>pv</sub>”), as shown below in figure 3.4. Press the up key to return to the previous interface.

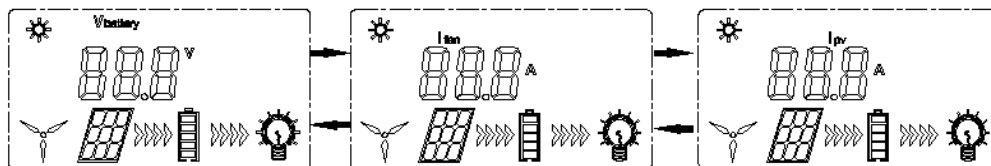


Figure 3.4 Parameter browsing menu

The above parameter browsing pages will be displayed for 60 seconds before the LCD backlight automatically times out. The backlight can be reactivated by pressing any key.

#### e) Parameter Settings Menu



## Float charging settings

To enter into the parameter settings menu as shown in figure 3.5, press the enter key, where you can firstly adjust the float charging value (“Vfloat”). Use the up and down keys to increase or decrease the float charging voltage by 1V. The controller can also be set to preset float charging settings including an under-voltage preset (“Vunder”), over-voltage preset (“Vover”), as well as a preset point at which the dump load is activated (“Vfan\_breaking”).

Once set up is complete, either press the ESC key to exit the parameter settings menu and return to the parameter browsing menu, or press the Enter key to switch to the next adjustable parameter, as shown below:

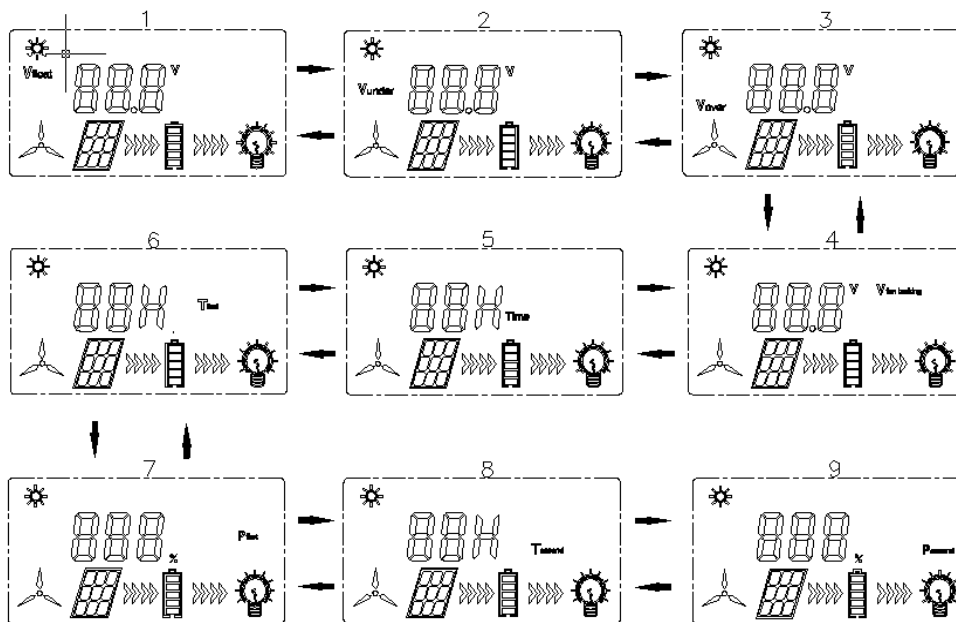


Figure 3.5 Parameter settings menu

## Lighting settings

If any lighting is connected to the load terminals of the controller, the user can switch between ‘household’ and ‘street light mode’ in the following settings interface. To do this, switch to the 5<sup>th</sup> screen (see figure 3.5), where the data value “time” will appear. Here, press the up or down keys to adjust the number of hours that the lights are switched on for (in 1hr increments). Please note, when the value is set to 24, the controller is in 24hrs working mode (i.e. ‘Household mode’). Any other chosen value will automatically be recognized as ‘street light’ mode.

## Advanced lighting settings

Depending on the specifications of the connected load, this controller has the capability to intelligently program specialized lighting such as streetlights. By scrolling down to the 6<sup>th</sup> screen (as shown in figure 3.5), the data value “Tfirst” will appear. Here, press the up or down keys to adjust the number of hours that the lighting will be on for. By scrolling down to the 7<sup>th</sup> screen, the data value “Pfirst” will appear. Here, press the up or down keys to adjust the percentage of full power used by the lights (value will change in increments of 10%).

The 8<sup>th</sup> and 9<sup>th</sup> screen allow the user to set a second set of values for the lighting, i.e. another time value (“Tsecond”) and another % power value (“Psecond”).



## VI. Product Dimensions

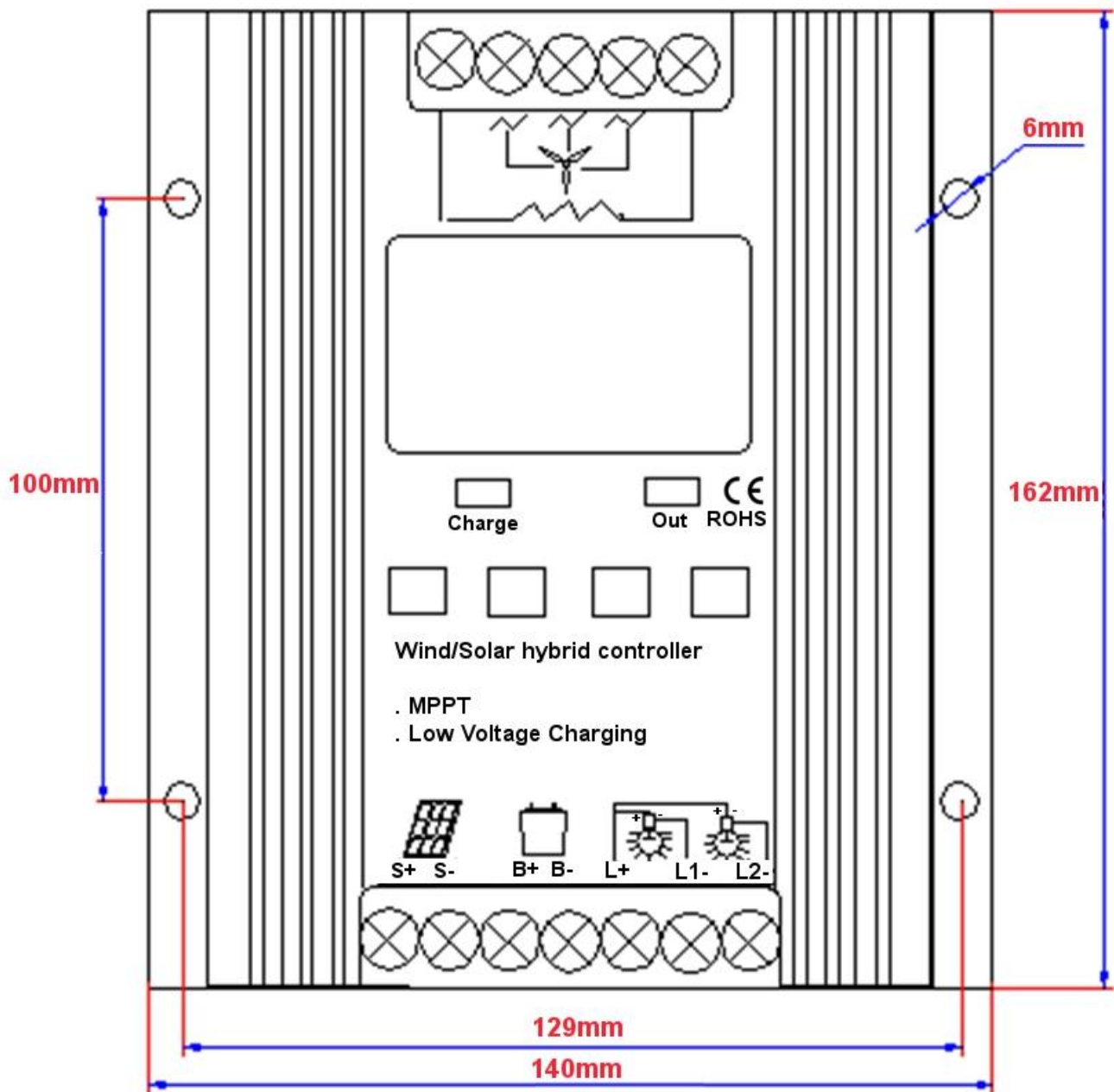


Figure 4.1 Hybrid charge controller diagram

Please note: The controller depth is 66mm.

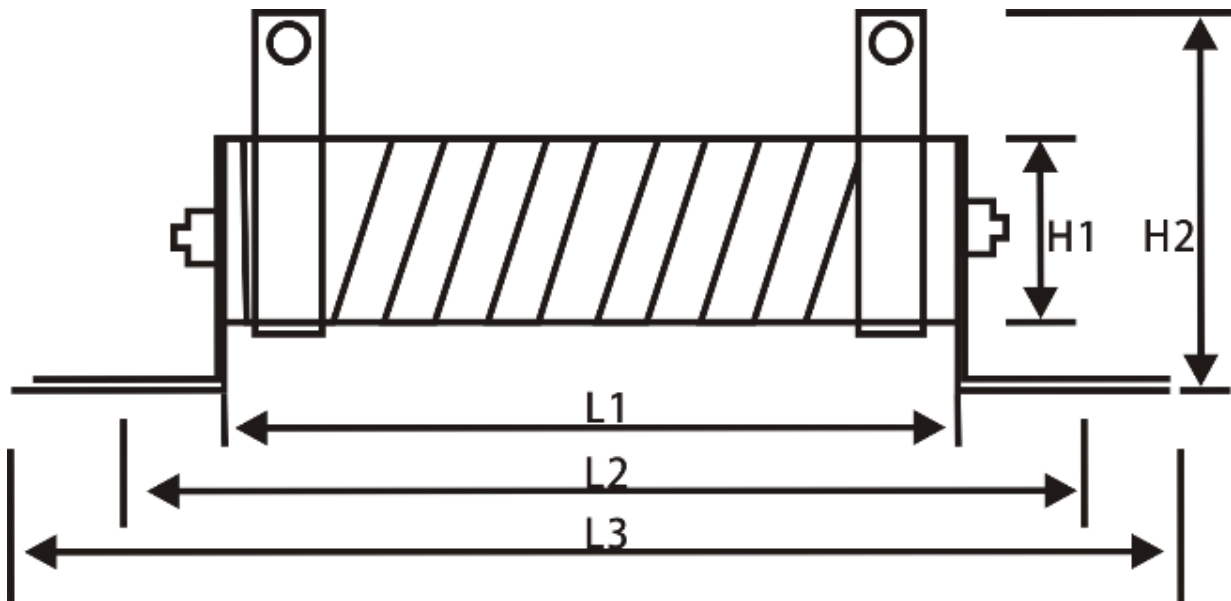


Figure 4.2 Dump load resistor diagram

Controller model	Dump load resistor dimensions (mm)					Weight
	L1±5	L2±5	L3±5	H1±2	H2±5	
JCM-2460	185	198	233	70	100	0.8 kg

Figure 4.3 Dump load resistor dimensions

## VII. Technical specifications

		JCM-1240	JCM-2460
Rated Voltage		12V	24V
Max Solar input Power		200W	500W
Max Wind input power		400W	600W
Charging	Charging current	30A	37.5A
	Braking voltage	14.4V±1%	28.8V±1%
	Float voltage	13.8V±1%	27.6V±1%
	Recovery voltage	13.2V±1%	26.4V±1%
	Temp compensation	-24mV/°C	-48mV/°C
Discharge	Disconnect voltage (DC)	10.8V±1%	21.8V±1%
	Recovery voltage (DC)	12.3V±1%	24.6V±1%
Over-voltage	Cut-off voltage (DC)	16.5V±1%	32.0V±1%
	Recovery voltage (DC)	15.0V±1%	30.0V±1%
Idle current (DC)		≤0.1A	
Voltage drop (DC)		≤0.5V	
Wind power circuit		MPPT charging technology	
Boost charging		Optional independent circuits for boost charging	
Parameters displayed		Voltage, charging current, battery power	
Display		LCD	
Protection functions		Lightning protection, solar reverse backflow protection, battery open circuit protection, high wind speed protection, over-voltage automatic braking, overload protection, etc.	
Ambient temperature		-25°C to +55°C	
Altitude		≤5500m (reduce power use above 2000m)	
Humidity		0-90% (non-condensing)	

## **VIII. Warranty**

This product is covered by a 1 year warranty, valid from the date of purchase. Claims made outside of this warranty period will not be accepted. Claims for damage resulting from transportation, improper use, mishandling or by force majeure will also be rejected.

Disclaimer: We reserve the right to make changes or updates to this user manual without prior notice.