MPPT SOLAR CONTROLLER

Owner's Manual

Rev: 1.3 (2022)

EN43510 - MPPT Solar Controller 12/24V - 10Amp
EN43520 - MPPT Solar Controller 12/24V - 20Amp
EN43530 - MPPT Solar Controller 12/24V - 30Amp
EN43540 - MPPT Solar Controller 12/24V - 40Amp

Please Keep This Manual For Future Reference

For safe and optimum performance, the MPPT Solar Controller must be used correctly.
Carefully read and follow all instructions and guidelines in this manual and give special attention to the CAUTION and WARNING statements.

Disclaimer

While every precaution has been taken to ensure the accuracy of the contents of this manual, Enerdrive assumes no responsibility for errors or omissions. Note as well that specifications and product functionality may change without notice.

Important

Please be sure to read and save the entire manual before using your MPPT Solar Controller .
Misuse may result in damage to the unit and/or cause harm or serious injury. Read manual in its entirety before using the unit and save manual for future reference.

Product Numbers - MPPT Solar Controller Series

EN43510	MPPT Solar Controller 12/24V-10Amp
EN43520	MPPT Solar Controller 12/24V-20Amp
EN43530	MPPT Solar Controller 12/24V-30Amp
EN43540	MPPT Solar Controller 12/24V-40Amp

MPPT Solar Controller Owners Manual Rev. 1.3. This Manual is applicable to all units with part numbers prefix EN435XXX (EN43510, EN43520, EN43530, EN43540).

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1. GENERAL INFORMATION

1.1 OVERVIEW

The Enerdrive MPPT Solar Controllers adopt the advanced Maximum Power Point Tracking control algorithm. It can minimise the maximum power point loss rate and loss time, quickly track the maximum power point (MPP) of the PV array and obtain the maximum energy from the solar array under any conditions; and it can increase the ratio of energy utilization in the solar system by up to 20%-30% compared with PWM charging method. IP33 Ingress protection and isolated RS485 design further improve the controller's reliability and meet the different application requirements.
Enerdrive MPPT Solar Controllers include self-adaptive three-stage charging mode based on digital control circuit, which can effectively prolong the lifespan of batteries and significantly improve the system performance. It also has comprehensive electronic protection for overcharge, over discharge and PV/ battery reverse polarity. This controller is suitable for RV, Marine, Remote Off Grid monitoring and many other applications.

FEATURES

- CE certification(LVD EN/IEC62109,EMC EN61000-6-1/3)
- LCD display
- Advanced MPPT technology & ultra-fast tracking speed with efficiency up to 99.5%
- Maximum DC/DC transfer efficiency is as high as 98.6%.
- Advanced MPPT control algorithm to minimize the MPP lost rate and lost time
- Accurate recognition and tracking of multi-peaks maximum power point
- Wide MPP operating voltage range
- Support lead-acid and lithium batteries; voltage parameters can be set on the controller
- Limit charging power & current over rated value
- Real-time energy statistics function
- Power reduction automatically over temperature value
- Multiple load work modes
- Comprehensive electronic protection
- Isolated RS485 with 5V/200mA protected output for no power devices, with Modbus protocol
- IP33 Ingress protection

For battery types other than Lithium, the BCV, FCV, LVD, and LVR, users can modify them on the controller by setting the battery type to "USE."

1.2 CHARACTERISTICS

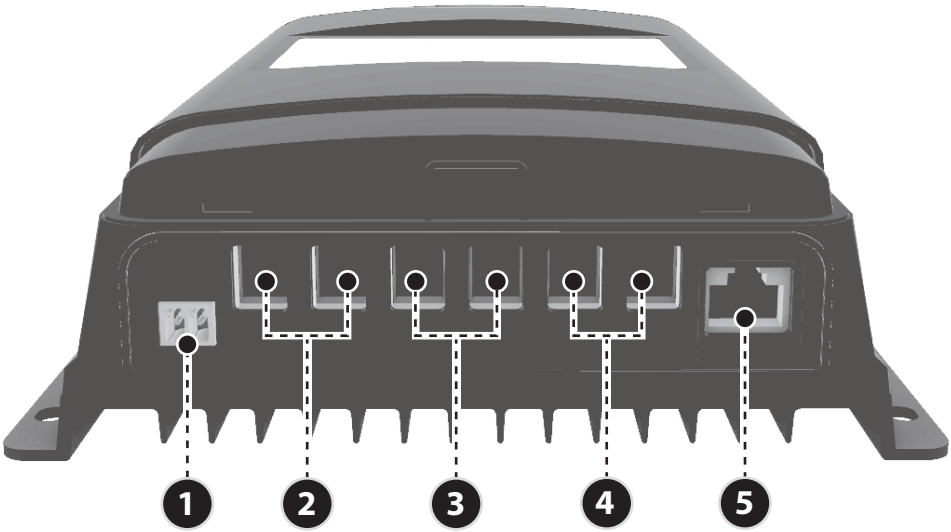


Figure 1 - Product Characteristics

1	RTS* Port
2	PV Terminals
3	Battery Terminals
4	Load Terminals
5	RS485 Communication Port

*If the temperature sensor is short circuited or damaged, the controller will charge/discharge according to the voltage set point at the default temperature setting of 25°C (no temperature compensation).

2. INSTALLATION

2.1 CAUTION

- Please read the entire installation instructions to get familiar with the installation steps before installation.
- Be very careful when installing the batteries, especially flooded lead-acid battery. Please wear eye protection and have fresh water available to wash and clean any contact with battery acid.
- Keep the battery away from any metal objects, which may cause short circuit of the battery.
- Explosive battery gases may come out from the battery during charging, so make sure ventilation condition is good - ensure proper ventilation is present.
- Ventilation is highly recommended if mounted in an enclosure. Never install the controller in a sealed enclosure with flooded batteries! Battery fumes from vented batteries will corrode and destroy the controller circuits.
- Loose power connections and corroded wires may result in high heat that can melt wire insulation, burn surrounding materials, or even cause fire. Ensure tight connections and use cable clamps to secure cables and prevent them from swaying in mobile applications.
- The controller can work with lead-acid battery and lithium battery within its specifications.
- Multiple same models of controllers can be installed in parallel on the same battery bank to achieve higher charging current. Each controller must have its own solar panel(s).
- Installation must be completed in accordance with applicable local standards.

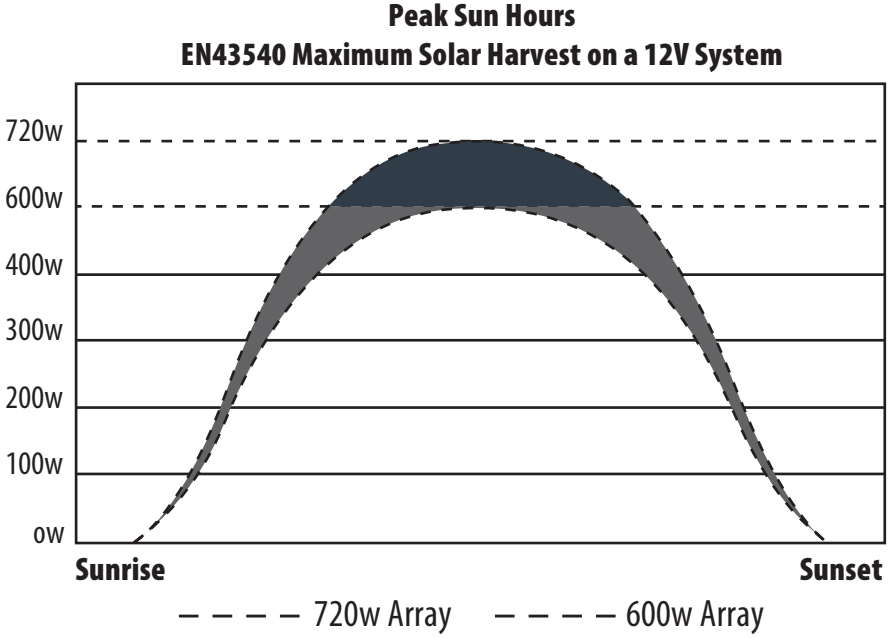
2.2 PV ARRAY REQUIREMENTS

(1) MAXIMUM PV ARRAY POWER

(1) – Enerdrive MPPT controllers include charge current limiting allowing the controller to limit the charging current if the incoming PV array exceeds the controllers maximum charging output. This allows the controller to protect internal charging components avoiding damage from oversized PV arrays. This function also allows for overdriving of the solar controller increasing the amount of time the controller is receiving its peak harvest from the PV array.

MPPT controller overdrive –

**Note:* The recommended maximum solar wattage input for the EN43540 controller is 600 watts 12V. You can however "overdrive" the MPPT controller. Please note that doing this is partially an economic decision. You can install more power than the controller can use and this will contribute to better power availability. Enerdrive suggest a total maximum overdrive of 20% (total 720W). On cloudy (or intermittent sunny) days there will be little or no power shaving and the extra power will serve the battery well with more energy harvest earlier and later in the day.*



According to "Peak Sun Hours diagrams", if the power of PV array exceeds the rated charging power of the controller, then the charging time as per the rated power will be prolonged, so that more energy can be obtained for charging the battery. However, in the practical application, the maximum power of PV array shall be not greater than 1.2x the rated charging power of controller. If the maximum power of PV array exceeds the rated charging power of the controller too much, it will not only cause the waste of PV modules, but also increase the open-circuit voltage of PV array due to the influence of environmental temperature, which may make the probability of damage to the controller rise. Therefore, it is very important to configure the system correctly. Excess Solar above the 1.2x rating is best suited to a higher rated controller, or split the array through multiple controllers.

CAUTION

When the PV modules connect in series, the open circuit voltage of the PV array must not exceed 92V at 25°C environment temperature.

For the recommended maximum power of PV array for this controller, please refer to the table below:

MODEL	RATED CHARGE CURRENT	MAX. PV ARRAY POWER RECOMMENDED	MAX. PV ARRAY POWER ALLOWED	MAX. PV OPEN CIRCUIT VOLTAGE
EN43510	10A	150W/12V 300W/24V	180W/12V 360W/24V	92V[1]
EN43520	20A	300W/12V 600W/24V	360W/12V 720W/24V	
EN43530	30A	450W/12V 900W/24V	540W/12V 1080W/24V	
EN43540	40A	600W/12V 1200W/24V	720W/12V 1440W/24V	

[1] *92v at 25˚C environment temperature*

2.3 WIRE SIZE

The wiring and installation methods must conform to all national and local electrical code requirements.

MODEL	MAX. PV INPUT CURRENT	MAX. PV WIRE SIZE*
EN43510	10A	4MM²/12AWG
EN43520	20A	6MM²/10AWG
EN43530	30A	10MM²/8AWG
EN43540	40A	13.2MM²/6AWG

BATTERY AND LOAD WIRE SIZE

The battery and load wire size must conform to the rated current, the reference sizes as below are a guide only:

MODEL	RATED CHARGE CURRENT	RATED DISCHARGE CURRENT	BATTERY WIRE SIZE	LOAD WIRE SIZE
EN43510	10A	10A	4MM²/12AWG	4MM²/12AWG
EN43520	20A	20A	6MM²/10AWG	6MM²/10AWG
EN43530	30A	30A	10MM²/8AWG	10MM²/8AWG
EN43540	40A	40A	13.2MM²/6AWG	13.2MM²/6AWG

NOTE

The wire size is the largest size the Solar Controller can accept.

2.4 MOUNTING

WARNING

- Risk of explosion! Never install the controller in a sealed enclosure with flooded batteries! Do not install in a confined area where battery gas can accumulate.
- Risk of electric shock! When wiring the solar modules, the PV array can produce a high open circuit voltage, so turn off the isolator or cover panels before wiring and be careful when wiring.

INSTALLATION PROCEDURE

Step 1: Determination of Installation Location and Heat-dissipation Space

Determination of installation location: The controller shall be installed in a place with sufficient air flow through the heatsync of the controller to ensure natural thermal convection.
See Figure 2-1: Mounting

**Figure 2-1: Mounting*

CAUTION

If the controller is to be installed in an enclosed box, it is important to ensure reliable heat dissipation through the box.
**Note: Correct ventilation is recommended.*

Step 2: Connect the system in the order of 1 battery > 2 load>3 PV array in accordance with Figure 1 - Page 6, "Schematic Wiring Diagram" and disconnect the system in the reverse order 3>2>1.

CAUTION

- While wiring the controller do not close the circuit breaker or fuse and make sure that the leads of "+" and "-" poles are connected correctly.
- A fuse which current is 1.25 to 2 times the rated current of the controller, must be installed on the battery side with a distance from the battery or main distribution point not greater than 200 mm.
- If an inverter is to be connected to the system, connect the inverter directly to the battery, not to the load side of the controller.

Step 3: Grounding

Enerdrive MPPT Solar Controllers are a common-negative controller, where all negative terminals of the PV Array, Battery and Loads can be grounded through the controller or at a common ground position where only one negative terminal will need to be present at the unit along with the case ground being connected. However best practice will dictate that all negative terminals should be present at the unit both simplifying the installation and assisting with any fault finding should it be required.

CAUTION

Enerdrive MPPT controllers are not suitable for positively grounded systems.

Step 4: Connect Accessories

• If the batteries being charged are in a different location to the solar controller it is recommended to use the remote temperature sensor.

Controller Mounted Temperature Sensor

Remote Temperature Sensor

Connect the remote temperature sensor cable to the solar controller and place the other end close to the battery/batteries being charged.

NOTE

If the remote temperature sensor is not connected to the controller, the default setting for battery charging or discharging temperature is 25 °C without temperature compensation.

Step 5: **Powering the controller**

Closing the battery fuse/circuit breaker will switch on the controller. Then check the status of the battery indicator (the controller is operating normally when the indicator is lit in green). Close the fuse and circuit breaker of the load and PV array. Then the system will be operating in the preprogrammed mode.

! CAUTION

If the controller is not operating properly or the battery indicator on the controller shows an abnormality, please refer to 5.2 “Troubleshooting” (page 24 & 25).

3. DISPLAY

3.1 OVERVIEW

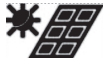
(1) LED Indicator

INDICATOR	COLOUR	STATUS	INSTRUCTION
● SOLAR	Green	On solid	PV connection normal but low voltage (low output) from PV, not charging
	Green	OFF	No PV voltage (night time) or PV connection problem
	Green	Slowly Flashing	Charging
	Green	Fast Flashing	PV over voltage
● LOAD	Red	ON SOLID	Load ON
	Red	OFF	Load OFF

(2) Buttons

MODE	NOTE
Load ON/OFF	When load manual mode is selected, you can turn the load On/Off via the ENTER button
Clear Fault	Press the ENTER button
Browsing Mode	Press the SELECT button
Setting Mode	Press the ENTER button and hold on for 5s to enter the setting mode
	Press the SELECT button to select the parameters
	Press the ENTER button to confirm the setting parameters. No interaction for 10s, it will exit the setting interface automatically

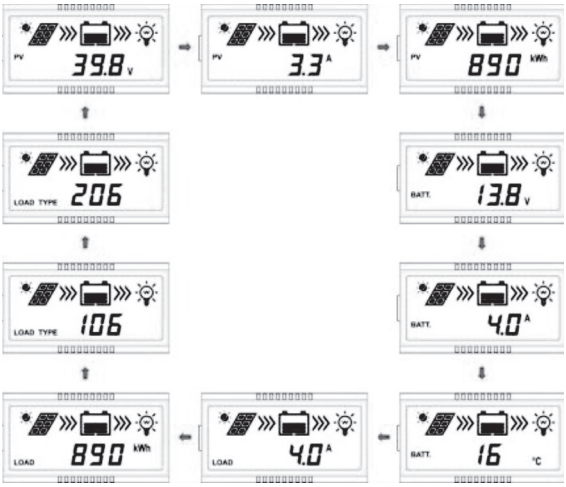
(3) Interface

INDICATOR	ICON	STATUS
PV Array		Day
		Night
		No Charging
		Charging
	PV	PV Voltage, Current, Generated Energy
Battery		Estimated Battery Capacity, In Charging
	BATT.	Battery Voltage, Current, Temperature
	BATT. TYPE	Battery Type
Load		Load ON
		Load OFF
	LOAD	Current/Consumed Energy/Load mode

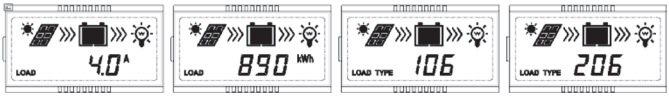
3.2. OPERATION

(1) Browse Interface

Press the SELECT button to cycle through the display to show the following interfaces.



(2) Load Parameter Display



Display: Current/Consumed energy/Load working mode-Timer1/ Load working mode-Timer2

(3) Setting

① Clear the recorded energy

Operation:

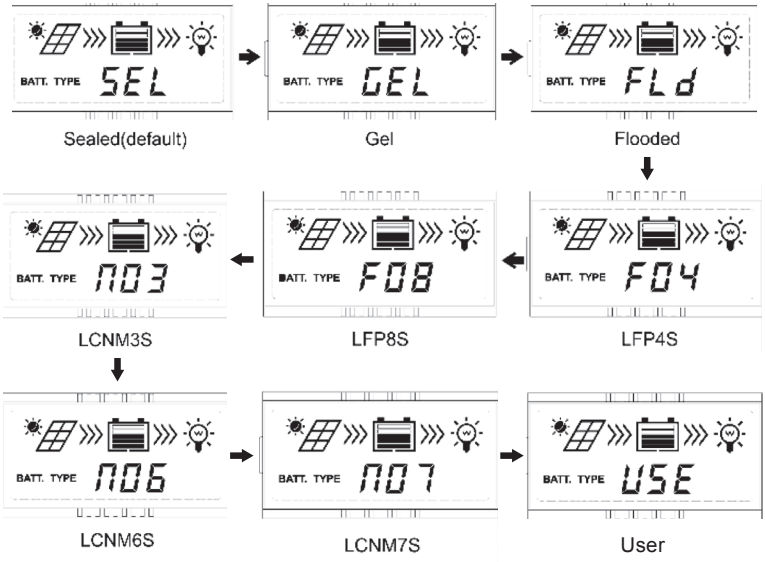
Step 1: Press the ENTER button and hold for 5s under the PV recorded energy interface and the value will then be flashing.

Step 2: Press the ENTER button to clear the recorded energy.

② Switch the battery temperature unit

Press the ENTER button and and hold 5s under the battery temperature interface.

③ Battery Type



Operation:

Step 1: Press the ENTER button and hold for 5s under the battery voltage interface.

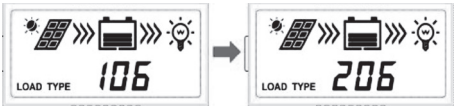
Step 2: Press the SELECT button when the battery type interface is flashing to cycle through the battery types.

Step 2: Press the ENTER button to confirm the battery type.

CAUTION

Please refer to chapter 4.1 for the battery parameters setting, when the battery type is "USE".

④ Load Working Mode



Operation:

Step 1: Press the ENTER button and hold 5s under the load mode interface.

Step 2: Press the SELECT button when the load mode interface is flashing, to cycle through the load settings.

Step 2: Press the ENTER button to confirm the load mode.

NOTE: Please refer to chapter 4.2 for the load working modes.

4. PARAMETERS SETTING

4.1 SUPPORTED BATTERY TYPES

1.	Battery	Sealed (default)
		Gel
		Flooded
2.	Lithium Battery	LiFePO4(4S/8S)
		Li(NiCoMn) O2 (3S/6S/7S)
3.	User	

NOTE

Enerdrive only recommend to use the Lithium Ion - Li(NiMnCo)O2 battery selection when the controller is installed in specific commercial applications only. (Battery Type N03, N06, N07).
For specific charging parameters for this battery type, please contact Enerdrive.

NOTE

When the default battery type is selected, the battery voltage parameters cannot be modified. To change these parameters, select the "USE" type. (Not applicable for Lithium Profiles)

4.1.2 BATTERY TYPE "USE" SETTINGS

Step 1: Enter the "USE" battery type. For detailed operations of entering the "USE" battery type refer to the below instructions.The battery parameters that can be local set are shown in the table below:

Parameters	Default	Range	Settings on EN43510, EN43520, EN43530 & EN43540
SYS (System Voltage)	12VDC	12/24V	**1)** Under the "USE" battery type, press the ENTER button to enter the "SYS" interface. **2)** Press the ENTER button again to display the current "SYS" value. **3)** Press the SELECT button to modify the voltage 12/24V. **4)** Press the ENTER button to confirm and enter the next parameter.
BCU (BULK)	14.4V	9~17V	**5)** Press the ENTER button again to display the current voltage value. **6)** Press the SELECT button to modify the parameter (short press to increase by 0.1V, long press to decrease by 0.1V). **7)** Press the ENTER button to confirm and enter the next parameter.
FCU (FLOAT)	13.8V	9~17V	
LVA (LOW VOLTAGE ALARM)	12.6V	9~17V	
LVD (LOW VOLTAGE DISCONNECT)	11.1V	9~17V	
LEN (cut charging below ≤0°C)	NO	YES/NO	Press the SELECT button to modify the switch status. Note: Controller will exit automatically from the current interface after no interaction for more than 10 seconds.

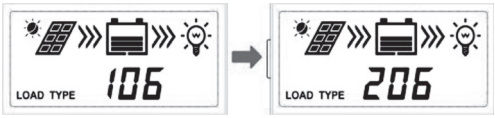
The SYS value can only be modified for battery types other than lithium (F04 for 12V lithium, F08 for 24V Lithium systems). When utilising USE battery type all chemistries other than lithium charging parameters can be modified within the voltage ranges set out in figure 4.1.

Figure 4.1

BATTERY TYPE / BATTERY PARAMETERS	SEALED	GEL	FLD	USER	LFP4S (12V Lithium)	LFP8S (24V Lithium)
Over voltage disconnect voltage	16.0V	16.0V	16.0V	9~17V	14.8V	29.6V
Charging limit voltage	15.0V	15.0V	15.0V	9~17V	14.6V	29.2V
Over voltage reconnect voltage	15.0V	15.0V	15.0V	9~17V	14.6V	29.2V
Equalise charging voltage	14.6V	--	14.8V	9~17V	14.5V	29.0V
Boost charging voltage	14.4V	14.2V	14.6V	9~17V	14.5V	29.0V
Float charging voltage	13.8V	13.8V	13.8V	9~17V	13.8V	27.6V
Boost reconnect charging voltage	13.2V	13.2V	13.2V	9~17V	13.2V	26.4V
Low voltage reconnect voltage	12.6V	12.6V	12.6V	**9~17V**	12.8V	25.6V
Under voltage warning reconnect voltage	12.2V	12.2V	12.2V	9~17V	12.2V	24.4V
Under voltage warning voltage	12.0V	12.0V	12.0V	9~17V	12.0V	24.0V
Low voltage disconnect voltage	11.1V	11.1V	11.1V	9~17V	11.1V	22.2V
Discharging limit voltage	10.6V	10.6V	10.6V	9~17V	11.0V	22.0V

4.2 LOAD WORKING MODES

1) DISPLAY AND OPERATION



When the LCD shows the above interface, operate as following:

Step 1: Press the ENTER button and hold for 5s to enter the load mode interface.

Step 2: Press the SELECT button when the load mode interface is flashing.

Step 3: Press the ENTER button to confirm the load working modes.

2) LOAD WORKING MODE

1**	Timer 1 - After Sunset	2**	Timer 2 - Before Sunrise
100	Light ON/OFF. Must be 101-115 to use 2N function.	**2n**	Disabled
101	Load will be on for 1 hour after sunset	**201**	Load will be on for 1 hour before sunrise
102	Load will be on for 2 hours after sunset	**202**	Load will be on for 2 hours before sunrise
103 ~113	Load will be on for 3 ~ 13 hours after sunset	**203 ~213**	Load will be on for 3 ~ 13 hours before sunrise
114	Load will be on for 14 hours after sunset	**214**	Load will be on for 14 hours before sunrise
115	Load will be on for 15 hours after sunset	**215**	Load will be on for 15 hours before sunrise
116	Test mode	**2 n**	Disabled
117	Manual mode (default load ON)	**2 n**	Disabled

TECHNICAL INFORMATION

Please set Light ON/OFF, Test mode and Manual mode via Timer1. Timer2 will be disabled and display "2 n".

5. OTHERS

5.1 PROTECTION

PV Over Current/Power	Should the PV array exceed the controllers rated output the controller will go into overdrive maximising the output of the unit, the controller will not exceed its maximum rated output. Exceeding the controllers maximum current input will not damage the unit. If this input exceeds 1.5 times the maximum, it is recommended to install a second controller to maximise input and minimise losses. **WARNING:** Exceeding the controller's maximum voltage input (92 VOC at 25 degrees Celsius) will cause damage to the controller.
PV Short Circuit	Short circuiting the PV array connected to the controller will damage the controller. Always ensure to isolate your solar array prior to any work being carried out on either the controller or solar array itself. **WARNING:** DO NOT short-circuit the PV array during charging. Otherwise, the controller may be damaged.
PV Reverse Polarity	**WARNING:** Always ensure PV array polarity prior to connection to the controller. Incorrect polarity will cause damage to the controller.
Night Reverse Charging	Prevents the battery from discharging to the PV module at night.
Battery Reverse Polarity	Always ensure polarity of battery connections prior to connection. Incorrect polarity will cause damage to the controller. **WARNING:** When the PV connection is correct and battery connection reversed, the controller will be damaged.
Battery Over Voltage	When the battery voltage reaches the over voltage disconnect voltage, it will automatically stop battery charging to prevent battery damage caused by over-charging.

Battery Over Discharge	When the battery voltage reaches the low voltage disconnect voltage, it will automatically stop the load circuit to prevent battery damage caused by over-discharging. (Any controller connected loads will be disconnected. Loads directly connected to the battery will not be affected and may continue to discharge the battery.)
Battery Overheating	The controller can detect the battery temperature through an optional external temperature sensor. The controller stops working when the sensor temperature exceeds 65 °C and restarts when its temperature is below 55 °C.
Lithium Battery Low Temperature	When the temperature detected by the optional temperature sensor is lower than the Low Temperature Protection Threshold (LTPT), the controller will stop charging automatically. When the detected temperature is higher than the LTPT, the controller will return to normal operation. (The LTPT is 0 °C by default).
Load Short Circuit	When the controllers load is short circuited the controller will automatically cut off the output load circuit. The load will then attempt to reconnect after a short delay of 5 seconds. If the short circuit is still present the controller will repeat this process a further 4 times. After the 5th attempt to reconnect, the controller will stay disconnected until the load is manually turned back on through the use of the menu functions on the controller. Please ensure the short circuit has been removed before attempting to turn the load of the controller back on.
Load Overload	When the load circuit is overloaded the controller will automatically cut off the output load circuit. The load will then attempt to reconnect after a short delay of 5 seconds. If the overload is still present the controller will repeat this process a further 4 times. After the 5th attempt to reconnect the controller, will stay disconnected until the load is manually turned back on through the use of the menu functions on the controller. Please turn off some appliances connected to the load circuit to reduce the overall load on this circuit before turning the load back on.
Controller Overheating*	Enerdrive (EN43510, EN43520, EN43530, EN43540) solar controllers have internal temperature sensors to avoid overheating. The controller will automatically shut down should the internal temperature exceed 85 °C. The controller will return to normal operation when the temperature drops below 75 °C.
TVS High Voltage Transients	The internal circuitry of the controller is designed with Transient Voltage Suppressors (TVS) which can only protect against high-voltage surge pulses with less energy.

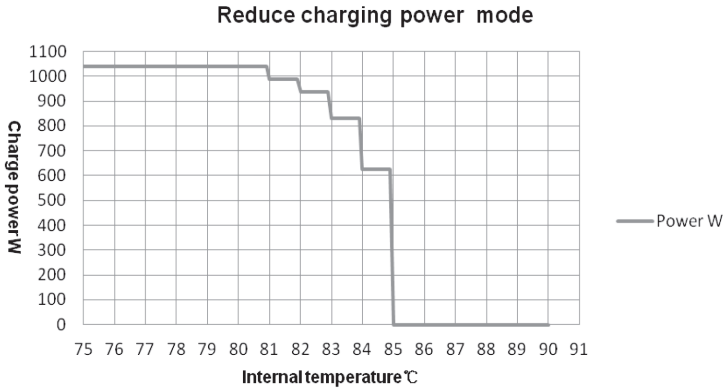
5.2 TROUBLESHOOTING

Possible Reasons	Fault Indication	Troubleshooting
PV Array Disconnnected	Charging LED indicator off during daytime when sunshine falls on PV modules properly	Confirm that PV wire connections are correct and tight
Battery Voltage is lower than 8V	Wire connection is correct, the controller is not working.	Please check the voltage of battery. At least 8V required to activate the controller.
Battery over Voltage	⚠  Battery level shows full, battery frame and fault icon blink.	Check if battery voltage is higher than the OVD (over voltage disconnect voltage) and disconnect the PV.

CAUTION

When the internal temperature of the controller is higher than 85 °C, the controller will experience a 5% drop-off in performance for every degree above 80 °C. For example, 84 °C would see the controller lose 20% of its maximum output. If the controller reaches 85 °C, it will stop operation until the temperature drops to below 75 °C. See Figure 4.2.

Figure 4.2



Battery over Discharged	 Battery level shows empty, battery frame and fault icon blink	When the battery voltage is restored to or above the LVR (low voltage reconnect voltage), the load will recover.
Battery Overheating	 Battery frame and fault icon blink	The controller will automatically turn the system off. When the temperature declines to below 55 ºC, the controller will resume.
Controller Overheating	PV/BATT indicator fast flashing -See Figure 4.2 reduce charging mode	When the heatsync of controller exceeds 85˚C, the controller will automatically cut off input and output circuit. When the temperature below 75˚C, the controller will resume operation.
System Voltage Error		① Check whether the battery voltage matches with the controller working voltage. ② Please change to a suitable battery or reset the working voltage.
Load Overload	Reduce load connected to the controller	① Please reduce the number of loads connected to the load circuits of the controller. ② Restart the controller.
Load Short Circuit	 Load and fault icon blink	① Check carefully loads connection, clear the fault. ② Restart the controller. ③ Carefully check load connections before continuing operation.

5.3 MAINTENANCE

The following maintenance checks are recommended to be carried out at least every 6 months for optimal performance.

- Make sure the controller is securely mounted in a clean dry environment.
- Ensure the unit has good ventilation present on all sides.
- Check all terminals are tight, no broken cables or burnt wire connections from poor connections and inspect cables for any corrosion present and clean accordingly.
- Check the unit is functioning correctly with the correct LED indicators. Keep any eye out for any error codes requiring further trouble shooting.
- Confirm that all the system components are grounded correctly.
- Confirm that all the terminals have no corrosion, insulation damage, ensure cables are not burnt or discoloured, and tighten terminal screws.

WARNING

Risk of electric shock!
Make sure that all the power is turned off before above operations,and then follow the corresponding inspections and operations.

6. TECHNICAL SPECIFICATIONS

Enerdrive Part No.	EN43510	EN43520	EN43530	EN43540
Nominal Voltage Range	12/24VDC Auto①			
Battery Voltage Range	8 ~ 32V			
Maximum Battery Current	10A	20A	30A	40A
Load Current Rating	10A	20A	30A	40A
Maximum PV open circuit voltage	100V② 92V③			
MPPT Voltage Range	(Battery Voltage +2V) ~ 72V			
Maximum PV Array Power Recommended	150W/12V 300W/24V	300W/12V 600W/24V	450W/12V 900W/24V	600W/12V 1200W/24V
Maximum PV Array Power Allowed (Overdrive)	180W/12V 360W/24V	360W/12V 720W/24V	540W/12V 1080W/24V	720W/12V 1440W/24V
Efficiency (Maximum)	98.20%	98.30%	98.60%	98.60%
Self-Consumption	≤30mA (12V)			
Temperature Compensate Coefficient④	-3mV/°C/12V(Default)			
Grounding	Common negative			
RS485 interface	5VDC/200mA (RJ45)			
LCD Backlight Timeout	Default: 60S, Range,: 0~999S (0S: the backlight is ON all the time)			
Environmental Parameters				
Environmental Temperature⑤	-25°C ~ +50°C			
LCD Backlight Timeout	-20°C ~ +70°C			
Relative Humidity	≤95%, N.C.			
IP Rating	IP33			
Dimensions (mm) LxWxH	175x143x48	217x158x56.5	230x165x63	255x185x67.8
Mounting Hole Dimensions (mm)	120x134	160x149	173x156	200x176
Mounting Hole Size	Φ5mm			
Maximum Cable Size	12AWG (4mm^2)	6AWG (16mm^2)	6AWG (16mm^2)	6AWG (16mm^2)
Recommended Cable Size	12AWG (4mm^2)	10AWG (6mm^2)	8AWG (10mm^2)	6AWG (13.2mm^2)

① When lithium battery is used, the system voltage can't be identified automatically.
② At minimum operating environment temperature.
③ At 25°C environment temperature.
④ When lithium battery is used, the temperature compensate coefficient must be 0, and can't be changed.
⑤ The controller can full load working in the environment temperature. When the internal temperature reaches 81°C, the reducing charging power mode is turned on.

CERTIFICATION

Safety	EN/IEC62109-1, UL1741, CSA C22.2#107.1
EMC (Emission immunity)	EN61000-6-3/EN61000-6-1
FCC	47 CFR Part 15, Subpart B
Performance & Function	IEC62509
ROHS	IEC62321-3-1

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