

DC DC Battery Charger

With Solar MPPT Input

01.9x.250

更改记录

Revision History

版本号 Revision	作者 Author	日期 Date	审核 Auditing	说明 Description
V1.0	李刚	2022-4-7		Initial version

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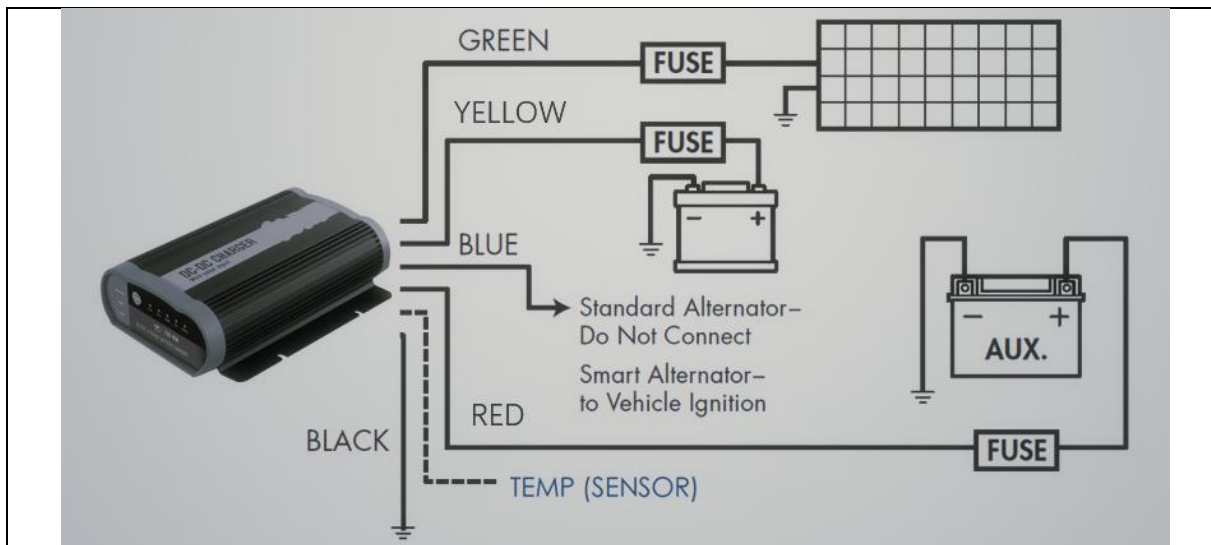
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1. 产品基本规格 Basic Specifications

产品轮廓 Product Appearance

产品轮廓 Product Appearance	
输入电压范围 Input Voltage Range	5-32V DC
发电机工作电压范围 Operating Voltage of Alternator System	12V/24V Alternator 9-32V DC
太阳能工作电压范围 Operating Voltage of Solar System	10-32V DC
最大输入电流 Maximum Input Current	27A max
最大持续充电电流 Maximum Continuous Charging Current	25A
最大输出功率 Maximum Output Power	300W
静态漏电流 No load Current Draw	<15 mA
典型效率 Typical Efficiency	满载整机效率>93%（不包括线损） >93% when full load (Cord Damage Excluded)
可充电电池类型 Compatible Battery Type	12V STD, GEL, AGM, CAL, LiFePO4
起充电压 Minimum O/P Battery Voltage	4V for STD,GEL,AGM,CAL 0V for LiFePO4
可充电电池容量 Battery Capacity	50-500Ah
工作环温 Working Temperature Range	-20~80°C
尺寸 Dimensions	151*121*44mm
重量 Weights	870g
防水等级 IP Rating	IP66

2. 安装图 Product Installation



3. 人机界面 Human Machine Interaction



Alternator: 通过常亮指示发电机是否接入，闪烁指示发电机是否输出功率。
Solid on indicates alternator access and flash indicates power output of alternator.

Solar: 通过常亮指示太阳能电池板是否接入，闪烁指示太阳能电池板是否输出功率。
Solid on indicates solar panel access and flash indicates power output of solar panel.

Fault: 错误指示灯。
light indicates operating fault.

MODE: 长按（2~4s）选择所需充电的电池类型；选择到对应档位，其指示灯常亮。系统记忆上次的设置值，出厂默认选项为 STD。
Press and hold the button for 2 ~ 4 seconds to change different battery charging profile and the corresponding LED will be solid on. The battery type is recorded by memory function for use the next time. (Default: STD)

4. 基本功能 Product Functions

4.1 12V/24V 发电机充电功能 12V/24V Charging from Alternator

4.1.1 开启和关断门槛 Threshold Voltage: Cut-in, Cut-out and Shut-down

Alternator 作为输入源充电时，充电器会充电 2min，停止 2s，2s 时间用来检测输入端电池的真实电压。此电压若低于 V_cut-out 电压值，则充电器停止充电，若高于 V_cut-out，则继续充电。充电过程中，若 Alternate 电压低于 Shut_down 门槛值，则直接停止充电。

When alternator is applied as input source, the charger firstly charges for 2 minutes then stops for 2 seconds to check actual voltage of input battery:

When the voltage $< V_{\text{cut-out}}$, the charger stops charging after 2-second check.

When the voltage $> V_{\text{cut-out}}$, the charger continues charging after 2-second check.

In the charging process, when alternate voltage $< \text{Shut_down}$, the charger stop charging immediately.

Note:

V_cut-in: 充电器开始充电的门槛电压。

Threshold Voltage when charger starts charging.

V_cut-out: 充电器停止充电的门槛电压。

Threshold Voltage when charger stops charging.

Shut_down: 充电过程中停止充电的门槛电压。

Threshold Voltage for charger to immediately stop charging.

Ignition:

标准发电机：连接线悬空。

12V/24V Standard Alternator: Ignition input is floating.

智能发电机：连接线接汽车发电机，当汽车发动机点火启动时，产品才可以工作。

12V/24V Smart Alternator: Ignition input is connected to vehicle ignition terminal.

Charger starts charging when the engine turns on.

Input	V_cut-in	V_cut-out	Shut_down
12V Standard Alternator	13.1V	12.8V	9.0V
24V Standard Alternator	26.2V	25.6V	20.0V
12V Smart Alternator	12.0V	11.8V	9.0V
24V Smart Alternator	24.0V	23.6V	20.0V
Ignition			
最低有效输入电压 Minimum voltage of ignition input	10.0V		

注意：以上表格所有的电压点都是以充电器内部端子电压值为判断标准，实际带负载测试时，由于线压降的存在某些值可能与实际测试值存在偏差。

Note: All voltages mentioned above are based on the voltage of charger inner terminals. During load test, difference could be exist due to line drop.

4.1.2 发电机过压锁定 Alternator Over-voltage Lock

充电器程序设定的 12V Alternator 有效输入电压范围为 9-18V，若充电器检测到电压大于 18V，则会被锁定为 24V Alternator，即使电压回落到 18V 以下，充电器仍旧以 24V Alternator 的电压点作为开启门槛。若要重新使用 12V Alternator 让充电器工作，则需要先让充电器掉电再重新上电。

The charger is recognized that effective input voltage range of 12V alternator system is 9-18V. When voltage is above 18V, the alternator system is regarded as 24V alternator which means charger will work based on V_Cut-in of 24V alternator even if the voltage goes back below 18V again. For working by 12V alternator system again, please disconnect the charger first and then power it on.

4.2 太阳能电池板充电功能 Charging from Solar Panels

4.2.1 开启和关断门槛 Threshold Voltage: Cut-in, Cut-out and Shut-down

Input	V_cut-in	Shut_down
太阳能电池板工作门槛 Threshold Voltage (Solar Panels)	12V	10.0V
太阳能电池板最小输出功率 Minimum Output Power (Solar Panels)	15W	

太阳能电池板达到 V_cut-in,充电器开始追踪电池板最大功率，给辅助电池充电，充电过程中，电池板电压低于 Shut_down 门槛值，则会重新搜索或转去 Alternator 充电。若电池板输出功率不足，且产品 Alternator 输入端不满足充电条件，连续追踪 5 次，若失败则进入 Stand-By 模式，等待 5min 后再次尝试。

When solar panels output voltage reaches V_Cut-in, the charger starts to track maximum power of solar panels. During this mppt charging, if solar panels voltage is below the Shut_down threshold, the charger will retry or stop track and draw power from alternator. When the solar panel output is too weak to charge and the alternator input also can not reach the charging threshold, the charger will turn to Stand-by mode if it fails to tracking 5 times. The charger will restart to track in the next 5 minutes.

4.2.2 太阳能优先功能 Solar Priority Function

当发电机和太阳能电池板都能够满足充电条件，充电器根据实际太阳能电池板的输出功率优先选择使用太阳能电池板充电。充电器内部设定的优先级的功率门槛为 200W.

When the alternator input and solar input both reaches the charging threshold, the charger will be draw power from solar input prior. If the solar panel output watts below 200W, the charger will be charging from alternator input.

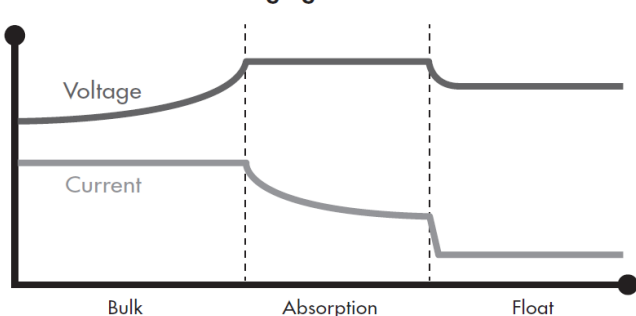
4.3 辅助电池充电 Auxiliary Battery Charging

4.3.1 不同类型电池充电电压 Maximum Charging Voltages of Different

Batteries Types

充电器的设计是为了给 12V 铅酸电池和磷酸铁锂电池充电，充电方式为 3 段式，即 Bulk, Absorption and Float.

This charger is designed for charging 12V lead-acid or LiFePO4 (LFP) batteries with 3 stages charging process, including Bulk, Absorption and Float stages.

Charge type	3 stage				
	<div> <div>Charging Process</div>  </div>				
Battery type	STD	GEL	AGM	CAL	LiFePO4 (BMS)
Absorption Voltage	14.4V	14.1V	14.7V	15.3V	14.5V
Float Voltage	13.4V	13.5V	13.4V	13.6V	13.6V
Absorption to Float stage	<p>满电电流<2.6A Absorption 结束，充电器进入 float 阶段后会关闭输出，让电池静置 3min 待电压稳定，若电池电压低于相应电池类型浮充电压 0.3V，则进入 Bulk 阶段重新充电。 The charger will turn to float stage if charging current below 2.6A in absorption stage. After 3 minutes, if the battery voltage is below the corresponding Float Voltage 0.3V, the charger will go back bulk stage continue charging.</p>				

4.3.2 充电指示 Indicators for Charging

Definition of led:

Long flash: 1.0s off, 2.0s on, 1.0s off...

Short flash: 0.5s off, 0.5s on, 0.5s off...

Solid: Continuous on...

Alternator (green)	Solar (green)	Battery Type (green)	Fault (red)	Charging Stage
Short flash	Solid	Solid	off	Bulk or Absorption
Long flash	Solid	Solid	off	Float
Solid	Short flash	Solid	off	Bulk or Absorption
Solid	Long flash	Solid	off	Float

4.3.3 锂电充电程序 LiFePO4 Battery Charging

锂电 BMS 保护后的激活：当电池类型选择为 LiFePO4，充电器会每隔 1min 执行一次电池激活程序，若电池端开路或短路异常，则会进入 Stand-By 模式，等待下一次激活。若激活成功，则会以 3 段式充电程序开始充电。

注意：LiFePO4 档位 0°C 以下充电可能会对电池造成不可逆伤害。

How to activate BMS-protected lithium battery?

When the battery type is LiFePO4, the charger will activate pulse charge program every one minute. And if activating successfully, the charger continues to charging. It will be turned to Stand-by mode if the battery is open-circuit or short-circuit.

Note: Charging LiFePO4 Battery below 0°C may cause unpredictable damage of battery.

4.3.4 外部电池温度补偿 Battery Temperature Compensation

外部温度探头用来检测被充电电池的温度，为了防止高温和低温下充电对铅酸电池寿命的影响，充电器会对最高充电电压进行温度补偿。补偿的标准是基于常温的充电电压 $\pm 18mV/^\circ C$ 。高温时，充电电压会低于常温充电电压，低温时充电电压会高于常温充电电压。

External temperature sensor is applied for detecting the temperature of auxiliary battery. To achieve long life-span of auxiliary battery when charging at a high or low ambient temperature, the charger compensates the maximum charging voltage. The standard compensation is based on the maximum charging voltage under room temperature $\pm 18mV/^\circ C$. At high ambient temperature, the maximum charging voltage will be lower.

4.3.5 电流降额 Current Derating

充电器的设计考虑到产品安装在发动机仓可能会承受较高的环境温度，因此，充电器可以工作的环境温度高达 80°C。产品的高功率密度设计会带来充电器的高温电流

降额。产品的降额逻辑为充电器检测功率器件的温度，当温度高于100℃时，充电电流降额一档，低于80℃时电流恢复上一档。

The charger is designed for a variety of installation environments, including chassis rail, engine cabin, driver cabin and etc. The charger uses advanced technology so that the product can work at the shaking, wet, dusty and muddy environment. The charger is as thin as 43mm and it can work up to 80℃, so it can be installed in the engine cabin.

When the charge works at a high ambient temperature, the derating logic is base on the value of inner power devices temperature. When the power device temperature $> 100^{\circ}\text{C}$, charging current is derating to a lower rate and when the temperature $< 80^{\circ}\text{C}$, it will be back to the previous charging rate.

降额电流分 5 个电流档：25A/20A/15A/10A/OTP

There are 5 current rates for derating: 25A/20A/15A/10A/OTP

由于产品输入电压范围较宽，不同的电压工作点效率不一致、不同的电压工作点最高的发热功率器件的不同，导致同一环境温度下，不同的工作电压点充电电流会存在差异。

The charger has a wide input voltage range. Differences of convert efficiency will lead a discrepancy charging current even at same working temperature.

5. 保护逻辑 Protections

5.1 输入输出过压保护 Over-voltage Protection

当产品输入 Alternator 电压 $>33\text{V}$ ，或 Solar 电压 $>33\text{V}$ ，或输出电压 $>16\text{V}$ ，产品进入过压保护模式，fault 指示灯亮。

注意：若输入、输出、ignition 电压高于 35V，则产品可能会发生永久性的损坏。

When input voltage (Alternator or Solar) $>33\text{V}$ or output voltage $>16\text{V}$, over-voltage protection is activated and indicated by Fault Light.

Note: When input or output or ignition voltages $>35\text{V}$, it could be cause permanent damage to charger.

5.2 反接保护 Reverse Protection

产品内部有反接保护电路，产品的供电源较多，反接的种类可能包括单独的输入输出反接、**输入正接输出反接**、**输入反接输正接**、输入端又分为 Alternator 和 Solar，所有反接可有效保护，但是某些情况下不会报错，产品也不能工作。

Reverse protection included below conditions: Input Reverse plus Output Reverse、Input Normal plus Output Reverse、Input Reverse plus Output Normal.

Note: Input types include alternator and solar. In some cases, reverse fault would not be indicated.

5.3 过温保护 Over-temperature Protection

当环境温度高于 80~100℃时，产品会高温报错，具体的温度点取决于产品工作时的输入电压点。

When the ambient temperature rises up to 80~100℃, over-temperature fault is indicated.

5.4 报错指示 Fault Indication

产品报错通过 fault 指示灯和 Alternator、Solar、Battery type 指示灯组合实现。Faults are indicated by alternator, solar, battery type and fault LED.

Definition of led:

Quick flash: 1.8s off, 0.2s on, 1.8s off...

Alternator (green)	Solar (green)	Battery Type (green)	Fault (red)	Trouble	Solution
Quick flash	off	Quick flash	off	Low voltage detected at Alternator input	Check alternator input voltage
off	Quick flash	Quick flash	off	Low voltage detected at Solar input	Check Solar Input voltage
Quick flash	Quick flash	Quick flash	off	Low voltage detect at Alternator and Solar input	Check voltage of both alternator and solar input
Quick flash	off	off	Quick flash	High voltage detected at Alternator input	Check alternator input voltage
Off	Quick flash	off	Quick flash	High voltage detected at Solar input	Check solar input voltage
off	off	Quick flash	Quick flash	High voltage detected at Output	Check auxiliary battery voltage
Off	Off	Off	Quick flash	Over temperature	Let the unit cool down for some time or get better ventilation