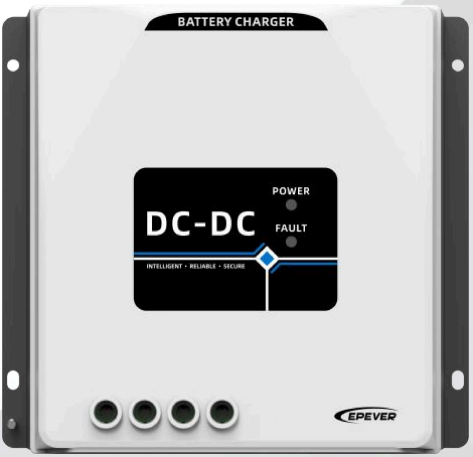
USER MANUAL



DUC SERIES

DC-DC Battery Charger

DUC3011, DUC4011, DUC5011

EN

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Preface

Copyrights

Authorized Manufacturer: Huizhou EPEVER Technology Co., Ltd.

Disclaimers

Before using the product, please read this manual carefully to ensure you fully understand the product and can use it correctly. Please keep this manual properly for future reference after reading. Improper use of this product may cause serious injury to you or others, or result in product damage and property loss. By using this product, you are deemed to have understood, acknowledged, and accepted all terms and contents in this manual. BEIJING EPSOLAR TECHNOLOGY CO., LTD. shall not be liable for any losses caused by the user's failure to use the product in accordance with this manual.

The warranty does not apply to the following conditions:

- Damage caused by improper use or inappropriate environments (such as the humid, salt spray, corrosive, greasy, flammable, explosive, dust accumulative or other harsh environments).
- The actual current/voltage/power exceeds the limit value of the charger.
- Damage caused by operating temperature exceeding the rated temperature range.
- Electric arc, fire, explosion and other accidents caused by failure to follow charger labels or manual instructions.
- Unauthorized disassembly and maintenance of the charger.
- Damage caused by force majeure such as lightning strikes, rainstorms, mountain torrents and utility failures.
- Damage occurred during transportation or loading/unloading the charger.

Scope of application

This user manual describes the installation, electrical connection, commissioning, maintenance and troubleshooting of the DUC series DC-DC battery charger (hereinafter referred to as "charger"). The DUC series includes the following product models:

DUC3011, DUC4011, DUC5011

This manual is only intended for professionals who are familiar with local regulations, standards and electrical systems, have received professional training, and know the product well.

Symbol definition

To ensure the user's personal and property safety during operation, as well as the efficient use of this product, relevant safety instructions are provided in the manual and highlighted with the corresponding symbols. To prevent personal injury and property damage, please fully understand and strictly follow these highlighted information. The symbols used in this manual are as follows:

DANGER

Indicates a high-level hazard that, if not avoided, will result in serious injury or death.

WARNING

Indicates a medium-level hazard that, if not avoided, could result in death or serious injury.

CAUTION

Indicates a low-level hazard that, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates an important reminder during the operation which, if ignored, may result in an equipment error alarm.

Tip	Indicates recommendation for reference.
	Read through the user manual before any operations.

Important Safety Instructions

Please keep this manual for future reference.

- Read all the instructions and warnings carefully in the manual before installation.
- No user-serviceable components inside the charger, do not attempt to disassemble or repair the charger.
- Install the charger indoors to avoid component exposure and water ingress.
- Install the charger in a well-ventilated place, the heat sink temperature will be very high during operation.
- Do not install the charger in the humid, salt spray, corrosive, greasy, flammable, explosive, dust accumulative or other harsh environments.
- It is recommended to install the proper fast-acting fuses/breakers externally.
- Disconnect PV array connections and the battery fast-acting fuse/breakers before charger installation and adjustment.
- Check whether the wiring is tight to avoid the danger caused by heat accumulation due to loose connection.
- The entire system should be installed and operated by professional personnel.

1 General Information

1.1 Product overview

The DC-DC battery charger adopts the all-digital intelligent design, featuring fast response speed and high reliability.

The charger has three operating modes: charging mode, power supply mode, and reverse charging mode. It is suitable for various application scenarios.

The charging mode adopts an adaptive three-stage charging mode controlled by digital circuits, which can extend the service life of the battery and improve system performance. The input side adopts generator start-stop detection logic to ensure normal charging even when the generator operates under low voltage and low power conditions, thus improving the energy utilization efficiency of the generator. It is compatible with smart/Euro 6 generators or traditional generator types, providing more friendly and comprehensive adaptation to various generator types.

The power supply mode provides a wide-range stabilized voltage output. The charger output can directly drive the load without batteries.

The reverse charging mode enables the house battery to charge the starter battery, effectively solving the problem of insufficient power in the starter battery and ensuring its normal operation.

With the functions such as the charging current limit, charging power limit and automatic reduction of charging power at high temperature, the charger can ensure the system stability when it is connected to the excess generators and operating at high temperature.

Excellent low power design significantly reduces static power consumption and extends system standby time.

The charger adopts a dust-proof and water-proof design, which enhances its reliability and adaptability, and extends its service life.

The charger is equipped with a CAN communication port with the RV-C communication protocol. It has RS485 communication interface, and can be connected with optional 4G, WiFi and other modules to achieve remote monitoring via the APP or cloud platform.

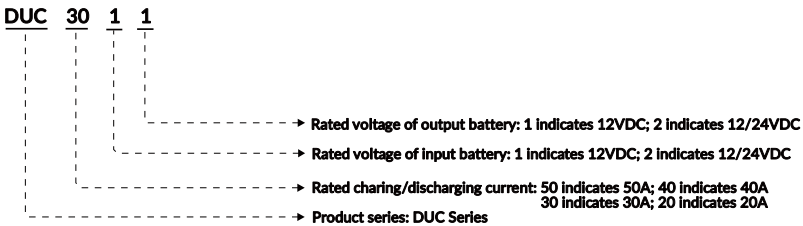
The charger also has comprehensive electronic protections for overcharge, over discharge and short circuit etc, to ensure the safety, stability and long-lasting operation of the system. The charger can be widely used for RV systems equipped with dual battery systems.

Features

- Multiple operating modes for different application scenarios
- Generator start-stop detection logic for enhanced generator energy efficiency
- Supporting multiple generator types, including smart/Euro 6 generators
- Conversion efficiency up to 98.1%

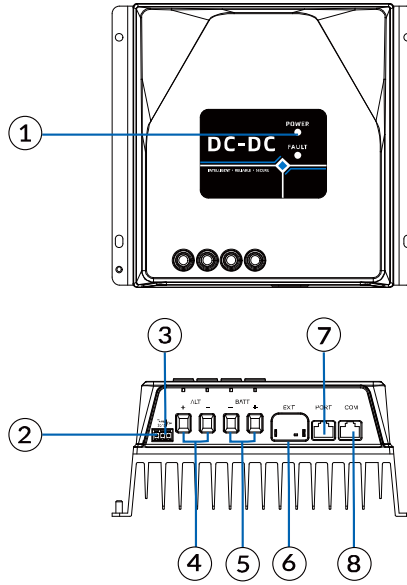
- Multi-stage charging curve algorithm
- House battery supports various battery types, including lithium batteries
- Stable self-activation for lithium batteries
- Dual limits for input and output power, and current
- Protection level IP32
- Natural cooling for heat dissipation, and low noise operation
- RS485/CAN communication
- Comprehensive electronic protections
- Energy statistics
- Compliant with IEC62477-1, EMC and other relevant standards

Naming rules



1.2 Product exterior

1.2.1 Appearance and ports



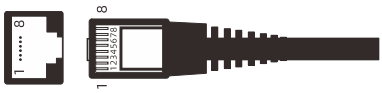
No.	Description	No.	Description
1	Indicator (see Subsection 1.2.2)	5	BATT port
2	Remote temperature sensor (RTS) port(1)	6	Bluetooth expansion hub
3	Smart generator D+ signal port (0–32V)(2)	7	PORT COM port (CAN communication)(3)
4	ALT port	8	COM: RS485 COM port (RJ45, 5VDC/200mA)(4)

(1) Connect an external temperature sensor (model: RT-MF58R47K3.81B) through **port 2** to detect the ambient temperature, or connect a remote temperature sensor (model: RTS300R47K3.81A) to detect the battery temperature. **Note:** If the temperature sensor is not connected to the charger, the default temperature for battery charging is 25℃ without temperature compensation.

(2) When “D+ signal control enable” is set to “YES”, D+ input signal above 5V is high level to enable charging, and D+ input signal below 2V is low level to disable charging. When “D+ signal control enable” is set to “NO”, D+ signal does not participate in control.

(3) CAN communication, RV-C protocol, and it can be connected to RV System with the RV-C protocol. It can also be customized for LIN and CI-BUS communication protocols.

The pin definitions are as follows:

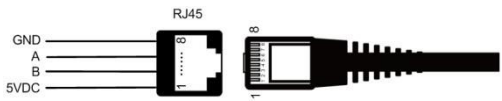


1-+5VDC
4-CAN-H
5-CAN-L
8-GND

Pin	Definition	Pin	Definition
1	+5VDC	5	CAN-L
2	/	6	/
3	/	7	/
4	CAN-H	8	GND

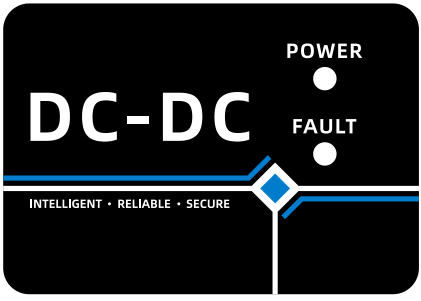
(4) RS485 communication port adopts the MODBUS communication protocol, and it can be connected to computer cloud platforms, WiFi, Bluetooth, TCP, 4G and other modules to enable remote monitoring.

The pins of the RS485 interface (RJ45) are defined as follows:



Pin	Definition	Pin	Definition
1	+5VDC	/	/
/	/	6	RS485-A
3	RS485-B	/	/
/	/	8	GND

1.2.2 Indicators

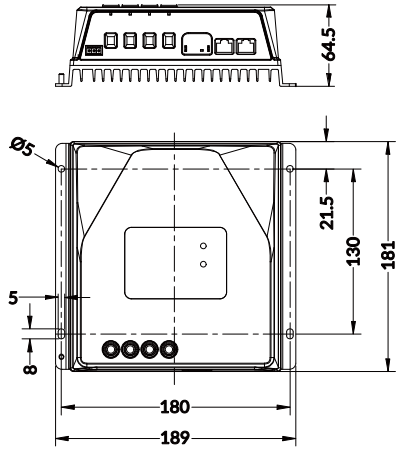


Indicator	Color	Status	Description
POWER	Green	Solid ON	Normal ALT input connection, but no charging.
		Shutter flashing (0.1s on 2s off)	Sleep mode
		Slowly flashing (1s on 1s off)	Normal output
FAULT	Red	Solid ON	Battery over temperature, device over temperature
		Slowly flashing (1s on 1s off)	ALT undervoltage protection, BATT undervoltage protection
		Fast flashing (0.3s on 0.3s off)	ALT overvoltage protection, BATT overvoltage protection
		Long flashing (2s on 0.1s off)	Short circuit protection
		OFF	Sleep mode, normal output

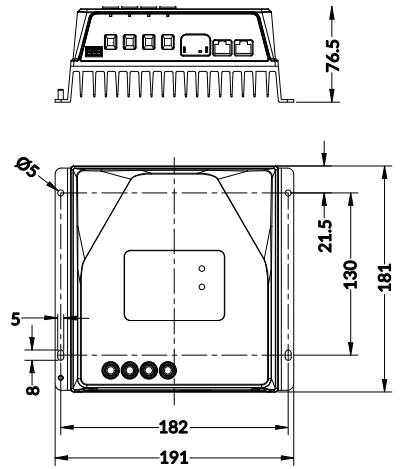
1.2.3 Dimensions

Unit: mm

DUC3011



DUC4011, DUC5011

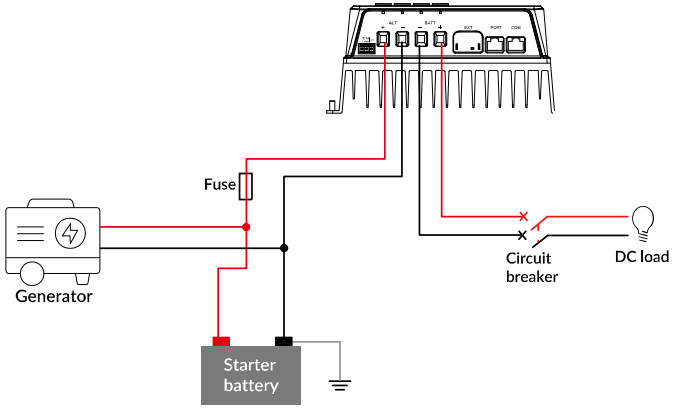


1.3 System schematic diagram

- **No battery mode-power supply mode**

When there is no battery, the charger can be connected to the DC load directly. The DC load must be connected to the output terminals of the charger.

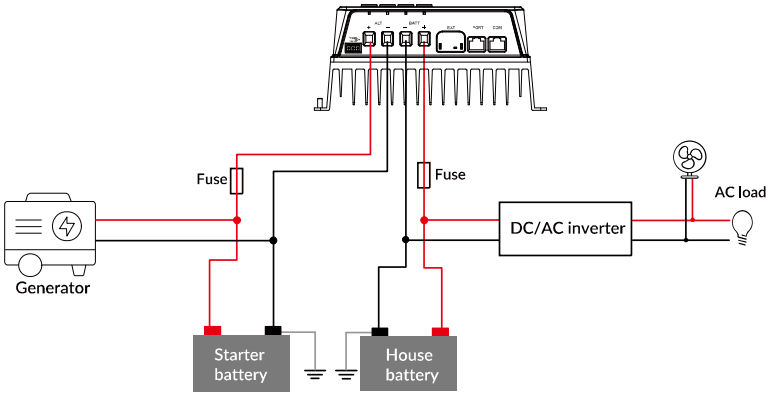
Note: Set the operating mode to power supply mode.



- **Battery mode-charging mode and reverse charging mode**

In a system with battery connected, if you need to connect an inverter, please connect the inverter directly to the battery pack.

Note: Set the operating mode to charging mode or reverse charging mode.



2 Installation and Connection

2.1 Precautions

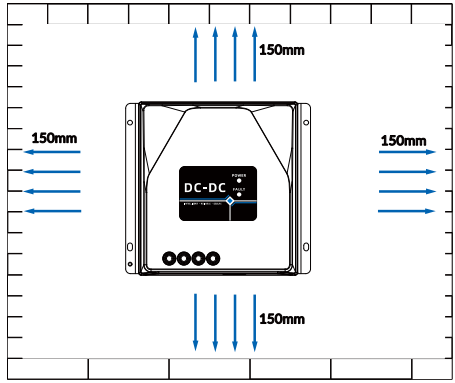
- Be careful when installing the batteries. Wear protective goggles when installing flooded lead-acid batteries, and rinse with clean water in time once in contact with battery acid.
- Keep the battery away from any metal objects to prevent battery short circuit.
- Acidic gases may be generated when charging the battery, ensure that the environment is well ventilated.
- Avoid direct sunlight and rain infiltration for outdoor installation.
- Do not install the charger in the humid, salt spray, corrosive, greasy, flammable, explosive, dust accumulative or other harsh environments.
- Loose power connections and corroded cables may result in high heat, melting cables insulation, burning surrounding materials, or even causing a fire. Ensure tight connections and secure cables with cable ties to prevent them from swaying while moving the charger.
- Charge the lead-acid and lithium-ion batteries that are within the control range of this charger only.
- Select the system connection cables according to the current density of no greater than 5A/mm^2.
- The stripped length for wiring should not be too long, and the exposed metal part of the wire should not protrude from the metal part of the terminal block.
- Please refer to IEC62109 for the cross-sectional area of the grounding wire, which should not be less than 4mm^2.

2.2 Installation requirements

Determine the installation position and heat-dissipation space

When installing the charger, ensure that there is enough air flow through the charger's heat sink, and leave at least 150mm of clearance above and below the charger to guarantee natural convection for heat dissipation.

Note: If the charger is mounted in a closed cabinet, ensure that heat can be dissipated through the cabinet.



2.3 Wire size

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

Recommended battery wire size

Battery wire size should be selected according rated current, please refer to the table below for wiring specifications.

Model	Rated Current	Wire Size
DUC3011	30A	10mm²/8AWG
DUC4011	40A	16mm²/6AWG
DUC5011	50A	16mm²/6AWG

NOTICE

The wire size is only for reference. If there is a long distance between the charger and the battery, thicker cables can be used to reduce the voltage drop and improve system performance.

2.4 Device connection

⚠ DANGER

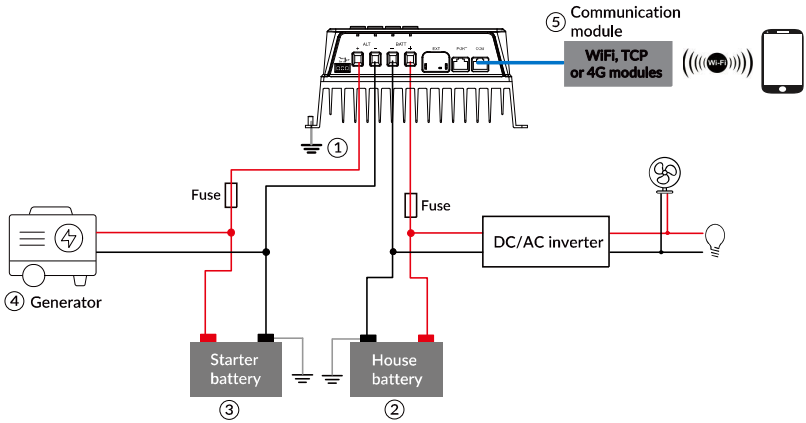
Risk of explosion! Never install the charger in the enclosed space with flooded batteries! Do not install it in a confined area where battery gas can accumulate either.

NOTICE

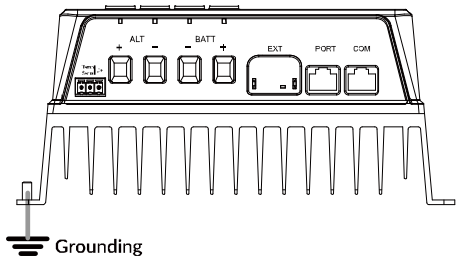
- DUC series chargers have no battery reverse protection. Do not reverse the battery during the wiring. Otherwise, the charger may be damaged.
- When installing the charger, ensure that there is enough air flow through the charger's heat sink, and leave at least 150mm of clearance above and below the charger to guarantee natural convection for heat dissipation. If the charger is mounted in a closed cabinet, ensure that heat can be dissipated through the cabinet.

Connect the charger in the sequence of "①Ground > ②③Battery > ④Generator > ⑤Communication modules", and disconnect the charger wiring in the reverse order of the following diagram.

The following wiring diagram is illustrated with the appearance of "DUC5011". Please refer to the actual terminals position for correct wiring of other models.



2.4.1 Connecting the ground cable (PE)



DANGER

According to the practical application, the negative terminals of generator and battery can also be ungrounded, but the grounding terminal on charger's shell must be grounded, which may effectively shield the electromagnetic interference from the outside, and prevent some electric shock to human body due to the electrification of the shell.

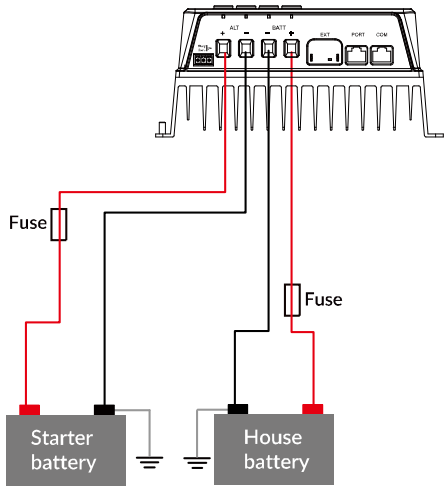
NOTICE

For common-negative system, it is recommended to use a common-negative charger. If a common-positive charger is used and the positive electrode is grounded in the common-negative system, the charger may be damaged.

2.4.2 Connecting the battery

NOTICE

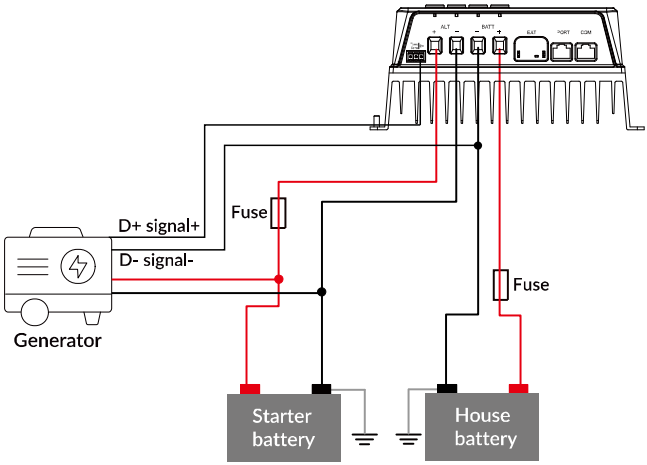
- Do not connect the circuit breaker or fast-acting fuse when wiring and ensure that the leads of "+" and "-" poles are connected correctly.
- A fast-acting fuse whose current is 1.25 to 2 times the charger's rated current must be installed on the battery side with a distance from the battery no longer than 150mm.



2.4.3 Connecting the generator

NOTICE

There are various types of generators with complex output conditions. It is recommended to use the inverter generator. If non-inverter generators are used, they must be tested in practice before use.

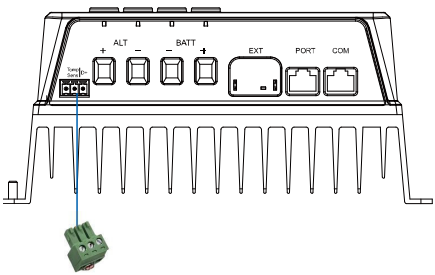


2.4.4 Connecting the accessories

a) Connect the temperature sensor

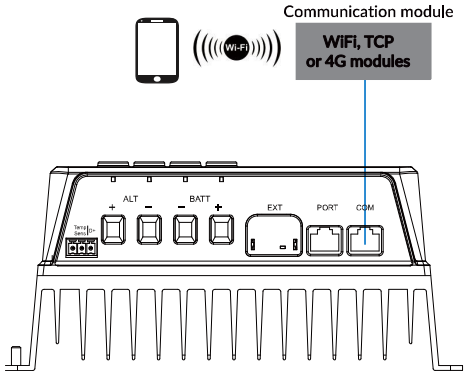
The charger can be connected to an external temperature sensor (model: RT-MF58R47K3.81B) through the Temp Sens port to detect the battery temperature.

Note: If the remote temperature sensor is not connected to the charger, the default temperature for battery charging is 25℃ without temperature compensation.



b) Connect the communication module

Connect the communication modules such as WiFi, Bluetooth, TCP or 4G modules to the RS485 COM port. You can remotely monitor the charger or modify its related parameters on the APP by phone. For specific setting methods, please refer to the user manuals of communication modules such as Cloud APP, WiFi, Bluetooth, TCP and 4G (4G module needs to be powered separately).



3 Operation

3.1 Checking before powering on

- Whether the charger is installed correctly and securely.
- Whether the terminal wirings are connected correctly.
- Whether the terminal polarities are connected correctly.
- Whether the communication module is connected correctly and securely.

3.2 Operating the device

Connect the house battery's fast-acting fuse to power on the charger, the POWER indicator normally displays. Connect the starter battery, then connect the generator. The charger starts charging when charging conditions are met. The POWER indicator is flashing slowly, and the FAULT indicator is solid OFF.

Tip	If the charger does not work properly or the fault indicator indicates after the charger is powered on, refer to Chapter 6 Troubleshooting.

3.3 Parameter setting

3.3.1 Parameters list

The default values and setting range of the charger parameters are shown in the following table, the parameters can be directly modified by the APP.

No.	Parameters	Default	User Define
1	Battery Rated Voltage	12V	Read-only
2	Overvoltage Disconnect Voltage	14.5V	User define: 9.0–17.0V
3	Charging Limit Voltage	14.3V	User define: 9.0–17.0V
4	Overvoltage Recovery Voltage	14.3V	User define: 9.0–17.0V
5	Equalization Charging Voltage	14.2V	User define: 9.0–17.0V
6	Bulk Charging Voltage	14.2V	User define: 9.0–17.0V
7	Float Charging Voltage	13.3V	User define: 9.0–17.0V

8	Bulk Recovery Voltage	13.0V	User define: 9.0–17.0V
9	Low Voltage Recovery Voltage	12.8V	User define: 9.0–17.0V
10	Undervoltage Alarm Recovery Voltage	12.2V	User define: 9.0–17.0V
11	Undervoltage Alarm Voltage	12.0V	User define: 9.0–17.0V
12	Low Voltage Disconnect Voltage	11.3V	User define: 9.0–17.0V
13	Discharging Limit Voltage	11.0V	User define: 9.0–17.0V
14	Bulk Charging Time	120Min	User define: 0–180Min
15	Equalization Charging Time	120Min	User define: 0–180Min
16	Battery Type	LFP4S	AgM, GEL, FLD, LFP4S, LNCM3S, USER **Note:** After setting the parameter, restart the charger for the setting to take effect.
17	Battery Capacity	100Ah	User define: 5–10,000Ah **Note:** To accurately display the battery capacity, you need to set this parameter according to the actual battery capacity.
18	Temperature Compensation Coefficient	0	User define: -9 to 0
19	Lithium Battery Protection	YES	User define: YES (enable), NO (disable) **Note:** For non-lithium batteries, the battery type is disabled by default and cannot be modified; for lithium batteries, the battery type is enabled by default and cannot be modified. Only the "USER" battery type can be configured.
20	Li-Bat Low Temperature Charging Limit	-5℃	User define: -25℃ to 10℃ **Note:** This parameter takes effect after "Lithium Battery Protection" is set to "YES". The battery will stop charging when the battery temperature is less than this value.

21	Li-Bat Low Temperature Discharging Limit	-20℃	User define: -45℃ to 10℃ **Note:** This parameter takes effect after "Lithium Battery Protection" is set to "YES". The battery will stop discharging when the battery temperature is less than this value.
22	Manual Equalization	NO	User define: NO (equalization charging is disabled), YES (one equalization charging is triggered)
23	Power supply mode output current limit value	50A	Output current limit value at the BATT terminal in power supply mode. DUC5011: User define: 0–50A
		40A	Output current limit value at the BATT terminal in power supply mode. DUC4011: User define: 0–40A
		30A	Output current limit value at the BATT terminal in power supply mode. DUC3011: User define: 0–30A
24	Reverse charging mode input current limit value	50A	Input current limit value at the BATT terminal in reverse charging mode. DUC5011: User define: 0–50A
		40A	Input current limit value at the BATT terminal in reverse charging mode. DUC4011: User define: 0–40A
		30A	Input current limit value at the BATT terminal in reverse charging mode. DUC3011: User define: 0–30A

25	Charging mode output current limit value	50A	Output current limit value at the BATT terminal in charging mode. DUC5011: User define: 0–50A
		40A	Output current limit value at the BATT terminal in charging mode. DUC4011: User define: 0–40A
		30A	Output current limit value at the BATT terminal in charging mode. DUC3011: User define: 0–30A
26	Power supply mode Output voltage value	12V	Output voltage at the BATT terminal in power supply mode. User define: 10–17V
27	Charge Start Delay Time	1S	In charging mode and power supply mode, when the ALT meets the output conditions after powered on, the output will be enabled after a delay of this value. User define: 1–60S
28	ALT Maximum Power	700W	Maximum output power at the ALT terminal in charging mode and power supply mode. DUC5011: User define: 10–700W
		560W	Maximum output power at the ALT terminal in charging mode and power supply mode. DUC4011: User define: 10–560W
		420W	Maximum output power at the ALT terminal in charging mode and power supply mode. DUC3011: User define: 10–420W

29	Power supply mode input current limit value	50A	Input current limit value at the ALT terminal in power supply mode. DUC5011: User define: 0–50A
		40A	Input current limit value at the ALT terminal in power supply mode. DUC4011: User define: 0–40A
		30A	Input current limit value at the ALT terminal in power supply mode. DUC3011: User define: 0–30A
30	Reverse charging mode output current limit value	10A	Output current limit value at the ALT terminal in reverse charging mode. User define: 0–30A
31	Charging mode input current limit value	50A	Input current limit value at the ALT terminal in charging mode. DUC5011: User define: 0–50A
		40A	Input current limit value at the ALT terminal in charging mode. DUC4011: User define: 0–40A
		30A	Input current limit value at the ALT terminal in charging mode. DUC3011: User define: 0–30A
32	Reverse charging mode output voltage value	12.8V	Output voltage value at the ALT terminal in reverse charging mode. User define: 12.5–13V
33	Reverse charge duration	30Min	In reverse charging mode, reverse charging will stop after maintaining the set time. User define: 0–120Min **Note:** If the battery voltage reaches the

			“Reverse charging mode output voltage value”, reverse charging will stop after delay for 5 seconds, and this delay time will no longer be evaluated.
34	Power supply mode charging lock voltage	10.5V	In power supply mode, the output will be disabled when the input voltage at the ALT terminal is lower than this value. User define: 9–17V
35	Power supply mode charging lock recovery voltage	12.0V	In power supply mode, the output is enabled when the input voltage at the ALT terminal exceeds this value. User define: 9–17V
36	Generator Type	Smart Generator	User define: Smart Generator, Standard Generator, and User **Note:** After setting the parameter, restart the charger for the setting to take effect.
37	Generator Rated Voltage	12V	Read-only
38	D+ signal control enable	YES	User define: YES (D+ signal enabled for charge control, D+ input high level enables charging, low level stops charging), NO (D+ signal disabled and not involved in charge control) **Note:** D+ signal is only valid in charging mode.
39	Generator shutdown detection enable	YES	User define:YES (shutdown detection enabled; charging mode operates generator shutdown detection logic), NO (Disabled; shutdown detection logic is not allowed in charging mode)
40	Charging Mode Start Charging Delay Time	120S	User define: 0–120S
41	Charging mode off charging delay time	120S	User define: 0–120S
42	Charging mode charging start voltage	14V	User define: 9.0–17.0V When “Generator shutdown detection enable” is set to “YES”, charging will start if the ALT input voltage exceeds this set value.

43	Charging mode charging delay start voltage	13.3V	User define: 9.0–17.0V When “Generator shutdown detection enable” is set to “YES”, if the set value < ALT input voltage < charging mode charging start voltage, charging will start after the charging mode enables charging delay time.
44	Charging mode off charging voltage	13.1V	User define: 9.0–17.0V When “Generator shutdown detection enable” is set to “YES”, if charging mode charging lock voltage < ALT input voltage < the set value, charging will stop after the charging mode disables charging delay time.
45	Charging mode charging lock voltage	12.5V	User define: 9.0–17.0V Charging will stop immediately when ALT input voltage is lower than the set value. **Note:** When “Generator shutdown detection enable” is set to “YES”, charging will resume only when the ALT input voltage exceeds the charging mode charging start voltage. When “Generator shutdown detection enable” is set to “NO”, charging will resume when the ALT input voltage exceeds the charging mode charging lock recovery voltage.
46	Charging mode charging lock recovery voltage	12.8V	User define: 9.0–17.0V When “Generator shutdown detection enable” is set to “NO”, charging will start when the ALT input voltage exceeds the set value. **Note:** This function takes effect only when “Generator shutdown detection enable” is set to “NO”.
47	Operation Mode	Charging Mode	User define: Charging Mode, Power Supply Mode
48	Reverse charging mode enabled	NO	User define: NO (reverse charging mode is disabled), YES (reverse charging mode is enabled) **Note:** Reverse charging mode is only allowed in charging mode.

49	Battery Statistics Enabled	NO	User define: NO (battery statistics is disabled), YES (battery statistics is enabled) **Note:** After power statistics is enabled, data will be saved every 12 hours when the system is not charging and the current power is not zero.
50	Manual power accumulation recording enabled	Disable	User define: Enable (manual power accumulation recording is enabled), disable (manual power accumulation recording is disabled) **Note:** One accumulated power is recorded immediately after enabled.
51	COM Baudrate	1152	User define: 96, 1152 **Note:** After setting the parameter, restart the charger for the setting to take effect.
52	COM ID	2	User define: 1–32
53	Clear Fault	OFF	User define: ON (clear faults in device), OFF (do not clear faults)
54	Factory Reset	OFF	User define: ON (restore system to factory default settings), OFF (do not restore system to factory default settings)
55	Reset Energy Statistics	OFF	User define: ON (reset the energy statistics), OFF (do not reset the energy statistics)

3.3.2 Setting the operation modes

The charger provides charging mode, supply mode, and reverse charging mode. The operation mode can be configured via settings.

- **Mode 1: Charging Mode, for charging the house battery.**

In charging mode, the customer can charge the house battery. "Generator shutdown detection enable" is enabled by default (refer to Section 3.3.3 Generator shutdown detection for detailed charging logic), which improves generator adaptability and ensures normal operation across all power ranges. The battery charging adopts an adaptive three-stage charging mode, which can extend the service life of the battery.

When "Generator shutdown detection enable" is set to "NO", charging will start if the ALT input voltage exceeds the charging mode charging lock recovery voltage, and charging will stop if the ALT input voltage is lower than the charging mode charging lock voltage.

The device can limit the input and output current via the charging mode's input current limit and

output current limit, adapting to scenarios with different power.

⚠ WARNING

Charging mode does not support regulated voltage output and must not be directly connected to loads.

- **Mode 2: Power Supply Mode, for supplying power to DC loads as a voltage source.**

In power supply mode, the device can provide regulated output as a voltage stabilizer at the BATT port. The output voltage is adjustable (10V to17V) and can be directly connected to DC loads. The output is enabled when the ALT input voltage exceeds the power supply mode charging lock recovery voltage. The output is disabled when the ALT input voltage is lower than the power supply mode charging lock voltage.

The device can limit the input and output current via the power supply mode's input current limit and output current limit, adapting to scenarios with different power.

⚠ WARNING

If a house battery is connected in power supply mode, the output voltage must be set within the battery's operating voltage range; otherwise, the battery may be damaged. It is recommended to select charging mode for normal charging.

- **Mode 3: Reverse Charging Mode, for charging the starter battery from the house battery.**

The reverse charging mode must be selected manually. It is typically used when the starter battery cannot start the system, to support vehicle starting. The reverse charging mode is only allowed in charging mode.

The reverse charging will start when battery voltage at the BATT port exceeds the low voltage disconnect voltage. The reverse charging will stop when battery voltage at the BATT port is lower than the low voltage disconnect voltage. The reverse charging output voltage can be adjusted via the reverse charging mode's output voltage (12.5V to 13.0V), and the reverse charge operating time can be set via the reverse charging sustain time.

During reverse charging, when the battery voltage at the ALT port reaches the set reverse charging mode's output voltage or the set reverse charging time expires, the device will exit reverse charging mode and continue to operate in charging mode.

The device can limit the input and output current via the reverse charging mode's input current limit and output current limit, adapting to scenarios with different power.

⚠ WARNING

Reverse charging mode does not support regulated voltage output and must not be directly connected to loads.

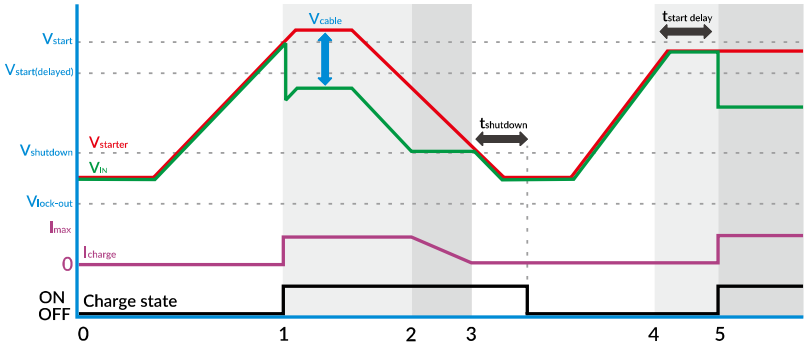
3.3.3 Generator shutdown detection

Generator shutdown detection is always enabled by default in any charging mode. When this function is disabled or power supply mode is selected, the generator is considered to be running, and no shutdown detection will be performed.

Generator type included “Smart Generator”, “Standard Generator”, and “User”. When “Smart Generator” and “Standard Generator” is selected, the default values for the smart generator will be applied to the generator shutdown detection settings. If the set parameters differ from the default values of the two generator options, the “User” option can be selected. The default type is “Smart Generator”.

Start and stop voltage ranges from 9V to 17V.

Generator shutdown detection logic:



- $V_{starter}$ refers to the generator output voltage.
- V_{IN} refers to the ALT input voltage.
- V_{cable} refers to the voltage drop on the cable.
- V_{start} refers to the charging start voltage of charging mode.
- $V_{shutdown}$ refers to the shutdown charging voltage of charging mode.
- I_{max} refers to the maximum charging current.
- $t_{shutdown}$ refers to the shutdown charging delay time of charging mode.
- $V_{start(delayed)}$ refers to the charging delay start voltage of charging mode.
- $t_{start\ delay}$ refers to the start charging delay time of charging mode.

0 to 1: If the generator is running, the alternator voltage will rise. Charging is enabled when $V_{starter} > V_{start}$.

1 to 2: The input current generates voltage (V_{cable}) across the input cable; this voltage reduces the voltage measured by the charger (V_{IN}). The charger operates at I_{max} if $V_{IN} > V_{shutdown}$.

2 to 3: If $V_{IN} \leq V_{shutdown}$, the charging current will be reduced to prevent V_{IN} from falling below $V_{shutdown}$.

3 to 4: If $V_{IN} < V_{shutdown}$ for more than 1 minute ($t_{shutdown}$), "Generator OFF" is detected and charging is disabled. Charging remains enabled if $V_{IN} > V_{shutdown}$ before the $t_{shutdown}$ time expires.

4 to 5: If $V_{start(delayed)} < V_{IN} < V_{start}$, charging is enabled after a configurable $t_{start\ delay}$.

The generator shutdown detection logic is only valid in charging mode and can be enabled or disabled via settings. It is enabled by default in charging mode.

3.3.4 Battery voltage control parameters

Note: Only use batteries connected to the BATT port.

a) Lead-acid battery parameters

Battery Type / Voltage Control Parameters	AGM	GEL	FLD	User define
Overvoltage Disconnect Voltage	16.0V	16.0V	16.0V	9–17V
Charging Limit Voltage	15.0V	15.0V	15.0V	9–15.5V
Overvoltage Recovery Voltage	15.0V	15.0V	15.0V	9–15.5V
Equalization Charging Voltage	14.6V	--	14.8V	9–15.5V
Bulk Charging Voltage	14.4V	14.2V	14.6V	9–15.5V
Float Charging Voltage	13.8V	13.8V	13.8V	9–15.5V
Bulk Recovery Voltage	13.2V	13.2V	13.2V	9–15.5V
Low Voltage Recovery Voltage	12.6V	12.6V	12.6V	9–15.5V
Undervoltage Alarm Recovery Voltage	12.2V	12.2V	12.2V	9–15.5V
Undervoltage Alarm Voltage	12.0V	12.0V	12.0V	9–15.5V
Low Voltage Disconnect Voltage	11.1V	11.1V	11.1V	9–15.5V
Discharging Limit Voltage	10.6V	10.6V	10.6V	9–15.5V
Equalization Charging Time*	120 minutes	--	120 minutes	0–180 minutes
Bulk Charging Time*	120 minutes	120 minutes	120 minutes	10–180 minutes

★ When the battery type is changed to lithium battery, the lithium battery protection is automatically enabled.

★ When the battery type is changed to “AGM, GEL or FLD”, the lithium battery protection is disabled.

When the default battery type is selected, the battery voltage control parameters can be modified based on its default parameters. If new battery voltage control parameters are re-entered, the battery type can be set to "USER". For the battery voltage control parameters, follow the logic below:

A. Overvoltage Disconnect Voltage > Charging Limit Voltage ≥ Equalization Charging Voltage ≥ Bulk Charging Voltage ≥ Float Charging Voltage > Bulk Recovery Voltage;

B. Overvoltage Disconnect Voltage > Overvoltage Recovery Voltage;

C. Low Voltage Recovery Voltage > Low Voltage Disconnect Voltage ≥ Discharging Limit Voltage;

D. Undervoltage Alarm Recovery Voltage > Undervoltage Alarm Voltage ≥ Discharging Limit Voltage;

E. Bulk Recovery Voltage > Low Voltage Recovery Voltage.

b) Lithium battery parameters

Battery Type / Voltage Control Parameters	LFP	
	LFP4S	User Define
Overvoltage Disconnect Voltage	14.5V	9–17V
Charging Limit Voltage	14.3V	9–15.5V
Overvoltage Recovery Voltage	14.3V	9–15.5V
Equalization Charging Voltage	14.2V	9–15.5V
Bulk Charging Voltage	14.2V	9–15.5V
Float Charging Voltage	13.3V	9–15.5V
Bulk Recovery Voltage	13.0V	9–15.5V
Low Voltage Recovery Voltage	12.8V	9–15.5V
Undervoltage Alarm Recovery Voltage	12.2V	9–15.5V
Undervoltage Alarm Voltage	12.0V	9–15.5V
Low Voltage Disconnect Voltage	11.3V	9–15.5V
Discharging Limit Voltage	11.0V	9–15.5V

Battery Type / Voltage Control Parameters	LNCM	
	LNCM3S	User Define
Overvoltage Disconnect Voltage	12.8V	9–17V
Charging Limit Voltage	12.6V	9–15.5V
Overvoltage Recovery Voltage	12.5V	9–15.5V
Equalization Charging Voltage	12.5V	9–15.5V
Bulk Charging Voltage	12.5V	9–15.5V
Float Charging Voltage	12.2V	9–15.5V
Bulk Recovery Voltage	12.1V	9–15.5V
Low Voltage Recovery Voltage	10.5V	9–15.5V
Undervoltage Alarm Recovery Voltage	12.2V	9–15.5V
Undervoltage Alarm Voltage	10.5V	9–15.5V
Low Voltage Disconnect Voltage	9.3V	9–15.5V
Discharging Limit Voltage	9.3V	9–15.5V

When the battery type is set as "USER", follow the logic below to set the voltage parameters of the lithium battery.

A. Overvoltage Disconnect Voltage < Over Charging Protection Voltage (Protection Circuit Modules(BMS)) plus 0.2V;

B. Overvoltage Disconnect Voltage > Overvoltage Recovery Voltage = Charging Limit Voltage ≥ Equalization Charging Voltage = Bulk Charging Voltage ≥ Float Charging Voltage > Bulk Recovery Voltage;

C. Low Voltage Recovery Voltage > Low Voltage Disconnect Voltage ≥ Discharging Limit Voltage;

D. Undervoltage Alarm Recovery Voltage > Undervoltage Alarm Voltage ≥ Discharging Limit Voltage;

E. Bulk Recovery Voltage > Low Voltage Recovery Voltage;

F. Low Voltage Disconnect Voltage ≥ Over Discharging Protection Voltage (BMS) plus 0.2V.

NOTICE

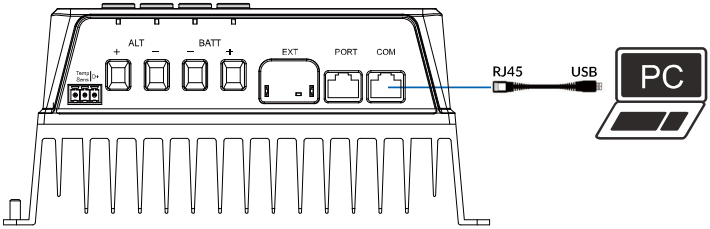
- The lithium battery parameters must be set according to its BMS voltage parameters.
- It is required that the BMS accuracy of the lithium battery installed in the system is less than

or equal to 0.2V, if it is higher than 0.2V, we shall not be liable for any system error.

3.3.5 Setting parameters remotely

a) Setting the "USER" voltage parameters by PC software

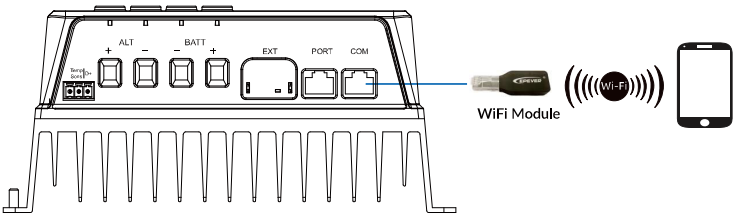
Connect the COM port of the charger to the PC USB port by the USB to RS485 communication cable. Set the "USER" voltage parameters by the PC software.



b) Setting by APP

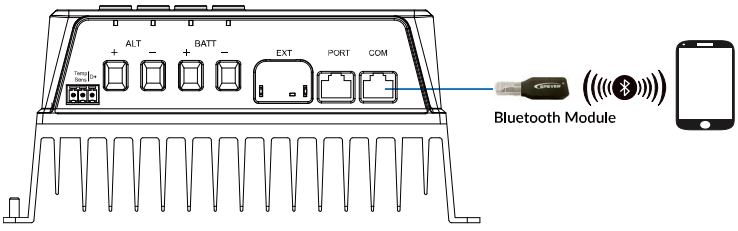
- Connecting the external WiFi module

Connect the WiFi module to the COM port of the charger, set the "USER" voltage parameters on the APP through the WiFi signal. For specific setting methods, please refer to the cloud APP manual.



- Connecting the external Bluetooth module

Connect the Bluetooth module to the COM port of the charger, set the “USER” voltage parameters on the APP through the Bluetooth signal. For specific setting methods, please refer to the cloud APP manual.



4 Maintenance

To maintain long-term working performance, it is recommended to have the following items inspected twice a year.

- Ensure the airflow around the charger is not blocked, and remove dirt or debris from the heat sink.
- Check whether the insulation of exposed cables have been damaged by sunlight, friction with other surrounding objects, dryness, insects or rodents, etc. Repair or replace the cables if necessary.
- Check whether the indicator and display are consistent with the actual operation of the equipment, and note that corrective action should be taken in case of inconsistency or error.
- Check terminals for signs of corrosion, insulation damage, high temperature or burning/discoloration, tighten terminal screws.
- Check for signs of dirt, insect nesting and corrosion and clean up as required.
- If the lightning arrester has failed, replace it in time to avoid lightning strikes' damage to the charger or even other equipment.

⚠ DANGER

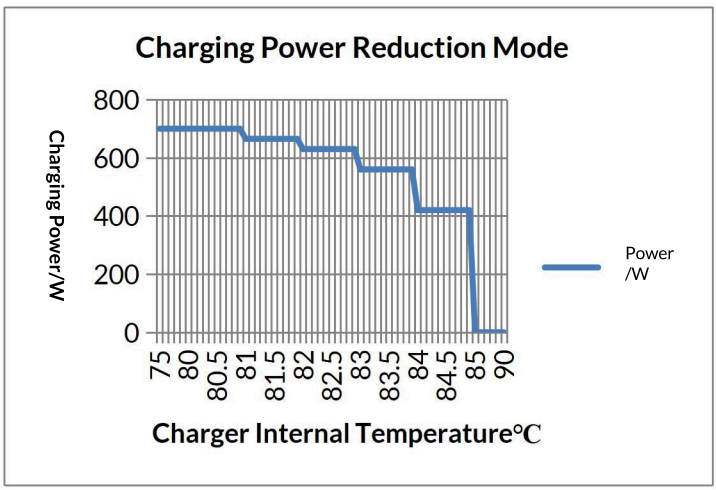
Electric shock hazard! Ensure that the power supply of the charger is disconnected when performing the above operations!

5 Protections

Protections	Description
ALT current limit	When the charger ALT current exceeds the input current limit setting, the charger will limit the input current to the input current limit setting.
ALT overvoltage	The charger will stop charging when the ALT voltage exceeds the overvoltage protection voltage (17.5V), and resume charging when the ALT voltage is lower than the overvoltage protection recovery voltage (16.5V).
ALT undervoltage	In charging mode and power supply mode, the charger will stop charging immediately when the ALT voltage is lower than the input lock voltage.
BATT current limit	When the charger BATT current exceeds the output current limit setting, the charger will limit the BATT current to the output current limit setting.
BATT overvoltage	In charging mode and reverse charging mode, when the charger BATT voltage exceeds the overvoltage disconnect voltage, the charger will stop charging to protect the battery from overcharging. The charger will resume charging when the BATT voltage is lower than the overvoltage recovery voltage. In power supply mode, the charger will stop charging when the BATT voltage exceeds the overvoltage protection voltage (17.5V). The charger will resume charging when the BATT voltage is lower than the overvoltage protection recovery voltage (17V).
(Lithium) Battery over discharge	In reverse charging mode, when the house battery voltage is lower than the low voltage disconnect voltage, the charger will automatically stop reverse charging to protect the house battery from over discharging.
Remote sampling over temperature	The charger detects the ambient temperature by an external temperature sensor. The charger stops working when the remote sampling temperature goes higher than 65℃ and resumes operation when the temperature is below 55℃.
Lithium battery low temperature charging	The charger detects the battery temperature by an external temperature sensor. The battery stops charging and discharging when its temperature is less than the low

	temperature protection threshold, and resumes charging and discharging when its temperature goes higher than the low temperature protection threshold.
Lead temperature sensor damage	When the temperature sensor is short-circuit or damaged, the charger will charge or discharge at 25℃ by default, to protect the battery from overcharging or over discharging.
TVS high voltage surge	The internal circuit of this charger is designed with Transient Voltage Suppressors (TVS), which can only protect against high-voltage surge pulses with less energy. If the charger is used in an area with frequent lightning strikes, it is recommended to install an external lightning arrester.
Charger over temperature★	The charger detects its internal temperature by the internal temperature sensor. The charger stops operating when its internal temperature is higher than 85℃; when its internal temperature is below 75℃, the protection will be released after delay for 30s and the charger resume operation.

★ When the charger's internal temperature is 81℃, the charging power reduction mode is turned on. For every 1℃ increase in temperature, the charging power is reduced by 5%, 10%, 20%, and 40% respectively. When the temperature is higher than 85℃, the charging is stopped. While the internal temperature is not more than 75℃, the charger will resume charging as per the rated charging power. For example, DUC5011 system:



6 Troubleshooting

No.	Status	Possible Reasons	Troubleshooting
1	Fault indicator is fast flashing	ALT overvoltage	Check whether the ALT voltage exceeds the ALT overvoltage protection voltage (17.5V). The fault is cleared when the ALT voltage is lower than the overvoltage protection recovery voltage (16.5V).
		BATT overvoltage	In charging mode and reverse charging mode, check whether the BATT voltage exceeds the overvoltage disconnect voltage. The fault is cleared when the BATT voltage is lower than the overvoltage recovery voltage. In power supply mode, check whether the BATT voltage exceeds the BATT overvoltage protection voltage (17.5V). The fault is cleared when the BATT voltage is lower than the overvoltage protection recovery voltage (17V).
2	Fault indicator is slowly flashing	ALT undervoltage	In charging mode and power supply mode, check whether the ALT voltage is lower than the input lock voltage. The fault is cleared when the ALT voltage exceeds the input lock recovery voltage.
		BATT over discharging	Check whether the BATT voltage is lower than the low voltage disconnect voltage. The fault is cleared when the BATT voltage exceeds the low voltage recovery voltage.
3	Fault indicator is long flashing	BATT short circuit	In charging mode and power supply mode, the charger performs a power-off inspection to check whether the BATT battery or load is short-circuited. The fault is cleared after the short circuit is resolved.

		Reverse charging short circuit	In reverse charging mode, the charger performs a power-off inspection to check whether the ALT is short-circuited. The fault is cleared after the short circuit is resolved.
4	Fault indicator is solid ON	Battery over temperature	Ensure the battery is installed in a cool and well-ventilated place. When the battery temperature drops below the battery over temperature, the fault is cleared.
		Device over temperature	Ensure the charger is installed in a cool and well-ventilated place. When the charger temperature drops below the device over temperature, the fault is cleared.

7 Technical Specifications

Model	DUC3011	DUC4011	**DUC5011**
Rated Voltage	12V–12V		
Input Voltage Range	9V–17V		
Maximum Input Voltage	17V		
Output Charging Voltage Range	10V–17V		
Output Voltage Error Range	±1%		
Input and Output Current Range	1A–30A	1A–40A	1A–50A
Maximum Output Power	420W	560W	700W
Maximum Efficiency	≥ 98.3%	≥ 98.5%	≥ 98.1%
Standby Current Losses	10mA	10mA	11mA
Communication Method	CAN (RV-C Protocol)/RS485 (5VDC/300mA)		
Operating Temperature	-20℃ to +60℃ (> 40℃ derating)		
Altitude	2,000m		
Relative Humidity	≤ 95% (N.C.)		
Ingress Protection	IP32		
Dimensions (L × W × H)	189mm × 181mm × 64.5mm	191mm × 181mm × 76.5mm	191mm × 181mm × 76.5mm
Weight	1.08kg	1.37kg	1.45kg

8 Technical Support

For technical inquiries regarding our products, please contact us through the following channels:

Service Hotline: 010-82894896/82894112

0752-3889706

0755-89236770

Email: support@epever.com

For more product information, please visit: www.epever.com.

iOS

Google Play

Any changes without prior notice! Version number: V1.0

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