LDSOLAR

User's Manual

SOLAR CHARGE CONTROLLER

Sky Dream Series

12V/24V 10A 20A 30A

Your battery guard

※ Thank you for selecting Sky Dream DN Series Duo Battery PWM solar charge controller.
**Please read this manual carefully before using the product.**

1.Overview

Thank you for selecting the Sky Dream DN series common negative duo battery solar charge controller(SD-DN in short). The SD-DN series controller is a PWM charge controller with built in LCD display that adopts the most advanced digital technique. The intelligent charging process has been optimized for long battery life and improved system performance.Duo battery charging technology enable it can be widely used on RV, caravan, ship and other occasions. The features are listed below:

- Adopt high quality components of ST,Samsung and Fenghua Hi-Tech, ensure product using lifespan.
- 3-Stage intelligent PWM charging：Bulk, Boost and Float charging mode.
- Support 5 battery type: Sealed, Gel,Flooded and LiFePO4, Li(NiCoMn)O2 battery.
- Support startup from solar panel
- New LCD display design, dynamically displaying two battery's operating data and working condition.
- Double USB design, the power supply charge for more electronic devices.
- RJ45 supports optional Bluetooth and WiFi
- A variety of charging modes enable users to easily set the charging priority of the battery
- Two LEDs indicate the operating status of both batteries
- With humanized button settings, operation will be more comfortable and convenient.
- Energy statistics and working record function.
- Battery temperature compensation function.
- 12 Electronic protections.

2.Product Feature
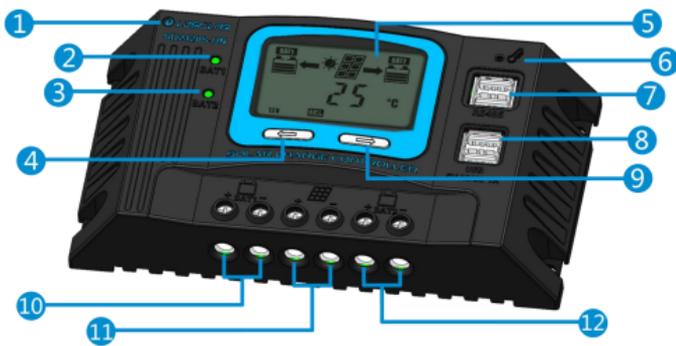
1	Logo	7	RJ45 Port（RS485）
2	Battery1 Indicator	8	USB Output Ports※
3	Battery2 Indicator	9	Operation Button
4	Menu Button	10	Battery1 Terminals
5	LCD	11	PV Terminals
6	Temperature Sensor	12	Battery2 Terminals

※ **USB output ports provide the power supply of 5VDC/1A and have the short circuit protection.**

4.PWM controller charging technology

Due to the nonlinear characteristics of solar array, there is a maximum energy output point (Max. Power Point) on the curve. PWM controllers, with switch charging technology and PWM charging technology, can't charge the battery at the maximum power point,because PWM controller is pulses direct connection from solar panel to battery.the Input voltage (V_{Mpp}) pulls down to battery voltage,but the battery current (I_{Bat}) can not increase when Input voltage (V_{Mpp}) drops to Battery voltage (V_{Bat}).Assuming that the loss is ignored,input current (I_{PV}) is equal to battery current (I_{Bat}).let us see the following formula:
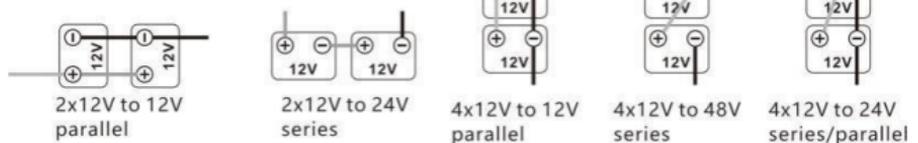

Solar Input power= Input voltage (V_{Mpp}) *input current (I_{PV})

Power into battery=Battery voltage (V_{Bat}) *battery current (I_{Bat})

Normally, the VMpp is always higher than VBat,But the IBat is always equal to IPV.so Solar input power is greater than Power into battery.The greater the discrepancy between VMpp &VBat, the greater the loss.If the VMpp is lower than VBat .it cannot be charged.Therefore, we require the solar system using PWM controller, nominal voltage of solar array must match the battery bank.The below table is for reference

Battery Rated Voltage	PV Module							Controller Rated Voltage
	36 cell Voc < 23V			72 cell Voc < 46V		60 cell Voc < 38V		
	1S	2S	4S	1S	2S	1S	2S	
12V	√	—	—	—	—	—	—	12V
24V	×	√	—	√	—	√	—	24V

√: Match　—:Not Match,Loss is great,please use MPPT controller instead　　×: Not Match,cannot charge.

⚠ "4S" means four solar panels are connected in series, and so on

Solar panel array and battery bank can change the voltage of the whole array and bank in series and parallel, The followings are several common series parallel modes for reference

2x12V to 12V parallel　　2x12V to 24V series　　4x12V to 12V parallel　　4x12V to 48V series　　4x12V to 24V series/parallel

5.Wiring

Step 1: choose the installation site

Do not install the controller at a place that is subject to direct sunlight, high temperature or water intrusion, and make sure the ambient environment is well ventilated.

Step 2: Place the controller at a proper position, use a screw driver to fit screws in

mounting hole.

⚠️ **CAUTION:** If the controller is to be installed in an enclosed box, it is important to ensure reliable heat dissipation through the box

Step 3: Wiring

Connect the system in the order of ❶battery 1 or battery 2(after connected the battery1 or 2,the LCD will be on. If LCD not on, stop connecting,and check whether the positive and negative poles are reversely connected.Only after the LCD displays, you can continue to the next step.Always connect the battery 1 first, in order to allow the controller to recognize the system voltage) ❷PV array and disconnect the system in the reverse order❷❶.

⚠️ Attention:①If the system voltage is set as automatic identification(default),the voltage type of the first connected battery will be set as that of the system voltage when it starts.

②The battery fuse should be installed as close to battery as possible. The suggested distance is within 150mm.

③The SD-DN series is a negative ground controller.Ground the negative electrode as needed

④If possible,Please add breakers to solar and batteries.

⑤If two batteries are connected,the rated voltage and battery type of both batteries should be consistent.Battery capacity can be inconsistent

⑥When lithium battery is selected,the system voltage has no automatic identification function and needs to be manually set.

6.Operation
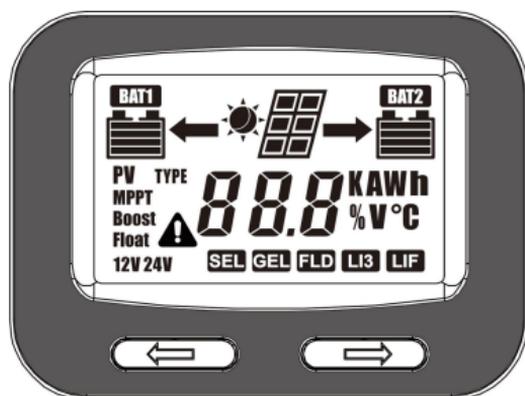
6.1 Button

Mode	Note
USB output ON/OFF	In load manual mode, it can turn the USB output On/Off via the "**OPERATION**" button(→)
Clear Fault	Press the "**OPERATION**" button(→)
Browsing Mode	Press the "**MENU**" button(←).
Setting Mode	Press the "**MENU**" button. and hold on 5s to enter the setting mode Press the "**OPERATION**" button. to set the parameters, Press the "**MENU**" button. to confirm the setting parameters or no operation for 10s, it will exit the setting interface automatically.

6.2 Interface

(1) Status Description

Item	Icon	Status
PV array	☀️📶	In daytime and PV connected correctly
	🌙	At night or no PV connect or reverse connect
	☀️📶 🔋	No Charging
	🔋BAT1 ← ☀️📶	Battery1 Charging
	📶 → 🔋BAT2	Battery2 Charging
	Float	In Float Charging Mode
	Boost	In Boost Charging Mode
	PV	PV Voltage
Battery	🔋BAT1	Battery1 Capacity Indicating, Voltage and Current
	🔋BAT2	Battery2 Capacity Indicating, Voltage and Current
	SEL GEL FLD LI3 LIF	Battery Type
	12V 24V	Current System Voltage

(2) Error Code Table

Status	Error Codes	Description
BAT1 Error Code	E10	BAT1 Normal
	E11	BAT1 Low Voltage Alarm
⚡E 10	E12	BAT1 Over Voltage Alarm
	E13	BAT1 Over Current Protection
12V SEL	E14	Controller Internal Over Temperature
BAT2 Error Code	E20	BAT2 Normal
	E21	BAT2 Low Voltage Alarm
⚡E 20	E22	BAT2 Over Voltage Alarm
	E23	BAT2 Over Current Protection
12V SEL	E24	Controller Internal Over Temperature

(3) LED Indicator

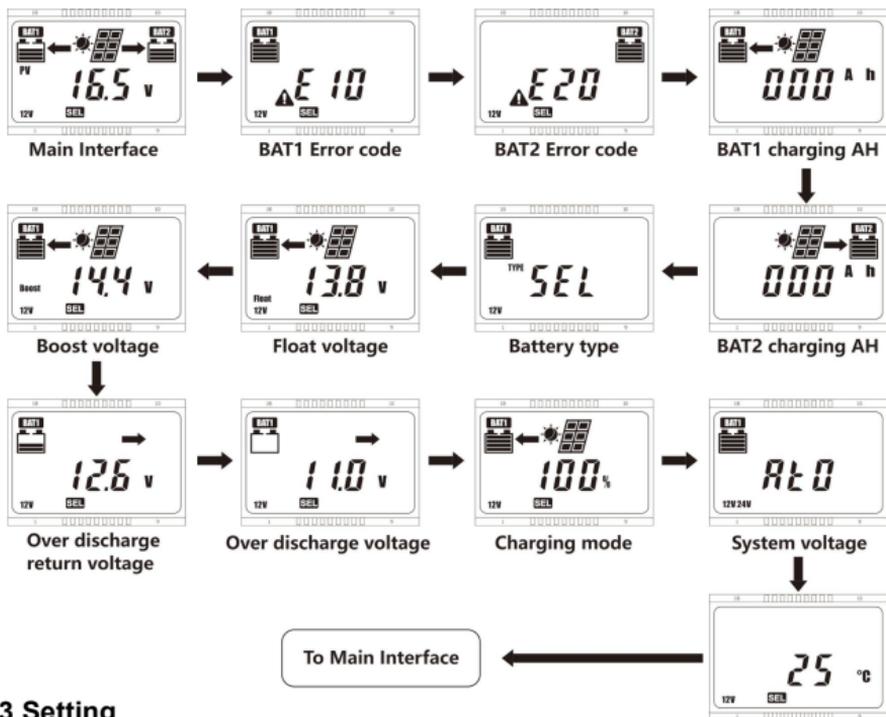| Status	Explanation
LED OFF	The battery is not connected or the battery voltage is lower than 8V
LED ON	Battery is Connected and working normally
LED Slow Flash	On Charging
LED Fast Flash	Error

(4) Browse interface

① If there is no operation within 20s in any interface or after powered on within 10s, The main interface will cycle to display the PV voltage,battery1 voltage,battery1 charge current,battery2 voltage,battery2 charge current and battery temperature every 3s.Long press the "**OPERATION**" button (→) can speed up the cycle display time.

PV Voltage	Battery1 Voltage	Battery1 Current
Battery Temperature	**Battery2 Current**	**Battery2 Voltage**

4
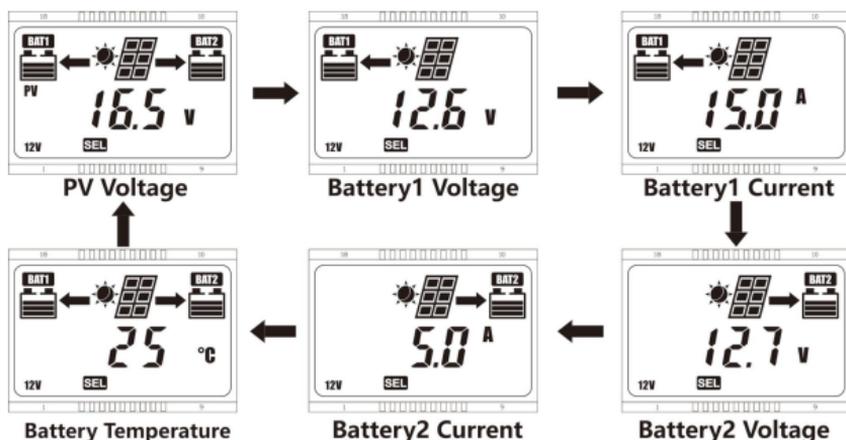
②At main interface(cycle display),long press menu and operation button at same time to enter working record status,it can show times of low voltage,working days and times of full charging.

| Main Interface | Number of low voltage | Working days | Number of charge full |
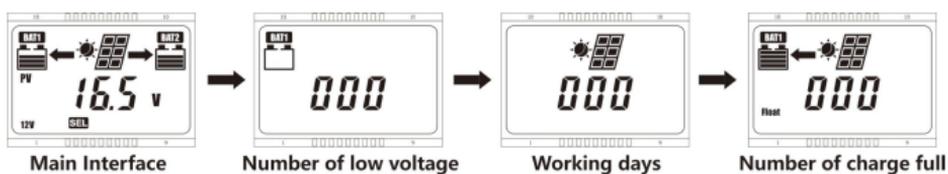
③At main interface(cycle display),Press the "**MENU**" button(←) and enter menu interface

| Main Interface | BAT1 Error code | BAT2 Error code | BAT1 charging AH |

| Boost voltage | Float voltage | Battery type | BAT2 charging AH |

| Over discharge return voltage | Over discharge voltage | Charging mode | System voltage |

To Main Interface

6.3 Setting

(1) Clear the charging AH

Operation:

Step 1: Press the "**OPERATION**" button (→) and hold for 5s under the battery1 charging AH interface and the value will be cleared.

Step 2: Press the "**OPERATION**" button (→) and hold for 5s under the battery2 charging AH interface and the value will be cleared

(2) Battery type

①**support battery types**

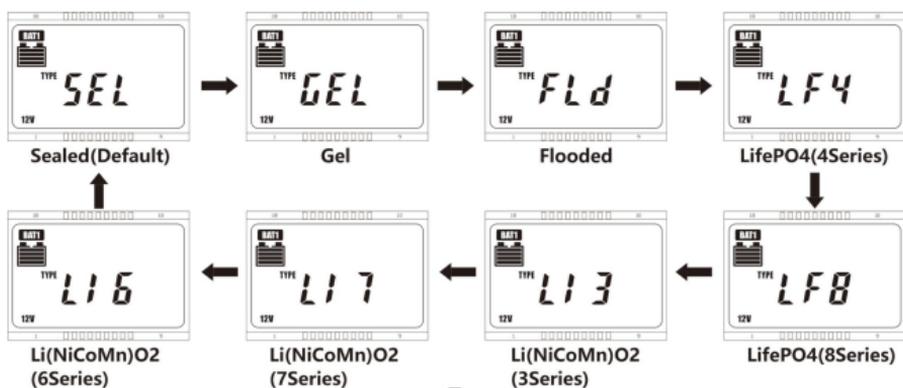| Lead-acid battery	Sealed(default)/Gel/Flooded/User
Lithium battery	LiFePO4 LF4/12V;LF8/24V;
	Li(NiCoMn)O2 LI3/12V;LI6/24V;LI7/24V;

②**Setting the battery type via LCD**

Step 1: At main interface(cycle display),Press the "MENU" button to enter battery type mode interface.

Step 2: Long press the "MENU" button(≥5S) until the "SEL" is flashing,then it enters the setting state.

Step 3: Press the "MENU" and "OPERATION" button to confirm the battery type below:

Step 4: Long press the "MENU" button(≥5S) to save the new setting.If there is no operation within 20s,the controller will enter the main interface and cycle to display automatically.


| Sealed(Default) | Gel | Flooded | LifePO4(4Series) |

| Li(NiCoMn)O2 (6Series) | Li(NiCoMn)O2 (7Series) | Li(NiCoMn)O2 (3Series) | LifePO4(8Series) |

5

(3) Float Voltage Setting

Operation:

Step 1: At main interface(cycle display),Press the "MENU" button to enter float voltage interface

Step 2: Long press the "MENU" button(≥5S) until the value is flashing,then it enters the setting state.

Step 3: Press the "MENU" and "OPERATION" button to change the value
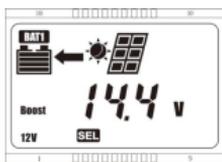

Float voltage

Step 4: After setting,Long press the "MENU" button(≥5S) to save the new setting.If there is no operation within 20s,the controller will enter the main interface and cycle to display automatically.
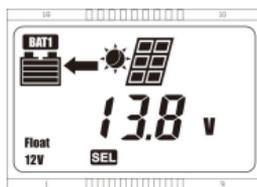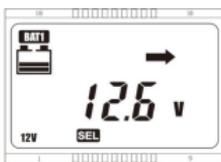
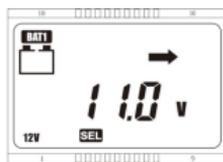### (4) Setting of boost voltage, low voltage reconnect voltage and low voltage disconnect voltage

Operation:At main interface(cycle display),Press the "MENU" button to enter the relevant interface below：

Boost voltage　　　**Over discharge return voltage**　　　**Over discharge voltage**

The operation method of setting is the same as float voltage setting,Please refer to the above"3"

■ **The following rules must be observed when modifying the parameter values in User**

　Ⅰ.Charging Limit Voltage >Boost Charging Voltage >Float Charging Voltage > Boost Reconnect Charging Voltage.

　Ⅱ.Low Voltage Reconnect Voltage > Low Voltage Disconnect Voltage(BMS+0.2V)

　Ⅲ. Boost Reconnect Charging voltage > Low Voltage Reconnect Voltage> Low Voltage Disconnect Voltage(BMS+0.2V)

■ **Battery Voltage Control Parameters**

Below parameters are in 12V system at 25 ºC, please double the values in 24V system

Battery Type	SEL 24V*2	GEL 24V*2	FLD 24V*2	LF4(LiFePO44S/12 V) LF8 (LiFePO4 8S/24V*2)	LI3 (Li(NiCoMn)O2 3S/12V) LI6 (Li(NiCoMn)O2 6S/24V*2)	LI7 (Li(NiCoMn) O2 7S/24V)
Over Voltage Disconnect	16.0V	16.0 V	16.0 V	16.0V	17.0 V	32.0V
Charging Limited Voltage	15.0 V	15.0 V	15.0 V	14.8V	17.0 V	30.0V
Over Voltage Reconnect	15.0 V	15.0 V	15.0 V	14.8V	17.0 V	30.0V
Boost charge	14.4 V	14.2 V	14.6 V	14.6V	12.6V	29.4V
Float charge	13.8 V	13.8 V	13.8 V	14.4V	12.4V	29.0V
Boost Restart Voltage	12.6V	12.6V	12.6V	13.0V	11.5V	26.0V
Low voltage reconnect	12.6V	12.6V	12.6V	12.6V	11.0V	25.2V
Low voltage disconnect	11.0V	11.0V	11.0V	10.5V	9.0V	21.0V

(5)Charging Modes

The system comes with nine charging modes which can be set via the button.they represent the charging percentage of battery 1.only the charging percentage of battery 1 is required,and the controller will automatically calculate the charging percentage of battery 2.

Operation

Press the "MENU" button to enter the Charging mode interface.The operation method of setting is the same as float voltage setting,Please refer to the above"3"

Charging modes	LCD display	Battery 1	Battery 2
0	0%	0%	100%
1	10%	10%	90%
2	20%	20%	80%
3	30%	30%	70%
4	40%	40%	60%
5	50%	50%	50%
6	60%	60%	40%
7	70%	70%	30%
8	80%	80%	20%
9	90%	90%	10%
10(Default)	100%	100%	0%

⚠️Note:①In normal charging state,the controller will distribute the energy of solar panel to battery 1 and battery 2 according to the set percentage.

②When one of the batteries is fully charged,all energy will be distributed to the other battery instead of setting percentage

③When the controller detects only one battery connected,all energy will be automatically distributed too this battery.

(6)System Voltage Setting
The default system voltage of the controller is set as automatic identification (ATO), and the system will set the voltage type of the first connected battery as the system voltage type during startup. If you want to change the system voltage, you can set it to "12U" (12V) or "24U" (24V)

 Operation

Press the "MENU" button to enter the system voltage interface.The operation method of setting is the same as float voltage setting,Please refer to the above"3"

7.Protection

❖ **Protection Icon and Indication**

Status	Icon	Explanation
Low Voltage	⚠ 🔋BAT1	Battery level shows empty, battery frame blink, fault icon blink
Over Voltage	⚠ 🔋BAT1	Battery level shows full, battery frame blink, fault icon blink
Over Current	⚠ A	A and warning icon flash at the same time
Over-Temperature	⚠ ℃	Temperature and warning icons flash at the same time

❖ **Short Circuit and Reverse Connected Protection (Solar Panel)**
    When the solar panels have short circuit or reverse connection, the controller will stop charging immediately, after clearing of the short circuit, the charging will automatically return to normal.
❖ **Battery Reverse Connection Protection**
    When the battery is reversed connection , the controller will not be damaged and will continue to work normally after correct wiring.
❖ **Battery Over Voltage Protection**
    When the battery voltage reaches the over voltage disconnection voltage point, the controller will automatically stop charging to prevent the battery and load from being damaged by high voltage.
❖ **Battery Low Voltage Protection (LVD)**
    When the battery **voltage** reaches the low-voltage disconnection voltage(LVD) point, the controller will automatically stop discharging to prevent the battery from being damaged.
❖ **Charging Over Current Protection**
    If the charging current exceeds 1.1 times the rated current of the controller, It will stop charging after a delay of 1 minute and lock the state. The controller automatically restarts charging after 30s.
❖ **High Temperature Protection**
    When the internal temperature of the controller exceeds 85 ℃, the controller starts to alarm and start charging. The temperature icon and warning icon flash. When the temperature drops to 70 ℃, Return to normal
❖ **Lightning Protection**
    This controller can only protect inductive lightning with small energy. In areas with frequent lightning, it is recommended to install external lightning arresters

8.Troubleshooting
8.1 Troubleshooting

Fault Phenomenon	Possible Reason	Troubleshooting
LCD No Display	The battery voltage is lower than 8V or the battery connection is incorrect	Please check whether the battery is connected correctly or reverse connected and whether the voltage is normal
No charging when there is sunlight	PV reverse connection or PV voltage is less than battery voltage	Please check whether the PV connection is correct and whether the PV voltage matches the system voltage
The controller displays Low voltage protection	Battery over discharge	Please check whether the system configuration or use is reasonable. Wait until the battery is charged to low voltage recovery voltage before using again
The controller	Battery over charge	Please disconnect the solar panel to

displays over voltage protection		see if it can return to normal. If the problem cannot be solved, restart the controller.
The controller displays the over current protection	The charging current is more than 1.1 times of the rated current	Please reduce PV power below rated power and try again
Only one battery can be charged	The battery voltage does not match the system voltage	Please check the battery wiring to confirm whether the battery voltage matches the system voltage

9. Technical Specifications
9.1 Electrical Parameters

Model	SD2420S-DN
Rated Current	20A
System Voltage	12V/24V Auto(Default)
	Manual set
Rated Power	300W/12V 600W/24V
Self-consumption	<10mA
Solar Input Voltage	<55V
Max.allowable voltage of the battery	<34V
Battery Type	Sealed(Default)/Gel/Flooded/LiFePO4/ Li(NiCoMn)O2/ User
LVD	11.0V ADJ 9V...12V ; x2/24V ;
LVR	12.6V ADJ 11V...13.5V ; x2/24V ;
Float Voltage	13.8V ADJ 13V... 15V ; x2/24V ;
Boost Voltage	14.4V ADJ 13V...17V ; x2/24 ; battery voltage less than 12.6v auto boost 2hours
Battery Over Voltage Protection	16.5V ; x2/24V
Temperature Consumption	-24 mV /°C for 12Vsystem ; x2/24V
Communication port	RJ45(RS485)
USB Port	USB 5V1A
Grounding	Common negative
Working Temperature	-20°C—+55°C
Waterproof grade	IP32
Weight	340g
Terminal scale	10mm^2

9.2 Installation Guide and Attentions

The controller should be installed securely and the dimensions are as follows:

Outline dimensions: 168.0×92×34(mm)

Installation dimensions: 156×62 (mm)

Installation hole diameter: 3.5(mm)

Any changes without prior notice

Version:SD-DN V1.0

LDSCLAR