MPPT
CHARGE
CONTROLLER
USER MANUAL

Solar Mate SP600 series

WARNING: HIGH VOLTAGE INSIDE

CAUTION: THE DC FUSE MUST HAVE BEEN TURNED OFF BEFORE SERVICING

MADE IN CHINA

Disclaimer

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➢ Takes no warranty as to the accuracy, sufficiency of suitability of any technical or other information provided in this manual or other documentation.

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➢ Offers standard warranty with its products, taking no responsibility for direct or indirect loss due to equipment failure.

About This Manual

This manual describes our product features and provides procedures of installation. This manual is for anyone intending to install our equipment.

General Instruction

Thanks for choosing our products and this manual is suitable for Solar Mate series MPPT.

This chapter contains important safety and operation instructions. Read and keep this User Guide well for later reference.

MPPT charge controller has high voltage inside. Solar Mate MPPT charge controller needs to be installed by professionals and only the authorized electrician can open the case.

Contents

1 General Safety Instruction

1.1 Safety Instruction

As dangerous voltage and high temperature exist within the charge controller, only qualified and authorized maintenance personnel are permitted to open and repair it.

This manual contains information concerning the installation and operation of the charge controller. All relevant parts of the manual should be read prior to commencing the installation. Please follow the local regulations meantime.

Any operation against safety requirement or against design, manufacture, safety standards are out of the manufacturer warranty.

1.2 General Precaution

➢ Do not expose to rain, snow or liquids of any type. It is designed for indoor use.

➢ To avoid fire and electric shock, make sure all cables are selected with right gauge and are connected well. Cables with smaller diameter or broken cables are not allowed to use.

➢ Please do not put any inflammable goods next to charge controller.

➢ Never place SP600 directly above batteries. Gas from a battery will corrode and damage the charge controller.

➢ Do not place battery over the charge controller.

1.3 Precaution regarding Battery Operation

➢ Use plenty of fresh water to clean in case battery acid contacts skin, clothing, or eyes and consult with a doctor as soon as possible.

➢ The battery may generate flammable gas during charging. Never smoke or allow a spark or flame in vicinity of a battery.

➢ Do not put the metal tool on the battery. Spark and short circuit might lead to explosion.

➢ Remove all personal metal items such as rings, bracelets, necklaces, and watches while working with batteries. Batteries can cause short-circuit current high enough to melt metal, and could cause severe burns.

2 Instruction

2.1 Brief Instruction

2.1.1   General Description

SP600 series, a high-voltage and high power isolated MPPT solar charge controller (**hereinafter referred to as SP600**), is designed with 600V open-circuit PV input voltage and Maximum Power Point Tracking (MPPT) function. It is suitable for energy storage applications, to convert solar energy into electricity and charge a 48V lithium battery or lead-acid battery.

SP600 series has the following features:

1. With high open-circuit voltage and a wide 80-525V MPPT tracking, it can save your configuration and installation cost of the combiner box, thus greatly minimizing the system cost.

2. With two independent MPPT trackers, two PV arrays can be installed on both sides of a sloped roof to optimize the use of installation site and solar energy.

3. High-voltage isolation, to realize electrical isolation at reinforced insulation level between the PV side and the battery, improving electrical safety.

4. High conversion efficiency, maximum efficiency >97%.

5. High power density and compact design, saving installation space.

6. Intelligent fan control to minimize noise.

7. Human-machine interface visualization design: LCD display + LED indicators.

8. Built-in PV array insulation resistance detection (earth fault detection).

9. APP Intelligent interface for communication and monitoring: 1xRS485, 1xCAN, support Bluetooth APP.

10. Good dust-proof design.

11. The positive pole of the battery can be grounded, meeting the requirements of telecommunication applications.

12. Equipped with 1 programmable relay (dry output contact) and 1 programmable dry in (dry input contact).

13. Parallel function, support parallel connection up to 15 units.

14. Work well with lead-acid and lithium batteries, equipped with CAN bus interface for communication with lithium batteries.

2.1.2 Naming Rules
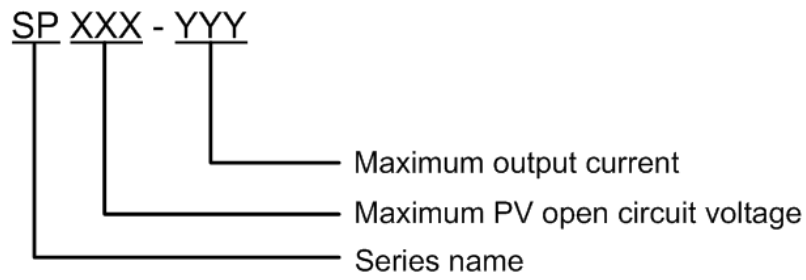
Field	Character	Description	
SP	SP	SP series MPPT solar charge controller	
XXX	600	PV open circuit voltage	600V
YYY	120	Maximum output current	120A

2.2 Structure

2.2.1 Front
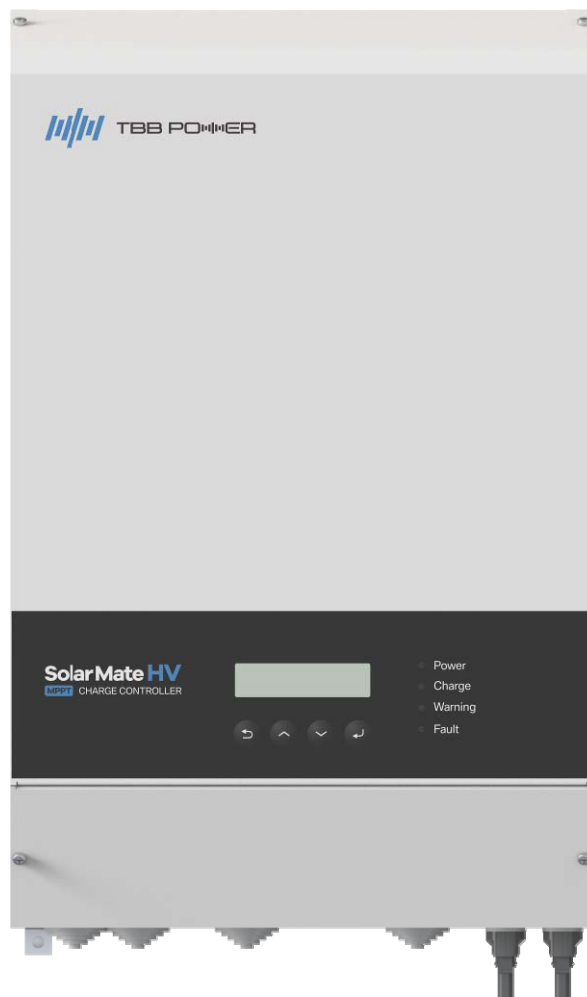
Figure 2-1 MPPT charge controller structure in front view

2.2.2 Connection Terminal
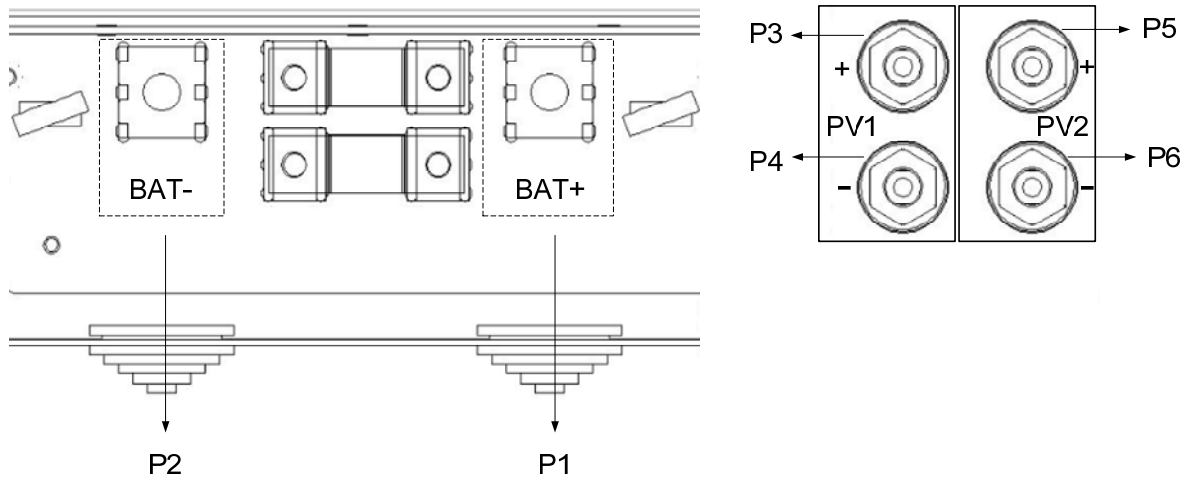
Figure 2-2 Power connection terminals

Table 2-3 Power connection terminal introduction

No.	Name	Description	Note
P1	BAT+	Battery Positive Input	M8 bolt
P2	BAT-	Battery Negative Input	
P3	PV1+	PV Array 1 Positive Input	MC4 terminal
P4	PV1-	PV Array 1 Negative Input	
P5	PV2+	PV Array 2 Positive Input	
P6	PV2-	PV Array 2 Negative Input	
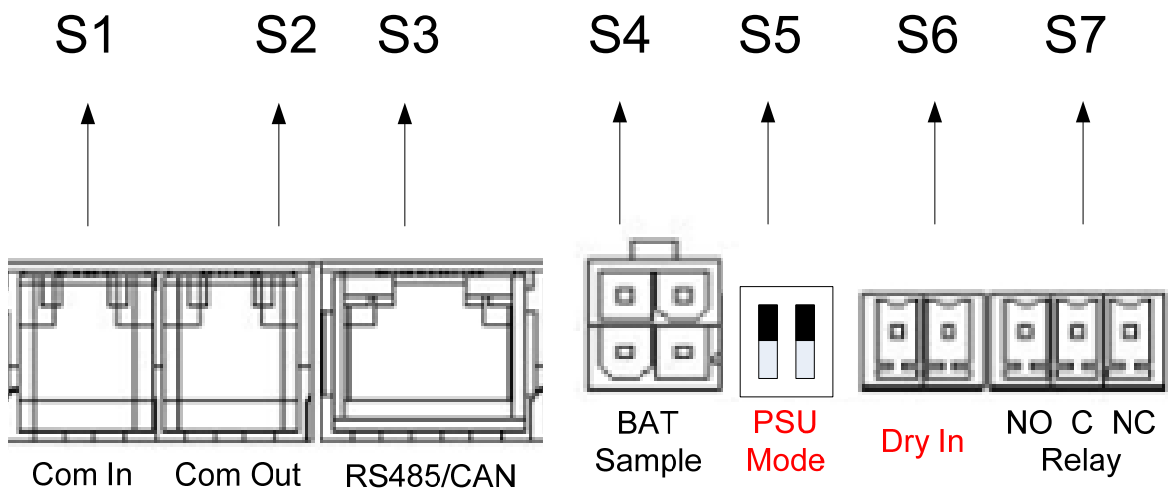
Figure 2-3 Signal connection terminals

Table 2-4 Signal connection terminal introduction

No.	Name	Description	Note
S1	Com In	For parallel connection of SP600 series for system expansion	The Com Out terminal of the first SP600 is connected to the Com In

S2	Com Out	For parallel connection of SP600 series for system expansion	terminal of the second unit, and more units can be connected in this way. The Com In terminal of the first SP600 can be connected to the inverter for a DC Couple PV application.
S3	RS485/CAN	RS485 for debugging with the upper computer CAN for communication with lithium battery	When Com In and Com Out terminals are connected to the inverter, there is no need to use RS485/CAN
S4	BAT Sample	For battery temperature sampling	Use with a specialized battery temperature sampling cable
S5	PSU Mode	When SP600 is connected to the battery, you can dial up or down the DIP switch to power on SP600 in accordance with the PV input	Dial up both or one of the DIP switches, SP600 will be powered on (by default) whether there is PV input or not Dial down both switches, SP600 will be powered on only when there is a PV input and the PV voltage is higher than 100V
S6	Dry In	Dry input contact	! Only for connecting to open/short circuit dry contact signals; it is forbidden to connect to voltage signals to avoid the damage to the internal components of the terminal
S7	Relay	Dry output contact, its control logic can be selected through the LCD screen on SP600 or the upper computer	Built-in 28VDC/4A relay

2.2.3 Dimension
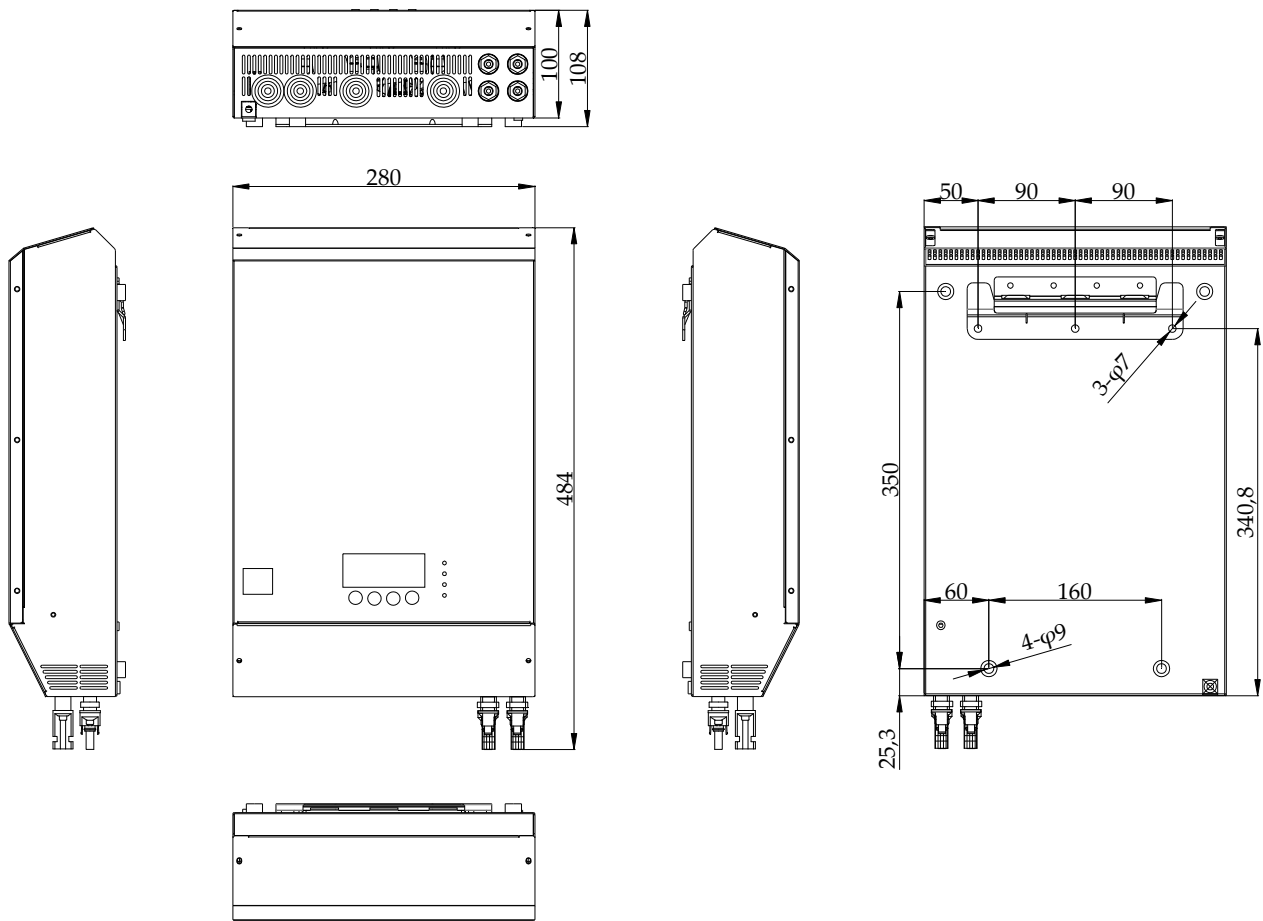
Figure 2-4 Dimension of Solar Mate MPPT charge controller

2.3 Function

2.3.1 Maximum Power Point Tracking

The output power of PV array is determined by the sun irradiation intensity and weather condition. The maximum power point varies a lot under different weather conditions.

Maximum Power Point Tracking technology maximizes the harvest of PV energy for charging the battery. The MPPT software algorithm will be continuously adjusted in accordance with the change of the sun irradiation intensity and weather condition, so as to find the maximum power point of the array. With MPPT, the user can maximize the usage of the PV energy.

2.3.2 Battery Charging Control

2.3.2.1 Battery Type Setting

SP600 supports working with lithium and lead-acid batteries. The current battery type and charging parameters can be displayed and set on the LCD screen.

No	Battery Type	Absorption charging voltage (Default)	Float charging voltage (Default)	Battery Default Charge Rate	Battery Maximum Charge Rate
0	GEL/OPzV	14.1V	13.7V	0.15C	0.25C
1	AGM	14.4V	13.5V	0.15C	0.25C
2	Lead-Carbon	14.1V	13.5V	0.2C	0.5C
3	Customized	13.3V (48V system)	13.1V (48V system)	0.3C	1.0C

4	TBB Lithium (TBB SUPER-L)	BMS Communication Set
		  (General Can Communication Protocol for Residential Energy Storage Industry)
		  The initial absorption charging voltage is 13.3V, and the float voltage is 13.0V; when the communication is established, it will follow the instructions from the BMS			

Note: The above voltage is based on 12V battery voltage as a reference. For the 48V battery system, please multiply the given values by 4.

2.3.2.2 Compatible with TBB Inverter

SP600 supports working with Kinergier Pro (only for CK-II models) and Tyrann for DC Couple PV system.

2.3.2.3 Compatible with Lithium Battery

SP600 supports working with general 48V lithium battery for residential energy storage. After connecting to the lithium battery via Can communication through its "RS485/CAN" port, SP600 can automatically set the battery type as lithium battery and save such information into itself.

When the connection to the lithium battery is set up, SP600 can automatically respond to the charging request of the lithium battery BMS, and meantime read the information sent by the lithium battery BMS for monitoring and display.

When a communication error occurs after working with the lithium battery for a period of time, SP600 can automatically detect the error and raise an alarm.

2.3.2.4 Compatible with Lead-acid Battery

SP600 supports TBB standard multi-stage lead-acid battery charging solution.
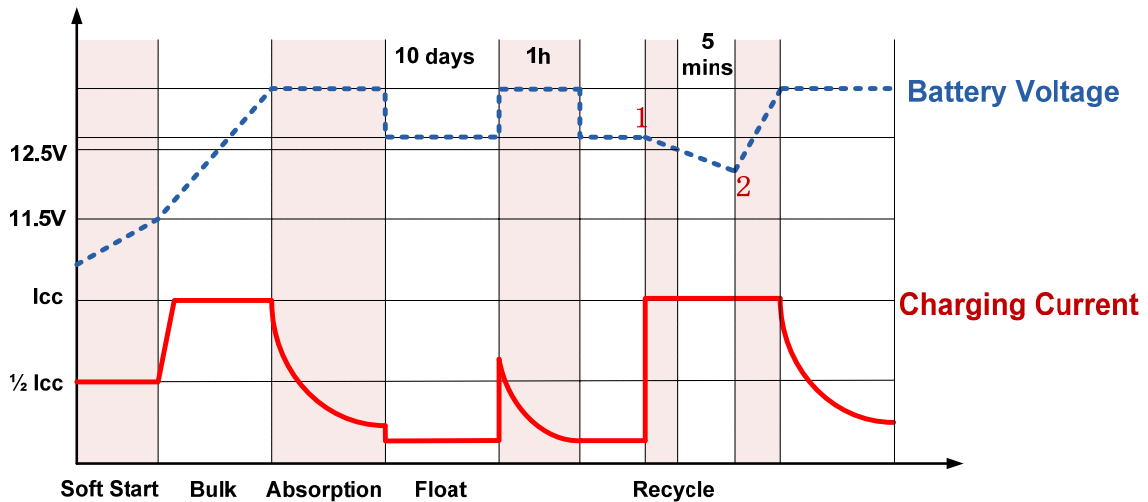
2.3.3　Input PV Source Adaptability

1. If the input PV voltage is within the maximum voltage range (<600V) allowed by SP600, then the SP600 will not get damaged. It can communicate and display normally.

2. If SP600 can start up with an input PV voltage higher than the starting voltage of 120V, then it should be able to perform charging normally within its MPPT voltage range (80~525V).

3. In the event of larger configured input PV power, SP600 will automatically limit the maximum current (18A) and maximum power (5000W) for each of the input terminal.

4. SP600 will automatically distribute the charging power of the two trackers based on the actual input power and target charging current of the two PV arrays, to maximize the use of PV energy.

2.3.4　Operation without Battery

SP600 supports operating without battery, which enables a soft start charge to restore the lead-acid battery to the normal voltage range when the lead-acid battery is in low voltage, or wakes up the lithium battery with an external charging voltage when the lithium battery is in sleep mode.

2.3.5　Low Power Consumption Mode

For low power consumption scenarios, the user can select the low power consumption mode by dialing down the DIP switch (PSU_Mode). When there is no PV input available, the auxiliary power supply will be turned off to reduce battery energy consumption.

2.3.6　Battery Overcurrent Detection at the Output

In the event of a large short-circuit current at the output terminal during charging process, SP600 can automatically detect it and shut down immediately for security reason.

After the short-circuit condition at the output terminal is over, SP600 will automatically restart after the user unlocks the fault on the LCD screen.

2.3.7　PV Array Insulation Resistance Detection

SP600 is designed with built-in PV array insulation resistance detection (earth fault detection) function. The   insulation resistance value is displayed in polling on the SP600 LCD screen, and is also sent to the inverter via RS485 at the same time.

SP600 will automatically perform insulation resistance detection every time auxiliary power supply restarts and stabilizes. In the event of the insulation resistance value lower than the safety threshold (indicating an earth fault), SP600 will stop charging the battery, stay in a standby state, and meantime send the error signal to the inverter via RS485. When there is something wrong with the PV insulation detection, disconnect the input PV circuit breaker of SP600 and turn off the battery switch, and then troubleshoot and deal with the problem. When the insulation resistance is restored to normal, restart the SP600 to perform insulation resistance detection and to charge the battery if the insulation resistance detection is successfully passed.

2.3.8　Comprehensive Protection

The equipment is being protected against many failures through hardware and software, making it robust and reliable.

PV array reverse polarity protection

When PV reverse polarity is detected, SP600 will stop working. The maximum PV short-circuit current cannot exceed 20A. After the PV is correctly wired, the SP600 will work normally.

PV over voltage protection

When the PV voltage is higher than the operating voltage, the SP600 will shut down output with light alarm, to ensure that the SP600 will not be damaged.

When the PV voltage exceeds the highest PV open circuit voltage range of SP600 MPPT charge controller, it may cause damage. Damage caused by improper use is not warranted.

3 Installation and Wiring

3.1 Pre-installation Inspection

3.1.1 Check Outer Packaging

➢ Check the outer packaging for damage before unpacking, and check if it is the correct model. If there is something wrong, please don't open it and contact your dealer.

➢ Check the inner contents for any visible damage after unpacking.

➢ If any item is missing or there is any damage, please contact your dealer.

Table 3-1 Packing list

Packing list	
Description	Quantity
MPPT charge controller	1
User manual	1
3Pin connector	1
2Pin connector	1
MC4 terminal	2+2
Expansion bolt	5
M6 screw	5

3.2 Select Installation Location

3.2.1 Requirement

1. The protection category of this charge controller is IP21, so it can only be installed indoors.

2. During the operation of the heat sink, the temperature of the chassis and heat sink will be relatively high. Please do not install it in the place where it is easy to reach.

3. Do not install it in the place where inflammable and explosive articles are stored.

4. Do not install it in the place where children can touch it.

5. Do not install it on flammable building materials.

6. Please make sure that the support surface is solid enough to bear the weight of the charger controller.

⚠ Do not install SP600 in a sealed compartment containing batteries.

3.2.2 Installation Space Requirements

A good ventilation can guarantee the normal operation of equipment. Please always guarantee there is enough space around SP600 upon installation.
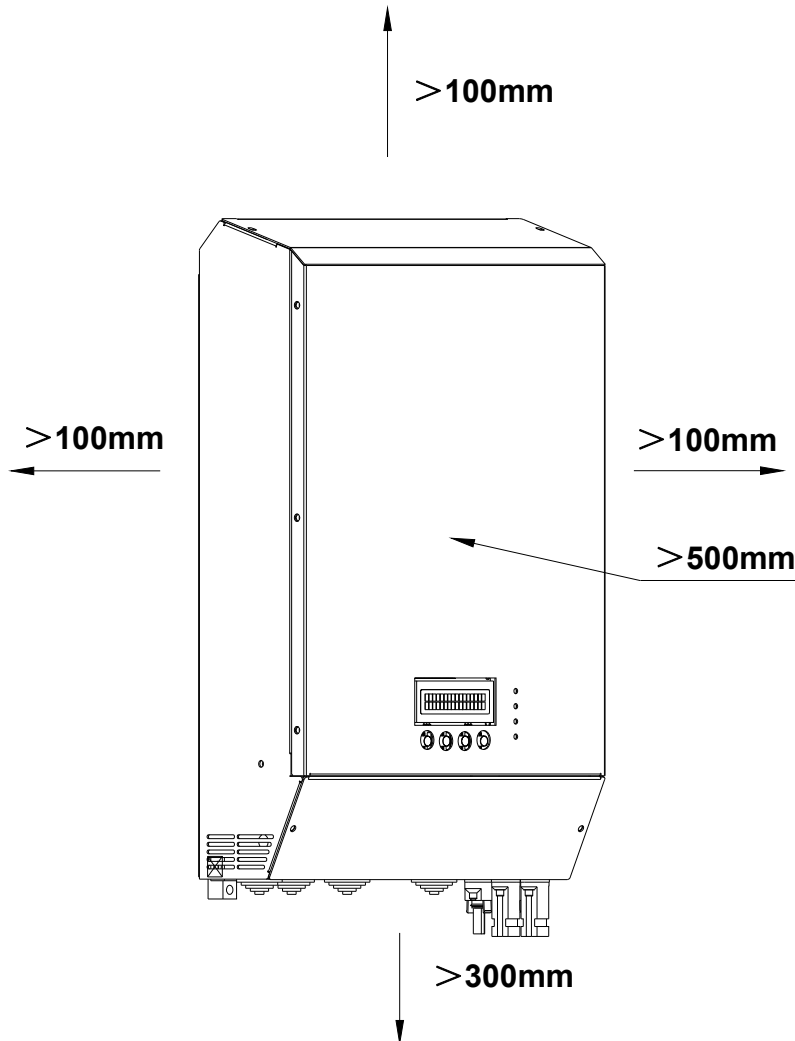
3.3 Installation

Step1: Find a flat solid wall surface. Use the wall-mount bracket as a template and drill 3 holes. Insert 3 expansion bolts after drilling. Fix the wall-mount bracket on the wall with 3 M6 self-tapping screws.

Step2: Remove the bottom cover of the SP600 and mount the SP600 onto the wall-mount bracket. Mark the positions of holes on the wall with a marker in accordance with the left and right mounting holes at the bottom of the SP600, and remove the SP600 after the marking is made. Drill the 2 marked holes and mount the SP600 onto the wall-mount bracket again after drilling.

Step3: Fix the SP600 on the wall by securing the left and right mounting holes at the bottom of the SP600 with 2 M6 self-tapping screws.
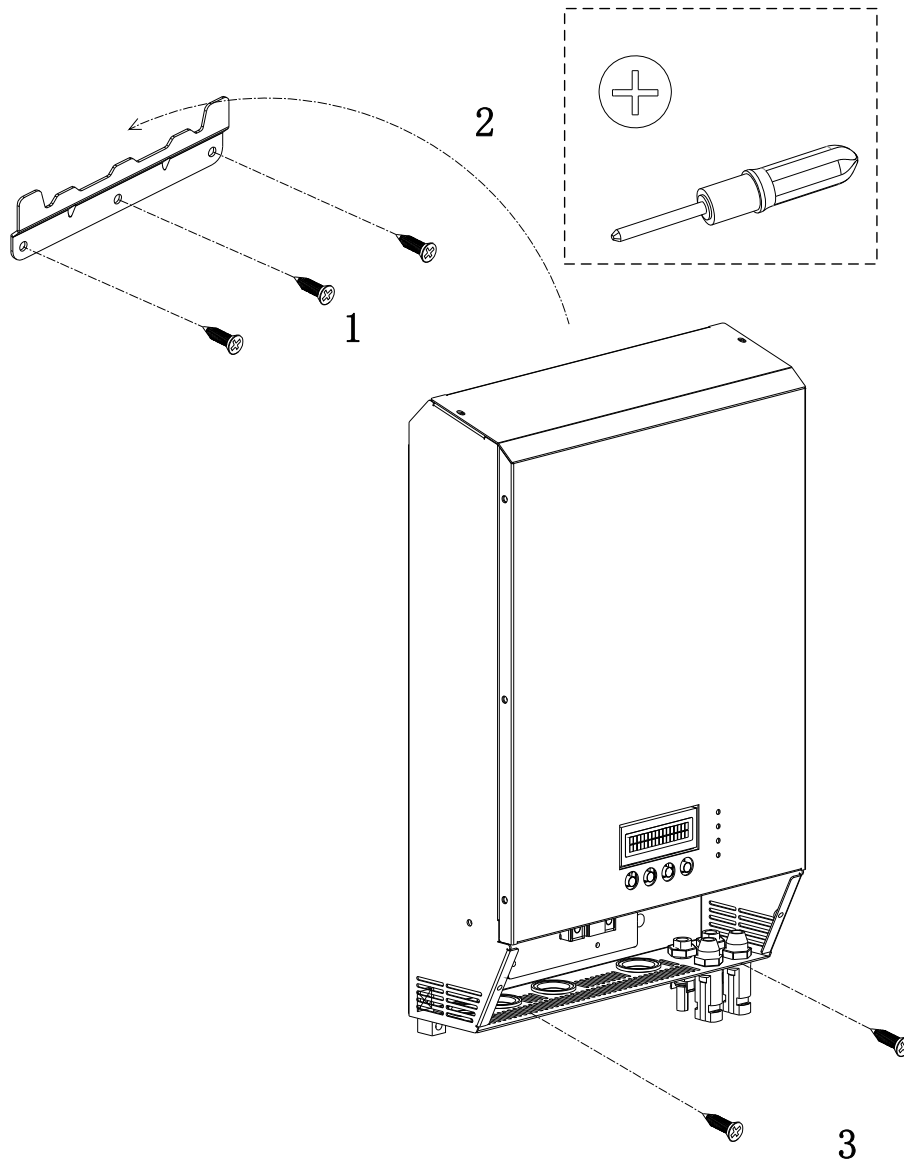
Figure 3-2 Illustration of installation

⚠️ Please double check the SP600 is securely installed.

3.4 Preparation Before Wiring

3.4.1 PV Array Preparation

The PV array configuration for SP600 is recommended as follows:

Max. PV voltage（total Voc @ **lowest temperature**）	525V
Min. PV voltage（total Voc @ **highest temperature**）	120V
Max. PV current（total Isc @ **highest temperature**）	20A per tracker
Max. PV power（total Power @ STC）	8000W per tracker

3.4.2 Breaker Preparation

➢ An over current protection device such as DC fuse or DC circuit breaker needs to be installed on positive cable rated at 125% of the nominal rating.

➢ The withstand voltage of the DC circuit breaker on the battery side should be greater than 63V.

➢ The withstand voltage of the DC circuit breaker on the PV array side should be greater than the PV open-circuit voltage.

➢ Circuit breaker requirements are shown in the Table 3-3.

Table 3-3 Breaker Requirement

NO.	Parts	Model	Requirement
1	Battery breaker	SP600-120	(1) The voltage should be greater than 63Vdc. (2) The current should be greater than 150A.
2	PV array breaker	SP600-120	(1) The voltage should be greater than 600Vdc per tracker. (2) The current should be greater than 25A per tracker.

3.4.3 Cable Preparation

➢ It is recommended to install SP600 with cables with insulation rating of at least 90°C (194F).

➢ Minimum requirements on the cross-sectional area for the cables are shown in the Table 3-4.

Table 3-4 Recommended Battery wiring

Model	Recommended DC wiring			
	Length (The total length of the positive and negative cable of the battery)	4m	6m	10m
SP600-120	Cross-sectional area	35mm²	50mm²	50mm²
	Voltage drop	0.5V	0.5V	0.8V

3.5 Wiring

Step 1: Connect the ground wire firmly.

Step 2: Connect the corresponding communication cable according to the requirements of SP600.

Step 3: Connect the corresponding battery sampling cable, dry in and relay signal cable according to the requirements of SP600.

Step 4: Connect the positive and negative cables of the battery (! Pay attention to the positive and negative polarity of the battery. Make sure that a battery circuit breaker that meets the requirements of 3.4.2 has been installed between the SP600 and the battery before performing the connection,

and that the circuit breaker has been disconnected.)

Step 5: Connect the MC4 terminal (! Pay attention to the positive and negative polarity of the PV array. Make sure that a PV array circuit breaker that meets the requirements of 3.4.2 has been installed between the SP600 and the PV array before performing the connection, and that the circuit breaker has been disconnected.)

Step 6: After all wiring is completed, please fix the bottom cover back to the SP600 by screwing the screws.
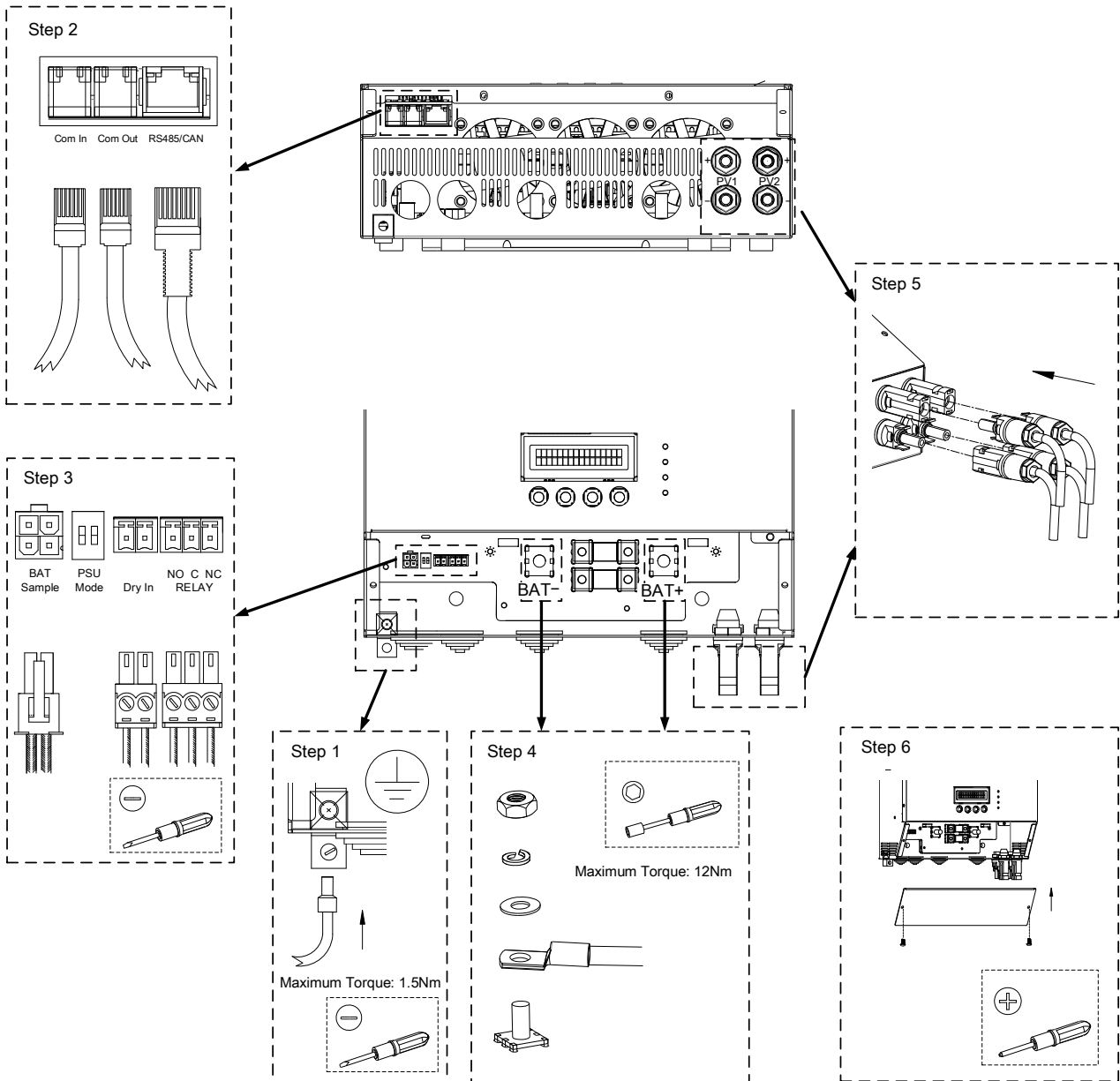
4 Configuration

4.1 Check Before Operation

Please check before operation according to the following:

1. Solar Mate MPPT charge controller is installed correctly and firmly.

2. Reasonable cable layout to meet customer requirements.

3. Make sure the grounding is reliable.

4. Make sure the ground wire is properly, firmly and reliably connected.

5. Double check to make sure the battery breaker and PV array breaker is OFF.

6. Make sure the cables are properly, firmly and reliably connected.

7. Reasonable installation space, clean and tidy environment, no construction residue.

4.2 Power ON Test

⚠️ Make sure the battery voltage and PV array voltage are within the permissible range before the breaker is turned ON.

Please follow the instructions step by step.

Step 1: Turn on the circuit breaker between the PV array and the MPPT charge controller.

Step 2: Turn on the circuit breaker between the battery and the MPPT charge controller.

Step 3: Set the parameters step by step according to the setup wizard.

Step 4: Observe the LED light to make sure the MPPT charge controller is running normally (refer to Table 2-2 LED directive function).

4.3 Power OFF

⚠️ After the MPPT charge controller is powered OFF, there is still residual power and heat in the chassis, which may lead to electric shock or burns. Therefore, 5 minutes after the MPPT charge controller is powered off, you should wear protective gloves before remove the MPPT charge controller.

Please follow the instructions step by step.

Step 1: Turn off the circuit breaker between the PV array and the MPPT charge controller.

Step 2: Turn off the circuit breaker between the battery and the MPPT charge controller.

4.4 Operation and Display Panel

Please check before Operation according to the following.

The operation and display panel includes 4 buttons, 4 LEDs and a LCD, indicating the operating status of Solar Mate.

LCD

Power

Charge

Warning

Fault

LED Indicator

ESC   UP   DOWN   ENTER
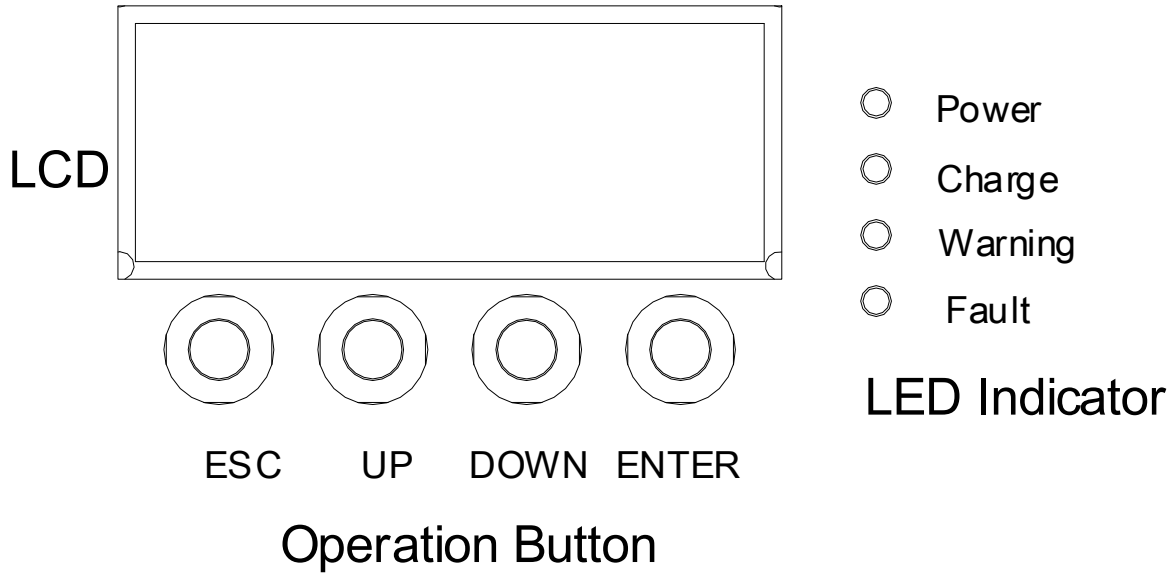
Operation Button

Table 4-1 Operation Button

Button	Function
	➢ Cancel the selection. ➢ Display the previous level of menu.
	➢ Display the previous page. ➢ Increase the value of the selected item.
	➢ Display the next page. ➢ Decrease the value of the selected item.
	➢ Enter into this menu, displaying the next level. ➢ Select and confirm the selection of a menu item.

Table 4-2 LED Indicator

LED	Function
Power	➢ It illuminates when SP600 is power on.
Charge	➢ It flashes when SP600 is in float charging state. ➢ It illuminates when SP600 is performing charging.
Warning	➢ It flashes when a warning occurs to SP600.
Fault	➢ It flashes when a fault occurs to SP600.

4.5 Setup wizard

Setup wizard is a quick configuration process for all basic setups.

Power ON at the first time or after restoring to factory settings, the MPPT charge controller needs to

enter the setup wizard to work normally. The user can also reset the Setup Wizard through the Parameter Set interface.

Note: If you want to leave the default values unchanged during the setup process, simply press <Down> to prompt <Confirm?> , and press <Enter>.

```
┌─────────────────┐      ┌─────────────────┐      ┌─────────────────┐
│ Enter The       │ ───▶ │ Time Set        │ ───▶ │ Battery_Type    │
│ Setup Wizard?   │      │ 2019-03-10 13:26│      │ 0- GEL/OPzV     │
└─────────────────┘      └─────────────────┘      └─────────────────┘
                                                           │
                         ┌─────────────────┐      ┌─────────────────┐
                         │ SYS_Module_Addr │ ◀─── │ Battery_AH      │
                         │ 1               │      │ 200AH           │ ◀──┘
                         └─────────────────┘      └─────────────────┘
```
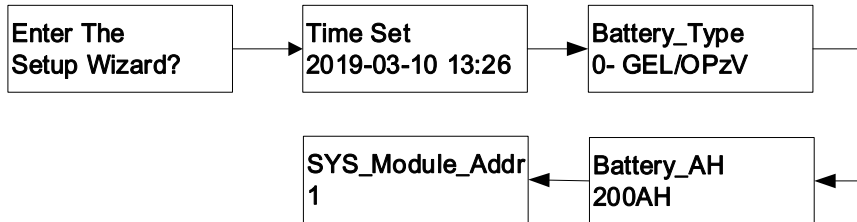
5 Operation

5.1 Menu Introduction

There is a main menu and three levels of submenus on the LCD screen showing all active parameters and alarms for you to configure all parameters of the SP600.
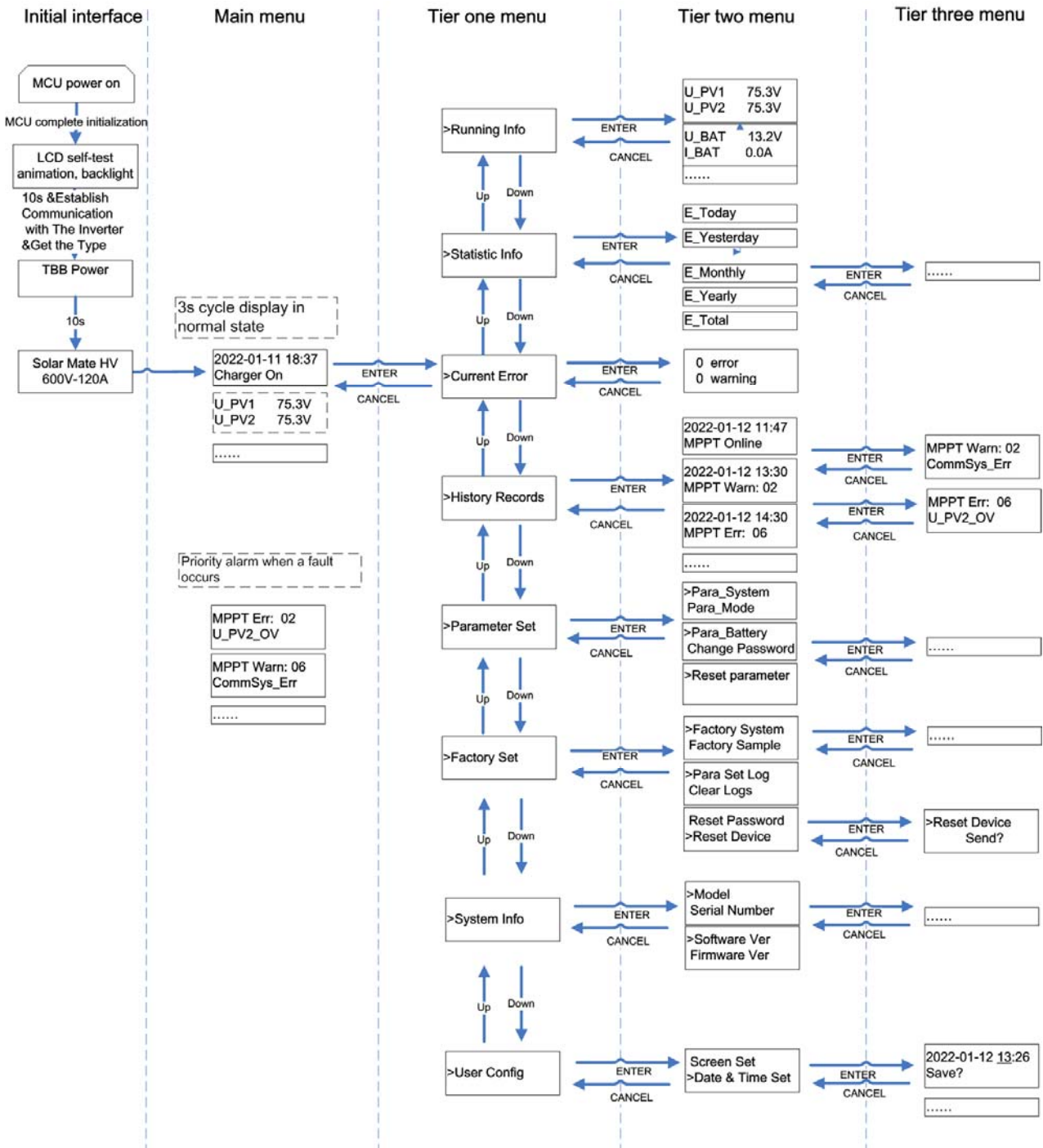
5.2 Initial Interface

Once the SP600 is powered on, the following screen will display manufacturer name and model number. In case of communication failure between LCD and SP600, there will be a alarm displayed as well.

```
  ┌ Logo ┐                    ┌ Model Series ┐
  └──────┘                    └──────────────┘
       │                             │
       ▼                             ▼
  ┌──────────────┐          ┌──────────────────┐
  │  TBB POWER   │──────────│  Solar Mate HV   │
  │              │          │     600-120      │
  └──────────────┘          └──────────────────┘
```
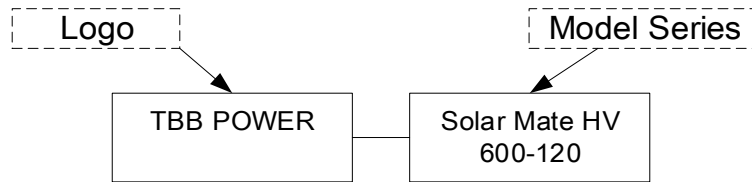
5.3 Main Menu

The LCD main menu is a real-time information interface displaying data of the equipment. The default interval time is 5s, and the time can be set manually. When pressing <UP> or <Down> to turn the pages, it will stay on the chosen page for 30s and the time can be set manually.

In the parallel system or three phase system with the common battery pack, the battery's parameters are only displayed on the master SP600.

```
┌──────────────┐    ┌──────────────────┐    ┌──────────────────┐
│ Running In DC│───▶│ 2022-01-11 05:06 │───▶│ U_PV1    73.4V   │
│ Source Mode  │    │ Charger_Standby  │    │ U_PV2    73.4V   │
└──────────────┘    └──────────────────┘    └──────────────────┘
     ▲                                               │
     │                                               ▼
┌──────────────┐    ┌──────────────────┐    ┌──────────────────┐
│ E_Today:     │◀───│ P_Output:        │◀───│ U_BAT    51.2V   │
│      0.0kWh  │    │          0.0W    │    │ I_BAT      0A    │
└──────────────┘    └──────────────────┘    └──────────────────┘
     │
     ▼
┌──────────────┐
│ DC Coupling Addr│
│ MPPT      1#  │
└──────────────┘
```
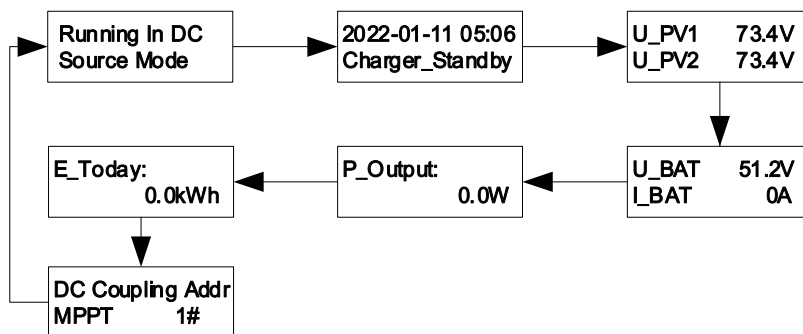
5.4 Information Query Interface

After pressing <Enter> button, you will approach Level One Menu. Scroll to find your specific screen, then press <Enter> button, you can enter Level Two Menu and then Level Three Menu. Press <Back> button, you can return to the previous menu.

Among Level One Menu, there are three categories: information query, configuration and control.

Tier one menu

```
┌──────────────┐ ◀─<Up>─  ┌──────────────┐ ◀─<Up>─  ┌──────────────┐ ◀─<Up>─  ┌──────────────┐
│>Running Data │ ─<Down>▶ │>Statistic Data│ ─<Down>▶│>Current Error│ ─<Down>▶ │>History Record│
└──────────────┘          └──────────────┘          └──────────────┘          └──────────────┘
                                                                                  ▲    │
                                                                               <Up>  <Down>
                                                                                  │    ▼
┌──────────────┐ ◀─<Down>─ ┌──────────────┐ ◀─<Down>─ ┌──────────────┐ ◀─<Down>─ ┌──────────────┐
│>User Control │ ─<Up>─▶   │>System Info  │ ─<Up>─▶   │>Factory Set  │ ─<Up>─▶   │>Parameter Set │
└──────────────┘          └──────────────┘          └──────────────┘          └──────────────┘
```
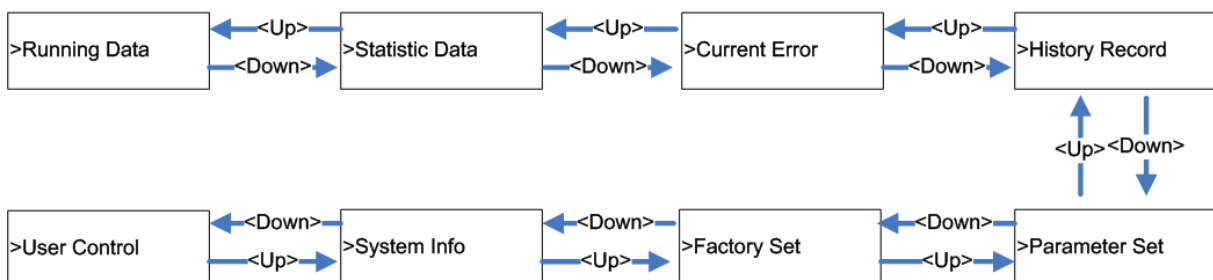
5.4.1   Running Data

Select "Runnig Info" and press <Enter> button to view the operation information of Solar Mate HV. Press <Up> or <Down> button to scroll as shown in the figure below, in which BAT_SOC is displayed only when the battery type is lithium battery; the value of Insul_Impedence is displayed as "---" when it is not detected or when the insulation detection board is disconnected during detection, and the value of T_BattExt is displayed as "---" when the external battery temperature detection is not connected.

```
┌─────────────────────┐    ┌─────────────────────┐    ┌─────────────────────┐
│ U_PV1    235.7V     │ →  │ I_PV1      5.60A    │ →  │ U_BAT     51.6V     │
│ U_PV2    218.4V     │    │ I_PV2      4.30A    │    │ I_BAT      41.9A    │
└─────────────────────┘    └─────────────────────┘    └─────────────────────┘
                                                                  │
                                                                  ▼
┌─────────────────────┐    ┌─────────────────────┐    ┌─────────────────────┐
│ Insul_Impedence:    │ ←  │ P_Output:           │ ←  │ T_Heatsink  62℃     │
│           899kΩ     │    │            2155W    │    │ T_MCU       48℃     │
└─────────────────────┘    └─────────────────────┘    └─────────────────────┘
           │
           ▼
┌─────────────────────┐    ┌─────────────────────┐
│ T_BattExt:          │ →  │ BAT_SOC:            │
│            50℃      │    │            90%      │
└─────────────────────┘    └─────────────────────┘
```
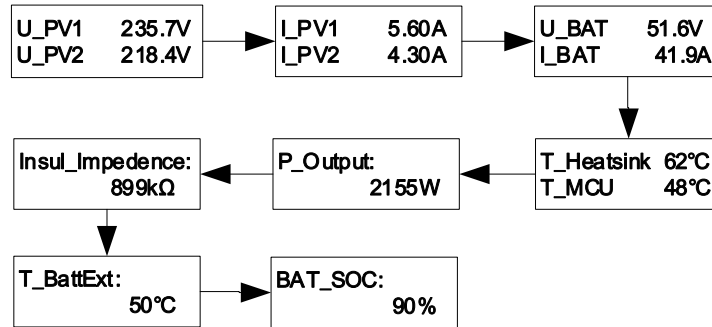
5.4.2   Statistic Data

Enter the interface, and you can view the information of the current system.

```
                              ┌──────────────┐     ┌──────────────────┐
                          →   │ >E_Today     │ →   │ Energy MPPT:     │
                              │              │     │     1.00kWh      │
                              └──────────────┘     └──────────────────┘

                              ┌──────────────┐     ┌──────────────────┐
                          →   │ >E_Yesterday │ →   │ Energy MPPT:     │
                              │              │     │     0.25kWh      │
                              └──────────────┘     └──────────────────┘

      ┌──────────────┐        ┌──────────────┐     ┌──────────────────┐     ┌────────────────────┐
      │ >Statistic   │    →   │ >E_Month     │ →   │ >E_January       │ →   │ Jan. 1st           │
      │  Data        │        │              │     │  E_February      │     │ E_MPPT: 2.12kWh    │
      └──────────────┘        └──────────────┘     │  ...             │     │  ...               │
                                                   └──────────────────┘     └────────────────────┘

                              ┌──────────────┐     ┌──────────────────┐
                          →   │ >E_Year      │ →   │ Jan.   E_MPPT:   │
                              │              │     │     32.4kWh      │
                              └──────────────┘     │  ...             │
                                                   └──────────────────┘

                              ┌──────────────┐     ┌──────────────────┐
                          →   │ >E_Total     │ →   │ E_MPPT:          │
                              │              │     │     75.9kWh      │
                              └──────────────┘     └──────────────────┘
```
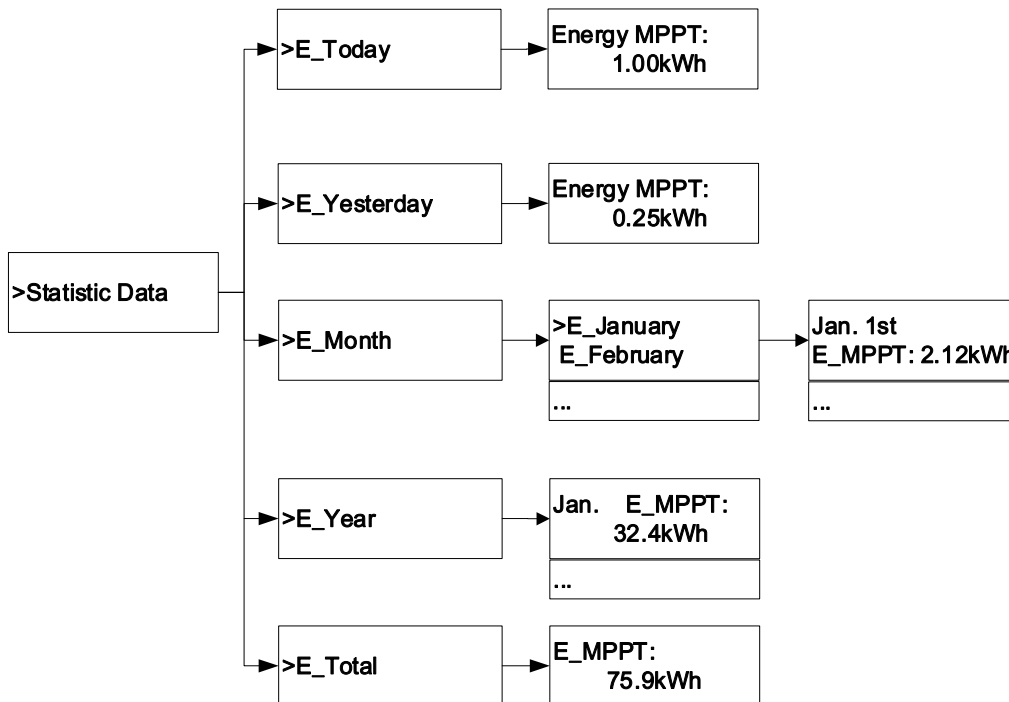
5.4.3   Current Error

Enter this page, user can check the active alarm and error. Press <UP> and <Down> to scroll

through the pages. For detailed explanation of the error code, please refer to Chapter 6.
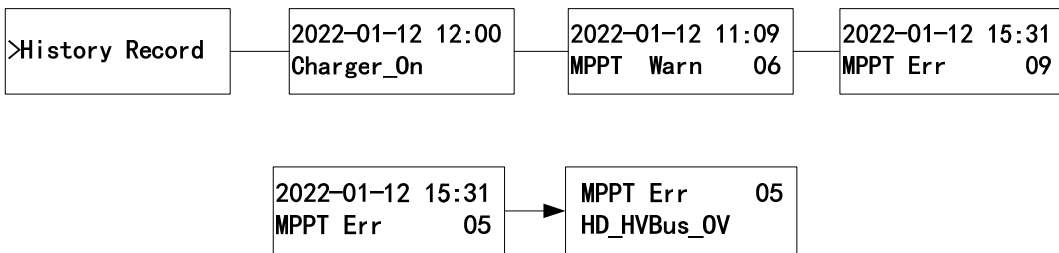
```
>Current Error   →   MPPT Err      08   →   MPPT Warn     05   →   MPPT Warn     06
                     HD_U_PSU_LV         I_PV1_CurLimit        I_PV2_CurLimit
```
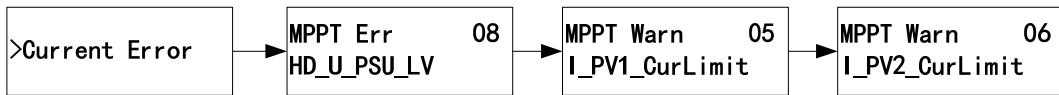
The page will display as the following image shows when there is no fault:

```
>Current Error   →   0  error
                     0  warning
```
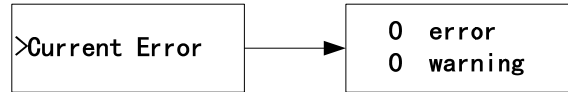
5.4.4   History Record

Enter this page, by pressing <UP> or <Down> button, user can review the history record including event and alarm. Holding the <UP> or <Down>, it will enter into auto scroll. If you want to check details for specific alarm, user can press <Enter>

```
>History Record  →  2022-01-12 12:00  →  2022-01-12 11:09  →  2022-01-12 15:31
                    Charger_On           MPPT  Warn   06      MPPT Err       09
```

```
2022-01-12 15:31  →  MPPT Err      05
MPPT Err      05      HD_HVBus_OV
```

5.4.5   System Info

After entering this page, user can check the manufacturing data of the SP600, including serial number, software version, firmware version, etc.

```
>System Info
   ├→ >Model         →  Solar Mate HV 600-120
   ├→ >Serial Number →  0123456789*#@
   ├→ >Software Ver  →  Software V1.00
   ├→ >Firmware Ver  →  Firmware V1.00
   ├→ >Hardware Ver  →  Hardware V1.00
   └→ >IRD Ver       →  IRD V1.00
```
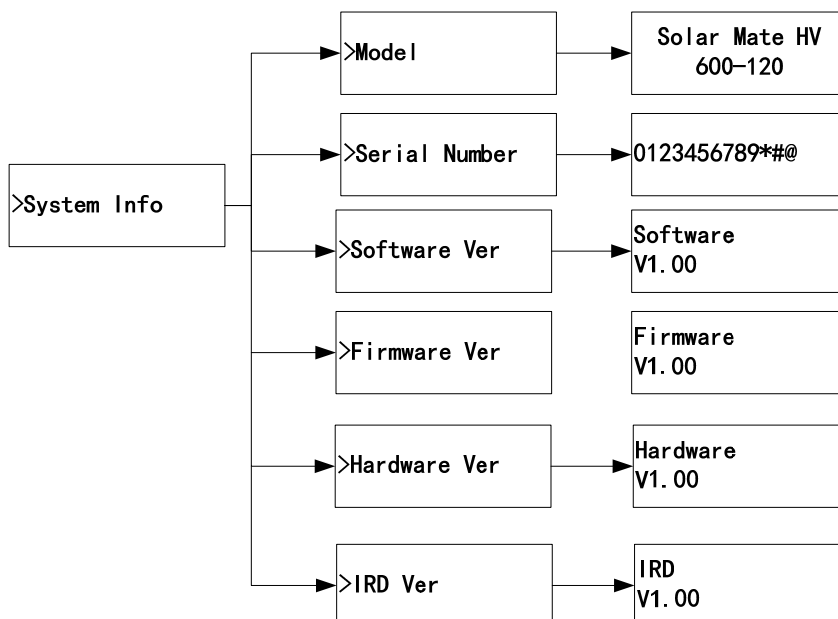
5.5 Configuration Interface

5.5.1   General Operation Instruction

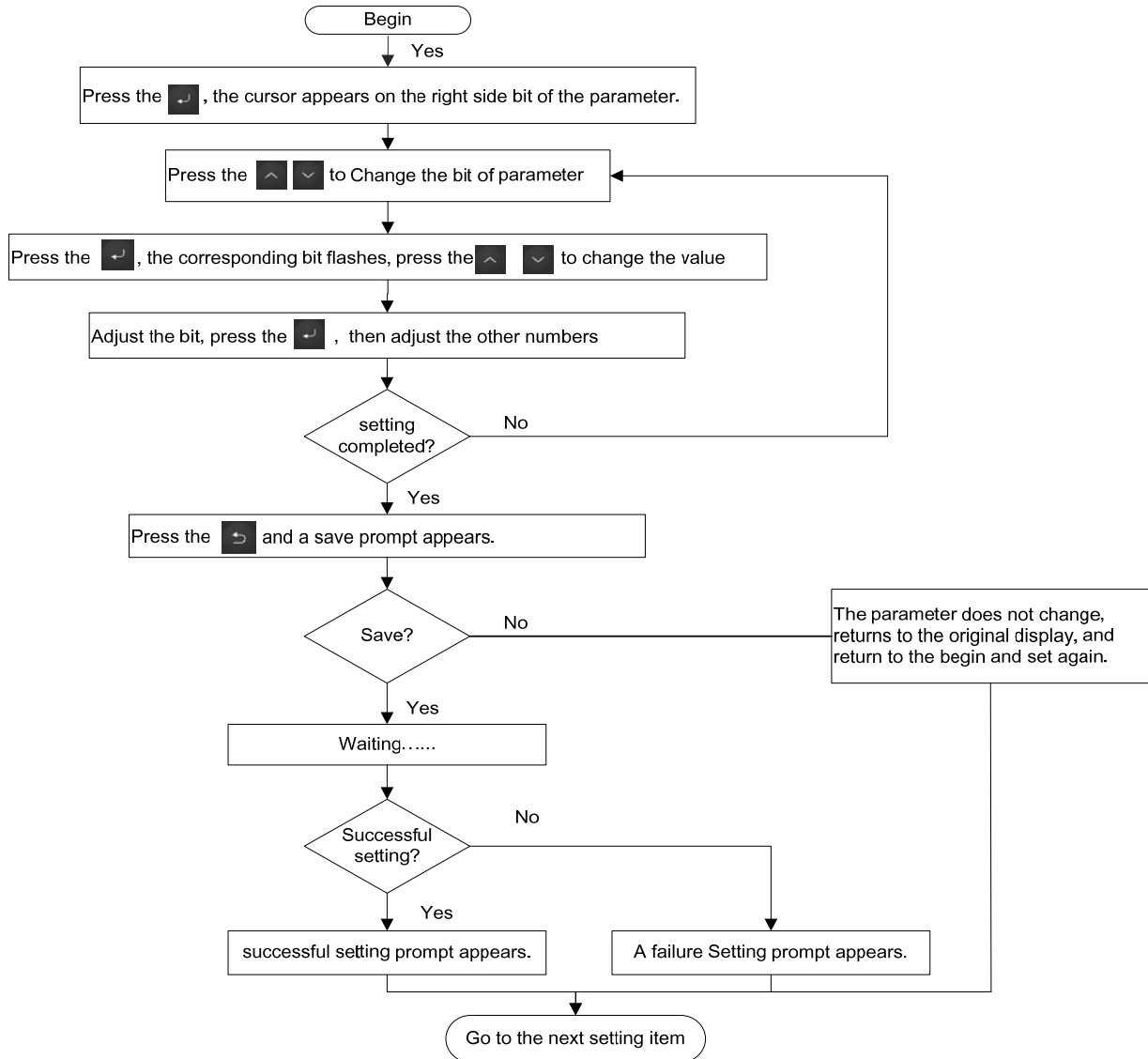SP600 offers unlimited possibility for users to program the SP600 and system for different configurations, systems and applications. The configuration can be done by combination of four switches on the front panel or through TBB Link.

The following chapters explain how to configure the parameters through the combination of switches.

➢   Scroll to the "Parameter Set" interface and press "Enter" to confirm.

➢   This menu is protected by password. The default password is "1000" and it can be changed by clients.

➢   Choose the interface for the parameters you want to set.

➢   With the combination of four buttons, you can achieve all configurations in this chapter. Please find the following functions of each button during configuration.

1.   Press <UP> or <DOWN> button to choose the specific number you want to program.

2.   Press <Enter> button to confirm.

3.   Press <UP> or <Down> button to choose the specific digit you want to set.

4.   Press <Enter> button to confirm.

5.   After entering all four digits, please press <Back> button to go back or <Enter> button to confirm.

Begin

Yes

Press the ↵ , the cursor appears on the right side bit of the parameter.

Press the ∧ ∨ to Change the bit of parameter

Press the ↵ , the corresponding bit flashes, press the ∧ ∨ to change the value

Adjust the bit, press the ↵ , then adjust the other numbers

setting completed? — No

Yes

Press the ↺ and a save prompt appears.

Save? — No → The parameter does not change, returns to the original display, and return to the begin and set again.

Yes

Waiting…….

Successful setting? — No

Yes

successful setting prompt appears.   A failure Setting prompt appears.

Go to the next setting item

5.5.2 Parameter Settings

A password is required for entering the parameter setting interface. The default is '1000' and it can be changed. This menu contains the following sub-menus for settings:

```
>Parameter Set

        >Para_System      >Para_Battery       >Setup Wizard
         Para_Mode         Change Password     Reset Parameter
```
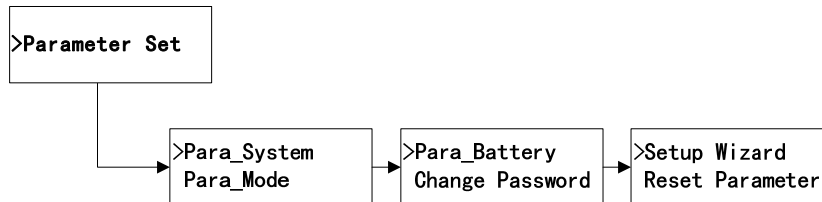
5.5.3 Para_System

	Item	Setting range	Description
Para_System	SYS_Module_Addr	1~15	System address **Default**: 1
	DC_Coupling_EN	0-Disable 1-Enable	Can be configured on the TBB inverter in a DC Couple PV system **Default**: 0-Disable

5.5.4 Para_Mode

	Item	Setting range	Description
Para_Mode	RlyCtrl_Config	0-Default 1-Alarm Switch 2-Out Ctrl	Relay configuration If the 0 is selected, and the communication loss is detected in a DC Couple PV system, it will change the NO/NC state every 5 minutes to wake up the inverter (the relay signal cable of SP600 is connected to the dry input contact of the inverter). If the 1 is selected, the relay will change the NO/NC state when any fault or alarm occurs. If the 2 is selected, the relay is controlled by the system. **Default**: 0-Default
	AUTO_ON_EN	0-Disable 1-Enable	Enable auto startup If the 0 is selected, the SP600 can only be switched on by the external control command to start charging. If the 1 is selected, the SP600 will automatically start charging when the PV voltage reaches the starting condition and the insulation resistance value is within the normal range. **Default**: 1- Enable

5.5.5   Para_Battery

Para_Battery Basic Set and Advanced Set

The Para_Battery interface includes two submenus: Basic Set, Advanced Set

Basic Set includes the following settings:

	Item	Setting range	Description
Basic Set	Battery_Type	Please refer to 2.3.2.1 for detail explanation. 0-GEL/ OPzV 1-AGM 2-Lead-Carbon 3-Customized 4-TBB Lithium	Battery type settings, see the 2.3.2.1 battery type table for details. **Default**: 1-AGM
	Battery_AH	100~2000AH	Battery Ah settings **Default**: 1000Ah

Advanced Set includes the following settings:

	Item	Setting range	Description
Advanced Set	U_Absorp_CHG	See the absorption charging voltage explained in the 2.3.2.1 battery type table for details.	Absorption charging voltage of a single battery (battery specification: 12V/each battery) Note: This value will be affected when the battery type is changed, and the user can modify it again according to actual needs. Related setting: Make sure the value is higher than that of "U_Float_CHG" and lower than that of "BAT_OV_WARN" – 0.2V/each battery; when setting the range for batteries of different voltages, you need to multiply by the number of batteries: multiply by 1 for the 12V battery, multiply by 2 for the 24V battery, or multiply by 4 for the 48V battery.
	U_Float_CHG	See the float voltage range explained in the battery type table for details.	Float voltage of a single battery (battery specification: 12V/each battery) Note: This value will be affected when the battery type is changed, and the user can modify it again according to actual needs. Related setting: Make sure the value is lower than that of "U_Absorp_CHG"; when setting the range for batteries of different voltages, you need to multiply by the number of batteries: multiply by 1

		for the 12V battery, multiply by 2 for the 24V battery, or multiply by 4 for the 48V battery.
BAT_OV_WARN	(12.0~17.0V) * number of batteries	Overvoltage warning threshold for a single battery (battery specification: 12V/each battery) Related setting: Make sure the value is higher than or equal to that of " U_Absorp_CHG "+0.2/each battery. Note: The parameter setting range varies with the battery voltage level, so when setting the range for batteries of different voltages, you need to multiply by the number of batteries. **Default**: 14.9V
Max_CHG_Current	3~Rate_CHG_CUR	System maximum charging current Note: When the battery Ah number and battery type are changed, this value will be affected, and the user can configure it again according to actual needs. Note: This value is affected when changing the battery Ah capacity and battery type, and the user can modify it again according to actual needs.
Min_Bulk_Time	1~600min	Minimum Bulk Time **Default**: 120min
Max_Absorp_Time	1~240h	Maximum absorption time **Default**: 8h
Auto_CHG_Cycle	24~2400h	Absorption cycle time **Default**: 240h
CHG_T_Compensate	1-Enable; 0-Disable	Enable the charging temperature compensation **Default**: 0-Disable
CHG_TEMP_Coef	0 ~ -36mV/℃	Charging temperature compensation coefficient **Default**: -18 mV/℃ Note: The parameter setting range varies with the battery voltage level, so when setting the range for batteries of different voltages, you need to multiply by the number of batteries.
BAT_OT_WARN_Gate	(when the battery type is non-lithium)	Over temperature warning threshold **Default**: 55℃
Mask_OV_Warn	0-Disable 1-Enable	Enable overvoltage warning shield Can be set when the battery is set to TBB LFP, to shield the BMS overvoltage

			warning. **Default**: 1-Enable
	Lower_CHG_Volt	0~2.0V	Lower charging voltage Can be set when the battery is set to TBB LFP, to reduce the charging voltage **Default**: 0V
	Float_CHG_EN	0-Disable 1-Enable	Enable float charge Can be set when the battery is set to TBB LFP. If it is enabled, the float charging current will maintain at 2A even when the lithium battery sends out a 0A charging current command. **Default**: 1-Enable

5.5.6 Change Password

Through this menu, you can change the password.

5.5.7 Reset Parameter

With this menu, you can restore the parameter settings.

5.6 User control

Using this menu, user can configure some working logic.

```
>User Control  →  >Screen Set      →  >Trigger Command
                   Date & Time
```

5.6.1 Screen Settings

Backlight _KeepOn	Enable the backlight always on function 0-Disable 1-Enable **Default:** 0-Disable
Page_Interval	To set time interval for auto page flipping to display the real-time information, 3~30s. **Default:** 5s

5.6.2 Date & Time

Set the current Date & Time.

5.6.3 Trigger Command

Fault Unlock	Unlock the fault, and the SP600 can be restarted.

5.6.4 IRD Settings

This setting interface is mainly for parameter setting of insulation resistance. The setting items are as follows :

Threshold_value	Insulation resistance detection threshold Setting range: 80kΩ-120kΩ **Default**: 100kΩ Step: 1kΩ

5.6.5 IRD Command

This setting interface is mainly for setting the commands of insulation resistance. The setting items are as follows :

IRD_Reset	Re-detect insulation resistance (valid upon single trigger)

6 FAQ

6.1 Fault code

6.1.1   MPPT fault code

Fault code	Display	Description	Solution
01	U_PV1_OV	PV input 1 overvoltage	Check the connection of PV tracker 1 and make sure the open circuit voltage does not exceed the limit
02	U_PV2_OV	PV input 2 overvoltage	Check the connection of PV tracker 2 and make sure the open circuit voltage does not exceed the limit
03	I_PV1_OC	PV input 1 overcurrent	Check the connection of PV tracker 1 and make sure the configured power does not exceed the limit
04	I_PV2_OC	PV input 2 overcurrent	Check the connection of PV tracker 2 and make sure the configured power does not exceed the limit
05	HD_HVBus_OV	High voltage bus overvoltage inside the charger	Internal failure. If it occurs repeatedly, please contact the after-sales service for replacement or maintenance
06	HD_OutBat_OV	battery overvoltage at the output	Check whether the bafttery pack at the output has a high voltage and make sure whether there is a abnormal high voltage from other charging source to the battery at the output
07	HD_LLC_OC	Overcurrent inside the charger	Internal failure. If it occurs repeatedly, please contact the after-sales service for replacement or maintenance
08	HD_U_PSU_LV	Auxiliary power supply undervoltage inside the charger	Internal failure. If it occurs repeatedly, please contact the after-sales service for replacement or maintenance
09	T_HS_OT	Heatsink over temperature inside the charger	Check the installation place of the charger and its ventilation conditions and ambient temperature
10	T_HS_LT	Heatsink low temperature inside the charger	Check the installation place of the charger and its ventilation conditions and ambient temperature
11	T_Mcu_OT	Microcontroller unit over temperature inside the charger	Check the installation place of the charger and its ventilation conditions and ambient temperature
12	U_Bat_LV_SD	battery low voltage protection	Check the validity of the PV input to

		at the output	avoid the situation where the battery is uncharged as the PV has not been connected for a long time.
13	Sam_HD_Fault	Hardware sampling fault	Check whether the PV input is reversedly connected. If it occurs repeatedly, please contact the after-sales service for replacement or maintenance.

6.1.2 BMS fault code

Fault code	Display	Description
01	Module_OV	Module overvoltage protection
02	Module_UV	Module undervoltage protection
03	Module_OT	Module over temperature protection
04	Module_UT	Module under temperature protection
05	Discharge_OC	Battery discharge overcurrent protection
06	Charge_OC	Battery charge overcurrent protection
07	SYS_Err	Module system internal fault

6.2 Warning code

6.2.1 MPPT warning code

Warning code	Display	Description	Solution
01	U_PV1_High	PV input 1 high voltage	Check the connection of PV tracker 1 and make sure the open circuit voltage does not exceed the limit
02	U_PV2_High	PV input 2 high voltage	Check the connection of PV tracker 2 and make sure the open circuit voltage does not exceed the limit
03	U_HVBus_High	High voltage bus high voltage inside the charger	Internal failure. If it occurs repeatedly, please contact the after-sales service for replacement or maintenance
04	U_OutBat_High	Battery High voltage at the output	Check whether the battery pack at the output has a high voltage and make sure whether there is a abnormal high voltage from other charging source to the output battery
05	I_PV1_CurLimit	PV input 1 current limit	Internal failure. If it occurs repeatedly, please contact the after-sales service for replacement or maintenance
06	I_PV2_CurLimit	PV input 2 current	Internal failure. If it occurs

		limit	repeatedly, please contact the after-sales service for replacement or maintenance
07	OutBat_Connect_Abanormal	Battery connection error at the output	Check whether the length and cross-sectional area of the cable for the connection of the battery pack at the output meets the requirements, and whether the battery connection circuit is disconnected
08	OutBat_ShortCut	Battery short circuit at the output	Check whether there is a short circuit in the battery circuit at the output
09	EEPROM_Err	EEPROM error inside the charger	Internal failure. If it occurs repeatedly, please contact the after-sales service for replacement or maintenance
10	ComHMI_Offline	Communication error inside the charger	Internal failure. If it occurs repeatedly, please contact the after-sales service for replacement or maintenance
11	LVBus_Low	battery volatage is too low	Check the battery pack's connection and voltage
12	T_BatExt_OT	External battery over temperature	Check the actual temperature of the external battery
13	DSP_IO_Err	IO timeout	
14	Impedance Low	Insulation resistance value is lower than the set threshold	Check the insulation of PV panel, wire and terminal.
15	INSCheck_Offline	Display screen is disconnected from the detection board during insulation resistance detection	Internal failure. If it occurs repeatedly, please contact the after-sales service for replacement or maintenance
30	Comm_Inner_Err	Internal communication error	Internal failure. If it occurs repeatedly, please contact the after-sales service for replacement or maintenance

6.2.2   BMS warning code

Warning code	Display	Description
01	Module_HV_Warn	Module overvoltage warning
02	Module_LV_Warn	Module undervoltage warning
03	Module_HT_Warn	Module over temperature warning

04	Module_LT_Warn	Module low temperature warning
05	Discharge_HC_Warn	Battery discharge overcurrent warning
06	Charge_HC_Warn	Battery charging overcurrent warning
07	INT Comm Fail	Internal communication fails among modules in parallel
08	BMS_SOC_Low	System low SOC warning
09	BMS_Offline	Communication lost between display screen and lithium battery

7 Specification

Model	SP600-120
Charger	
Battery voltage (V)	48
Maximum charge current (A)	120
Maximum charge Power	7000W @ 57.6V total 5000W @ 57.6V per tracker
Charge voltage 'absorption' (V)	Default: 57.6
Charge voltage 'float' (V)	Default: 55.2
Charger voltage range (V)	40-60
Battery types	AGM / GEL / OPzV / Lead-Carbon / Lithium
Battery temperature sensor	Included
Maximum efficiency	97%
Self consumption	80mA @ 48V
Solar	
Maximum PV open circuit voltage (V)	600
Start-up voltage (V)	120
PV operating voltage range (V)	120-525 *SP600-120 will stop working if a higher PV open circuit voltage (525V~600V) is connected.
MPPT voltage range (V)	80-525
Number of MPPT trackers	2
Maximum PV input current per tracker (A)	18 + 18
Maximum PV short circuit current per tracker (A)	20 + 20
Maximum PV power per tracker (W)	8000 + 8000
MPPT efficiency	>99.9%
PV array insulation resistance detection (Earth fault detection)	Integrated
General data	
Surge Protection	Yes
Protection	a) battery voltage too high, b) battery voltage too low c) temperature too high, d) PV reverse polarity ;
Dry In port	1x
Programmable	1x (28Vdc/4A or 250Vac/2A)
General purpose com. Port	RS485
Operating temperature range	-20˚C to 65˚C
Relative humidity in operation	95% without condensation
Altitude (m)	3000
Mechanical Data	
Dimension (mm) (max)	484*280*108
Net Weight (kg)	7.8
Cooling	Forced fan
Protection index	IP21
Standards	
Safety	EN-IEC 62109-1, EN-IEC 62109-2
EMC	EN61000-6-1, EN61000-6-2, EN61000-6-3

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