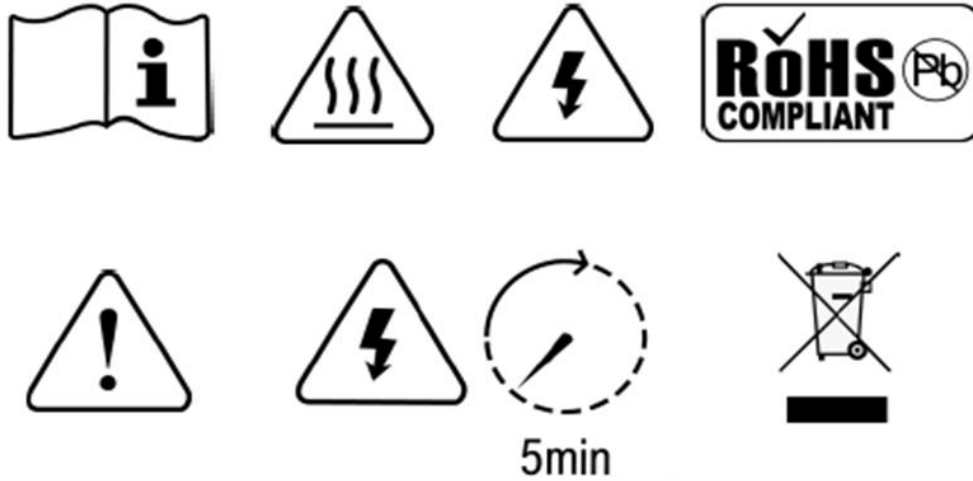||||/|| TBB POWER

Version: A1.0

MPPT
CHARGE
CONTROLLER
USER MANUAL

Solar Mate SP900 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.

➤ Assumes no responsibility or liability for loss or damage, whether direct, indirect, consequential or incidental, which might arise out of the use of such information.

➤ 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 SP900 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

SP900 series, a high-voltage and high power isolated MPPT solar charge controller (**hereinafter referred to as SP900**), is designed with 900V 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.

SP900 series has the following features:

1. With high open-circuit voltage and a wide 80-850V 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 >98%.

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

6. Intelligent fan control to minimize noise.

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

8. Good dust-proof design.

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

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

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

2.1.2   Naming Rules
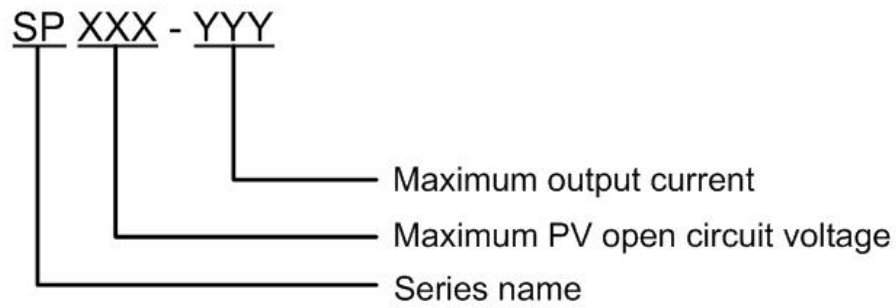
Table 2-1 Power connection terminal introduction

Field	Character	Description	
SP	SP	SP series MPPT solar charge controller	
XXX	900	PV open circuit voltage	900V
YYY	200	Maximum output current	200A

2.2 Structure

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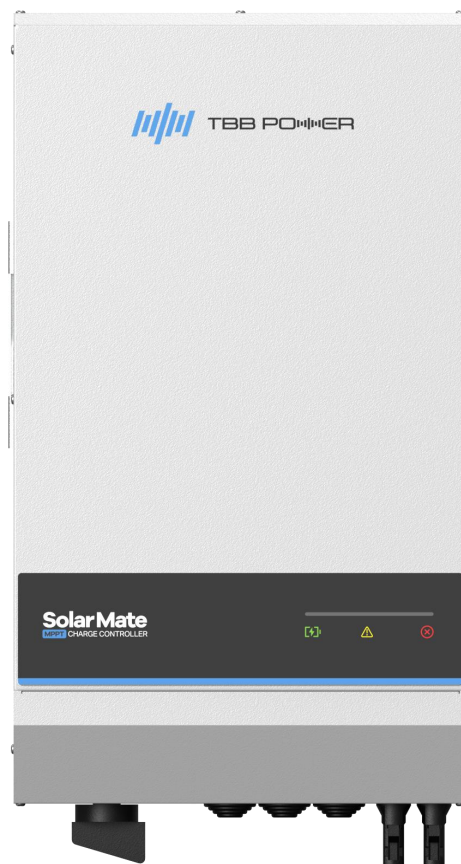
Figure 2-1 MPPT charge controller structure in front view

2.2.2 Connection Terminal
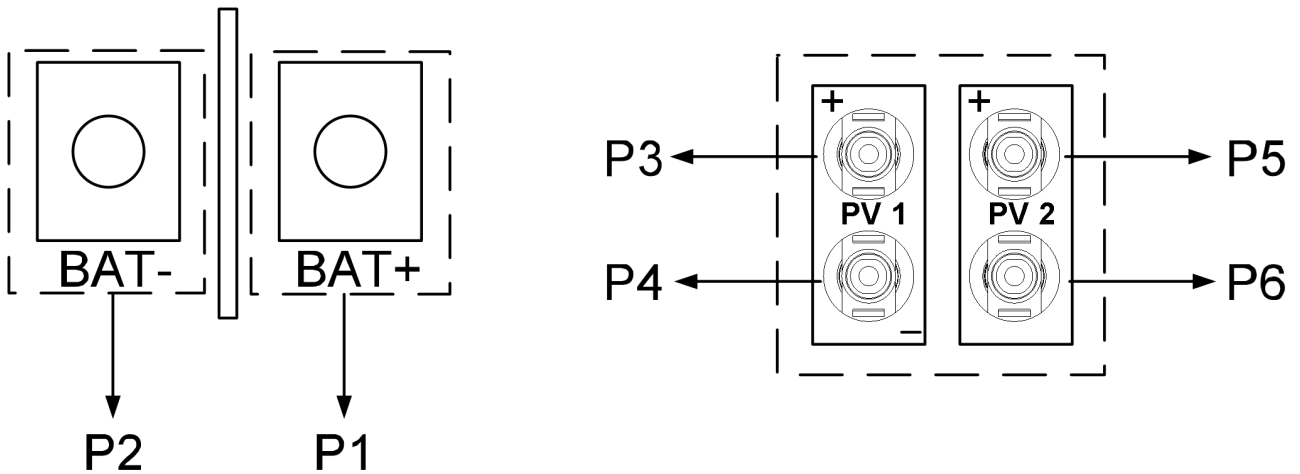
Figure 2-2 Power connection terminals

Table 2-2 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	
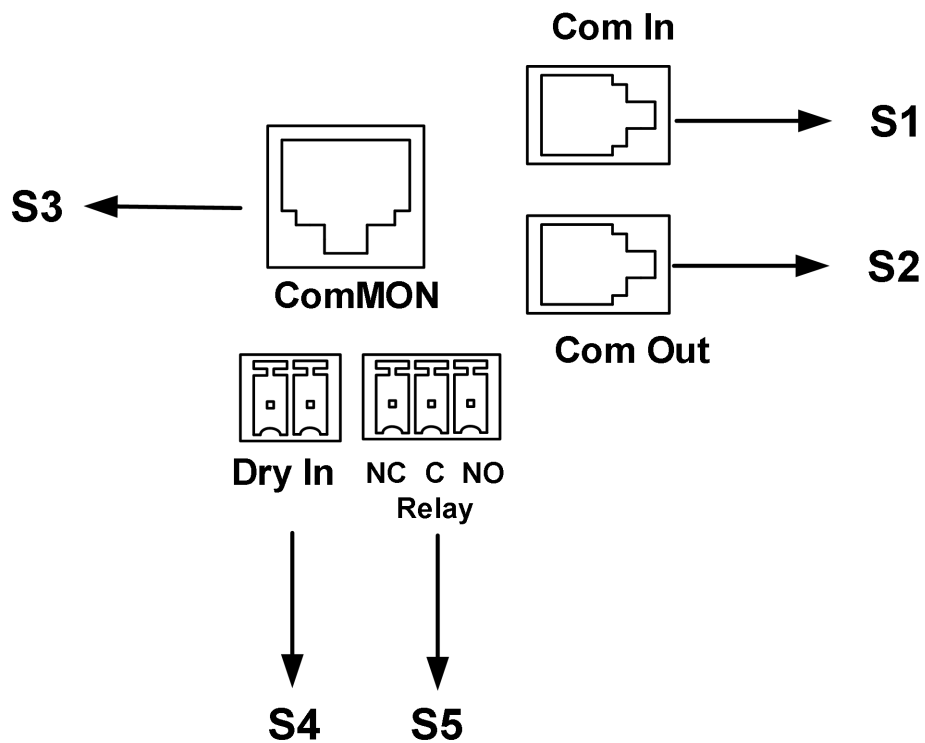
Figure 2-3 Signal connection terminals

Table 2-3 Signal connection terminal introduction

No.	Name	Description	Note
S1	Com In	For parallel connection of SP900 series for system expansion	The Com Out terminal of the first SP900 is connected to the Com In terminal of the second unit, and more units can be connected in this way. The Com In terminal of the first SP900 can be connected to the inverter for a DC Couple PV application.
S2	Com Out	For parallel connection of SP900 series for system expansion	
S3	ComMON	RS485 for debugging with the TBB Interface CAN for communication with lithium battery	When Com In and Com Out terminals are connected to the inverter, there is no need to use ComMON
S4	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
S5	Relay	Dry output contact, its control logic can be selected through the TBBLinking	Built-in 28VDC/4A relay

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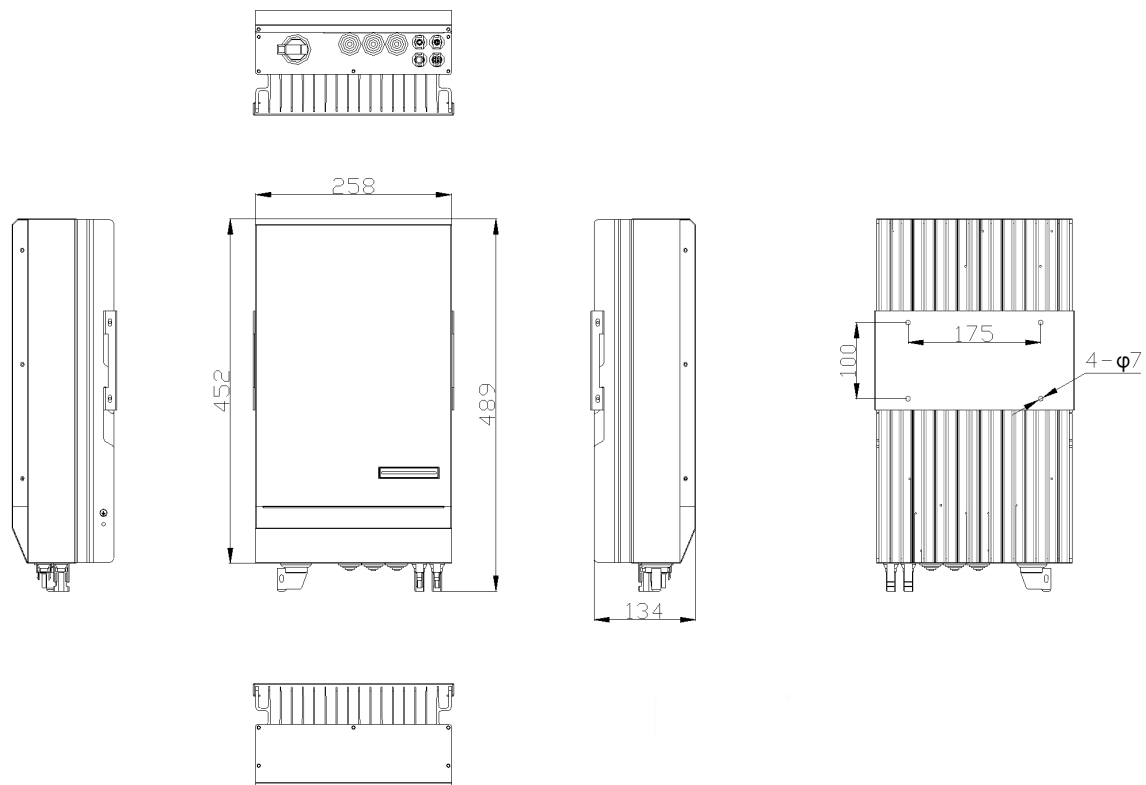
Figure 2-4 Dimension of Solar Mate MPPT charge controller

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

SP900 supports working with lithium and lead-acid batteries. The current battery type and charging parameters can be displayed and set on the TBBLingking.

| 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

SP900 supports working with Tyrann II and Matrix II for DC Couple PV system.

2.3.2.3 Compatible with Lead-acid Battery

SP900 supports TBB standard multi-stage lead-acid battery charging solution.
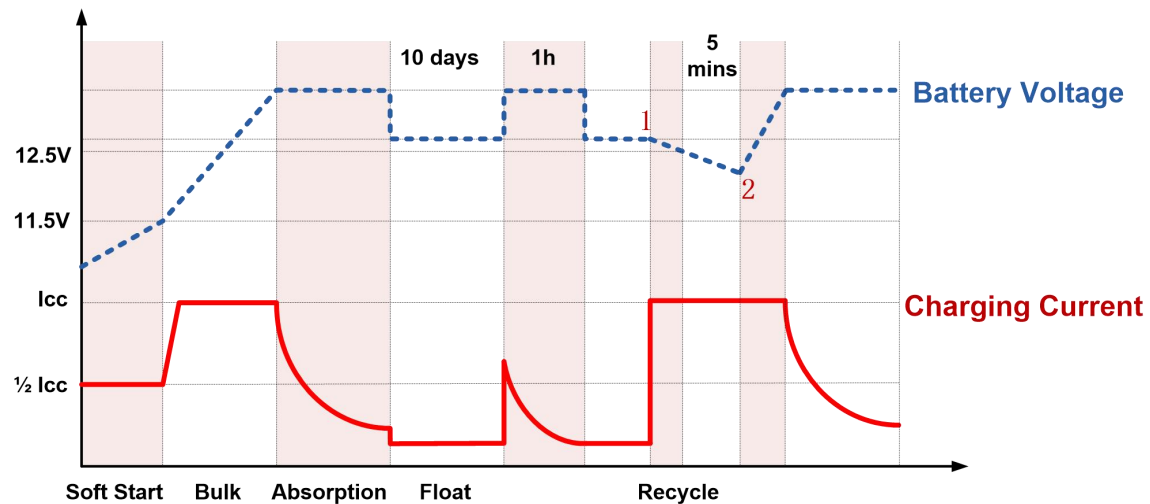
2.3.3 Input PV Source Adaptability

1. If the input PV voltage is within the maximum voltage range (<900V) allowed by SP900, then the SP900 will not get damaged. It can communicate and display normally.

2. If SP900 can start up with an input PV voltage higher than the starting voltage of 160V, then it should be able to perform charging normally within its MPPT voltage range (80~850V).

3. In the event of larger configured input PV power, SP900 will automatically limit the maximum current (20A) and maximum power (8000W) for each of the input terminal.

4. SP900 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

SP900 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 Battery Overcurrent Detection at the Output

In the event of a large short-circuit current at the output terminal during charging process, SP900 can automatically detect it and shut down immediately for security reason.

After the short-circuit condition at the output terminal is over, SP900 will automatically restart.

2.3.6 PV Array Insulation Resistance Detection

SP900 is designed with built-in PV array insulation resistance detection (earth fault detection) function.

SP900 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), SP900 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 SP900 and turn off the battery switch, and then troubleshoot and deal with the problem. When the insulation resistance is restored to normal, restart the SP900 to perform insulation resistance detection and to charge the battery if the insulation resistance detection is successfully passed.

2.3.7   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, SP900 will stop working. The maximum PV short-circuit current cannot exceed 20A. After the PV is correctly wired, the SP900 will work normally.

PV over voltage protection

When the PV voltage is higher than the operating voltage, the SP900 will shut down output with light alarm, to ensure that the SP900 will not be damaged.

When the PV voltage exceeds the highest PV open circuit voltage range of SP900 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
M6*40mm self-tapping screw and expansion bolt (For fixing the wall-mount bracket on the wall)	5
M4*12mm screw (For fixing the MPPT charge controller on the wall-mount bracket)	4

3.2 Select Installation Location

3.2.1 Requirement

1. The protection category of this charge controller is IP41, 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 SP900 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 SP900 upon installation.
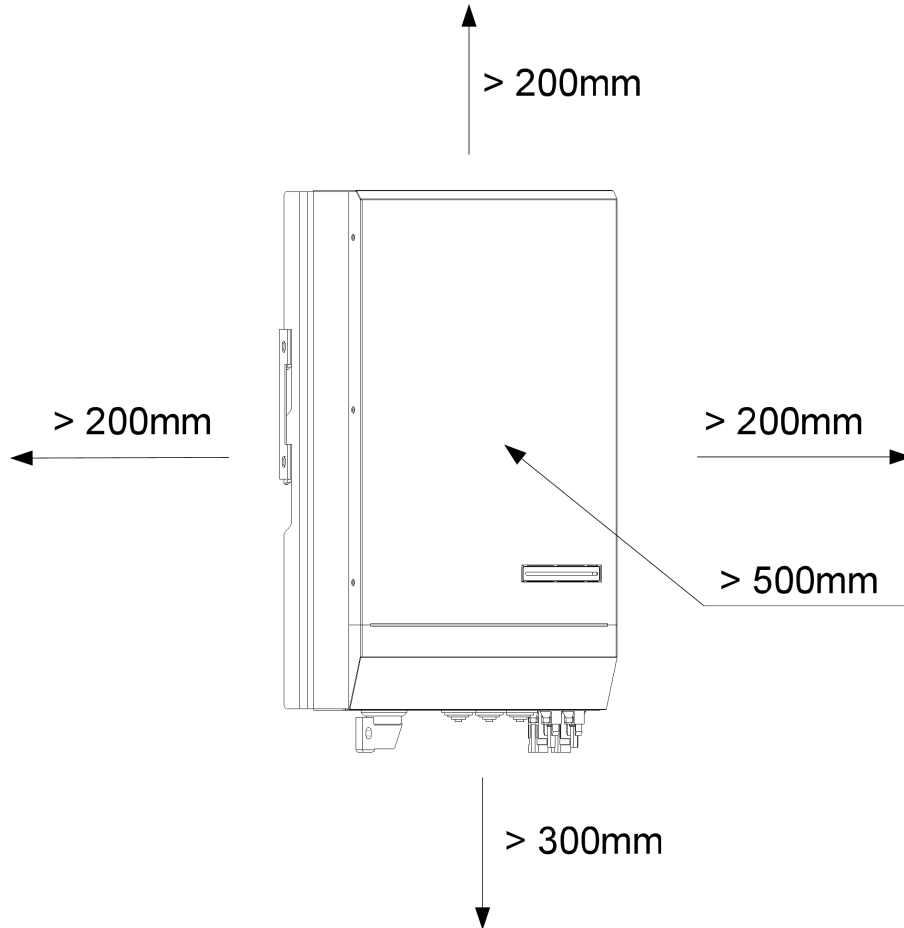

Figure 3-1 Space Requirements

3.3 Installation

Step1: Find a flat solid wall surface. Use the wall-mount bracket as a template and drill 4 holes. Insert 4 expansion bolts after drilling. Fix the wall-mount bracket on the wall with 4 M6*40mm self-tapping screws.

Step2: Mount the SP900 onto the wall-mount bracket.

Step3: Fix the SP900 with 4 M4*12mm screws.
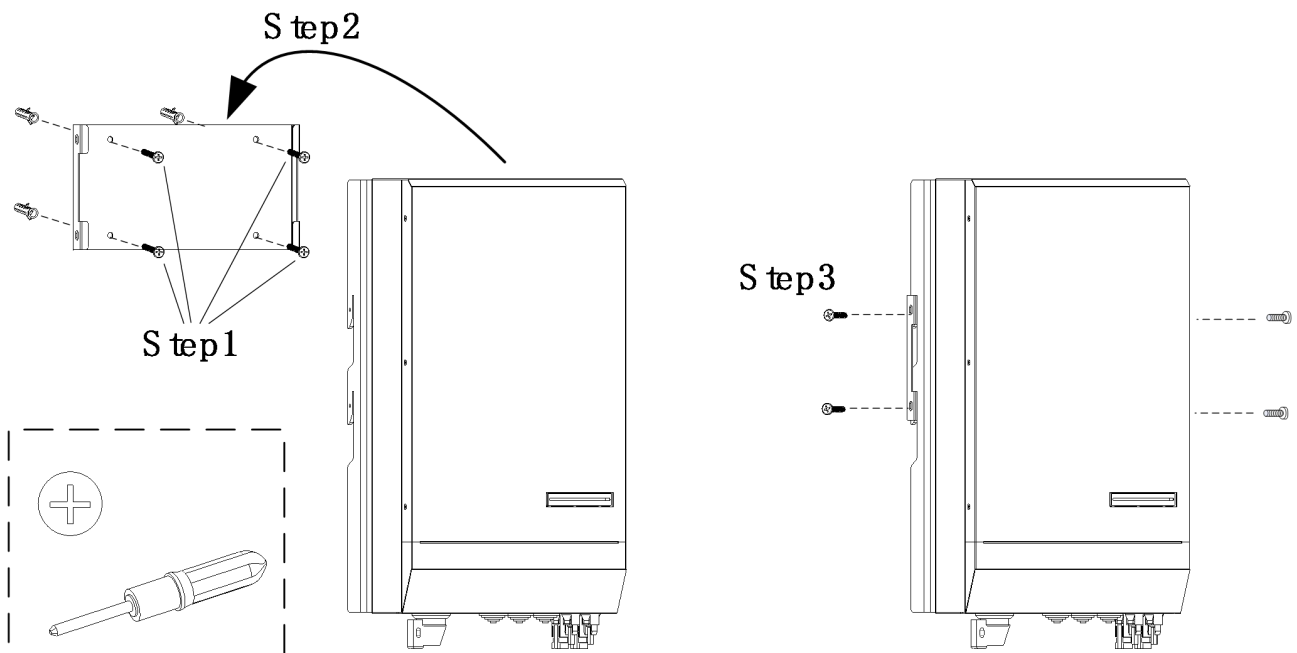
Figure 3-2 Illustration of installation

⚠ Please double check the SP900 is securely installed.

3.4 Preparation Before Wiring

3.4.1 PV Array Preparation

Table 3-2 Recommended PV array configuration for SP900

Max. PV voltage（total Voc @ **lowest temperature**）	900V
Min. PV voltage（total Voc @ **highest temperature**）	160V
Max. PV current（total Isc @ **highest temperature**）	25A 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	SP900-200	(1) The voltage should be greater than 63Vdc. (2) The current should be greater than 250A.
2	PV array breaker	SP900-200	(1) The voltage should be greater than 900Vdc per tracker. (2) The current should be greater than 25A per tracker.

3.4.3 Cable Preparation

➢ It is recommended to install SP900 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
SP900-200	Cross-sectional area	50mm²
	Voltage drop	0.6V

3.5 Wiring

Step 1: Connect the ground wire firmly.

Step 2: Connect the corresponding communication cable according to the requirements of SP900.

Step 3: Connect the corresponding dry in and relay signal cable according to the requirements of SP900.

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 SP900 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 the circuit breaker on the SP900 has been disconnected.)

Step 6: After all wiring is completed, please fix the bottom cover back to the SP900 by screwing the screws.

TBB POWER

Step 5

OFF

ON

+ +

PV 1 PV 2

_

_ PV Switch

Step 1

1.5Nm~2Nm

Step 4

M8 / 10~12 Nm

Step 2

ComMON Com Out Com In

Step 3

Dry In NC C NO
Relay

Step 6

1.5Nm~2Nm
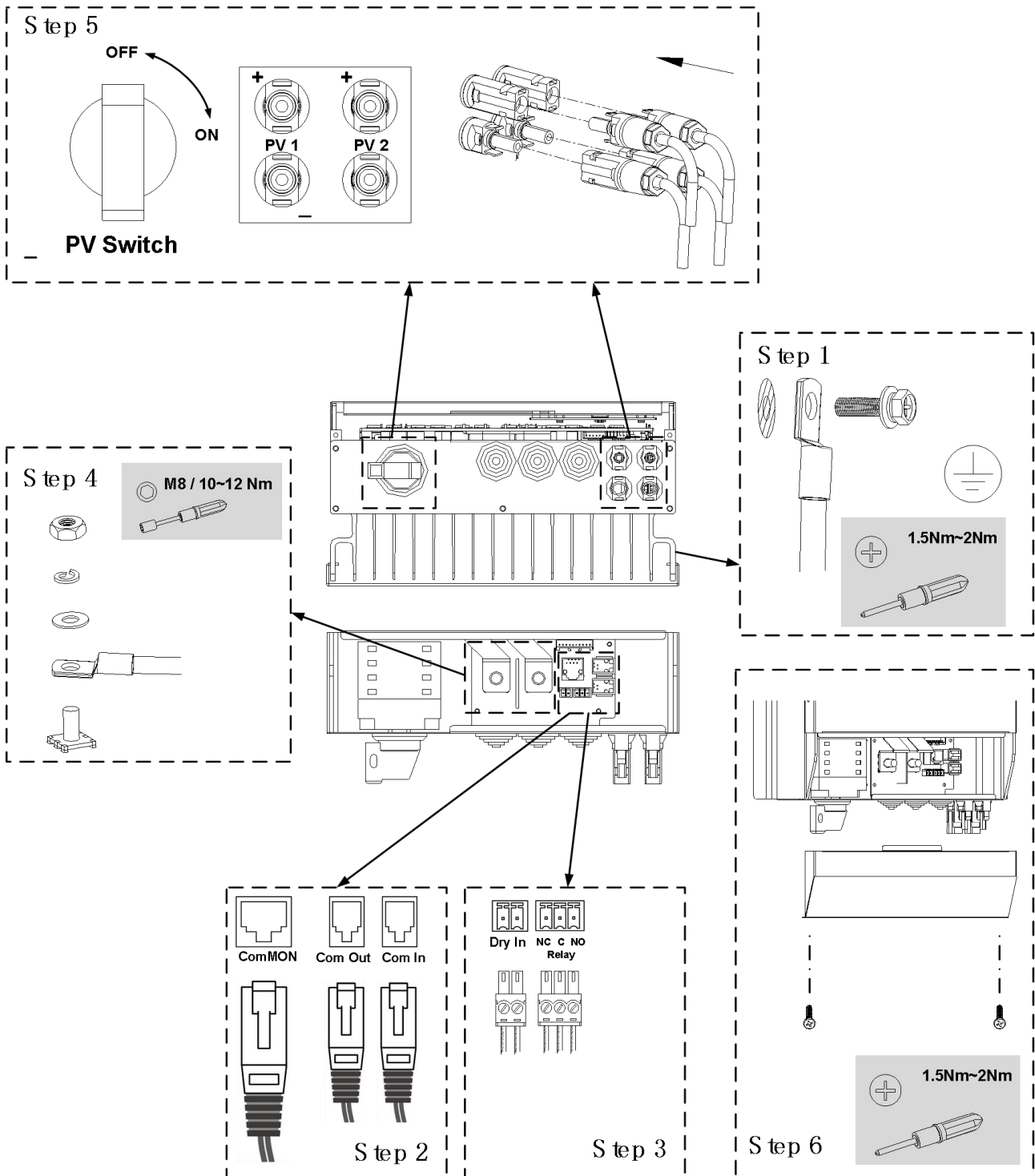
4 Configuration

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 through TBBLinking with TBB Inverter.

Step 4: Observe the LED indicator to make sure the MPPT charge controller is running normally.

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 LED indicator

Table 4-1 LED indicator

Color	Status	Function
Green	Solid On	The battery is charging.
	Flashing	Standby Mode.
Yellow	Solid On	Warning occurs.
Red	Solid On	Fault occurs.

5   Operation

5.1 Configure SP900 Through TBBLinking

SP900 supports working with Tyrann, Tyrann II and Matrix II for DC Couple system, connect inverter to a computer via the TBB Interface module, and configure SP900's parameters on the TBBLinking.

The configure items described in the following sections are for reference only. Please refer to the configure items on the TBBLinking for actual settings.

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 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 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 at the output	Check the validity of the PV input to avoid the situation where the battery is

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

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 limit	Internal failure. If it occurs 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	Internal failure. If it occurs

		inside the charger	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	Impedance Low	Insulation resistance value is lower than the set threshold	Check the insulation of PV panel, wire and terminal.

7 Specification

Model	SP900-200
Charger	
Battery voltage (V)	48
Maximum charge current (A)	200
Maximum charge Power	11500W @ 57.6V total 8000W @ 57.6V per tracker
Charge voltage 'absorption' (V)	Default: 57.6
Charge voltage 'float' (V)	Default: 54.0
Charger voltage range (V)	40-60
Battery types	AGM / GEL / OPzV / Lead-Carbon / Lithium
Battery temperature sensor	Included
Maximum efficiency	98%
Solar	
Maximum PV open circuit voltage (V)	900
Start-up voltage (V)	160
MPPT voltage range (V)	80-850
Number of MPPT trackers	2
Maximum PV input current per tracker (A)	20 + 20
Maximum PV short circuit current per tracker (A)	25 + 25
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 / CAN
Operating temperature range	-40˚C to 65˚C
Relative humidity in operation	95% without condensation
Altitude (m)	4000
Mechanical Data	
Dimension (mm) (max)	258W*452H*134D (Excluding Connectors and Brackets)
Net Weight (kg)	12
Cooling	Natural Cooling
Protection index	IP41
Standards	
Safety	EN-IEC 62109-1, EN-IEC 62109-2
EMC	EN61000-6-1, EN61000-6-2, EN61000-6-3

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