

Vor der Installation unbedingt Bedienungsanleitung lesen!

Achtung

Anschlussreihenfolge und Polung unbedingt beachten

1. Batterie auf BAT
2. Verbraucher (sofern vorhanden) auf LOAD
3. Solarmodul auf PV

Niemals das Modul auf Load (=Verbraucher!)
Nichtbeachtung führt zur Zerstörung des Reglers

Bedienungsanleitung Apple 5, Apple 10, Apple 15, Apple 20

Bitte vor Installation unbedingt lesen!

Der Apple ist ein Laderregler speziell für den Einsatz in Solar-Stromanlagen (Photovoltaik). Er vereint modernste SMD-Technologie mit attraktivem Preis-Leistungsverhältnis. Durch seine besonders leistungsfähige Elektronik ist der Eigenverbrauch an elektrischer Energie sehr niedrig. Der patentierte FHI[®] Algorithmus passt die vom Solarmodul zur gelieferte Leistung exakt an den Lade-Zustand der Batterie an. Zum Schutz der Batterie alarmiert ein eingebauter Warnnton das Erreichen der Tiefentlade-schwelle, der eingebaute Tiefentladeschutz trennt angeschlossene Verbraucher von der Stromzufuhr. Die 8-stufige LED-Anzeige informiert über den aktuellen Ladestand der Batterie.

Wiederholtes Verweilen der Batterie im ungeladenen Zustand führt zu schneller Alterung und Schädigung der Batterie, verursacht durch Sulfatierung und dadurch Zellen-Kurzschluss. Bei Anschluss der Verbraucher an den „Load-Anschluss“ werden diese bei Erreichen der Tiefentladeschwelle vom Stromverbrauch getrennt. Nach Auslösen dieses sog. „LVD“ (Low Voltage Disconnect), kann die Batterie beim nächsten Entladevorgang nicht wieder auf das gleiche niedrige Level entladen werden. Das wird dem Benutzer durch einen gelben LED-Strafmodus angezeigt. Erst nach Maximalladung auf 14,5V, sog. „Boost Charge Level“, wird der Strafmodus gelöscht und die volle Kapazität der Batterie zur Verfügung gestellt. Der „Apple“ wird in 3 Leistungsklassen geliefert: mit 5, 10 oder 15 Ampère. Der Apple Laderegler ist nicht für die ungeschützte Montage im Freien geeignet.

Wesentliche Merkmale in Kürze:

- 8-stellige Batterie-Zustandsanzeige (SOC)
- Anzeige verschiedenster Betriebszustände
- Geringer Eigenverbrauch
- Elektronischer Überspannungs- und Verpolungsschutz
- Gasungssteuerung & Pulsweiten Modulation (PWM)
- Überlade- und Tiefentladeschutz
- Vorwarnung Tiefentladung durch Akustik Alarm
- Ein-, Ausschalter für angeschlossene Verbraucher
- Verdeckte Kabelanschlüsse
- Selbstlernender FHI[®] Algorithmus zur optimalen Ladung der Batterie

LED-Anzeigen und Tasterfunktionen:

- 8-Stufen LED-Anzeige „SOC“
- Die SOC Anzeige (State of Charge = Ladezustand der Batterie) zeigt den Ladezustand der Batterie in 1/8 Schritten an. Leuchten alle LED's, ist die Batterie voll geladen. (Batteriespannung mind. 12.7 – 13.1 V). Leuchtet nur die unterste LED, ist die Batterie nahezu entladen, der Load-Ausgang des Reglers wird bei weiterer Entladung von der Batterie getrennt. (Batteriespannung zwischen 11.4 - 11.7 V)
- „Cut Off“: Tiefentladeschutz
- Nach Unterschreiten der Batteriespannung von 11,9V (+/- 0,1V) im „Penalty Mode“ bzw. 11,5V bei normalem Betrieb, wird der Lastausgang „Load“ deaktiviert. Angeschlossenen Verbraucher werden von der Stromzufuhr aus der Batterie getrennt.
- „Display“-Taster

Durch Betätigen des Tasters werden angezeigt:

- Die 8-stufige LED-Anzeige „SOC“,
- Auslösung des Tiefentladeschutzes „Cut Off“,
- „Master Switch Off/Short/Overload“,
- „Penalty“
- „On/Off“-Taster

Zum Ein- oder Abschalten von an „Load“ angeschlossener Verbraucher durch einmaliges Betätigen des Tasters.

- „Master Switch Off/Short/Overload“-Anzeige
- Die Anzeige leuchtet auf nach Betätigung des „Master Switch Off/Short/Overload“ Tasters zur Abschaltung angeschlossener Verbraucher oder bei Kurzschluss auf der Verbraucherseite.
- „Penalty“ LED-Anzeige

- Die LED-Anzeige leuchtet auf, wenn der Fehlermodus aktiviert ist. Ursachen dafür sind:
- Erst-Inbetriebnahme
- Batteriespannung bei erster Inbetriebnahme unter 12.7 V
- Unterschreiten der Batteriespannung von 11,9V im Fehlermodus, oder 11.5 V im Nicht-Fehlermodus
- „Charging“:

Leuchtet auf, sobald die Batterie geladen wird. Die Leuchtstärke variiert dabei von hell = hoher Ladestrom, bis dunkel = geringer Ladestrom.

Installation:

Vor Anschluss des Reglers unbedingt erst die Bedienungsanleitung lesen. Reklamationen durch unsachgemäßen Anschluss des Reglers können nicht anerkannt werden!

Anschlüsse auf der Rückseite des Reglers:

1. „**BAT**“: Verbinden Sie den (+) Pol des Reglers mit dem (+) Pol der Batterie, den (-) Pol des Reglers mit dem

(-) Pol der Batterie.

2. Drücken Sie den „Display“-Taster. Alle 8 Stufen der LED-Anzeige leuchten nun auf, wenn die Batterie voll geladen ist.

3. „**LOAD**“: Verbinden Sie den (+)-Pol des Reglers mit dem (+) Anschluss des elektrischen Verbrauchers, den

(-) Pol mit dem (-) Anschluss des Verbrauchers.

Achtung: Bei Einsatz eines Kompressorkühlschranks darf dieser nicht mit dem Load-Ausgang des Reglers verbunden werden!

Kompressorkühlschränke haben einen eigenen Tiefentladeschutz.

Die Funktion des Reglers wird nicht beeinträchtigt, wenn keine elektrischen Verbraucher angeschlossen werden.

4. Drücken Sie den „On/Off“ Taster und halten sie ihn für 1 bis 2 Sekunden gedrückt. Der „Load“ Ausgang wird aktiviert, angeschlossene elektrische Verbraucher mit Energie versorgt.

5. „**PV**“: Verbinden Sie den (+) Pol des Reglers mit dem (+) Anschluss des Solarmoduls, den (-) Pol des Apple mit dem (-) Anschluss des Solarmoduls.

6. Die „Charging“ LED leuchtet, wenn das Solarmodul ausreichend Ladeenergie liefert. (Nicht nachts oder bei extrem schlechter Witterung)

7. Montieren sie nun den Regler mit beiliegenden Schrauben. Geeignete Installationsorte sind z.B. die Innenbereiche von Gebäuden und Fahrzeugen mit nicht elektrisch leitenden Oberflächen (z.B. Mauerwerk, Kunststoff- oder Holzoberflächen). Nicht geeignet sind Montagen im Freien, Umgebungen mit Regen- und Spritzwasser, oder hohen Temperaturen, z.B. in der Nähe von Öfen, Herden, Heizungen.

Warnhinweise:

- Schließen sie den Regler niemals an 230V Wechselstrom an. Apple Laderegler sind für den ausschließlichen Betrieb in 12V Gleichstrom-Systemen geeignet.
- Beachten sie, dass die Modulleistung des Solargenerators die Leistung des Apple Ladereglers nicht übersteigt. (Siehe unten)
- Überprüfen sie vor Anschluss der elektrischen Komponenten diese auf die richtige Polarität.
- Verwenden sie Apple Regler nur im Innenbereich.

Apple 5: maximale Solarmodulleistung 5A oder 80Wp

Apple 10: maximale Solarmodulleistung 10A oder 160Wp

Apple 15: maximale Solarmodulleistung 15A oder 240Wp

Garantie/Haftungsausschlüsse:

Sundaya gewährt auf alle Apple Regler die im Land des Kaufs geltenden gesetzlichen Gewährleistungen. Diese variieren von Land zu Land. Ihr Händler informiert sie gerne darüber.

Haftungsausschlüsse sind z.B.:

- Wasser oder Feuchtigkeit im Gerät
- Nicht autorisiertes Öffnen des Reglers
- Siegelbruch
- Missbrauch

Mechanische Spezifikation:

Gehäuse: ABS Kunststoff

Farbe: Grün

Ausführung: rund

Maße: 120 mm x 40 mm

Anschlussklemmen: 8 mm

Technische Spezifikation:

Systemspannung: 12 V

Eigenverbrauch: 4 mA

Max. Solar-Strom Apple 5: 0 5A – 0/+25% Überlastfähigkeit

Max. Solar-Strom Apple 10: 10A – 0/+25% Überlastfähigkeit

Max. Solar-Strom Apple 15: 15A – 0/+25% Überlastfähigkeit

Tiefentladewarnung: 11,7 V (im Nicht-Fehlermodus)

Lastabwurf : 11.5 V +/- 0,1 V (im Nicht-Fehlermodus)

Tiefentladewarnung: 12,1 V (im Fehlermodus)

Lastabwurf: 11,9 V (im Fehlermodus)

Lastaufschaltung: 12,7 V

Fehlermodus Neustart: 14,5 V +/- 0,1 V

Ladeendspannung: 14,5 V

Temperaturkompensation: - 0,02 V



Apple

User's Manual

Product Description

The "Apple" is a unique small PV charge/discharge controller in the Sundaya product range, specially designed for cost-effective applications based on SMD technology. The Apple is extremely power-efficient due to its very low voltage drop over both input and output switching Mosfets. Unique features include Forced Health Improvement (FHI®) algorithm, and a buzzer to remind the User of the battery's SOC (State of Charge) as it gets close to LVD (Low Voltage Disconnect). Furthermore, it comes with a self-reset electronic master-switch, so that whenever the Apple is reconnected to the battery or simply newly installed, the output will always stay inactive until the user presses on the reset switch. A SOC (State of Charge) indicator gives clear indication of the battery's status.

Forced Health Improvement (FHI®):

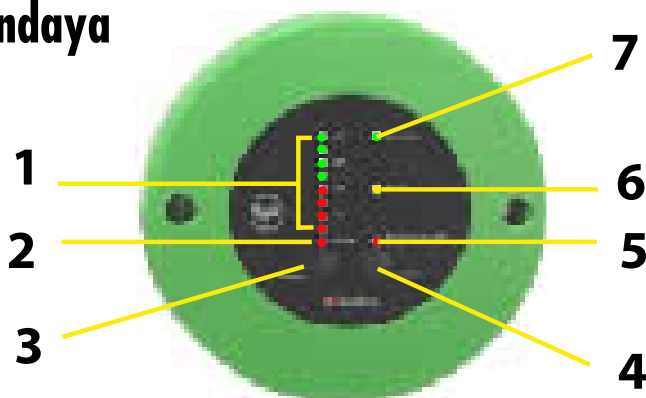
Frequent cycling of the battery at a very low state of charge causes fast deterioration of the battery due to sulphation and stratification. The Apple will not allow the User to frequently operate the battery at low state of charge. After reaching a forced Low Voltage Disconnect (LVD), the user will not be able to discharge the battery to the same low level again next day. This is indicated to the user with a yellow LED Penalty mode. Only after reaching the Boost Charge level of 14.5V the Penalty mode will be reset and the Apple will allow the user to use the full battery capacity again.

The Apple is available in 3 standard charge/discharge current capacities 5, 10 and 15 Amperes. With its clean and round appearance, and all cable connections nicely covered at the backside of the unit, the Apple is esthetically attractive for indoor installation.

Main Features:

- # Strong input and output connectors with clear polarity markings
 - # Cable connectors not reachable and not visible after mounting on the wall (safety and esthetic reasons)
 - # Extremely low voltage drop over power mosfets
 - # Boost Charge mode
 - # LED Indicator for charging
 - # LED Indicator for state of charge in 8 steps
 - # Electronic Overload/Short circuit protection with LED Indicator
 - # Electronic Master-switch to centrally cut off all loads
 - # Deep discharge cut off with LED Indicator
 - # Forced Health Improvement (FHI®) feature
-

 **Sundaya**



LED Indicators and Button/Switch Description:

1 8-steps SOC (State of Charge) LED Indicator

To indicate the SOC of the batteries, the SOC level is proportional to the numbers of the LEDs lit up. **Example:** All 8 LEDs lit up indicate the batteries are fully charged (SOC = 12.7 - 13.1V); Only the first (lowest) LEDs lit up indicate the batteries close to exhaustion, the output of the controller will soon be cut if the LOAD continues to be connected without sufficient charging to replenish the batteries (SOC = 11.4 - 11.7V).

2. Deep discharge Cut-Off LED Indicator

To indicate that the controller disconnected the output due to SOC falling below 11.9 V +/- 0.10 V on Penalty mode, or 11.5V +/- 0.10 V on Non Penalty mode.

3. Display Button

The 8-steps SOC (State of Charge) LED Indicator, Deep discharge Cut-Off LED Indicator, Master-switch / Overload/Short circuit LED Indicator, and Penalty mode LED Indicator will display the status only when the Display Button pressed.

4. On/Off Master-Switch

Toggle the controller output from on to off, or off to on by pressing the switch once.

5. Master-switch / Overload/Short circuit LED Indicator

The LED Indicator will light up when the User turns off the output by pressing the On/Off Master-Switch once, or the controller cuts off the output due to a short circuit detected.

6. Penalty mode LED Indicator

The LED Indicator will light up when the Penalty mode is in effect, due to:

- During controller's first power up, the SOC of the battery is below 12.7V
- After the controller disconnected the output due to SOC falling below 11.9V +/- 0.10 V on Penalty mode, or 11.5V +/- 0.10 V on Non Penalty mode.

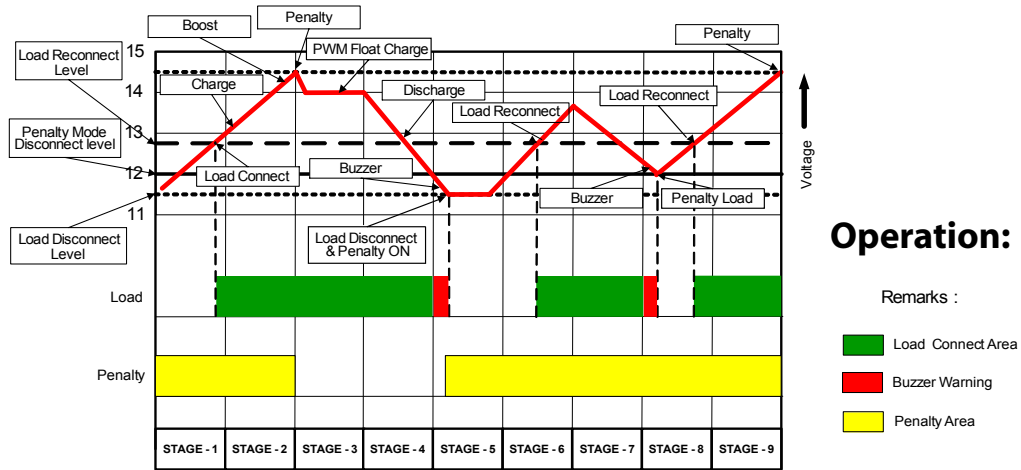
7. Charging LED Indicator

The LED Indicator will light up when charging take place.



Installation procedure:

1. Unpack the controller.
 2. Prepare a fully charged battery.
 3. Connect the controller to the fully charged battery. (Caution: - please make sure the polarities are correctly connected)
 4. Press on the Display Button. All the 8-steps SOC (State of Charge) LED Indicator should light up if the battery is fully charged.
 5. Connect the controller output to the load. Ideally, use low power load first such as DC lighting product (Ulite3), to verify proper operation. (Caution: - please make sure the positive and negative polarities are correctly connected)
 6. Press the On/Off Master-Switch, and hold for one or two seconds, then release. The Load will turn on.
 7. Connect the Solar Panel Input to either 12Vdc Solar modular or 12Vdc charger such as DC10. (Caution: - please make sure the positive and negative polarities are correctly connected)
 8. The Charging LED Indicator should light up if charging is taking place.
 9. Mount the controller in indoor environment with minimum exposure to rainwater, water spill or hot temperature such as cooking oven.
 10. The surface to mount the controller should be of good isolated material such as brick wall, plastic, or wood.
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- Operation:**
- Remarks :
- Load Connect Area
 - Buzzer Warning
 - Penalty Area
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- Stage-1:** - When the Controller is first connected to a half charged battery (SOC < 12.7V).
Penalty mode LED Indicator - on
Load cut-off
- Stage-2:** - After the battery is charged up to SOC \geq 12.7V.
Load indicator on
- Stage-3:** - After the battery fully charged (SOC \geq 14.5V)
Penalty mode LED Indicator - off
Controller entry to PWM mode to prevent the battery being over charged
The Charging LED indicator will start to blink
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- Stage-4:** - The battery discharged to SOC < 11.7V.
Warning buzzer on
- Stage-5:** - The battery continues discharge to SOC < 11.5V.
Deep discharge Cut-Off LED Indicator on
Penalty mode LED Indicator on
Load cut-off
- Stage-6:** - The battery recharged back to SOC \geq 12.7V
Deep discharge Cut-Off LED Indicator off
Load indicator on
- Stage-7:** - Under the Penalty mode, the battery discharged to SOC < 12.1V.
Warning buzzer on
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- Stage-8:** - Under the Penalty mode, the battery continues to be discharged to SOC < 11.9V Load cut-off
- Stage-9:** - The battery charged back to SOC \geq 12.7V
Load indicator on
After the battery fully charge (SOC \geq 14.5V)
Penalty mode LED Indicator - off
Controller entry PWM mode to prevent over charge

Safety:

- # User should ensure the surface for mounting the controller is sufficiently strong to carry the weight of the unit.

- # Short circuit of batteries could generate excessive heat and possibly melt down the cables, causing injury to the User. During installation or battery replacement it is advisable to connect and secure the battery cable to the controller first, before connecting to the terminals on the battery.

Warning:

- # Do not connect the controller to AC power.
- # Although all controllers are reverse polarity protected, User should ensure correct connection by respecting the polarities.
- # All controllers are designed for indoor uses only.
- # All solar panel or charger connected to the controller should be dedicated to 12Vdc applications, and the current supplied to the controller should be equal to or smaller than the controller's output current. For *example*: -
 - Apple-5** - The maximum current input from solar panel or charger should NOT exceed 5A.
 - Apple-10** - The maximum current input from solar panel or charger should NOT exceed 10A.

Apple-15 - The maximum current input from solar panel or charger should NOT exceed 15A.

Warranty:

All Sundaya Controller are warranted for any defects caused by faulty components or factory error. Warranty period varies depending on the country. Please check with your local dealer for details.

The warranty will be void under the following conditions:

- The Product shows signs of having been exposed to water spill or submerged in liquid.
- The Product shows signs of being opened, or warranty seal is broken.
- The Product shows signs of abuse or misuse.

Mechanical Specification:

- Enclosure Materials : ABS
- Color : Green
- Shape : Round
- Size : 120mm x 40mm
- Terminals :
 - # 8mm width Input terminal for Battery (bottom side)
 - # 8mm width Input terminal for Solar Panel (top side)
 - # 8mm width Output terminal for Load (top side)

Electrical Specification:

Nominal operating Voltage	: 12VDC
Self consumption	: 4 mA
Current Model Apple 5	: 5 Amp -0% +25%
Current Model Apple 10	: 10 Amp -0% +25%
Current Model Apple 15	: 15 Amp -0% +25%
Low Voltage Buzzer Warning Level	: 11.70 V (Non-Penalty mode)
Low Voltage disconnect (Non-Penalty mode)	: 11.50 V +/- 0.10 V (Non- Penalty mode) (with discharge current compensation -0.04V/A)
Low Voltage Buzzer Warning Level	: 12.10 V (Penalty mode)

Low Voltage disconnect (Penalty mode)	: 11.90V +/- 0.10V (Penalty mode) (with discharge current compensation -0.04V/A)
Load Reconnect level	: 12.70 V
Penalty mode reset	: 14.50V +/- 0.10V
Boost Charge Level @250c	: 14.5V (with Temperature compensation -0.02V/deg C)
PWM float Charge level	: 14.10V (with Temperature compensation -0.02V/ deg C)

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PN-SPR Modules

Safety and Installation Instructions

1.0 Introduction

This manual provides safety and installation instructions for Phaesun photovoltaic (PV) modules manufactured with back-contact PV cells (Model number SPR defines product power output variants).

IMPORTANT! Failure to comply with these instructions will invalidate the Phaesun Limited Warranty for PV Modules. Read this instruction sheet in its entirety before installing, wiring, or using this product in any way.

1.1 Disclaimer of Liability

The installation techniques, handling and use of this product are beyond company control. Therefore, Phaesun does not assume responsibility for loss, damage or expense resulting from improper installation, handling or use.

1.2 Limited Warranty

Module limited warranties are described in the Phaesun warranty certificates obtainable at www.phaesun.com

1.3 Application Conditions

WARNING! This solar module shall not be used for applications that connect to the utility electricity grid and Phaesun has no liability, and all warranties shall be voided, to the extent the modules are used in any such application.

2.0 Safety Precautions

Before installing this device, read all safety instructions in this manual.

DANGER! Module interconnects pass direct current (DC) and are sources of voltage when the module is under load and when it is exposed to light. Direct current can arc across gaps and may cause injury or death if improper connection or disconnection is made, or if contact is made with module components that are damaged. Do not connect or disconnect modules when current from the modules or an external source is present

- Cover all modules in the PV array with an opaque cloth or material before making or breaking electrical connections.
- It is imperative to use the supplied locking connectors and safety clips in order to defend against untrained personnel disconnecting the modules once they have been installed.
- All installations must be performed in compliance with all applicable regional and local codes.
- There are no user serviceable parts within the module. Do not attempt to repair any part of the module.
- Installation should be performed only by qualified personnel.
- Remove all metallic jewelry prior to installing this product to reduce the chance of accidental exposure to live circuits.
- Use insulated tools to reduce your risk of electric shock.
- Do not stand on, drop, scratch or allow objects to fall on modules.

- If the front glass is broken, or the back sheet is torn, contact with any module surface or module frame can cause electric shock
- Do not install or handle the modules when they are wet or during periods of high wind.
- Contact your module supplier if maintenance is necessary.
- Save these instructions!

3.0 Electrical Characteristics

The module electrical ratings are measured under Standard Test Conditions (STC) of 1 kW/m² irradiance with AM 1.5 spectrum and a cell temperature of 25° C. Phaesun modules have specific electrical characteristics as shown on the datasheets.

A photovoltaic module may produce more current and/or voltage than reported at STC. Sunny, cool weather and reflection from snow or water can increase current and power output. Therefore, the values of I_{sc} and V_{oc} marked on the module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor ampacities, fuse sizes, and size of controls connected to PV output. An additional 1.25 multiplier may be required by certain codes for sizing fuses and conductors.

Phaesun recommends the use of open-circuit voltage temperature coefficients listed on the datasheets when determining Maximum System Voltage.

4.0 Electrical Connections

Modules may be connected in series and/or parallel to achieve the desired electrical output as long as certain conditions are met. Please use only the same type of modules in a combined source circuit.

4.1 General Wiring

Phaesun recommends that all wiring be double insulated with a minimum rating of 85° C (185° F). All wiring should use flexible copper (Cu) conductors. The minimum size should be determined by the applicable codes. We recommend a size not less than 4mm². The insulation type should be appropriate for the type of installation method used and must meet SCII (Safety Class II) and IEC 61730 requirements.

4.2 Equipment Grounding

Please refer to the applicable regional and local codes on grounding PV arrays and mounting frames for specific requirements (e.g. lightning protection).

4.3 Series Connection

The modules may be wired in series to produce the desired voltage output. Extra care must be taken in case of system voltage above 50V DC. Do not exceed the maximum system voltage.

4.4 Parallel Connection

The modules may be combined in parallel to produce the desired current output. Series string must be fused prior to combining with other strings if the resulting maximum reverse current exceeds the fuse rating as shown in the datasheets. Bypass diodes are factory installed in the modules. Please refer to the applicable regional and local codes for additional fusing requirements and limitations on the maximum number of modules in parallel

5.0 Module Mounting

The Phaesun Limited Warranty for PV Modules is contingent upon modules being mounted in accordance with the requirements described in this section.

5.1 Site Considerations

Phaesun modules should be mounted in locations that meet the following requirements:

Maximum Operating Temperature	+90 °C, +194 °F
Minimum Operating Temperature	-40 °C, -40 °F

IMPORTANT! Care should be taken to provide adequate ventilation behind the modules, especially in hot environments.

When mounting modules in snow prone or high wind environments, special care should be taken to mount the modules in a manner that provides sufficient design strength while meeting local code requirements.

Excluded Operating Environments:

No Phaesun module should be mounted at a site where it may be subject to direct contact with salt water.

5.2 Installation

Modules may be mounted at any angle from horizontal to vertical. Select the appropriate orientation to maximize sunlight exposure.

In order to prevent water from entering the junction box, which could present a safety hazard, modules should not be mounted such that the front/top glass faces downward (e.g., on a tracking structure that positions the module with the junction box facing skyward during sleep mode).

Clearance between the module frames and structure or ground is required to prevent wiring damage and allows air to circulate behind the module.

When installed on a roof, the module shall be mounted over a fire-resistant roof covering rated for the application.

The module is only guaranteed for use when its factory frame is fully intact. Do not remove or alter the module frame. Creating additional mounting holes may damage the module and reduce the strength of the frame.

Modules may be mounted using the following methods only:

- 1) **Frame Holes:** Secure the module to the structure using the factory mounting holes. Stainless steel bolts, with nuts, washers, and lock washers are recommended per module.
- 2) **Pressure Clamps or Clips:** Mount the module with the clips on the side frame of the module. The side frames are attached to the longer sides of the module. Installers should ensure the clamps are of sufficient strength to allow for the maximum design pressure of the module. Clips and clamps are not provided by Phaesun.
- 3) **End Mount:** End mounting is the capture mounting of the length of the module's end frame to a supporting rail. The end frames are on the shorter sides of the module. The end-mounting rail and clips or clamps must be of sufficient strength to allow for maximum design pressure of the module. Verify this capacity with the mounting system vendor before installation.

6.0 Maintenance

Inspect all modules annually for safe electrical connections, sound mechanical connection and freedom from corrosion. Periodically clean the module surface with water and a soft cloth or sponge. Fingerprints may be removed with standard glass cleaner. Do not use harsh cleaning materials such as scouring powder, steel wool, scrapers, blades or other sharp instruments to clean the glass surface of the module. Use of such materials will invalidate the product warrant.

7.0 Contact to Phaesun

For technical questions or information about the product, please do not hesitate to contact us.

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