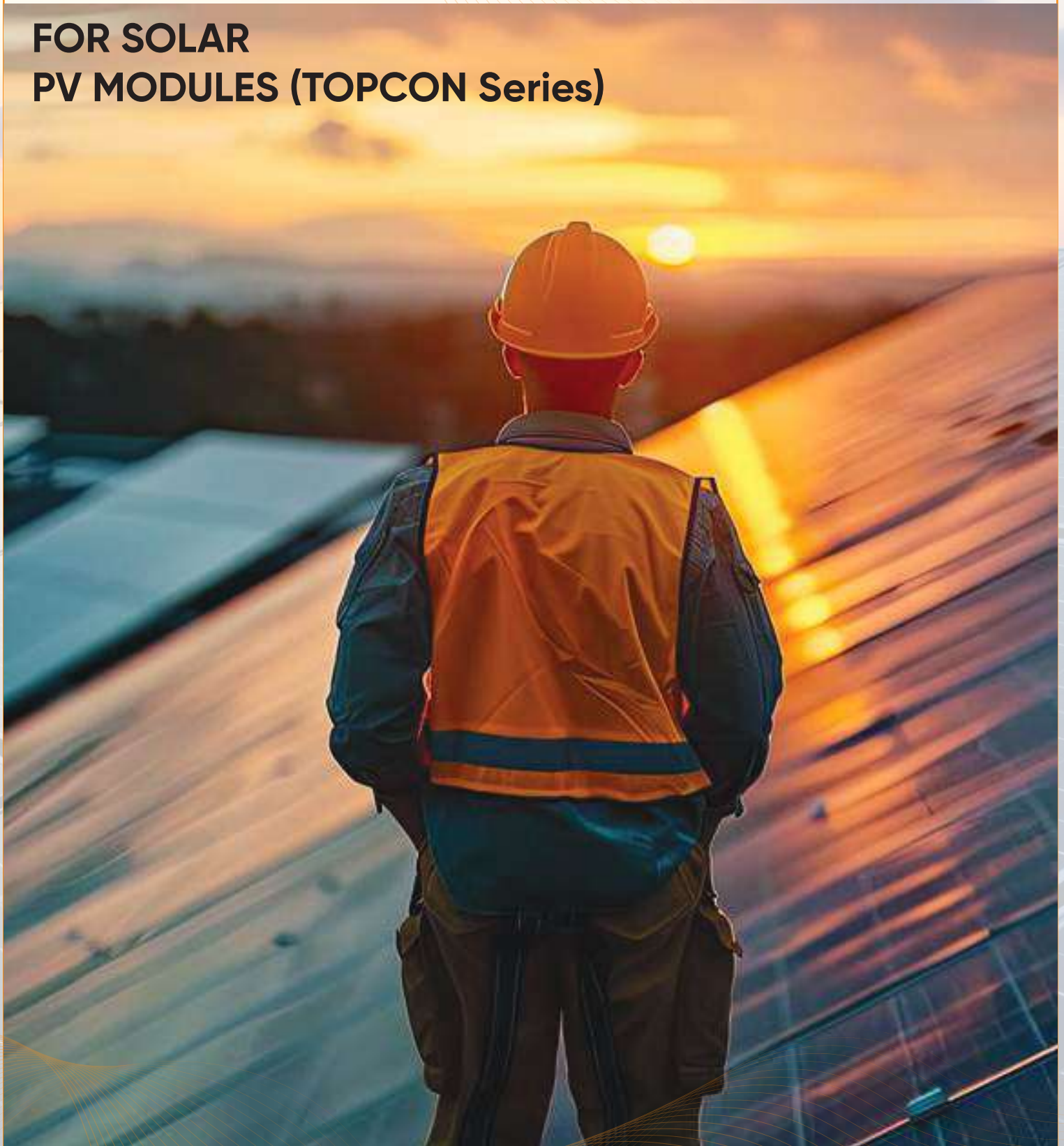




# INSTALLATION MANUAL

FOR SOLAR  
PV MODULES (TOPCON Series)



**1800-103-2600**

[www.jakson-solar.com](http://www.jakson-solar.com)

## PURPOSE

This manual provides relevant information on the installation and safe use of Solar PV modules manufactured and supplied by Jakson Engineers Limited (Hereinafter referred to as JAKSON), and recommends safe and reliable module installation and maintenance instructions for our customers.

Before installation, the installer must read and understand this manual. If you have any questions, please contact sales or customer service staff of JAKSON for further understanding. When installing, the installer shall comply with all safety precautions and installation laws and regulations in this manual.

The installation personnel should be familiar with the mechanical load and electrical requirements of the installation system, and JAKSON has the right to refuse to compensate for the damage of the modules caused by the operation reasons or design defects of the power generation system.

## SCOPE

This document is applicable to the installation of **TOPCon N-type range of JAKSON Solar PV Modules**.

## Unloading, Handling & Storage

Refer our separate manual on Unloading, Handling & Storage guidelines while handling of solar PV modules.

## SUPPLEMENTARY PROVISIONS

JAKSON reserves the final right to interpret this document. Something that violates the management of documents is prohibited for any department or individual, such as printing, copying, and duplicating the document. If there is any discrepancy caused by translation, the English version shall prevail. Also, if there is any discrepancy to understand the issue/problem, kindly contact Jakson technical team / customer support team.

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## 1. Manual Introduction

Thanks for choosing Solar PV modules from Jakson Engineers Ltd. (hereinafter called Jakson). In order to ensure that the PV modules are installed correctly, please read the following installation manual carefully before modules are installed and used.

Please let the well-trained professional engage in PV module's installation, running and maintenance. The personnel for the installation should be familiar with the mechanical and electrical requirements.

Please contact Jakson service Department (service.support@jakson.com & customer.support@jakson.com) or contact us on toll free number (1800-103-2600 India ) or write to us through our website <https://jakson-solar.com/> if you want to get more details or there is any question.

## 2. Applicable Products

Jakson's photovoltaic solar module is a DC power supply, which has the character of high reliability and nearly no-maintenance. It can be used in solar power plants systems for different applications (Grid connected/Off-grid/Hybrid) as per the system design.

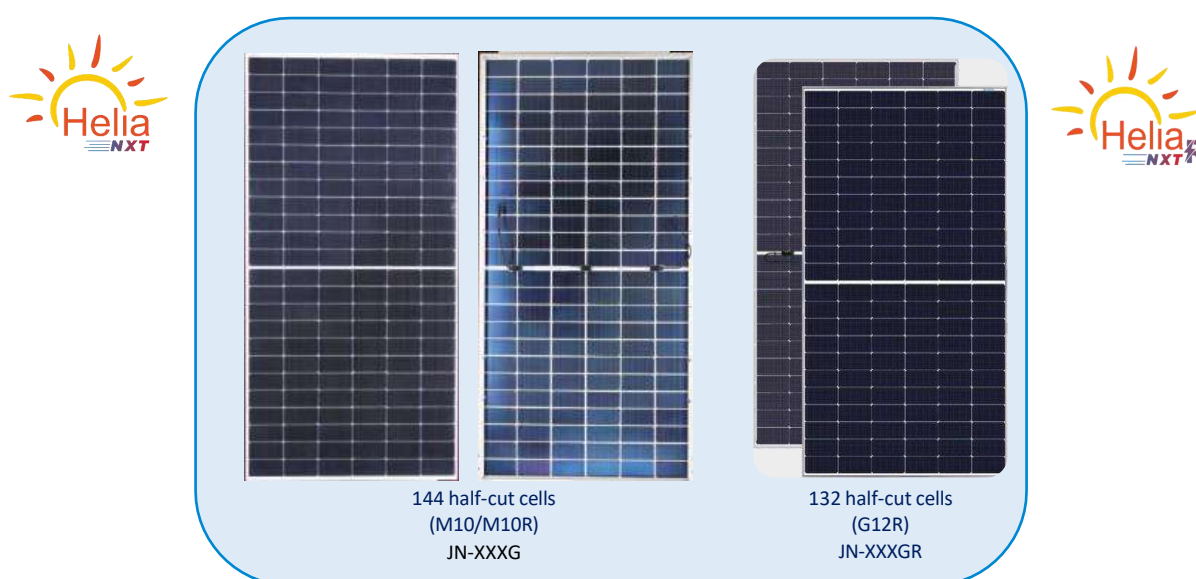


Fig.2.1: Front & rear view of the module

This document is applicable to the following PV Solar Modules types:

SR.	MODULE	MODEL NUMBER
1	Bifacial TOPCon N-type with Dual Glass	JN-XXXG
2	Bifacial TOPCon N-type with Dual Glass	JN-XXXGR

Table 2.1

**Note:**

XXX refers to rating of the module range with different cell combinations. ranging from 400Wp to 630Wp.

The Solar PV modules described in this manual are terrestrial used only, cannot be used in space. The high-altitude influence to module operation should be considered when the modules are installed in high altitude area. **The maximum rated altitude for which the PV module designed is 2000m.**

### 3. Warning

Please read and understand all the safety cautions before the PV module installation, wiring, operation and maintenance. When exposed to the sun light or other light sources directly, the PV modules will generate the Direct Current, there will be the risk to cause people death when touching the electrical part like the connectors/terminals no matter whether the modules are connected or not. **Maximum Fuse rating is 30A/35A as per the applicable models.**


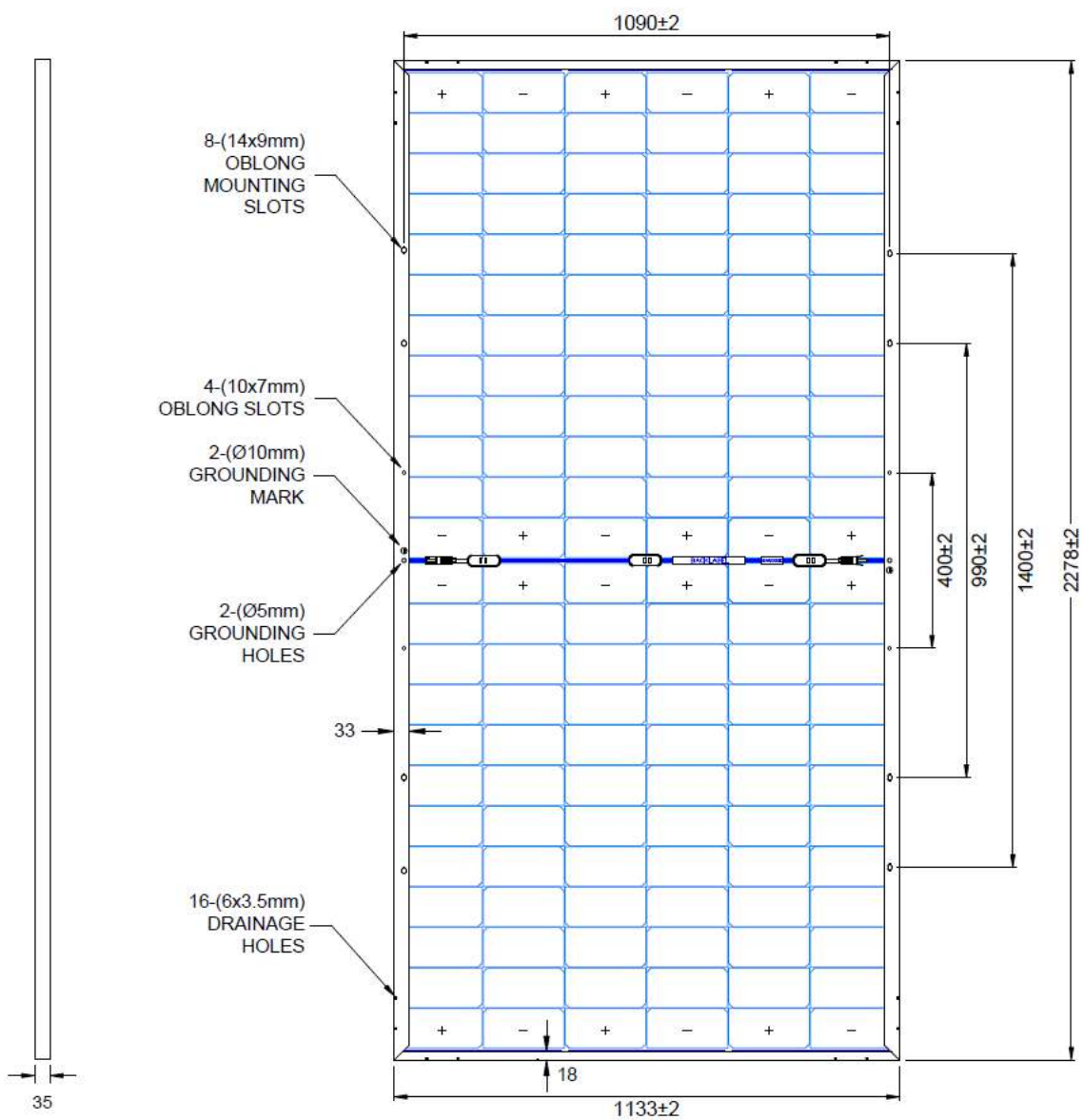
 <p><b>WARNING</b></p>	<p>Power production tolerance <math>\pm 3\%</math></p> <p>This module produces electricity when exposed to light.</p> <p>Follow all applicable safety precautions.</p> <p>Only qualified personnel should install or perform maintenance work on these modules</p> <p>Be aware of dangerous high DC voltage when connecting modules.</p> <p>Do not damage or scratch the rear surface of the modules.</p> <p>Do not handle or install modules when they are wet.</p> <p>Follow the battery manufacturer's recommendations if batteries are used with modules.</p>
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Fig.3.1 Warning

#### 4. Mechanical Drawings:



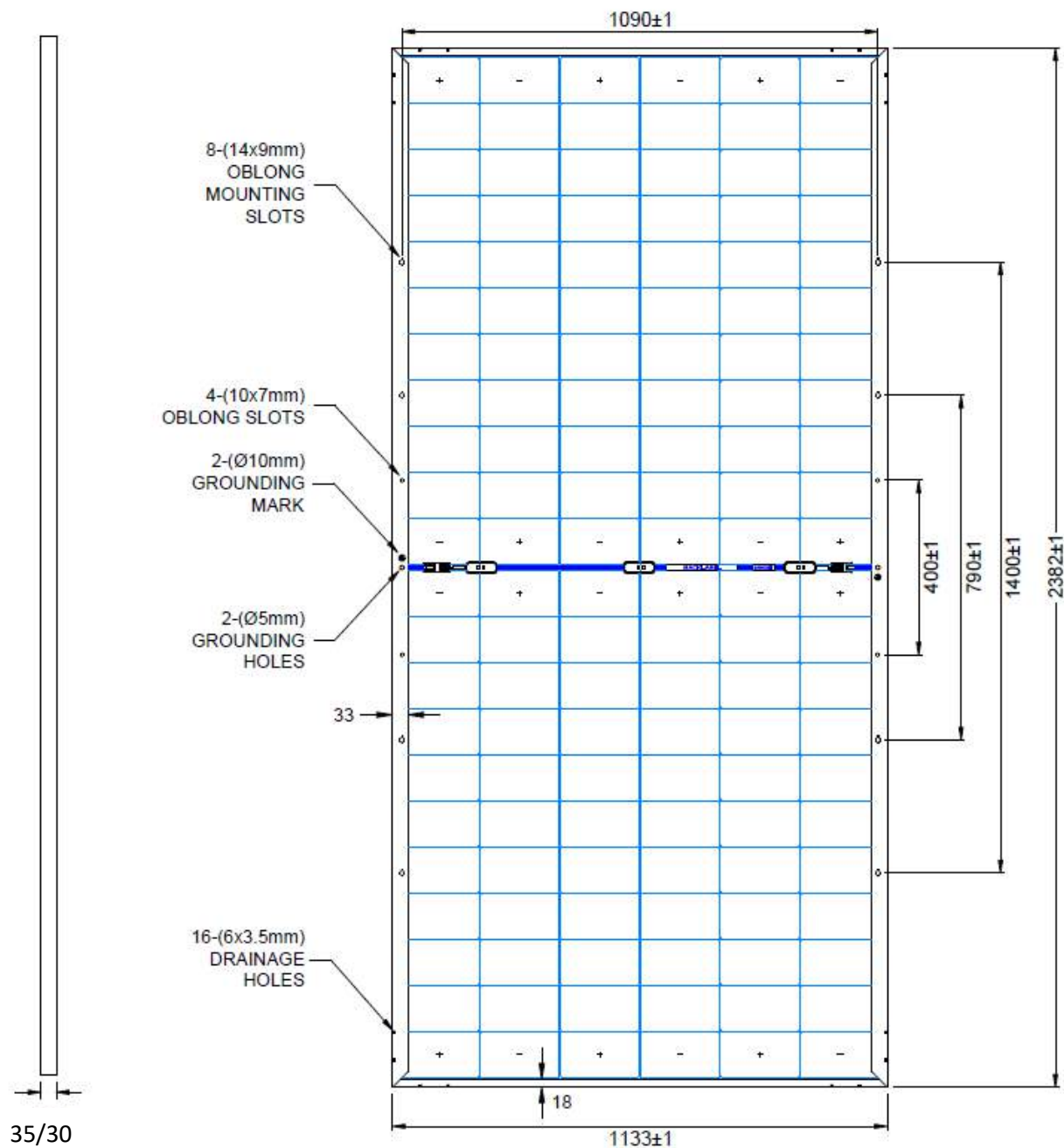
### Helia NXT series (Model Number JN-XXXG 144 Cells) – Dimension of PV Module Unit: mm



Rear View



## Helia NXTR series (Model Number JN-XXXGR 132 Cells) – Dimension of PV Module Unit: mm



Rear View

## 5. Safety Cautions

In the installation and maintenance, all the Safety Cautions mentioned in this manual should be followed, in the meantime, all the requirements defined by local law, authority agency or government should be followed.

Failure to follow this manual or the above rules/law will void our Limited Warranty to the modules.

1. Please get in contact with the local authority agency to confirm if the installation is legally allowed and meets the installation inspection requirements before installing the PV system.
2. When designing the PV system, please be sure to consider the voltage change under different temperatures (please check the temperature coefficients of all PV modules, when the temperature drops, the variable output voltage of the module will rise).
3. The shading on the module surface will affect the power generation much, the module should be installed in the shadow-free (such as the shadow from building, chimney and tree etc.), and even the partially shading (such as the dirt, snow and aerial wire etc.) should be avoided.
4. It is prohibited to stand, climb, walk or jump on the solar PV modules.
5. To avoid damaging of module and its safety, please never put any heavy or sharp objects on the front and rear surface of the module at anytime.
6. Please ensure all the modules and electrical contact parts are clean and dry during installation.
7. Do **NOT** install any module when it is raining, snowing and strong windy.
8. Artificially concentrated sunlight should NOT be directed on the module.
9. Use durable, rust-resistant and UV-resistant materials to fabricate the module bracket structures which have been tested, certified and approved.
10. When the modules are installed on the brackets, the brackets' structure should have the ability to bear the wind load and snow load at site. And please ensure these loads will not exceed the maximum design load of the module.

11. The modules with the broken glass cannot be repaired and **CANNOT** be used, there will be the electrical shock risk in case to touch the surface or frame of these kinds of modules. Do **NOT** try to disassemble the module, and do **NOT** remove or damage the module nameplate and any other parts of the module.
12. It is **FORBIDDEN** to stand on the modules in the installation progress, and do **NOT** damage or scratch the glass surface of the module.
13. Do **NOT** apply any paint or glue to the module glass surface.
14. The Solar PV modules will generate electrical power when exposed to sunlight, and this power is sufficient to cause fatal electrical shock and burning risk. Only the authorized personnel who are professionally trained along with safety gears (PPE kits) should handle the solar PV module.
15. Never handle and move the module via the cable or the J-Box at any time. At least 2 personnel with non-slip gloves are required to handle one module at the same time. Do **NOT** carry the module via overhead and do **NOT** handle the stacked modules for moving.
16. To avoid the electrical shock and burning risk, the opaque material can be used to cover the modules during installation.
17. To avoid the electrical shock risk by damaged module, please do **NOT** wear metal objects such as ring, watch, ear-ring and nose ring during installation and maintenance.
18. Do **NOT** disconnect any electrical connections or unplug any connectors under circuit load.
19. In order to prevent the degradation of the module insulation ability, please avoid scratching and cutting any cables or connectors.
20. Use well-insulated tools in accordance with relevant electrical installation standards. Keep children away from the installation site during transportation and assembly.
21. Installation shall comply with local safety regulations (e.g., safety regulations, plant operation regulations), including wires and cables, connectors, charging controllers, inverters, batteries, rechargeable batteries, etc
22. Under the requirements of the NEC (National Electrical Code), the maximum system voltage shall not be higher than 1000V or 1500V. And the Maximum system voltage is specified on the nameplate of the module you are using.

23. Under normal conditions, a TOPCon N-type dual glass PV module is likely to experience conditions that produce more current and/ or voltage than reported at standard test conditions. The requirements of the National Electrical Code (NEC) in Article 690 shall be followed to address these increased outputs. In installations not under the requirements of the NEC, the values of  $I_{sc}$  and  $V_{oc}$  marked on this module should be multiplied by a factor of 1.25 when determining module voltage ratings, conductor ampacities, overcurrent device ratings, and size of controls connected to the PV output; for bifacial modules, additional factor of 1.1 should be multiplied at the same time.
24. Jakson Solar PV module is designed according to the IEC61215 and IEC61730, The module meets the requirements of Protection against electric shock is **Class II**. The module is classified under **Fire Type: 3B/ Class C**
25. A photovoltaic module is likely to experience conditions that produce higher current and/or voltage than reported at standard test conditions. Factors to consider include module temperature and front side irradiance (and, for bifacial modules, ground or roof albedo, row spacing, and installation height). Accordingly, the values of  $V_{OC}$  and  $I_{SC}$  (or for bifacial modules,  $I_{SC-aBSI}$ ) marked on this PV module should be multiplied by a factor of 1.25 when determining voltage and current ratings for components connected to the PV output.



26. **Meaning of crossed-out wheeled dustbin:** Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities. Contact your local government for information regarding the collection systems available. If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being. When replacing old appliances with new ones, the retailer is legally obligated to take back your old appliance for disposals at least free of charge.

27. The safety factor of 1.25 given for the minimum voltage rating of the components in the example statement above may be modified during the design of a system according to the minimum temperature of the location of the installation and the temperature coefficient for VOC. The safety factor of 1.25 given for conductor current ratings values for ISC (or for bifacial modules, ISC-aBSI) may be adjusted based on the maximum values of irradiance incident on the front side of the module (and the rear side for bifacial modules). To this purpose, a full simulation for the specific location and module orientation (and for bifacial modules, ground albedo, row spacing and installation height) is required. Further guidance for the choice of a safety factor other than 1.25 is given in IEC 62548.
28. Modules with exposed conductive parts should be grounded according to the instructions in the installation manual and the electrical specifications required by local regulations. For use in regions or countries where UL61730 is required, it must comply with the requirements of the U.S. National Electrical Code or it will be considered a violation of UL61730. Please consult with local authorities for the requirements on installation methods and fire safety of buildings.
29. Assess the fire rating of the system according to the condition of the roof and mounting brackets, subject to local electrical safety regulations. A suitable layer of fireproof material for this class shall be covered and the ventilation should be maintained.
30. The difference of the roof structure and installation method will affect the fire safety performance, and unappropriated installation will take the risk to cause the fire. In order to ensure the fire rating of the roof, the minimum recommended distance between the module frame and the roof surface is 120mm, and appropriate modules such as fuses, circuit breakers and ground connectors should be used according to local electrical safety regulations.
31. Observe the safety precautions of the module installation manual. If the modules are installed on the roof, ensure that the roof structure is strong enough to handle the load. In addition, the installation of any roof modules must be sealed to prevent leakage and to ensure the fire rating levels. The accumulation of dust on the modules

surface will impair the performance of the modules. During the installation, the module tilt angle should be maintained to allow the rain to wash away the dust, while the module with too small tilt angle requires more frequent cleaning.

32. Please do **NOT** operate any devices at the place which is close to flammable gas.

## 6. Installation

### 6.1 Environment conditions and site selection

Jakson module should be installed in the following environmental conditions.

NO	Environmental conditions	Range
1	Ambient temperature	-40°C to +50°C.
2	Operating temperature	-40°C to +85°C
3	Storage temperature	-20°C to +50°C
4	Humidity	<85 RH%

Table 6-1 operation conditions

**Remarks:** The working environment temperature is the monthly average maximum temperature and minimum temperature of the installation site. The mechanical load bearing capacity of the solar PV module is determined based on the installation method. The professional solar PV system installer must be responsible for calculating the solar PV system machinery when designing the solar PV system load bearing capacity.

1. For most places, Jakson solar PV modules should be installed where the sunlight can be maximally acquired throughout the year. In the Northern hemisphere, the light-receiving surface of the module is usually selected to face the South; in the Southern hemisphere, the light-receiving surface of the module is usually selected to face the North.

2. When selecting the installation location, avoid areas with trees, buildings, or obstacles because these objects will form shadows on solar PV modules, especially when the sun is at the lowest position on the horizon in winter. The shadow will cause the loss of the output power of the solar photovoltaic system. Although the bypass diode installed in the solar photovoltaic module can reduce this loss to some extent, do not ignore the shadow factor.
3. Do not install solar PV modules near fire or flammable materials. Do not install solar PV modules where there is water soaking, sprinkler or water spray.

## 6.2 Tilt angle of Installation

- A. The installation of solar PV module string should be in the same orientation and the same installation angle. Different installation directions and installation angles will lead to the mismatches in current and voltage which is caused by different light absorption of different solar modules, this mismatch will cause the PV system power output loss.
- B. The largest power will be generated When direct sunlight on solar PV module. For modules which are installed on the fixed brackets, the best installation angle should be selected to ensure the maximum power output can be generated at winter time, if the angle can guarantee enough power output during the winter, it will make the whole solar PV system in the rest of the year can have enough power output also.
- C. Installation inclination refers to the Angle between the solar photovoltaic module and the ground plane, as shown in **Figure 6.1**.

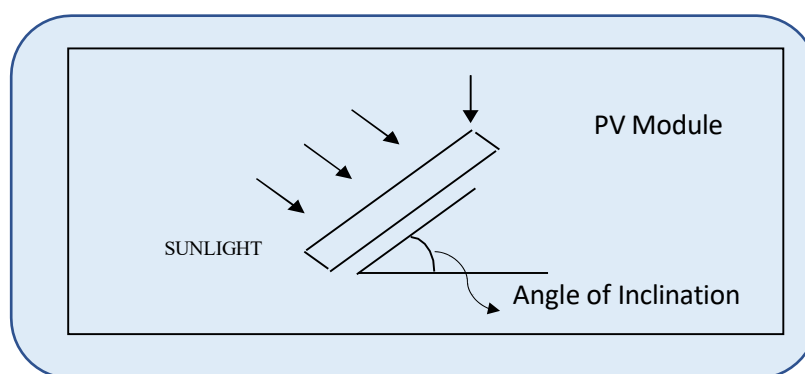


Fig. 6.1 Tilt angle

### 6.3 Installation requirements for module

- A. With suitable installation bifacial module will also generate power using reflected sunlight from the backside of module. This will bring additional power generation gain to the SPV Plant.
- B. The shading on the module surface will affect the power generation much, the module should be installed in the place which are shadow-free (such as the shadow from building, chimney and tree etc.), and even the partially shading (such as the dirt, snow and aerial wire etc.) should be avoided as it can lead to generate hotspots.
- C. The back-side generation gain is related to the ground reflectivity, the module installation height to the ground, the array spacing and the shadow shading to the module backside.
- D. Generally speaking, the reflectance varies with the different ground (See table 6-2), and this will lead to different power generation gain.

The ground type	Water	Grassland	Ground	Concrete	Sand	Snow
Reflectivity range (%)	2-5	10-20	20-25	20 - 40	20 - 30	80- 85

Table 6-2 Tentative reflectivity of different surfaces

- E. To gain better output from rear side from Bifacial modules, refer Albedo table while installing PV modules. Typical Indicative values for different surfaces are:

Surface Type	Typical Value
Fresh asphalt	0.03 – 0.04
Sand	0.15 – 0.18
Agricultural crop	0.18 – 0.25
Bare soil	0.17
Green grass	0.15 - 0.25
Desert sand	0.30 – 0.40
Snow	0.40 – 0.90
Fresh snow	0.80 – 0.90
Ocean Ice	0.50 – 0.70
Concrete	0.25 - 0.35

**NOTE:**

The albedo values mentioned are indicative and provided for reference purposes only. Actual values may vary.

Table 6-3 Indicative Albedo values

- F. Different ground clearance height will affect the power generation gain, it is recommended to install the module at a height from 0.5M to 1.2M. See Fig. 6.2.

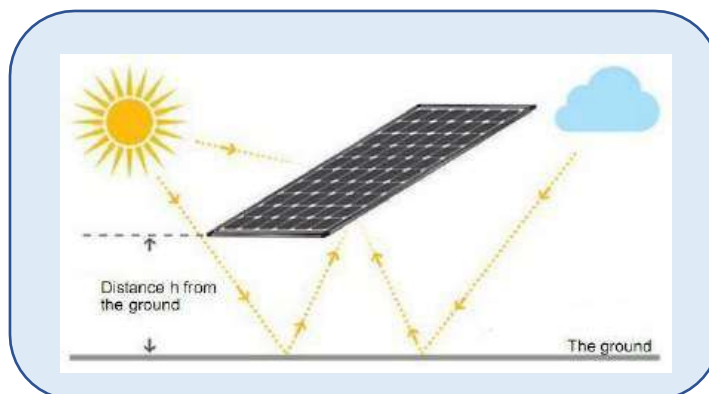


Fig. 6.2 Distance from the ground level

- G. When designing the system, in addition to the type of ground and the height above the ground, the appropriate array spacing and how to avoid the back shadow should be considered. Consult professional system designers for the same.

## 7. Installation Guidelines

Ensure that the support system is strong enough and the components must be fixed to the support system as required.

- ✚ The limit load of the support system must be calculated according to the project site conditions, installation methods, etc. and the local specifications. The support system supplier must be responsible for the design, verification, installation and maintenance of the photovoltaic system.
- ✚ In order to reduce the adaptation loss, please ensure that the modules with similar power ratings and technology should be installed together.
- ✚ To ensure ventilation and heat dissipation, the minimum clearance between module frame and wall or roof should be at least 150 mm.

- ✚ The module frame has the effect of thermal expansion and cold contraction, the minimum clearance between two adjacent modules must not be less than 20mm.
- ✚ The module frame drain holes cannot be blocked in any situation during installation or use.
- ✚ Packaging angle bead, frame poly film and assembly safe edge play protective role in packaging and transportation, should be removed during installation. The PV support system is generally divided into fixed installation system and tracker system. Jakson PV module can be installed on both type of installations. The PV module and support system can be connected by bolts and clamps. Jakson recommends some installation methods and accessories, which should be followed. Other installation methods need to be confirmed with Jakson.

## 7.1 Installation Method for framed TOPCon N-type Jakson module

### Bolts installation :

The Jakson PV modules can be installed with bolts. There are mounting holes on the back frame of the PV module for connecting with the support system, including the mounting holes of  $\phi$  9x14 or  $\phi$  7x10. When using the  $\phi$  9x14 mounting hole, please use the M8 bolt set in **Table 7-1**.

Install the fasteners	M8 bolt set	Note
Bolt	1*M8	use of corrosion resistant fasteners SS304 is recommended. While using M6 nut bolts for $\phi$ 7x10 hole use suitable size of nut, bolt, 1 spring washer and 2 plain washers.
Flat washer	2*M8	
Spring washer	1*M8	
Nut	1*M8	
Torque range	16N·m-20 N·m	

Table 7-1 Bolt set

Fixture installation :

- 1. The Jakson PV module can also be installed with clamps. The PV module shall be fixed on the mounting bracket with M8 bolts and clamp. It is strictly forbidden for the clamp to contact the front glass. The aluminum frame of the PV module shall not be deformed during installation, and the front of the module shall not be covered. Each PV module needs to be fixed with four/six clamps (Recommended six clamps for module >2M length), and the applied torque is 16N · m ~ 20N · m.
- 2. The size, quantity and installation method of the clamp can be determined according to the actual load of the project site, but it needs to meet the basic requirements in Table 6-2 and be confirmed by the professional technical team of Jakson.

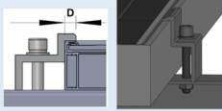
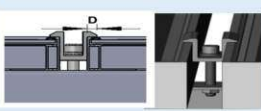
Type	Clamp	
	Side clamp	Middle Clamp
Apply to aluminum frame assembly clamp		

Table 7-2 clamp

Offshore PV module connector protection device

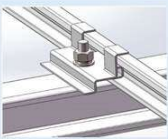
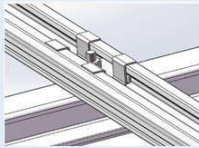
Apply to zinc-magnesia- aluminum steel frame assembly clamp		
Attention	Ensure that the clamp is in contact with the A side of the module frame by 7mm≤ D ≤10mm ;	
Attention	Ensure that the clamp is in contact with the A side of the module frame by 7mm≤ D ≤10mm ;	
Specifications	clamp size : length≥50mm, thickness≥3mm; (For aluminum frame modules)	

Table 7-3 Offshore PV module connector protection device

7.2 Installation method of fixed support

Recommended Installation method is A3. The design safety factors  $\gamma_m=1.5$ , positive 5400 Pa and negative 2400 Pa for testing.

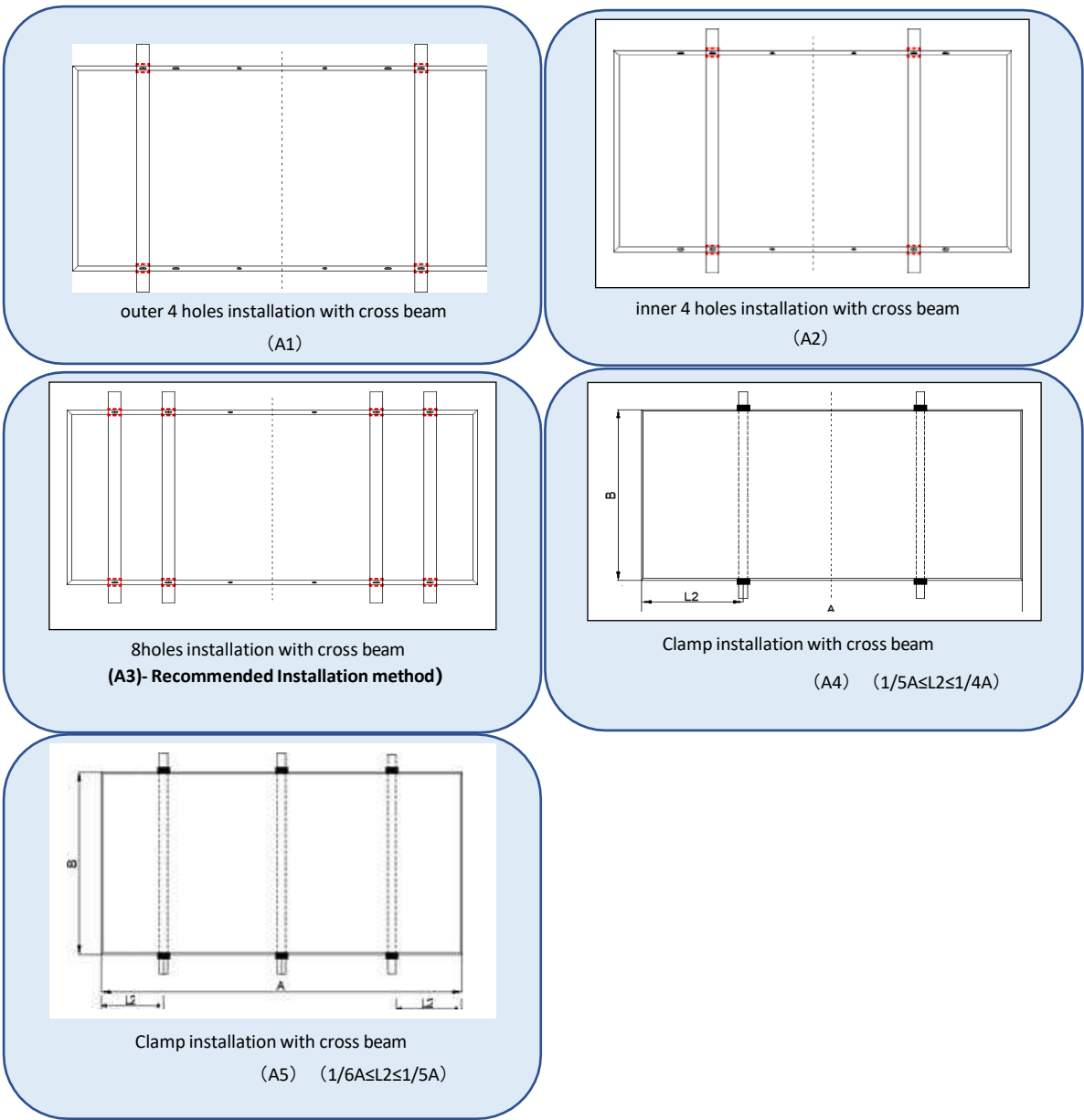


Table 7-4 Installation mode

Installing of modules in marine environment (offshore land /near sea) can lead to risk of module corrosion. Wherever annual rainfall hours/annual total hours are more than 25%, or using modules on the offshore sea it's recommended to install waterproof cold

shrinkable tubes to prevent the connector from water inlet and corrosion; Silicone rubber is recommended for the material of cold shrinkable tube.

### 7.3 Photovoltaic module connector accessories







Step	Method	Explanatory Chart
1	After unplugging the photovoltaic connector, take either end and cover the cold shrinkable tube to the connector in the direction shown on the right	
2	Slide the cold shrinkable tube over the head of the connecting head and expose the head	
3	Connect the positive and negative ends of the connector	
4	Move the connection to the middle of the cold shrinkable tube	
5	Pull the inner ring exposed in the cold shrinkable tube by hand, rotate it again and again and pull it out until the inner ring is completely pulled out	
6	The cold shrinkable tube has completely cold shrinkable seal connectors	

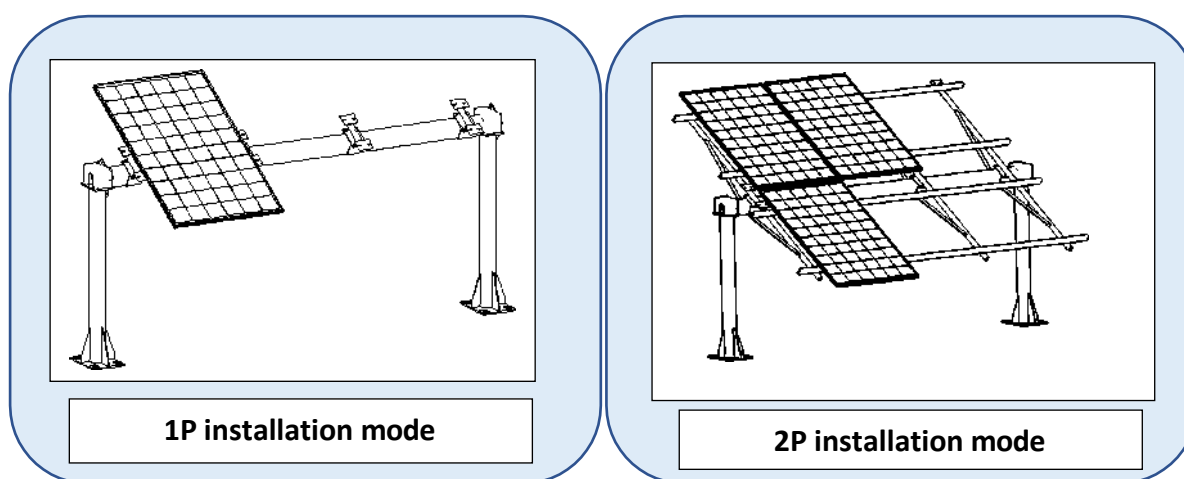
Table 7-5 Connector accessories

**Notes for installation of cold shrinkable pipe :**

1. Before installation, make sure that there is no sand, water, sharp objects and other sundries inside the cold shrinkable tube.
2. It is forbidden to tie the label on the shrink tube to prevent the tie from scratching the shrink.
3. Pay attention to environmental protection on site (handling of support strips/instructions/packaging bags).
4. There are no cracks or gaps at both ends of the cold shrinkable tube and no cracks on the surface.
5. The cold shrinkable tube should be affixed to the connector and cable in a natural way, and no wrinkle or bulge is allowed

**7.4 Tracking system**

Jakson PV modules can be installed on the tracking system, and the installation hole should be selected according to the design form of the tracker.



**Table 7-6 Installation mode of tracking system**

Jakson module can be installed and used on the tracking system, and the installation hole position or clamp position shall be selected according to the design of the support system.

Please refer to Table 7-6;

The system installer or professional designer shall recheck the bearing capacity of the support system (photovoltaic support, foundation, etc.) according to the selected installation hole position or pressing block position.

## 8. Junction Box and Connectors

- ✚ Cable Length: Jakson TOPCon N-type modules come with standard cable length 400mm for +ve and -ve. Different cable length options are also available.
- ✚ Bending of cable shall be such to avoid any sharp bend/stress at the joints. Kindly refer below image for reference



Fig.8.1 Recommended cable routing

The recommended vertical installation connection methods for module with split J-Box are as follows (The extension DC cable of suitable size to be used as per site requirement).

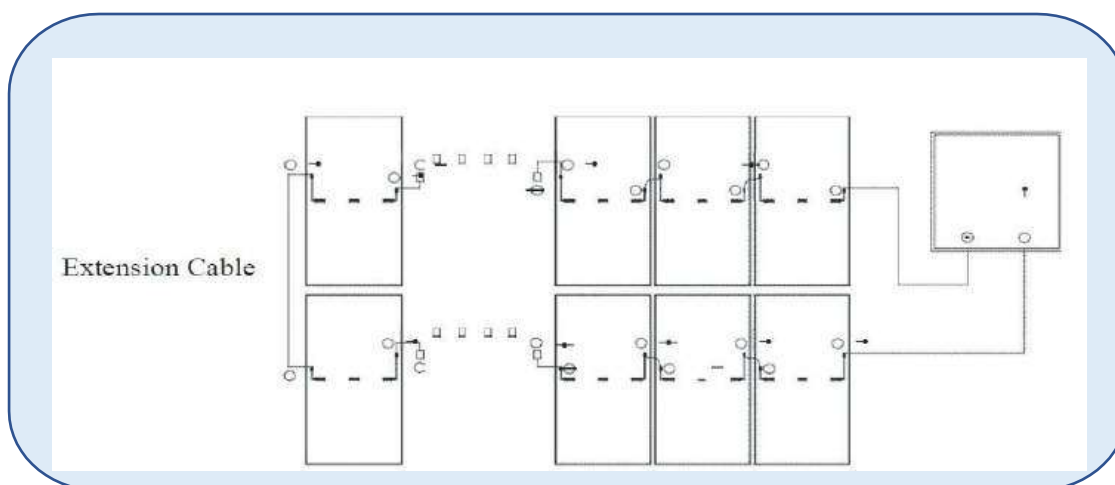


Fig. 8.2 Split J-Box at module middle position for vertical direction

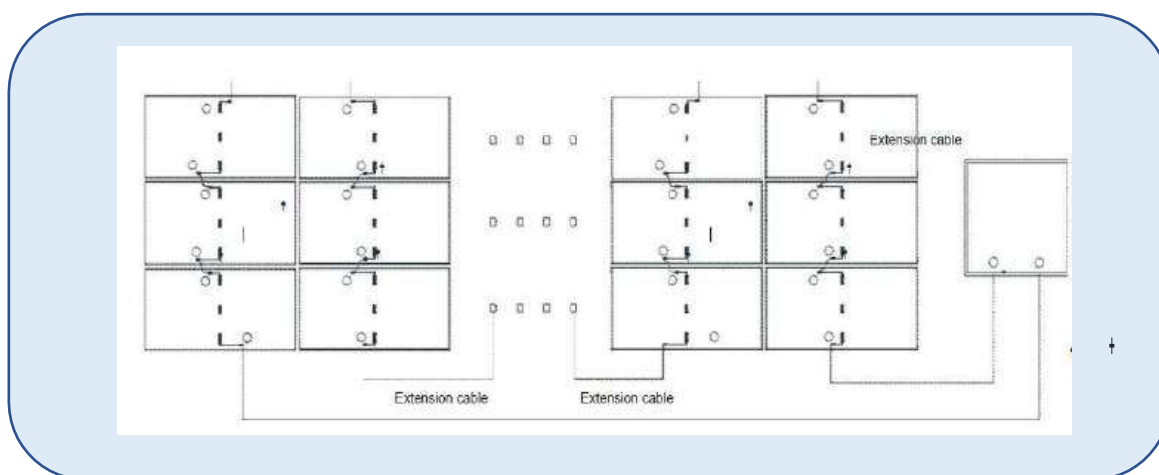


Fig. 8.3 Split J-Box at module middle position for horizontal direction

### Precautions:

- Pay attention to the direction of the wire when installing the modules. It should be connected along the wire direction to avoid bending the wire.
- In order to avoid bad or damaged connection of the cable and connector, the cable and junction box caused by human factors, affecting the electrical safety or service life of the product, it is recommended that the force applied between the cable and connector, cable and junction box shall not be greater than 60N during the installation, dismantling, maintenance and any other related process of the Product.

### Connector details:

We recommend to use the similar/compatible tested connectors as used with your PV module.

Manufacturer	Connector Model No.
Zhejiang Zhonghuan Sunter PV technology Co. Ltd	PV-ZH202B
Staubli Electrical Connectors	PV-KST4-EVO 2/xy_UR (male)
	PV-KBT4-EVO2/xy_UR (female)
	PV-KST4-EVO2 A/xy_UR (male) PV-KBT4-EVO2 A/xy_UR (female)
Dhash PV Technologies	DS01
GenX PV India	GXC-01
Jiangsu Haitian Microelectronics Corp.	PV-HT03

## 9. Electrical Connection

- A. The Direct Current (DC) generated by the PV system can be converted to Alternating Current (AC) and connected to the public power grid. Different regions may have different policies, laws and regulations to stipulate the installation and grid-connection requirements of PV systems. Therefore, during the design, installation and grid-connection of PV system, please comply with the local policies, laws and regulations.
- B. PV modules can obtain different current and voltage outputs through series connection and parallel connection. Read this installation manual carefully before electrical connection and installation. Please design and connect according to the current and voltage required by customers. Before connection, please ensure that the connection part is free from corrosion and keep it clean and dry.
- C. In order to ensure the normal running of the system, when connecting modules or loads, please ensure that the polarity of the cable connection is correct. If the modules are incorrectly connected, the bypass diodes and junction boxes may be damaged. PV modules can be connected in series (Fig. 8.1), in parallel (Fig. 8.2) and in series-parallel (Fig. 8.3).
- D. The number of serial or parallel connections shall be reasonably designed according to the system configuration. Also note that if the number of parallel connections  $\geq 2$ , there must be an over-current protection device on each string assembly and bypass diodes are used for over current protection, and the maximum over current protection is 30A/35A as per the applicable models.

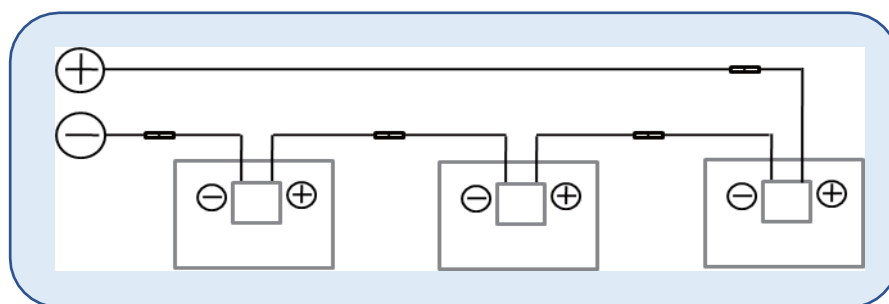


Fig. 9.1 Series Connection

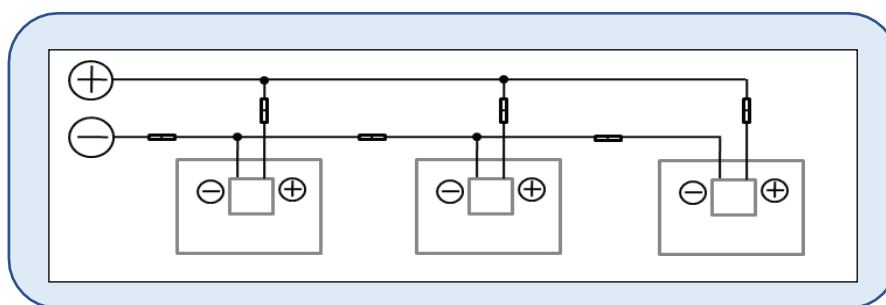


Fig.9.2 Parallel Connection

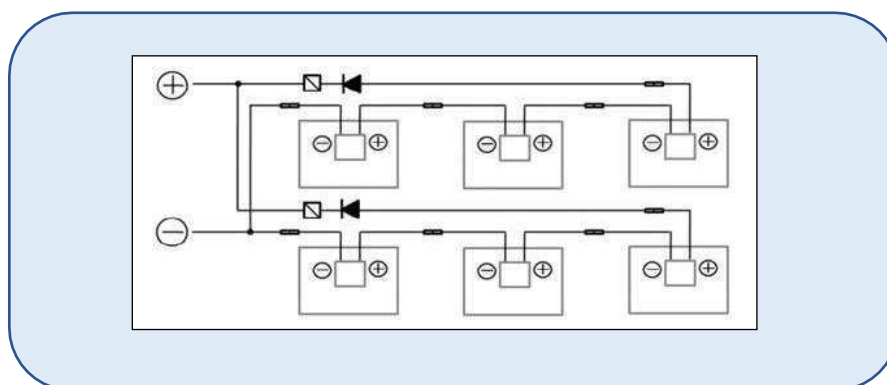


Fig.9.3 Parallel-series Connection

- E. Different types of modules cannot be connected in series. Modules connected in series should ensure the consistency of their current. The voltage of the module string should not exceed the allowable system voltage value, which can be found on the nameplate or datasheet of the module.
- F. The maximum number of modules in series depends on the system design, the type of converter used and the environmental conditions. In general, the maximum number (N) of PV modules in series can be calculated by dividing the maximum system voltage by the open circuit voltage of the relevant solar PV modules. When designing the solar PV system, it is necessary to take into account the characteristic that the voltage of the solar PV module changes with the temperature. Considering the voltage increase caused by temperature drop in extreme environment in winter, the maximum series connection number of solar PV modules can be calculated by the following formula.

Formula	Maximum system voltage $V \geq N \times V_{oc} \times [1 + \beta \times (T_{min} - 25)]$
V	Maximum system voltage
N	The number of maximum solar PV modules in series
V <sub>oc</sub>	The open circuit voltage of each module (see product label or data sheet)
$\beta$	Temperature coefficient of open circuit voltage of the module (refer to data sheet)
T <sub>min</sub>	The lowest ambient temperature at installation site

Table 9-1 maximum series connection number calculation

**Remarks:** if the number of parallel connections is greater than or equal to 2, there must be an over- current protection device on each string of modules.

- G. Product can be irreparably damaged if an array string is connected in reverse polarity to another. Always verify the voltage and polarity of each individual string before making a parallel connection. If you measure a reversed polarity or a difference of more than 10V between strings (same numbers of module in each string) then check the string configuration before making the connection.
- H. Before wiring the module, ensure that the contact points are corrosion resistant, clean and dry; If a string of modules is reversed, irreparable damage can be caused
- I. For relatively large installations, Jakson recommends that suitable size and number of lightning protection should be used in accordance with local requirements and regulations.
- J. Each Jakson solar PV module has two PV cables (+ve and -ve) which can withstand 90°C temperature and they are UV resistant. The cross-sectional area of the cable is 4mm<sup>2</sup> or 12AWG, and the external diameter is 4mm-7mm. Plug & Play connectors are included at the end of each cable. All other cables used to connect the direct current system shall have similar (or higher) specifications, and should have suitable insulation ability which can suffer the possible maximum system Voc as per applicable

standards. Jakson requires all cables and electrical connections to comply with the electrical regulations of the countries where the PV system is installed.

- K. When selecting a cable, the minimum current-carrying capacity of the cable can be calculated by the following formula.

$$\text{Minimum current-carrying capacity of the cable} = 1.25 \times I_{sc} \times N_p I_{sc}: \text{short-circuit current of PV module (unit: A)}$$

$N_p$ : the number of modules in parallel or module strings

- L. To clear or trim excess cables and Jakson recommends that all cables be placed in proper conduiting and away from standing water.
- M. Jakson recommends using lightning protection devices which are complied with local laws and electrical regulations.

## 9.1 Bypass secondary

- a. If solar photovoltaic module is partially blocked by shadow, it can lead to reverse voltage related to solar cells, solar photovoltaic modules in other unaffected string or other solar PV modules in the system. This will result in blocking of current and power loss leading to heating of affected cell. When the solar photovoltaic module is connected in parallel with the bypass diode, the current in the system will flow directly through the diode, so as to bypass the blocked part of the solar photovoltaic module and minimize the heating degree and power consumption of the solar photovoltaic module.
- b. Each module has three diodes. Please do not try to open the junction box to replace the diode, contact Jakson or trained and certified professional to do this work.

## 10. Grounding

1. All PV module frames and mounting brackets must be properly grounded in accordance with the applicable national electrical code.

2. Correct grounding is achieved by continuously connecting the PV module frame and all metal modules together using the appropriate grounding conductor. The grounding wire may be copper, copper alloy or other materials that can be used as conductors and meet the requirements of the national electrical code. It is recommended to use the copper wire (4-14 mm<sup>2</sup> or AWG 6- 12) as the grounding wire. The symbol "⏏" can be found at the grounding hole position. The ground wire must also be connected to ground through a suitable ground electrode. The tight connection of all the joint point should be ensured.
3. Installers may only use single-conductor cable listed and labeled as USE-2 or PV wire which is 90°C wet rated in North America, and single conductor cable, 4-16mm<sup>2</sup>(5-12 AWG), 90°C wet rated in other areas (i.e. TUV 2PfG1169 or EN50618 approved), with proper insulation which is able to withstand the maximum possible system open-circuit voltage. Only copper conductor material should be used. Select a suitable conductor gauge to minimize voltage drop and ensure that the conductor current carrying capacity with local regulations (i.e. NEC 690.8(D), IS 3043-1987).
4. On a grounding hole with a diameter of  $\phi 5$  mm, use a separate grounding wire and related accessories to connect the aluminum frame of the solar PV module and connect the grounding wire to the ground. The grounding uses the M4 x 12mm bolts and M4 nuts, star washers and plain washers, this ensures that the modules are firmly grounded. You can find the corresponding product drawing in module datasheet to know the detailed number, size and position of the grounding holes. The torque applied to ground fixation is 4N·m~8N·m.

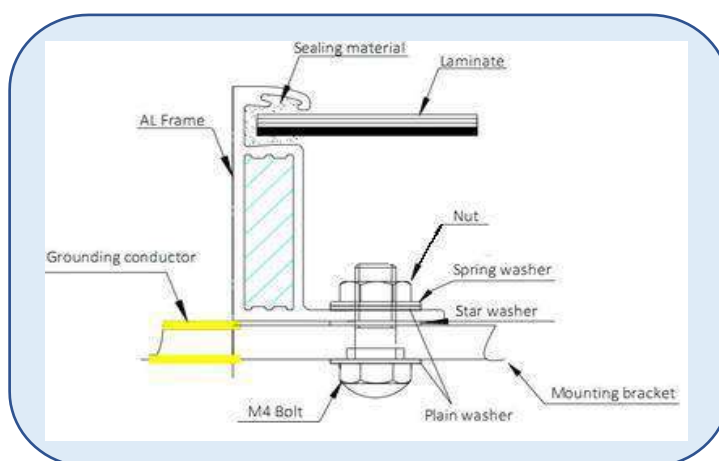


Fig. 10.1 Grounding

In addition to using the grounding hole, you can also choose the following grounding ways:

- ✓ Grounding by unused mounting holes
- ✓ Other professional grounding devices

The electrical contact points of all the above grounding methods should penetrate the anodized film of the aluminum frame. Jakson modules can be grounded by other grounding devices, which must be reliable and certified. The manufacturer's requirements should be followed.

## 11. Inspection and Maintenance

In order to ensure the long-term using of the installed PV system and maximize the Power output performance of the modules, the installed PV modules need to be inspected and maintained regularly. The inspection and maintenance of modules in the PV array shall be carried out by personnel who have received professional PV system maintenance training and obtained relevant qualifications and authorization.

### a. Module visual inspection and replacement

- A. The PV modules installed in the PV array should be inspected periodically for damage. If functional and safety faults are found due to the following factors, the modules of the same type should be replaced immediately.
  - a. PV modules have broken glass.
  - b. Bubbles or delamination form a continuous path between electric circuit and the edge of the module.
  - c. Junction box is deformed, cracked or burned, and the terminals cannot be connected well.
- B. Replace failed PV modules with same type. Do not touch live wires and connectors directly. When you need to touch them, use suitable safety devices (insulation

tools/gloves, etc.).

- C. The warning signs on the PV modules must not be lost.
- D. Check the electrical, grounding and mechanical connections every 6 months to ensure they are clean and safe, free from damage or rust. Check that the mounting parts are tight. Check all cables and make sure that the connectors are securely. PV modules frames and brackets should be well mechanically connected.
- E. Check whether there is any foreign body on the surface of the PV modules and whether there is any shielding.
- F. When repairing PV modules, cover the surface of PV modules with opaque material to prevent electric shock. Exposure of PV modules to sunlight will generate high voltages, this is dangerous. Please pay attention to safety when maintenance and it must be done by professionals.
- G. Comply with maintenance instructions for all modules used in the PV system, such as brackets, charging rectifiers, inverters, batteries, lightning protection systems, etc.
- H. Warning: Before doing any electrical maintenance, PV system must be shut down. Improper system maintenance may cause fatal dangers such as electric shock and burning.

## **b. Cleaning**

- 1. Dust accumulation on the glass surface of the module will reduce its power output and may cause hot spots. So, the surface of photovoltaic modules should be kept clean on regular basis.
- 2. Warning: It should be carried out by trained personnel. Workers should wear PPE, such as goggles, electric insulation gloves and safety shoes. The gloves should withstand DC voltages of no less than 2000V.

3. Use dry or wet soft cloths, sponges, etc. to clean the modules during the cleaning process, but do not put any modules directly into the water, do not use corrosive solvents and do not wipe the PV modules with hard objects. When the pressure water is used, the water pressure on the glass surface of the module must not exceed 35 bar(500 Psi) at the nozzle. The module must not be subjected to additional external force. If necessary, use isopropyl alcohol (IPA) according to the safety instructions to clean and ensure that no IPA flows into the gap between the edge of the module and the module frame.
4. Clean PV modules when the irradiance is below 200W/m<sup>2</sup>. Liquid with a large temperature difference compared to modules shall not be used for cleaning. For example, do not use cold water to clean the module when the temperature of it is high during the day, otherwise there will be the risk of module damage.
5. It is forbidden to clean photovoltaic modules under weather conditions with heavy rain, heavy snow or winds greater than class 4.

Water requirements when cleaning:

- a. PH: 6.5 – 8
- b. Temperature: 10-30 degree C
- c. Chloride as CL: <250mg/L
- d. Turbidity: <1 NTU
- e. Calcium should not exceed: 75 mg/ml
- f. Total dissolved solids (TDS) : ≤750 mg/L
- g. Water hardness: <75 mg/L
- h. Non-alkaline water must be used, and softened water can be used when conditions permitted.

**c. Module inspection after cleaning**

- A.** Visual inspection to ensure the module is clean, bright and free of stains;
- B.** Spot check to verify whether there is soot deposit on the module surface;
- C.** Check whether there are visible scratches on the surface of the module or not;
- D.** Check whether there is man-made cracks on the module surface or not;
- E.** Check whether the module support structure is leaning or bent or not;
- F.** Check whether the connectors of the module are detached or not;
- G.** After cleaning, fill out the PV module cleaning record.

## 12. Recycling


PV module that have reached the designed service life of the product or cannot be used due to malfunction should be removed from the system. You can deal with these scrapped components in the following ways:

- ✓ Please consult and follow the local laws and regulations, must have a qualified institution to recover processing, the product disposal.
- ✓ If your area is covered by a PV Cycle specialist, you can contact them directly for processing.

You may contact Jakson for any support needed for proper recycling

## 13. Electrical Parameters

Reference Back label for Helia NXT series:

 <p><b>WARNING – ELECTRICAL HAZARD</b> The unit produces electricity when exposed to light. Cover the glass before opening terminal box. Don't disconnect the plugs under load.</p> <p>Jakson Engineers Ltd. Plot No. 25, EcoTech-II, Udyog Vihar, Greater Noida, Gautam Buddha Nagar, Uttar Pradesh, India, 201306 Contact: Customer.support@jakson.com, solar.in@jakson.com   Toll Free: 1800-103-2600   www.jakson-solar.com</p>	Model No. JN-585G		STC	BNPI	BSI	Bifaciality Coefficient $\Phi_{Pmax}$	80 ± 5%	Dimension	2278*1133*35mm
	Maximum Power (P <sub>max</sub> )	585 Wp (± 3%)	644 Wp (± 3%)			Bifaciality Coefficient $\Phi_{Voc}$	100 ± 5%	Weight	33 Kgs
 	Open Circuit Voltage (V <sub>oc</sub> )	52.57 V (± 3%)	52.57 V (± 10%)			Bifaciality Coefficient $\Phi_{isc}$	80 ± 5%	Min. Design Load	+3600Pa/-1600Pa
	Maximum Power Voltage (V <sub>mp</sub> )	44.09 V	44.09 V			Max. System Voltage	1500 V	Module (T98) max	70°C
	Short Circuit Current (I <sub>sc</sub> )	14.05 A (± 3%)	15.46 A (± 10%)	17.42 A (± 10%)		Protection against electric shock	Class II	N-Type Crystalline Si	
	Maximum Power Current (I <sub>mp</sub> )	13.27 A	14.60 A			Max. Series Fuse Rating	30 A		
STC: 25°C, 1000 W/m², AM 1.5; BNPI: 25°C, Isc=1 – 1000 W/m², rear – 150 W/m², AM 1.5; BSI: Isc=1 – 1000 W/m², rear – 300 W/m²									
									MADE IN INDIA

Reference Back label for Helia NXTR series:





 <p><b>WARNING – ELECTRICAL HAZARD</b> The unit produces electricity when exposed to light. Cover the glass before opening terminal box. Don't disconnect the plugs under load.</p> <p>Jakson Engineers Ltd. Plot No. 25, EcoTech-II, Udyog Vihar, Greater Noida, Gautam Buddha Nagar, Uttar Pradesh, India, 201306 Contact: Customer.support@jakson.com, solar.in@jakson.com   Toll Free: 1800-103-2600   www.jakson-solar.com</p>	Model No. JN-615GR		STC	BNPI	BSI	Bifaciality Coefficient $\Phi_{Pmax}$	80 ± 5%	Dimension	2382*1133*35mm
	Maximum Power (P <sub>max</sub> )	615 Wp (± 3%)	677 Wp (± 3%)			Bifaciality Coefficient $\Phi_{Voc}$	100 ± 5%	Weight	34.5 Kgs
 	Open Circuit Voltage (V <sub>oc</sub> )	49.47 V (± 3%)	49.47 V (± 10%)			Bifaciality Coefficient $\Phi_{isc}$	80 ± 5%	Min. Design Load	+3600Pa/-1600Pa
	Maximum Power Voltage (V <sub>mp</sub> )	41.09 V	41.09 V			Max. System Voltage	1500 V	Module (T98) max	70°C
	Short Circuit Current (I <sub>sc</sub> )	15.82 A (± 3%)	17.41 A (± 10%)	19.63 A (± 10%)		Protection against electric shock	Class II	N-Type Crystalline Si	
	Maximum Power Current (I <sub>mp</sub> )	14.97 A	16.47 A			Max. Series Fuse Rating	35 A		
STC: 25°C, 1000 W/m², AM 1.5; BNPI: 25°C, Isc=1 – 1000 W/m², rear – 150 W/m², AM 1.5; BSI: Isc=1 – 1000 W/m², rear – 300 W/m²									
									MADE IN INDIA

Fig.13.1 Reference back labels

Electrical parameters are as per the official module datasheet available on website (<https://www.jakson-solar.com/>). To visit the website you may scan the given QR code.



## 14. TROUBLESHOOTING

If the PV system does not work properly, please inform your installer immediately. It is recommended to perform a preventive inspection every six months. If electrical or mechanical properties are required for inspection or maintenance, qualified professionals should be called for inspection/testing to avoid any electric shock or loss of life.

## 15. DISCLAIMER

Jakson is not responsible for any form of damage, including but not limited to module operation and system installation error, and personnel injury, hurt, and property loss resulted from failure to follow the instructions in this Manual.

Failure of the customer to follow the requirements outlined in this Manual during the installation of the module will result in the invalidity of product's limited warranty.

Jakson is not responsible for any infringement of third-party patents or any other rights arising from the use of solar PV modules.

Jakson reserves the rights to change this Manual without prior notice.

The information in this Manual is derived from knowledge and experience, and such information and recommendations do not constitute any warranty.

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