# Installation Instructions

## What is included in The RAQ Solar Mounting Kits?

**SR-3000 Includes**

Self squaring 3 Panel Rails with adjustable panel clamps, adjustable anchor bases, flashing and all hardware to assemble

**SR-1000 Includes**

Self squaring 1 Panel Rail, with adjustable panel clamps, adjustable anchor bases, flashing and all hardware to assemble

**SR-0700 Start Bracket Kit**

For a stand alone unit or to start a row, and grounding for stand alone or row of rails (up to 18 max.)

**SR-0400 Additional Wind Zone Kit**

4 additional flashing, 4 adjustable anchor bases, end clips and all hardware to assemble.

**SR-0900 Micro Inverter Bracket Kit**

3 Micro inverter brackets and all hardware to assemble

## What will I need to Install The RAQ Solar Mounting Kits?

**Safety Equipment:**

Ladders, eye protection , hard hats and all fall protection

**Tools:**

1/2" Socket and Driver (with extra charged batteries on hand)
3/8" Cold Rolled Drill Bit (incase of odd anchor feet placement, or misaligned rafter spacing)
4 1/2" Long Wood Drill Bit (for predrilling lag bolt penetrations)

1

**SR-3000: 126" X 9"X 8.5" 50 LBS**
**SR-1000: 43.5" X 9" X 8.5" 21.5 LBS**

2

**Open by removing strap that is securing box with box cutter**

3

**Unpack Contents and verify order is accurate**
**Familiarize yourself with the various components and prepare kit for installation**

4

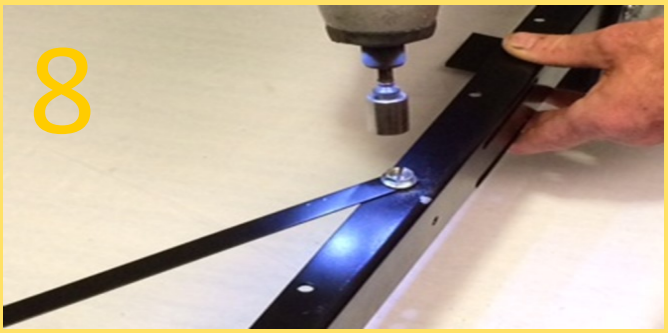
**Take all equipment on roof and set up for installation**

**Cut zip tie on assembly**


**Open the assembly until bi-fold center brace (s) is straight, ensure holes are lined up for securing**


**Place T23 Bolt into predrilled hole by bi-fold hinge ensuring it is lined up with the predrilled hole below and tighten.**

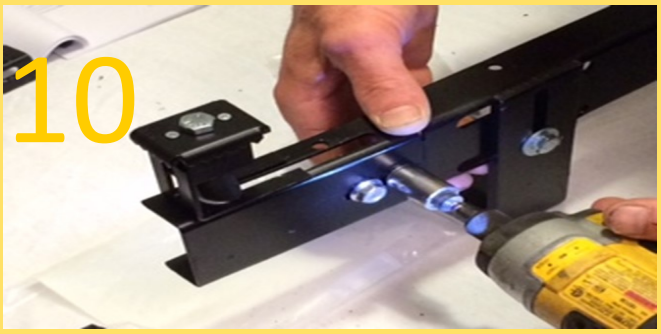

**Locate all squaring arms; connected to the underside of cross brace, rotate them out to the point where they naturally land on the top of rail.**




**Secure all of the squaring arms individually with preinstalled T23, tighten fully by drilling with 1/2" socket it into prepositioned hole.**


**Locate Start Brackets and attach onto left end**

***Remember Start brackets are only used at the beginning of a row (on the farthest left side of the row )or to complete a stand alone unit.***

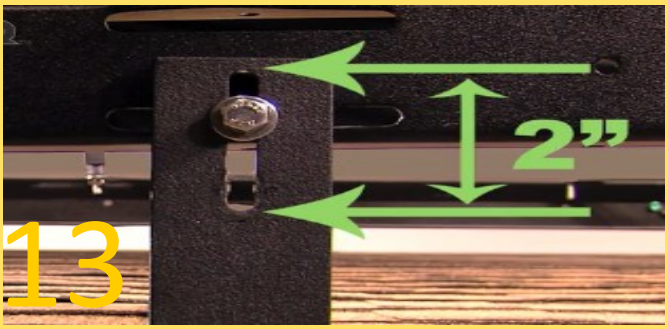



**Using drill with 1/2" socket, secure by tighten bolt fully.**

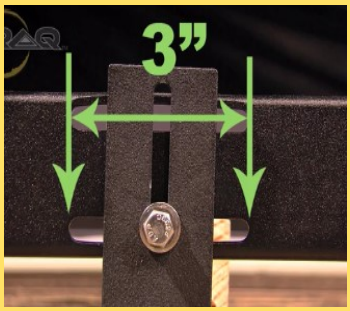
***Remember Start brackets are only used at the beginning of a row (on the farthest left side of the row )or to complete a stand alone unit.***


Before we secure rail (s) into roof we must be aware of a few things. First, anchor bases will always point up to the peak of the roof. Secondly, placement of preinstalled anchor bases may need to be relocated (depending on rafter spacing on roof being installed onto and wind and snow load capacities) . Preassembled anchor base spacing is set for 24" on center.

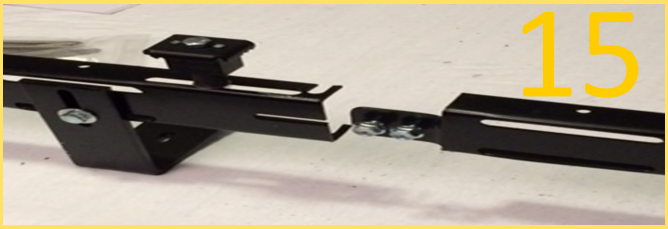

Now is the time to configure rafter spacing for proper installation of anchor bases onto rail to be lined up with the rafter spacing. *Predrilled holes are placed along the rail based upon, 16", 24", 32", 48', even 72" & 96" spans are available*. If rafter spacing does not line up with the preassembled holes available feel free to drill a hole (s) using cold rolled drill bit . Keep in mind this reduces self-leveling abilities so please ensure placement before hole is drilled.




Keep in mind: The anchor bases also allow for vertical adjusts to compensate for variances in roof levels, while maintaining minimum height distance from roof to the bottom of the solar panel


Keep in mind: The prepositioned slot available on the rail allows for up to 3" of adjustment of the anchor foot left or right, to compensate for most of all adjustments due to roof rafter spacing. Placement of the bolt for securing onto rail always goes in lower slot.




If combining RAQ's into a row now is the time to interconnect the rails. *(If you are only building a standalone unit you may move on to next step)* Connect together by sliding male end into female end of rails. Tighten attached bolts completely with a driver and 1/2" socket. As many as 18 PV's can be assembled in a row before you must start a new row. (*Only 1 start bracket kit needed per row).*

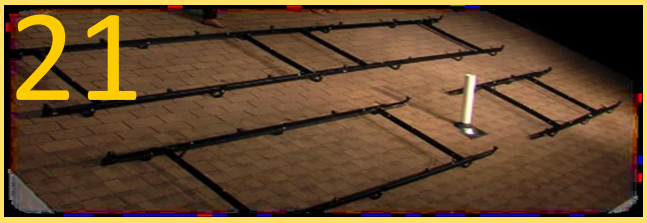
*A second row requires there is proper spacing between rows, (generally 27" when using the standard 60 cell panel)*


Next we must locate the roof rafters. An industry standard way to locate roof rafters is to utilize a hammer and strike the roof while listening for sound differences.

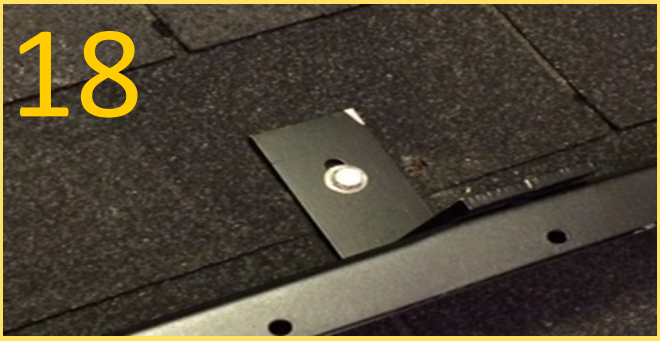
*If the rafter is missed when predrilling minor adjustments can be made to properly locate the rafter, these small adjustments will be protected by the anchor foot flashing to be installed later or you can use roofing caulk to seal the unused hole.*


Once the rafter location is determined based on your installation layout configuration predrilled holes should be made with the 4 1/2" drill bit in the location where anchor bases will be installed into roof rafters. *Note: Anchor bases may need additional adjustments off the rail before they line up with rafters.* Start from the top work your way to the right, then below. *If you have a second row below be sure there is proper spacing between rows, (generally 27" when using the standard 60 cell panel)*


Begin by inserting the flashing under the shingle line above the anchor foot location. Continue to rotate the flashing under the shingle line until it is fully seated over the anchor foot. Once flashing is seated over the anchor base bend the tabs to secure the flashing around the anchor foot. *If you have a second row below be sure there is proper spacing between rows, (generally 27" when using the standard 60 cell panel)*



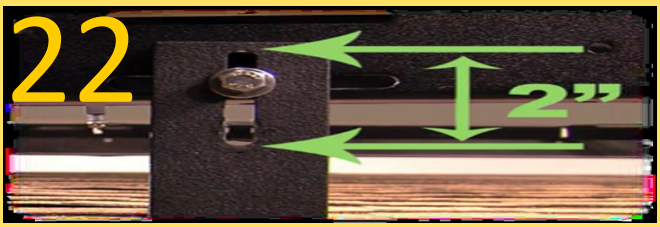

Leveling the racking for multiple units in a row usually requires the installer to view the array from the ground to determine if it is level based on aesthetics. Please use a tape measure, string line, and a discerning pair of eyes to make certain the array looks good from every angle.




Once the anchor foot has been properly bolted to the roof rafters water protection or roof flashing can be placed. Unlike the majority of other racking systems, The RAQ, uses a Mechanical method of water proofing, not a chemical protection.


Each RAQ comes with pre drilled locations for the inverters which allows for a multitude of spacing adjustments for cord management. Simply install inverter with the T23 bolt provided. This bolt can be moved to any predrilled location in the main rail. Once placement is established set bolt but do not tighten. Slide the inverter under the bolt, then tighten the bolt to hold the inverter in place, the inverter may be positioned on either side of the rail . *Connect inverter cables to inverters according to manufacture suggestions.*

*A zip tie is also included for cable management to be run down inside of C Channel.*




To adjust leveling simply locate the anchor base that need adjusting and modify anchor base till it is flush with the roof surface.

*Note: Occasionally, one side of the installation may be more visible*

*Next prepare PV 's to be installed on leveled racking*


Starting from the top row, from left to right, place the #1 PV module in the portrait position and place the module onto the 1st RAQ unit (under panel clamps on start brackets ) and hold up on right side to attach PV to inverter cables.


Once attached, set PV down and center. Keep in mind: The start bracket panel clamps must be adjusted uniformly; they allow for 3" of variance, determined by installation configuration. Secure upper and lower panel clamps on the left side ONLY. To secure the # 1 PV module, use the ½" socket on the top panel clamp, start by securing the panel clamp on the start bracket side( left). Then slide the panel clamps from the right side to the left thus aligning the panel clamp over the frame of the module. Only secure the panel clamps on the frame of PV module.


Before securing the next set of panel clamps onto 1st PV bring in PV module # 2 onto the next RAQ unit to the right. Install just like #1; by setting and tilting left side of PV in portrait position under panel clamps, attach PV to inverter and set down. Before securing # 2 PV to RAQ be sure it is flush and level with #1 PV. Then secure the 1 & 2 PV module by securing the next set of panel clamps upper first, then lower clamp on panel. Repeat for up to 18 panels before needing to

Leveling the solar array for multiple units in a row requires the installer to view the array from the ground to determine if it is level; based on aesthetics. Visual examination after PV's installed adjustments made based on installers eye to judge what anchors need to be adjusted.

Occasionally, one side of the array may be more visible from the ground or even from a second-story window. Continue using tape measure, string line, and a discerning pair of eyes to make certain the array
looks good from every angle.

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# SP-1000

# The Solar PaQ

*Solar Panel + Inverter + Universal Roof Mount Racking*

**UPC: 861150002609**

# Microinverter Instructions



# SP-1000

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# Microinverter Instructions

## COMPANY PROFILE

Northern Electric & Power Inc. (NEP) was founded in the United States and has manufacturing and R&D facilities in China. The mission of the company is to develop cutting-edge clean energy technologies and provide state-of-the-art solar inverter products to its customers. The first round of investment to the company was US$20 Million, with a planned total investment of US$50 Million. The company is headquartered in the city of Tsingtao, a major industrial center andtrading port in the northeastern China. The company campus occupies more than18 acres in the Tsingtao Export Processing Zone, and has more than 650,000square feet building space. The campus is planned to be connected through amicro smart grid demo community and powered by electricity from solar, windand micro turbines. Outside China, the company has operation offices in Chicago,U.S. and Vancouver, Canada.

The technology founders of the company are well-known experts in the fields ofpower electronics, automatic control, signal processing, and communications.
Each of the founders has multiple U.S. and world patents in their specialty areas.They received Ph.D. degrees from top universities in North America, and each has
more than 10 years engineering and management experiences in leading U.S.companies.

NEP has a complete product line of grid-tied solar inverters, including 250W~500W micro inverters, 1.5kW~5kW single phase solar inverters, and 10kW~500kW three-phase solar inverters. Field deployment results demonstrated high system efficiency and reliability of NEP solar inverters.

NEP is committed to develop *Clean, Reliable, Affordable and Efficient* (CARE)products for worldwide customers.

### 1. INTRODUCTION

#### 1.1 Prefix

Dear customer, thank you for choosing the BDM-250 micro inverter from NEP.
We hope you will find our products meet your need for renewable energy.
Meantime, we appreciate your feedback regarding our products.

#### 1.2 Grid-tied PV System

Grid-tied PV system consists of PV panels, grid-tied inverter and junction boxes. The DC output from the PV panels is converted into AC energy and feedback to the grid through the BDM-250. BDM-250 series PV micro inverter contains isolation transformer with basic insulation between PV input and AC grid output. The PV panel terminals on BDM-250 shall not be earthed via external wiring, for BDM-250 connects PV panel to earth via an internal earth fault interrupting fuse.

#### 1.3 How to Use This Manual

This manual provides detailed product information and installation instructions for the BDM-250 micro solar inverter. Please read through this manual before installation and operation.

**WARNING:** This indicates a situation where failure to follow instructions may be a safety hazard or cause equipment malfunction. Use extreme caution and follow instructions carefully.

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# The Solar PaQ

*Solar Panel + Inverter + Universal Roof Mount Racking*

**UPC: 861150002609**

# Microinverter Instructions

### 1.4 Label

The label is located on the side of the inverter. The information on the label includes technical data as well as type, firmware version and serial number of the device. Safety instructions on the label are listed and explained below:

### 2. SAFETY INSTRUCTION

**WARNING:**

PLEASE READ THIS MANUAL BEFORE INSTALLATION. ANY DAMAGE TO THE PRODUCT DUE TO NOT FOLLOWING THIS MANUAL IS NOT COVERED BY THE WARRANTEE.

ALL THE INSTALLATION SHOULD BE DONE BY CERTIFIED ELECTRICIAN.

BESIDES THE CABLE CONNECTORS, NOTHING INSIDE THE INVERTER SHOULD BE MODIFIED.

ALL INSTALLATION SHOULD FOLLOW THE LOCAL ELECTRIC CODES. FURTHER PROTECTION ON THE AC WIRING FROM THE INVERTERS SHOULD BE PROVIDED AND MAY BE REQUIRED BY LOCAL AND NATIONAL WIRING REGULATIONS. THIS PROTECTION IS LIKELY TO INCLUDE RESIDUAL CURRENT DEVICES, EARTH FAULT MONITORS AND CIRCUIT BREAKERS. THIS PRODUCT MAY CAUSE AC CURRENT WITH A DC COMPONENT. IF A RESIDUAL CURRENT-OPERATED PROTECTIVE DEVICE (RCD) OR A MONITORING DEVICE (RCM) IS USED FOR PROTECTION IN CASE OF DIRECT OR INDIRECT CONTACT, ONLY AN RCD OR RCM OF TYPE B IS ALLOWED ON THE AC SIDE OF THIS PRODUCT.

NEVER DISCONNECT PV MODULE FROM THE MICRO-INVERTER WITHOUT FIRST ISOLATING THE AC MAINS. ALL PV CONNECTORS AND AC CONNECTORS ARE FORBIDDEN TO BE DISCONNECTED UNDER LOAD BEFORE SWITCHING OFF THE CIRCUIT BREAKER ON THE AC BRANCH.

PLEASE CONTACT AUTHORIZED SERVICE AGENTS FOR ANY SERVICE WORK.

BDM-250 IS A GRID-TIED SOLAR INVERTER. IT MAY REQUIRE APPROVAL FROM LOCAL UTILITY COMPANY TO CONNECT IT TO THE POWER GRID.

BDM-250 DOES NOT INCLUDE COMPONENTS THAT CAN BE SERVED BY CUSTOMERS.

**WARNING:**

WHEN THE PHOTOVOLTAIC ARRAY IS EXPOSED TO LIGHT, IT SUPPLIES A DC VOLTAGE TO THE MICRO-INVERTER.

### 3. FCC COMPLIANCE

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by the party responsible for compliance may void the user's authority to operate the equipment.

# 4. INSTALLATION

**WARNING:** BE AWARE THAT INSTALLATION OF THIS EQUIPMENT INCLUDES RISK OF ELECTRIC SHOCK. NORMALLY GROUNDED CONDUCTORS MAY BE UNGROUNDED AND ENERGIZED WHEN A GROUND FAULT IS INDICATED.

## Parts Included

In addition to the micro inverters, PV modules, racking, and associated hardware, you'll need the BDM-250 installation kit. This kit includes the following items:

- Protective end cap
- Mounting Bracket (adapter plate)
- AC interconnect cable and protective end CAP

## Other Parts and Tools Required

In addition to your PV array and its associated hardware, you will need the following parts:

- Junction box
- Continuous grounding conductor, grounding washers
- Number 2 Phillips screwdriver
- Sockets, wrenches for mounting hardware
- Torque wrench
- Mounting hardware suitable for module racking

## Lightning Surge Suppression

Lightning does not actually need to strike the equipment or building where PV system is installed to cause damage. Often, a strike nearby will induce voltage spikes in the electrical grid that can damage equipment. BDM-250 has integrated surge protection, greater than most string inverters. However, if the surge has sufficient energy, the protection built into the BDM-250 can be exceeded, and the equipment can be damaged.

Since the NEP Limited Warranty does not cover "acts of God" such as lightning strikes, and since lightning strikes can occur anywhere, it is best practice to install surge protection as part of any solar installation. Installation of surge protection devices should follow vendor instructions.

## Installation Procedure

**WARNING:** DO NOT CONNECT BDM-250 TO THE UTILITY GRID OR ENERGIZE THE AC CIRCUIT(S) UNTIL YOU HAVE COMPLETED ALL OF THE INSTALLATION PROCEDURES AS DESCRIBED IN THE FOLLOWING SECTIONS.

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*Solar Panel + Inverter + Universal Roof Mount Racking*

**UPC: 861150002609**

# Microinverter Instructions

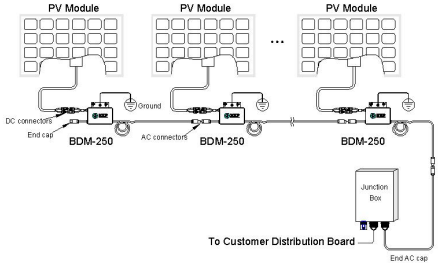
Installing the BDM-250 Micro inverter System involves several key steps:

1. Measuring service and installing the AC branch circuit junction box.

**WARNING:** ONLY USE ELECTRICAL SYSTEM COMPONENTS APPROVED FOR WET LOCATIONS.

2. Attaching the BDM-250 Micro inverter to the racking.
3. Connecting the BDM-250 Micro inverter wiring harnesses.
4. Grounding the system.
5. Completing the BDM-250 Micro inverter installation map and connecting the PV modules.

The finished system should be similar as in the diagram. Detailed installation steps are listed in the following section.




## Step 1 - Install the AC Branch Circuit Junction Box

1. Measure service entrance conductors to confirm AC service at the site. Acceptable ranges are shown in the table below:

- BDM-250-240A & BDM-250-208A (North America)

| 240 Volt AC Single Phase | | 208 Volt AC Single Phase | |
|---|---|---|---|
| L1(red) to L2(black) | 211 to 264 Vac | L1(red) toL2(black) | 183 to 229 Vac |
| L1(red), L2(black) to neutral(blue) | 106 to 132 Vac | L1(red), L2(black) to neutral(blue) | 106 to 132 Vac |

- BDM-250-AU (Australia and New Zealand)

| | |
|---|---|
| L1(red)to L2(black) | 200 to 270 Vac |

- BDM-250-EU (Europe)

| | |
|---|---|
| L1(red) to L2(black) | Refer to the grid code requirement of local authority |

2. Mount the adapter plate at a suitable location on the PV racking system (typically at the end of a row of modules).
3. Install an appropriate junction box with the adapter plate.

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# Microinverter Instructions

4. Connect the open wire end of the AC interconnect cable into the junction box using an appropriate gland or strain relief fitting. The AC interconnect cable requires a strain relief connector with an opening of 3/8 inches in diameter.

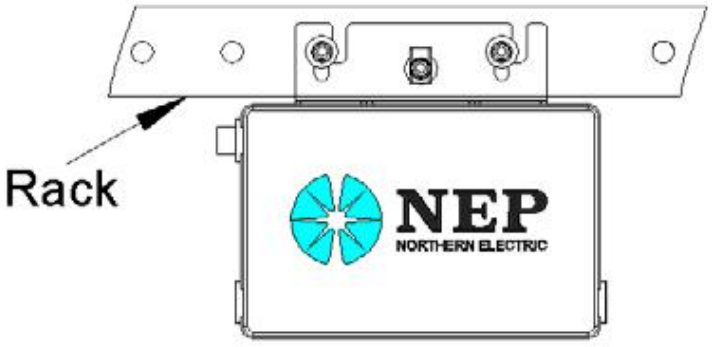
### Step 2 - Attach the BDM-250 to the Racking

1. Mark the approximate centers of each PV module on the racking system. Evaluate the location of the micro inverter with respect to the PV module junction box or any other obstructions.

**WARNING:** ALLOW A MINIMUM OF .75 INCHES BETWEEN THE TOP OF THE ROOF AND THE BOTTOM OF BDM-250. WE ALSO RECOMMEND THAT YOU ALLOW .50 INCHES BETWEEN THE BACK OF THE PV MODULE AND THE TOP OF BDM-250. DO NOT MOUNT BDM-250 IN A LOCATION THAT ALLOWS LONG-TERM EXPOSURE TO DIRECT SUNLIGHT.

2. If using grounding washers (e.g., WEEB) to ground the micro inverter chassis to the PV module racking, choose a grounding washer that is approved for the racking manufacturer. Install a minimum of one grounding washer per micro inverter. Torque the micro inverter fasteners to the values listed below.
1/4” mounting hardware – 45 inlbs minimum 5/16” mounting hardware – 80 inlbs minimum

3. Mount one micro inverter at each of these locations using hardware recommended by your module racking vendor. Mounting slots on the micro inverter are 0.33 inches in diameter. Maximum bolt size is 5/16 inch. The two slots on the micro inverter are 4 inches apart.



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# Microinverter Instructions

### Step 3 - Connect the BDM-250 Wiring Harnesses

Each BDM-250 comes with one 3-pin bulkhead receptacle (or short pigtail) and one 70-inch AC wire harness with multi-pin connectors. (The DC input wires are approximately six inches long and are terminated with single pole connectors.) The AC connectors are oppositely sexed, so that multiple inverters can be connected to form one continuous AC branch circuit.

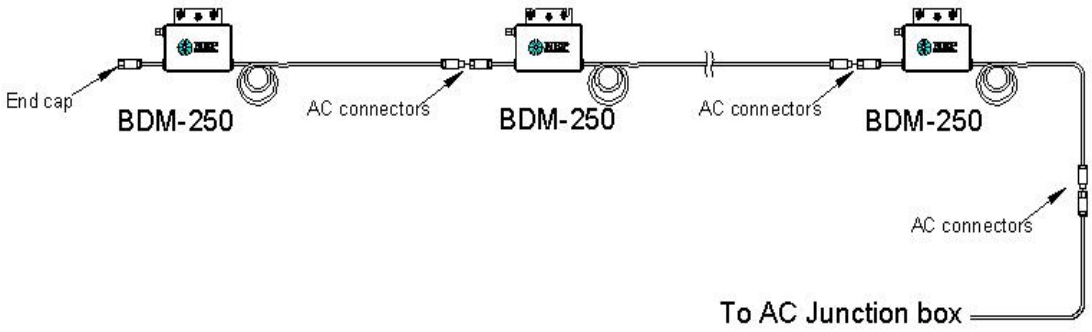
1. Orient the first BDM-250 in each branch with its male connector facing the junction box. The junction box AC interconnect cable has a female connector. The BDM-250 can be mounted with either side facing up to accommodate cable routing. Connect the first BDM-250 to the AC interconnect cable.

2. Plug the AC connector of the first BDM-250 into the connector of the next BDM-250, and so forth, to form a continuous AC branch circuit. Please check the BDM-250 rating label for the maximum allowable number of BDM-250 on one AC branch circuit. For the chain of the BDM-250 micro inverters thus formed, one end of the AC cable should be protected by a CAP (refer to the BDM-250 accessories). For the other end of the AC cable, it should be connected to an AC junction box through a tail cable (refer to the BDM-250 accessories). For BDM-250-240A and BDM-250-208A, the L1 wire (red), L2 wire (black) and neutral wire (blue) in the AC cable should be connected to the corresponding phases of the main grid through the AC junction box. For BDM-250-AU and BDM-250-EU, the L1 wire (red) and L2 wire (black) should be connected to the L and N phases of the main grid respectively at the AC junction box, the green/yellow wire should be connected to PE.

**WARNING: DO NOT EXCEED THE MAXIMUM NUMBER OF BDM-250 IN AN AC BRANCH CIRCUIT, AS DISPLAYED ON THE UNIT-RATING LABEL. EACH BDM-250 AC BRANCH CIRCUIT MUST BE SOURCED FROM A DEDICATED BRANCH CIRCUIT PROTECTED BY A 15A MAXIMUM BREAKER.**

3. Install a protective end cap on the open AC connector of the last BDM-250 in the AC branch circuit.

**WARNING:** MAKE SURE PROTECTIVE END CAPS HAVE BEEN INSTALLED ON ALL UNUSED AC CONNECTORS. UNUSED AC BDM-250 WIRE HARNESS CONNECTORS ARE LIVE WHEN THE SYSTEM IS ENERGIZED BY THE UTILITY SYSTEM.



# SP-1000

# The Solar PaQ

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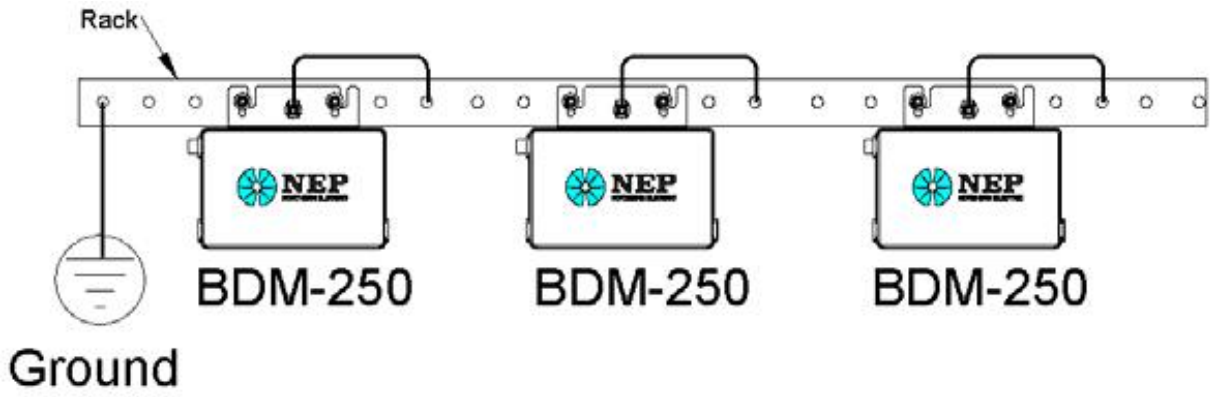
# Microinverter Instructions

### Step 4 – Ground the System

Each BDM-250 comes with a ground clip that can accommodate a 6-8 AWG conductor. If you are not using grounding washers to ground the BDM-250 chassis as described in step2, route a continuous GEC through each of the BDM-250 to the NEC approved AC grounding electrode. The racking and module could be grounded to this conductor using a crimp connection. An alternative method would be to connect the BDM-250 to the grounded racking using a grounding washer approved for the racking.

NOTE: The neutral wire (blue) in the AC cable is NOT bonded to earth and earth/ground connection is not provided via the AC cable through the micro-inverter. The earth/ground connector on the enclosure of micro-inverter shall be reliably connected to the earth; otherwise there will be a risk of person shock hazard or fire hazard. The ground conductor size is recommended with at least 4mm$^2$ and should be larger than live conductor cross section area. Refer



# SP-1000

# The Solar PaQ

*Solar Panel + Inverter + Universal Roof Mount Racking*

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# Microinverter Instructions

### Step 5 – Complete the connection map and connect the PV Modules

BDM-250 connection Map is a diagrammatic representation of the physical location of each BDM-250 in your PV installation. The virtual array in NEP micro inverter gateway BDG-256 is created from the map you create.

### Complete the connection map

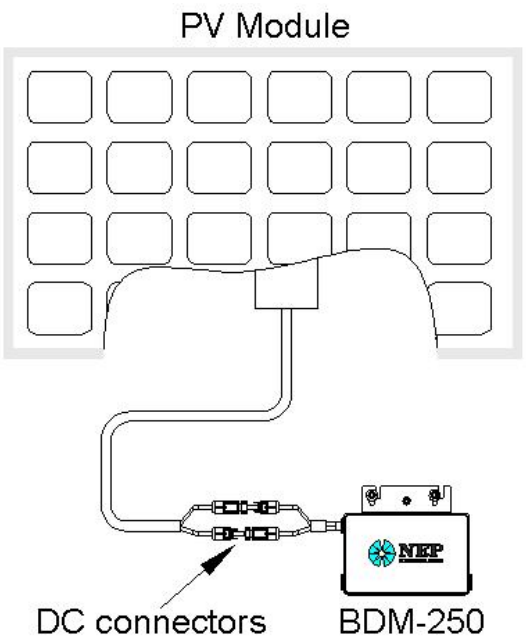
Each BDM-250 has a removable serial number located on the individual label. Enter the unique address contained in part of the serial number into a BDG-256, and correspond it to a number in the connection map.

### Connect the PV Modules

Completely install all BDM-250 and all system inter-wiring connections prior to installing the PV modules.

1. Mount the PV modules above their corresponding BDM-250. Each BDM-250 comes with two oppositely sexed DC connectors.

2. First connect the positive DC wire from the PV module to the positively marked DC connector (male pin) of the BDM-250. Then connect the negative DC wire from the PV module to the negatively marked DC connector (female socket) of the BDM-250. Repeat for all remaining PV modules using one BDM-250 for each module.



**SP-1000**

# The Solar PaQ

*Solar Panel + Inverter + Universal Roof Mount Racking*

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# Microinverter Instructions

## 5. COMMISSIONING

**WARNING:** CONNECT BDM-250 TO THE ELECTRICAL UTILITY GRID ONLY AFTER RECEIVING PRIOR APPROVAL FROM THE UTILITY COMPANY.

**WARNING:** BE AWARE THAT ONLY QUALIFIED PERSONNEL CAN CONNECT BDM-250 TO THE ELECTRICAL UTILITY GRID.

**WARNING:** ENSURE THAT ALL AC AND DC WIRING IS CORRECT. ENSURE THAT NONE OF THE AC AND DC WIRES IS PINCHED OR DAMAGED. ENSURE THAT ALL JUNCTION BOXES ARE PROPERLY CLOSED.

Following these steps to commission the BDM-250 PV system:

1. Turn on the AC disconnects or circuit breakers on each BDM-250 AC branch circuit.

2. Turn on the main utility-grid AC circuit breaker. Your system will start producing power after a few minutes wait time.

3. The BDM-250 will start to send performance data over the power lines using power line communication (PLC) to the BDG-256. The time required for each BDM-250 in the system to communicate to the BDG-256 will vary with the number of BDM-250 in the system.

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# The Solar PaQ

*Solar Panel + Inverter + Universal Roof Mount Racking*

**UPC: 861150002609**

# Microinverter Instructions

## 6. OPERATING INSTRUCTIONS

The BDM-250 is powered on when sufficient DC voltage from the module is applied. The status LED will start flashing after sufficient DC power is applied as an indication that the BDM-250 is live.

### Status: standby

The LED light is on by 2 second, and off by 2 seconds.

### Status: producing power

The LED light is on by 1 second, and off by 1 second.

| Error code | Error |
|---|---|
| Bit-0 | DC over voltage |
| Bit-1 | DC under voltage |
| Bit-2 | hardware error |
| Bit-3 | Inverter over voltage |
| Bit-4 | Frequency over |
| Bit-5 | Frequency under |
| Bit-6 | AC voltage RMS over |
| Bit-7 | AC voltage RMS under |
| Bit-8 | Peak AC voltage over |
| Bit-9 | AC current RMS over |
| Bit-10 | Peak AC current over |
| Bit-11 | Temperature over |
| Bit-12 | ADC error |
| Bit-13 | GFDI fault indicator |
| Bit-14 | Relay fault (BDM-250-AU/BDM-250-EU only) |
| Bit-15 | PLC Communication Error |

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# The Solar PaQ

*Solar Panel + Inverter + Universal Roof Mount Racking*

**UPC: 861150002609**

# Microinverter Instructions

### Status: producing power and communicating with BDG-256

The LED light is on by 0.5 second, and off by 0.5 second.

In case of fault, BDM-250 has multiple protective functions and stops output power. The fault message may be sent to a connected BDG-256 gateway through power line communication. The error message is displayed on the screen of BDG-256 gateway by a 16-bit error code.

## 7. TROUBLESHOOTING AND MAINTENANCE

**WARNING:** DO NOT ATTEMPT TO REPAIR THE BDM-250; IT CONTAINS NO USER-SERVICEABLE PARTS. IF TROUBLESHOOTING METHODS FAIL, PLEASE RETURN THE BDM-250 TO YOUR DISTRIBUTOR FOR MAINTENANCE.

**WARNING:** NEVER DISCONNECT THE DC WIRE CONNECTORS UNDER LOAD. ENSURE THAT NO CURRENT IS FLOWING IN THE DC WIRES PRIOR TO DISCONNECTING. AN OPAQUE COVERING MAY BE USED TO COVER THE MODULE PRIOR TO DISCONNECTING

**WARNING:** ALWAYS DISCONNECT AC POWER BEFORE DISCONNECTING PV MODULE WIRES FROM BDM-250. THE AC CONNECTOR OF THE FIRST BDM-250 IN A BRANCH CIRCUIT IS SUITABLE AS A DISCONNECTING MEANS ONCE THE AC BRANCH CIRCUIT BREAKER IN THE LOAD CENTER HAS BEEN OPENED.

**WARNING:** BDM-250 IS POWERED BY DC POWER FROM PV MODULES. MAKE SURE YOU DISCONNECT THE DC CONNECTIONS AND RECONNECT DC POWER TO WATCH FOR THE TWO SECONDS LED ON AND TWO SECONDS LED OFF AFTER DC IS APPLIED.

### LED indication of error

- **Error report: AC or DC fault**

The LED light is on by 4 second, and off by 4 seconds.

- **Error report: GFDI fault** The LED light stays on.

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*Solar Panel + Inverter + Universal Roof Mount Racking*

**UPC: 861150002609**

# Microinverter Instructions

## Troubleshooting an inoperable BDM-250

To troubleshoot an inoperable BDM-250, follow the steps in the order shown:

1. Check the connection to the utility grid. Verify that the utility voltage and frequency are within allowable ranges shown in the label of BDM-250.
2. Verify utility power is present at the inverter in question by removing AC, then DC power. Never disconnect the DC wires while the BDM-250 is producing power. Re-connect the DC module connectors, and then watch for the LED blinks.
3. Check the AC branch circuit interconnection harness between all the BDM-250. Verify that each inverter is energized by the utility grid as described in the previous step.
4. Make sure that any AC disconnects are functioning properly and are closed.
5. Verify the PV module DC voltage is within the allowable range shown in the label of BDM-250.
6. Check the DC connections between the BDM-250 and the PV module.
7. If the problem persists, please call customer support at NEP.

**WARNING:** DO NOT ATTEMPT TO REPAIR THE BDM-250; IT CONTAINS NO USER-SERVICEABLE PARTS. IF TROUBLESHOOTING METHODS FAIL, PLEASE RETURN THE BDM-250 TO YOUR DISTRIBUTOR FOR MAINTENANCE.

## Disconnecting a BDM-250 from the PV Module

To ensure the BDM-250 is not disconnected from the PV modules under load, adhere to the following disconnection steps in the order shown:

1. Disconnect the AC by opening the branch circuit breaker.
2. Disconnect the first AC connector in the branch circuit.
3. Cover the module with an opaque cover.
4. Using a DC current probe, verify there is no current flowing in the DC wires between the PV module and the BDM-250.
5. Care should be taken when measuring DC currents, most clamp-on meters must be zeroed first and tend to drift with time.
6. Disconnect the PV module DC wire connectors from the BDM-250.
7. Remove the BDM-250 from the PV array racking.

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# Microinverter Instructions

## Installing a replacement BDM-250

1. Attach the replacement BDM-250 to the PV module racking using hardware recommended by your module racking vendor. If you are using grounding washers (e.g., WEEB) to ground the chassis of the BDM-250, the old grounding washer should be discarded, and a new grounding washer must be used when installing the replacement BDM-250. Torque the BDM-250 fasteners to the values listed below: 1/4" mounting hardware – 45 in-lbs minimum
5/16" mounting hardware – 80 in-lbs minimum.

2. If you are using a grounding electrode conductor to ground the BDM-250 chassis, attach the grounding electrode conductor to the BDM-250 ground clamp.

3. Connect the AC cable of the replacement BDM-250 and the neighboring BDM-250 to complete the branch circuit connections.

4. Complete the connection map and connect the PV Modules.

1) Complete the connection map

2) Each BDM-250 has a removable serial number located on the individual label. Enter the unique address contained in part of this serial number into a BDG-256, and correspond it to a number in the connection map.

3) Connect the PV Modules

4) Completely install all BDM-250 and all system inter-wiring connections prior to installing the PV modules.

a) Mount the PV modules above their corresponding BDM-250. Each BDM-250 comes with two oppositely sexed DC connectors.

b) First connect the positive DC wire from the PV module to the positively marked DC connector (male pin) of the BDM-250. Then connect the negative DC wire from the PV module to the negatively marked DC connector (female socket) of the BDM-250. Repeat for all remaining PV modules using one BDM-250 for each module.

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# Microinverter Instructions

## 8. SPECIFICATION

| MODEL<br>BDM-250-208A | | BDM-250-240 | |
|---|---|---|---|
| INPUT(DC) | Max Recommended PV Power (Wp) | 285 | |
| | Max DC Open Circuit Voltage (Vdc) | 60 | |
| | Max DC Input Current (Adc) | 12 | |
| | MPPT Tracking Accuracy | >99.5% | |
| | MPPT Tracking Range (Vdc) | 22-55 | |
| OUTPUT(AC) | Rated AC Output Power (Wp) | 220 | |
| | Nominal Power Grid Voltage (Vac) | 240 / 220 | 208/220 |
| | Allowable Power Grid Voltage (Vac) | 211-264/198-253 | 186-228/198-253 |
| | Allowable Power Grid Frequency (Hz) | 59.3-60.5/45.5-52.5 | |
| | THD | <2% (at rated power) | |
| | Power Factor (cos phi, fixed) | >0.99% | |
| SYSTEM EFFICIENCY | Peak Efficiency | 96.3% | 95.70 % |
| | CEC Efficiency | 95% | |
| | Night Time Tare Loss (Wp) | 0.17 | |
| PROTECTION | Over/Under Voltage Protection | Yes | |
| | Over/Under Frequency Protection | Yes | |
| | Anti-Islanding Protection | Yes | |
| | Over Current Protection | Yes | |

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# Microinverter Instructions

| | | |
|---|---|---|
| FUNCTIONS | Reverse DC Polarity Protection | Yes |
| | Overload Protection | Yes |
| | Protection Degree | NEMA-6 |
| | Environment Temperature | -40℃——+65℃ |
| OTHER PARAMETERS | Environment Humidity | 100%, condensation |
| | Display | LED LIGHT |
| | Communications | Power Line |
| | Dimension (D-W-H mm) | 230*138*35 |
| | Weight (Kg) | 2 |

| | MODEL | BDM-250-AU | BDM-250-EU |
|---|---|---|---|
| INPUT(DC) | Max Recommended PV Power (Wp) | 285 | |
| | Vmax PV (absolute maximum) (Vdc) | 60 | |
| | PV Input Operating Voltage Range (Vdc) | 22-55 | |
| | Maximum Operating PV Input Current (Adc) | 12 | |
| | MPPT Tracking Accuracy | >99.5% | |
| | Isc PV (absolute maximum) (Adc) | 14 | |
| | Maximum Inverter Backfeed Current to the Array (Adc) | 0 | |
| OUTPUT(AC) | Rated AC Output Power (W) | 220 | |
| | Nominal Power Grid Voltage (Vac) | 230 | |
| | Current (maximum continuous) (Aac) | 1.1 | |
| | Current (inrush) (Peak and Duration) | 12A, 15us | |
| | Nominal Frequency (Hz) | 50 | |
| | Power Factor (cos phi, fixed) | >0.99 | |
| | Maximum Output Fault Current (Aac) | 2.2A peak | |
| | Maximum Output Overcurrent Protection (Aac) | 6.3 | |
| | Maximum Number of Units Per Branch | 15 | |
| SYSTEM EFFICIENCY | Peak Efficiency | 96.30% | |
| | CEC Efficiency | 95.0% | |
| | Night Time Tare Loss (Wp) | 0.17 | |
| | Over/Under Voltage Protection | Yes | |
| | Over/Under Frequency Protection | Yes | |

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# Microinverter Instructions

| | | |
|---|---|---|
| PROTECTION FUNCTIONS | Anti-Islanding Protection | Yes |
| | Over Current Protection | Yes |
| | Reverse DC Polarity Protection | Yes |
| | Overload Protection | Yes |
| | Protective Class | I |
| | IP Rating per Part 1 | IP67 |
| OTHER PARAMETERS | Environment Temperature | -40□ ~ +65□ |
| | Environment Category | Indoor and outdoor |
| | Wet Location | SUITABLE |
| | Pollution Degree | PD 3 |
| | Environment Humidity | 100%, condensation |
| | Maximum Altitude | 2000 M |
| | Overvoltage Category | II(PV), III (AC MAINS) |
| | Display | LED LIGHT |
| | Communications | POWERLINE |
| | Dimension (D-W-H mm) | 230*138*35 |
| | Weight(Kg) | 2 |
| | Product Safety Compliance | IEC/EN 62109-1 |
| | Grid Code Compliance* (Refer to the label for the detailed grid code compliance) | VDE-AR-N 4105* VDE V 0126-1-1/A1 G8372 AS 4777.2 & AS4777.3 |
| | Note: For grid code VDE-AR-N 4105, maximum 3.68kVA PV plant is limited. The grid protection report and setting are readable from the gateway. For grid code G83/2, maximum 16A per phase is limited. The grid protection report and getting are readable from the gateway. | |

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# The Solar PaQ

*Trina ALLMAX M Plus 60 Cell 295 watt*

**UPC: 861150002609**

# PANEL INSTALLATION MANUAL

**1. DISCLAIMER OF LIABILITY**

- The installation, handling and use of Trina Solar crystalline modules are beyond company control. Trina Solar does not assume any responsibility for loss, damage, injury or expense resulting from the improper installation, handling, use or maintenance.
- Trina Solar assumes no responsibility for any infringement of patents or other rights of third parties that may result from use of the module. No license is granted by implication or under any patent or patent rights.
- Specifications included in this manual are subject to change without prior notice.

**2. SAFETY PRECAUTIONS**

- Potentially lethal DC voltages can be generated whenever PV Modules are exposed to a light source, therefore, avoid contact with electrically active parts and be sure to isolate live circuits before attempting to make or break any connections.
- Only authorized and trained personnel should have access or perform work on the modules or solar system, always wearing rubber gloves and boots with maximum working voltage not lower than 1000V DC (For TSM-PE05A.**, PE14A.**, not lower than 1500V DC).
- When working on electrical connections, remove all metallic jewelry, use properly insulated tools and wear appropriate personal protective equipment to reduce the risk of electric shock.
- Do NOT stand or step on, damage or scratch the front or backside surfaces of the module.
- Broken modules cannot be repaired and contact with any module surface or frame can lead to electrical shock. Do NOT use a module with broken glass or torn substrate.
- Do NOT disassemble the modules or remove any part of the module.
- Protect the electrical plug contacts against corrosion and soiling. Make sure that all connectors are corrosion free and clean before making the connection.
- Do NOT install or handle modules when they are wet or during periods of high wind.
- Ensure that all connections are securely made with no gap between the contacts. Any gap can result in electrical arcing that can cause a fire hazard and/or an electric shock.
- Make sure that the polarity of each module or a string is not reversed considering the rest of the modules or strings.
- Do NOT artificially concentrate sunlight on these solar modules.
- Trina Solar modules are certified for operating in Application Class A installations at voltages below 1000V DC (For TSM-PE05A.**, PE14A.**, below 1500V DC). This maximum voltage should not be exceeded at any time and, as the voltage of the module increases, above data sheet values, at operating temperatures below 25°C, then these need to be taken into account when designing a PV system.
- Maximum system voltage must not exceed 1000V DC when UL 1000V products (TSM-****D*. **) are used.
- Maximum system voltage must not exceed 1500V DC when UL 1500V products (TSM-****E*. **) are used.
- Do NOT use water to extinguish fires of an electrical origin.

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- Do NOT walk on the modules.
- Do NOT disconnect the modules under load to avoid arcs and electrical shocks. If needed cover the module surface with an opaque cover.
- For modules under IEC investigation, under normal conditions, a solar photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly, the values of Isc and Voc marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor current ratings, fuse sizes and size of controls connected to the PV output.
- For modules under UL investigation, most of the time, the solar module is likely to produce more power, or current, than that rated at standard test conditions. Accordingly, the value of ISC marked on this module should be multiplied by a factor of 1.25 when determining the conductor current ratings, fuse sizes and size of controls connected to the PV output. Refer to Section 690.8 of the National Electric Code to check when an additional multiplying factor of 1.25 may be applicable.
- Installation in Canada shall be in accordance with CSA C22.1, Safety Standard for Electrical Installations, and Canadian Electrical Code Part 1.The System Fire Class Rating of the module or panel in a mounting system in combination with a roof covering complete with requirements to achieve the specified System Fire Class Rating for a non-BIPV module or panel.
- Any module or panel mounting system has limitations on specific inclination required to maintain a specific System Fire Class Rating.
- Where common grounding hardware (nuts, bolts, star washers, spilt-ring lock washers, flat washers and the like) is used to attach a listed grounding/bonding device, the attachment must be made in conformance with the grounding device manufacturer's instructions.
- Common hardware items such as nuts, bolts, star washers, lock washers and the like have not been evaluated for electrical conductivity or for use as grounding devices and should be used only for maintaining mechanical connections and holding electrical grounding devices in the proper position for electrical conductivity. Such devices, where supplied with the module and evaluated through the requirements in UL1703, may be used for grounding connections in accordance with the instructions provided with the module.
- Rated electrical characteristics are within ± 10 percent of measured values at Standard Test Conditions of 1000 W/m², 25°C cell temperature and AM 1.5 solar spectral irradiance.
- The fire rating of a Trina Solar PV module is valid only when mounted in the manner specified in the mechanical mounting instructions of this installation manual.
- The module is considered to be in compliance with UL1703 only when the module is mounted in the manner specified by the mounting instructions below.
- A module with exposed conductive parts is considered to be in compliance with UL1703 only when it is electrically grounded in accordance with the instructions presented below and the requirements of the National Electrical Code for UL listed products only.
- Any module without a frame (laminate) shall not be considered in compliance with the requirements of UL1703 unless the module is mounted with hardware that has been tested and evaluated with the module under this standard or via a field inspection certifying that the installed module complies with the requirements of UL1703.
- The Type 1 and/or Type 2 modules with the specified constructions in the table below, when installed with a UL listed mounting system that has been rated as a Class A System, is suitable to maintain the System Class A Fire Rating.

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# The Solar PaQ

*Trina ALLMAX M Plus 60 Cell 295 watt*

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| Module model | Specific construction | Marking |
|---|---|---|
| TSM-xxxPD05<br>TSM-xxxPD05.05<br>TSM-xxxPD05.08 | Please check the related UL description files when checking the fire protection rank of the BOM concerned | Module Fire Performance:<br>Type 1/ Type 2 |
| TSM-xxxPE05A<br>TSM-xxxPE05A.08 | Please check the related UL description files when checking the fire protection rank of the BOM concerned | Module Fire Performance:<br>Type 1/ Type 2 |
| TSM-xxxDD05A(II)<br>TSM-xxxDD05A.05(II)<br>TSM-xxxDD05A.08(II) | Please check the related UL description files when checking the fire protection rank of the BOM concerned | Module Fire Performance:<br>Type 1/ Type 2 |
| TSM-xxxPD05.08D | Please check the related UL description files when checking the fire protection rank of the BOM concerned | Module Fire Performance:<br>Type 1/ Type 2 |
| All series in this description | All construction in this description | Fire resistance rating: Class C<br>(This rating will be invalid after 2016-10-25) |

The Type 1 and/or Type 2 modules with the specified constructions in the table below, when installed with a UL listed mounting system that has been rated as a Class A System, is suitable to maintain the System Class A Fire Rating.

| Module model | Specific construction | Marking |
|---|---|---|
| TSM-xxxPD14 | Please check the related UL description files when checking the fire protection rank of the BOM concerned | Module Fire Performance:<br>Type 1/ Type 2 |
| TSM-xxxPE14A | Please check the related UL description files when checking the fire protection rank of the BOM concerned | Module Fire Performance:<br>Type 1/ Type 2 |
| TSM-xxxDD14A(II) | Please check the related UL description files when checking the fire protection rank of the BOM concerned | Module Fire Performance:<br>Type 1/ Type 2 |
| All series in this description | All construction in this description | Fire resistance rating: Class C<br>(This rating will be invalid after 2016-10-25) |

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# The Solar PaQ

*Trina ALLMAX M Plus 60 Cell 295 watt*

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- For cUL listed products only:
- Fire class rating: C
- The fire rating of the module is valid only when mounted in the manner specified in the mechanical mounting instructions.
- The module is considered to be in compliance with UL1703 only when the module is mounted in the manner specified by the mounting instructions.
- A module with exposed conductive parts is considered to be in compliance with UL1703 only when it is electrically grounded in accordance with the instructions and the requirements of the National Electrical Code.
- Any module without a frame (laminate) shall not be considered to comply with the requirements of UL1703 unless
  the module is mounted with hardware that has been tested and evaluated with the module under this standard or by a field Inspection certifying that the installed module complies with the requirements of UL1703.

## 3. UNPACKING AND STORAGE

- At time of receipt, verify that the product delivered is in fact the product ordered. The product name, subname, and serial number of each laminate are clearly marked on the outside of each packing box.
- Leave the product in its original packing box until you are ready to install.
- Store packing boxes in a clean, dry area with relative humidity below 85% and ambient temperatures between -20°C and 50°C.
- Do NOT stack more than the maximum amount of allowable pallets on top of each other.
- At the installation site, take care to keep modules and particular their electrical contacts clean and dry before installation. If connector cables are left in damp conditions then the contacts may corrode. Any module with corroded contacts should not be used.
- If pallets are stored temporarily outside then place a protective covering over the pallet to protect it from direct weathering and do not stack more than 1 pallet high.
- Two people are required to unpack the modules from the packing box, when handling modules always use both hands.
- Protect the module edges for temporary storage outside the pallet.
- Do NOT use a knife to cut the zip-ties, but use wire cutting pliers.
- Do NOT place modules directly on top of each other.

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### 3.1 PRODUCT IDENTIFICATION

Each individual module has a unique serial number laminated behind the glass and another permanently attached to the back-sheet of the module on the product sticker. Note all serial numbers in an installation for your future records.

## 4. ENVIRONMENTAL CONSIDERATIONS

### 4.1 CLIMATE CONDITIONS

Trina Solar Crystalline series modules may be installed in the following conditions for more than 25 years. In addition to the required IEC certification, Trina Solar products have also been tested to verify resistance to ammonia fumes that may be present around barns sheltering cattle, as well as suitability for installation in humid (coastal) areas and areas of high sand storms.

**Environment**

- Ambient temperature: -40°C to 50°C
- Operating temperature: -40°C to +85°C
- Storage temperature: -20°C to +50°C
- Humidity: < 85RH%
- Mechanical Load Pressure*:5400Pa (550 Kg/m²) Max from the front side (snow) & 2400Pa (wind) from the rear (Except Installation Method C: Mounting with Single-axis Tracking System - 2400Pa (snow) & 2400Pa (wind)

max under UL1703 standard)

***Notes:**

-The modules have been evaluated by TUV according to IEC61215 for a maximum positive or negative design loading of below 550Kg/m² (5400Pa),by UL according to UL 1703, below 30lbs.ft$^2$.

-The mechanical load bearing is dependent upon the mounting methods used and failure to follow the instructions of this manual may result in different capabilities to withstand snow and wind loads.

-The system installer must ensure that the installation methods used meet these requirements and any local codes and regulations.

## 5. SITE SELECTION

- Trina Solar Modules can be mounted in landscape or portrait orientation however the impact of dirt shading the solar cells can be minimized by orienting the product in landscape.
- Solar module is recommended to be installed at an optimized tilt angle to maximize the energy output. It is roughly equal to the latitude of the project site as a rule of thumb, facing to equator. But always to design based on local situations to find out the optimum one.
- When installing solar modules on a roof always leave a safe working area between the edge of the roof and the external edge of the solar array.
- In case of residential installations on the ground, modules shall be installed following local regulations, e.g. using fence.
- Position the modules to minimize the chances of shading at any time of the day.
- Do not install PV modules in a location where they will be immersed in water or continually exposed to water from a sprinkler or fountain, etc.
- Avoid using a mounting method that will block the drainage holes in the module frame.

- When all solar modules (except for smart module) are mounted in the same plane and orientation then all can be expected to have similar performance throughout the day and can be connected together to the same inverter channel.
- If solar modules (except for smart module) on the same installation are mounted at different angles or orientations then energy production can normally be optimized by connecting the different orientations to different inverters (or different MPPT if the inverter has more than one MPPT). Refer to inverter manufacturers for further guidelines.
- According to Intertek-conducted IEC 61701:2011, salt mist corrosion testing of photovoltaic (PV), Trina Solar modules can be safely installed in corrosive salt areas within proximity of the ocean or sulfurous areas.
- According to IEC62716:2013 “Ammonia corrosion testing of photovoltaic (PV) modules” and DLG Fokus testing for ammonia resistance, Trina Solar modules can be safely installed in ammonia-heavy environments, such as farm houses.

## 6. MOUNTING INSTRUCTIONS

### 6.1 MOUNTING METHODS

PV modules can be mounted to the substructure using either corrosion-proof M8 bolts placed through the mounting holes on the rear of the module or specially designed module clamps.

Regardless of the fixing method the final installation of the modules must ensure that:

- A clearance of at least 115mm(4.5in) (recommended) is provided between modules frame and the surface of the wall or roof. If other mounting means are employed this may affect the UL Listing or the fire class ratings.
- The minimum distance between two modules is 10mm(0.4in).
- The mounting method does not block the module drainage holes.
- Panels are not subjected to wind or snow loads exceeding the maximum permissible loads, and are not subject
  to excessive forces due to the thermal expansion of the support structures.

Note: The drain holes cannot be blocked in any situation during installation or use.

**A. Mounting with Bolts**

The frame of each module has 4-ϕ9*12mm mounting holes, ideally placed to optimize the load handling capability, to secure the modules to supporting structure.

- To maximize mounting longevity, Trina Solar strongly recommends the use of corrosion proof (stainless steel) fixings
- Secure the module in each fixing location with an M8 bolt and a flat washer, spring washer and nut as shown in Figure 1 and tighten to a torque of 16~20 N.m(140-180lbf.in.).
  - All parts in contact with the frame should use flat stainless steel washers of minimum 1.8mm thickness with an nut.
- Electrical contact is made by penetrating the anodized coating of the aluminum frame, and tightening the mounting hex nut (come with the star washer) to the proper torque of 25lbf.in.
- Grounding wire size (6 to 12 AWG solid bare copper) should be selected and installed underneath the wire binding bolt.
- The wire binding bolt should be tightened to the proper torque of 45lbf.in.
- The Tyco grounding bolt is only listed for use with 6 to 12 AWG bare solid copper wire.

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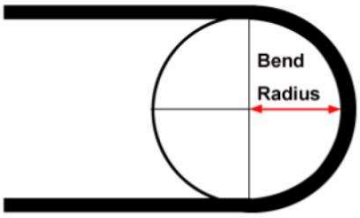
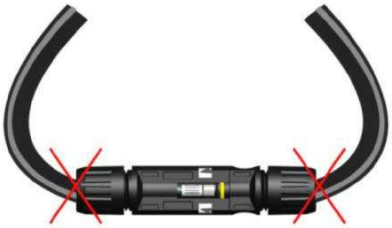
**6.3 MODULE WIRING**

- All wiring should be performed, by qualified installers, in accordance with the local codes and regulations.
- Modules can be connected in series to increase the operating voltage by plugging the positive plug of one module into the negative socket of the next. Before connecting modules always ensure that the contacts are corrosion free, clean and dry.
- 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 then check the string configuration before making the connection.
- Trina Solar modules are provided with stranded copper cables with a cross sectional area of 4mm²(0.006in²) which are rated for 1000V DC, 90°C and are UV resistant.( For TSM-PE05A.**, PE14A.**, 1500 V DC, 90°C and are UV resistant) All other cables used to connect the DC system should have a similar (or better) specification. Trina Solar recommend that all cables are run in appropriate conduits and sited away from areas prone to water collection.
- The maximum voltage of the system must be less than the maximum certified voltage 1000V typically (For TSM-PE05A.**, PE14A.** , less than 1500V) and the maximum input voltage of the inverter and of the other electrical devices installed in the system. To ensure that this is the case, the open circuit voltage of the array string needs to be calculated at the lowest expected ambient temperature for the location. This can be done
  using the following formula.

- Each module have two standards 90°C sunlight resistant output cables each terminated with plug & play connectors. The wire type and gauge of the output cables are 1000V (For TSM-PE05A.**, PE14A.** which are 1500V DC) rated PV Wire cable and are 12AWG in size. This cable is suitable for applications where wiring is exposed to the direct sunlight. We require that all wiring and electrical connections comply with the appropriate National Electrical Code.
- The minimum and maximum outer diameters of the cable are 5 to 7mm(0.038 to 0.076in$^2$).
- For field connections, use at least 4mm$^2$ copper wires insulated for a minimum of 90°C and sunlight resistance with insulation designated as PV Wire.
- The minimum bending radius cables should be 43mm(1.69in).



Incorrect Routing of cable

Correct Routing of cable

## 7. ELECTRICAL CONFIGURATION

Photovoltaic (electric) systems operate automatically and require very little day-to-day supervision. The solar array generates DC electricity whenever light falls on it similarly the inverter automatically turns ON as soon as there is sufficient energy from the solar array to efficiently convert this into grid.

***Caution:**

- The module is rated to operate at potentially lethal DC voltages which have the potential can cause severe electrical shock, arcing and fire hazards. Whilst some solar modules, manufactured by Trina Solar, are certified to operate up to 1000V DC (For TSM-PE05A.**,PE14A.**, to 1500V DC) always check the module label to confirm the actual rating of your product before making connections.
- It is recommended to use a suitably rated isolator (DC switch) to interrupt the current flow before disconnecting the connectors.

### 7.1 FUSING

- When fuses are fitted they should be rated for the maximum DC voltage and connected in each, non-grounded pole of the array (i.e. if the system is not grounded then fuses should be connected in both the positive and negative poles).
- The maximum rating of a fuse connected in series with an array string is typically 15A but the actual module specific rating can be found on the product label and in the product datasheet.
- This fuse rating value also corresponds to the maximum reverse current that a module can withstand (when one string is shaded then the other parallel strings of modules will be loaded by the shaded string and current will flow) and therefore impacts the number of strings in parallel.

### 7.2 INVERTER SELETION AND COMPATIBILITY

- When installed in systems governed by IEC regulations, Trina Solar modules normally do not need to be electronically connected to earth and therefore can be operated together with either galvanically isolated (with transformer) and transformerless inverters.
- Potential Induced Degradation (PID) is sometimes observed in PV modules due to a combination of high humidity, high temperature and high voltage. PID is most likely to cause degradation under the following conditions:
  a) Installations in the warm and humid climates
  b) Installation close to a source of continual moisture, such as bodies of water
- To reduce the risk of PID, we strongly suggest that modules feature Trina Solar's Anti-PID technology, which
  can be applied to any Trina product. Alternatively, we recommend the use of an inverter that includes a transformer as well as proper grounding of the negative DC leg of the PV array.
- Choose inverters with isolation transformers in hot and wet areas (such as shores, wetlands), to ensure proper module function under positive voltage.

**8. MAINTENANCE AND CARE**

- A well designed solar system requires minimal maintenance; however, system performance and reliability can be improved by taking some simple steps.
- Maintenance should be carried out at least once a year by trained personnel, always wearing rubber gloves and
  boots with maximum working voltage not lower than 1000V DC (For TSM-PE05A.**, PE14A.**, not lower than 1500V DC).
- Trim any vegetation which may shade the solar array thus impacting performance.
- Check that mounting hardware is properly tightened.
- Inspect all cables to verify that connections are tight; the cables are protected from direct sunlight and sited away from areas of water collection.
- Check that all string fuses in each non/earthed pole are operating.
- It is recommended to check the torque of terminal bolts and the general condition of wiring at least once a year. Also, check that mounting hardware is properly torqued. Loose connections will result in damage to the array.
- Replacement modules must be of same type. Do not touch live parts of cables and connectors. Use appropriate safety equipment (insulated tools, insulating gloves, etc.) when handling modules.
- The amount of electricity generated by a solar module is proportional to the amount of light falling on it. A module with shaded cells will produce less energy and therefore it is important to keep modules clean.
- Normally rain water is sufficient to keep the modules clean however it is particularly important to ensure that the solar modules are clean before onset of summer. Products installed at a tilt angle below 10° or which are located in particularly dusty areas, are installed in landscape orientation or in areas of high pollution or close to large bird populations will require more regular cleaning.
- When cleaning the module use a soft cloth together with a mild detergent and clean water. Take care to avoid severe thermal shocks which might damage the module by cleaning modules with water which has a similar temperature to the modules being cleaned.
- When cleaning the back surface of the module, take care to avoid penetrating the substrate material. Modules that are mounted flat (0° tilt angle) should be cleaned more often, as they will not ''self-clean'' as effectively as modules mounted at a 10° tilt or greater.
- The benefit of cleaning dirt and debris from the array is a trade-off between the cost of the cleaning, increased energy production as a result of this cleaning, and the inevitable re-soiling of the laminates over time once they have been cleaned.
- In the event that the solar modules need to be cleaned then clean the module use a soft cloth together with a mild detergent and clean water. Take care to avoid severe thermal shocks which might damage the module by cleaning modules with water which has a similar temperature to the modules being cleaned.
- On large systems, the benefit of cleaning dirt and debris from the array is a trade-off between the cost of the cleaning, increased energy production as a result of this cleaning, and the time for the re-soiling of the modules after cleaning.
- If you are unsure whether the array or section thereof needs to be cleaned then first select an array string that is particularly soiled then
  - Measure & record the inverter feed in current from that string
  - Clean all modules in the string
  - Measure the inverter feed in current again and calculate the % improvement from cleaning

- If the improvement is less than 5% then it is normally nor worth spending the expense on cleaning

- The above verification should only be carried out when the insolation is effectively constant (clear sky, strong sunshine, no clouds)
- The back surface of the module normally does not need to be cleaned but, in the event this is deemed necessary, avoid the use of any sharp projects that might damage the penetrating the substrate material.
- Cover the front surface of modules by an opaque material when repairing. Modules when exposed to sunlight generate high voltage and are dangerous.
- Trina Solar PV modules are equipped with bypass diodes in the junction box. This minimizes module heating and current losses.
  - Do not try to open the junction box to change the diodes even if they malfunction.
  - In a system using a battery, blocking diodes are typically placed between the battery and the PV module output to prevent battery discharge at night.
- **Product Replacement:**
  In the event that a module is damaged (broken glass or scratch on back sheet) and needs to be replaced then
  - Observe the safety precautions listed earlier in the manual
  - Wear cut resistant gloves and other personal protective equipment required for the particular installation.
  - Isolate the impacted array string to prevent current flow before attempting to remove the module.
  - Disconnect the connectors of the affected module using the related disconnect tool provided by suppliers.
  - Replace the damaged module with a new module of the same type.
  - Check the open circuit voltage of the array string and verify that this is within 10V of the other strings to be connected in parallel.
  - Turn the isolator back on.
- **Troubleshooting:**
  - If your installation does not work properly, please inform your installer immediately.
- **Reporting Technical Issues or Claims:**
  - Contact your installer
  - Contact Trina Solar after sales service team at http://customerservice.trinasolar.com
  - Submit the Customer Feedback form at: http://www.trinasolar.com/ and one of our technical service representatives will contact you within 5 business days. A username and password is required to send feedback from the customer service link
  - For module specifications or datasheets, please download from: http://www.trinasolar.com/

## 9. WARNING

**WARNING: For any electrical maintenance, the PV system must first be shut down. Improper maintenance can cause lethal electric shock and/or burns.**