

# The RAQ in a Box B

## RB-1100

### Installation and Instruction Manual

Universal solar racking that fits 60/72 cell solar panels

31mm to 45mm in thickness and 982 mm to 1000mm in width

Wind/Snow Load for 24" on set is 190mph for wind zone and 120lbs for snow load

Material: AR36-GS120 12-Guage Steel

Coating: Painted Black with 1-3mm of Textured Powder Coating

*Important: If you have difficulty following or understanding these installation instructions, please consult a qualified installation specialist or visit [www.raqinabox.com](http://www.raqinabox.com) to see tutorial videos on all instructions. Or call toll-free at 1-888-665-8880*





## **CAUTION!**

Prior to installation of this product, the installation instructions should be read and completely understood. The installation instructions must be read to prevent personal injury and/or property damage. Keep these installation instructions in an easily accessible location for future reference. This mount contains small parts which can act as a choking hazard if swallowed. Please keep out of reach of children. Recommended securing structures are wood rafters; if to solid-flat concrete, brick, tile or other roof material types use suitable hardware (not included but commercially available). Do not install on a structure that is prone to vibration, movement or chance of impact. Failure to do so could result in damage to the product and/or damage to the mounting surface. Do not install near fireplace, air conditioning, or any other fire producing source. Failure to do so may result in damage to the product or surface and could increase the risk of fire. Make sure no electrical, water or natural gas lines are present where the mount is to be installed. Cutting or drilling into electrical, water or natural gas lines could cause personal injury or property damage. When mounting to wood rafters, it is recommended not to exceed placement on sheathing of a maximum 5/8". Proper installation procedure by yourself or a qualified service technician, as outline in the installation instructions, must be adhered to. Failure to do so could result in serious personal injury. When mounting to roofs that contains wood rafters, confirm the dead center of the wood rafter prior to installation, it is recommended that the wood studs be a minimum of 16" apart (if applicable). It is recommended that two people perform the installation, minimum. Injury and/or damage can result from dropping or mishandling the RAQ. If you don't understand these installation instructions, please consult an installation specialist.

# Stop!

Do not return this product to the store. If there are any problems with your RAQ purchase, please contact us at:

Phone 313-473-7271 or 1-888-665-8880

Returns can only be accepted with prior authorization from The RAQ, LLC., and must include the receipt of sale in order to return products. Any product that is returned must be in new condition, in the original manufacturer's packaging with all hardware and documentation. Returns will not be accepted for installed or used items. Returns must be shipped via prepaid freight carrier of your choice within 30 days of delivery. We will not accept returns beyond 30 days of the original delivery. Shipping charges are non-refundable.

Returned items will be charged a 25% restocking fee unless it applies to damages, overages, shortages or other errors on behalf of the distributor or The RAQ, LLC. Returns will be inspected by either our distributor or The RAQ, LLC. to evaluate if acceptance of a return is qualified for waiver of the restocking fee.

\*Some items are NCNR Non-Cancellable, Non-Returnable, (such as special orders), and cannot be returned once shipped. If an item is NCNR, a sales representative will notify you before placing your order.

If you need to obtain a Return Authorization Number (RAN) please contact us at [information@solarraq.com](mailto:information@solarraq.com) or call us at 313-473-7271 or 1-888-665-8880

Further Information about The RAQ may be found on our web site at [www.solarraq.com](http://www.solarraq.com)

# Table of Contents

1. <u>Hardware.....</u>	<u>5</u>
2. <u>Recommended tools.....</u>	<u>6</u>
3. <u>Notes from the Manufacturer.....</u>	<u>6</u>
4. <u>Layout.....</u>	<u>7</u>
5. <u>Installation of Anchor Bases onto the RAQ in A Box Rail.....</u>	<u>8</u>
6. <u>Locking and Squaring The RAQ in a Box B.....</u>	<u>9</u>
7. <u>Interconnecting RAQ in a Box A to RAQ in a Box B.....</u>	<u>9</u>
8. <u>Installation of the Start Bracket.....</u>	<u>10</u>
9. <u>Installation of the RAQ in a Box(es) into the Roof Rafters.....</u>	<u>10</u>
10. <u>Grounding the Array.....</u>	<u>11</u>
11. <u>Installation of the Flashings.....</u>	<u>11</u>
12. <u>Inverter Installation.....</u>	<u>12</u>
13. <u>Solar Panel Installation.....</u>	<u>12</u>
14. <u>Leveling the Solar Array.....</u>	<u>13</u>
15. <u>Tips for Installation.....</u>	<u>14</u>



## Hardware Kit

### Squaring Arms

- Used for squaring upper rail and lower rail to cross brace

### Anchor Base

- Used to hold RAQ railing off surface of roof and for leveling the RAQ

### Cross Brace

- Used to align lower rail and upper rail of racking

### Panel Clamp

- Used to hold the solar panel in place

### (2) 1¼" Flat Washers

- Used for securing the anchors to the RAQ

### (2) 5/16" Square Nuts

- Used for securing the anchors to the RAQ

### (2) 5/16" x 1" Hex Bolts

- Used for securing the anchors to the RAQ

### (2) 5/16" Lock Washers

- Used for securing the anchors to the RAQ

### (1) Zip Tie

- Used for cable management

### (2) 5/16 x 4" Stainless Steel Lag Bolts

- Used to secure anchors to the rafters

### (2) Type 23 Self Tapping Bolts

- Used for securing the cross arm.

- Used for mounting inverters

### (2) Flashings

- Used to protect the lag bolt and roof penetrations from water

### **Recommended Tools**

Ladders, safety goggles, hard hats, and all required fall protection

½” Socket and Driver and charged batteries

3/8” Cold Rolled Drill Bit (in the case of anchor replacement for misaligned rafter spacing)

4 ¼” Long Wood Drill Bit (for predrilling lag bolt locations)

### **Notes from the Manufacturer**

There are a few different techniques that installers have used in the field. One method includes prepping the racking units on the ground first then taking them onto the roof, we do not suggest this because once the RAQ's are opened, locked and squared they become more challenging to get on the roof in a safe and timely manner. Trained installers simply do the entire install on the roof, which is what we suggest. Because each of the RAQ units have slight variations we request you first familiarize yourself and installers with the products.

The RAQ in a box A is intended for portrait position, it holds 1 panel is a stand-alone unit or can be connected to other Raq in a Box B for a row.

The RAQ in a BOX B is intended for portrait position, it holds 1 panel and should be connected to 1 to RAQ in a Box A on left side and all other units RAQ in the Box B to follow.

#### **Please take note of the other variations between each of our products.**

*\*Take care when opening the units up, until you get use to “the give” once rail is released from inside the C channel of the rail. We recommend that you familiarize yourself with this process before installing on the roof, just as a precautionary measure.*

#### **RB-1000 Box A 1 Panel RAQ Portrait Stand Alone or Start of a Row**

When opening the RB-1000 there is one cross brace in the center that will be secured with the type 23 self-tapping bolt provided, this will lock RAQ into position. It also has 2 squaring arms that are tucked under the C channel, these will be secured on the rail in the pre-drilled holes provided which will square the unit. This unit also has 2 adjustable panel clamps located on the top of the unit. This unit requires the Start Bracket Kit, included, for a stand-alone unit and/or to start a row, these will secure the PV module to the racking assembly.

#### **RB-1100 Box B 1 Panel RAQ Portrait Part of a Row**

When opening the RB-1100 there is 1 cross brace in the center that will be secured with a type 23 self-tapping bolt, this will lock RAQ into position. It also has 2 squaring arms that are tucked under the C channel, these will then be secured on the rail in the pre-drilled holes provided, which will square the unit. This unit also has 2 adjustable panel clamps located at the top of the unit, these will secure the PV module to the racking assembly.

\*Before Assembling the RAQ in a Box you must determine layout and rafter spacing for proper placement of the RAQ in a Box technology.

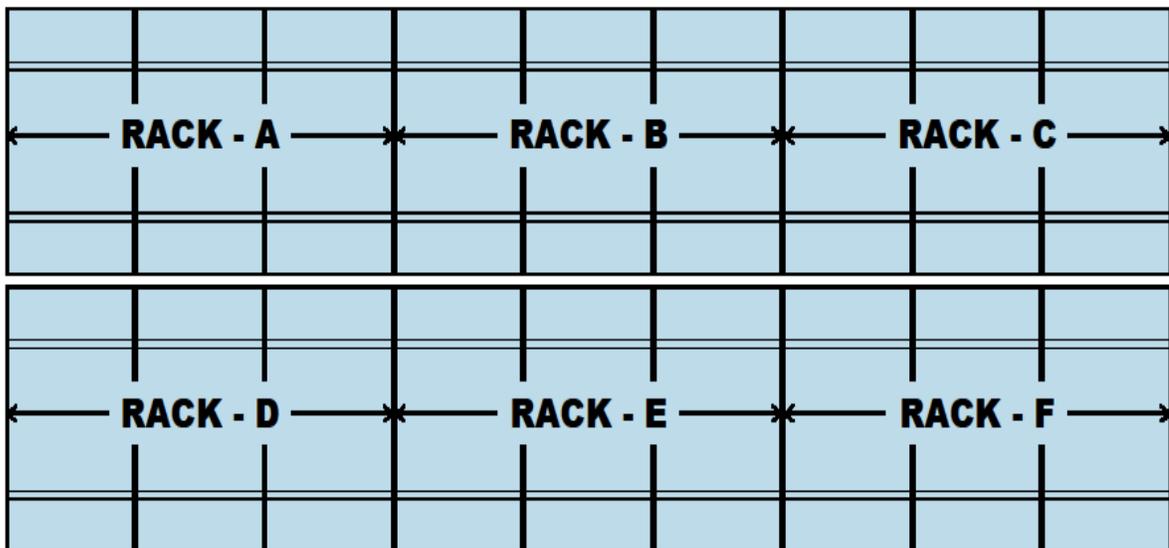
## Layout

Take measurements on roof. Verify position of system and determine if PV Array layout, as designed, is compatible with roof geometry, roof obstructions / penetrations, rafter spacing and any/all other structural, aesthetic and geographic conditions which may affect PV Array installation.

Subject to verification of the PV Array design being compatible with all applicable existing conditions, proceed with installation process. If PV Array Design is not compatible with existing roof conditions consult PV Array Designer to revise PV Array Design as required. Keep in mind the anchor bases have a variance that allows you to install a level array.

Locate the center of ALL Rafters which are usually at 48" on center (or your specific rafter spacing, generally they are every 12", 16", 24", or 48" on center) by measuring the empty space between them to the Right of the first rafter at the left end of the roof, located directly and mark with chalk. Anchor Bases provided are intended for 24" on center anchor points.

Example Below



*Locate your rafter spacing on your mounting surface by measuring the empty space between them, generally it is every 12", 16", 24", or 48" on center.*

For a video tutorial on this step visit: [www.raginabox.com](http://www.raginabox.com)

### **Installation of Anchor Bases onto the RAQ in a Box Rail**

Installation of the anchors onto the RAQ is determined by the rafter spacing.

There are pre-positioned slots available for standard spacing on the sides of the rail install anchors on the lower slot. If the prepositioned slots do not line up with the placement needed simply drill a hole on the side of rail for anchor attachment, keep leveling in mind when drilling the hole.

Utilize the bolt, washer and anchor on the front side of rail and lock washer and square nut on the back side of the rail in the C channel. We suggest that all anchors be in the lowest position before installation onto mounting surface for easy leveling later.

Be sure to install the bolt, washer and nut provided, in the lower slot

Make sure that the slot side of the anchor is attached to the rack and not the drill hole which will be used mount the rack onto the roof later.

Make sure that all of the anchors are facing towards the peak of the roof. This is very important because if the anchors are facing towards the bottom of the roof the flashing will not be able to be applied.

For a video tutorial on this step visit: [www.raqinabox.com](http://www.raqinabox.com)

### **YOU MAY NOW TAKE THE PRE-ASSEMBLED UNITS ONTO THE ROOF FOR INTER-CONNECTION AND INSTALLATION INTO THE ROOF**

#### ***Before Locking and Squaring The RAQ in a Box A for Installation***

- 1. The layout must be resolved for proper placement and for esthetics***
- 2. You must attach your anchor bases ONTO RAQ unit***
- 3. Once you have familiarized yourself with the products, you may take tools and RAQ in a Box(es) on the roof for installation.***

### **Locking and Squaring The RAQ in a Box B**

Unfold the RAQ unit until the center bar is completely straight.

Insert one of the T-23 bolt in the pre-drilled hole at the hinge point on the center brace. Align with hole underneath then fully tighten the small bolt with a with ½” socket.

Locate both of the squaring arm braces that are connected to the center brace and tucked under the rail. Then unfold by rotating them out from within the center brace to the point where they naturally align the main rail.

Adjust the squaring arms on the main railing until they are both aligned with the prepositioned hold forming a right triangle with the rail.

Tighten the secured bolt through the squaring arms pre-positioned holes in the rail with driver. Repeat on the other side as well.

### **IF STAND ALONE UNIT MOVE ON TO START BRACKET INSTALLATION**

For a video tutorial on this step visit: [www.raginabox.com](http://www.raginabox.com)

***Before installation into the roof can be done it is very important that the RAQ is facing the correct way. From the perspective of the ground looking towards the peak of the roof the RAQ is to be situated with the tongue facing the left. That way RAQ in a Box B can easily be connected to Rack in a Box A.***

### **Interconnecting RAQ in a Box A to RAQ in a Box B**

To add more PV Modules to the installation Box B must be purchased. RAQ in a Box B provides you with the necessary racking to expand the solar rack into a row of solar panels. Up to 18 panels can be attached to each other before a new row. To start a new row Box A will be needed.

With tongues on rail pointed to the left and anchor bases pointed up you simply attach the female end of RAQ Box A to the male end of RAQ Box B; tighten the two provided bolts with ½ socket and then continue install to roof surface once desired row is achieved. Then following the remainder of directions for BOX A to complete the RAQ installation. 18 RAQ units is the maximum number before a new row must be started.

For a video tutorial on this step visit: [www.raginabox.com](http://www.raginabox.com)

### **Installation of the Start Bracket**

Attach one of the starter brackets by connecting it to the male end of your row starter RB-1000, straighten and then tighten prepositioned bolts with 1/2" socket on both sides. This process must be done prior to installation of PV modules to start a row or for stand-alone units.

**After this step is complete the RAQ will be ready to install onto the roof!**

For a video tutorial on this step visit: [www.raqinabox.com](http://www.raqinabox.com)

*Warning: Make sure no electrical, water or natural gas lines are present where the mount is to be installed. Cutting or drilling into electrical, water or natural gas lines could cause personal injury or property damage. Proper installation procedure by yourself or a qualified service technician, as outline in the installation instructions, must be adhered to. Failure to do so could result in serious personal injury.*

### **Installation of the RAQ in a Box(es) into the Roof Rafters**

Place RAQ in position for first anchor to be placed on center of first rafter, Pre drill holes and fasten one of the 4" lag bolts and washers through anchor and set into hole with 1/2" socket. Fully tighten the lag bolts into place ensuring placement into rafter. Follow directions for all the following anchors securing top row first from left to right then install lower level anchors.

Only 8lbs. or torque is necessary to achieve proper installation

*Warning - Make sure no electrical, water or natural gas lines are present where the mount is to be installed. Cutting or drilling into electrical, water or natural gas lines could cause personal injury or property damage.*

After you install the RAQ units you can them square to the lines of the structure that will be most visible from the ground. The rails are rigid and square, from rail to rail there is connectivity. To line up the installed rails, use a string line. Adjust the bolts on the upper and lower rails at the anchor points, then use the straight-edge to level the rails in between. If the middle of the roof sags, the rails in between will be adjusted higher. If the middle of the roof is raised, then the top and bottom rows will need to be raised.

For a video tutorial on this step visit: [www.raqinabox.com](http://www.raqinabox.com)

## **Grounding the Array**

Grounding the row: Install the grounding lug on any portion of the rail on a row (Boxes A+B) or on the stand-alone (Box A) unit. Using a ½ socket open the grounding lug then attach to chosen location on the rail and then attach on the rail using drill. Only one is needed per row or stand-alone unit. For grounding inverters please follow the manufactures suggestions.

For grounding rows together use a # 6 or # 8 copper wire between grounding lug (provided) at connection points on the end of your rails to ground the entire array.

Ground lug provided by UL for the RAQ is UL rated, if a different ground lug is used for assembling the RAQ then the RAQ UL rating will not apply because the ground lug provided is not being used in combination with the RAQ.

For a video tutorial on this step visit: [www.raqinabox.com](http://www.raqinabox.com)

## **Installation of the Flashings**

Warning: Inappropriate installation of the flashing or water proofing can result in water damage. If you don't understand these installation instructions, please consult an installation specialist.

Flashing is added after racking is secured to roof. It is mechanical flashing so no adhesives are needed. Simply lift tab on shingles, without damaging the shingles.

Slide under shingle and over anchor.

Fold end tabs behind the anchor to secure in place. Place shingle back into position properly.

For a video tutorial on this step visit: [www.raqinabox.com](http://www.raqinabox.com)

## **Inverter Installation**

Provided in this kit is an additional T 23 bolt for attachment of inverters to the top of the RAQ, there are many prepositioned holes for inverter installation to choose from. A zip tie is also included for cable management to be run down inside of C Channel. Please refer to the inverters manufacture's guidelines when grounding installing your inverters. Inverters are not included in RAQ in a Box.

For a video tutorial on this step visit: [www.raqinabox.com](http://www.raqinabox.com)

## **Solar Panel Installation**

Stand-alone RAQ Box A: In the portrait position place the photovoltaic module onto the RAQ unit and center it. The panel clamps must be adjusted on the start bracket end (left side) to the appropriate starting position so that the unit remains centered insuring the panel clamp is attached properly on the frame of the PV module. Then secure panel clamp to solar panel frame, insure panel clamp remains in contact with the solar panel frame only.

RAQ in a Box A+ Box B's: In the portrait position place the photovoltaic module onto the RAQ A unit and center it. The panel clamps must be adjusted on the start bracket end (left side) to the appropriate starting position so that the unit remains centered and also insuring the panel clamp is attached properly on the frame of the PV module. Then secure panel clamp to solar panel frame, insuring panel clamp remains in contact with the solar panel frame only.

To secure the PV module, use the ½" socket on the top panel clamp first then the lower panel clamp on the start bracket side. Then slide the panel clamps from the right side to the left thus aligning the panel clamp over the frame of the module. Before securing this set of panel clamps onto PV bring in module # 2 onto RAQ B then secure the first and second module by securing the panel clamps upper first, then lower clamp on panel. Repeat for up to 17 Box B's before needing to start another row.

Finally, verify that all of the solar panel clamps are tightened to their recommended specifications.

For a video tutorial on this step visit:

For a video tutorial on this step visit: [www.raqinabox.com](http://www.raqinabox.com)

## **Leveling the Solar Array**

Roofs are rarely square, so to install the racking and solar panels, make them square to the lines of the structure that will be most visible from the ground. If the modules are not aligned to the prominent edges of the structure, it will be very visible. The rails are rigid and square, from rail to rail there is connectivity. To line up the installed rails, use a string line. Adjust the bolts on the upper and lower rails at the anchor points, then use the straight-edge to level the rails in between. If the middle of the roof sags, the rails in between will be adjusted higher. If the middle of the roof is raised, then the top and bottom rows will need to be raised.

Check that the top and bottom rails are in the same plane before working on the rails in between.

Generally, PV modules have very square edges, which make line-of-sight an excellent way to confirm alignment as the installation progresses. However, do not assume that all PV modules are perfectly square—the module frame itself can get slightly out of square during shipping and handling.

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. Once the first row of solar panels is in place, the other rows usually install quickly as they are spaced uniformly adjacent to the first row. 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.

**CONGRATULATIONS! YOU HAVE COMPLETED YOUR INSTALLATION.**

**THANK YOU FOR CHOOSING THE RAQ**

## Tips for Installation

Impact driver safety:

When it comes to using power tools, a little knowledge goes a long way toward preventing injuries and prolonging the life of tools. Below are some power drill safety tips that will help to protect the user the tools. Some of them may seem new or just a good safety refresher.

Power Drill Safety Tips:

1. **Avoid baggy clothing.** Loose sleeves, jewelry and hair can be a hazard when you are operating a power drill. The spinning action of a cordless drill can catch and tangle any loose objects. While operating any power tools, wear short sleeves, forgo jewelry and tie hair back if necessary.
2. **Wear protective gear.** Safety goggles are always a good idea when using a power drill. A breathing mask is recommended if the material being drilled into produces a lot of dust or shavings. Gloves can help protect hands, but only if they are form-fitting and not baggy. Loose gloves can get caught in the drill.
3. **Secure your work piece.** It is important that the wood or metal piece being used for drilling does not move during the process. Clamp the work piece down or secure it in a vice before applying the power drill to it.
4. **Drill pilot holes.** It is much easier to insert a screw into a pre-drilled pilot hole in a piece of wood. The holes tend to be straighter, too. Plus, less pressure can be applied to the power drill as the screw goes in, reducing the chances slipping.
5. **Properly set the drill bit.** Make sure the drill bit is properly inserted into the chuck and tighten it firmly with the chuck key. With a loose bit, the power drill will not make straight holes and could slip.

6. **Apply proper pressure to the drill.** The power drill should do most of the work, so do not apply too much force. If pushed too hard, the power drill can slip or the motor can be strained.

For video tutorials for this step visit [www.raqinabox.com](http://www.raqinabox.com)