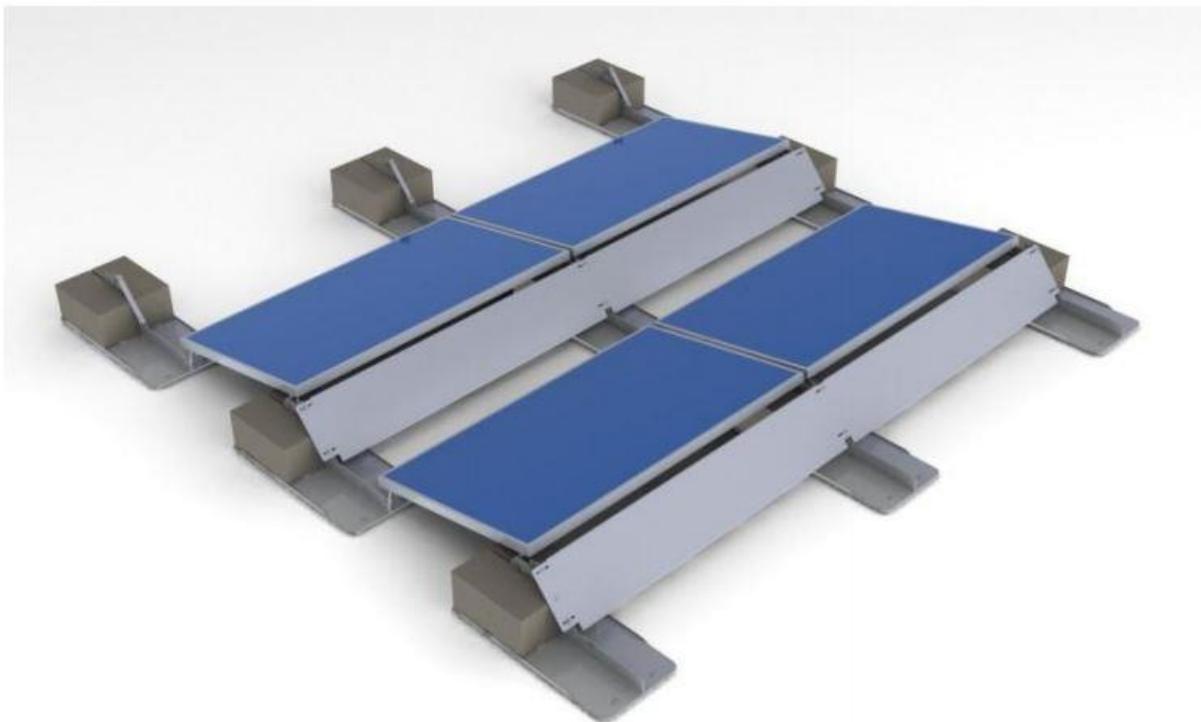




PanelClaw Europe
Essentials GmbH & Co KG
Grafenberger Allee 190
D-40237 Düsseldorf
Tel: +49 211 930 70 400
+49 211 930 70 401
Fax: +49 211 930 70 402
Mail: projects@panelclaw-europe.de

Polar Bear® FR Installation Manual



Introduction

Polar Bear® FR is designed to maximize array construction speed and minimize construction risk. Polar Bear's patent pending, innovative, streamlined construction features:

- Just three major components plus two nut and bolt sizes
- Several labor saving factory-installed features
- A modular, adaptable design with a single-module tilt-up feature

The Polar Bear system has been extensively tested, undergoing individual component finite element analysis, computational fluid dynamics modeling, static load modeling, and wind tunnel testing. All testing has been independently conducted by third parties and provided to PanelClaw, Inc. ("PanelClaw").

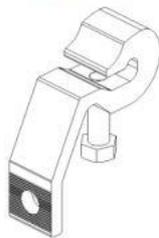
Additionally, every Polar Bear® FR Support requires a roof protection pad underneath each support to protect the roof membrane. Suitable roof protection pad material may be purchased from PanelClaw. Please consult with PanelClaw Customer Technical Support for a list of suitable roof protection pad materials.

Parts List

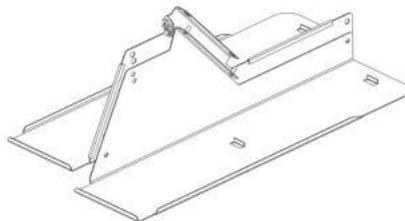
This is a parts list for a ballasted Polar Bear® FR installation not requiring mechanical attachment. Please refer to the Roof Connector Installation Manual, available at panelclaw.com, for instructions on mechanical attachment of the system.

Standard Claw

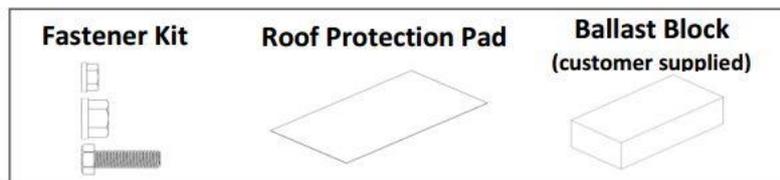
(Claw I)



Support



Wind Deflector



Support

Studded flange Support unit
Slotted flange Support unit

Claw

Pre-installed hex head cap screw M10 Stainless Steel 18-8
(Please see Appendix A Multi-piece and Long Claw information)

Wind Deflector

Slotted wind deflector

Fastener Kit

Hex head cap screw M10 x30 Stainless Steel 18-8 (304)

Serrated flange nuts M10 Stainless Steel 18-8 (304)

Serrated flange nuts M6 Stainless Steel 18-8 (304)

Roof Protection Pad

Roof protection pad dependent on roof type

Ballast Block

Solid cap concrete block (customer supplied). We Recomend: DIN EN 1338, Class D/J/K, (200MM X 100MM X 80MM 3,5KG)

Installation

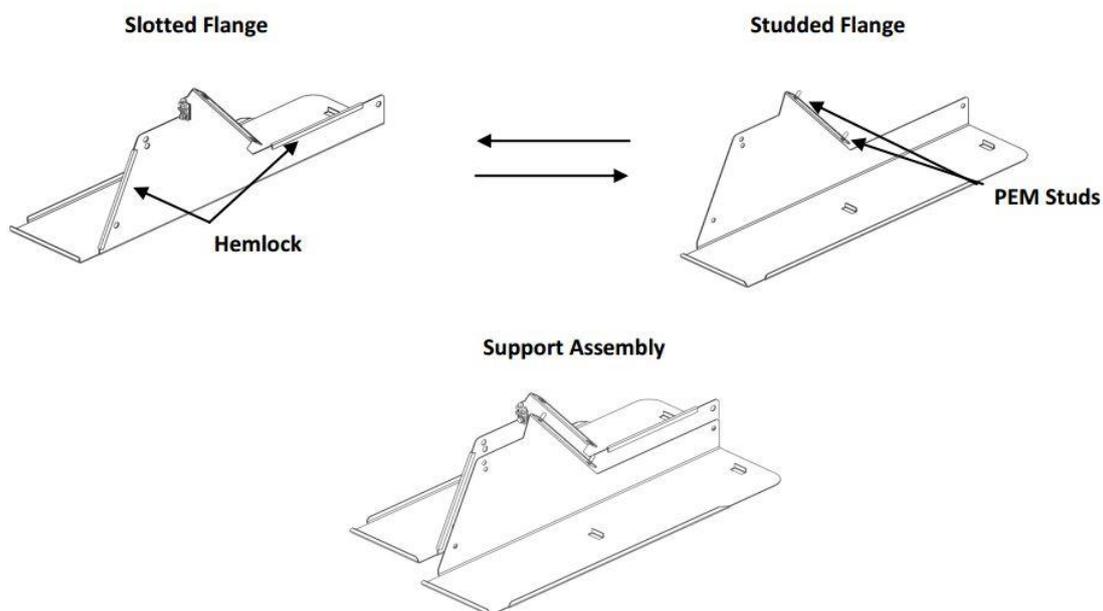
Polar Bear® FR can be installed in 6 easy steps.

Step 1. Mark Array Perimeter and Assemble Supports

Mark the array perimeter using a chalk line or similar method. See site's ballast layout drawing provided by PanelClaw for array dimensions.

Once the array perimeter is marked, assemble the slotted flange and slotted flange units to form the Support. No tools are required for Support assembly. The slotted flange unit will fit over the flange of the studded unit. Hemlocks on the back and front of the slotted unit will slip over the studded unit as seen in Fig. 1 below.

Fig. 1 Support Assembly

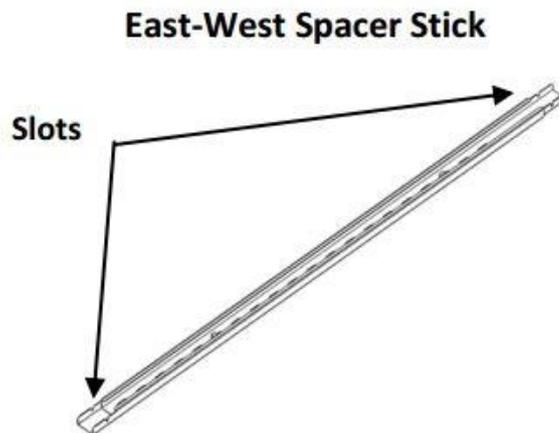


Step 2. Lay Out Supports

Deploy the Supports along the marked array perimeter using the Universal Configurable Spacer Sticks and add the specified number of Ballast Blocks to each Support*.

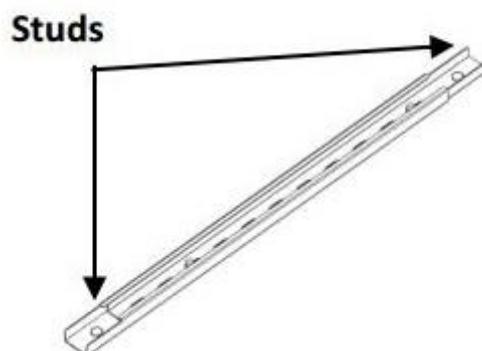
1. To assist in proper row and module spacing, PanelClaw makes Spacer Sticks available. These tools are easily employed to ensure module Supports are properly spaced in the array. To assemble the Spacer Sticks please follow the directions below.

To set the Spacer Sticks to the correct length, first locate and remove the hardware from each Spacer Stick. Then reference the Ballast Layout Drawing to determine proper stick length. Spacer Stick length is based on the specific module used for the project. The "Project Details" section of the Ballast Layout will contain lengths for both the longer, slotted East-West and shorter North-South spacer stick with PEM studs.



The lengths indicated in the Ballast Layout reflect the length between the two slots on the East-West spacer stick and between the center of each of the two PEM studs on the North-South Spacer stick. Set the spacer sticks to the correct length and then replace and tighten the hardware to secure the Spacer Sticks in position. The Spacer Stick lengths can also be established by using the procedure found in Appendix C.

North-South Spacer Stick



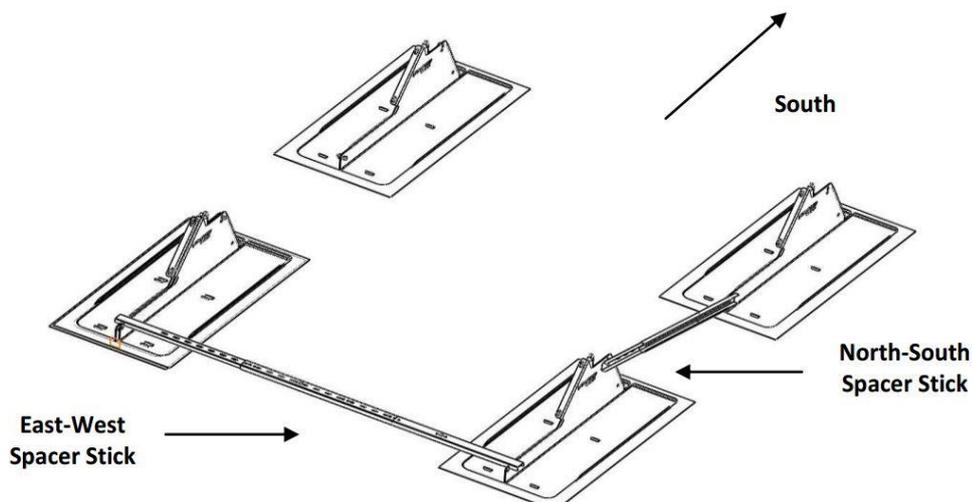
The Spacer Sticks are now ready for use to set Support spacing and attach PV modules.

2. Pick a starting corner on the North end of the array and place four (4) Supports as shown below (Fig. 2), each Support should be laid out with the high end to the South and the low end to the North. Ensure that the proper roof protection pad is centered under the Support such that the roof protection pad extends beyond the edge of the Support by an equal amount on all sides (E-W and N-S).

Note: PanelClaw recommends starting the array in a corner with low complexity and moving outwards in a direction that best suits the individual array you are building (e.g. rows and columns with the least number of interruptions/breaks).

Use the properly configured East/West Spacer Stick (the longer stick) to position the first Supports. Place the notch in the East/West Spacer over the low end of the Support at the edge of the array and position the Support directly to the East or West (depending on build direction) so that the notch at the other end of the spacer stick fits over the low end of the adjacent Support. The distance to the Support directly to the South can be established using the North/South Spacer Sticks. In this case the M10 PEM studs in the Spacer Stick are placed in the top (default) hole at the high end of the Support at the edge of the array and used to position the Support directly South by placing the M10 PEM stud at the other end of the spacer stick in a hole at the low end of the Support to the South (Fig. 2). This process can be continued to layout the remainder of the array.

Fig. 2 Support Layout



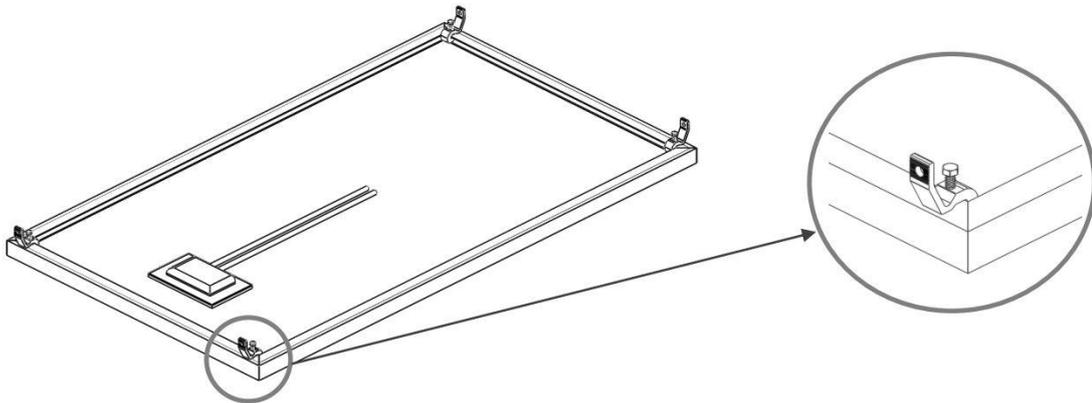
3. Place ballast on each Support based on Ballast layout drawing. Each Support will accommodate up to 24 Solid Cap Concrete 3,5kg blocks as ballast (not provided). Blocks of various weights may be used in advance consultation with PanelClaw's engineering department.

Step 3. Attach Claws to Module

PanelClaw offers two Claw options to accommodate different frame types, Standard and Multi-piece. The following directions are for the Standard Claw.

Place a PV module face down on protected work surface and place a Claw over the module frame flange on the short side of the module; slide to the corner and tighten the M10 hex head cap screw between 18 and 20 ft-lb (24.4-27.1 N-m). Ensure that the Claw is seated up against the flanges of both the long and short sides of the module as shown in Fig. 4 below. Each module must be fitted with four (4) Claws. The module is now ready to be attached to the Supports.

Fig. 4 Claw Attachment



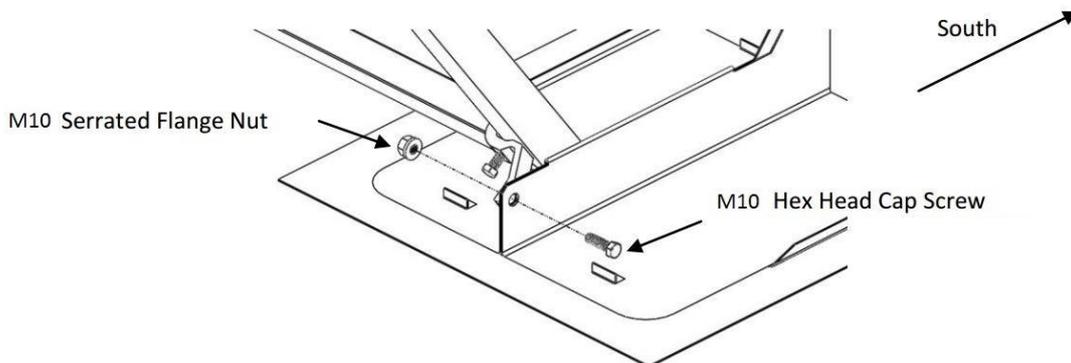
Step 4. Mount Modules to Supports

Begin attaching modules to Supports moving from West to East (or East to West) starting at the Southwestern (or Southeastern) most corner of the array and moving North as each row is completed.

For the steps below, assume the Southwestern most corner is the starting point.

1. Attach the module to the inside of the low end of the first two North facing Supports, by inserting a M10 x30 hex head cap screw through the hole in the Claw and the Support. Ensure that the hex head cap screws are inserted into the Support mounting holes so the threaded end of each hex head cap screw faces the next Support to be installed (to the East). A M10 serrated flange nut should then be finger tightened on the Western-most Support only to initially secure the module (Fig. 5).

Fig. 5 Attach Module to North Support



2. Tilt the module back and attach the Claws to the high end of the North Support by inserting a M10 x30 hex head cap screw through the hole in the Claw and the Support. Ensure that the hex head cap screws are inserted into the Support mounting holes so the threaded end of each hex head cap screw faces the next Support to be installed (to the East) (Fig 6).
 - a. Note the high end of each Support is equipped with two Claw mounting holes that can be used to alleviate module misalignment in wavy roof situations. The top mounting hole should always be used as the default mounting hole (Fig 7).

Fig. 6 Tilt Module to Attach to North Support

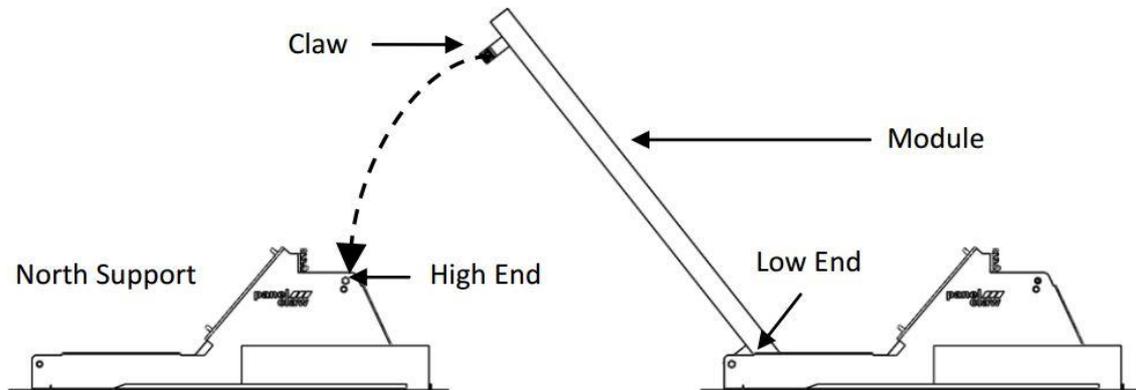
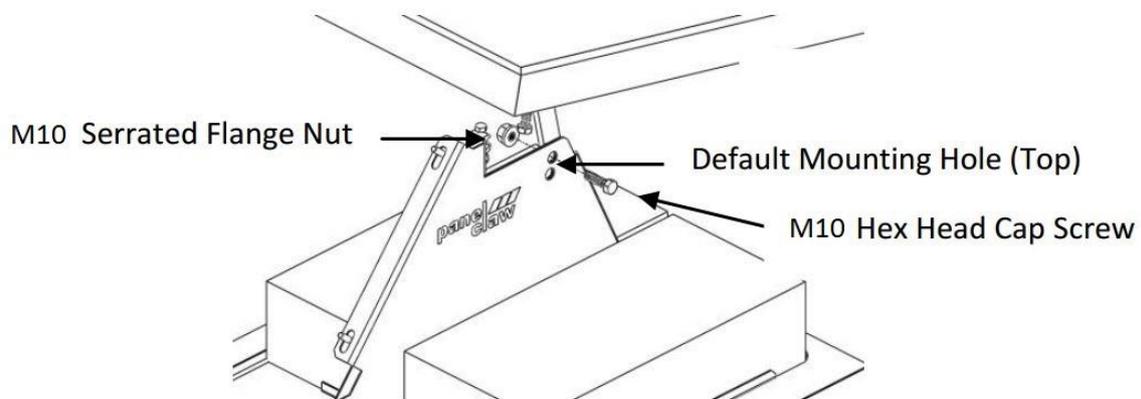


Fig. 7 Default Mounting Hole



3. Secure Western-most Claws to Supports using the M10 serrated flange nuts. The recommended minimum torque is 30 ft-lb (40.7 N-m).
4. Continue building the array from West to East (or East to West) by bringing the next module into place.
 - a. The hex head cap screws on the Northwest and Southwest sides of the array are already in place from the prior module mounting.
 - b. Add hex head cap screws to the Northeast and Southeast sides.
 - c. Secure the Western-most Claws only to Supports using the M10 serrated flange nuts.
 - d. Connect the module to module wiring.

Repeat this process until all modules are mounted.

Step 5. Electrical Grounding

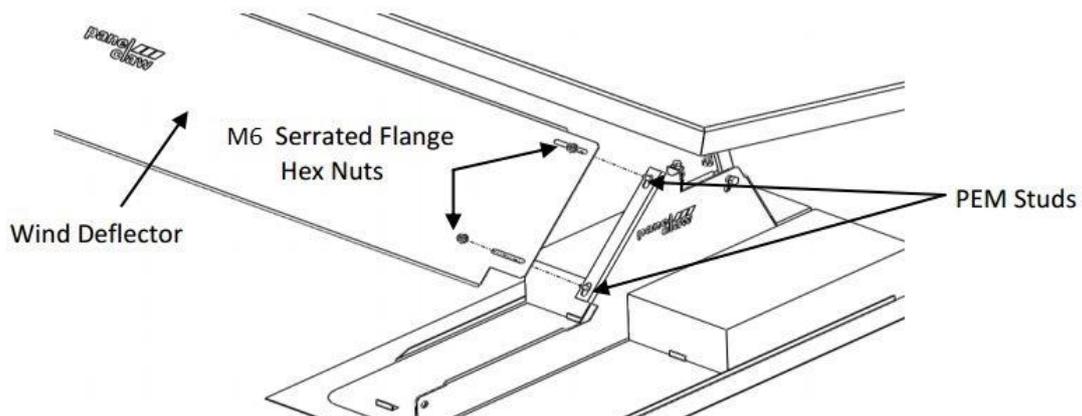
(only US-Version)

Step 6. Install Wind Deflectors

Wind Deflectors mount to the Supports via the Support's pre-installed PEM studs using two M6 serrated flange nuts per Support (Fig 9). Tighten each serrated flange nut to a minimum of 8 ft-lb. Deflectors should be installed on the Southern-most row of Supports (these Supports will only have modules attached at the low end of the Support). At the end of each work day a deflector must be attached to any Supports to which a module has been mounted with the exception of the Southern-most row of Supports as noted above.

Note: The Wind Deflector is installed with the PanelClaw logo facing toward you and right side up. At the end from a deflected row the last deflector has to be fixed with an endplate under the serrated M6 nuts.

Fig. 9 Wind Deflector Installation



Appendix A: Alternate Claw Attachment to Module

Multi-piece Claw

This claw is used when the PV module specified does not allow short-side PV frame Flange mounting. For proper attachment, place a Claw over the module frame flange on the long side of the module; slide to the corner, and tighten the M10 hex head cap screw between 18 and 20 ft-lb (24.4-27.1 N-m). Ensure that the "C" shaped portion of the Claw is seated up against the flange on the long side of the module and that the "L" shaped piece of the Claw is seated over the module frame, with the Tab flush against the short side of the module as shown in Figure 4 above.

