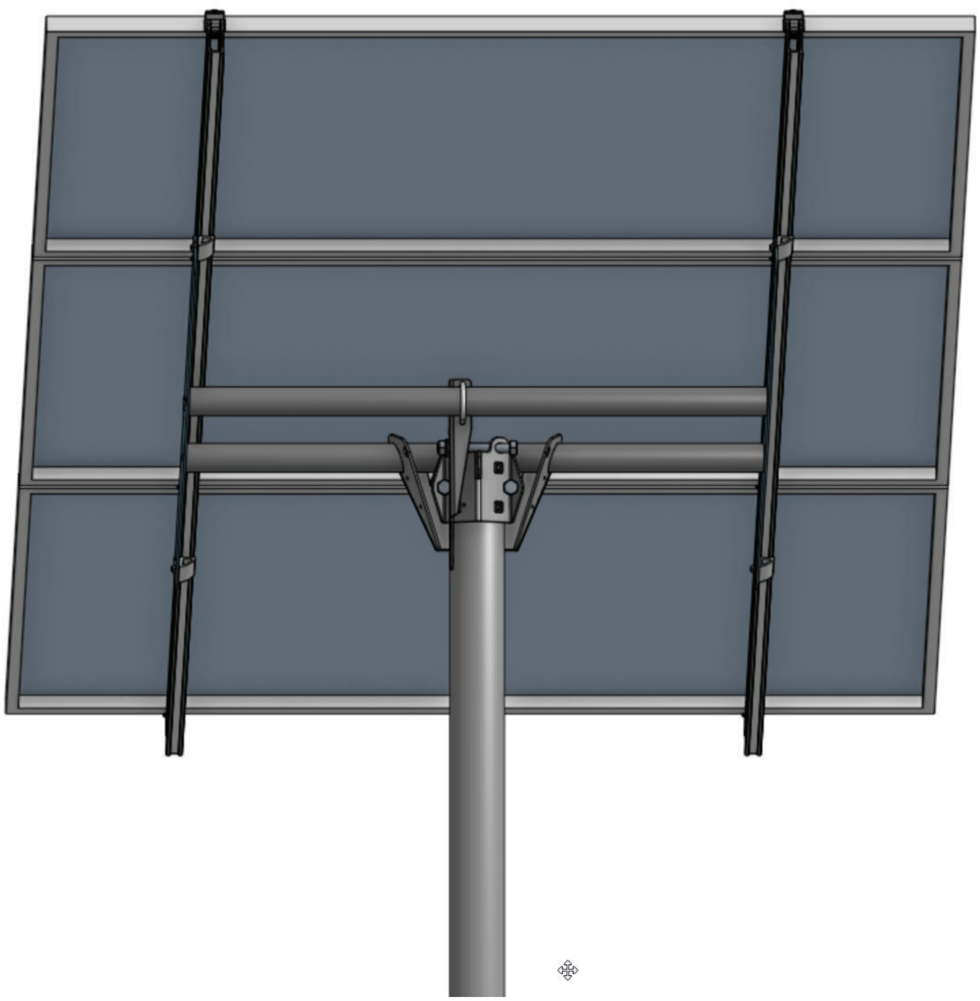
Tamarack
Solar Products

Installation Manual

For Models TTP-2, TTP-3

TTP-23-MAN 2022 Edition v1.1



90286	**TTP-2**	**2 Module Top of Pole Mount**
90293	**TTP-3**	**3 Module Top of Pole Mount**

Disclaimer

This manual describes proper installation procedures and provides necessary standards required for product reliability. Warranty details are available on our website. www.tamaracksolar.com
All installers must thoroughly read this manual and have a clear understanding of the installation procedures prior to installation.
Failure to follow the proper installation procedures may result in equipment failure, potentially causing property damage or injury to persons or animals.
Structural parts of this mount are made with painted steel which will show signs of rust in areas that get scratched during assembly. It is good practice to repaint scratched parts after assembly.

Installer Responsibilities

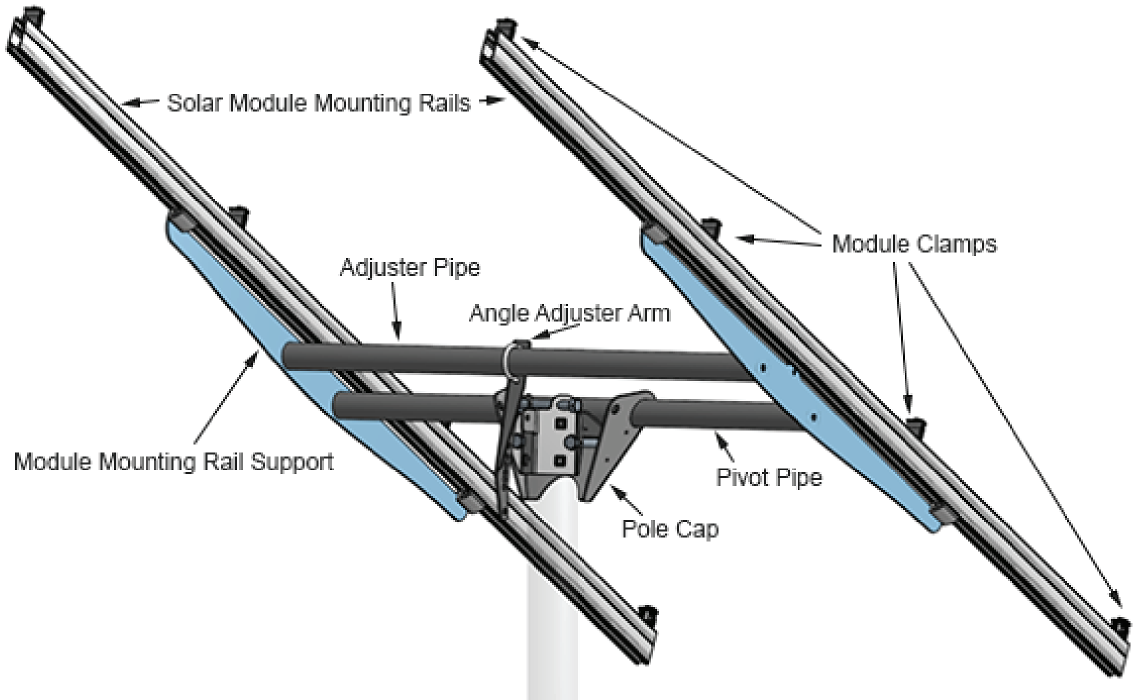
- Follow all applicable local or national building and fire codes, including any that may supersede this manual.
- Electrical installation should be conducted by a licensed and bonded electrician or solar contractor.
- Module maintenance or removal must not break the bonding path of the system.
- Ensure all products used are appropriate for the installation and array under the site's loading conditions.
- Use only Tamarack parts or parts approved by Tamarack; substituting parts may void any applicable warranty.
- Comply with all applicable fire codes including, but not limited to, keeping walkways clear.
- Ensure bare copper grounding wire does not contact aluminum and zinc-plated steel components, to prevent risk of galvanic corrosion.
- If loose components or loose fasteners are found during periodic inspection, retighten immediately. If corrosion is found, replace affected components immediately.
- Provide an appropriate method of direct-to-earth grounding according to the latest edition of the National Electrical Code, including NEC 250: Grounding and Bonding, NEC 690: Solar Photovoltaic Systems, and CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part 1
- Disconnect AC power before servicing or removing microinverters and power optimizers.
- Review module manufacturer's documentation to ensure compatibility and compliance with warranty terms and conditions.
- Maximum Series Fuse Rating is 20 Amps.

Technical Support: 707-234-8107 or 800-819-7236 ext.556

Tools Required:

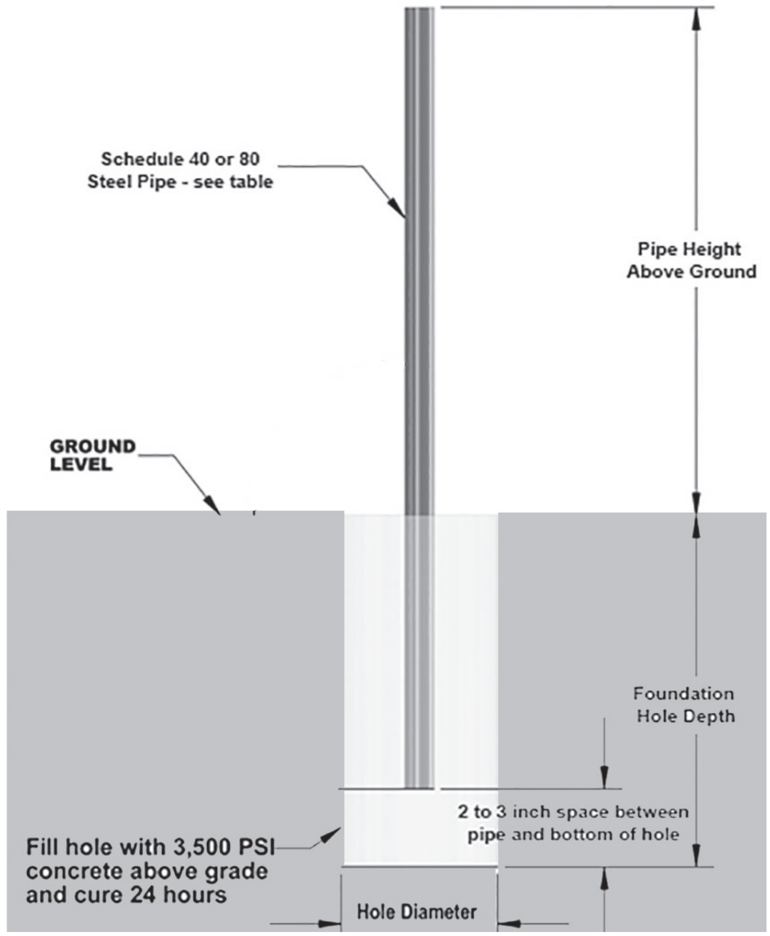
- 1- 1/8-inch Socket
- 1-1/8-inch Wrench
- 3/4-inch Socket
- 9/16-inch Socket
- 1/2-inch Socket
- Ratchet to fit Sockets
- Crescent Wrench
- Torque Wrenches (settings range from 6 to 100 foot-pounds. This may require multiple wrenches)
- Tape Measure
- Angle Finder
- Compass
- Ladder

TTP-2 and TTP-3 Pole Mount Components



	Part #	Part Description	TTP-2	TTP-3	Box #
Cap Assembly - 90309	53-1001	Pole Cap, Pivot 4-inch pipe, 2-inch holes	1	1	1
	53-1002	Pole Cap Backplate	1	1	1
	53-1013	Tilt Adjuster Arm	1	1	1
	53-1024	Pole Top Cover, 4-inch	1	1	1
	TTP-23-MAN	Manual, TTP2 and TTP3	1	1	1
	26-2107	Pole Cap Bolts 3/4 -10 x 7-inch	2	2	1
	26-2106	Pole Cap Top Support Bolt 3/4-10 x 6-inch	1	1	1
	26-2113	Pole Cap FlangeNut 3/4-10	3	3	1
	26-2141	Set Bolts 1/2-13 x 1-1/2-inch	6	6	1
	26-2122	Hex Bolt ½-13 x 1 ½" for Adjuster	1	1	1
	26-2125	Flange Nut ½ - 13 for Adjuster	1	1	1
	26-2129	Adjuster U-Bolt 3/8-inch x 3-1/8-inch	1	1	1
H-Frame 90439	53-1107	Rail Support Blade 5-foot	2	2	3
	53-4048	Support Pipe 2-inch Sch 40 x 48-inch	2	2	2
	26-2121	Hex Bolt ½-13 x 1-1/4-inch	4	4	1
	26-2133	Split Washer 1/2-inch	4	4	1
	26-2136	Flat Washer 1/2-inch	4	4	1
Module Mounting Rails	89488	3.1 Rail 85-inch	2	2	3
	89600	3.1 Rail 42.5-inch	0	2	3
	89938	Module Rail Splice with Bolts and Nuts	0	2	3
	88832	Module Mounting Clamp	6	8	3
	88795	Rail Mounts	4	4	3
	88788	Module Rail End Caps	4	4	3
	88931	Ground Lug	1	1	3
	88971	Module Lead Clips	6	9	3

Foundation Hole and Pole Guidelines



- The suggestions below are recommendations only. It is the installer's responsibility to validate foundation parameters prior to installation, a local geotechnical report may be required to assess soil conditions. We recommend consulting with a local engineer familiar with local regulations and build site requirements, including soil conditions, terrain, and load criteria (wind, snow, seismic). All of these parameters may impact foundation requirements.
- If you are planning to make seasonal adjustments to the solar array angle, use the steepest angle that you plan to use for foundation and pipe sizing to insure that the pole and foundation are strong enough to support the array, and that the desired minimum ground clearance is maintained, at all projected angles.
- Highlighted lines in the tables on the next 2 pages require schedule 80 pipe for the main support pole.
- Dig hole according to recommended depth and diameter. Remove or properly compact any loose material at the bottom of the hole.
- The pipe lengths listed in the following tables are based on having the pole pipe installed 2-3 inches from the bottom of the dug holes. Use a brick, concrete block, tiles, or other non-organic solid material at the bottom of the hole to support the pole on, allowing it to be raised above the bottom of the hole and allowing the concrete to fully encapsulate the pipe pole. If using a thicker material, be sure to allow for the added thickness when calculating the above-ground and total pipe lengths.
- Set pipe in hole and use a level to insure that it is straight and plumb in all directions.
- Brace pipe to prevent movement while pouring concrete. Pouring so that concrete is in direct contact with the soil is recommended. If forming or using sonotube, properly compact backfill. Allow concrete to cure for recommended length of time.

Soil Classifications

- If in doubt about the soil type and holding strength, consult a local engineer.
- Class 3 - Sandy Gravel and/or Gravel - Lateral Bearing Pressure - 200 lbs/sq ft below natural grade
- Class 4 - Sand; silty sand, clayey sand, silty gravel, and clayey gravel - Lateral Bearing Pressure - 150 lbs/sq ft below natural grade
- Class 5 - Clay, sandy clay, silty clay, silt and sandy silt - Lateral Bearing Pressure - 100 lbs/sq ft below natural grade

TTP-2 For Array Ground Clearance of 3 Feet														
Foundation Hole Depth, Height of Pole Above Ground and Total Pole Length for **Ground Clearance of 3 Feet** at Lowest Part of the Array & Exposure Catgory B For Various Soil Class and Foundation Hole Diameter. Vertical Pipe is 4-inch Schedule 40. Highlighted sections in the table below require 4-inch Schedule 80 Pipe.														
		Soil Type →	Class 3				Class 4				Class 5			
		Foundation Diameter →	24"		36"		24"		36"		24"		36"	
Array Tilt Angle ↓	Wind Speed (mph) ↓	Pipe Above Ground (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)
20°	100	4.1	2.5	6.4	2.1	6.0	2.8	6.7	2.4	6.3	3.3	7.2	2.8	6.7
	120		2.9	6.8	2.4	6.3	3.2	7.1	2.7	6.6	3.8	7.7	3.2	7.1
	140		3.2	7.1	2.8	6.7	3.6	7.5	3.1	7.0	4.3	8.2	3.6	7.5
30°	100	4.7	2.9	7.3	2.5	6.9	3.3	7.7	2.8	7.2	3.8	8.2	3.3	7.7
	120		3.4	7.8	2.9	7.3	3.8	8.2	3.2	7.6	4.4	8.8	3.8	8.2
	140		3.8	8.2	3.2	7.6	4.3	8.7	3.6	8.0	5.0	9.4	4.3	8.7
40°	100	5.1	3.3	8.2	2.8	7.7	3.7	8.6	3.2	8.1	4.3	9.2	3.7	8.6
	120		3.8	8.7	3.2	8.1	4.3	9.2	3.6	8.5	5.0	9.9	4.3	9.2
	140		4.3	9.2	3.7	8.6	4.8	9.7	4.1	9.0	5.7	10.6	4.8	9.7
50°	100	5.6	3.6	8.9	3.1	8.4	4.0	9.3	3.4	8.7	4.7	10.0	4.0	9.3
	120		4.1	9.4	3.5	8.8	4.6	9.9	4.0	9.3	5.5	10.8	4.6	9.9
	140		4.7	10.0	4.0	9.3	5.2	10.5	4.5	9.8	6.2	11.5	5.2	10.5
60°	100	5.9	3.8	9.4	3.3	8.9	4.3	9.9	3.7	9.3	5.0	10.6	4.3	9.9
	120		4.4	10.0	3.8	9.4	4.9	10.5	4.2	9.8	5.8	11.4	4.9	10.5
	140		5.0	10.6	4.2	9.8	5.6	11.2	4.7	10.3	6.6	12.2	5.6	11.2

TTP-2 For Array Ground Clearance of 6 Feet														
Foundation Hole Depth, Height of Pole Above Ground and Total Pole Length for **Ground Clearance of 6 Feet** at Lowest Part of the Array & Exposure Catgory B For Various Soil Class and Foundation Hole Diameter. Vertical Pipe is 4-inch Schedule 40. Highlighted sections in the table below require 4-inch Schedule 80 Pipe.														
		Soil Type →	Class 3				Class 4				Class 5			
		Foundation Diameter →	24"		36"		24"		36"		24"		36"	
Array Tilt Angle ↓	Wind Speed (mph) ↓	Pipe Above Ground (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)
20°	100	7.1	2.9	9.8	2.5	9.4	3.3	10.2	2.8	9.7	3.8	10.7	3.3	10.2
	120		3.3	10.2	2.9	9.8	3.7	10.6	3.2	10.1	4.4	11.3	3.7	10.6
	140		3.8	10.7	3.2	10.1	4.2	11.1	3.6	10.5	4.9	11.8	4.2	11.1
30°	100	7.7	3.4	10.8	2.9	10.3	3.8	11.2	3.2	10.6	4.4	11.8	3.8	11.2
	120		3.9	11.3	3.3	10.7	4.3	11.7	3.7	11.1	5.1	12.5	4.3	11.7
	140		4.4	11.8	3.8	11.2	4.9	12.3	4.2	11.6	5.7	13.1	4.9	12.3
40°	100	8.1	3.8	11.7	3.3	11.2	4.2	12.1	3.6	11.5	4.9	12.8	4.2	12.1
	120		4.4	12.3	3.7	11.6	4.9	12.8	4.2	12.1	5.7	13.6	4.9	12.8
	140		4.9	12.8	4.2	12.1	5.5	13.4	4.7	12.5	6.4	14.3	5.5	13.4
50°	100	8.6	4.1	12.3	3.5	11.8	4.6	12.9	3.9	12.2	5.3	13.6	4.6	12.9
	120		4.7	13.0	4.0	12.3	5.3	13.6	4.5	12.8	6.1	14.4	5.3	13.6
	140		5.3	13.6	4.5	12.8	5.9	14.2	5.1	13.4	6.9	15.2	5.9	14.2
60°	100	8.9	4.3	12.9	3.7	12.3	4.8	13.4	4.1	12.7	5.6	14.2	4.8	13.4
	120		5.0	13.6	4.3	12.9	5.6	14.2	4.8	13.4	6.5	15.1	5.6	14.2
	140		5.6	14.2	4.8	13.4	6.3	14.9	5.4	14.0	7.3	15.9	6.3	14.9

TTP-3 For Array Ground Clearance of 3 Feet

Foundation Hole Depth, Height of Pole Above Ground and Total Pole Length for **Ground Clearance of 3 Feet** at Lowest Part of the Array & Exposure Catgory B For Various Soil Class and Foundation Hole Diameter. Vertical Pipe is 4-inch Schedule 40. Highlighted sections in the table below require 4-inch Schedule 80 Pipe.

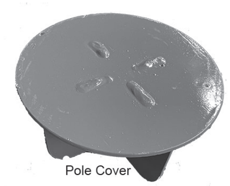
Soil Type →			Class 3				Class 4				Class 5			
Foundation Diameter →			24"		36"		24"		36"		24"		36"	
Array Tilt Angle ↓	Wind Speed (mph) ↓	Pipe Above Ground (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)
20°	100	4.7	3.0	7.5	2.5	7.0	3.3	7.8	2.8	7.3	3.9	8.4	3.3	7.8
	120		3.5	7.9	2.9	7.4	3.8	8.3	3.3	7.8	4.5	9.0	3.8	8.3
	140		4.0	8.4	3.3	7.8	4.3	8.8	3.7	8.2	5.1	9.6	4.3	8.8
30°	100	5.5	3.6	8.9	3.1	8.4	4.0	9.3	3.4	8.7	4.7	10.0	4.0	9.3
	120		4.2	9.5	3.6	8.9	4.6	9.9	3.9	9.2	5.4	10.7	4.6	9.9
	140		4.7	10.0	4.0	9.3	5.2	10.5	4.4	9.7	6.1	11.4	5.2	10.5
40°	100	6.2	4.1	10.1	3.5	9.5	4.5	10.5	3.9	9.9	5.3	11.3	4.5	10.5
	120		4.7	10.7	4.0	10.0	5.3	11.2	4.5	10.5	6.2	12.2	5.2	11.2
	140		5.3	11.3	4.5	10.5	5.9	11.9	5.0	11.0	7.0	13.0	5.9	11.9
50°	100	6.8	4.4	11.0	3.8	10.4	4.9	11.5	4.2	10.8	5.8	12.4	4.9	11.5
	120		5.1	11.7	4.4	11.0	5.7	12.3	4.8	11.4	6.6	13.3	5.6	12.1
	140		5.7	12.3	4.9	11.5	6.4	13.0	5.4	12.0	7.5	14.1	6.2	13.0
60°	100	7.3	4.7	11.8	4.0	11.1	5.2	12.3	4.5	11.6	6.1	13.2	5.2	12.3
	120		5.4	12.4	4.6	11.7	6.0	13.1	5.2	12.3	7.1	14.3	6.0	13.1
	140		6.1	13.0	5.2	12.3	6.8	13.9	5.8	12.9	8.0	15.1	6.8	13.9

TTP-3 For Array Ground Clearance of 6 Feet

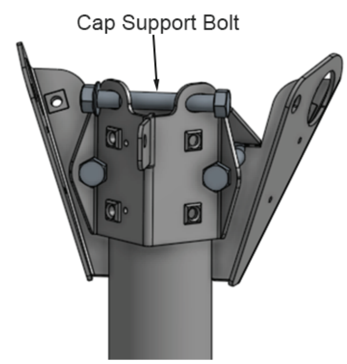
Foundation Hole Depth, Height of Pole Above Ground and Total Pole Length for **Ground Clearance of 4 Feet** at Lowest Part of the Array & Exposure Catgory B For Various Soil Class and Foundation Hole Diameter. Vertical Pipe is 4-inch Schedule 40. Highlighted sections in the table below require 4-inch Schedule 80 Pipe.

Soil Type →			Class 3				Class 4				Class 5			
Foundation Diameter →			24"		36"		24"		36"		24"		36"	
Array Tilt Angle ↓	Wind Speed (mph) ↓	Pipe Above Ground (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)	Hole Depth (ft)	Total Pipe Length (ft)
20°	100	7.7	3.4	10.9	3.0	10.5	3.8	11.3	3.3	10.8	4.5	12.0	3.8	11.3
	120		3.9	11.4	3.4	10.9	4.4	11.9	3.8	11.3	5.2	12.7	4.4	11.9
	140		4.4	11.9	3.8	11.3	5.0	12.5	4.3	11.8	5.8	13.3	5.0	12.5
30°	100	8.5	4.1	12.4	3.5	11.8	4.5	12.8	3.9	12.2	5.3	13.6	4.5	12.8
	120		4.7	13.0	4.0	12.3	5.2	13.5	4.5	12.8	6.1	14.4	5.2	13.5
	140		5.3	13.6	4.5	12.8	5.9	14.2	5.0	13.3	6.9	15.2	5.9	14.2
40°	100	9.2	4.5	13.5	3.8	12.8	5.0	14.0	4.3	13.3	5.8	14.8	5.0	14.0
	120		5.2	14.2	4.4	13.4	5.8	14.8	4.9	13.9	6.7	15.7	5.8	14.8
	140		5.8	14.8	5.0	14.0	6.5	15.5	5.5	14.5	7.6	16.6	6.5	15.5
50°	100	9.8	4.9	14.5	4.2	13.8	5.5	15.1	4.7	14.3	6.4	16.0	5.5	15.1
	120		5.7	15.3	4.8	14.4	6.3	15.9	5.4	15.0	7.4	17.0	6.3	15.9
	140		6.4	16.0	5.4	15.0	7.1	16.7	6.1	15.7	8.3	17.9	7.1	16.7
60°	100	10.3	5.2	15.3	4.5	14.6	5.8	15.9	5.0	15.1	6.8	16.9	5.8	15.9
	120		6.0	16.1	5.2	15.3	6.7	16.8	5.7	15.8	7.8	17.9	6.7	16.8
	140		6.7	16.8	5.8	15.9	7.5	17.6	6.4	16.5	8.8	18.9	7.5	17.6

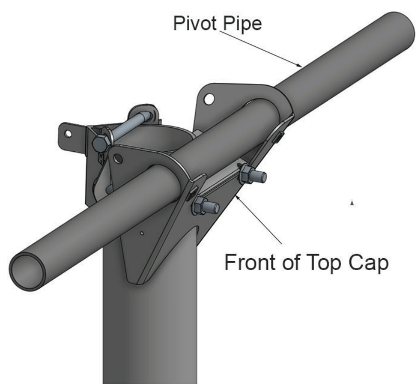
Step One - Pole Cap Assembly

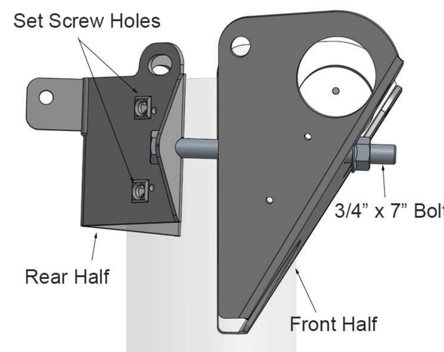


- Place the Pole Cover on top of the mounting pole.
- Install the 3/4 x 6-inch Cap Support Bolt through the two top holes in the rear half of the cap and install nut and tighten firmly. This bolt keeps the cap at the top of the pole.



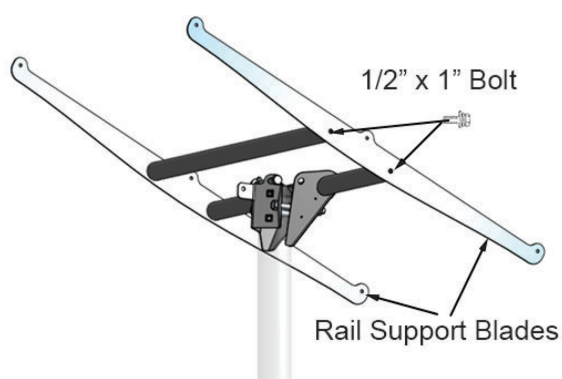
- Put the two 3/4 x 7-inch bolts into the back half of the mount, then through the front half and put the nut losely on the bolts.
- Slide the assembled Cap over the 4-inch vertical pole.
- Rotate the cap on the pole so that the front (larger) half of the cap is on the side of the pole the the array will be facing.
- Loosely install the four 1/2-inch set screws in the threaded holes on the rear half of the cap. Do not tighten at this time.
- Securely tighten the two 3/4-inch bolts in the cap assembly, but do not fully torque to spec until final assembly is complete.





Step Two - Assemble Frame

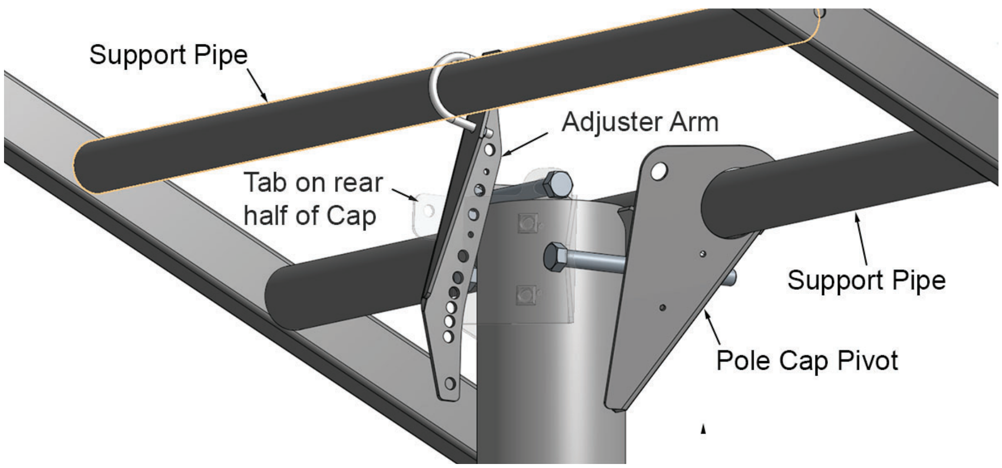
- Slide one of the 2” Support Pipes (2-3/8-inch O.D.) through the holes on the side of the front half of the Pole Cap. Center the pipe in the Pole Cap.
- Install a Rail Support Blade to each side of this Support Pipe with a 1/2-13 x 1-1/4-inch bolt, flat washer and split lock washer. Leave these bolts hand-tight until you install the second support pipe.



- Attach the other 2-inch Support Pipe (2-3/8-inch O.D.) between the two Rail Support Blades with a 1/2-13 x 1-1/4-inch bolt, flat washer and split lock washer on each side. This support must be above the back section of the cap when it is attached between the blades. Tighten the 4 bolts to 45 ft-lbs.

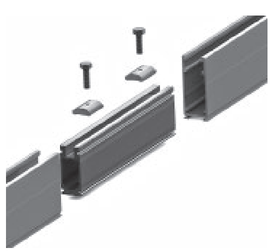
Step Three - Assemble Adjuster Arm

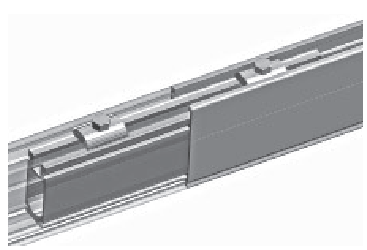
- Install the Adjuster Arm as shown in the image below. Attach it to the Support Pipe that does not go through the holes in the Pole Cap with a 2-3/8-inch U-bolt and two flange nuts. Tighten hand tight to allow it to be alligned with the tab on the Pole Cap Backplate.
- Attach the Adjuster Arm to the tab provided on the Pole Cap Backplate with a 1/2-13 x 1-1/2-inch bolt and nut.
- Use the hole that makes the Rail Support Blades approximately horizontal for assembly purposes. This will be readjusted in final assembly.



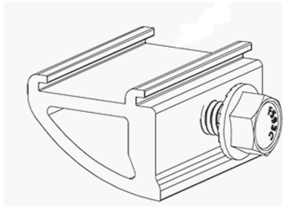
Step Four - Module Mounting Rail Assembly (for TTP-3 only)

- Assemble a 127.5-inch Module Mounting Rail by splicing an 85-inch rail and a 42.5-inch rail section using a rail splice and two 5/16” x 1.125-inch bolts and channel nuts. Slip the splice 5-inches into the end of one rail section, place a channel nut and bolt approximately 2.5-inches from the end and tighten. Slide the second rail section over the splice, butting the rail section ends together, and repeat this process
- Tighten Splice Bolts to 12 ft-lb. If a Module Clamp needs to be placed between the two Splice Bolts, they will need to be loosened to allow it to be inserted.
- Repeat this process for the second Module Mounting Rail.

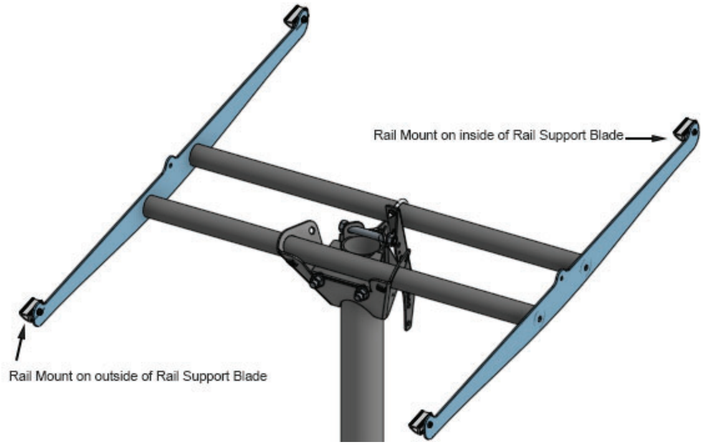




Step Five - Rail Mount Attachment

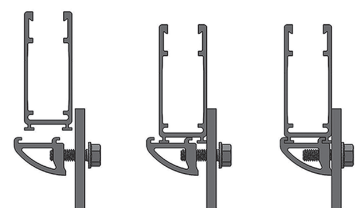


- Attach a Rail Mount to each of the 4 end holes on the Rail Support Blades. If the length of the solar module being used is less than 70-inches, place the Rail Mounts on the inside of the Rail Support Blades. If the solar module length is 70-inches or more, place the Rail Mounts on the outside of the Rail Support Blades. Leave the bolts on the Rail Mounts loose until the Rails are installed.



Step Six - Module Mounting Rail Attachment

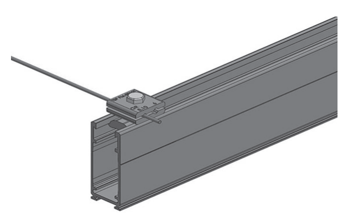
- Place one of the Module Mounting Rails on the two Rail Mounts installed on the Rail Support Blades, and center it in the north/south direction so it extends past both Rail Mounts the same distance. Make sure that the Rail Mount slips into both of the mounting features on the bottom of the rails (see drawing at right).



- Tighten the the 3/8-inch bolts with a 9/16-inch socket to 18 ft-lbs.
- Repeat above step for the other Module Mounting Rail.

System Grounding

- Tamarack Module Mounting Rails and the PV module frames are electrically bonded together by the Tamarack Module Clamps. This creates a single electrically bonded unit for grounding purposes per UL 2703 requirements. Only one Ground Lug is required to provide equipment grounding for the entire column of PV modules.

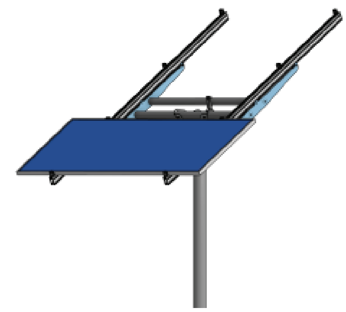


- The Ground Lug can be attached at any location desired on either one of the two Module Support Rails.
- Connect the ground lug to the ground wire in the system according to local code.

Mount Solar Modules on Rails

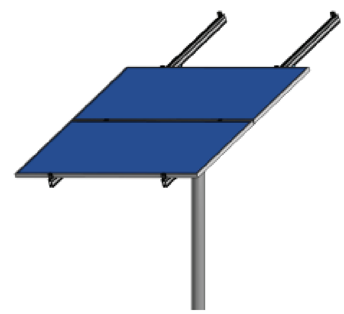
- To center the modules on the rails, calculate the amount of excess Module Mounting Rail length:
  1) Add the width of the modules plus 1/2-inch space between modules.
  2) For TTP-2: subtract the above calculated number from 85-inches.
  For TTP-3 subtract the above calculated number from 127.5-inches.
  3) This will give you the total excess length of the Module Mounting Rails.

- Start module installation at the bottom. To center the column of modules on the rails, place the first two Module Clamps on the rails 1/2 of the total excess rail length from the bottom of the rails. Be sure to put the side of the top clamp with the two bonding pins inward toward the module frame.



- Center the first module east to west over the rails and hold in place. Make sure that the module is straight and level on the rails and tighten the two end clamp bolts to 108 inch-pounds (9 foot-pounds).

- Install one Module Clamp in each rail on the other side of the first module and slide it down so that the inside of the clamp contacts the frame of the first module. The springs will hold the clamps in place prior to tightening. Place the second module on the rails, align it with the first module, and slide down and fully into the two mid-clamps. Tighten the mid-clamp bolts to 144 inch-pounds (12 foot-pounds) to fully secure the module. Install the third module on TTP-3 in the same manor.



- On the top edge of the last module of the first column, install the Module Clamps so that the sides with the two stainless-steel pins are facing in toward the module frame, and the clamp is tight up against the module frame. Tighten the two end clamp bolts to 108 inch-pounds (9 foot-pounds).

Final Assembly

- Set the array tilt to the desired angle and tighten the Tilt Adjuster bolt to 40 ft-lbs.
- Tighten the U-bolt on the Tilt Adjuster to 20 ft-lbs.
- Rotate the array to point in the desired direction. Tighten the 3/4-inch nuts on the Pole Cap to 100 ft-lbs.
- Tighten all of the 1/2-inch set screws on the Pole Cap to 40 ft-lbs with a 3/4-inch socket.