

SunArx T-21 Owner's Manual



rev. 20100518
applies to T-21 serial numbers 00026-00050

38150 River Frontage Rd. #1D
New Castle CO 81647
970-984-3750

Contents

Safety	3
Parts List	4
Layout and Foundation	5
Assembly	7
Maintenance and Warranty	16

Support

Current Documentation:
www.sunarx.com/downloads.html

Technical Support
email: info@sunarx.com
phone: 970-984-3750
forum: www.sunarx.com/forum

Important Safety Instructions

PLEASE READ AND SAVE THESE INSTRUCTIONS!

This manual contains important safety instructions for SunArx® Trackers. Read all instructions and cautionary markings on the SunArx® Trackers and on any accessories or additional equipment included in the installation. Failure to adhere to these instructions could result in bodily injury, severe shock, or possible electrocution. Exercise extreme caution at all times to prevent accidents.



KEEP CHILDREN AWAY FROM TRACKER.

General Safety



CAUTION: Equipment Damage

Only use components or accessories recommended or sold by SunArx® Trackers or its authorized agents.



NOTE:

Do not attempt to install this equipment if it appears to be damaged in any way. Please contact SunArx® Trackers for instructions on how to return the equipment if you know, or suspect, it is damaged.

Personal Safety



WARNING: Personal Injury

- This equipment weighs over 100 lbs (45 kg). Use safe lifting techniques when lifting this equipment as prescribed by the Occupational Safety and Health Association (OSHA) or other local codes.
- Use standard safety equipment such as safety glasses, ear protection, steel-toed boots, safety hard hats, etc. as prescribed by the Occupational Safety and Health Association or (other local codes) when working on this equipment.
- Use standard safety practices when working with electrical equipment (e.g., remove all jewelry, use insulated tools, wear cotton clothing, etc.)
- Never work alone when installing or servicing this equipment. Have someone nearby that can come to your aid if necessary.



NOTE:

Wiring of solar panels and SunArx® power supply should only be done by qualified personnel.

Parts For Each T-21 Frame:

Bundled:

Rail 163" 4

On the Pallet:

Mid Assembly 1

H-Frame, Left 1

H-Frame, Right 1

H-Frame, Center 1

Actuator 1

In the Box:

Base 1

Adjustment Tube 1

Rail Clamp 8

1/2" x 3/4" SS Bushing 2

Pins:

3/4" o.d. x 5-1/2" 2

7/16" x 1-1/2" 2

1/2" x 2-1/4" 2

1/2" x 3-1/2" incl. clip 1

1/4" x 1" Roll Pin 1

1/8" x 1" Cotter Pin 5 (1 extra)

1/2" Retaining "E" Clip 3 (1 extra)

Bolts:

1-12 x 1-3/4" special 2

1/2-20 x 3" 8

3/8-16 x 4" special carriage 16

set screw 1/2" x 1" 4

Nuts:

1-12 2

1/2-20 x serrated lock 8

3/8-16 x serrated lock 17 (1 extra)

Washers:

1 x lockwasher 2

1/2 x .093 flat 14 (6 for spacers for actuator end adjustment)

Module mounting clamps 40

1-1/2" combination wrench 1 (1 per system)

C-6 Control Box, usually one per system:

C-6 Control Box 1 (120VAC or 24VDC)

14/4 Actuator Wire 12' (enough for single tracker)

Strain Relief 1

Stainless Steel Strap Kit 1 (includes 1/4" bolts)

Other Optional Accessories:

Grounding Kits

Additional 14/4 Actuator Wire

Extra SS Straps and Bolts

DLO 30' Solar Panel Wiring Extensions

Planning

Choose a location with good exposure to the horizon throughout the year. In the summertime even exposure to the east and west are very important. For multiple trackers a single row on the N-S or E-W axes is suggested, although not required. The N-S spacing depends on latitude and maximum tilt desired, and the rows should be spaced for no shadowing on Dec 22, the shortest day of the year. The N-S spacing if the poles are lined up North-South is generally in the range of 25-45'. E-W spacing should be at least 30' center-to-center, more if possible, to minimize shadows early and late near the equinoxes, when the sun rises directly in the East and sets directly in the West. (note we do not currently produce trackers for the Southern Hemisphere)

Make sure children will not have access to the tracker.

Foundation

The T-21 mounts to a section of 6" sch. 40 structural pipe, 6-5/8" O.D., set in a concrete base engineered for local soil type and wind loads. Sch. 80 pipe has the same outside diameter and may be used if desired. Refer to SunArx foundation drawings for an example foundation. Please note the provided drawings limit the pole height to 10 feet above grade. On a level site, a 10' pole height provides 33" of clearance between the solar panels and the ground when the tracker is in the steepest tilt position. More ground clearance will require a larger pipe, necked down to 6-5/8" O.D., and a larger footing.

It is strongly recommended that the concrete pilaster (column) extends 2-3' above grade to add additional stiffness to the steel pipe.



The installer is responsible for making sure the foundation has been engineered for local codes and conditions.



The installer is responsible for obtaining additional engineering for pole heights over 10 feet above grade. Maximum pole height above grade is 12', even if reinforced.

Layout and Foundation

It is recommended to place electrical conduit inside the concrete form before pouring concrete. On each pole, there may be conduit for: power to the control board, power from the solar modules, and motor wires for the trackers. The conduit should enter the concrete at the depth required by code, and then sweep to follow the pipe vertically. It is recommended to put conduit for control board and actuator wiring on the west side of the pole, and solar module power output wiring on the east side of the pole. Also, a ground rod may be placed inside the form before pouring to allow the ground rod to be convenient and close to the pole.

Brace the pole plumb using long boards solidly staked at the bottom and attached to the top of the pole with C clamps. It usually works best to set up braces 90 degrees apart, so one can use a level to check plumb in one plane, and then another. Take your time bracing the pole plumb as it is impossible to fix later! A concrete vibrator is recommended to insure the air escapes from the concrete. These can often be rented at reasonable cost.



Suggested method of bracing pole plumb before concrete pour.

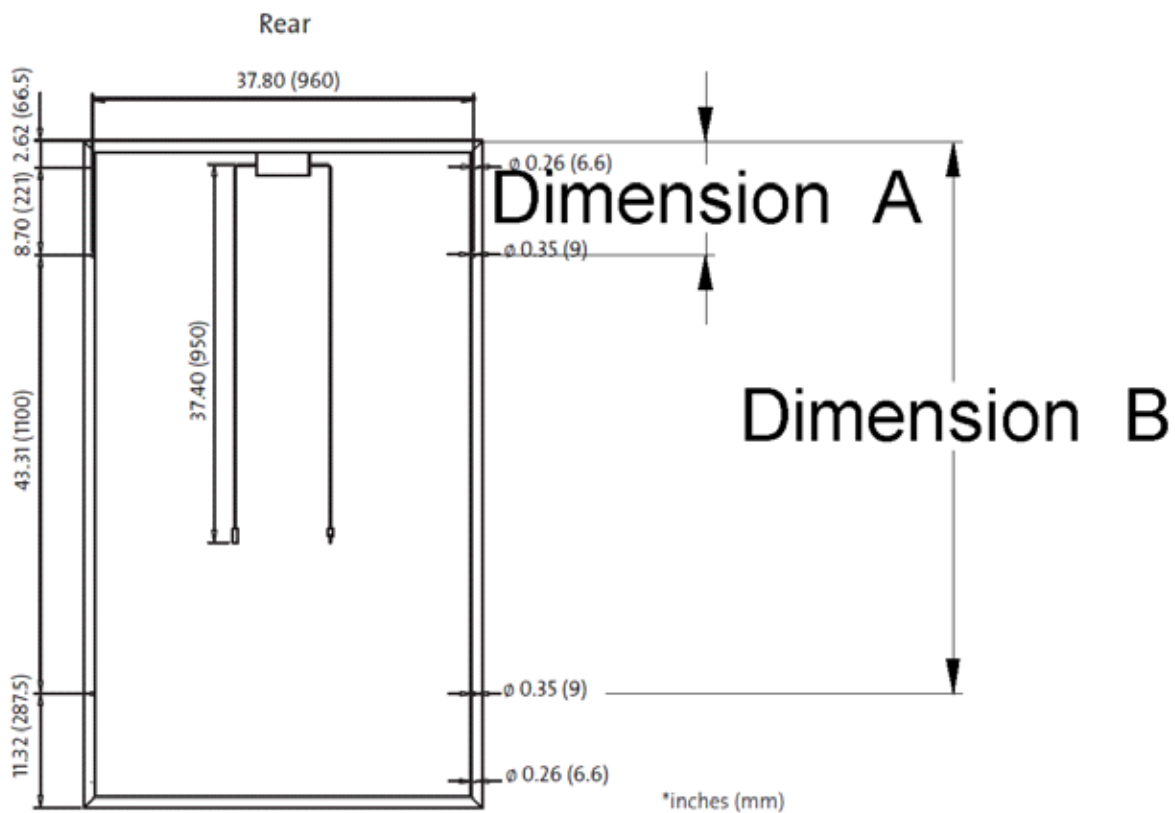
Tracker Assembly

Setting up two frames of 5W' x 10L' scaffolding, one on either side of the pole, will provide a good platform for assembling the tracker and attaching the solar modules. 2 people are required to assemble the tracker safely. Make sure the platform can support 2 people plus the weight of parts being handled.



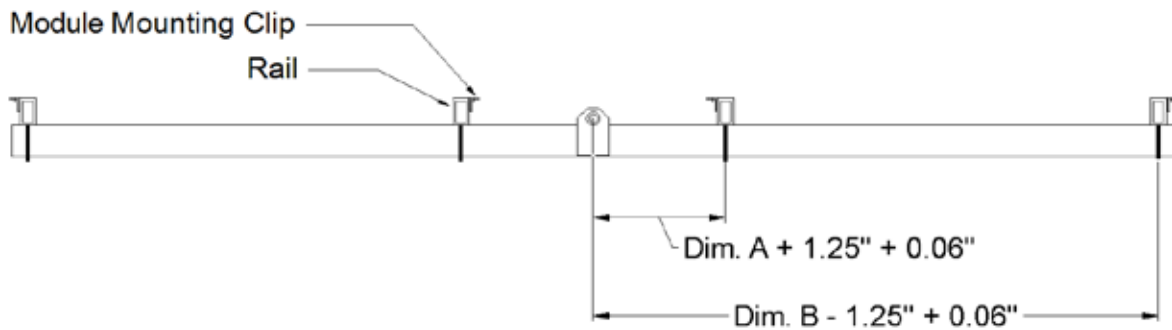
Hard Hats are strongly recommended when working under a tracker.

Mark the two H-frame pieces (the 2" x 3" steel tubes) for the rail locations, depending on the hole spacing of your solar modules. A fine point Sharpie® works well. You will need two dimensions from your solar modules, obtained from the spec sheets or by measuring from one end of the module to the mounting holes:



In the example above, dimension A would be 11.32", dimension B would be 54.63".

Mark the 4 centerlines on one side of each H-frame piece according to the drawing below -



1.25" is the offset from the center of the rail to the module mounting hole. The 0.06" is to create a 1/8" space between module rows.

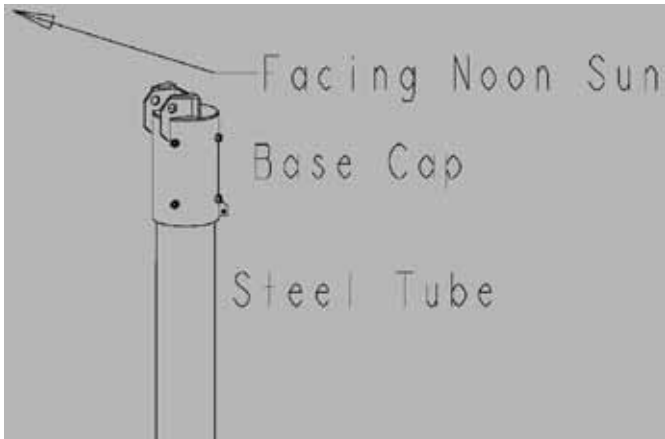
Attaching the mid assembly to the base is the first step of tracker assembly. It can be done on the ground, with the mid assembly upside down, as shown in the photos below, or it can be done after placing the base over the top of the pole. Thread the 1-12 x 1-3/4" bolts from the inside out, with the flat spot on the head of the bolts against the lower surface of the mid assembly. Note the smaller tabs on the side of the base must face the rectangular hole in the down tube of the mid (out of sight on the back of the base in the photo).



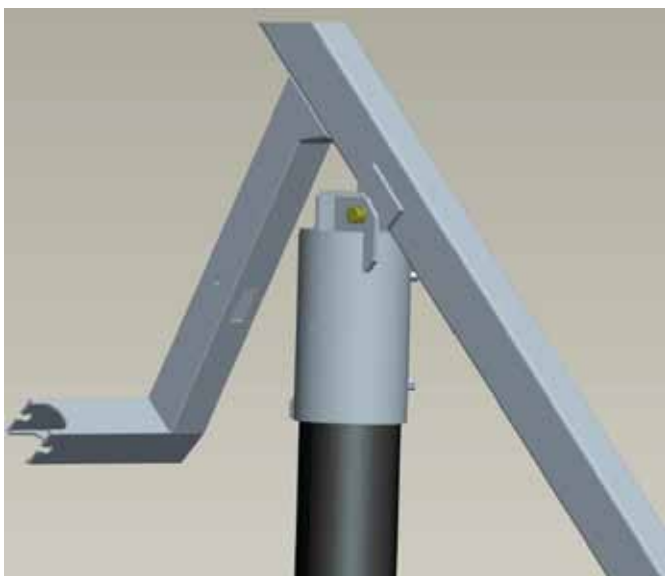
Put a 1" internal tooth lock washer and nut on each bolt, and snug slightly with a 1-1/2" wrench or socket.



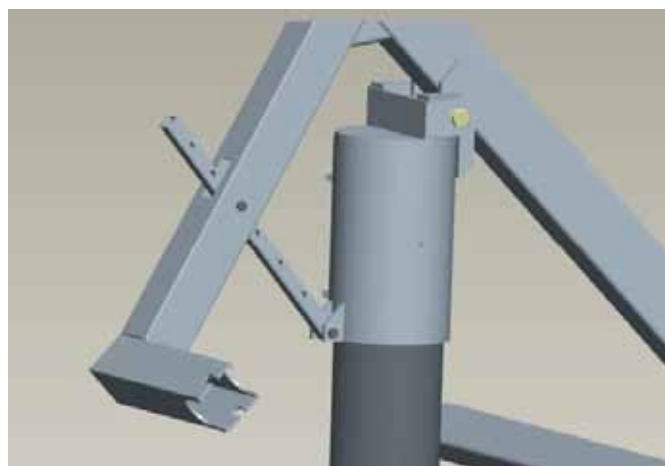
There are multiple pinch points between the mid assembly and the base. Be very careful not to pinch fingers when handling the partly assembled mid assembly and base.



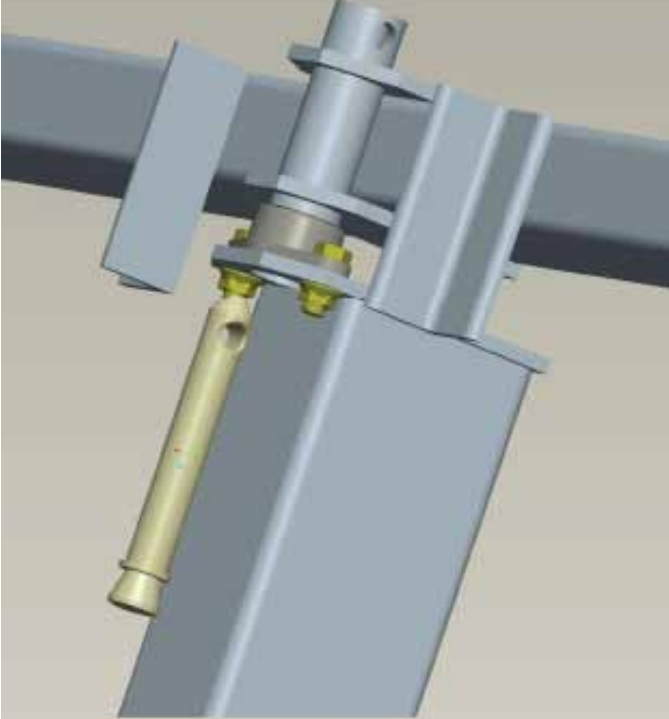
Place the base cap onto the top of the pole. Orient the large flanges toward true south. Bolt in place using four square headed bolts. It will probably be helpful to leave the set bolts loose so the frame can be swung around for access during assembly. When you are finished assembling the frame and certain the base cap is oriented towards true south, tighten the four square headed bolts to 45 foot-lbs.



The base and mid assembly should look like this. The down leg of the mid-assembly must be on the north side of the post/base.

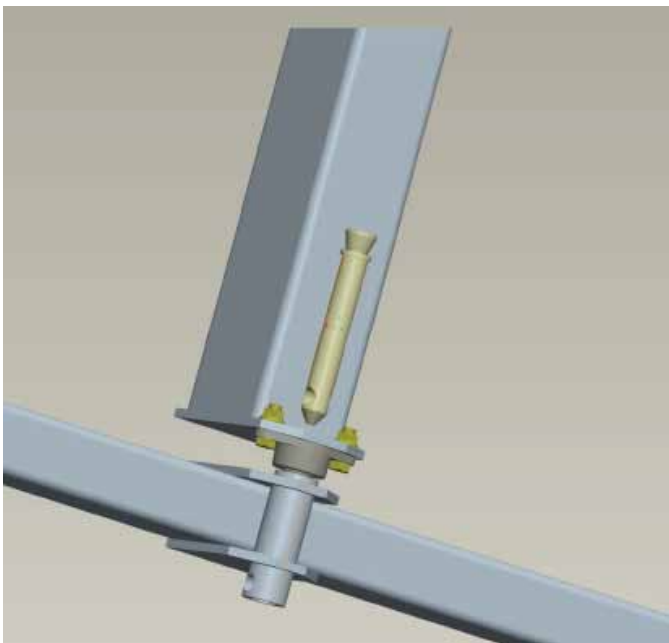


Attach the adjustment arm, using a 1/2" x 2-1/4" pin on the bottom, and a 1/8" x 1" cotter pin retaining it, and the 1/2" x 3-1/2" tapered pin and retaining clip on the top. The end of the arm with the hole closest to the end must be on the bottom. Usually putting the tracker in the flattest position makes further assembly easiest.

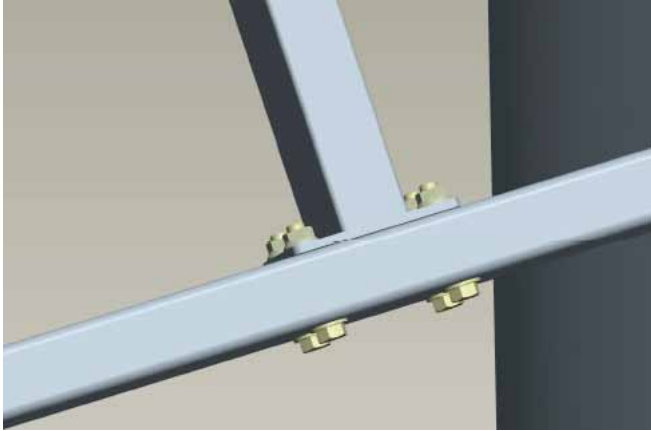


Place the two H-Frame beams side by side on the ground or platform, running east-west. The 4 bolt holes in each beam should be towards the west end, and the short cylindrical pipe sections should face up and away from each other. The upper beam is the beam on the north side.

Note in the current T-21, the bearing is welded to the mid assembly, so the bolts in the picture are not actually there. Lift the upper (north) beam so the cylinder lines up with the bearing, with the cylinder facing up and away from the mid-assembly, and the 4 bolt holes in the beam on the west side. Pin the upper beam to the north end of the mid-assembly using a $3/4 \times 5-1/2$ " inch pin through the bearing. grease the pin before insertion. The pin must enter from the mid-assembly side of the bearing. Pin the top link pin with a $7/16 \times 1-1/2$ " clevis pin by aligning the holes in the cylinder with the hole in the top link pin. Insert a $1/8 \times 1$ " cotter pin thru the clevis pin's hole and flare out the pin's free legs.



Repeat the above for the lower beam. Again the cylinder should be facing away from the mid-assembly and the 4 bolt holes should be towards the west end of the beam.



Orient the H-frame center beam by facing the middle brackets down, and the shorter length from bracket to end toward the north. Bolt both ends as shown using 1/2" x 3" bolts, 1/2" washers under the bolt heads, and 1/2" serrated lock nuts. Before final tightening make sure the whole H frame is flat, that is, not twisted, then torque the nuts to 45 foot-lbs.



The tracker frame should look like this, with the H-frame beams below the bearings, the H-Mid on the west side, and the shorter section of the H-Mid toward the north.

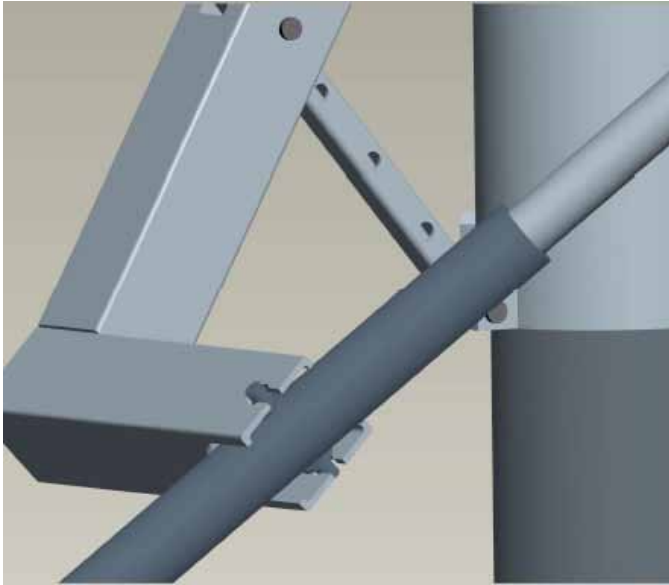
In order to continue assembly, it is helpful to put the actuator in approximately the center position, by applying 12 or 24VDC to the MOTOR terminals inside the motor. The motor terminals in the actuator should be the ones with red and white wires attached. The polarity will determine if the actuator extends or retracts; you can determine the correct polarity to extend by trial and error. The distance from the center of the studs to the center of the actuator end should be about 27-1/2" when it is extended to the center position. It is also possible to insert a temporary brace in place of the actuator for assembly. The brace has to be sturdy and have a 1/2" hole in one end and a 3/4" hole in the other, and a 3/4" x 4" pin will be needed also, in order to put the brace where the actuator normally goes..



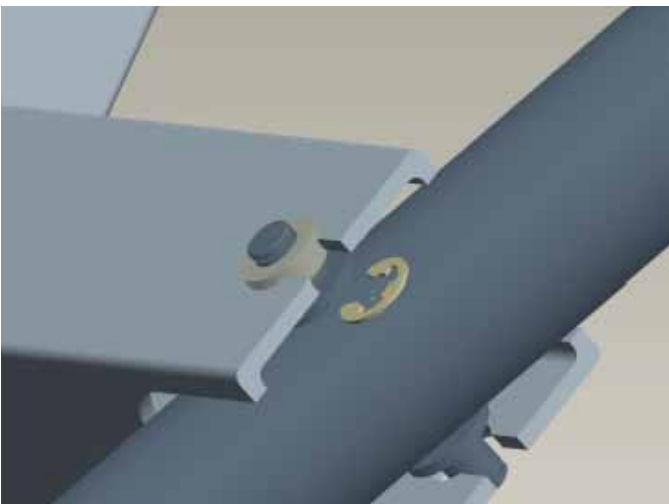
Be careful not to apply voltage to the sensor terminals in the actuator! The motor terminals should be the ones with red and white wires connected to them. See the SunArx C-6 owner's manual for clarification of the motor wires versus the sensor wires.



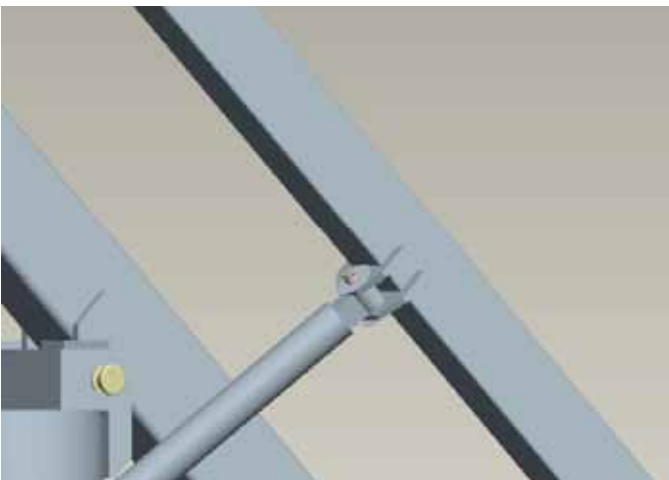
Be careful not to let the actuator end spin relative to the motor end while extending! It must be held against spinning so it will extend straight out.



The actuator is positioned by first sliding the trunnions (the welded studs on the side of the tube) into the keyhole slot on the down tube. The actuator motor must be positioned **away** from the pole. This will put the motor on top, and the drain hole on the motor housing on the bottom, as the tracker is tilted up.



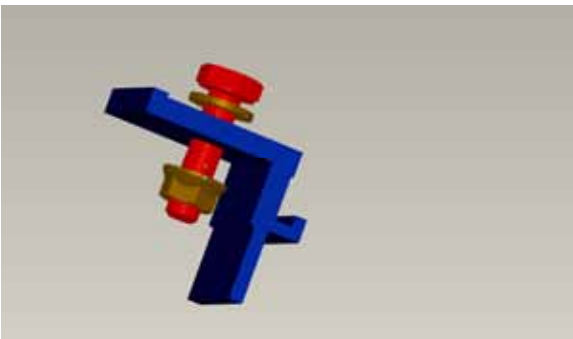
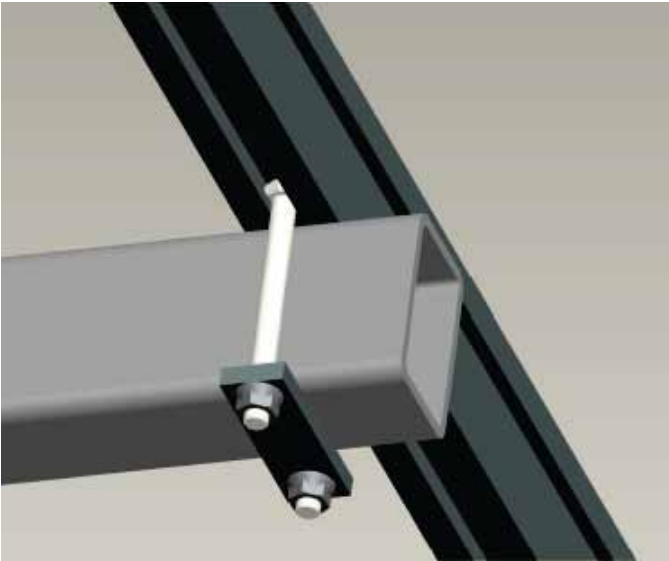
Next, press the 1/2" x 3/4" stainless bushings into the round hole until the studs can be secured with 2 "E" clips. The stainless bushings may be a tight fit in the keyhole.



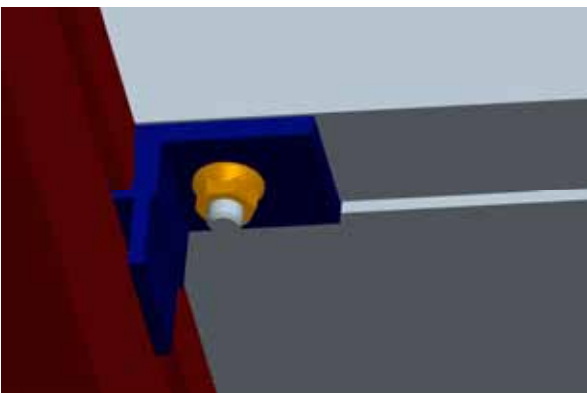
Attach the flat eye of the actuator to the H Mid frame using a 1/2" x 2-1/4" pin. Use a few 1/2" flat washers on both sides of the 1/2" eye as shims to take up the extra length of the pin. The eye should be centered in the slot. The washers allow adjustment side to side to correct for misalignment if necessary. Use a cotter pin and bend the ends to secure the 1/2" pin.



Using the 3/8-16 x 4" special carriage bolts, rail clamp plates, and 3/8-16 serrated lock nuts, attach the rails to the H-frame, locating them on the centerlines previously marked on the H-frame. The rail overhang should be approximately 39-1/2" outside of the H-frame, top and bottom. Also check that the H-frame rails are parallel. Tighten the nuts so rails are secure enough for further assembly. Once the rails are located correctly, nuts can be tightened to 28 ft-pounds. It is difficult to loosen the flange nuts, so it is recommended to wait until modules are mounted to do final tightening on the 3/8" nuts.



Attach the solar modules using the module mounting clips. Locate the clips along the rails so they are located under the module mounting holes. The clips are a tight fit in the slot so may be placed in position before mounting the rails using a known layout, and they will stay in place until the modules are mounted. Make sure the clips are completely seated in the slot on the side of the rail. **Failure to completely seat the clips may result in module loosening!** A hammer and block of wood may be used to gently tap the bottom edge of the clip if necessary. Torque to 15 ft-lbs.



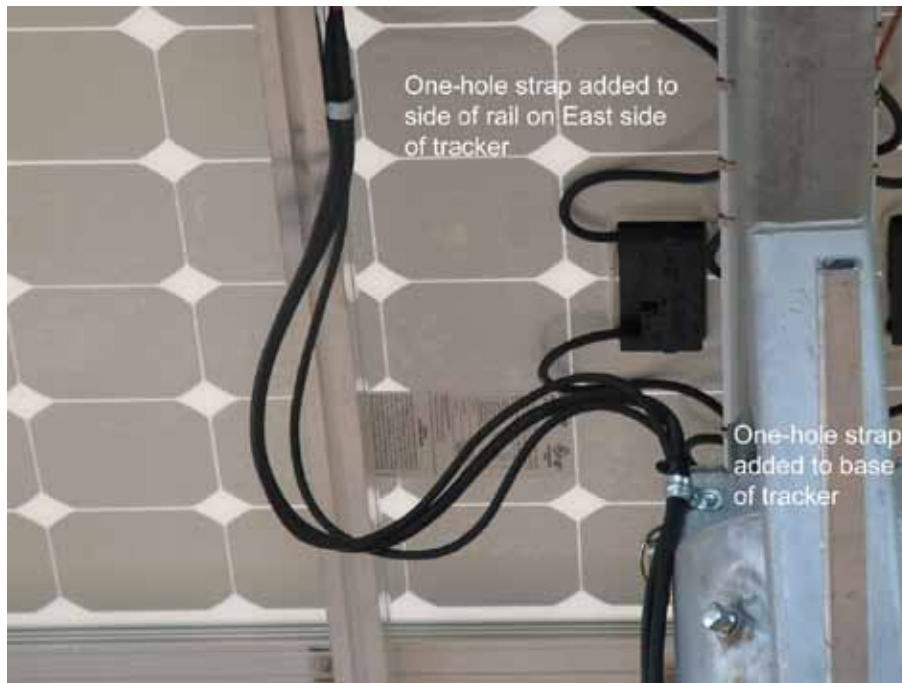
Wiring and Grounding the Solar Modules

We recommend installing solar modules on the T-21 so the module junction boxes are facing the tracker mid assembly. It is easier to connect and run all module wires before running module grounding wire. Connect module wires in series as necessary and attach using Acme cable clips or high quality cable ties to the edges of the modules. Place loops in the wires and clip as needed to use up any extra wire encountered.



SunArx® offers optional extension wires made with type DLO wire for maximum flexibility and durability.

We recommend gathering the wires for the PV output circuits along the inner aluminum rail, on the East side of the tracker, providing a 30" drip loop which allows full range of motion of the tracker, and then enter a junction box or combiner box high on the East side of the pole, below the base of the tracker. Do not fully attach the drip loop until the ground wire is ready also, then all wires can be bundled together.



Completed drip loop with one circuit plus ground wire.

Installing the optional T-21 module grounding kit

Install a ground lug on each module at its ground hole closest to the center of the tracker. The grounding kit includes 10-32 stainless screws which are meant to cut threads in the module frame, creating a good bond. Some modules have grounding holes which are ready to accept the included screws which can be carefully threaded in with a cordless drill, preferably one with a clutch to avoid stripping the aluminum. Other modules may need different hardware to mount the lugs, or different holes added.

The longer, 30' of stranded #6 bare copper wire will run through the ground lugs. Place the crimped splice on the longer side of the stranded #6 at the location of the one hole strap on the center/east rail. Run the #6 back to the nearest lug and tighten the lug screw onto the wire. Run the #6 to the next lug. Use pliers to grab the wire and lever the wire tight using the inside edge of the next module frame as you tighten the lug screw. Continue to run the ground wire on around until you have made a complete loop around the tracker and have hit every lug. Check that you have installed a lug on each panel. Cut the excess ground wire and bend the end back toward the lug.

The shorter section of stranded copper is long enough to reach a ground rod at the base of the pole. That section of wire may also go directly to a combiner box on the pole if preferred. Complete the drip loop as shown in the photo above.

When the tracker is complete and you are certain it is accurately pointed to the south, tighten the set screws on the base and drill through the 1/4" hole in the side of the base into the pole, and hammer in the 1/4" roll pin. This completes assembly of the tracker; wiring of the actuator and the control board are described in the C-6 Owner's Manual.

Maintenance

All bolted connections must be inspected annually. The set screws in the base should be inspected and tightened if necessary annually. The rubber boots on the actuators should be inspected and replaced if torn. Replacements are available from SunArx. This is important to prevent water from getting into the actuator.

All moving parts must be lubricated periodically. The grease zerks on the main pivots will accept a standard grease gun. Other moving parts can be sprayed with WD-40 or Rust Inhibitor such as LPS to limit rusting, or disassembled and greased for maximum protection.

SunArx® Limited Warranty

SunArx® warrants to the original purchaser that the T-21 tracker frame shall be free from defects in materials and workmanship for a period of ten (10) years from the date of purchase. SunArx® warrants to the original purchaser that the linear actuator shall be free from defects in materials and workmanship for a period of five (5) years from the date of purchase. SunArx® will repair, or replace at their option, any T-21 or linear actuator that is determined to be defective in material or workmanship under the terms and conditions of this document. SunArx® reserves the right to elect, at its sole discretion, to give you a refund of your purchase price instead of a replacement. This is your exclusive remedy for defective products.

- The SunArx® product must have been installed in accordance with the installation instructions.
- The defective item must be received by SunArx® no later than one (1) week after the end of the warranty period.
- Return shipping is to be pre-paid by the original purchaser.
- The T-21, linear actuator, and/or their components must not be modified or altered in any way from original state unless modifications are made by an authorized source or have been previously authorized in writing by SunArx®.

This limited warranty does not cover:

- Accidental or intentional damage.
- Damage due to winds over 90mph, tornados, hurricanes, floods, earthquakes, ice storms, etc.
- Damage due to improper installation, misuse, abuse or neglect..
- Corrosion or cosmetic appearance.
- Damage to product that occurs during its shipment, storage, or installation.
- Solar panels, equipment, materials, or supplies not manufactured by SunArx®.

SunArx® IS NOT LIABLE FOR ANY DAMAGES CAUSED BY THE PRODUCT OR THE FAILURE OF THE PRODUCT TO PERFORM, INCLUDING ANY LOST PROFITS OR SAVINGS OR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.