



July 16, 2009

A large, faint, stylized sun with wavy rays is centered in the background. The sun has a red and orange core with yellow rays.

Tap The Sun

10 Camino del Senador Tijeras, NM 87059-7631

505-281-0399 Voice  505-281-4248 Fax

www.tapthesun.com



SolarTrak® Prospector™ Series

Installation and Operation Guide

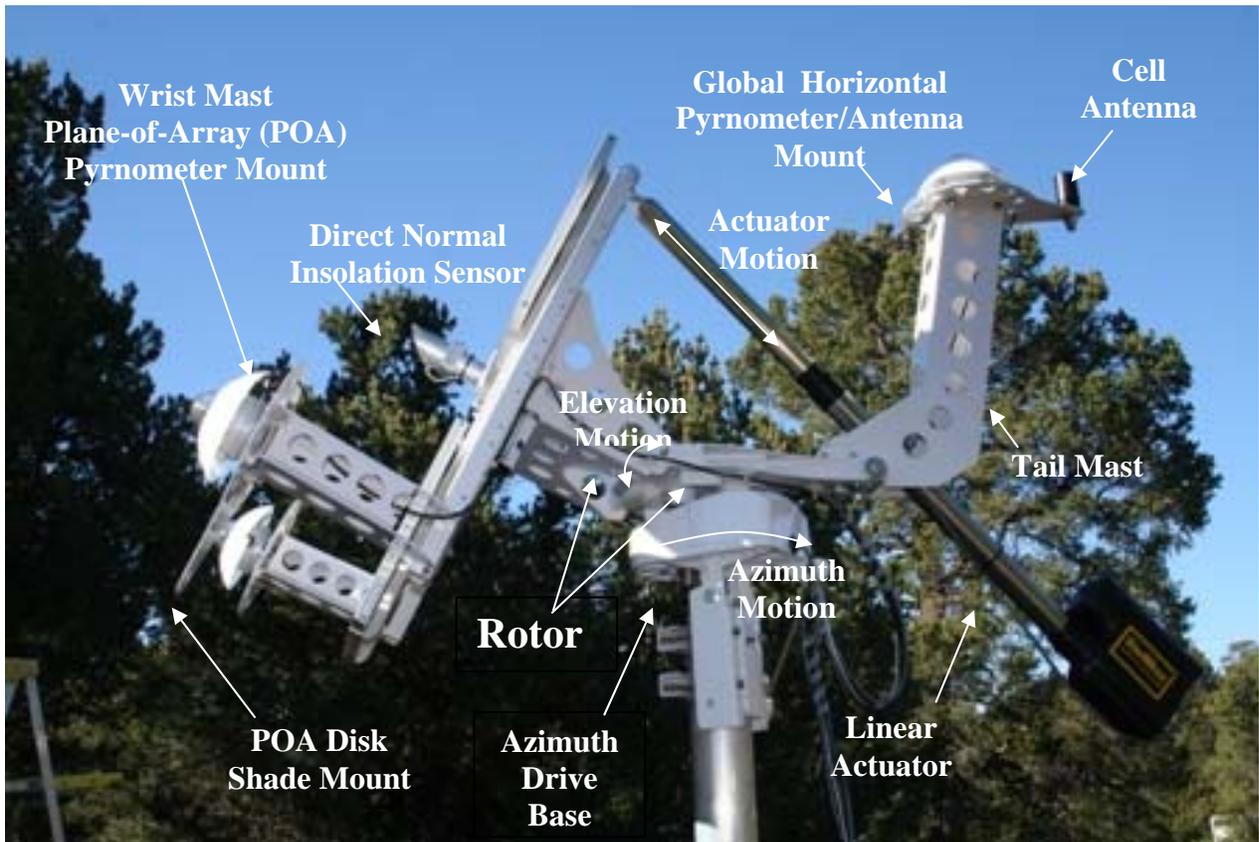


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Overview

The SolarTrak® Prospector™ with its optional models; the Assayer™ and Observer™ is a compact, single-pole-mounted solution for solar radiation and weather data collection and reporting. The Prospector offers a two-axis tracking platform for direct-normal solar radiation sensors and plane-of-array global or diffuse radiation sensors as well as single-axis mounts for measuring diffuse solar radiation with a shaded global, horizontally-mounted radiation sensor. The unique geometry and resulting appearance provide non-conflicting sight lines for up to twelve solar radiation instruments, a six-piece weather station and the dependability of stand-alone power provided by photovoltaic panels and high-capacity batteries. The standard Prospector model utilizes a high-quality datalogger equipped with cellular-modem Internet communications and an on-board Compact Flash card and hardwire Ethernet connection. The Assayer™ model also includes additional differential or single-ended voltage inputs for monitoring energy production and thermal data from nearby solar collection systems. The Observer™ model includes an outdoor-rated, high-quality video camera for site monitoring and visual data confirmation.



Shipped Components

The SolarTrak Prospector comes with many different options. Check your packing slip to see which of the following components you have received:

1 Azimuth Motor Base with Mounting Brackets Attached



1 Elevation Rotor Assembly



1 Linear Actuator either
- Von Weisse
- PowerTech (Moteck)



1 Tail Mast



2 Wrist Masts



1 Reflective Pointer



1 Control Cabinet



Vertical Cabinet Option



Horizontal Cabinet Option

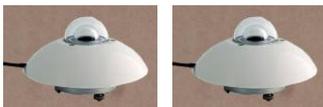
3 Pyrometer Mounting Plates



1 DNI Sensor Mounting Bracket



2 Pyrometers Hukseflux model SR11



1 DNI Sensor Hukseflux Pyrheliometer model DR01



12 screws:
14-20 x 1/2"



12 Cable Ties



8 Adhesive Cable Tie Anchors



2 feet Wire Wrap

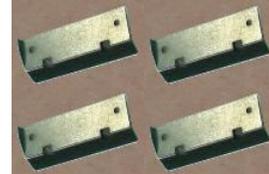


Optional Items: Weather Station

3 Instrument Booms



4 Boom Mounting Brackets – Plain



2 Boom and Weather Plate Mounting Brackets



2 Hose Clamps



1 Pre-assembled Atmospheric Sensor Plate



1 Rain Gauge with Mounting Plate and Bracket



1 Wind Vane



1 Anemometer



Optional Items: ShadowBand

1 ShadowBand with non-lethal bird spikes



1 ShadowBand boom half, R



1 ShadowBand mast



1 ShadowBand boom half, L



12 Offset Spacers

Hardware

- (4) 10-32 x 5/8" S/S screws
- (1) 10-32 x 3/8" S/S screw
- (12) 1/4-20 x 3/4" S/S screws

Optional Items: Cellular Antenna

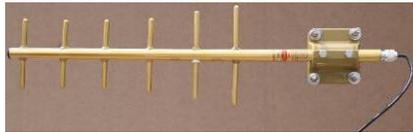
1 Omni Cellular Antenna or



1 Mounting Plate or



1 Yagi Cellular Antenna



Yagi Antenna Boom Attachment Mount



Optional Items: Disk Shade

1 Disk Shade with Standoff Pole Mount

1 Mounting Plate



Optional Items: Portable Stand / Non-penetrating Roof Mount

6 base rails



1 torque strap



2 front braces



1 8' post



2 62" rear braces



2 72" rear braces



2 5" rubber mats (optional)



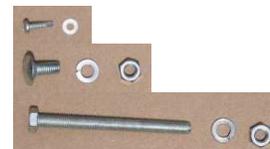
2 16" rubber mats (optional)



4 #8 self-tapping screws with washers

14 M8 x 18mm carriage bolts with split-lock washers and nuts

3 M8 x 90mm hex bolts with split-lock washers and nuts



Assembling the SolarTrak Prospector

Requirements

Location

- **Line of sight:** Your location must have an unobstructed view of the track of the sun during all seasons.
- **Clearance:** The top 30" of your mounting post must be clear of obstacles for a 36" radius about the post.
- **Access to the site** after installation weekly to clean the instrument lenses.

Mounting Post

- 3" OD (3.5" Max OD) Steel Pipe or Tube for most applications. Do not exceed 5' of unsupported length for aluminum tube. The mounting post needs to support 200 pounds vertical force and 75 pounds lateral force.
- Typical ground-mount installation has a minimum hole diameter of 12" with 50% penetration (1/2 foot in the ground for every foot above ground, for example: 4' deep for 8' above ground).
- Minimum height 8' above ground with weather station, 6' above ground without weather station.
- Optional non-penetrating 8' roof mount with full ballast (ballast not included).

Position:

- The longitude and latitude of your SolarTrak Prospector installation, accurate to within one-hundredth of a degree.

Computer:

- If using the PC Interface, a portable computer running DOS, Windows 95 or 98.

Tools Required

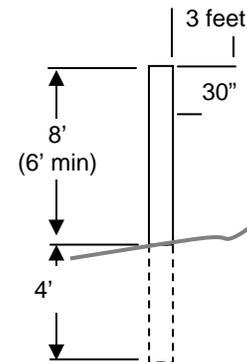
- 3/4" Open/Box Hand Wrench
- 3/4" Socket and Ratchet Handle (or 2 of #1)
- 13mm Deep-Socket or Hand Wrench
- Qty. (2) 5/8" Open/Box Hand Wrench
- 9/16" Open-End Hand Wrench
- 3/16" Hex Key (T-Handle Driver or Allen Wrench)
- 7/16" Nut Driver, Socket or Open/Box Wrench
- #2 Phillips Screwdriver

Assembly Procedures

A.1 Assemble the Mounting Post

If using your own mounting post, the post must meet these criteria:

- **Diameter:** 3" (OD) (3 ½" Max OD)
- **Length above ground:** at least 6', 8' with weather station
- **Thickness:** 1/8"
- **Load:** at least 200 lbs vertical and 75 lbs horizontal
- **Clearance:** the top 30" must have at least 3 feet clear on all sides.
- **Mount in Ground:** recommend burying the post at least 4' in the ground with a minimum of 12" of cement around it



If using the optional non-penetrating roof mount, assemble according to the instructions provided with the roof mount.

Note: Make sure to put enough weight on the base of the roof-mount to counter any winds you may expect at your site. The mount is designed to hold 14 standard-sized cement blocks.

Assembling the Non-penetrating Roof Mount

For this procedure, you will need:

- 6 – base rails
- 2 – 16" rubber mats (optional)
- 2 – 5" rubber mats (optional)
- 1 – 8' post
- 1 – torque strap
- 2 – front braces
- 2 – 62" rear braces
- 2 – 72" rear braces
- 4 – #8 self-tapping screws with washers
- 14 – M8 x 18mm carriage bolts with split-lock washers and nuts
- 3 – M8 x 90mm hex bolts with split-lock washers and nuts
- water-resistant shim material
- 13mm deep-well socket or wrench
- Phillips screwdriver
- compass

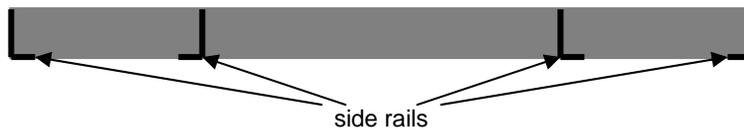


1. Lay the six rails out on the ground to form the base of the roof mount.

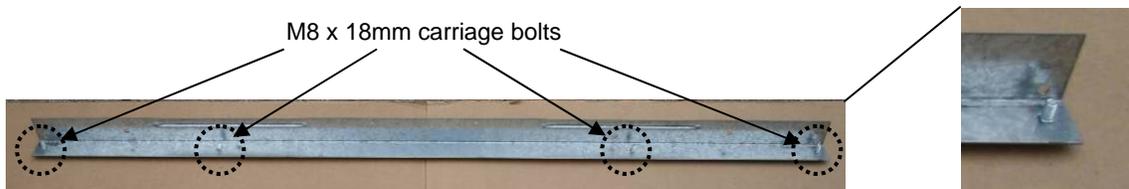


The narrower side of the rail is the base, the taller side is up. 

The four side rails must face each other to form a trough on either side of the base.



2. Slide four M8 x 18mm carriage bolts up through the four square holes in the bottom of the end rails.



3. Fit the ends of the side rails over the carriage bolts in the end rail and fasten them with lock washers and M8 hex nuts. Tighten them with a 13mm wrench or socket until **snug but not tight**.

Attach the rails on both ends.



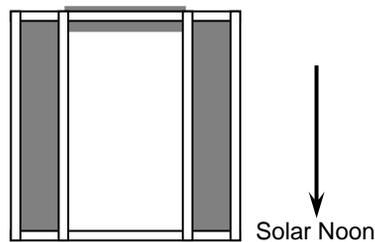
4. If you will be using this frame on a surface you want to protect, slide the two 16" rubber mats under the side rails. Then stack the two 5" rubber mats and slide them under the end rail where you plan to attach the post.



5. Attach the two 16" mats at either end of the frame with a #8 self-tapping screw and a washer.



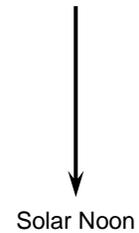
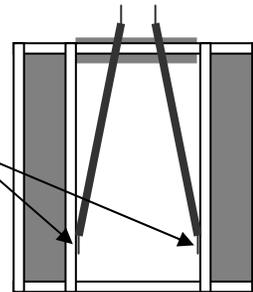
6. Make sure the frame is square and tighten all the bolts.
7. Orient the mount so the end where you plan to attach the post faces due north (away from solar noon).



8. Attach a 62" rear brace to each of the inner side rails at the second hole from the south end (toward solar noon). Use an M8 x 18mm carriage bolt, lock washer, and nut.

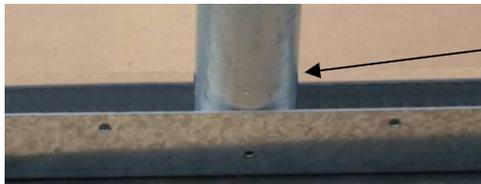


62" rear braces

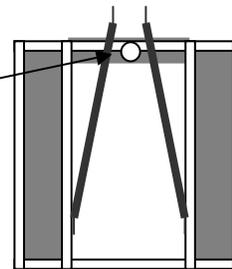
2nd hole

Solar Noon

9. Stand the 8' post on the inside edge of the center of one end rail so that the bolt hole in the base of the post lines up with the hole in the middle of the rail.

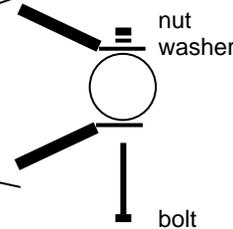
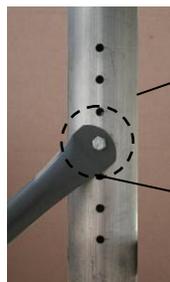


8' post



10. Place a level on the north side of the post.

11. While holding the post plumb, raise the rear braces to the bolt hole in the post which lines up with the ends of the braces. If the holes do not exactly line up, lean the post toward the frame to the first hole that does line up. Attach them with an M18 x 90mm hex bolt, lock washer, and nut.

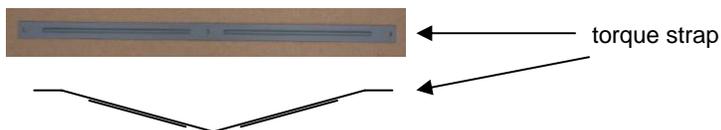
nut
washer

bolt

12. Slide an M8 x 90mm hex bolt through the frame and through the post.



13. Bend the torque strap slightly at the middle and both ends.



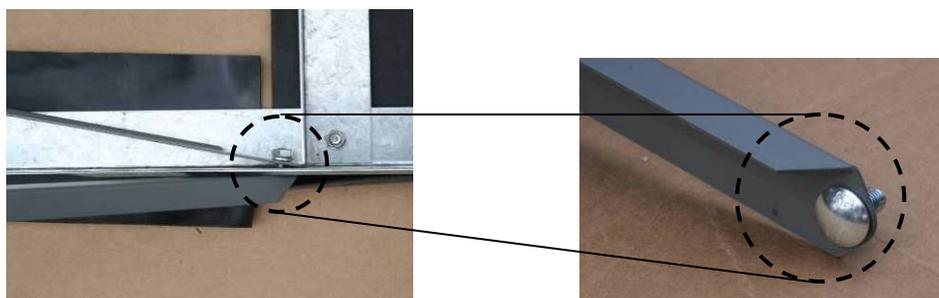
14. Slip the torque strap around the base of the pole so the center hole on the strap slides over the bolt holding the pole to the base and the two ends line up over the square carriage bolt holes in the frame.



15. Tighten an M8 hex nut and washer on the bolt where it comes through the torque strap.



16. Attach a front brace to the frame member so that a carriage bolt passes through the end of the front brace, through the end rail and through the hole in the end of the torque strap.

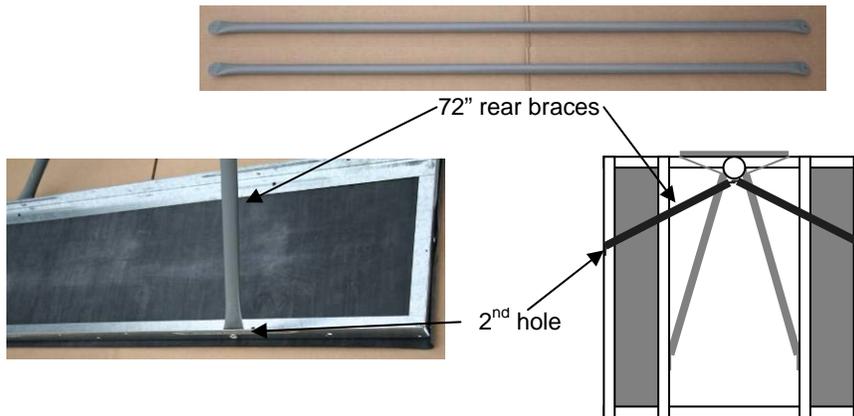


Attach both front braces, one on either side of the post.

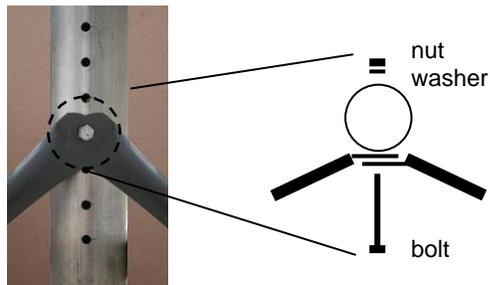
17. Attach both front braces to the post with an M8 x 90mm hex bolt, lock washer, and nut.



18. Attach a 72" rear brace to the second hole from the north end (away from solar noon) of an outer side rail. Repeat with the other 72" rear brace on the other outer side rail.



19. Raise the 72" rear braces to the bolt hole in the post that lines up with the ends of the braces. Attach them with a hex bolt, lock washer, and nut.



20. Place a level on the east or west side of the post and check it for plumb in the east-west direction. Shim the sides of the frame if necessary with weatherproof shim material to make the post plumb.

Note: The post needs to be plumb within the adjustment range of the Prospector azimuth base mount, $\pm 3^\circ$.

A.2 Attach SolarTrak Control Cabinet to Post

Vertical Control Cabinet on Optional Portable Stand / Roof Mount

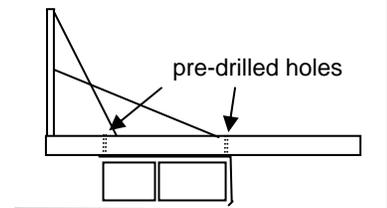
For this procedure you will need:

- Portable Stand / Non-penetrating Roof Mount
- Vertical Control Cabinet
- Two 5/16"-18 x 3 1/2" bolts with split lock washers or
- Two 4" U-bolts with split lock washers and nuts
- 1/2" deep-well socket or wrench
- A large sheet of cardboard or a blanket

The vertical control cabinet weighs approximately 65 lbs and may be difficult for one person to mount on a vertical post. Therefore, it is best to lay the cabinet face down, mount the post onto its back, and then lift the post.

Important: Mount the control cabinet so that the glass faces north (or away from solar noon). This will minimize heat build up and direct sun exposure.

1. Clear a work space on the floor at least 12 feet long. Place a blanket or piece of cardboard on the ground to protect the control cabinet from scratches.
2. Lay the control cabinet on the ground with the glass face down.
3. Position the post over the back of the cabinet so that the pre-drilled screw holes in the post line up with the threaded holes in the back of the cabinet.
4. Slide a split lock washer and a flat washer onto two 5/16"-18 x 3 1/2" bolts and slide the bolts through the pole into the cabinet. Tighten the bolts with a 1/2" socket.



Note: You can use U-bolts instead of the two 5/16"-18 x 3 1/2" bolts to mount the cabinet to the post.

5. Tilt the pole back upright with the cabinet attached, orient the ballast platform toward south (toward solar noon), level the post, and add some ballast immediately. You can use cement blocks, sand bags, or any appropriate ballast.

Note: You can mount the cabinet with U-bolts at any height. Keep in mind there must be at least 30" of clearance between the top of the box and the base of the SolarTrak Prospector unit.

Horizontal Control Cabinet on Optional Non-penetrating Roof Mount



For this procedure you will need:

- Portable Stand / Non-penetrating Roof Mount
- Horizontal Control Cabinet
- Two 4" U-bolts with split washers and nuts
- ½" deep-well socket or wrench

The horizontal control cabinet weighs approximately 35 lbs and can be lifted into place to mount. It should be mounted with u-bolts for proper stability.

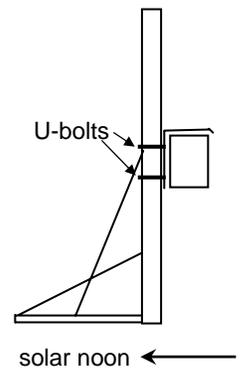
Important: Mount the control box so that the glass faces north (or away from the solar noon). This will minimize heat build up and direct sun exposure.

1. Assemble the roof mount according to the instructions
2. Lift the control box and line the pre-drilled holes on the back of the cabinet up with the post, approximately 3' – 5' from the ground.
3. Slide a U-bolt over the pole into the top two holes.

Note: If you slide the U-bolt over the over the post above where the rear braces attach to the post, you can rest some of the weight of the cabinet on the braces until you tighten the U-bolts.

4. Fit a flat washer, split lock washer and nut onto each end of the u-bolt and tighten with a socket.
5. Slide the second U-bolt into the lower set of holes and tighten.
6. Orient the ballast platform toward south (toward solar noon) and add some ballast immediately. You can use cement blocks, sand bags, or any appropriate ballast.

Note: You can mount the control box at any height. Keep in mind that there must be at least 30" of clearance between the top of the box and the base of the SolarTrak Prospector unit.



Mounting the Control Cabinet on other 3" or 3 ½" Posts

You can mount the control cabinets onto any pole or surface, as long as they are close enough to the SolarTrak Prospector unit for the wires to reach easily and at least 30 inches below the top of the pole to allow space for the movement of the Prospector. The control cabinets have the following pre-drilled mounting holes:

- centered, threaded for mounting with a 5/16"-18 x 3 ½" bolt on the vertical cabinet
- centered, unthreaded for mounting with a 5/16" bolt or screw on the horizontal cabinet
- 3 ½" apart for U-bolts
- 12" apart for mounting on UniStrut.

A.3 Mount the Azimuth Drive Base

For this procedure, you will need

For this procedure, you will need:

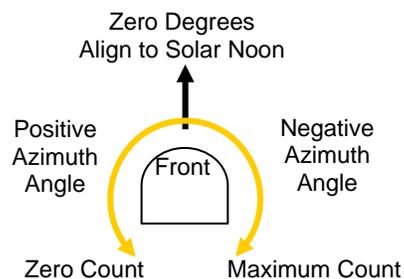
- 1 – Azimuth drive base
- 13mm deep-well socket or wrench
- Compass



The azimuth drive base must be aligned to solar noon and mounted to the post.

Note: If you are using a 3 1/2" (OD) post, remove the front clamps from the U-bolts before proceeding.

1. Determine the direction of solar noon. The front of the azimuth drive base must point as closely as possible toward solar noon.



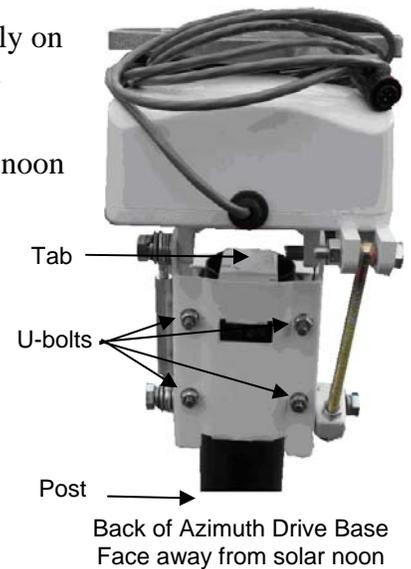
- **Northern hemisphere, north of 23° north:** Solar noon is due south.
- **Southern hemisphere, south of 23° south:** Solar noon is due north.
- **Tropics:** Within the tropics, (between 23° north and 23° south), the Prospector must point toward the equator during the summer months and away from the equator during the winter months. Therefore, you must re-orient the base on the pole twice a year, within two days of the day the sun is directly overhead. This re-orientation supports the geometric sight line requirements of the instruments.

If using the optional portable stand / roof mount, rotate the ENTIRE stand then re-level the base and post. See the steps for assembling the roof mount in Procedure 1 for instructions on leveling the post.

In addition to rotating the base 180°, you must also level the azimuth drive, perform a reference check, and reset the solar offset. Combined with the necessary weekly site visit to clean the instrument lenses these procedures should require only an additional 30 minutes or less on each of the two trips to accomplish this re-orientation.

See the table in the appendix for a list of dates to reorient your Prospector for your latitude.

- **Equator:** Solar noon is due north from the vernal equinox (March 20) to the autumnal equinox (September 23) and due south during the other half of the year.
2. Loosen the nuts on the U-bolts to near the end of the bolt.
 3. Slide the mounting bracket over the post so that the tab rests firmly on the top of the post. You may need to wiggle the U-bolts and front brackets to allow the base to slide onto the post smoothly.
 4. Make sure the front of the azimuth drive base is pointing to solar noon for your latitude and season.
 5. Tighten the U-bolts with the 13mm deep-socket or wrench. Make sure that the U-bolts are straight (perpendicular to the post) so that thermal cycles will not loosen them over time. As you tighten each U-bolt, wiggle it up and down to find its “sweet spot” where it is the loosest before continuing.



A.4 Assemble the Tracking Rotor

For this procedure, you will need

- 1 – Elevation Rotor Assembly



1 Linear Actuator
either

- Von Weise
- PowerTech (Moteck)



- 2 – ¾” sockets or wrenches

The tracking rotor consists of the azimuth deck, riser, and elevation deck. It is pre-assembled except for the linear actuator (screwjack). A wooden strut holds the assembly rigid for shipping. You will replace the wooden strut with the screwjack. Use two ¾” wrenches for this step.

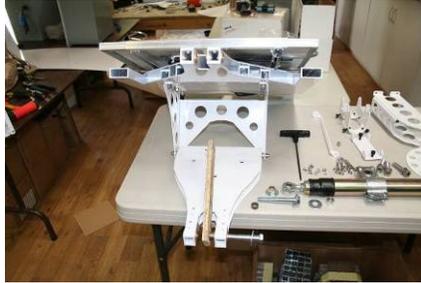
Warning: Do not loosen the clamp on the linear actuator. It has been precisely positioned at the factory. The position of the clamp determines part of the mathematical geometry of the tracking rotor and moving it will adversely affect tracking accuracy.

1. Place the tracking rotor assembly with the PV panels facing up on the edge of a table or vehicle tailgate so there is at least 18” of space below the brackets for the actuator.

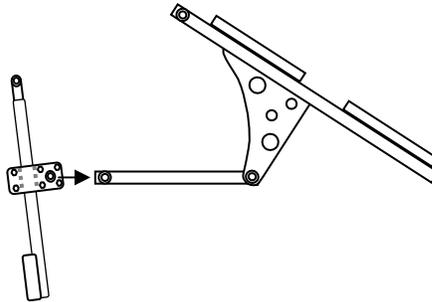


Make sure that the majority of the weight of the unit is supported on the table.

- Remove the wood strut (note position of the brass spacers). **Gently** lower the top half of the assembly onto the table.

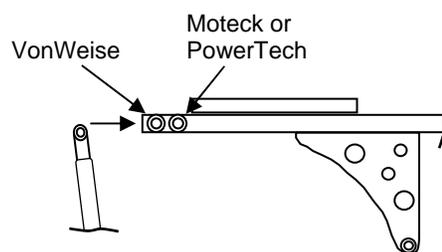


- Insert clamp on the jack into the bottom connection.



Replace the bolt, washers, brass spacers, and nut in the same position they were when the wood strut was in place. Tighten just enough to be snug against the sides of the assembly with two $\frac{3}{4}$ " sockets or wrenches.

- Insert the top of the jack into the top connection on the assembly. If you have the VonWeise brand screwjack (gold/brass color), use the outermost hole of the two provided. If you have the Moteck or PowerTech brand jack (gray color), use the inner hole;



Replace the bolt, washers, brass spacers, and nut and tighten them just until snug against the sides.



A.5 Mount the Tracking Rotor to the Azimuth Drive Base

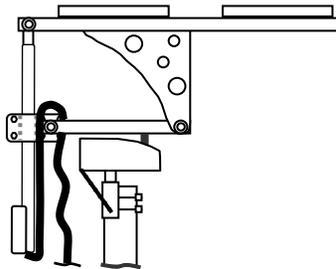
This step requires three ½” x 2” bolts with split-lock washers.

1. Place the completed rotor on the azimuth mounting plate.



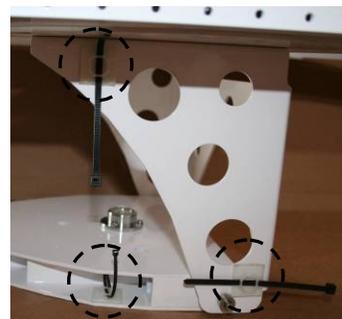
Note: you can use the linear actuator as a handle to lift the unit without damaging anything.

2. Align the three mounting holes and insert the three ½” x 2” bolts with split-lock washers.
3. Tighten only until the lock washer has been fully compressed. Further tightening can warp the azimuth deck and skew the reading of the bubble level.
4. Uncoil the wire from the actuator and run it up along the body of the actuator past the clamp and then over the hinge bolt for the clamp and then down through the hole in the bottom section of the tracking rotor in front of the actuator clamp.

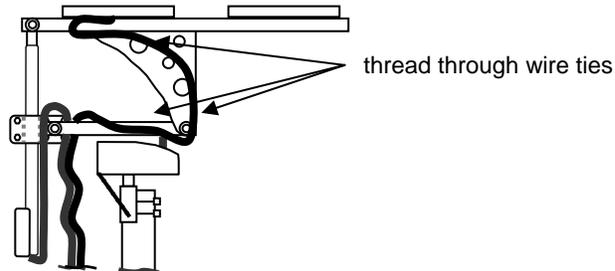


This allows the actuator to pivot without binding the wire.

5. Slide three wire ties through the anchors on base and the hinged part of the tracking rotor.



- Pass the cable from the photovoltaic array through the wire ties where indicated by the illustration and just close the ends of the wire ties. Then pass the wire down through the hole in the lower frame along with the cable from the linear actuator.



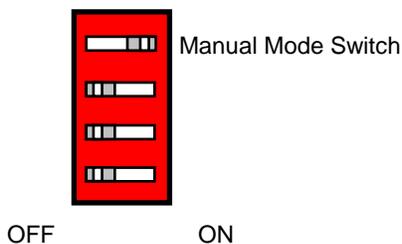
Note: Close but **do not tighten** the wire ties. You will need to thread the wires from the instruments through them later



A.6 Connect the Batteries, Photovoltaic Panels, and Motors to the Controller

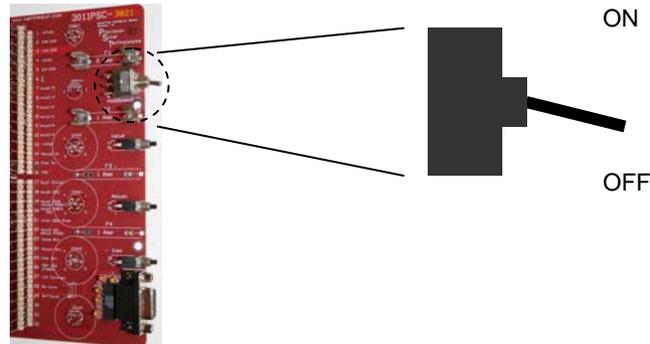
Overview: Connect the batteries and solar panel cable in this step so the batteries can start charging while you assemble the rest of the Prospector. Connect the azimuth and elevation motors so that you can move the Prospector to make it easier to perform the rest of the assembly.

- Make sure the SolarTrak controller is switched into manual mode. Open the glass door on the control cabinet. On the main control board is a red box containing four dip switches. Make sure the top switch is switched to the right (on) and that the remaining three are switched to the left (off).



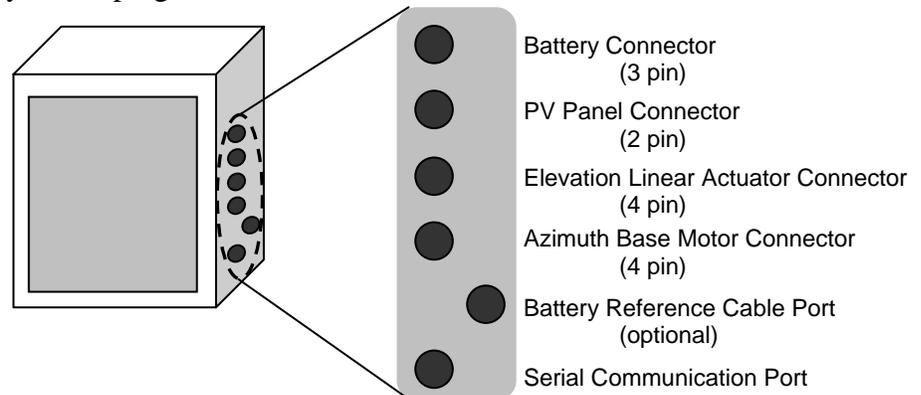
Note: Keep the controller in manual mode until you have finished assembling the Prospector.

2. Make sure the power switch for the SolarTrak controller is turned off. On the right side of the control cabinet is a board with a toggle switch above three small buttons and a serial port. Make sure the toggle switch is in the down (off) position.



The glass-door box in the control cabinet contains the SolarTrak controller. The box has five (optionally six) weatherproof connectors on the right side.

Each connector will only fit the plug on the correct cable.



3. Connect the battery cable from the lower box in the control cabinet to the top connector in the controller box. Twist the ring on the cable connector until it locks. You are compressing an O-ring so it may be a little stiff.
4. Connect the cable from the PV panel to the second connector from the top.
5. Connect the cable from the linear actuator (screw jack) to the third connector from the top.
6. Connect the cable from the azimuth base motor to the fourth connector from the top.
7. Turn the power switch on the controller on (up).

Note: The battery will not start charging until the power is turned on.

A.7 Assemble Plane-of-array (POA) Wrist Mast Pyrometer Mounts

For this procedure you will need

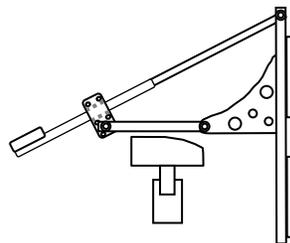
- 2 – wrist masts
- 2 –pyrometer mount plates
- 1 – pyrometer mount plate with flip-shade mount (optional)
- 1 – pyrometer (2 optional)
- 1 – Disk shade
- 12 – 10-23 x 3/8” screws with split-lock washers
- 8 – 1/4-20 1/2” screws with split-lock washers (12 optional)
- 4 – 1/4-20 stand-off couplers (optional)
- Philips screwdriver
- 7/16” wrench



Note: if you are only using one POA pyrometer, you can choose to attach only one wrist mount, or you can mount the second wrist mount as a convenient mount for temporary calibration equipment.

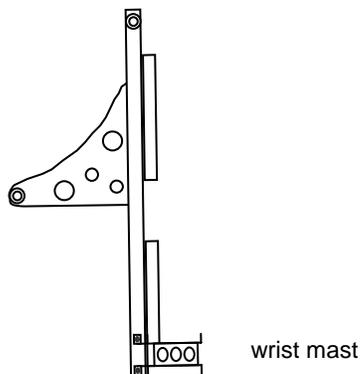
If you plan to use the optional ShadowBand on the tail mast, the assembly of the wrist mounts contains two additional. Steps 3 and 4 add a spacer to the wrist mast so that the instruments on the wrist masts will be level with the instruments on the tail mast when the screw-jack is fully retracted. Skip steps 3 and 4 if you do not plan to use the ShadowBand on the tail mast.

1. To make it easier to mount the wrist mast on the prospector, use the joystick on the control board to tilt the prospector as close to vertical as you can. Push the joystick down to tilt the prospector toward vertical.



Note: The joystick has a built-in four-second delay. After each movement, it waits four seconds before responding to the joystick and moving again. This allows time for the system to come to a complete stop before turning the motor on again.

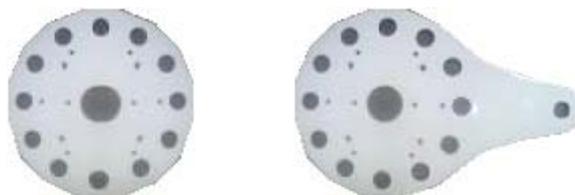
2. Place the wrist mast assembly on the prospector so that it lines up with the screw holes furthest toward the front of the unit, away from the screw jack.



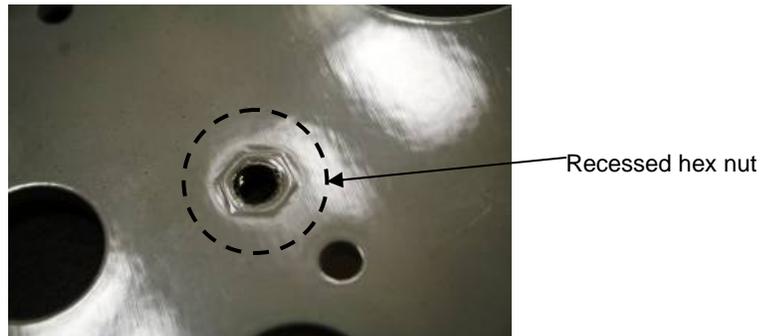
3. Insert six 10-32 3/8" screws with lock washers and tighten them.



4. Select the pynometer mounting plate. If you plan to use the pynometer without a shade, use the round mounting plate. If you plan to use the optional disk shade, use the more oblong mounting plate.



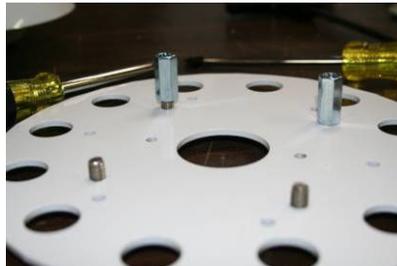
5. Locate the nut side of the mounting plate. The mounting plate has four threaded hex-nuts recessed into its surface, faintly visible on one side of the plate.



6. **If using the optional ShadowBand on the tail mast:** Insert four ¼-20 ½” screws and split-lock washers from the ‘nut’ side of the pynometer mounting plate. Tighten the screws until the lock washers compress.



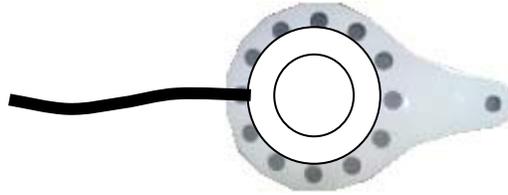
7. **If using the optional ShadowBand on the tail mast:** Attach and tighten four ¼-20 standoff couplers to the screws poking through the mounting plate



8. Hold the pynometer glass-side down in one hand. Rest the mounting plate, nut-side down (couplers facing up), on the feet of the pynometer. Line up the two holes closest to the center of the mounting plate with the screw holes on the back of the pynometer.



If you are using the optional disk shade, align the pynrometer so the power cord comes out opposite the oblong disk shade mount on the mounting plate.

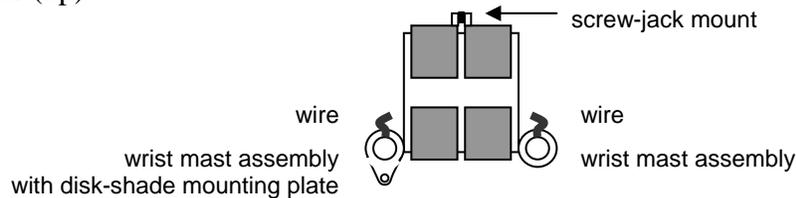


9. Insert two 10-32 black plastic thumb screws through the mounting plate and screw them into the pynrometer. Tighten the thumb screws until secure.

Note: You will level the pynrometers after you have finished assembling the prospector and leveled the entire unit.

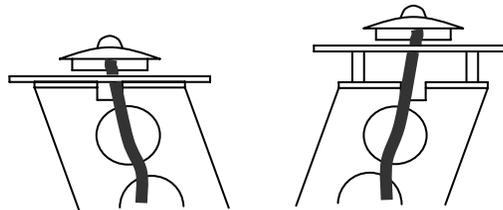
10. Line up the four threaded screw holes in the mounting plate (or the four couplers) with the four holes on the top of the wrist mast.

Align the pynrometer so that the wire will be on the side of the wrist mast facing the back of the Prospector (up).



If you are using the disk shade mounting plate, align it so the disk shade mounting hole will point to the front of the Prospector (down).

11. Insert four ¼-20 ½” screws with lock washers through the screw holes in the wrist mast into the threaded holes in the mounting plate and tighten them.
12. Run the wire from the pynrometer through the nearest hole in the mounting plate and then in through the second round hole in side of the wrist mast and along inside the wrist mast.



A.8 Assemble the Tail Mast Pynrometer Mount and optional ShadowBand

For this procedure you will need

- 1 – tail mast
- 1 –pynrometer mount plates
- 1 – pynrometer mount plate with antenna mount (optional)
- 1 – pynrometer
- 1 – ShadowBand with non-lethal bird spikes (optional)
- 1 – ShadowBand boom half, R (optional)
- 1 – ShadowBand boom half, L (optional)
- 1 – ShadowBand mast (optional)
- 1 – Omni antenna (optional)
- 4 – ¼-20 x ½” screws with split-lock washers
- 4 – ¼-20 x 2” hex-socket cap screws with split-lock washers and nuts
- 4 – 10-32 x 5/8” S/S screws (optional)
- 1 – 10-32 x 3/8” S/S screw (optional)
- 12 – ¼-20 x 3/4” S/S screws (optional)
- 4 – ¼-20 stand-off couplers (optional)
- Philips screwdriver
- 7/16” socket or wrench
- 3/16” hex key



The tail mast holds a pyrometer and can optionally hold a ShadowBand for the pyrometer and an optional omnidirectional cellular antenna. The pyrometer on the tail mast measures the global horizontal solar irradiation without the ShadowBand or the horizontal diffuse irradiation with the ShadowBand.



tail mast with optional Omni cellular antenna



tail mast with optional ShadowBand

It is easier to mount the pyrometer to the tail mast before mounting the mast to the Prospector.

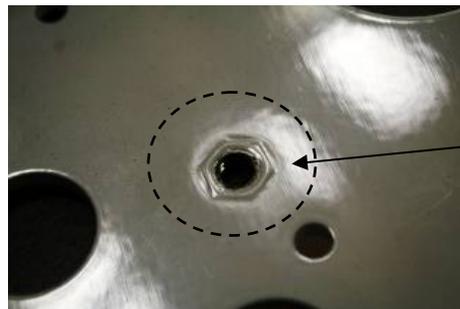
If you plan to use the optional ShadowBand on the tail mast, the assembly contains several more steps. The steps are clearly marked with a ShadowBand icon. If you are not using the ShadowBand, skip those steps.

If you plan to use the optional omnidirectional antenna, the assembly contains some extra steps. The steps are clearly marked with an antenna icon.

1. Select the pyrometer mounting plate. If you do not plan to use the optional cellular antenna, use the round mounting plate. If you plan to use the optional cellular antenna, use the more oblong mounting plate.



2. Locate the nut side of the mounting plate. The mounting plate has four threaded hex-nuts recessed into its surface, faintly visible on one side of the plate.

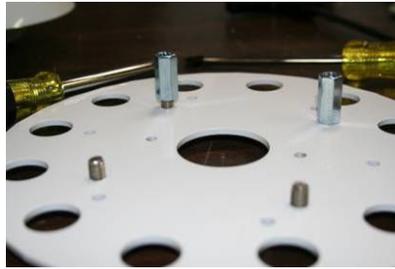


Recessed hex nut

3. **If using the ShadowBand:** Insert four ¼-20 ½” screws and split-lock washers from the ‘nut’ side of the pynometer mounting plate. Tighten the screws until the lock washers compress.



4. **If using the ShadowBand:** Attach and tighten four ¼-20 standoff couplers to the screws poking through the mounting plate

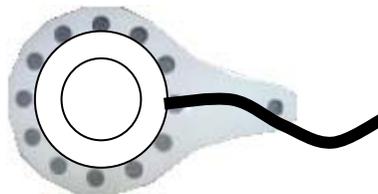


5. Hold the pynometer glass-side down in one hand. Rest the mounting plate, nut-side down (couplers facing up), on the feet of the pynometer. Line up the two holes closest to the center of the mounting plate with the screw holes on the back of the pynometer.



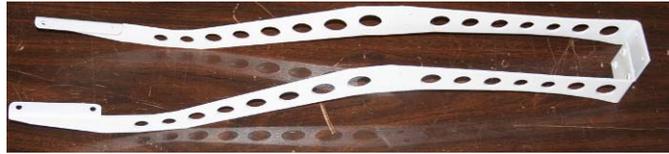
(((()))

If using the Omni antenna, align the pynometer so the power cord comes out along the oblong antenna mount on the mounting plate.



6. Insert two 10-32 black plastic thumb screws through the mounting plate and screw them into the pynometer. Tighten the thumb screws until secure.

7. **If using the ShadowBand:** The ShadowBand mounting boom comes in two pieces. The left piece has threaded screw holes on one end and is slightly shorter than the right piece. Line the two pieces of the mounting boom up so that the bent end of the right side folds over the bent end of the left side



Loosely thread 10-32 3/8" screw through the end to hold the two pieces together.

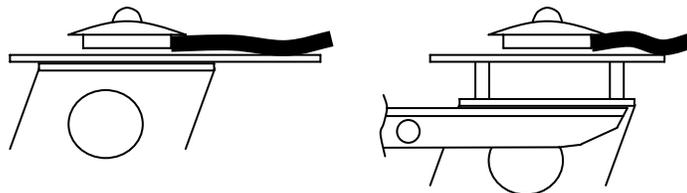


8. **If using the ShadowBand:** Lay the rear mast on a work surface. Tuck the flanges on the ShadowBand mounting boom under the tail mast flange.



9. Line up the four threaded screw holes in the mounting plate or the four couplers with the four holes on the top of the tail mast.

Align the plate so that the wire from the pyrometer runs out the back of the assembly (away from the ShadowBand).

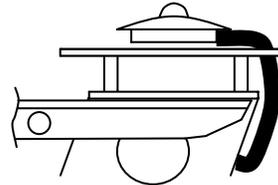
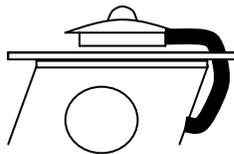




10. Insert four ¼-20 ½” screws with lock washers through the screw holes in the flanges on the ShadowBand mounting boom and the tail mast into the threaded holes in the mounting plate or the couplers and tighten them.



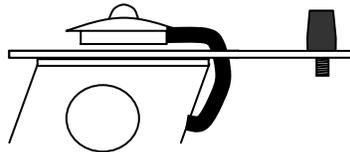
11. Run the wire from the pynrometer through the nearest hole in the mounting plate and then through the top hole in the tail mast so that it runs down inside the mast.



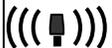
12. **If using the omni cellular antenna:** remove the wire and the mounting nut from the base of the antenna.



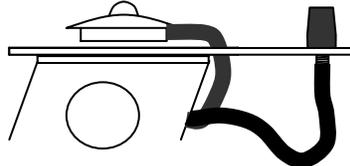
13. **If using the omni cellular antenna:** Slide the base of the antenna through the hole in the oblong end of the pynrometer mounting plate so the antenna sits beside the pynrometer.



14. **If using the omni cellular antenna:** Replace the mounting nut on the antenna and tighten it.



15. **If using the omni cellular antenna:** Reattach the wire and run it through the same hole in the tail mast as the wire from the pynrometer.



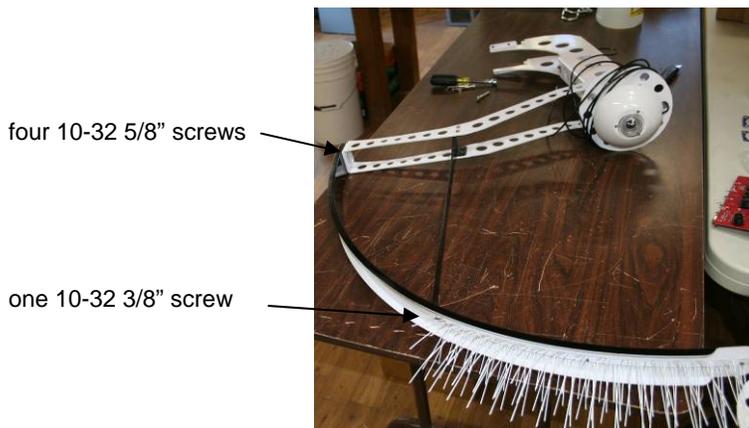
16. **If using the ShadowBand:** Slide the ShadowBand mounting post into the ShadowBand mounting boom so that the screw-holes line up and the black side faces the pynometer.



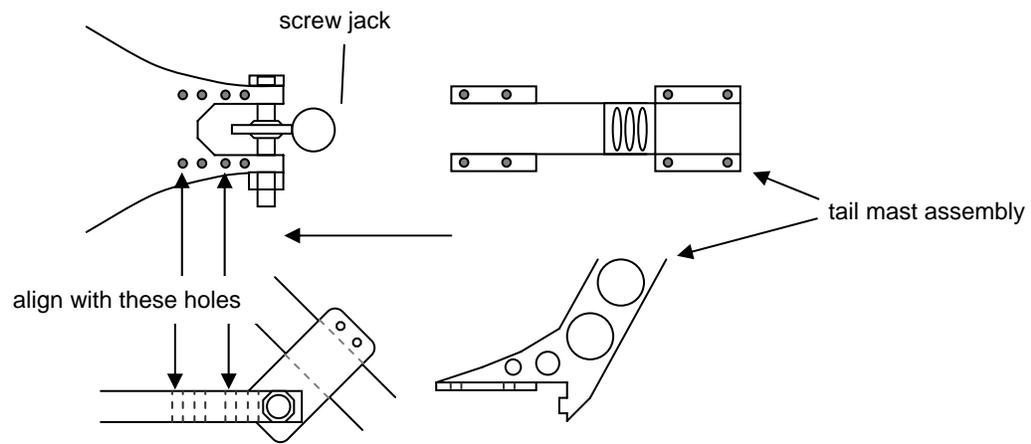
17. **If using the ShadowBand:** Insert four 10-32 3/8" screws with lock washers and tighten them.



18. **If using the ShadowBand:** Line the ShadowBand up on the work surface with the tail mast assembly so the four screw holes in the end line up with the screw holes in the end of the mounting boom away from the pynometer, the single screw hole in the middle of the band line up with the top of the mounting post, and the bird spikes are at the top, above the pynometer.



19. **If using the ShadowBand:** Remove the screw you put into the end of the boom to hold the two pieces together (Step 9). Then insert four 10-32 x 5/8" screws with lock washers into the end of the ShadowBand and tighten them.
20. **If using the ShadowBand:** Insert one 10-32 x 3/8" screw with a lock washer through the middle of the ShadowBand into the top of the mounting post and tighten it.
21. Align the tail mast assembly on the lower plate of the Prospector so the mounting flanges in the tail mast pass around the screw jack and line up with the screw holes farthest forward of the mount for the screw jack clamp.



22. Insert four 1/4-20 x 2" hex socket-cap screws down through the holes in the flange on the tail mast and through the holes in the Prospector base. Tighten on four nuts with lock washers.

A.9 Mount the Direct Normal Insolation (DNI) Sensor

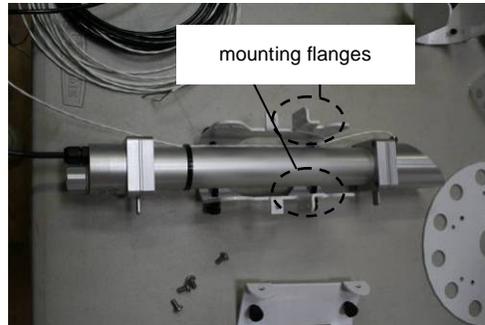
The DNI sensor measures the direct insolation normal to the plane of the array. Mount it on the side of the Prospector array so that it is aligned with the Prospector. Unless otherwise specified, the DNI sensor shipped with the SolarTrak Prospector is a Hukseflux Pyrheliometer model DR01.



The DNI sensor mount comes in two separate pieces.



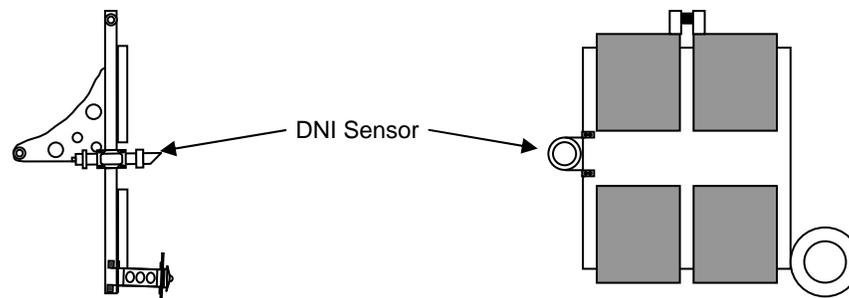
1. Insert the DNI sensor into the curved piece of the mounting bracket. Align the instrument so the light-sensitive end is on the end of the bracket with the mounting flange.



2. Insert the back plate of the mounting bracket. You may need to loosen the thumb screws before it will fit smoothly.

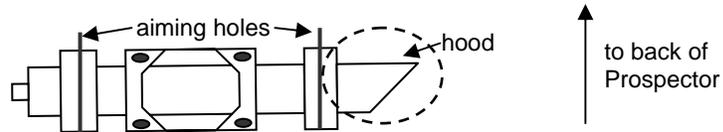


3. Use four 10-32 x 3/8" screws with lock washers to attach the back.
4. Tighten the thumb screws evenly all around until the instrument is secure.
5. Mount the instrument on the Prospector on the side of the top between the solar panels.



Line up the mounting flanges with the screw holes and use six 10-32 x 3/8" screws with lock washers to mount the instrument.

Make sure the hood is back of the hood and the two aiming holes on the instrument are facing the back of the Prospector (up—toward the screw jack). If they are not, loosen the black thumb screws and turn the instrument.



Note: If you are using a different brand of DNI sensor (pyrheliometer) make sure the aiming holes are not blocked by the black plastic thumb screws and they are facing to the back of the prospector if possible

A.10 Attach the Reflective Pointer

For this procedure you will need

- 1 – reflective pointer
- 1 – ¼-20 ½” hex-socket head screw with split-lock washer
- 3/16” hex key

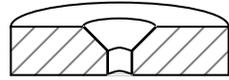


The reflective pointer lets you fine-tune the accuracy with which the Prospector is aimed at the sun.

1. If the Prospector is not already tilted to vertical (facing the horizon), use the joystick on the control panel to tilt it to its vertical limit (make sure the controller is in manual mode to use the joystick. See Step 6 for instructions on placing the controller in manual mode).
2. On the face of the prospector top plate, in the middle, between the photovoltaic panels is a small mirror, attached firmly to the surface. To the right of the mirror is a threaded screw hole.



The reflective pointer has holes on both ends. The smaller hole on the larger end is the actual pointer. It has a beveled edge on one side. The larger hole on the smaller end is a screw hole.

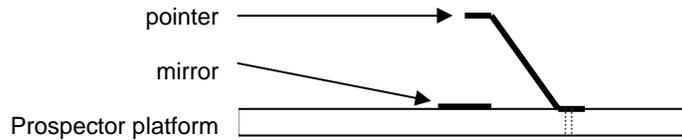


profile of pointer hole

pointer end



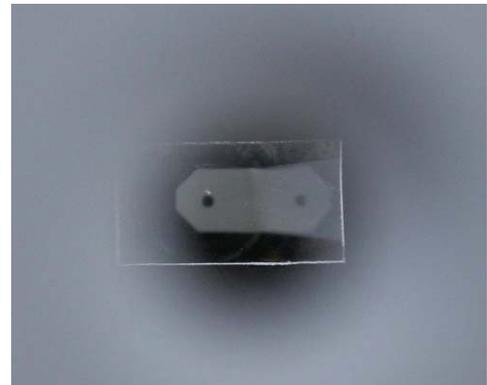
Place the pointer on the surface of the prospector so the screw holes line up and so that the hole in the pointer is directly over the mirror.



3. Insert a ¼-20 ½” hex-socket head screw and finger-tighten it. Do not fully tighten it yet.
4. Align the pointer by looking directly through the hole in the top of the pointer. You should see the pointer roughly centered over the mirror, and you should see a reflection of the back of the pointer through the hole. If you do not see this, very gently turn and bend the pointer until you do.



Looking down through pointer



Reflection seen in center of pointer

5. Tighten the screw without moving the pointer.

A.11 Assemble the Weather Instrumentation

The Prospector is designed to hold weather instrumentation on three booms that radiate out from the pole, at least 30” below the base of the prospector.



The booms hold an electronic rain gauge, anemometer, and wind vane. A thermometer, a barometer, and a hygrometer are mounted on a plate between the booms

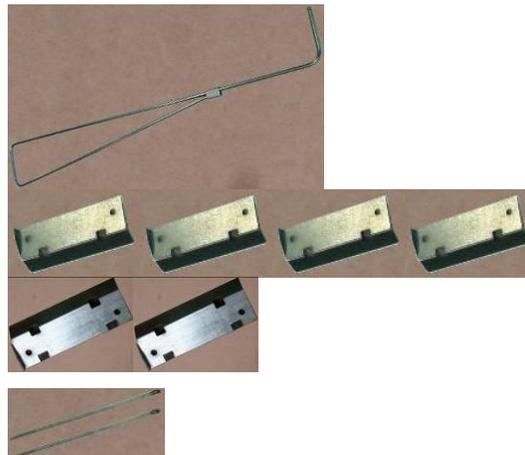


The weather plate faces south (toward solar noon) and the rain gauge is mounted to the north (away from solar noon). This alignment prevents rain water from running into the rain gauge from the Prospector’s solar panels and affecting the rain measurement.

Mount the Weather Stations Booms to the Post

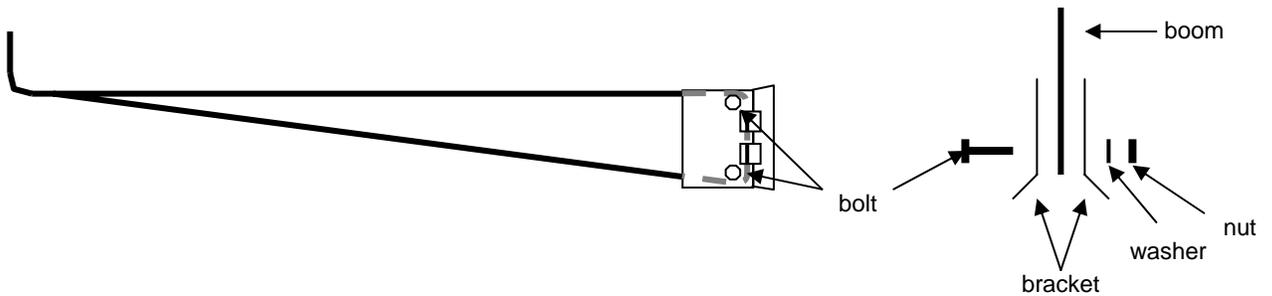
For this procedure you will need

- 3 – weather instrument booms
- 4 – weather boom mounting plates
- 2 – weather boom mounting plates with weather plate mounting flanges
- 2 – hose clamps

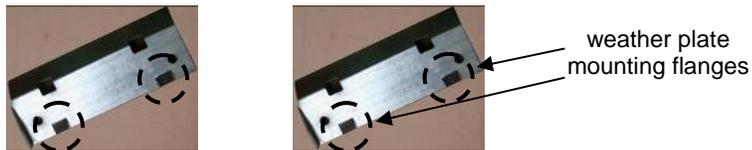


- 6 bolts with lock washers and nuts.
- 5/16" socket or a flat-blade screwdriver
- 9/16" socket or wrench

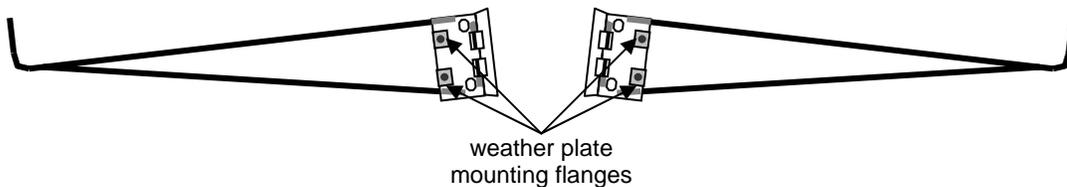
1. Remove all the booms from the packaging and lay them beside the post.
2. Bolt the two halves of a bracket the base of each boom.



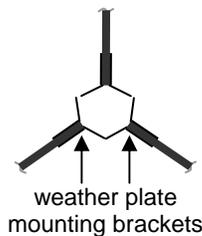
Note: Two of the brackets have flanges with threaded screw holes in them. These are the weather plate mounting brackets.



They must face each other on the south-facing (toward solar noon) side of the southeast and southwest pointing booms.

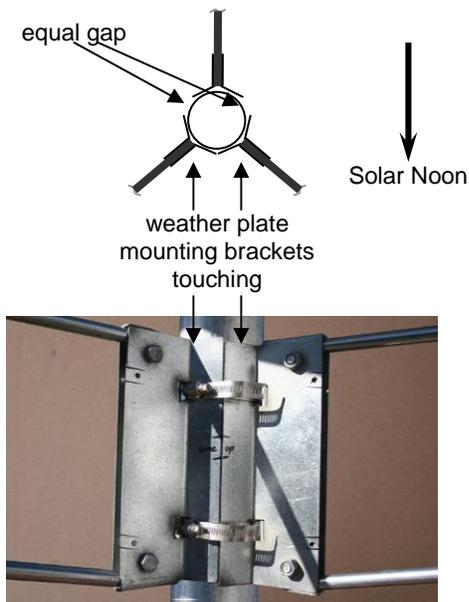


3. Arrange all three booms out on the ground approximately 120 degrees apart with their brackets touching and the brackets with the weather plate mounting flanges together.



4. Open a hose clamp and thread it through the top hole on all three brackets.

5. Thread another hose clamp through the lower hole on all three brackets.
6. Mark the spot on the post where you want to attach the top of the booms. They must be at least 30" below the bottom of the Prospector azimuth base drive.
7. Lift all three booms to the mark on the pole. Make sure the two weather plate mounting brackets are touching and are facing south (toward solar noon). Make sure the boom opposite the mounting plates is pointing north. This should leave you a roughly equal gap between the mounting brackets on the north boom and the brackets for the other two booms.



8. Close the top hose clamp and tighten it. Then close and tighten the bottom clamp.
9. Mount the two stabilizing bars on the north boom.

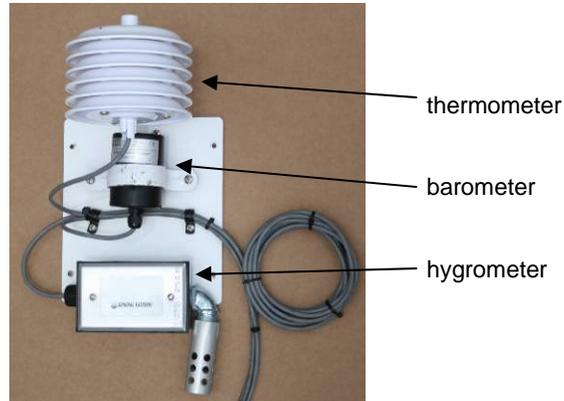
Mount the Atmospheric Sensor Plate

For this procedure you will need:

- 1 – pre-assembled atmospheric sensor plate
- 4 – #10-32x5/8" screws with lock washers
- Philip's screwdriver



The atmospheric sensor plate comes pre-assembled with a barometer, a hygrometer, and a shaded thermometer. It mounts facing south between two of the weather instrument booms.



1. Line up the screw holes on the weather plate with the threaded holes in the flanges on the south-facing brackets.



2. Attach the right side of the weather plate to the bracket with 10-32 x 5/8" screws and split lock washers.
3. If the screw holes on the left side do not line up exactly, loosen the hose clamps slightly (while another person holds up the booms, and slide the adjacent boom left or right until they line up. Then tighten the hose clamps.
4. Attach the left side of the weather plate and tighten all four screws.

Mount the Rain Gauge

For this procedure you will need:

- 1 – Rain Gauge with Mounting Plate and Bracket
- 2 – ¼” nuts with lock washers
- 2 – ¼ - 20 x ½” screws with lock washers
- wire ties
- 7/16” socket or wrench
- Philip’s screwdriver



Mount the rain gauge on the north-pointing (away from solar noon) boom.

1. The rain bucket is mounted to its mounting plate and ½ of its mounting bracket. Place the mounting plate on top of the boom and slide it to the point where the mounting bracket fits snugly around the lower part of the boom.



Note: It is recommended to have a second person help with this step to hold the rain gauge steady while you install the mounting bracket.

2. Slide the studs in the smaller half of the rain gauge mounting bracket through the bolt holes in the rain gauge mounting bracket.



3. Fasten the two halves of the mounting bracket with lock washers and ¼” nuts. Do not tighten the nuts yet.

4. Attach the second half of the bracket to the mounting plate with two ¼ - 20 x ½” screws and lock washers. Tighten the screws until the lock washers compress.



5. Tighten the nuts holding the mounting bracket together.
6. Run the wire along the boom to the post and secure it with wire ties.

Mount the Anemometer and Wind Vane

For this procedure you will need:

- 1 – anemometer
- 1 – wind vane
- wire ties
- needle-nose pliers
- Philip’s screwdriver



This procedure is the same for both the anemometer and the wind vane.

1. Slide the cone-shaped rubber cups down the wires from the anemometer and wind vane to expose the mounting screws.



2. Slide the cotter pin out of the base of the instrument.

- Slide the rubber cup down over the end of a boom and then slide the mounting hole in the instrument over the top of the boom.



- Line the hole for the cotter pin up with the hole in the end of the boom.
- Insert the cotter pin and bend it down
- Tighten the set screw in the side of the base of the instrument.



- Slide the rubber cup up and secure it around the base of the instrument.

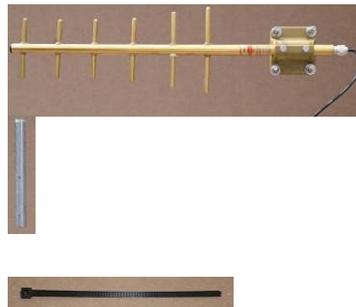


- Run the wire along the boom and secure it with wire ties.

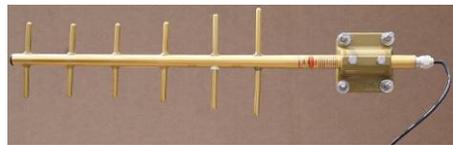
Mount the Optional Yagi Antenna

For this procedure you will need:

- 1 – Yagi directional antenna
- 1 – mounting bracket
- 2 – U-bolts
- wire ties
- 9/19” wrench
- 3/16” hex key
- Philip’s screwdriver



The optional Yagi directional antenna allows you to use a cell modem at a greater distance from the cell tower than the omni directional antenna. It mounts on the end of the boom holding the rain gauge and points in the direction of the nearest cell towers.

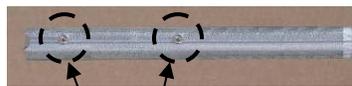


Yagi antenna



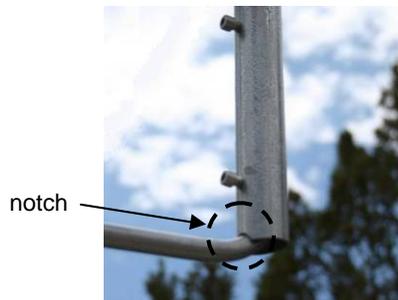
mounting bracket

1. Loosen the set screws on the antenna mount bracket with a 3/16" hex key.



set screws

2. Slide the mount over the end of the boom so that the notch in the bracket rests on the curve of the boom.



notch

3. Tighten the set screws.
4. Slightly loosen the U-bolts on the antenna and slide the antenna over the mounting bracket.



5. Tighten the U-bolts only enough to let the antenna rest on the set screws but loose enough to let it turn freely on the mounting bracket.
6. Point the antenna in the general direction of the nearest cell towers.
7. Run the wire from the antenna along the boom and secure it with wire ties. Leave enough slack so you can turn the antenna to aim it.

8. Run the wire through one of the weatherproof wire seals in the side of the box where the cellular modem is mounted. If you are using the vertical control cabinet, the cellular modem is mounted inside the top box with the glass front. If you are using the horizontal control cabinet, it is mounted in a separate box.
 9. Connect the cable to the cellular modem.
 10. Following the instructions in your modem's documentation, connect a computer to the cellular modem and read the signal strength.
 11. If the signal strength is not as high as you would like, turn the antenna about the mounting bracket as you read the signal strength. Stop when you see the greatest signal strength.
- Note:** You may need to turn the antenna slowly so the signal strength display has time to refresh.
12. Carefully maintaining the direction of the antenna, lift it about an inch above the set screws and tighten the U-bolts.

A.12 Cable Looming

For this procedure you will need:

- wire ties
- wire wrap



Looming is the process of bundling up all the wires so they won't bind or interfere with the operation of the prospector.

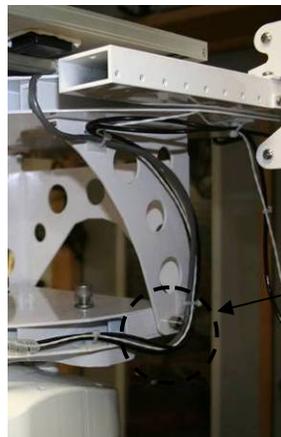
1. Make sure the wires from any wrist mast mounted instrumentation pass through a hole on the mounting plate, pass through a hole in the side of the wrist mast, and down the inside of the wrist mast.



2. Pass the wires from the wrist masts under the top prospector plate, and clip them into wire ties on the underside of the surface along with the wires from the DNI sensor.



3. Join the wires from the instruments with the wire from the PV Panels.
4. Loop the wires together in a curve around the hinge point where the two main plates of the Prospector meet. Make sure to leave a couple of inches slack to allow for the movement of the hinge.



5. Pass the wires through the space where the screw jack clamp mounts to the prospector.



6. Make sure the wires from any tail mast mounted instruments pass through the mounting plate, through a hole at the top of the mast, and down the inside of the mast.



7. Pass the wires from the tail mast out through the lowest hole and down through the space in front of the screw jack mount, along with the other wires.



8. Wherever you have the wires bundled together, wrap them with wire wrap to keep them together.



wire wrap

9. Bundle the all the wires passing through the screw jack mounting hole together with the cord for the azimuth base motor. Attach them to the top of the azimuth base pitch adjust screw with a wire tie.

Important: Leave enough slack to allow for the full range of movement of the prospector—at least 30”.



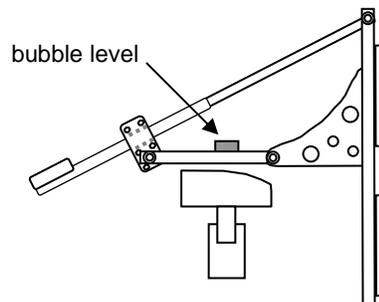
10. Attach the wires again at the bottom of the azimuth base pitch adjust screw.

A.13 Level the Prospector

For this procedure you will need

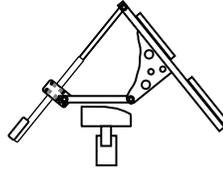
- 5/8” open end wrench
- 3/4” socket or wrench

The prospector comes with a bubble level mounted above the azimuth base motor to help you level it.



Level the Prospector facing each direction, east, south, and west (east, north, and west in the southern hemisphere). Compare the measurements. It is better to have the level be off by the same amount in each direction than to have it perfectly level in one direction and farther off in another.

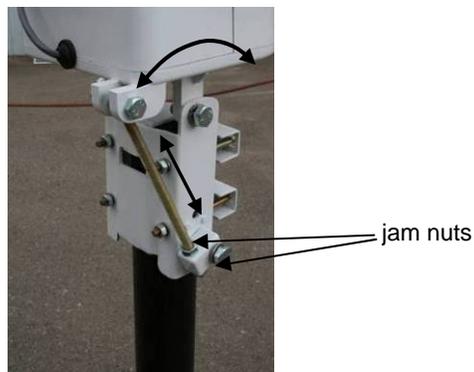
1. Use the joystick on the control panel to tilt the Prospector to about 50° from level.



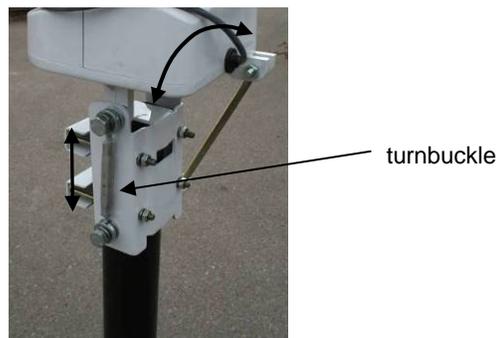
2. Use the joystick to turn the prospector to face east.
3. Read the level.

On this first measurement, adjust the level as closely as possible to level.

4. Adjust the pitch by alternately loosening and tightening the jam nuts to shorten or lengthen the adjust screw.



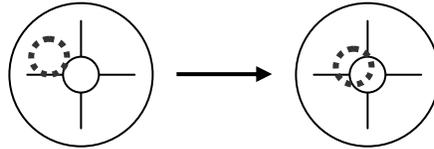
5. Adjust the roll by loosening or tightening the turnbuckle.



6. Turn the prospector to face south.

7. Read the level

If the level is off, adjust the level of the Prospector so the bubble is half way between where it reads and perfectly level. For example, if the bubble is fully outside the circle but touching it, then adjust the prospector so that the bubble is just halfway across the line of the circle.



8. Turn the prospector to face west.

9. Read the level and level the Prospector to split the difference between the new measurement and where you last adjusted it.

10. Repeat the level adjustments in all three directions until the level is the same distance off center for all measurements.

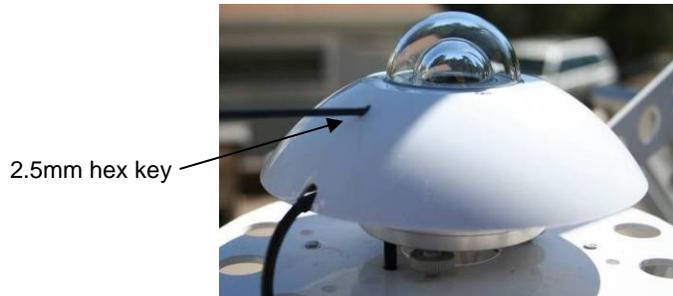
A.14 Level the Pynometers

For this procedure you will need

- 2.5mm hex key

Each Pynometer has adjustable legs and a built-in bubble level, so you can adjust their level. This step only makes sense after you have leveled the prospector.

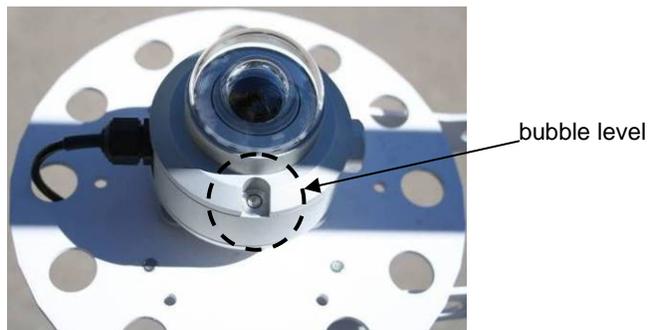
1. To level wrist mast mounted pynometers, use the joystick to tilt the Prospector until it is flat with the base. The tail mast is already level.
2. Remove the white plastic cover from the pynometer. Use a 2.5mm hex key to loosen the set screw in the back of the cover—just above the power cord. Then gently rock the cover off.



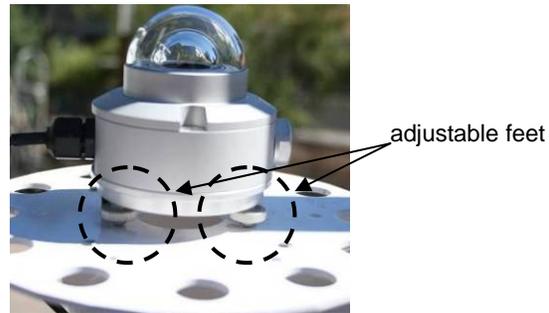
3. Reach under the mounting plate with your fingers and gently loosen the plastic mounting screws. Loosen them just enough to allow the pynometer to move without letting it fall.



4. The bubble level is built into the side of the pynometer. Check the level.



5. Turn the adjustable feet of the pynrometer until it is level.



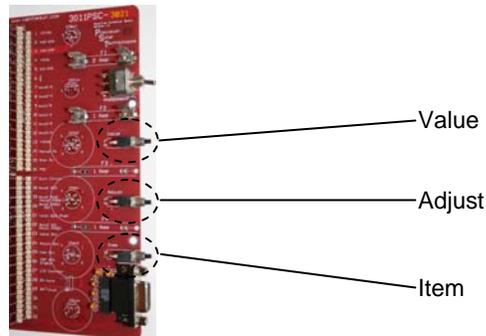
6. Tighten the plastic mounting screws with your fingers. Tighten one screw a little bit, then tighten the other one, going back and forth until they are both snug.
7. Gently replace the cover on the pynrometer and tighten the set screw with the 2.5mm hex key.

Congratulations, your SolarTrak Prospector is now fully assembled. Before you can start it tracking the sun and collecting data, you must configure it.

Configuration Procedures

Before you can start the SolarTrak Prospector, you need to give it the information it needs to track the sun accurately.

Most of the configuration procedures use the buttons on the control panel. On the right side of the control cabinet is a board with a toggle switch above three small buttons and a serial port. The buttons are labeled **Item**, **Adjust**, and **Value**. **Item** is the lowest button, close to the serial port.



You will use these buttons to adjust and configure the Prospector:

1. Press the **Item** button to cycle through the display to the parameter or command you want to set.
2. Press the **Adjust** button to put the controller in adjust mode. The cursor will blink over the first digit of the value or the name of the command will blink.
3. Press the **Value** button to change the value or activate the command. Each press of the value button will increase the value of the digit you are changing. When you reach the top value (for example **9**, the value will start again at the lowest value, for example **0**. Therefore, if you want to change the value of a digit from **8** to **1**, you would press the **Value** button three times to change it to **9**, **0**, and then **1**.
4. Press the **Item** button to move to the next digit.
5. Press the **Adjust** button again to accept your changes.

Note: The buttons have a one-second delay to avoid accidental input. You must press and hold a button for one second before it will register.

C.1 Check Level

Use the bubble level on the Prospector to make sure it is consistently level.

1. In manual mode, tilt the Prospector to about 50° and turn it to check the level with the Prospector facing east, south (north for the southern hemisphere), and west.
2. Adjust the level if necessary.

C.2 Set the Clock

The Prospector uses the time and date to know where the sun should be for your location and time zone.

Important: Set the clock for your local time, but **do not set it for daylight savings time**. If it is currently daylight savings time where you are setting up the Prospector, set the clock one hour behind the local time.

1. On the control panel, the LCD display should be flashing between **TIME** and **MODE: MANUAL**. If it is showing a different display, press the **Item** button to change move through the different display until you reach the Time/Mode display.
2. In the Time display, press the **Adjust** button.
3. When the cursor is blinking over the first digit of the time, press the **Value** button to adjust the value of that digit. Use 24- hour time (0 – 23).
4. Press the **Item** button to move to the next digit.
5. When you have finished setting the hours, minutes, and seconds, press the **Adjust** button to accept the change.

C.3 Set the Date

1. Press the **Item** until you see the **Date MDY** prompt.
2. In the Time display, press the **Adjust** button.
3. When the cursor is blinking over the first digit of the date, press the **Value** button to adjust the value of that digit.
4. Press the **Item** button to move to the next digit.
5. When you have finished setting the month, day, and year, press the **Adjust** button to accept the change.

Note: On Baker Island or Howland Island, set the date one day ahead. SolarTrak The controller does not distinguish between UTC -12 and UTC +12 time zones.

C.4 Enter the Latitude and Longitude

Enter the Latitude and Longitude to the nearest 100th of a degree (or to the nearest 10th of a degree if 100ths are not available).

Note: you will enter longitude as a positive number from 0 to 355.99 counting west from the Prime Meridian. Therefore, enter longitude west 0 to 180 as 0 to 180. Enter longitude east 0 to 180 as 360 – east longitude.

1. Press the **Item** button until you see the **LAT:** prompt.
2. Press the **Adjust** button.
3. Use the **Value** and **Item** buttons to adjust each digit to your current latitude.

4. Press the **Adjust** button to accept your changes.
5. Press the **Item** button to display the **LONGIT :** prompt.
6. Use the **Value** and **Item** buttons to enter the longitude in *degrees west*.

Note: the controller ignores the +/- sign for longitude.

7. Press the **Adjust** button to accept your changes.

C.5 Enter the Time Zone

Enter the time zone as a value from 0 to 23, which represents the number of hours west of Greenwich Mean Time. For example, the Eastern Time Zone in the US is 5 hours west of GMT, the Pacific Time Zone is 8, and Saudi Arabia is 21. Use the following **Time Zone Value table** to look up the value for some common time zones and locations.

Note: The time zone can only accept whole numbers. If you are in an area where the time zone is a fraction of an hour off, enter 0 and set the clock to Greenwich Mean Time.

Time Zone Value Table

Time Zone Value	UTC Offset	Time Zone / Region
0	UTC	Greenwich Mean Time
1	UTC - 1	Azores, Cape Verde
2	UTC - 2	South Georgia and the South Sandwich Islands
3	UTC - 3	Antarctic Peninsula, Argentina, Brazil, French Guiana, Uruguay
4	UTC - 4	Atlantic Time Zone, Eastern Caribbean Time Zone
5	UTC - 5	Eastern Time Zone, Bahamas, Ecuador, Peru
6	UTC - 6	Central Time Zone, Costa Rica, El Salvador, Honduras, Nicaragua
7	UTC - 7	Mountain Time Zone
8	UTC - 8	Pacific Time Zone, Clipperton Islands, Pitcairn Islands
9	UTC - 9	Alaska Time Zone, Gambier Islands
10	UTC - 10	Aleutian Islands, Cook Islands, Hawaii
11	UTC - 11	Niue, Samoa
12	UTC - 12 (+ 12)	Antarctica, Fiji, Marshal Islands, New Zealand
13	UTC + 11	New Caledonia, Solomon Islands
14	UTC + 10	Australian Eastern Standard Time, Guam, Papua New Guinea
15	UTC + 9	Japan Standard Time, Korean Standard Time
16	UTC + 8	Australian Western Standard Time, China, Philippines, Singapore
17	UTC + 7	Cambodia, Java, Laos, Sumatra, Thailand, Vietnam
18	UTC + 6	Bangladesh, Bhutan, Kyrgyzstan
19	UTC + 5	Pakistan Standard Time, Tajikistan, Uzbekistan
20	UTC + 4	Georgia, Oman, United Arab Emirates
21	UTC + 3	Iraq, Kenya, Saudi Arabia, Sudan
22	UTC + 2	Egypt, Finland, Greece, Libya, South Africa, Turkey, Zimbabwe
23	UTC + 1	Central European Time

6. Press the **Item** button to display the **ZONE:** prompt.
7. Press the **Adjust** button.
8. Use the **Value** button to set the time zone.
9. Press the **Adjust** button to accept your change.

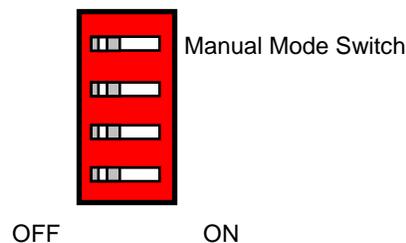
C.6 Perform a Morning Reference Check

In a morning reference check, the controller moves the turns and tilts the Prospector all the way to its limits of motion to reset the zero count for tracking the Prospector's angle and elevation. The controller performs a reference check every time it is turned on and every morning.

1. Turn the power switch on the controller board off.
2. Wait five seconds or more.

Warning: Wait at least five seconds before turning the power switch back on. This allows all motors to reach a full stop and preserves their life.

3. Turn the power back on.
4. Toggle the Manual Mode dip switch off (out of Manual mode). The prospector is now in tracking mode.



The prospector will tilt to a slightly steeper angle and turn slightly to the west and then pause for four seconds. Then it will tilt all the way to horizontal and turn all the way toward northeast. Then it will pause for four more seconds and then turn to face directly to the sun.

C.7 Set Sun Offset

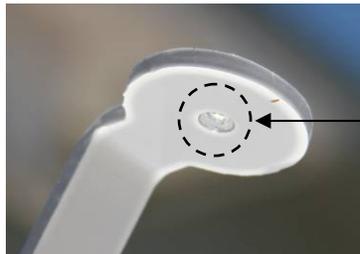
Setting the sun offset allows you to fine-tune the Prospector's aim at the sun. You need only do this once after setting up the unit or after each time you move it.

Note: You can only set the sun offset when it is bright and sunny outside. You need direct sunlight to aim the Prospector with the reflective pointer.

1. Push the **Item** button until you see the **SET SUN OFFSET** command displayed.
2. Push the Adjust button to start the command. The display will now say **POSITION ARRAY**.
3. Look up at the underside of the reflective pointer. You should see a dot of sunlight that may be off center of the small hole in the center.



4. Use the joystick to move the Prospector until the dot of sunlight becomes a halo, perfectly centered on the hole in the back of the reflective pointer.

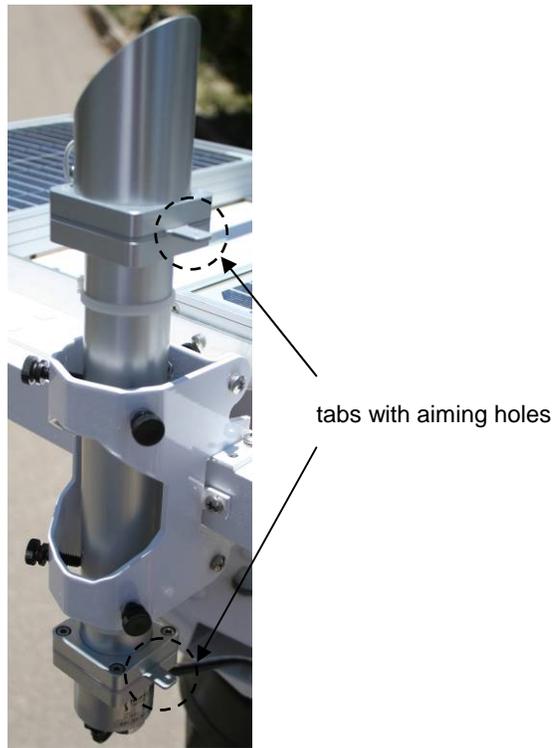


Light centered on
hole in pointer

5. Press the Value button to accept this position. The display should switch back to flashing between the time and the **MODE: TRACKING** message.

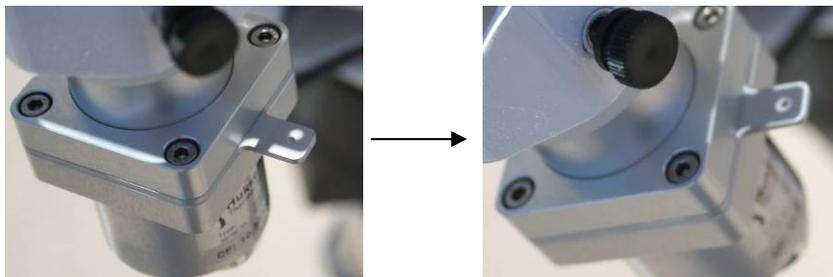
C.8 Align DNI sensor

The DNI sensor has two tabs with aiming holes. The line between the holes is exactly parallel to the center of the instrument.



Note: Only align the DNI sensor once the Prospector is aimed accurately at the sun. It helps to have bright sunlight to aim the DNI sensor

1. Check the reflective pointer on the Prospector to make sure it is aimed correctly at the sun
2. Alternately loosen and tighten the three plastic mounting screws near the lower end to move instrument so that the dot of sunlight from the top aiming hole aligns perfectly with the bottom aiming hole.



3. Gently tighten the mounting screws to hold the instrument firmly. Be careful to preserve your alignment while tightening the screws.

C.9 Set up data collection

If you are not trained in setting up a datalogger, we strongly recommend having a trained professional connect the wiring from the weather and radiation instruments. An untrained person wiring the datalogger runs the risk of damaging the instruments.

This procedure provides the information a trained professional needs to connect the instruments to the correct ports in the datalogger.

<Information>

C.10 Calibrate the Clock

The crystal that provides timing pulses to the clock chip on the SolarTrak® has two modes of deviation that must be accounted for in order to provide accurate time over long periods. The first is operating temperature variation and the second is variations in the original crystal fabrication within published tolerances for the part.

Temperature is accounted for through the mathematical integration of operating temperature applied to a formula provided by the crystal manufacturer. The SolarTrak® is equipped with an onboard thermistor-based device (thermometer) mounted adjacent to the crystal that allows local operating temperature to be sampled once per minute. The time adjustment is applied automatically once per day at midnight.

The fabrication variation issue must be dealt with using empirical methods. The required correction is reduced to a daily and weekly correction keeping the time within plus or minus ten seconds of the correct universal time, corresponding to about one-tenth of a degree of sun motion.

The clock on the SolarTrak Prospector is calibrated before being shipped but you should observe it for a few days to see if it needs further calibration. Variations of up to 6 or 7 seconds off of local 'atomic' time may be noticed due to the fact that the clock is only corrected internally once per day at about midnight. At that time the thermal correction is computed and added to the current time. The second two corrections, seconds-per-day and seconds-per-week, are then added to that result (as appropriate) to correct for daily and weekly variations of the crystal frequency.

Note: Proper clock calibration procedure requires several observations over several weeks.

The best devices for setting the clock are GPS hand held devices or WWV radio clocks... cell phones are typically the next best or an on-line application hooked into NIST or similar service... cell phones and I-Phones can have as much as 15 seconds difference and that will cause more problems with calibrating the clock than not.

The basic computation for determining the correction is simply the number of days since the clock was set exactly on universal time divided into the number of seconds of observed deviation over that time frame. If that value is applied to the current clock value by the processor once per day, the time will remain accurate.

Since the time is not kept in fractional parts within the clock calendar device, the correction is broken into two parts, seconds-per-day deviation plus seconds-per-week. Seconds per month might be applicable but there are space constraints associated with internal storage for parameters and program code that makes the addition less than optimal.

The PC Interface software (F9 then F3) and the User Interface Board (Set Controller to UIB time) both provide an automated method for performing this calibration provided that the operation is performed with the respective clocks on those devices set to precisely universal time. The SolarTrak® stores the last time-set date as an internal, non-volatile parameter and performs the required calculation at each time-set operation from the PC or UIB, reducing the overall deviation to an update of the seconds-per-day and seconds-per-week in integer (whole numbers) rather than fractional form.

This operation can be done by hand using several iterations by performing the following steps.

1. Set the clock/calendar to universal time. Note the day it was set.
2. Progressively extend the time between time-set operations from a few days to a few months over three or four iterations.
3. Note the time deviation (in seconds) for the elapsed time (in days), divide out to produce seconds per day and add that deviation (using only the integer part with the sign convention + was running slow, - was running fast) to any previously computed value.
4. Take the remaining seconds of deviation not accounted for by step three (seconds-per-day times elapsed time in days) and divide by the number of elapsed weeks (use fractional divisor if not whole weeks, adding that integer value to the seconds-per-week parameter using the same sign convention).
5. Repeat steps 1-4 three or four times over several weeks time using progressively longer periods.

The same progressive time lapse between operations should be applied to the automated methods as well.

Proper calibration of the clock/calendar will produce clock error within the twenty-second window over as long as a year without further updates. Note that someone will need to clean the instruments at least once per week (ideally once per day) and even if the clock is off, it takes only a few seconds to reset.

Communicating With the SolarTrak Prospector

--- See the SolarTrak PC Interface Manual ---



SolarTrak® LIMITED 5-YEAR WARRANTY

Precision Solar Technologies (PST) will repair or replace, at our option, any Controller part that fails during normal operation and is reported to PST during the first five years following the date of sale. This does not include (a) costs for labor required to identify the failed part, to remove it for shipping to PST, or to replace with a new or repaired part or (b) shipping costs, which costs will be invoiced to Buyer.

The warranty excludes:

- a) Repairs to any part or material other than the SolarTrak Controller or MiniTrak Instrumentation Platform and excludes any parts which are provided by Buyer;
- b) Failures that are the result of misuse, damage during transportation except to the extent caused by negligent packaging when shipped from PST;
- c) Unauthorized repairs or modification by the Buyer, vandalism, acts of war or other non-operational, man-made or -induced failures.

In the event of a failure, the customer must report the incident to the manufacturer by phone, e-mail or facsimile transmission, prior to attempting any troubleshooting or repairs. Only those activities that are authorized by the manufacturer may be undertaken to diagnose or repair the Controller.

The Buyer must remove the Controller failed parts and/or board as directed by PST in writing, return that to PST for repair or replacement, then reinstall the parts and/or board as directed by PST. Under no circumstances shall PST be liable for any loss of profit or for special, consequential, liquidated or exemplary damages over and apart from the repair or replacement of PST's part.

The SolarTrak Prospector tracking equipment is designed to withstand all outdoor conditions when properly installed and grounded to the earth; it is therefore warranted against meteorological events such as lightning, flood, hurricanes and other natural phenomena. Instruments and datalogger components are warranted by the respective manufacturers on their respective terms.

There are no other warranties, expressed or implied, including that of merchantability or fitness for a particular use or purpose. PST excludes from its warranty any part or material purchased by Buyer to be incorporated in the product.

Contacting Precision Solar Technologies Corporation

www.tapthesun.com

10 Camino del Senador

Tijeras, New Mexico 87059-7631

505-281-0399 Voice

505-281-4248 Fax