INSTALLATION GUIDE

TR-15 Single Axis, Linear Actuator Drive Solar Tracker

Congratulations, you have purchased the finest solar tracker available. With proper installation, your tracker will provide years of trouble-free service while maximizing your solar power production.

Your tracker may include the following options: (Check your packing slip.):

- **Stainless Steel Hardware Option** - Recommended for tropical or salt laden environments.

The tracker comes complete with all the hardware necessary for assembly and installation of the PV array. The Wattsun™ Tracker requires a length of 2-1/2" ID Schedule 40 steel pipe for use as the pipe mast. Specifications for the pipe mast can be found on the data sheet for this tracker. **All array wiring, additional fuses, disconnects and electrical junction boxes must be provided by your electrician or installer**.

- **After installation: Check all nuts and bolts for tightness. Recheck bolts at least once a year.**

WARNING:

If the Wattsun™ Azimuth Solar Tracker is not installed to manufacturer's specifications, such failure to properly install unit may cause tracker malfunction and or serious bodily injury or death. This tracker moves, therefore the tracker should be situated away from anybody or anything that may come in contact with it as it moves.

KEEP CHILDREN AWAY FROM TRACKER AT ALL TIMES.

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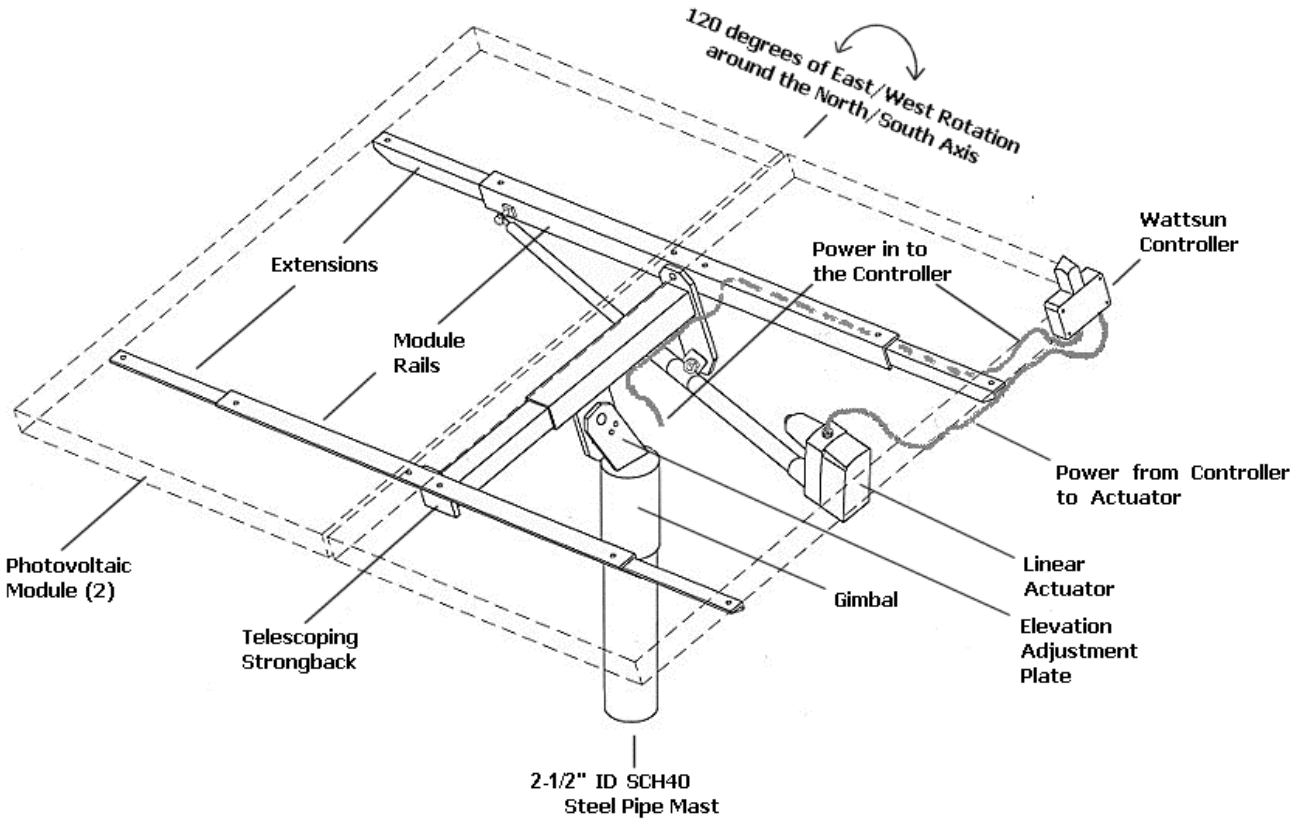


<u>IMPORTANT DESIGN CHANGE IN AUGUST 2003</u>:
The Tracker fits on top of a 2-1/2" ID SCH40 Steel Pipe

TR-15 Universal 2-Module Tracker Installation Guide:
Version 3.3, August 2003

WARNING TO ELECTRICIAN OR INSTALLER

- **Please read this instruction manual completely.**

- **If you are unfamiliar** with **NEC** compliant solar electric installation, then **consult with the dealer** from that supplied your tracker. They should have the skill and expertise to supply you with the necessary wiring diagrams and the appropriate connection wire, grounding equipment, junction boxes and fusing.

- **Failure to ground the array structure**, including each module frame, the aluminum tracker frame, the drive head assembly and the pipe mast may make the tracker susceptible to damage by lightning.

- **Do not rely on the pipe mast to act as a ground rod**. It is not a reliable substitute for a properly installed ground rod.

- **Please send in the Wattsun Tracker Warranty Card**. Array Technologies does not share any of the information provided on the warranty card.

- **Please leave this manual for the tracker owner(s)**. It is their property and will help resolve any potential problems.

- **Please provide the following information for the owner:**

Serial Numbers: _____
Serial Number located on the controller

Tracker Type is a Single-Axis Tracker

Controller is powered from: . Battery Bank . Array-Direct

System Type: . Off-Grid/Remote Home . Grid-Intertie - no battery backup . Grid-Intertie - battery backup
. Water Pumping . Other _____

PV Array: PV System Voltage is _____ VDC Number of Modules: _____

Module Manufacturer: _____ Module Model: _____

Mounting Pole Height above the Ground is: _____ FT

TABLE OF CONTENTS

Section 1 — Installation of Tracker pipe mast and foundation

WARNING! WINDY CONDITIONS CAN EXERT EXTREME FORCES ON THE ARRAY, FOUNDATION, AND PIPE MAST OF YOUR TRACKER.

1.1) Choose an optimum solar location to install the PV array for in the ground mounting. The location should be as free from solar obstructions as reasonably possible. Keep in mind that over a period of time, that trees, shrubs, etc. may grow enough to obscure the PV array from the sun. Consult with your dealer for tracker spacing and alignment regarding a multiple tracker installation.

1.2) Dig an appropriate sized hole for your tracker's foundation using a shovel, auger, or backhoe. The variables that affect the design of the foundation include: tracker size, pipe mast height, soil conditions, geographical location, and local building codes. Due to the variables, employ a qualified professional to design the foundation.

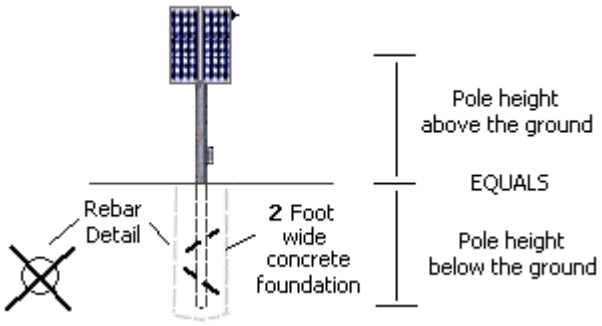
1.3) A general rule of thumb is to have an equal amount of pipe underground as above the ground and a three-foot diameter reinforced concrete foundation. If you are unsure about the size and type of foundation required, contact your Wattsun Dealer or seek professional design assistance.

1.4) Use the appropriate length of 2-1/2" ID Schedule 40 pipe in order to leave the recommended pipe mast height protruding from ground. Consult your specific Wattsun Technical Data Sheet for the appropriate mast height. Note: If the recommended pipe mast height is exceeded, it may be necessary to telescope a larger diameter pipe in the lower portion and increase the foundation size in order to withstand the increased forces exerted during windy conditions.

1.5) Cut at least two pieces of re-bar at lengths equal to the full diameter of the foundation. Weld re-bar onto (or drill holes and insert re-bar into) the underground portion of the pipe so that the pieces of re-bar form an 'x' pattern that remains parallel to the ground. When the tracker pipe mast is completely installed, the re-bar will be perpendicular to the pipe and parallel to the ground and protrudes radially outward into the concrete foundation.

1.6) Set the pipe into the hole and pour concrete around the pipe until it completely fills the hole. Also pour concrete into the pipe to secure the re-bar inserted in the bottom portion of pipe. Make certain the pipe is vertically level and allow concrete to set for at least 24 hours. **If you fill the entire pipe mast with concrete, leave at least one foot of hollow pipe at top for drive assembly clearance.**

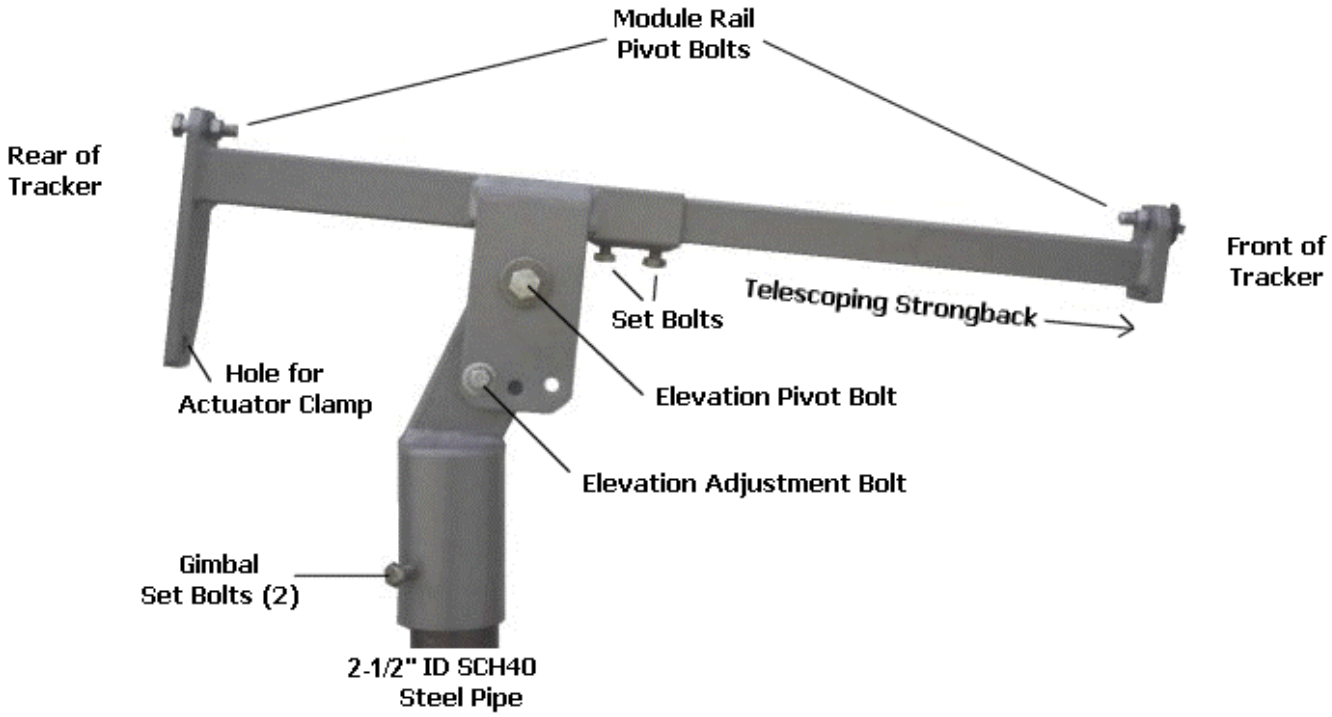
SUGGESTED TRACKER FOUNDATION DIAGRAM
(Using recommended mast height from your Technical Data Sheet)



Array Technologies, Inc. assumes no liability for your foundation installation.
Please consult with a local professional or your Wattsun Solar Tracker Dealer.

Section 2	Install the Gimbal & Strongback on Top of the Pipe Mast

Detail of TR-15 Universal Gimbal-Strongback Assembly Mounted on 2-1/2" ID SCH40 Pipe Mast



2.1) Northern or Southern Hemisphere installations.

Loosen the Elevation Adjustment Bolt and move the gimbal so that it is at a right angle to the strongback. Align the Elevation Adjustment Bolt with the threaded hole in the other plate and screw it in firmly.

For Northern Hemisphere installations, point the rear of the drive assembly to 'true north' ***** and tighten the two set bolts to secure tracker to pipe mast. The Gimbal set bolts should be tightened equally so that the mast head clamp digs symmetrically into the pipe mast.

For Southern Hemisphere locations, point the rear of the drive assembly to 'true south' ***** and tighten the two set bolts to secure tracker to pipe mast. The Gimbal set bolts should be tightened equally so that the mast head clamp digs symmetrically into the pipe mast.

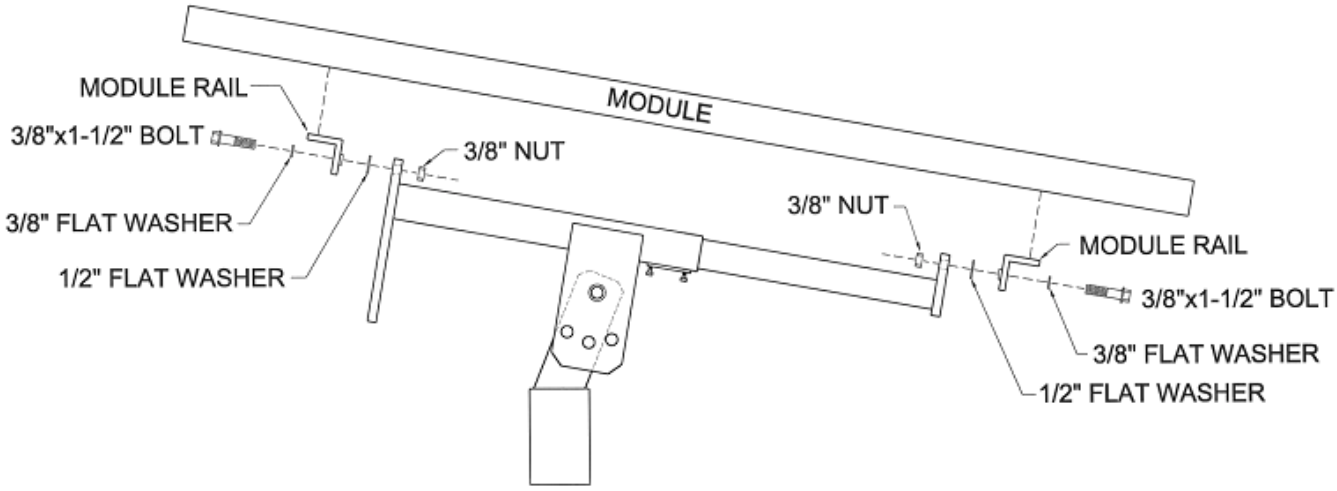
*** Note:**

True north and south differ from magnetic north and south depending on geographical location. Locate 'magnetic north' or 'magnetic south' using a compass and adjust your tracker setting accordingly. Your Wattsun Tracker Dealer should be able to provide you with the Magnetic Declination for your area. The Array Technologies web site (www.wattsun.com) has links to geomagnetic data. You can find, or calculate, the magnetic declination for any place on the globe.

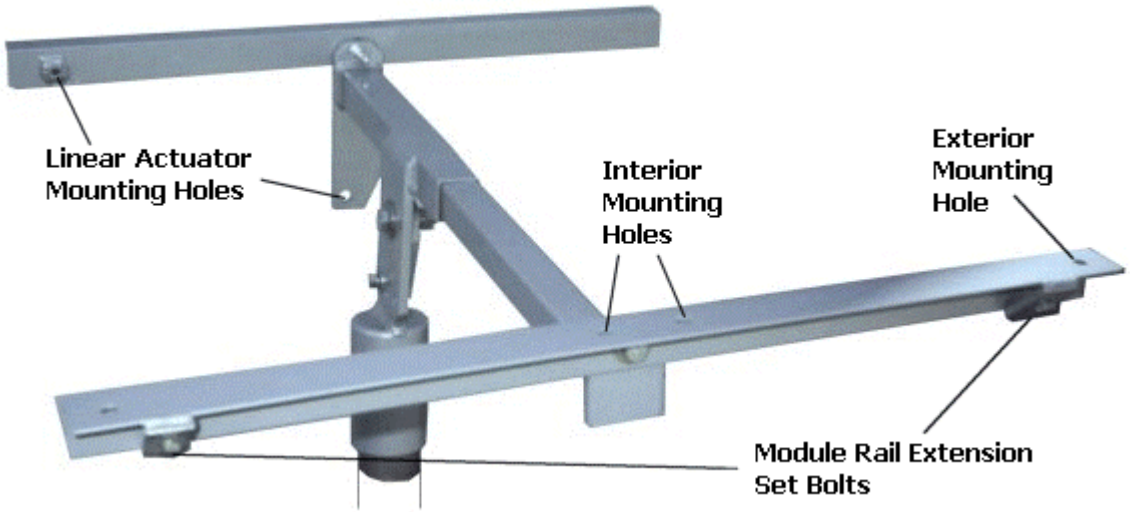
Perhaps the easiest way to find the North-South line is to get a copy of your local newspaper and find the Sunrise and Sunset times. Determine the time (hour and minute) that falls exactly halfway between Sunrise and Sunset. At the halfway or 'Solar Noon' point, anything that casts a shadow will do so along a North-South line. Get a friend to help hold up a length of wood or a stick of conduit straight up into the sky. Then stake out or mark the North-South shadow line.

Section 3	Install the Module Support Frame Assembly

3.1) INSTALL THE MODULE RAILS



Bolt the module rails onto the strongback. Refer to the line diagram above and make sure that the upper edge of the module rails face outward. One rail has a nut welded on the interior side. Mount that rail on at the rear end of the strongback with the nut facing to the inside. Tighten the 3/8" bolts. Rotate the module rails in either direction to make sure they move smoothly.

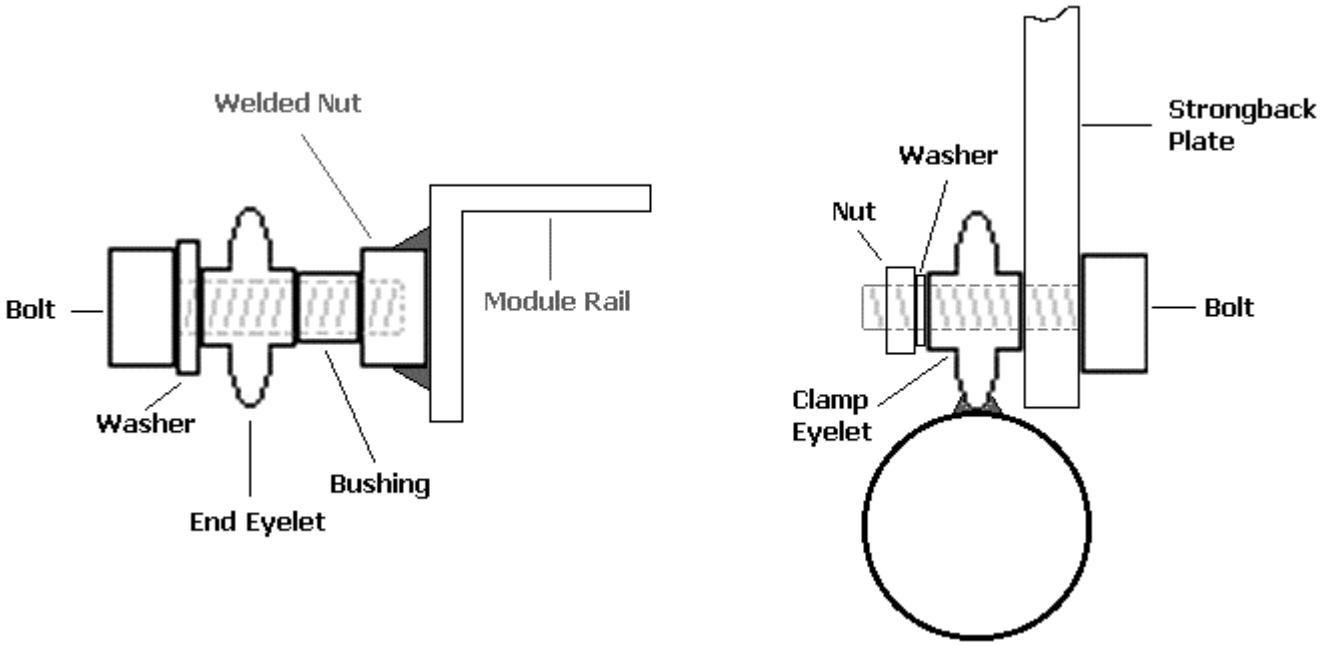


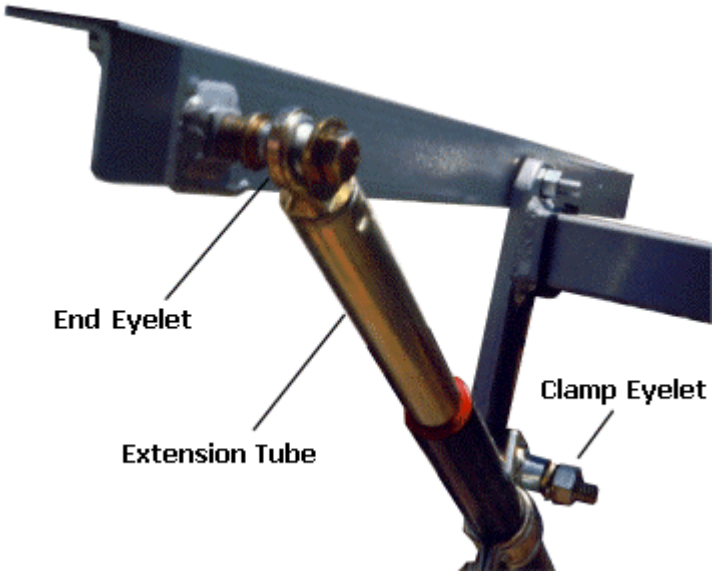
3.2) MOUNTING THE LINEAR ACTUATOR

The Linear Actuator is a motorized device that moves the tracker in an East or West direction. The inner tube of the actuator slides in and out. Your actuator is shipped in the fully retracted position. Do not allow the inner tube to unscrew while you are installing it. This will destroy the limit switch (motor stop) settings! However, for ease of installation, you might want to run the actuator out a bit to make the module installation easier.

To extend out the inner tube so that the tracker frame is nearly horizontal: Lay the actuator on a table and place a long shafted screwdriver through the end eyelet to keep the inner tube from unscrewing. Alternatively, mount the actuator to the frame. Then remove the back of the motor cover and apply at least 12 VDC (24 VDC nominal max) to the terminal strip. If you are in the field, you can "tap" the output of one module to use as your power supply.

Connect positive to the top terminal (white motor wire) and negative to the lower adjacent terminal (red motor wire). Do not allow the inner tube to unscrew. Reversing the polarity to the terminal strip retracts the actuator. Make sure that the wire exiting the actuator faces up when you install the actuator. See **Section 6** for details.



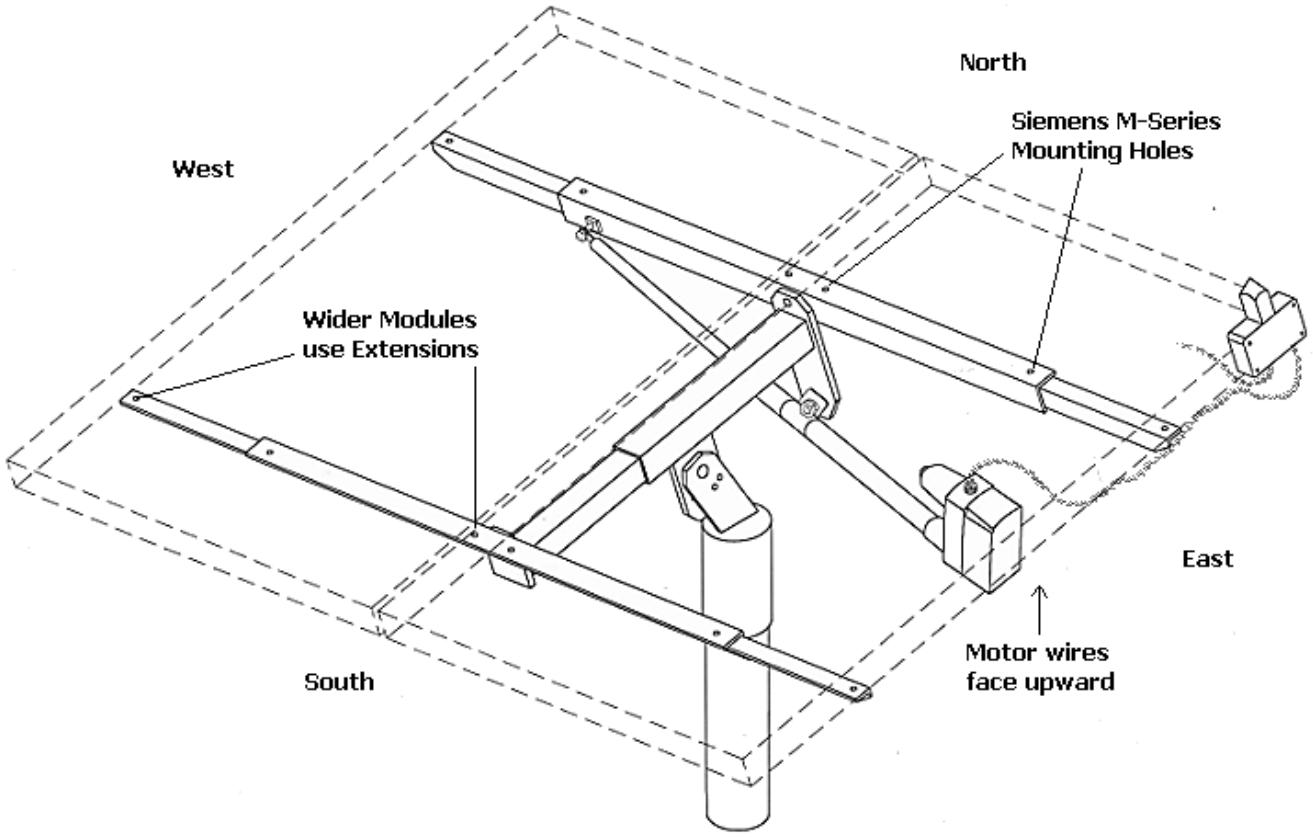


Section 4	Mounting the modules on the Tracker Frame

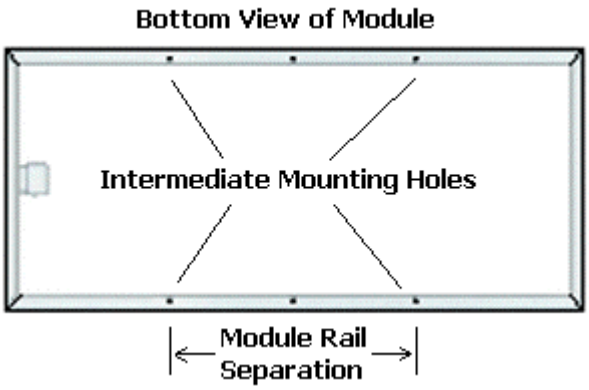
YOU MAY DECIDE TO BUILD THE COMPLETE TRACKER FRAME ASSEMBLY ON THE GROUND OR ON A TABLE. AND THEN MOUNT THE MODULES AND PREWIRE THE ARRAY BEFORE BOLTING IT TO THE MOUNTING POLE.

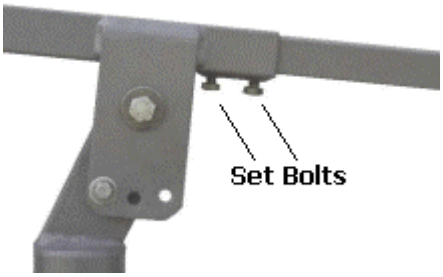
BE AWARE THAT THE ARRAY ASSEMBLY WILL BE HEAVY AND WILL REQUIRE ASSISTANCE IN LIFTING AND MOUNTING IT ON THE POLE.

PLEASE READ THE ENTIRE INSTALLATION GUIDE BEFORE PROCEEDING WITH THE INSTALLATION.



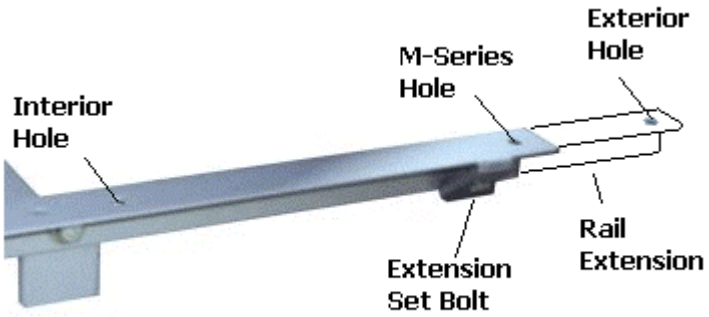
4.1) If you are mounting Siemens M-Series Modules, you will not need to use the module rail extensions. All wider modules will require the use of the 4 extensions. The tracker is designed to utilize the intermediate mounting holes away from the end of the module frame.





4.2) Measure the distance between your intermediate mounting holes. This is the dimension required between the mounting holes of the module rails. Relax the two strongback set bolts and telescope the strongback out to the necessary distance. Tighten the set bolts to a snug, "finger-tight" position. This allows for some "play" when you are mounting the modules. Once both modules are mounted you can come back and firmly tighten the set bolts.

4.3) Slip in the extensions if you are using modules wider than a Siemens M-Series.



Align the inside **intermediate hole** of the module with the **interior hole** in the rail. Secure ("finger-tight") the module to the frame with a stainless steel hex bolt. Slide out the extension until the mounting holes of the module frame and extension line up. Again, bolt it through with "finger-tight" pressure. Leaving the nuts a little loose allows for adjustment to "square-up" the frame. Do the same procedure at the other end of the module.

Mount the second module on the other side of the module frame. Then go back and firmly tighten all the module bolts. Next tighten the set bolts that restrain the extensions. And last, tighten the two set bolts on the strongback.

Go back over the entire tracker frame and modules to check for any loose nuts or bolts. Retighten them if necessary.

Section 5 — Installing the Wattsun Solar Tracker Controller

WARNING! Never apply power to the controller output wires! The controller will be damaged and the repair charge is not covered under warranty.

5.1) 24 VOLT TRACKER CONTROLLER SPECIFICATIONS

- **Controller input power specifications:**
- **24-Volt Mode**: The input voltage range is **23 to 50** volts DC. Power output is 16.6 volts DC
- **12-Volt Mode**: The input voltage range is **11 to 17** volts DC. Power output is 11 to 16.6 volts DC (12 VDC system requires a connection to 12 VDC battery bank.)
- **Voltages higher that 50 VDC will destroy the controller!**

- **Tracker controller wiring and drive motor wiring:**
- **Do not connect the output wire harness to a power source!**
  Connecting any of these output wires to the PV array or a power source will cause permanent damage to the controller and void the warranty.

- **Power supply connection options:**
- The input power leads are Red (positive) and Black (negative) wires in the two-wire cable mounted on the left-hand side of the controller chassis. The input wires are clearly marked with a tag.

- **Power consumption, including motor:**
- Less than 5 watt-hours per day.

5.2) FUNCTION OF WATTSUN TRACKER CONTROLLER

WARNING! The last connection made is from a power source to the tracker controller! Please read Sections 5, 6, 7 and 8 completely. Failure to do so might cause you harm or injury.

Wattsun™ Solar Trackers utilize a patented, closed loop, optical sensing system to sense the sun's position and track it. The sun sensors are mounted on the controller chassis and feed information to the control electronics about the direct component of sunlight available, the diffuse amount of sunlight, the total amount of sunlight as well as the differential amount of sunlight on opposing sensors. Based on this information, the controller seeks to equalize the sunlight received by opposing sensors.

The controller circuitry automatically adjusts the tracker sensitivity. It increases the sensitivity with increased direct sunlight and decreases the sensitivity with scattered or diffused light - present during cloudy conditions. This enables the tracker to eliminate undue hunting in cloudy or overcast conditions when the sunlight is scattered. It also adjusts according to the total amount of light received by the sensors.

Since the sensor knows how much light is available, it enables the controller to sense sunset, and return to the sunrise position in the evening - if the controller is connected to a battery bank. When it is powered directly from the PV array, the tracker returns to sunrise at first morning light. The controller uses energy integration circuitry, enabling the tracker to move with as little as 20ma of available current.

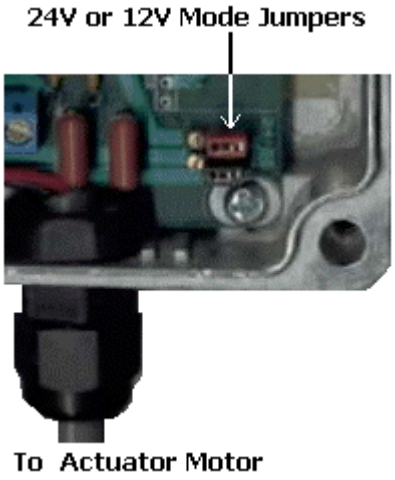
The tracker controller sends a signal to the DC gear motor that moves the PV array to a perpendicular position relative to the sun's rays. The motor is a small, fraction HP, low voltage, gear motor that moves the tracker into position. The gearing is designed such that high winds or other forces cannot drive the tracker back. Since it is a DC drive motor, one polarity moves it in the forward direction and reversing the polarity moves it in the opposite direction. When the controller wants the tracker to move, it sends a signal of the appropriate polarity to the DC gear-motor. Once the tracker has moved to the "on track" position, the controller electrically "brakes" the motor to stop movement that results in greater tracking accuracy.

5.3) SETTING THE 24 OR 12 VDC MODE

The controller comes preset for 24V Mode. You can power the controller from a nominal 24-Volt array or from 24-Volt battery bank. If you want to run the controller from a 12-Volt power source, it must be connected to a 12 VDC battery bank. A 12V array will not have sufficient voltage to power the controller.

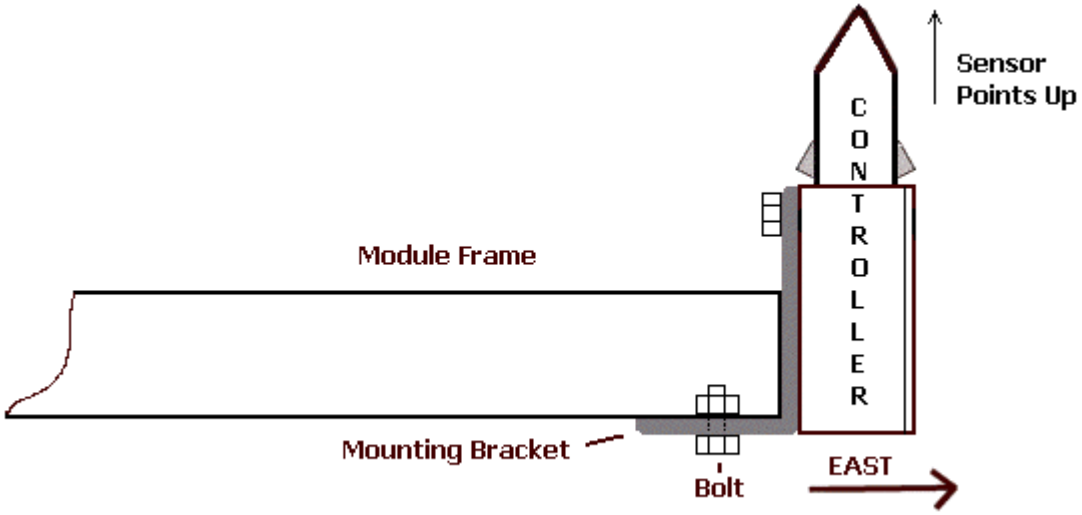
If you are connecting to a 12 VDC battery bank, then you will need to move two jumpers inside the controller. You must be careful not to damage either sensor eye. Place the controller on the edge of a bench so that shade pole and sensors hang over the side. That will ensure that you can't inadvertently crack a sensor.

Remove the four machine screws on the cover plate. The red and black jumpers are located in the lower right hand corner of the controller. Pull each of them straight out and move them one pin over to the left. Make sure that the gasket inside the cover is still in place and replace the cover. Firmly tighten the cover screws.



5.4) MOUNTING THE WATTSUN TRACKER CONTROLLER

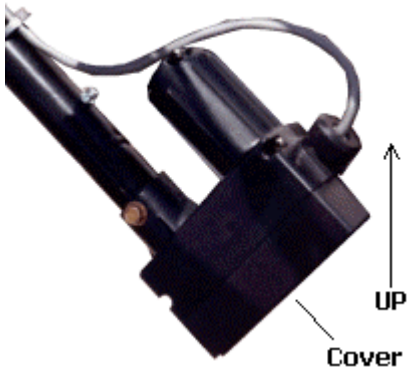
Make sure that you do not inadvertently bump either of the sensor eyes while mounting the controller. Mount the controller on the eastern edge of the array using the mounting bracket. Use the module frame endhole so that the controller is perpendicular to the plane of the array and the cover faces east. Some modules do not have end holes so you might need into drill the frame with a 1/4" bit. Refer to the diagram on Page 2 if necessary



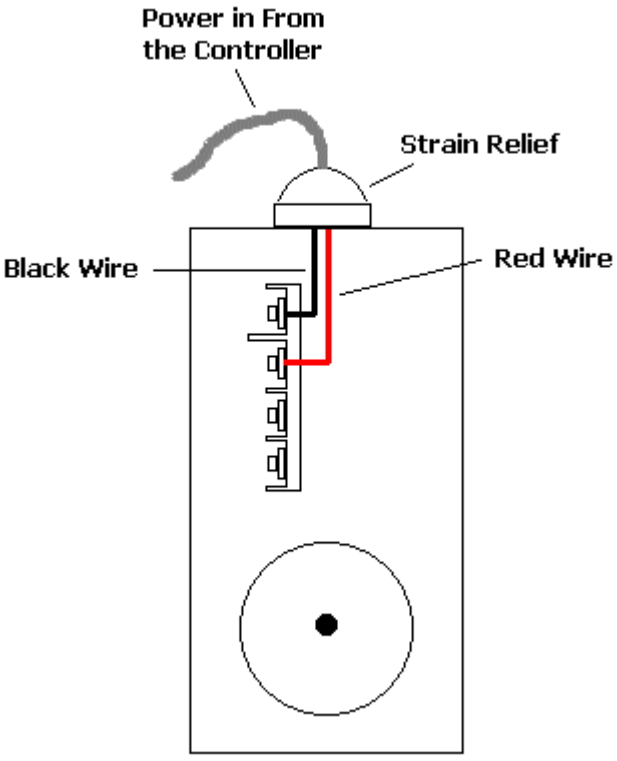
Section 6	Power Connection to the Tracker Controller

6. 1) CONNECTION FROM THE CONTROLLER TO THE DRIVE MOTOR.

Loosen the motor cover screw and remove the plastic drive motor cover.



Loosen the raintight strain-relief fitting on the top of the motor housing. **Run the power output wire** of the controller through the fitting**.** Use a screwdriver to make the connection to the terminal strip as indicated below. **Gently tug on the wires to make sure that they are snug under the terminal screw plate.**



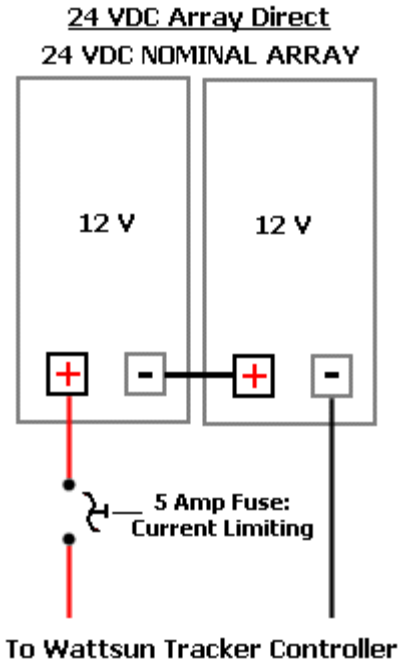
The black wire connects to the top terminal and the red wire connects to the terminal just below. Leave the other terminals as they are. Replace the cover and tighten the strain-relief fitting.

POWER OPTION #1: POWER THE CONTROLLER FROM A 24-VOLT PV ARRAY

- **The controller ships from the factory to operate in the 24-volt mode**.
- **The positive lead running from the array, to the power input of controller, must be fused with a 5 amp, current limiting, DC-rated fuse.**
- **Failure to fuse the input power wire at may create a potential fire hazard.**

The input power leads should be connected to a nominal 24-volt PV array. Typically, this will be the output of two 12-volt PV modules in series. The **input voltage should never exceed 50 volts** DC and will only operate when the input voltage is above 23 volts. If the 50 VDC maximum input is exceeded, the controller will be damaged. **The damage is not covered under warranty**.

BASIC WIRING DIAGRAM FOR ARRAY DIRECT TO CONTROLLER



The tracker will return east at first morning light when powered directly from the PV array. The tracker controller will automatically adapt to whatever current is available from the PV array. If the PV array is only capable of producing small amounts of current (20 to 300 milliamps) the tracker controller will move the tracker in small increments. When the array provides over 1/3 an amp (300 ma) of current, the array will move in a smooth fashion. Typical full east return should occur within 15 minutes after sunrise.

If you are using the array for water pumping, the tracker controller power connection must be made on the "array side" of the pump controller. Do not make the connection on the "pump side" of the pump controller. Connect the Wattsun Tracker Controller input wires as follows: Red lead to PV positive (+) and the Black lead to PV negative (-). It is recommended that you fuse the positive leg as shown in the diagram above.

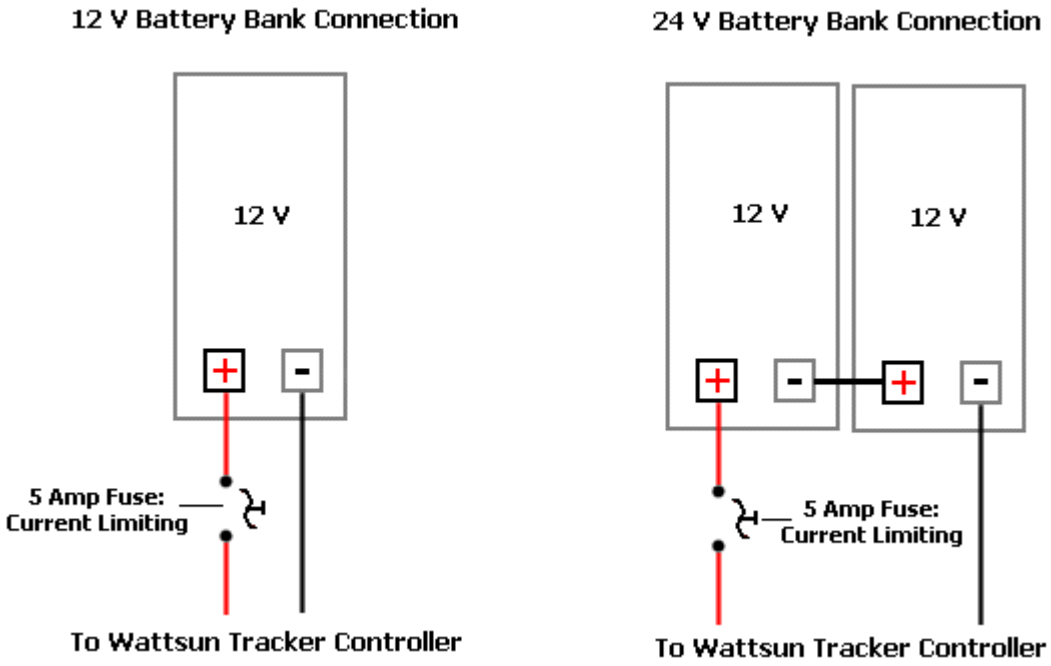
WARNING! Once the power has been connected to the controller the tracker can move. Make sure that the area around the tracker is clear of people, obstruction and tools!

POWER OPTION #2: POWER CONTROLLER FROM A 12 or 24 VDC VOLT BATTERY BANK

- **The controller ships from the factory to operate in the 24-volt mode**.
- **If the installation is a 12-volt system, then connection to a 12V battery bank is mandatory**.
- **The positive lead running from the battery bank, to the power input of the controller, must be fused with a 5 amp, current limiting, DC-rated fuse.**
- **Failure to fuse the input power wire at the battery bank may create a potential fire hazard.**

The input power leads for the controller can be connected directly to the main 12 or 24 volt battery bank. The **positive lead** running from the battery bank **must be fused at the battery bank with a 5-amp fuse**. When connecting the controller to a 12-volt battery bank, the voltage selector jumpers inside the controller chassis must be set to the left position**. See Section 5.3 for details.**

BASIC WIRING DIAGRAM FOR BATTERY BANK TO CONTROLLER



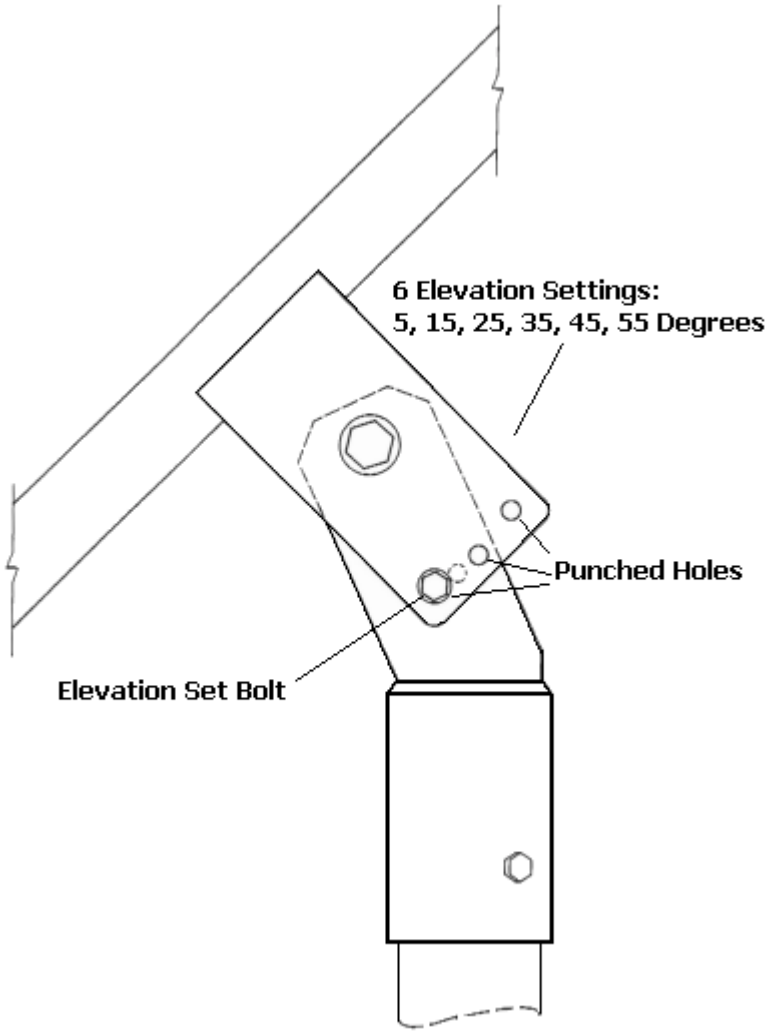
Connect the Wattsun Tracker Controller input wires as follows: Red lead to battery positive (+) and the Black lead to battery negative (-). It is recommended that you fuse the positive leg as shown in the diagram above.

WARNING! Once the power has been connected to the controller the tracker can move. Make sure that the area around the tracker is clear of people, obstruction and tools!

Section 7	Seasonal Adjustment of the S/A Elevation

SEASONAL ADJUSTMENT OF THE PV ARRAY

Season	Typical Elevation Setting
Spring	Set at tilt angle equal to your latitude.
Summer	Set at tilt angle equal to your latitude minus 15 degrees.
Fall	Set at tilt angle equal to your latitude.
Winter	Set at tilt angle equal to your latitude plus 15 degrees.



Warning! You might want to tie down the backside of the tracker before you adjust the elevation. Once the set bolt is withdrawn, the array can swing down and contact the pole. This might be a two-person job.

Withdraw the Elevation Set Bolt and pivot the tracker frame to the desired angle. One of the punched holes will align with threaded hole on the other plate. Pass the bolt through the punched hole and screw it into the threaded hole. Tighten it firmly with a wrench.

Array Technologies, Inc. Limited Warranty

Array Technologies, Inc. warrants its Wattsun™ Solar Trackers to the original consumer purchaser that it will repair, or replace, at Array Technologies Inc.'s option, any Wattsun™ Tracker component that is determined to be defective in material or workmanship for the following terms:

Two years from date of purchase on all components including tracker controller, frame, and drive assembly.

To be eligible for repair or replacement under this warranty, the part in question must be sent to Array Technologies, Inc. within the warranty period and the original consumer purchaser must comply with the following conditions:

- The tracker or component thereof must not have been modified or altered in any way by an unauthorized source.
- The tracker or component thereof must have been installed in accordance with the installation instructions including electrical connections of tracking controller.

This limited warranty does not cover:

- Damage due to improper or installation;
- Accidental or intentional damage;
- Misuse, abuse, corrosion, or neglect;
- Products impaired by severe conditions, such as excessive wind, ice, storms or other natural occurrences;
- Trackers used for purposes other than the intended use, including mounting modules or components which the tracker was not intended for;
- Trackers with more than the intended number and type of modules mounted on it;
- Damage due to improper packaging on return shipment.

Any and all labor charges for troubleshooting, removal or replacement of tracker and/or components of the tracker are not covered by this warranty and will *not* be honored by Array Technologies, Inc.

Return shipping is to be pre-paid by the original consumer purchaser. Array Technologies, Inc. will pay the normal return UPS shipping charges within the USA only.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES OF ANY KIND, EXPRESSED OR IMPLIED, INCLUDING (WITHOUT LIMITATION) ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND OF ANY NONCONTRACTUAL LIABILITIES BASED UPON NEGLIGENCE OR STRICT LIABILITY. IN NO EVENT SHALL ARRAY TECHNOLOGIES, INC. BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING (WITHOUT LIMITATIONS) ANY DAMAGE FOR PERSONAL INJURY OR PROPERTY DAMAGE OR OTHER PRODUCT LIABILITIES BASED UPON ALLEGED NEGLIGENCE OR BREACH OF EXPRESS OR IMPLIED WARRANTIES OR STRICT LIABILITY. ARRAY TECHNOLOGIES, INC. NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR IT ANY OTHER OBLIGATION IN CONNECTION WITH THE SALE OF ITS WATTSUN™ SOLAR TRACKERS.

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