



TR-55 INSTALLATION GUIDE

(Formerly TR-75)

Guide for your Single Axis Tilt & Roll Solar Trackers

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 one of the following options: (Check your packing slip.):

- ♦ **Stainless Steel Hardware Option** - Recommended for high humidity and salt laden environments.
- ♦ **Wattsun Voltage Converter Option** - Required for PV Systems or Water Pump Systems other than 24 VDC. This tracker will not operate properly on 12 VDC Array Direct Systems.

The tracker comes complete with all the hardware necessary for assembly and installation of the PV array. The Wattsun™ Tracker requires a length of **4" 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 particular tracker. **All array wiring, additional fuses, disconnects and electrical junction boxes, etc. must be provided by your electrician or installer.**

WARNING:

If the Wattsun™ 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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September 2002**

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 ☐ Single-Axis Tracker ☐ Dual-Axis Tracker

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

System Type: ☐ Off-Grid/Remote ☐ 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 Inner Diameter is: _____ FT

Mounting Pole Height above the Ground is: _____ FT

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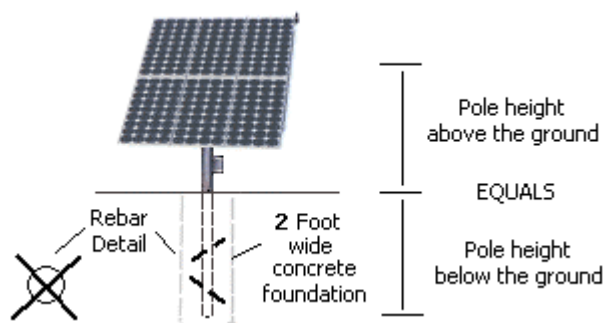
Section 1

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 two-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 4-inch 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 and pipe diameter size. 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 azimuth drive assembly clearance.**

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

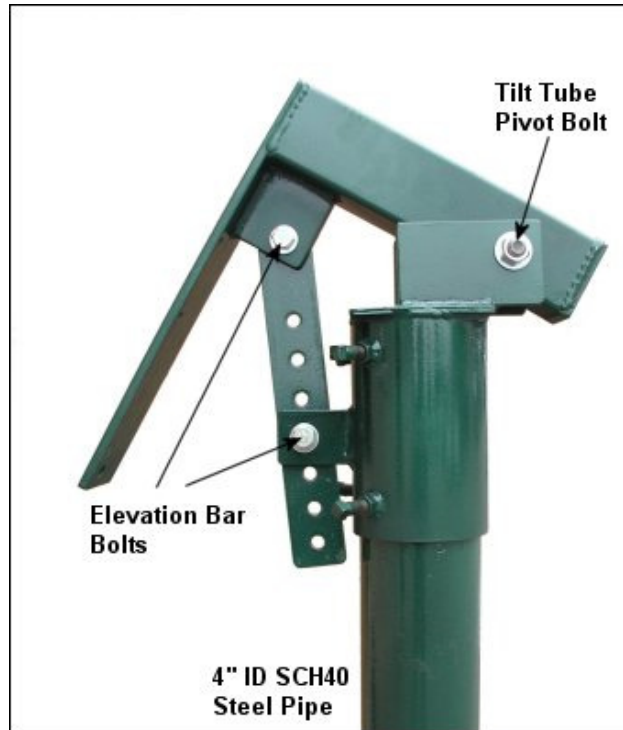


Array Technologies, Inc. assumes no liability for your foundation installation.
Please consult with a local professional or your Wattsun Solar Tracker Dealer.

Section 2

Install the Tilt & Roll Drive Assembly on top of the Pipe Mast

Side View Detail of TR-55 Drive mounted on 4" ID, SCH40 Pipe Mast



2.1) Northern or Southern Hemisphere installations.

For Northern Hemisphere installations, point the rear of the drive assembly to 'true north' * and tighten the 4 set bolts to secure tracker to pipe mast. The 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 4 set bolts to secure tracker to pipe mast. The set bolts should be tightened equally so that the mast head clamp digs symmetrically into the pipe mast.

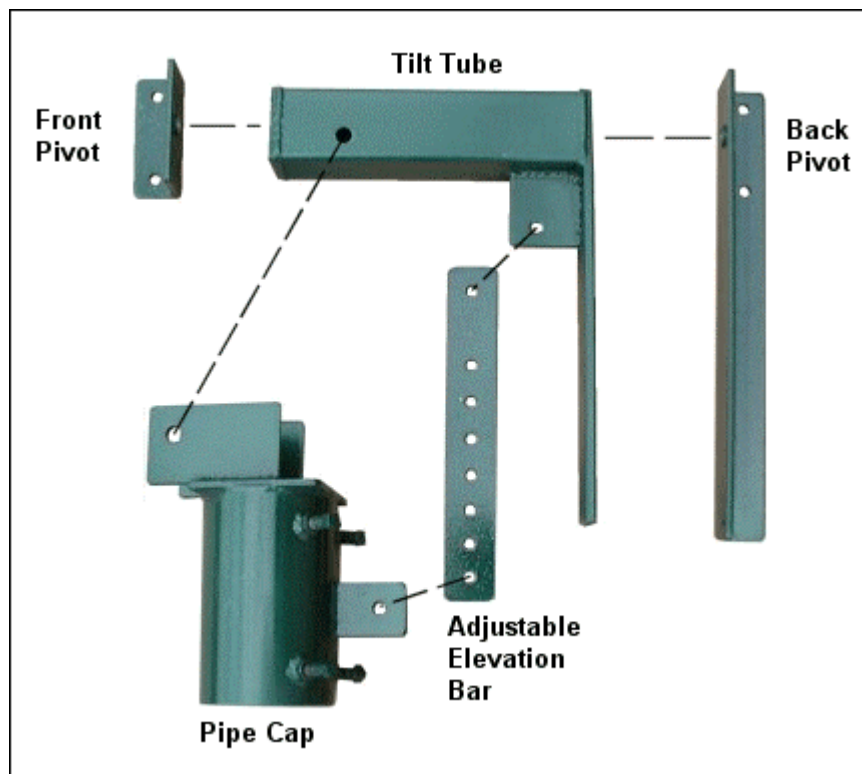
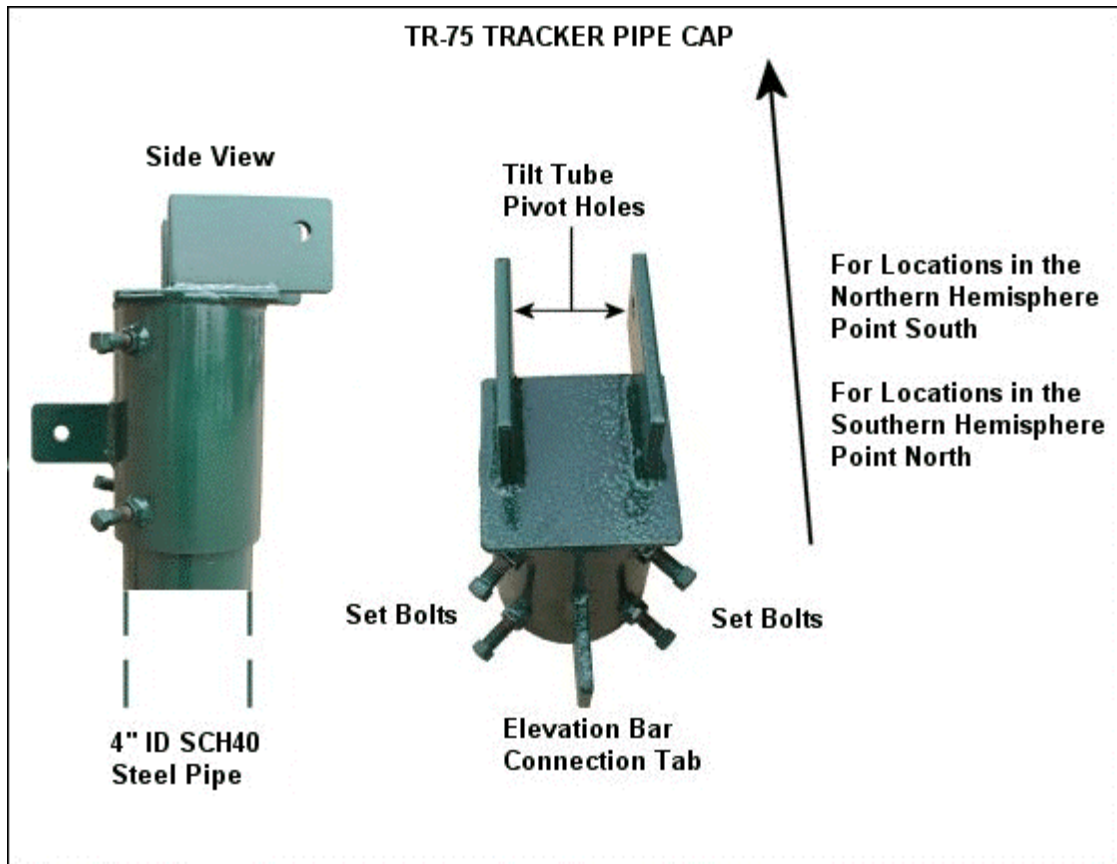
Tropical and Equatorial Installations are discussed in Section 3.5

*** Note:**

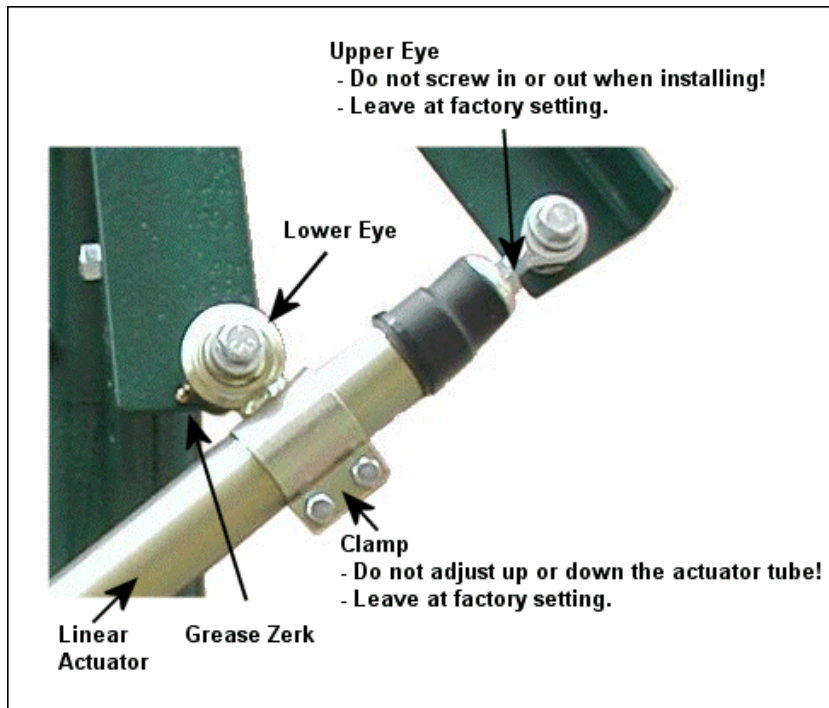
True north and south differ from magnetic north and south depending on geographical location. Locate 'magnetic north' or 'magnetic south' using a compass and adjust your tracker setting accordingly. Your Wattsun Tracker Dealer should be able to provide you with the Magnetic Declination for your area. 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.

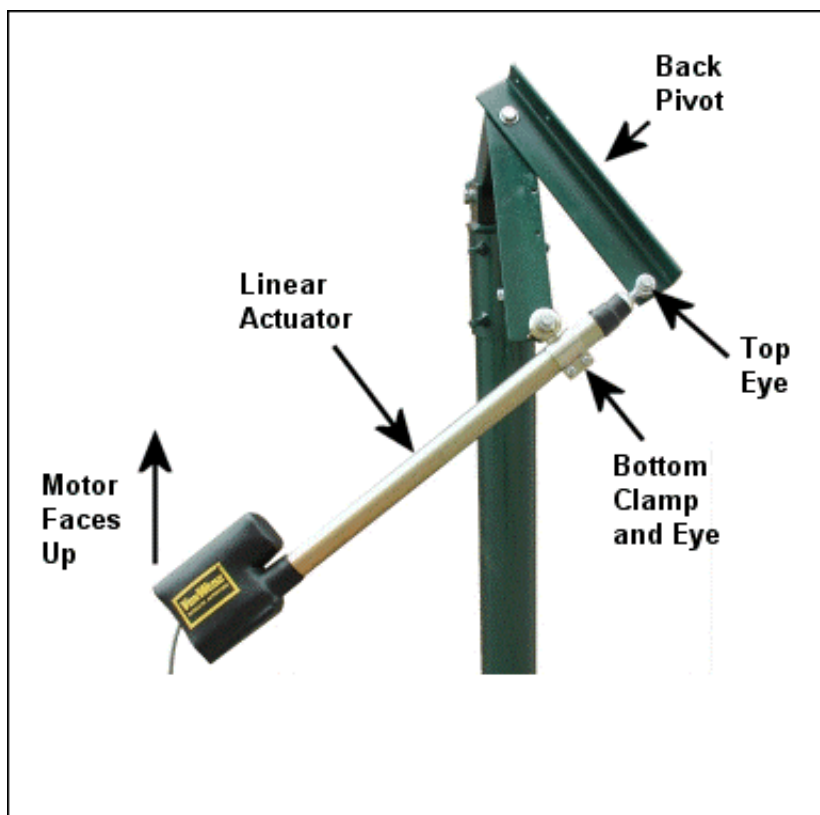
2.2) IDENTIFYING THE TRACKER DRIVE PARTS

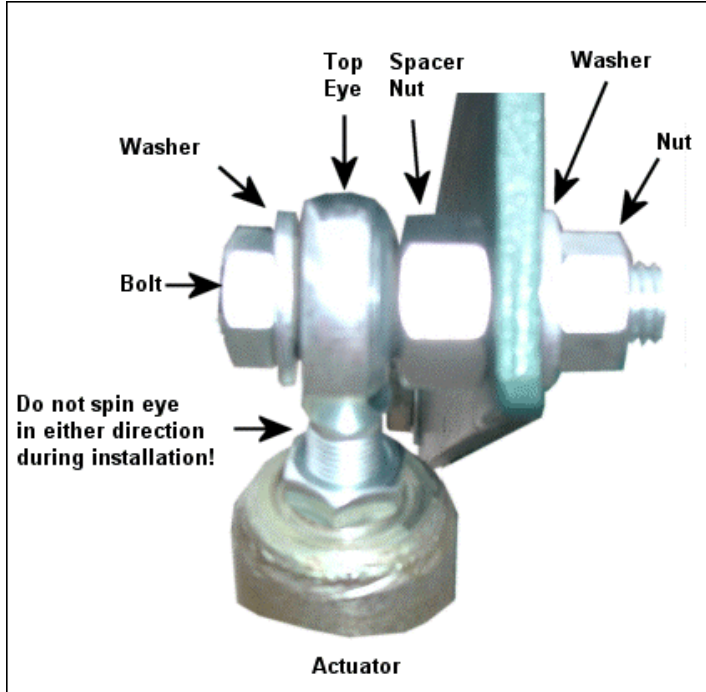


3.1) INSTALLING THE LINEAR ACTUATOR

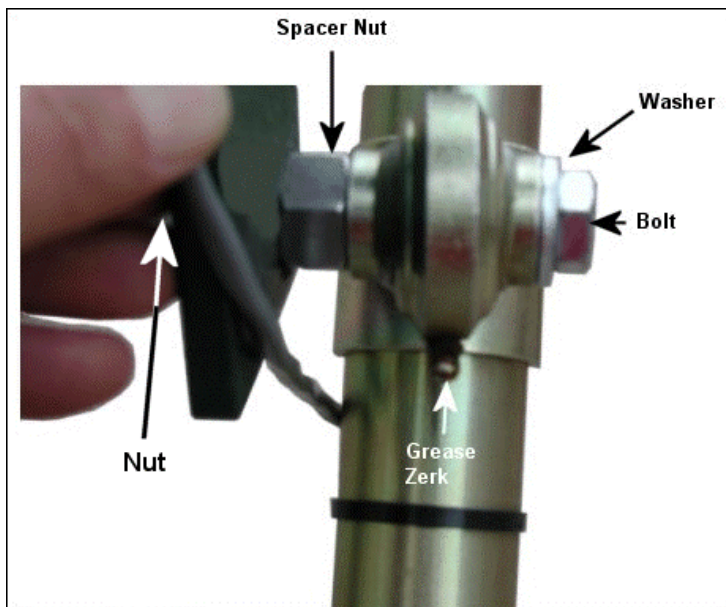


Function of the Linear Actuator: The linear actuator pushes or pulls on the rear lever arm and rotates the tracker frame to follow the sun from East to West. It is very important that the actuator is mounted to the drive before the module frame is attached. The linear actuator will lock the drive into position and keep the frame from flopping around and creating harm to you or damage to the tracker!





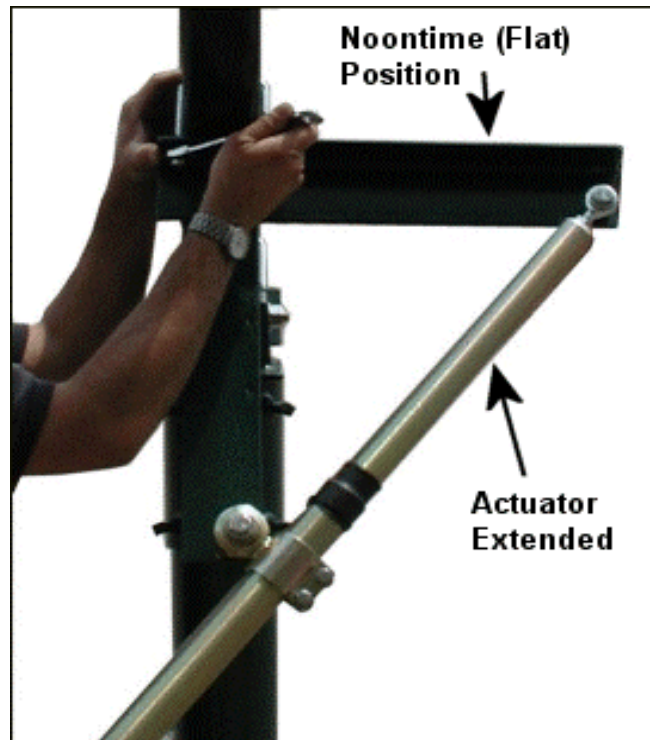
Do not unscrew the inner tube of the elevation actuator! This destroys the factory pre-set mechanical upper and lower limit switch settings. The tracker will bind up in normal operation and likely blow a fuse, or worse, damage the actuator. Bolt in the top eye using the illustration above as a guide.



Do not adjust the clamp the lower eye of the elevation actuator! This destroys the factory pre-set mechanical upper and lower limit switch settings. The tracker will bind up in normal operation and likely blow a fuse, or worse, damage the actuator. Bolt in the Lower Eye using the illustration above as a guide.

3.2) LEVEL THE TRACKER DRIVE

Once you have bolted the actuator in place it will make the rest of your installation much easier if you power up and extend the actuator so that the tracker is in a level (noontime) position. You can supply power to the actuator in several ways. The first is to use a small battery such as a rechargeable battery pack for a cordless drill. Use clip-lead jumpers from the positive (+) and negative (-) battery and connect them to the positive (red +) and negative (black -) power input wires of the actuator. The actuator will start extending. Disconnect power when the tracker is flat.



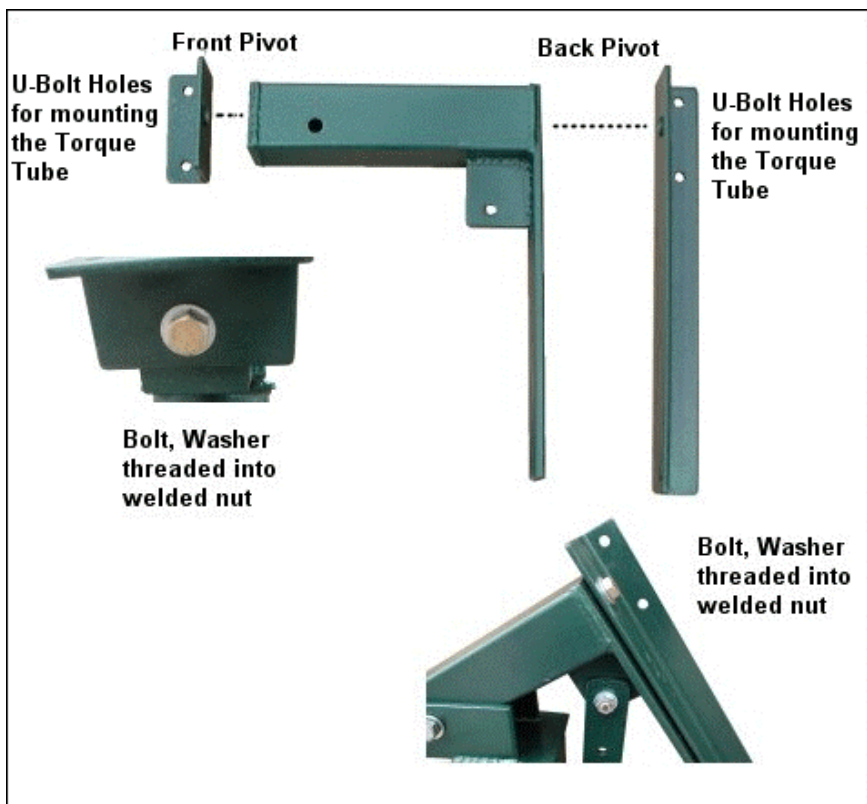
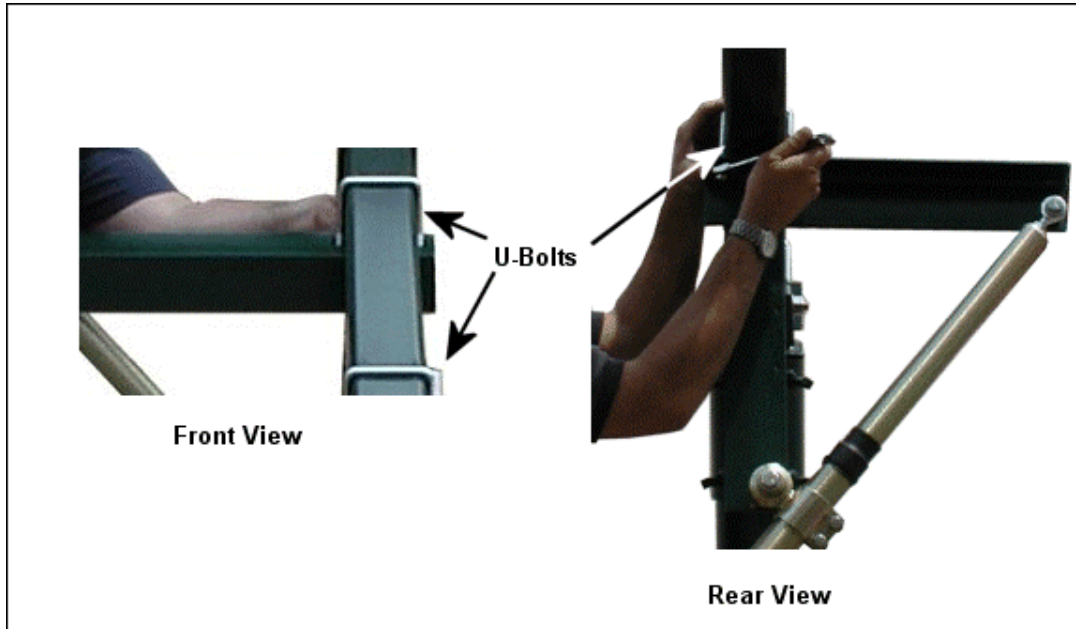
Another method is to take power directly from a 12V or 24V nominal solar module. Do not use this method with high voltage modules! Jumper from positive (+) and negative (-) of the module to the positive (red +) and negative (black -) power input wires of the actuator. The actuator will start extending. Disconnect power when the tracker is flat.

Section 4

Install the Torque Tube and Module Mounting Frame

4.1) MOUNT THE TORQUE TUBE ONTO THE TRACKER DRIVE ASSEMBLY

Use the two largest U-bolts to bolt the Torque Tube to the top of the drive assembly. The U-bolts go over the torque tube and down through the front and back pivot plates. Use a tape measure to center the torque tube over the gear drive. Tighten the U-bolts using the accompanying nuts and washers.



4.2) MOUNT THE MODULE STRUTS AND SUPPORT ANGLES TO THE TORQUE TUBE

WARNING!

YOU MAY DECIDE TO BUILD THE COMPLETE TORQUE TUBE AND ALUMINUM FRAME ASSEMBLY ON THE GROUND OR ON A TABLE. THEN YOU CAN MOUNT THE MODULES AND PREWIRE THE ARRAY BEFORE BOLTING IT TO THE GEAR DRIVE. BE AWARE THAT THE ARRAY ASSEMBLY WILL BE SIGNIFICANTLY HEAVIER AND REQUIRES ASSISTANCE IN BOLTING IT TO THE TRACKER DRIVE.

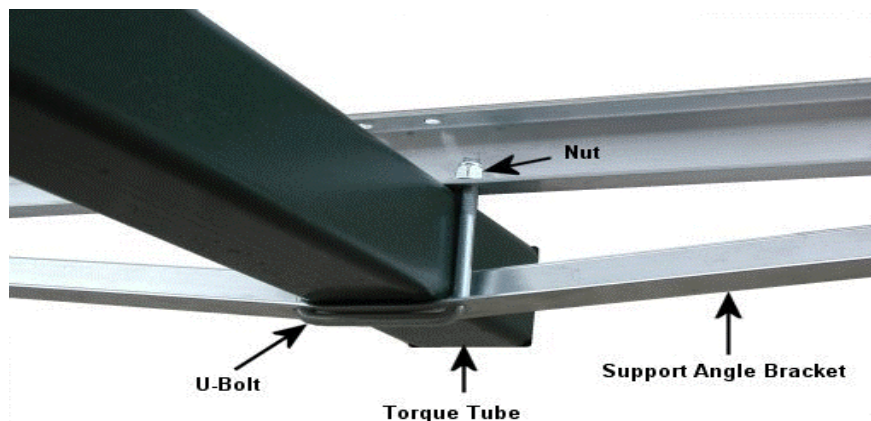
PLEASE READ THE ENTIRE INSTALLATION GUIDE BEFORE PROCEEDING WITH THE INSTALLATION.

Sample of a Completed Two Row Tracker Frame

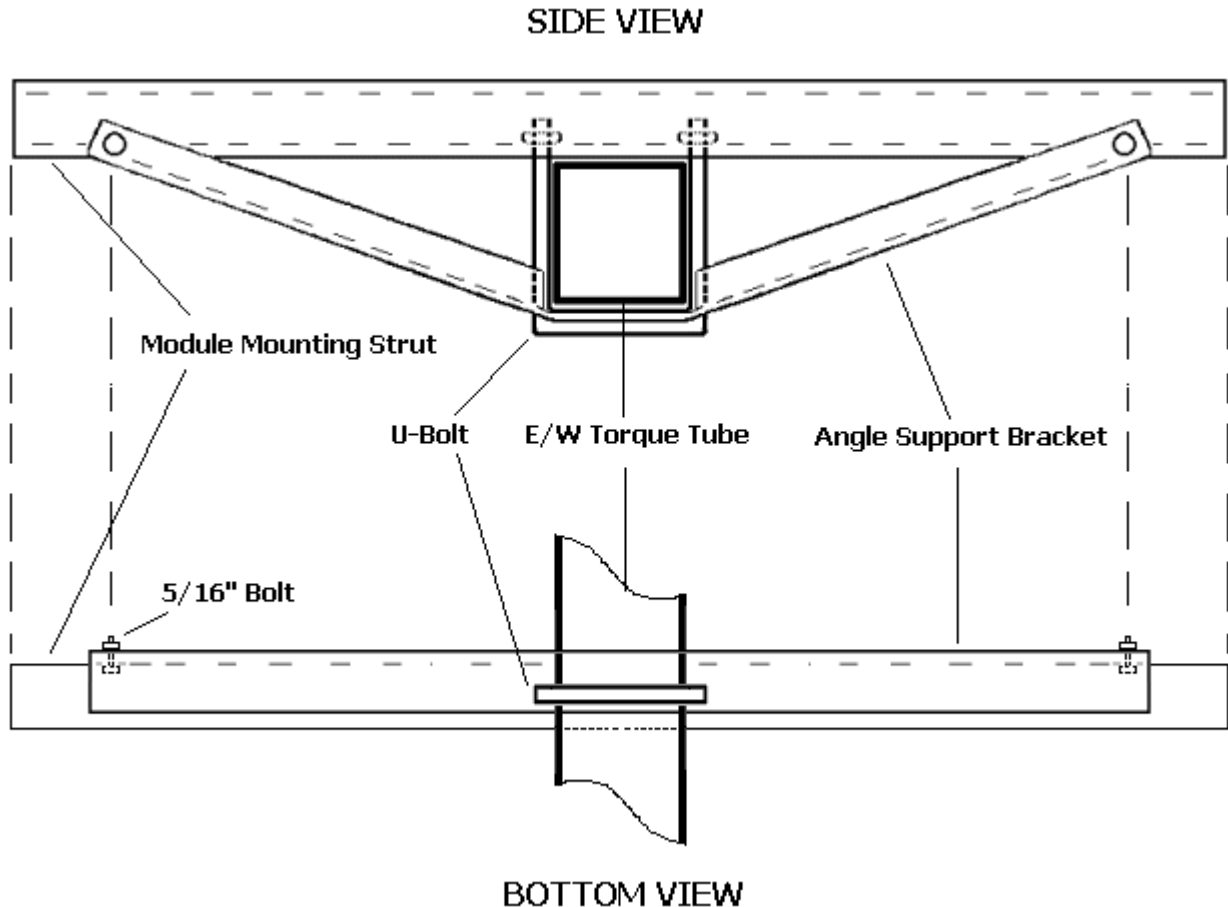
(The TR-55 Frame is now manufactured from 3" Heavy Duty Aluminum Channel and does not require "endcap channel." The smallest TR-55 frames do not require support angles.)



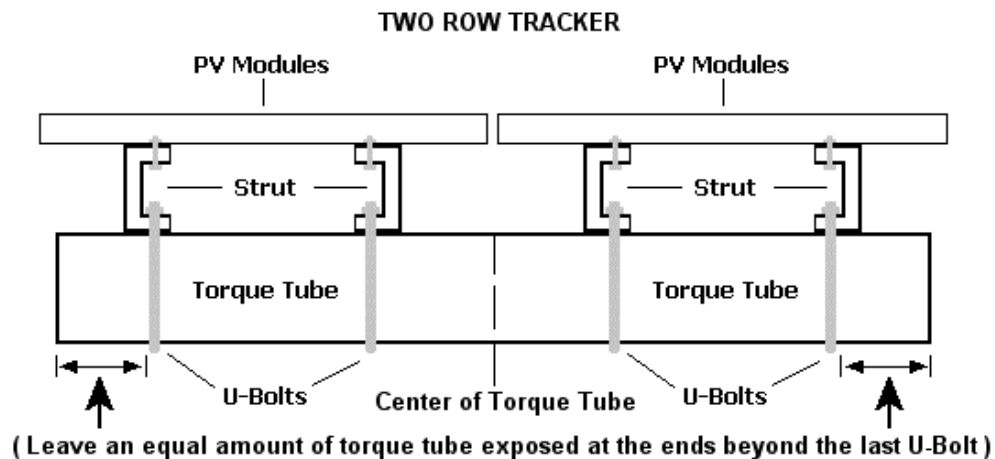
Torque Tube – Mounting Strut – Support Angle Detail



Your tracker frame is either a one row frame (2 struts, 2 support angles) or two row frame (4 struts, 4 support angles) . Match up one module strut with a support angle. Make sure that the "pairs of legs" of the strut point inward toward each other and that the support angle notch cradles the underside of the torque tube. Bend the support angle toward the module strut and bolt each end of the support angle to the side hole on the module strut. Slip a U-bolt through the support angle and into the matching holes on the underside of the module strut. Tighten the nuts "finger tight."



CENTER THE MODULE ROWS ON THE TORQUE TUBE



(Support Angle Brackets are omitted to show Strut details)

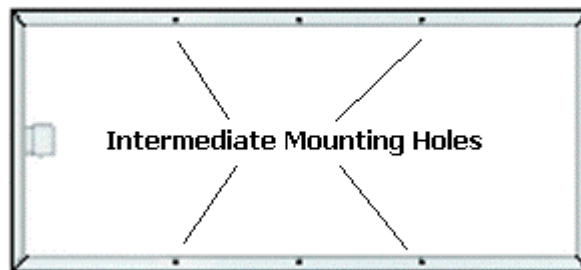
Section 5

Mounting the modules on the Tracker Frame

- 5.1) Your tracker is supplied with Heavy Duty aluminum mounting struts. The frame does not require the “endcap” channel. Larger TR-55 tracker frames include the angle support brackets as shown in the instructions. Make sure that the diagonal cut edge faces downward!

Start at one end of the frame and mount a module to the tracker frame. Align the intermediate holes of the module with the holes in the strut. Each end of the module will hang out over the frame.

Bottom View of Module



Mount the modules onto the struts. The modules align and mount using the four intermediate holes on the long sides of the module. Use the stainless steel bolts, washers and lock washers provided. The procedure is bolt – washer – pass through the module rail and then the serrated nut. The nut should “dig in” to the module rail.

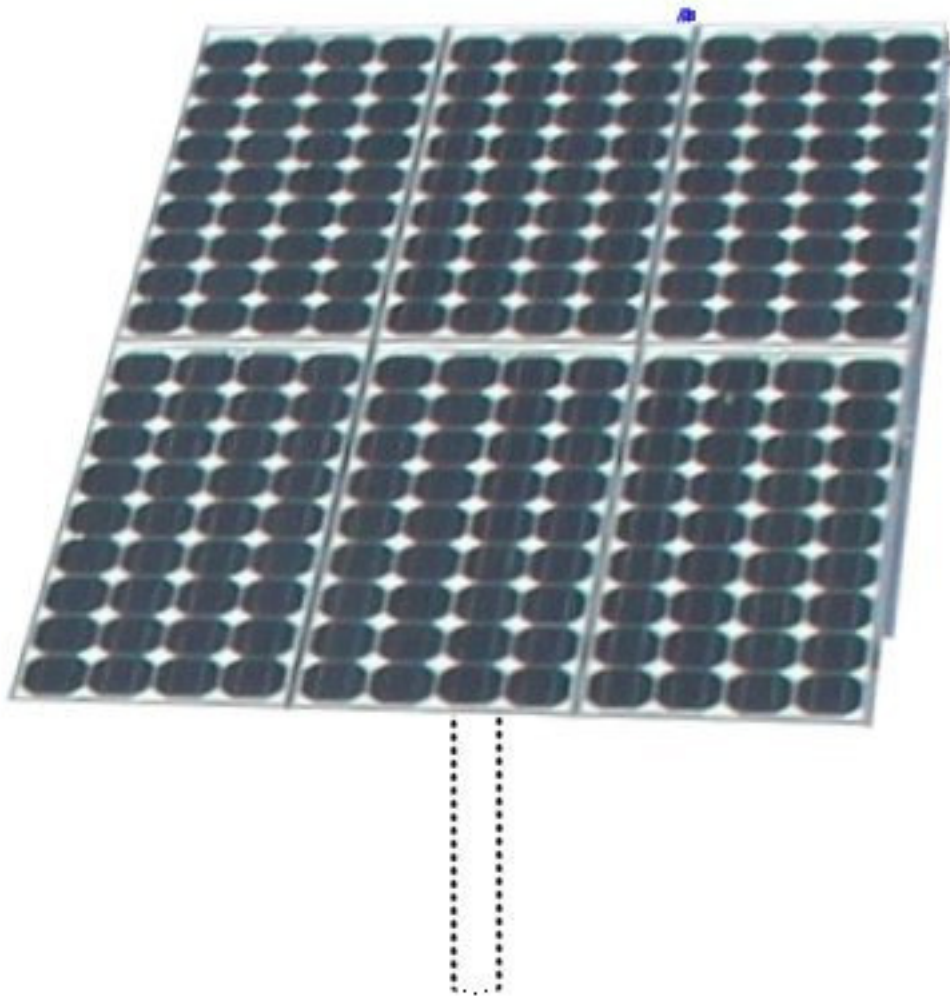
- 5.2) Leave the nuts a little loose so that you can adjust the frame. Tighten them up when you are finished “squaring up” the rack.
- 5.3) Mount the second module on the other end of the module frame. This will “square up” the tracker. Mount the remaining modules to the frame.



- 5.4) **VERIFY THAT THE FRAME IS CENTERED ON THE TORQUE TUBE**

Tighten all the nuts on the U-bolts. Start with the ones that attach the torque tube to the drive and then tighten the set that mounts the Module Strut/Support Angle Assembly to the tube. Next tighten the End Cap hex bolts and finish up tightening all of the module mounting bolts.

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



5.5) Six Siemens SP75 Modules mounted on a Two-Row Wattsun TR-55 Tracker

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

6.1) MOUNTING THE WATTSUN TRACKER CONTROLLER

Carefully unbox the controller. Make sure that you do not inadvertently bump either of the sensor eyes during the installation. Mount the main box of the controller according to the diagrams below. Starting from the backside of the controller mounting plate, pass the bolts through the holes on tilt tube. The controller has two holes that are threaded to receive the mounting bolts.





**Remote
Sensor**

- 6.2)** Mount the sensor on the top edge of the array using the mounting bracket. Most modules already have a hole in the frame that you can use. If your modules do not have an "endhole" then you will need to drill a 1/4" hole in the frame to mount the sensor. Slip a thin piece of wood between the module frame and the back of the module. The wood "spacer" will keep you from inadvertently digging your drill bit into the back of the module once you have drilled through the frame.



WATTSUN TRACKER CONTROLLER: FUNCTION AND FEATURES.

WARNING! The last connection made is from your power source to the tracker controller!

OVERVIEW

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 remote 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 the sensors.

The controller circuitry automatically adjusts the tracker sensitivity. It increases the sensitivity under direct sunlight and decreases the sensitivity with scattered or diffused light. 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. If the controller is connected to a battery bank or power supply the tracker will reset to the east after sunset. When the controller is powered directly from the PV array, the tracker returns to sunrise in the early morning.

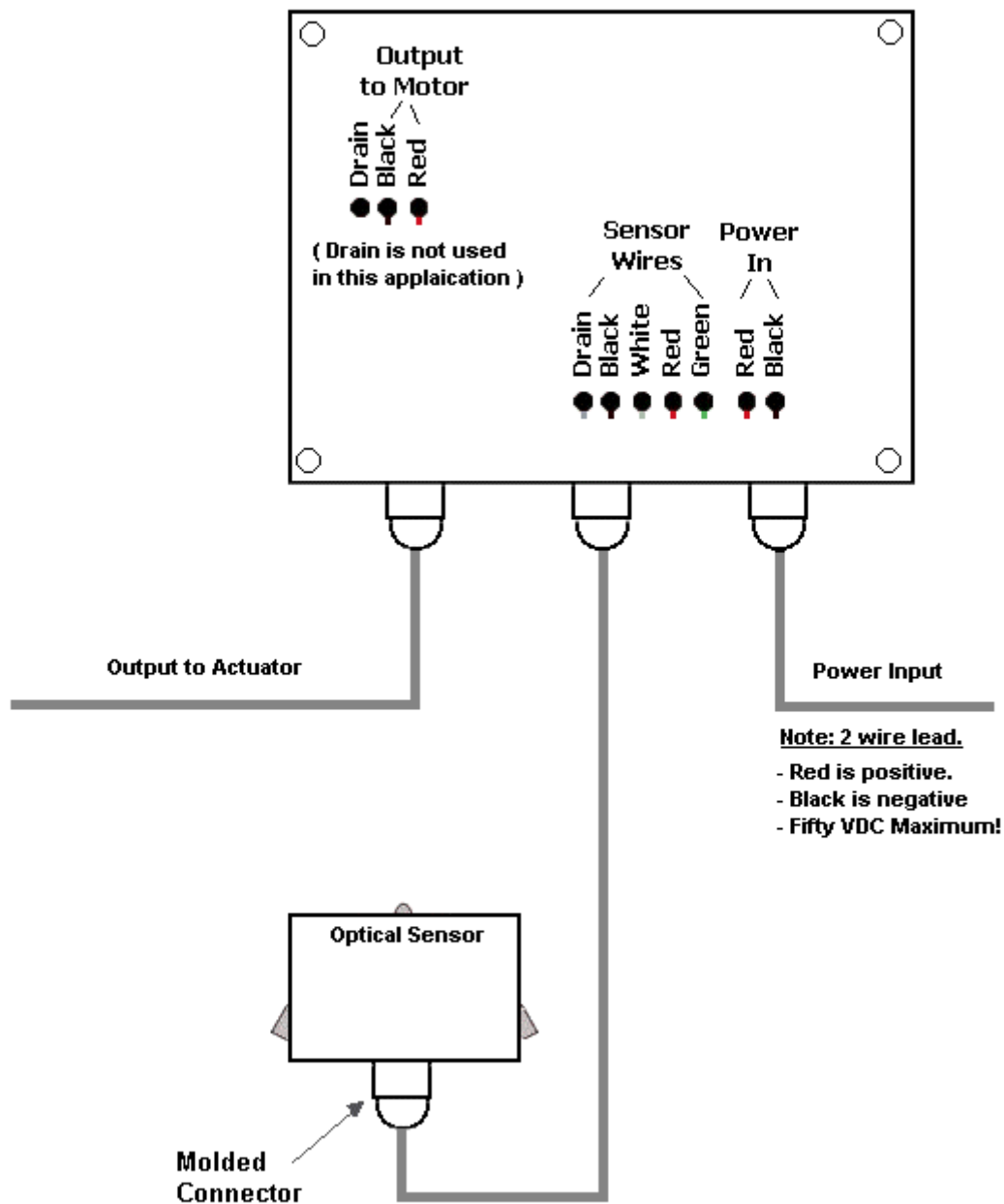
The Wattsun Tracker Controller uses energy integration circuitry, enabling the tracker to move with as little as 20 milliamps of available current. The tracker controller sends a signal to a Direct Current gear motor that moves the PV array perpendicular to the sun's rays. The motors are small, fractional horsepower, low voltage, gear motors that move the tracker into position. The drive gearing is designed such that high winds or other forces cannot drive the tracker backward.

When the controller wants the tracker to move, it sends a signal of the appropriate polarity to the DC gear-motor. The DC motors can move in a "positive" or "negative" direction. One polarity moves East direction and reversing the polarity moves it West. 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.

STANDARD FEATURES OF YOUR TR-55 SINGLE-AXIS WATTSUN CONTROLLER

- ◆ Sensor mounts independently of the main chassis.
- ◆ The controller only operates the East/West axis.
- ◆ Dip switches to test the East and West Limits.
- ◆ Controller outputs will limit the output current to 3 amps.
- ◆ Light sensitivity adjustment potentiometer .
- ◆ A 5-amp automotive spade type fuse (ATO) inside the controller chassis.
- ◆ Filtering to protect the tracker motor against "noisy" PWM charge controllers.

Wattsun Solar Tracker Controller General Wiring Diagram

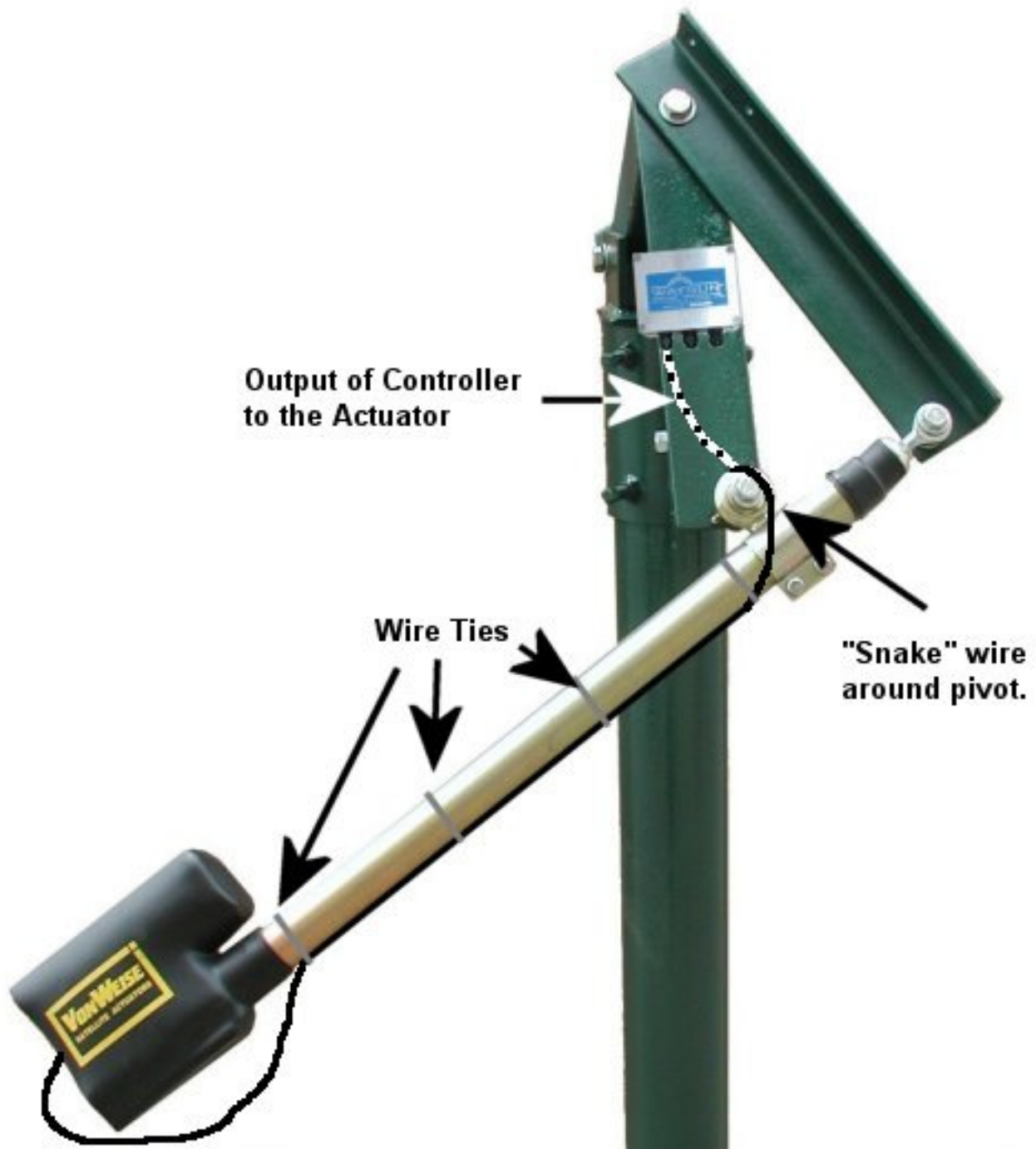


CONNECTION FROM THE CONTROLLER TO THE LINEAR ACTUATOR.

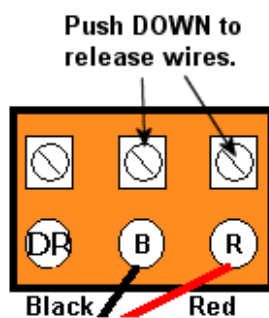
The Linear Actuator is prewired at the factory. You will have to open the controller cover and make the actuator-controller connection in the field.



Be careful when you remove (and re-install) the controller cover plate. Use a Phillips screwdriver or cordless drill (the Phillips bit size is 2R) to remove the stainless steel machine screws. An undersized or oversized bit combined with too much torque will tear up head of the screw!



7. 1) CONNECT THE ACTUATOR TO THE CONTROLLER



Unscrew the 4 cover plate screws on the controller and remove the cover. Be careful not to lose the interior gasket material. Run the power wire up into the open plastic strain relief on the bottom of the controller. There is a 3-hole orange colored terminal trip in the upper left-hand corner.

The Black wire goes in the center hole and the Red wire goes in the right hole. To insert the wire, press down on the nub just above the hole. Pushing the nub down releases a spring clip and you can then slip the wire inside. Do not twist on the nub! **(The DR hole is not used in this installation).** Close up the cover when you are finished with the installation.

7. 2) POWER OPTION #1: POWER CONTROLLER FROM A 12, 24 or 48 VDC VOLT BATTERY BANK

- ♦ If the installation is a 12-volt system, then the connection to the main battery bank is **mandatory** and you must use a 12 to 24 VDC converter (Wattsun Part# W12-24 15W Converter).
- ♦ 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.**

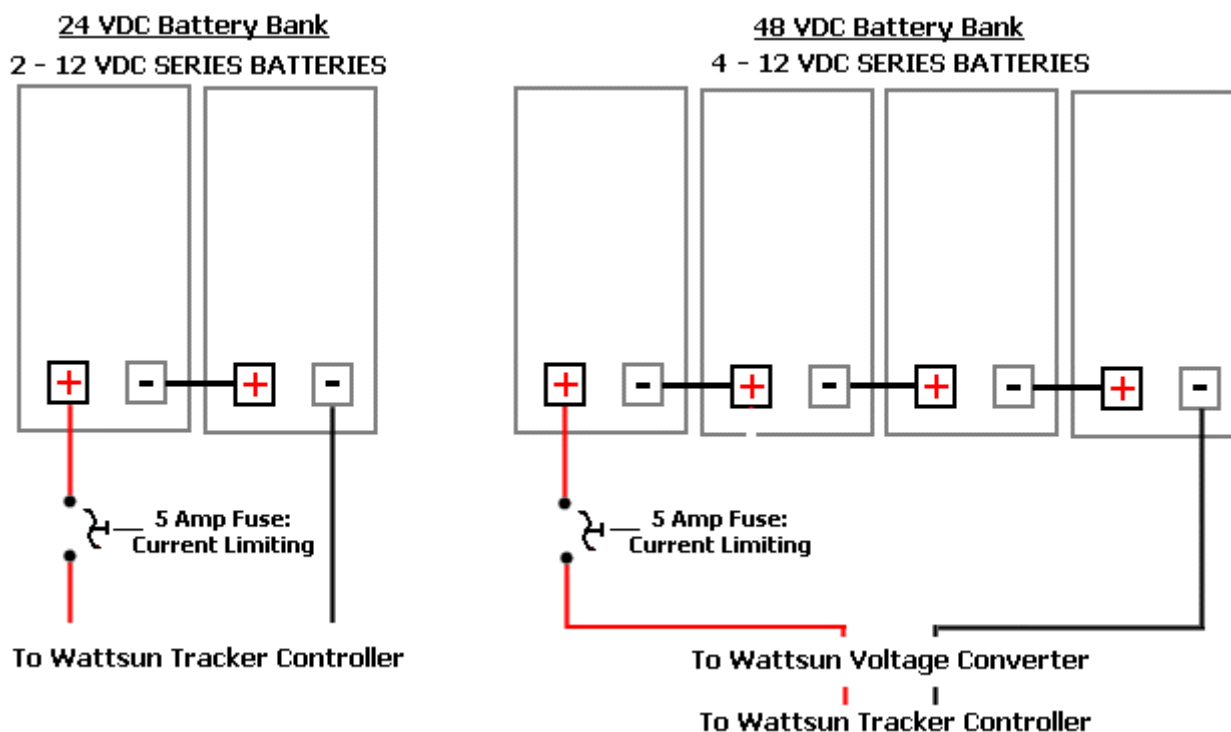
The tracker will **return to the East at sunset.**

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 toggle switch inside the controller chassis must be set to the middle position.

WARNING! Do not power the controller from a 48 VDC battery bank. The "working voltage" of a 48 VDC bank exceeds the controller's 50 VDC maximum input rating. A 48 VDC bank can easily reach 56 VDC during an equalize cycle. Array Technologies manufactures a **voltage adapter** for battery banks with voltages over 24 VDC. Please contact your Dealer if you need the adapter.

BASIC WIRING DIAGRAM FOR BATTERY BANK TO CONTROLLER

(12 VDC Battery Connection not shown)



POWER OPTION #2: POWER THE CONTROLLER FROM A 24 or 48-VOLT PV ARRAY

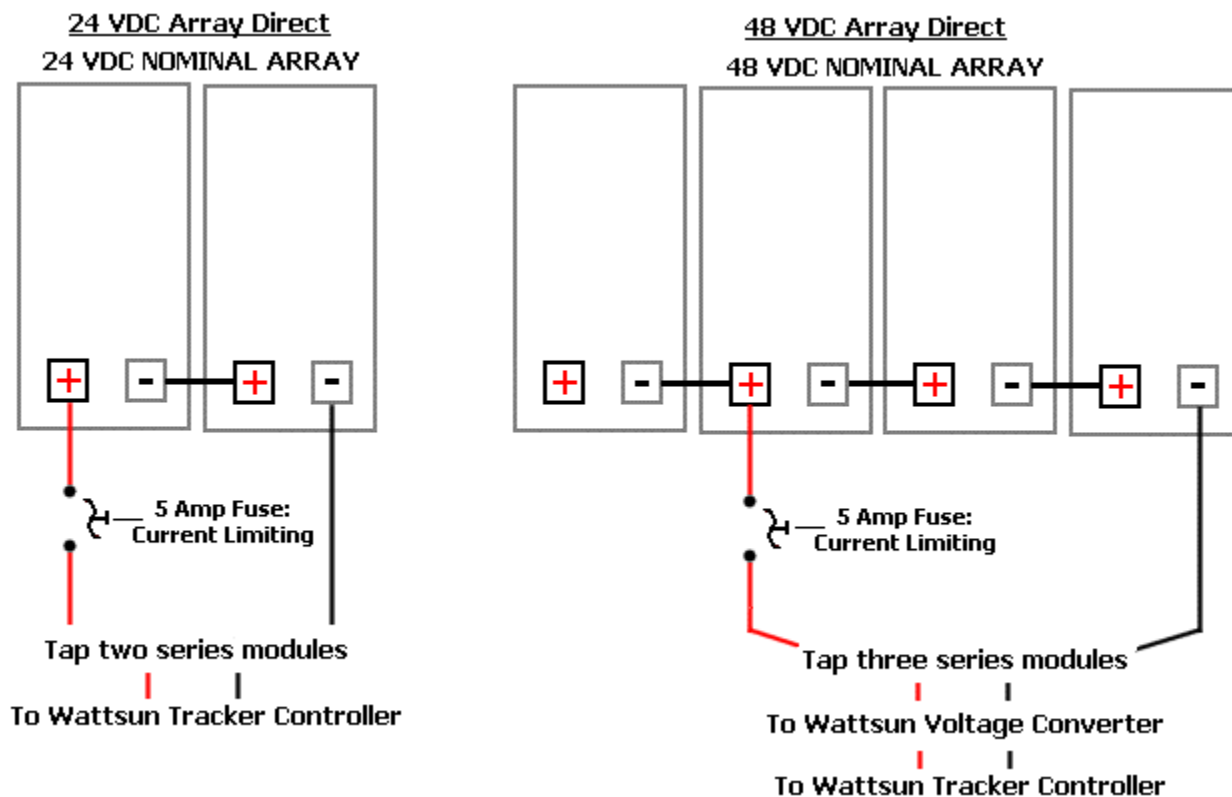
- ♦ The controller ships from the factory to operate in the 24-volt, array-direct, mode.
- ♦ The positive lead running from the array, to the power input of controller, must be fused with a 5 amp, current limiting, DC-rated fuse.
- ♦ Failure to fuse the input power wire at may create a potential fire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

Typical **Open Circuit Voltage**, or **Voc**, of a 24 VDC array is **44 VDC**. A 48 VDC nominal array has a Voc of **88 VDC**. Array Technologies manufactures a **voltage adapter** for PV arrays with voltages over 24 VDC. Please contact your Dealer if you need the adapter.

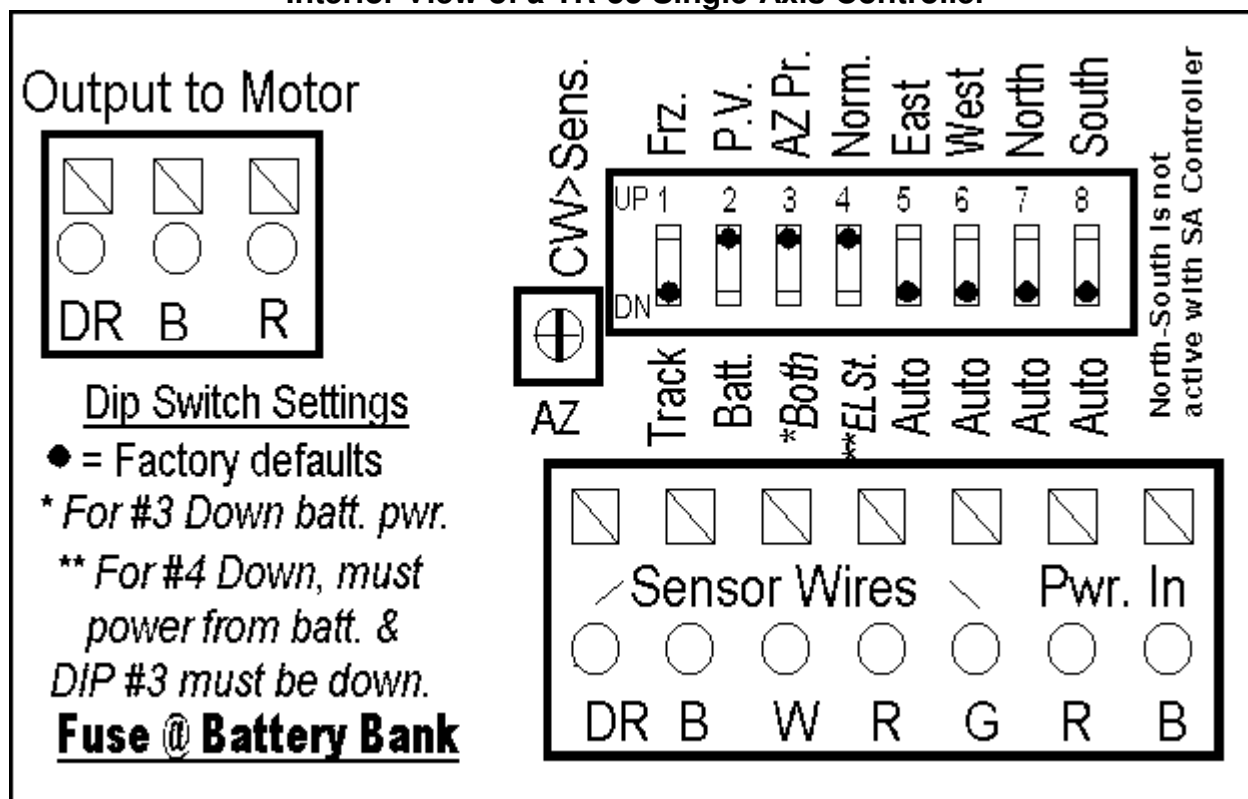
The tracker will return east at first morning light when powered directly from the PV array. The tracker controller will automatically adapt to whatever current is available from the PV array. If the PV array is only capable of producing small amounts of current (20 to 300 milliamps) the tracker controller 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.

BASIC WIRING DIAGRAM FOR ARRAY DIRECT TO CONTROLLER



CONTROLLER DIAGRAM, COMPONENTS, SWITCH SETTINGS AND FUSING

Interior View of a TR-55 Single-Axis Controller



DIP SWITCH SETTINGS FOR A SINGLE-AXIS CONTROLLER

Dip	Default	Up Position	Down Position
#1	Down	Freeze Tracker - Temporary off only	Track
#2	Up	Power from PV 24 VDC nominal array or whenever you are supplying power using a Wattsun 12 or 48 V voltage adapter.	Power from 24VDC Battery Bank only. (Allows for low battery bank voltage)
#3	Up	Default	Not Available on Single Axis TR-55
#4	Up	Default	Not Available on Single Axis TR-55
#5	Down	Manually move East	Auto Track
#6	Down	Manually move West	Auto Track
#7	Down	Not Available on Single Axis TR-55	Auto Track
#8	Down	Not Available on Single Axis TR-55	Auto Track

SENSITIVITY TRIM POT

Inside the controller chassis is an adjustment potentiometer to control light sensitivity. It is a single-turn pot: clock-wise rotation equals greater sensitivity, counter clock-wise rotation equals lower sensitivity. This adjustment is factory pre-set and should only be adjusted by qualified personnel. Do not turn more than ½ turn in either direction!

INTERIOR FUSE

Replaceable 5-Amp automotive spade type fuse (ATO). Pull out gently to inspect or replace.

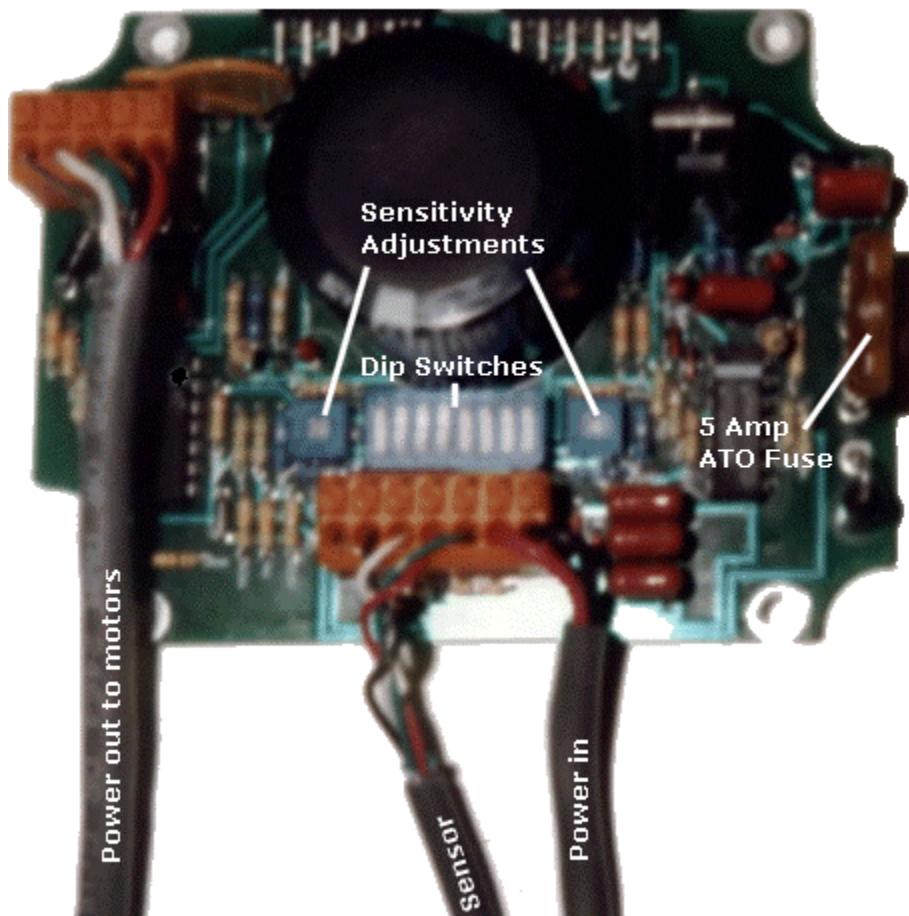
NOTE FOR YOUR TR55 SINGLE AXIS CONTROLLER

- ♦ There is only **one** adjustment potentiometer for (East-West) Tracking.
- ♦ Dip switches **#3, #4, #7 & #8** are not functional. Leave at factory default.
- ♦ Sensor has only one set of "eyes."

OPERATING THE CONTROLLER

- 6.3) **Visually inspect the area** around the array. Make sure that there is **nothing in the way of the tracker** when it begins to rotate. A common mistake is to leave a ladder standing nearby.
- 6.4) **Inspect the wiring** from the array to the controller and your junction box. Make sure that all wire service loops are long enough and that the wires are free from binding at all pivot points. Is there enough slack in the wires to accommodate the East-West movement?
- 6.5) **Pull your exterior fuse or disconnect switch, to break the power to the controller.**

Loosen the 4 Phillips bit machine screws and remove the metal cover of the controller.



INTERIOR VIEW OF A TYPICAL WATTSUN CONTROLLER
(Dual-Axis Board Shown: The TR-55 Controller is a Single-Axis Controller)

- 6.6) Depress the top rocker of Dip Switch #1 to the UP position to temporarily freeze the tracker position.
- 6.7) Set Dip Switch #2 according to your requirements. Leave UP for array-direct or if you are using a 12 or 48 volt adapter and rock DOWN for 24 volt battery power. The down position bypasses the Energy Integration Circuitry and low-battery voltage cutoff. This allows the tracker to operate when the battery voltage is below 23.5 VDC.
- 6.8) Inspect the area around the tracker again. Remove any ladders, tools or obstructions from the area.
- 6.9) Replace the battery fuse and or disconnect.

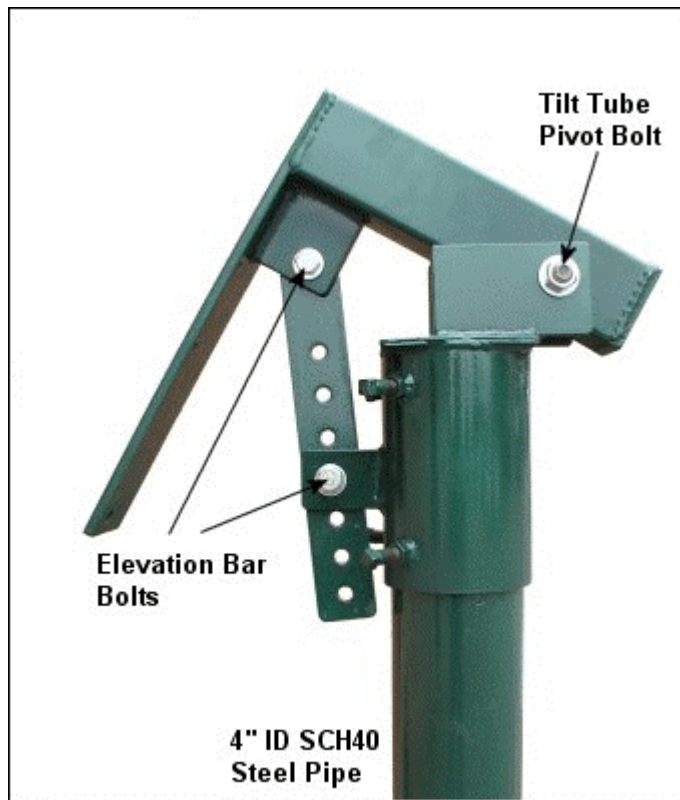
- 6.10)** Depress the bottom rocker of Dip Switch #1 to Track.
- 6.11)** After a 3 second delay, the tracker will move and track the sun.
- 6.12)** Manually move the tracker East by depressing the top of Dip Switch # 5.
Depress the bottom of Dip Switch # 5 to return to Auto Tracking.
- 6.13)** Manually move the tracker West by depressing the top of Dip Switch # 6.
Depress the bottom of Dip Switch # 6 to return to Auto Tracking.

Setting the Sensor Light Sensitivity: The sensor sensitivity is preset at the factory. Inside the controller chassis are two adjustment potentiometers for light sensitivity. They are a single-turn pot: clockwise rotation equals greater sensitivity, counter-clockwise rotation equals lower sensitivity. Only qualified personnel should perform this adjustment. Do not turn more than ½ turn in either direction!

SEASONAL ADJUSTMENT SINGLE-AXIS ELEVATION

7. 1) INCREASE OR DECREASE THE ELEVATION ANGLE

The holes are punched for tilts of 0,15,30,65 and 60 degrees. Unbolt the lower adjustment bolt and move the tracker elevation bar to the desired position. Tighten the bolt securely!



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.

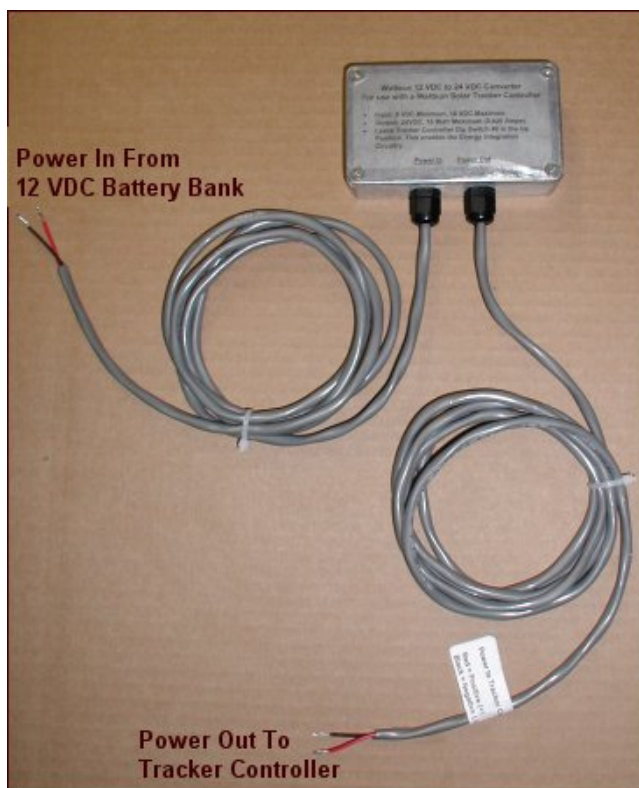
9. 1) 12-24 15W LVC: Wattsun DC/DC Converter for 12-Volt Battery Systems (Replaces Wattsun PN W12-30 LVC, Effective Jan 2002)

SPECIFICATIONS:

- ♦ Voltage Input = 9 VDC Minimum, 18 VDC Maximum.
Power from a 12 VDC battery bank only!
- ♦ Voltage Output at Maximum Input = 24 VDC under load.
- ♦ Output Current Maximum = 15 Watts, 0.625 Amps.
- ♦ Fuse the pre-regulator positive input wire with a 5 amp DC-rated fuse.
Appropriate fuse to be provided by your installer.
- ♦ All wire color coding is: RED = POSITIVE (+) , BLACK = NEGATIVE(-)

FUNCTION:

The typical voltage input for a standard Wattsun Tracker Controller is 24 VDC. Battery banks (or arrays) that have a "working" voltage of only 12 VDC nominal do not provide enough voltage to power the drive motors on large azimuth trackers. The 12-24 regulator boosts the voltage input to meet the requirements of the tracker controller. It must be connected to a 12VDC battery bank to function properly.



INSTALLING THE 12-24 CONVERTER:

- 1) Disconnect the main battery bank so that no power can flow through any wires you are working on.
- 2) Connect the output wires of the voltage regulator (bottom right two-wire cable) to the input power wires of the Wattsun Tracker Controller. IE: Red to Red (+), Black to Black (-).
- 3) We recommend that you fuse the input of the voltage regulator (bottom left two-wire cable) with a 5 amp DC rated fuse. The fuse is inserted in the positive (Red,+) lead of the 12 VDC battery wire.
4. A) Battery bank connection: Connect the fused input side (two-wire, shorter cable) of the voltage regulator directly to the output of a 12-volt battery bank. Battery positive to fused red input. Battery negative to voltage regulator input negative.
4. B) PV array direct connection: Will not work as intended. Maximum input voltage of 18 VDC will be exceeded and destroy the regulator.
- 5) Reconnect the main battery bank (or fuse) so that power can flow through the voltage regulator and Wattsun Solar Tracker Controller.

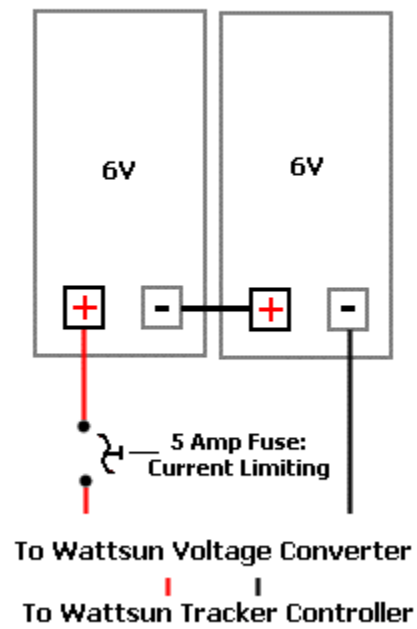
WARNING!

- ◆ **Connection to the output of a 12 VDC nominal module will not supply the proper power the drive motors . The 12-24 LVC can be damaged and cause the Wattsun Solar Tracker Controller or drive motors to fail. Warranty does not cover this damage. Both parts will have to be returned to the factory for repair!**
- ◆ **Never apply power into the 12-24 LVC output wires. Warranty does not cover this damage. Damage can occur and it will have to be returned to the factory for repair!**
- ◆ **A self-resetting fuse is incorporated in the 12-24 LVC. If the output wires touch each other and are shorted, the interior fuse can blow and will disconnect the power output of the regulator. If this happens: Repair the output short then reset the fuse. Disconnecting power to the regulator resets the fuse. Wait a minute for the fuse to cool. Then reconnect power to the regulator.**

CAUTION!

CONVERTOR CASE MAY GET VERY HOT UNDER HIGH LOAD OR SHORT CIRCUIT. DO NOT MOUNT TO A FLAMABLE SURFACE SUCH AS WOOD OR OTHER. DO NOT LET CHASSIS COME INTO CONTACT WITH OTHER WIRES AS HEAT MAY MELT INSULATION.

Wiring Diagram for a Wattsun 12-30 LVC



9. 2) 48-24LVC: Wattsun DC/DC Converter for 48-Volt Battery Systems

SPECIFICATIONS:

- ◆ **Voltage Input Maximum = 66 VDC.**
Power from a 48 VDC battery bank or from three, 12 VDC nominal, modules in series.
- ◆ **Voltage Output at Maximum Input = 35 VDC under load.**
- ◆ **Output Current Maximum = 4.5 A.**
- ◆ **Fuse the 48-24 LVC positive input wire with a 5 amp DC-rated fuse.**
Appropriate fuse to be provided by your installer.
- ◆ **All wire color coding is: RED = POSITIVE (+) , BLACK = NEGATIVE(-)**

FUNCTION:

The maximum voltage input for a standard Wattsun Tracker Controller is 50 VDC. PV arrays and battery banks that have a "working" voltage greater than 24 VDC nominal can exceed the 50 VDC threshold. The 48-24 LVC regulator limits the voltage input to the tracker controller to a maximum of 35 VDC. At 37 VDC and below, the actual operating voltage is 2 VDC lower than the input voltage. At input voltages of 37 VDC to 66 VDC, the output voltage will be regulated at 35 VDC.



INSTALLING THE 48-24 LVC:

- 4) Disconnect the main battery bank or PV array circuit so that no power can flow through any wires you are working on.
- 5) Connect the output of the voltage regulator (longer cable exiting the regulator) to the input power wires of the Wattsun Tracker Controller. IE: Red to Red (+), Black to Black (-).
- 6) Fuse the input of the voltage regulator (shorter cable side) with a 5 amp DC rated fuse. The fuse is inserted in the positive (Red,+) lead of the input wire.
4. C) Battery bank connection: Connect the fused input side (two-wire, shorter cable) of the voltage regulator directly to the output of a 48-volt battery bank. Battery positive to fused red input. Battery negative to voltage regulator input negative.
4. D) PV array direct connection: Connect the fused input side (two-wire, shorter cable) of the voltage regulator directly to the output of three, 12- volt modules in series. When connecting directly to the PV Array: You will want to make the connection on the lower side of the 4-module string. IE: From the negative of array to the positive tap of the third module, in the 4-module, 48 VDC nominal string.
- 6) Open the Wattsun Solar Tracker Controller and set switch #2 to the UP (PV) Energy Integration setting.
- 7) Reconnect the main battery bank or PV array circuit so that power can flow through the voltage regulator and Wattsun Solar Tracker Controller.

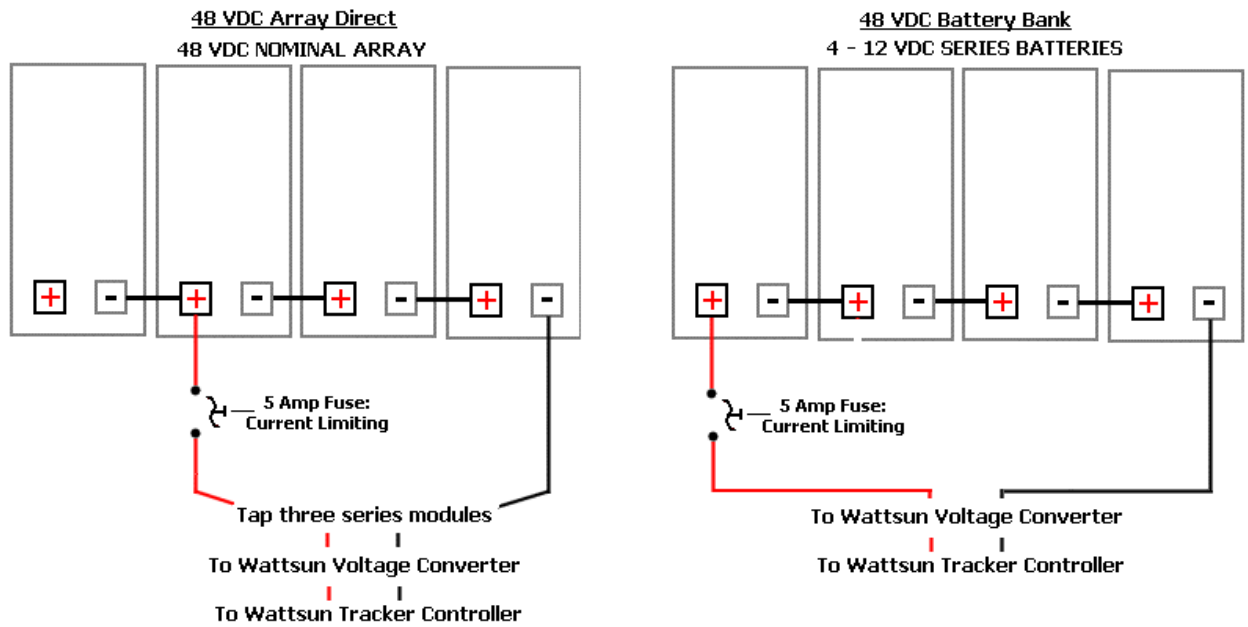
WARNING!

- ◆ Connection to the output of 4-modules in series will exceed the 66 VDC maximum input of the voltage regulator. The 48-24 LVC will be damaged and cause the Wattsun Solar Tracker Controller to fail. Warranty does not cover this damage. Both parts will have to be returned to the factory for repair!
- ◆ Never apply power into the 48-24 LVC output wires. Warranty does not cover this damage. Damage can occur and it will have to be returned to the factory for repair!
- ◆ A self-resetting fuse is incorporated in the 48-24 LVC. If the output wires touch each other and are shorted, the interior fuse can blow and will disconnect the power output of the regulator. If this happens: Repair the output short then reset the fuse. Disconnecting power to the regulator resets the fuse. Wait a minute for the fuse to cool. Then reconnect power to the regulator.

CAUTION!

CONVERTOR CASE MAY GET VERY HOT UNDER HIGH LOAD OR SHORT CIRCUIT. DO NOT MOUNT TO A FLAMABLE SURFACE SUCH AS WOOD OR OTHER. DO NOT LET CHASSIS COME INTO CONTACT WITH OTHER WIRES AS HEAT MAY MELT INSULATION.

Wiring Diagram for a Wattsun 48-24 LVC



PERIODIC MAINTENANCE

- ♦ Maintenance should be performed at least once a year. More often if your tracker is installed in severe weather areas.
- ♦ Inspect all the tracker hardware and the module bolts for tightness. Tighten all nuts and bolts that need it.
- ♦ It is unnecessary to lubricate the bushings on the ends of the Tilt Tube. They are oil-impregnated and self-lubricating.
- ♦ Inspect all wires for abrasion and gently tug on them to make sure that they are secure.

WARNING!

- The information provided here is a general guideline for grounding your Wattsun Solar Tracker.
- This information is not a substitute for following the National Electrical Code.
- You should hire a qualified Electrician, Electrical Contractor or Solar Professional to install and wire your Wattsun Solar Tracker.
- Array Technologies does not assume any liability for your failure to adhere to the NEC.
- Failure to ground your tracker may void your Wattsun Warranty and may result in damage to your Wattsun Solar Tracker Controller or motors.

REFERENCES:

<u>Grounding the South Forty</u> John Wiles Code Corner Home Power Magazine Issue # 74 December 1999 / January 2000 <u>http://www.sandia.gov/pv/pvsys/sforty.pdf</u>	<u>To Ground or Not to Ground</u> John Wiles Code Corner Home Power Magazine Issue # 72 August 1999 / September 1999 <u>http://www.sandia.gov/pv/pvsys/groundcdcrnr.pdf</u>
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[Codes, Standards, and Safety](#) available online at: <http://www.sandia.gov/pv/sfty.htm>

FIG 1: GROUNDING THE MODULES, TRACKER FRAME, DRIVE AND MOUNTING PIPE
(Dual-Axis Shown but the Grounding Procedure is the same for all trackers)

The array equipment-grounding conductors, for the modules, tracker frame, drive and mounting-pipe, should terminate at one location—probably a grounding terminal strip in the junction/combiner box. Then, there should be a conductor from this point to the grounding electrode (ground rod).

The steps are:

- The frame of every module is interconnected with grounding wire.
- The module grounding wire ties into the tracker frame on the torque tube or struts.
- A flexible loop of grounding wire continues from the torque tube to the base of the drive.
- The ground wire continues to the mounting pipe or combiner box that is bonded to the pipe.
- The ground wire goes down the pole and is bonded to an 8-foot copper ground rod.
- The ground rod is set in the earth outside of the concrete foundation of the pipe.
- Do not rely on the mounting pipe to act as a ground rod.

(AZ-200 Drive shown for illustration purposes)

FIG 1
Grounding a Wattsun Tracker

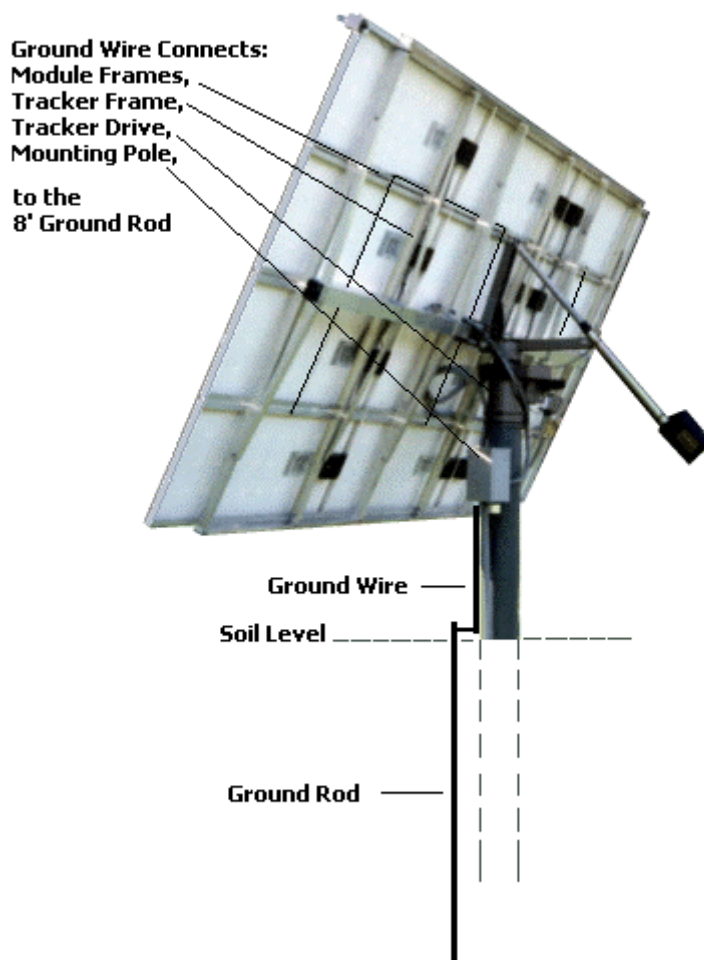
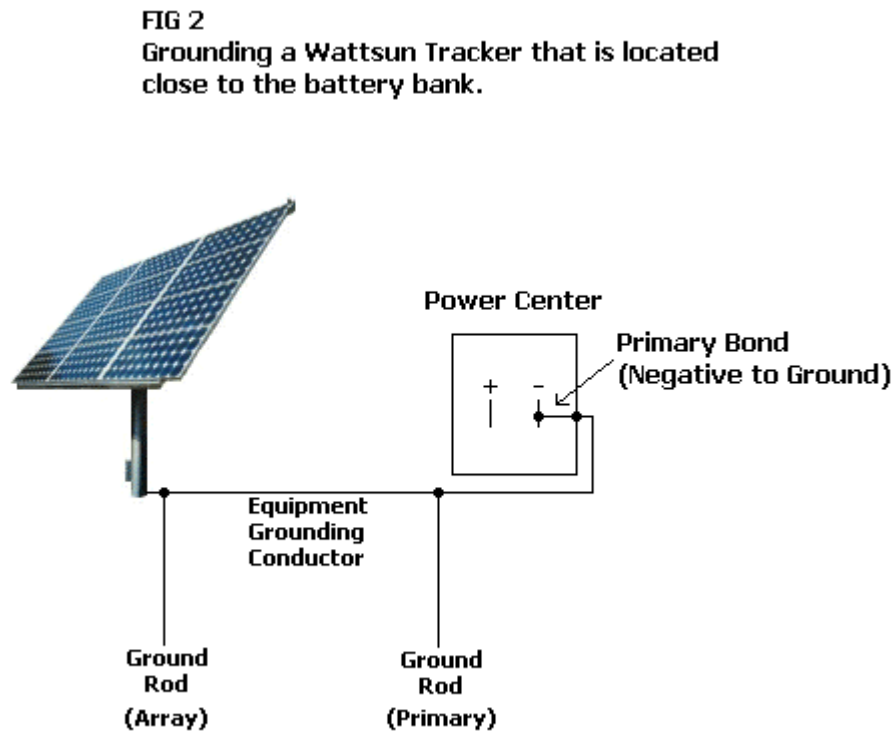


FIG 2: TYPICAL GROUNDING OF A TRACKER TO THE BATTERY BANK/POWERCENTER.

- The modules, Wattsun Tracker, and mounting pipe are grounded as shown in Figure 1.
- The normal, (primary bond) negative-to-ground bonding is required in the power center or ground-fault device.
- The negative current-carrying (PV Negative) conductor is bonded (connected) to the grounding system at the power center or charge controller.
- An equipment-grounding conductor is run from the PV array to the power center or charge controller.



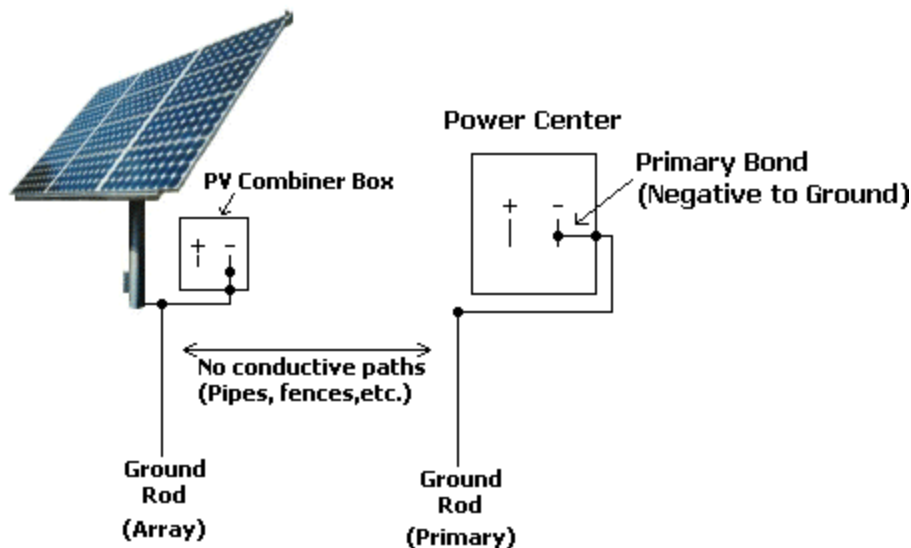
WARNING!

If you ground according to FIG 2, you must ground the PV Negative at the powercenter, not at the array. There can only be one ground for the current carrying conductor (PV Negative) in this situation.

FIG 3: ALTERNATIVE GROUNDING FOR A TRACKER THAT IS DISTANT FROM THE BATTERY BANK/POWERCENTER.

- The modules, Wattsun Tracker, and mounting pipe are grounded as shown in Figure 1.
- The PV array is ground mounted some distance (perhaps over 30 feet) away from other PV components (inverter, batteries, etc.). The distance is not specified in the NEC.
- There are no AC power circuits between the array and the bank/powercenter.
- There are no conductive paths (electrical or other) such as water pipes, metal fences, communication circuits, or telephone circuits between the array and the other structure.
- Bond the negative conductor (PV Negative) to the grounding system at both the array and at the inverter/battery/power center location.
- Do not run any equipment grounding conductors between the array and at the inverter/battery/power center location.
- Use ground rods at the array and at the inverter/battery/power center location.

FIG 3
Grounding a Wattsun Tracker that is over
30 feet from the battery bank



WARNING!

If you ground according to FIG 3, you must ground the PV Negative at both the array and at the powercenter. Do not run any equipment grounding conductors between the array and at the inverter/battery/power center location.

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, drive assembly, and actuator. A 5-year Extended Warranty is available from Array Technologies.

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.

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THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU ALSO MAY HAVE OTHER RIGHTS THAT MAY VARY FROM STATE TO STATE. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY WILL LAST OR THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU.

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