

November 2022

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Superstate Solar Tracker Installation Manual

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INTRODUCTION

Thank you for purchasing this solar tracking system by Superstate we will wholeheartedly provide first-class products and services to you.

This manual provides important information about constructing the necessary concrete foundation, and the assembly of the tracking mechanism. Be sure to retain this manual for future reference. Read it carefully & thoroughly **before** starting the installation. We accept no responsibility for your failing to follow these instructions. Use proper tools and follow good safe work practices to avoid injury during assembly.



Superstate Solar Tracker just installed at Eneby Farm in Stallarholmen, Sweden

GENERAL TECHNICAL SPECIFICATIONS

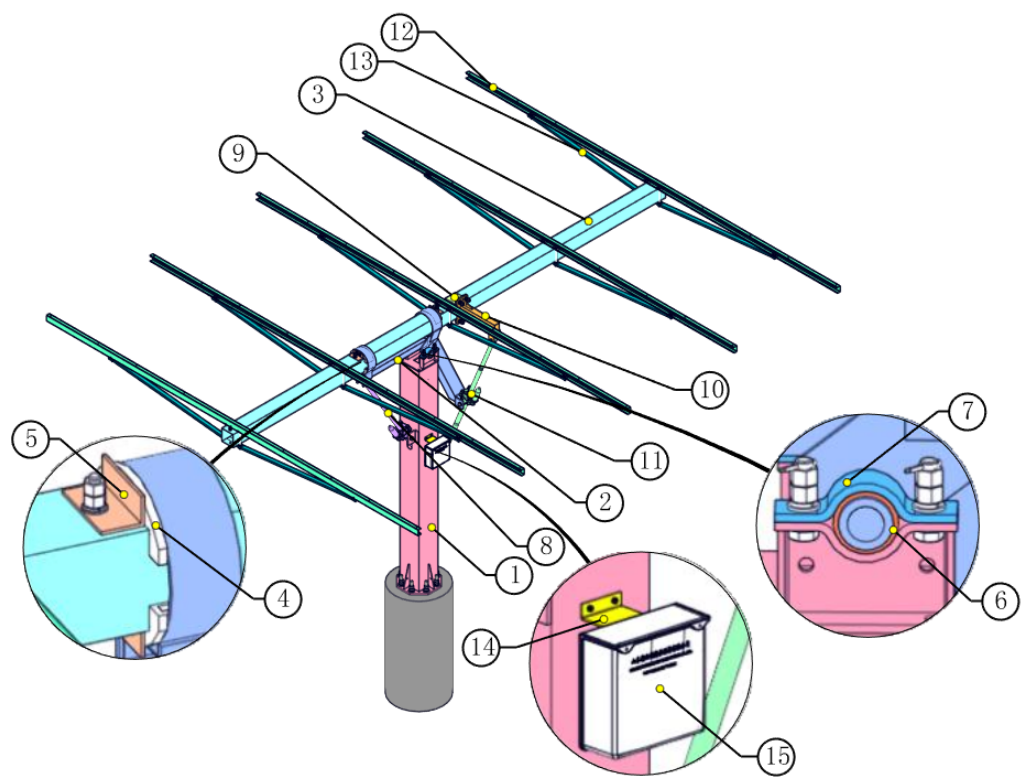
Item	Data
Control mode	Time + GPS
Average tracking accuracy	0.1 - 2.0 degrees (adjustable)
Gear motor	24V/1.5A
Output torque	5,000 N x M
Tracking power consumption	< 0.01 kWh/day
Azimuth angle tracking range	100 degrees
Elevation angle tracking range	50 degrees
Max. wind resistance in safety mode	> 40m/s
Max. wind resistance in working mode	> 24m/s
Material	Hot-dipped galvanized steel > 65µm
Working temperature	-40C - +75C
Certifications	CE, TUV



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Part I. Superstate Solar Tracking system structure chart



System structure chart

Main parts of Superstate Solar Tracking system

Item	Description	Weight (kg)	Total Weight	Dimensions (mm)	Quantity
1	Vertical pole	56.7	56.7	2000*200*200	1
2	L-shaped bracket	20.4	20.4	1078*970*220	1
3	Center beam	43.6	43.6	120*120*4170	1
4	Sliding blocks	0.8	1.6	φ60*45	2
5	Sliding block limited plates	0.42	1.68		4
6	Shaft sleeves	0.4	1.6	φ60*45	4
7	Pressing plates	0.4	0.8	36*166*40	2
8	Elevation linear actuator (tracks south-north)	8.0	8.0	L=875	1
9	Swing arm connecting plate	1.88	1.88	212*110*120	1
10	Swing arm	5.3	5.3	100*50*370	1
11	Azimuth linear actuator (tracks east-west)	8.6	8.6	L=1105	1
12	C-shaped beams	6.7	33.5	32*55*3300	5
13	U-shaped Inclined struts	1.6	8		5
14	Control unit seat	0.64	0.64		1
15	Control unit	1.0	1.0		1
Total			191.9		31

Part II. Connecting Screws and Clamps Details

Item	Specification	Description	Quantity
S1	M22, 2 nut, 1 flat washer,1 spring washer	For foundation bolts	8 sets
S2	M16*70 bolt, double nut,1 flat washer, 1 big flat washer, 1 spring washer, 1 split pin	Hardware for vertical pole & L-shaped bracket	4 sets
S3	∅ 16*80 bolt, flat washer, split pin	Hardware for fixing linear actuator	2 sets
S4	M18*40 bolt, split pin	Hardware for fixing linear actuator	4 sets
S5	M14*160 bolt, double nut, 2 flat washer, 1 spring washer	Hardware for center beam & sliding blocks	2 sets
S6	M16*65 bolt, 2 nut, 2 flat washer, 1 spring washer	Hardware for center beam & Swing arm	4 sets
S7	M10*35 Hexagon socket bolt, 2 nut, 2 flat washer, 1 spring washer, 1 big connect plate (for M8 bolt)	For fixing solar panels	18 sets
S8	M12*160 Hexagon socket bolt, 2 nut, 2 flat washer,1 spring washer, 1 big flat washer	Hardware for center beam & C-shaped beams & Inclined struts	10 sets
S9	M12*30 bolt,1 nut, 2 flat washer, 1 spring washer	Hardware for C-shaped beams & Inclined struts	11 sets
S10	M8*25 bolt, 2 nut, 2 flat washer, 1 spring washer	Hardware for fixing solar panels	36 sets
S11	M8*25 bolt, 2 nut, 2 flat washer, 1 spring washer, 1M8 big flat washer	Hardware for fixing solar panels	12 sets
S12	M5 self-tapping screw	For fixing control unit	8 sets

For ‘double nuts’, please fasten the first nut, then fasten the second nut.

Part III. Tools Required for Installation (Prepared by users)

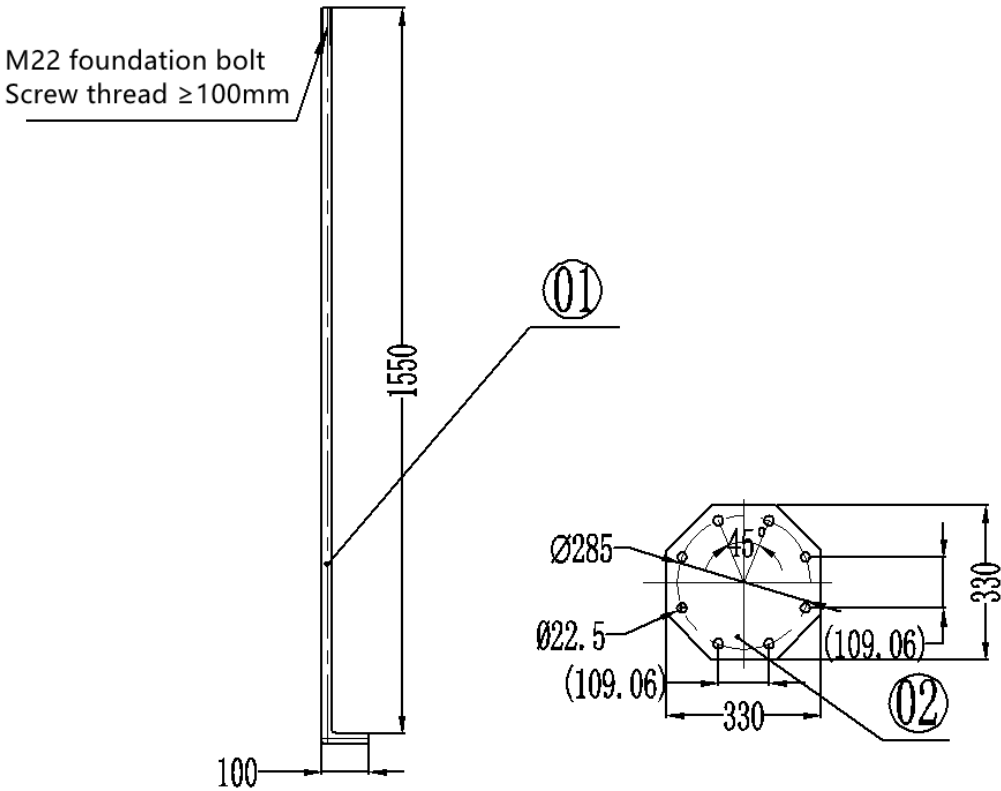
No.	Tools	Spec.	Quantity	Remarks
1	Open spanner	13/14	2	M8 screws
2	Open spanner	17/19	2	M12 screws
3	Open spanner	20/22	2	M14 screws
4	Open spanner	22/24	2	M16 screws
5	Open spanner	30/32	1	M20 screws
6	Adjustable spanner	10 Inch	2	Crescent adjustable wrench
7	Screwdriver	3#	1	Electric debugging (flat head or cruciform)
8	Rubber Hammer		1	Facilitate the installation
9	Double ladder or Scaffolding		2	or use small crane

Part IV. Concrete Foundation

Materials Preparation

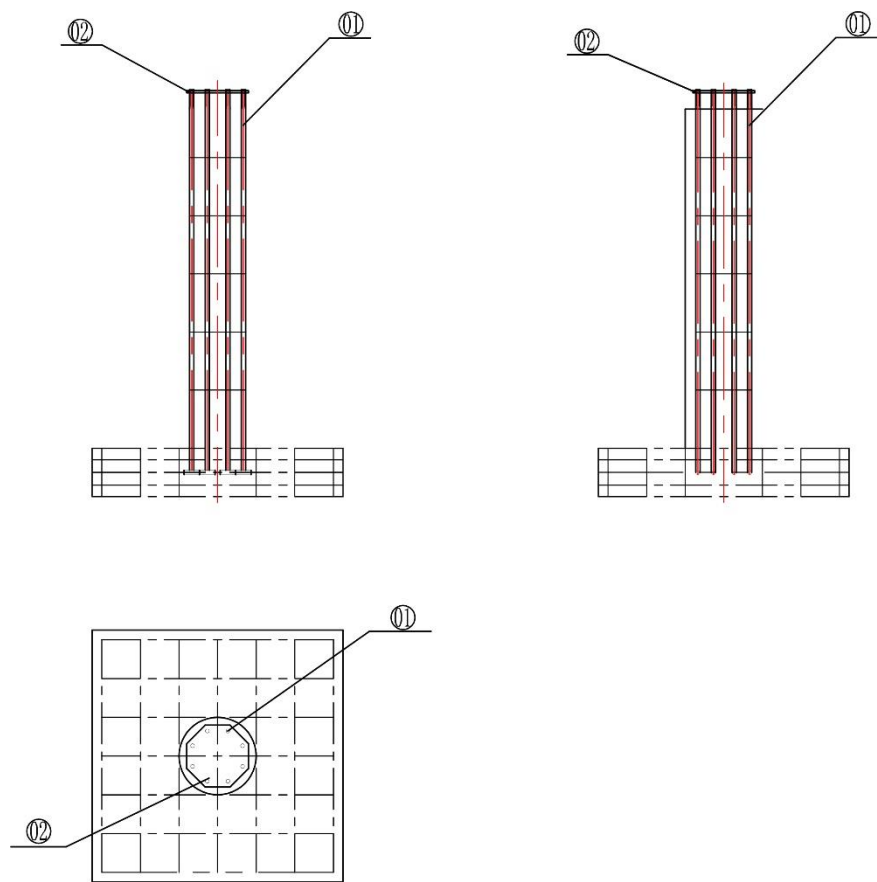
Marks	Description	Material	Quantity
01	Foundation bolt	M22	8
02	Fixture template	---	1
03	Foundation (above ground)	C30 concrete	---
04	Foundation (below ground)	C30 concrete	---

1. Make 8 foundation bolts 01, one foundation bolt fixture template 02 (using rigid material, only for positioning bolts, thickness is not important).



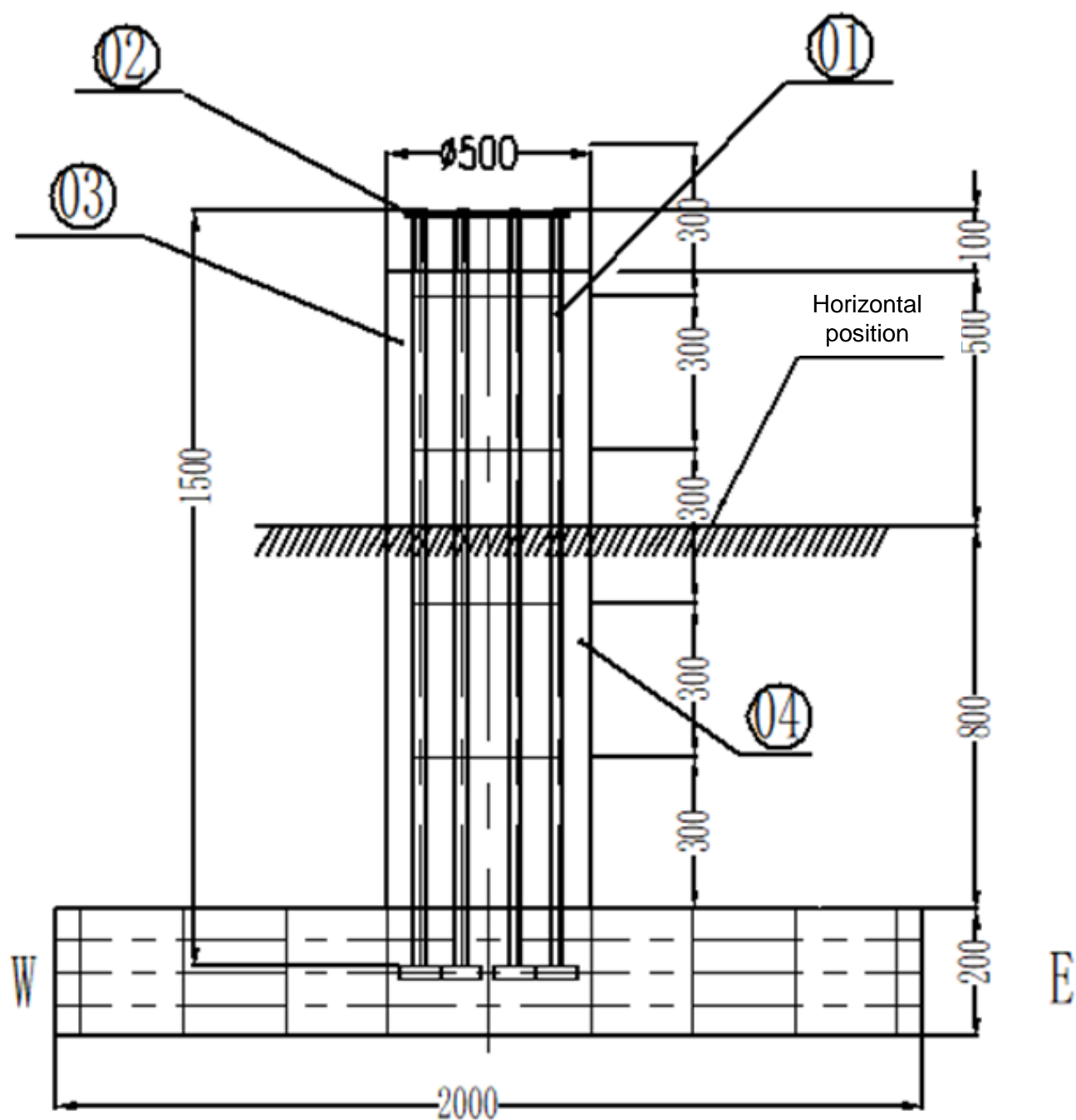
Unit:mm

2. Position 8 foundation bolts 01 with the fabricated fixture template 02, secure the bolts to foundation steel mesh grid (using $\Phi 8$ steel rebar).

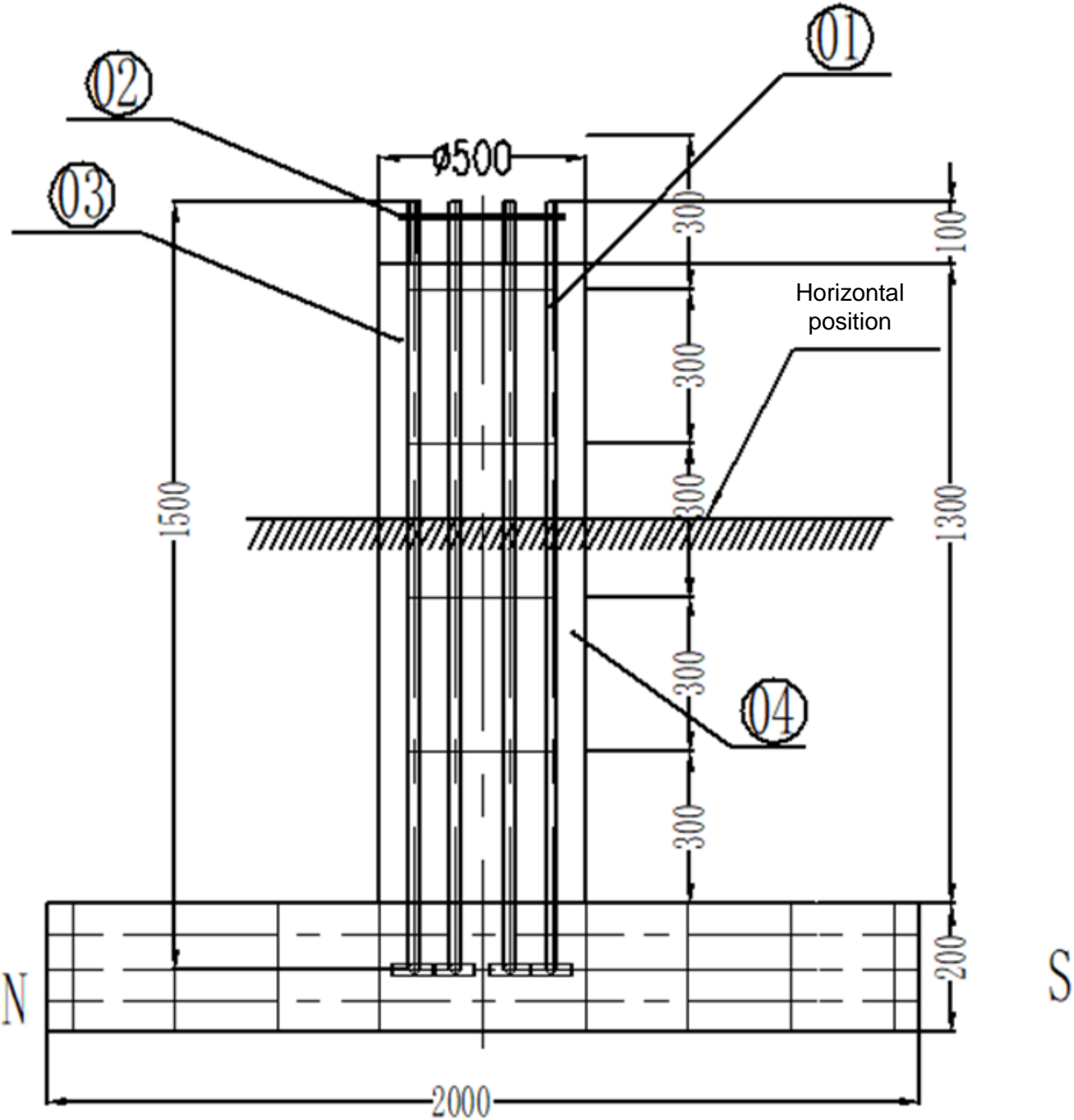


3. Confirm the east-west direction carefully, pour concrete foundation according to the dimensions shown in the following drawings, remove the fixture template 02 after the concrete is cured. The solar tracking system installation can be carried out only AFTER the concrete is thoroughly cured.

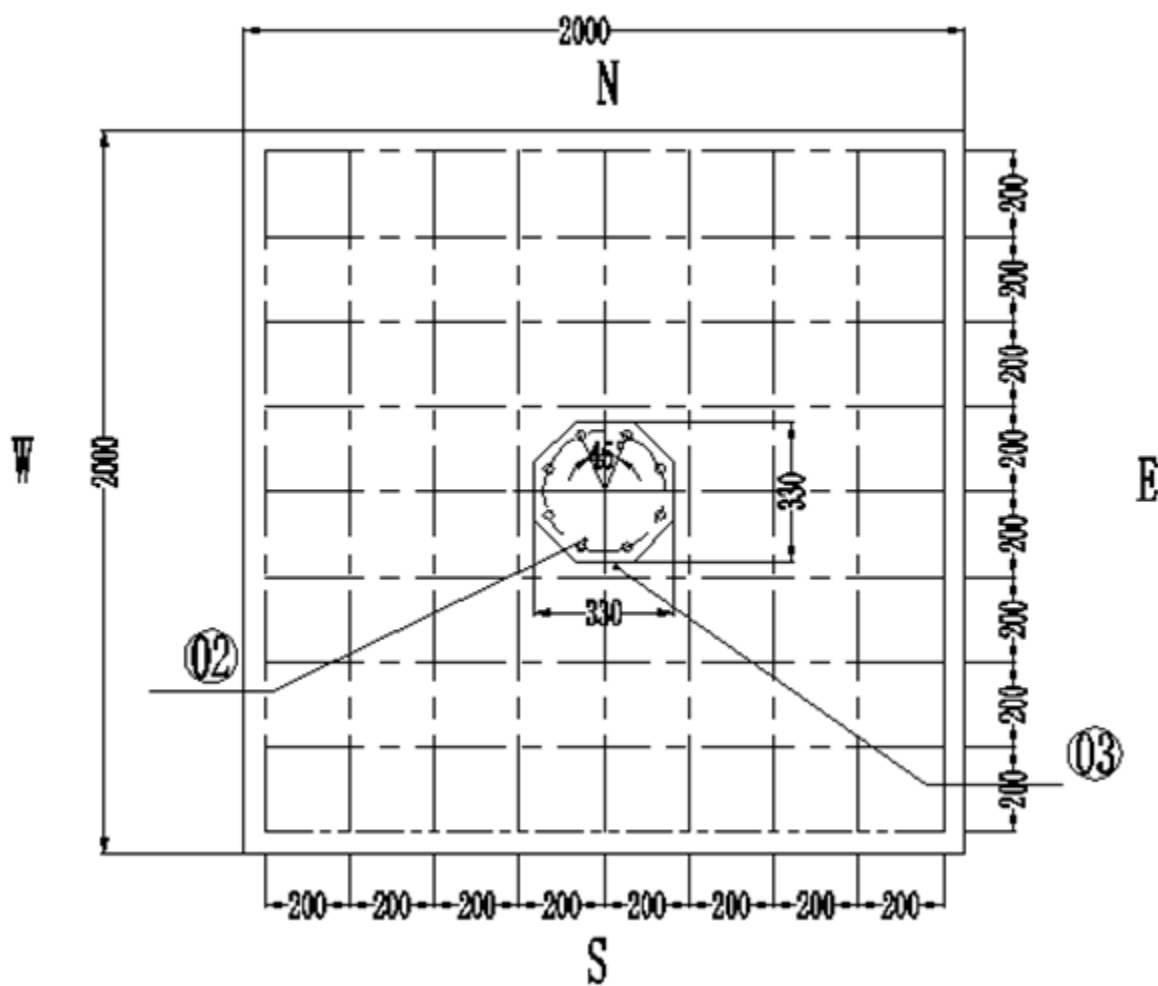
(Covering the poured concrete with a plastic sheet will make it stronger, because it will dry out slower from sun exposure.



Foundation as viewed from the South



Foundation as viewed from the West



Foundation as viewed from Above

Note: Foundation above the ground should be more than 500 mm, exposed foundation bolts 01 thread at least 100 mm. In order to ensure the verticality of the tracking system pole, the top face of the foundation shall be leveling with the spirit level. The dimension and depth of the concrete foundation is just a guide, please design it for your local soil conditions and maximum wind speeds.

Concrete, foundation bolts 01 and fixture template 02 shall all be prepared by the users. $\Phi 40\text{mm}$ conduit for electrical wires can be planned into the concrete foundation, used for threading PV lines, controller power lines, etc.

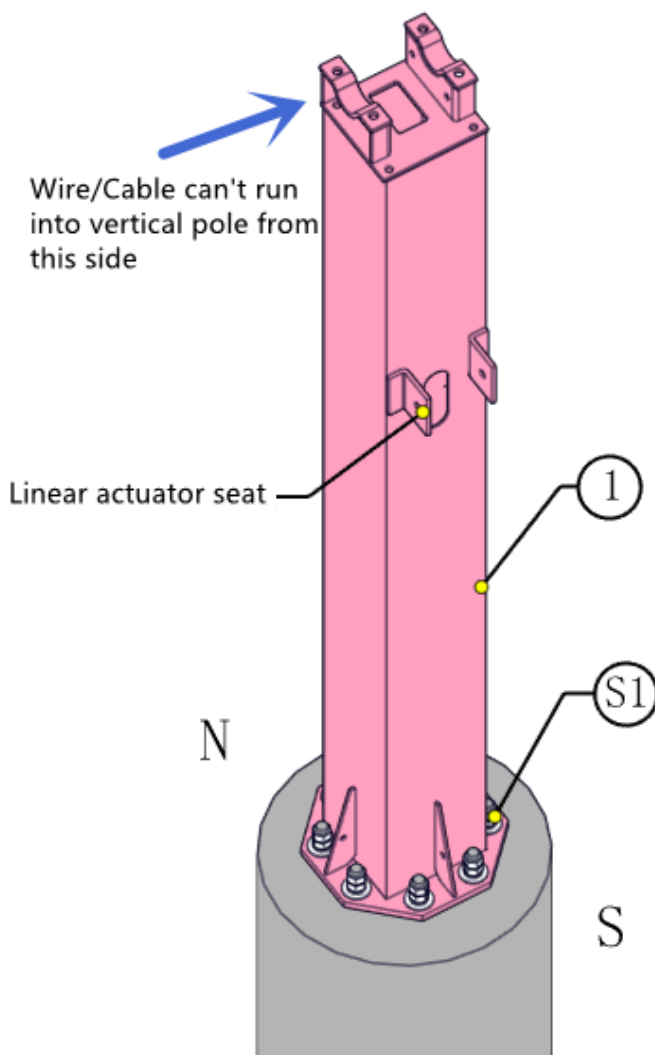
Part V. Installation of Superstate Solar Tracking system

5.1 Installation of Vertical Pole

Screw on one nut on each foundation bolt first, make them on the same level, put on one flat washer, then put the vertical pole 1 on the concrete foundation, **verify the orientation of the vertical pole 1** to ensure the side with the linear actuator seat is facing **South**, then put on flat and spring washers, secure with hardware S1 (double nuts) to stabilize the vertical pole 1. **The nuts below the vertical pole are used for adjusting the levelness of the vertical pole.** We suggest pouring concrete between the foundation and the bottom plate of the vertical pole.

Note: The Vertical pole 1 with the linear actuator seat **must be facing South!**

South means the direction of the geographical longitude lines, it can be confirmed with a gyroscope or compass (need to amend for the geomagnetic declination, different sites have different geomagnetic declination).



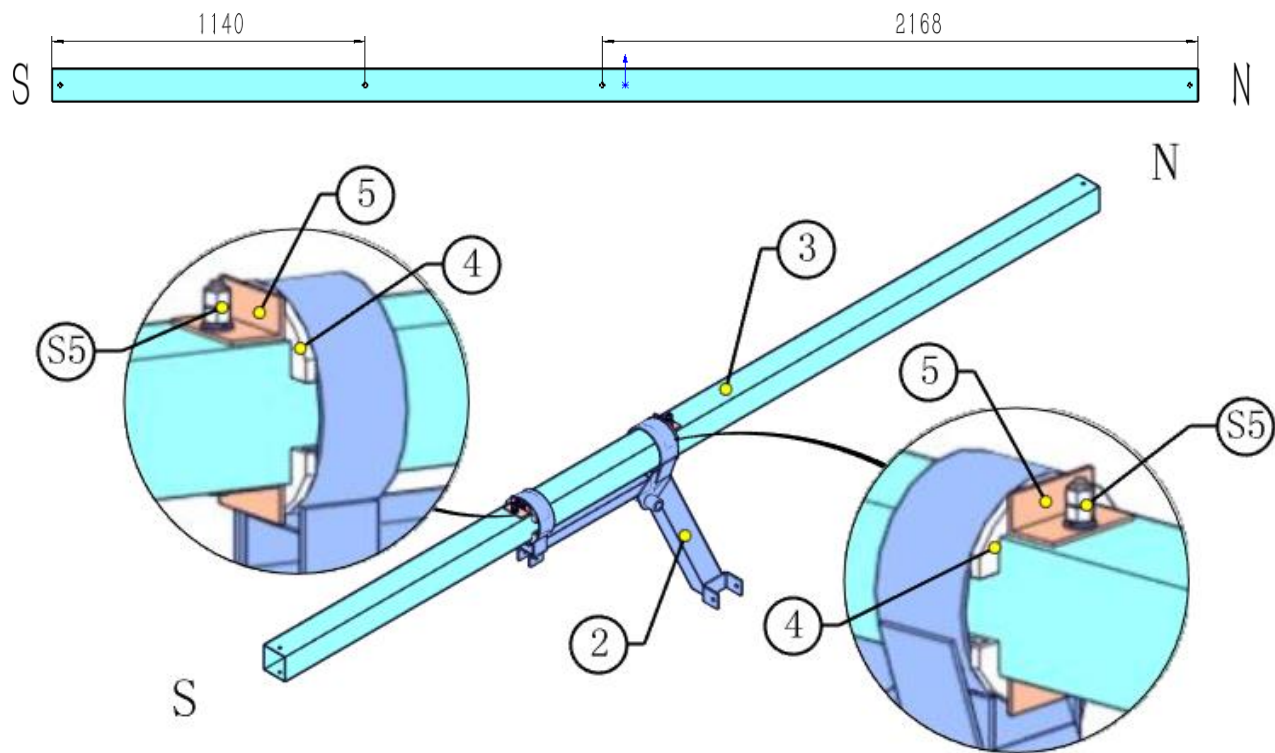
5.2 Installation of Center beam & Sliding blocks

Pay attention to the two fixing holes in the middle of the center beam, the distance between the south fixing hole to south end is 1140mm. Put the **center beam 3** into the **L-shaped bracket 2**, please pay attention to the direction of the center beam.

Put two north sliding blocks 4 into the **north** hoop of the L-shaped bracket (insert the sliding blocks from the **north** side), then install the sliding blocks limited plate 5 into the center beam 3 by hardware S5.

Put two **sliding blocks** 4 into the **south** hoop of the L-shaped bracket (insert the sliding blocks from the **south** side). Then use **hardware** S5 to fix the sliding block limited plate 5 with the center beam.

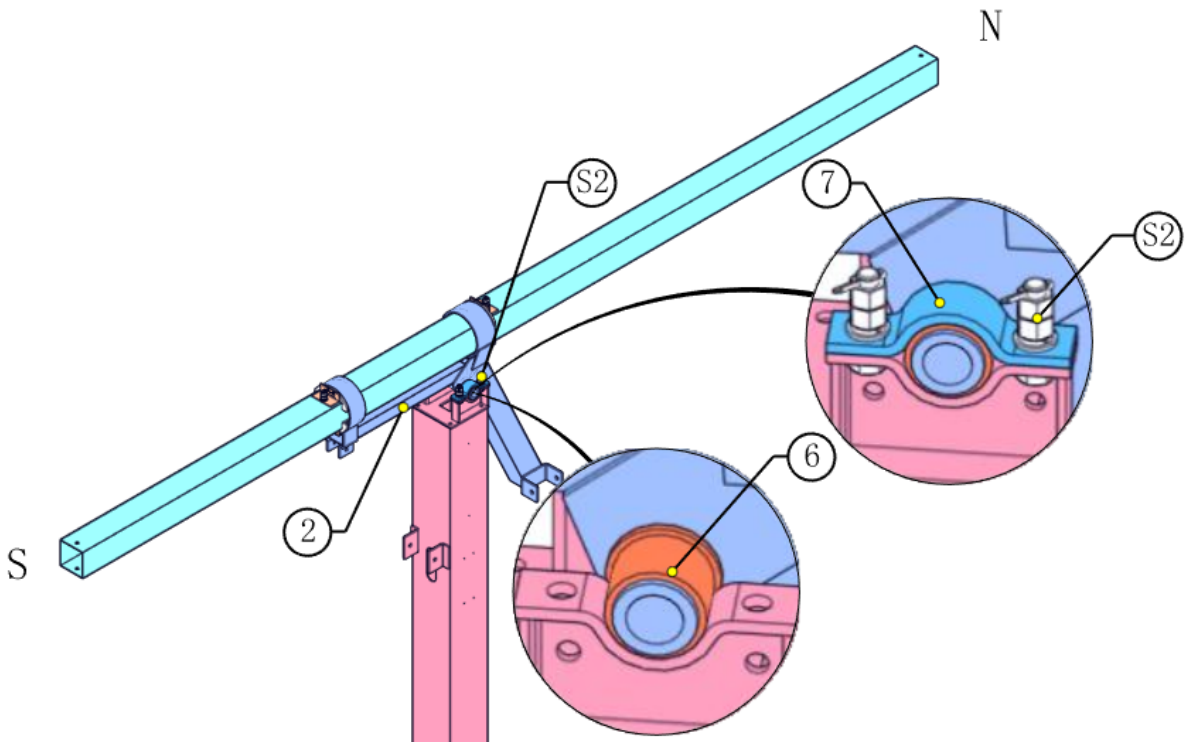
Note: Tools needed to fix the sliding blocks into the center beam.



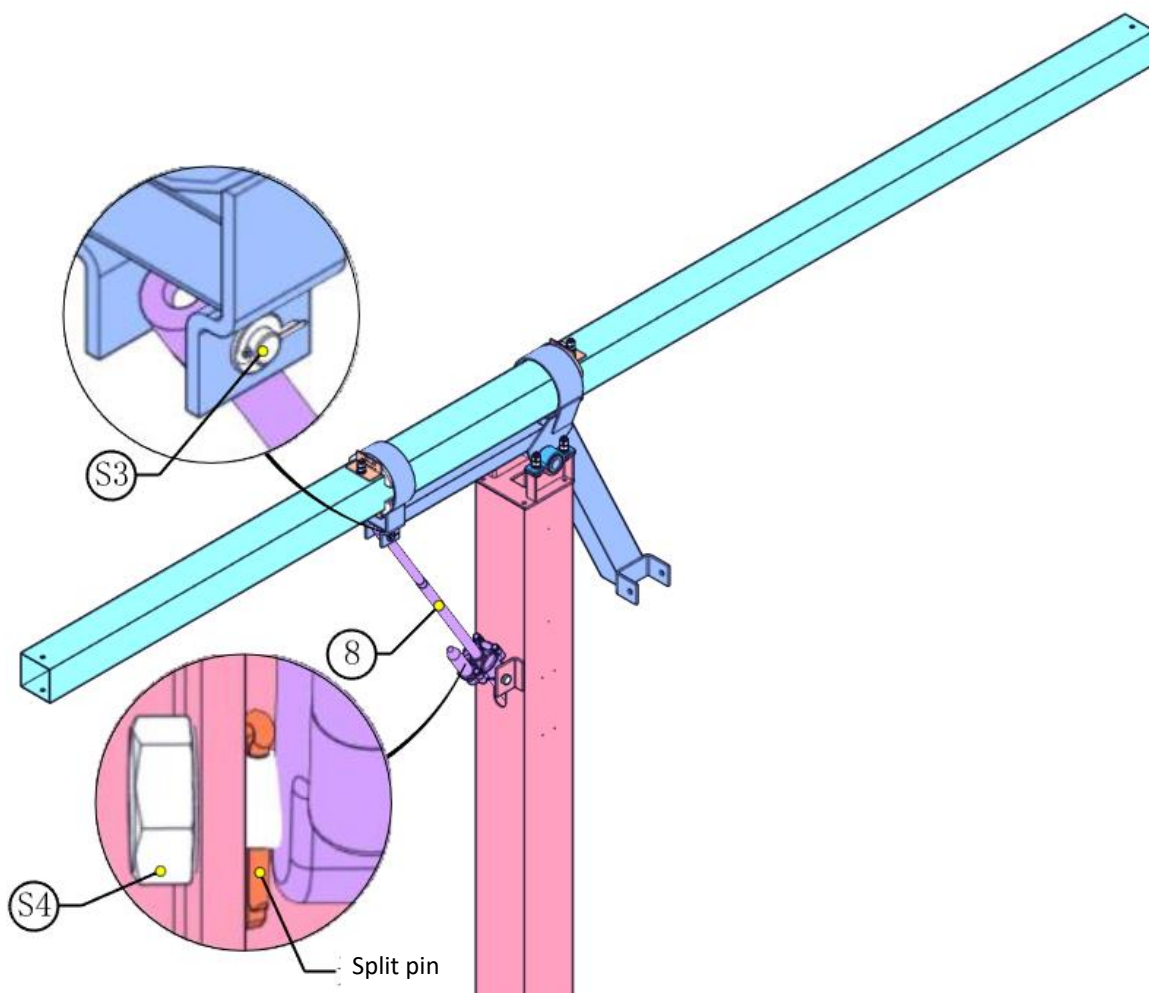
5.3 Installation of the L-shaped bracket & the Elevation Linear Actuator

5.3.1 Put the **shaft sleeves** 6 onto the L-shaped bracket 2 (pay attention to the direction of the shaft sleeves), affix the **L-shaped bracket** 2 onto the **vertical pole** 1 with **pressing plates** 7 and hardware S2, tighten the S2 screws as far as possible while still allowing the rotation of the **L-shaped bracket** 2, to reduce the shaking clearance between the **vertical pole** and the **L-shaped bracket**.

Note: Please pay attention to the direction of the L-shaped bracket 2!

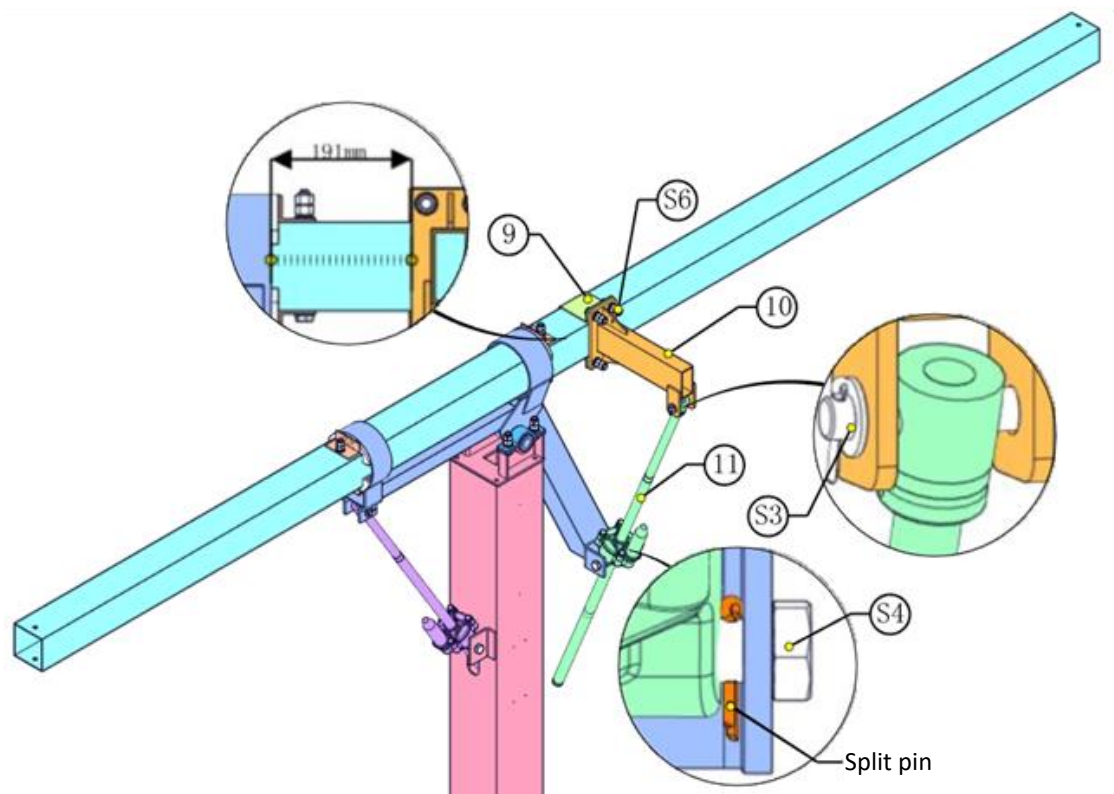


5.3.2 Connect the elevation linear actuator 8 (the short one) to the vertical pole 1 and **L-shaped bracket** 2 with hardware S3 and S4. The split pin of S4 should be inside the linear actuator seat, the motor of the linear actuator should be at the south side.



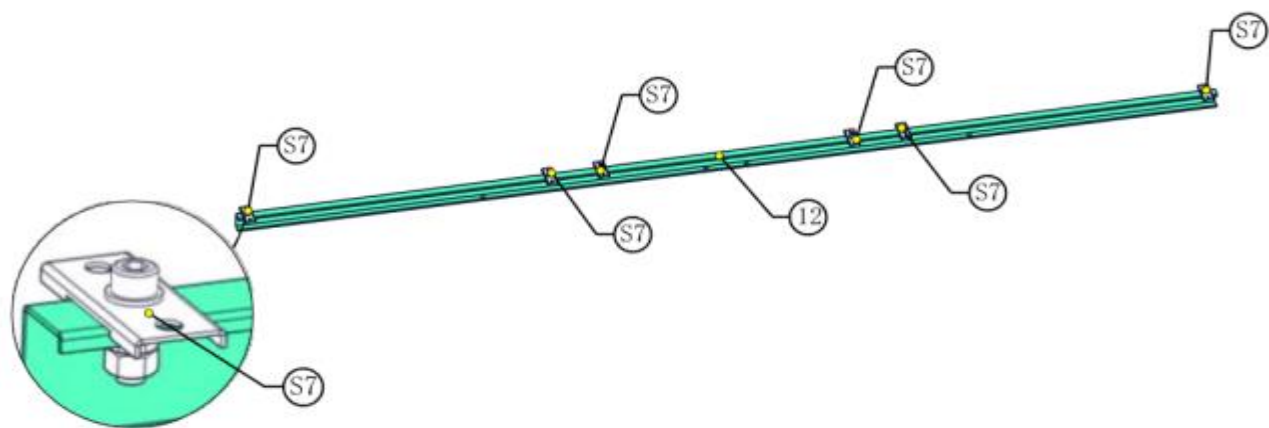
5.4 Installation of the Azimuth Linear Actuator

Fix the **swing arm connecting plate 9** onto the **center beam** with hardware S6 (do not lock the screws for the time being). Please note the distance 191mm. Connect the azimuth linear actuator 11 onto the **L-shaped bracket 2** and **swing arm 9** with hardware S3 and S4. The split pin of hardware S3 should be at the south side, the split pin of S4 should be inside the linear actuator seat, the motor of the linear actuator should be outside. Adjust the position of **swing arm 10**, **place the linear actuator at the center position** of the swing arm, then lock the hardware S6.



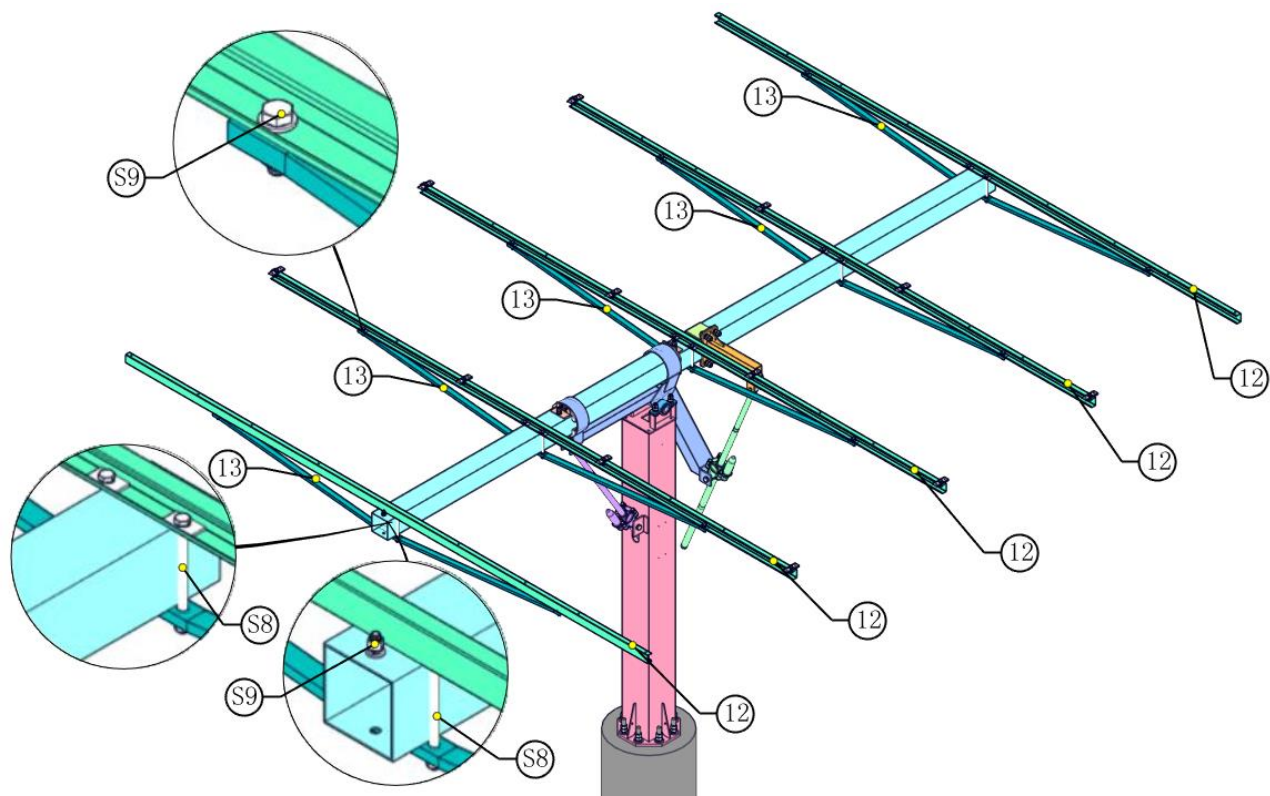
5.5 Installation of C-shaped Beams

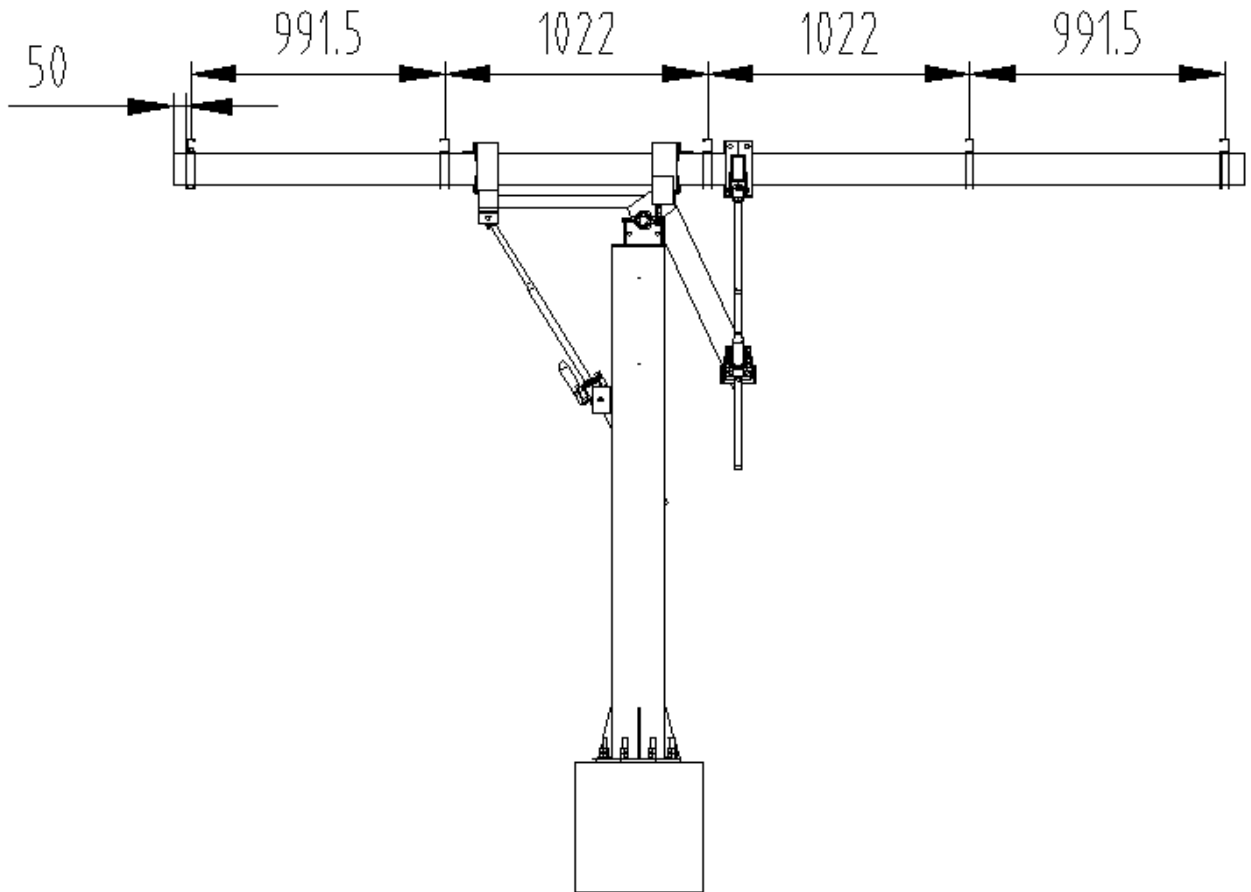
Fix the hardware S7 onto the middle **three C-shaped beams** according to the following drawing. 6 sets of hardware S7 need to be fixed onto each piece of **C-shaped beam**.



Fix the **south end C-shaped beam 12** (without hardware S7) and Inclined strut 13 onto the center beam with hardware S8 (the big flat washer is inside of the C-shape beam) & S9 first, leave 50mm space between the south side of the C-shaped beam and the south end of the center beam.

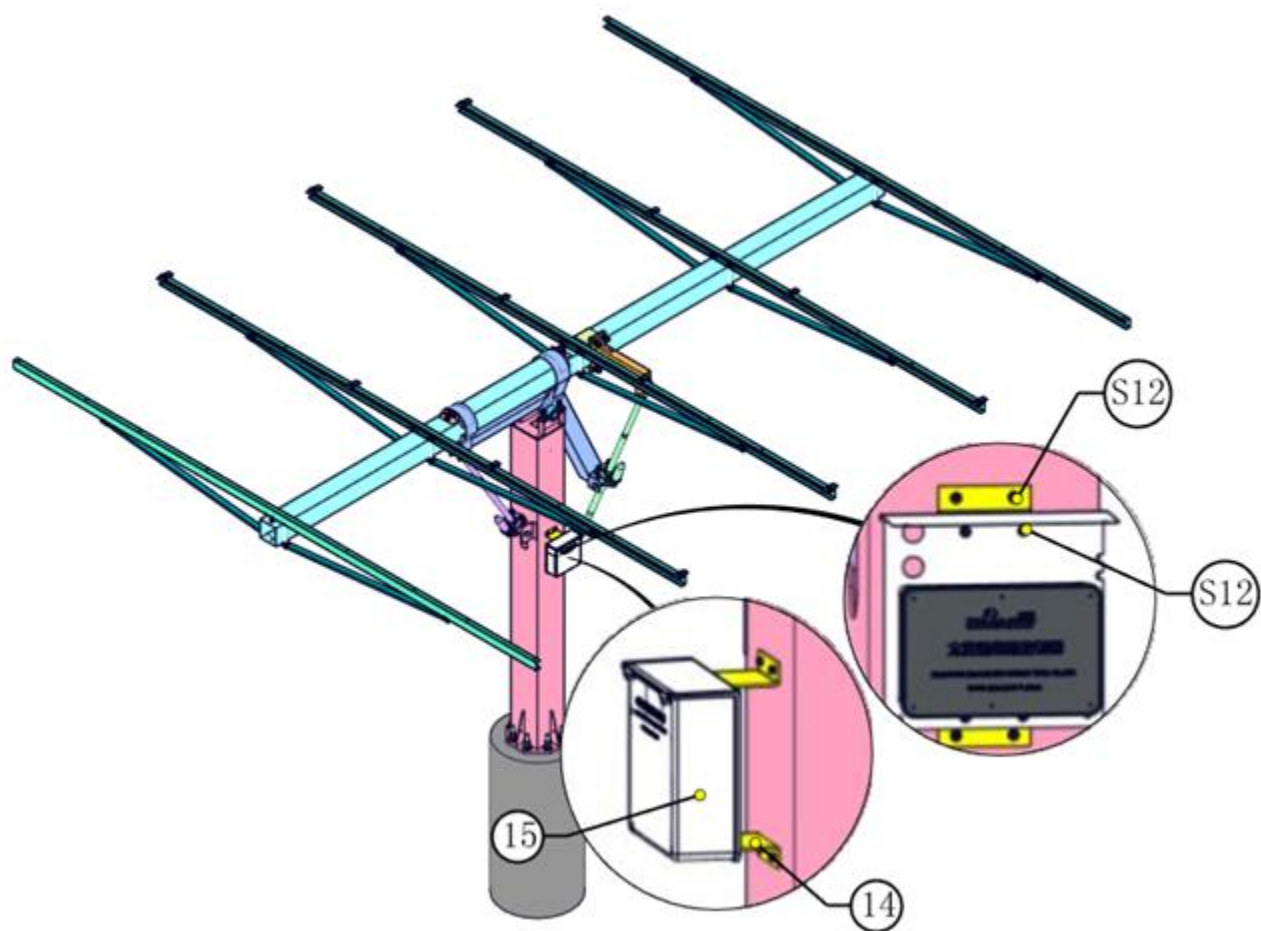
Then fix the other **C-shaped beams** 12 and **Inclined struts** 13 as distances in the following drawing, the three **C-shaped beams** with hardware S7 should be in the middle. Then install a M12*30 bolt of hardware 12 at the south end of the center beam for anti-slip purpose.





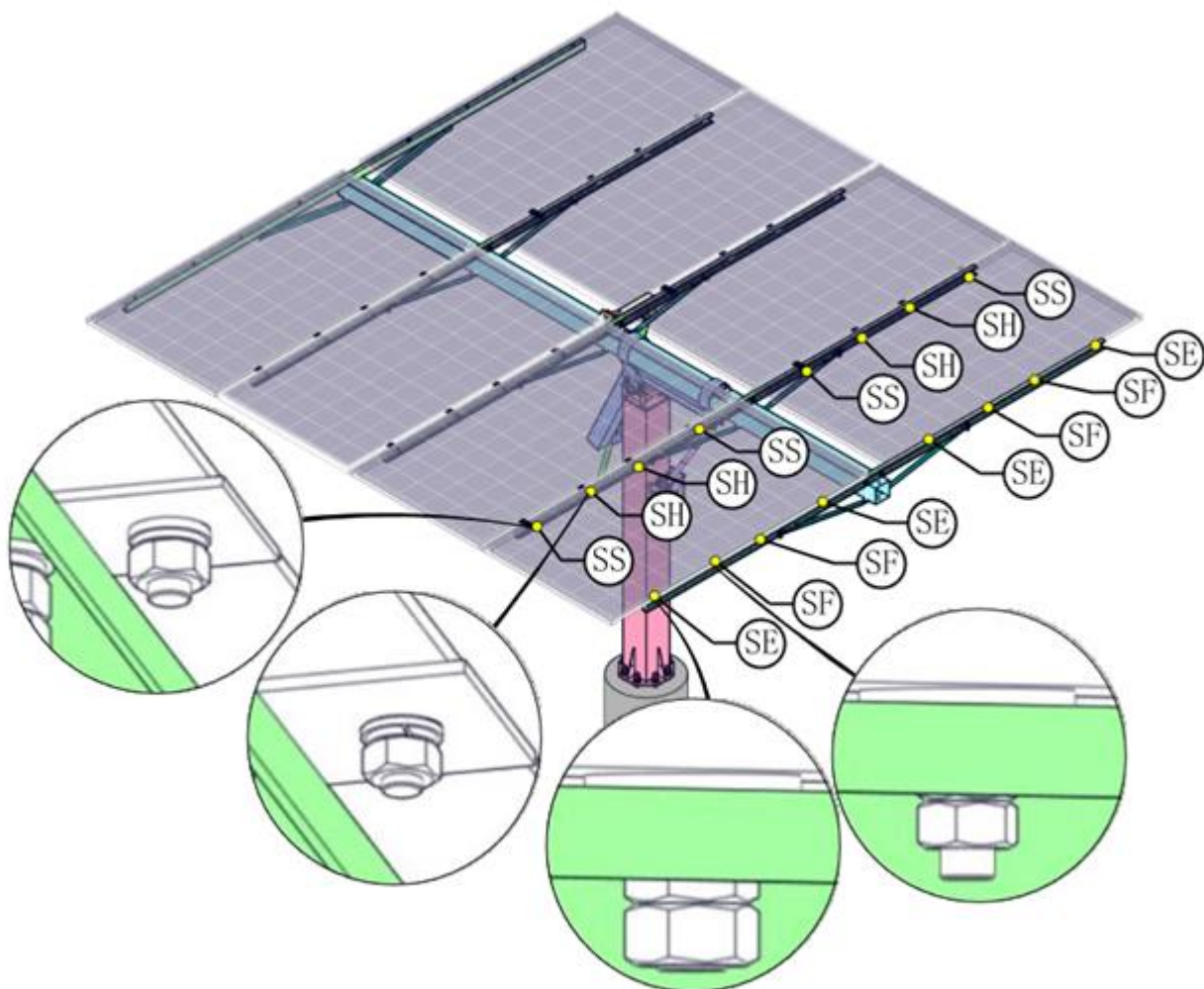
5.6 Installation of the Control Unit

Fix the **control unit seat** 14 onto the east side of the **vertical pole** with **hardware S12** , there are small holes on vertical for fixing the control unit seat. Then open the control unit 15, fix the control unit 15 onto the control unit seat with **hardware S12** . Fix the cover of the control unit after installation and wiring. **Each project need one Host control unit, the others should be Slave control units.**



5.7 Installation of Solar Panels

Adjust the elevation angle to 0° first, then fix all the solar panels as shown in the following drawing. Use **hardware S11** for the C-shaped beam on the south end first and use **hardware S10** for the three C-shaped beams in the middle, at last use **hardware S11** for the C-shaped beam on the north end. Each solar module is fixed by eight bolts.

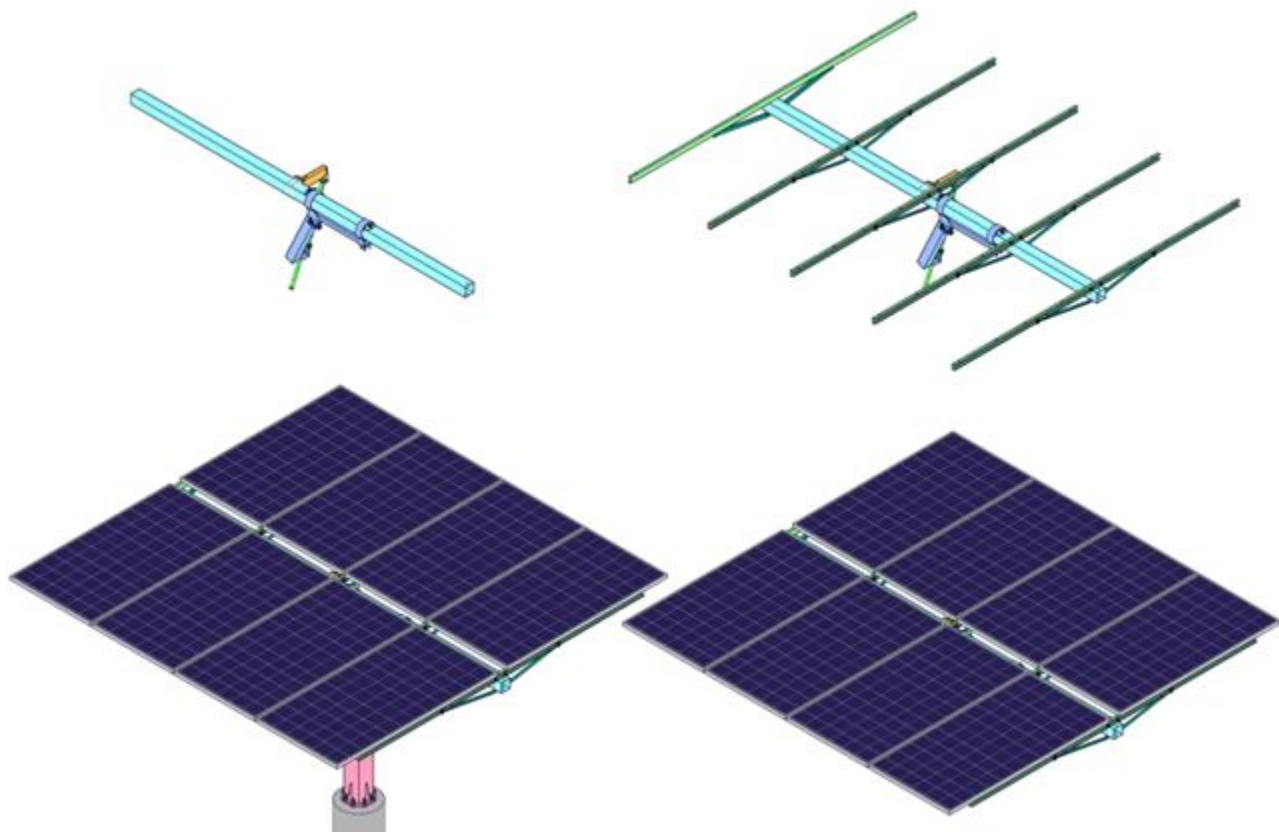


Note: After finishing the installation of solar panels, please lock all the connection screws.

There are reserved connecting holes at the bottom of the vertical pole for lightning protection grounding, please ground the brackets properly according to the PV power station grounding standard in your country.

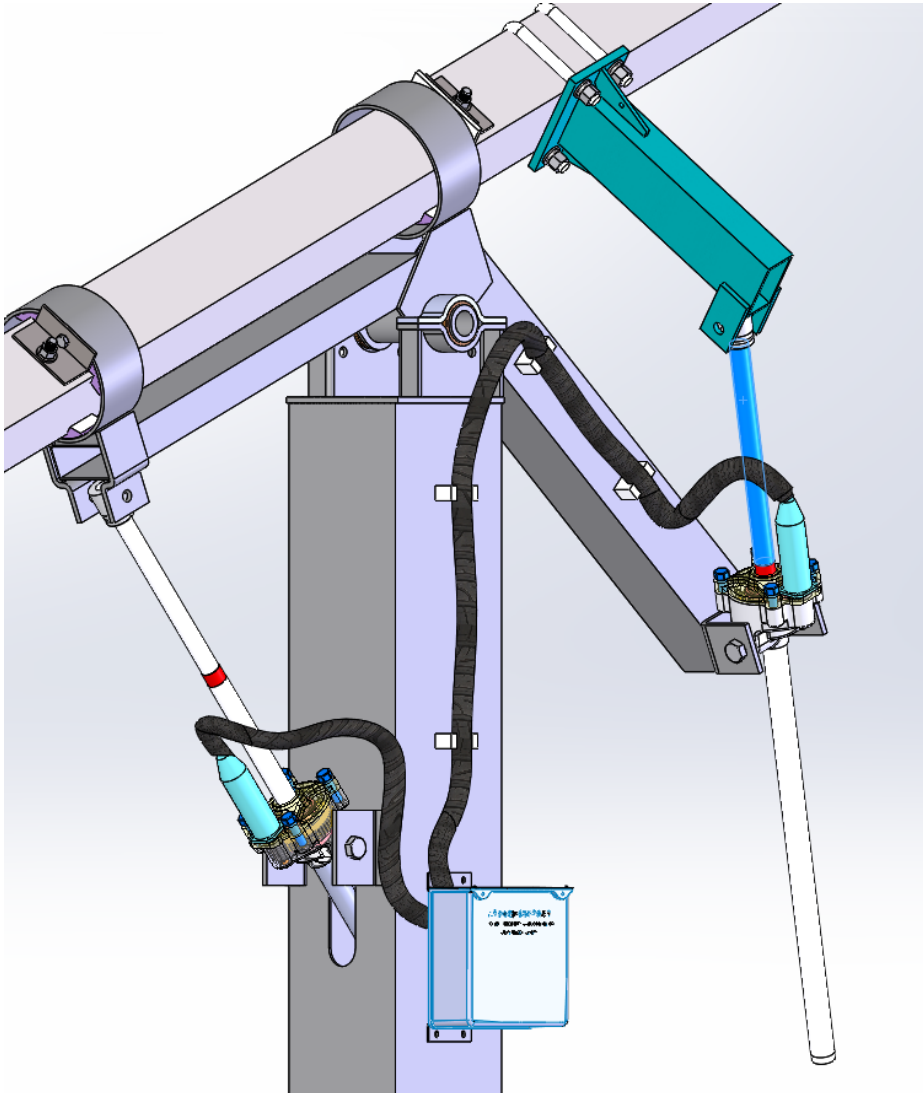
Advice: If there is a small crane equipped at the installation site, the L-shaped bracket, azimuth linear actuator, frames and solar panels can be assembled in advance, then hoist it onto the vertical pole 1 directly, then follow the previous steps of 5.2 to fix the L-shaped bracket and the elevation linear actuator.

Part VI. Connecting Driving System Circuit

**Using A/C power supply**

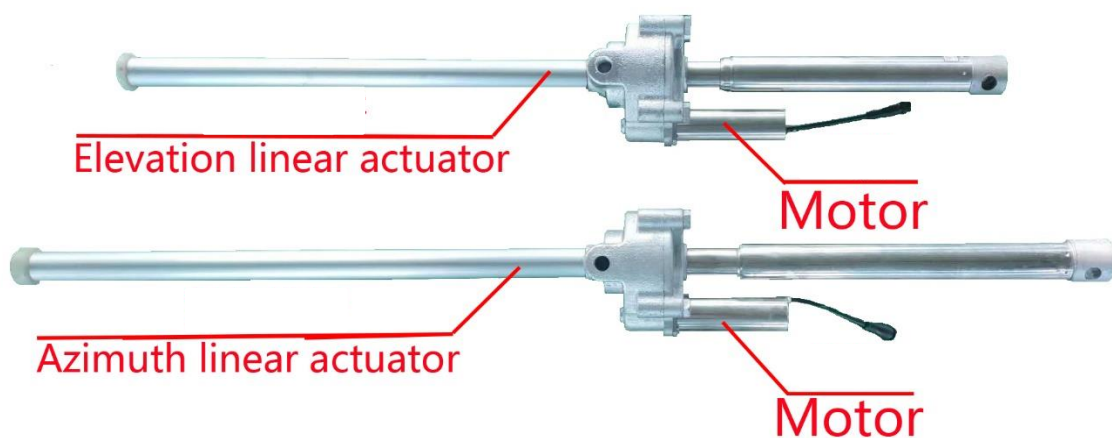
Connect the azimuth motor cable (the **long** one) with the motor on the azimuth linear actuator, connect the elevation motor cable (the **short** one) with the motor on the elevation linear actuator. Run A/C power from the back of the driving system and connect the two wires to the **power connector**. Use corrugated pipes and pipe clamps to fix the azimuth motor cable onto the vertical pole and the L-shaped bracket, there are reserved small fixing holes on the vertical pole and the L-shaped bracket. **Installers can connect the wind sensor to the connector of the host driving system with wind sensor wire for wind protection purpose.**





Part VII. Driving System & System Debugging

7.1 Driving System



7.2 Control box



7.3 System Debugging

After connecting the A/C power to the driving system, the controller will automatically start after 5 minutes, and the control unit will download GPS data automatically (takes about 1 - 10 minutes), then the system will rotate to the east or west and hit the angle limit position, then it will rotate to the north or south and hit the angle limit position, then it will wait for a while and go to the right position automatically. The slave driving systems will follow the movement of the host driving system.

Part VIII. Daily Operation and Maintenance – Important!

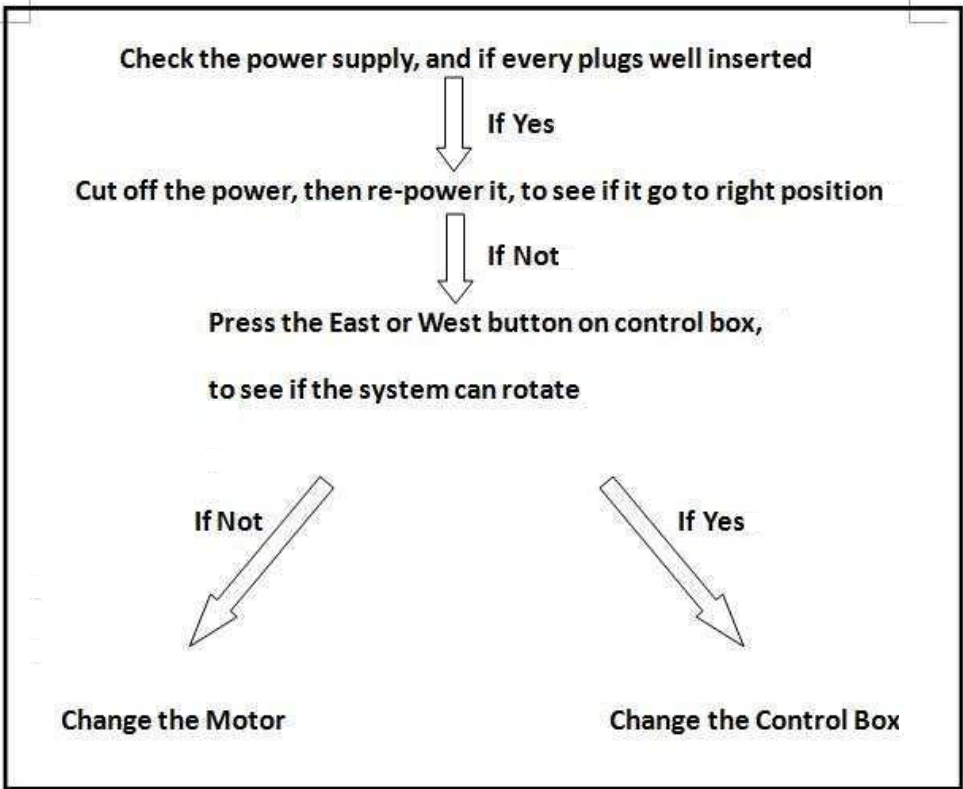
8.1 Regular inspection and maintenance

1. In order to discover potential errors in a timely manner, and to improve the system operation reliability, regular inspection shall be done once every six months.
2. After bad weather like strong winds or heavy snow, maintenance personnel should make a general check of the Solar Tracker and repair it in time if there is any damage.

8.2 Inspection items and problem treatment

Item	Inspection content	Solutions
Bolts and nuts	Check whether bolts and nuts were loosened	If bolts and nuts were not well fastened during the installation, or loosened due to strong winds, maintenance personnel need to re-fasten it.
Clamps	Check if clamps were deformed or loosened	If clamps was loosened because the screws were not well fastened, there is a need to re-fasten the screws. If clamps were deformed, there is a need to replace it.
Solar panels	Check whether the solar panels are flat	If the solar panels are not flat and this is caused by structural distortion, there is a need to rectify the distortion, or replace some parts. If it was caused by loosed screws, there is a need to re-fasten or replace the screws.
Brackets	Check whether there is any crack or rust problem	If there is rust, there is a need to use abrasive paper for rust removing, then spray epoxy zinc-rich primer or other antifouling paint for protection. If cracks appear, consult with Superstate for a solution
Wire connection in the driving box	Check whether the wire connection has loosened	If there is a loosened wire connection, there is a need re-connect it or replace the plugs.

Part IX. Quick Trouble Shooting



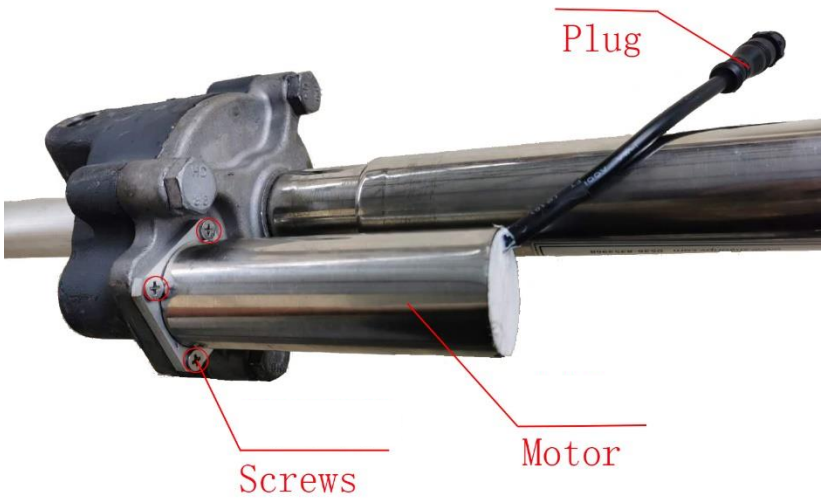
For situations not easily to be diagnosed and solved, please contact Superstate.

Part X. Spare Parts Replacement

Note: Cut off the power supply before replacement. If using PV power directly, disconnect all the connectors at input and output terminal of junction box or four-way connector. If using A/C power supply, cut off the A/C power switch.

10.1 Gear Motor Replacement

Unplug the gear motor plug, unscrew four fixing screws, take off the gear motor, then fix a new gear motor with fixing screws, plug in the motor plug.

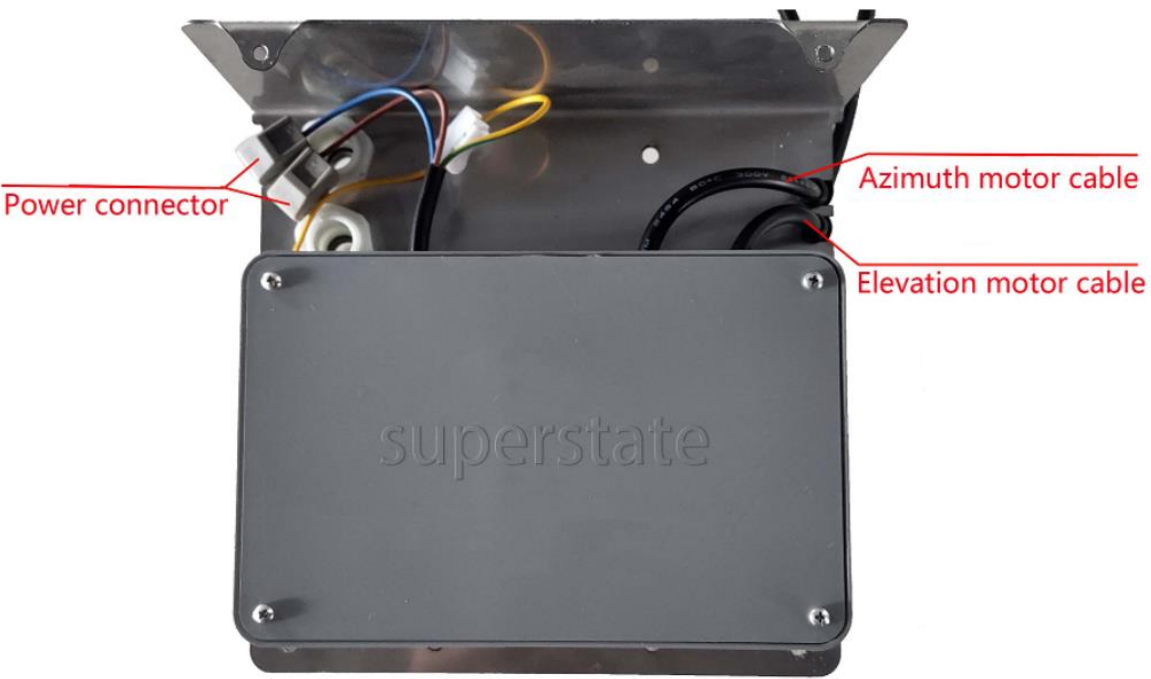


10.2 Control box replacement

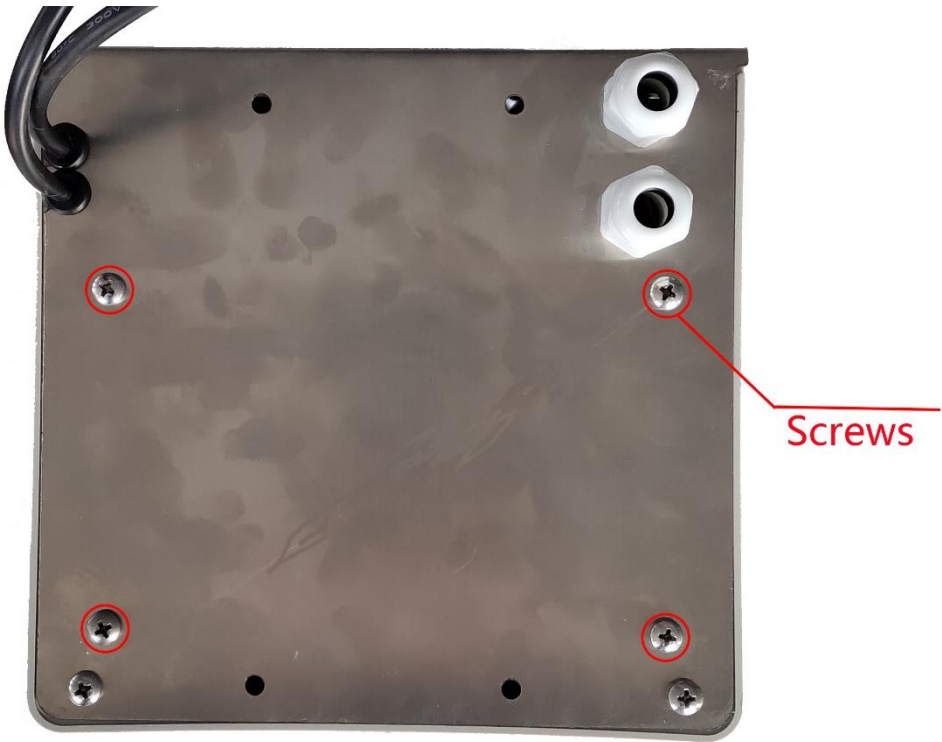
Unscrew the four fixing screws in the following drawings, take off the cover on the control box.



Disconnect all the plugs on the control box, including power connector and motor cables.



Unscrew the four fixing screws as the following drawing, take off the control box. Then fix a new control box with the fixing screws, and connect all plugs as before, fix the cover on the control box.



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