SUNO
The Self-oriented Solar Mirror

USER MANUAL

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EUROPEAN PROJECT SEMESTER

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1. General information

Thank you for purchasing SUNO's Self-Oriented Solar Mirror (SOSM). This device tracks the Sun and reflects Sunlight to your desired area. Among the functions for which the device can be used, are:

- Light up a dark room.
- Alleviate the symptoms of seasonal affective disorder.
- Desalinate Water.
- Increase the efficiency of a solar thermal water heater.

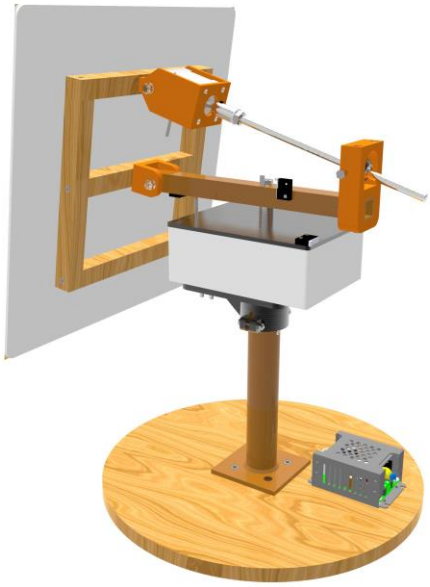


Figure 1: SUNO - Product view

2. The product

2.1 List of components

To assemble the SOSM, all necessary items are shipped. Below is the list with all the components that are inside this packaging.

Table 1: List of components 1

N. º	Description	Qty.
001	Circular base	1
002	Central post	1
003	Cross recessed countersunk head tapping screw DIN 7982 Ø5 x 15	4
004	Grub screw DIN 916 M6 x 6	2
005	Box	1
006	Box holder	1
007	Box cover	1
008	Azimuth shaft	1
009	Shaft spacer	1
010	Shaft holder	1
011	Hexagonal head screw DIN 933 M5 x 12	1
012	Flat washer DIN 125a M5	1
013	Radial bearing 6001-2Z	4
014	Philips oval countersunk machine screw DIN 963 M3 x 10	8
015	Socket head cap screw DIN 912 M4 x 25	8
016	Hexagonal nut DIN 934 M4	7
017	Flat washer DIN 125a M4	7
018	Stepper motor NEMA 17	2
019	Azimuth motor bracket	1
020	Worm wheel	1
021	Worm gear	1
022	Grub screw DIN 916 M4 x 6	2
023	Socket head cap screw DIN 912 M4 x 10	1
024	Control system	1

Table 2: List of components 2

N. º	Description	Qty.
025	Lateral square profile	2
026	Frontal square profile	2
027	Central square profile	1
028	Mirror joint	1
029	Cross connector square profile	1
030	Mirror's surface	1
031	Mirror joint's articulating shaft	1
032	Leadscrew joint	1
033	Flat washer DIN 125a M6	5
034	Hexagonal nut DIN 934 M6	4
035	Cross recessed countersunk head tapping screw DIN 7982 Ø3.5 x 35	6
036	Cross recessed countersunk head tapping screw DIN 7982 Ø3.5 x 25	2
037	Cross recessed countersunk head tapping screw DIN 7982 Ø3.5 x 19	4
038	Leadscrew motor bracket	1
039	Motor coupling	1
040	Flat washer DIN 125a M8	1
041	Hexagonal nut DIN 934 M8	3
042	Threaded rod M8	1
043	M8 nut housing	1
044	Hexagonal head screw DIN 931 M5 x 25	2
045	M8 housing lower support	1
046	M8 housing upper support	1
047	Hexagonal head screw DIN 933 M6 x 16	1
048	Socket head cap screw DIN 912 M4 x 40	1
049	Motor joint's articulating shaft	1
050	End range sensor	4
051	Slotted cheese head machine screw DIN 84 M2 x 12	6
052	Power supply	1

Due to the considerable number of components, it is recommended to thoroughly check that none are missing.

2.2 List of Tools

To assemble the SOSM, some tools are needed. These are mentioned below.

Table 3: List of tools

Description	Image
Allen Key 2mm	
Allen Key 3mm	
Open-ended Spanner 8x9 mm	
Open-ended Spanner 10x11 mm	
Slotted Screwdriver	
Phillips Screwdriver	

Likewise, an electric screwdriver and an adjustable spanner can be used as a substitute of the tools mentioned above.

2.3 Assembly Instructions

To facilitate the assembly of the SOSM, the same is performed in separate stages. The assembly instructions are detailed in the next pages. Moreover, it is important to mention the next:

The product has been designed using a 3D program. Besides, some of the components have been obtained from different CAD libraries. Therefore, some of the components shipped may look different as they do in the images shown in this manual.

Stage 1: Central structure + central box

1. Position part nº. 001 above part nº. 002, then screw with the component nº. 003.


Parts:
- 001 x 1
- 002 x 1
- 003 x 4

2. Place the grub screws in the lower bores, and screw them with the help of an Allen key.


Parts:
- 004 x 2

3. Insert the four bearings (nº. 013), with the spacer (nº. 009) between them, in the shaft (nº. 008). Lock the relative movement with elements nº. 010, 011 and 012.

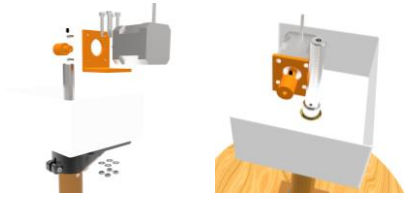

Parts:
- 008 x 1
- 009 x 1
- 010 x 1
- 011 x 1
- 012 x 1
- 013 x 4

4. Put the shaft inside the central structure.


5. Place component nº. 005 and attach it to the central post using components nº. 015, 016 and 017. Then, place above it the box (nº. 005).

Parts:
- 005 x 1
- 006 x 1
- 015 x 2
- 016 x 2
- 017 x 2

6. Insert the worm gear (nº. 021) in the motor (nº. 018), and lock it with the grub screw (nº. 022). Then, attach the bracket (nº. 019) to the box, using components nº. 015, 016 and 017. Finally, attach the motor to the bracket with the screws nº. 014.

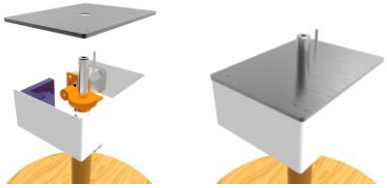


Parts:
- 014 x 4
- 015 x 4
- 016 x 4
- 017 x 4
- 018 x 1
- 019 x 1
- 021 x 1
- 022 x 1

7. Insert the worm wheel (nº. 020) in the shaft, and lock it with the screw nº. 023. Place the electronics components (nº. 024).

Parts:
- 020 x 1
- 023 x 1
- 024 x 1

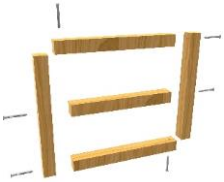
8. Finally, close the box with its cover (nº. 007).



Parts:
- 007 x 1

Stage 3: Mirror

1. Place part nº. 025 on the laterals, nº. 026 up and down, and nº. 027 on the centre. Use a screwdriver to connect them with the screws nº. 035.

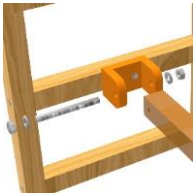



Parts:
- 025 x 2
- 026 x 2
- 027 x 1
- 035 x 6

2. Using the screws nº. 036, screw the part nº. 028 to the central profile. Next, using the screws nº. 037, screw the part nº. 32 to the upper profile.

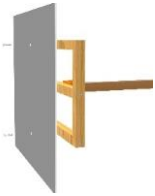

Parts:
- 028 x 1
- 032 x 1
- 036 x 2
- 037 x 2

3. Position part nº. 029 and screw to it the part nº. 031. Then, close with the flat washer and the nut (nº. 033 and nº. 034).




Parts:
- 029 x 1
- 031 x 1
- 033 x 2
- 034 x 2

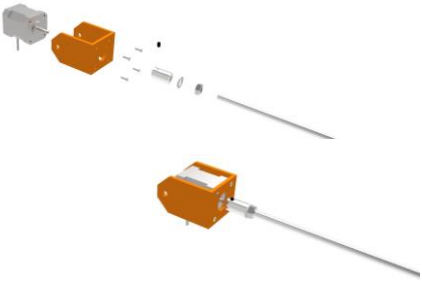
4. Glue the mirror (nº. 030) to the wood profiles. Then, use the screws nº. 037 to fix them.




Parts:
- 030 x 1
- 037 x 2

Stage 4: Leadscrew

1. Place the motor (nº. 018) in the bracket (nº.38). Then, use a screwdriver to attach them with the screws (nº. 014). After, attach the coupling (nº. 039) to the motor and the threaded rod (nº. 042). To do this, use the grub screw (nº. 022) and the flat washer and the nut (nº. 040 and 041, respectively).



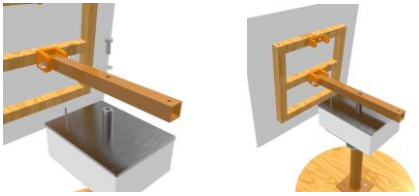
Parts:
- 014 x 4
- 018 x 1
- 022 x 1
- 038 x 1
- 039 x 1
- 040 x 1
- 041 x 1
- 042 x 1

2. Put in the part nº. 043 the M8 nuts (nº. 041). Then, screw the component nº. 044.

Parts:
- 041 x 2
- 043 x 1
- 044 x 2

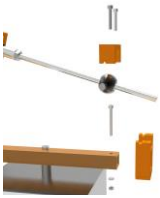
Stage 5: Final Assembly

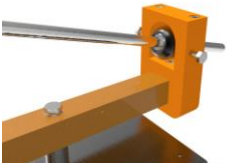
1. Put together the assemblies obtained in the stages 2 and 3. For it, insert the shaft in the middle hole of the component nº. 029. Then, lock them using the flat washer and the screw nº. 033 and 047, respectively.



Parts:
- 033 x 1
- 047 x 1

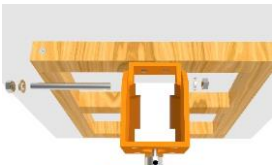
2. Place the component nº. 045 at the end of the component nº. 029. Then, attach it using components nº. 048, 016 and 017. Then, take the leadscrew assembly and place the screws of the M8 housing on component nº. 045. Add component nº. 046 and use the screws nº. 015 to fix it.





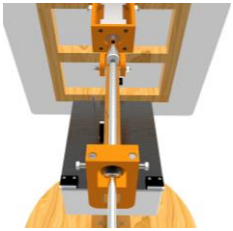
Parts:
- 015 x 2
- 016 x 1
- 017 x 1
- 045 x 1
- 046 x 1
- 048 x 1

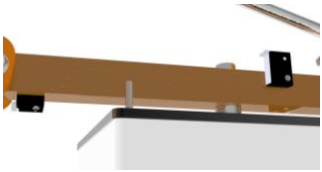
3. Attach the leadscrew to the mirror. For it, turn the rod, until the holes of the joint and the bracket of the leadscrew match. Once done, position part nº. 049 and close with the flat washer and the nut (nº. 033 and nº. 034).



Parts:
- 033 x 1
- 034 x 1
- 049 x 1

5. Put the end of range sensors (nº. 050). Match the holes presents in components nº. 007 and 029, and screw with component nº. 051.





Parts:
- 050 x 4
- 051 x 6

The last step is to put the power supply (nº. 052) above the circular base. **Almost done**! To make the product work, is necessary to follow the electrical instructions given in the next chapter.

3. Electrical connection

The electrical connection for the SUNO prototype is made via the 220-240V mains supply. Simply plug the device into an appropriate mains outlet.

3.1 System schematics

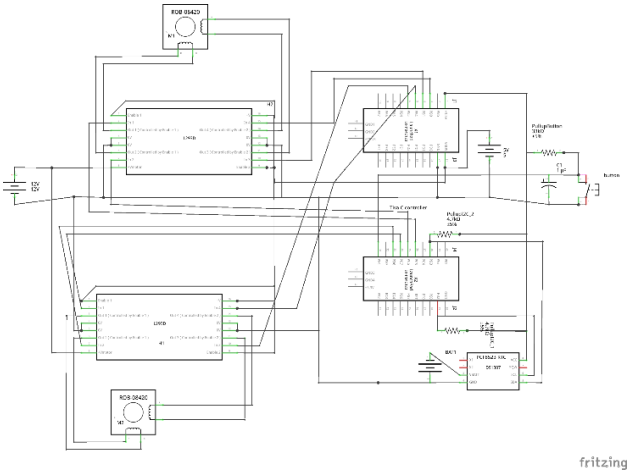


Figure 2: System schematics

3.2 Motors and power connection

Connect the lower motor to the breadboard according to the following mapping of wire colour to pin:

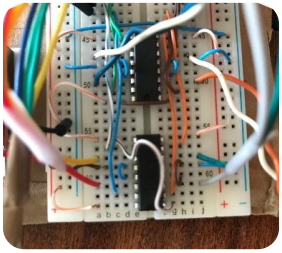
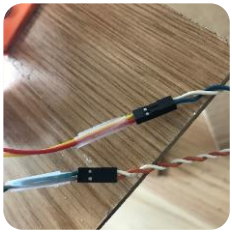


Figure 3: Lower motor connection

- Red – a61
- Yellow - a58
- Grey – j61
- Green – j58

For the upper motor connect it to the orange/white and blue/white wires:



Red, Yellow - Blue, White

Grey, Green - Orange, White

Figure 4: Upper motor connection

The power supply has to be connected as follows:

12V - j-side +V bus
Yellow jumper wire to Red wire

5V - a-side +V bus
Red jumper wire to middle Grey wire

Ground - ground bus
Blue wire to outter Grey wire

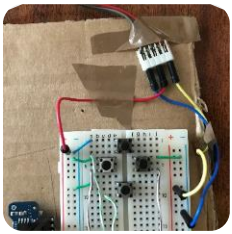


Figure 5: Power supply connection

4. Further information

4.1 Maintenance

For the correct operation of the device, it is recommended:

- Keep the reflective surface clean by wiping with a clamp cloth.
- Grease the leadscrew from time to time, for the mechanism to work smoothly.
- Check the correct operation of the end of range sensors.

4.2 Safety

To ensure your safety when using the device always follow these rules:

- Never look directly at the Sun or it's reflection in the mirror.
- Ensure that the Sunlight is not reflected onto flammable liquids or materials.
- To avoid damage to your property, ensure that the sunlight is not reflected onto objects that are sensitive to or degraded by Sunlight.
- Ensure that the power supply for SUNO does not come into contact with liquids and do not use in humid environments.
- Ensure that the mains voltage corresponds to the voltage indicated on the power supply rating label.
- If the power supply cable is damaged do not use the device and replace the power supply.

4.3 Warranty

- **Length of warranty:** two-year limited warranty from the date of purchase.
- **SUNO will pay for**: Hassle- free replacement of your SOSM or spare parts.
- **SUNO will not pay for**:
  1. Repairs when the SOSM is used in other than normal home use.
  2. Damage resulting from accident, alteration, misuse or abuse or use with products not approved by SUNO.
  3. Replacement parts or repair labour costs for the SOSM when they were operated outside the country of purchase.

4.4 Recycling

SUNO has been designed in such a way as to be user serviceable. If a part fails, contact us to be sent a replacement part. If for any reason you do not want the product anymore please send it back to us and we will recycle it. Alternatively, you can recycle SUNO's parts yourself using the following advice:

- All metal and wooden parts of SUNO are recyclable – take them to your local recycling centre. You may also repurpose these parts for your own projects to reduce environmental impact.
- Take all electronic parts to your local e-waste facility. Never throw electronics directly into the bin as they can contain substances which are harmful to the environment and should be recycled properly. It is possible to desolder some of the various electronic components for your own use – to do so is at your own risk.

4.5 Troubleshooting and Support

I can't see any reflected light
Ensure that SUNO's reflective surface is clean.

Reflected light is in the incorrect area
Ensure that you are using SUNO in the location that you stated when you purchased the it. Use the buttons to position the reflected light to your desired area.

I have placed the mirror but it has not repositioned itself
Ensure that SUNO is plugged in and switched on.

When I press the buttons, nothing happens
Wait a moment and try again
SUNO may still be repositioning itself after being turned on
Ensure SUNO is plugged in and switched on.

The reflected light position is unstable/repositioning does not happen frequently/SUNO operates out with daylight hours
Contact us and we will help you to reconfigure the device - you will need access to a computer to reset SUNO's controller using the micro USB connection. There may be a problem with SUNO's real time clock in which case we will send you a replacement part.