



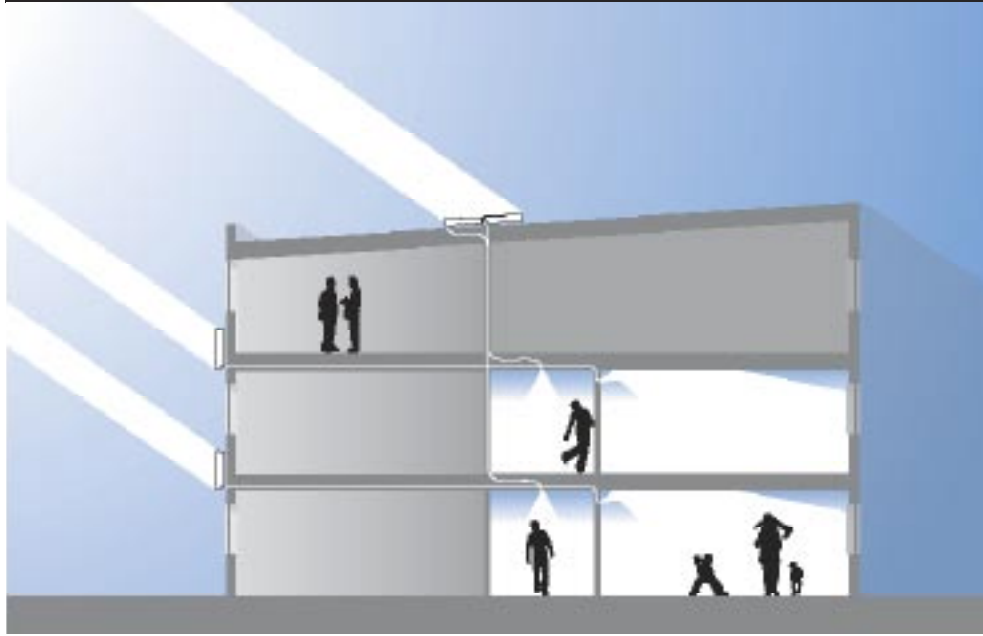
# **Installation Manual**

## **Parans SP2.1**

HUVCO Daylighting Solutions  
Post Office Box Three  
Rohrersville, Maryland 21779  
United States of America  
Phone: 301-432-0678  
Fax: 301-432-7185  
Web: [www.huvco.com](http://www.huvco.com)  
Toll-free: 800-832-6116

**USA Contact: HUVCO Daylighting Solutions 800-832-6116 [www.huvco.com](http://www.huvco.com)**

<b>Introduction</b>	2	About Parans Solar Lighting
	3	Steps the Installation
	4	Product Line Overview
<b>Installation Planning</b>	5	Basic Considerations
		Parans Solar Lighting Design
	6	Placement of Parans SP2.1
		Feasibility of Mounting
		Sunlight Exposure
		Compass Orientation
		Elevation Angle
		Alternative Orientations
<b>Parans SP2.1 Mounting</b>	7	Aligning the Fixture
		Adjusting the Fixture
	8	Mounting the Fixture
		Attaching Parans SP2.1 to the Fixture
<b>Gallery</b>	9	Example Gallery of Installed Parans SP2.1:s
<b>Cable Ducting</b>	10	Roof/Wall Penetration
		Swan's Neck Dimensioning
	11	Adjusting the Cabling to the Installation
		Shortening the Protective Hose
<b>Sun Switch</b>	12	General Information
		Function Description
		Installing the Sun Switch Hub
<b>Electrical Connection</b>	13	Connecting the Mains Power
		Warnings
<b>Commissioning the Installation</b>	14	Start-up Sequence
		Scanning Procedure
		Solar Tracking



*This installation manual is made for all parties involved in installing Parans solar lighting. It deals with project planning, lighting design with sunlight and the practicalities of an installation of Parans solar lighting. Parans recommends that this installation manual is studied entirely before starting planning the installation.*

## **About Parans solar lighting**

Definition:

*Parans solar lighting = lighting solution from Parans Solar Lighting AB transporting sunlight into buildings.*

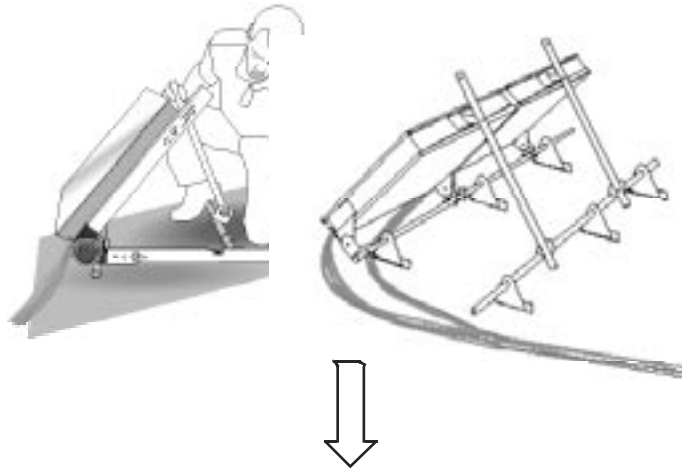
Parans solar lighting consists of Parans solar panels that collect sunlight which is focused onto Parans optical cables. These cables are connected to Parans luminaires in the chosen room where the sunlight flows out.

Parans SP2.1 is the second version of Parans SP2.1. It contains optics, mechanics and electronics, enclosed in a 1 x 1 meter weather resistant shell of anodized aluminium and an anti-reflective, hardened top glass. Except for the need of electrical supply, it is an autonomous unit. It tracks the sun without site-specific programming and stores data of the solar path in its internal memory.

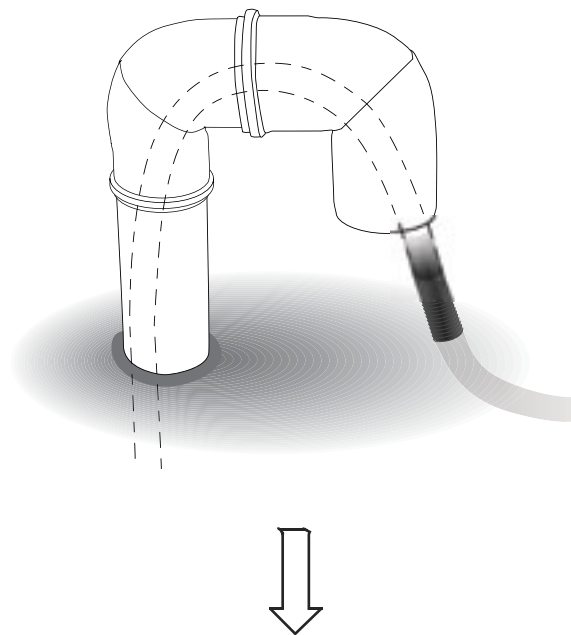
Parans SP2.1 carries four optical cables as well as electrical cables for power supply and software download. These are bundled together in a protective, yet flexible hose to secure handling during installation.

## Steps of the Installation

### Step 1 Install the Parans SP2.I



### Step 2 Duct the Cables



### Step 3 Install the Luminaires (instructions in product sheets)

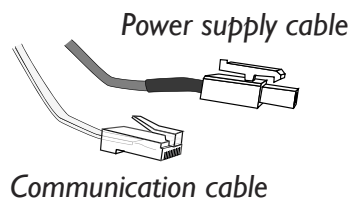
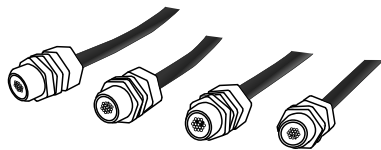
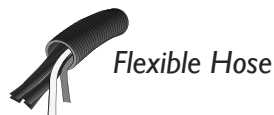
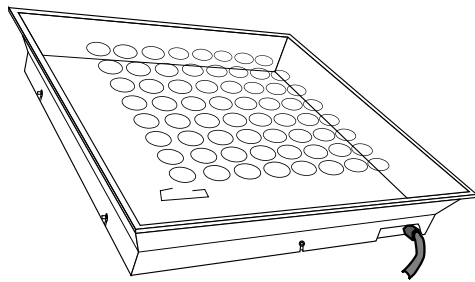


# INTRODUCTION

*This overview shows the different products that can be included in a typical installation of Parans solar lighting.*

## **Parans SP2.I**

Parans solar panel



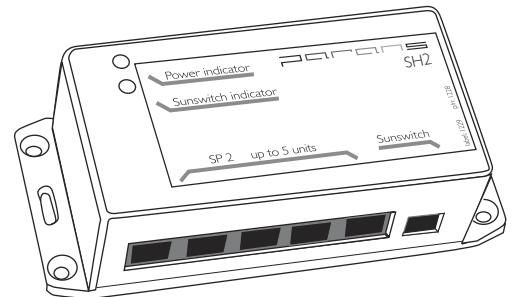
## **Parans SP2F**

Parans SP2 Fixture, for mounting on roofs or facades



## **Parans SH2**

Sun Switch Hub, for switching on and off sunlight. Optional.



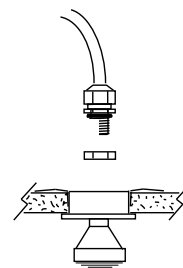
## **Parans LI (S/M/L)**

Luminaire available in three sizes. Image showing model Parans LI Small.



## **Parans L3**

Spotlight luminaire for highlights and indirect lighting.



**USA Contact: HUVCO Daylighting Solutions 800-832-6116 [www.huvco.com](http://www.huvco.com)**



*This chapter guides the reader through the considerations which are necessary to create a complete installation plan.*

## Basic Considerations

- I The Parans SP2.1 requires direct sunlight. Examine the sunlight exposure throughout the year to avoid placing the solar panel in a shadow during seasons when the sun is low.
- II From the Parans SP2.1 to the luminaires, the optical cables can be no longer than 20 meters. Shorter distances if permissible is preferred due to attenuation in the optical fibers.
- III The standard mounting orientation is  $180^\circ =$  due south ( $360^\circ =$  due north on the southern hemisphere) and the standard elevation angle equals the latitude.

An installation plan should include a time schedule, qualification- and certification requirements for installation material and installation workers (roof work etc) as well as details about the following:

Luminaire placement

Placement and orientation of the Parans SP2.1

Ducting of optical- and electrical cables

Size and placing of roof- and wall penetrations

Place and mode of electrical connection

## Tools Required

The tools required for an installation depends on the material and specific properties of the building where the products are to be installed. These are all standard tools. The tools that are specific for Parans' products:

- A 13 mm spanner (for mounting the Parans SP2.1 and adjusting the Parans SP2 Fixture)
- A cable stripper tool (for stripping the protective hose in those cases when necessary)

## Solar Lighting Design

The light design can include considerations to how Parans solar lighting differs from electrical lighting. That it is not intended as general lighting but rather to be used strategically where many people can experience it or where it has a special meaning. Beyond the direct effects and properties of the light, a valuable connection to the outdoor environment is achieved. We say that we bring nature inside. How can this best be expressed in your project?

## **Placement of Parans SP2.1**

The Parans SP2.1 should be mounted where it receives a maximum amount of sunlight during the functioning hours of the panel and that the resulting length of the optical cables is as short as possible. The maximum length of the fiber optic cables is 20m. In fact, the shorter the optical cables are, the stronger the luminous output is achieved from the luminaires since there are losses in the optical cables.

## **Feasibility of Mounting**

The weight of a Parans SP2.1 plus the standard Parans fixture is 40 kg. It is important that the fixture, whether it is Parans or custom made is so securely mounted that Parans SP2.1 withstands strong winds, snow and other loads. Parans SP2.1 has been installed on metal, concrete- and tar roofs and walls as well as on metal pillars.

## **Sunlight Exposure / Solar Charts**

In order to find an installation position that is unshaded, it is advisable to study the sun's path across the sky throughout a whole year and comparing this solar path with the actual surroundings. With data of the solar path and an optical instrument to tell directions, it is easy to tell if the intended installation position will be shaded and if so during which hours of which days of the year. Data of the solar path is represented in a sun chart, showing the direction to the sun throughout one year for a specific geographical position. It has the compass direction or "azimuth" ( $0^{\circ}$ - $360^{\circ}$ ) on the X-axis and the vertical angle or "elevation" ( $0^{\circ}$ - $90^{\circ}$ ) on the Y-axis. The following url:s are examples on internet sites where solar charts can be generated:

<http://solardat.uoregon.edu/SunChartProgram.html>

<http://www.jgiesen.de/azimuth/>

Align-A-Site is an example of an optical instrument that can be used on the installation site to tell the direction (azimuth and elevation) to structures that might interfere with incident sunlight. This tool can be ordered from Parans.

## **Compass Orientation**

As for many other types of solar panels, the ideal compass orientation of Parans SP2.1 is generally due south ( $180^{\circ}$  on the compass dial) on the northern hemisphere. Vice versa on the southern hemisphere.

## **Elevation Angle**

The ideal elevation angle is generally the same as the latitude of the specific installation site.

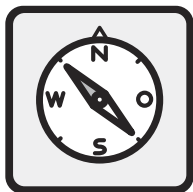
## **Alternative Orientations**

In some cases, Parans SP2.1 can be orientated differently, due to specific considerations. For example a western offset for more evening sunlight (the sun moves  $15^{\circ}$  from east to west per hour), mounted flat on a facade or roof for aesthetic reasons or mounted in line with solar shades on a building's facade.

**USA Contact: HUVCO Daylighting Solutions 800-832-6116 [www.huvco.com](http://www.huvco.com)**

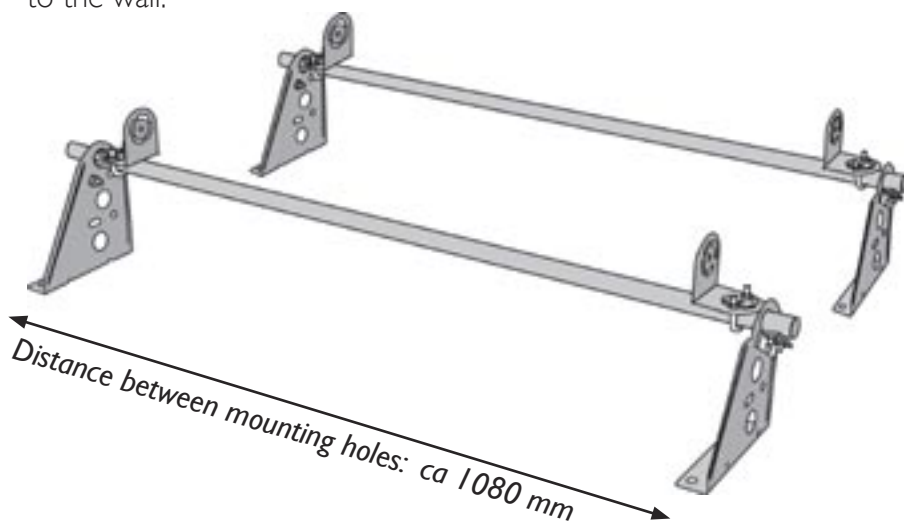
This chapter guides the reader through the procedure of mounting the Parans SP2. Don't miss the inspirational photo gallery on page 9!

## Aligning the Fixture

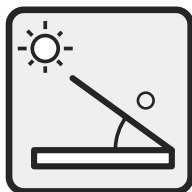


Align using a compass!

Temporarily lay out the Parans SP2.1 Fixture so that the Parans SP2.1 when later on mounted will have the correct azimuth (compass direction, see chapter *Installation Planning*, page 6). This is easy when on a roof but tricky on a facade. For wall installations, this step must be adapted to the site-specific conditions. It is advised to make the lay out on the ground and take exact measurements which can be transposed to the wall.

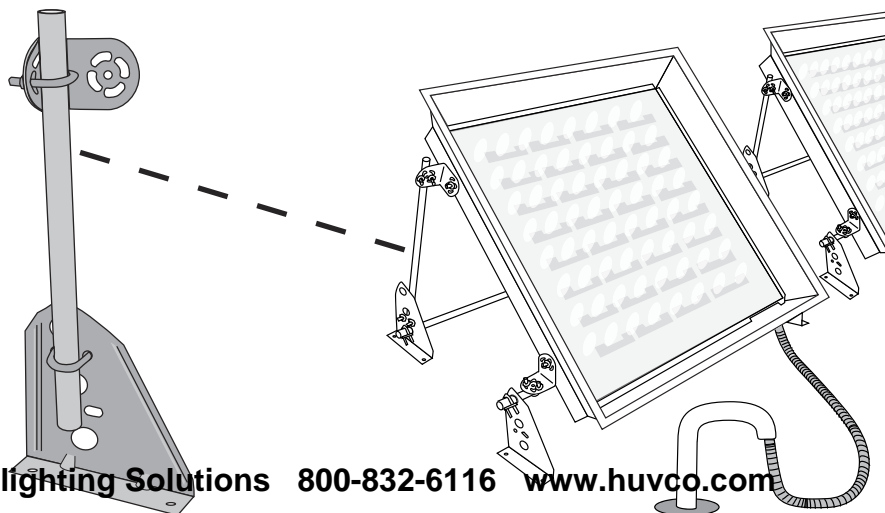


## Adjusting the Fixture



Check the elevation angle in the chapter "Installation Planning"

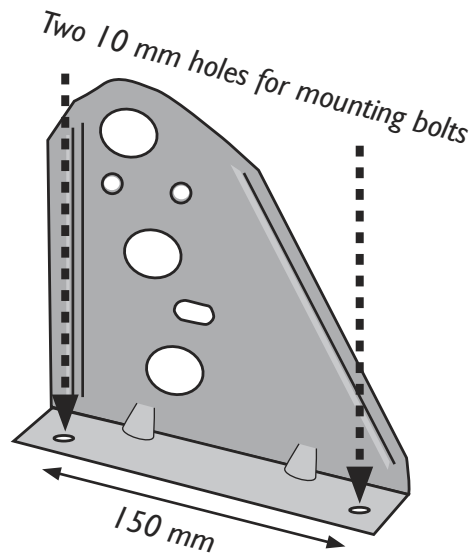
Adjust the fixture to achieve the correct elevation angle (see chapter *Installation Planning*, page 6, to learn about elevation angles). Different elevation angles can be achieved by mounting a tube vertically on two of the fixture's feet (see fig at the bottom of this page). This tube can be one of the two tubes of the Parans SP2.1, cut in half. On this tube, mount the brackets which will hold the two mounting bolts on the top side of the Parans SP2.1. By varying the lengths of these vertical tubes, different elevation angles can be achieved.



## Mounting the Fixture

Secure the feet to the surface. In This requires workmanship in knowledge of materials and dynamics as well as craftsman skills.

- Don't forget to reseal waterproof membranes!
- Make sure the fixture is securely fastened, to withstand weight-, wind- and snow loads!



## Attaching Parans SP2.1 to the Fixture

Parans SP2.1 is attached to the fixture using the four 13 mm bolts on the two vertical sides of the panel and the included locking nuts. Fasten the nuts securely! Note that the panel should be orientated so that the cables exit the bottom side of the panel.

# GALLERY

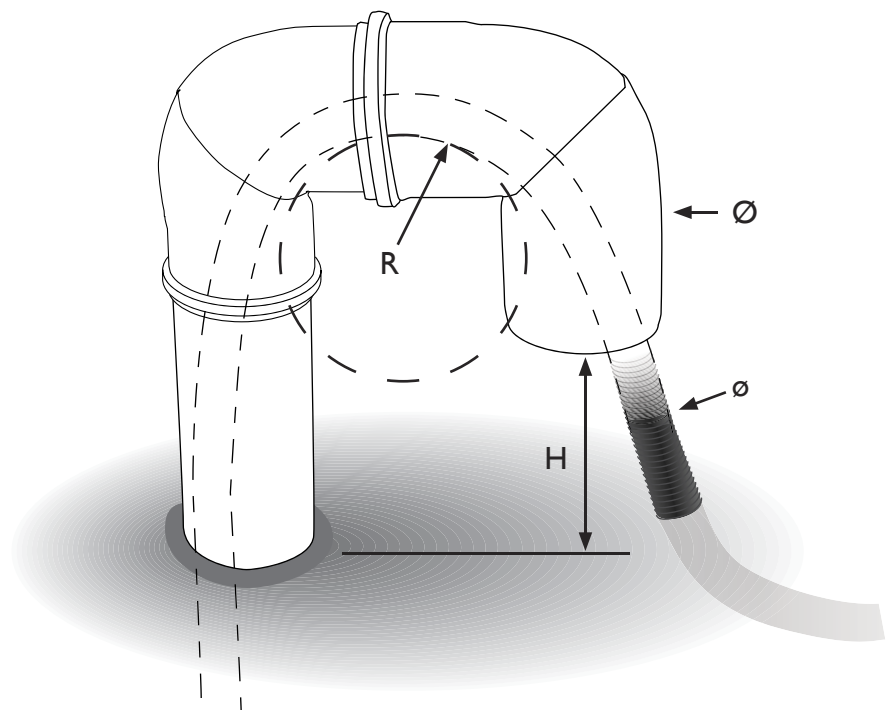


USA Contact: HUVCO Daylighting Solutions 800-832-6116 [www.huvco.com](http://www.huvco.com)

To duct cables into a building often involves penetrating the building's protective membrane and is therefore a task for certified professionals.

## Roof/Wall Penetration

The four optical cables, the power supply cable and the communication cable from Parans SP2.1 are enclosed in a protective corrugated plastic hose. This hose shall be ducted into the building through a water-tight aperture. On roofs, it is recommended to duct the cables through a swan's neck in order to prevent water leakage. This is a curved cylinder usually made of stainless steel or weather resistant plastic, see illustration below.



## Swan's Neck Dimensioning

*Do not underdimension the swan's neck!*

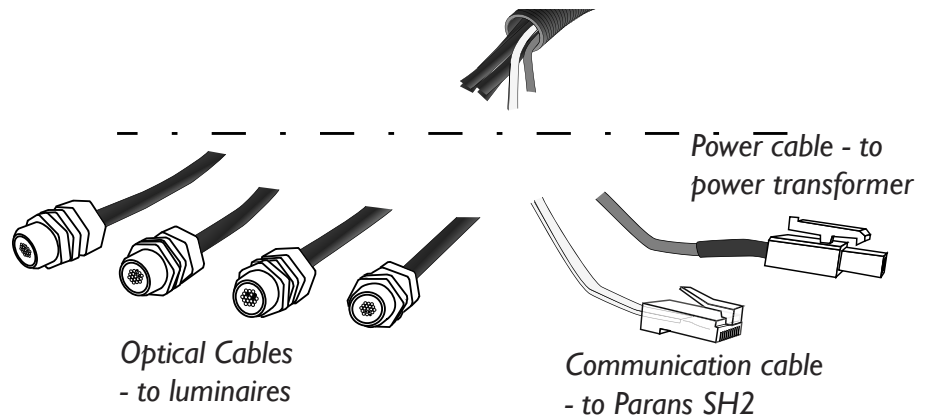
The following dimensions are recommended due to cable restraints and to prevent water leakage. Note that the swan's neck's diameter depends on its shape and material. The values indicated below serves therefore as guidelines only. It is important not to underestimate the friction as the hose is to be drawn through the curve.

Label	Significance	Measurements (mm)
∅	Hose Diameter	30
∅	Swan's neck Diameter	1 Parans SP2.1: 50 2 Parans SP2.1: 80 3 Parans SP2.1: 90 4 Parans SP2.1: 100
R	Bending Radius	≥ 100
H	Roof Clearance	≥ 200

**USA Contact: HUVCO Daylighting Solutions 800-832-6116 www.huvco.com**

## Adjusting the Cabling to the Installation

The protective hose is normally only required for outdoor applications. As the optical cables, the electricity cable and the communication cable often are ducted to different locations, it is usually necessary to shorten the protective hose.



## Shortening the Protective Hose



*Do not damage the cables!*



*Do not connect the communication cable to any equipment that is not supplied by Parans!*

Due to friction between the cables and the hose, it is easiest to pull off shorter sections of the hose, about one meter, at a time. Method: carefully make circular incisions in the hose while bending it in order not to damage the internal cables. A cable stripper tool that makes this task easier can be found in well sorted hardware stores or ordered from Parans. Orientate the plug of the power cable so that the sharp tongue faces inwards the center of the hose and pull off the excess protective hose sections.

The power supply cable shall be connected to the power transformer, which is plugged into an electricity outlet. The communication cable shall either be stored away for potential future use or connected to the Parans SH2 if the sun switch function is included in the installation.

The communication cable has for two purposes:

1) Transfer signals from the sun switch to the solar panel.

2) Create log files when connected to a PC.

These files show both historical and instant operation data of run-time, solar path data, information on tracking, temperature inside panel and more. The log files can also be used when trouble-shooting as the error messages in combination with historical data indicates what errors may have occurred.

– Do not connect the communication cable to any equipment that is not supplied by Parans! This may cause critical damage to both Parans products and other equipment!

# SUN SWITCH

With Parans' Sun Switch function, the sunlight output from Parans solar lighting can temporarily be switched off. Useful for conference rooms where on-screen presentations are common.

## General Information

When the Sun Switch function is desired, Parans delivers a switch hub, Parans SH2, that is connected to an external switch. One Parans SH2 controls 1-5 Parans SP2.1:s. Simply enough, there are only two modes: "Sunlight ON" or "Sunlight OFF".

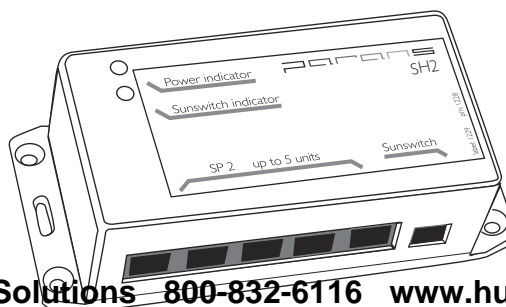
## Function Description

When the external switch is closed, it triggers the microcomputer inside the Parans SP2.1 to turn the lenses away from the sun, preventing direct sunlight to enter the fibers. As soon as the switch is returned, the lenses start tracking the sun. The sunlight is back within approximately 20 seconds. If the switch is left in the mode "Sunlight OFF" for more than 48 hours, it will automatically set the Parans SP2.1 into "Sunlight ON" mode again, to avoid the risk that the system is left in Sunlight OFF mode by mistake. The Parans SH2 has two light indicators:

Label	Light Color	Indication
Power indicator	Green	One or more of the connected Parans SP2.1:s are supplied with power.
Sun Switch indicator	Red	All of the connected Parans SP2.1:s are in mode "Sunlight OFF".

## Installation

- 1) Mount the Parans SH2 on a suitable position, wall-mounting is easy and practical.
- 2) Connect a low-voltage two-pole electrical cable to an external two-way switch and to the included green connector. This plug is to be inserted into the socket named Sun Switch. As the function simply relies on "closed- or open circuit", this connection is not sensitive for polarities.
- 3) Connect the number of Parans SP2.1:s by inserting the modular plugs of the Parans SP2.1:s communication cables in any of the sockets labelled "SP2 up to 5 units".



USA Contact: HUVCO Daylighting Solutions 800-832-6116 [www.huvco.com](http://www.huvco.com)

The Parans SP2.1 is delivered with a universal power transformer that works globally and is equipped with the correct type of plug to match the electricity outlets of the specific country and place of installation.

## Installation



Ensure that the electrical outlet is always powered!



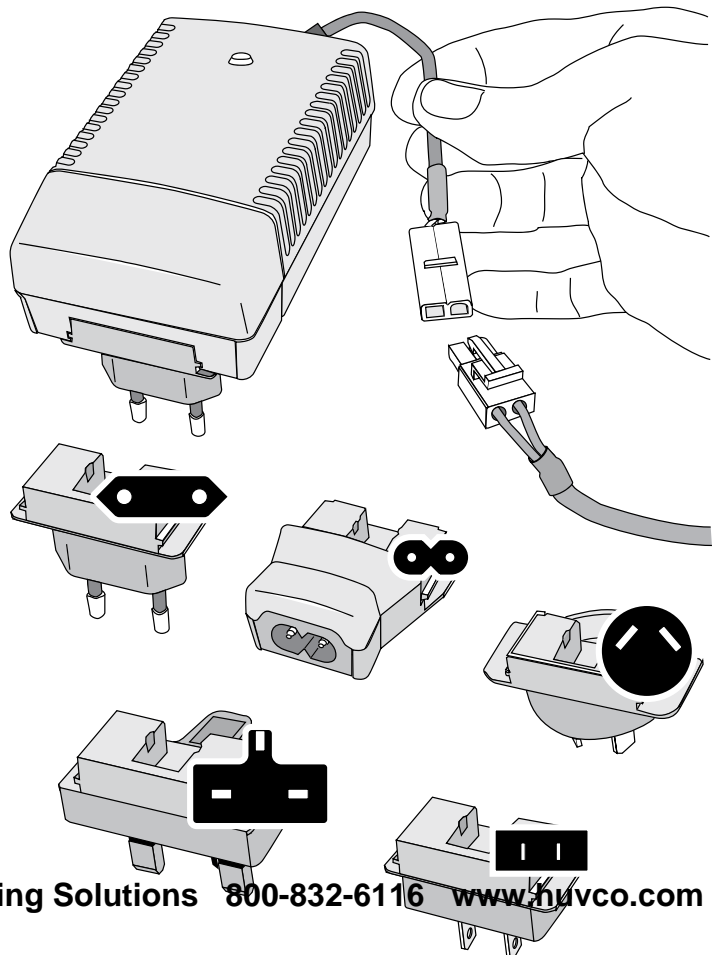
Critical damage if the polarities in the power cable are swapped!!

As the final step of installation: electricity supply. Start by connecting the Parans SP2.1 power supply cable to the power transformer and then plug the transformer into an electricity outlet.

The electricity outlet shall constantly be supplied with electricity in order for Parans SP2.1 to function optimally. Otherwise, historical data of solar path is lost which decreases accuracy of solar tracking, especially on cloudy days.

The polarities of the power cable must not be swapped! If for any reason the cable needs to be reconnected by any other means than with the original connectors seen in the fig below, the internal wires must have the following configuration to avoid critical damage:

Power Supply	Parans SP2.1
Black Cable	----- Black Cable
White Cable	----- Grey Cable



*It is important to be familiar with the start-up sequence and function of Parans SP2 during the first few days after installation in order to commission an installation properly. With time, more data of the solar path is analyzed and stored, resulting in improved tracking.*

## **Start-up Sequence**

When first connected to power, Parans SP2 performs a start-up sequence. This sequence is a mechanical check - and adjustment procedure that assures that all components function correctly.

## **Scanning Procedure**

After the start-up sequence, the sky is scanned in order to find the sun. The scanning is performed by stepping the lenses and sun sensors through all positions in the sky where the lenses can collect sunlight. During this movement, a multitude of light values are stored. On a clear day, the sun is usually found during the first scanning upon which the lenses are directed towards the sun and start tracking it's path.

On a cloudy or semi-cloudy day, the sun might be covered by clouds when the sensors are directed towards the point in the sky where the sun is. In this case, the scanning procedure restarts within a few minutes. If again no sun is found, the scanning procedure restarts and will do so until the sun is found. This pause between scanings will result in that the panel is inactive even though no sunlight flows through the optical cable, which is not a fault in the operation but rather the standard operation procedure if the first few days of operation are cloudy.

## **Solar Tracking**

The tracking is based on active sun sensors, stored data of solar paths and an algorithm predicting the sun's movement.

Data of the solar path begins to be stored once Parans SP2.1 is installed and begins tracking the sun. This data enables the tracking system to orientate the lenses to the position in the sky where the sun is calculated to be. For example in the morning, the lenses are orientated to the point in the sky where the sun rose the previous morning. This point will vary over the year but only minimally from day to day. The sensors can easily compensate for this day-to-day deviation.

On cloudy days the stored values of solar paths in combination with an algorithm of the sun's movement enables tracking of the solar path even though the sun light is shaded by clouds. If the clouds disappear, the lenses are correctly orientated and light starts to flow immediately.