



sunbotics

# The Modular Solar Cleaning Robot

made in Germany 

## Modular Allrounder

Whilst working in the solar cleaning industry for **more than 11 years**, our founder of the sun-X company and creator of the sunbotics has experienced a wide range of constellations, cleaning solutions and witnessed multiple challenges. He therefore developed the sunbotics system – to have a single **solution for every kind of solar system**.

With sunbotics, it is possible to **effortlessly set up and dismantle or completely convert the machine** at any time and in just a few minutes. Thanks to its **absolute modularity**, the machine can be adapted to all specific requirements of any system at any time – and thus **ensures thorough cleaning**. Instead of investing in a multitude of different cleaning systems with different focuses and advantages, cleaners can now use the sunbotics system – either in its basic form or adapt to the challenge at hand by simply using different conversion kits.

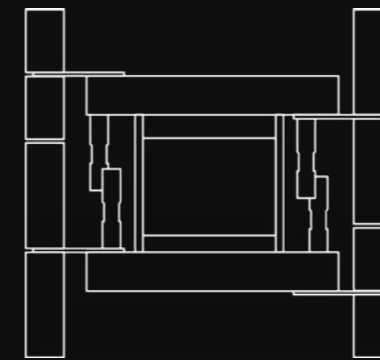
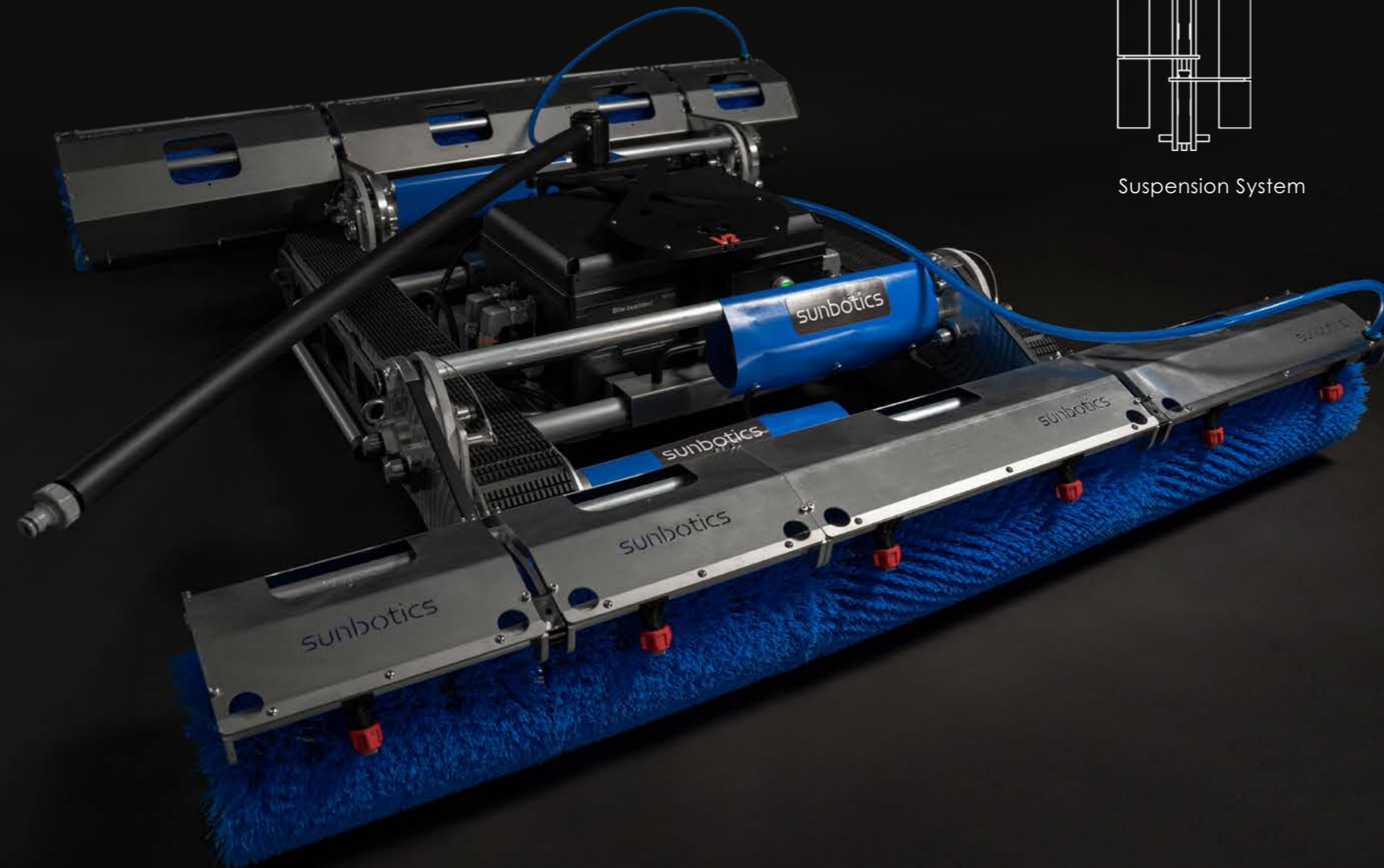
Revolutionary  
Versatility

# So What Makes sunbotics So Special?

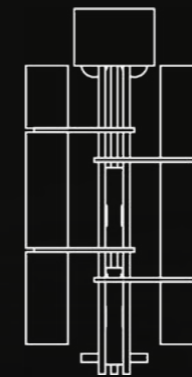


## Highest Standards

In order to meet the highest standards in the industry, we accepted the challenge and are now the only PV cleaning robot on the market to be CE, UL as well as TÜV certified – we can therefore offer the best performance for your photovoltaic system.



Robot



Suspension System

## Individual and Adaptive

In just a few simple steps, you can retrofit the machine individually, according to your needs.

It can be effortlessly extended and / or shortened, brush lengths can be exchanged and what makes it unique, is that the chassis can be adapted in the process. In this way, the sunbotics can cope with even highest inclinations.

## Modular System

Thanks to the modularity of our sunbotics, you can easily and quickly transform the robot into a completely different product – the suspension system.

The suspension system is the solution for steep, elevated installations and can be extended to a total length of 4.20 metres. The conversion to the completely new system only takes approximately 20 minutes.

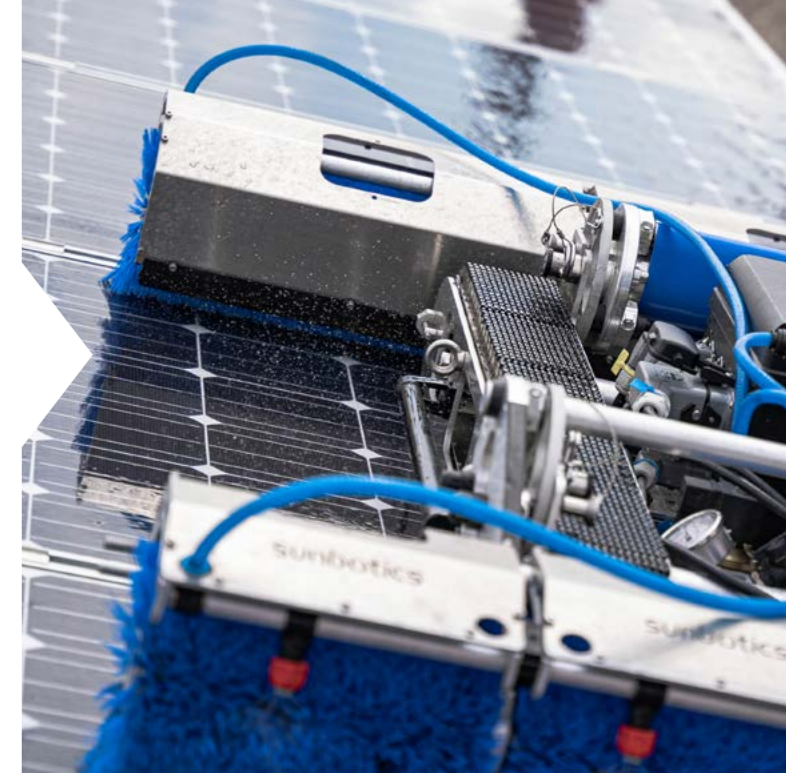


## Intelligent Cleaning

The unique mobility of the brushes is made possible thanks to the intelligent carrier arms. Parts of the brushes function independently of one other – meaning they do not move stiffly over the modules, but adapt to the module surface. Regardless of whether the module is bulbous or set lower, our sunbotics cleans without leaving any residue. The form of carrier arms is unique on the market.

## Highly Impervious

All our motors as well as the e-box are equipped with membranes. This means that any condensed water can immediately escape.

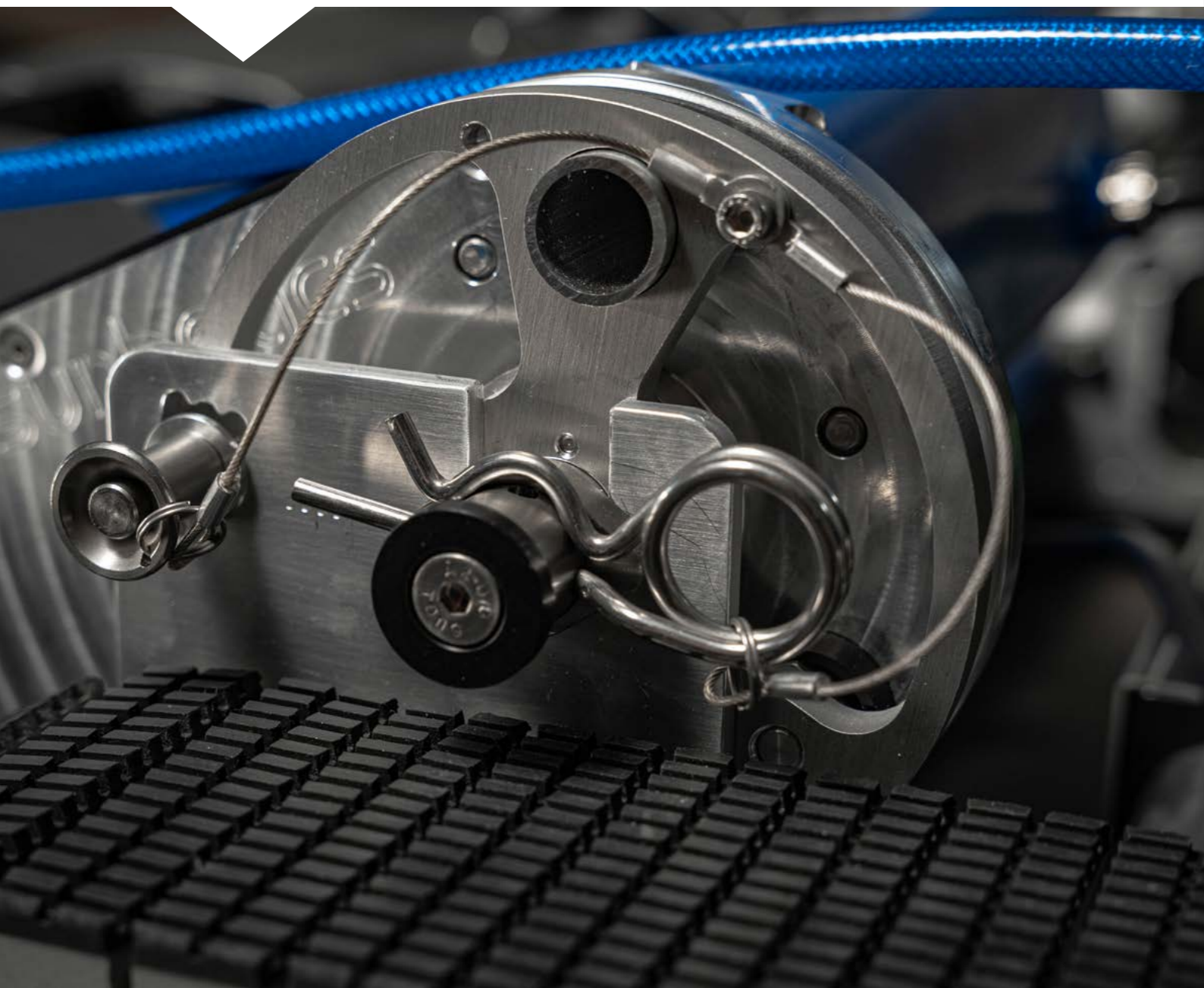


## Protector Lacquer

Thanks to the protector lacquer of the e-Box, it has a high resistance to scratches and other sources of impact.

## Power & Battery Operation

The e-Box can either be connected to a power-connection or used via battery, to ensure stress-free cleaning. The e-box including all connections has a membrane which has been subjected to a leak test.



# Robot

## Brush Lengths

Different brush lengths are available in the following standardised sizes:

110 cm  
145 cm  
210 cm

Customised brush sizes are possible at request.

## Possible Inclinations<sup>1</sup>

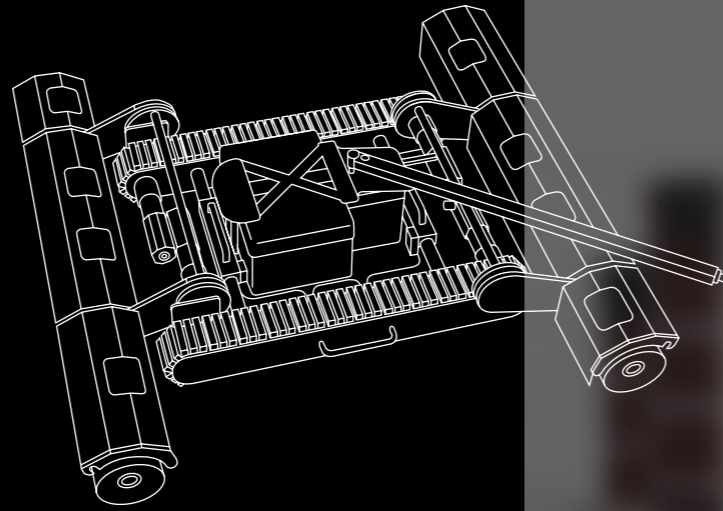
Different brush sizes allow the sunbotics to climb different inclinations.

up to 1,45 m width      Inclination 25° - 30°  
up to 2,10 m width      Inclination 20° - 25°

## Power Supply

e-Box V4  
4 Brush connections  
2 Drive connections  
24 V Output  
Water relay connection  
Membrane

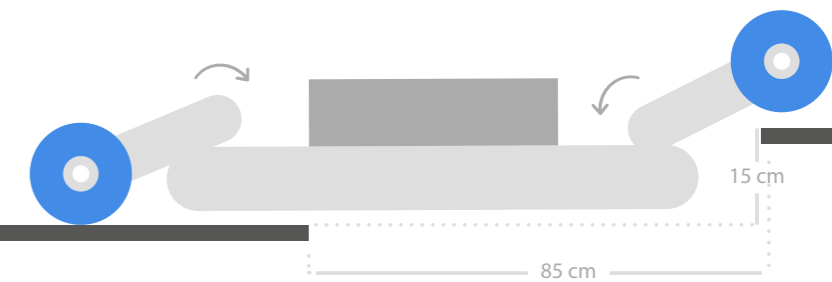
<sup>1</sup> The inclinations specified are those approved by sun-X GmbH. These are to be understood depending on the photovoltaic system to be cleaned and the soiling. The operator is responsible for the safe operation of the machine. (Observe operation manual)



The running tracks driving on the module surface preserve the modules thanks to the special rubber profiles. Since the tracks are 90 cm long the weight distribution for the maximum load on the modules is 4,000 pa for the base robot.

The specially developed rubber profiles of the tracks also provide extra grip when driving on inclinations of up to 30° for the base robot.<sup>1</sup>

Thanks to these stable running tracks the robot can drive over significant module gaps of up to approx. 85 cm without having to lift the robot from one module table to the next. The adjustable brushes allow it to also easily climb differences in height of up to approx. 15 cm.



# Robot

## Technical Data



### Metrics

<b>Width</b>	110 cm*	145 cm	210 cm
<b>Length</b>	155 cm	155 cm	155 cm
<b>Height</b>	38 cm	38 cm	38 cm

\* Regular width of solar systems with east/west mounting

### Weight

<b>Total</b> <sup>2</sup>	84 kg	89 kg	99,5 kg
<b>Central unit</b>	17 kg	17 kg	17 kg
<b>Chassis</b>	31 kg	31 kg	32,5 kg
<b>Brush unit</b>	2 x 18 kg	2 x 20,5 kg	2 x 25 kg
<b>Load calculation</b> <sup>3</sup>	3.820 Pa	3.910 Pa	4.160 Pa

### Operation

<b>Maximum speed</b>	25 m <sub>min</sub>	25 m <sub>min</sub>	25 m <sub>min</sub>
<b>Cleaning speed</b> <sup>1</sup>	1.470 m <sup>2</sup> /h	1.940 m <sup>2</sup> /h	2.790 m <sup>2</sup> /h
<b>Max. inclination of solar modules</b> <sup>4</sup>	25° - 30°	25° - 30°	20° - 25°
<b>Water supply</b> <sup>5</sup>	0-600 l/h, 2-4 bar	0-600 l/h, 2-4 bar	0-600 l/h, 2-4 bar
<b>Battery performances</b> <sup>1</sup>	120 min	120 min	90 min
<b>Brush rotation</b>	200 rpm	200 rpm	200 rpm

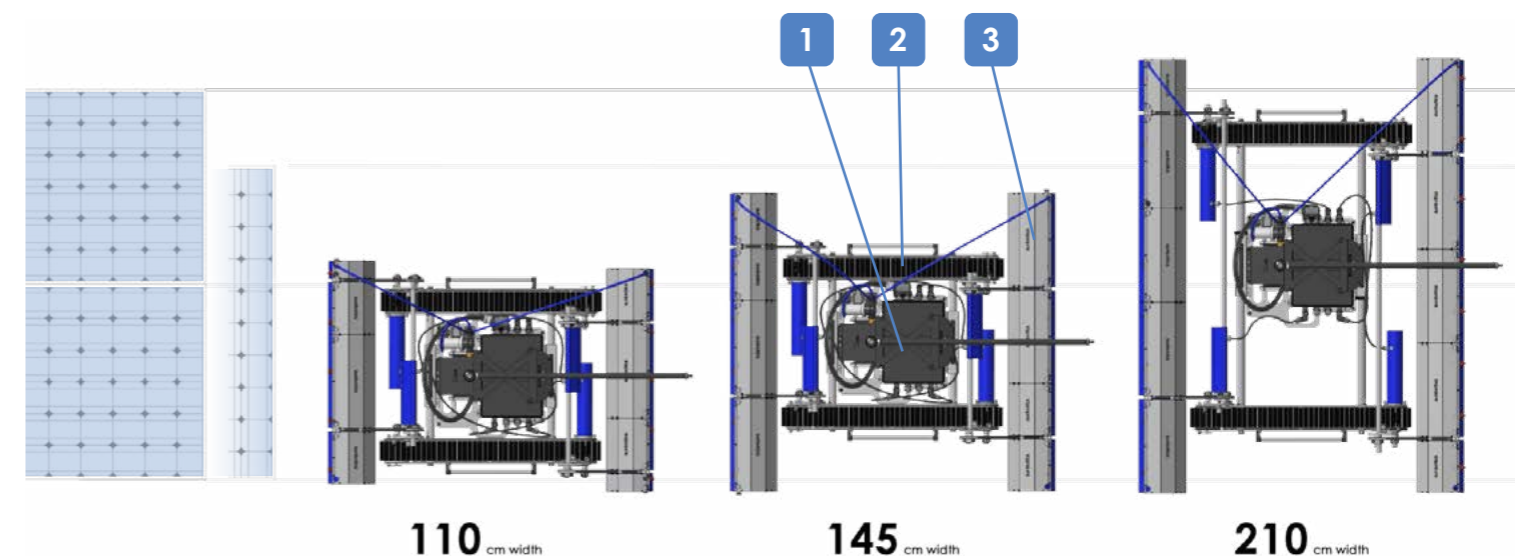
1 The maximum value is specified here  
 2 Specifications given without battery  
 3 Specifies loads with brush in place on surface  
 4 The inclinations specified are those approved by sun-X GmbH. These are to be understood depending on the photovoltaic system to be cleaned and the soiling. The operator is responsible for the safe operation of the machine. (Observe operation manual)  
 5 A consumption of 0 l refers to dry cleaning

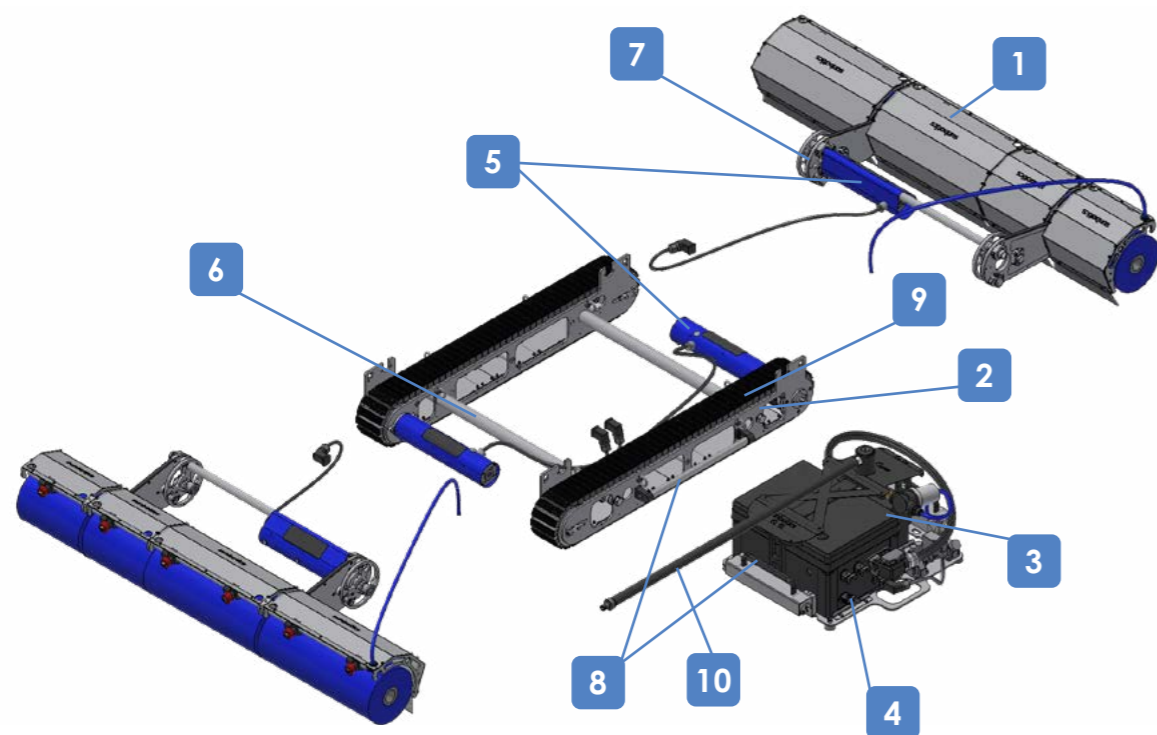
### Extras

- Modular build
- Warning system for low battery
- Maintenance package for small repairs on site
- Protection class for motors (imperviousness) IP 65
- Splash guards for additional protection of motors
- Adjustable water flow

### Assembly Box

- 1 Central unit
- 2 Chassis
- 2 Brush unit



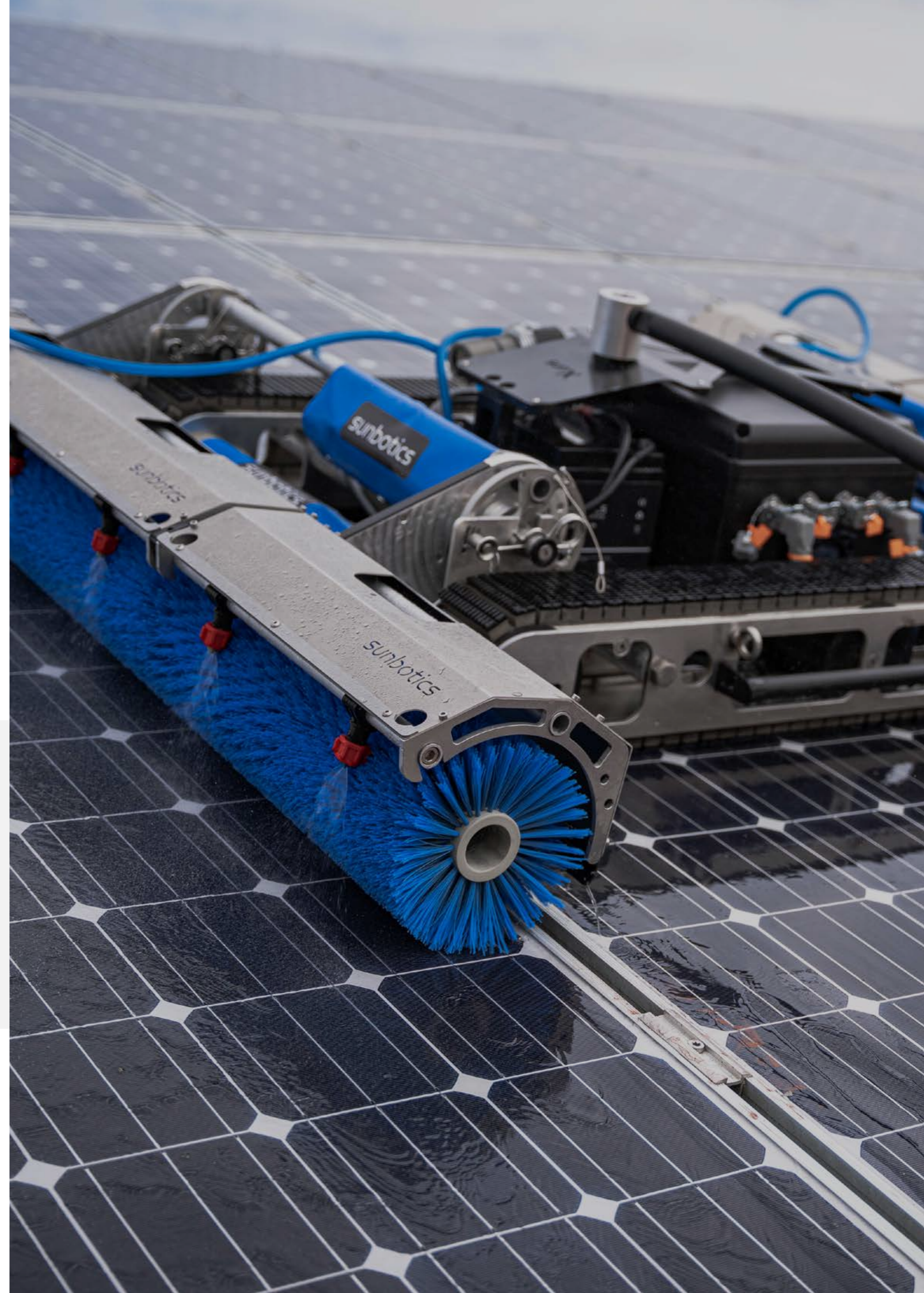


- 1 Brushmodule with cover
- 2 Drive unit (large)
- 3 Battery
- 4 e-Box (electronic Box)
- 5 Motor
- 6 Connecting rod drive unit
- 7 Carrier arm with quick coupling system
- 8 Handle bar
- 9 Module glider
- 10 Water connection

Light, safe and mobile – 3 keywords to describe sunbotics. Its mobility offers numerous advantages compared to conventional cleaning systems and facilitates your cleaning project considerably.



You can find a construction manual for our sunbotics machines at:  
<https://www.youtube.com/watch?v=wwZKA5IX8dc>



# Rivolta® P.H.C. Photovoltaic cleaner



- tested material compatibility by Fraunhofer CSP Institute
- biodegradable
- excellent cleaning effect
- reduces resoiling
- improves the power output of the PV modules
- not subject to labelling according to CLP

## Properties

**Rivolta P.H.C.** is a material-friendly, highly efficient and biodegradable\* cleaning concentrate for removing dirt from photovoltaic systems.

**P.H.C.** is based on a combination of special active ingredients, each of which gently removes various residues and soiling, e.g. dust, pollen, soot, bird droppings, green coatings, road dirt and other environmental deposits from PV modules.

**P.H.C.** is supplied exclusively as a concentrate and should be diluted min. 1:4 with water before use. The application concentration depends on the type of process and the degree of soiling of the modules to be cleaned.

## Fields of application

**Rivolta P.H.C.** is equally used in solar parks, the entire industry, agriculture, etc. for the material-friendly and efficient cleaning of photovoltaic systems.

## Instructions for use

**Rivolta P.H.C.** can be applied e.g. to small PV modules manually by spraying and washing down using a pressure pump sprayer with foam nozzle and is very well suited for large-area cleaning with cleaning robots as well as abseiling and hand brushes.

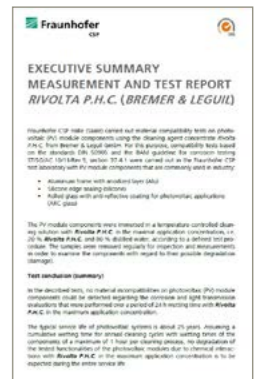
## Material compatibility

Extensive material compatibility tests were carried out for **Rivolta P.H.C.** by the Fraunhofer CSP Institute in order to analyse possible risks for PV modules when wetted with the cleaning agent. In the process, the following customary components were tested:

- Aluminium frame with anodised coating
- Silicone edge sealing and
- PV rolled glass with anti-reflective coating

**Result:** The typical service life of photovoltaic systems is about 25 years. Based on the test results, no impairment of the tested functionalities of the photovoltaic modules due to chemical interactions as a result of contact with **Rivolta P.H.C.** is to be expected during the entire service life – with an annual cleaning cycle and a wetting time of the components of maximum 1 hour per cleaning process and use of the cleaner in the maximum application concentration (1:4).

(Source: Measurement and Test Report Fraunhofer Center for Silicon-Photovoltaic CSP)



	Value	Norm
<b>Density at +15 °C</b>	1,02 g/cm <sup>3</sup>	DIN 51757
<b>pH value undiluted at +20 °C</b>	10,6	DIN 19268
<b>Form</b>	liquid	
<b>Colour</b>	clear	
<b>Odour</b>	characteristic	
<b>Available in</b>	20 kg cans	

\* The surfactants used in this product are considered biodegradable as they meet the legal requirements regarding biodegradability (e.g. according to the Washing and Cleaning Agents Act - WRMG). In addition, all organic ingredients are considered readily biodegradable according to OECD 301 (inorganic ingredients that are not subject to biodegradability, such as water, are not considered).



**Bremer & Leguil GmbH**  
Am Burgacker 30–42 • 47051 Duisburg • Germany  
Tel. +49 203 99 23-0 • Fax +49 203 2 59 01  
[info@bremer-leguil.de](mailto:info@bremer-leguil.de)

This text contains facts and statements and is determined with our best knowledge and will be checked continuously. These statements are depending – among other reasons – on experiences gained in the industry. We only pass them on without liability. Before using our products you should test the applicability and you should convince yourself of the satisfactory performance. Our application examples and suggestions should not request to violate patent rights. Product illustrations partly consist of picture compositions and therefore, do not necessarily reflect the reality.



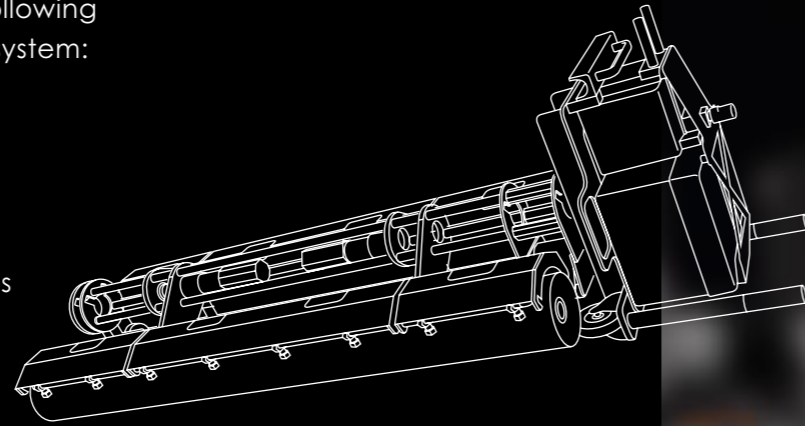
# Suspension System

## Brush Lengths

Different brush lengths result in the following maximum lengths of the suspension system:

- 120 cm
- 175 cm
- 210 cm

Extensions up to 4.20 m are possible. Customised brushes in special lengths can also be provided if requested.



## Possible Inclinations<sup>1</sup>

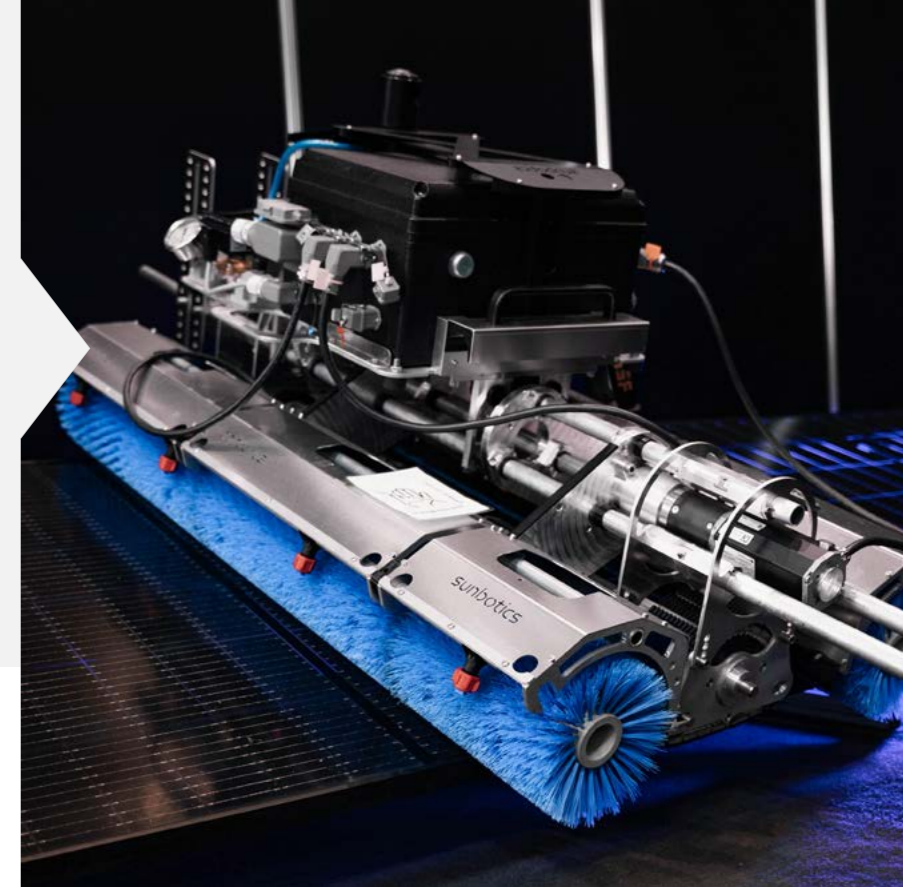
Different brush sizes allow the sunbotics to climb different inclinations up to 40°.

## Power Supply

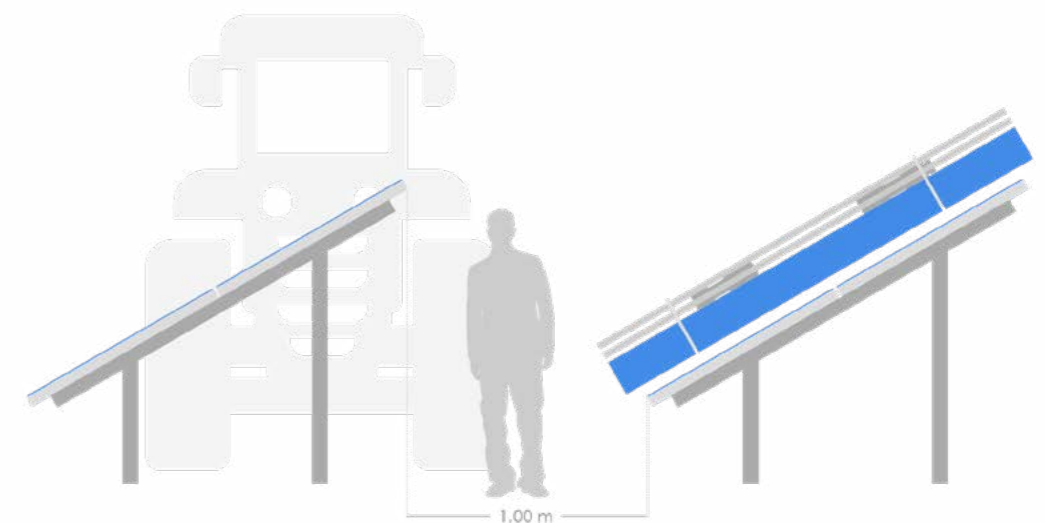
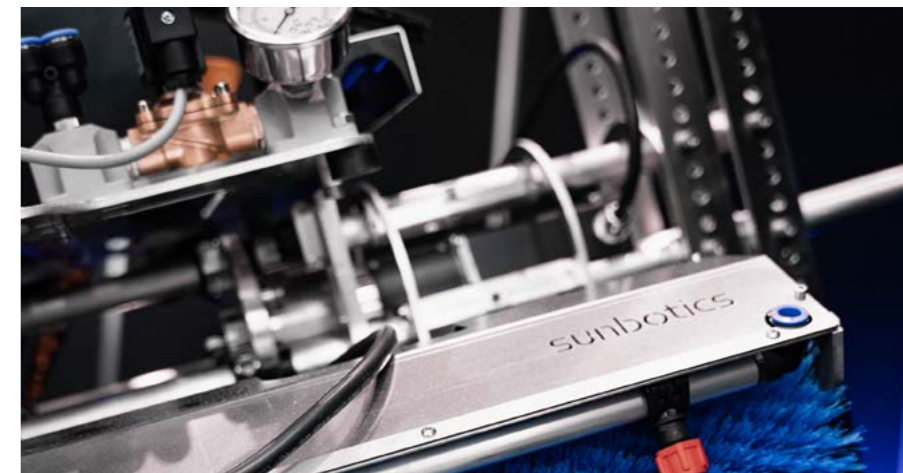
- 4 Brush connections
- 2 Drive connections
- 24 V Output
- Water relay connection
- Membrane

<sup>1</sup> The inclinations specified are those approved by sun-X GmbH. The operator is responsible for the safe operation of the machine. (See operating manual)

The gentle rubber profile of the drive unit prevents sensitive modules from damage. It is also possible to drive over module clamps of up to 1-2 cm.



Take advantage of the full scope of the sunbotics system by using the quick coupling system of the products. That way, you can extend your suspension system up to 4.20 in just a few simple steps. Especially if the space between the module rows is narrow, you can drive comfortably with your suspension system.



# Suspension System

## Technical Data



### Metrics

<b>Width</b>	120 cm	175 cm	210 cm
<b>Length</b>	76,5 cm	76,5 cm	76,5 cm
<b>Height</b>	69 cm	69 cm	69 cm

### Weight

<b>Total</b> <sup>2</sup>	80,5 kg	88 kg	94,5 kg
<b>Suspension box</b>	18 kg	18 kg	18 kg
<b>Driving-, steering-, brush unit</b>	62,5 kg	70 kg	76,5 kg

### Operation

<b>Maximum speed</b>	25 m/ <sub>min</sub>	25 m/ <sub>min</sub>	25 m/ <sub>min</sub>
<b>Cleaning m<sup>2</sup> per hour</b> <sup>1</sup>	1.595 m <sup>2</sup> / <sub>h</sub>	2.325 m <sup>2</sup> / <sub>h</sub>	2.790 m <sup>2</sup> / <sub>h</sub>
<b>Max. inclination of solar modules</b> <sup>3</sup>	40°	40°	40°
<b>Water usage</b> <sup>4</sup>	0-600 l/ <sub>h</sub> , 2-4 bar	0-600 l/ <sub>h</sub> , 2-4 bar	0-600 l/ <sub>h</sub> , 2-4 bar
<b>Battery power</b> <sup>1</sup>	120 min	120 min	90 min
<b>Brush rotation</b>	200 rpm	200 rpm	200 rpm

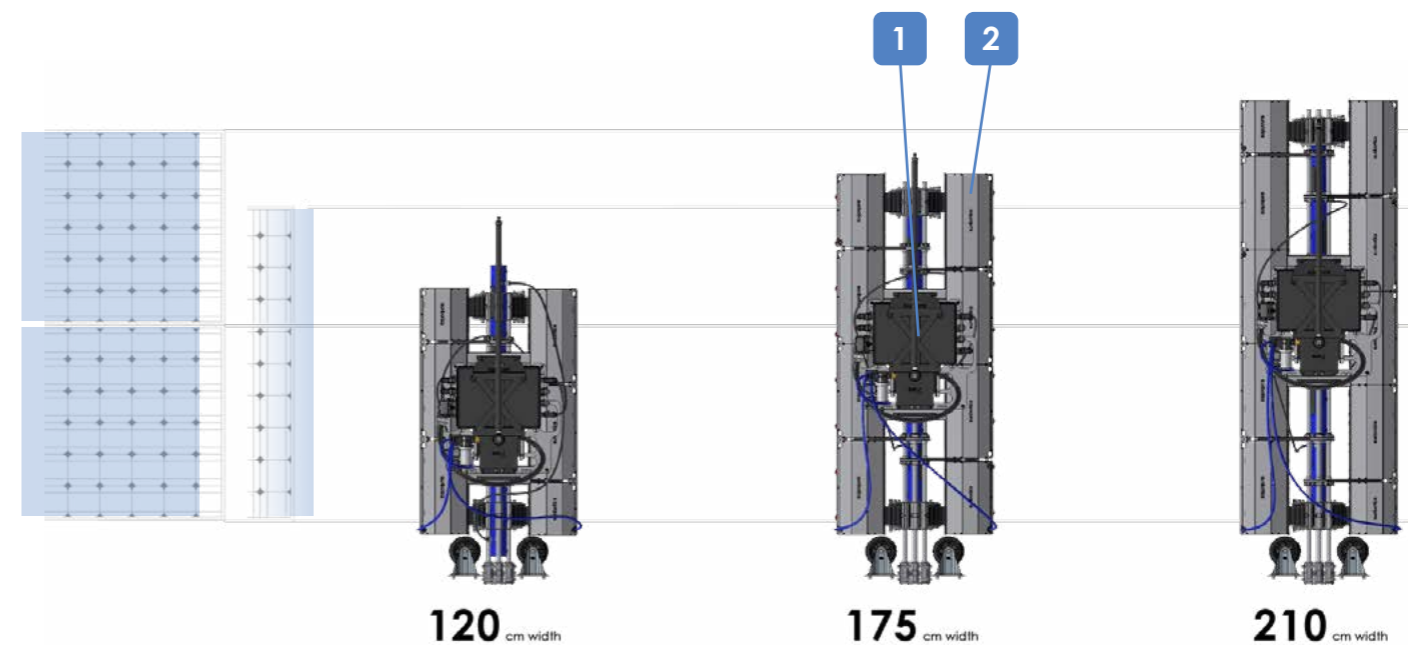
1 The maximum value is specified here  
 2 Indication without internal power supply, chain units must always run on module frame  
 3 The inclinations specified are those approved by sun-X GmbH.  
 The operator is responsible for the safe operation of the machine. (See operating manual)  
 4 A consumption of 0 l refers to dry cleaning

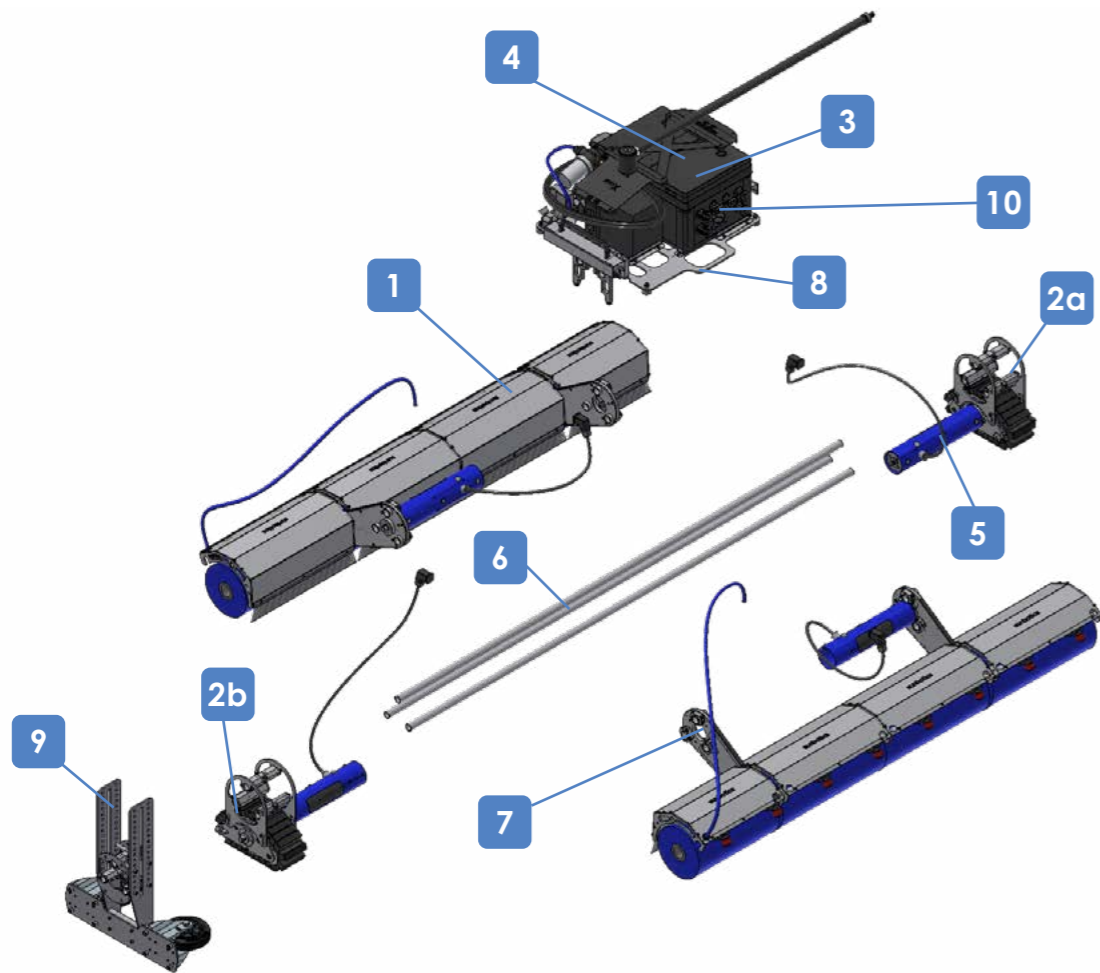
### Extras

- Variable build
- Driving tracks and guide roles can be adapted to the under construction
- Warning system for low battery
- Maintenance package for minor repairs on site
- Motor impervious IP 65
- Covers for additional protection of the motors
- Adaptable water usage

### Assembly Box

- 1 Suspension box
- 2 Driving-, steering-, brush unit





- 1 Brushmodule with cover
- 2a Drive unit (small)
- 2b Running unit
- 3 Battery
- 4 e-Box (electronic Box)
- 5 Motor
- 6 Connecting rod drive unit
- 7 Carrier arm with quick coupling system
- 8 Handle bar
- 9 Module glider
- 10 Water connection

Perfect for ground mounted systems – Once the driving unit is set on the top of the top of the module, the suspension system travels directly on the module frame. It thus cleans your installation effortlessly and with maximum efficiency.



You can find a construction manual for our sunbotics machines at:  
<https://www.youtube.com/watch?v=wwZKA5IX8dc>



## A Team Looking at the Future

At sun-X, we are always working on the further development of our products so that photovoltaic cleaning becomes more efficient and gets the attention it deserves. We want to represent modularity not only in the cleaning system, but in all our future-oriented solutions.

Therefore, future developments for sunbotics will also always be based on the basic robot, so that customers who have already trusted us will continue to use their machines optimally and benefit from changes.

Please feel free to follow us on our social media channels to stay up to date on our product range.

**We look forward to hearing from you!**



We provide you with interesting and useful videos on our YouTube channel.



**sun-X GmbH**

**An der Erdinger Straße 27  
D-85447 Fraunberg**

**Tel.: +49 (0) 8122 55 37 98 - 00**

**E-Mail: [info@sun-x.energy](mailto:info@sun-x.energy)  
[sales@sun-x.energy](mailto:sales@sun-x.energy)**

**[www.sun-x.energy](http://www.sun-x.energy)**

