

## Solar system rehabilitation and upgrading for

### Solar pumping project

**Note:** Torughoundi Uila and house holds at elevated part of all three villages.

### Parameter

|                        |   |                    |       |
|------------------------|---|--------------------|-------|
| Location:              | Afghanistan, Herat (34° North; 62° East)      | Water temperature: | 25 °C |
| Required daily output: | 195 m <sup>3</sup> ; Sizing for average month | Dirt loss:         | 5.0 % |
| Pipe type:             | plastic                                       | Static head:       | 50 m  |
|                        |   | Motor cable:       | 80 m  |
|                        |   | Pipe length:       | 750 m |

### Products

| Quantity         | Details   |
|------------------|---|
| PSk2-9 C-SJ17-11 | 1 pc. Submersible pump system including controller with DataModule, motor and pump end                                |
| LC250-P60        | 57 pc. 14,250 Wp; 19 x 3 modules; 34 ° tilted   |
| Motor cable      | 80 m 25 mm <sup>2</sup> 3-phase cable for power and 1-phase cable for ground  |
| Pipeline         | 750 m 100 mm (inner diameter) Pipeline  |
| Accessories      | 1 set Well Probe, Float Switch, Surge Protector, PV Disconnect 1000-40-5, PV Protect 1000-125, SmartPSUK2, SmartStart |

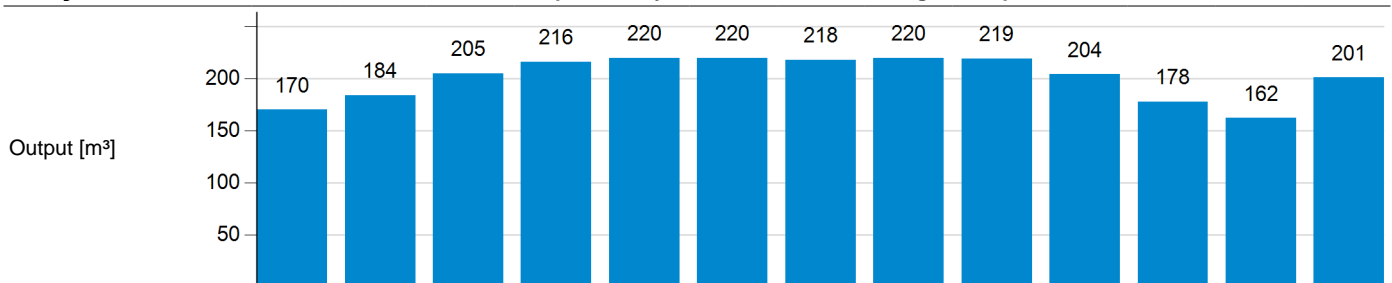
### SunSwitch setting in PumpScanner

min. 100 W/m<sup>2</sup>

### Daily output in average month

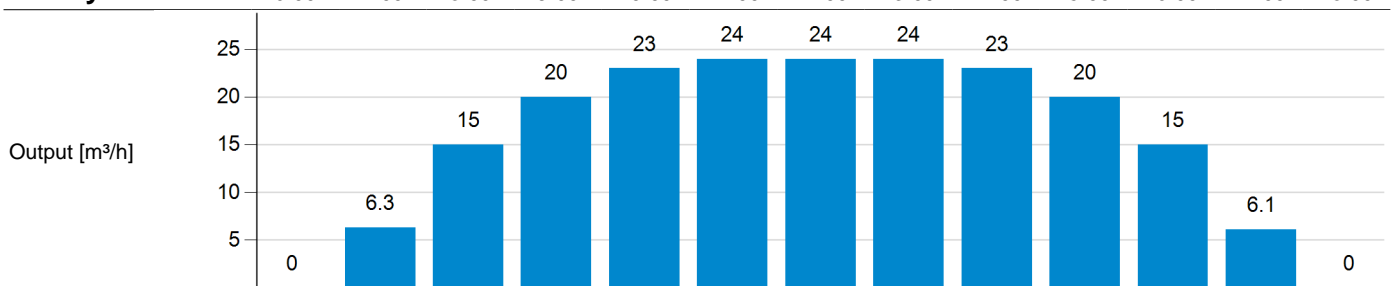
201 m<sup>3</sup>

#### Daily values



|                                   |     |     |     |     |      |     |     |     |     |      |      |     |      |
|-----------------------------------|-----|-----|-----|-----|------|-----|-----|-----|-----|------|------|-----|------|
| Energy [kWh]                      | 56  | 67  | 73  | 78  | 79   | 79  | 78  | 80  | 82  | 75   | 62   | 53  | 72   |
| Irradiation [kWh/m <sup>2</sup> ] | 4.1 | 4.9 | 5.5 | 6.1 | 6.4  | 6.4 | 6.3 | 6.5 | 6.5 | 5.8  | 4.6  | 3.8 | 5.6  |
| Rainfall [mm]                     | 1.7 | 1.9 | 2.3 | 1.4 | 0.37 | 0   | 0   | 0   | 0   | 0.13 | 0.50 | 1.4 | 0.80 |
| Ambient temp. [°C]                | 2   | 3   | 8   | 15  | 20   | 25  | 26  | 24  | 19  | 14   | 9    | 4   | 14   |

#### Hourly values

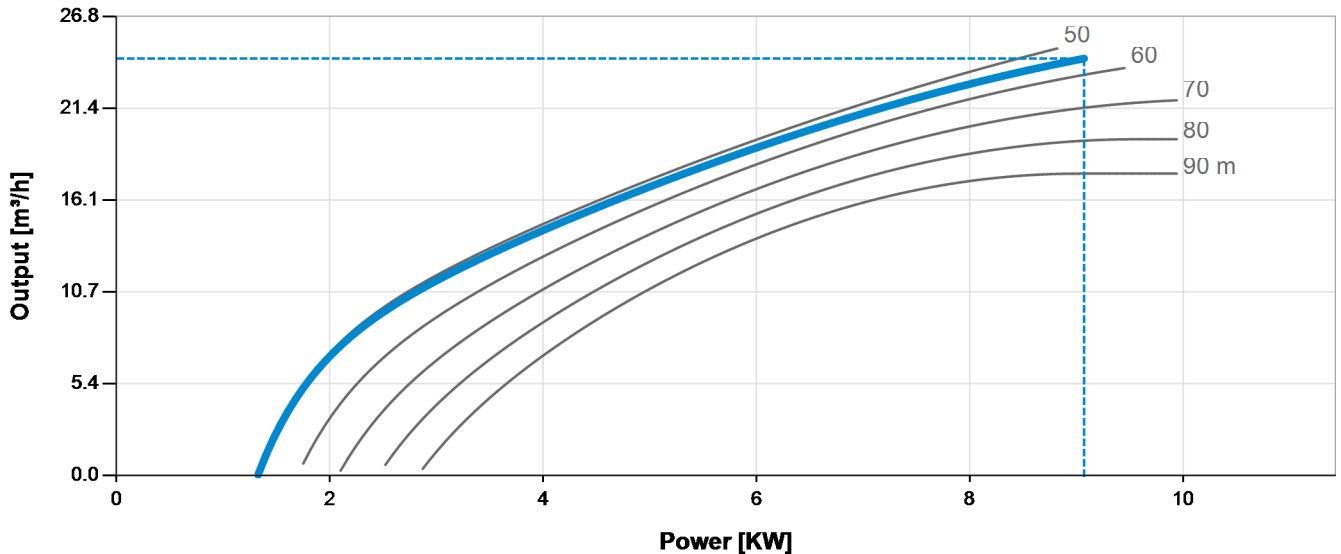


|                                   |       |      |      |      |      |      |      |      |      |      |      |      |       |
|-----------------------------------|-------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Energy [kWh]                      | 0.31  | 1.9  | 4.4  | 6.7  | 8.5  | 9.6  | 9.9  | 9.5  | 8.3  | 6.5  | 4.2  | 1.9  | 0.30  |
| Irradiation [kWh/m <sup>2</sup> ] | 0.023 | 0.14 | 0.32 | 0.50 | 0.65 | 0.75 | 0.79 | 0.75 | 0.65 | 0.50 | 0.32 | 0.14 | 0.023 |
| Ambient temp. [°C]                | 9     | 9    | 10   | 12   | 14   | 16   | 18   | 19   | 19   | 19   | 19   | 18   | 18    |

## Solar system rehabilitation and upgrading for

Solar pumping project

### System characteristic



|                     |                    |            | Min.  | 800 W/m², 20 °C | Max./STC* |
|---------------------|--------------------|------------|-------|-----------------|-----------|
| <b>PV generator</b> | Cell temperature   | [°C]       |       | 46              | 25        |
|                     | Temperature loss   | [%]        |       | 8.8             | -         |
|                     | Dirt loss          | [%]        |       | 5.0             | -         |
|                     | Pmax               | [Wp]       |       | 9,870           | 14,250    |
|                     | Vmp                | [V]        |       | 527             | 578       |
|                     | Imp                | [A]        |       | 19              | 25        |
|                     | Voc                | [V]        |       | 650             | 714       |
|                     | Isc                | [A]        |       | 20              | 26        |
|                     | Pout               | [W]        |       | 9,180           | -         |
|                     | Vout               | [V]        |       | 562             | -         |
|                     | Iout               | [A]        |       | 17              | -         |
|                     | <b>Motor cable</b> | Power loss | [%]   | 0.14            | 0.47      |
| <b>Pump systems</b> | Motor power        | [W]        | 1,330 | 9,070           | 9,070     |
|                     | Motor voltage      | [V AC]     | 262   | 380             | 380       |
|                     | Motor current      | [A]        | 3.4   | 16              | 16        |
|                     | Motor speed        | [rpm]      | 1,945 | 3,075           | 3,075     |
|                     | Frequency          | [Hz]       | 34    | 54              | 54        |
|                     | Flow rate          | [m³/h]     | 0.083 | 24              | 24        |
|                     | Efficiency         | [%]        | 0.85  | 40              | 53        |
| <b>Pipeline</b>     | Flow speed         | [m/s]      | 0.003 | 0.86            | 0.86      |
|                     | Friction loss      | [m]        | 0.001 | 5.1             | 5.1       |

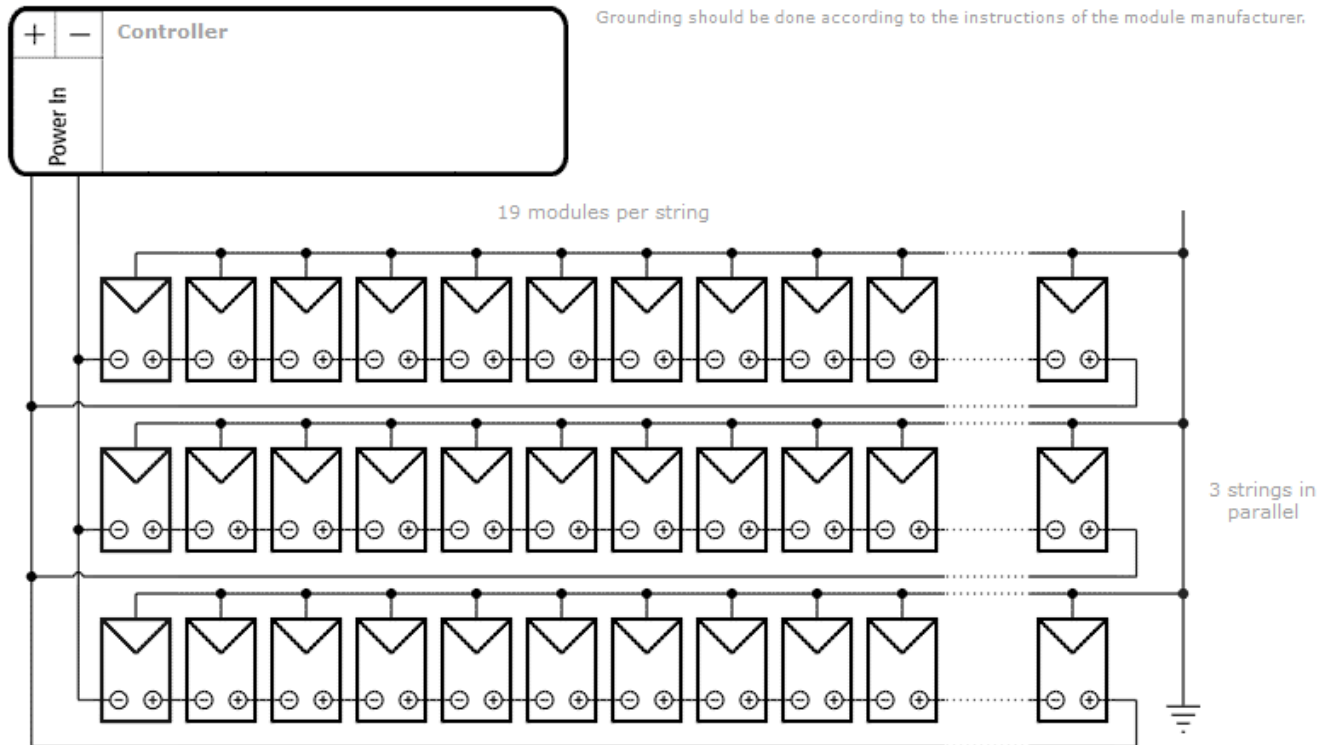
\*STC: Standard test conditions for photovoltaic modules, 1000 W/m² solar irradiance, 25 °C cell temperature

Wednesday, 04 December 2019

## Solar system rehabilitation and upgrading for

Solar pumping project

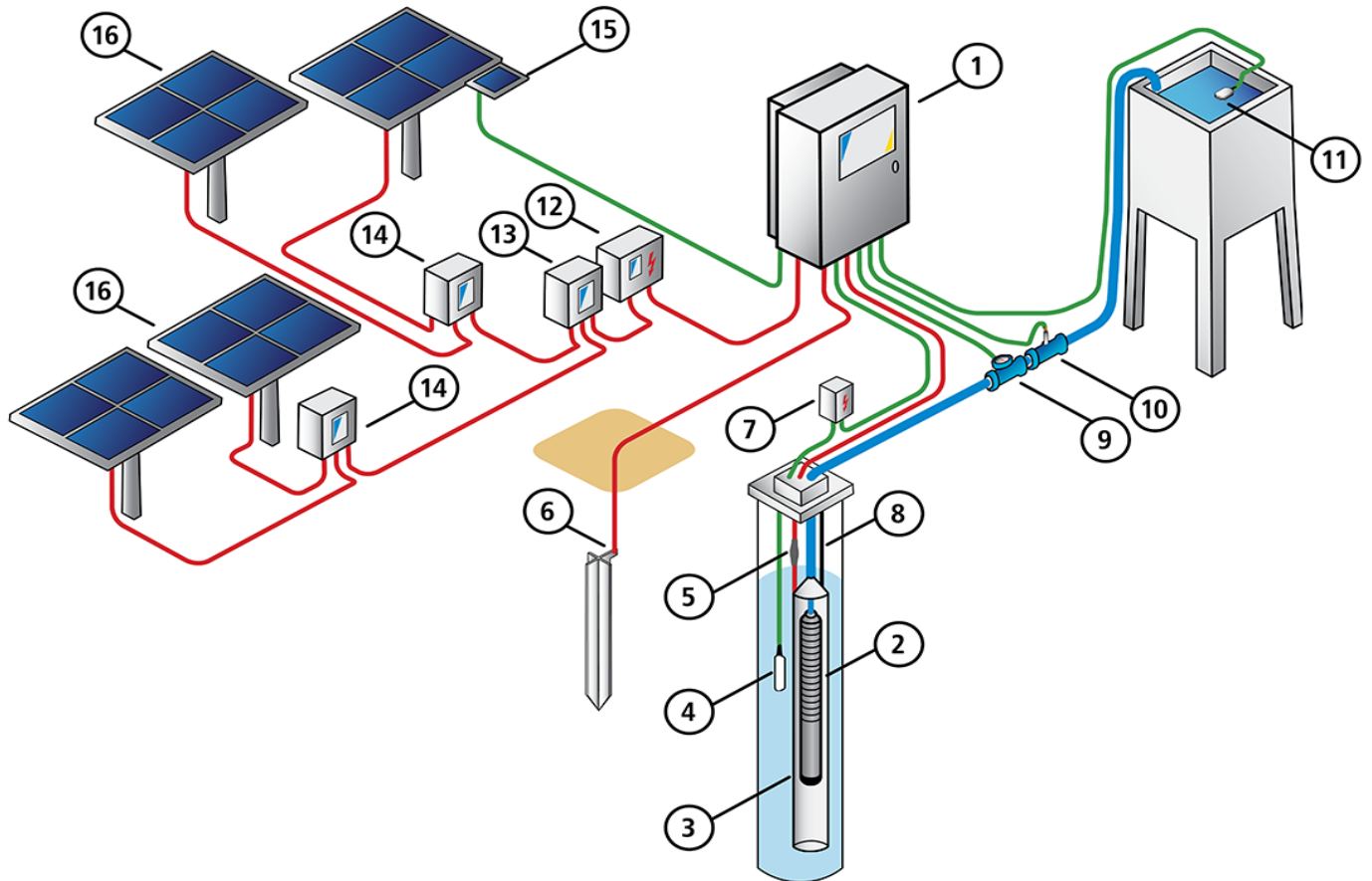
### Wiring diagram



## Solar system rehabilitation and upgrading for

Solar pumping project

### System Layout



1: PSk2 Controller

2: Submersible Pump

3: Stilling Tube

4: Well Probe

5: Cable Splice Kit

6: Grounding Rod

7: Surge Protector\*

8: Safety Rope

9: Water Meter

10: Pressure Sensor

11: Float Switch

12: PV Protect

13: PV Combiner

14: PV Disconnect

15: PV Module for Sun Switch

16: PV Generator

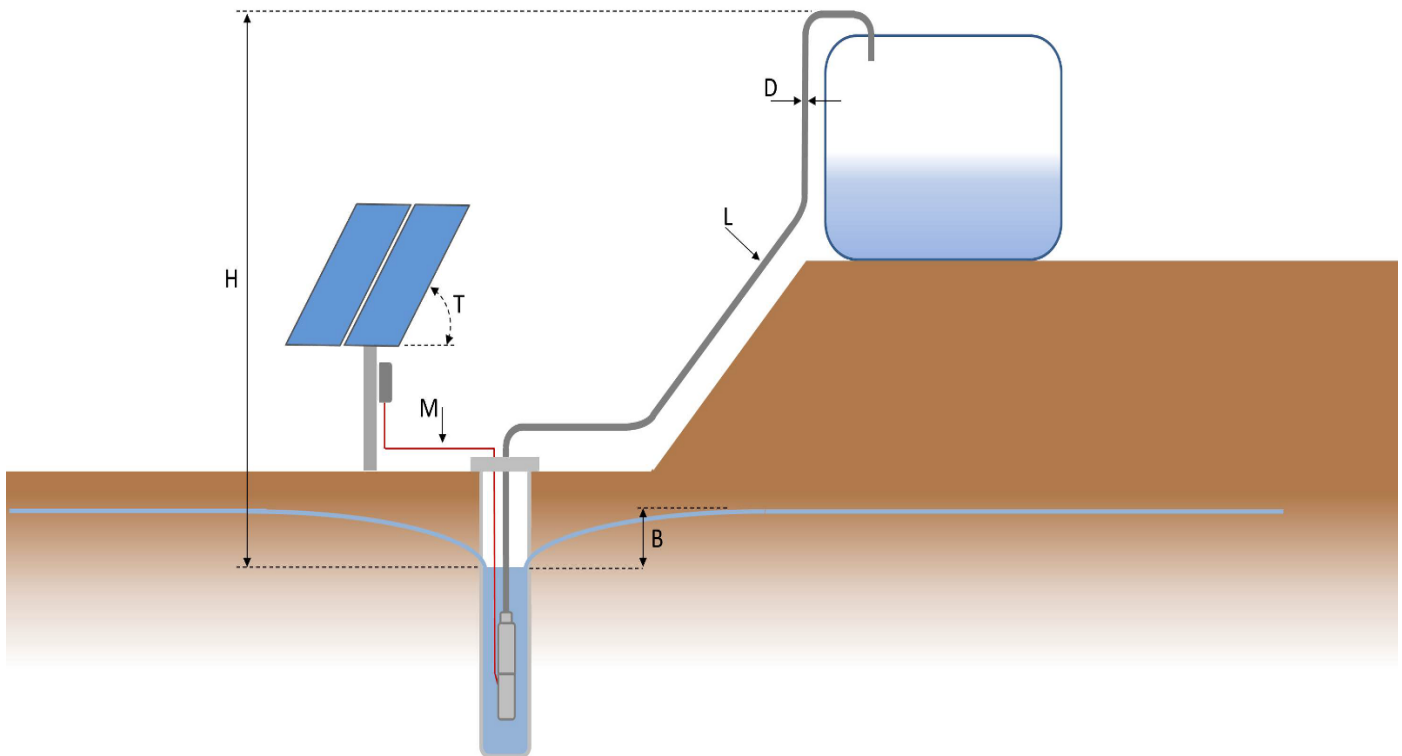
\*It is recommended to install a Surge Protector at each controller sensor input.

Wednesday, 04 December 2019

## Solar system rehabilitation and upgrading for

Solar pumping project

### Sizing Layout



|                                    |   |
|------------------------------------|---|
| <b>H (Static head):</b>            | Vertical height from the dynamic water level to the highest point of delivery.  |
| <b>B (Drawdown):</b>               | Lowering of water level depending on flow rate and recovery rate of the well.   |
| <b>D (Pipeline inner diameter)</b> |   |
| <b>L (Pipe length):</b>            | Entire pipeline from the pump outlet to the point of delivery. Ellbows and armatures must be added as an equivalent length of pipeline. |
| <b>M (Motor cable):</b>            | The cable between controller and pump unit.   |
| <b>T (Tilt angle):</b>             | Angle of the PV generator surface from the horizontal plane.  |

# PSk2-9 C-SJ17-11

## Solar Submersible Pump System for 6" wells

### System Overview

|           |                           |
|-----------|---------------------------|
| Head      | max. 90 m                 |
| Flow rate | max. 25 m <sup>3</sup> /h |

### Technical Data

#### Controller PSk2-9

- High efficiency solar pump controller
- Hybrid power (solar / grid / generator) support with LORENTZ SmartSolution
- Inputs for water meter, pressure sensors, digital switches
- Simple configuration with LORENTZ PumpScanner Android™ App
- Onboard data logging and system monitoring
- Inbuilt applications for constant pressure, constant flow and daily amount
- Integrated Sun Sensor
- Active temperature management
- Integrated MPPT (Maximum Power Point Tracking)

|                 |             |
|-----------------|-------------|
| Power           | max. 10 kW  |
| Input voltage   | max. 850 V  |
| Optimum Vmp**   | > 575 V     |
| Motor current   | max. 17 A   |
| Efficiency      | max. 98 %   |
| Ambient temp.   | -30...50 °C |
| Enclosure class | IP54        |

#### Motor AC DRIVE SUB 6" 7.5kW

- Highly efficient 3-phase AC motor
- Frequency: 25...54 Hz
- Premium materials, stainless steel: AISI 304
- No electronics in the motor

|                  |                   |
|------------------|-------------------|
| Efficiency       | max. 80 %         |
| Motor speed      | 1,400...3,080 rpm |
| Power factor     | 0.87              |
| Insulation class | F                 |
| Enclosure class  | IP68              |
| Submersion       | max. 150 m        |

#### Pump End PE C-SJ17-11

- Non-return valve
- Premium materials, stainless steel: AISI 304
- Centrifugal pump

|            |           |
|------------|-----------|
| Efficiency | max. 73 % |
|------------|-----------|

#### Pump Unit PUK2-9 C-SJ17-11 (Motor, Pump End)

|                   |                |
|-------------------|----------------|
| Borehole diameter | min. 6,0 in    |
| Water temperature | max. 30 °C**** |

### Standards



2006/42/EC, 2004/108/EC, 2006/95/EC

IEC/EN 61702:1995, IEC/EN 62253 Ed.1

The logos shown reflect the approvals that have been granted for this product family. Products are ordered and supplied with the approvals specific to the market requirements.

\*\*Vmp: MPP-voltage under Standard Test Conditions (STC): 1000 W/m<sup>2</sup> solar irradiance, 25 °C cell temperature

\*\*\*\*Special solutions available for >30 °C, please consult your distributor

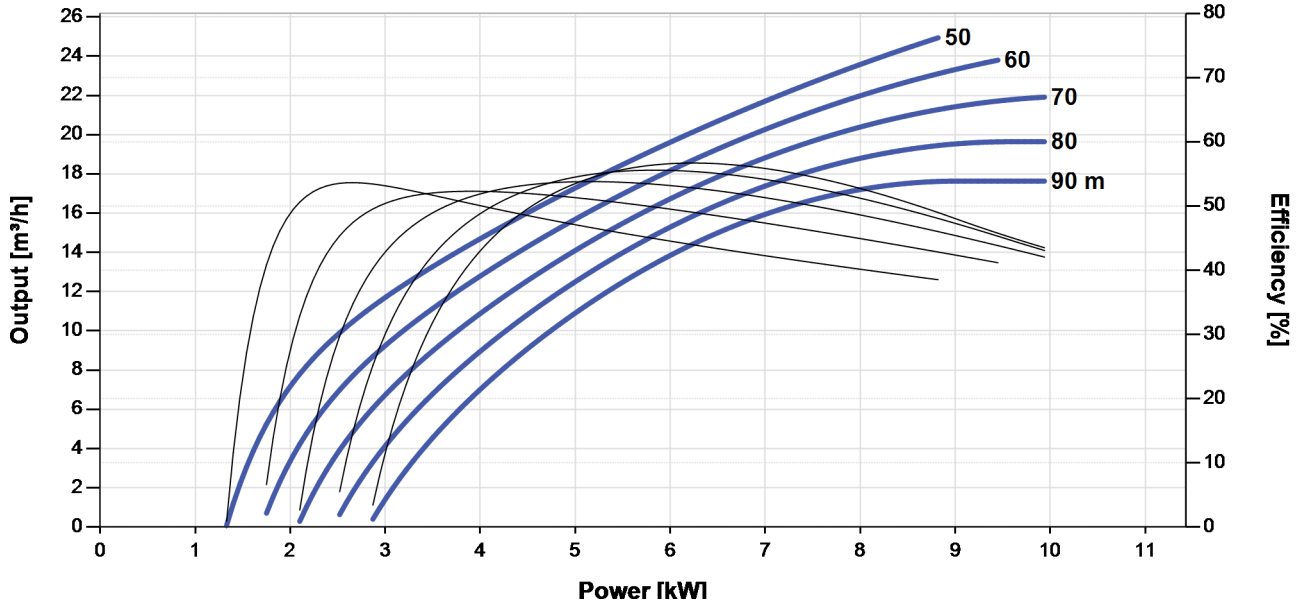


## PSk2-9 C-SJ17-11

Solar Submersible Pump System for 6" wells

### Pump Chart

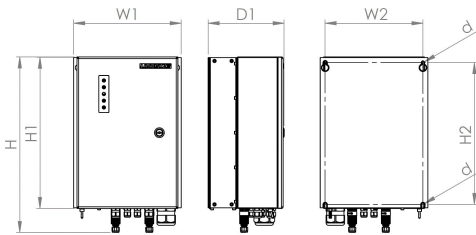
Vmp\* > 575 V



### Dimensions and Weights

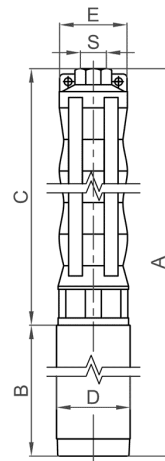
#### Controller

- H = 500 mm
- H1 = 450 mm
- H2 = 421 mm
- W1 = 320 mm
- W2 = 290 mm
- D = 9.0 mm
- D1 = 226 mm



#### Pump Unit

- A = 1,568 mm
- B = 645 mm
- C = 923 mm
- D = 144 mm
- E = 133 mm
- S = 2.5 in



|            | Net weight |
|------------|------------|
| Controller | 18 kg      |
| Pump Unit  | 72 kg      |
| Motor      | 51 kg      |
| Pump End   | 21 kg      |

\*Vmp: MPP-voltage under Standard Test Conditions (STC): 1000 W/m² solar irradiance, 25 °C cell temperature



# Well Probe

## Mechanically Activated Device for Dry Run Protection in Applications with LORENTZ Solar Pump Systems

The switch can be used to detect the water level within a well. When the water level in the well dropped below the level of the well probe, the LORENTZ Controller will stop the pump and indicates Source Low LED.

### ORDER INFORMATION

- **Item no.:** 19-000000    **product name:** Well probe sensor

### FEATURES

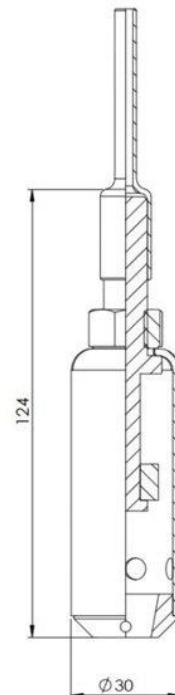
- Reliable dry run protection
- Simple to install
- Trouble free operation
- Corrosion-free
- Splicing kit included

### TECHNICAL DATA

- Max. operating temperature 55 °C
- Enclosure class: IP68  
Submersion depth: max 50 m
- Cable length: 1.5m
- Wire size: 2x 0.75mm<sup>2</sup> or AWG 19, waterproofed
- Mounted in vertical position
- Meets the requirements for CE

### DIMENSION/WEIGHT

- Packaging dimensions: 260 x 170 x 40 mm  
10.3 x 6.7 x 1.6 in
- Total weight: 0.1 kg / 0.2 lbs





# Float Switch

## Mechanically Activated Device for Water Level Detection in Applications with LORENTZ Solar Pump Systems

The switch can be used to detect the water level within a tank. When the water level in the tank reaches the maximum, the LORENTZ Controller will stop the pump and indicates Tank Full LED.

### ORDER INFORMATION

- Item no.: 19-000030    product name: Float Switch

### FEATURES

- **N.O.** (normally open) and **N.C.** (normally closed) function
- Reliable water level detection
- Simple to install
- Trouble free operation
- Not sensitive to rotation
- Corrosion-free

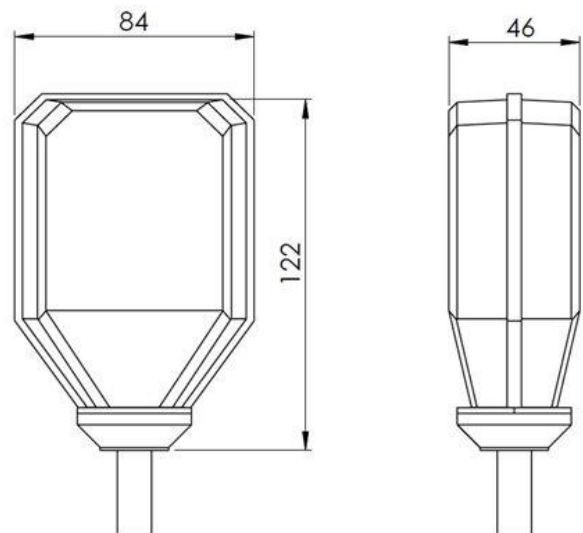


### TECHNICAL DATA

- Operating temperature: -10°C to 55°C
- Storage temperature: : -10°C to 55°C
- Enclosure class: IP68
- Cable length: 3m, waterproof
- Wire size: 3x 1.0mm<sup>2</sup> or AWG 18
- Meets the requirements for CE

### DIMENSION/WEIGHT

- Packaging dimensions: 230 x 160 x 55 mm  
9.1 x 6.3 x 2.2 in
- Total weight: 0.8 kg / 1.8 lbs



# Surge Protector

Device to Protect LORENTZ Pump Accessories from Voltage Spikes

## ORDER INFORMATION

- Item no.: 19-000280    product name: Surge Protector

## FEATURES

- Reliable surge protection for all LORENTZ pump accessories
- Can be installed inside the PS Controller

## TECHNICAL DATA

- Max. voltage: 14 VDC
- Max current 8/20 $\mu$ s: 500 A
- Enclosure class: IP65
- Ambient temperature: max. 50°C
- Wire size: 2x 1.5mm<sup>2</sup> or AWG 16
- Meets the requirements for CE



## DIMENSION/WEIGHT

- Packing dimensions:    70 x 45 x 20 mm  
                                  2.8 x 1.8 x 0.8 in
- Total weight            0.1 kg / 0.2 lbs

# PV Disconnect 1000-40-5

Five string connection box with DC Disconnect Switch

## ORDER INFORMATION

- Item no.: 19-000115
- Product name: PV Disconnect 1000-40-5

## FEATURES

- Simple and cost effective unit to connect up to five module strings
- Includes an appropriate DC rated disconnect switch
- Designed for PSk2 / PSk pump systems
- Used as part of a professional system installation



## TECHNICAL DATA

- Wiring of up to 5 PV-strings in parallel
- DC rated disconnect switch enclosed
- Enclosure class IP 54
- Meets the requirements for CE

### PV Disconnect 1000-40-5

|                         |                                    |
|-------------------------|------------------------------------|
| Max. voltage            | 1,000 V DC (Uoc)<br>880 V DC (Ump) |
| Max. current per string | 40 A                               |
| Max. total current      | 40 A                               |
| Max. no. of strings     | 5                                  |
| String cable size       | 4 - 10mm <sup>2</sup>              |
| Output cable size       | 4 - 16mm <sup>2</sup>              |

## RELATED PRODUCTS

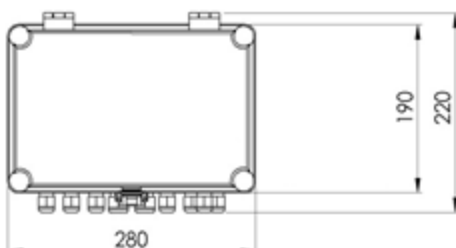
### PV Combiner 1000-125-4

- Connection Box for parallel wiring of two or more PV Disconnect 1000-40-5
- Item no.: 19-000116

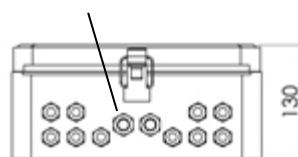
### PV Protect 1000-125

- Surge protection device for PV systems
- Item no.: 19-000117

## DIMENSION/WEIGHT [mm]



PG cable glands  
(2x PG11 10x M16)



Net. Weight: 2,50kg

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Siebenstuecken 24, 24558 Henstedt-Ulzburg, Germany  
Tel +49 (0)4193 8806-700, [www.lorentz.de](http://www.lorentz.de)

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# PV Protect 1000-125

Surge protective device for PV systems

## ORDER INFORMATION

- Item no.: 19-000117
- Product name: PV Protect 1000-125

## FEATURES

- Provides enhanced level of protection to the PSK controller from electrical surges (indirect lightning)
- Designed for PSk2 / PSk pump systems
- Used as part of a professional system installation
- Installed on the DC input line close to pump controller
- Requires a reliable ground connection to operate



## TECHNICAL DATA

- Connects between PV Generator and Controller
- Enclosure class IP 54
- Meets the requirements for CE

### PV Protect 1000-125

|                      |                        |
|----------------------|------------------------|
| Max. voltage         | 1,000 V DC             |
| Max. current         | 125 A                  |
| Input cable size     | 10 - 35mm <sup>2</sup> |
| Output cable size    | 10 - 35mm <sup>2</sup> |
| Grounding cable size | 16 mm <sup>2</sup>     |

## RELATED PRODUCTS

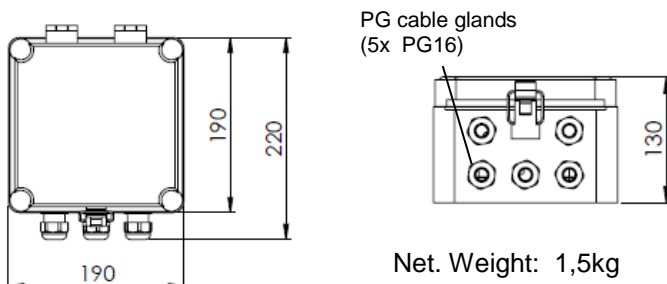
### *PV Disconnect 1000-40-5*

- Five string DC connection box with DC disconnect
- Item no.: 19-000115

### *PV Combiner 1000-125-4*

- Combiner box for parallel wiring of two or more PV Disconnect 1000-40-5 units
- Item no.: 19-000116

## DIMENSION/WEIGHT [mm]



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# SmartPSUk2

**AC/DC Converter to Supply PSk2 Pump Systems with Power from a Generator or Grid Supply**

## ORDER INFORMATION

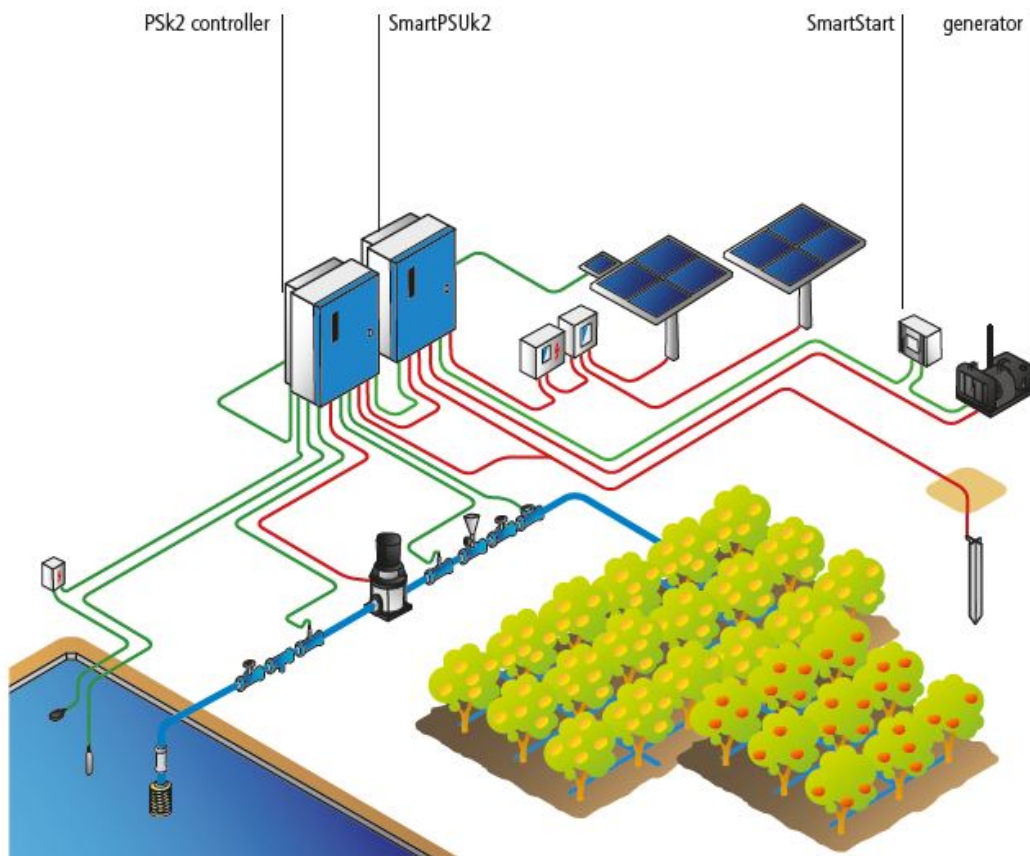
- Item no.: 19-002585    Product name: SmartPSUk2

## FEATURES

- Provides DC power to PSk2 pump controllers from AC and DC sources
- Blends solar power (DC) with AC power from the grid or generator
- Part of the PSk2 SmartSolution for hybrid powering of water pumping systems
- Data link to PSk2 for control and monitoring
- Integrated overheat protection and active cooling



## SmartSolution OVERVIEW



**BERNT LORENTZ GmbH**  
Siebenstuecken 24, 24558 Henstedt-Ulzburg,  
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Tel +49 (0)4193 8806-700, [www.lorentz.de](http://www.lorentz.de)

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## TECHNICAL DATA

- Compatible with PSk2-xx pump controllers (from July 2016)
- 3-Phase AC input
  - 380 – 415 V ( $\pm 10\%$ )
  - 50 Hz/60 Hz
  - max. 38 kW (48 kVA)
- PV max open circuit voltage: 850 V DC
- DC output
  - $U_{\max} = 850$  V DC
  - $I_{\max} = 70$  A
- Enclosure class: IP54, stainless steel powered coated case
- Ambient temperature: -10 to 50°C

## PRODUCT CONTENT

The SmartPSUk2 comes with a cable to connect to the PSk2 Controller (1.00 m) and a back plate for mounting on non-flat surfaces.

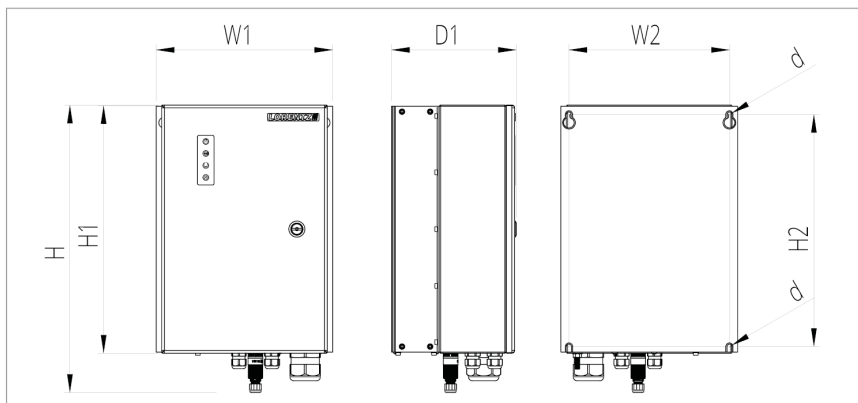
## STANDARDS

- Meets the requirements for CE



## DIMENSION/WEIGHT

- Packing dimensions: 560 x 400 x 340 mm (22.0 x 15.7 x 13.4 in)
- Net weight: 18 kg (39 lbs)



| Model | Dimension [mm] |     |     |     |     |     |   | Net Weight [kg] |
|-------|----------------|-----|-----|-----|-----|-----|---|-----------------|
|       | W1             | W2  | H   | H1  | H2  | D1  | d |                 |
| all   | 320            | 290 | 500 | 450 | 421 | 226 | 9 | 18              |



# SmartStart

## Automatic Remote Diesel Generator Switching Device

The SmartStart can automatically and remotely start and stop diesel generators for hybrid solar pumping. It has a secondary ancillary output for switching other devices. It connects to the PSk2 Controller and to the remote switch input of the diesel generator.

### ORDER INFORMATION

- Item no.: 19-004280    Product name: SmartStart

### FEATURES

- Automatically switches on/off diesel engines equipped with remote start input (NO)
- SmartStart provides power to the PSk2 systems for night time logic operation such as early morning pump starting
- Battery charging from PSk2 Controller
- Shows system status via LEDs
- Ancillary output for switching other devices



### TECHNICAL DATA

- Max. contact rating: 277 V AC / 30 V DC / 3 A
- Enclosure class: IP54
- Nominal cross section for GEN Link cable 1.5 mm<sup>2</sup>
- Further information is available in the PSk2 manual on partnerNET

### PRODUCT CONTENT

The SmartStart comes with a cable to connect to the PSk2 Controller. (1.50 m) The required battery must be ordered separately. The battery must meet the following requirements:

- Sealed 12 V AGM lead acid battery Min capacity: 7 Ah

### DIMENSION/WEIGHT

- Packaging dimensions: L x W x H 270 x 250 x 230 mm (10.6 x 9.8 x 9.1 in)
- Total weight (without battery): 2.8 kg (6.2 lbs)
- Battery case: L x W x H 151 x 70 x 95 mm (5.94 x 2.56 x 3.74 in)

# LC250-P60

## High-efficiency PV Module

### Features

- high energy yields ensured by high conversion efficiency
- sturdy, clear-anodized aluminum frame with pre-drilled holes for quick installation
- advanced EVA encapsulation with triple-layer backsheet, meets the most stringent safety requirements for high-voltage operation
- pre-wired junction box equipped with connectors "plug'n'play"
- reliable bypass diodes to prevent overheating (hot spot effect) and to minimise power loss by shading
- manufactured in ISO 9001:2000-certified factory

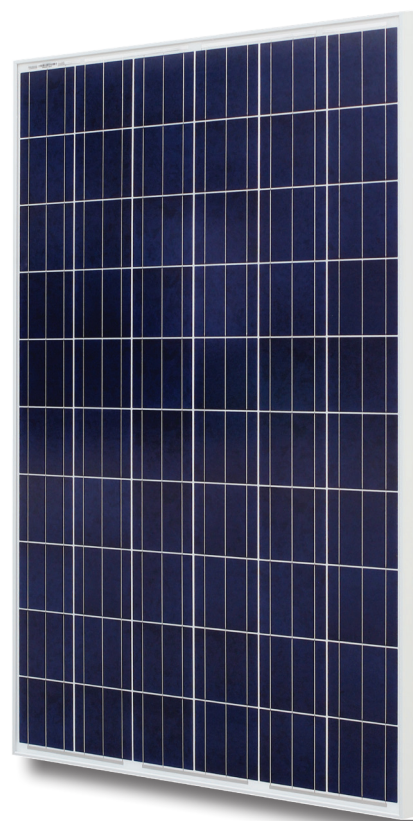


photo may differ from actual product

### Warranty

- Warranty: 2 years
- Performance guarantee:  
up to 10 years (90% power output)  
up to 20 years (80% power output)

Details according to warranty issued by LORENTZ

### Standards

LC250-P60 is certified according to IEC 61215 and 61730 by TÜV Rheinland and meets the requirements for CE.



IEC 61215  
IEC 61730  
Regular Production  
Surveillance

www.tuv.com  
ID 1419063782



### Specifications

#### Electrical Data

|                                   |      |        |       |
|-----------------------------------|------|--------|-------|
| Peak power                        | Pmax | [Wp]   | 250   |
| Tolerance                         |      | [%]    | + 5/0 |
| Max. power current                | Imp  | [A]    | 8.23  |
| Max. power voltage                | Vmp  | [V]    | 30.4  |
| Short circuit current             | Isc  | [A]    | 8.81  |
| Open circuit voltage              | Voc  | [V]    | 37.6  |
| Temperature co-efficient for Pmax |      | [%/°C] | -0.42 |
| Temperature co-efficient for Voc  |      | [%/°C] | -0.34 |
| Temperature co-efficient for Isc  |      | [%/°C] | 0.06  |
| Max. system voltage               |      | [VDC]  | 1,000 |
| Module efficiency                 |      | [%]    | 15.27 |
| Practical module efficiency       |      | [%]    | 17.12 |

All technical data at standard test condition:  
AM = 1.5, E = 1,000W/m<sup>2</sup>, cell temperature: 25 °C

#### Cells

|                             |                 |
|-----------------------------|-----------------|
| Number of cells in series   | 60              |
| Number of cells in parallel | 1               |
| Cell technology             | polycrystalline |
| Cell shape                  | rectangular     |

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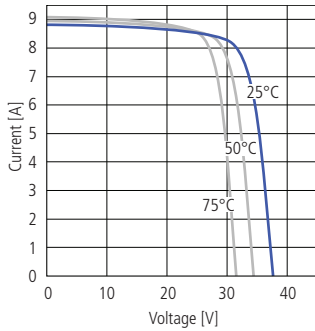
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## Electrical Performance

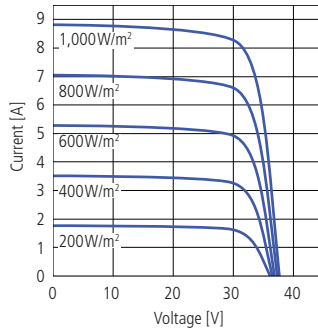
### Electrical Performance

for different temperatures, at AM=1.5, E=1,000W/m<sup>2</sup>



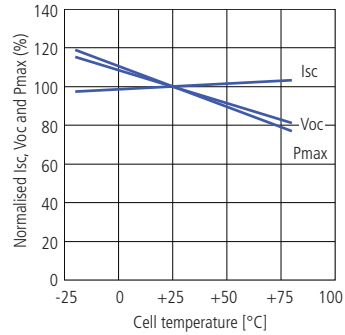
### Electrical Performance

for different irradiation, at 25 °C



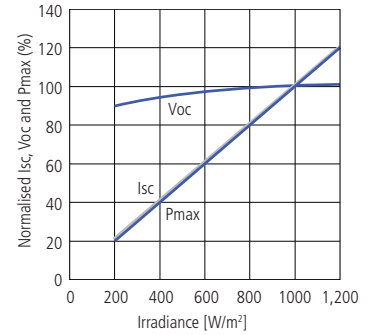
### Temperature Dependence

of I<sub>sc</sub>, V<sub>oc</sub> and P<sub>max</sub>

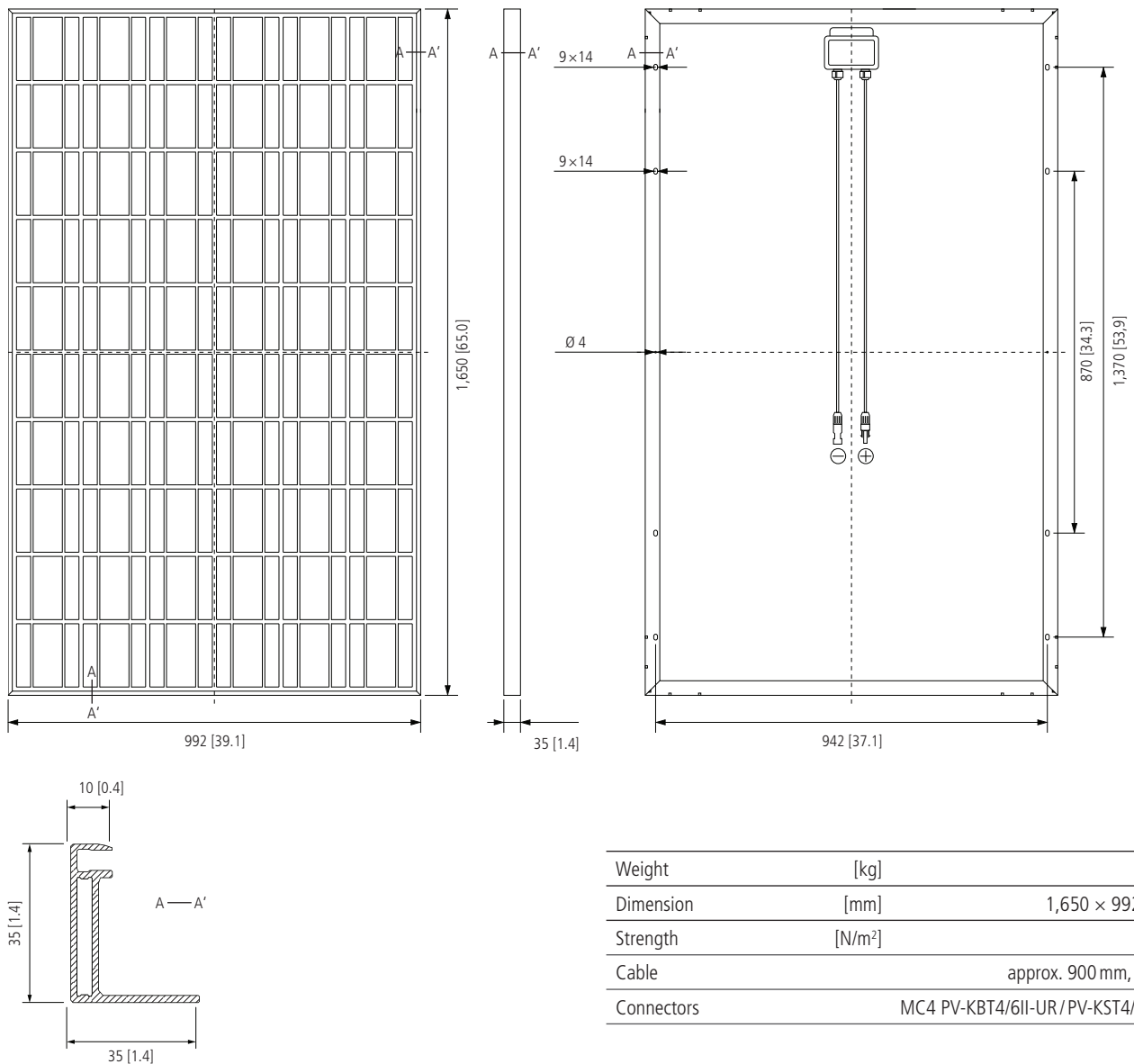


### Irradiation Dependence

of I<sub>sc</sub>, V<sub>oc</sub> and P<sub>max</sub> at 25 °C



## Physical Specifications mm



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All specifications and information are given with good intent, errors are possible and products may be subject to change without notice. Pictures may differ from actual products depending on local market requirements and regulations.

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