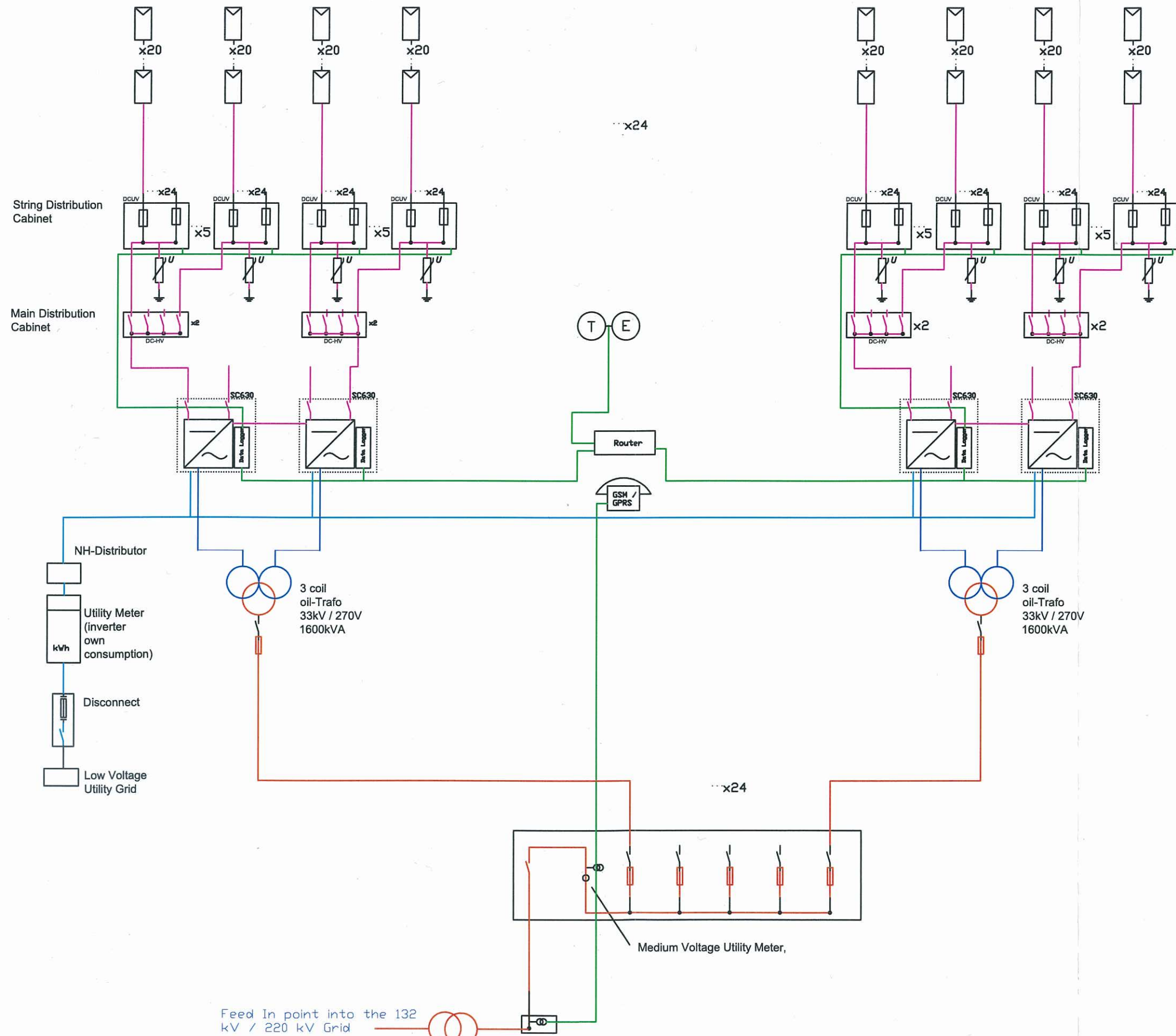


## **Appendix C Proposal information**

- C.1 PRELIMINARY ELECTRICAL SINGLE LINE DIAGRAM**
- C.2 SPECIFICATION SHEET FOR AN EXAMPLE SUNTECH 270 WATT POLY-CRYSTALLINE SOLAR PANEL**
- C.3 SPECIFICATION SHEET FOR EXAMPLE INVERTERS**
- C.4 SPECIFICATION SHEET FOR EXAMPLE KIOSK TRANSFORMERS**
- C.5 EXAMPLE PV MOUNTING SYSTEM (HABDANK) BROCHURE**



- DC
- low voltage 270V (AC)
- low voltage 230V (AC)
- Dataline
- medium voltage 33kV (AC)

Phoenix Solar AG  
 Schillerstr.1/6  
 89077 Ulm  
 Tel: 0731/140540  
 Fax: 0731/1405419  
 www.phoenixsolar.de  
 Revisionsdaten:



|          |                                  |
|----------|----------------------------------|
| Maßstab: | Projekt:                         |
| Einheit: | PV Power Plant                   |
| Datum    | Solar Flagship 30 MWac base unit |
| 05.02.10 | Planinhalt:                      |
| Bindel   | Single Line Diagram              |
| DeDucq   |                                  |

## 270 Watt

### POLY-CRYSTALLINE SOLAR PANEL

#### Features

- High conversion efficiency based on leading innovative photovoltaic technologies
- High reliability with guaranteed  $\pm 3\%$  power output tolerance, ensuring return on investment
- Withstands high wind-pressure and snow load (passed IEC 5400Pa mechanical loading test), and extreme temperature variations

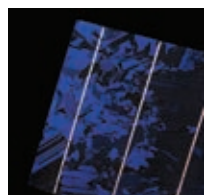
#### Quality and Safety

- 25-year power output warranty \*
- Rigorous quality control meeting the highest international standards
- ISO 9001:2000 (Quality Management System) and ISO 14001:2004 (Environmental Management System) certified factories manufacturing world class products
- IEC61215, IEC61730, conformity to CE

#### Recommended Applications

- On-grid utility systems
- On-grid commercial systems
- Off-grid ground mounted systems

\* Refer to Suntech's warranty document for terms and conditions



Unique Suntech Back Surface Field (BSF) structure and anti-reflective coating increase cell conversion efficiency.



Thermal isolation between the lamination and latest designed J-box improves panel performance stability. The new J-box also provides perfect interconnection between modules and inverters to ensure the fully utilization of module power output (option with MC4 connector).



Special design on drainage holes and rigid construction prevents frame from deforming or breaking due to freezing weather and other forces.



Advanced cell texturing and passivation processes improve module low light irradiance performance and provide more field power output.

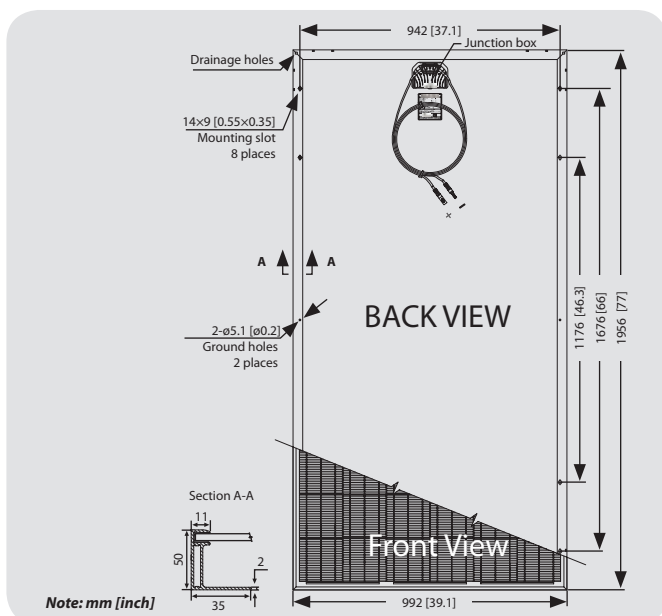


*Suntech was named Frost and Sullivan's 2008 Solar Energy Development Company of the Year*

## Electrical Characteristics

| Characteristics                 | STP280-24/Vd   | STP270-24/Vd   | STP260-24/Vd   |
|---------------------------------|----------------|----------------|----------------|
| Open - Circuit Voltage (Voc)    | 44.8V          | 44.5V          | 44.0V          |
| Optimum Operating Voltage (Vmp) | 35.2V          | 35.0V          | 34.8V          |
| Short - Circuit Current (Isc)   | 8.33A          | 8.20A          | 8.09A          |
| Optimum Operating Current (Imp) | 7.95A          | 7.71A          | 7.47A          |
| Maximum Power at STC (Pmax)     | 280Wp          | 270Wp          | 260Wp          |
| Operating Temperature           | -40°C to +85°C | -40°C to +85°C | -40°C to +85°C |
| Maximum System Voltage          | 1000V DC       | 1000V DC       | 1000V DC       |
| Maximum Series Fuse Rating      | 20A            | 20A            | 20A            |
| Power Tolerance                 | ±3 %           | ±3 %           | ±3 %           |

STC: Irradiance 1000W/m<sup>2</sup>, Module temperature 25°C, AM=1.5



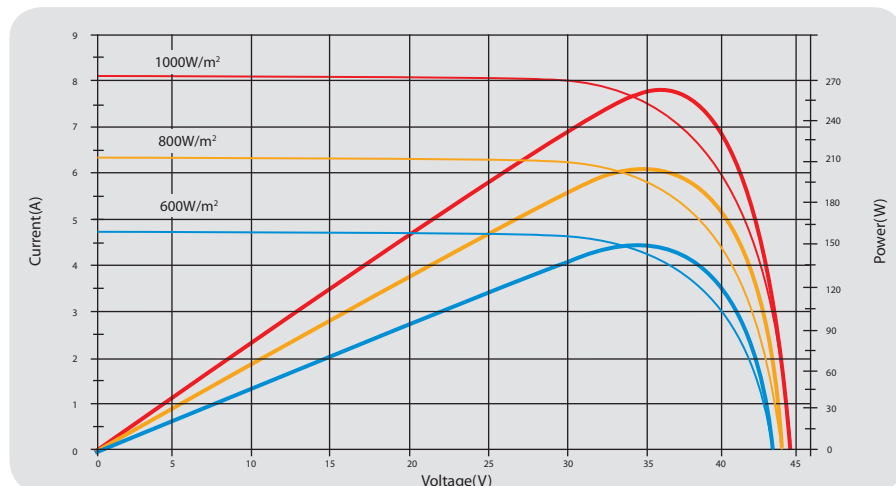
## Mechanical Characteristics

|               |                                                                                                                                                                                                              |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Solar Cell    | Poly-crystalline 156×156mm (6inch)                                                                                                                                                                           |
| No. of Cells  | 72 (6×12)                                                                                                                                                                                                    |
| Dimensions    | 1956×992×50mm (77.0×39.1×2.0inch)                                                                                                                                                                            |
| Weight        | 27 kg (59.5lbs.)                                                                                                                                                                                             |
| Front Glass   | 4mm(0.16inch) tempered glass                                                                                                                                                                                 |
| Frame         | Anodized aluminium alloy                                                                                                                                                                                     |
| Junction Box  | IP67 rated                                                                                                                                                                                                   |
| Output Cables | H+S RADOX® SMART cable 4.0mm <sup>2</sup> (0.006inch <sup>2</sup> ), symmetrical lengths (-) 1000mm (39.4inch) and (+) 1000mm (39.4inch), RADOX® SOLAR integrated twist locking connectors or MC4 connectors |

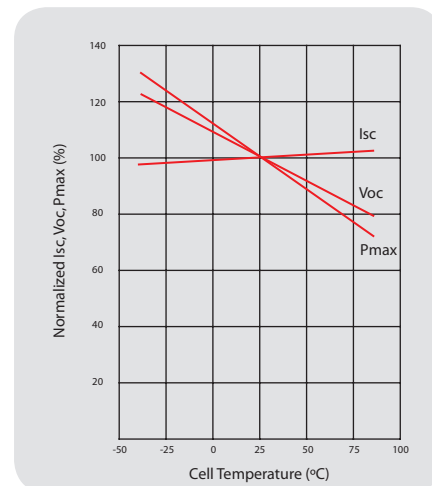
## Temperature Coefficients

|                                           |           |
|-------------------------------------------|-----------|
| Nominal Operating Cell Temperature (NOCT) | 45±2/°C   |
| Temperature Coefficient of Pmax           | -0.47%/°C |
| Temperature Coefficient of Voc            | -0.34%/°C |
| Temperature Coefficient of Isc            | 0.045%/°C |

Current-Voltage & Power-Voltage Curve (260W)



Temperature Dependence of Isc, Voc, Pmax



Specifications are subjected to change without further notice

## SC 500CP / 630CP / 800CP Outdoor

**Low system costs**

- > Direct deployment in the field due to outdoor enclosure
- > Simplified shipping without concrete substation
- > Easy installation due to a separate connection compartment
- > Optional: extended input voltage range up to 1,100 V

**High performance as a standard**

- > Full nominal power at ambient temperatures up to 50 °C
- > 10 % additional power in continuous operation at ambient temperatures up to 25 °C
- > Powerful grid management functions (including LVRT)



# SUNNY CENTRAL CP OUTDOOR

## Out.Standing

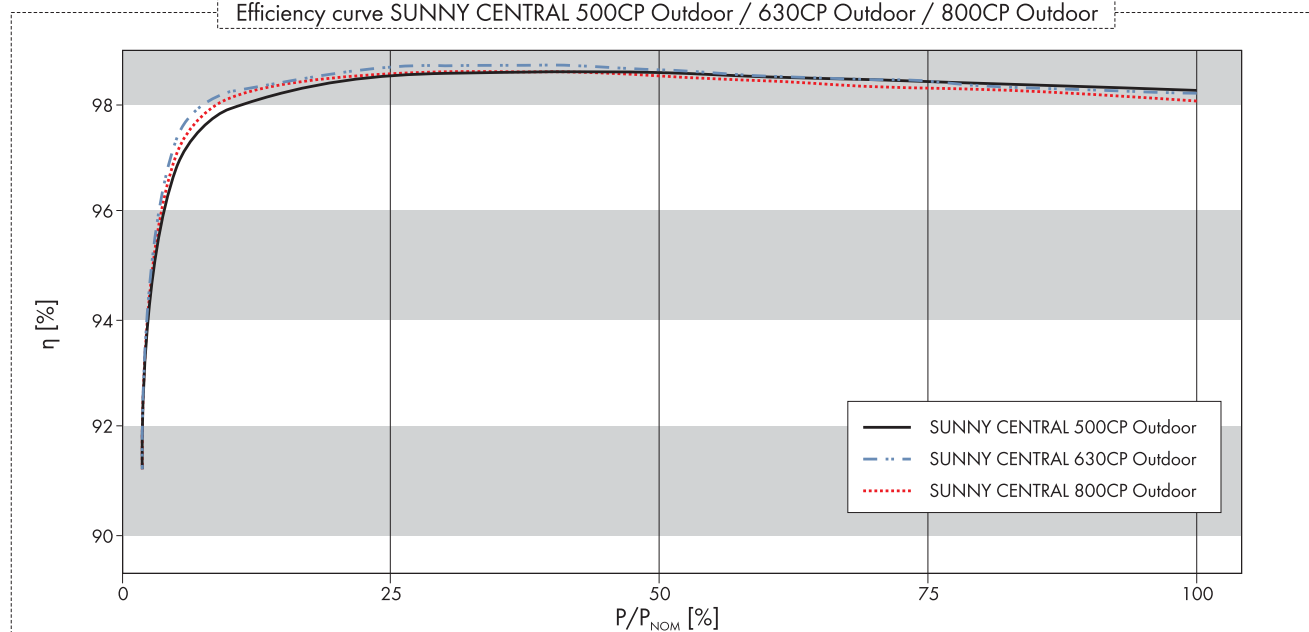
The completely new design of the Sunny Central Compact Power series saves you real money. The compact and weatherproof enclosure is easy to load and transport and can be installed almost anywhere – there is no need for heavy protective concrete substations any longer. The innovative cooling concept OptiCool allows the inverter to operate at full nominal power with ambient temperatures up to 50 °C. With the powerful grid management functions you are perfectly prepared for today's utility requirements as well as those still to come. The intelligent power management is the most important feature: in continuous operation, the Sunny Central 800CP Outdoor can feed 880 kVA to the grid at ambient temperatures of up to 25 °C – that's 10 % more than the rated nominal power. Thus, the specific price is reduced even further.

# Technical Data

## SUNNY CENTRAL 500 / 630 / 800CP Outdoor

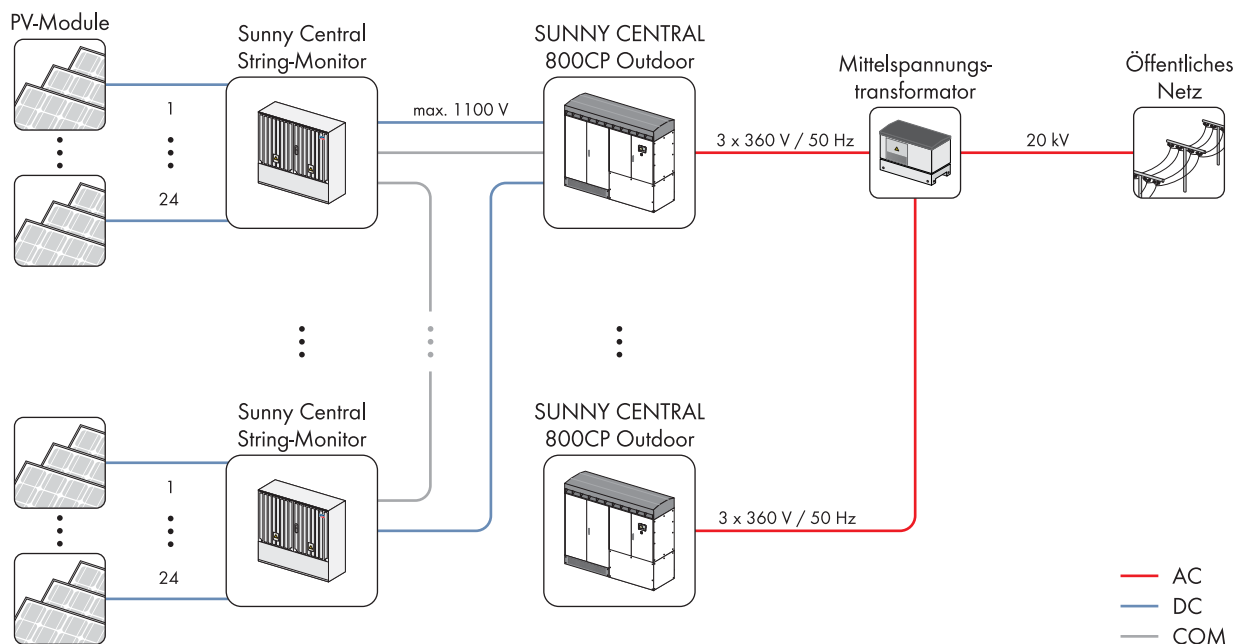
|                                                                                                                       | SC 500CP Outdoor                                                                                                 | SC 630CP Outdoor                                                                                                  | SC 800CP Outdoor                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Input data                                                                                                            |                                                                                                                  |                                                                                                                   |                                                                                                                   |
| PV voltage range, MPPT                                                                                                | 430 V – 820 V <sup>5)</sup>                                                                                      | 500 V – 820 V <sup>5)</sup>                                                                                       | 570 – 820 V <sup>5)</sup>                                                                                         |
| Max. DC voltage                                                                                                       | 1000 V / 1100 V <sup>1)</sup> Optional                                                                           | 1000 V / 1100 V <sup>1)</sup> Optional                                                                            | 1000 V / 1100 V <sup>1)</sup> Optional                                                                            |
| Max. DC current                                                                                                       | 1250 A                                                                                                           | 1350 A                                                                                                            | 1400 A                                                                                                            |
| Number of DC inputs                                                                                                   | 9 fused inputs                                                                                                   |                                                                                                                   |                                                                                                                   |
| Output data                                                                                                           |                                                                                                                  |                                                                                                                   |                                                                                                                   |
| Nominal AC output                                                                                                     | 500 kVA @ 50° C                                                                                                  | 630 kVA @ 50° C                                                                                                   | 800 kVA @ 50° C                                                                                                   |
| Max. AC-power                                                                                                         | 550 kVA @ 25° C                                                                                                  | 700 kVA @ 25° C                                                                                                   | 880 kVA @ 25° C                                                                                                   |
| Max. AC current                                                                                                       | 1167                                                                                                             | 1271                                                                                                              | 1411                                                                                                              |
| Nominal AC current                                                                                                    | 1069 A                                                                                                           | 1155 A                                                                                                            | 1283 A                                                                                                            |
| Harmonic distortion of grid current                                                                                   | < 3 % at nominal power                                                                                           |                                                                                                                   |                                                                                                                   |
| AC voltage range ±10 %                                                                                                | 243 ... 297 V                                                                                                    | 284 ... 347 V                                                                                                     | 324 ... 396 V                                                                                                     |
| Nominal AC voltage                                                                                                    | 270 V                                                                                                            | 315 V                                                                                                             | 360 <sup>3)</sup>                                                                                                 |
| AC grid frequency                                                                                                     | 50 Hz / 60 Hz                                                                                                    | 50 Hz / 60 Hz                                                                                                     | 50 Hz / 60 Hz                                                                                                     |
| Adjustable displacement power factor (cos φ)                                                                          | 0.9 leading – 0.9 lagging                                                                                        |                                                                                                                   |                                                                                                                   |
| Efficiency <sup>2)</sup>                                                                                              |                                                                                                                  |                                                                                                                   |                                                                                                                   |
| Max. efficiency (@ U_AC <sub>nom</sub> )                                                                              | 98.6 % @ U_DC 450V                                                                                               | 98.7 % @ U_DC 500V                                                                                                | 98.6 % @ U_DC 600V                                                                                                |
| Euro-Eta (@ U_AC <sub>nom</sub> )                                                                                     | 98.4 % @ U_DC 450V                                                                                               | 98.5 % @ U_DC 500V                                                                                                | 98.4 % @ U_DC 600V                                                                                                |
| CEC-Eta                                                                                                               | 98.5 %                                                                                                           | 98.5 %                                                                                                            | 98.4 %                                                                                                            |
| Dimensions and Weight                                                                                                 |                                                                                                                  |                                                                                                                   |                                                                                                                   |
| Width / Height / Depth in mm (W / H / D)                                                                              | 2562 / 2279 / 956                                                                                                | 2562 / 2279 / 956                                                                                                 | 2562 / 2279 / 956                                                                                                 |
| Weight approx. (kg)                                                                                                   | 1800                                                                                                             | 1800                                                                                                              | 1800                                                                                                              |
| Power consumption                                                                                                     |                                                                                                                  |                                                                                                                   |                                                                                                                   |
| Internal consumption in operation / day                                                                               | < 1500 W <sup>4)</sup>                                                                                           | < 1500 W <sup>4)</sup>                                                                                            | < 1500 W <sup>4)</sup>                                                                                            |
| Internal consumption in standby / night                                                                               | < 100 W                                                                                                          | < 100 W                                                                                                           | < 100 W                                                                                                           |
| External auxiliary supply                                                                                             | 3 x 230 V, 50 / 60 Hz                                                                                            | 3 x 230 V, 50 / 60 Hz                                                                                             | 3 x 230 V, 50 / 60 Hz                                                                                             |
| Operating temperature range                                                                                           | -20 °C ... +50 °C                                                                                                | -20 °C ... +50 °C                                                                                                 | -20 °C ... +50 °C                                                                                                 |
| Relative humidity, not condensing                                                                                     | 15 ... 95 %                                                                                                      | 15 ... 95 %                                                                                                       | 15 ... 95 %                                                                                                       |
| Max. altitude (above sea level)                                                                                       | 2000 m                                                                                                           | 2000 m                                                                                                            | 2000 m                                                                                                            |
| Fresh air consumption                                                                                                 | 3000 m³ / h                                                                                                      | 3000 m³ / h                                                                                                       | 3000 m³ / h                                                                                                       |
| Protection rating as per EN 60529                                                                                     | IP54                                                                                                             | IP54                                                                                                              | IP54                                                                                                              |
| Protection rating as per EN 60721-3-3<br>Ambient conditions: fixed location, with protection against wind and weather | • Classification of chemically active substances 3C1L<br>• Classification of mechanically active substances: 3S2 | • Classification of chemically active substances: 3C1L<br>• Classification of mechanically active substances: 3S2 | • Classification of chemically active substances: 3C1L<br>• Classification of mechanically active substances: 3S2 |

Efficiency curve SUNNY CENTRAL 500CP Outdoor / 630CP Outdoor / 800CP Outdoor

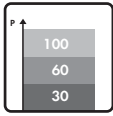


|                                                  | SC 500CP Outdoor                  | SC 630CP Outdoor                  | SC 800CP Outdoor                  |
|--------------------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| Type name                                        | SC-500-CP-10                      | SC-630-CP-10                      | SC-800-CP-10                      |
| <b>Features</b>                                  |                                   |                                   |                                   |
| Sunny WebBox                                     | Yes                               | Yes                               | Yes                               |
| Communication                                    | Ethernet (optical fiber optional) | Ethernet (optical fiber optional) | Ethernet (optical fiber optional) |
| Communication with Sunny String-Monitor          | RS485                             | RS485                             | RS485                             |
| Display                                          | Yes                               | Yes                               | Yes                               |
| Cabinet color                                    | RAL 9016                          | RAL 9016                          | RAL 9016                          |
| Color of base                                    | RAL 7005                          | RAL 7005                          | RAL 7005                          |
| Color of roof                                    | RAL 7004                          | RAL 7004                          | RAL 7004                          |
| Ground fault monitoring / isolation monitoring   | Yes                               | Yes                               | Yes                               |
| Circuit breaker AC side                          | Yes                               | Yes                               | Yes                               |
| Motor driven fuse-switch-disconnector on DC side | Yes                               | Yes                               | Yes                               |
| AC overvoltage protector                         | Yes                               | Yes                               | Yes                               |
| DC overvoltage protector                         | Yes                               | Yes                               | Yes                               |
| Overvoltage protectors for auxiliary supply      | Yes                               | Yes                               | Yes                               |
| <b>Standards</b>                                 |                                   |                                   |                                   |
| EMC                                              | EN 61000-6-2<br>EN 61000-6-4      | EN 61000-6-2<br>EN 61000-6-4      | EN 61000-6-2<br>EN 61000-6-4      |
| Grid monitoring                                  | as per BDEW regulations           | as per BDEW regulations           | as per BDEW regulations           |
| CE conformity                                    | Yes                               | Yes                               | Yes                               |
|                                                  |                                   |                                   |                                   |
|                                                  |                                   |                                   |                                   |
|                                                  |                                   |                                   |                                   |
|                                                  |                                   |                                   |                                   |
|                                                  |                                   |                                   |                                   |
|                                                  |                                   |                                   |                                   |
|                                                  |                                   |                                   |                                   |

- 1) At 1100 V<sub>DC</sub> the max. MPP-voltage increases to 850 V<sub>DC</sub>, startup < 1000 V DC. MPP voltages between 820 V<sub>DC</sub> and 850 V<sub>DC</sub> are can only be processed up to 500 hours per year.
- 2) Efficiency measured without internal power supply
- 3) Further AC-voltages, DC-voltages and power classes can be configured.
- 4) Internal consumption at nominal power
- 5) Bei 1.05 U<sub>AC,nom</sub> and cos φ=1

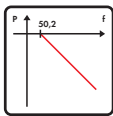


# Powerful grid management functions



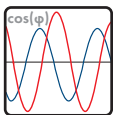
## Remote controlled power reduction in case of grid overload

In order to avoid short-term grid overload, the grid operator presets a nominal active power value which the inverter will implement within 60 seconds. The nominal value is transmitted to the inverters via a ripple control receiver in combination with the SMA Power Reducer Box. Typical limit values are 100, 60, 30 or 0 per cent of the nominal power.



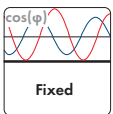
## Frequency-dependent control of active power

As of a grid frequency of 50.2 Hz, the inverter automatically reduces the fed-in of active power according to a definable characteristic curve which thereby contributes to the stabilization of the grid frequency.



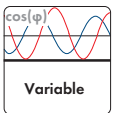
## Static voltage support based on reactive power

SMA inverters feed capacitive or inductive to the grid in order to stabilize the grid voltage. Three different modes are available:



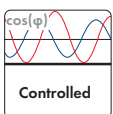
### a) Fixed definition of the reactive power by the grid operator

The grid operator defines a fixed reactive power value or a fixed displacement factor between  $\cos(\varphi)_{\text{leading}} = 0.90$  and  $\cos(\varphi)_{\text{lagging}} = 0.90$ .



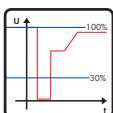
### b) Definition of a dynamic setpoint of the reactive power by the utility operator

The grid operator defines a dynamic displacement factor - any value between  $\cos(\varphi)_{\text{leading}} = 0.90$  und  $\cos(\varphi)_{\text{lagging}} = 0.90$ . It is transmitted through a communication unit. The evaluation can e.g. be (evaluated and) processed by the SMA Power Reducer Box.



### c) Control of the reactive power over a characteristic curve

The reactive power or the phase shift is controlled by a pre-defined characteristic curve - depending on the active power fed into the grid or the grid voltage.



## Limited Dynamic Grid Support

The inverter continues to feed to the grid after short term voltage drops - as long as the grid voltage is within a defined voltage window.

## Dynamic Grid Support

LVRT (Low-Voltage Ride Through): The inverter stays connected to the grid during voltage drops and supports the grid by feeding reactive power.

