MONITORING
POWER PLANT CONTROL
REMOTE SUPERVISION
O&M SERVICE
Field Monitoring

- string-op
- string-rev
- °C
- w/m²
- °F
- m/s
- mm/h
- hPa
- %RH
We understand the demands of the rapidly changing energy sector, to which we bring our experience, expertise, products and services, uniting these in a comprehensive system solution. Our innovation is a complete solution for PV power plants. Systematic and, at the same time, flexible, fast and reliable, we adapt to meet the new challenges of the market. For your success.
THE SYSTEM SOLUTION
FOR PV POWER PLANTS FROM A SINGLE SOURCE

Our innovations are founded on research and development. Our goal is profitable and sustainable value creation. The challenge is to create needs-based, customised solutions for PV power plants that can be implemented quickly and reliably, and that can react flexibly to changes in the market. To this end, we have combined our expertise in various fields with our range of products to create a complete solution.

Years of experience, constant innovation, proven power plant expertise and seasoned service, come together with our products for monitoring, control and supervision of PV power plants – accompanied by our cross-project O&M service.

Our tried-and-tested product range and supervision platform, which is equipped with sophisticated algorithms, are linked to the functional cooperation of our internal divisions. This enables us systematically and, at the same time, flexibly to address the various demands of our customers – worldwide.

Our customers understand the advantages of this overall package. Our innovations secure your investments in renewable energy over the long-term and enhance the performance of your assets. Always transparent, with maximized yields, sustainable and profitable.
OVERVIEW PRODUCTS AND SERVICES

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YOUR PARTNER FOR PV POWER PLANTS
01 POWER PLANT MONITORING
Data collection – 100 ms samples, one-min mean values / On-site logging of all plant, control and grid-injection data / Independent of inverter type and make / Local access to real-time data over the skylog® web interface

02 POWER PLANT CONTROL
Closed-loop control using feedback of actual parameters at the grid connection point / Advanced grid control functions such as active power curtailment, reactive power injection, voltage and frequency stabilization / Energy trading and dispatching

03 SCADA PLATFORM
Control room for remote plant supervision – service log, failure detection, dashboard / Alarm management with self-learning fault-detection algorithms / Remote service management / Plant performance analysis / Monthly reporting / Hourly production forecasts

04 O&M SERVICE
Complete life-cycle O&M Services / Worldwide plant supervision through our control room staff / Technical support for immediate advice / Project Engineering / Technical due diligence / Plant commissioning support / Hands-on workshops
PV PLANT MONITORING
skylog® / skyCONNi / skyserv®

- High-quality, robust industry-standard components: skyCONNi weather units and skylog® data loggers
- High-resolution data collection (100 ms samples, one-minute mean values)
- Salt*-, sand*- and UV-resistant components
- Local access to real-time data over the skylog® web interface
- Independent of inverter type and make

YOUR BENEFITS

- Reduced downtime through precise and timely fault detection
- Significant reduction of yield losses over plant lifetime
- Flexible sourcing of equipment from different manufacturers
- Reliable and lasting operation under harsh outdoor environments
- Improved bankability with more attractive assets should plant be subsequently offered for sale

“Creating trust. This is an important criterion in the development of new markets – we do it with our system.”

Monika Hennessen
PARTNERSHIP DEVELOPMENT AFRICAN COUNTRIES
skylog®
Data Logger System

Our powerful data logging system for PV installations, skylog®, has been designed with robustness and versatility in mind. Communicating with the plant using any of the standard bus technologies (CAN, RS-422, RS-485, Ethernet), skylog® can read and save data from a variety of terminal devices, irrespective of make. On request, an uninterruptable power supply (UPS) can provide power to all other monitoring components supplied by the CAN bus cable, ensuring dependable operation even in the event of a power failure. In locations having unreliable internet connections, local data storage is secured by skylog®’s substantial data buffering capacity. skylog® therefore forms an indispensable component of any monitoring system where dependable operation is key.

FUNCTIONS

☑ Data logger component of a complete monitoring system for photovoltaic power plants
☑ Uninterrupted power supply for all monitoring components
☑ Data buffer in case of Internet breakdown, depending on system configuration (string or central inverters): 1–4 weeks
☑ Support of inverters from various manufacturers as listed in the skytron® energy compatibility list
☑ Basis for long-term energy production verification
☑ Optional available: grid stability management functions

MONITORED DEVICES

☑ Inverter, for example:
  › inverter state, failure state, energy production
☑ DC USV:
  › battery charge condition and battery temperature
☑ skyCONNi, data gateway for the connection of several devices such as:
  › energy meters, temperature sensors, reference cells, pyranometers, analogue sensors and actuators, alarm systems and process control systems (inputs and outputs), modules: module and ambient conditions
☑ skylog® CP:
  › Special adapter for connecting a reference module

Compatibility notice: current compatibility list under www.skytron-energy.com
01 INDUSTRIAL PC
High-performance industrial PC with robust aluminium housing. The wide temperature range makes the system suitable for any installation site.

02 ETHERNET SWITCH
Industrial grade fibre optic multimode switch. Optional available: single-mode or copper only switches.

03 COMMUNICATION AND MEASUREMENT CIRCUIT BOARDS
Master device combinable with multiple interface and measurement cards

04 REMOTE ACCESS FUSES
Remote switchable 24 V DC fuses

05 24 V DC UNINTERRUPTABLE POWER SUPPLY (UPS)
195 to 265 V AC, 47 to 63 Hz (optional 85 to 264 V AC, 44 to 66 Hz) mains, overvoltage protected

06 SURGE PROTECTION DEVICES
Protection for CAN bus signals

07 TERMINALS
Separated clamp area for easy handling on installation and service.

08 CABINET
IP 66 electric cabinet, powder-coated steel

09 CABLE GLANDS
For all cabling leading in and out with the required diameter, UV-resistant, additional strain relief needless
## Technical Data

<table>
<thead>
<tr>
<th>TYPE</th>
<th>skylog® CP</th>
<th>skylog®</th>
<th>1SLA053YX</th>
<th>1SLA054YX</th>
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<tr>
<td>ARTICLE No.</td>
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<td></td>
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<td>Power supply</td>
<td>24 V DC / 20 W from external power supply device</td>
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<td>–</td>
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<tr>
<td>UPS DC (24 V)</td>
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<tr>
<td>PC</td>
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<td>Industrial PC (400 MHz, Flash card up to 1 GB, Linux OS, battery-backed clock)</td>
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<td>✓</td>
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<td>Interfaces</td>
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<td>RS-485 HD – without surge protection (connection for energy meter)</td>
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<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS-485 HD – with surge protection (connection for energy meter)</td>
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<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS-485 HD – without surge protection (connection for weather sensors)</td>
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<td>–</td>
<td></td>
<td></td>
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<tr>
<td>RS-485 HD – without surge protection (connection for inverter)</td>
<td>– / 4 2 / – (alternative)</td>
<td>–</td>
<td></td>
<td></td>
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<tr>
<td>RS-485 HD – with surge protection (connection for inverter)</td>
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<td>– / 2 (alternative)</td>
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<td></td>
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<td>ETH RJ-45 – without surge protection</td>
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<td>✓</td>
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<td></td>
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<tr>
<td>ETH RJ-45 – with surge protection</td>
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<td>–</td>
<td></td>
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<tr>
<td>Digital outputs (relays / changeover contacts) max. 6 A / 250 V AC</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Digital inputs 5 V or 24 V (adjustable via jumper)</td>
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<td>–</td>
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<td>Digital inputs SO-pulse input</td>
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<tr>
<td>CAN with surge protection</td>
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<tr>
<td>Temperature sensor PT1000 (cabinet or ambient temperature)</td>
<td>–</td>
<td>–</td>
<td></td>
<td></td>
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<tr>
<td>Temperature sensor interface</td>
<td>2</td>
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<tr>
<td>Radiation sensor interface</td>
<td>2</td>
<td>–</td>
<td></td>
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</tr>
<tr>
<td>Remote fuses 24 V (remote reset function)</td>
<td>–</td>
<td>–</td>
<td></td>
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<tr>
<td>Cabinet for data logger</td>
<td>400 x 400 x 200 mm / 15.7 x 15.7 x 7.9 in (IP 66)</td>
<td>–</td>
<td></td>
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</tr>
<tr>
<td>Battery cabinet</td>
<td>–</td>
<td>–</td>
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<td></td>
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<tr>
<td>Operating temperature</td>
<td>-15°C to 50°C / 5°F to 122°F, up to 95% relative humidity (non-condensing)</td>
<td>–</td>
<td></td>
<td></td>
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<td>Certification</td>
<td>cETLus / CE</td>
<td>cETLus / CE</td>
<td>cETLus / CE</td>
<td>cETLus / CE</td>
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<tr>
<td>Product variations router</td>
<td>0 = without router</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>1 = industrial router (UMTS)</td>
<td>alternative</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 = industrial router (LTE)</td>
<td>alternative</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product variations Ethernet 1</td>
<td>0 = no switch</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>1 = FOC switch (2 x FOC multimode, 3 x Cu) with SC-plug</td>
<td>–</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 = FOC switch (2 x FOC multimode, 6 x Cu) with SC-plug</td>
<td>–</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 = FOC switch (2 x FOC single-mode, 6 x Cu) with SC-plug</td>
<td>–</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 = FOC switch (2 x FOC single-mode, 3 x Cu) with SC-plug</td>
<td>–</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product variations Ethernet 2</td>
<td>0 = no switch</td>
<td>✓</td>
<td>✓</td>
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<td>1 = FOC switch (2 x FOC multimode, 3 x Cu) with SC-plug</td>
<td>–</td>
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<td></td>
<td></td>
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<tr>
<td>2 = FOC switch (2 x FOC multimode, 6 x Cu) with SC-plug</td>
<td>–</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 = FOC switch (2 x FOC single-mode, 6 x Cu) with SC-plug</td>
<td>–</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 = FOC switch (2 x FOC single-mode, 3 x Cu) with SC-plug</td>
<td>–</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cabinet</td>
<td>0 = standard cabinet</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>1 = outdoor cabinet with integrated heating</td>
<td>–</td>
<td>–</td>
<td></td>
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</tr>
</tbody>
</table>
**SYSTEM SOLUTION / PV PLANT MONITORING / skylog®**

**13 Pioneers of Energy**

**ARTICLE No.** 1SLA001YX 1SLA049YX 1SLA005YX 1SLA041YX 1SLA047YX 1SLA0445Y

**POWER SUPPLY**
- Power supply 24 V DC / 20 W from external power supply device
- 230 V AC / 50 Hz, internal power supply unit (24 V DC)
- 195 to 265 V AC, 47 to 63 Hz, with surge protection, (optional: 85 to 264 V AC, 44 to 66 Hz, with surge protection)
- UPS DC (24 V)
- Battery (12 V, 40 Ah)

**PC**
- Industrial PC (400 MHz, Flash card up to 1 GB, Linux OS, battery-backed clock)

**INTERFACES**
- RS-485 HD – without surge protection (connection for energy meter)
- RS-485 HD – with surge protection (connection for energy meter)
- RS-485 HD – without surge protection (connection for weather sensors)
- RS-485 HD – without surge protection (connection for inverter)
- RS-485 HD – with surge protection (connection for inverter)
- ETH RJ-45 – without surge protection
- ETH RJ-45 – with surge protection
- Digital outputs (relays / changeover contacts) max. 6 A / 250 V AC
- Digital inputs 5 V or 24 V (adjustable via jumper)
- Digital inputs S0-pulse input
- CAN with surge protection
- Temperature sensor PT1000 (cabinet or ambient temperature)
- Temperature sensor interface
- Radiation sensor interface
- Remote fuses 24 V (remote reset function)

**BATTERY CABINET**
- 400 x 400 x 200 mm / 15.7 x 15.7 x 7.9 in (IP 66)
- 700 x 500 x 250 mm / 27.5 x 19.7 x 9.8 in (IP 66)

**OPERATING TEMPERATURE**
- -15°C to 50°C / 5°F to 122°F, up to 95% relative humidity (non-condensing)

**CERTIFICATION**
- cETLus / CE

**PRODUCT VARIATIONS**

<table>
<thead>
<tr>
<th>ROUTER</th>
<th>ethernet 1</th>
<th>ethernet 2</th>
<th>cabinet</th>
</tr>
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<tbody>
<tr>
<td>0 = without router</td>
<td>0 = no switch</td>
<td>0 = standard cabinet</td>
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</tr>
<tr>
<td>1 = industrial router (UMTS)</td>
<td>1 = FOC switch (2 x FOC multimode, 3 x Cu) with SC-plug</td>
<td>1 = outdoor cabinet with integrated heating</td>
<td></td>
</tr>
<tr>
<td>2 = industrial router (LTE)</td>
<td>2 = FOC switch (2 x FOC multimode, 6 x Cu) with SC-plug</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 = FOC switch (2 x FOC single-mode, 6 x Cu) with SC-plug</td>
<td>3 = FOC switch (2 x FOC single-mode, 3 x Cu) with SC-plug</td>
<td></td>
<td></td>
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<tr>
<td>4 = FOC switch (2 x FOC single-mode, 3 x Cu) with SC-plug</td>
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</tbody>
</table>

700 x 500 x 250 mm / 27.5 x 19.7 x 9.8 in (IP 66)
380 x 380 x 247 mm / 15 x 15 x 9.7 in (IP 54)

-15°C to 50°C / 5°F to 122°F, up to 95% relative humidity (non-condensing)
skyCONNi
Universal Weather Unit

Our universal system for the measurement of ambient conditions. skyCONNi-Sun is capable of integrating a number of different weather sensors into the plant communication network. The basic system offers integrated ambient and module temperature sensors as well as two interfaces for the connection of irradiation sensors, be it pyranometers or reference cells. A compact weather station providing information about wind, precipitation and humidity conditions can also be connected. The skyCONNi-Sun cabinet is of robust design and suitable for outdoor installation.

FUNCTIONS

- The sensor kit is capable of measuring a wide range of weather data relevant for the operation and revenue of your PV power plant:
  - irradiation
  - ambient temperature
  - module temperature
  - atmospheric pressure and air humidity
  - wind speed
  - wind direction
  - amount, duration and intensity of rain and hail
- Suitable for indoor and outdoor application:
  - wall mounting
  - module-frame mounting or
  - pole mounting
- Telescopic mast for mounting: skyCONNi and sensors is available as an option

FEATURES

- Pyranometer air conditioning with ventilation unit for enhanced accuracy and reliability of the pyranometer
- Reference Module Adapter (RMA) enables solar irradiation measurement in connection with thin film modules (Article No. 3RMA00151)
- Zone Monitoring – skyCONNi-Zone:
  - PV strings bundled to zones are measured and evaluated as a total, at the inverters’ inputs employing current transducers (not included)
01 COMMUNICATION AND MEASUREMENT CIRCUIT BOARDS
Mainboard with integrated CAN and RS-485(HD) interface combined with circuit boards for temperature and irradiation measurement.

02 CAN BUS + 24 V DC (OVERVOLTAGE PROTECTED)
Terminal clamps for CAN bus and 24 V power supply

03 TERMINALS 24 V DC POWER SUPPLY FOR EXTERNAL DEVICES
For digital weather sensors (like Vaisala WXT520)

04 SURGE PROTECTION DEVICES
Protection for RS-485 bus signals

05 CABLE GLANDS
For all cabling loading in and out with the required diameter, UV-resistant, additional strain relief needless

06 CABINET
Polycarbonate with polyurethane sealing

07 INTERFACES
› RS-485 (HD)
› Temperature measurement (2 channels)
› Irradiation measurement (2 channels)

08 VAISALA WEATHER TRANSMITTER
Digital weather sensor measuring wind, precipitation, humidity and temperature

09 TEMPERATURE SENSORS
Ambient temperature sensor (left), module temperature sensor (right)

10 IRRADIATION SENSORS
Reference cell (left), pyranometer (right), Reference Module Adapter (not shown)
# Technical Data

## TYPE

<table>
<thead>
<tr>
<th>ARTICLE No.</th>
<th>skyCONNi-Sun (Set 1)</th>
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<th>skyCONNi-Sun (Set 3)</th>
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<td>1SSU40101</td>
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## POWER SUPPLY

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<th>Power supply</th>
<th>Supply other components</th>
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<tr>
<td></td>
<td>24 V DC, max. 20 W (via CAN bus) / 230 V AC or 24 V DC external power supply for Ethernet devices without CAN bus</td>
<td>24 V DC (Vaisalla weather transmitter)</td>
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## INTERFACES

<table>
<thead>
<tr>
<th></th>
<th>Temperature channel interfaces PT100 / PT1000</th>
<th>Interface 0–25 mV for pyranometer</th>
<th>Interface 0–150 mV for reference cell</th>
<th>Impulse input</th>
<th>Analog inputs (4–20 mA)</th>
<th>RS-485 HD (with surge protection, galvanically isolated)</th>
<th>RS-485 FD</th>
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## SENSORS

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<th>Ambient temperature sensor PT1000</th>
<th>Module temperature sensor PT1000</th>
<th>Pyranometer Kipp &amp; Zonen type CMP11</th>
<th>Pyranometer Hukseflux type SR11</th>
<th>Monocrystalline reference cell type SOZ-03</th>
<th>Fixing material for pyranometer / reference cell</th>
<th>Anemometer Thies type PB100H</th>
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## CABINET

<table>
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<th>300 x 300 x 170 mm / 11.8 x 11.8 x 6.7 in</th>
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## PRODUCT VARIATION ETHERNET

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<th>Ethernet Cu on RJ-45 and external power supply (without CAN)</th>
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## PRODUCT VARIATION UL-CERTIFICATION

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<tr>
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</table>

## Accessories skyCONNi

- Vaisalla Weather Transmitter WXT 520 (Art. Nr. 9UNT0041)
MODULAR MONITORING TECHNOLOGY

➤ Flexibility in the redesign of components to meet local requirements
➤ Fulfills the special grid standards in South Africa, which are required by the public electricity company ESKOM
➤ Clean energy for more than 30,000 households, with a total capacity of 86.2 MWp and an annual power generation of 108 million kWh

“...We value the flexibility in skytron® energy’s monitoring technology and the fact that the company adapts its products to our needs. Considering the particular local requirements in South Africa, we selected skytron® energy as the best partner to fulfill such needs for the Prieska project. Beyond its state-of-the-art technology, we were also impressed by its highly experienced team.”

Andre Steffen, Senior Project Manager of juwi Renewable Energies

Mulilo Sonnedix Prieska - Monitoring, control and supervision for one of the largest solar power plants on the African continent

More info about this project here www.skytron-energy.com/news
skyserv®
Server for Photovoltaic Power Plants

skyserv® CP

skyserv® CP provides enhanced local storage facilities and data backup for one year. At the same time skyserv® CP prepares the incoming data from the local data loggers for broadband transfer to the external long-term data hosting server, i.e. by way of data compression, filtering and preprocessing. Even in the event of internet failure the data server ensures data consistency and backup as it allows filling data gaps that would otherwise occur.

TECHNICAL DATA

<table>
<thead>
<tr>
<th>TYPE</th>
<th>skyserv® CP</th>
<th>skyserv® CP</th>
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<tr>
<td>POWER SUPPLY</td>
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<tr>
<td>100 – 240 V AC / 50 – 60 Hz mains</td>
<td>✓</td>
<td>–</td>
</tr>
<tr>
<td>85 – 264 V AC / 44 – 66 Hz mains</td>
<td>–</td>
<td>✓</td>
</tr>
<tr>
<td>DC-USV (24 V)</td>
<td>optional</td>
<td>✓</td>
</tr>
<tr>
<td>PC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intel Xeon processor, 24 GB RAM, 4 TB HDD (RAID Level 1)</td>
<td>✓</td>
<td>–</td>
</tr>
<tr>
<td>Intel Atom processor, 2 GB RAM, 100 GB HDD oder 120 GB SSD (RAID Level 0)</td>
<td>–</td>
<td>✓</td>
</tr>
<tr>
<td>ETHERNET</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOC switch</td>
<td>optional single mode FOC</td>
<td>✓</td>
</tr>
<tr>
<td>Ethernet Cu on RJ-45</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>ROUTER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial router (LTE)</td>
<td>–</td>
<td>optional</td>
</tr>
<tr>
<td>CABINET</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19&quot; 1 RU rack mounted</td>
<td>✓</td>
<td>–</td>
</tr>
</tbody>
</table>
**skyserv® Local**

Skyserv® Local provides enhanced local storage facilities, data backup for up to 20 years. Together with PVGuard® Local you can access all data – both live and historic – from your PV plant, whether there is an internet connection available or not.

Use the standard scope of functions of the PVGuard® supervision platform at the local sites. In addition data can be exported at any time for further processing and analysis. A power plant’s operating data can be analyzed with custom charts as needed.

**TECHNICAL DATA**

<table>
<thead>
<tr>
<th>TYPE</th>
<th>skyserv® Local</th>
<th>skyserv® Local</th>
<th>skyserv® Local</th>
<th>skyserv® Local</th>
</tr>
</thead>
<tbody>
<tr>
<td>POWER SUPPLY</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>220 – 240 V AC / 50 – 60 Hz mains</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>AC-UPS / uninterruptible power supply with 1.920 W (90 – 260 V AC)</td>
<td>optional</td>
<td>optional</td>
<td>optional</td>
<td>optional</td>
</tr>
<tr>
<td>PC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intel Xeon processor, 24 GB RAM, 4 TB HDD configured as RAID Level 1 – hot spare</td>
<td>✓</td>
<td>–</td>
<td>✓</td>
<td>–</td>
</tr>
<tr>
<td>2x Intel Xeon processor, 64 GB RAM, 14 TB HDD configured as RAID Level 6 – hot spare</td>
<td>–</td>
<td>✓</td>
<td>–</td>
<td>✓</td>
</tr>
<tr>
<td>ETHERNET</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOC switch (2 x FOC multimode, 3 x Cu) mit SC connector</td>
<td>✓</td>
<td>✓</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Ethernet Cu on RJ-45 (without overvoltage projection)</td>
<td>✓</td>
<td>✓</td>
<td>–</td>
<td>✓</td>
</tr>
<tr>
<td>ROUTER</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial router (LTE)</td>
<td>optional</td>
<td>optional</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>CABINET</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 RU, 1,200 x 800 x 1,000 mm, indoor</td>
<td>✓</td>
<td>✓</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>19” 2 RU rack mounted</td>
<td>–</td>
<td>–</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
skyserv®
Server for Photovoltaic Power Plants

skyserv® OPC
skyserv® OPC supports Open Platform Communications Data Access (OPC DA) and Unified Architecture (OPC UA) as the leading standards for industrial interoperability. It provides a simple way to connect PVGuard® data bases with third party systems to make data available in OPC format.

Note: To run this service skyserv® CP or skyserv® Local is needed on site.

TECHNICAL DATA

<table>
<thead>
<tr>
<th>TYPE</th>
<th>skyserv® OPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE</td>
<td></td>
</tr>
<tr>
<td>ARTICLE NO.</td>
<td>1SSC00151</td>
</tr>
<tr>
<td>POWER SUPPLY</td>
<td>100 – 240 V AC / 50 – 60 Hz mains</td>
</tr>
<tr>
<td>PC</td>
<td>Intel Xeon processor, 4 GB RAM, 1 TB HDD (RAID Level 1)</td>
</tr>
<tr>
<td>ETHERNET</td>
<td>Ethernet Cu on RJ-45</td>
</tr>
<tr>
<td>CABINET</td>
<td>19&quot; 1 RU rack mounted</td>
</tr>
<tr>
<td>SOFTWARE</td>
<td>Windows Server 2012 (operating system), interface software</td>
</tr>
</tbody>
</table>
**skyserv® RtSO**

skyserv® RtSO provides a gateway server platform for real-time remote control operations out of PVGuard®. Located within the power plant network, the server equipped with skytron® energy’s gateway software collects defined incoming values from data loggers or a power plant controller and sends it directly to PVGuard®. Switching commands are transmitted in the same way from PVGuard® dashboard via skyserv® RtSO to data loggers or a power plant controller which will forward the command to the connected switches / inverters.

**Note:** To run the remote switching commands a virtual private network (VPN) between skyserv® RtSO and PVGuard® is required.

---

**TECHNICAL DATA**

<table>
<thead>
<tr>
<th>TYPE</th>
<th>skyserv® RtSO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>POWER SUPPLY</strong></td>
<td>100 – 240 V AC / 50 – 60 Hz mains</td>
</tr>
<tr>
<td><strong>PC</strong></td>
<td>Intel Xeon processor, 4 GB RAM, 1 TB HDD (RAID Level 1)</td>
</tr>
<tr>
<td><strong>ETHERNET</strong></td>
<td>Ethernet Cu en RJ-45</td>
</tr>
<tr>
<td><strong>CABINET</strong></td>
<td>19” 1 RU rack mounted</td>
</tr>
<tr>
<td><strong>SOFTWARE</strong></td>
<td>UNIX (operating system), skytron® gateway software</td>
</tr>
</tbody>
</table>
POWER PLANT CONTROL
skycontrol

- Customisable to meet even the most complex local grid-operator requirements
- High-precision closed-loop control using feedback of actual parameters at the grid connection point
- Advanced grid control functions such as active power curtailment, reactive power injection, voltage and frequency stabilisation
- Support for virtually all solar inverters on the market and public utilities’ upstream SCADA systems
- 4 GWp are equipped with our skycontrol plant controller

YOUR BENEFITS

- Reduces your risk by facilitating grid connection of your solar PV plant
- Flexible adjustment to changes in grid regulations and smart-grid integration
- Enhanced yields while meeting bulk power-system reliability criteria
- Stable grid integration irrespective of the topology of the PV plant portfolio
- Proven track record in ensuring grid stability, even for large plants with multiple, independent sections

“To be able to react to changing grid requirements at any time – that’s sustainable power plant utilization.”
Benjamin Licht
PROJECT ENGINEERING
skycontrol
Power Plant Control

skycontrol is an integrated system for PV power plant control and grid stability management. It meets grid operators’ requirements for utility-scale PV installations to ensure controlled grid injection, both at the medium and high voltage level, and can be flexibly adjusted to comply with different regional, national and international grid codes. An optionally included TeleControl Gateway complements the skycontrol system in accordance with Transmission Protocols IEC 60870, IEC 61850 and DNP3. Of course, the controller uses the genuine closed-loop control principle, ensuring high-precision control by measurement of all relevant physical quantities at the grid connection point and their continuous feedback to the controller input. Combined with adaptable control algorithms and communication sequences, this makes skycontrol a highly efficient tool for fast and stable power plant control, even in large-scale and distributed PV installations comprising several independent PV sections.

KEY FEATURES

- Closed-loop control of active and reactive power
- Reactive power injection, reactive power compensation of passive components, voltage and frequency stabilisation
- Fast and precise settlement of control functions
- Highly adaptable to grid operators’ requirements
- Fully integrated in the monitoring system of skytron® energy

- Feedback of actual values from grid connection point at medium or high voltage level
- Compatible with virtually all inverters on the market (see document “Compatible Inverters” on www.skytron-energy.com)
- Suitable for mixed PV installations, equipped with different makes of inverters
- Optional available: a power plant controller and a data logger in one device

ADD-ON OPTIONS

- skycontrolRI
  skycontrolRI integrates your PV power plants with higher-level energy management systems complying with current technical and regulatory requirements for remote controlled plants. The telecontrol interface skycontrolRI expands the plant controller skycontrol.

- skyCONNi
  Further analog and digital interfaces are available on request through our customised skyCONNi components.

By adding advanced performance control to PV power plants, skytron® energy’s skycontrol significantly contributes to the worldwide integration of renewable power into the electricity grid while ensuring grid stability and availability. To date, worldwide, PV power plants with an accumulated power of 4 GWp are equipped with skytron® energy’s skycontrol power plant controller.
01 INDUSTRIAL PC
High-performance industrial PC with robust aluminium housing. The wide temperature range makes the system suitable for any installation site.

02 ETHERNET SWITCH
Industrial grade fibre optic multimode switch. Optional available: single-mode or copper only switches.

03 24 V DC UNINTERRUPTABLE POWER SUPPLY (UPS)
195 to 265 V AC, 47 to 63 Hz (optional 85 to 264 V AC, 44 to 66 Hz) mains, overvoltage protected

04 REMOTE ACCESS FUSES
Remote switchable 24 V DC fuses

05 SURGE PROTECTION DEVICES
For CAN bus signals and RS-485

06 TERMINALS
Separated clamp area for easy handling on installation and service.

07 CABINET
IP 66 electric cabinet, powder-coated steel

08 BATTERIES
Two batteries AGM 12 V, 40 h (for SkyControl CP placed in an external cabinet)
skycontrol
Integration of PV into Power Grids

COMMUNICATION SCHEME

LEVEL 01
Reliable field busses between data logger and inverter.

LEVEL 02
Fibre Optic Ring (Ethernet based, redundant, wide area connection) between data logger and plant controller.

LEVEL 03
Dedicated secure connection to grid operator and/or energy trader, and Internet to monitoring provider, data base, and supervision platform.
ADVANTAGES

- Power plant acts as a single generator towards the grid
- Power control works dynamically and is capable to balance:
  - the outage of inverters
  - intermittent cloud cover (rising edge ramp rate control)
  - losses through passive power components
- Independence from inverter type or vendor and even plant layout
- Infinite degrees of freedom for utility specs and interfaces

FEATURES

- Active power control:
  - according to fixed set-point values and to dynamic set-point values through interface
  - limitation of active power gradients
  - frequency-based: P(f), even including a power reserve for under-frequency conditions
- Reactive power control:
  - according to fixed set-point values and to dynamic set-point values through interface
  - voltage-based: Q(V), cos phi(V)
  - power-based: cos phi(P)
  - phase shift in night mode (specific inverter and statcom types)
- Voltage control
- Integrated switch and protection functions
- Interfaces (digital I/O, 4 – 20 mA, 0 – 10 V, MODBUS, IEC 60870-5-101/-104, IEC 61850, DNP3)
- Cabinet options for industrial environment, including UPS, depending on required mounting space available
- Full integration of plant controller values, alarms and notifications within skytron® energy’s supervision platform PVGuard®, including specific plant controller view options
- Comprehensive engineering services available for project specific product customization

UNIQUENESS

EXPERIENCE

- skycontrol runs 4 GWp PV power plants worldwide
- More than 430 running plant controllers, from 400 kWp up to 86 MWp
- Medium and high voltage grid connection
- Our team of qualified engineers will support all project phases from design, though acceptance of the power plant by the local grid operator, up to operation.

VERSATILITY

- Controls plurality of technologies – solar, statcom, capacitor and inductor banks, wind, storage, and multitude of inverter makes, even in parallel
- Highly adaptable to customer needs
- Remotely-controllable through grid operator and energy trader

INNOVATION

- Ramp rate control without storage (rising edge)
- Frequency support by providing balancing power
- Complex consumption solutions available
- Cascadable

Actual Values
Set-points
PLANT CONTROLLER
GRID ANALYSER
PASSIVE COMPONENTS
INVERTERS
GRID
Control Values
Actual Values
PLANT CONTROLLER
GRID ANALYSER
PASSIVE COMPONENTS
INVERTERS
GRID
## Technical Data

### POWER SUPPLY

<table>
<thead>
<tr>
<th>TYPE</th>
<th>skycontrol</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTICLE No.</td>
<td>1SCA048YX</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>POWER SUPPLY</th>
<th>skycontrol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply AC, with surge protection</td>
<td>195 to 265 V AC, 47 to 63 Hz, (on request: 85 V to 264 V AC, 44 to 66 Hz)</td>
</tr>
<tr>
<td>DC UPS (24V)</td>
<td>🟢</td>
</tr>
<tr>
<td>Lead-acid battery (12 V, 40 Ah)</td>
<td>🟢</td>
</tr>
</tbody>
</table>

### DATA LOGGER

<table>
<thead>
<tr>
<th>TYPE</th>
<th>skycontrol</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTICLE No.</td>
<td>1SCA059YX 1SCA060YX 1SCP054YX</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATA LOGGER</th>
<th>skycontrol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data logger functionality via RS-485 / ETH with surge protection (supports up to 6 central inverters or 100 string inverters, depending on the inverter type)</td>
<td>–</td>
</tr>
</tbody>
</table>

### PC

<table>
<thead>
<tr>
<th>TYPE</th>
<th>skycontrol</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTICLE No.</td>
<td>1SDI00401 1SCI00101 1SUA00601 1SUA00401 1SUA00701</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PC</th>
<th>skycontrol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial PC (400 MHz, flash card up to 1 GB, Linux OS)</td>
<td>–</td>
</tr>
</tbody>
</table>

### INTERFACES

<table>
<thead>
<tr>
<th>TYPE</th>
<th>skycontrol</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTICLE No.</td>
<td>1SDI00401 1SCI00101 1SUA00601 1SUA00401 1SUA00701</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INTERFACES</th>
<th>skycontrol</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-485 HD – without surge protection (connection for energy meter)</td>
<td>– / ✓</td>
</tr>
<tr>
<td>RS-485 HD – with surge protection (connection for energy meter)</td>
<td>–</td>
</tr>
<tr>
<td>S0 interface – pulse signal (connection for energy meter)</td>
<td>2</td>
</tr>
<tr>
<td>RS-485 HD – without surge protection (connection for direct marketers)</td>
<td>–</td>
</tr>
<tr>
<td>IEC 60870-5-101 (RS-232 / RS-485 communication grid operator)</td>
<td>–</td>
</tr>
<tr>
<td>IEC 60870-5-104 (communication grid operator)</td>
<td>–</td>
</tr>
<tr>
<td>Digital outputs (relays / changeover contacts) max. 6 A / 250 V AC</td>
<td>–</td>
</tr>
<tr>
<td>Analog inputs (4 – 20 mA)</td>
<td>–</td>
</tr>
<tr>
<td>Analog outputs (4 – 20 mA)</td>
<td>–</td>
</tr>
<tr>
<td>CAN with surge protection for NSM-enhancement via skyCONNi</td>
<td>✓</td>
</tr>
<tr>
<td>CAN with surge protection for sensors via skyCONNi</td>
<td>–</td>
</tr>
<tr>
<td>RS-485 HD – with surge protection (connection for inverter *)</td>
<td>–</td>
</tr>
<tr>
<td>ETH RJ-45 – with surge protection (connection for inverter *, Janitza, direct marketers)</td>
<td>– / ✓ / 2</td>
</tr>
<tr>
<td>Temperature sensor PT1000 (cabinet or ambient temperature)</td>
<td>✓</td>
</tr>
<tr>
<td>Remote fuses 24 V (remote reset function)</td>
<td>✓</td>
</tr>
</tbody>
</table>

### GRID ANALYSER

<table>
<thead>
<tr>
<th>TYPE</th>
<th>skycontrol</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTICLE No.</td>
<td>1SDI00401 1SCI00101 1SUA00601 1SUA00401 1SUA00701</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GRID ANALYSER</th>
<th>skycontrol</th>
</tr>
</thead>
<tbody>
<tr>
<td>JANITZA UMG604E 24 volt power supply via internal UPS (external mounted)</td>
<td>✓</td>
</tr>
</tbody>
</table>

### TEMPERATURE RANGE

<table>
<thead>
<tr>
<th>TYPE</th>
<th>skycontrol</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTICLE No.</td>
<td>1SDI00401 1SCI00101 1SUA00601 1SUA00401 1SUA00701</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TEMPERATURE RANGE</th>
<th>skycontrol</th>
</tr>
</thead>
<tbody>
<tr>
<td>95% relative humidity (non-condensing)</td>
<td>-20°C to +50°C (operation temperature) / -4°F to 122°F</td>
</tr>
</tbody>
</table>

### PRODUCT VARIATIONS

<table>
<thead>
<tr>
<th>TYPE</th>
<th>skycontrol</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTICLE No.</td>
<td>1SDI00401 1SCI00101 1SUA00601 1SUA00401 1SUA00701</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRODUCT VARIATIONS</th>
<th>skycontrol</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROUTER 0 = no router</td>
<td>alternative</td>
</tr>
<tr>
<td>1 = industrial router (UMTS)</td>
<td>✓</td>
</tr>
<tr>
<td>2 = industrial router (LTE)</td>
<td>alternative</td>
</tr>
<tr>
<td>ETHERNET 1</td>
<td>skycontrol</td>
</tr>
<tr>
<td>0 = no switch</td>
<td>✓</td>
</tr>
<tr>
<td>1 = FOC switch (2 x FOC multimode, 6 x Cu) with SC-plug</td>
<td>✓</td>
</tr>
<tr>
<td>2 = FOC switch (2 x FOC single-mode, 6 x Cu) with SC-plug</td>
<td>alternative</td>
</tr>
<tr>
<td>3 = copper switch (8 x Cu)</td>
<td>alternative</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRODUCT VARIATIONS</th>
<th>skycontrol</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETHERNET 2</td>
<td>skycontrol</td>
</tr>
<tr>
<td>0 = no switch</td>
<td>✓</td>
</tr>
<tr>
<td>1 = FOC switch (2 x FOC multimode, 6 x Cu) with SC-plug</td>
<td>optional</td>
</tr>
<tr>
<td>2 = FOC switch (2 x FOC single-mode, 6 x Cu) with SC-plug</td>
<td>optional</td>
</tr>
<tr>
<td>3 = copper switch (8 x Cu)</td>
<td>optional</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRODUCT VARIATIONS</th>
<th>skycontrol</th>
</tr>
</thead>
<tbody>
<tr>
<td>CABINET 0 = wall-mountable cabinet IP 54 (700 x 300 x 250 mm) + battery cabinet IP 54 (380 x 380 x 247 mm)</td>
<td>✓</td>
</tr>
<tr>
<td>1 = standing cabinet IP 54 (1,800 x 600 x 600 mm)</td>
<td>optional</td>
</tr>
<tr>
<td>2 = outdoor-cabinet with integrated heating</td>
<td>optional</td>
</tr>
</tbody>
</table>

### SYSTEM SOLUTION / POWER PLANT CONTROL / skycontrol
## Power Supply

- **24 V DC (via skycontrol)**

## Interfaces

<table>
<thead>
<tr>
<th>skycontrol CP</th>
<th>skycontrol CP</th>
<th>skycontrol pro</th>
<th>skycontrol pro</th>
</tr>
</thead>
<tbody>
<tr>
<td>1SCA059YX</td>
<td>1SCA060YX</td>
<td>1SCP054YX</td>
<td>custom</td>
</tr>
</tbody>
</table>

- **RS-485 bus router**
- **Ethernet**
- **USB**

**SYSTEM SOLUTION / POWER PLANT CONTROL / skycontrol**

### Technical Specifications

- **Power Supply**
  - 195 to 265 V AC, 47 to 63 Hz, (on request: 85 V to 264 V AC, 44 to 66 Hz)
  - **DC UPS (24V)**
  - **Lead-acid battery (12 V, 40 Ah)**

- **Data Logger**
  - Data logger functionality via RS-485 / ETH with surge protection (supports up to 6 central inverters or 100 string inverters, depending on the inverter type)

- **PC**
  - Industrial PC (400 MHz, flash card up to 1 GB, Linux OS)

- **Interfacing**
  - **RS-485 HD – without surge protection (connection for energy meter)**
  - **RS-485 HD – with surge protection (connection for energy meter)**
  - **S0 interface – pulse signal (connection for energy meter)**
  - **RS-485 HD – without surge protection (connection for direct marketers)**
  - **IEC 60870-5-101 (RS-232 / RS-485 communication grid operator)**
  - **IEC 60870-5-104 (communication grid operator)**
  - **IEC 61850 (communication grid operator)**
  - **DNP3 (communication grid operator)**
  - **Digital outputs (relays / changeover contacts) max. 6 A / 250 V AC**
  - **Digital inputs 5 V or 24 V (adjustable via jumper)**
  - **Analog inputs (4 – 20 mA)**
  - **Analog outputs (4 – 20 mA)**
  - **CAN with surge protection for NSM-enhancement via skyCONNi**
  - **CAN with surge protection for sensors via skyCONNi**
  - **RS-485 HD – with surge protection (connection for inverter)**
  - **ETH RJ-45 – with surge protection (connection for inverter)**
  - **Temperature sensor PT1000 (cabinet or ambient temperature)**
  - **Remote fuses 24 V (remote reset function)**

### Cabinet Variations

- **Routing**
  - 0 = no router alternative
  - 1 = industrial router (UMTS)
  - 2 = industrial router (LTE) alternative

### Ethernet Variations

- **0 = no switch**
- **1 = FOC switch (2 x FOC multimode, 6 x Cu) with SC-plug**
- **2 = FOC switch (2 x FOC single-mode, 6 x Cu) with SC-plug**
- **3 = copper switch (8 x Cu)**

### Grid Analyser

- **Janitza UMG604E 24 volt power supply via internal UPS (external mounted)**

### Temperature Range

- 95% relative humidity (non-condensing) -20°C to +50°C (operation temperature) / -4°F to 122°F

### Products

- **1SRI00101**
- **1SRI00102**
- **1SRI00104**

---

*With a connected energy meter this skycontrol variant provides only 4 digital inputs.*

*With skycontrol CP, inverters can be connected directly. All other skycontrol need one or more skylog* – dependent of project – for the inverter communication.

*Instrument transformer are not included.*
# System Accessories
## Add-ons for components

### skycomm
Digital signal converter for multimode FOC through Ethernet signals

<table>
<thead>
<tr>
<th>TYPE</th>
<th>skycomm</th>
<th>skycomm</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTICLE NO.</td>
<td>1SMA00101</td>
<td>1SMA01201</td>
</tr>
<tr>
<td><strong>POWER SUPPLY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FOC switch (2 x FOC multimode, 3 x Cu) with SC-connector</td>
<td>optional</td>
<td>optional</td>
</tr>
<tr>
<td>FOC switch (2 x FOC multimode, 3 x Cu) with SC-connector</td>
<td>optional</td>
<td>optional</td>
</tr>
<tr>
<td>Copper switch (8 x Cu)</td>
<td>optional</td>
<td>optional</td>
</tr>
<tr>
<td>Ethernet Cu on RJ-45 (without overvoltage protection)</td>
<td>2</td>
<td>–</td>
</tr>
<tr>
<td><strong>INTERFACE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS-232</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>CABINET</strong></td>
<td>Powder-coated steel sheet, IP66</td>
<td>400 x 400 x 200 mm / 15.7 x 15.7 x 7.9 in</td>
</tr>
</tbody>
</table>

### skybackup
24 V DC USV-system, battery, temperature control and digital control interface are integrated

<table>
<thead>
<tr>
<th>TYPE</th>
<th>skybackup</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTICLE NO.</td>
<td>1SBA00101</td>
</tr>
<tr>
<td><strong>POWER SUPPLY</strong></td>
<td></td>
</tr>
<tr>
<td>Supply AC with surge protection</td>
<td></td>
</tr>
<tr>
<td>USV DC (24 V)</td>
<td>–</td>
</tr>
<tr>
<td>Lead-acid battery (12 V, 40 Ah)</td>
<td>2</td>
</tr>
<tr>
<td><strong>INTERFACE</strong></td>
<td></td>
</tr>
<tr>
<td>RS-232</td>
<td>–</td>
</tr>
<tr>
<td><strong>CABINET</strong></td>
<td>IP 54</td>
</tr>
</tbody>
</table>
STABILITY FOR THE ISLAND

- Feeds into the country’s 66 kV grid
- Highly flexible control scheme for the island grid with its inherent imbalances, in line with the country’s demanding grid connection requirements
- Active and reactive power capping, maximum ramp rate, frequency control based on power shifting, voltage stabilisation and reactive power set-point control functions for grid control and stabilisation.
- On-site access to actual values of all plant data at one-minute resolution as well as selected power data such as active, reactive and apparent power, frequency, current and power factor at one second intervals measured at the grid connection point
- Energy forecast – weather-model based production forecasts supplying estimates of hourly production

“With skytron® energy we have found a highly competent partner whose expertise in flexibly adjusting their control system to local grid requirements has helped tremendously to integrate this first solar plant into the island’s electricity grid.”

André Pohl, CEO of Tauber Solar Energietechnik GmbH

Bambous – Monitoring and control of Mauritius’ first grid-connected utility-scale PV plant
More info about this project here www.skytron-energy.com/news
PVGuard®

- PVGuard® Supervision Platform – multi-site plant management, independent of the deployed hardware components in the power plant
- Efficient control room operation (fleet manager, service log, failure detection, dashboard)
- Smart and reliable alarm management
- Comprehensive operation and maintenance records
- Historic database of high accuracy data to a one minute resolution over the entire life, with option for even higher resolution data
- Flexible analytics and highly customisable reporting
- Hourly production forecasts for up to 7 days in advance

YOUR BENEFITS

- Consistent asset management (optimal resource deployment, site comparison and improvement, best practices)
- Security of investment through maximised operating efficiency and yields
- Invaluable source of information for potential warranty or insurance claims
- Plant performance and availability always “in view”
- Compatibility with different forms of electricity dispatching and trading

“To operate flexibly and independently anywhere in the world – that’s what we call progressive, global thinking and action.”

Stephan Raulin
HEAD OF SALES
PVGuard® MOBILE
MOBILE ACCESS TO PV PLANT

With PVGuard® Mobile, you get worldwide fast access to the most important data across your plant portfolio. The interests of investors and operators are catered for through customized views, with key data about performance and yield being clearly presented on your mobile device.

BENEFITS AT A GLANCE

✓ Mobile access to your entire global power plant portfolio

✓ Shows current status, device data and historic performance

✓ Personalized plant overview with key performance data from your PV systems
PVGuard®

10 BENEFITS TO KEEP YOUR INVESTMENT INTACT
PVGuard®
Supervision Platform

01 PROVIDES VENDOR-INDEPENDENT MONITORING
- String and central inverters
- Energy meters and environment sensors
- Combiner boxes

02 MANAGES ALL YOUR POWER PLANTS, WORLDWIDE
- In a single platform
- With definable areas of responsibility
- Using consistent, user-configurable views

03 VISUALIZES ALL ACQUIRED DATA AND STORES INDIVIDUAL TEMPLATES
- In tables and charts according to your need
- Optimized operation using color-coded heatmaps
- Down to a one-minute resolution

04 COMPARES YOUR PV PLANT DATA
- In consistent views with all relevant parameters
- Regardless of location, with time zone correction
- Across all components, providing a quick overview

05 REPORTS ALARMS
- Automatically from all components
- With detailed fault descriptions
- Clearly displaying alarm processing status
06 CONTROLS YOUR FLEET
✓ With a full supervision log including control and output curtailment
✓ With calculation of expected yields
✓ With alerts for curtailment events

07 STORES HISTORIC DATA
✓ Over the whole lifecycle
✓ Allowing assessment against manufacturer warranty
✓ Providing historical comparison of your data

08 GENERATES FLEXIBLE PLANT REPORTS AND VIEWS
✓ In templates created by yourself
✓ Adapted to your requirements
✓ With your own choice of plant data

09 PRODUCES PRODUCTION FORECASTS
✓ For today, tomorrow or a few days ahead
✓ At an hourly resolution for up to 7 days in advance
✓ Updated several times a day

10 INCORPORATES AN INTEGRATED SERVICE LOG
✓ For documenting operation, service and repair
✓ With links to alarm management
✓ Simplifying compliance with record keeping needs
PVGuard® Add-ons

PVGuard® LOCAL  8SOF00030

Local availability of all monitored data for a PV plant

With PVGuard® Local you can access all data – both live and historic – from your PV plant, whether there is an Internet connection available or not.

It isn’t always possible to monitor PV plants from a remote supervision platform. Using PVGuard® Local you obtain direct access to all your plant’s live and historic data locally, even when there is a break in the Internet connection. Together with the locally installed skyserv® Local server, PVGuard® Local provides long-term storage of all plant data on-site – for up to 20 years. Naturally all data can be exported at any time for reports and further analysis.

Apart from plant data and views, PVGuard® Local also provides you with live images from cameras installed at the plant.

01 Local monitoring of plants independent of an Internet connection
02 Data source is on-site, allowing unimpeded access to live and historical plant data
03 Additional data buffering to provide enhanced data availability

LOCAL ACCESS TO ALL MONITORED DATA

REMOTE MONITORING THROUGH CENTRAL PLATFORM

LOCAL
› On-site access
› Reading and evaluating of live and historical data
› Live images from installed cameras

STAND-ALONE
› Autonomous monitoring – no Internet connection required
› Local storage of all monitored data for up to 20 years
› Unlimited use of historic data
› All monitored data exportable

CLEARLY PRESENTED
› Graphic presentation of inverter status
› Detailed views showing all combiner boxes including all string currents
› User-definable analyses
PVGuard® PRODUCTION FORECASTS

PVGuard® Production Forecasts provide you with reliable forecasts about the expected power output of your PV plant at a defined time – today, tomorrow, or in a few days.

An auto-adaptive algorithm creates forecasts of plant output on the basis of the current weather data and the plant’s actual output over recent weeks. Forecasts are updated multiple times per day and are available to an hourly resolution up to 7 days in advance.

Main Features
› Hourly resolution up to 7 days in advance (up to 5.5 days in the southern and 7 days in the northern hemisphere)
› High-quality weather forecasts from a leading agency
› Fully automated system modelling of the photovoltaic plant
› Continuous adjustment according to varying plant characteristics

PVGuard® DATAPUSH

PVGuard® DataPush assembles the data, transforms it into standard format, packs it into CSV files and delivers these by FTP push to the customer’s remote FTP server. The plant data includes any measured data channel across all devices and sensors in a plant, for example, energy yield, power output, irradiance, performance ratio.

The data compilation can be customized
› Selection of data to be transferred
› Execution interval of data transmission
› Resolution of the data
› Aggregate functions for the data

PVGuard® DataPush performs the following tasks
› The transfer of data to other software systems (analysis and statistics)
› Automated production of reports outside the PVGuard® platform (business intelligence)
› Data transfer to other SCADA systems

The data is provided in a standardized format (CSV) for further processing and analysis.

PVGuard® COM

PVGuard® Com integrates the data of PV systems, which are not equipped with data loggers from skytron® energy into the PVGuard® Supervision Platform. The data from third-party data loggers is automatically imported into the PVGuard®.

PVGuard® COMBOX

As an optional supplement for this import interface, the compact data server PVGuard® ComBox actively fetches the plant information stored on the plant’s data logger. Data retrieval from several data loggers is enhanced by data concentration on the server, and by subsequent data conditioning, for efficient data transmission across the Internet. The server’s web-based user interface allows configuration of data transmission, network settings and administrative features.
O&M SERVICE
Service and Project Engineering

✔ Complete life-cycle O&M services
✔ Plant supervision through our experienced control room staff and technical support for immediate advice
✔ Development of flexible grid integration concepts for enhanced grid stability and balancing
✔ Reengineering of existing monitoring and communication systems
✔ Project engineering, technical due diligence and plant commissioning support
✔ Hands-on workshops based on real-life applications

YOUR BENEFITS

✔ Maintaining value and maximised yields across your plant’s entire life
✔ Shorter plant commissioning times
✔ Trouble-free operation of your power plant
✔ Higher plant availability
✔ Comprehensive service to fulfil all technical requirements
✔ Highly experienced engineering team at your disposal

“Accompanying your project from the beginning – that’s how we ensure the long-term quality of our solution.”
Melanie Lambertz
TEAMLEAD BACKOFFICE-SERVICE
O&M SERVICE
Service and Project Engineering

PVGuard®
SUPERVISION PLATFORM
› PVGuard® continuously monitors your PV system, constantly updates your plant portfolio and promptly alerts you to problems
› Its integrated alarm management simplifies fault tracking
› Thus you have fast access to all the operations data you need – clearly presented and independent of its location, its time zone and the technologies used

OPERATIONS MANAGEMENT
CONTROL CENTRE
› Our expert PV technicians supervise your plants anywhere in the world by using our Control Room Software PVGuard® assuring a high plant availability as well as excellent performance of the power plant
› Detection, confirmation and troubleshooting of issues
› Notification of owners and of maintenance crews within minutes of any production-impacting event
› Creation of reliable energy production forecasts as needed by grid operators and wholesale energy traders

PERFORMANCE ENGINEERING
› Performance engineers track, analyse and optimize asset performance
› We issue predictive maintenance recommendations especially for sensitive components like inverters and transformers to prevent plant or plant component failures
› Daily DC health analysis in order to detect underperformance

O&M SERVICES
MAINTENANCE
› Optimized plant operation and excellent maintenance management ensure a permanent high performance and reliability of your asset
› Our maintenance crews maintain the entire power plant from modules to combiners, trackers, inverters, transformers and medium- or high-voltage switchgear
› We prioritize maintenance activities based on energy, availability, and revenue impact without compromising quality or safety by using our fleet-wide computerized maintenance management system (CMMS)

› Predictive maintenance programs detect common inverter and transformer issues before they become urgent to minimize equipment replacement costs
› Our technicians can even perform maintenance activities at night in order to reduce production impact

SUPERVISION PLATFORM
› Our professional service is based on that – with the goal of a constantly increasing value development and performance of your assets
### MONITORING DATA PLATFORM

<table>
<thead>
<tr>
<th>Features / services available to customers</th>
<th>Optional features / services</th>
<th>Features used by our operations centre staff, only available to customers on request.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real-time supervision software with advanced analytics, alerts &amp; reporting</td>
<td>✖</td>
<td>✖</td>
</tr>
<tr>
<td>Web portal &amp; mobile applications to view plant output &amp; performance</td>
<td>✖</td>
<td>✖</td>
</tr>
<tr>
<td>Real-time control centre software for remote power plant operation</td>
<td>✖</td>
<td>✖</td>
</tr>
<tr>
<td>Data aggregation from multiple third-party software / hardware platforms</td>
<td>✖</td>
<td>✖</td>
</tr>
</tbody>
</table>

### OPERATIONS CENTRE

<table>
<thead>
<tr>
<th>Features / services available to customers</th>
<th>Optional features / services</th>
<th>Features used by our operations centre staff, only available to customers on request.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power plant monitoring and real-time supervision by PV technicians</td>
<td>✖</td>
<td>✖</td>
</tr>
<tr>
<td>Remote power plant control per utility or grid operator instructions</td>
<td>✖</td>
<td>✖</td>
</tr>
<tr>
<td>Regulatory compliance according to system operator requirements</td>
<td>✖</td>
<td>✖</td>
</tr>
<tr>
<td>Energy production forecasting</td>
<td>✖</td>
<td>✖</td>
</tr>
<tr>
<td>Warranty claim management</td>
<td>✖</td>
<td>✖</td>
</tr>
</tbody>
</table>

### PERFORMANCE ENGINEERING

<table>
<thead>
<tr>
<th>Features / services available to customers</th>
<th>Optional features / services</th>
<th>Features used by our operations centre staff, only available to customers on request.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily DC health analysis and recommendations for performance optimization</td>
<td>✖</td>
<td>✖</td>
</tr>
<tr>
<td>Predictive maintenance recommendations to prevent inverter / transformer faults</td>
<td>✖</td>
<td>✖</td>
</tr>
<tr>
<td>Monthly plant performance review &amp; in-depth report</td>
<td>✖</td>
<td>✖</td>
</tr>
</tbody>
</table>

### MAINTENANCE

<table>
<thead>
<tr>
<th>Features / services available to customers</th>
<th>Optional features / services</th>
<th>Features used by our operations centre staff, only available to customers on request.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning, scheduling and supervision of maintenance activities</td>
<td>✖</td>
<td>✖</td>
</tr>
<tr>
<td>Preventive and predictive maintenance (from modules to MV/HV switchgear)</td>
<td>✖</td>
<td>✖</td>
</tr>
<tr>
<td>Corrective maintenance (from modules to MV/HV switchgear)</td>
<td>✖</td>
<td>✖</td>
</tr>
<tr>
<td>Night-time preventive maintenance</td>
<td>✖</td>
<td>✖</td>
</tr>
<tr>
<td>Creation and update of technical training and procedures</td>
<td>✖</td>
<td>✖</td>
</tr>
<tr>
<td>Spare parts and inventory management incl. supply chain management</td>
<td>✖</td>
<td>✖</td>
</tr>
<tr>
<td>On-site staff presence during business hours</td>
<td>✖</td>
<td>✖</td>
</tr>
<tr>
<td>Module cleaning</td>
<td>✖</td>
<td>✖</td>
</tr>
<tr>
<td>Vegetation management</td>
<td>✖</td>
<td>✖</td>
</tr>
<tr>
<td>Other services (grounds maintenance, pest control, water / waste, etc.)</td>
<td>✖</td>
<td>✖</td>
</tr>
</tbody>
</table>

- ✖ Features / services available to customers
- ✖ Optional features / services
- ✖ Features used by our operations centre staff, only available to customers on request.
GET IN TOUCH

CONTACT DETAILS AND CONTACTS

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