



# SI series (350 – 1500 W)

Pure Sine Wave Inverters



- Input/output fully isolated for more application flexibility
- Input and output protected against over and under voltage
- “Low power saving mode” < 1 W (350 W) increases system efficiency and reduces costs
- Advanced microprocessor optimises operation processes while reducing energy consumption
- Status indicator for operation verification
- Usual home appliances (supplied from AC mains) can be integrated in a small solar home system (12-48 voltage range)
- Certified for mobile applications (RVs, cars and many more), certification class B

This new product line of inverters converts DC energy from solar modules into clean, stable AC power that is ideal for powering demanding appliances. Phocos inverters are designed for high efficiency: Integrated advanced microprocessor technology combined with pure sine wave output makes them the perfect choice for use with high-end electronics and electrical equipment. Thanks to their low weight and long lifespan, the SI series is also ideal for mobile

and outdoor applications (e.g. RVs, cars and many more).

An extra advantage: THD < 3 %.

As a special, high performance benefit Phocos True Sine Wave Inverters offer a less than 3 per cent THD (total harmonic distortion), providing top performance and superior efficiency. Overload, short circuit, DC over/under voltage and overheating protection are standard on all models.

| Type: Model - SI 350                    | SI350-12110          | SI350-12230          | SI350-24110          | SI350-24230          |
|-----------------------------------------|----------------------|----------------------|----------------------|----------------------|
| Rated Power                             | 350 W                |                      |                      |                      |
| Surge Power                             | 700 W (6 s)          |                      |                      |                      |
| Input                                   | 12 Vdc               |                      | 24 Vdc               |                      |
| Voltage range                           | 10.5 to 15.5 Vdc     |                      | 21.0 to 31.0 Vdc     |                      |
| Shut down low battery                   | 10.5 Vdc             |                      | 21.0 Vdc             |                      |
| Battery Low Voltage Alarm               | 11.0 Vdc             |                      | 22.0 Vdc             |                      |
| Shut down high battery                  | 16 Vdc               |                      | 32 Vdc               |                      |
| No load current draw (A) @ nom. Voltage | < 0.65               | < 0.9                | < 0.32               | < 0.5                |
| Save Mode (A) min. @ nom. Voltage       | < 0.09               |                      | < 0.06               |                      |
| Output                                  | 110 Vac <sup>1</sup> | 230 Vac <sup>2</sup> | 110 Vac <sup>1</sup> | 230 Vac <sup>2</sup> |
| Output Socket                           | Universal            | Universal            | Universal            | Universal            |
| Efficiency at rated Vdc, full load %    | 90                   | 91                   | 91                   | 93                   |
| Dimensions                              | 210 x 160 x 73 mm    |                      |                      |                      |
| Weight                                  | 1.6 kg               |                      |                      |                      |

**Note:** Due to the high current demanded by inverters, they should be directly connected to the battery terminals.

Selectable:

<sup>1</sup> 100/110/115/120 Vac ± 5%

<sup>2</sup> 200/220/230/240 Vac ± 5%

# SI series (350 – 1500 W)

Pure Sine Wave Inverters

| <b>Type: Model - SI 700</b>          | <b>SI700-12110</b>                                               | <b>SI700-12230</b> | <b>SI700-24110</b>  | <b>SI700-24230</b> | <b>SI700-48110</b>  | <b>SI700-48230</b> |                     |
|--------------------------------------|------------------------------------------------------------------|--------------------|---------------------|--------------------|---------------------|--------------------|---------------------|
| Rated Power                          | 700 W                                                            |                    |                     |                    |                     |                    |                     |
| Surge Power                          | 1400 W (6 s)                                                     |                    |                     |                    |                     |                    |                     |
| Input                                | 12 Vdc                                                           |                    | 24 Vdc              |                    | 48 Vdc              |                    |                     |
| Voltage range                        | 10.5 to 15.5 Vdc                                                 |                    | 21.0 to 31.0 Vdc    |                    | 42.0 to 60.0 Vdc    |                    |                     |
| Shut down low battery                | 10.5 V                                                           |                    | 21.0 V              |                    | 42.0 V              |                    |                     |
| Battery Low Voltage Alarm            | 11.0 V                                                           |                    | 22.0 V              |                    | 44.0 V              |                    |                     |
| Shut down high battery               | 16 V                                                             |                    | 32 V                |                    | 61 V                |                    |                     |
| No load current draw (A)             | < 1.25                                                           | < 1.2              | < 0.64              | < 0.6              | < 0.31              | < 0.28             |                     |
| Stand-by current draw (A)            | < 0.25                                                           |                    | < 0.15              |                    | < 0.08              |                    |                     |
| Output                               | 110 Vac                                                          | 230 Vac            | 110 Vac             | 230 Vac            | 110 Vac             | 230 Vac            |                     |
| Output Socket                        | Universal                                                        | Universal          | Universal           | Universal          | Universal           | Universal          |                     |
| Efficiency at rated Vdc, full load % | 89                                                               | 91                 | 92                  | 91                 | 93                  | 94                 |                     |
| Dimensions                           | 310 x 192 x 75 mm                                                |                    |                     |                    |                     |                    |                     |
| Weight                               | 2.7 kg                                                           |                    |                     |                    |                     |                    |                     |
| <b>Type: Model - SI 1500</b>         | <b>SI1500-24110</b>                                              |                    | <b>SI1500-24230</b> |                    | <b>SI1500-48110</b> |                    | <b>SI1500-48230</b> |
| Rated Power                          | 1500 W                                                           |                    |                     |                    |                     |                    |                     |
| Surge Power                          | 3000 W (6 s)                                                     |                    |                     |                    |                     |                    |                     |
| Input                                | 24 Vdc                                                           |                    |                     |                    | 48 Vdc              |                    |                     |
| Voltage range                        | 21.0 to 31.0 Vdc                                                 |                    |                     |                    | 42.0 to 60.0 Vdc    |                    |                     |
| Shut down low battery                | 24.0 Vdc                                                         |                    |                     |                    | 42.0 Vdc            |                    |                     |
| Battery Low Voltage Alarm            | 22.0 Vdc                                                         |                    |                     |                    | 44.0 Vdc            |                    |                     |
| Shut down high battery               | 32 Vdc                                                           |                    |                     |                    | 61.0 Vdc            |                    |                     |
| No load current draw (A)             | < 0.75                                                           |                    | < 0.7               |                    | < 0.4               |                    | < 0.4               |
| Stand-by current draw (A)            | < 0.15                                                           |                    |                     |                    | < 0.09              |                    |                     |
| Output                               | 110 Vac                                                          |                    | 230 Vac             |                    | 110 Vac             |                    | 230 Vac             |
| Output Socket                        | Universal                                                        |                    | Universal           |                    | Universal           |                    | Universal           |
| Efficiency at rated Vdc, full load % | 92                                                               |                    | 90                  |                    | 93                  |                    | 94                  |
| Dimensions                           | 420 x 205 x 90 mm                                                |                    |                     |                    |                     |                    |                     |
| Weight                               | 4.8 kg                                                           |                    |                     |                    |                     |                    |                     |
| <b>All inverters</b>                 |                                                                  |                    |                     |                    |                     |                    |                     |
| AC Regulation                        | +/- 3%                                                           |                    |                     |                    |                     |                    |                     |
| Frequency swith select. (Hz)         | 50/60 +/-0.1%                                                    |                    |                     |                    |                     |                    |                     |
| Protections                          | Overload, Short Circuit, DC over/under Voltage, over Temperature |                    |                     |                    |                     |                    |                     |
| Waveform                             | True Sine Wave                                                   |                    |                     |                    |                     |                    |                     |
| Power factor cos Ø                   | -90° to + 90°                                                    |                    |                     |                    |                     |                    |                     |
| Operating temperature                | -20° C to + 40° C                                                |                    |                     |                    |                     |                    |                     |
| Storage temperature                  | -30° C to + 70° C                                                |                    |                     |                    |                     |                    |                     |
| Max. humidity operating              | 90%                                                              |                    |                     |                    |                     |                    |                     |
| Safety Standards                     | Meet UL458                                                       |                    |                     |                    |                     |                    |                     |
| Cooling                              | Load/temperature controlled fan                                  |                    |                     |                    |                     |                    |                     |
| Reverse polarity protection          | No, will result in permanent damage                              |                    |                     |                    |                     |                    |                     |
| Remote control unit                  | CR-6 (not for model SI 350) for 12 V and 24 V                    |                    |                     |                    |                     |                    |                     |

Datasheet\_SI series\_2/2\_e\_2011-08-19\_Subject to change without notice

## Pico Lamp

Power LED Lamp



- Rechargeable from 7 V to 25 V solar panel, 12 V car or solar battery, or AC adaptor
- Innovative capacitive switch: no moving parts, no corrosion
- High environmental protection (IP65) against soil and climate influences
- USB output to charge mobile phones, MP3 players, etc.
- High-power LED
- 3 light levels
- Automatic reduction of the lighting level when batteries are running down
- Modularly expandable

The Pico Lamp is a multifunctional stationary or mobile lighting device that is specially designed to meet the needs of rural households and recreational activities. It is equipped with a high-efficiency power LED and excellent charging technology.

The device can easily be installed as a ceiling lamp or is portable to use as a flashlight. The Pico features industry-leading charge capacity which allows the user to have sufficient light for up to 55 hours depending upon the level of light selected. The high-power LED supplies up to 120 lumens of light and has an extremely long lifespan (50,000 h).

Equipped with a USB output, the Pico Lamp also facilitates fast mobile phone or MP3 player charging. A robust sealed housing ensures continued function in dusty or humid environments. The capacitive touch switch has no moving parts and is fully protected against corrosion.

With the Pico Accessory Series, the Pico Lamp can be extended to a modular lighting system. It can be configured precisely according to the needs of the user.

### **Optionally available: Pico Lamp Accessory Series**

- USB mobile phone adaptor for most common brands
- AC charger, 12 V car adaptor
- Remote switch
- USB Extension with 3 m cable
- NiMH 2100 mAh rechargeable batteries
- 3 W and 5 W module
- USB Hub for using remote switch and charging mobile phone at the same time
- Pico System Expander: Allows charging and operation of multiple Pico Lamps in the same system

# Pico Lamp

Power LED Lamp

| Type                                          | Pico                                                                                                                                                                                       |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Battery                                       | 6 V (4 x AA NiMH, 2100 mAh, low self-discharge)                                                                                                                                            |
| Full charge/discharge cycle                   | > 500 cycles                                                                                                                                                                               |
| Light intensity                               | 120 lm                                                                                                                                                                                     |
| Light color                                   | 3,950 to 4,300 K                                                                                                                                                                           |
| Lighting level (time)                         | 3 settings: Standard: 50 lm (16.5 h); Low: 20 lm (55 h); High: 120 lm (5.5 h)                                                                                                              |
| DC charging input                             | Solar module UMPP > 7 V, Uoc < 25 V (max. 1.5 A @ 7 V) or battery<br>12 V (max. charging current 800 mA)                                                                                   |
| Barrel connector for panel/ DC charging input | Ø: 5.5 x 2.5 mm                                                                                                                                                                            |
| Ambient temperature range                     | -20 to +50 °C                                                                                                                                                                              |
| Charging technology                           | High-efficiency MPPT (Maximum Power Point Tracker)                                                                                                                                         |
| Charging via a 3 Wp solar panel               | 3 to 5 hours for a full charge depending on incident solar radiation                                                                                                                       |
| AC or 12 V battery charging                   | Completely charged in 2.5 hours                                                                                                                                                            |
| Mobile phone charging                         | About 2 hours are needed for full charge of a mobile phone                                                                                                                                 |
| Special Features                              | <ul style="list-style-type: none"> <li>• Modularly expandable</li> <li>• Phosphorescent ring for easy location in the dark</li> <li>• External remote on/off switching (option)</li> </ul> |
| Warranty                                      | 2 year warranty on electronics                                                                                                                                                             |
| Fitting                                       | Steel hoop with seven notches for positioning (45° steps)                                                                                                                                  |
| Weight                                        | 570 g                                                                                                                                                                                      |
| Dimensions                                    | 296 x Ø 155 mm                                                                                                                                                                             |
| Type of protection                            | IP 65                                                                                                                                                                                      |
| <b>USB Charge Data</b>                        |                                                                                                                                                                                            |
| Output voltage                                | 4.4 – 5.1 V                                                                                                                                                                                |
| Nominal output current                        | 750 mA                                                                                                                                                                                     |
| Overload and short-circuit protection         | Yes                                                                                                                                                                                        |
| Plug                                          | USB-A                                                                                                                                                                                      |

## SL LED (3 – 9 W)

DC High Power LED Lamps



- Extremely low power consumption
- Very high illumination efficiency
- Lifespan 50,000 h
- Infinite number of switching cycles
- Standard socket E27
- Metal housing

The Phocos solar SL LED lamp provides high illumination levels with very low power consumption and a long lifespan. The 12 V DC lamps can be used directly in 12 V battery or

solar systems without any ballast. More than 80% of the luminosity is retained after 50,000 hours. The lamp has a standard E27 socket.

| Type                | SL 1230NF210            | SL 1290NF630           |
|---------------------|-------------------------|------------------------|
| Voltage range       | 9V - 15V                |                        |
| Power consumption   | 3 W                     | 9 W                    |
| Supply current      | 240 mA @ 12,5 V ± 10%   | 720 mA @ 12,5 V ± 10 % |
| Luminous intensity  | > 210 lm                | > 630 lm               |
| Luminous efficiency | > 70 lm/W               |                        |
| Irradiation angle   | 170°                    |                        |
| Light color         | 3,950 K - 4,300 K       |                        |
| Temperature range   | -20 °C to +50 °C        |                        |
| Humidity            | Max. 95% not condensing |                        |
| Socket              | E27                     |                        |
| Diameter            | 50 mm                   | 92 mm                  |
| Length              | 90 mm                   | 165 mm                 |
| Type of protection  | IP20                    |                        |

## CIS-LED series (5 – 20 A)

Solar Charge Controller



- Combines three functions in one: charge controller + flexible timer + LED drivers
- Developed especially for rough environments, solar LED lamps, and solar LED street lights
- Fully protected by the encapsulated case (protection class IP68): increased lifetime and reliability, reduced costs
- Flexible dimming functions: renders ambient, pleasant light and extends operation time
- Auto-protect function: two voltage disconnects extends system operation time and reliability
- Small size: fits everywhere

### CIS series:

Charge controllers are the core of every PV system, precisely controlling the energy flow, protecting the battery, and increasing system efficiency. Harsh weather conditions may damage the electronics. In order to protect these core elements, increase system operation time, reliability, and efficiency, Phocos has designed a product line with fully encapsulated housing (protection class IP68): the CIS series.

It is the first line of fully encapsulated 4-stage PWM-charge controllers that can withstand extreme temperature shocks, dust, and water.

CIS series charge controllers with temperature compensation are extremely robust, since there are no moving parts, switches, or buttons. All connections to other devices are made by conductors rather than wire terminals, eliminating risk of damage from external influences. Settings such as battery type, deep discharge disconnects, timers, and other configuration items are made quick and easily by an infrared remote control. The small size of the devices renders extra flexibility, as they fit into every application.

### CIS-LED series:

The Phocos CIS series has now has new members. Specifically developed for rough environments and especially for the requirements of users of solar LED lamps and solar LED

street lights: the CIS-LED series. The highlight of this series is that it combines three functions in one fully protected case: charge controller + flexible timer + LED drivers. The energy required to power LEDs is directly delivered by the charge controller. No other power source is required. Customers get three solutions included in one single product, with many advantages:

- The built-in LED drivers (for up to three LED strings), timer and charge controller are harmonically combined and protected in one fully encapsulated housing (IP68), increasing system reliability, lifetime and lowering investment costs.
- An on/off timer combined with an adjustable dimming function renders flexibility extending operation time and futuremore, saves energy.
- CIS-LED series also offers an auto-protect function: by means of its two low voltage disconnect levels, the LEDs light will automatically be dimmed when the charge of the battery is getting low. The levels can be programmed by means of remote control CIS-CU.

Datasheet\_CIS-LED series\_1/2\_e\_2011-08-04\_Subject to change without notice

# CIS-LED series (5 – 20 A)

Solar Charge Controller

| Type                                                       | CIS-LED 05 1S                                                                        | CIS-LED 10 2S       | CIS-LED 20 3S       |
|------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------|---------------------|
| System voltage                                             | 12 V                                                                                 |                     |                     |
| Max. charge/current                                        | 5 A                                                                                  | 10 A                | 20 A                |
| Float charge                                               | 13.8 V (25 °C)                                                                       |                     |                     |
| Main charge                                                | 14.4 V (25 °C), 30 min. (daily)                                                      |                     |                     |
| Boost charge                                               | 14.4 V (25 °C), 2 h<br>Activation: battery voltage < 12.3 V                          |                     |                     |
| Equalization                                               | 14.8 V (25 °C), 2 h<br>Activation: battery voltage < 12.1 V (at least every 30 days) |                     |                     |
| Deep discharge protection:                                 |                                                                                      |                     |                     |
| Cut-off voltage                                            | 11 – 12 V                                                                            |                     |                     |
| Reconnect level                                            | 12.8 V                                                                               |                     |                     |
| Overvoltage protection                                     | 15.5 V                                                                               |                     |                     |
| Undervoltage protection                                    | 10.5 V                                                                               |                     |                     |
| Max. panel voltage<br>(Overvoltage protection by varistor) | 30 V @ 12 V                                                                          |                     |                     |
| Temperature compensation<br>(Charge voltage)               | –25 mV/K at 12 V                                                                     |                     |                     |
| Max. self consumption                                      | 5 – 10 mA                                                                            |                     |                     |
| Grounding                                                  | Negative terminal grounded                                                           |                     |                     |
| Ambient temperature                                        | –40 to +60 °C                                                                        |                     |                     |
| Max. altitude                                              | 4,000 m above sea level                                                              |                     |                     |
| Battery type                                               | Lead acid (GEL, AGM, flooded)                                                        |                     |                     |
| Adjustment range:                                          |                                                                                      |                     |                     |
| Evening/morning hours timer                                | 0 – 15 h / 0 – 14 h                                                                  |                     |                     |
| Night/day PV panel level detection                         | 2.5 – 10 V                                                                           |                     |                     |
| Connection Wire length                                     | 10 cm                                                                                |                     |                     |
| Dimensions (W x H x D)                                     | 82 x 58 x 20 mm                                                                      |                     |                     |
| Weight                                                     | 150 g                                                                                |                     |                     |
| Wire cross section                                         | 1.5 mm <sup>2</sup>                                                                  | 1.5 mm <sup>2</sup> | 2.5 mm <sup>2</sup> |
| Type of protection                                         | IP68 (1.5 m, 72 h)                                                                   |                     |                     |

| LED driver data                               | CIS-LED 05                             | CIS-LED 10 | CIS-LED 20 |
|-----------------------------------------------|----------------------------------------|------------|------------|
| Output voltage                                | 15 V to 38 V (5 to 10 LEDs per string) |            |            |
| Nominal output current per sting              | 300 mA                                 |            |            |
| Length of LED temperature sensor<br>conductor | 50 cm                                  |            |            |
| Dimming level                                 | 0 – 100% (adjust step 10%)             |            |            |

Datasheet\_CIS-LED series\_2/2\_e\_2011-08-04\_Subject to change without notice

## CIS-N series (5 – 20 A)

Solar Charge Controller



- Developed for applications in demanding and harsh environments, especially in the oil and gas industry
- Fully protected by the encapsulated case (protection class IP68): increased lifetime and reliability, reduced costs
- Intelligent timer and dimming functions available for lighting control
- Auto-protect function: two voltage disconnects extends system operation time and reliability
- Can be operated via the remote control unit CIS-CU
- Small size: fits everywhere
- Negative grounded

### CIS series:

Charge controllers are the core of every PV system, precisely controlling the energy flow, protecting the battery, and increasing system efficiency.

Harsh weather conditions may damage the electronics. In order to protect these core elements, thus increasing system operation time, reliability, efficiency, and saving costs, Phocos has designed a product line with a fully encapsulated housing (protection class IP68): the CIS series.

It is the first line of fully encapsulated 4-stage PWM-charge controllers that withstand extreme temperature shocks, dust, and water. CIS series charge controllers are extremely robust, as they do not contain any moving parts, switches, or buttons. All connections to other devices are realized by lead wires rather than wire terminals, eliminating risk of damage from external influences. Settings such as battery type, deep discharge thresholds, timers, and other configuration items are made quickly and easily by infrared remote control. The high quality 4-stage PWM-charging is combined with low voltage disconnect, flexible load timer functions, and a multi-LED system status display. The small size of the devices gives extra flexibility, as they fit in every application.

It is available in two versions:

- A single load version with dimming output (CIS): the CIS comes with a load and a control output for dimmable ballasted lamps.
- A dual load version with two load outputs (CIS-2L): the CIS-2L comes with two charge outputs to independently control two loads.

### CIS-N series:

CIS-N series is a new member of the CIS series. It was specifically developed to bring optimum performance and the useful features of the popular positive-grounded CIS charge controller to negative-grounded applications. Thanks to its robustness and design, this charge controller is ideal for applications in demanding environments like the gas and oil industry, for traffic systems (e.g. traffic control systems, signal lamps), and for any PV applications which are exposed to harsh environmental conditions.

Datasheet\_CIS-N series\_1/2\_e\_2011-05-23\_Subject to change without notice

# CIS-N series (5 – 20 A)

Solar Charge Controller

| Type                                                       | CIS-N-05                                                                                       | CIS-N-10            | CIS-N-20            |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------|---------------------|---------------------|
|                                                            | CIS-N-05-2L                                                                                    | CIS-N-10-2L         | CIS-N-20-2L         |
| System voltage                                             | 12/24 V auto recognition                                                                       |                     |                     |
| Max. charge current                                        | 5 A                                                                                            | 10 A                | 20 A                |
| Float charge                                               | 13.8/27.6 V (25 °C)                                                                            |                     |                     |
| Main charge                                                | 14.4/28.8 V (25 °C), 30 min. (daily)                                                           |                     |                     |
| Boost charge                                               | 14.4/28.8 V (25 °C), 2 h<br>Activation: battery voltage < 12.3/24.6 V                          |                     |                     |
| Equalization                                               | 14.8/29.6 V (25 °C), 2 h<br>Activation: battery voltage < 12.1/24.2 V (at least every 30 days) |                     |                     |
| Deep discharge protection:                                 |                                                                                                |                     |                     |
| Cut-off voltage                                            | 11 – 12 V / 22 – 24 V                                                                          |                     |                     |
| Reconnect level                                            | 12.8/25.6 V                                                                                    |                     |                     |
| Overvoltage protection                                     | 15.5/31.0 V                                                                                    |                     |                     |
| Undervoltage protection                                    | 10.5/21 V                                                                                      |                     |                     |
| Max. panel voltage<br>(Overvoltage protection by varistor) | 50 V @ 24 V / 30 V @ 12 V                                                                      |                     |                     |
| Temperature compensation<br>(Charge voltage)               | –25 mV/K at 12 V<br>–50 mV/K at 24 V                                                           |                     |                     |
| Max. self consumption                                      | 5 – 8 mA at 12 V<br>6 – 10 mA at 24 V                                                          |                     |                     |
| Grounding                                                  | Negative terminal grounded                                                                     |                     |                     |
| Ambient temperature                                        | –40 to +60 °C                                                                                  |                     |                     |
| Max. altitude                                              | 4,000 m above sea level                                                                        |                     |                     |
| Battery type                                               | Lead acid (GEL, AGM, flooded)                                                                  |                     |                     |
| Adjustment range:                                          |                                                                                                |                     |                     |
| Evening/morning hours                                      | 0 – 15 h / 0 – 14 h                                                                            |                     |                     |
| Night/day detection                                        | 2.5 – 10 V                                                                                     |                     |                     |
| Connection Wire length                                     | 10 cm                                                                                          |                     |                     |
| Dimensions (W x H x D)                                     | 82 x 58 x 20 mm                                                                                |                     |                     |
| Weight                                                     | 150 g                                                                                          |                     |                     |
| Wire cross section                                         | 1.5 mm <sup>2</sup>                                                                            | 1.5 mm <sup>2</sup> | 2.5 mm <sup>2</sup> |
| Type of protection                                         | IP68 (1.5 m, 72 h)                                                                             |                     |                     |
| <b>Technical data dimming output</b>                       | <b>CIS-N-05</b>                                                                                | <b>CIS-N-10</b>     | <b>CIS-N-20</b>     |
| Dimming value                                              | 0 – 100% output power                                                                          |                     |                     |
| Dimming output voltage                                     | 0 – 10 V (max. 1 mA)                                                                           |                     |                     |

## CIS series (5 – 20 A)

Solar Charge Controller



- Can be ordered with one output as on-off switch and another as output with dimmer function (CIS) or two on-off switches (CIS-2L)
- Corrosion-proof epoxy-encapsulated PCB (IP68)
- Compact size
- Infrared remote control programming accessory (CU)
- Intelligent timer functions available for lighting control
- Four-stage battery charging (main, float, boost, equalization), temperature compensated
- Automatic system voltage recognition (12/24 V)

Isolated PV systems exposed to extreme weather/environmental conditions (streetlights, navigation buoys, etc.) have increased risk for damage to the power electronics. In order to assure reliable battery protection under such conditions, Phocos developed a fully encapsulated charge controller to prevent corrosion: CIS.

CIS is an industrial-grade charge controller that is suitable for all practical PV applications. It conforms to the IP68 protection system. Four-stage PWM-charging is combined with low-voltage disconnect, flexible load timer functions, and a multi-LED system status display. CIS is available in two versions:

**SingleLoad version with dimming output (CIS):** The CIS comes with a charge output and a control output for dimmable ballasted lamps.

**DualLoad version with two load outputs (CIS-2L):** The CIS-2L comes with two charge outputs to independently control two loads.

The CIS has no moving parts, switches, or buttons. Settings such as battery type, deep discharge thresholds, timers, and other configuration items are made quick and easy by infrared remote control.



Datasheet\_CIS series\_1/2\_e\_2011-04-01\_Subject to change without notice

# CIS series (5 – 20 A)

Solar Charge Controller

| Type                                                       | CIS 05                                                                                         | CIS 10              | CIS 20              |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------|---------------------|---------------------|
|                                                            | CIS-2L 05                                                                                      | CIS-2L 10           | CIS-2L 20           |
| System voltage                                             | 12/24 V auto recognition                                                                       |                     |                     |
| Max. charge/load current                                   | 5 A                                                                                            | 10 A                | 20 A                |
| Float charge                                               | 13.8/27.6 V (25 °C)                                                                            |                     |                     |
| Main charge                                                | 14.4/28.8 V (25 °C), 30 min. (daily)                                                           |                     |                     |
| Boost charge                                               | 14.4/28.8 V (25 °C), 2 h<br>Activation: battery voltage < 12.3/24.6 V                          |                     |                     |
| Equalization                                               | 14.8/29.6 V (25 °C), 2 h<br>Activation: battery voltage < 12.1/24.2 V (at least every 30 days) |                     |                     |
| Deep discharge protection:                                 |                                                                                                |                     |                     |
| Cut-off voltage                                            | 11 – 12 V / 22 – 24 V                                                                          |                     |                     |
| Reconnect level                                            | 12.8/25.6 V                                                                                    |                     |                     |
| Overvoltage protection                                     | 15.5/31.0 V                                                                                    |                     |                     |
| Undervoltage protection                                    | 10.5/21 V                                                                                      |                     |                     |
| Max. panel voltage<br>(Overvoltage protection by varistor) | 55 V                                                                                           |                     |                     |
| Temperature compensation<br>(Charge voltage)               | –25 mV/K at 12 V<br>–50 mV/K at 24 V                                                           |                     |                     |
| Max. own consumption                                       | 5 – 8 mA at 12 V<br>6 – 10 mA at 24 V                                                          |                     |                     |
| Grounding                                                  | Positive grounding possible                                                                    |                     |                     |
| Ambient temperature                                        | –40 to +60 °C                                                                                  |                     |                     |
| Max. altitude                                              | 4,000 m above sea level                                                                        |                     |                     |
| Battery type                                               | Lead acid (GEL, AGM, flooded)                                                                  |                     |                     |
| Adjustment range:                                          |                                                                                                |                     |                     |
| Evening/morning hours                                      | 0 – 15 h / 0 – 14 h                                                                            |                     |                     |
| Night/day detection                                        | 2.5 – 10 V                                                                                     |                     |                     |
| Wire length                                                | 10 cm                                                                                          |                     |                     |
| Dimensions (W x H x D)                                     | 82 x 58 x 20 mm                                                                                |                     |                     |
| Weight                                                     | 150 g                                                                                          |                     |                     |
| Wire cross section                                         | 1.5 mm <sup>2</sup>                                                                            | 1.5 mm <sup>2</sup> | 2.5 mm <sup>2</sup> |
| Type of protection                                         | IP68 (1.5 m, 72 h)                                                                             |                     |                     |
| <b>Technical data dimming output</b>                       | <b>CIS 05</b>                                                                                  | <b>CIS 10</b>       | <b>CIS 20</b>       |
| Dimming value                                              | 0 – 100% output power                                                                          |                     |                     |
| Dimming output voltage                                     | 0 – 10 V (max. 1 mA)                                                                           |                     |                     |

# Dingo (20 A)

Solar Charge Controller



- Symmetrical charging and load current of 20 A each
- Four-stage charging method (industry standard)
- 12/24/32/36/48-V selectable battery voltage
- Exceptionally thermally robust: full charging current and load current without interruption in operation, even at 50 °C
- Single-button operation and easy-to-understand menu structure

The Dingo has a negative ground and can therefore easily be used in vehicles. Its communication interface makes use of the MODBUS protocol, which has been tried and tested in harsh environments. Its large memory allows data to be stored such as charging Ah, load Ah, battery voltage range

and the daily state of charge for 512 days. The data of the past 99 days can be accessed using the LC display with LED backlighting. Zero-potential contacts, which are required in many generator starting systems, are now included in the basic model of the charge controller.

| Type                      | Dingo                            |
|---------------------------|----------------------------------|
| Nominal voltage           | 12/24/32/36/48 V                 |
| Max. solar panel current  | 20 A                             |
| Max. load current         | 20 A                             |
| Regulation set points     | 4 preset programs or user adjust |
| Weight                    | 455 g                            |
| Ambient temperature range | -20 to +55 °C                    |
| Grounding                 | negative grounding possible      |
| Max. wire size            | 16 mm <sup>2</sup> (6 AWG)       |
| Mounting hole spacing     | 116 mm                           |
| Mounting hole size        | 5 mm                             |
| Dimensions (W x H x D)    | 137 x 121 x 45 mm                |
| Self consumption          | 9 mA@12 V, max. 26 mA@60 V       |
| Case                      | polycarbonate                    |
| Heatsink                  | anodised aluminium               |

# MCS

Modular Current Sensor



- Current meter
- Variable resolutions by shunt (50/100/200/400/800 A)
- Plug & Play setup
- Two-LED status indicator
- Powder-coated metal case

The MCS (Modular Current Sensor) is a component of the Modular Power Management controller family. MCS works in combination with MCU (Modular Central Unit) within the modular power management system. MCS measures system current In and Out of the battery which is not otherwise collected by other MPM units. This can be charge current from Wind and/or Diesel Generators or load current used by Inverters. Equipped with a current shunt, the MCS measures current in the measurement range of 50 A up to 800 A and reports to the MCU for data logging system analysis and monitoring purposes.

MCS can be connected to any free bus port within the Modular Power Management system. Simple DIP-Switch

settings for address allocation and current range setting (according to the applied current shunt) is made at the time of installation. No further configuration is necessary. A sensor cable is connected to the current shunt. Two LED's display the status of the unit. MCS is built into a robust metal housing which is prepared for DIN-rail mounting. MCS and the Phocos Modular Power Management family allow for an unprecedented variety of PV-Hybrid System designs. The modular nature of this controller family assures simple, customized and safe system design with amazing expandability potential. The use of intelligent components such as MCS and MCU provides complete system performance monitoring for accurate system analysis.

| Type                      | MCS                          |
|---------------------------|------------------------------|
| Current measurement range | 50/100/200/400/800 A (shunt) |
| Dimensions (W x H x D)    | 26 x 80 x 50 mm              |
| Weight                    | 150 g                        |
| Input voltage range       | 0 – 50 mV                    |
| Length of sensor wire     | 50 cm                        |
| Temperature range         | -40 to +60 °C                |
| Self consumption          | < 15 mA                      |
| Mounting                  | DIN rail                     |

## MCU 2.0

Modular Central Unit



- Synchronizes up to 16 power modules (MPS/MPPT) (up to 8 MPM chargers, up to 8 MPM load switches, up to 4 MCS shunt interfaces)
- Excess energy management
- Up to five years datalogging memory
- Relay control output
- Intelligent load management
- PC interface
- Advanced diversion control
- DIN rail mounting

As the central control unit, MCU is a key component of Phocos' modular power management family. MCU offers a variety of functions such as priority load management based on user-adjustable voltage thresholds as well as control or alarm functions through an integrated relay control output. This intelligent control unit allows for the synchronization of up to sixteen Phocos power modules (MPPT/MPS) while providing complete system monitoring with integrated datalogging memory.

MCU's features open an endless spectrum of system design possibilities and combinations. Customizing your system electronics is as simple as choosing the appropriate Modular Power Management components for the application and assigning their responsibilities. This flexibility eliminates production lead times for customized electronics for standalone power supplies.

| Type                   | MCU               |
|------------------------|-------------------|
| Nominal voltage        | 12/24/48 V        |
| Self consumption       | < 20 mA           |
| Ambient temperature    | -25 to +50 °C     |
| Dimensions (W x H x D) | 90 x 150 x 112 mm |
| Weight                 | 380 g             |
| Type of protection     | IP22              |

# MPPT 100/30 (30 A)

Maximum Power Point Tracker



- Maximum Power Point Tracking technology increases the efficiency of your PV system
- Less expensive solar-panels for gridfeed-in systems can now be used for 12/24 V off-grid systems
- Electronic protection (reverse polarity, over-current, short-circuit, overtemperature)
- High efficiency
- DIN Rail compatible
- Negative ground

With innovative maximum-power-tracking technology, Phocos' MPP-Tracker ensures maximum performance from your solar array at all times and in all weather conditions. The MPPT can yield an energy gain from your PV array (up to 30%). When a Central Unit is used, up to 8 MPPTs can be used together in one system. The charge regulation is then done via data bus by the Central Unit. This will enable

you to increase your system capacity substantially.

The temperature-compensated three-stage I-U curve charge regulation algorithm significantly extends the lifespan of your battery. The possibility to use less expensive grid-feed-in solarpanels with up to 95 V open circuit voltage for 12 V or 24 V stand-alone systems will significantly reduce the cost of the total system.

| Type                           | MPPT 100/30                                                                      |
|--------------------------------|----------------------------------------------------------------------------------|
| Nominal voltage                | 12/24 V, automatic recognition                                                   |
| Nominal battery charge current | 30 A                                                                             |
| Max. solar input voltage Voc   | 95 V                                                                             |
| Max. PV input power            | 450 W@12 V, 900 W@24 V                                                           |
| Max. battery charge current    | 33 A                                                                             |
| Power conversion efficiency    | up to 98%                                                                        |
| Standby power consumption      | < 30 mW at 12 V system voltage (< 2 mA); < 80 mW at 24 V system voltage (< 3 mA) |
| Temperature compensation       | -24 mV/K (12 V); -48 mV/K (24 V)                                                 |
| Max. wire size                 | 35 mm <sup>2</sup>                                                               |
| Dimensions (W x H x D)         | 185 x 150 x 115 mm                                                               |
| Weight                         | 1.6 kg                                                                           |
| Temperature range              | -40 to +50 °C                                                                    |
| Type of protection             | IP22                                                                             |
| Float charge                   | 13.8/27.6 V (25 °C)                                                              |
| Main charge                    | 14.4 V/28.8 V (25 °C), 0.5 h (daily)                                             |
| Boost charge activation        | 14.4/28.8 V (25 °C), 2 h battery voltage < 12.3/24.6 V                           |
| Equalization activation        | 14,8/29,6 V (25 °C), 2 h battery voltage < 12.1/24.2 V                           |
| Max. battery voltage           | 32 V                                                                             |
| Grounding                      | Negative grounding                                                               |
| Battery type                   | Lead (GEL, AGM, float)                                                           |

Datasheet\_MPPT 100/30\_1/1\_e\_2011-11-17\_Subject to change without notice

## MPS series (45 – 80 A)

Modular Power Switch



- 12/24/48 V (automatic oder manually selectable)
- Low-voltage or overcharge disconnect (adjustable)
- Overcharge protection
- Pulse-width modulation or two-point series switching
- Can also be used with hybrid systems
- Excess energy management
- Flexible grounding
- DIN rail mounting

The MPS is Phocos's innovative new multi-functional power switching module for stand-alone power systems.

It can be configured to operate as an overcharge or deep discharge protection unit in PV systems as well as a dumpload controller for wind and micro-hydro turbine systems. A single MPS unit can control up to 80 A of current. Switching can be set for pulse-width modulation, two-point series switching, or dumpload in order to protect your system against overcharge or deep discharge.

The power electronics allow for positive or negative grounding. The power switch is a fundamental unit within Phocos's innovative Modular Power Management range. Multiple MPS units can be operated together with the help of Phocos's MCU modular control unit and can control up to 200 A of total load current and up to 640 A of charge current in steps of 45 or 80 amperes.

MPS is a cost-effective, simple, yet versatile power switch and offers a valuable solution for stand-alone PV, wind, micro-hydro, or hybrid power systems.

| Type                   | MPS 45                                      | MPS 80  |
|------------------------|---------------------------------------------|---------|
| Nominal voltage        | 12/24/48 V (automatic or manually selected) |         |
| Load current max.      | 45 A                                        | 80 A    |
| Own consumption        | < 10 mA                                     |         |
| Ambient temperature    | -40 to +50 °C                               |         |
| Dimensions (W x H x D) | 108 x 150 x 112 mm                          |         |
| Weight                 | 1,007 g                                     | 1,100 g |
| Type of protection     | IP22                                        |         |

# MRD

Remote Display for Phocos MCU



- Displays panel current, load current, and battery voltage, Ah, SOC, etc.
- Large three-digit LCD display
- Displayed values selectable by means of two push buttons
- DIN rail adapter and wall mounting possible

The Phocos MRD can be used in combination with Phocos MCU via interface connector. Phocos MRD remote display is designed to display panel current, load current, and battery voltage of your PV system as actual values. In addition,

several values like Ah, SOC battery voltage (morning, evening) from the MCU data logger can be displayed.

| Type                    | MRD                               |
|-------------------------|-----------------------------------|
| Voltage range           | 10 V - 70 V                       |
| Current range           | 0 - 640 A                         |
| Ambient temperature     | -10 to +55 °C                     |
| Connecting cable length | 6 m                               |
| Dimensions (W x H x D)  | 72 x 68 x 29 mm                   |
| Weight                  | 94 g (including connecting cable) |
| Type of protection      | IP22                              |

# MTS

Modular Temperature Sensor



- Compatible with modular power
- Management (MPM)
- Robust design (IP 54)
- Simple assembly
- Wide temperature range
- Optimizes battery calculation

The MTS is an external temperature sensor specifically designed for the use in off-grid PV- and PVhybrid-systems. It is an accessory for the innovative Modular Power Management (MPM) family from Phocos. The MTS can be integrated when the Phocos MCU is available in the system design. All components within the MPM family are equipped with internal temperature compensation. Should the temperature at the battery bank be significantly different from the temperature at the MPM components, MTS can be used to measure battery temperature and optimize the battery calculation.

The installation of the MTS is quick and easy thanks to the simple connection and the robust mounting design. The temperature sensor is installed directly to the battery and is connected via RJ-11 plug to any free bus port on MPM. The MTS works reliably and accurately within a specified temperature range of  $-40\text{ }^{\circ}\text{C}$  to  $+80\text{ }^{\circ}\text{C}$ . The integration of this temperature sensor ensures precise regulation by MPM at all times, thus, extending battery lifetime.

| Type                   | MTS                                               |
|------------------------|---------------------------------------------------|
| Temperature range      | $-40$ to $+80\text{ }^{\circ}\text{C}$            |
| Measurement accuracy   | $\pm 1\text{ }^{\circ}\text{C}$                   |
| Self consumption       | $< 10\text{ mA}$                                  |
| Weight                 | 0.122 kg                                          |
| Cable length standard  | 6 m (longer version available on special request) |
| Interface              | Phocos MPM-Bus                                    |
| Dimensions (W x H x D) | 38 x 20 x 15 mm                                   |
| Type of protection     | IP54                                              |

## CA series (6 – 14 A)

Solar Charge Controller



- Electronically regulated charging mode: boost and float charge
- Deep discharge protection
- PWM series regulation (PV panel is not short-circuited)
- Integrated temperature compensation
- Fully electronically protected against:
  - Panel surge voltage
  - Wrong polarity (panel or battery)
  - Overload and short circuit at load
- Three LED indications: Charge Status, SOC, LVD, Overload/Short Circuit
- Common positive allows grounding

The new version of the CA solar charge controller series is especially designed for small solar systems requiring low-battery disconnect. The CA series is fully electronically protected. Three LEDs display charging progress,

battery SOC and load status (load disconnect).

Leisure and rural electrification systems are the typical applications for this product. It is a perfect solution for cost-sensitive systems.

| Type                     | CA 06              | CA 08 | CA 10 | CA 14 |
|--------------------------|--------------------|-------|-------|-------|
| Normal voltage           | 12 V               |       |       |       |
| Max. module current      | 5 A                | 8 A   | 10 A  | 14 A  |
| Max. load current        | 6 A                | 8 A   | 10 A  | 14 A  |
| Own consumption          | 4 mA               |       |       |       |
| Temperature compensation | -4 mV/cell*K       |       |       |       |
| Max. wire size           | 16 mm <sup>2</sup> |       |       |       |
| Ambient temperature      | -40 to +50 °C      |       |       |       |
| Dimensions (W x H x D)   | 80 x 100 x 32 mm   |       |       |       |
| Weight                   | 182 g              |       |       |       |
| Type of protection       | IP22               |       |       |       |

## CX series (10 – 40 A)

Solar Charge Controller with LCD Display



- LCD display
- Display indicates charge and discharge status
- Load disconnect prewarning by acoustic signal
- Load status indication
- Choose among five load disconnect algorithms
- Four-stage PWM charging algorithm with integrated temperature compensation
- Protected terminals (up to 16 mm<sup>2</sup> wire size)
- Full electronic protection
- Programmable nightlight function

The CX series offers outstanding features in this class. In addition to sophisticated PWM charge regulation with integrated temperature compensation, the CX controllers provide substantial display, programming, and safety functions. The battery state of charge is clearly displayed by means of a bar graph, as well as energy flow from and to the battery and the load status (e.g. overload, load short circuit).

The deep discharge protection function can be set to five different modes: two voltage-controlled, two SOC-controlled, or one adaptive (battery deep discharge protection). Acoustic alarms are built in and a programmable nightlight function as well. The CX-DR can optionally be used for DIN rail mounting.

# CX series (10 – 40 A)

Solar Charge Controller with LCD Display

| Type                                                       | CX 10                                                                 | CX 20 | CX 40 |
|------------------------------------------------------------|-----------------------------------------------------------------------|-------|-------|
| System voltage                                             | 12/24 V auto recognition                                              |       |       |
| Max. charge/load current                                   | 10 A                                                                  | 20 A  | 40 A  |
| Float charge                                               | 13.7/27.4 V (25 °C)                                                   |       |       |
| Main charge                                                | 14.4/28.8 V (25 °C), 30 min. (daily)                                  |       |       |
| Boost charge                                               | 14.4/28.8 V (25 °C), 2 h<br>Activation: battery voltage < 12.3/24.6 V |       |       |
| Equalization                                               | 14.8/29.6 V (25 °C), 2 h<br>Activation: battery voltage < 12.1/24.2 V |       |       |
| Deep discharge protection:<br>State-of-charge dependent    | A: 11.4 – 11.9 V / 22.8 – 23.8 V<br>B: 11.0 – 11.75 V / 22.0 – 23.5 V |       |       |
| Voltage dependent                                          | A: 11.0/22 V<br>B: 11.5/23 V                                          |       |       |
| Adaptive                                                   | 11.0 – 12.2 V / 22.0 – 24.4 V                                         |       |       |
| Reconnect level                                            | 12.8/25.6 V                                                           |       |       |
| Overvoltage protection                                     | 15.5/31.0 V                                                           |       |       |
| Undervoltage protection                                    | 10.5/21.0 V                                                           |       |       |
| Max. panel voltage<br>(Overvoltage protection by varistor) | 30 V in 12 V system<br>50 V in 24 V system                            |       |       |
| Temperature compensation<br>(Charge voltage)               | –25 mV/K at 12 V<br>–50 mV/K at 24 V                                  |       |       |
| Own consumption                                            | < 4 mA                                                                |       |       |
| Grounding                                                  | Positive grounding possible                                           |       |       |
| Ambient temperature                                        | –20 to +50 °C                                                         |       |       |
| Max. height                                                | 4,000 m above sea level                                               |       |       |
| Battery type                                               | Lead acid (GEL, AGM, flooded)                                         |       |       |
| Wire cross section                                         | Up to 16 mm <sup>2</sup>                                              |       |       |
| Weight                                                     | 168 g                                                                 |       | 179 g |
| Dimensions (W x H x D)                                     | 92 x 93 x 38 mm                                                       |       |       |
| Type of protection                                         | IP22                                                                  |       |       |

## CX48 V series (20 – 40 A)

Solar Charge Controller with LCD Display



- LCD - Charge and discharge status display
- Audible alert before load disconnect
- Load status indicator
- 5 load disconnect algorithms
- Four-stage PWM charging (series type)
- Integrated temperature compensation
- Full electronic protection

The CX48 Series offers outstanding features for its class: Along with a PWM charge controller with integrated temperature compensation, the CX controller comes equipped with an extensive range of control, programming and safety functions. The battery charge status is continuously displayed via a bar graph, including the input and

output current of the battery as well as the load status (e.g. overloading, load short circuiting). The deep discharge protection mode has 5 settings: two fixed voltages, two charging states or adaptive (for battery protection). An audible alarm and a programmable nightlight function are standard on all CX controllers.

## CX48 V series (20 – 40 A)

Solar Charge Controller with LCD Display

| Type                                                       | CX48 20                                                               | CX48 40 |
|------------------------------------------------------------|-----------------------------------------------------------------------|---------|
| System voltage                                             | 24/48 V auto recognition                                              |         |
| Max. charge/load current                                   | 20 A                                                                  | 40 A    |
| Float charge                                               | 27.4/54.8 V (25 °C)                                                   |         |
| Main charge                                                | 28.8/57.6 V (25 °C), 30 min. (daily)                                  |         |
| Boost charge                                               | 28.8/57.6 V (25 °C), 2 h<br>activation: battery voltage < 24.6/49.2 V |         |
| Equalization                                               | 29.6/59.2 V (25 °C), 2 h<br>activation: battery voltage < 24.2/48.4 V |         |
| Deep discharge protection:                                 |                                                                       |         |
| State of charge dependent                                  | A: 22.8 - 23.8 V / 45.6 - 47.6 V<br>B: 22.0 - 23.5 V / 44.0 - 47.0 V  |         |
| Voltage dependent                                          | A: 22/44 V<br>B: 23/46 V                                              |         |
| Adaptive Reconnect level                                   | 22.0 - 24.4 V / 44.0 - 48.8 V<br>25.6/51.2 V                          |         |
| Overvoltage cut off                                        | 31.0/62.0 V                                                           |         |
| Undervoltage cut off                                       | 21.0/42 V                                                             |         |
| Max. panel voltage<br>(Overvoltage protection by varistor) | 50 V in 24 V system<br>95 V in 48 V system                            |         |
| Temperature compensation<br>(Charge voltage)               | -50 mV/K at 24 V<br>-100 mV/K at 48 V                                 |         |
| Self consumption                                           | < 10 mA                                                               |         |
| Grounding                                                  | positive grounding                                                    |         |
| Ambient temperature                                        | -20 to +50 °C                                                         |         |
| Max. height                                                | 4,000 m above sea level                                               |         |
| Battery type                                               | lead acid GEL, AGM, flooded                                           |         |
| Wire cross section                                         | =< 16 mm <sup>2</sup>                                                 |         |
| Weight                                                     | 348 g                                                                 | 365 g   |
| Dimensions (W x H x D)                                     | 110 x 92 x 58 mm                                                      |         |
| Type of protection                                         | IP 22                                                                 |         |

## CXN series (10 – 40 A)

Programmable Solar Charge Controller, Negative Grounded



- Built-in one-year data logger for system analysis
- Load disconnect prewarning by acoustic signal
- LCD display: battery state-of-charge and charge current
- Choose among five load disconnect algorithms
- Temperature-compensated three-stage PWM series charging regulation
- Automatic 12/24 V detection
- Prepared for DIN rail mounting (CX-DR2.1)
- Optional external temperature sensor (CXNT)
- Optional remote display (CXM multi-meter)
- Optional USB interface (CXI + CXCOM)

The CXN is a programmable solar charge controller series with negative grounding. The built-in data logger stores system information for a complete year, unique for its class. In addition to perfect PWM regulation with integrated temperature compensation, the controllers provide extraordinary display, programming, and safety functions. The

battery state of charge is clearly displayed using a bar graph. The deep discharge protection function can be set to up to five different modes: two voltage-controlled, two SOC-controlled, or one adaptive SOC-controlled. Acoustic warnings are built in as well as a programmable nightlight function. The compact case design is prepared for DIN rail mounting (mounting adaptor available as an accessory).

# CXN series (10 – 40 A)

Programmable Solar Charge Controller, Negative Grounded

| Type                                                       | CXN 10                                                                | CXN 20 | CXN 40 |
|------------------------------------------------------------|-----------------------------------------------------------------------|--------|--------|
| System voltage                                             | 12/24 V auto recognition                                              |        |        |
| Max. charge/load current                                   | 10 A                                                                  | 20 A   | 40 A   |
| Float charge                                               | 13.7/27.4 V (25 °C)                                                   |        |        |
| Main charge                                                | 14.4/28.8 V (25 °C), 30 min. (daily)                                  |        |        |
| Boost charge                                               | 14.4/28.8V (25 °C), 2 h<br>Activation: battery voltage < 12.3/24.6 V  |        |        |
| Equalization                                               | 14.8/29.6 V (25 °C), 2 h<br>Activation: battery voltage < 12.1/24.2V  |        |        |
| Deep discharge protection:<br>State-of-charge dependent    | A: 11.4 – 11.9 V / 22.8 – 23.8 V<br>B: 11.0 – 11.75 V / 22.0 – 23.5 V |        |        |
| Voltage dependent                                          | A: 11.0/22 V<br>B: 11.5/23 V                                          |        |        |
| Adaptive                                                   | 11.0 – 12.2 V / 22.0 – 24.4 V                                         |        |        |
| Reconnect level                                            | 12.8/25.6 V                                                           |        |        |
| Overvoltage protection                                     | 15.5/31.0 V                                                           |        |        |
| Undervoltage protection                                    | 10.5/21.0V                                                            |        |        |
| Max. panel voltage<br>(Overvoltage protection by varistor) | 30 V in 12 V system<br>50 V in 24 V system                            |        |        |
| Temperature compensation<br>(Charge voltage)               | –25 mV/K at 12 V<br>–50 mV/K at 24 V                                  |        |        |
| Own consumption                                            | < 6 mA                                                                |        |        |
| Grounding                                                  | Negative grounding possible                                           |        |        |
| Ambient temperature                                        | –20 to +50 °C                                                         |        |        |
| Max. altitude                                              | 4,000 m above sea level                                               |        |        |
| Battery type                                               | Lead acid (GEL, AGM, flooded)                                         |        |        |
| Wire cross section                                         | up to 16 mm <sup>2</sup>                                              |        |        |
| Weight                                                     | 168 g                                                                 |        | 179 g  |
| Dimensions (W x H x D)                                     | 92 x 93 x 38 mm                                                       |        |        |
| Type of protection                                         | IP22                                                                  |        |        |

## CML series (5 – 20 A)

Solar Charge Controllers with LED Indication



- Battery state-of-charge indication by means of 3 LEDs
- Load disconnect prewarning by acoustic signal
- Three-stage PWM charging algorithm with (integrated) temperature compensation (boost, equalization, and float charging)
- Automatic 12/24 V detection
- Large terminals: up to 16 mm<sup>2</sup> cable
- SOC- and voltage-controlled LVD
- Fully electronically protected

The CML charge controllers are equipped with a number of outstanding features like status display, warning, and protection functions.

The temperature-compensated three-stage PWM charging algorithm (boost-equalization-float) is adjustable to sealed and vented lead-acid batteries. The CML series also allows

either SOC- or voltage-controlled low-voltage disconnect function.

The battery status is clearly indicated by three LEDs. This was the first controller in its price class available on the market to incorporate an alarm signal for low-voltage disconnect.

## CML series (5 – 20 A)

Solar Charge Controllers with LED Indication

| Type                                 | CML 05                                                                 | CML 08 | CML 10 | CML 15 | CML 20 |
|--------------------------------------|------------------------------------------------------------------------|--------|--------|--------|--------|
| System voltage                       | 12/24 V auto recognition                                               |        |        |        |        |
| Max. charge/load current             | 5 A                                                                    | 8 A    | 10 A   | 15 A   | 20 A   |
| Float charge                         | 13.7/27.4 V (25 °C)                                                    |        |        |        |        |
| Boost charge                         | 14.4 /28.8 V (25 °C), 2 h<br>Activation: battery voltage < 12.3/24.6 V |        |        |        |        |
| Equalization                         | 14.8/29.6 V (25 °C), 2 h<br>Activation: battery voltage < 12.1/24.2 V  |        |        |        |        |
| Deep discharge protection:           |                                                                        |        |        |        |        |
| State-of-charge dependent            | 11.4 – 11.9 V / 22.8 – 23.8 V                                          |        |        |        |        |
| Voltage dependent                    | 11.0/22.0 V                                                            |        |        |        |        |
| Reconnect level                      | 12.8/25.6 V                                                            |        |        |        |        |
| Overvoltage protection               | 15.5/31.0 V                                                            |        |        |        |        |
| Undervoltage protection              | 10.5/21.0 V                                                            |        |        |        |        |
| Max. panel voltage                   | 30 V in 12 V system                                                    |        |        |        |        |
| (Overvoltage protection by varistor) | 50 V in 24 V system                                                    |        |        |        |        |
| Temperature compensation             | –25 mV/K at 12 V                                                       |        |        |        |        |
| (Charge voltage)                     | –50 mV/K at 24 V                                                       |        |        |        |        |
| Max. own consumption                 | < 4 mA                                                                 |        |        |        |        |
| Grounding                            | Positive grounding possible                                            |        |        |        |        |
| Ambient temperature                  | –40 to +50 °C                                                          |        |        |        |        |
| Max. height                          | 4,000 m above sea level                                                |        |        |        |        |
| Battery type                         | Lead acid (GEL, AGM, flooded)                                          |        |        |        |        |
| Wire cross section                   | Up to 16 mm <sup>2</sup>                                               |        |        |        |        |
| Weight                               | 160 g                                                                  |        |        |        |        |
| Dimensions (W x H x D)               | 80 x 100 x 32 mm                                                       |        |        |        |        |
| Type of protection                   | IP22                                                                   |        |        |        |        |

## CM series (4 – 10 A)

Solar Charge Controllers



- LED charging display
- Large terminals up to 16 mm<sup>2</sup>
- Two-stage PWM charging algorithm (boost & float charging)
- Electronic overvoltage protection
- Reverse polarity protection

The CM charge controllers were especially designed for use in small solar systems where no load disconnect is required, such as in boats or trailers.

The charge controllers provide excellent battery charging at a reasonable cost.

| Type                                                       | CM 04                                          | CM 10 |
|------------------------------------------------------------|------------------------------------------------|-------|
| System voltage                                             | 12 V                                           |       |
| Max. charge current                                        | 4 A                                            | 10 A  |
| Float charge                                               | 13.7 V                                         |       |
| Boost charge                                               | 14.5 V<br>Activation: battery voltage < 12.2 V |       |
| Max. panel voltage<br>(Overvoltage protection by varistor) | 30 V                                           |       |
| Max. own consumption                                       | 4 mA                                           |       |
| Grounding                                                  | Positive grounding possible                    |       |
| Ambient temperature                                        | -40 to +50 °C                                  |       |
| Max. height                                                | 4,000 m above sea level                        |       |
| Battery type                                               | Lead acid (GEL, AGM, flooded)                  |       |
| Wire cross section                                         | Up to 16 mm <sup>2</sup>                       |       |
| Weight                                                     | 68 g                                           |       |
| Dimensions (W x H x D)                                     | 72.6 x 61 x 30.4 mm                            |       |
| Type of protection                                         | IP22                                           |       |

Datasheet\_CM series\_1/1\_e\_2011-04-01\_Subject to change without notice

# CMM

Remote Display for CA and CML Charge Controller



- Displays panel current, load current, and battery voltage
- Large three-digit display
- Three-position select switch for indicating choice
- Three LEDs help indicate which value is displayed by LCD
- DIN rail and wall mounting options

The Phocos CMM has been designed to measure and display panel current, load current, and the battery voltage of your PV system actual values.

The CMM can be used in combination with Phocos CA and CML series charge controllers.

| Type                            | CMM                          |
|---------------------------------|------------------------------|
| Voltage range                   | 0 to 35 V                    |
| Current range                   | 0 to 25 A                    |
| Ambient temperature             | -25 to +50 °C                |
| Length of connecting cable      | 2 m                          |
| Dimensions of interface (WxHxD) | 84 x 44 x 32 mm              |
| Dimensions of display (WxHxD)   | 72 x 68 x 29 mm              |
| Weight (interface + display)    | 195 g (with connecting wire) |
| Type of protection              | IP22                         |

# CXM

Remote Display for Phocos CXN Charge Controllers



- Displays panel current, load current, and battery voltage, Ah, SOC, etc.
- Large three-digit LCD display
- Displayed values selectable by means of two push buttons
- DIN rail adapter and wall mounting possible

The Phocos CXM can be used in combination with Phocos CXN series charge controllers by means of an interface connector. The Phocos CXM remote display is designed to display panel current, load current, and battery voltage of a

PV system as actual values and status as well, like charging, overload, and low-voltage disconnect (symbols). In addition, several values like Ah, SOC battery voltage (morning, evening) from the CXN data logger can be displayed.

| Type                    | CXM                                        |
|-------------------------|--------------------------------------------|
| Voltage range           | Will display the voltage range of your CXN |
| Current range           | Will display current range of your CXN     |
| Ambient temperature     | -25 to +50 °C                              |
| Connecting cable length | 2 m                                        |
| Dimensions (W x H x D)  | 72 x 68 x 29 mm                            |
| Weight                  | 94 g (including connecting cable)          |
| Type of protection      | IP22                                       |

# BCM

DC Battery Charger



- AA size battery charger
- Protection from overcharging, ensure long life span of the battery
- Efficient use of excess energy of PV system
- Charge up to 4 AA size batteries
- LED display „Charging on“ and „off-Switch“
- Holder for DIN rail mounting available

BCM is an innovative charger for AA-Size rechargeable NiMeH and NiCd Batteries. It is specially designed for application in PV solar systems. In addition, it can be used together with any 12 V Battery.

The AA-size batteries are charged over a small constant current which is kept on a low level to prevent any overcharging. Additional protection is given by the additional voltage limitation. Because of the special voltage and current limitation, the batteries are well protected against overcharging even if they are kept for longer time in the charger. The gentle

charging process guarantees long life for your AA-size battery. BCM allows to charge up to four AA size batteries. Because each battery has got its own voltage limitation, it is possible to mix different types and sizes of rechargeable batteries. It is also possible to charge one, two three or four batteries at a time. A new innovative feature is the use of excess energy management. By using this feature only the excess energy which cannot be taken over by the systems main battery, is used to charge the AA batteries. This way it is possible to increase the performance of the system.

| Type                               | BCM                         |
|------------------------------------|-----------------------------|
| Nominal input voltage              | 12 V                        |
| Input voltage range                | 10.5 – 15 V                 |
| Nominal output voltage             | 4 x 1.5 V                   |
| Max. charging current (@1.35V)     | < 60 mA                     |
| Charging time for 500mAh battery   | approx. 14 h                |
| Charging time for 1,000mAh battery | approx. 28 h                |
| Charging time for 1,500mAh battery | approx. 42 h                |
| Charging time for 2,500mAh battery | approx. 70 h                |
| Battery size                       | AA(in Europe called Mignon) |
| Battery types                      | NiMeH/NiCd                  |
| Battery capacity                   | 500 – 2,500 mAh             |
| Dimensions (W x H x D)             | 80 x 100 x 32 mm            |
| Weight                             | 180 g                       |
| Temperature range                  | -40 to +50 °C               |

Datasheet\_BCM\_1/1\_e\_2010-04-01\_Subject to change without notice

# DCS and DCL

DC Voltage Converters



- DC/DC converters extend users' applications
- Maximum output current adapts to output voltage
- Excess energy management system in DCL, makes the PV system more efficient
- Overheating protection extends product lifetime
- Display LEDs for "Power on" and "Current limitation", "Excess Energy" additional for DCL
- DIN-rail mounting adapter available

The DCS is a DC/DC converter specially designed for PV systems. It enables a 12 V Battery Voltage to lower voltage DC appliances such as small radios or cassette players. The DCS utilizes innovative overheating protection which adapts the maximum output current to the output voltage in order to enhance product reliability and lifetime.

The DCL extends the functionality of the DCS by adding excess energy management functionality that provides usable energy that would normally be wasted because the

battery cannot accept the extra solar energy. With DCL it is possible to charge a second battery with excess energy. This is widely used in mobile-homes and boats which often have a battery for the solar system and a second battery for starting the engine. Another typical application is to power a small fan for air exchange on a boat powered only with excess energy. Only your imagination limits the number of possible applications.

| Type                   | DCS, DCL                   |        |        |        |        |          |          |  |
|------------------------|----------------------------|--------|--------|--------|--------|----------|----------|--|
| Nominal voltage        | 12 V                       |        |        |        |        |          |          |  |
| Output voltage         | 1.5 V                      | 3.0 V  | 4.5 V  | 6.0 V  | 9.0 V  | 12.0 V   | 13.6 V   |  |
| Maximum output current | 250 mA                     | 300 mA | 400 mA | 450 mA | 650 mA | 1,000 mA | 2,000 mA |  |
| Self consumption       | 6 mA                       |        |        |        |        |          |          |  |
| Diameter wire          | 0.75 to 16 mm <sup>2</sup> |        |        |        |        |          |          |  |
| Temperature range      | -20 to +50 °C              |        |        |        |        |          |          |  |
| Max. power dissipation | 4 W                        |        |        |        |        |          |          |  |
| Dimensions (B x H x T) | 100 x 80 x 34 mm           |        |        |        |        |          |          |  |
| Weight                 | 125 g                      |        |        |        |        |          |          |  |

\*Can only be got when the input voltage is higher than 13.6 V.

| Type                         | DCL    |
|------------------------------|--------|
| Nominal voltage 2nd battery  | 12 V   |
| Float voltage 2nd battery    | 13.4 V |
| Max. charging current @13.4V | 2 A    |

Datasheet\_DCS, DCL\_1/1\_e\_2010-04-01\_Subject to change without notice

## PL series (20 – 60 A)

Solar Charge Controllers



- 12 V, 24 V, 32 V, 36 V and 48 V (menu selectable)
- Multifunctional LCD display
- Widely programmable charging characteristics
- External current sensing (shunt)
- Built-in 30-days data logger
- Control of hybrid systems
- Built-in programmable logic controller
- PLI interface (optional)

The PL series offers complete control over the charge cycle and various information about past and actual battery performance. The PL regulators have a built-in battery load disconnect function. In addition, the versatile event controller can switch power to lamps and pumps on or off, depending on the program. Regulation can be switched between series and shunt modes. Other features include backup diesel generator control and the charging of a second battery. This enables the regulation of wind turbines and

small water turbines, also in hybrid systems. The LCD display shows battery voltage, charging current, ampere hours (entering and leaving the battery), load current, and charge status. External shunts can be connected to the PL. Information is available about the past 30 days. With the optional PLI interface, the user can access the charge controller from a computer. Data can be read or settings adjusted. The PL can be operated from 12, 24, 32, 36, or 48 volt systems and is thus appropriate for all PV applications.

| Type                      | PL 20                               | PL 40             | PL 60             |
|---------------------------|-------------------------------------|-------------------|-------------------|
| Nominal voltage           | 12/24/32/36/48 V                    |                   |                   |
| Max. solar charge current | 20 A                                | 40 A              | 60 A              |
| Max. load current         | 20 A                                | 7 A               | 30 A              |
| Max. voltage drop         | 0.4 V                               |                   | 0.42 V            |
| Own consumption           | 9 mA                                | 13 mA             | 20 mA             |
| Temperature sensor range  | -15 to +50 °C                       |                   |                   |
| Regulation set point      | 4 present programs, one user adjust |                   |                   |
| Ambient temperature       | -20 to +50 °C                       |                   |                   |
| Dimensions (W x H x D)    | 100 x 109 x 41 mm                   | 130 x 124 x 50 mm | 225 x 175 x 62 mm |
| Weight                    | 320 g                               | 515 g             | 1,100 g           |

# PLA

Control Unit for Multi-PL Controller Systems



- Synchronizes up to 3 PLs
- Built-in 30 days data logger for the complete system
- Built-in RS232 interface
- Isolated alarm indication and outputs
- Suitable for great systems of up to 180 A

The PLA allows multiple PL series charge controllers to work together in a single system. It provides a common RS232 communication interface and four alarm/control channel outputs; it can also control a LSI load switch unit.

The PLA can also be used as an autonomous alarm or in combination of up to three PL charge controllers. For this application PL controllers type PL 20, PL 40 and PL 60 can be combined in any form. This leads to a powerful combination for large stand alone solar and hybrid systems of up to 180 Amps charge current.

The PLA makes the retrieval of system performance data easier by providing total system information in addition to the comprehensive data acquisition features of the PL charge controllers. Communication is done via a galvanic isolated RS232 serial port.

The unit has high and low battery voltage alarms with alarm state indicators. The alarm levels are programmable. The PLA keeps the individual PL controllers synchronized. This results in properly charge sharing between controllers.

| Type                              | PLA                                |
|-----------------------------------|------------------------------------|
| Battery supply voltage            | 7 – 100 V                          |
| Supply current                    | 70 mA at 11 V, 22 mA at 48 V       |
| Communications interface          | RS232 at 300/1,200/2,400 baud rate |
| Galvanic isolated output contacts | 100 V, 0.3 A                       |
| Ambient temperature               | -20 to +60 °C                      |

## SPS series (100 – 300 A)

High-end Solar Charge Controller



- Designed for Telecom applications
- 12, 24 and 48 V versions available
- Very low noise emission due to bank switching design
- Customer specific configurations are possible

The SPS series Solar Charge Controller is an advanced electronic system for solar power systems used in remote locations, like for telecommunications sites. It will prevent overcharging, reduce electrolyte loss and stop deep discharge. This will considerably extend battery life.

Simple modular construction enables this system to display better performance and more features than any other controller in its class. All control levels are fully adjustable and can be changed by remote command. Bank switching design substantially reduces noise emission compared to other PWM charge controllers. Various customer specific accessory features are available on request.



| Type                  | SPS 12D100<br>SPS 12D200<br>SPS 12D300 | SPS 24D100<br>SPS 24D200<br>SPS 24D300 | SPS 48D100<br>SPS 48D200<br>SPS 48D300 |
|-----------------------|----------------------------------------|----------------------------------------|----------------------------------------|
| Voltage               | 12 V                                   | 24 V                                   | 48 V                                   |
| Max. charging current | 100 A<br>200 A<br>300 A                |                                        |                                        |
| Max. load current     | 50 A                                   |                                        |                                        |

Datasheet\_SPS series\_1/1\_e\_2011-10-06\_Subject to change without notice

## CL 12 (7 – 11 W)

DC Compact Fluorescent Lamps



- 12 V DC Operation
- Extremely high illumination efficiency
- Extremely high number of switching cycles
- Over-Temperature Protection (OTP)
- Standard socket available

Phocos' CFL lamps provide very high illumination levels at low power consumption. This high quality 12 V DC lamp can be used directly in 12 V battery or solar systems. The life span of the lamp is more than 8,000 hours. The new version of CFL lamps is now regulated by a DC-preheating circuit which makes an extremely high number of switching cycles possible (IEC925).

Furthermore the lamps are equipped with an over-

temperature protection (OTP) which causes the lamps to automatically switch off prior to overheating (especially when operated at too extreme environmental conditions) and therefore prevents damage to the lamp. Thus, the product life span is significantly increased. It is an excellent choice for any illumination purpose which requires more than 100 lumens.

| Type              | CL 1207C                   | CL 1209C | CL 1211C                 |
|-------------------|----------------------------|----------|--------------------------|
|                   | CL 1207W                   | CL 1209W | CL 1211W                 |
| Voltage range     | 11 – 15 V                  |          |                          |
| Nominal power     | 7 W                        | 9 W      | 11 W                     |
| Nominal current   | 560 mA                     | 720 mA   | 900 mA                   |
| Light intensity   | 350 lm                     | 520 lm   | 630 lm (C)<br>670 lm (W) |
| Light temperature | 6,400 K (C)<br>2,700 K (W) |          |                          |
| Temperature range | -10 to +50 °C              |          | -10 to +40 °C            |
| Socket            | E27 (Edison)               |          |                          |

## CL 12 (15 – 30 W)

DC Compact Fluorescent Lamps



- 12 V DC Operation
- Extremely high illumination efficiency
- Extremely high number of switching cycles
- Over-Temperature Protection (OTP)
- Standard socket available

Phocos' CFL lamps with 15 W and 30 W power consumption open up a new range for 12 V DC lighting equipment. The life span of the lamp is more than 8,000 hours. The new version of CFL lamps is now regulated by a DC-preheating circuit which makes an extremely high number of switching cycles possible (IEC925).

Furthermore the lamps are equipped with an over-temperature protection (OTP) which causes the lamps to automatically switch off prior to overheating (especially

when operated at too extreme environmental conditions) and therefore prevents damage to the lamp. Thus, the product life span is significantly increased.

Of course the lamps comply with the CE standards for low interference with radios and other electronic devices. The special shape of the 15 W tube allows the installation in locations where usually only incandescent bulbs fit. As the lamps are produced in our own factory, we can provide customized versions on request.

| Type              | CL 1215C      | CL 1230C      |
|-------------------|---------------|---------------|
|                   | CL 1215W      | CL 1230W      |
| Voltage range     | 11 – 15 V     |               |
| Nominal power     | 15 W          | 30 W          |
| Nominal current   | 1,200 mA      | 2,400 mA      |
| Light intensity   | 925 lm (C)    | 1,500 lm (C)  |
|                   | 950 lm (W)    | 1,500 lm (W)  |
| Light temperature | 6,400 K (C)   |               |
|                   | 2,700 K (W)   |               |
| Temperature range | -10 to +40 °C | -10 to +35 °C |
| Socket            | E27 (Edison)  |               |

## CLD 12 (5 – 15 W)

DC compact fluorescent lamps, detachable tube



- Detachable tube
- 12 V DC Operation
- Over-Temperature Protection (OTP)
- Extremely high illumination efficiency
- High number of switching cycles
- Standard E27 lamp socket
- Tube socket G24

The new D-series of CFL lamps come with a special feature: a detachable tube. Therefore the ballast can be reused in case of a broken or damaged tube. The lamps provide very high illumination levels at low power consumption. This high quality 12 V DC lamp can be used directly in 12 V battery or solar systems. The life span of the lamp is more than 8,000

hours. A special electronic circuit guarantees an extremely high number of switching cycles.

The lamp has a standard E27/Edison socket. It is an excellent choice for any illumination purpose which requires more than 100 lumens. The lamps are produced in our own factory. Therefore we can provide customized versions on request.

| Type              | CLD 1205C                  | CLD 1207C                | CLD 1211C              | CLD 1215C |
|-------------------|----------------------------|--------------------------|------------------------|-----------|
|                   | CLD 1205W                  | CLD 1207W                | CLD 1211W              | CLD 1215W |
| Voltage range     | 11 – 15 V                  |                          |                        |           |
| Nominal power     | 5 W                        | 7 W                      | 11 W                   | 15 W      |
| Nominal current   | 400 mA                     | 560 mA                   | 900 mA                 | 1,200 mA  |
| Light intensity   | 240 lm                     | 350 lm (C)<br>360 lm (W) | 620 lm(C)<br>650 lm(W) | 900 lm    |
| Light temperature | 6,400 K (C)<br>2,700 K (W) |                          |                        |           |
| Temperature range | -10 to +50 °C              |                          | -10 to +40 °C          |           |
| Socket            | E27 (Edison)               |                          |                        |           |

## CL 24 (15 W)

DC compact fluorescent lamps



- 24 V DC Operation
- Extremely high illumination efficiency
- Extremely high number of switching cycles
- Over-Temperature Protection (OTP)
- Standard socket available

Phocos' CFL lamps provide very high illumination levels at low power consumption. This high quality 24 V DC lamp can be used directly in 24 V battery or solar systems. The life span of the lamp is more than 8,000 hours. The new Version of CFL lamps is now regulated by a DC-preheating circuit which makes an extremely high number of switching cycles possible (IEC925).

Furthermore the lamps are equipped with an over-temperature protection (OTP) which causes the lamps to

automatically switch off prior to overheating (especially when operated at too extreme environmental conditions) and therefore prevents damage to the lamp. Thus, the product life span is significantly increased. It is an excellent choice for any illumination purpose which requires more than 100 lumens.

As the lamps are produced in our own factory, we can provide customized versions on request.

| Type                        | CL 2415C                   |
|-----------------------------|----------------------------|
|                             | CL 2415W                   |
| Nominal voltage             | 25 V                       |
| Voltage range               | 20 – 30 V                  |
| Nominal power               | 15 W                       |
| Nominal current             | 600 mA                     |
| Light intensity             | 900 lm                     |
| Average luminous efficiency | 65 lm/W                    |
| Light temperature           | 6,400 K (C)<br>2,700 K (W) |
| Temperature range           | -10 to +50 °C              |
| Socket                      | E27/B22                    |

## SL LED (1 – 2 W)

DC LED Lamps



- Extremely low power consumption
- Very high illumination efficiency
- Lifespan 50,000 h
- Infinite number of switching cycles
- Standard socket E27

The Phocos solar SL LED lamp provides high illumination levels with very low power consumption and a long lifespan. The 12 V DC lamps can be used directly in 12 V battery or

solar systems without any ballast. More than 80% of the luminosity is retained after 50,000 hours. The lamp has a standard E27 socket.

| Type                | SL 1210CF70                | SL 1220CF120         |
|---------------------|----------------------------|----------------------|
| Operating voltage   | 12 V (9 – 15 V)            |                      |
| Operating current   | 85 mA @ 12.5 V ±10%        | 160 mA @ 12.5 V ±10% |
| Electrical power    | 1 W                        | 2 W                  |
| Ambient temperature | -20 to +50 °C              |                      |
| Ambient humidity    | max. 95% (no condensing)   |                      |
| Irradiation angle   | 170°                       |                      |
| Light color         | Cool white (Type: 6,500 K) |                      |
| Light output        | > 70 lm                    | > 120 lm             |
| Light efficiency    | > 70 lm/W (@ 12 V)         | > 60 lm/W (@ 12 V)   |
| Socket              | E27                        |                      |

## FR (50/165/225 l)

FR refrigerator units (R), FR freezer units (F)



- Very low energy requirement
- 12 V or 24 V DC operating voltage featuring shutoff at low voltage
- Eco-friendly cooling agent (R-134a)
- Scratch-proof steel-panel housing
- Easy-to-clean aluminum lining
- Lockable lid (except for the model FR 50 R)
- Interior lighting
- Patented low-frost system
- Adjustable interior temperature
- Highly-efficient cooling

Phocos offers refrigerator units (R) and freezer units (F) with 50-, 165- and 225-l capacities. Due to their energy-efficient cooling concept, Phocos refrigeration devices are especially suited to solar-powered applications. The top-quality craftsmanship guarantees a long useful life. An 11-cm-thick insulation layer made of polyurethane ensures minimal

thermal losses. The refrigeration system is equipped with a maintenance-free, brushless DC compressor. The patented low-frost system reduces the formation of condensation water and ice. A drainage opening at the base simplifies the cleaning of the interior.

| Type                        | FR 50 R                                               | FR 165 R                                             | FR 225 R                                             |
|-----------------------------|-------------------------------------------------------|------------------------------------------------------|------------------------------------------------------|
|                             | FR 50 F                                               | FR 165 F                                             | FR 225 F                                             |
| Operating voltage           | 12/24 V DC                                            |                                                      |                                                      |
| Ambient temperature         | -10 to +43 °C                                         |                                                      |                                                      |
| Power input (typ./ max.)    | 40/80 W                                               |                                                      |                                                      |
| Energy consumption at 21 °C | n/a                                                   | 96 Wh/d (R)<br>300 Wh/d (F)                          | 120 Wh/d (R)<br>480 Wh/d (F)                         |
| Energy consumption at 32 °C | 114 Wh/d (R)                                          | 168 Wh/d (R)<br>444 Wh/d (F)                         | 204 Wh/d (R)<br>540 Wh/d (F)                         |
| Content (capacity)          | 50 l                                                  | 165 l                                                | 225 l                                                |
| Dimensions (W x H x D)      | 83 x 71 x 63 cm                                       | 98 x 76 x 98 cm                                      | 124 x 76 x 98 cm                                     |
| Delivery                    | 54 units/20 ft container<br>114 units/40 ft container | 30 units/20 ft container<br>72 units/40 ft container | 26 units/20 ft container<br>56 units/40 ft container |
| Delivery weight             | 34 kg                                                 | 51 kg                                                | 59 kg                                                |

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