Phocos CIS

User Manual

CID：181814611

Please read the instructions carefully and thoroughly before using the product. It comes with a number of outstanding features, such as:

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- Case protection: IP68 protection, in 1.5 m water depth 72 Hours.
- Dimming function
- Control unit (CU) to configure CIS charge controller via infra-red data link
- External temperature sensor for temperature compensation of charge voltages
- Widely programmable
- 3 stage charging (boost, equalization, float) for flooded battery, 2 stage charging (boost, float) for sealed battery
- Automatic recognition of system voltage 12/24 V
- Positive grounding

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions for CIS-05-1.1, CIS-10-1.1, CIS-20-1.1, CIS-05-1.1-2L, CIS-10-1.1-2L, CIS-20-1.1-2L models that shall be followed during installation and maintenance of the charge controller.

INSTRUCTIONS DE SÉCURITÉS IMPORTANTES

CONSERVER CES INSTRUCTIONS

Cette notice contient d'importantes instructions visant les modèles CIS-05-1.1, CIS-10-1.1, CIS-20-1.1, CIS-05-1.1-2L, CIS-10-1.1-2L, CIS-20-1.1-2L, lesquelles doivent être suivies au moment de

l'entretien de l'appareil.

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If connection to the power lead or battery lead are accessible during operational maintenance the following warning shall be marked adjacent to the connection where practical or prominently displayed on the enclosure: WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS. and AVERTISSEMENT - RISQUE D'EXPLOSION. NE PAS DÉBRANCHER TANT QUE LE CIRCUIT EST SOUS TENSION, À MOINS QU'IL NE S'AGISSE D'UN EMPLACEMENT NON DANGEREUX.

EXPLOSION HAZARD. DO NO DISCONNECT WHILE THE CIRCUIT IS LIVE OR UNLESS THE AREA IS KNOWN TO BE FREE OF IGNITIBLE CONCENTRATIONS.

THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS A-D, T4A.

UL 1741 and UL 1604, ANSI/ISA 12.12.01-2011, C22.2 No. 213-M1987.

RISK OF FIRE – MOUNT IN CONTACT WITH BATTERIES

Battery type: Lead acid, (GEL, AGM, flooded)

Nominal voltage rating of the battery: 12 or 24 V

Batteries fuse: use a fast acting fuse with a minimum of 1000A interrupting rating on the battery side. We recommend to use fast acting melting fuses (e.g. car type fuses) on the battery side, as close as possible at the battery terminal with 1.5 times the current rating of the maximum nominal current (see table).

Fuse ratings:

CIS type	CIS-05	CIS-10	CIS-20
Fuse	7.5 A	15 A	30 A

Please do not disassemble or attempt to repair Phocos products. Phocos charge controllers do not contain user serviceable parts.

Please observe all instructions with regards to external fuses/breakers as indicated.

Maintenance and installation notes

When installing or working on the PV system, please disconnect the PV (solar) modules from the charge controller first, to prevent any damages to the charge controller!

Please verify that all cable/wire connections are tightly fastened to the connectors/connecting posts in order to avoid any bad or loose connections that could result in excessive heating.

Please install a fuse or breaker near the battery before installing or adjusting the controller!

Please install and operate the controller in a dry environment.

High voltage risks

Operation of this device may produce a high voltage which could cause severe injuries or death in case of improper installation or operation of the device.

PV modules can generate high DC voltages!

Make sure the cables are always connected to the correct terminal. An electrical shock c an be lethal. In general, any electric shock can be dangerous to your health.

CE labeling

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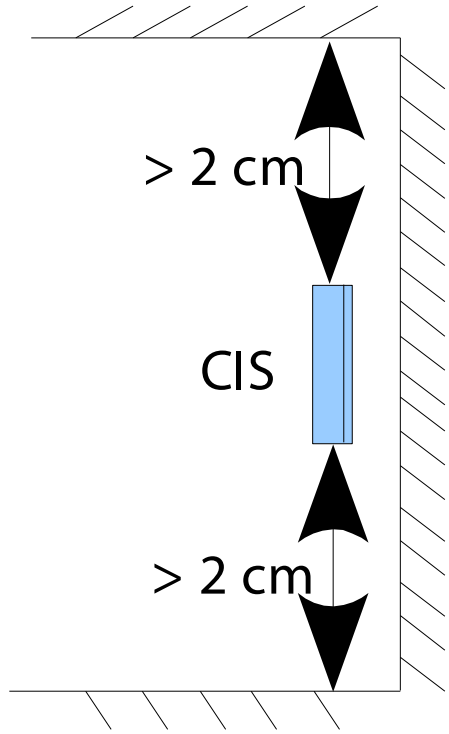
The product is CE compliant.

Mounting of the unit

Since the charge controller must be able to sense the battery temperature it must be mounted into the same compartment together with the battery. It shall be mounted as close as possible to battery. We recommend not to use more than 1m wire length between battery and charge controller. This apparatus is suitable for use in Class I, Division 2 groups A, B, C, D or unclassified locations.

- Vertical mounting on non flammable surface with minimum 2 cm distance below and above unit.
- In case of higher ambient temperatures and limited heat dissipation (e.g. by surrounding compartment or smaller mounting distances), charge controller will limit its charge current to reduce temperature.
- If heat dissipation is limited by surrounding compartment, unit will limit charge current to reduce temperature.
- The charge controller is not intended to be installed within the wiring compartment of a PV module. The wiring methods in accordance with the National Electrical Code, ANSI/NFPA 70 are to be used.



Connecting and Grounding

- Connect wires in order indicated 1 2 3 4 5 6 7 to avoid installation faults
- To avoid any voltage on the wires, first connect the wire to the controller, then to the battery, panel or load.
- Recommended minimum wire size: CIS-05: 1.5 mm^2; CIS-10: 2.5 mm^2; CIS-20: 4 mm^2
- Make sure the wire length between battery and controller is as short as possible.
- Be aware that the Positive terminal of CIS are connected together and therefore have the same electrical potential. If any grounding is required, always do this on the Positive wires.

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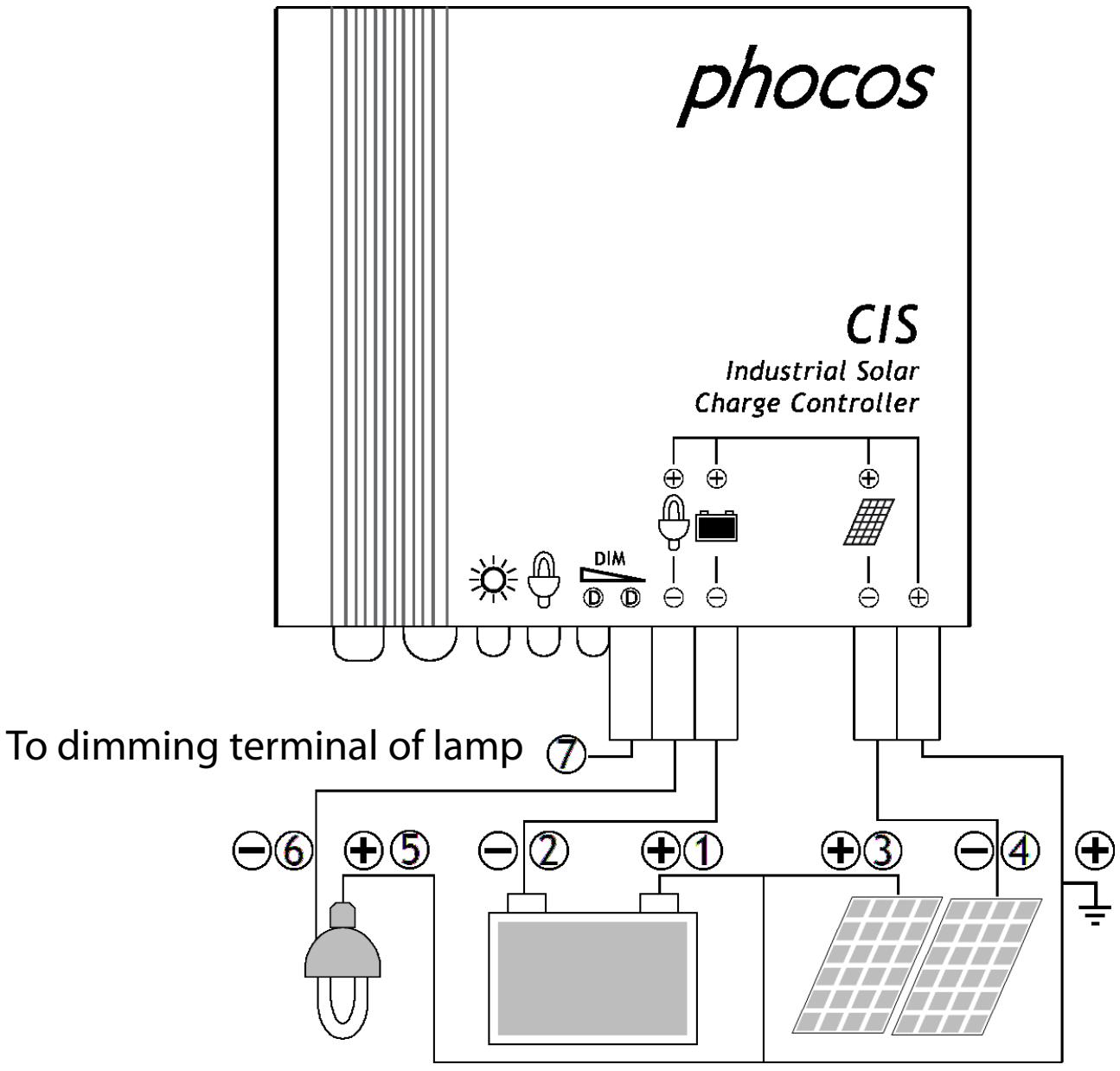
- Some equiptment, like relays, gates or motors, can damage the controller by magnetic induction, when it switches off. To prevent this, reverse connect the diode (such as 1N5401 .. 1N5408) between LOAD positive and LOAD negative.
- Connectors used in incendive circuits and incorporated within equipment shall be considered normally non-arcing if disconnection is not required under operational maintenance conditions, and if they are so secured that a separating force of at least 15 N is required for loosening.

	Function	Cable marker	Wire size (cross section)	color
①	Positive battery terminal	COMMON +	AWG 13 (2.5 mm^2)	Red
②	Negative battery terminal	BATTERY -	AWG 13 (2.5 mm^2)	Black
③	Positive panel terminal	COMMON +	AWG 13 (2.5 mm^2)	Red
④	Negative panel terminal	SOLAR -	AWG 13 (2.5 mm^2)	Blue
⑤	Positive load terminal	COMMON +	AWG 13 (2.5 mm^2)	Red
⑥	Negative load terminal	LOAD -	AWG 13 (2.5 mm^2)	Green
⑦	Dimming signal terminal	---	AWG 19 (0.6 mm^2)	Black


phocos
CIS
Industrial Solar
Charge Controller
DIM
To dimming terminal of lamp
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6
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CIS operational description

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The CIS charge controllers are built to be operated with 12V or 24V vented and sealed lead acid batteries. A series PWM-charge controller like the CIS connects the PV-panel to the battery, to charge it or disconnects it when the battery voltage is high enough. Depending on the battery voltage it will frequently switch ON and OFF the charge current to regulate the battery voltage. This voltage depends on the charge state (Main charge/ Boost/ Equalisation/ Float)

The CIS will disconnect the PV-panel from battery at night to prevent any current to flow back from the battery to the panel at night. These functions are achieved by the use of modern semiconductor switches, called power-MOS-FETs. one is used to switch on/off the charge current, the other one acts as actively switched diode to prevent back current from flowing from the battery backwards to the PV-panel at night. The CIS also provide one or two (-2L) power outputs to supply electronic loads with electricity. The output voltage of these load outputs is the battery voltage.

To protect the battery from getting deep discharged, the charge controller will disconnect the load output at a low SOC (state of charge). This level is adjustable. To protect connected load, the CIS will also disconnect the load at too high battery voltage levels. This function is also realized by a power-MOS-FET, one for each load output. To achieve temperature compensation of the charge voltage, the CIS have got an external temperature sensor to sense the ambient (battery) temperature. The charge controller will adapt the charge voltage according to this external temperature, to provide a charge voltage compensation of -4mV per degree Celsius and battery cell (24mV/K for a 12V battery, 48mV/K for a 24V battery).

To provide over-temperature protection functions, it has also a built in temperature sensor. If the internal temperature gets higher than about 75°C (e.g. at high charge currents and high ambient temperatures, the charge current will be decreased, to limit the internal power loss and thus to reduce internal heating. If the internal temperature is too high, it will also switch off the load current. This shall prevent the charge controller from being damaged by too high internal temperatures.

CIS units with one load output have got an additional DIM-output that provides a signal between 0 .. 10V to control the brightness of a lamp by use of a compatible LED driver. Widely adjustable settings can control the load output(s) and DIM output to provide various night light functions. These can be programmed/adjusted by use of the CU, an infrared remote control especially designed for the CIS series.

This all is realized by the use of a micro-controller inside the CIS. This micro controller is a small computer, equipped with software (firmware) and integrated peripherals to measure voltages, currents and digital signals, and output digital signal, to switch on and off transistors, controlling the FETs, LEDs, etc.

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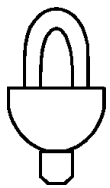
Display & Warning Functions

LED	Status	Function
	On	Controller connected to battery, night detected
	Flash	Controller connected to battery, day detected
	Off	No battery connected
	On	Load 1 low/high voltage disconnect(LVD/HVD)
	Flash	Load 1 over current
	Off	Load 1 OK
	On	Dimming because of low/high voltage disconnect
	Off	Time control dimming
All LED	Green->Red->Green->	Programming

Night-Light Function

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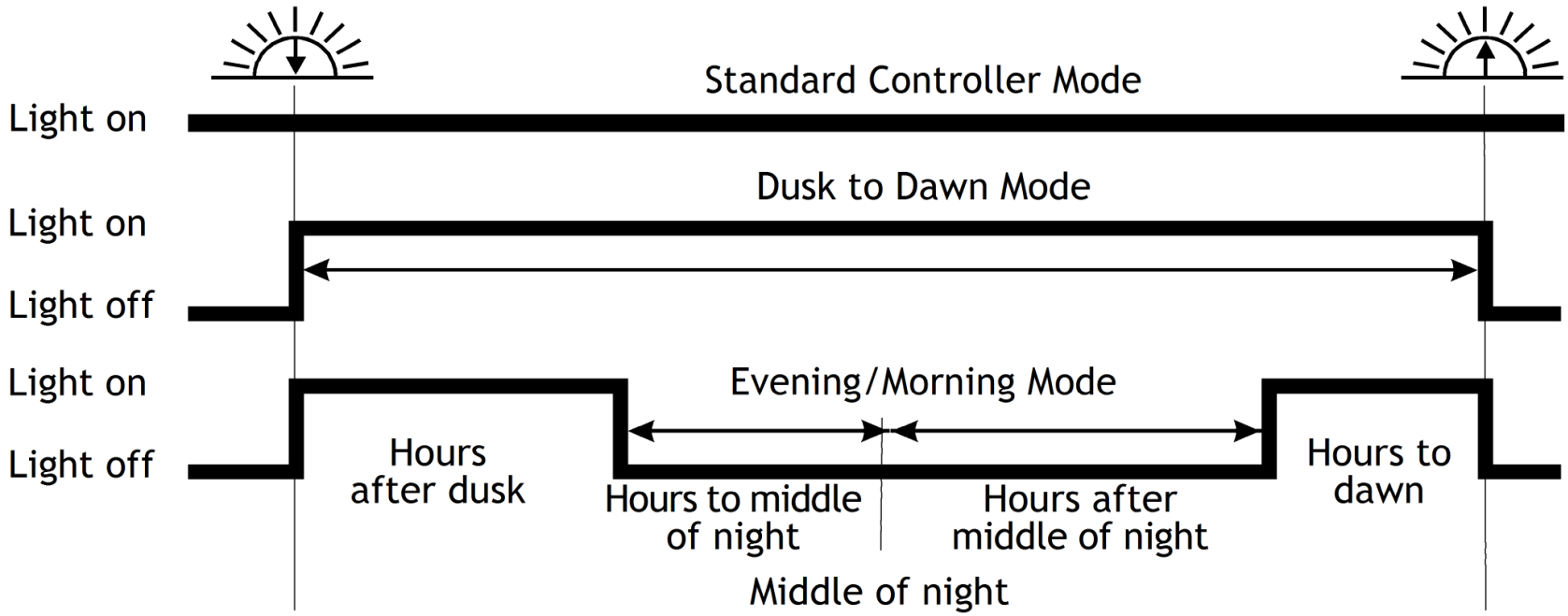
The CIS controller comes with a sophisticated night-light function. It controls the load output at night and is widely programmable.
There are 3 modes available:
Standard Controller, Dusk to Dawn and Evening/Morning modes.



"Middle of night" is detected automatically as the midpoint between dusk and dawn, no setting of a clock is required. It may take several days until the controller has "learned" the middle of the night precisely. "Middle of night" may be different from 12:00 midnight depending on your location.

The controller recognizes day and night based on the solar array open circuit voltage.

This day/night threshold can be modified according to local light conditions and the solar array used.

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Dimming Function

- Output voltage 0 V to 10 V relative to battery minus(adjust step 1 V).
- Load hours(load 1 on CU case printing) and Dimming hours(load 2 on CU case printing) work together to effect dimming function:

	No dimming	**Dimming on**	**Load off**
Load hours	on	on	off
Dimming hours	on	off	N/A
Dimming output voltage	10 V	Voltage proportional to dimming level	0 V

- Corresponding relationship of 'Output voltage' and 'Dimming value'

Output voltage	0 V	1 V	2 V	3 V	4 V	5 V	6 V	7 V	8 V	9 V	10 V
Dimming value	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

Testing Function

Pushing the test button on the CU (Control Unit) will switch on load terminal for 1 minute.
If pressing the button causes a load disconnect event (LVD/SOC, over current) the load will be switched off immediately.

Safety Features

	PV terminal	**Battery terminal**	**Load terminal**
Reverse polarity	Protected (1)	Protected (1)	Protected (2)
Short circuit(3)	Protected (8)	Protected (4)	Switches off immediately(8)
Over current	N/A	N/A	Switches off with delay(5)
Reverse current	Protected(6)	N/A	N/A
Over voltage	Max. 55 V (7)	Max. 40 V	Switches off above 15.5/31.0 V
Under voltage	N/A	N/A	Switches off
Over temp.	Reduces the charging current by PWM if over temperature occurs and switches off the load if the temperature reaches a high level.		

(1) Upanel-Ubattery is limited to 60 V.
(2) Controller can protect itself, but loads might be damaged.
(3) Short circuit: >3x – 20x nominal current.
(4) Battery must be protected by a fuse, or the it can be permanently damaged in case of a

short circuit.
(5) >200% nominal current: disconnect with 3s delay,
>150% nominal current: disconnect with 10s delay,
>110% nominal current: disconnect with 120s delay.
(6) Reverse current through solar panel is blocked by serial MOSFET. This function is tested and activated approx. once in 1min +/-5s.
(7) The solar panel voltage should not exceed this limit for a long time as voltage protection is done by a varistor.
(8) Limited electronic protection; must be additionally protected by an external fast acting fuse against short circuit to prevent damage from charge controller; nominal fuse rating shall be 1.5 times the maximum charge current.

WARNING: The combination of different error conditions may cause damage to the controller. Always remove the error before you continue connecting the controller!

Low Voltage Disconnect Function (LVD)

- State of charge (SOC) controlled: Disconnect at 11.00/22.00 V to 11.70/23.40 V(SOC1), 11.12/22.24 V to 11.76/23.52 V(SOC2), 11.25/22.50 V to 11.83/23.63 V(SOC3), 11.38/22.72 V to 11.89/23.78 V(SOC4), 11.51/23.02 V to 11.96/23.92 V(SOC5), 11.64/23.28 V to 12.02/24.04 V(SOC6).
- Voltage controlled (LVD): Disconnect at a fixed voltage between 11.0/22.0 V and 11.9/23.8 V (Step 0.1/0.2 V).

Note: Battery voltage must be below setting for longer than 2 minutes for LVD to take effect.

Note: The two voltage levels before/after the slash are valid for 12 V and 24 V systems respectively (valid for the charge controllers in this manual).

Factory Settings

You can configure CIS charge controllers via the Control Unit (CU). See CU manual for details.

	Factory setting
Load mode	Standard controller(night light off)
Low voltage disconnect	SOC4
Battery type	Gel
Night light level	8.0/16.0 V (1)
Load 1 evening hours	0 h
Load 1 morning hours	0 h
Dimming evening hours	0 h
Dimming morning hours	0 h
Dimming value	50 %

(1) PV panel open circuit voltage: Day level = Night level + 1.5/3.0 V

Night light level

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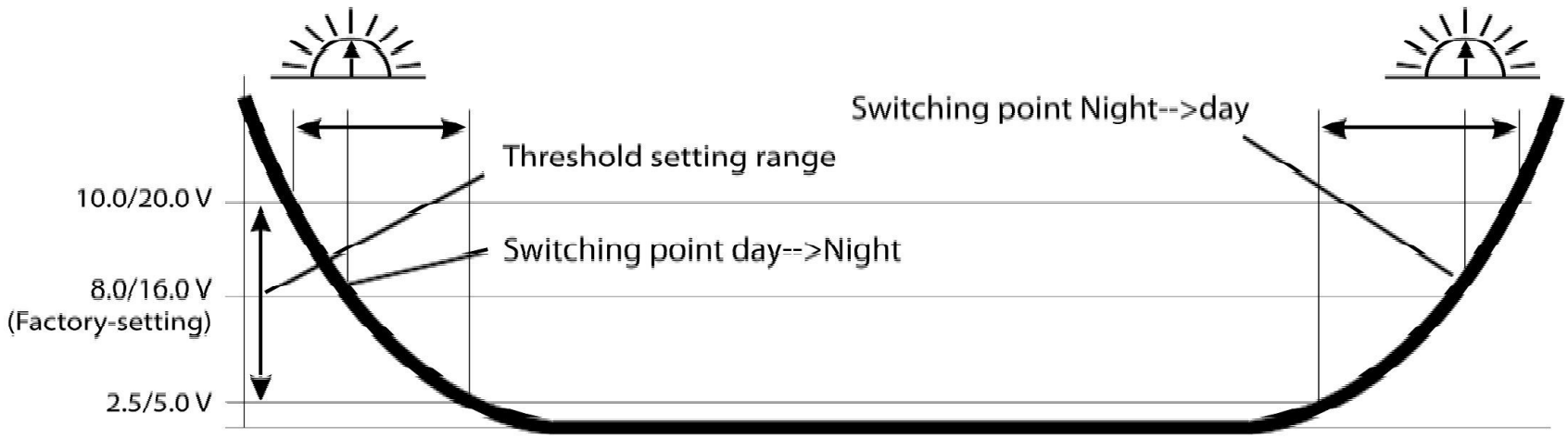
The controller recognizes "day" and "night" based on the solar PV array open circuit voltage. The daylight threshold can be modified according to the requirements of the local conditions and the solar PV array used.



Curve of open-circuit voltage solar array

To find the correct values, we recommend measuring the PV solar array open circuit voltage at the time when twilight has reached the level when the controller should switch the loads "on" or "off". This value (the closest available) can then be set according to the description in the programming section.

Technical Data

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Note: The two voltage levels before/after the slash are valid for 12 V and 24 V systems respectively.

Technical Data	**CIS-05**	**CIS-10**	**CIS-20**
System voltage	12/24 V auto recognition		
Max. charge current	5 A**	10 A**	20 A**
Max. load current	5 A**	10 A**	20 A**
Float charge	13.8/27.6 V(25 °C)		
Main charge	14.4 V (25 °C), 0.5 h (daily)		
Boost charge	14.4/28.8 V (25 °C), 2 h activation: battery voltage < 12.3/24.6 V		
Equalization	14.8/29.6 V (25 °C), 2 h activation: battery voltage < 12.1/24.2 V (at least every 30 days)		
Deep discharge protection Cut-off voltage	11.00-12.02/22.00-24.04 V By SOC 11.0-11.9/22.0-23.8 V By voltage (adjustable step 0.1/0.2 V)		

Reconnect level	12.8/25.6 V
Overvoltage protection	15.5/31.0 V
Undervoltage protection	10.5/21.0 V
Maximum solar voltage	30 V/50V (12/24 V system voltage)
Temperature compensation (Charge voltage)	-4.2 mV/K per cell
Max. self consumption	Lower than 8/10mA
Grounding	Positive Grounding
Ambient temperature range	–40 to +60 °C**
Maximum operational ambient temperature	50°C
Max. height	4,000 m above sea level
Battery type	lead acid (GEL, AGM, flooded)
Adjustment range: Evening hours Morning hours Night detection	 0 – 15 h 0 – 14 h 2.5 – 10.0 V / 5.0 – 20.0 V (adjust step 0.5/1.0 V)

Day detection	4.0 – 11.5 V / 8.0 – 23.0 V (adjust step 0.5/1.0 V)
Wire length	10 cm
Dimensions(WXHXD)	82 x 58 x 20 mm
Weight	150 g
Wire cross section	AWG 13 (2.5 mm^2)
Type of protection	IP68 (1.5 m, 72 h)

Dimming output	**CIS-05**	**CIS-10**	**CIS-20**
Dimming value	0 – 100 % output power (adjust step 10 %)		
Dimming output voltage	0 V to 10 V relative to battery minus		

** : At an ambient temperature above 50°C, with all currents applied, the charge controller will automatically reduce the charge current to limit the internal temperature.

Liability Exclusion

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The manufacturer shall not be liable for damages, especially on the battery, caused by use other than as intended or as mentioned in this manual or if the recommendations of the battery manufacturer are neglected. The manufacturer shall not be liable if there has been service or repair carried out by any unauthorized person, unusual use, wrong installation, or bad system design.

Subject to change without notice. Version: 20130412
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ISO9001

CE RoHS