

Skylla-i

24/80 (1+1)

24/80 (3)

24/100 (1+1)

24/100 (3)

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1. SAFETY INSTRUCTIONS

1.1. General

- Please read the documentation supplied with this product first, so that you are familiar with the safety signs and directions before using the product.
- This product is designed and tested in accordance with international standards. The equipment should be used for the designated application only.

- **WARNING: danger of electric shock**

The product is used in combination with a permanent energy source (battery). Even if the equipment is switched off, a dangerous electrical voltage may still be present at the input and/or output terminals. Always disconnect the AC power and the battery before performing maintenance.

- The product contains no internal user-serviceable parts. Do not remove the front panel unless the mains and the battery are disconnected. Do not put the product into operation unless all panels are fitted. All maintenance should be performed by qualified personnel.
- Never use the product at sites where gas or dust explosions could occur. Refer to the specifications provided by the manufacturer of the battery to ensure that the battery is suitable for use with this product. The battery manufacturer's safety instructions should always be observed.
- **WARNING: do not lift heavy objects unassisted.**

1.2. Installation

- Read the installation instructions before commencing installation activities.
- This product is a safety class I device (supplied with a ground terminal for safety purposes). **Its AC input and/or output terminals must be provided with uninterruptible grounding for safety purposes. An additional grounding point is located on the outside of the product.** If it can be assumed that the grounding protection is damaged, the product should be taken out of operation and prevented from accidentally being put into operation again; contact qualified maintenance personnel.
- Ensure that the connection cables are provided with fuses and circuit breakers. Never replace a protective device by a component of a different type. Refer to the manual for the correct part.
- Check before switching the device on whether the available voltage source conforms to the configuration settings of the product as described in the manual.

- Ensure that the equipment is used under the correct operating conditions. Never operate it in a wet or dusty environment.
- Ensure that there is always sufficient free space around the product for ventilation, and that ventilation openings are not blocked.
- Install the product in a heatproof environment. Ensure therefore that there are no chemicals, plastic parts, curtains or other textiles, etc. in the immediate vicinity of the equipment.

1.3. Transport and storage

- During storage or transport of the product, ensure that the mains supply and battery cables are disconnected.
- No liability can be accepted for damage in transit if the equipment is not transported in its original packaging.
- Store the product in a dry environment; the storage temperature should range from -20°C to 60°C .
- Refer to the battery manufacturer's manual for information on transport, storage, charging, recharging and disposal of the battery.

2. INSTALLATION AND WIRING

2.1. Installation

Find a dry and well-ventilated area to mount the Skylla charger and battery. Keep the cable length between the charger and the battery less than 6 meters.

The charger may be wall or floor mounted. Vertical mounting improves the air circulation within the charger cabinet and will prolong the lifetime of the battery charger.

Wall mounting

The unit can best be mounted to a wall using the supplied mounting plate. With this plate fixed to the wall, the charger can be hung on this mounting plate. The charger can then be fixed by installing two screws at the lower backside of the charger. Now the charger is fully secured.

Wiring

The inlets for the mains cable, the battery cables, the remote functions and the connection to attach the earth cable are located at the bottom of the housing, see Figure 1 for the two output models and figure 3 for the three output models

Figure 1 Bottom view of cabinet showing cable entries: two output models

1. Mains cable
2. Remote connections
3. Starter battery
4. Main battery
5. Grounding point

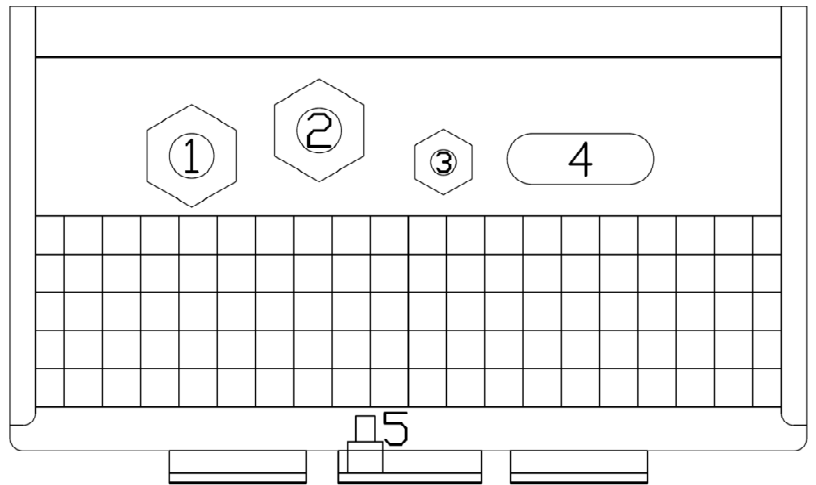
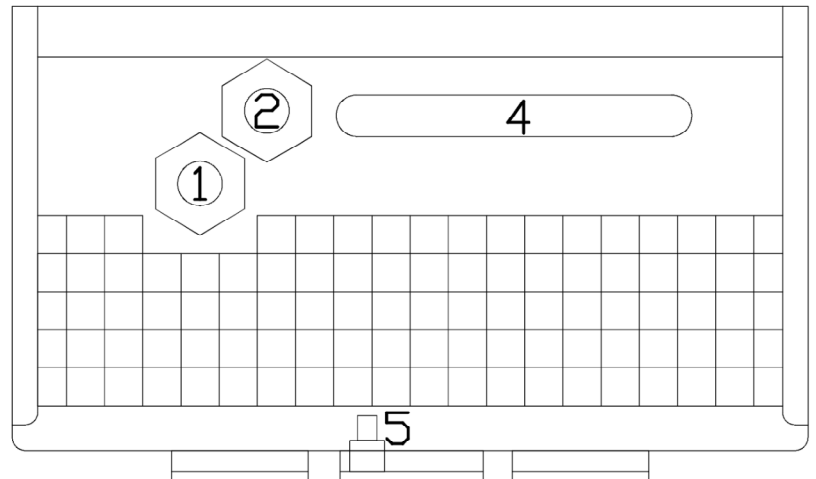


Figure 2 Bottom view of cabinet showing cable entries: three output models

1. Mains cable
2. Remote connections
3. (not present)
4. Main batteries
5. Grounding point



Connecting earth

Connect the grounding point (5) to a real earth-point. Connections to earth have to be according to applicable safety standards.

- On a ship: connect (5) to the earth plate or to the hull of the ship.
- On land: connect (5) to the earth of the mains. The connection to the earth of the mains has to be according to applicable safety standards.
- Mobile applications (a vehicle, a car or a caravan): Connect (5) to the frame of the vehicle.

The battery connections of the charger are fully floating with respect to this grounding point.

2.2. Connecting the batteries

Recommended cable cross section:


Skylla-i type	cable length up to 1,5m	cable length 1,5m - 6m
24/80 (1+1)	25 mm ²	35 mm ²
24/80 (3)	25 mm ² to each battery	35 mm ² to each battery
24/100 (1+1)	35 mm ²	50 mm ²
24/100 (3)	35 mm ² to each battery	50 mm ² to each battery

2.2.1. Connecting the starter battery

The starter battery has to be connected using wire of at least 2.5 mm².


Connect the positive (+) battery-pole to the "Starter battery plus" connector, see figure 2.

2.2.2. Battery connection sequence




The Skylla is NOT protected against reverse battery polarity. ("+" connected to "-" and "-" connected to "+"). Follow the installation procedure. The warranty expires when the Skylla becomes defective due to reverse polarity.

WARNING



The on/off switch at the front of the cabinet does not switch off the mains supply.

CAUTION




Disconnect the mains supply before making or breaking connections to the battery.

CAUTION

1. Disconnect the mains supply.
2. Disconnect battery cables from the battery.
3. Remove the front cover of the charger.
4. Connect battery cables to the charger.
5. Connect battery cables to the battery.

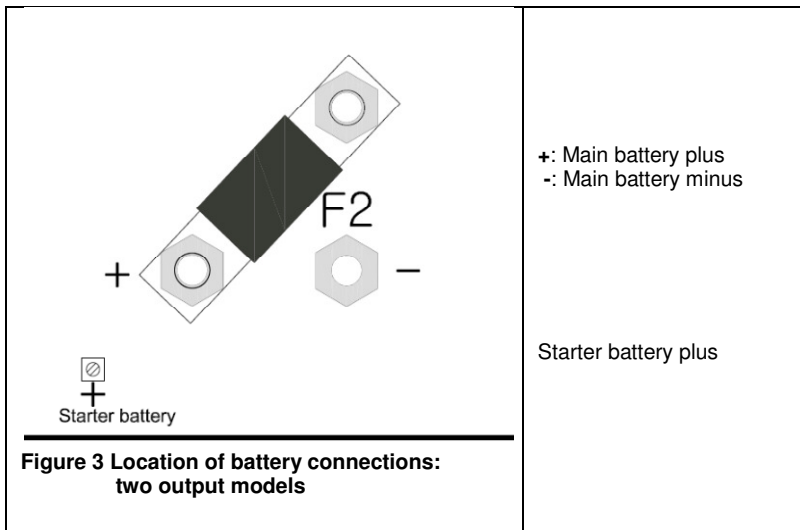
2.2.3 Battery disconnection sequence



When disconnecting the battery cables, be very careful not to accidentally short circuit the battery.

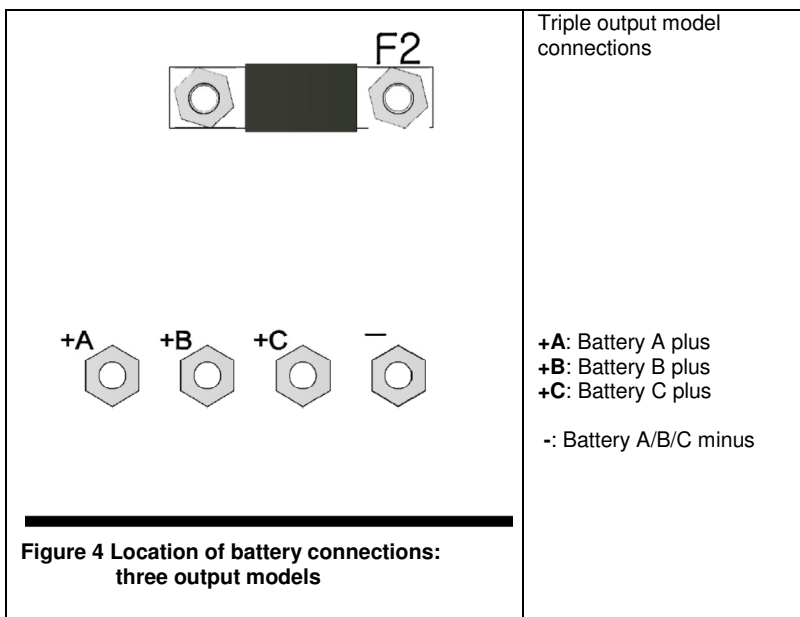
WARNING

1. Switch off the charger.
2. Disconnect the mains supply.
3. Disconnect battery cables from the battery.
4. Remove the front cover of the charger.
5. Disconnect the negative battery-cable.
6. Disconnect the positive battery-cable.
7. Disconnect all other cables like temperature sensor and/or voltage sensor used with this particular battery.



Note:

The starter battery can draw current from the battery connected to the main battery terminals in case the starter battery voltage is lower than the main battery voltage. However, the main battery cannot draw current from the starter battery even when the starter battery is fully charged and the main battery is at minimum charge level.



2.3. Other options

The wiring of these signals must be done with the mains disconnected from the charger.

CONNECTION BLOCK FOR EXTERNAL SENSORS, SWITCH AND RELAY

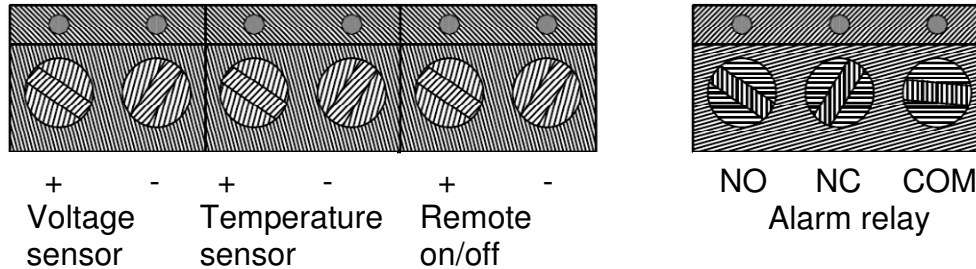


Figure 5 Connector block

2.3.1. External voltage sensor (see fig 3)

External voltage sensing may be used when accurate battery voltage sensing is important, such as high charging currents in combination with long cables.

To connect the external voltage sensing option, proceed as follows:

- connect a red wire (0.75 mm²) between the positive battery pole and connector "+ Voltage sensor"
- connect a black wire (0.75 mm²) between the negative battery pole and connector "- Voltage sensor"
- check that the accompanying LED is lit, otherwise check cabling

2.3.2. External temperature sensor

The external temperature sensor, supplied with the charger, can be connected to these terminals in order to perform temperature compensated charging of the battery. The sensor is electrically isolated and must be connected to the negative pole of the battery.

To connect the temperature sensor, proceed as follows:

- connect the red wire to connector "+ Temperature sensor"
- connect the black wire to connector "- Temperature sensor"
- mount the temperature sensor on the negative pole of the battery
- check that the accompanying LED is lit, otherwise check cabling

2.3.3. Remote on/off

The wiring of the remote switch requires extra attention. Since this input is quite sensitive it is advised to use twisted wires for this connection.

The remote on/off input can also be connected to an open collector optocoupler: the open circuit voltage is 3 V and the closed circuit current is 100 µA.

When no remote switch is connected the remote on/off terminals must be short circuited by a short wire.

2.3.4. Alarm relay connections

The alarm relay is triggered by a battery under-voltage situation (<23,8 V). The function may be used for any desirable action: starting a generator, sounding an alarm etc.

2.3.5. CAN bus connection (VE.Can)

The CAN bus connectors (RJ45) provide access for control (Skylla-i remote control panel or NMEA 2000).

The two RJ45 connectors in each charger (see figure 7) are parallel connected. There is therefore no functional difference between these connectors.

The end of a CAN cable should have a bus terminator. This is achieved by inserting a bus terminator in one of the two RJ45 connectors and the CAN cable in the other. In case of a node (two CAN cables, one in each RJ45 connector), no termination is needed.

Several Skylla-i control panels can be connected to one charger or to a set of synchronised and parallel connected chargers.

2.3.6. Synchronised parallel operation

Several chargers can be synchronised with the CAN interface. This is achieved by simply interconnecting the chargers with RJ45 UTP cables (bus terminators needed, see section 2.3.5).

The paralleled chargers must have identical DIP switch and rotary switch settings .

A mix of Skylla-i 100A and 80A chargers can be paralleled.

Two output and three output chargers cannot be paralleled with each other.

The shore current limit of the parallel charger group can be set with the Skylla-i control panel. The current limit as shown on the panel is the shore current of the group.

The output current of one charger may differ from another charger although connected in parallel.

If one charger from the parallel connected chargers is disconnected, the other charger(s) will blink the "ON" LED every three seconds.

In case of using remote sensors (voltage and/or temperature), the remote sensor needs to be connected to one of the parallel operating chargers. All other chargers will share the information via the CAN interface. The green LED in the charger with the sensor connected to it, will be lit continuously, the other chargers will blink the corresponding LED.

In case of synchronized parallel operation the LED "ON" will blink every 3 seconds on all paralleled units.

2.3.7 Connecting the mains (see fig 4)

1. Check if the battery is connected to the charger.
2. Remove the front of the battery charger to access the AC input connector.
3. Connect the mains PE cable (green/yellow) to the AC input connector, terminal PE, located on the circuit board, see Figure
4. Connect the mains neutral cable (blue) to the AC input connector terminal N.
5. Connect the mains line cable (brown) to the AC input connector terminal L.
6. **Select the correct battery charge curve before applying AC power (see section 3).**

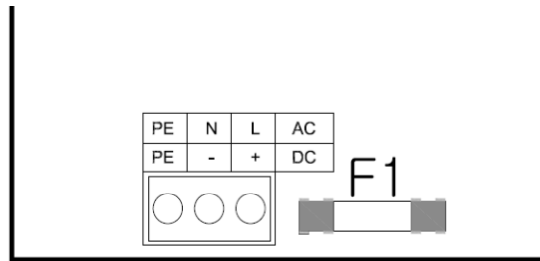


Figure 6 Mains cable connection

3. CONTROL AND ADJUSTMENT

When the charger is installed correctly and before mains power is applied, the charger should be set up to suit the battery connected.

Note about the models with three outputs: all settings are applied to the three outputs simultaneously

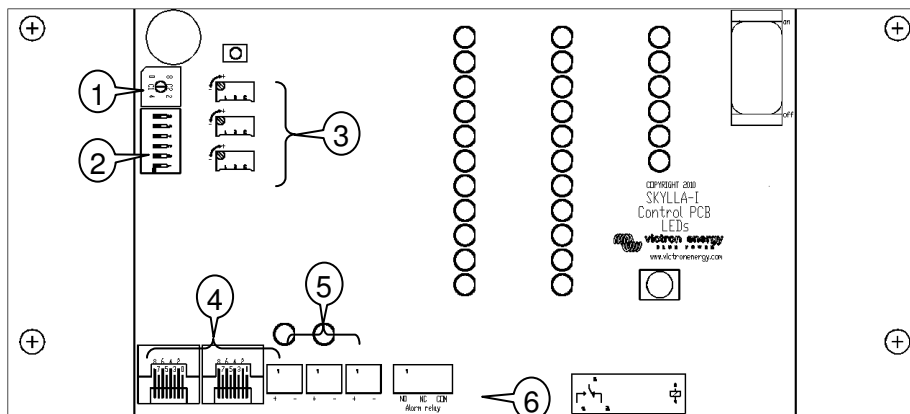


Figure 7 Internal controls and connections

For this purpose, the control board is fitted with a number of switches and connectors to facilitate the user with the following options:

1. Rotary switch for choice of battery type.
2. Dip switch for setting various options.
3. Fine tuning of current and voltage for position 8 of the rotary switch.
4. CAN bus connection (RJ45).
5. Indicators for correct connection of voltage and temperature sensors.
6. Connection block for external sensors, switch and relay.

3.1. Rotary switch

The rotary switch provides the user with a selection of preset battery types to be charged. See table below.

Warning: the charge voltages as given below are indicative only. Always refer to the battery supplier for the right charge voltages.

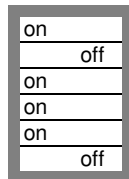
Pos	Description	Absorption V	Float V	Storage V	Equalization maxV@% of Inom	dV/dT mV/°C
0	Canbus control					
1	Gel Victron long life (OPzV) Gel exide A600 (OPzV) Gel MK	28,2	27,6	26,4	31,8@8% max 1hr	-32
2	Default setting Gel Victron deep discharge, Gel Exide A200 AGM Victron deep discharge Stationary tubular plate (OPzS) Rolls Marine (flooded), Rolls Solar (flooded)	28,8	27,6	26,4	32,4@8% max 1hr	-32
3	AGM spiral cell Rolls AGM	29,4	27,6	26,4	33,0@8% max 1hr	-32
4	PzS tubular plate traction batteries or OPzS batteries in cyclic mode 1	28,2	27,6	26,4	31,8@25% max 4hrs	-32
5	PzS tubular plate traction batteries or OPzS batteries in cyclic mode 2	28,8	27,6	26,4	32,4@25% max 4hrs	-32
6	PzS tubular plate traction batteries or OPzS batteries in cyclic mode 3	30,0	27,6	26,4	33,6@25% max 4hrs	-32
7	Lithium Iron Phosphate (LiFePo₄) batteries	28,4	n. a.	26,7	n. a.	0
8	Adjustable: maximum charge current and absorption and float voltages can be set with potentiometers	Adj.	Adj.	26,4	(Vabs. + 3,6)@25% max 4hrs	-32
9	Power supply mode	24,0	n. a.	n. a.	n. a.	0

3.2. DIP switch

The DIP switches are numbered 6 to 1, **top to bottom**.

Default settings:

DS-6 Bulk Protection
DS-5 Absorption time
DS-4 Absorption time
DS-3 Adaptive
DS-2 Watch
DS-1 Automatic equalization



3.3. Explanation of settings:

DS-6. Bulk Protection. When switched on, the failure led will be lit and the charger will shut down when the bulk time exceeds 10 hrs.

DS-5 and DS-4. Absorption time. The combination of switches 5 and 4 sets the maximum absorption time in case of adaptive charging, and a fixed time in case the adaptive mode has been switched off (DS-3).

DS-5	DS-4	Absorption time
Off	Off	2 hrs (preferred for LiFePo₄ batteries)
On	Off	4 hrs.
Off	On	8 hrs. (default)
On	On	12 hrs.

DS 3. Adaptive. When switched on, the absorption and float time depend on the bulk time (with the maximum time set by DS-5 and DS-4).

The dependencies are as follows:

Absorption time = (bulk time)*20 with a minimum of 30 minutes and a maximum as set by DS-5 and DS-4.

Float time = (bulk time)*20 with a minimum of 4hrs and a maximum of 8hrs.

DS-2. Watch. When DS-2 is on, the battery voltage is checked when the charger is switched on. If the voltage exceeds 26V, the charger will consider the battery fully charged, and start in storage mode. If the voltage is lower, the charger will start in bulk mode.

When DS-2 is off, the charger will always start in bulk mode.

DS-1. Automatic equalization. When DS-1 is switched on, the absorption charge will be followed by a voltage limited constant current period (see table). The yellow LED “abs” will blink during equalization.

The current is limited to 8% of the bulk current for all VRLA (Gel or AGM) batteries and some flooded batteries, and to 25% of the bulk current for all tubular plate batteries. The bulk current is the rated charger current (80A or 100A) unless a lower setting has been chosen (charge current can be reduced with the current setting potentiometer and rotary switch in position 8, or with the Can bus interface).

If, as recommended by most battery manufacturers, the bulk charge current is about 20A per 100Ah battery capacity (i.e. 500Ah for a 100A charger), the 8% limit translates to 1,6A per 100Ah battery capacity, and the 25% limit translates to 5A per 100Ah capacity.

In case of all VRLA batteries and some flooded batteries (rotary switch position 1, 2 or 3) automatic equalization ends when the voltage limit maxV has been reached, or after $t = (\text{absorption time})/8$, whichever comes first.

For all tubular plate batteries automatic equalization ends after $t = (\text{absorption time})/2$.

Warning

Some battery manufacturers do recommend a constant current equalization period, and others do not. Do not use constant current equalization unless recommended by the battery supplier.

Rotary switch position 8: manual setting potentiometers

These potentiometers provide adjustable levels for (from top to bottom):

- bulk current (range 0A .. 100A for a 100A charger)
- absorption voltage (range 11.5V .. 30V)
- float voltage (range 11.5V .. 30V)

Control direction is such that the values increase when turning the potentiometer clockwise. For easy adjustment the charger will automatically jump to the appropriate mode as soon as it detects a change in the position of a potentiometer. When satisfied with the settings, restart the charger and it will go through the regular charge sequence using the new settings.

Rotary switch position 9: DC power supply mode

The charger can be set to operate as a DC power supply.

In this mode, the charger functions as a constant voltage source with a maximum output current of 80 resp. 100 A. By default the output voltage is set to 24V, if needed the output voltage can be changed by adjusting the absorption voltage potentiometer (range 11.5V .. 30V). When satisfied with the new setting switch off the charger using the main on/off switch and it will store the voltage level.

3.4. Temperature compensation

The temperature sensor should be connected to the plus pole of the battery.

The temperature compensation is set at $-32\text{mV}/^\circ\text{C}$ for all 24V lead acid batteries (see table and fig 7), and all charge states.

The temperature sensor must be installed when:

- ambient temperature of the battery is expected to regularly be lower than 15°C or to regularly exceed 30°C
- charge current exceeds 15A per 100Ah battery capacity

Temperature compensation is not required for Li-Ion batteries.

3.5. Manual equalize function

With the equalize button on the front, the charger can be put in equalize mode only during absorption and float periods. When the charger is still in bulk mode equalization is not possible.

To enable equalization, press the equalize button for three seconds. The yellow led “abs” and “bulk” will alternate during equalization.

Current and voltage limits are identical to the automatic equalize function (see section 3.3). The equalize duration is however limited to max. 1hr when triggered with the equalize button.

3.6. Power Control – maximum use of limited shore current

A maximum input current can be set in order to avoid fusing the mains supply.

This adjustment is only available with the optional Skylla-i control panel.

4. OPERATION

4.1. Battery charging

After applying mains power and switching the unit ON:

- all led's will be lit during two seconds
- the green led will then be on to indicate the unit is "On"
- the state of charge will be indicated by lighting one of four yellow led's
- the actual output voltage and current will be indicated by the appropriate red led bars
- the internal fans may run depending upon the temperature inside the cabinet (temperature controlled)

In case the red led is lit, refer to section 6.

4.2. Seven stage charge curve for lead-acid batteries

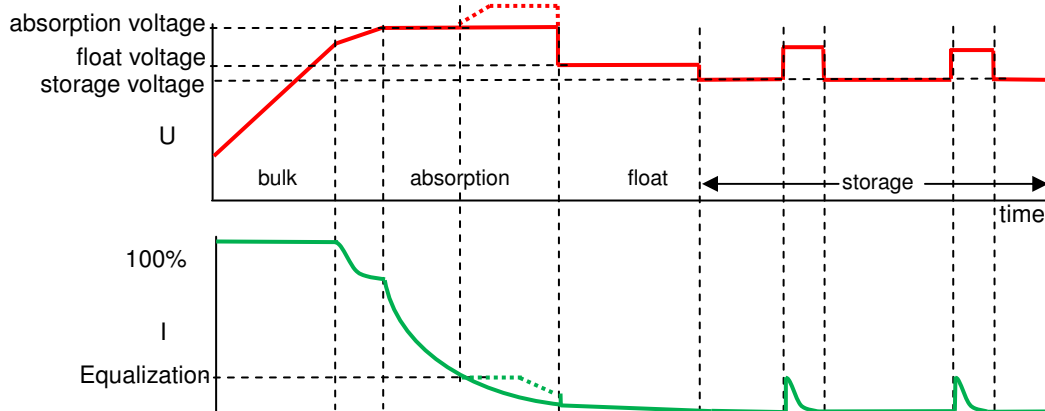


Figure 8

4.2.1. Bulk

Entered when the charger is started (DS-2 on and battery voltage <26V, or DS-2 off), or when the battery voltage falls below 26,4V (due to a heavy load) during at least 1 minute. Constant current is applied until gassing voltage is reached (28,8V for a 24V battery).

4.2.2. BatterySafe

If absorption voltage is set higher than 28,8V, the rate of voltage increase beyond 28,8V is limited to 14mV/minute, in order to prevent excessive gassing.

4.2.3. Absorption

After the absorption voltage has been reached, the charger operates in constant voltage mode.

In case of adaptive charging, the absorption time is dependent on the bulk time, see section 3.3.

4.2.4. Automatic equalization

If automatic equalization has been set to "on", the absorption period is followed by a second voltage limited constant current period: see section 3.3. This feature will charge VRLA batteries to the full 100%, and prevent stratification of the electrolyte in flooded batteries.

Alternatively, manual equalization can be applied.

4.2.5. Float

Float voltage is applied to keep the battery fully charged.

In case of adaptive charging, the float voltage time is dependent on the bulk time, see section 3.3.

4.2.6. Storage

After float charge the output voltage is reduced to storage level. This level is not sufficient to compensate for slow self-discharge of the battery, but will limit water loss and corrosion of the positive plates to a minimum when the battery is not used.

4.2.7. Weekly battery 'refresh'

Once a week the charger will enter Repeated Absorption-mode during one hour to 'refresh' (i. e. to fully charge) the battery.

4.3. Four stage charge curve for Lithium Iron Phosphate (LiFePo4) batteries

4.3.1. Bulk

Entered when the charger is started (DS-2 on and battery voltage <26V, or DS-2 off), or when the battery voltage falls below 26,7V (due to a heavy load) during at least 1 minute. Constant current is applied until absorption voltage is reached (28,4V for a 24V battery).

4.3.2. Absorption

After the absorption voltage has been reached, the charger operates in constant voltage mode. The recommended absorption time is 2 hours.

4.3.3. Storage

After absorption charge the output voltage is reduced to storage level. This level is not sufficient to compensate for slow self-discharge of the battery, but will maximize service life.

4.3.4. Weekly battery 'refresh'

Once a week the charger will enter Repeated Absorption-mode during one hour to 'refresh' (i. e. to fully charge) the battery.

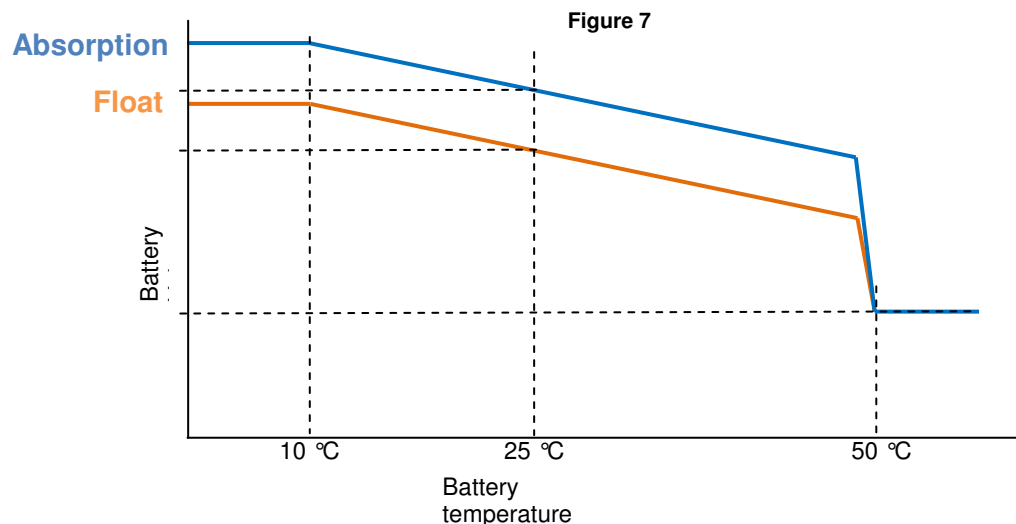
5. MAINTENANCE

This charger does not require any specific maintenance. However an annual check of the battery connections is recommended. Keep the charger dry, clean and free of dust.

6. TROUBLESHOOTING

Problem	Possible cause	Solution
Charger does not function	The mains is not ok	Measure mains: 180 -265 VAC
	Input or output fuses are defective	Return product to your dealer
The battery is not fully charged	A bad battery connection	Check battery connection
	The battery select switch is in the wrong position	Select correct battery type with rotary switch
	Cable losses too high	Use cables with larger cross section Use external voltage sensing
The battery is being overcharged	The battery select switch setting is switch is in the wrong position	Select correct battery type with rotary switch
	A battery cell is defective	Replace battery
Battery temperature too high	Overcharging or fast charging	Connect external temperature sensor
Failure led on (see also chapter 9)	Battery voltage too high (> 36 V)	Check all charging equipment Check cables and connections
	Bulk time too long (> 10 hrs)	Possible cell failure, or higher charge current needed
	Temperature in cabinet too high	Check air vents of cabinet Improve cooling of environment

7. TEMPERATURE COMPENSATION



8. SPECIFICATION

Skylla-i	24/80 (1+1)	24/80 (3)	24/100 (1+1)	24/100 (3)
Input voltage (VAC)	230 V			
Input voltage range (VAC)	185-265 V			
Input voltage range (VDC)	180-350 V			
Maximum AC input current @ 180 VAC	16 A		20 A	
Frequency (Hz)	45-65 Hz			
Power factor	0,98			
Charge voltage 'absorption' (VDC) (1)	28,8 V			
Charge voltage 'float' (VDC)	27,6 V			
Charge voltage 'storage' (VDC)	26,4 V			
Charge current (A) (2)	80 A	3 x 80 A (max total output: 80A)	100 A	3 x 100 A (max total output: 100A)
Charge current starter batt. (A)	4 A	n. a.	4	n. a.
Charge algorithm	7 stage adaptive			
Battery capacity (Ah)	400-800 Ah		500-1000 Ah	
Charge curve, Li-Ion	4 stage, with on-off control or CAN bus control			
Temperature sensor	Yes			
Can be used as power supply	Yes			
Remote on-off port	Yes (can be connected to a Li-Ion BMS)			
CAN bus communication port	Two RJ45 connectors, NMEA2000 protocol, galvanically isolated			
Synchronised parallel operation	Yes, with the CAN bus			
Remote alarm relay	DPST	AC rating: 240VAC/4A	DC rating: 4A up to 35VDC, 1A up to 60VDC	
Forced cooling	Yes			
Protection	Battery reverse polarity (fuse)		Output short circuit	Over temperature
Operating temp. range	-20 to 60°C (Full output current up to 40°C)			
Humidity (non condensing)	max 95%			
ENCLOSURE				
Material & Colour	aluminium (blue RAL 5012)			
Battery-connection	M8 bolts			
230 VAC-connection	screw-clamp 10mm ² (AWG 7)			
Protection category	IP 21			
Weight kg (lbs)	7 kg (16 lbs)			
Dimensions hxwx d in mm (hxwx d in inches)	405 x 250 x 150 mm (16.0 x 9.9 x 5.9 inch)			
STANDARDS				
Safety	EN 60335-1, EN 60335-2-29			
Emission	EN 55014-1, EN 61000-6-3, EN 61000-3-2			
Immunity	EN 55014-2, EN 61000-6-1, EN 61000-6-2, EN 61000-3-3			
1) Output voltage range 20-36V. Can be set with rotary switch or potentiometers.	2) Up to 40°C (100°F) ambient. Output will reduce to 80% at 50°C, and to 60% at 60°C.			

9. LED INDICATION

Regular LED status:

- is permanent on
- ⊗ is blinking
- is off

LEDs: O B A F S E = On Bulk Absorption Float Storage failure

LEDs	Skylia-i						Panel			
	O	B	A	F	S	E	B	A	F	E
Bulk	●	●	○	○	○	○	●	○	○	○
BatterySafe (dU/dt)	●	●	●	○	○	○	●	●	○	○
Absorption	●	○	●	○	○	○	○	●	○	○
TPTB	●	○	●	●	○	○	○	●	●	○
Float	●	○	○	●	○	○	○	○	●	○
Storage	●	○	○	○	●	○	○	○	⊗	○
Repeated absorption	●	○	●	○	●	○	○	●	⊗	○
Reduced current mode (*1)	⊗	●	○	○	○	○	●	○	○	○
Equalization (*2)	●	⊗	⊗	○	○	○	⊗	⊗	○	○
Power supply mode	●	●	●	●	●	○	●	●	●	○

(*1) This can be due to temperature, voltage, input current limit etc; the panel displays the input current, therefore no blinking indication there.

(*2) Blink alternating

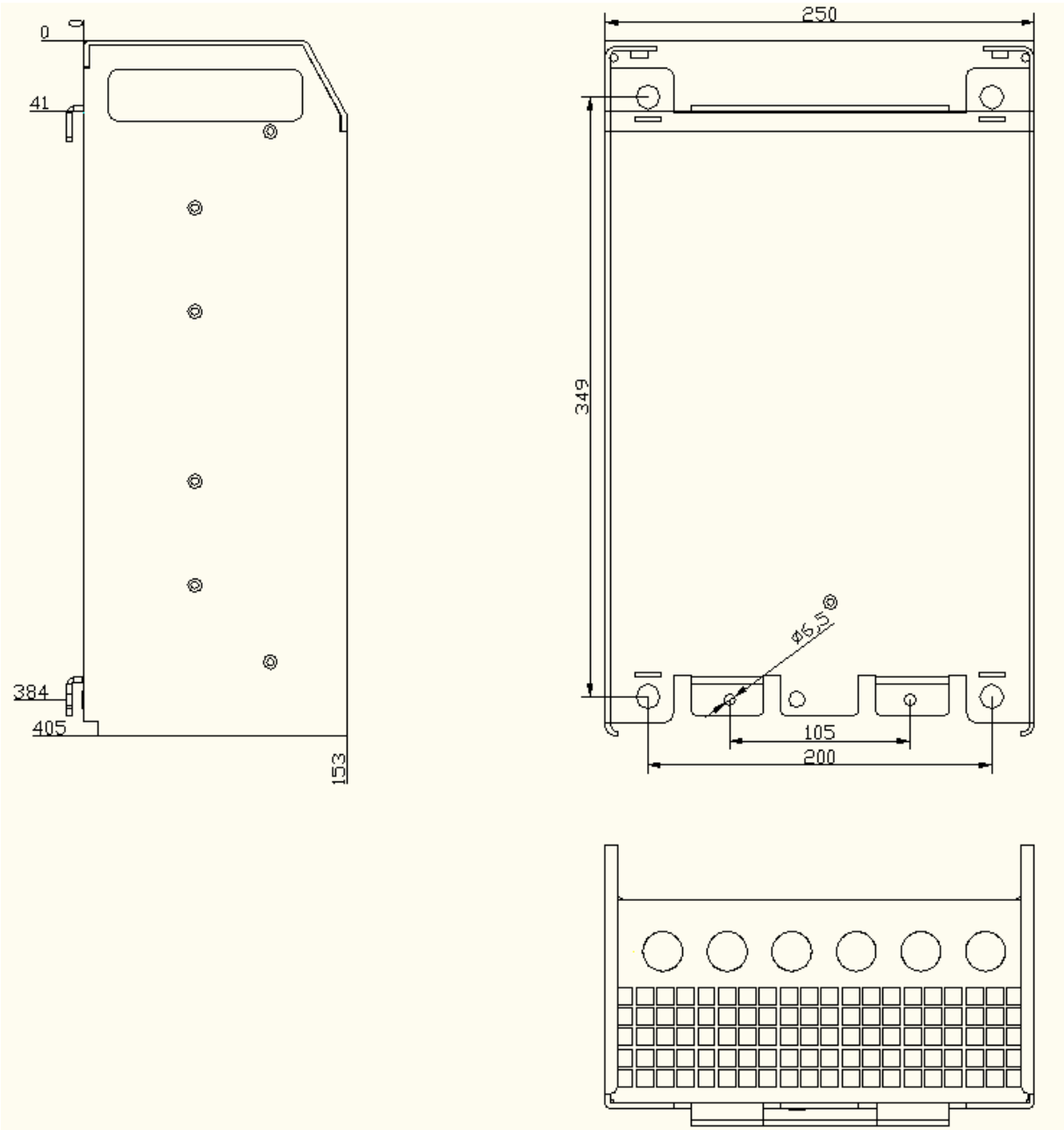
Fault situations

LEDs	O	B	A	F	S	E	
Battery temperature sensor	●	○	⊗	⊗	○	●	
Battery sense wires	●	⊗	⊗	○	○	●	
Bulk time protection (10hrs)	●	⊗	○	○	○	●	
Charger temperature too high	●	⊗	⊗	⊗	⊗	●	
Charger over-current	●	⊗	○	○	⊗	●	
Charger over-voltage	●	○	⊗	○	⊗	●	
Internal error	●	⊗	⊗	⊗	○	●	(e.g. calibration data lost)

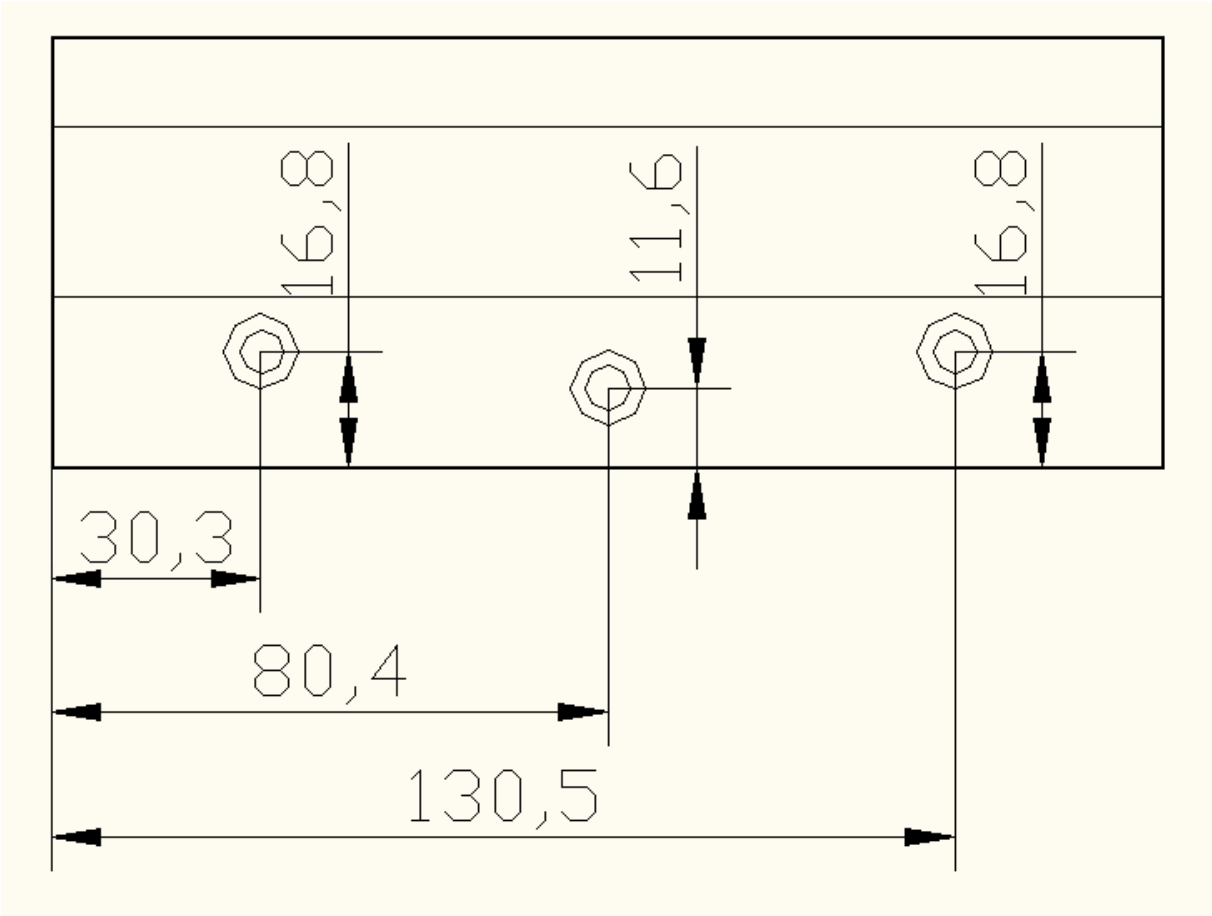
Note: LEDs blink synchronously

The panel lights the error led and displays the error code.

Appendix A: Dimensions



Appendix B: Wall mounting bracket



Victron Energy Blue Power

Distributor:

Serial number:

Version : 05
Date : 28 May 2013

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