

Installation and Operating Manual for Unit Combination of Mains Charger, Charging Converter and MPPT Solar Controller

VBCS 30/20/400 Triple HV CI Converter VCC 12 V-12 V/30 A, AC Mains 12 V/20 A, MPPT Solar 400 Wp No. 3270

VBCS 45/30/600 Triple HV CI Converter VCC 12 V-12 V/45 A, AC Mains 12 V/30 A, MPPT Solar 600 Wp No. 3271

VBCS 60/40/800 Triple HV CI Converter VCC 12 V-12 V/60 A, AC Mains 12 V/40 A, MPPT Solar 800 Wp No. 3272

All-automatic battery charger with 3 charging sources for optimum battery charging during mains operation and solar operation, designed for motor homes and intervention vehicles.



Please completely read this operating and installation manual thoroughly prior to connection and start-up, in particular "Safety Regulations and Appropriate Application", see page 18.

VOTRONIC chargers of series "VBCS Triple" excel by their compact design, low weight (high-frequency switching power supply, Switch Mode Technology), as well as the intelligent microprocessor charging control with characteristic lines of charging „IU1oU2oU3“ and dynamic charging time calculation.

9 charging programs stored in the memory for **Lead-Acid, Gel and AGM**, as well as advanced **Lithium LiFePO4 Batteries**, ensure unattended, quick and careful full charging from any charging state with subsequent trickle charging and maintenance of the battery and simultaneous supply of the connected consumers 12 V during the entire charging process. Consumed energy will be compensated immediately.

Mains Operation, during standstill operation at the external socket of the mains supply:

- The full charging capacity in the universal wide range from 110 V AC - 230 V AC without any switching is available worldwide, even in case of large deviations in the power supply (low voltage/overvoltage, sine curve, frequency).
- Efficient charging of the board battery and supply of the 12 V consumers via mains.
- Auxiliary charging with 13.2 V or 12 V/4-5 A for support charging and trickle charging of the vehicle's (lead) starter battery in case of extended standstill periods.
- Due to the long-term characteristic lines of charging, the unit may be connected continuously to the mains (such as for standstill periods or winter breaks).

Charging Converter, "B2B" Operation, mobile operation from dynamo and starter battery (Battery to Battery):

- The efficient charging converter (booster) allows full charging of the board battery during driving.
- It increases/reduces the voltage to the level, which is required for precise charging of the board battery with the optimum characteristic line of charging.
- Cable losses and considerable voltage fluctuations of the dynamo, known from **Euro 6** vehicles, are completely compensated.
- The simultaneously supplied 12 V consumers are protected against overvoltage and voltage fluctuations.

Solar Operation, "MPPT" (Maximum-Power-Point-Tracking):

- Controllers according to the MPP technology are continuously and automatically calculating the maximum power yield (MPPT) of the solar modules several times per second. This surplus of charging current of 10 % to 30 % ensures short charging times and the best possible power yield of the solar system.
- Auxiliary charging for support charging and trickle charging of the vehicle's starter battery in case of extended standstill periods.
- **Terminal "AES"**, for automatic commutation of refrigerators with "AES" (Automatic Energy Selector, Electrolux/ Dometic) from gas operation to 12 V operation in case of excess solar power.

Further Characteristics of the Unit:

- The **charging voltage** being **free from peaks** is **controlled in such a way**, that **overcharging** of the batteries is **excluded**.
- **All-automatic Continuous Operation:** The charger may be connected continuously to the batteries, thus keeping the full charge. If the charging source is missing (power failure, engine stop, night), the batteries will **not be** discharged.
- **Parallel and Floating Operation:** In case of simultaneous consumption, charging of the battery is continued or trickle charging is effected. Calculation and control of the adaptation of the charging times is effected automatically by the charger.
- **Unattended Charging:** Multiple protection against overload, overheating, overvoltage, short-circuit, incorrect behaviour and back discharge of the battery by electronically controlled gradual reduction down to complete separation of charger and battery.
- **Power Pack Function:** Allows supply of the consumers without battery (such as during battery replacement).

- **Integrated On-board Mains Suppression Filter:** Unproblematic parallel operation of further charging sources (wind-driven, motor-driven and petrol-driven generators) at one battery.
- **Charging Cable Compensation:** Automatic compensation of voltage losses on the charging cables.
- Connection for **Battery Temperature Sensor** (included in the standard delivery scope):
Lead batteries (acid, gel, AGM): In case of **low outside temperatures**, full charging of the weak battery is **improved** by automatic adaptation of the charging voltage to the **battery temperature**, and in case of summery temperatures **unnecessary battery gassing** will be avoided.
LiFePO4 Batteries: Battery protection in case of high temperatures or particularly in case of low temperatures < 0°C.
Highly recommended, if the battery temperature might drop below 0 °C during operation.
- **Lead Battery regeneration** in case of standstill: automatically twice a week to avoid harmful acid accumulation.
- **Charging aid for totally discharged lead batteries:** Gentle preliminary charging of the (lead-acid, gel, AGM) battery to 8 V, followed by powerful support of the battery, in case of possibly switched-on consumers.



Battery Lifetime and Efficiency:

- Keep the batteries cool, **LiFePO4 preferably above 0 °C**. Choose an appropriate location for installation.
- **Store only fully charged batteries and recharge them periodically.**
- **Open lead-acid batteries and batteries being "maintenance-free according to EN / DIN": Check the acid level periodically!**
- **Recharge totally discharged lead batteries immediately!**
- **LiFePO4: Only use complete batteries with BMS and safety circuit.**
! Total discharge is absolutely to be avoided !

Installation of the Unit

Install the charger **near the board supply battery I (for short charging cables)** at a clean, even and hard mounting surface, which is protected from moisture, humidity and aggressive battery gases. The unit can be installed in any position.

Despite the charger's high efficiency, heat is produced, which is brought out of the casing by means of the built-in fans. The vent holes at the unit rear should never be covered (minimum distance 10 cm) to ensure full charging capacity. Ensure sufficient **ventilation** in the **environment of the unit** so that the heat can be carried-off.

Otherwise, the unit might effect a slight reduction of the charging capacity in case of increased heating.

Unit Connection



To ensure the best possible and durable electrical and mechanical connection at the terminals, we recommend connecting all cables without using ferrules. The terminals are designed in such a way that connecting stranded wires without ferrules is permitted and results in a superior electrical and mechanical connection.

- Choose the suitable connection plan according to your application. Observe the indications, fuses, polarity +/-!
- Produce the power connections observing **table 1, page 6** and the "Recommended Cable Cross-Sections, Cable Lengths and +Fuse Capacities".
Reverse battery (+/-) might result in severe damages of the unit!
Tightening torque 2.0 Nm!
- Produce the control connections. See description from **page 7**, "Configuration of the 9-pole Terminal Strip (Sensor Inputs and Terminals)".
Tightening torque 0.5 Nm!

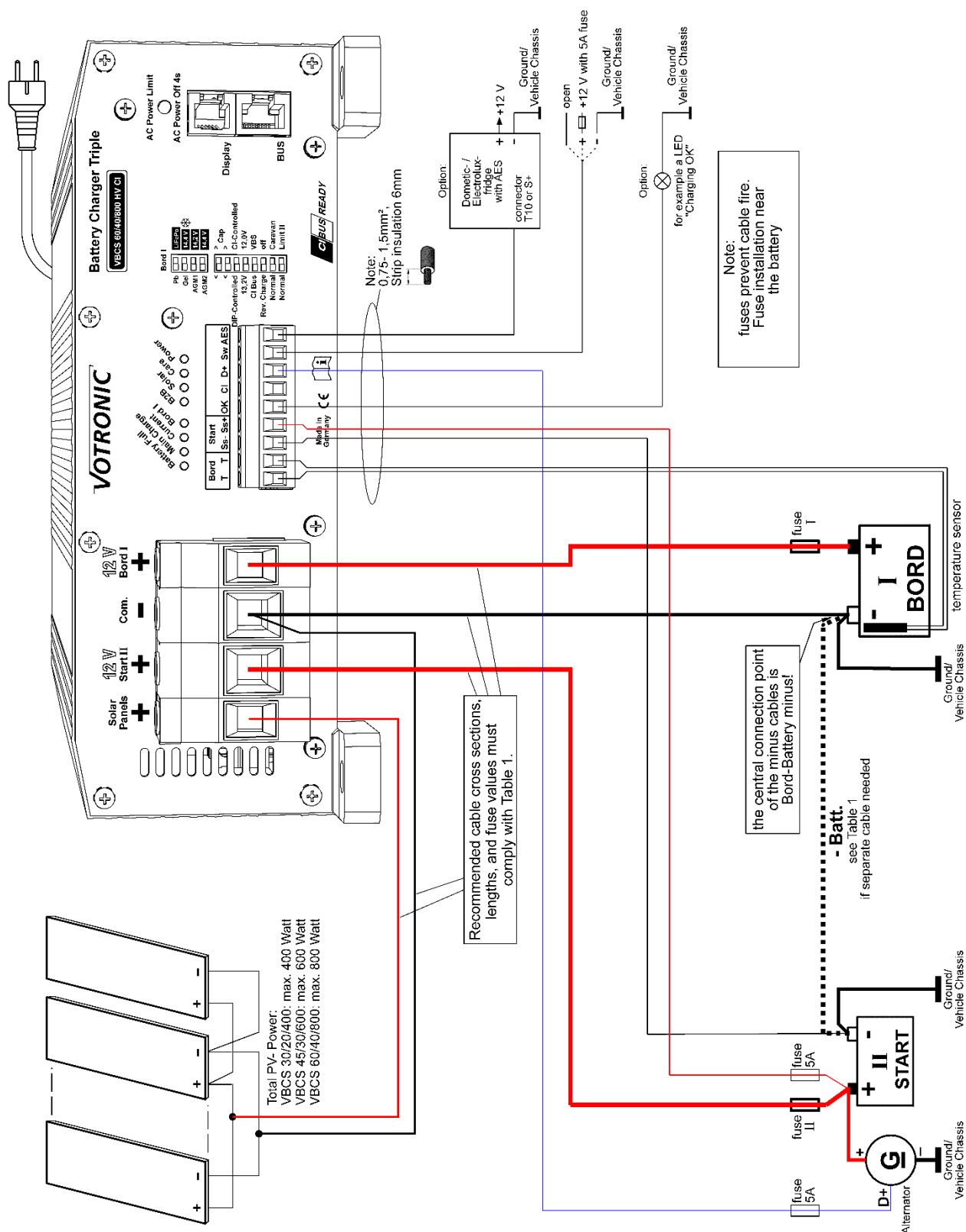


Unit Settings

- Set the **battery type** "Board I" (design, technology), see 1.) **Page 9**.
- Adjust the further settings and functions, set the 8 slide switches, **page 12, table 2 and 2.) -- 8.)**.

Start-up and Function Test:

- Further description, see **page 16**.





Use the cabling and the fuses for the electroblock provided by the customer and insert the changeover relay into the cable to the starter battery (changeover relay only necessary if starter battery should be connected during motor off (D+ low) with the Output B1). Connect the VBCS Triple with the cross-sections and fuses according to table 1. If required, combination with special case TR-Bypass Relay, page 4, in the VBCS triple cables.

Table 1: Recommended Cable Cross-Sections, Cable Lengths and +Fuse Capacities:

Configuration of the 4 large capacity terminals "- Com.", "+ Board I", "+ Start II", "+ Solar Panels".

- **The central connection point of all minus cables for units and batteries is the – pole of the battery Board I!**

If a **current measuring shunt** is used (for instance, by the battery computer), the central point of the minus cables is at the measuring shunt.

- As indicated, a cable "- Batt." is to be laid separately **between the negative poles of the battery –Start II and –Board I:**
 - ❖ In case of **insulated bodies!**
 - ❖ If required, for relief of the (lightweight) vehicle chassis for the most powerful types VBCS.
- Full charging capacity during driving mode is ensured, **if the cable cross-sections and cable lengths are observed**, which are indicated in the following tables!

VBCS 30/20/400 Triple HV CI							
cable cross section	cable length "+ Start II"	cable length with insulated construction "- Batt."	"fuse II" cable protection	cable length "- Com." to "- Board I"	cable length "+ Board I"	"fuse I" cable protection	cable lengths "- and + solar panels"
2.5 mm ²	-	-	-	-	-	-	up to 4.5 m
4 mm ²	-	-	-	0.5 - 1.5 m	0.5 - 1.5 m	40 A	up to 7 m
6 mm ²	up to 5 m	up to 5 m	50 A	1.0 - 2.5 m	1.0 - 2.5 m	40 A	up to 10 m
10 mm ²	up to 8 m	up to 8 m	50 A	2.0 - 4.0 m	2.0 - 4.0 m	40 A	up to 16 m

VBCS 45/30/600 Triple HV CI							
cable cross section	cable length "+ Start II"	cable length with insulated construction "- Batt."	"fuse II" cable protection	cable length "- Com." to "- Board I"	cable length "+ Board I"	"fuse I" cable protection	cable lengths "- and + solar panels"
4 mm ²	-	-	-	-	-	-	up to 4.5 m
6 mm ²	-	-	-	0.5 - 1.5 m	0.5 - 1.5 m	60 A	up to 7.5 m
10 mm ²	up to 5 m	up to 5 m	80 A	1.0 - 2.5 m	1.0 - 2.5 m	60 A	up to 12 m
16 mm ²	up to 9 m	up to 9 m	80 A	2.0 - 4.0 m	2.0 - 4.0 m	60 A	up to 19 m
25 mm ²	up to 14 m	up to 14 m	80 A	3.0 - 6.0 m	3.0 - 6.0 m	60 A	-

VBCS 60/40/800 Triple HV CI							
cable cross section	cable length "+ Start II"	cable length with insulated construction "- Batt."	"fuse II" cable protection	cable length "- Com." to "- Board I"	cable length "+ Board I"	"fuse I" cable protection	cable lengths "- and + solar panels"
4 mm ²	-	-	-	-	-		up to 4 m
6 mm ²	-	-	-	-	-		up to 6 m
10 mm ²	-	-	-	0.5 - 2.0 m	0.5 - 2.0 m	80 A	up to 10 m
16 mm ²	up to 7 m	up to 7 m	100 A	1.5 - 3.0 m	1.5 - 3.0 m	80 A	up to 16 m
25 mm ²	up to 10 m	up to 10 m	100 A	2.5 - 5.0 m	2.5 - 5.0 m	80 A	-

Connection of the **9-pole Terminal Strip** (Sensor Inputs, Terminals):

Plug-in Terminal Strip: In case of limited space, the strip can be withdrawn and inserted at any time for easy cable connection.

Tightening torque 0.5 Nm!

Cable Cross-Sections: 0,75 mm² or more.

Length to be stripped: approx. 6 mm.

Protection: All inputs and outputs at this strip are protected against overvoltage, reverse battery and overload.

The rating of all **outputs** is **up to max. 1 A**, and they are protected by means of a self-resetting thermal fuse.

"T T": Measuring input for the **temperature sensor** of the supply battery "**Board I**"

Connect the sensor (included in the standard delivery scope) to the **terminals "T T"** (any polarity). Further details concerning the functions of the sensor can be drawn from the paragraph "**Battery Temperature Sensor**" and from the characteristic lines of charging.

"Ss-" and "Ss+": Measurement inputs for accurate starter battery voltage, **voltage sensor leads**:

The sense leads enable the unit to determine the exact voltage of the **starter battery** and optimise control during charge converter operation. To do this, the "Ss" and "Ss+" must be connected directly to the terminals of the starter battery.

- Connect "Ss-" to the negative pole of the starter battery.
- Connect "Ss+" to the positive pole of the starter battery.



The charger will automatically recognize and evaluate the sensor cables.

If the sensor cable is not installed or in case of a cable break or fuse failures, it will be switched to normal operation with charging cable compensation, to wit, calculated compensation of the voltage losses on the charging cables within the values of table 1.

"OK Output" (Option):

Supplies a 12V signal when the device detects no errors (inverted fault signal output). A possible error could be, for example, a missing temperature sensor connected to the unheated LiFePO₄ charging program.

The signal is powered by the "Start +" terminal. If this terminal is temporarily disconnected from the VBCS in the system configuration—for example, via a relay—the output will be unable to provide a signal. In this case, a resistor (e.g., 20 kΩ) can be connected between the "Bord I +" terminal and "Start II +." The current-carrying capacity of the signal output is reduced by the resistor.

"CI BUS": (Option):

Connection to a CI-BUS on-board management system for displaying all relevant data on a central vehicle display. The VBCS Triple must be integrated into the CI-BUS on-board management system by the vehicle manufacturer, a fit-out partner or a system integrator!

"D+": Control input of the dynamo for the **charging converter** (B2B-Booster) operation **ON/OFF**:

Connect the terminal "D+" directly to the existing signal in the vehicle. The D+ signal is preferably to be used for the "active dynamo".

If the D+ signal does not exist in the vehicle, the signal "Ignition ON" (terminal 15) can be used for unit control.

Attention: When the motor is not running, the starter battery might be discharged!

The "D+ Simulator Pro" can be used, see page 16.

"Sw": Control Input (Option):

The Sw control input controls how the device operates. There are three different operating modes:

1. The Sw input is not activated (floating, normal operation):

- The device operates in normal mode; all functions are available as usual.

2. The Sw input is set to GND:

- The device is completely deactivated and does not charge
- The 'Solar' and 'Power' LEDs flash simultaneously every 5 seconds.

3. The Sw input is set to 12 V:

- The device operates at a constant voltage of 13.2 V.
- A temperature sensor is not required!
- The "Battery Full" and "Care" LEDs remain lit continuously when the battery voltage is close to 13.2 V

If the Sw input on the device is not activated (normal operation), all functions can be changed via the CI-BUS in the extended control frame. If the Sw input is set to GND or 12 V, the charging voltage and charging current cannot be adjusted, but all other functions can still be changed!

"AES": Signal output for refrigerators with **Automatic Energy Selector** (Option):

The delivery scope of Dometic/Electrolux and of other companies includes "AES" refrigerators with all-automatic energy selection (230 V AC, 12 V DC or gas).

Particularly in summer, a lot of excess energy might be produced due to strong solar radiation, full batteries and low energy consumption, which is left unused. The solar controller recognizes this condition and uses the "AES" output to give a signal to the refrigerator, which will switch from gas operation to 12 V operation to benefit from the excess energy (gas saving).

Connection:

Lead a single-pole cable (0.5-1.5 mm²) from the unit's terminal "AES" to the refrigerator's terminal "T10" or "S+".

For "AES" operation please make sure that the "heating cartridge" of the refrigerator is also supplied with 12V!

Function:

The solar controller recognizes excess power (the lighting LED „Solar“ extinguishes for a short moment every 2 s). Then, the refrigerator switches from gas operation to 12 V operation. This mode will be kept for **at least 15 minutes** to avoid that the refrigerator will be "swinging" too quickly between 12 V operation and gas operation.

Should the solar power be still sufficient, the 12 V operation of the refrigerator will be kept.

Should the solar power be insufficient, "AES" will be switched-off by the solar controller, the refrigerator will be switched to gas operation, it will keep this mode for at least 15 minutes, and the solar power will be used for recharge of the (possibly slightly discharged) battery. This mode of operation can only be taken into account in case of sufficient efficiency of the solar panel and under favourable conditions, such as 110 Wp, better from 150 Wp or more.

Optionally:

Optionally, small 12 V consumers can be operated at the AES output, such as 12 V fans, car relays or refrigerators with control input D+ (Thetford etc.).

For these applications, it must be observed, that the output must be active for at least half an hour.

If **not used**, the terminal is to be left free.

Battery Temperature Sensor:

Connect the temperature sensor 825 (included in the standard delivery scope) to the **terminals "T T"** (any polarity).

The temperature sensor controls the **temperature** of the supply **battery board "I"**.

Ensure that the installation place of the sensor is not influenced by any source of heat (engine heat, exhaust, heater etc.)!

Lead-Acid, Gel, AGM Batteries:

Installation: The **thermal contact** of sensor and **battery inside temperature** **should be well**. Thus, it should be screwed down to the negative pole or positive pole of the battery. It is also possible to fasten it at the sidewall centre of the battery casing.

Function: The temperature-dependent charging voltage of battery I will be adapted automatically to the battery temperature (automatic temperature compensation). The temperature sensor measures the battery temperature. In case of low temperatures (winter operation), the charging voltage will be increased, in order to improve and accelerate full charging of the weak battery. Sensitive consumers are protected by a limitation of the voltage in case of very low outside temperatures. In case of summery temperatures, the charging voltage is reduced to minimize the load (gassing) of the battery and to extend the lifetime of gas-tight batteries.

Battery Protection: In case of excessive battery temperatures (from +50 °C), the charging voltage will be reduced strongly to **safety charging voltage**, approx. 12.80 V, for battery protection, and the maximum charging current rate will be halved (safety mode, LED "Board I" is flashing). Any charging data being recorded hitherto will be kept in memory. Battery charging is then interrupted, but the supply of consumers being possibly connected will be continued by the unit, and the battery is allowed to cool down. After that, automatic charging will be resumed. Also refer to "**Lead Batteries, 4 Characteristic Lines**, Charging Voltage Rates and **Temperature Compensation**", from **page 9**.

The unit recognizes automatically a missing sensor, cable break or short-circuit of the sensor cables, as well as unreasonable measuring values. In that case, it will switch automatically to the usual charging voltage rates of 20 °C / 25 °C being recommended by the battery manufacturers.

LiFePO4 Batteries:

Installation: The **thermal contact** of sensor and **inside temperature** of the battery **should be well**. Thus, it should be screwed down to the **negative pole** of the battery, because in most of the cases, this is the cooler side (the positive pole is often falsified with the exhaust heat of internal fuses, electronic systems for cell equalization, balancers etc.)!

Function: In case of abnormal battery temperatures, such as < -20 °C, > 50 °C, the charging voltage will be reduced strongly to **safety charging voltage**, approx. 12.80 V, for battery protection, and the maximum charging current rate will be halved (safety mode, LED "Board I" is flashing). Any charging data being recorded hitherto will be kept in memory. Battery charging is then interrupted, but the supply of consumers being possibly connected will be continued by the charger until the battery temperature is again in the admissible range. After that, automatic charging will be resumed.

There are two different 14.4 V and 14.2 V LiFePO4 charging profiles to choose from, which behave differently below 0°C:

Charging programmes 7 and 8:

For batteries that need to be charged with a reduced charging current below 0°C. The charging current is limited to approx. 2 A when the battery voltage exceeds 12.0 V.

Charging programmes 6 and 9:

For batteries that are internally heated or suitable for charging below 0°C. Charging current and voltage are not limited. A large proportion of the maximum charging current remains available to the loads during the heating phase.

In both charging programmes, the "Bord I" LED flashes briefly every two seconds at temperatures below 0°C.



Attention: When charge curves 7 and 8 are selected for a LiFePO4 battery, the 825 temperature sensor must be connected to ensure the battery's safety; otherwise, the unit will not function and the "Main Charge" LED will flash!

Unit Settings:

Carefully move the **12 micro slide switches** behind the front panel of the unit to the desired position using a small screw-driver.

The **switch actuators** are shown in **white**.

1.) How to Set the battery type "Board I"- (Design, Technology):

8 Charging programs for the different battery types are stored in the unit. They can be selected by means of the **upper 4 slide switches**:

If not being specified divergently by the battery manufacturer, the suitable charging program for the supply battery Board I can be determined by means of the following description and the technical data (voltage rates U1 and U2).



The possible parallel/floating operation with consumers being connected to the battery Board I is also automatically considered by all charging programs.

TS = Temperature Sensor (Effect with/without connection of the temperature sensor)

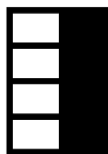
Lead Batteries (Acid, Gel, AGM):

4 Characteristic lines, charging voltage rates and temperature compensation for batteries in lead technology:

1 "Lead Acid"

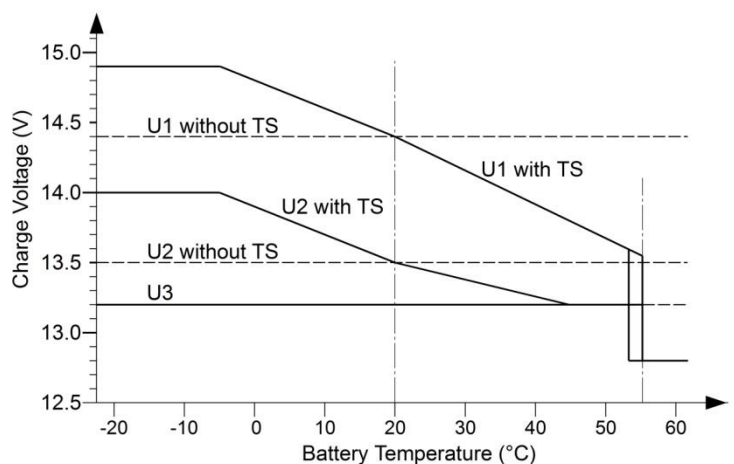
Switch Position

U1=14.40 V U2=13.50 V U3=13.20 V
2-6 h 24 h Continuous
Regeneration 2x per week for 1 h
at mains operation



Universal charging program for Acid batteries according to DIN 57 510/VDE 0510 for charging and trickle charging of supply (board) batteries.

Ensures short charging times, high charging factor and acid mixing for open standard batteries and closed, SLA, low-maintenance, maintenance-free "non-solid electrolyte", "lead-acid", drive, lighting, solar and heavy duty batteries. Also suitable for recently developed batteries (low-antimonous, with silver-alloy, calcium or similar) and batteries with low (L) and very low (VL) water consumption.



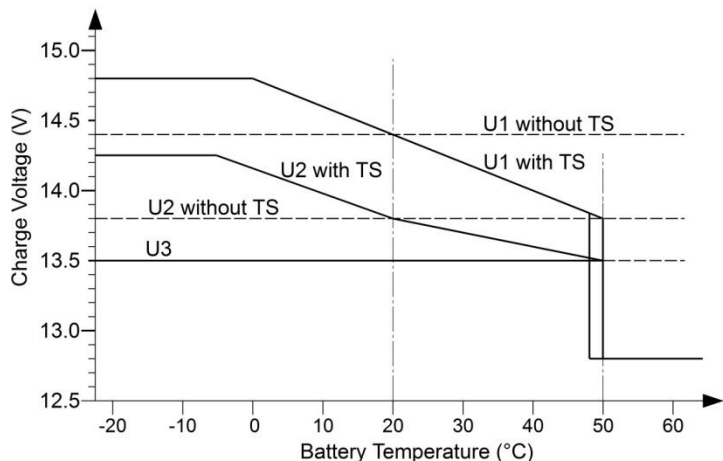
2 "Gel"

Switch Position

U1=14.40 V U2=13.80 V U3=13.50 V
 6-12 h 48 h Continuous
 Regeneration 2x per week for 1 h
 at mains operation



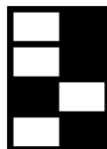
Adapted to closed, gas-tight **Gel/dryfit** batteries **VRLA** with determined electrolyte, which are generally requiring longer dwell times U1 to achieve particularly high capacity storage and to avoid total discharge (becoming deaf) of the battery, such as EXIDE, Sonnenschein, "dryfit", Varta, Bosch, Banner, Mobil Technology etc. If not being specified divergently by the battery manufacturer, also recommended for batteries in round cell technology.



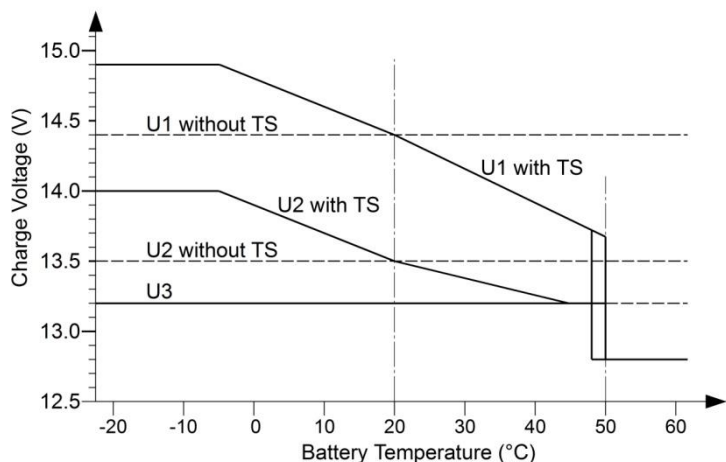
3 "AGM 1 14.4 V"

Switch Position

U1=14.40 V U2=13.50 V U3=13.20 V
 1.5-5 h 24 h Continuous
 Regeneration 2x per week for 1 h
 at mains operation



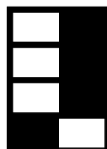
Adapted to closed, gas-tight AGM (absorbed glass mat)/lead-fleece batteries **VRLA** with an indicated charging voltage of "14.4 V".



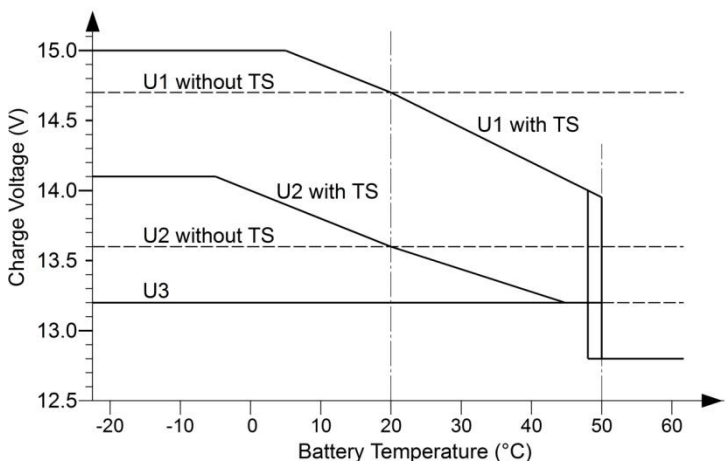
4 "AGM 2 14.7 V"

Switch Position

U1=14.70 V U2=13.60 V U3=13.20 V
 1.5-5 h 24 h Continuous
 Regeneration 2x per week for 1 h
 at mains operation



Adapted to closed, gas-tight AGM (absorbed glass mat)/lead-fleece batteries, Lead Crystal, **VRLA** with an indicated charging voltage of "14.7 V or 14.8 V" and also "Lead Crystal" Batteries (14.7V). It is highly recommended to check the specification sheet of the battery concerning the high charging voltage U1 **14.7 V**!



LiFePO4 Batteries:

5 Characteristic lines, charging voltage rates and temperature control adapted to lithium batteries:



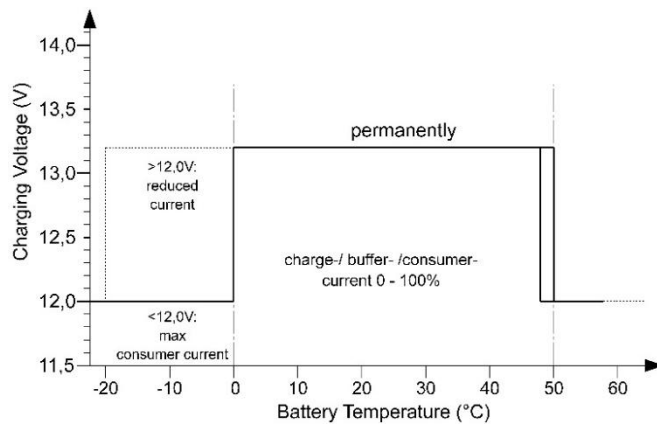
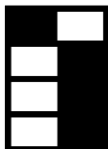
- The charging regulations of the battery manufacturer are absolutely to be observed!
- An operation of the unit at a LiFePO4 battery without **BMS Battery Management System** and without **equalization charging of the cells** (balancing) as well as **safety circuit** is not admissible!
- The battery temperature sensor must be installed at the battery (screw to the negative pole) and connected at the unit. It serves as protection for the battery. No function without temperature sensor, LED "Main Charge" is flashing!
- If possible, the battery temperature should be kept above 0 °C.

5 "LiFePO4 13.2 V"

13.20 V permanently

Adapted to hibernation or storage of a LiFePO4 battery.

Switch Position



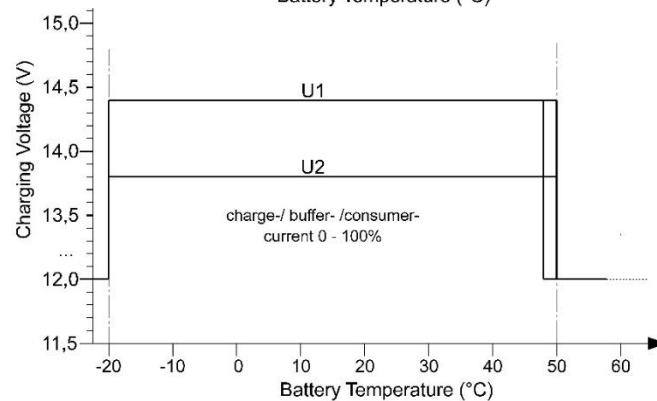
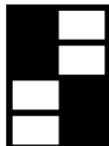
6"LiFePO4 (heated) 14.4 V"

U1=14.40 V U2=13.80 V

0,3-1h Continuous

Auto Wake Up every 10 days for 0,4h at mains operation

Switch Position



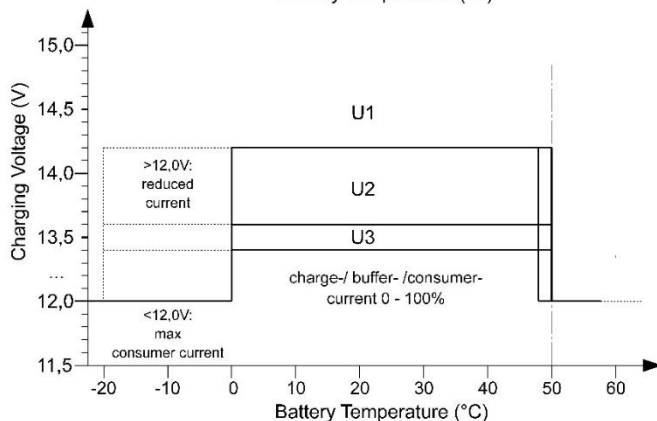
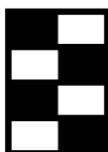
7"LiFePO4 14.2 V"

U1=14.20 V U2=13.60 V U3=13.40 V

0,5 h 24 h Continuous

Auto Wake Up every 10 days for 0,4h at mains operation

Switch Position



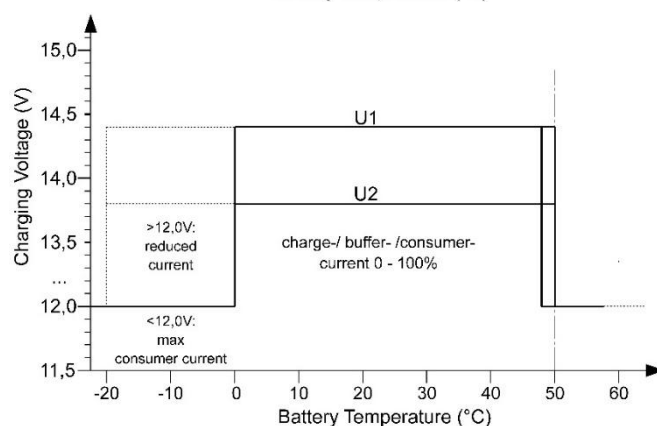
8 "LiFePO4 14.4 V"

U1=14.40 V U2=13.80 V

0,3-1h Continuous

Auto Wake Up every 10 days for 0,4h at mains operation

Switch Position



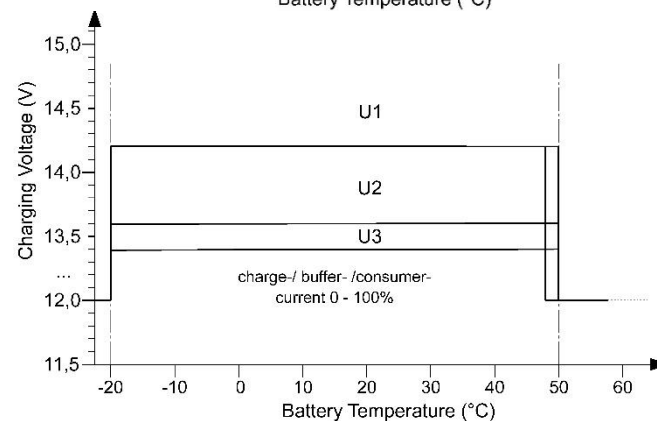
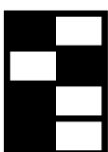
9 "LiFePO4 (heated) 14.2 V"

U1=14.20 V U2=13.60 V U3=13.40 V

0,3-0.5h 24 h Continuous

Auto Wake Up every 10 days for 0,4h at mains operation

Switch Position



2.) Further Settings and Functions, 8 Slide Switches:

**Table 2: How to set "Cap." Battery Size (Capacity, Ah) Board I:
How to set the 2 Slide Switches for 4 Capacity Ranges (Ah):**

The safety timer is not required for LiFePO4 and is automatically deactivated when a LiFePO4 characteristic curve is active!



battery capacity selector switch "Cap."	VBCS 30/20/400	VBCS 45/30/600	VBCS 60/40/800	charging phase I safety timer max. h
	recommended battery capacity Bord I Ah	recommended battery capacity Bord I Ah	recommended battery capacity Bord I Ah	
	75 - 95	110 - 145	150 - 190	11
	100 - 170	150 - 260	200 - 340	20
	180 - 300	270 - 420	360 - 560	32
	No Timer (Not recommended)			

Note: If two or several batteries are connected in parallel to the charging port "+Board I", set the total capacity (total Ah-value of the connected units)!
According to the battery manufacturers, **permanent** parallel operation is admissible in case of two or several batteries of the same type, the same capacity, as well as of the same age (history) in cross connection.
The above mentioned capacity rates should be considered as approximate values regarding battery load and charging time.

3.) DIP-Controlled - CI-Controlled



This switch determines whether the charging characteristic curve set via the DIP switches is active, or whether you wish to predefine a charging voltage and charging current via the CI-BUS. The Sw input must not be active in this case!

In the DIP-Controlled position:

The charging characteristic curve is set as usual via the DIP switches.

In the CI-Controlled position (should only be set by the CI-BUS integrator):

The switch enables control of the charging current and charging voltage via the CI-BUS extended Control Frame. This allows you to set a perfectly tailored charge for your battery.

Please note: without control via CI-BUS, a safety voltage of 12 V is set!

4.) 13.2 V – 12 V:



Setting the maximum **charging voltage for the starter battery's trickle-charge circuit**. A higher voltage setting ensures a higher charge level in the starter battery, but in modern vehicles this can lead to unintended behaviour when the vehicle is stationary (D+ detection, faulty light control, false alarms, etc.).

In the "13.2 V" position:

The maximum charging voltage for the starter battery is set to 13.2 V.

In the "12.0 V" position:

The maximum charging voltage of the starter battery is set to 12.0 V. This switch position should only be selected for vehicles that cannot cope with a charging voltage of 13.2 V.

5.) VBS – CI:



The switch is used to change between the VBS (VOTRONIC-BUS-System) and the CI-BUS (CIVD e. V.).

The VBCS Triple must be integrated into the VOTRONIC-BUS-System or CI-BUS Board Management by the vehicle manufacturer, extension partner or a system integrator!

6.) Rev. Charge – off:



The switch can be used to deactivate the reverse charging function for the starter battery when the system is operating via the solar controller or the 230 V mains supply. The maximum charging voltage can be set between 13.2 V and 12 V by adjusting the switch position.

In the "Rev. Charge" position:

The reverse charging circuit is active in 230 V mains and solar controller mode and is controlled automatically. If the voltage of the **on-board battery** is higher than the set charging voltage, e.g. when switching to 13.2 V winter mode, the on-board battery is slowly discharged down to the set voltage and the energy flows via the reverse charging circuit into the starter battery!

In the "off" position:

The reverse charging circuit is deactivated in both 230 V mains and solar controller operation.

7.) Normal – Caravan:



Limits the maximum current draw from the vehicle's starter circuit to 19 A or 14 A, thereby enabling the device to be operated in a caravan whilst travelling, using the 13-pin plug on the towing vehicle.

Note: For further Information see following Table

Note: Adjusting the input current via CI-BUS is not possible in Caravan mode.

8.) Normal – Limit II (only Charging Converter Operation):



Limits the **maximum current consumption from the starter circuit of the vehicle**.

The charging converter draws the highest current from the starter circuit at the "+ Start II" terminal **when the voltage here is low** (long cables to the starter battery, low voltage in the starter circuit/alternator) **and the charging power is high** at the same time, i.e. with high charging/load currents and high charging voltages at the on-board I battery, e.g. towards the end of the I main charging phase.

Note: For further Information see following Table

Input Current B2B	Dip-Switches 7./8.	VBCS 30/20/400	VBCS 45/30/600	VBCS 60/40/800
	Normal/ Normal	42 A	63 A	82 A
	Normal/ Limit II	25 A	48 A	65 A
	Caravan/ Normal	19 A	19 A	19 A
	Caravan/ Limit II	14 A	14 A	14 A

Notes on controlling the device via the CI-BUS:

The CI-BUS allows you to control certain functions of the device, which are set via a control frame and an additional, switchable extended control frame (hardware settings take precedence!):

Control frame settings:

- Power Limit or Silent Run
- AC ON/OFF (solar controller operation takes precedence)

Extended Control Frame settings:

- Sw input (Normal Mode, Device Off, Fixed Voltage).
- AES output (Automatic, ON, OFF).
- Auxiliary charging branch (Automatic, OFF).
- The setting for the charging voltage and charging current when the DIP switch is set to CI-Controlled and the **switch input is not connected or is controlled via CI-BUS!**
- The setting for the current draw from the starter battery for the charging converter operation. The setting can be adjusted at **any time (except in caravan mode)**, regardless of the Sw input or the DIP-Controlled – CI-Controlled switch!

To use all control functions, the extended Control Frame must be activated via the CI-BUS Integrator (further details can be found in the separate document available for the CI-BUS Integrator).

When can I control the output voltage and output current via CI-BUS:

- When the DIP switch is set to CI-Controlled
- When the Sw input is set to normal operation (not switched to GND or 12V and not controlled via CI-BUS)

Note:

In caravan mode, the **output current** can be reduced further, but cannot be increased to such an extent that more than the set 19 A (Normal) or 14 A (Limit II) is drawn from the starter battery on the input side.

When can I control the input current via CI-BUS:

- When the device is not in caravan mode. The DIP-Controlled or CI-Controlled switch position and the Sw wiring have no effect.

All other functions of the extended control frame can be changed at any time.

Operation

Push-button at the Unit Front "AC Power Limit" and "AC Power Off":

"AC Power Limit": Push the button shortly (approx. 1 s) for activation (possible at any time, also without mains connection):

Display: LED "Power" is **switched-off shortly** every 2s.

Mains Allows operation of the unit with reduced capacity in case of weak local mains, such for weakly protected

operation: location, country current supply, generator operation.

The current consumption of the unit from the mains will be kept lower than 2 A, but the charging current for the batteries and the consumers 12 V can still be higher than 25 A.

Silent Run: The noise-optimised operation during mains operation is activated at the same time. This will be achieved by setting the internal cooling fan of the unit to constant lowest noise, steady speed (nighttimes).

Return to normal operation with full charging capacity:

- is possible at any time by pressing the key again for a short moment (approx. 1 s).
- Automatically with driving mode (engine start), when changing the location.

"AC Power Off": Push and hold the button (approx. 4 s) for activation (possible at any time, also without mains connection):

Display: LED "Power" is **flashing** every 2 s.

Function: Mains charging is switched off.

To prioritise charging with solar energy, mains charging can be disabled and put into sleep mode if a mains connection is available.

A special protective function ensures the reactivation of an (erroneously) switched-off mains charging, if the batteries run the risk to become totally discharged due to high consumption and low solar power in consequence of continuing unfavourable weather conditions. Then, mains charging will be switched-on automatically, and the batteries will be charged for reasons of safety.

Return to normal operation with priority mains charging (full charging, if mains connection exists):

- Is possible at any time by pressing and holding the key again (approx. 4 s).

Further actions at the unit are not required during normal automatic mode.

Option: Remote Controls and Displays (Tip Jack "Display")

If the device is installed in a hard-to-reach location, convenient remote monitoring and operation is possible. Plug connection into the tip jack "Display" of the charger.

LCD Charge Control S, Order No. 1247 (cable, 5 m length, included in the delivery scope)

It indicates the status of the individual charging sources, the current charging phase, the voltage of board and starter battery, as well as the instantaneous charging current.

During solar operation, the instantaneous solar power (W) and the energy values (Wh and Ah, which can be reset to "zero" at any time) are displayed for own statistical purposes.

Convenient remote control of the above described functions **"AC Power Limit"**, as well as **"AC Power Off"** at the push of a button.



Votronic LCD Kontrollboards with solar-computer function:

Also ready to push for the solar features are different LCD-prepared boards on the operation with the device, for example, VPC Jupiter (illustration), VPC Merkur, VPC Terra and further more.



Bluetooth Connector S-BC incl. Energy Monitor App, Order No. 1430

The data of the solar functions are graphically processed, recorded and stored over a longer period of time.

Possible use individually or with the above displays together as well as with a Votronic LCD Battery Computer S for the battery data.

Ready to use with connection cables (Plug and Play).



Pilot Lamps:

"Battery Full" (Battery Board I fully charged, **green**):

- If it is lighting: 1. Battery (batteries) had (have) been charged to 100 %, trickle charge U2 and storage charge U3, finished.
2. Sw input set to 12 V, fixed voltage regulation at 13.2 V.
- If it is flashing: Main charging process is effected in the charging phase U1, indication of charging state of approx. 75 % (lead) / 90 % (LiFePO4). Gradual increase to 100 % (long flashing).
- Off: Main charging process is still being executed in the phase I.

"Main Charge" (Main charging, **yellow**):

- If it is lighting: Main charging process is effected in the phase I and after that in the charging phase U1.
- Off: Trickle charge U2 or storage charge U3.
- If it is flashing one per second
 - 1. Battery temperature sensor is not connected with characteristic lines of charging LiFePO4!
 - 2. External battery overvoltage

> 15.5 V	delay 20 s,
automatic reset	< 13.2 V (depending on type),
	delay 30 s.
- If it is flashing irregularly:
Control behavior at low currents e.g., during the transition between charging phases

"Current" (Charging current, **red**):

- If it is lighting: The lighting intensity of the LED "Current" will be **reduced or increased** depending on the **supplied charging current**.
- Off: Charging current is less than approx. 0.2 A

"Board I" (Board battery, **yellow**):

- If it is lighting: Charging and control of the supply battery.
- Off: Charging port is blocked (safety switch).
If it is flashing: Battery Protection: battery overtemperature (or LiFePO4 under -20° C), switchover to low safety charging voltage and half of the max. charging current. Automatic return, as soon as the temperature is 2 °C less.
- If it extinguishes shortly every 2 sec.:
Only LiFePO4: Battery temperature below 0 °C. The charging current can be reduced for battery protection during all modes of charging. If batteries are discharged, longer charging times.

"B2B" (Charging converter, **green**):

- If it is lighting: Driving mode, the charging converter charges from the starter battery to the board battery.
- If it is flashing: Operating voltage at terminal "Start II" is too low. Thus, the power control of the charging converter had reduced the output capacity by more than 30 %.
- Off: Charging converter is switched-off.

"Solar" (MPP Solar Controller, **yellow**):

- If it is lighting: MPP control of the solar controller is active and works properly. AES is not active, yet.
- If it extinguishes shortly every 2 s:
Sufficient excess solar power is available, the output "AES" for automatic energy selection of the refrigerator is activated.
- Short flashing every 5 s: 1. Display of readiness for service in case of missing solar power (at night).
2. Sw input connected to GND.
- If it is flashing: Solar voltage at terminal "+Solar Panels" too high.

"Care" (Battery care, **green**):

- If it is lighting: 1. Equalization charging of the battery cells in the progressed charging phase U2, storage charge U3.
2. The Sw input is set to 12 V, the fixed voltage regulation is 13.2 V.
- If it extinguishes shortly every 2 s: Lead battery regeneration or Lithium Auto Wake Up is activ.
- Off: Charging process is still in phase I, U1 or beginning of the phase U2.

"Power" (Mains, **red**):

- If it is lighting: Mains charging mode is active.
- Off: No connection to mains.
- If it extinguishes shortly every 2 s:
"AC Power Limit" is active. The Mains charging capacity is limited. Silent Run (nighttimes).
- Short flashing every 2 s: "AC Power Off". Solar has priority. Automatic mains charging in case of insufficient solar power.
- If it is flashing: Internal unit failure (overheating), automatic reset after cooling down.
- If it extinguishes shortly every 5 s: Sw input connected to GND.

All LEDs "Battery Full", "Main Charge", "Current", "Board I", "B2B", "Solar", "Care", "Power" are flashing simultaneously:

The positions of the upper 4 selector switches "Board I" are **incorrect**. For reasons of safety, the unit had been switched-off. Set the desired battery type according to page 9 "How to set the battery type "Board I"- (Design, Technology)".



During power pack operation (without batteries or with defective fuse) the active charging ports provide the desired charging voltage. The LEDs "Board I", "Solar" and "Battery Full" are still lighting.

Start-up and Function Test:

The battery Board I (lead-acid, gel, AGM or Lithium-LiFePO4) will be controlled according to the set characteristic line of charging "IU1oU2oU3" during all modes of charging.

During mains and solar operation, the integrated auxiliary charging automatically provides max. 4-5 A charging current for support charging and trickle charging of the (lead) starter battery II of the vehicle, without overcharging due to extended standstill periods and current consumption (such as by own consumption of the vehicle, lighting, audio equipment etc.).

Mains operation during standstill operation at the external socket of the mains supply, has generally priority. Also refer to MPPT: Automatic start of the charging process after insertion of the mains plug. The LED "Power" is lighting.

Full charging current is not reached:

- Battery Board I had been already charged: Load with powerful consumers.*
- Check cabling –Com, +Board I and fuse I. Check cross-sections and lengths according to table 1. Check cables Ss and Ss+, as well as stripped cable ends. Measure the voltage directly at the terminals/their screws.*
- Check the adjustment of the slide switches "Cap." according to table 2.*
- Deactivate the function "AC Power Limit" by pressing the key.*

Charging Converter-, Booster- "B2B" Mode (Battery to Battery), Mobile mode by dynamo and starter battery:

Remove mains connection and start the engine. The battery Board I is charged from the starter circuit Start II.

The "D+" signal of the dynamo activates the charging converter automatically and switches it off in case of an engine stop.

Function of the Power Control:

After the engine start, also the starter battery shall be charged and its starting capacity shall be maintained. The charging converter will only effect a gradual increase of the charging capacity for the battery board I, if the starter battery is able to provide sufficient voltage.

In case of strong load on the starter circuit due to many large consumers and the starter battery's voltage drops because of motor idling, a gradual reduction of the charging capacity for the battery board I will be effected to relieve the starter circuit.

A reduction of the charging capacity by more than 30 % due to insufficient input voltage of the dynamo will be indicated by a flashing LED "B2B". The LED will extinguish, as soon as the input voltage is sufficient or when the power requirement had dropped anyway due to a charged battery board I.

Unit does not start, the LED "B2B" is not lighting:

- Check the voltage at the activation input terminal "D+", > 8 V.*

Full charging current is not reached, the LED "B2B" is flashing:

- Check the voltage at terminal +Start II: >11 V. Increase the engine speed, in order that the charging converter is able to effect an increase.*
- Check items a. to c. of the mains operation. If the mains operation works faultlessly:*
- Check the cabling +Start II, fuse II, cross-sections and lengths (also "Minus" connection to chassis, if required, cable "-Batt." from the starter to the board battery) according to table 1. Trace the concealed battery cutoff relay of the previous cabling.*
- Shortly deactivate the function "Limit II" for reasons of testing, if required.*

Operation with EBL, EVS etc.:

- The charging converter changes permanently between active and quiescent condition: "D+" must arrive directly from the vehicle, and not from the EBL.*

Solar Operation, "MPPT" (Maximum-Power-Point-Tracking):

Remove the mains connection, stop the engine (D+ low), orientate the solar panels towards the sun. The charging converter works, the LED "Solar" is lighting.

Controllers according to the MPP technology are continuously and automatically calculating the maximum power yield (MPP) of the solar modules several times per second. The voltage surplus of the solar module will be transformed to a higher charging current for the battery (realised by high-frequency switching controller technology with high efficiency). This surplus of charging current ensures short charging times and the best possible power yield of the solar system.

Function "AC Power Off", description see page 14: By this, the solar operation will get priority over the mains operation.

"AES": Signal output for refrigerators with Automatic Energy Selector, description, see page 7.

Solar charging does not start:

- Check item b. of the mains operation. If the mains operation works faultlessly:*
- Check polarity + and - of the solar panels. Check the voltage at terminal + solar panels, approx. 15 V up to max. 55 V.*
- Check the input D+ of the unit. The voltage must be significantly lower than 8 V.*

Expected charging current is not reached:

- Battery Board I had been already charged: Load with powerful consumers.*
- Check the cabling + and - of the solar panels, the cross-sections and lengths acc. to table 1.*
- Check the solar panels for cleanliness, orientation towards the sun, possible shading and clean connection contacts.*

Device constantly switches between the charge converter "B2B" and solar operation back and forth:

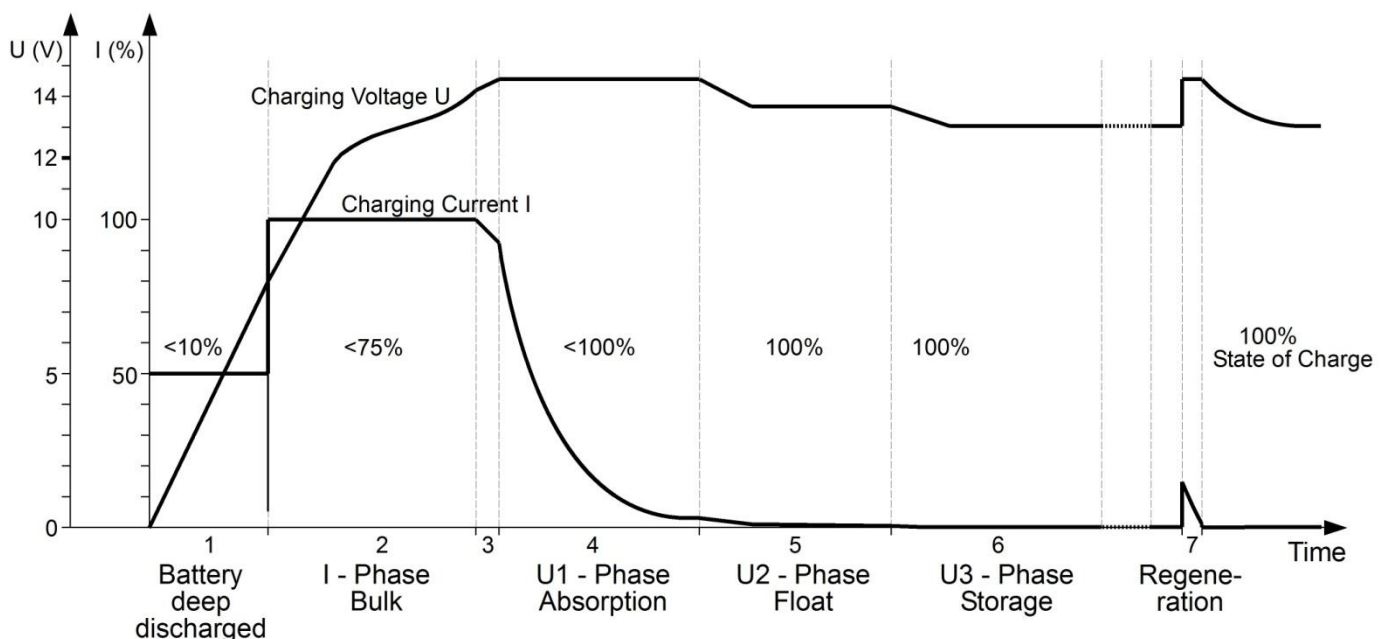
- Can occur when using a "D + simulator" (Voltage controlled) on the starting battery: Solar also recharges the starting battery somewhat, the D + simulator then incorrectly detects "engine running", device switches to "B2B", start battery is easily discharged etc. Workaround: D + connection to terminal 15, ignition set, p. Page 7.*

Charging Process Main Port "Board I":

A new, complete main charging cycle will be executed:

- At night, if the D+ signal is missing or in case of power failure.
 - In case of a lower deviation of the battery reset voltage of approx. 12.75 V/13.25 V beyond the maximum charger current for 30 seconds due to high load.
- Charging aid for totally discharged (lead) batteries. From 0 V, they will be subject to gentle preliminary charging for recovery with a small current rate up to approx. 8 V.
 - Main charging** with maximum charging current (**phase I**) in the mean voltage range up to close to the phase U1 **for short charging times**, LED "Main Charge" is lighting, and approx. 75 % (lead), approx. 90 % (LiFePO4) of the capacity will be charged. The duration of phase I depends on the battery conditions, the load by additional consumers and the charging state. The charger is recording the course of charging. For reasons of safety, the phase I will be terminated by the safety timer (see table 2) after 15 hours, at the latest (cell defects of the battery etc.).
 - In case of high battery voltage rates, the charging current will be slightly reduced for battery protection (orientation phase). After that, automatic switching to the following phase U1.
 - During the **phase U1 (full charging, cell equalization charging, LED "Main Charge" is lighting)**, the battery voltage will be kept constant on a high level. The green LED "Battery Full" is **flashing** (at first, short flashing, with rising charge increasingly longer flashing), and gentle charging of the additional high battery capacity. The charger controls the charging time, as well as the charging current. From these values and from the course of charging being recorded during the phase I, the charger determines the **100 % full charge point** of the battery for automatic commutation to U2. In case of only slightly discharged batteries, the duration of phase U1 will be kept short for relief of the battery and low maintenance expenditure. In case of major discharge, the phase U1 must be extended for full charging of the battery and cell equalization charging. During this process, any influence by consumer loads is avoided reliably. The LED "Main Charge" extinguishes at the end of the phase U1.
 - Phase U2 (Full trickle charge, LED "Battery Full" is lighting permanently):** The charger has now switched to the lower voltage for trickle charge maintaining and buffering 100 % charge of the battery. Depending on the battery type, the duration of the phase U2 is limited to 24 to 48 hours to allow gentle recharging and equalization charging of the cells with small charging current rates.
 - Phase U3 (storage charge, LED "Battery Full" is lighting continuously, adapted to the battery type):** In case of long-term operation, such as for extended standstill periods or for lead-acid batteries during winter break, the charging voltage will be reduced to the low level U3 for minimization of battery gassing and corrosion.
 - Regeneration during Mains operation:** For (lead) batteries activation (avoidance of electrolyte accumulation and sulphation), the charger will automatically run up to the charging voltage U1 twice a week for a short time (approx. 1 hour). After that, direct return to the lower storage charge U3.
- LiFePO4-Maintenance, Auto Wake Up, Maintenance period:** Periodical automatic activation of the cell equalization charging (balancing) by the battery BMS in case of extended standstill periods by systematic voltage increase every 10 days for 0.4 hour. After that, return to the lower storage charge U3. This function is blocked during "Li Storage" charge.

Note: During the phases **U1, U2 and U3 (Battery Full)** almost the total charger current is available for additional supply of consumers without any discharge of the battery.





Safety Regulations and Appropriate Application:

The charger has been designed according to the valid safety regulations.

Appropriate application is restricted to:

1. **Charging of lead-gel, lead-AGM, lead-acid or LiFePO4 complete batteries (with integrated BMS, balancing and approval!) Batteries with the indicated nominal voltage and simultaneous supply of the consumers being connected to these batteries in fixed installed systems.**
2. **Connection to a shock-proof socket, which has been installed according to the valid technical regulations, protected with max. 16 A (if required mobile/stationary with a fault current breaker (FI) with a nominal residual current of 30 mA).**
3. **With solar panels up to the maximum power rating (Wp) of the used unit.**
4. **With solar panels below the max. admissible voltage (Voc).**
5. **Connection in consideration of the indicated cable cross-sections at the inputs and outputs of the unit.**
6. **Fuses of the indicated capacity are to be provided near the battery to protect the cabling between battery and unit.**
7. **Technically faultless condition.**
8. **Installation in a well-ventilated room, protected from rain, humidity, dust, aggressive battery gases, as well as in an environment being free from condensation water.**

Never use the unit in locations where the risk of gas or dust explosion exists!

- Open-air operation of the unit is not allowed.
- Lay the cables in a way, that damages are excluded and observe to fasten them tightly.
- Never lay 12 V cables and 110 V/230 V mains supply cables into the same cable conduit (empty conduit).
- Check live cables or leads periodically for insulation faults, points of break, as well as loosened or overloaded connections and remedy possible defects.
- The unit is to be disconnected from any connection prior to execution of electrically welding or work on the electric system.
- If the user is not able to draw from the manual, which characteristic values are valid for a unit or which regulations are to be observed, a specialist is to be consulted.
- The user/buyer is obliged to observe any construction and safety regulations.
- **The unit does not contain any parts, which can be replaced by the user.** Even after withdrawal of the mains plug, the unit may be **extremely live** for an extended period (particularly in case of failure).
- Keep children away from the charger and the batteries.
- Observe the safety regulations of the battery manufacturer; deaerate the battery room.
- Non-observance may result in injury or material damage.
- The manufacturer's warranty is 60 months from delivery.
- Improper use, operation outside the technical specifications, improper operation or third-party intervention will void the warranty or manufacturer's guarantee. No liability is accepted for any resulting damage. The exclusion of liability also extends to any services provided by third parties that were not commissioned by us in writing. Services exclusively provided by VOTRONIC Elektronik-Systeme GmbH, Lauterbach.



Declaration of Conformity:

In accordance with the provisions of Directives 2014/35/EU, 2014/30/EU, 2009/19/EC, this product complies with the following standards or normative documents:
EN55014-1; EN 61000-3-2; EN 61000-3-3; EN61000-6-1; EN61000-4-2; EN61000-4-3; EN61000-4-4; EN61000-4-5; EN 61000-4-6; EN 61000-4-11; EN60335-1; EN60335-2-29; EN50498.



The product must not be disposed of in the household waste.



The product is RoHS compliant. It complies with the directive 2015/863/EU for Reduction of Hazardous Substances in electrical and electronic equipment.



Recycling:

At the end of its useful life, you can send us this device for professional disposal:
You can find more information about this on our website at www.votronic.de/recycling

Technical Data:

VBCS 30/20/400 Triple HV CI

VBCS 45/30/600 Triple HV CI

VBCS 60/40/800 Triple HV CI

Charging Port Supply Battery "Board I":

Lead-Acid, Gel, AGM Batteries	Nominal Voltage:	12 V	12 V	12 V
Capacity (Battery Size), adjustable, recommended		75 - 300 Ah	110 - 420 Ah	150 - 560 Ah
Lead Charging Programs Stored in the Memory		4	4	4
Prelim. Charg. Current (Tot. Discharged Batt. <8 V) max		15 A	22 A	30 A
Minimum Battery Voltage for Charging Start		0 V	0 V	0 V
Safety Charging Voltage at Battery Overtemperature		12.8 V	12.8 V	12.8 V
LiFePO4 Battery	Nominal Voltage:	12.0 - 13.3 V	12.0 - 13.3 V	12.0 - 13.3 V
Capacity (Battery Size), adjustable, recommended		75 - 300 Ah	110 - 420 Ah	150 - 560 Ah
LiFePO4 Charging Programs Stored in the Memory		4	4	4
Safety Charging Voltage at Insufficient/Excess Batt. Temperature		12.0 V	12.0 V	12.0 V
Lock Input "Sw", Ri=30 KOhm		Yes	Yes	Yes

Charging Input/Output Vehicle Starter Battery "Start II":

Vehicle Starter Battery Nominal Voltage	12 V	12 V	12 V
Min. Battery Capacity (Size), recommended	60 Ah	80 Ah	100 Ah

Mains Operation:

Nominal Operating Voltage (AC)	110 V to 230 V / 45 - 65 Hz (Full Charging Capacity)		
Operating Voltage Range (AC)	90 V to 270 V, Short-time (5s) 305 V		
Sinusoidal Current Consumpt. Power Factor Correction (CosPhi =< 1)	Yes	Yes	Yes
Max. Power Consumption (AC)	360 W	520 W	700 W
Max. Power Consumption (100 V AC/207 V AC)	3.8 A / 1.7 A	5.5 A / 2.5 A	7.4 A / 3.4 A
Max. Power Consumption "AC Power Limit" (100 V AC/207 V AC)	3.2 A / 1.5 A	4.1 A / 2.0 A	4.1 A / 2.0 A
Mains Power Consumption "AC Power Off"	<1 W	<1 W	<1 W
"Board I" Charg./Floating/Load Curr., contr. IU1oU2oU3, Lead, LiFePO4	0 A - 20 A	0 A - 30 A	0 A - 40 A
Charging/Trickle Current, of which for "Start II", controlled	0 A - 4 A	0 A - 4 A	0 A - 5 A
Automatic Battery Regeneration: 2 x week 1 h	Yes	Yes	Yes
LiFePO4 Auto Wake Up at extend. down-time, every 10 days 0.4 h	Yes	Yes	Yes
Noise-reduction of Fan at "AC Power Limit" (Silent Run)	Yes	Yes	Yes
Power Pack Operation "Board I"			
(such as Supply During Battery Replacement)	Yes	Yes	Yes

12 V / 12 V B2B Charging Converter-Booster Operation:

Input Voltage Range "Start II" (EURO 6+), D+, controlled	10.5 - 16.5 V	10.5 - 16.5 V	10.5 - 16.5 V
Input Overvoltage Disconnection "Start II" (EURO 6+), max.	16.5 V	16.5 V	16.5 V
Power Consumption from "Start II", max.	470 W	700 W	930 W
Maximum Input Current „Start II“			
with DIP Switch "Normal" and "max."/ "Limit II"	42 A / 25 A	63 A / 48 A	82 A / 65 A
with DIP Switch "Caravan" and "max."/ "Limit II"	19 A ¹⁾ / 14 A ¹⁾	19 A ¹⁾ / 14 A ¹⁾	19 A ¹⁾ / 14 A ¹⁾
¹⁾ Suitable for use with a plug connection to the towing vehicle. Check the load capacity of the plug connection beforehand!			
"Board I" Charg./Floating/Load Curr., contr. IU1oU2oU3, Lead LiFePO4	0 A - 30 A	0 A - 45 A	0 A - 60 A
Activation Control Input "D+", from D+, Terminal 15, Ignition	8 - 17 V	8 - 17 V	8 - 17 V

Operation with MPPT Solar Controller:

Capacity of Solar Module, recommended min to max. (Pmax)	50 - 400 Wp	50 - 600 Wp	60 - 800 Wp
Current Solar Module	0 - 15.0 A	0 - 21.0 A	0 - 26.0 A
Voltage Solar Module, max. Open Circuit Voltage (Voc)	max. 50 V,	max. 50 V	max. 55 V
"Board I" Charg./Floating/Load Curr., contr. IU1oU2oU3, Lead, LiFePO4	0 A - 29.0 A	0 A - 43.5 A	0 A - 58.0 A
Charging/Trickle Current, of which for "Start II", controlled	0 A - 4 A	0 A - 4 A	0 A - 5 A
Control Output "AES" Refrigerator, max.	12 V / 1 A	12 V / 1 A	12 V / 1 A

General:

Signal Output "OK/TR", Switch Position "OK", Charg. O.k. Active/max.	12 V / 1 A	12 V / 1 A	12 V / 1 A
Input "T" for Battery Temperature Sensor "Board I"	Yes	Yes	Yes
"Ss-" "Ss+" Inputs Sensor Cables "-" and "+" for Battery "Start II"	Yes / Yes	Yes / Yes	Yes / Yes
Reverse Current from Battery, Stand-by, w/o Mains, w/o D+, at Night	17 mA	17 mA	17 mA
Safety Timer per Charging Phase I/U1, U2	Yes	Yes	Yes
Ripple Factor Voltage	< 30 mV rms	< 30 mV rms	< 30 mV rms
Charging Voltage Limitation for Protection of the Consumers, max.	15.00 V	15.00 V	15.00 V
External Overvoltage Disconnection "Board I" (20 s)	15.50 V	15.50 V	15.50 V
Fitting Position of Unit	any	any	any
Safety Protection against Short-circuit/Back Discharge	Yes	Yes	Yes
Temperature Range	-20/+45 °C	-20/+45 °C	-20/+45 °C

Speed-controlled, Temperature-controlled Fans	Yes	Yes	Yes
Gradual Reduction of Charging Capacity at Overtemperature	Yes	Yes	Yes
Safety Disconnection in Case of Overheating	Yes	Yes	Yes
Connection "Display", LCD Charge Control S/Solar-Computer S	Yes	Yes	Yes
Connection "BUS" for VBS-Bus	Yes	Yes	Yes
Protection Class/System of Protection	I / IP2X	I / IP2X	I / IP2X
Dimensions, incl. mounting flanges/feet (D/W/H)	256 x 218 x 85 mm	256 x 218 x 85 mm	256 x 218 x 85 mm
Weight	2700 g	2850 g	2900 g
Ambient Conditions, Humidity of Air	max. 95 % RH, no condensation		
Tightening torque power connections:	2.0 Nm	2.0 Nm	2.0 Nm
Tightening torque control connections:	0.5 Nm	0.5 Nm	0.5 Nm



Declaration of Conformity:

In accordance with the provisions of the statutory requirements and the relevant directives, Electrical Equipment (Safety) Regulations 2016, Electromagnetic Compatibility Regulations 2016, The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 this product complies with the following standards or normative documents:

BS EN55014-1; BS EN 61000-3-2; BS-EN 61000-3-3; BS EN61000-6-1; BS EN61000-4-2; BS EN61000-4-3; BS EN61000-4-4; BS EN61000-4-5; BS EN61000-4-6; BS EN61000-4-11; BS EN60335-1; BS EN60335-2-29; BS EN50498, BS EN IEC 63000.

Delivery Scope:

- 1 VBCS Triple HV CI
- 1 Mains Supply Cable with Shock-proof Plug
- 1 Temperature Sensor 825
- 1 Installation and Operating Manual

Temperature Sensor 825



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