VOTRONIC

Installation and Operating Manual

Charging Converter, B2B Battery to Battery, **Optimal Battery Charging During Driving:**

VCC 1212-30 CI Input Voltage 12 V Charging Capacity 12 V / 30 A **No. 3360**

Please read the mounting instructions and the operating manual including the safety instructions carefully.
Particularly observe page 15 "Safety Regulations and Appropriate Application", prior to starting connection and start-up.

Fully automatic Battery Charging Converter for special purpose vehicles, campers, boats.

The charging converter (**booster**) of series "VCC" ensures optimum charging of the supply battery (BOARD battery) in the living area during driving. **Four (4)** adjustable IU1oU2 **charging programs** for conventional **gel, AGM batteries** as well as advanced **LiFePO4** batteries ensure unattended, quick and gentle full charging from any charging state with subsequent trickle charging of the battery.

The power for the charging converter is supplied by the vehicle's starter circuit (generator with STARTER battery). There is no intervention into the starter circuit itself. The unit acts like a powerful load at the generator. The automatic power control gives the required safety and ensures the vehicle's starting ability.
Depending on the driving condition, the voltage of modern **EURO standard 6, 6 + plus-**vehicles with energy-saving, intelligent generators fluctuates considerably (12.6 V … 15.5 V). These fluctuations are handled by the charging converter to ensure uniform charging of the BOARD battery and protection of the 12 V loads.

Due to the high charging currents, which are now possible, considerably shorter charging times and fully charged batteries are achieved, even with conventional generators and long connection cables.

- The efficient charging converter ensures high charging capacity, even with short driving distances.
- Full charging when driving longer distances.
- It regulates the voltage to the level, which is required for precise charging of the BOARD battery with the optimum charging characteristic line.
- The charging converter excels with its compact design, low weight (high-frequency switch mode boost and buck converter technology) and powerfully dimensioned power components for safe operation.
- The simultaneously supplied 12 V loads are protected against overvoltage and voltage fluctuations.
- The integrated recharging branch 12 V / 0 ... 1.8 A provides charging/trickle charging of the 12 V STARTER battery in case of extended inactivity. This recharging branch is activated automatically when the BOARD battery is being charged externally via a battery charger.

Further Characteristics of the Unit:

- The **charging voltage** is **free from spikes** and is **controlled** in such a way, that **overcharging** of the batteries is **excluded**.
- **Fully Automatic Operation:** The unit is permanently connected to the batteries, and it is automatically activated when the generator of the vehicle is running. Battery discharge in case of an engine stop **is avoided**.
- **Charging aid for deeply discharged lead batteries or switched off LiFePO4 batteries:** Gentle preliminary charging of the (gel, AGM) battery or automatic reactivation of the LiFePO4 battery, in case of possibly switched-on loads.
- **Parallel and Buffer Operation:** If a load is present while charging, the battery will either continue to be charged or maintained via trickle charging. The charging time is automatically corrected and monitored by the unit.
- **Unattended Charging:** The unit protects against overload, overheating, overvoltage, short circuit, incorrect behaviour and reverse current from BOARD battery by controlling the output voltage/current or in extreme cases disconnecting the BOARD battery.
- **Integrated Vehicle Power Supply Filter:** Unproblematic parallel operation of charging sources (EBL, chargers, motor-driven and petrol-driven generators, solar systems) on one battery.
- **Charging Cable Compensation:** Automatic compensation of voltage losses on the charging cables.
- Connection for **Battery Temperature Sensor** (Sensor 825 included in the standard delivery scope):
  Lead batteries (gel, AGM): In case of **low outside temperatures**, full charging of the weak battery is **improved** by automatically correcting the charging voltage based on the battery temperature, and in case of summery temperatures **unnecessary battery gassing** and **battery load** will be avoided.
  LiFePO4 Batteries: Battery protection in case of high temperatures and particularly in case of low temperatures below 0 °C.

Installation of the Unit

Install the charger **near the BOARD battery to be charged (for short charging cables)** at a clean, level 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 fan. The vent holes of the unit 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 dissipated.
Otherwise, in the event of overheating, the charger will reduce its charging capacity.

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.

a. Choose the appropriate connection plan for the application of the unit:

1. **Standard** Connection Plan, Page 3.
2. **Combination** with electroblock **"EBL"** (often already existing in the vehicle) with further use of the existing cabling and fuses, page 4.
3. **Combination** with power supply **"EVS"** (often already existing in the vehicle with further use of the existing cabling and fuses, page 5.
4. **Special case:** In case of an existing cutoff relay, which exists in the vehicle and is not easily accessed, see page 6.
5. **Connection Plan** for pickup and separable living cabins, page 7.

b. **Implement the power connections** at the large terminals, observe table **1,** see below.
Reverse battery (+/-) might result in **serious damage** of the unit!
Tightening torque 1.2 Nm!

c. Implement the control connections at the 5-pole terminal strip, for instance:
Terminal "D+": 1) Connect it: automatic unit control via signal vehicle D+.
2) Not used: automatic unit control via operating voltage.
Further description, see page 8.

Unit Settings

d. The charging program for the BORD battery must be set (type, design, technology gel, AGM, LiFePO4), from page 10.

Start-up and Function Test:

e. Further description, see page 13.

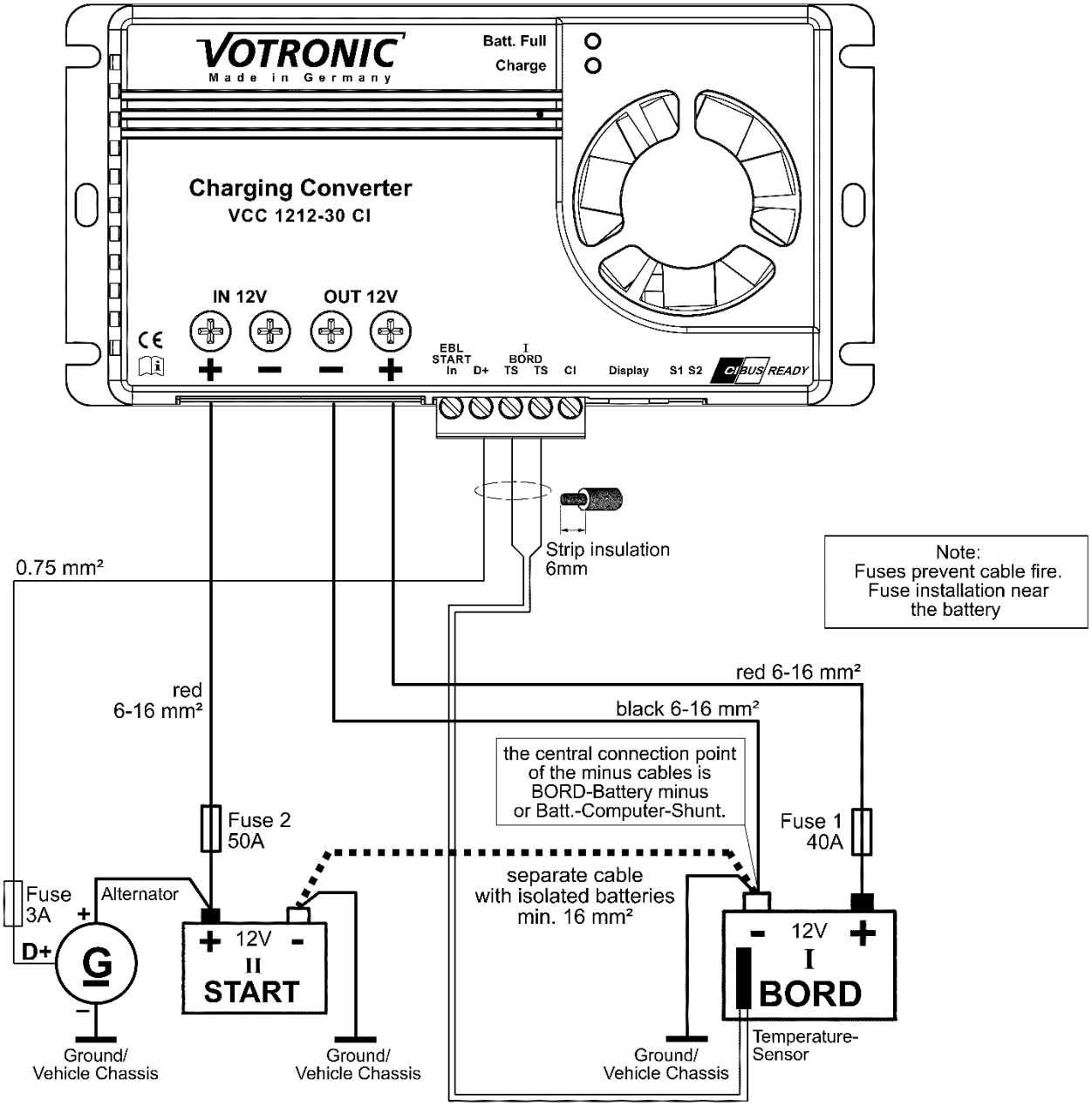
Table 1: Recommended Cable Cross-Sections, Cable Lengths and +Fuse Capacities

Configuration of the capacity terminals **"IN 12 V + / –"** and **"OUT 12 V + / –":**

- **The central connection point of all minus cables for units** and **batteries** is the **– pole** of the **BOARD** battery!
- If a **current measuring shunt** in the minus cable (for instance, of the battery computer) is used, the **central point** of all minus cables is at the measuring shunt, and not at the BOARD battery**!**
- In case of **isolated assemblies,** a **cable** must be laid (see drawing) **between the two negative poles of the battery –IN 12V** und **–OUT 12V** with a minimum cross-section of 16 mm²!
- Full charging capacity is ensured, if the **cable cross-sections and cable lengths** are observed according to the **table below**!

VCC 1212 – 30 CI					
Cable Cross-section	Cable Length **"+ IN 12V"** to **"+ START"**	**"Fuse 2"** Cable Protection	Cable Length **"– OUT 12V"** to **"– BOARD"**	Cable Length **"+ OUT 12V"** to **"+ BOARD"**	**"Fuse 1"** Cable Protection
6 mm²	up to 3.5 m	50 A	0.8 … 2.0 m	0.8 … 2.0 m	40 A
10 mm²	up to 6 m	50 A	1.5 … 3.0 m	1.5 … 3.0 m	40 A
16 mm²	up to 10 m	50 A	2.5 … 5.0 m	2.5 … 5.0 m	40 A

1 **Standard** Connection Plan:



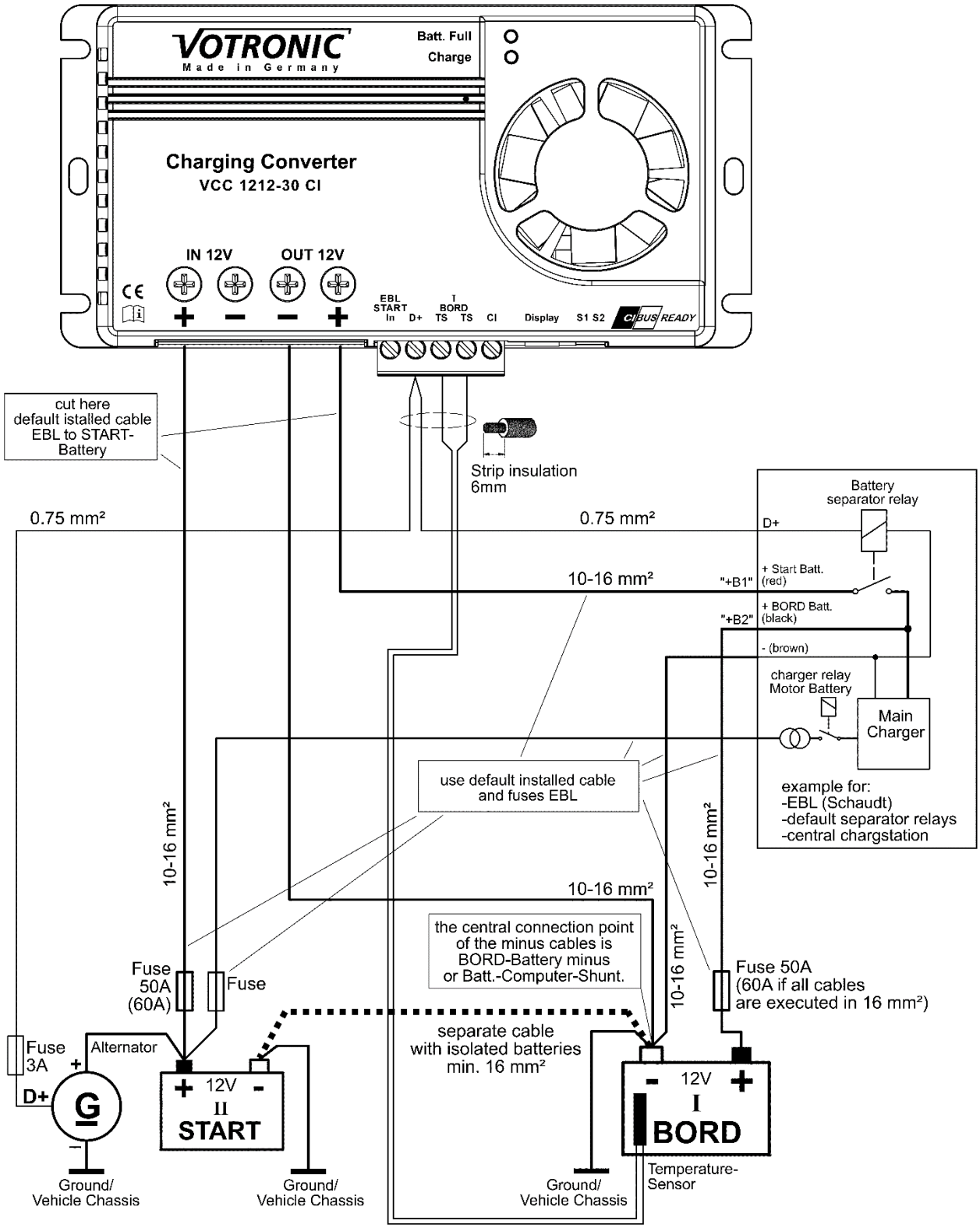
If possible, the unit should always be installed **as close as possible** to the **BOARD** battery.

During mains charging of the BOARD battery, the recharging branch of the VCC 1212-30 CI for charging / trickle charging of the vehicle's STARTER battery is active.

Safety Instructions for All Connection Methods:

- Observe the cross-sections and lengths of the cables (table 1).
- Insert fuses near the battery for protection of the cables.
- **Reverse battery (12 V +/-** mix up) at the large power terminals must be avoided in any case. This will result in serious damage of the unit!

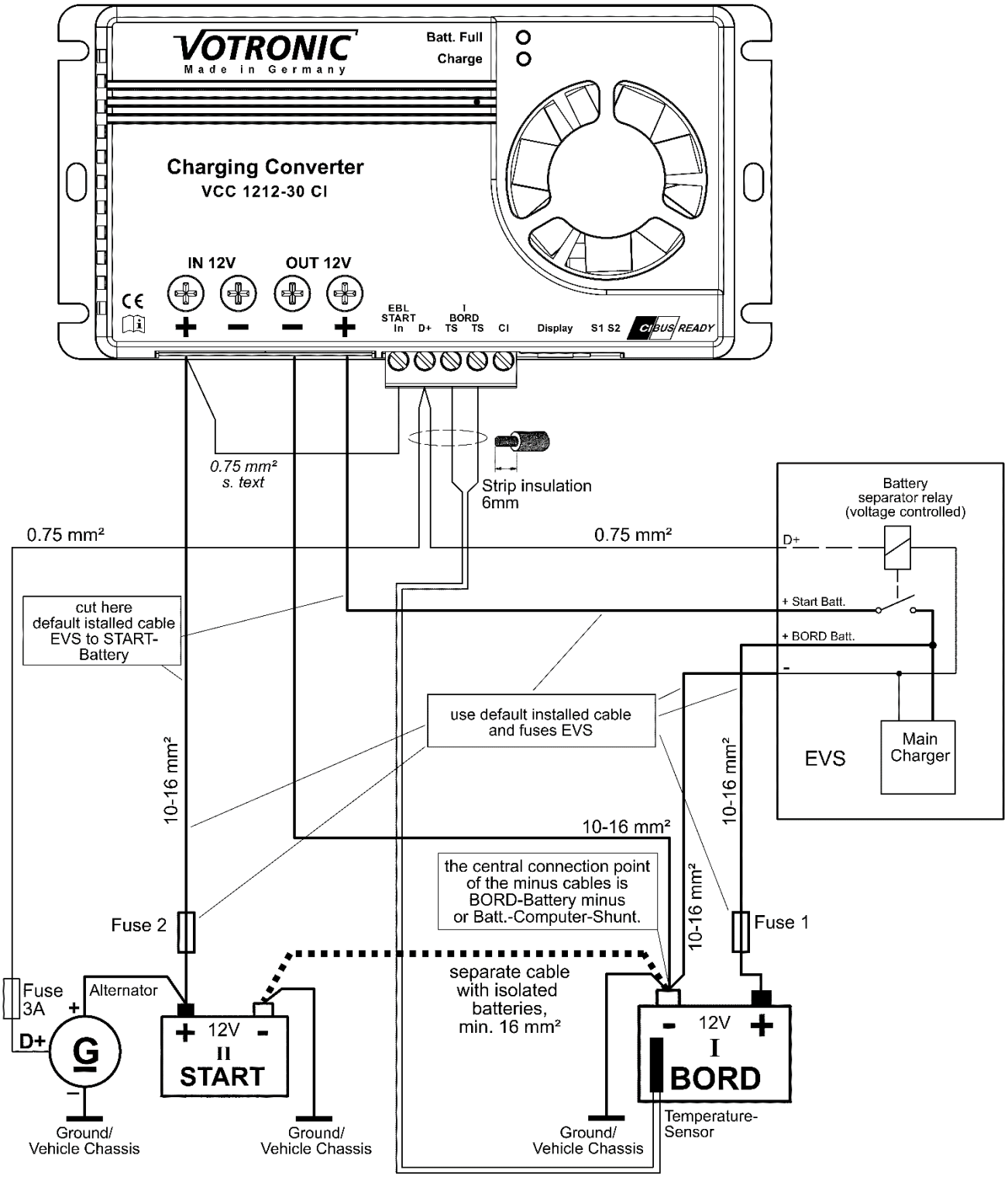
2 In combination with electroblock **"EBL"** with use of existing cables and fuses, the + cable to the STARTER battery must be disconnected:



During mains operation, the STARTER battery will be charged by the EBL. Then, the recharging branch of the charging converter is not active.

Special feature: Voltage display on <u>older</u> EBL designs <u>without</u> a separate charging/measuring circuit for the STARTER battery:
When the charging converter is installed on an older EBL design, the voltage of the STARTER battery may not be displayed when the charging converter is switched off. In the event that the voltage is not displayed, a jumper wire must be installed between "+IN 12 V" and "EBL START In". Due to the system, the voltage of the STARTER battery will not be displayed correctly at the EBL while driving. During EBL mains operation, the recharging branch of the charging converter for charging/trickle charging of the STARTER battery is active. See EVS, page 5.

3 In combination with power supply **"EVS"** with use of existing cables and fuses, the +cables to the STARTER battery must be disconnected:

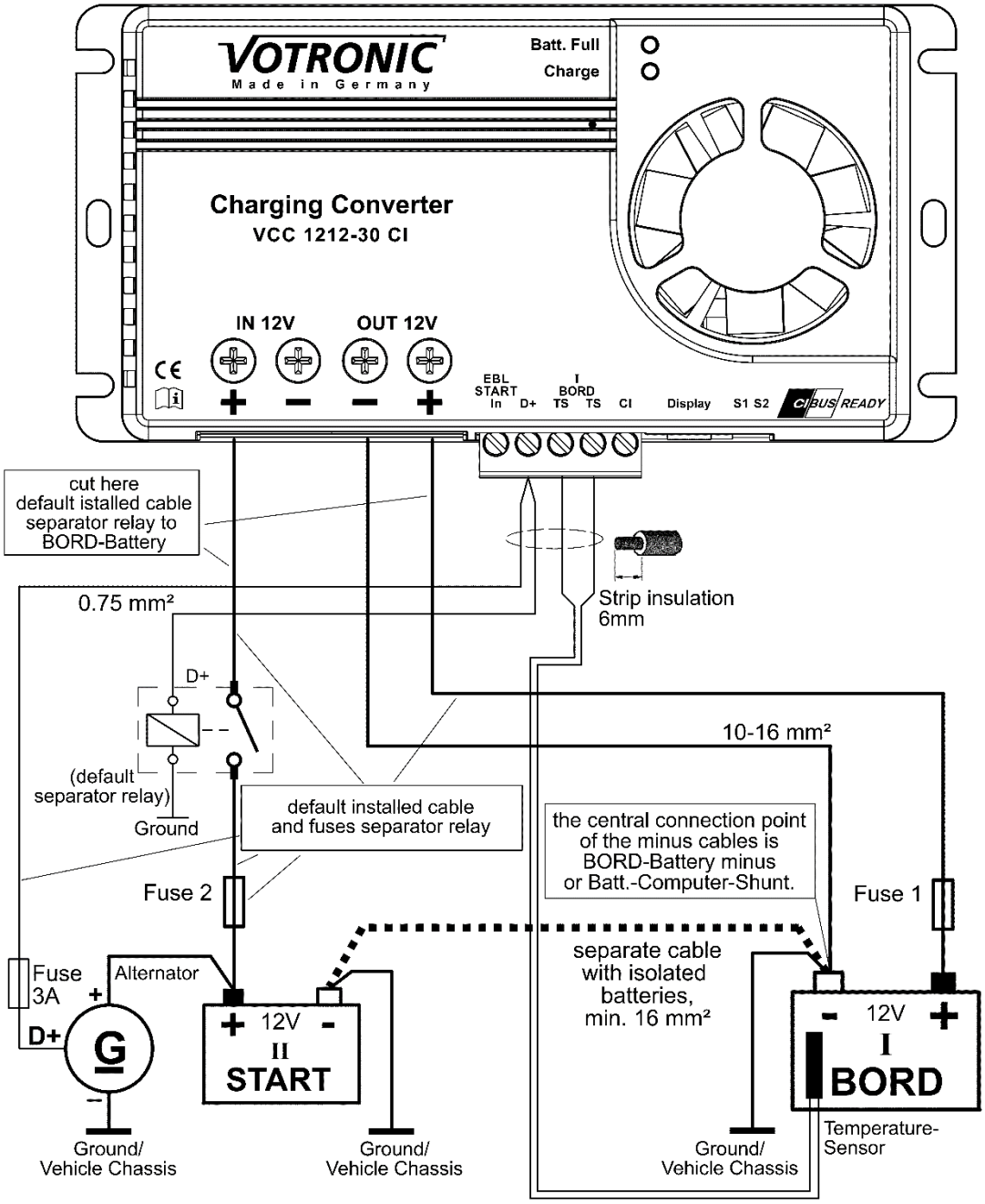


A special feature of the "EVS" systems is only a single connection to the starter battery, which means, that separate connections for charging and voltage measurement for the STARTER battery do not exist.
For this reason, the connection "EBL Start In" at the charging converter must be <u>bridged</u> with terminal "+IN 12 V" to ensure that the voltage of the STARTER battery can be displayed by the EVS when the charging converter is switched off.

Due to the system, the voltage of the STARTER battery will not be displayed correctly at the EVS while driving.

During EVS mains operation, the recharging branch of the VCC 1212-30 CI for charging / trickle charging of the STARTER battery is active.

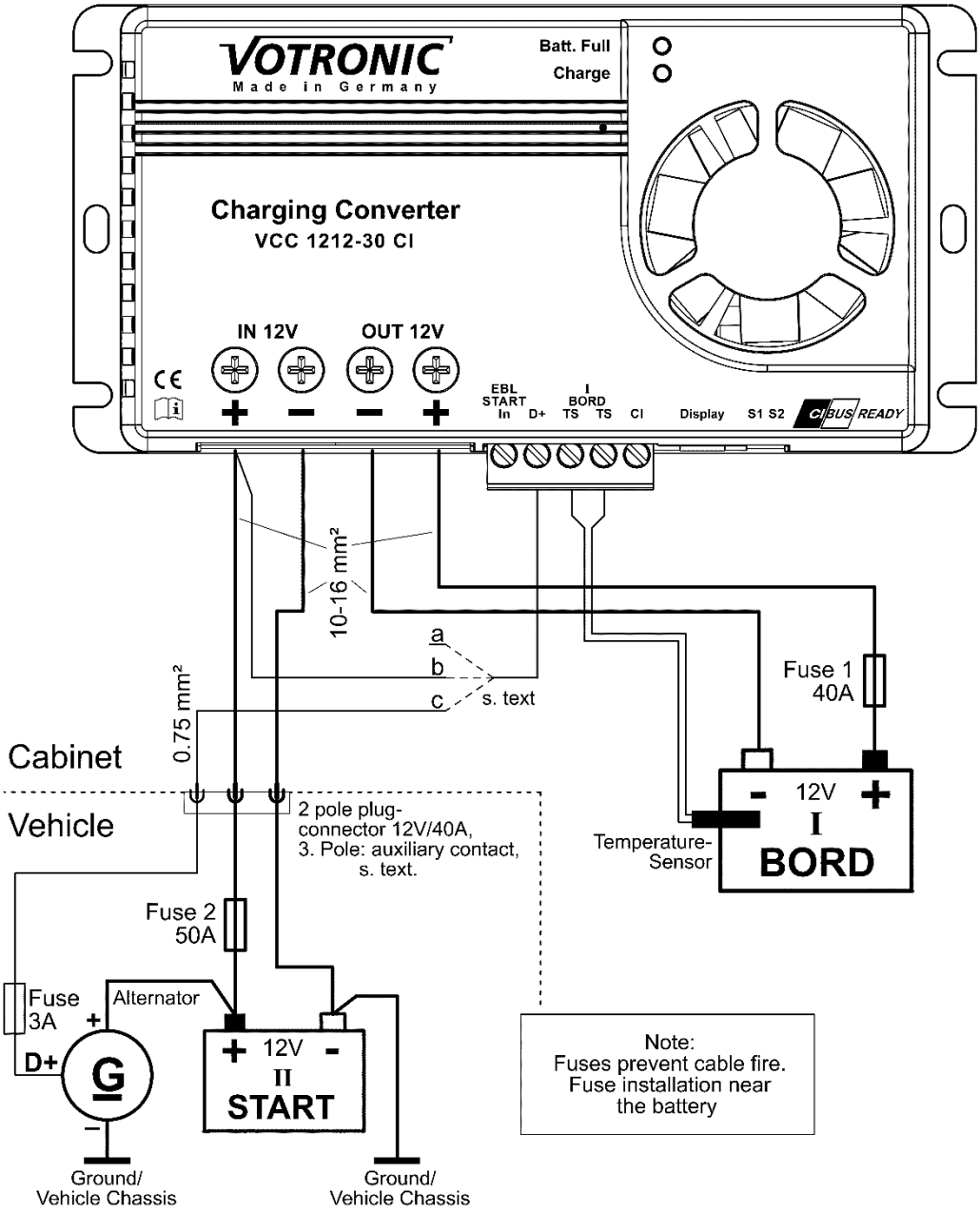
4 **Special case:** In case of a cutoff relay, which exists in the vehicle and is not accessed easily, disconnect the + cable to the BOARD battery.



Note: During external mains charging, the recharging branch of the VCC 1212-30 CI for charging/trickle charging of the STARTER battery from the BOARD battery is not active. (The cutoff relay is switched off.)

5 Connection Plan: Pickup and separable living cabins:

Note: Not suitable for connectors of conventional camper trailers (exceeds maximum current)!



Plug-type Connector:

- 2-pole. The rating of the contacts must be 12 V/40 A!
- Where available, the "D+" signal can be supplied from the vehicle via a 3rd pole (auxiliary contact 12 V/<1 A).

"D+" Connection with 2-Pole Plug-type Connector:

a. The terminal "D+" at the charging converter is not used. Therefore, the unit operates with voltage control (see page 8), and the STARTER battery cannot be discharged (even at engine stop). Full converter capacity can only be achieved with large cable cross-sections and constant high generator voltage, in order that the unit "receives" min. 13.3 V. Not suitable for vehicles with intelligent generators (Euro 6).

b. The terminal "D+" is connected to "+IN 12 V". The unit starts working, once the plug-type connector had been inserted. At least 11.7 V must be supplied to the unit ensuring the suitability for Euro 6 with intelligent generators and long cables.
WARNING: When the engine is stopped, the STARTER battery might be heavily loaded! This can be remedied by means of a vehicle-sided cutoff relay (12 V/40 A) behind fuse 2, which is controlled automatically by "D+".

"D+" Connection with 3-Pole Plug-type Connector:

c. The terminal "D+" is connected to the vehicle-sided signal "D+" ensuring the suitability for Euro 6 with intelligent generators and long cables, since only 11.7 V must be supplied to the unit. Discharge of the STARTER battery in case of an engine stop is avoided. During mains charging of the BOARD battery, the recharging branch of the VCC 1212-30 CI for charging/trickle charging of the vehicle's STARTER battery is active.

Connection of the **5-pole Plug-in Terminal Strip** (Control Connections)**:**

Plug-in Terminal Strip: In case of limited space, the strip can be **removed** and **reinserted** at any time for easy cable connection. **Tightening torque 0.5 Nm!**

Cable Cross-Sections: 0.75 mm^2 or more.

Length to be stripped: approx. 6 mm.

Protection: The inputs of this strip are protected against overvoltage and reverse battery.

"TS TS": Measuring input for the **temperature** of the **BOARD** supply battery:

Connect the temperature sensor to the **terminals "TS TS"** (any polarity). Further details concerning the functions of the sensor can be found under the paragraph "**Battery Temperature Sensor**" (page 9) and in the charging characteristic lines.

"EBL START In": (Transmission of the STARTER battery voltage for measuring purposes at EVS).

After installation of the charging converter in connection with an EVS or EBL of older design, the voltage for the STARTER battery may not be displayed, if the charging converter had been switched off.

In that case, the input serves as voltage display of the STARTER battery on the power supply EVS, shown and described on the Connection Plan "EVS", page 5.

Also applicable for EBL of older design without separate charging/measuring circuit for the STARTER battery. Further details, see page 4, paragraph *"Special Feature…"*.

If these two cases are not applicable, the terminal is not to be used.

"CI": Connection to a CI-BUS on-board management system to display all relevant data on a central vehicle display. The charge converter 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 charging converter ON / OFF and function selection:

Two (2) operating modes for automatic ON / OFF control of the unit are possible:

1) Connection of terminal "D+": Activation of the charging converter by control signal "D+" of the vehicle:

This operating mode is particularly provided for **EURO standard 6, 6+ vehicles** with energy management, start/stop automatics, strongly varying voltage of generator/STARTER battery during energy recovery etc.

Also required for operation in combination with electroblock **EBL**, power supply **EVS** and long cables between STARTER battery and charging converter.

*If need, the control input "D+" can also be connected to the vehicle Kl.15 (ignition ON), but in this case, the STARTER battery might be inadvertently **strongly** discharged when the engine is stopped!*

Increase of the charging capacity*:	> **11.70 V**
Reduction of the charging capacity*:	< **11.40 V**
Switching off threshold (with continuous signal "D+")*:	< **11.20 V** with delay 30 s
Recharging branch for STARTER battery (trickle charging), if the BOARD battery is charged by a mains supply charger:	**ACTIVE**

2) Do not connect the terminal "D+". Leave it blank: Pure voltage control of the charging converter:

The unit is activated by the increased voltage at the STARTER battery due to the running engine. It will be switched off automatically in case of a voltage drop (engine off).

This operating mode requires powerful, short cables to the STARTER battery and a non-intelligent generator with sufficient high and uniform charging voltage (not Euro 6).

During this operating mode the STARTER battery cannot be discharged, due to the high switching off threshold.

Note: If voltage had been supplied to the terminal "D+" by mistake, the unit will memorize this "control by signal D+" and will expect this signal for the further operation.

Reset: Return to the operating mode "Voltage Control" (without "D+") is possible by disconnecting the unit from any operating voltage for 30 seconds. (Disconnect BOARD and STARTER battery).

Increase of the charging capacity*:	**> 13.30 V**
Reduction of the charging capacity*:	**< 13.00 V**
Switching off threshold*:	**< 12.90 V** with delay 30 s
Recharging branch for STARTER battery (trickle charging), if the BOARD battery is charged by mains supply charger:	**BLOCKED**

* Also see "Function of the Power Control at STARTER Battery and Generator", page 12.

Battery Temperature Sensor:

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

The temperature sensor controls the **temperature** of the BOARD supply **battery**.
Ensure that the installation place of the sensor is not influenced by any source of heat (engine heat, exhaust, heater etc.)!

Gel, AGM Batteries:

Installation: The temperature sensor needs to have a good thermal contact to the internal battery temperature. Therefore, it is recommended to fasten the sensor to the minus pole of the battery. Alternatively, the sensor can be attached to the long side of the battery in the middle.

Function: The temperature-dependent charging voltage of the BOARD battery will be adapted automatically to the battery temperature (automatic temperature compensation). For this purpose, 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 loads are protected by a voltage limitation 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 to a **safe charging voltage** of approx. 12.80 V for battery protection, and the maximum charging current rate will be halved (safety mode, LED **"Charge" is flashing**). Any previously recorded charging data will be kept in memory. Battery charging is then interrupted, but the supply of possibly connected loads 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, 2 characteristic lines, charging voltage rates and **temperature equalization"** from **page 10.**

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 temperature sensor needs to have a good thermal contact to the internal battery temperature. Therefore, it is recommended to fasten the sensor to the minus pole of the battery, because in most of the cases, this is the cooler side (the positive pole is often biased by the exhaust heat of internal fuses of the battery, 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 to a **safe charging voltage** of approx. 12.0 V for battery protection. The maximum charging current is still available to the consumer (safety mode, LED **"Charge" is flashing**), all previously recorded charging data will be kept in memory. A battery charge no longer takes place, but connected loads continue to be supplied by the unit if the battery voltage falls below 12.0 V. If the battery temperature is within the permissible range again, charging continues automatically.

There are two different LiFePO4 charging characteristics to choose from which behave differently below 0°C:

Charging programme 3:

For batteries that have to be charged below 0°C with reduced charging current. The charging current is limited to approx. 2 A above a battery voltage of 12.0 V. **The "Charge" LED flashes briefly every two seconds when the temperature is below 0°C.**

Charging programme 4:

For batteries that are heated internally or are suitable for charging below 0°C. Charging current and voltage are not limited. A large part of the maximum charging current is still available for the consumers during the heating phase.

Warning: If the charging program 3 "LiFePO4 14,4 V" has been set, the temperature sensor must be connected for reasons of battery safety. Otherwise, the unit will not operate, and the LEDs **"Batt. Full"** and "**Charge**" are flashing alternately!

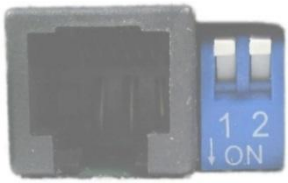
"Display" 6-pole plug-type connector for remote control:

Connection (plug and play) of a remote display / remote control is possible for convenient remote control, if the charging converter has been installed in a difficult to access location.

Both units are equipped with a power "limit" function allowing to reduce the charging capacity temporarily at the touch of a button (see technical data).

- LED Remote Control S Order No. 2076
  7 LEDs for convenient control of functions and charging state.
- LCD Charge Control S-VCC Order No. 1248
  With illuminated, excellently readable display showing the state of the charging converter, the current charging phase, the voltage of board and starter battery and the instantaneous charging current.

Unit Settings:



Carefully move the **2 micro slide switches** on the side of the unit to the desired position using a small screw-driver.
The **switches** are shown in **white**.

1.) How to Set the Charging Program BOARD Battery Type (Design, Technology):

Four (4) charging programs for the different battery types are stored in the unit.
They can be selected by means of the shown **2 slide switches**:

Unless otherwise specified by the battery manufacturer, the appropriate charging program for the BOARD supply battery can be found in the following description and the technical data (voltage rates U1 and U2).

All charging programs automatically take into account the possibility of parallel/buffer operation with 12V loads being connected to the BOARD battery.

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

Charging Programs for **Lead** Batteries (Gel, AGM):

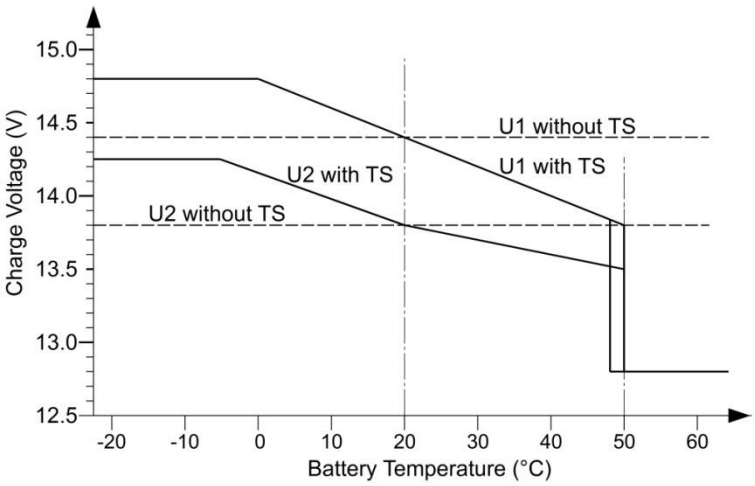
Charging programs 1-2, charging voltage rates and temperature equalization for batteries in lead technology:

1 "Gel 14.4 V"

Switch Position

U1=14.40 V U2=13.80 V
6…12 h Continuous

Adapted to closed, gas-tight **Gel/dryfit** batteries **VRLA** with specified electrolyte, which generally require longer dwell times U1 to achieve particularly high capacity storage and to avoid deep discharge (becoming dead) of the battery, such as EXIDE, Sonnenschein, "dryfit", Varta, Bosch, Banner, Mobil Technology etc. Also recommended, unless otherwise specified by manufacturer, for batteries in round cell technology.

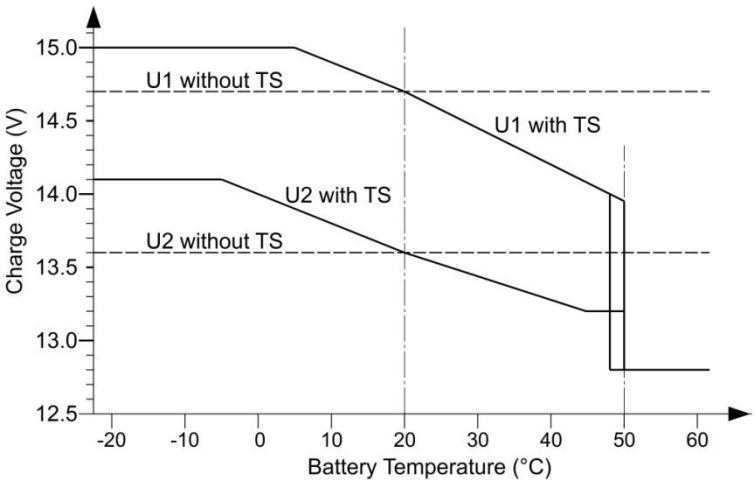


2 "AGM 2 14.7 V"

Switch Position

U1=14.70 V U2=13.60 V
1.5…5 h Continuous

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



Charging Program for **LiFePO4 Batteries:**

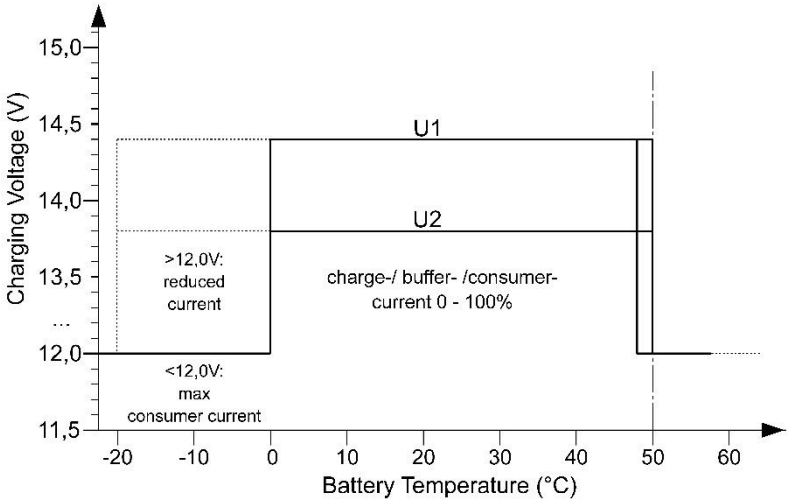
Charging program 3-4, charging characteristic lines and temperature control adapted to lithium batteries:

- **Observe the instructions of the battery manufacturer!**
- **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 prohibited!**
- **The battery temperature sensor must be installed at the battery (fastened to the negative pole) using charging program 3** and must be connected at the unit. It serves as protection for the battery. No function without temperature sensor. The LEDs "Batt. Full" and "Charge" are flashing alternately!
- If possible, the battery temperature should be kept above 0 °C.

3 "LiFePO4 14.4 V"

Switch Position

U1=14.40 V U2=13.80 V
0.3…1 h Continuous



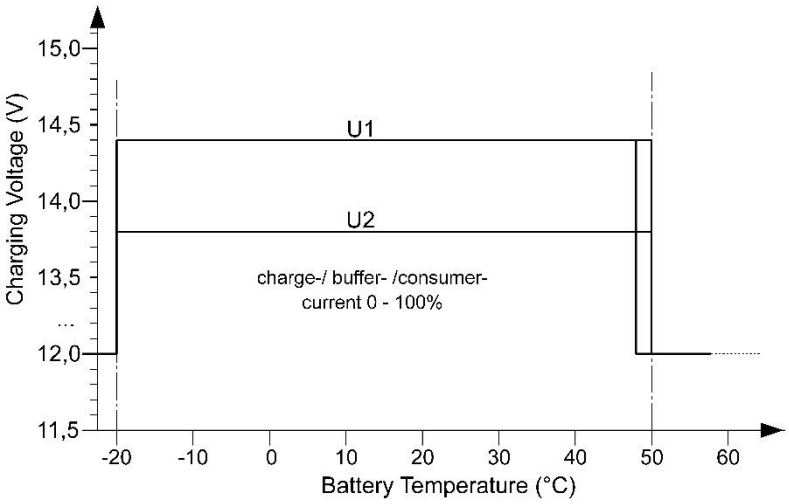
4 "LiFePO4 (heated) 14.4 V"

Switch Position

U1=14.40 V U2=13.80 V
0.3…1 h Continuous

Only for LiFePO4 batteries with internal heating!

A temperature sensor is not essential, but is recommended.



Further operation at the unit is not required during normal automatic mode.

Pilot Lamps:

"Batt. Full" (BOARD battery fully charged, **green**)**:

- On: Battery has been charged to 100 %, trickle charge U2, finished.
- Flashing: Main charging process is active in the charging phase U1, indication of the charging state of 75 % (lead), approx. 90 % (LiFePO4) (short flashing), gradual increase to 100 % (long flashing).
- Off: Main charging process is still in the phase I.

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

- On: Charging converter operates, the BOARD battery is controlled and charged.
- Flashing: Battery Protection: Battery overtemperature > 50 °C, switchover to low safe charging voltage and half of the max. charging current. Automatic return, as soon as the temperature is 2 °C less.
- Turns off shortly every 2 s:
  1. The power control of the charging converter has reduced the output capacity by more than 30 % (STARTER battery discharge protection), since the voltage of the STARTER battery dropped below the value for "Reduction of the charging capacity". The charging capacity will be increased automatically, as soon as the voltage exceeds the value for "increase of the charging capacity".
  2. Only LiFePO4: Battery temperature below 0 °C. The charging current is reduced for all modes of charging to protect the battery. If the battery is discharged, charging times will increase.
- Off: Charging converter in idle mode.

**** "Batt. Full"** and **"Charge"** are flashing alternately:

The battery temperature sensor is not connected with charging program LiFePO4!

Function of the Power Control at STARTER Battery and Generator:

The charging converter is either voltage-controlled or via the control input "D+". It will be deactivated automatically if the engine is switched off. It starts with minimum charging capacity.

After the engine starts, the STARTER battery will begin charging immediately and its starting capacity will be maintained. Therefore, the charging converter does not start charging the BOARD battery, before the voltage value "increase of the charging capacity" of the starter battery is reached.

The unit gradually increases the charging current of the BOARD battery as the STARTER battery's voltage exceeds the "increase of the charging capacity" threshold.

In case of a heavy load on the starter circuit due to many large loads, and the STARTER battery's voltage drops again below the value "reduction of the charging capacity", there will be a gradual reduction of the charging current for the BOARD battery to relieve the starter circuit.

If the voltage drops below the "Switching off threshold" for 30 seconds, the charging converter will be switched off automatically. As soon as the voltage exceeds the threshold "increase of the charging capacity", the converter will be switched on, and the capacity will be increased gradually until the required (maximum) charging capacity is reached.

A reduction of the charging current by more than 30 % due to insufficient input voltage of the generator will be indicated by the LED "Charge", which turns off shortly every 2 seconds. The LED will again light permanently, as soon as either the input voltage is sufficient or the power requirement has dropped due to a charged BOARD battery.

The charging converter simulates a large load at the generator/starter circuit to ensure an activation also with Euro 6 vehicles with intelligent generators, if required.

Recharging Branch for STARTER Battery 12 V:

The unit is equipped with a charging branch, which ensures support charging and trickle charging of the STARTER battery 12 V in case of extended standstill periods. It will be activated automatically, as soon as the BOARD battery has been sufficiently charged, for instance by a mains supply charger (see Technical Data "Recharging Branch"). A small part of the charger current (approx. 0 - 1 A) is diverted from the BOARD battery to the STARTER battery.

Charging voltage and charging current are reduced to prevent the STARTER battery from being overcharged.

Activation of the recharging branch is only possible with control "D+" of the charging converter, and not with "voltage control", described under**"D+"** Control Input, page 8 !

A possible use of the recharging branch is detailed in the different connection plans.

Start-up and Function Test:

After connection and configuration of the charging converter, a function test can be performed:

1. Start the vehicle:
   - The charging converter will be activated (LED "Charge" is on) and starts with minimum charging capacity.
2. Increase the speed of the vehicle to increase the voltage at the STARTER battery until it exceeds the adjusted value for the "increase of the charging capacity".
   - The charging capacity will be increased and is raised to the maximum value or to the required value of the charging characteristic line, if the BOARD battery is already full.

Tips:

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

a. *Check the voltage at the activation input terminal "D+", > 8 V.*
b. *In case of pure voltage control (without D+), check the voltage directly on the terminals of the unit. See page 8.*

Full charging current is not reached:

c. *BOARD battery is already charged: Turn on devices with high current draw.*

Full charging current is not reached, the LED "Charge" turns off every 2 seconds:

d. *Check the voltage directly at the terminals +/- IN 12 V: The voltage must be higher than the* threshold "Increase of the Charging Capacity". *Increase the engine speed, in order that the charging converter is able to regulate to a higher voltage.*
e. *Check the cabling +/-OUT 12 V and fuse 1. Check the cross-sections and lengths according to table 1.*
f. *Check the cabling +IN 12 V, fuse 2, cross-sections and lengths (also "minus" connection to chassis), if required, separate cable of isolated batteries between "-STARTER" and -BOARD battery according to table 1.*
g. *Concealed battery cutoff relay (such as in EBL, EVS) bridges the charging converter: Check connection plan.*

Operation with EBL, EVS etc.:

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

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 deeply discharged lead batteries immediately!**
- **LiFePO4: Only use batteries with BMS and safety circuit.**

Option: Several Batteries at the Charging Port:

Parallel charging of two or several batteries of the same voltage (12 V) is admissible. For this purpose, the batteries are connected "in parallel". The capacity values (Ah) are summed up. **The total capacity (total Ah) should not exceed the indicated maximum battery capacity** (depending on the case of application).

According to the battery manufacturers, **permanent parallel operation** is admissible in case of two or several batteries of the same voltage, same type (gel/AGM/LiFePO4), same capacity, and of about the same age (history).
Example: Connection in parallel of 2 batteries (cross connection):
Both positive poles must be connected with a large cable. Also, both negative poles must be connected with a large cable.
Now, the supply cables are connected "in cross connection". This connection is beneficial and means
Minus supply cable at negative pole of battery "1".
Plus supply cable at positive pole of battery "2".
This ensures that both batteries "1" and "2" of the system will receive/supply the same voltage.

Option: Parallel Connection of Two Charging Converters:

An increase of the charging capacity for large battery systems or high loads can be realized by parallel connection of two identical units. It should be noted that both units must be connected as symmetrically as possible, with the same cable lengths and cable cross-sections, to achieve identical power performance.
Due to high currents, the required **cable cross-sections** of the power supply connections must be multiplied by two, or they must be observed when separately installed (table1).

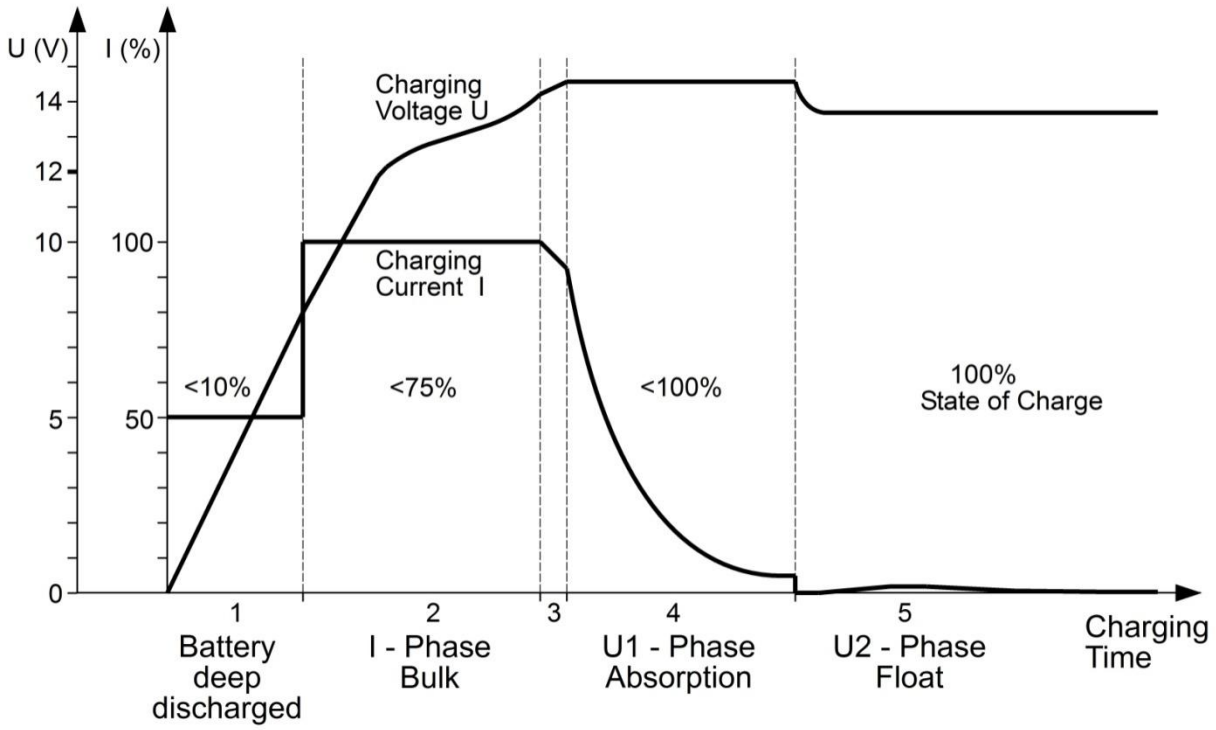
Chronological Sequence at the BOARD Battery (OUT):

A new, complete main charging cycle will be executed:

- After a standstill of the generator or removal of the control signal "D+".
- If the voltage of the STARTER battery has dropped below the turn off threshold for more than 30 seconds.
- When the BOARD battery is brought below the battery reset voltage for 30 seconds due to high load beyond the maximum charging current.

1. Activation of switched off LiFePO4 batteries, charging aid for deeply discharged lead batteries, which will be subject to gentle preliminary charging to approx. 8 V.
2. Maximum charging current (**phase I**) in the voltage range from 8 V to the beginning of the phase U1 for short charging times. The LED **"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, any active loads and the charging state. The charging converter records the charging process.
3. In case of a high battery voltage, the charging current will be slightly reduced for battery protection (orientation phase). After that, automatic switching to the following phase U1.
4. During the **phase U1** (LED **"Charge"** is on), the battery voltage will be kept constant at a high level. The green LED **"Batt. Full" is flashing** and the additional high battery capacity will be charged. The battery charging current is decreased slowly as the battery is charged. The charging converter determines the **100 % full charge point** of the battery and automatically changes to the U2 phase by monitoring the charging time, charging current and the charging process. In contrast to conventional voltage transformers or boosters with fixed default values for charging current thresholds, an unnecessary long phase U1 is avoided, which might be caused by loads being also supplied, and thus falsifying the charging current.
5. **Phase U2** (LED **"Batt. Full" is lighting permanently**)**:** The charging converter has now switched to the lower voltage for trickle charge maintaining 100 % charge of the battery. Only the low compensating recharging current is flowing, which is determined by the battery, and which is required to hold the battery at a full charge.

Note: During the **phases U1, U2** (battery full) almost the **total charger current** is available for the additional **supply of loads**, without any discharge of the battery.



Safety Regulations and Appropriate Application:

The charging converter has been designed according to the valid safety regulations.

Appropriate application is restricted to:

1. **Charging of lead-gel, lead-AGM or LiFePO4 complete batteries (with integrated BMS, balancing, safety circuit and approval!) Charging of batteries of the indicated nominal voltage and simultaneous supply of the consumers being connected to these batteries in fixed installed systems with the indicated battery capacities and charging programs.**
2. **Simultaneous supply of loads being connected to these batteries in fixed installed systems.**
3. **Connection with the indicated cable cross-sections at the inputs and outputs of the unit.**
4. **Connection with the indicated battery capacities at the inputs and outputs of the unit.**
5. **Fuses of the indicated capacity are to be provided near the battery to protect the cabling of the batteries.**
6. **In perfect technical condition.**
7. **Installation in a well-ventilated room, protected from rain, humidity, dust, aggressive battery gases, as well as in an environment being free from condensation.**

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 to avoid damage, and ensure the cables are fastened securely.
- Never lay 12 V cables and 230 V mains supply cables into the same cable conduit (empty conduit).
- Check live cables or leads periodically for insulation faults, points of break or loosened connections. Any defects must be remedied immediately.
- The unit is to be disconnected from all connections prior to the execution of arc welding or work on the electric system.
- If it is not clear to the end user which values apply or to which regulations must be adhered, from the descriptions provided, a specialist must be consulted.
- The user / buyer is responsible for the observation of construction and safety regulations of any kind.
- **The unit does not contain any parts, which can be replaced by the user.** Even after having been switched off, the unit may be live for an extended period (particularly in case of failure).
- Keep children away from the unit and the batteries.
- Observe the safety regulations of the battery manufacturer; vent the battery room, if required.
- Failure to comply 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 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 EN61000-6-1; BS EN61000-4-2; BS EN61000-4-3; BS EN61000-4-4; BS EN60335-1; BS EN60335-2-29; BS EN50498, BS EN IEC 63000.

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; EN61000-6-1; EN61000-4-2; EN61000-4-3; EN61000-4-4;
EN60335-1; EN60335-2-29; EN50498.

Disposal of the product in the household waste is not allowed.

The Product conforms to RoHS. 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: ***VCC 1212-30 CI***

Input from the vehicle's STARTER battery **"IN 12 V+":**	
Nominal Voltage Vehicle STARTER Battery	12 V
Min. Battery Capacity (Size), recommended	50 Ah
Input Voltage Range (EURO 6+), D+, controlled	10.5 … 16.5 V
Input Overvoltage Disconnection, max.	16.5 V
Power Consumption max.	490 W
Current Draw (at lowest input voltage) depending on load	0.05 A … 39 A
Activation Control Input "D+"	8 - 17 V / < 1 mA
Charging Port at the BOARD Supply Battery **"OUT 12 V+":**	
Charging/Floating/Load Curr., controlled, IU1oU2, Lead, LiFePO	0 A … 30 A (0 A … 20 A *)
Gel, AGM Batteries Nominal Voltage:	12 V
Capacity (Battery Size), recommended/up to	60…200/260 Ah
Lead Charging Programs Stored in the Memory	2
Prelim. Charg. Current (Deeply Discharged Batt. <8 V) max	15 A (10 A *)
Safety Charging Voltage at Battery Overtemperature	12.80 V
LiFePO4 Battery Nominal Voltage:	12 V … 13.3 V
Capacity (Battery Size), recommended/up to	60…200/260 Ah
LiFePO4 Charging Program Stored in the Memory	2
Safety Charging Voltage at Battery Overtemperature	12.0 V
Recharging Branch, Charging/Trickle Charging for 12 V STARTER Battery from the BOARD Battery (such as with Mains Charging of the BOARD Battery)	12 V / 0 … 1.8 A
Active at Lead-Acid, Gel, AGM, BOARD Battery Voltage	ON: > 13.1 V, OFF: < 13.0 V
Active at LiFePO4 Board Battery Voltage	ON: > 13.5 V, OFF: < 13.4 V
Input "TS TS" for BOARD Battery Temperature Sensor	Yes
EBL START In, Measuring Input EVS	Yes
Quiescent Current, Standby	3 ... 7 mA
Charging Timer	3-fold
Ripple Factor Voltage	< 30 mV rms
Limit of Charging Voltage "OUT 12 V+" (Load Protection)	15.0 V
Safety Protection against Short-circuit/Back Discharge	Yes
Fitting Position of Unit	any
Temperature Range	-20 / +45 °C
Speed-controlled, Temperature-controlled Fan	Yes
Gradual Reduction of Charging Capacity at Overtemperature	Yes
Safety Disconnection in Case of Overheating	Yes
Connection "Display"	Yes
Dimensions, incl. Fastening Flanges and Terminals (WxLxH)	73 x 136 x 40 mm
Weight	280 g
Ambient Conditions, Humidity of Air	max. 95 % RH, no condensation
Tightening torque terminals “IN 12 V+” and “OUT 12 V”	1.2 Nm
Tightening torque terminals “EBL”, “D+” and “TS”	0.5 Nm

* "Power Limit" or "Limit" function, temporary reduction of charging current, available with connection of a Remote Control No. 2076 or No. 1248.

Delivery Scope:

1 Charging Converter
1 Temperature Sensor 825
1 Installation and Operating Manual

Temperature Sensor 825

Available Accessories:

LED Remote Control S	Order No. 2076
LED-Charge Control S-VCC	Order No. 1248

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Made in Germany by VOTRONIC Elektronik-Systeme GmbH, Johann-Friedrich-Diehm-Str. 2, 36341 Lauterbach/GERMANY
Phone.: +49 (0)6641/91173-0; E-Mail: info@votronic.de; Internet: www.votronic.de