VOTRONIC

Installation and Operating Manual

Automatic Charger VAC 1215 F 3A II	Charging Capacity 12 V / 15 A	**No. 0471**
Automatic Charger VAC 1230 F 3A II	Charging Capacity 12 V / 30 A	**No. 0477**
Automatic Charger VAC 2416 F 3A II	Charging Capacity 24 V / 16 A	**No. 0495**

Fully-automatic built-in chargers in protection class II (mains connection 2-core, without protective conductor). **DIN 14679: 2008-03 Fire Protection** for fire-fighting and special purpose vehicles.

Please read these installation and operating instructions in full, in particular page 2 "Safety guidelines and intended use", before you start connecting and commissioning the device.
ATTENTION: The values being indicated in parentheses ( ) apply to 24 V operation.

VOTRONIC chargers of series "VAC F" distinguish by their compact design, low weight (high-frequency switching power supply, Switch Mode Technology), as well as full charging capacity - even in the event of large fluctuations in the power supply (undervoltage/overvoltage, sine wave form, frequency).
The intelligent microprocessor charging control with charging programs "IU1oU2oU3" (constant current - constant voltage) and dynamic charging time calculation ensures automatic, quick and gentle full charging, as well as subsequent 100 % trickle charge of the connected batteries from any charging state. At the same time, simultaneous supply of 12 V (24 V) consumer loads, which are connected in parallel, is ensured or charging of very large batteries (depending on case of application).

Battery Ports and Charging Programs:

Main charging port battery I (master), depending on the type of battery, 5 adjustable charging programs (see table 1):

a) **"DIN AGM":** Closed, gas-tight **AGM/fleece** batteries VRLA (lead-fleece technology) "**14.8 V"**
b) **"DIN Gel":** Closed, gas-tight **gel/dryfit** batteries VRLA (determined electrolyte)
c) **"DIN VL":** Closed **acid/lead-acid** batteries with water consumption according to DIN EN 50342-1 "very low"
d) **"DIN L":** Closed **acid/lead-acid** batteries with water consumption according to DIN EN 50342-1 "low" and closed **AGM/fleece** batteries with indication of the charging voltage "**14.4 V"**
e) **"Start":** Closed **acid/lead-acid** batteries with standard water consumption

Charging Port Battery II, adjustable charging programs depending on the type of battery (see table 2):

a) **"II = I":** Charging programs as battery I with parallel charging by integrated charging current distributor
b) **"II < I":** Designed for charging of starter batteries (max. charging current also for the starter battery)

Control Output "+86" (Engine Immobilizer)
12 V (24 V) signalling port for power supply indicator or vehicle engine immobilizer by external relay.
Voltage is supplied, as soon as the charger is connected to the mains, also during stand by.

Further Characteristics of the Unit:

- The **charging voltage** is **free from peaks** and is **controlled** in such a way, that **overcharging** of the batteries is **excluded**.
- **Fully Automatic Continuous Operation:** The charger may be connected continuously to the battery, thus keeping the full charge. Battery discharge in case of power failure **is avoided** (separation by safety relay).
- **Battery regeneration in case of extended standstill periods:** twice a week to avoid harmful acid accumulation.
- **Parallel and Floating Operation:** In case of simultaneous consumption, the battery will either continue to be charged or maintained via trickle charging. Calculation and control of the adaptation of the charging times is effected automatically by the charger.
- **Unattended Charging:** Multiple protection against overload, overheating, overvoltage, undervoltage, short circuit, reverse battery, incorrect behaviour and back discharge of the battery by electronically controlled gradual reduction down to complete separation of charger and battery **by integrated safety relays.**

- **Audible and visible alarm** in case of failure and/or effected safety disconnection.
- **Power Supply Function:** Allows supply of the consumers without battery (such as during battery replacement).
- **Charging Cable Compensation:** Automatic compensation of voltage losses on the charging cables.
- **Charging aid for deeply discharged batteries according to DIN 14679:** Allows manual, gentle charging of the battery **at the touch of a button** from 0 V to 8 V (16 V), followed by automatic charging of the battery with full charging current in case of possibly switched-on consumers.
- **Temperature Equalization:** 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 load**and **gassing** will be avoided. The temperature sensor is included in the delivery scope.
- **Integrated On-board Mains Suppression Filter:** Unproblematic parallel operation with petrol-driven generators, generators etc. on one battery.

Lifetime of the battery:

- Keep batteries cool; choose an appropriate location for installation.
- **Lead-acid batteries ("maintenance-free according to EN / DIN"): Check the acid level periodically!**
- **Batteries being totally discharged should be recharged immediately, partially discharged batteries should be recharged fully as soon as possible to avoid sulphation!**
- **Store only fully charged batteries and recharge them periodically,** particularly in case of older, used batteries and in case of lower and higher temperatures! If the grade of sulphation is not too intensive, the battery can recover part of the battery capacity after several charging/discharging cycles.

Safety Regulations:

Appropriate Application:

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

Appropriate application is restricted to:

1. **Charging of lead-acid, lead-gel or lead-AGM batteries of the indicated nominal voltage and simultaneous supply of the consumer loads being connected to these batteries in fixed installed systems with the indicated battery capacities and charging programs.**
2. **Connection to a mains socket, which has been installed according to the valid technical regulations, protected with max. 16 A**
3. **Connection in consideration of the indicated cable cross-sections at the charger inputs and outputs.**
4. **Fuses of the indicated capacity are to be provided near the battery to protect the cabling between battery and charger output.**
5. **Technically faultless condition.**
6. **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 damage is avoided and observe to fasten them tightly.
- Never lay 12 V (24 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. Occurring defects must be remedied immediately.
- 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 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 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.

Technical Data:	**VAC 1215 F 3A II**	**VAC 1230 F 3A II**	**VAC 2416 F 3A II**
Rated operating voltage (full charging power)	230 V, 45...65 Hz	230 V, 45...65 Hz	230 V, 45...65 Hz
Operating voltage range	85...265 V	85...265 V	85...265 V
Operating voltage range full charging power	190...265 V	190...265 V	190...265 V
Operating voltage range reduced charging power	85...190 V	85...190 V	85...190 V
Sinusoidal power factor correction	active	active	active
Max. Power consumption (AC)	240 W	490 W	510 W
Max. current consumption (230 V AC)	1.0 A	2.1 A	2.2 A
Max. current consumption (AC)	2.7 A	2.7 A	2.7 A
Unit Switch Stand-By (Remote Control "OFF")	1.6 W	1.8 W	1.8 W
Charging Ports Battery I + II:			
Nominal Voltage Battery	12 V	12 V	24 V
Autom. Charging Current Distributor Batt. I/ Batt. II	Yes	Yes	Yes
Battery Capacity I or I+II (Total) acc. to DIN 14679	30 Ah-75 Ah	50 Ah-150 Ah	30 Ah-80 Ah
Ditto acc. to DIN 14679 with standstill periods >24 h	30 Ah-150 Ah	50 Ah-300 Ah	30 Ah-160 Ah
Minimum Battery Voltage for Automatic Charging Start	> 8 V	> 8 V	> 16 V
Charging Current Main Charging, Phase **I**, 8 V (16 V) to U1, 0-15h	15 A	30 A	16 A
Charging/Floating/Load Current, controlled, Phase U1-U2	0 A - 15 A	0 A - 30 A	0 A - 16 A
Minimum Battery Voltage after Failure Message with Deeply Discharged Battery, Manual Charging Start	0 V - 8 V	0 V - 8 V	0 V - 16 V
Preliminary Charging Current, Totally Discharged Batt. 0-8 V (0-16 V)	7.6 A	15.1 A	8.2 A
Reverse Current from Battery (Power Failure)	<0.5 mA	<0.5 mA	<1 mA
Reset Voltage (30 sec)	12.75 V	12.75 V	25.50 V
Limit of Charging Voltage All Modes of Charging, Consumer Protect.	15.20 V	15.20 V	30.40 V
Overvoltage Disconnect. acc. to DIN 14679 above Set Value U, 20 sec	+0.50 V	+0.50 V	+0.50 V
Ripple Factor Voltage	< 30 mV rms	< 30 mV rms	< 30 mV rms
Charging Timer	4-fold	4-fold	4-fold
Reverse polarity/short circuit/back discharge/safety protection	Yes	Yes	Yes
Safety Timer per Charging Phase I /U1	Yes	Yes	Yes
Battery Regeneration in case of extended down-time 2 x week: 1 h	Yes	Yes	Yes
Main Charging Port Battery I (Master):			
Adjustable Charging Characteristic Lines Gel/AGM/Acid/Start	5	5	5
Charging/Floating/Load Current, controlled, Phase IU1oU2oU3	0 A - 15 A	0 A - 30 A	0 A - 16 A
Input for Battery I Temperature Sensor	Yes	Yes	Yes
Power Pack Operation (e.g. Supply During Battery Replacement)	Yes	Yes	Yes
Charging Port Battery II:			
Charging Characteristic Lines as Battery I, Gel/AGM/Acid/Start	5	5	5
Charging characteristic line at choice fixed for vehicle's starter battery	Yes	Yes	Yes
Charging/Floating/Load Current, controlled, Phase IU1oU2oU3	0 A - 15 A	0 A - 30 A	0 A - 16 A
Signalling Port +86:			
Nominal Voltage/Nominal Current	12 V / 0.5 A	12 V / 0.5 A	24 V / 0.5 A
Protection against Short Circuit/Overload	Yes	Yes	Yes
Connection for Remote Control Automatic Charger	Yes	Yes	Yes
Fitting Position of Unit	any	any	any
Temperature Range	-20/+45°C	-20/+45°C	-20/+45°C
Built-in Fan with current and temperature control	Yes	Yes	Yes
Gradual Reduction of Charging Capacity at Overtemperature	Yes	Yes	Yes
Safety Disconnection in Case of Overheating	Yes	Yes	Yes
Protection Class/System of Protection	II / IP2X	II / IP2X	II / IP2X
Dimensions, incl. Mounting Flanges/Feet	258 x 138 x 74 mm	258 x 138 x 74 mm	258 x 138 x 74 mm
Weight	1250 g	1350 g	1400 g
Ambient Conditions, Humidity of Air	max. 95 % RH, no condensation		
Tightening torque battery terminals	1.2 Nm	1.2 Nm	1.2 Nm
Tightening torque sensor terminals	0.5 Nm	0.5 Nm	0.5 Nm

Installation of the Unit:

The charger can be installed in the **driver's compartment or team compartment**, **as close as possible to the main battery I (master)** (short charging cables) at any location being clean and being protected from humidity and dust on an even and hard mounting surface.
Despite the charger's high efficiency, heat is produced, which is brought out of the casing by means of the built-in fan. Ensure sufficient **ventilation** in the **environment of the unit,** so that the heat can be removed. Protect the unit from aggressive battery gas.
The unit can be installed in any position. However, the **vent holes** of the casing should never be covered to ensure the full charging capacity (**minimum distance: 10 cm**).

Battery Connection and Battery Settings for Start-up:

Observe the connection plan with the cable cross-sections and the lengths of the cables, the polarity, as well as the fuses near the battery!

1. Connect the battery to the large terminals " **- Com.**" and "**+ I (Master)**" observing the correct polarity. **Tightening torque 1.2 Nm!**
2. Fasten the temperature sensor at battery "I" (master) and at the terminals "**T T**" (option).
3. **Never forget to set the charging program** 1) - 5) for the type (design) of main battery I (master): from **page 10.**
4. Option: Large Terminal "+ II": Connect the second main battery II at this location and to ground observing the correct polarity:
   Main battery II can be at choice:
   a.) A further battery (bank) of the same type as main battery I (switch II=I, see table 2).
   b.) The vehicle's starter battery (full charging current, own charging program for the starter battery, II<I, table 2).
5. Option: Small terminal "+ 86" 12 V (24 V) / 1 A , can be used as signalling port for a vehicle engine immobilizer.

Insert the mains plug ("beep"), position the unit switch to "On", and the automatic charging process starts.

Main Charging Port "Battery I" (Master):

Connect the main battery observing the recommended cross-sections and lengths for charging cables according to **Table 1**.
Note: If the unit is used with only 1 battery, use this charging port I (master).

Temperature Sensor (Temperature Sensor included in the delivery scope):

The temperature sensor controls the **temperature of main battery I (master)** and the temperature-dependent correction of the charging voltage. It is connected to the unit terminals **"T T"** (any polarity).

Sensor Installation:

The sensor needs a **good thermal contact to the battery I master** (inside temperature). Therefore, 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. Ensure, that the installation place is not influenced by any source of heat (engine block, exhaust, heater etc.).

Effect of the Temperature Equalization:

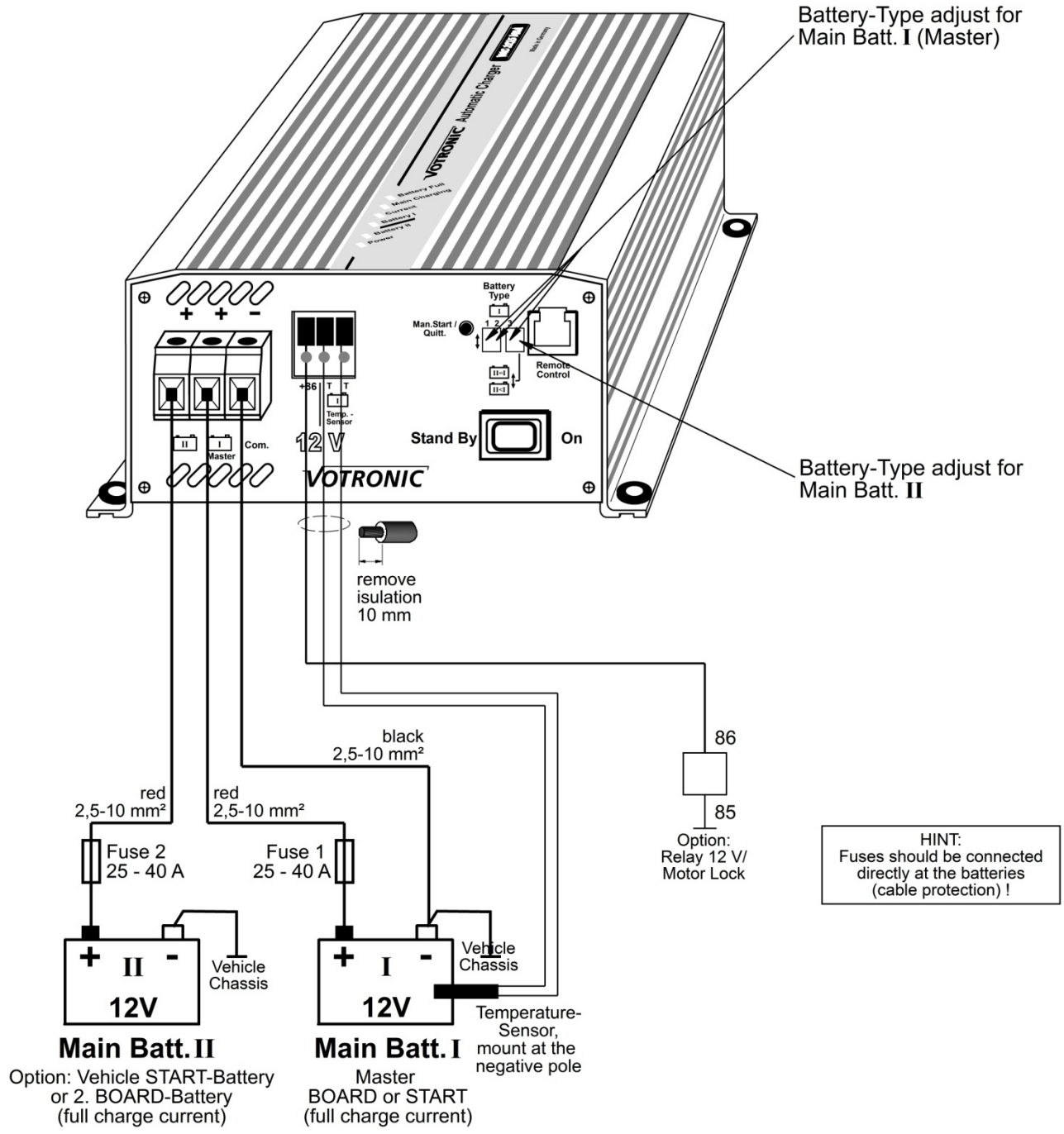
The temperature-dependent charging voltage of the battery will be adapted automatically to the battery temperature, also refer to **Charging Programs 1) - 5) in** this manual**.**

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 consumers 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 (50 °C or 60 °C, depending on battery type), the charging voltage will be reduced strongly to the **safety charging voltage**, approx. 12.8 V (25.6 V), for battery protection, and the maximum charging current rate will be halved (safety mode). LED **"Battery I" is flashing**. Any charging data being recorded hitherto will be kept in memory. Battery charging is then interrupted, but the supply of possibly connected consumers will be continued by the unit, and the battery is allowed to cool down. After that, automatic charging is resumed.

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

Connection Plan 12 V:



Note: If the unit is used with only 1 battery 12 V, use the charging port I (master).

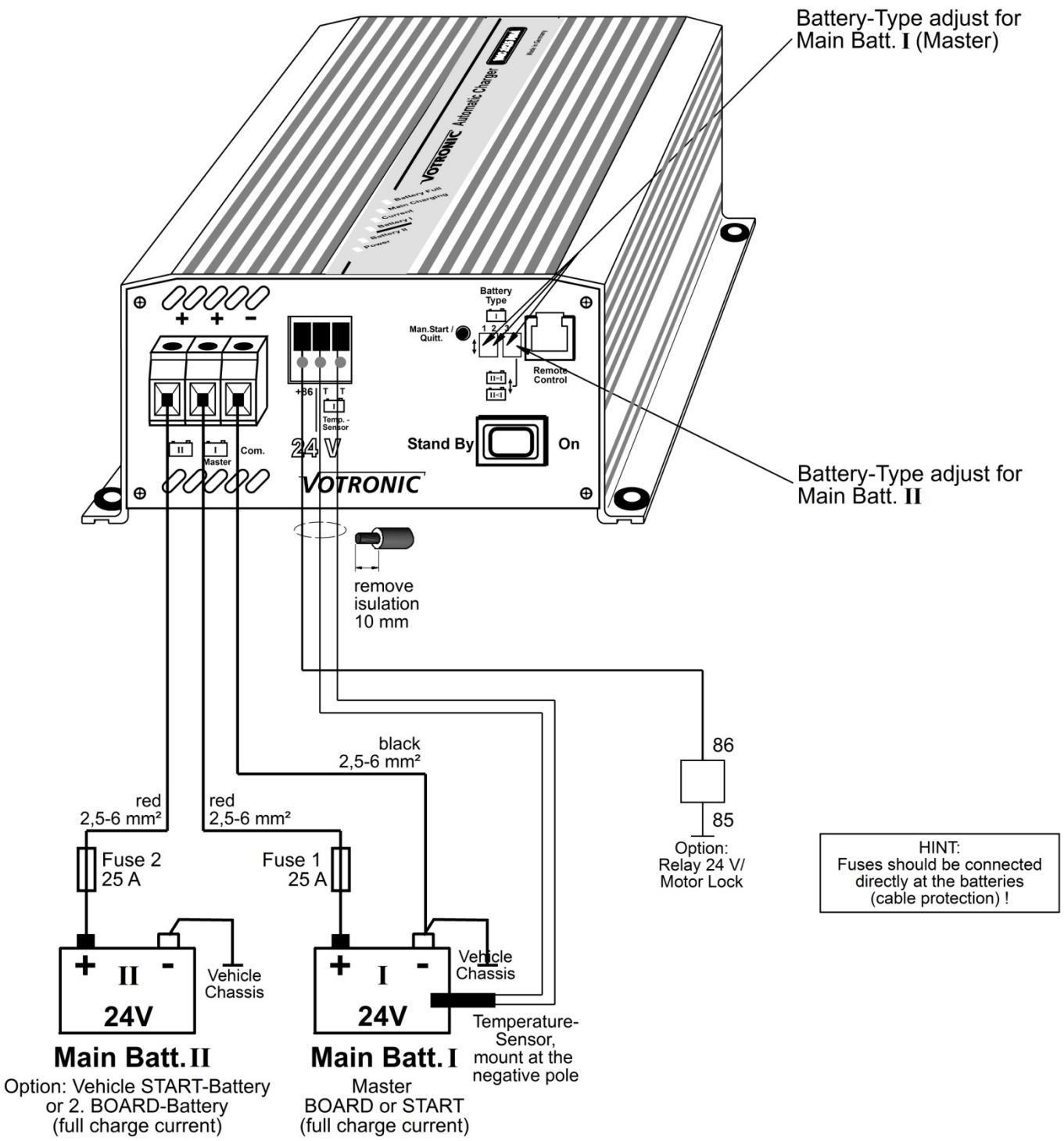
Table 1: Recommended Cross-sections and Lengths (one-way) for Charging Cables Unit and Battery I and II:

Cable Cross-sections	VAC 1215 F 3A II	VAC 1230 F 3A II
2.5 mm²	0.6 … 2.0 m	--
4 mm²	1.5 … 3.2 m	2x (3x) 0.5 ... 1.3 m
6 mm²	2.5 … 4.8 m *	2x (3x) 0.8 ... 2.0 m
10 mm²	4.1 … 7.8 m *	2x (3x) 1.3 ... 3.3 m
Fuse 1 and 2	25 A	40 A

We recommend connection without wire end ferrules. ***** if necessary, connect without wire end ferrules.

Safety Instruction: Connection is only allowed 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).

Connection Plan 24 V:



Note: If the unit is used with only 1 battery 24 V, use the charging port I (master).

Table 1: Recommended Cross-sections and Lengths (one-way) for Charging Cables Unit and Battery I and II:

Cable Cross-sections	VAC 2416 F 3A II
2.5 mm²	0.6 ... 1.7 m
4 mm²	1.0 ... 2.7 m
6 mm²	1.5 ... 4.0 m
Fuse 1 and 2	25 A

We recommend connection without wire end ferrules.

Safety Instruction: Connection is only allowed 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 breaker (FI) with a nominal residual current of 30 mA).

Option: 2. Main Charging Port "Battery II":

Set the charging port to full charging current. Use and setting of the charging program according to table 2.

Option: Control Output +86:

The output can be used as signalling port for a vehicle engine immobilizer (preventing an engine start, if the power supply of the vehicle is still inserted), see connection plan.

The output supplies the voltage during proper charging mode, also with switch position "Stand By" or remote control "OFF", or if battery failures (temperature, overvoltage) had been recognized.
In case of battery undervoltage alarm or unit failures, the output will not be active, either in case of power failure.

Unit Switch "Stand By/On":

Position "ON": All functions of the charger are available.

Position "Stand By": The charger has shut down to idle mode. Battery charging is stopped, all pilot lamps are switched-off, all charging timers will be reset, the internal protection devices (such as cooling fans) continue working. The mains power consumption is reduced to a minimum.
Thus, a restart of a complete charging cycle for the battery (batteries) is possible.

Key "Man. Start/Quitt.":

1. **Acknowledgement key** for audible failure messages.
2. **Emergency charging start:** If a **deeply discharged battery** has a low battery voltage of **< 8V (< 16V)** and charging shall start, the charger shall not start automatically the charging process acc. to DIN 14679, since the standard supposes, that there is possibly a damaged battery due to the deep discharge.
   Nevertheless, the user can start the unit **manually** by pressing a key > 2 sec. But the charging process should be observed.
   Please read the instructions in the paragraph "Failure Message Battery Failure at Main Battery "I" (Master)", page 13!

Option: Remote Control (Tip Jack "Remote Control")

If the charger had been installed in a difficult to access location, the **remote control S for automatic charger, order No. 2075,** allows remote control of the charging process (plug-and-go connection cable of 5 m length is included in the standard delivery scope).

Connection:
Just insert the plug of the remote control into the tip jack "Remote Control" of the charger.

Function:
The remote control is equipped with the same pilot lamps (light-emitting diodes) as the charger.

Switch Function:
Position "ON": Charger operates.
Position "OFF": Charger in stand by (stand by, see above unit switch).

Further actions at the unit are not required.

Mains Connection:

The charger is designed as built-in charger for the driver's compartment or team compartment of the vehicle.
It is executed in protection class II (no protective conductor). Thus, operation of the unit is allowed for mains sockets, which had been mounted according to the local regulations.

Simplified mains connection of the entire vehicle with protective conductor:

According to DIN 14679, the following execution is allowed for **single installation** of mains supply units of protection class II:

Single Installation: If **solely** the charger is installed in the vehicle without any further power supply units, a single installation in an insulated protection area according to **DIN 14679** is possible (protective earth is then not required):

The vehicles' mains supply is effected via a fixed installed plug-in device according to DIN EN 60309-1 (VDE 0623-1).

The 230 V supply must have a continuous connection to the charger according to protection class II.
Observe the following:

1. The protection area must be executed as body with protective insulation. The cable from the supply to the unit must be executed without further plug-type connector.
2. Observe for laying, that the cable H07RN-F 2 x 2.5 mm^2 must be protected from mechanical damage, if possible by laying it in a protective hose/tube.
3. PE connection with the vehicle is not admissible.

Connection plan for **single installation, see next page**.

Replacement/New Connection Mains Cable:

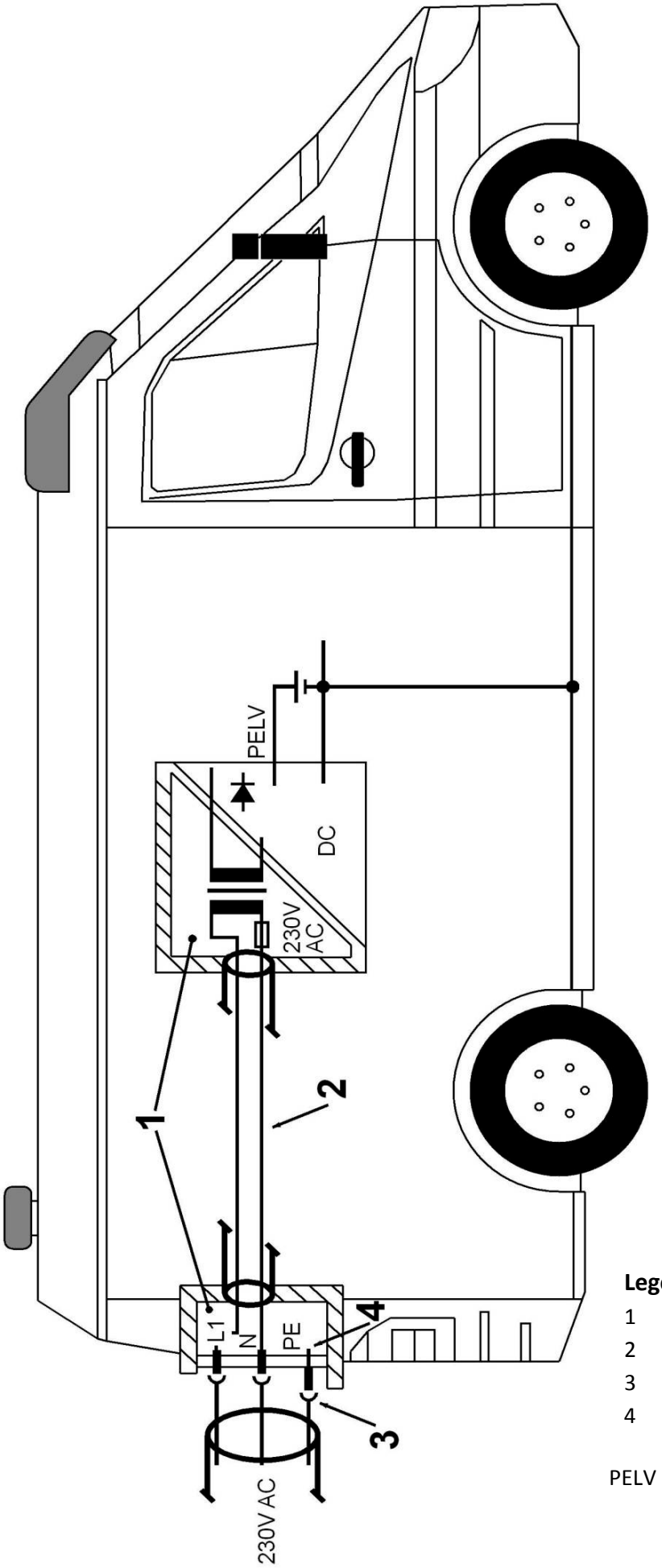
Prior to conversion, imperatively separate the mains supply of the vehicle from the external current supply!

A cover is installed at the lower side of the unit. Loosen the 2 fastening screws and remove the cover. The terminal area of the charger is now accessible.

Loosen the clamping screws and the screwed cable gland and withdraw the mains cable.

New connection is effected in reverse order. Also attach the cable gland again!

Mains Voltage Supply of the Unit via a **Plug-in Device** with
<u>Single Installation</u> in Protection Class II according to DIN 14679:



Legend

1 Protection Area
2 Cable H07RN-F 2x2.5 mm^2
3 Unit Connection acc. to DIN EN 60309-1
4 PE Connection (connection to the vehicle is **not** admissible)

PELV **P**rotective **E**xtra **L**ow **V**oltage

Unit Settings:

How to Set the Type (Design, Technology) of Main Battery "I":

5 Charging programs for the different battery types are stored in the unit. They can be selected by means of the **3 micro slide switches "1-2-3"** at the unit front. See connection plan:

The **control levers** of the slide switches are shown in **white**.

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 12 V (24 V) consumer loads being connected to the battery is also automatically considered by all charging programs.

24 V Operation: Indicated 12 V voltage rates **x2**.

TS = Temperature Sensor 825 (effect with/without connection of the battery temperature sensor)

Charging Programs **1)** – **5)** for **Lead-**Acid, Gel, AGM Batteries:

Charging programs, charging voltage rates and temperature equalization "with TS":

1)

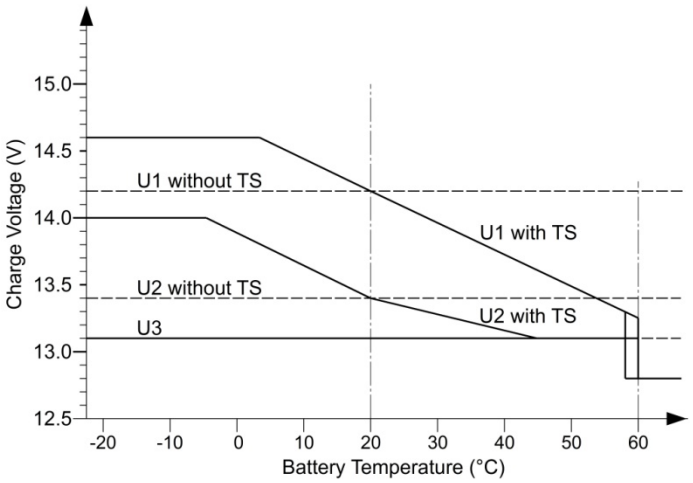
Start

14.2 V

U1=14.20 V U2=13.40 V U3=13.10 V

2.5-6 h 24 h Continuous

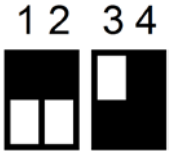
Regeneration: 2 x week 1 h



"Start": Charging program for **acid/lead-acid batteries:**

Characteristic line similar to dynamo/generator for mobile application (acid accumulation) with particularly low maintenance (battery gassing). Charging and trickle charging of starter batteries in intervention vehicles, in conformity with a former draft of the Standard Committee Fire Protection (FNFW): "Permanent readiness for use, even with additionally connected consumer loads". For usual, conventional standard starter batteries, antimonous, low-antimonous starter batteries "maintenance-free", "low-maintenance".

2)



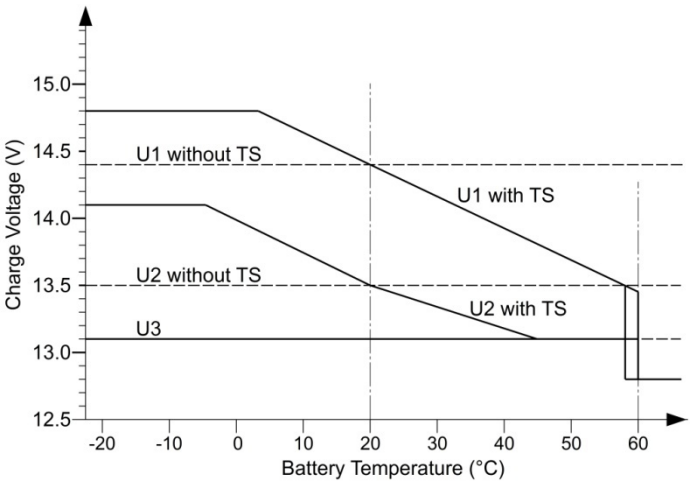
DIN L

14.4 V

U1=14.40 V U2=13.50 V U3=13.10 V

4-6 h 24 h Continuous

Regeneration: 2 x week 1 h:



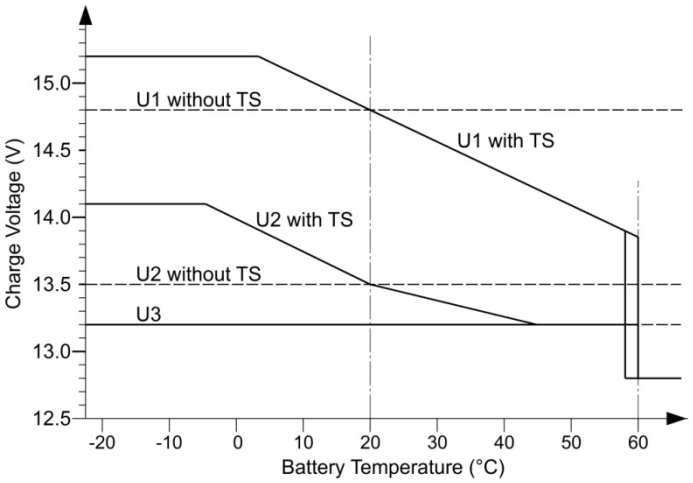
"L": Charging program according to DIN 14679 for **acid/lead-acid** batteries, **lead-acid L:**

Adapted to closed lead batteries with water consumption "L=Low" according to DIN EN 50342-1, also with removable cell plugs and device for acid level control and acid level correction (maintenance), for instance with "wet" drive, lighting , solar and heavy-duty batteries, "absolutely maintenance-free", "maintenance-free according to EN", "maintenance-free according to DIN" etc., and "**AGM**/**fleece** batteries with indication of the charging voltage "**14.4 V**".

3) 1 2 3 4

DIN VL

14.8 V



U1=14.80 V ! U2=13.50 V U3=13.20 V
4-6 h 24 h Continuous
Battery Regeneration: 2 x week 1 h

"VL": Charging program according to DIN 14679
for **acid/lead-acid** batteries, **lead-acid VL:**

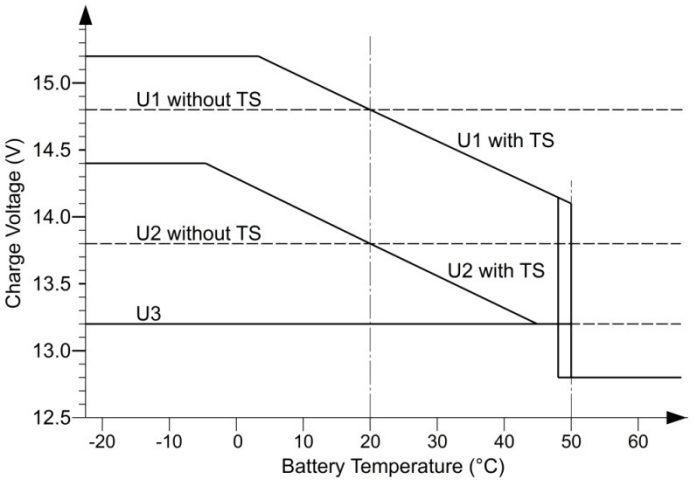
Adapted to closed lead batteries with water consumption "VL=Very Low" according to DIN EN 50342-1 (such as calcium/calcium etc.).

WARNING: It is highly recommended to check the specification sheet of the battery concerning the high charging voltage U1 **14.8 V**.
Unsuitable batteries might age prematurely due to loss of electrolyte!
If required, set the charging program "**DIN L**" (14.4 V / 13.5 V).

4) 1 2 3 4

DIN AGM

14.8 V



U1=14.80 V ! U2=13.80 V U3=13.20 V
4-6 h 24 h Continuous
Battery Regeneration: 2 x week 1 h

"AGM": Charging program according to DIN 14679 for **AGM/fleece** batteries (VRLA):

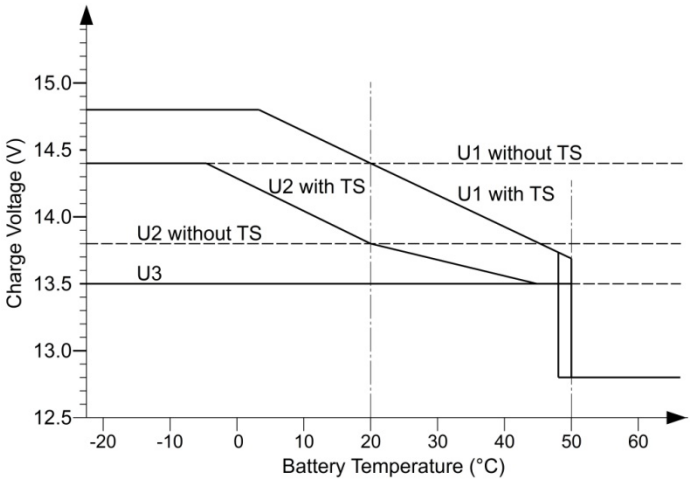
Adapted to closed, gas-tight AGM (absorbed glass mat) batteries and batteries in lead-fleece technology requiring a particularly high level U1 for full charging.

WARNING: It is highly recommended to check the specification sheet of the battery concerning the high charging voltage U1 **14.8 V**.
Unsuitable batteries might age prematurely due to loss of electrolyte!
Some manufacturers of AGM / fleece batteries are also prescribing a 14.4 V charging program for charging!
In these cases, please set "**DIN L**" (14.4 V / 13.5 V).

5) 1 2 3 4

DIN Gel

14.4 V



U1=14.4 0 V U2=13.80 V U3=13.50 V
8-12 h 48 h Continuous
Battery Regeneration: 2 x week 1 h

"Gel": Charging program according to DIN 14679 for **Gel/dryfit** batteries (VRLA):

Adapted to closed, gas-tight **Gel** batteries with determined electrolytes for particularly high capacity storage and avoiding deep discharge of the battery, Gel, of for instance, EXIDE, Sonnenschein, "dryfit“, Varta, Bosch, Banner, and many more.

Table 2: Setting of the Charging Program for Battery II Type (Design)

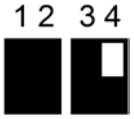
Use a small screw-driver to carefully move the **slide switch No. 4** behind the front panel of the unit to the desired position for **battery II.** Also refer to connection plan (factory adjustment "II < I" = starter battery).

If **charging port II is used, 2 different operating modes** are available for the integrated charging current distributor for battery **II**.

The **total of the battery capacities** (Ah) **should not exceed** the "battery capacity **I** or **I+II** (total) being indicated in the technical data according to DIN 14679.

*Charging port **II is not used (for instance, if only 1 starter battery circuit exists in the vehicle)**:*

*If terminal **II** is not used, the total capacity range is at disposal for battery **I** (master).*
*Move the switch to factory-adjustment ("below") "**II < I**" = starter battery.*



Batt. B = Batt. A, i.f. as separate 2. BOARD-Battery

Battery II is of the **same type** (design/technology gel, AGM or acid) **as battery I**. Thus, it requires the **same charging program as battery I**.

Application: **2 separate battery (banks)** for instance separate batteries for application and emergency.

The built-in **charging current distributor** charges **both batteries** with equal rights. **Automatic** charging begins with the battery showing the lower charging state (I or II) with full charging current.
If the charging state of both batteries is identical, the respective second battery will be included, both batteries (I and II) will be charged fully at the same time, and the charge will be conserved fully (trickle charge).

The charging currents will be distributed automatically in the correct ratio. Consequently, battery **I** and **II** may have **different capacity rates (Ah).** In this case, **the larger battery** should be connected to **charging port I (master)**.
The temperature equalization for battery **I** will also be applied to battery **II**.

Charging program for battery **II =** battery **I**. Also refer to charging programs 1) – 5)

Batt. B is the Vehicle-Starter-Battery

"**II < I**" the **starter battery** of the vehicle is connected at charging port **battery II:**

In case of need, **full charging current** is supplied to it by the built-in charging current distributor with an **own fixed charging program** for starter batteries (high starting capacity, low water consumption and low maintenance expenditure.

Application: Intervention vehicles with **high load of the starter battery** due to additional consumer loads with immediate start readiness.

The built-in charging current distributor **automatically** starts charging with **full charging current** of the battery showing the lower charging state (I or II), with which also the **starter battery** will be charged **very quickly** up to **starting capacity**, in case of need.

After that, the respective second battery will be included and full charging of both batteries (I and II) will be effected at the same time, whereas an **own charging program** (charging current, charging voltage, charging time) is active for the **starter battery**, and the charging currents are distributed in the correct ratio. This applies also to the trickle charge.

The different battery sizes (capacity rates, Ah) of the board battery at charging port **I** and of the starter battery at charging port **II** are considered by the charger.

The batteries may also have a different design (acid, gel, AGM/lead starter battery).

Charging Characteristic Line Battery **II**: IU1oU2oU3

U1	Full Charging:	14.2 - 14.4 V	(28.4 - 28.8 V)	20 °C	2-3 h
U2	Full/Trickle Charging:	13.2 - 13.5 V	(26.8 - 27.2 V)	20 °C	24 h
U3	Storage Charging:	13.1 - 13.5 V	(26.2 - 27.0 V)	20 °C	Continuous

Pilot Lamps:

"Battery Full" (Battery (batteries) fully charged, **green**):

- If it is on: Battery (batteries) had (have) been charged to 100 %, trickle charge U2 and storage charge U3, finished.
- If it is flashing: Main charging process is effected in the charging phase U1, indication of charging state of approx. 80 % (short flashing), gradual increase to 100 % (long flashing).
- Off: Main charging process is still being executed in the phase I.

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

- If it is on: Main charging process is effected in the phase I and after that in the charging phase U1.
- Off: Trickle charge U2, U3.
- If it is flashing: see below "Failure Message Battery Failure"

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

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

"Battery I" (yellow):

- If it is on: Control and charging of main battery "I" (Master).
- If it is flashing: see below "Failure Message Battery Failure"
- Off: Charging port is switched-off (safety switch)

"Battery II" (yellow):

- If it is on: Control and charging of auxiliary battery "II".
- If it is flashing: External overvoltage at battery II, check. Automatic reset, as soon as the voltage drops.
- Off: Charging port is switched-off (safety switch)

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

- If it is on: Mains supply is available and charger is ready for operation.
- If it is flashing:
  1. Disconnection of safety timer, duration of the charging phase I was too long, too many consumers, Battery defective (short circuit of the cells).
     Reset by moving the front switch to position "Stand by" or by withdrawal of the mains plug.
  2. Internal unit failure (overheating), automatic reset after cooling down.

  Note: An audible warning signal sounds. It can be switched-off with switch position "Stand By" or by withdrawal of the mains plug.

Failure Message Battery Failure at Main Battery "I" (Master):

Audible warning signal (beep) sounds and the pilot lamps "Battery I" and "Main Charging" are flashing simultaneously:

1) No charging due to low voltage, deep discharge of the battery:
   The battery voltage at charging start is less than 8 V (16 V). According to DIN, the battery might have been damaged. Charging should only be effected under control of the user. Switch off all consumer loads, and press the key "Man. Start" for 2 sec.: Now, the charging process will be started manually from any battery voltage. The unit continues the process automatically, the audible warning signal is acknowledged.
   Observe the battery during charging (temperature, gassing). Check the usage capacity after charging!
2) External battery overvoltage, voltage exceeds the nominal voltage U1 by 0.5 V for more than 20 sec.
   Reset is effected automatically, as soon as the voltage has dropped to nominal level.
   The audible warning signal can be acknowledged by means of the key "Ack".

Audible warning signal (beep) sounds, "Battery I" is flashing: Battery Overtemperature:

In case of excessive battery temperature (such as 50 °C or 60 °C, depending on the type), the charging voltage will be reduced strongly for battery protection (safety mode). The battery is relieved and is allowed to cool down. Battery charging is then interrupted, but the supply of possibly connected consumer loads will be continued by the charger. The battery will not be discharged. Any charging data being recorded hitherto will be kept in memory.

The audible warning signal can be acknowledged by means of the key "Ack".

Automatic charging is resumed, as soon as the battery temperature drops by 2 °C below the above mentioned temperatures. The audible warning signal will be switched-off.

After more than 10 hours overtemperature, a forced disconnection of the unit will be effected for reasons of safety. The LED "Power" will then be flashing.
Charging will be resumed with switch position "Stand By", by switching "OFF" at the remote control or by withdrawing the mains plug. Check battery!

Operating Instructions:

- **Indicator Residual Charging Time:** A flashing pilot lamp **"Battery Full"** allows conclusions concerning the progress of the charging phase U1 (full charging). Directly after the charging phase I (approx. 75-80 % charge) the indicator will only be flashing momentarily.
  With progressing charging time, flashing will change more and more to permanent lighting, until the pilot lamp will be lighting most of the time and will only stop lighting for a short moment, shortly before 100 % full charge is reached.
- **Interruption of the charging process:**
  In case of a power failure, withdrawal of the mains plug or positioning of the unit switch to position "Stand By" during the charging process, the charging process will be interrupted. The connected batteries will **not** be discharged by the charger. Thus, the charging process can be interrupted at any time.
  In case of frequent interruptions, particularly before reaching full charge (LED "Battery Full" is lighting **permanently**), the battery should be subject to an **occasional full charging cycle of 24 hours** for equalization of the charge.
- **Lifetime of the battery: partially discharged batteries:**
  In contrast to other battery types, batteries on lead basis **do not have any** harmful memory effect. Consequently: In case of doubt, partially discharged batteries are to be **charged fully** as soon as possible.
  Store only fully charged batteries and recharge them periodically, particularly in case of used (older) batteries and higher or lower temperatures.
- **Lifetime of the battery: Recharge deeply discharged batteries immediately:**
  Sulphation of the battery plates due to deep discharge is to be prevented by **immediate charging**, particularly in case of high ambient temperatures. If the grade of sulphation is not too intensive, the battery can recover part of the battery capacity after **several charging/discharging cycles**.
- **Lifetime of the battery:** Keep batteries cool; choose an appropriate location for installation.
- **Overvoltage Protection:**
  The charger protects itself against connection of excessive battery voltage or will be switched-off in case of defective additional charging systems, such as generators. Also refer to "External Battery Overvoltage".
- **Overvoltage Limitation:**
  Charging voltage limitation to max. 15.2 V (30.4 V) during all charging modes to protect sensitive consumers.
- **Overload / Overheating Protection Charger:**
  The charger is equipped with a double electronic protection against overload and protects itself against adverse installation conditions (e. g. insufficient ventilation, excessive ambient temperatures) by gradual reduction of the charging capacity.
- **Voltage Measurement:** Measurement of the voltage is to be effected at the battery and never at the charger (loss at the charging cable).

Option: Several Batteries at Main Charging Port I (Master)

Parallel charging of two or several batteries of the same voltage (12 V and 12 V or 24 V and 24 V) is admissible. The batteries are to be "paralleled", i. e. the "+" connections have to be coupled and should be connected to the "+" connection of the charger. The minus (-) connections have to be coupled in the same way.
The total capacity (total Ah) should not exceed the indicated maximum battery capacity !
According to the battery manufacturers, **permanent** parallel operation is admissible in case of two or several batteries of the same voltage, same type, same capacity, and of about the same age (history) in cross connection.

Chronological Sequence Charging Process Main Port Battery I (Master):

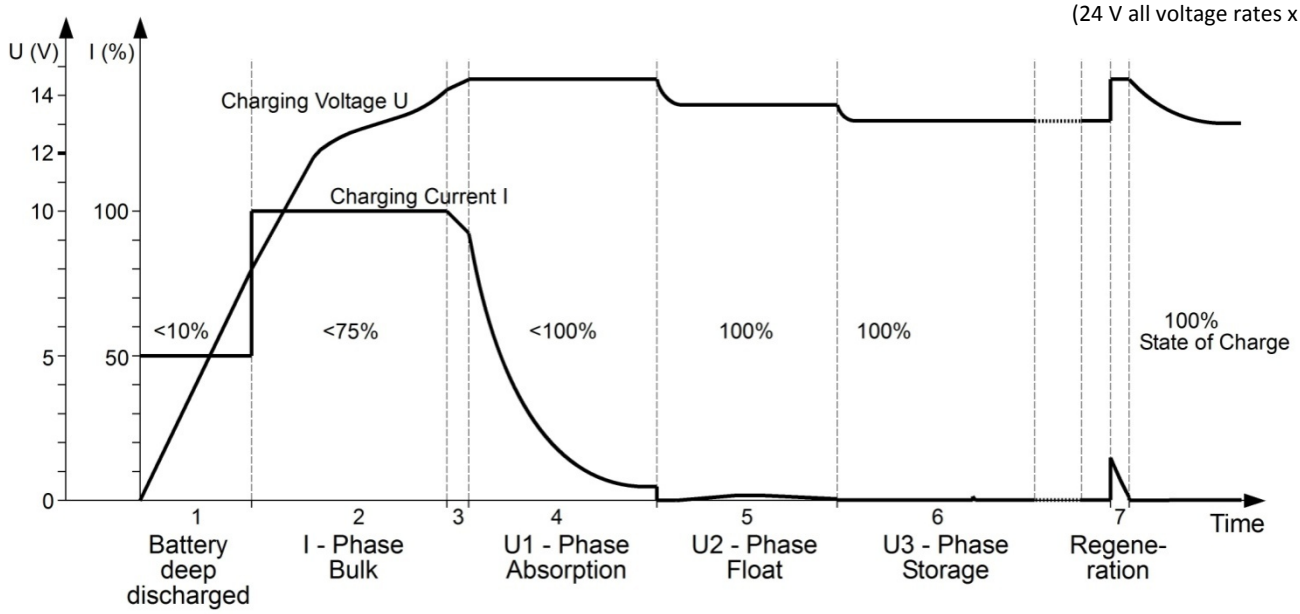
A new, complete main charging cycle will be executed:

- After a power failure (mains plug withdrawn or power failure).
- After unit switch in position "Stand By".
- After switch on the remote control "OFF".
- In case of a lower deviation of the battery reset voltage of 12.75 V (25.5 V) beyond the maximum charger current for 30 seconds due to high load.

1. Charging of an extremely discharged battery can be started manually by pressing a key. From 0 V, preliminary gentle charging with a small current rate up to 8 V (16 V) and after that automatic full charging.
2. **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 Charging"** is lighting, and approx. 75 - 80 % 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 after 15.5 hours, at the latest (cell defects of the battery etc.).
3. 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.
4. During the **phase U1** (**full charging**, cell equalization charging, LED "**Main Charging**" 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 and 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 switching to U2. In case of 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 Charging"** turns off at the end of the phase U1.
5. **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.
6. **Phase U3 (storage charge,** LED **"Battery Full" is permanently on**, adapted to the battery type):
   In case of long-term operation, such as for extended standstill periods or during winter break with lead batteries, the charging voltage will be reduced to the low level U3 for minimization of battery gassing and corrosion.
7. **Regeneration of lead-**acid/AGM/gel **batteries**: For battery 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.

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

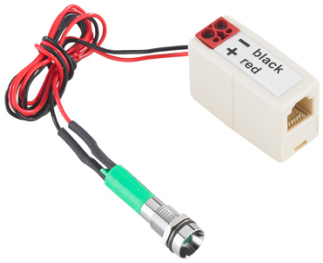
(24 V all voltage rates x 2)



Option: Remote Indicator IP67 — Order No. 2081

The green light-emitting diode shows the readiness for operation of the charger and of the mains/power supply. Mounting via 8 mm bore holes and packing washer for front installation with high tightness IP67. Connection with plug-and-go connection cable, 5 m length, at the charger tip jack "Remote Control".

Delivery Scope: Connection strands red/black of 0.4 m length, connection adapter, connection cable of 5 m length, plug-and-go on both sides, packing washer, coupling ring.



Option: Extension of the control cable, 5 m length, 6 poles with modular coupling — Order No. 2005

For above-mentioned remote displays. If required, for further extension of the connection cable, plug-and-go on both sides.

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.

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.

Quality Management System
DIN EN ISO 9001

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**

Delivery Scope:
1 Charger
1 Mains Supply Cable with Shock-proof Plug
1 Installation and Operating Manual

Temperature Sensor 825

Available Accessories:	Remote Control S for Automatic Charger	Order No. 2075
	Remote Indicator IP67	Order No. 2081

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