

Mounting Instructions and Operating Manual

Solar Controller MPP 150 Duo Digital

No. 3033

Charging Capacity 12 V / 11,5 A, Solar Power up to 150 Wp



Please read these mounting instructions and the operating manual completely prior to connection and start-up.

For campers, caravans, boats, independent solar systems (e. g. summerhouses, mountain huts)

VOTRONIC Solar Controllers of series „MPP“ (Maximum Power Point) with **characteristic line „I U1 U2“** are connected as a link between solar panel(s) and battery (batteries), thus optimizing their cooperation and adaptation. Solar controllers are working fully automatic and have the following functions:



Safety Regulations and Appropriate Application:

The solar controller has been designed according to the valid safety regulations.

Appropriate application is restricted to:

1. **Charging of lead-gel or lead-acid batteries of the indicated nominal voltage and the supply of the consumers being connected to these batteries in fixed installed systems.**
 2. **With solar panels up to maximum capacity (Wp).**
 3. **The indicated cable cross sections at the charging ports and at the panel input.**
 4. **Fuses of the indicated capacity near the battery to protect the cabling between battery and charging ports.**
 5. **Technically faultless condition.**
 6. **Installation in a well-ventilated room, protected from rain, humidity, dust, aggressive battery gas, as well as in an environment being free from condensation water.**
- **Never use the unit at locations where the risk of gas or dust explosion exists!**
 - Cables are always to be laid in such a way that damage is excluded. Observe to fasten them tightly.
 - **The connection cables have to be lead from below to the solar controller to ensure that penetrating humidity cannot reach the controller in case of failure, which will result in destruction of the controller.**
 - Never lay 12 V (24 V) cables and 230 V mains supply cables into the same cable conduit (empty conduit).
 - Live cables or leads being connected to the unit are always to be checked for insulation faults, points of break or loosened connections. If a fault has been detected, disconnect the unit immediately from the connections and remedy the faults.
 - The unit is to be disconnected from any connection prior to execution of electrically welding or work on the electric system.
 - If the non-commercial end-user is not able to recognize the characteristic values being valid for a unit or the regulations to be observed, a specialist is always to be consulted.
 - The user/buyer is obliged to observe any construction and safety regulations.
 - **Except from the fuse, the unit is not equipped with parts, which can be replaced by the user. Always use replacement car fuses of the indicated capacity!**
 - **Keep children away from the solar controller and the batteries.**
 - Observe the safety regulations of the battery manufacturer.
 - Deaerate the battery room. Protect the unit from aggressive battery gas.
 - Ensure sufficient **ventilation** of unit and panel!
 - Strictly observe the instructions of the manufacturer for installation of the solar panel.
 - Non-observance may result in injury or material damage.
 - The warranty period is 24 months from the purchase date (against presentation of the sales slip or invoice).
 - The warranty will be void in case of any inappropriate utilisation of the unit, if it is used beyond the technical specification, in case of improper operation, **intrusion of water** or external intervention. We do not assume any liability for any damage resulting hereof. The liability exclusion is extended to any service being executed by third, which has not been ordered by us in writing. Service is to be effected exclusively by VOTRONIC Grebenhain.

- § **MPP Charging Current Increase.** Compared with conventional controllers, the efficiency is increased by 10 % to 30 % (efficiency > 95 %) due to the advanced controller technology (microprocessor). Reduced charging time and higher charging current ensure an **optimum yield of the (expensive) panel capacity**. This enhanced capacity shows particularly in cooler times of the year, such as in case of foggy weather conditions or gloomy diffuse light (winter).
- **Switch Position „ Gel “:** Adapted to charging of closed, gas-tight **gel batteries** (such as dryfit-Start, dryfit-Sport-Line, DETA GelBatterie Funline, etc.) with particularly high capacity storage.
 - **Switch Position „ Acid “ (, Säure “):** Adapted to charging of **conventional acid batteries**.
 - (such as starter batteries, heavy duty, low-maintenance and maintenance-free open lead storage batteries, drive and lighting, solar). Minimum water consumption, extended lifetime
 - **Two Battery Charging Ports:** Automatic charging of the main or board battery (Board I). Support charging as well as conservation of charge (max. 1 A) of the vehicle's starter battery (Start II).
 - **Unattended Charging:** Standard features: protection against overload, overheating, wrong polarization, and back discharge of the battery (if the solar power is insufficient, or at twilight, at night etc.).
 - **Buffer Operation:** Keeping of the characteristic line of charging in case of simultaneous operation of consumers.
 - **Overcharge Protection:** Reduction of the charging current of the battery in case of excessive solar power and full battery. Immediate recharging in case of current consumption to ensure the maximum charging state of the battery.
 - **On-board Mains Suppression Filter:** Unproblematic parallel operation with wind-driven generators, petrol-driven generators, mains chargers, dynamos, etc.
 - **Connection for External Temperature Sensor** (Order No. 2001): Automatic adaptation of the charging voltage to the battery temperature. **In case of low outside temperatures a better full charging** of the weak battery will be effected, and in case of summery temperatures **unnecessary battery gassing** will be avoided. **This is highly recommended when the battery is exposed to strong variations in temperature, such as in the motor compartment.**
 - **Ready for connection** of the VOTRONIC Solar display units for optimal control of the system:
LCD SOLAR DISPLAY, Order No. 1216 (V, A, W, Ah and Wh) and
LCD SOLAR MONITOR, Order No. 1221 (V, A, W).



**Open acid batteries and „maintenance-free“ batteries according to EN / DIN:
Check the acid level periodically !**



**Recharge totally discharged batteries immediately !
Store only fully charged batteries and recharge them periodically !**

Mounting:

The VOTRONIC solar controller can be located at any location **near the battery** being protected from humidity. Observe to install the unit in such a way, to avoid that **water is flowing at the connection cables** along the solar panel into the controller. Mount the controller at the flanges of the casing near the main / board battery (Board I) to ensure **minimum length of the battery connection cable**. The length of the cable to the starter battery (Start II) may be longer.

Observe to install the unit in such a way, that the **vent holes** of the casing are never covered (minimum distance: 5 cm).

If the VOTRONIC solar controller shall be installed in a separate, closed casing, it is absolutely to be observed that the inlet and exhaust air openings should be sufficiently dimensioned! **Ensure excellent ventilation** to the ambiance **at the installation place**. It is further to be observed that the **mounting surface should be even and hard**, and that it has the corresponding mechanical stability. Ensure a solid and vibration reducing installation.



In case of high solar power, the casing or the dissipater might be heated intensively!

Connection:



Connect first the solar controller (it is short circuit-proof), and after that the battery (it is not short circuit-proof)! Absolutely observe the polarity (+ and -) of solar panel and batteries!
Cable protection: Insert fuses into the + lines at the batteries (risk of fire at the cables) !

Main / Board Battery „Board I“ („Bord I“):

Connect the **battery connections** of the controller - (minus) and + (plus) to the 12 V main battery by means of a connection cable (**wire cross sections: MPP 130: 4 – 6 mm², max. length: 2 m/ MPP 225: 6 – 10 mm², max. length: 2 m**). Observe the correct polarization (plus to plus and minus to minus). Only use black cables for – minus) and red cables for + (plus) (**refer to the connection plan**).

Starter Battery „Start II“ (Option):

Connect the **second charging port** to the second battery by means of the red connection cable (**wire cross section 1,5 – 2,5 mm²**). This cable may be longer. This connection terminal is to be **left unused** in case of **non-utilization**.



Connection of the negative pole „Start II“ is not required, if the negative pole „Board I“ („Bord I“) is connected to the vehicle body. Depending on the length of the cable, it may be also connected to the common negative connection of the solar controller or to the negative pole of „Board I“ („Bord I“).

Solar Panels:

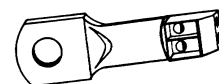
Connect the panel connections of the controller - (minus) and + (plus) to the solar panel by means of a connection cable (**wire cross section min. 4 mm²**). Observe the **correct polarization** (plus to plus and minus to minus). Observe the colours of the cables.

Should several small solar panels be used, they are to be connected in parallel (refer to connection plan).

Temperature Sensor Input „T T“ (Option):

Connections for the **VOTRONIC External Temperature Sensor (No. 2001)** for control of the battery temperature and temperature-dependent charging correction (refer also to the option temperature sensor).

These connection terminals are to be left unused in case of non-utilization.



Mounting of the Sensor:

Since a well thermal contact of the sensor to the battery is to be ensured, it must be connected to the negative pole of the battery or it is to be attached to the battery using double-coated adhesive tape. Ensure that the installation place is not influenced by any source of heat (e. g. heater, exhaust, motor unit).

Sensor Connection:

Connect the temperature sensor to the terminals „T T“ by means of a double-pole cable (cable cross section 0,5 – 1,5 mm²). The polarity is not important.

The solar controller recognizes the sensor automatically.

The controller recognizes automatically a missing temperature sensor, wire break or short-circuit, as well as unreasonable measuring values! In that case, it will switch to the usual nominal voltage rates of 20 - 25 °C being recommended by the battery manufacturers

Start-up:

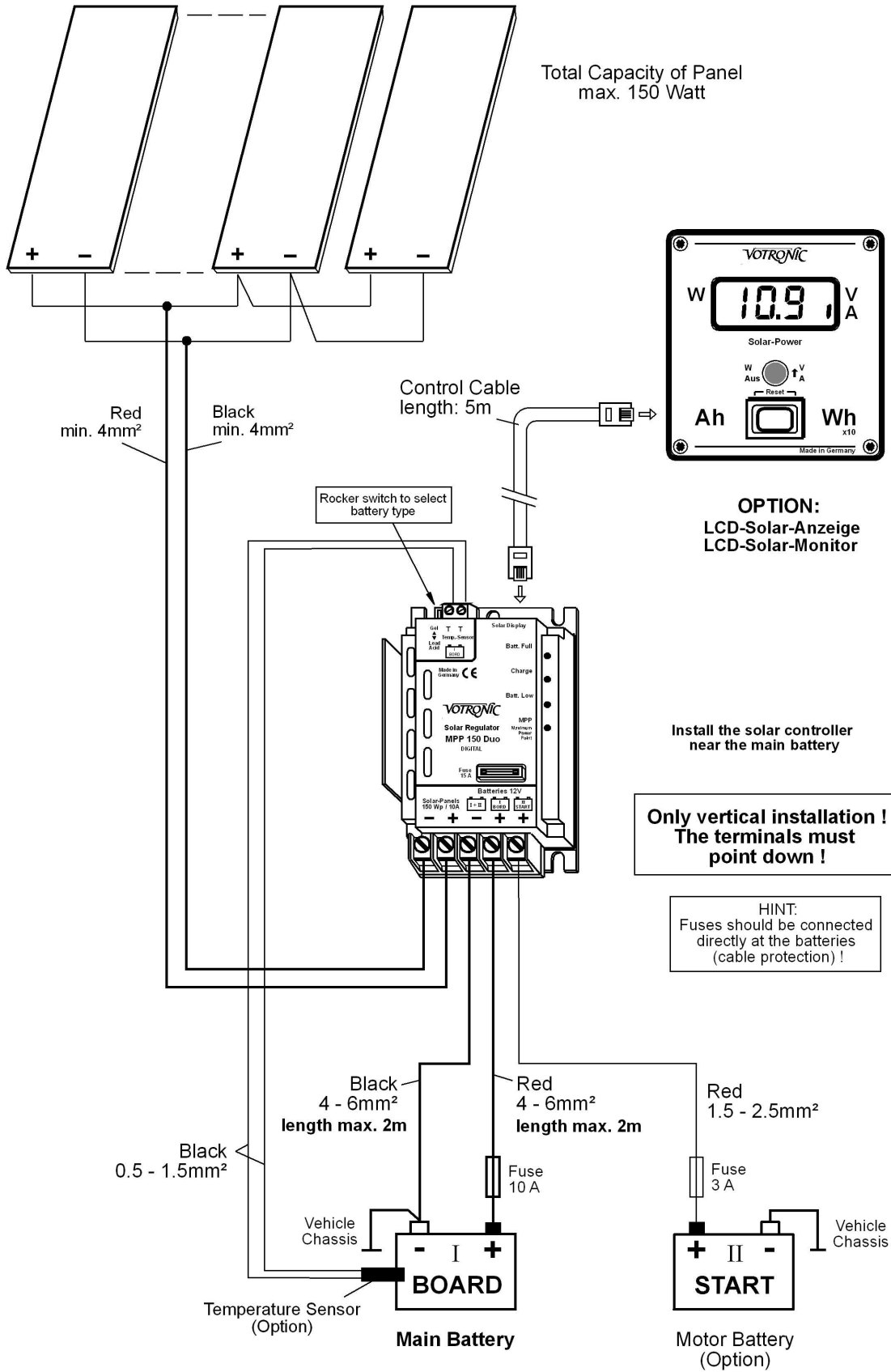
Selection of the battery type gel/acid (Gel/Säure) for the main / board battery (Batt. I):

Use a small screwdriver to move the commutator to the correct position.

Now, the solar controller is ready for operation.

Further actions or maintenance of the unit are not required.

Connection Plan:



Cut-off Relay:

The cut-off relay, which exists in most of the vehicles, can be still used. (For charging, the cut-off relay connects the board battery to the starter battery during running motor of the vehicle. The cut-off relay is not included in the connection plan).

Functions (at the Main / Board Battery,,Board I“ („Bord I“):

In case of **missing solar power** (at night), the controller indicates the readiness for operation by a **flashing LED** (light-emitting diode) „MPP“.

The LED "**Low Volt.**" indicates a **totally discharged battery during each operating state**.
Recharge immediately!

As soon as the **solar power is sufficient**, the LED "**Charge**" will be lighting and the charging process will be started.

The **lighting intensity of the LED "Charge"** indicates the **converted solar power**: The higher the intensity, the more the converted solar power.

A lighting LED „MPP“ indicates that the solar controller is operating correctly and that it is **adapted to the most favourable operating point** for cooperation of solar panel and battery.

1. Maximum charging current (**I-Phase**) in the lower and mean voltage range of the battery up to the beginning of the U1-phase. In contrast to convenient controllers, the MPP control is automatically adapting to the maximum operating point of the solar panel, in order to achieve the highest possible battery charging current within the shortest charging time being possible at the actual conditions (insolation, panel orientation, temperature and soiling).
2. During the following **U1-phase** the battery voltage will be kept constant on a high level which is almost at the gassing limit. The battery determines the charging current corresponding to its charging state, and the high battery capacity will be charged.
The MPP control ensures low panel load and temperature and increased capacity, if additional consumers are switched-on.
The solar controller controls the charging time as well as the charging current and switches automatically to the following U2-phase = conservation of charge. If the battery is already full, the charging time will be reduced.
3. During the **U2-Phase** (Full/Charging Conservation), the battery is kept on its charging level. Only the compensating recharging current being determined by the battery is flowing to keep the state "full". This phase is not limited in time, the LED „Full“ („Voll“) is lighting.
In contrast to convenient controllers, the MPP control ensures particularly here a low panel load and low panel temperatures. Keeping of additional consumers is improved.

If the battery has been loaded for an extended period or when the solar controller switches to the stand-by operation after sunset, it will be switched back to the I-phase of U1-phase.

Second Charging Port „, Start II “:

If used, the output for the starter battery II is operating with reduced voltage rates and charging current rates. Thus, more of the precious solar power will be distributed to the board/solar battery I being more suitable. The vehicle's starter battery II will be kept in restart condition, even after extended downtimes and during winter operation.

Operating Instructions:

- **Warning Light (LED „Low Volt.“ („Untersp.“):**
This warning light for a totally discharged battery is **always active**, even when solar power is missing (such as at night). If there is the **risk of total discharge** of the battery by too many consumers at insufficient solar power during unattended operation, we recommend the VOTRONIC "storage battery controller" as battery protection.
- **Overload:**
The maximum charging current is limited by the control. In case of insufficient ventilation (heat accumulation), the charging capacity will be reduced for reasons of safety.

- **Missing Battery I :**
Do not operate the controller without battery „Board I“ (Bord I).
The unit will not supply a defined output voltage when the battery is not connected!
- **Protection against Wrong Polarization / Protection against Short-circuit:**
In case of a wrong polarization of the battery or short-circuit, the internal fuse might be released.
When replacing the fuse, observe that the new fuse must be of the same size and type (car fuse)!

Several Batteries:

Two or several **batteries with the same voltage, of the same type, capacity and age (history)** can be charged **durably** in parallel. The batteries are to be „paralleled“, i. e. the „+“ connections of the batteries are to be coupled and are to be connected to the „+“ connection of the controller. The minus (-) connections are to be coupled in the same way.

Option Temperature Sensor:

The solar controller effects an automatic adaptation of the temperature-dependent charging voltage of the battery to the battery temperature. The required VOTRONIC temperature sensor (order No. 2001) measures the battery temperature.

In case of **low temperatures** (winter operation), the charging voltage will be increased in order to improve and accelerate the full charging of the weak battery. In case of **summery temperatures**, the charging voltage is reduced to minimize gassing of acid batteries and to extend the lifetime of gas-tight batteries (see diagram temperature compensation).

The temperature sensor serves also as battery protection against overheating:

Disconnection of the charging current in case of a battery temperature of 50 °C, reconnection at 45 °C.



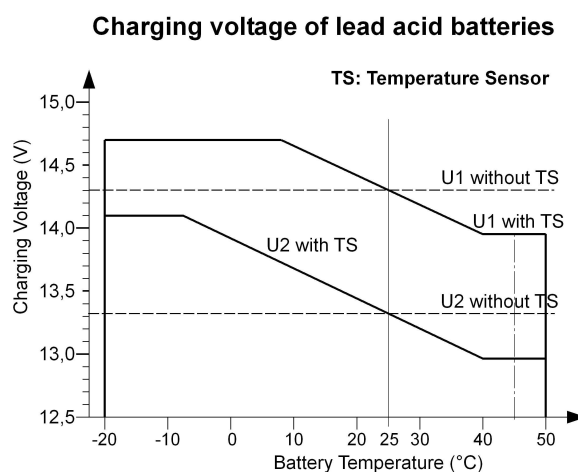
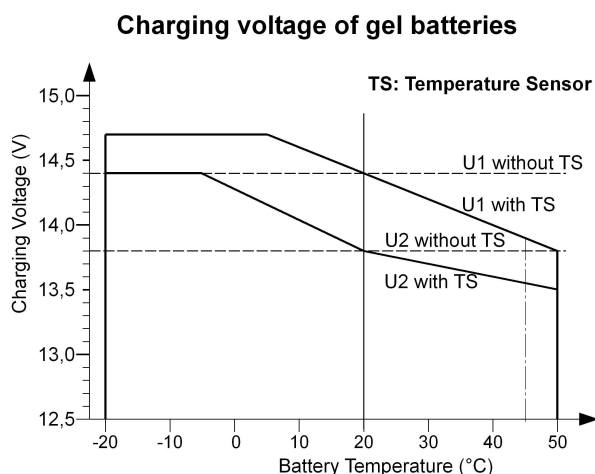
The controller recognizes automatically a missing sensor, wire break or short-circuit of the sensor lines, as well as unreasonable measuring values!

In that case, it will switch to the usual charging voltage rates of 20 - 25 °C being recommended by the battery manufacturers!



Use of a temperature sensor is generally recommendable, particularly, if the battery is exposed to strong variations in temperature.

Temperature Compensation of the Board-Battery:



Technical Data	
Battery (System) Voltage:	12 V
Solar Panel Capacity (recommended):	50 – 150 WP
Solar Panel Current:	0 – 9,5 A
Solar Panel Voltage:	max. 25 V
Characteristic Line of Charging (acc. to DIN):	I U1oU2
Own Electricity Consumption:	0,004 A
Main Battery Charging Port Board I:	
Max. Charging Current (constant I-Phase):	11,5 A
<u>Gel Battery:</u>	
Main Charging (constant U1-Phase):	14,40 V
Charging Current:	0,3A – 11,5 A
Conservation Charge (constant U2-Phase):	13,80 V
Charging Current:	0A – 11,5 A
<u>Acid Battery:</u>	
Main Charging (constant U1-Phase):	14,40 V
Charging Current:	0,4 A – 11,5 A
Conservation Charge (constant U2-Phase):	13,48 V
Charging Current:	0 A – 11,5 A
Input for Battery Temperature Sensor:	Yes
Auxiliary Battery Charging Port Start II:	12 V / 0 – 0,8 A
Integrated Overload Protection (Current Limitation):	Yes
Integrated Overtemperature Protection:	Yes
Car Fuse:	15 A
Dimensions (mm):	117 x 78 x 35 mm
Weight:	170 g
Ambient Conditions, Humidity of Air:	max. 95% RH, No condensation

Delivery Scope:	Available Accessories:	
• Solar Controller	- External Temperature Sensor	Order No. 2001
• 4 ea. Cable Lugs, U-shaped, 6 mm ² (yellow)	- LCD Solar Display	Order No. 1216
• 1 ea. Cable Lugs, U-shaped, 2.5 mm ² (blue)	- LCD Solar Monitor	Order No. 1221
• Operating Manual		



Declaration of Conformity

According to the stipulations of the regulations 73/23/EWG, 89/336/EWG, 92/31/EWG, 93/68/EWG. this product corresponds to the following standards or standardized documents:

EN 50081-1, EN 50082-1, EN 55022 Class B, EN 55014, EN55104



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