

VOTRONIC

Installation and Operating Manual

Solar Controller MPP 225 Duo Digital	(12 V / 17 A / 225 Wp)	No. 3035
Solar Controller MPP 320 Duo Digital	(12 V / 24 A / 320 Wp)	No. 3037
Solar Controller MPP 420 Duo Digital	(12 V / 32 A / 420 Wp)	No. 3039
Solar Controller MPP 320/24 Duo Digital	(24 V / 12 A / 320 Wp)	No. 6136
Solar Controller MPP 480/24 Duo Digital	(24 V / 18 A / 480 Wp)	No. 6137

MPP Solar Controller for campers, caravans and boats.

VOTRONIC Solar Controllers of series "MPP" (Maximum-Power-Point) with **characteristic line of charging** „IU1oU2“ are the link between solar panel(s) and battery (batteries). Thus, cooperation and adaptation are optimised to maximum panel utilization. The MPP Solar Controllers are working fully automatically and maintenance-free.

- **Increased MPP charging current** compared with conventional controllers, due to ultramodern controller technology (microprocessor) by 10 % to 30 % (efficiency > 95 %). This results in reduced charging times and in case of higher charging current an **optimum yield of the panel capacity** is achieved. This enhanced capacity shows particularly in cooler times of the year, such as in case of foggy weather conditions or gloomy diffuse light (winter break).
- **Switchable characteristic lines of charging** for optimum charging of gel/dryfit/AGM/fleece or acid/lead-acid batteries.
- The **charging voltage being free from peaks is controlled** in such a way, that any **overcharging** of the batteries is **excluded**.
- **Two Battery Charging Ports:** Automatic charging of the main battery or board battery (Board I): Support charging and conservation of charge (max. 1 A) of the vehicle's starter battery (Start II) with overcharge protection.
- **Unattended Charging:** Standard protection against overload, overheating, wrong polarization and back discharge of the battery (in case of insufficient solar power (such as at twilight, at night etc.).
- **Parallel and Floating Operation:** Observation of the characteristic lines of charging, even with 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 power consumption to ensure always the best possible charging state of the battery.
- **Characteristic Line of Charging "IU1oU2":** A defined charging boost (U1) avoids harmful acid accumulation and provides compensation charge to the individual battery cells. After that, automatic conservation charging (U2).
- **Charging Cable Compensation:** Automatic compensation of voltage loss on the charging cables.
- **On-board Mains Suppression Filter:** Unproblematic parallel operation with wind-driven generators, petrol-driven generators, mains supply chargers, dynamos etc.
- **Connection for External Battery Temperature Sensor** (Order No. 2001): Automatic adaptation of the charging voltage to the **battery temperature**. **In case of low outside temperatures, full charging of the weaker battery is improved**, and in case of summery temperatures **unnecessary battery gassing** will be avoided. Extension of the battery lifetime. **This is highly recommended, if the battery is exposed to strong variations in temperature, e. g. in the motor compartment.**
- **Ready for connection of the VOTRONIC Solar Displays** for optimum control of the system:
LCD SOLAR MONITOR: Displayed Values: Battery Voltage, charging current, charging capacity (V, A, W).
LCD SOLAR DISPLAY: Displayed Values: Battery voltage, charging current, charging capacity, stored capacity and energy (V, A, W, Ah, Wh).

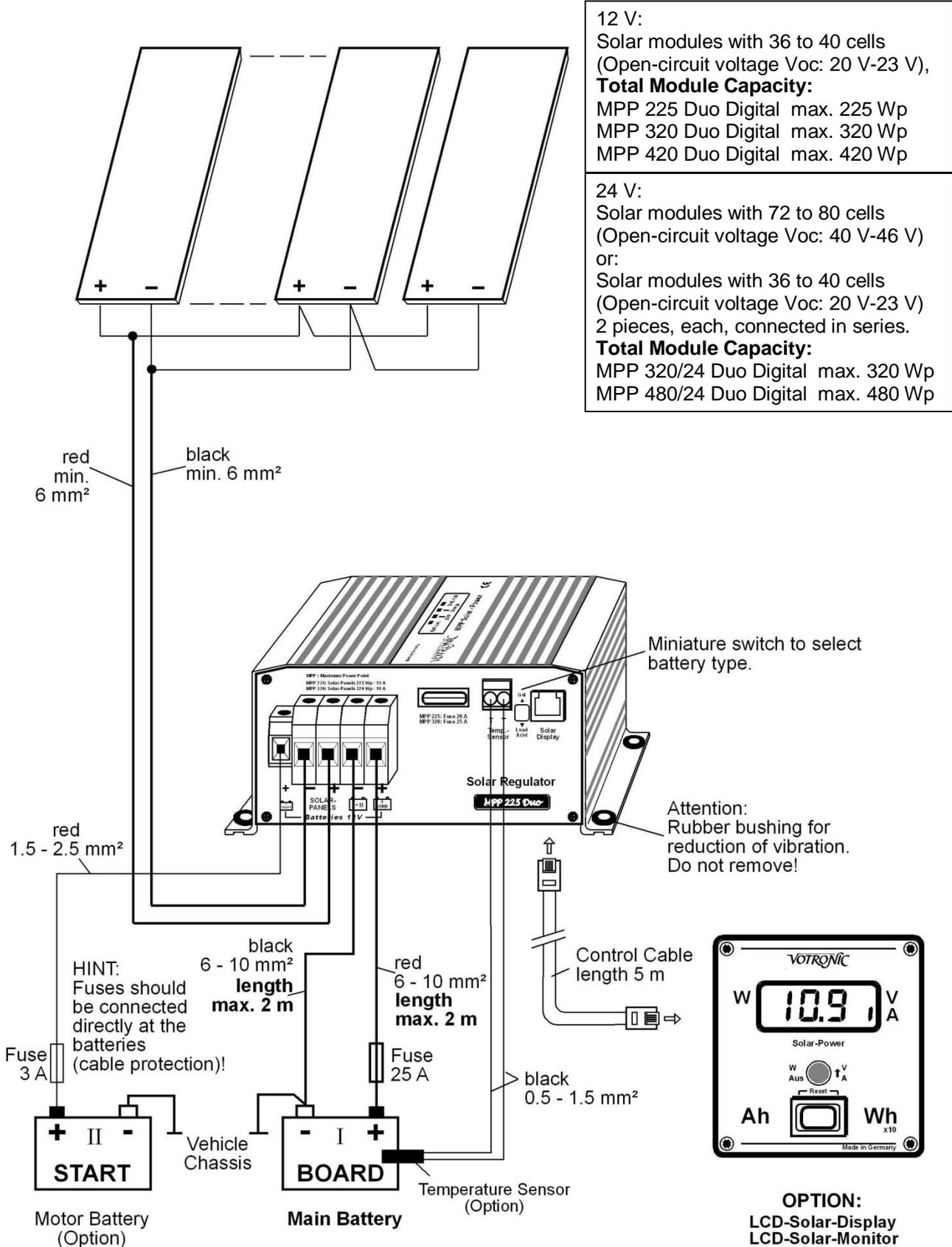


Open acid batteries and batteries being „maintenance-free according to EN / DIN“:
Check the acid level periodically!!



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

Connection Plan:



Cut-off Relay:

The cut-off relay, which exists in most of the vehicles, can still be 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).

Installation:

Screw-down the solar controller on an even and **hard mounting surface** at locations **being protected from humidity** and **near the main/board battery (BOARD I)** to ensure that the **length of the battery's connection cable is as short as possible**.

Vertical installation of the controller is highly recommendable (the **terminals** for solar panel and batteries **point down**).

This mode of installation improves cooling of the unit and **avoids that water runs along the connection cables** of the solar panel **into the solar controller**, even in case of damaged seals.

The cable to the starter battery (START II) can be longer.

Despite the solar controller's high efficiency, heat is produced. Ensure sufficient **ventilation in the environment of the unit**, so that the heat can be carried-off.

The **vent holes** of the casing should never be covered to ensure full charging capacity (**minimum distance** all around: **10 cm**). **The unit might be heated strongly in case of high solar power**.

Connection (See Connection Plan):

The polarities (+ and -) of solar panel and batteries are absolutely to be observed !

Observe the cross section and length measures of the cables!



1. **Connection of the solar controller to the battery "Board I" should be effected first.**

Protective Covering of Cables:

Insert the fuses near the batteries into the + cables (protection against cable fire)!

2. **The solar panels should be protected from direct sunlight (by covering or shading) prior to connection.**

1.) Main / Board Battery „BOARD I“ (must be connected):

Connect the **battery connections** of the controller - (Minus) and + (Plus) to the 12 V (24 V) main battery, observing the correct polarity and the cross section of the cables (**refer to connection plan**).

Never operate the controller without the battery „Board I“. If the battery is not connected, the unit will not deliver a defined output voltage.

In case of wrong polarization of battery I, the internal safety fuse will be released.

The replacement fuse should have the same capacity and it should be of the same type (car fuse) !

Parallel charging of two or several batteries of the same voltage (12 V) is admissible. The batteries are to be „paralleled“, i. e. the „+“ connections of the batteries have to be coupled and should be connected to the „+“ connection of the solar controller. The minus (-) connections have to be coupled in the same way.

According to the battery manufacturers, **permanent** parallel operation is admissible in case of two or several batteries of the same voltage, type, capacity, as well as of the same age (history) in cross connection.

24 V: Procedure as for 12 V, however each "battery" of the series connection consists of two 12 V batteries.

2.) Solar Modules:

Shade the modules to minimize sparking during connection and to avoid damages due to eventual wrong polarization.

Connect it to the solar controller by means of the connection cable (**min. wire cross section: 6 mm²**) observing the **correct polarization**.

If several small solar panels are used, they are connected in parallel (12 V, **refer to connection plan**).

24 V:

Solar modules with 72 to 80 cells for 24 V operation are available. Capacity is increased by simply connecting them in parallel and leading them to the MPP controller.

If "12 V" modules with 36 to 40 cells are used, 2 pieces of the same capacity are to be connected in series.

Capacity is increased by parallel connection of the created series connections of 2 modules, each, and by leading them to the MPP controller.

3.) Starter Battery „START II“ (Option, can be connected):

Connect the **second charging port** to the second battery using the red connection cable (**wire cross-section 1.5 - 2.5 mm²**). This cable may be longer. In case of **non-utilization**, this terminal is **left free**.

If used, the output for starter battery II will be working with reduced voltage and charging current rates. Thus, the greater share of valuable solar power will be supplied to board/solar battery I being more suitable.

However, the vehicles starter battery II will be kept in a condition, that starting will always be possible, even in case of longer downtimes and during winter operation.



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

4.) Plug-type Connection „Solar Display“ (Option, can be connected):

6-pole tip jack for connection of the **VOTRONIC Solar Displays** for optimum control of the solar system:

LCD SOLAR DISPLAY, Order No. 1216

Displayed Values: Battery voltage, charging current, charging capacity, stored capacity and energy (V, A, W, Ah, Wh).

LCD SOLAR MONITOR, Order No. 1221

Displayed Values: Battery voltage, charging current, charging capacity (V, A, W).

5.) Temperature Sensor, Input „T T“ (Option, can be connected):

Connection for **VOTRONIC External Temperature Sensor Order No. 2001**

For automatic adaptation and correction of the charging voltage to the **battery temperature**.

(Temperature Compensation).



Installation:

The **thermal contact** of sensor and **battery "Board I"** (inside temperature) **should be well**. Thus, it should be screwed down to the negative pole of the battery. It is also possible to fasten it at the centre of the battery's casing sidewall. Ensure that the installation place is not influenced by any source of heat (motor unit, exhaust, heater etc.).

Connection:

Withdraw double plug-in terminal "T T", connect the temperature sensor to the terminal by means of a double-pole cable (cable cross-section 0.5 -1.5 mm²) and reinsert double plug-in terminal. The polarity (insert position) and cable length is of no importance. **The solar controller recognizes the sensor automatically.**

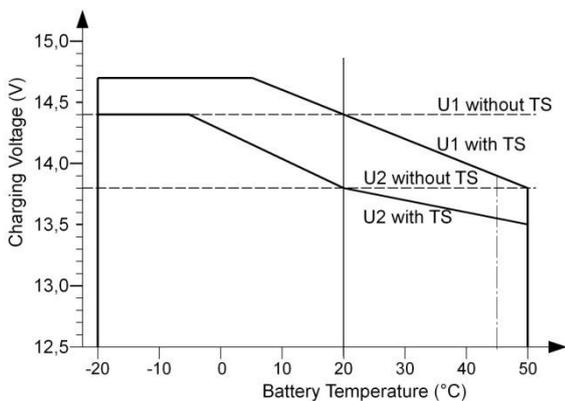
Effect:

The temperature-dependent charging voltage of battery I will be adapted automatically to the battery temperature.

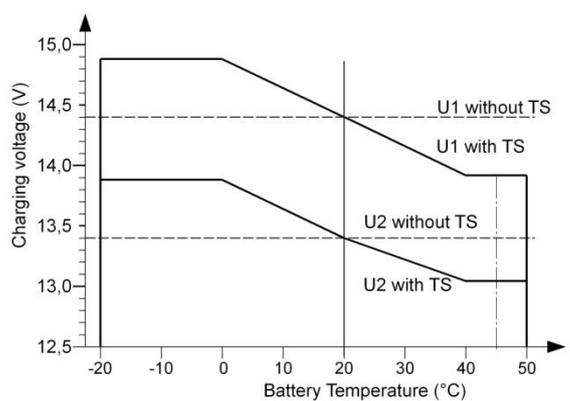
The temperature sensor measures the battery temperature. In case of low temperatures (winter operation), the charging voltage will be increased in order to improve and accelerate full charging of the weak battery. Sensitive consumers are protected by a limitation of the voltage in case of very low outside temperatures.

In case of summery temperatures, the charging voltage is reduced to minimize the load (gassing) of the battery and to extend the lifetime of gas-tight batteries.

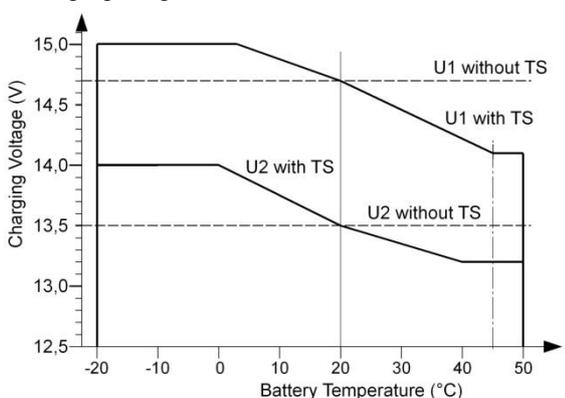
Charging Program „Gel“, Characteristic Line IU1oU2



Charging Program „Lead Acid“, Charact. Line IU1oU2



Charging Program „AGM“, Characteristic Line IU1oU2



In case of 24 V operation: Multiply all indicated voltage rates by 2!

TS = Temperature Sensor

Battery Protection:

Automatic disconnection of the charging current for protection of the battery in case of battery temperatures below -20 °C and above +50 °C (return +45 °C). Any charging data being recorded hitherto will be kept in memory. Charging will be resumed automatically.



The solar controller 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 to the usual charging voltage rates of 20 °C / 25 °C being recommended by the battery manufacturers.

Start-up:

Table 1: Main Battery I: How to set the correct charging program for the battery type (design):

Move the **2 slide switches for the characteristic line of charging** behind the front panel of the unit to the desired position using a small screw-driver.

Battery Type Selector Switch	<p>If not being specified divergently by the battery manufacturer, the suitable charging program for the battery type (design, technology) can be determined by means of the following description and the technical data (voltage rates U1 and U2, nominal temperature and dwell times U1).</p> <p>Note: The possible parallel/floating operation with consumers being connected to the battery is also automatically considered by all charging programs.</p>								
	<p>„ Lead Acid “: Charging program for lead acid/lead-acid batteries: For charging and conservation of charge of supply (board) batteries. Ensures short charging times, high charging factor and acid mixing for open standard batteries and closed, low-maintenance, maintenance-free "non-solid electrolyte", "lead-acid", drive, lighting, solar and heavy duty batteries. Also suitable for recently developed batteries (low-antimonous, batteries with silver-alloy, calcium/calcium or similar) and batteries with low and very low water consumption, as well as AGM batteries with the indication 14.4 V.</p> <p>Characteristic Line Acid IU1oU2:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding-left: 20px;">U1 Main/Full Charging:</td> <td style="text-align: right;">14.40 V</td> <td style="text-align: right;">20 °C</td> <td style="text-align: right;">2.5-5 h</td> </tr> <tr> <td style="padding-left: 20px;">U2 Full/Conservation/Storage Charging:</td> <td style="text-align: right;">13.40 V</td> <td style="text-align: right;">20 °C</td> <td style="text-align: right;">Continuous</td> </tr> </table>	U1 Main/Full Charging:	14.40 V	20 °C	2.5-5 h	U2 Full/Conservation/Storage Charging:	13.40 V	20 °C	Continuous
U1 Main/Full Charging:	14.40 V	20 °C	2.5-5 h						
U2 Full/Conservation/Storage Charging:	13.40 V	20 °C	Continuous						
	<p>„ AGM “: Charging Program for AGM / fleece Batteries: 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.</p> <p><u>ATTENTION:</u> It is highly recommended to check the specification sheet of the battery concerning the high charging voltage U1 14.7 V. Unsuitable batteries might age prematurely due to loss of electrolyte!</p> <p>Some manufacturers of AGM/fleece batteries are also prescribing a "gel" or "acid" charging program for charging! In this case, please set "Gel" (14.4 V / 13.8 V) or "Lead Acid" (14.4 V / 13.4 V).</p> <p>Characteristic Line AGM- / fleece IU1oU2:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding-left: 20px;">U1 Main/Full Charging:</td> <td style="text-align: right;">14.70 V (!)</td> <td style="text-align: right;">20 °C</td> <td style="text-align: right;">2-6 h</td> </tr> <tr> <td style="padding-left: 20px;">U2 Full/Conservation/Storage Charging:</td> <td style="text-align: right;">13.50 V</td> <td style="text-align: right;">20 °C</td> <td style="text-align: right;">Continuous</td> </tr> </table>	U1 Main/Full Charging:	14.70 V (!)	20 °C	2-6 h	U2 Full/Conservation/Storage Charging:	13.50 V	20 °C	Continuous
U1 Main/Full Charging:	14.70 V (!)	20 °C	2-6 h						
U2 Full/Conservation/Storage Charging:	13.50 V	20 °C	Continuous						
	<p>„ Gel “: Charging Program for gel/dryfit Batteries: Adapted to closed, gas-tight Gel batteries with determined electrolytes, which are generally requiring a higher charging voltage level and longer dwell times U1 to achieve short charging times with particularly high capacity storage and to avoid total discharge, e. g. EXIDE, Sonnenschein dryfit-Start, Dryfit-Sport-Line, DETA Gel Battery Funline, Bosch AS Gel Batteries Va/Z, AS Gel Drive Batteries, AS Gel Lighting Batteries. If not being specified divergently by the battery manufacturer, also recommended for batteries in round cell technology, such as EXIDE MAXXIMA (DC).</p> <p>EXIDE, DETA, VARTA Characteristic Line Gel IU1oU2:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding-left: 20px;">U1 Main/Full Charging:</td> <td style="text-align: right;">14.30 V</td> <td style="text-align: right;">20 °C</td> <td style="text-align: right;">6-8 h</td> </tr> <tr> <td style="padding-left: 20px;">U2 Full/Conservation/Storage Charging:</td> <td style="text-align: right;">13.80 V</td> <td style="text-align: right;">20 °C</td> <td style="text-align: right;">Continuous</td> </tr> </table>	U1 Main/Full Charging:	14.30 V	20 °C	6-8 h	U2 Full/Conservation/Storage Charging:	13.80 V	20 °C	Continuous
U1 Main/Full Charging:	14.30 V	20 °C	6-8 h						
U2 Full/Conservation/Storage Charging:	13.80 V	20 °C	Continuous						
	<p>Not used (operates like the gel / dryfit program)</p>								

Now, the solar controller is ready for operation.

Further actions or maintenance of the unit are not required.

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

If **solar power is missing** (at night), readiness for service of the controller will be indicated by short **flashing** of the LED (light-emitting diode) "MPP".

In any operating state, a totally discharged battery is indicated by means of the LED "Batt. Low" (low voltage). Now the battery has to be recharged as soon as possible (disconnect the consumers)!

A flashing LED "Charge" indicates a possible failure in the system: Controller overheated or failure found during self-test, battery too hot (>50 °C) when using the battery temperature sensor.

As soon as the **solar power** is again **sufficient**, the LED "Charge" will be lighting and the charging process starts. At the same time, the **brightness of the LED "Charge"** is a measure for the **converted solar power**: The brighter the LED, the more the power.

A lighting LED "MPP" indicates that the control of the solar controller is working perfectly, thus always **adapting** to the **most favourable working point** for the coordination of solar panel and battery.

1. Maximum charging current (**Phase I**) in the lower and mean voltage range of the battery up to the beginning of the phase U1. The MPP control adjusts to the maximum working point of the solar panel, and - in contrast to conventional controllers - thus achieves the highest possible battery charging current for short charging times under the given circumstances (sunlight, module orientation, module temperature and module soiling).
2. During the following **phase U1** the battery voltage will be kept constant on a high level close to the gassing limit, the battery determines the charging current according to its charging state, the high battery capacity will be charged and the LED "Batt. Full" is lighting slightly.
The MPP control ensures lower panel load and panel temperature, thus allowing an increased efficiency if consumers are switched-on additionally.
The solar controller will control the charging time as well as the charging current and will switch automatically to the following phase U2=conservation of charge. If the battery has already been charged fully, the charging time will be reduced accordingly.
3. During the **phase U2** (Full charging/conservation of charge) the battery will be kept on its charging level. Only the compensating recharging current is flowing being required for conservation of the full charge, which is determined by the battery. The duration of that phase is not limited, the LED „Batt. Full“ is lighting **intensively**.
In contrast to conventional controllers, especially here the MPP control ensures low panel loads and panel temperatures. Additional consumers can be held better.

Switching back to the phase I or U1 is effected, if the battery had been subject to load for an extended period or if the solar controller switches to stand-by mode after sunset.

Operating Instructions:

- **Lifetime of the battery: Recharge totally discharged batteries as soon as possible:**
Sulphation of the battery plates due to total discharge is to be prevented by **soon 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: 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 have 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 temperatures.
- **Lifetime of the battery:** Keep batteries cool; choose an appropriate location for installation.
- **Overvoltage Protection:**
The 12 V (24 V) solar controllers protect themselves against connection of excessive battery voltage rates or will be switched-off in case of defective additional charging systems (chargers, generators or similar systems), switching threshold 15.5 V (31.0 V).
- **Overvoltage Limitation:**
Sensitive consumers are protected by means of a limitation of the charging voltage to max. 15.0 V (30.0 V) during all modes of charging.
- **Overload / Overheating Protection Solar Controller:**
The solar controller is equipped with a double electronic protection against overload and with an automatic protection 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 solar controller (loss at the charging cable).



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/AGM or lead-acid batteries of the indicated nominal voltage and the simultaneous 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. **With 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 led from below to the solar controller to ensure that penetrating humidity cannot reach the controller in case of failure, which will result in damage of the controller.**
 - 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. 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 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 for 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 gases.
 - 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 guarantee 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 Lauterbach [/Germany](#).

Notes:

Technical Data:	MPP 225 Duo Dig.	MPP 320 Duo Dig.	MPP 420 Duo Dig.	MPP 320/24 Duo Dig.	MPP 480/24 Duo Dig.
Capacity of Solar Module (max.-recommended):	50–225 Wp	50–320 Wp	50–420 Wp	50–320 Wp	50–480 Wp
Current Solar Module:	0–13 A	0–19 A	0–25 A	0–9,5 A	0–14 A
Max. Voltage Solar Module:	50 V	50 V	50 V	50 V	50 V
Nominal Voltages of Batteries Board I and Start II:	12 V	12 V	12 V	24 V	24 V
Charging Current:	0–17.0 A	0–24.0 A	0–32.0 A	0–12.0 A	0–18.0 A
Current Consumption Stand-by:	4.5 mA	4.5 mA	4.5 mA	6.5 mA	6.5 mA
Main Port Battery I (BOARD I):					
Charging Voltage Limitation (max.):	15.0 V	15.0 V	15.0 V	30.0 V	30.0 V
Max. Prelim. Charg. Current (totally discharged battery):	6.0 A (<8 V)	8.0 A (<8 V)	11.0 A (<8 V)	5.0 A (<16 V)	7.0 A (<16 V)
Charging/Floating/Load Current:	0–17.0 A	0–24.0 A	0–32.0 A	0–12.0 A	0–18.0 A
Reset Voltage (30 sec):	12.75 V	12.75 V	12.75 V	25.50 V	25.50 V
Charging Programs for Gel/AGM/Acid Batteries:	Yes	Yes	Yes	Yes	Yes
Integrated Overload Protection (Current limiting device):	Yes	Yes	Yes	Yes	Yes
Integrated Protection against Short-circuit:	Yes	Yes	Yes	Yes	Yes
Integrated Protection against Overtemperature :	Yes	Yes	Yes	Yes	Yes
Integrated Cooling Fan with Temp. Control:	--	Yes	Yes	--	Yes
Unit Fuse (Type FKS):	20 A	25 A	40 A	15 A	20 A
Input Board Battery I -Temperature Sensor:	Yes	Yes	Yes	Yes	Yes
Charging Timer:	2-fold	2-fold	2-fold	2-fold	2-fold
Auxiliary Port Vehicle Starter Battery II (START II):					
Charging Current:	0–1.0 A	0–1.0 A	0–1.0 A	0–1.0 A	0–1.0 A
Integrated Overload Protection (Current limiting device):	Yes	Yes	Yes	Yes	Yes
Integrated Protection against Short-circuit:	Yes	Yes	Yes	Yes	Yes
Integrated Protection against Overtemperature :	Yes	Yes	Yes	Yes	Yes
Dimensions (mm):	137x71x102	137x71x102	137x71x102	137x71x102	137x71x102
Weight:	600 g	650 g	680 g	620 g	670 g
Ambient conditions, humidity of air:			max. 95 % RH, no condensation		
System of Protection:	IP 21	IP 21	IP 21	IP 21	IP 21

Delivery Scope:

- MPP Solar Controller
- Operating Manual

Available Accessories:

- External Temperature Sensor (12 V and 24 V) Order No. 2001
- LCD Solar Monitor (12 V) Order No. 1221
- LCD SOLAR MONITOR (12 V) Order No. 1216
- LCD SOLAR MONITOR (24 V) Order No. 6016



Declaration of Conformity:

According to the stipulations of the regulations 2006/95/EG, 2004/108/EG, 95/54/EG this product corresponds to the following standards or standardized documents: EN55014; EN55022 B; DIN14685; DIN40839-1; EN61000-4-2; EN61000-4-3; EN61000-4-4; ENV50204

**Quality Management
System**

DIN EN ISO 9001

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