

VOTRONIC

Installation and Operating Manual Solar Controller

MPP 160 Duo Digital Li (12 V / 11.5A / 160 W_p) **No. 098103034**

MPP 240 Duo Digital Li (12 V / 17.0 A / 240 W_p) **No. 098103036**



Please read the operating manual thoroughly prior to use, connection and start-up of the solar controller.

MPP Solar Controller for quality campers, caravans and boats.

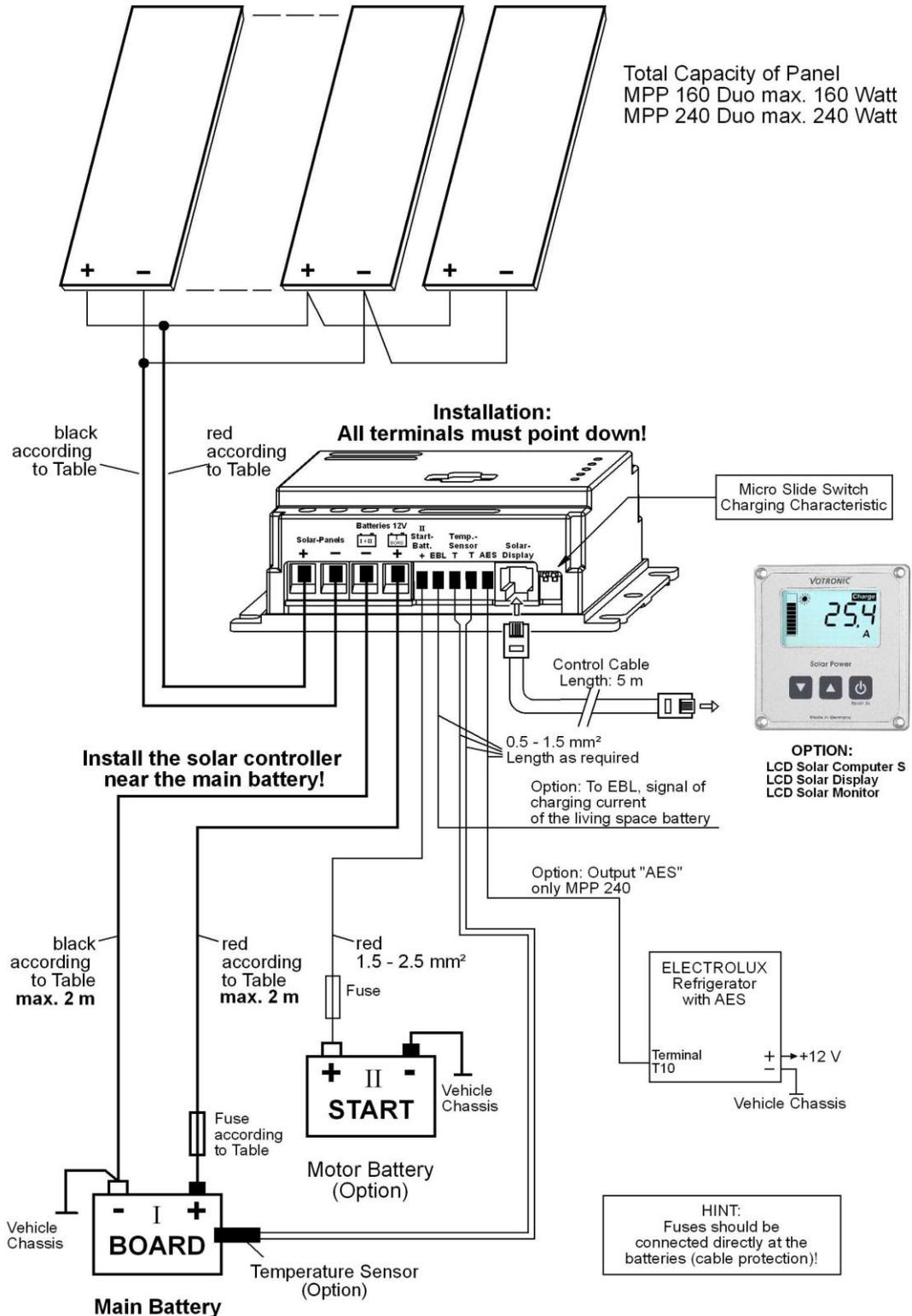
VOTRONIC Solar Controllers of series "MPP" (Maximum-Power-Point) with **characteristic line of charging „U1oU2“** are the link between solar panel(s) and battery (batteries).

In the MPP technology, the controller automatically deterministic mines all the time several times per second, the maximum output power (MPP) of solar modules. Then it transforms the excess voltage of the solar modules to a higher charging current for the battery (realized by high-frequency switching technology with high efficiency). This charging current gain results in shorter load times and the best power utilization of the solar system.

The MPP solar controllers operate automatically, require no maintenance and offer the following features:

- **Increased MPP charging current** compared with conventional controllers, due to ultramodern controller technology (microprocessor) by 10 % to 30 % (efficiency > 95 %). 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, acid/lead-acid or LFP- Li 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, reverse battery 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 „U1 U2“:** A defined charging boost (U1) avoids harmful acid accumulation and provides compensation charge to the individual battery cells. After that, automatic trickle charge (U2).
- **Charging Cable Compensation:** Automatic compensation of voltage losses on the charging cables.
- **On-board Mains Suppression Filter:** Unproblematic parallel operation with wind-driven generators, petrol-driven generators, mains supply chargers, dynamos etc.
- **Measurement Output for EBL (Electroblock of the Vehicle):** Allows convenient application of the solar (current display) being installed in the electroblock for supervision of the solar system.
- **Terminal "AES" (only MPP 240 Duo Dig.):** Automatic commutation of ELECTROLUX / DOMETIC refrigerators with "AES" (Automatic Energy Selector) from gas operation to 12 V operation in case of excess solar power.
- **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, such as in the motor compartment.
- **Ready for connection of the VOTRONIC Solar Displays** for optimum control of the system:
LCD SOLAR COMPUTER S: Displayed Values: Battery voltage, charging current, charging capacity, stored capacity and energy (V, A, W, Ah, Wh) Order No. 1250 .
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).

Connection Plan:



Required cable cross-sections, hints:	MPP 160	MPP 240
+/- Panel cable, Length as required	2.5 - 4 mm ²	4 - 6 mm ²
+/- Battery I cable, length max. 2 m	2.5 - 4 mm ²	4 - 6 mm ²
Fuse near Battery I (cable protection)	15 - 20 A	25 A



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 - it could also built in the EBL. 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!**
- **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)!**
- **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 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 polarity 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.

2.) Solar Modules:

Shade the modules to minimize sparking during connection and to avoid damages due to eventual voltage reversal.

Observe the Cable cross-sections (see connection plan)!

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

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** being ready for connection for optimum control of the solar system:

LCD SOLAR COMPUTER S Order No. 1250

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

LCD SOLAR DISPLAY Order No. 1216 (obsolete)

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

LCD SOLAR MONITOR Order No. 1221 (obsolete)

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

5.) "EBL" Connection for Electrobloc with Display Panel DT... / LT... (Option, can be connected):

A **cable set for connection of the solar controller to the EBL, order No. 2007**, is required. (It is not included in the standard delivery scope of the controller).

The solar controller supplies a signal at the terminal "EBL" for display of the solar charging current at board battery I (battery living area), which is suitable for electrobloc EBL... with DR.../LT... display panel.

The signal cable being required for that, as well as a connection cable for connection of the solar controller to the EBL are included in the set of EBL connection cables, cable lengths: 1 m, each.

Further information / possibilities of connection can be drawn from the manual being enclosed to the set of EBL connection cables.

6.) „AES“ (Automatic Energy Selector) only MPP 240 Duo Dig.

(Option, can be connected):

The delivery scope of DOMETIC / ELECTROLUX includes refrigerators with all-automatic energy selection (230 V AC, 12 V DC or gas).

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

Connection:

Lead a single-pole cable (0.5-1.5 mm²) from the solar controller's terminal „AES“ to the refrigerator's terminal „T10“.

Function:

The solar controller recognizes the excess capacity (LED „AES“ is lighting). The refrigerator switches from gas operation to 12 V operation. This mode will be kept for at least half an hour to avoid that the refrigerator will be “swinging” between 12 V operation and gas operation.

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

Should the solar power be insufficient, „AES“ will be switched off by the solar controller, the refrigerator will be switched to gas operation, it will keep this mode for at least half an hour, and the solar power will be used for recharge of the (possibly slightly discharged) battery.

7.) Temperature Sensor, Input „T T“ (Option, can 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 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 (motor unit, exhaust, heater etc.).

Connection:

The temperature sensor is connected to the terminals „T T“. The polarity 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.

Battery Protection:

Automatic voltage cut for protection of the battery in case of battery temperatures below -30 °C and above +55 °C or 60 °C (return 2 °C lower), LED "Charge" flashes. Any charging data being recorded hitherto will be kept in memory. Charging will be resumed automatically.

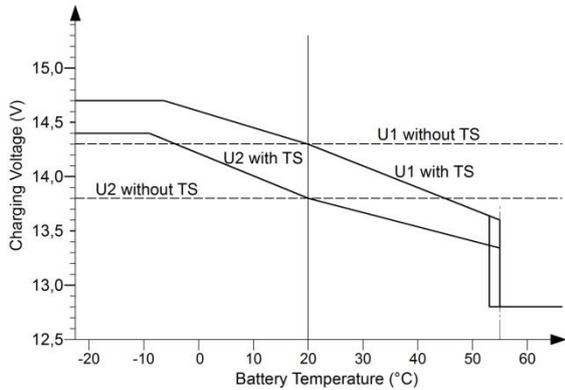


The solar controller recognizes automatically a missing sensor, cable break or short-circuit of the sensor lines, as well as unreasonable measuring values. In that case, it will switch to the usual charging voltage rates of 20 °C / 25 °C being recommended by the battery manufacturers.

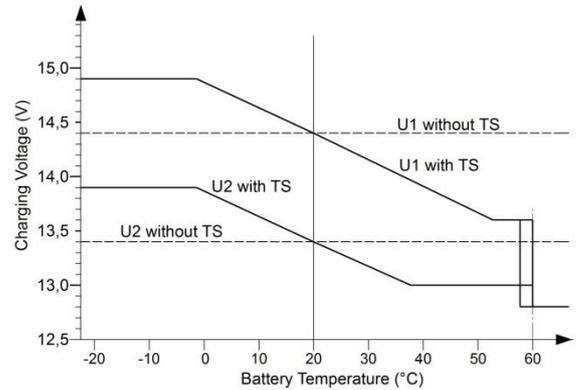
Charging voltages and temperature compensation of the board battery I:

TS = Temperature Sensor

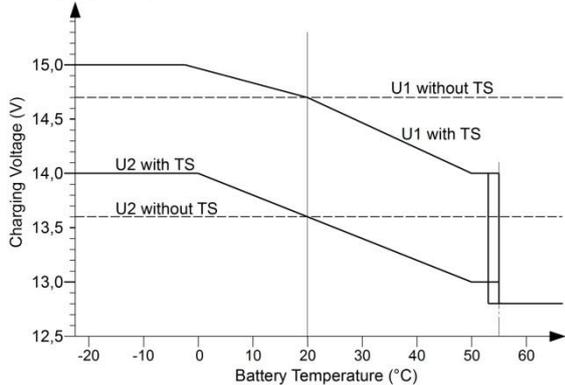
Charging Program „Gel“, Characteristic Line IU1oU2



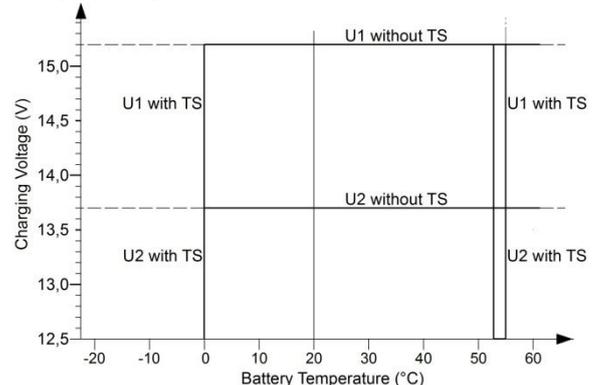
Charging Program „Lead Acid“, Charact. Line IU1oU2



Charging Program „AGM“, Characteristic Line IU1oU2



Charging Program „LiFePoY4“, Charact. Line IU1oU2



Start-up:

Table 1: Charging characteristic line, correct charging program for Main Battery “Board I” : set battery type:

Move the **2 slide switches for the characteristic line of charging** on the device side 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 border="0" style="width: 100%;"> <tr> <td style="padding-right: 20px;">U1 Main/Full Charging:</td> <td style="padding-right: 20px;">14.40 V</td> <td style="padding-right: 20px;">20 °C</td> <td>1.5-6 h</td> </tr> <tr> <td>U2 Full/Conservation/Storage Charging:</td> <td>13.40 V</td> <td>20 °C</td> <td>Continuous</td> </tr> <tr> <td>Thermal cut off voltage:</td> <td>12.80 V</td> <td>60 °C</td> <td></td> </tr> </table>	U1 Main/Full Charging:	14.40 V	20 °C	1.5-6 h	U2 Full/Conservation/Storage Charging:	13.40 V	20 °C	Continuous	Thermal cut off voltage:	12.80 V	60 °C	
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	<p>„AGM 2“: 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>ATTENTION: It is highly recommended to check the specification sheet of the battery concerning the high charging voltage U1 14.7 V.</p> <p style="padding-left: 40px;">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 / AGM 1" 14.3 V / 13.8 V or "Lead Acid" 14.4 V / 13.4 V.</p> <p>Characteristic Line AGM- / fleece IU1oU2:</p> <table border="0" style="width: 100%;"> <tr> <td style="padding-right: 20px;">U1 Main/Full Charging:</td> <td style="padding-right: 20px;">14.70 V (!)</td> <td style="padding-right: 20px;">20 °C</td> <td>1.5-5 h</td> </tr> <tr> <td>U2 Full/Conservation/Storage Charging:</td> <td>13.60 V</td> <td>20 °C</td> <td>Continuous</td> </tr> <tr> <td>Thermal cut off voltage:</td> <td>12.80 V</td> <td>55 °C</td> <td></td> </tr> </table>	U1 Main/Full Charging:	14.70 V (!)	20 °C	1.5-5 h	U2 Full/Conservation/Storage Charging:	13.60 V	20 °C	Continuous	Thermal cut off voltage:	12.80 V	55 °C	
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	<p>„GEL / AGM 1“: 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.</p> <p>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 border="0" style="width: 100%;"> <tr> <td style="padding-right: 20px;">U1 Main/Full Charging:</td> <td style="padding-right: 20px;">14.30 V</td> <td style="padding-right: 20px;">20 °C</td> <td>4-9 h</td> </tr> <tr> <td>U2 Full/Conservation/Storage Charging:</td> <td>13.80 V</td> <td>20 °C</td> <td>Continuous</td> </tr> <tr> <td>Thermal cut off voltage:</td> <td>12.80 V</td> <td>55 °C</td> <td></td> </tr> </table>	U1 Main/Full Charging:	14.30 V	20 °C	4-9 h	U2 Full/Conservation/Storage Charging:	13.80 V	20 °C	Continuous	Thermal cut off voltage:	12.80 V	55 °C	
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U2 Full/Conservation/Storage Charging:	13.80 V	20 °C	Continuous										
Thermal cut off voltage:	12.80 V	55 °C											
	<p>„Li“: Charging Program for Lithium LiFePoY4 Batteries, 4 (8) Cells: Adapted to 4 Li-Cells with 3.2V nominal voltage and charging cut-off voltage of 3.8V per cell.</p> <p>ATTENTION: It is highly recommended to check the specification sheet of the battery concerning the high charging voltage U1 15.2 V.</p> <p style="padding-left: 40px;">Unsuitable batteries might be damaged or overheat !</p> <table border="0" style="width: 100%;"> <tr> <td style="padding-right: 20px;">U1 Main/Full Charging:</td> <td style="padding-right: 20px;">15.20 V (!)</td> <td style="padding-right: 20px;">20 °C</td> <td>0.5-8 h</td> </tr> <tr> <td>U2 Full/Conservation/Storage Charging:</td> <td>13.70 V</td> <td>20 °C</td> <td>Continuous</td> </tr> <tr> <td>Thermal cut off voltage:</td> <td>12.00 V</td> <td>55 °C</td> <td></td> </tr> </table>	U1 Main/Full Charging:	15.20 V (!)	20 °C	0.5-8 h	U2 Full/Conservation/Storage Charging:	13.70 V	20 °C	Continuous	Thermal cut off voltage:	12.00 V	55 °C	
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Thermal cut off voltage:	12.00 V	55 °C											

Now, the solar controller is ready for operation.

Further actions or maintenance of the unit are not required.

Indicator lights:

"AES" (display of excess power, only MPP 240, green):

- If it is lighting: There is enough excess solar power. The output "AES" for automatic Energy selection of the refrigerator is turned on.
- Off: Output "AES" is turned off

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

- If it is lighting: Battery (s) charged to 100 %, trickle charge U2, finished
- If it is glowing: Main charging is still in the U1-charge phase
- Off: Main charging is still in the I phase

"Charge" (charging, green):

- If it is lighting: Brightness of a light glow to full brightness indicates the charge current rating
- Off: Not enough solar energy available
- If it is flashing:
 1. Battery shutdown protection: If Battery temperature $< -30\text{ }^{\circ}\text{C}$ or overtemperature $> +50\text{ }^{\circ}\text{C}$ or $> +55\text{ }^{\circ}\text{C}$, automatic return and charge again at $2\text{ }^{\circ}\text{C}$ lower.
 2. Overvoltage Protection: Solar controller shutdown at excessive battery voltage rates.

"MPP" (control, green):

- If it is lighting: The regulation of the solar controller is working properly
- If it is flashing: Display of availability in the absence of solar power (at night)

"Batt. Low " (red):

- If it is lighting: Low voltage on the main battery I

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 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.
- **Overvoltage Limitation:**
Sensitive consumers are protected by means of a limitation of the charging voltage to max. 15.0 V during all modes of charging, except Li 15.2 V.
- **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).

The battery can be fully discharged by too many consumers in case of lack of solar power. Therefore we recommend to protect the battery for the following devices:



Votronic **Battery Protector 40** (switch capacity 12 V / 40 A)
Votronic **Battery Protector 100** (switch capacity 12 V / 100 A)

Order No. 3075
Order No. 3078

Technical Data:	MPP 160 Duo Dig.	MPP 240 Duo Dig.
Capacity of Solar Module (max.-recommended):	40 ... 160 Wp	40 ... 240 Wp
Current Solar Module:	0 ... 10.5 A	0 ... 14 A
Solar Module open-circuit voltage (recommended VOC)	21 ... 28 V	21 ... 28 V
Solar Module open-circuit voltage also usable (VOC) max.:	50 V	50 V
Nominal Voltages of Batteries Board I and Start II:	12 V	12 V
Charging Current:	0 ... 11.5 A	0 ... 17.0 A
Current Consumption Stand-by (at night):	4.5 mA	4.5 mA
Main Port Battery I (BOARD I):		
Charging Voltage Limitation (max.):	15.0 V	15.0 V
Charging Voltage Limitation "Li" (max.):	15.2 V (!)	15.2 V (!)
Max. Prelim. Charg. Current (totally discharged battery):	6.0 A (< 8 V)	8.5 A (< 8 V)
Charging/Floating/Load Current:	0 ... 11.5 A	0 ... 17 A
Reset Voltage (30 sec):	12.70 V	12.70 V
Charging Programs for Gel/AGM/Acid Batteries:	Yes	Yes
Charging Program "Li" for Lithium LiFePoY :	4 cells	4 cells
Indicators for operating state "Batt. Full", "Charging", "MPP", "Low Voltage":	Yes	Yes
Indicator Lamp "AES":	--	Yes
Terminal for "AES":	--	Yes
Connector Solar Display / VBS Bus:	Yes	Yes
Input Board Battery I -Temperature Sensor:	Yes	Yes
Reverse Current Protection:	Yes	Yes
On-board Mains Suppression Filter:	Yes	Yes
Gassing Control:	Yes	Yes
Charging Timer:	4-fold	4-fold
Integrated Overload Protection (Current limiting device):	Yes	Yes
Integrated Protection against Short-circuit:	Yes	Yes
Integrated Cooling Fan with Temp. Control:	--	Yes
Gradual reduction in case of overtemperature:	Yes	Yes
Integrated Protection against Overtemperature:	Yes	Yes
Unit Fuse (Type FKS):	15 A	20 A
Auxiliary Port Vehicle Starter Battery II (START II):		
Charging Current:	12 V / 0 ... 1.0 A	12 V / 0 ... 1.0 A
Integrated Overload Protection (Current limiting device):	Yes	Yes
Integrated Protection against Short-circuit:	Yes	Yes
Integrated Protection against Overtemperature:	Yes	Yes
Dimensions incl. Fastening:	118x71x41 mm	118x71x41 mm
Dimensions without fastening device:	96x69x41 mm	96x69x41 mm
Weight:	185 g	198 g
Ambient Conditions, Humidity of Air:	max. 95 % RH, no condensation	
System of Protection:	IP 21	IP 21



**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!**



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 user of this specification is not clear which parameters are valid for the device or what rules he must follow, an expert should 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.

Notes:



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



RoHS
2002/95/EC
The product conforms to RoHS. Thus, it complies with the directives for Reduction of Hazardous Substances in Electrical and Electronic Equipment.



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; EN 61000-4-4.

Delivery Scope:

- MPP Solar Controller
- Operating Manual

Available Accessories:

- External Temperature Sensor Order No. 2001
- LCD Solar Computer S Order No. 1250
- Cable set for connection
of the solar controller to EBL Order No. 2007

Subject to misprints, errors and technical modification without notice.

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