

## MPPT-Solar-Wind-Hybrid-Charge-Controller SWMR1k-05k

### Product Description:

The SWMR1K-05K is a Solar-Wind Hybrid charge control system and consists of a SMR1000 and a windMax500 unit. Both, wind- and solar generator currents are fed into the battery terminals. This charger, in micro processor technique, contains all functions for smooth charging of lead Battery by solar modules of 1120Wp at 24V- and 560Wp at 12V-Systems. As well as by a windgenerator of 560W at 24V- and 280W at 12V battery systems. Because of the powertracking it is possible to increase the electrical power of a solar system up to 40%, compared to standard pwm or shunt chargers. The maximum solar voltage is 250V for a 12V- battery system as well as for a 24V and 48V-battery system (Open circuit voltage).

Windpower is increased as well, depending on the the generator voltage with relation to the battery voltage. The maximum wind generator voltage can be 250V (Open circuit voltage).

The buck converter topology feeds the maximum possible current from the power maximum, into the battery. As soon as the battery is full and reaches its end of charge voltage (14.5V/29.0V/58.0V) the device drives the solar voltage towards open circuit voltage, preventing overcharging of the battery. The windgenerator will be broken by an external dumpload resistor in case of full battery and also at a maximum generator voltage level, which is 160Vdc. Adjustment to other individual levels is possible.

A yellow LED indicates the state of full battery.

Deep discharge protection is activated with 60 seconds delay.

Switching is done by a Power Mosfet on the ground level. Indication of consumer switch off is by a red LED.

The green LED indicates solar- or wind generator current.

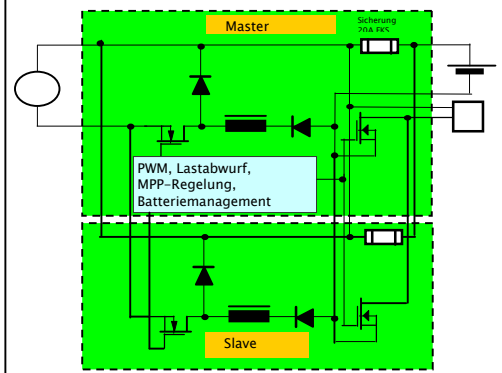
An optional temperature sensor tracks the maximum battery voltage at  $-4\text{mV}/^\circ\text{C}$ /Battery cell.

Solar powertracking is utilized every 8 seconds to optimize the solar power point. Wind powertracking is utilized every 1s, to follow the dynamic characteristics of windpower.

A battery management system allows adaptation to different battery types and optimal use of the battery capacity, including an automatic and manual equalization control.



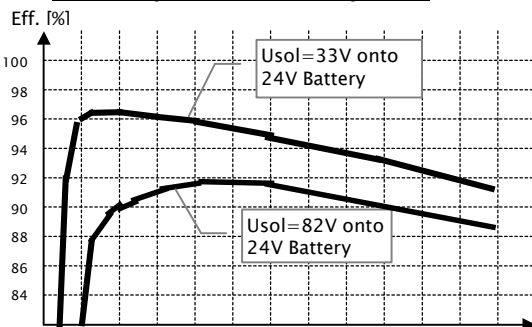
### Principal circuit diagram



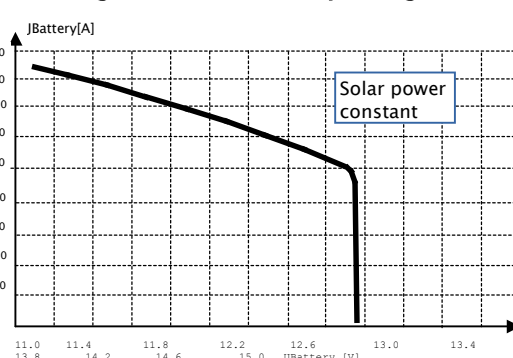
### Highlights:

- DC buck-converter to optimize solar & wind power income.
- MPP-Tracking of solar- and windgenerator voltage
- Selection of 3 Battery voltages 12V/24V/48V
- Indication of state of charge per LED
- Deep discharge protection
- Temperature tracking of Battery voltage
- Battery management system
- Temperature protection of power electronics
- Reverse polarity protection, over current protection, surge protection
- Option: LCD for Battery voltage, -current, Power, Energy

### Effectivity vs solar- wind power



### Charge current vs Battery voltage

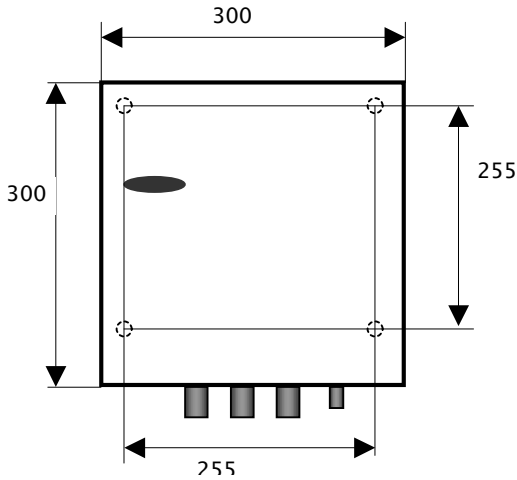


## Technical data

Solar charge controller:				Wind charge controller:			
Battery	12V	24V	48V	Battery	12V	24V	48V
Max. solar open circuit voltage, U <sub>soc</sub>	200V	250V	250V	Max. wind generator voltage, U <sub>wdc</sub>	200V	250V	250V
Max. solar current	40A	40A	25A	Max. wind generator current	8A	8A	8A
Max. charge current	40A	40A	25A	Max. charge current	20A	20A	12.5A
Max. solar power, P <sub>nom</sub>	560Wp	1120Wp	1410Wp	Max. wind power, P <sub>nom</sub>	280Wp	560Wp	755Wp
Efficiency	Ca. 93% @ 0.5P <sub>nom</sub>	Ca. 96% @ 0.5P <sub>nom</sub>	Ca. 96% @ 0.5P <sub>nom</sub>	Efficiency	Ca. 93% @ 0.5P <sub>nom</sub>	Ca. 96% @ 0.5P <sub>nom</sub>	Ca. 96% @ 0.5P <sub>nom</sub>
End of charge voltage	14.5V	29.0V	58V	End of charge voltage	14.5V	29.0V	58V
<u>Deep discharge protection</u>				<u>Deep discharge protection</u>			
Load disconnect	10.8V	21.6V	43.2V	Load disconnect	10.8V	21.6V	43.2V
Load reconnect	12.5V with 60 sec. delay	25.0V with 60 sec. delay	50.0V with 60 sec. delay	Load reconnect	12.5V with 60 sec. delay	25.0V with 60 sec. delay	50.0V with 60 sec. delay
Current consumption	7mA	7mA	7mA	Current consumption	3.5mA	3.5mA	3.5mA

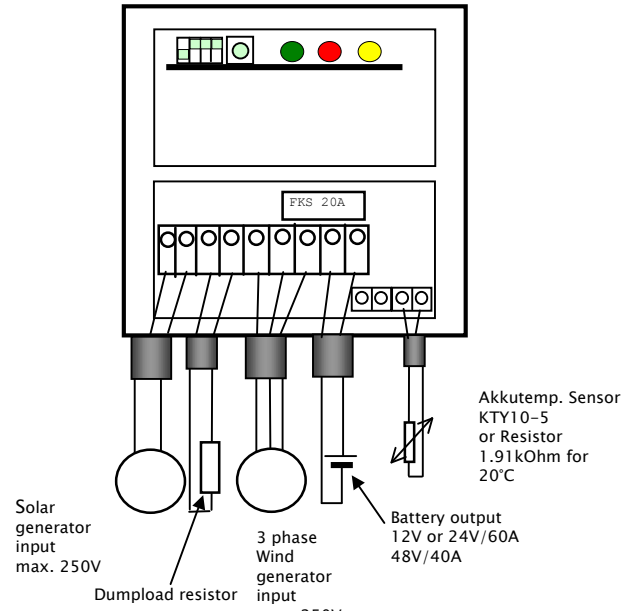
<b>Terminals:</b>	
2x solar generator input	16sqmm/10sqmm
3x wind generator input	16sqmm/10sqmm
2x dumpload	6sqmm/4sqmm
2x battery output	16sqmm/10sqmm
2x consumer output	16sqmm/10sqmm
2x temperature sensor	1.5sqmm
Temperature sensor	KTY10-5 or 1.91kOhm
Cable glands	3xPG16, 1x PG11, 2xPG7
LED's	right: yellow (Indication of max Battery voltage) left: green (Battery current>0.5A) middle: red (consumer off)
Housing	Steel wall mounted wxhxd 300x300x150mm
Protection	IP65
Weight	12kg
Moisture	90%
Operating Temperature	-20°C to +50°C

**Housing dimensions:**

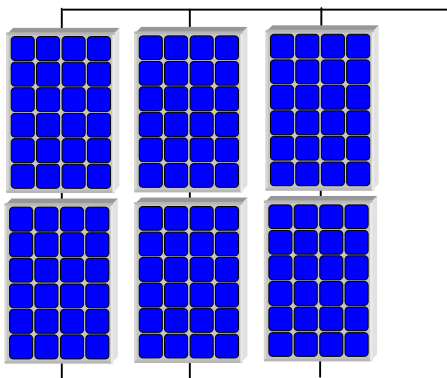


Height=150mm  
 Mounting holes in bottom of housing  
 D=10mm

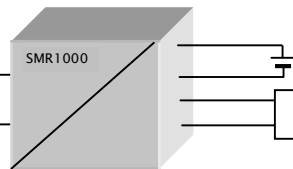
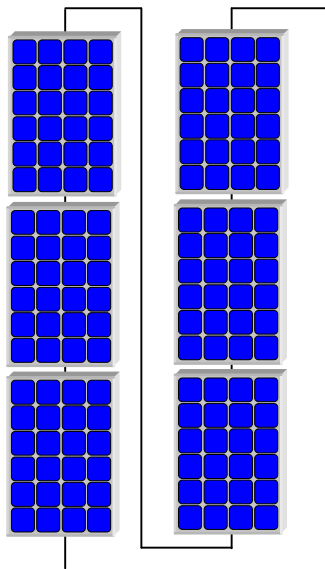
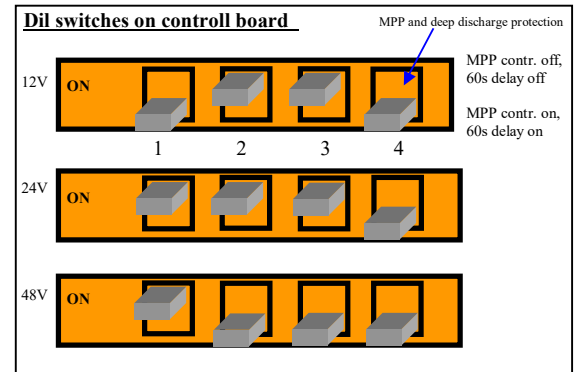
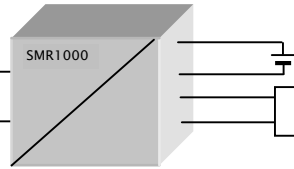
**Connection diagram**



**Applications:**



Configuration with optimal effectivity  
 2 modules - string, 72 cells.  
 $U_{mpp}=34V$ ,  $U_{soc}=41.5V$   
 $P_{nom}=1200Wp$ ,  
 Effectivity=96% @ 0.1P<sub>nom</sub>  
 95% @ 0.5P<sub>nom</sub>, 92% @ 1P<sub>nom</sub>  
 24V-Battery system, I<sub>Battery</sub>=40A



Configuration with maximum Solar voltage  
 6 modules - string, 216 cells.  
 $U_{mpp}=102V$ ,  $U_{soc}=124V$   
 $P_{nom}=1200Wp$ ,  
 Effectivity=81% @ 0.1P<sub>nom</sub>  
 91% @ 0.5P<sub>nom</sub>, 89% @ 1P<sub>nom</sub>  
 24V-Batterysystem,  
 I<sub>Battery</sub>=40A

### Windpower Basic calculations:

The maximum admissible input voltage of the charge controller is determined by the rectified AC-Voltage of the three phase generator. Depending on star or delta connection, the dc-voltage is different.

At a star connection the maximum generator dc-voltage is:  
 **$U_{gdc} = 1.35 \cdot U_{rs}$  or  $1.35 \cdot U_{st}$  or  $1.35 \cdot U_{rt}$**   
 **$U_{rs} = 1.73 \cdot U_{string}$**

At a delta connection the maximum generator dc-voltage is:  
 **$U_{gdc} = 1.35 \cdot U_{rs}$**



### Connection of dump load resistor

The load resistor must be connected to the terminal Load.

It's purpose is to remove electrical energy from the windgenerator when the battery is full and if the windpower is too large.

As soon as a generator dc- voltage ( **$U_{gdc}$** ) more than 150Vdc is at the charge controller, the load resistor is switched on.

Recommended dimensioning:

Resistor value:  $R_{load} = 150V \times 150V / P_{gen}$   
 Resistor power:  $P_{load} = 150V \times 150V / R_{load}$

Example:  $P_{gen} = 620W$

$R_{load} = 150 \times 150 / 620 = 36.3 \Omega \Rightarrow \mathbf{330 \Omega}$

