

Front view



Side view

The WT Charge Controller is a solid-state controller which regulates the charging of the batteries by the wind turbine, and the discharge to the user's load. It protects the battery against the damaging effects of over-charge and excessive discharge by keeping the charge/discharge cycle within prescribed limits. The special charge regulating technique enables a more efficient use of the available energy and the battery is charged faster compared to conventional controllers.

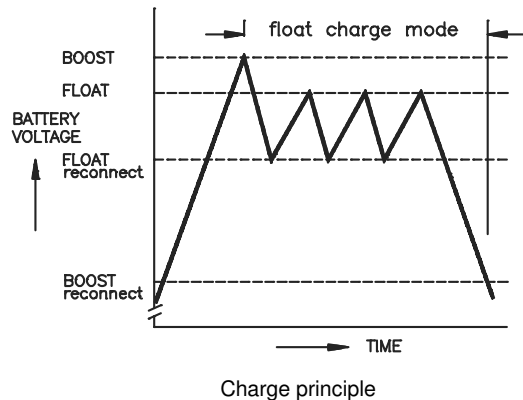
A combined external battery voltage and temperature sensor is standard.

Operation

The charge process is regulated by the charge controller, which can switch on and off five dump-loads who dissipate the excess energy. The first dump load will be operated via a modular pulse width modulation (PWM). Besides a much more precise charge regulation, this principle also prevents sudden slow down of the turbine in case a dump load is switched on. It saves the time and energy to spin up the turbine again until the required RPM's to generate energy are reached.

At high voltage a mechanical safety relay will be activated to isolate the turbine from the battery.

For maximum battery efficiency (for a longer lifetime) the charge controller performs a boost and float charge process (see diagram). This means that initially the battery is charged to a somewhat higher voltage, after that, the voltage is kept at a float charge level by selecting the appropriate number of module strings. The charge voltage levels are temperature compensated.



The switching frequency and resulting electro-magnetic field complies with EMC-regulations.

When the battery connection is interrupted the wind turbine will switch off within 0,1 seconds to avoid any damage to the appliances by the higher open circuit voltage of the modules. A battery (system) voltage of more than the given values (System High Voltage), see table below, will switch off the load relay.

At low State Of Charge of the battery the Charge Control Unit will switch off the load. When the batteries are recharged to a higher state of charge afterwards, the load is switched on again automatically. An electronic current limiter protects the output(s) against overload and short circuit.

Indicators, controls and other functions

- **Yellow LED "OPERATIONAL"**
This LED indicates that the control unit is connected correctly (polarity) and is ready for operation.
- **Green LED "BATTERY CHARGED/PWM"**
This LED is ON if the boost charge voltage level is reached and indicates that the controller is in float charge mode. Normally this LED stays on until the battery is discharged with a few percentage of the total battery capacity, e.g. during the night.
- **Three green LED's "DUMP LOAD"**
One or more LED's can be ON during float charge mode and indicates the specific dump load is switched on. The WT Charge Controller selects the number of connected dump loads in such a way that charge current is as high as possible without exceeding the float charge (gassing) voltage. The controller will react on changing wind speed conditions within seconds. During boost charge mode all the green LED's are OFF.
- **Green LED "TRICKLE CHARGE"**
This LED is ON if the boost charge voltage level is reached. The trickle charge heaters will be switched in series with the battery to reduce the charge current. Normally this LED stays on until the battery is discharged with a few percentage of the total battery capacity, e.g. during the night.
- **Red LED "PRE-WARNING LOW VOLTAGE"**
This LED is ON if battery voltage dropped dramatically and in a properly sized system it indicates an abnormal situation. This can be caused by a long period of less wind. If the option pre-warning low voltage alarm relay is mounted, this will be activated together with the LED. If an optional "non essential load" output is available, it will be disconnected.
- **Red LED "GENERAL ALARM/LOAD DISCONNECT"**
If this LED is ON the wind turbine is disconnected from the battery to avoid overcharging from the battery and the internal 25A output relay, or the optional 60A output relay unit, will disconnect the load(s) and the optional alarm relay will be activated.

The alarm can be caused by two different situations:

A: Battery low voltage:

In this case the general alarm/load disconnect LED is ON and the corresponding alarm relay is activated. For reasons see pre-warning low voltage.

B: System high voltage:

In this case the general alarm/load disconnect and all green LED's are ON. Possible reasons for this situation are disconnected batteries cable, defective battery fuse, defective WT charge controller.

Potentiometer "V charge/cell (at 20°C)"

The potentiometer is standard in the calibrated neutral position, i.e. 2,37 V/cell.

The potentiometer affects both float and boost charge voltage setting. Dependent of the battery type, capacity, load and operating conditions the recharge time and water usage (flooded types) of the battery is optimised by adjusting the float charge setting. Therefore we recommend consulting Tss4U first before adjusting the float charge setting of the controller.

Test switch

The test switch simulates a high or a low battery voltage (not a system high voltage). The system voltage is measured on battery power terminals inside the controller. With this switch the main functions of the controller can be tested.

Moving the switch to the high voltage position, the green LED's will be ON and the sub arrays be disconnected immediately (also on the slaves if present). The switch will return to its neutral position when released. The controller will need up to 15 seconds to resume normal operation.

After moving and holding the switch to the low voltage position, the pre-warning low voltage LED will be ON. Five to fifteen seconds later, the general alarm LED will be ON" and the output relay(s) is (are) activated. After releasing the switch the controller needs up to fifteen seconds to resume normal operation.

Overload or short circuit protection of the output

In case of overload or shortcut circuit of the output, the internal electronic protected solid-state switch will switch off the load. A LED on the front does not indicate this. For safety reasons, the load is not switched on again automatically.

To restore power to the load:

- Trace and correct the problem which caused the overload.
- Push the test switch to low position and hold until the red LED (general alarm/load disconnect) is ON.
- Release the switch and wait until both red LED's are off, the power is now restored.

Optional

Alarm relays with voltage-free contacts for pre-warning low voltage and general alarm.

The alarm statuses for different system conditions are as follows:

Status overview (for 24V system)			
Conditioning	Pre-warning alarm relay	General alarm relay	Load
Normal	OFF	OFF	ON
Vbat <23,6 V	ACTIVE	OFF	ON
Vbat <23,0 V	ACTIVE	ACTIVE	OFF
Vbat >29,5 V	OFF	ACTIVE	OFF