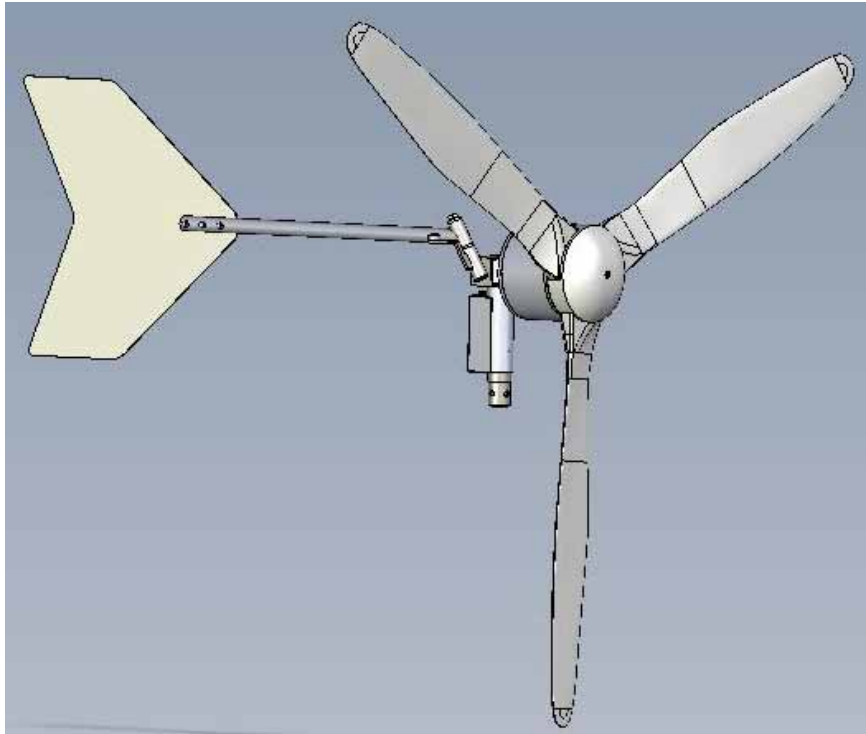


Assembly instructions and manual for the wind turbine Black 600



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2. security advices
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4. assembly of the wind turbine
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7. troubleshooting
8. checkup and maintenance
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Thank you very much for purchasing the wind turbine Black 600. You have bought a premium product which silhouettes explicitly against products of our competitors. The wind turbines of the Black series have no magnetic detent torque and holding torque, which allows a start-up from wind speeds of 0,8 m/sec. From 1, 8 m/sec on, you are able to be in loading area. The wires inside the mast will not roll up, because yaw control is made via abrasive ring contacts.

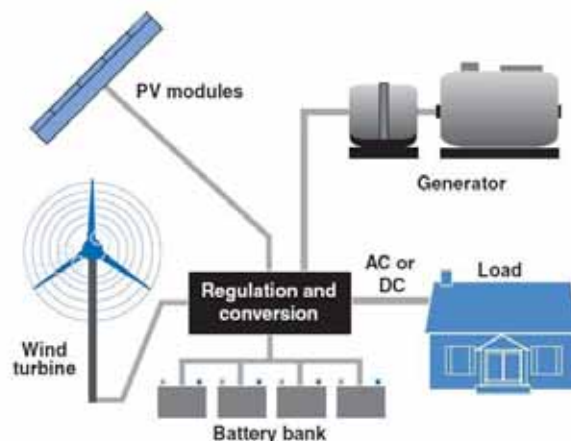
In order to get a bigger turbine's lifespan, there are some necessary advices for mounting the wind turbine assuredly and reliably.

Please notice that this manual is a part of the product and has to be followed strictly, so please read this manual carefully before installing the wind turbine. This manual should be positioned near the product and it should be given to possible new owners.

This manual describes the function, installation, operating and attendance of the wind turbine.

It addresses itself to the raiser of the turbine who should be technically experienced. If this is not the case, please let the installation be made by a technician.

The wind turbines BLACK are available in 12 or 24 Volt for charging batteries and in 48 Volt for supplying feed-in converters. There will also be a 500 Watt version in the near future.



Wind turbines for battery charging which are connected to a solar panel, are appropriate to the following appliances: street lamps, supply of gauging stations, traffic management systems, emergency call systems, isolated systems like summer residences, garden plot, camping, advertisement, lighting of billboards, for primary health care in developing countries, Wireless Lan Access Point and everywhere, where there is no electrical connection. There is also available a feed-in converter for the wind turbine BLACK which are able to feed in the electricity network.

These information are dependable, but the manufacturer does not take responsibility for impreciseness or omissions. The user of this information and of this product takes the full risk and responsibility. All specifications are changeable without any other messages. Wind turbines have to correspond to the local and national appointments, norms and laws, like other electric devices and sources, too. In some regions, you also need a building license before installation of the wind turbine. Before you start to mount the turbine, please check if you are allowed to install a turbine at your location.

Security advices

Wind turbines are dangerous devices because of their high rotational frequency and the created voltage, so please read these security advices carefully:

Mechanical risks:

The rotating rotor is a big danger because it turns invisible, when a certain wind speed is reached. The angles of the rotor blades are very sharp-edged because of their aerodynamical body. Therefore you can hurt yourself even at slowly-rotating rotors. Never touch the rotating rotor, never try to stop it with your hands, mount the turbine only at locations where nobody has the possibility to touch it easily- that is very important, especially on boats!

The rotor blades are manufactured from plastics which even bears up against high wind speeds, nevertheless, you should keep distance to the rotating blades. Severe injuries can occur if a rotor blade breaks off. Especially this is the case when a blade was hit by a flying object. When a blade is damaged, you should stop the turbine immediately. When a rotor blade is damaged, the whole tower can be in danger because the generator can get a big unbalance. So please pay attention to the choice of your installation location. Only mount the wind generator to the tower when the connections of the charge controller or the feed-in converter are disconnected and bypassed (short-circuit of the generator may only be done when the rotor turns faster than 100 times per minute) or a rotor blade is tied to the tower, so that you cannot get hurt by the rotating rotor.

The tower and the mounting to the tower have to resist the forces that are created by the wind force and by the strain. For this matter, a professional technician should be entrusted with the installation.

Please notice that you have to mount the tower with the help of at least two persons and that you have to follow the instructions and rules of the accident Ruihuaion and insurance association. When you mount the tower, please notice that no other persons may stand next to the tower. Encumbrances have to be secured with linkages during the process of lifting.

Elektrical risks:

A coasting wind turbine, especially the 48 V version, is able to create a DC voltage of more than 200 V. Please connect these devices only when you are technically experienced. These voltages can be fatal if you do not act accordant the instructions. Never touch uninsulated wire ends. Notice that uninsulated wires can do harm.

The wire, connective elements, plugs and other electrical components have to be dimensioned adequately at width, therewith wires do not warm up and cause a fire. The maximum current inside the wire can be up to 50 Ampere at a turbine 600 Watt 12V.

Wires have to be laid securely in order to protect wires from mechanical damages. An open wire is very dangerous!

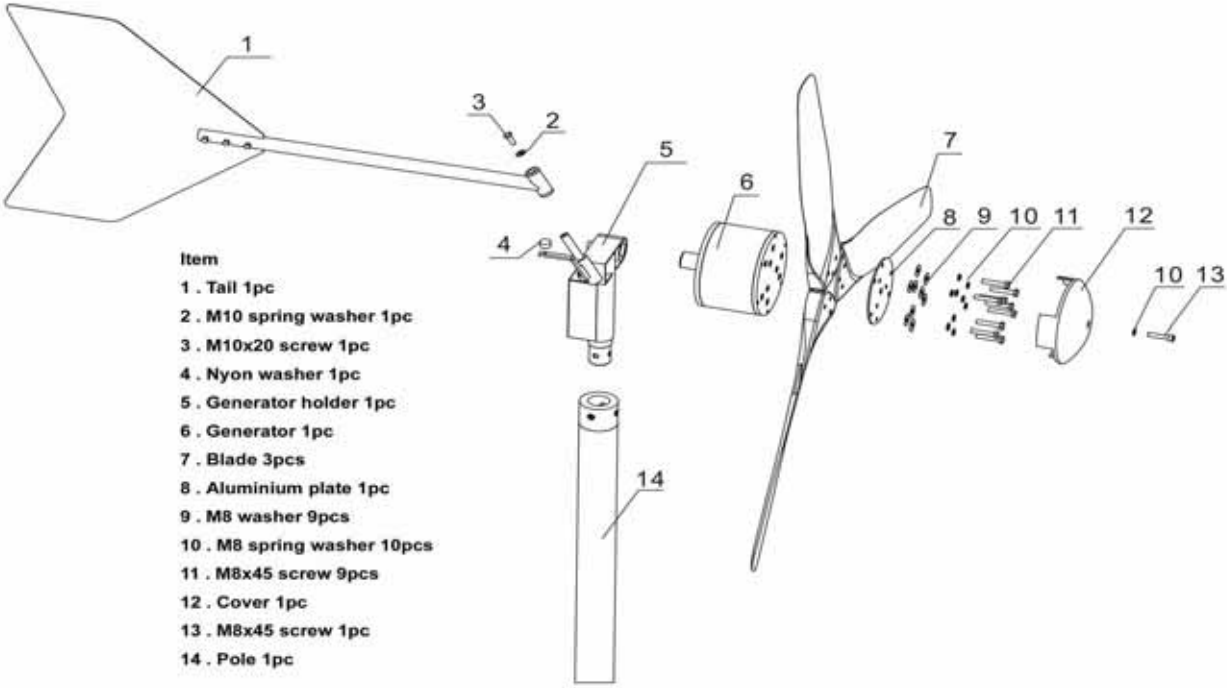
For fuse protection, you have to install a fuse to the feed cable, please do that as near as possible to the battery. A short-circuit of the battery cables and/or power lines has to be avoided on any account.

It has to be assured that the electric installation is only made by persons who have got expert knowledge.

The wind turbines are produced with a big accurateness, however it can happen that a wind turbine was not assembled completely or that a screw disengaged itself during transportation. Please check all single assemblies concerning damages and unfixed assemblies, e.g. like screws.

The wind turbine has to be switched to the brake mode before a storm rises. During a hurricane, the rotor blades should be tied to the tower, especially on boats.

Technical specifications of the wind turbine



position	description	number
1	Tail	1
2	M10 spring washer	1
3	M 10x20 screw	1
4	Nylon washer	1
5	Generator holder	1
6	Generator	1
7	Blades made from carbone nylon	3
8	Aluminium plate	1
9	M8 washer	9
10	M8 spring washer	9
11	M 8 x 45 screw	9
12	Cover	1
13	M 8 x 45 screw	1
14	Pole, not included.	0

The wind turbines are external rotors, triphase, with neodym magnets, permanently excited, 10-pole generator.

The BLACK wind turbines use the kinetic energy of the wind. The rotor blades are powered of this energy and inside the generator, this energy gets converted to three-phase AC. The energy, which is stored inside the wind, raises to the third power to the wind speed, therefore it is to be expected that when the wind speed is as double as before, you will get 8 times as much energy as before.

m/s	W/m ²	m/s	W/m ²	m/s	W/m ²
0	0	8	313,6	16	2508,8
1	0,6	9	446,5	17	3009,2
2	4,9	10	612,5	18	3572,1
3	16,5	11	815,2	19	4201,1
4	39,2	12	1058,4	20	4900,0
5	76,5	13	1345,7	21	5672,4
6	132,3	14	1680,7	22	6521,9
7	210,1	15	2067,2	23	7452,3

**) for an air density of 1,225 kg/m³, which corresponds dry air at normal atmospheric air pressure at sea level with 15° C.

The formula for the output per m² in Watt = 0,5 * 1,225 * v³, v is the wind speed in m/s

The rotor blades are aerodynamically optimized, sounds are hardly recognizable. On lower rotary speeds up to 400 rotations per minute, almost no sounds can be recognized.

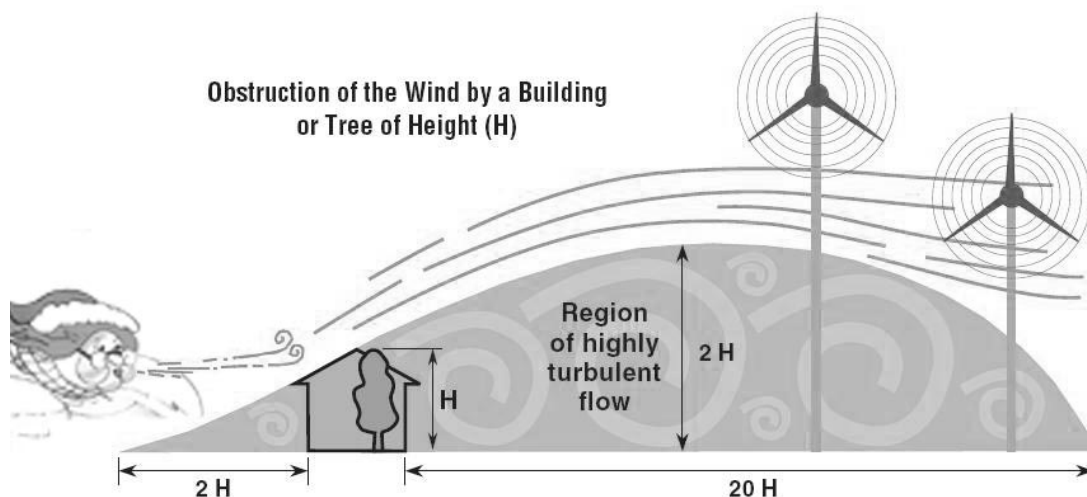
The combination of a holding-torque-free and a detent-torque-free generator and a balanced rotor blade allows to having a start-up from 0,8 m/s and a charging process from 1,8 m/sec.

Assembly of the wind turbine

Before mounting the turbine, you should have an appropriate installation location. That is almost always the most complicated task during installation of the wind turbine. Small wind measuring systems do not really help because the smaller the rotor the more swirl wind speeds are shown. Take following example in autumn: although it is very windy outside, a leaf rises 1,50m up into the air and then falls down again. Actually a leaf should fly from the left to the right at a high wind speed, right close to your window. These winds are not useful for your wind turbine, it would not rotate like the leaf does not, too. Obstacles back up the wind and do not let the wind go through, so the wind backs up at the obstacle and starts to twirl. The arriving wind now pushes against the air, which was compressed by the wind, and cannot go through. This incident continues until the wind blows around the obstacle, just like a curve. Obstacles are houses, hedges, trees, hills etc.

The bigger the rotor diameter, the more constantly the rotor has to be blown. You can choose the perfect installation location the most easily when you take a long stake and fasten a 3 m long and 4 cm wide, thin thermoplastic foil, at intervals of 2 m. Now put the stake to the chosen location and height where you want to install the wind turbine. Please only try to install it when the wind is blowing from the main wind direction. Follow the performance of barrier tapes. The optimum case is when the top barrier tape is positioned perpendicular to the wind. It is acceptable if the barrier tape undulates and slews round with an angle of 30° . If the angle is bigger than 30 degrees or if the barrier tape wraps round the tower or if it does not start to draft, then the installation location is not adequate and you will have to change the location or the installation height. Please notice that this proposal depends on the wind speed, so this attempt should only be made at an average wind speed.

The following chart can also be used but it has to be mentioned that the described points are shown with a tower of at least 4 m to 6 m.



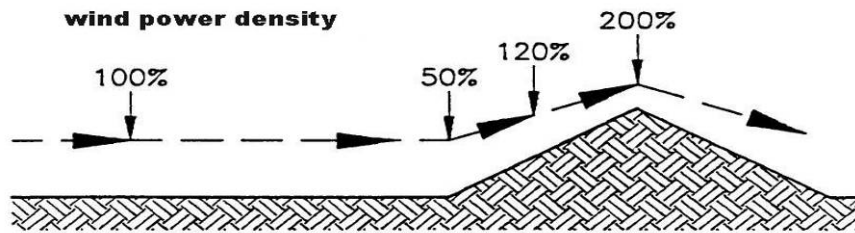
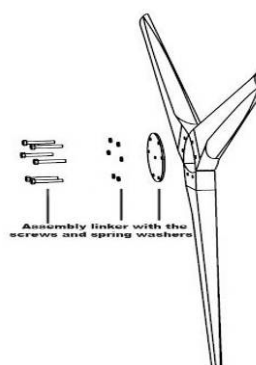


Figure 9

When an adequate installation location was found, you will have to choose an adequate tower. Because the tower has to be quite high, it would make sense to plan the height of the tower in a way that you can reach it easily in order to proof the security. If the tower is completed in a thin way, it has to be braced repeatedly according to the height of the tower. Please notice that we cannot give you more details regarding the tower because there are uncountable possibilities to install a tower correctly. The tower has to be set up in a way that the wind turbine is able to strain the tower with 3250 N at the top of it. It also has to be grounded according to the valid rules of technology. Grounding should be made with an earth electrode or an earth system, on boats grounding should be made with the tower of a sailboat or with the motor of a motor boat. Please pay attention to the valid rules and manuals of the manufacturers.

When the tower is ready for mounting the wind turbine and when the boreholes were made sideways, then you can start to mount the wind turbine. Every wind turbine has got a set of rotor blades. This set of three blades is coordinated. A set of blades may only be replaced with three others, otherwise the generator can be out-of-balance. Please mount the rotor blades in a wind-free location, the rotundity of the blade has to point to the generator and the even side has to be in the front- you can easily recognize the sides of the blades when you look at the peak of the rotor blade. Now take a rotor blade, the counterplate and one of the M8 screws and fasten them loosely. Please notice that the brass injection nut has to be directed to the generator. Now fasten the second screw, after that please mount the second and third rotor blade in the same way. Just fasten only one screw loosely per rotor blade.



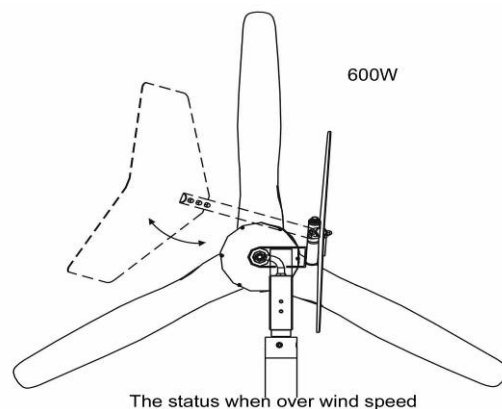
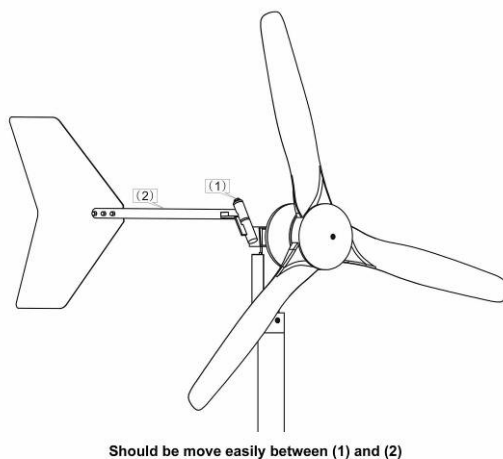
Now the rotor has to get balanced. It can only start up at 0,8 m/sec when the rotor is balanced, furthermore unnecessary vibrations can be avoided. Please bring the rotor in the Y-position, one rotor blade directed to the left up, one to the right up and one directed to the bottom. Now unhand the rotor blade and keep in mind if the rotor started to turn left or right. Then please turn the rotor 120° and watch to which direction it turns. On the basis of direction of rotation you can now know which blade ist he heaviest. Hold the round generator`s cabinet and correct the lacking balance with a small beat at the blades` angle. Please then check whether the rotor is balanced, no matter in which position you turn, the rotor may not turn in any direction after

you have unhandled it! Then fasten all six screws with 25 Nm. After that, please check again if the blades shifted because of tighten the screws. A small unbalance can be cleared with the mounting of the spinner. After all screws are tightened, locking varnish has to get smeared over the screws.



Mount the spinner into the counting plate with a 45mm long screw, do not fasten the screw too tightly. Now only the vane is missing.

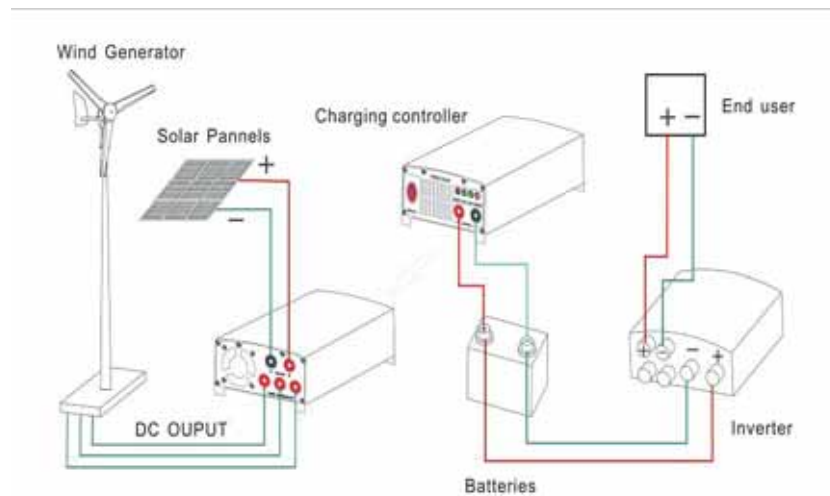
The tail is not only able to turn the wind turbine into the wind automatically, but also to protect the Black 600 of overload. The tail turns slowly out of the wind when the wind speed is too high at about 550 Watt. Therefore it is important that the tail is mounted correctly. The tail has always be able to dissemble itself laterally. The screw, which holds the tail, may not clamp the tail. During mounting please take care that you fill in much grease into the space where the pin will be placed in, so that there is always a certain movability.



The dashed line shows the position at too high wind speeds

The wind generator produces a three-phase alternating current, it makes sense to convert to continous current with the charge controller, but not until it is short of the battery. The reason

for it is that the consumption is lower at alternating current. You have to lay 3 wires from the wind generator to the charge controller, as seen on the following drawing.



Please take the correct wires profile from this chart:

12volt :

Distance from the wind generator to the charge controller in m	10.6	10.7-17.6	17.7-28.2	28.3-44.1	44.2-68.1	68.1-110
Wires profile in mm ²	10	16	25	35	50	65

24volt :

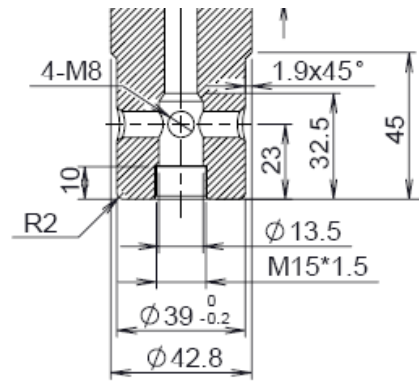
Distance from the wind generator to the charge controller in m	10.6	10.7-17.6	17.7-28.2	28.3-42.4	42.3-70.6	70.7-112.9
Wires profile in mm ²	4	6	10	16	25	35

48volt :

Distance from the wind generator to the converter	10.6	10.7-17.6	17.7-28.2	28.3-44.1	44.2-68.1	70.7-112.9
Wires profile in mm ²	2,5	2,5	4	6	8	10

Lay the triple core cable to the top of the tower. Because the cable has got a heavy empty weight, we suggest to mount the cable inside the tower with an extra strain relief before you connect the cable to the wind generator. Please combine all three core cables at the foot of the tower to a short circuit. Put a shrink hose over the cable head of each core. Twist each of the three cores with the cores of the cable and solder them up. Now put the shrink hose over the soldering of each core and shrink it with warmth. Wrap all three cores with a textile electrical tape.

Mount the wind turbine to the prepared tower, it has to be prepared in a way that the mounting axle fits well with its 39 mm, a borehole with 39,5 mm would be the best alternative. The tower may not go beyond a rotor diameter of 70 mm near the rotor blades, in order that the blades do not get pushed against the tower when a heavy storm is coming up.



Mount the tower pressure of the wind turbine with 4 screws M 8 with the tower. Notice that the screws may not go deeper than 11 mm into the tower pressure, because the cables lie in the middle of the axle.

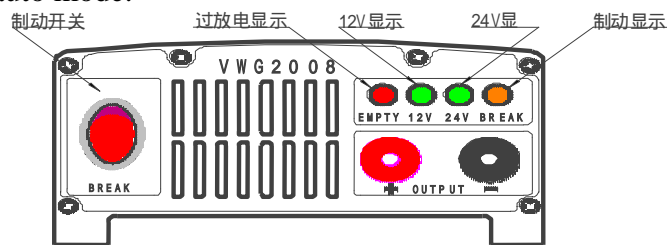
Erect the tower vertically. A slant tower stresses the wind turbine's mechanism too much. After the tower has been adjusted, it should also get stayed.

Connection to the charge controller

For connecting the converter, please pay attention to the instructions of the converter's manual. Notice that converters usually need to have a constant tension and need to be protected against overvoltage. You can also find suitable converters and overvoltage protection at our online shop.

The BLACK wind turbine may not get driven into short-circuit at full capacity. This is acceptable up to a rotation speed of maximum 100 rotations per minute. The turbine can be destroyed at higher rotations. If you like to have braking switch groups, they should be switched to brake resistance. That is very important for feed-in devices, otherwise the wind turbine cannot be braked manually.

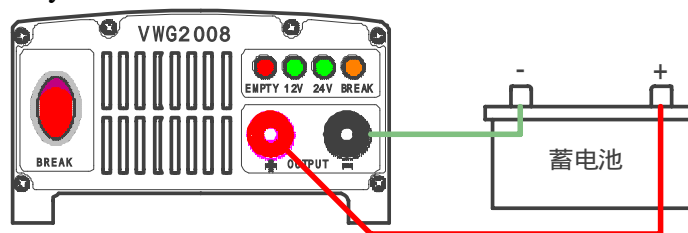
The front of the charge controller includes the terminal for the battery and the informative LEDs, as well as the braking switch group. Please notice that „I“ means that the brake is switched on, but not the wind turbine. The braking switch group does never brake the turbine by the idleness. The braking switch group should get activated in cases of danger, like hail or heavy storms or when the wind turbine has to get maintained. Switch to position „0“ when you want to use the auto mode.



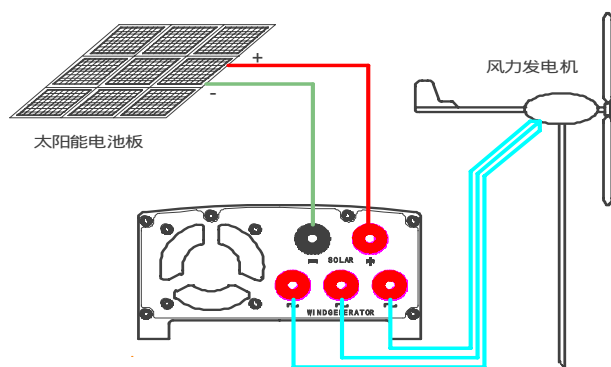
The left LED signals that the battery voltage is too low. Both green LEDs in the middle position tell you if the charge controller has found a 12 or 24 volts system. The very right LED tells you if the brake is activated at the moment, activation can be made manually or automatically.

The charge controller may not be installed near to the batteries because some batteries gas during operation. In some cases even explosions could occur. The charge controller can only be installed near the batteries when the batteries are deaerated outwards with degasification brasses so that the batteries cannot gas inside the room.

It is important to connect the battery to the charge controller first, before you connect to other components. The battery may not get discharged too deeply, especially at 24 volts devices, because the electronic system of the charge controller has to switch and the charge controller should be able to recognize the correct system voltage. Please notice that the charge controller will be destroyed when you mistake + for - .



After the battery was connected to the charge controller, the electric brake is activated for 20 minutes. During this period, you should connect the wind turbine. Please notice that when you release the short-circuit inside the generator's cable during windy conditions, the generator will accelerate and cables will be energized. So please take care when you touch uninsulated cable heads.



The three cores of the wind turbine have to be connected at the backside of the charge controller, the order of connection does not matter at 3-phases-alternating-current. It is also possible to connect a solar panel up to 100 Wp and a hybrid charge controller.

When the charge controller is connected correctly, the manual brake can be deactivated, normally a braking deceleration is still activated, so that the braking LED is still glowing. The light normally lapses after 20 minutes. When the brake is off, the wind turbine starts to turn faster until charging begins. In this case, battery cables may not be removed for test purpose, this will destroy the charge controller. When you want to control the current conduction, you will have to install an amperemeter or use a gripper-amperemeter. The charge controller now supervises the charging end voltage of the battery, which is dropped to 14,2 volts. When the charging end voltage is reached, the wind turbine brakes for 20 minutes. When the battery is smaller than 80 Ah, it can happen that the charging end voltage is reached too early and so the battery will not be charged correctly. To put things right, you can switch on a small device during charging which reduces the voltage and avoids braking.

The brake of the charge controller is controlled with the help of a temperature sensor – so when there is a reason of braking and there is a lot of wind, the braking process can last a while. When there is few wind the brake will be cooling down fast and the wind turbine will start working again.

The best thing about this charge controller is the fact that you can program the brake, not just the end charge voltage but also the charge current. The advantage is that the wind turbine can also run with a big battery. In the past, sometimes damages occurred at the charge controllers when big empty batteries came into a heavy storm and the charge currents became too high for the electronics. Following displays can be seen:

The charge controller has got five buttons, the button MENU is for choosing menu options, the button OK is for choosing menu options into the other direction, + and – are for choosing parameters, the button RESET can reset the charge controller, but not all calibrations will be changed.



Logo, version date, N= normal menu, L for 12 Volt, H for 24 Volt system voltage. The system voltage will be recognized when the battery gets connected. If the battery is deep-

discharged at a 24 volt system, it can happen that the charge controller will recognize a 12 Volt system.



You can see the voltage V and the current I, which lies against the battery.



Charge off: push the button + and - , program the charging end voltage of your batteries, pay attention to the descriptions of your battery's company, the charging end voltage can be between 12 and 15 Volts.



Charge shows you, how much ampere hours were charged into the battery. This value is used as a relation value, because every 10 seconds information of the charge controller get requested.



It is the same as above, just in kWh.



Shows you the capacity in Watt, which is produced at the moment.



You can also define and connect consumer load to the charge controller, when the consumer load should switch off or on. The consumer load is called User and is measured in ampere hours.



Push the + and - buttons to adjust at which voltage the charge controller will switch off the consumer load.



User on, defines the voltage, at which point the consumer load should switch on again. When the consumer load is switched off, battery voltage rises. If the value would not be big enough, the consumer load would switch on and off in short periods. This function can also be used with smaller batteries. You just connect another load in the upper area so that the end charging voltage will not be reached too early, in this way the brake stays deactivated for a longer period.



Here you can see how much current the consumer load needs at the moment.



With the use of the + and – buttons, you can adjust at which current your wind turbine has to get braked down. This Ruihuas an overcharge of the charge controller, especially when you connect bigger batteries. This function can also be used in order to define the engine speed. How to calculate the correct value: capacity of the wind turbine divided by the end charging voltage, which means that when you have a 300 Watt generator with 12 Volts, the end charging voltage would be 14, 4 Volts with a AGM battery. The result is that the maximum charge current is $300 \text{ VA} / 14, 4 \text{ V} = 20,83 \text{ Ampere}$.



Breaktime: you can adjust, how long the wind turbine needs until it is braked down. The longer time is adjusted the longer the brake needs until it brakes. In this way the brake resistance is heating and the drag braking can start until the temperature of the brake resistance drops out. Please do not adjust a value which is smaller than 10 seconds.



Here you can see the generator voltage, which starts at 8 volts. Afore you can just see the supply voltage of the processor. The generator voltage is higher than the battery voltage.

Connection to the feed-in inverter

Please read carefully the instructions of the inverter's manual when you want to connect an inverter. Notice that the most inverters need to use constant tension and have to be protected against overvoltage. There are suitable inverters and overload protections available at our online shop. The wind turbine should have a manual stop switcher which may not put the wind turbine to short-circuit, but must be able to brake the turbine with a resistor.

Troubleshooting

The wind turbine does not start to turn fast when:

- Brake of the charge controller is switched to I
- A short-circuit between the cores was created during connecting the cables
- An additionally installed stop switcher is switched on
- Rotor blades are mounted up-side-down
- Generator rubs against the syphon
- The position for the wind adjustment is too sluggish
- The rotor blades are not well balanced
- No battery is connected to the charge controller
- The locking device to the battery is defect
- There is not enough wind
- The wind turbine or the charge controller is defect

In order to find the mistake, we will have to do a process of elimination. Therefore you should disconnect the three cores of the wind turbine from the charge controller. When the wind turbine starts up, there has to be a mistake between the charge controller and the battery. When the turbine still turns very slowly, the mistake has to be between the charge controller and the wind turbine.

If the wind turbine does not have enough power:

- Wind speed is too low
- Installation location is not chosen well or the tower is not tall enough
- The cable diameter does not fit to the installed cable length
- The battery is too small, so that the charging end voltage is reached to early (the battery should at least have 100 Ah)
- The rotor is not balanced well

The wind turbine vibrates atop the tower:

- The rotor was not balanced well
- The wind turbine is in no vertical position
- The tower capacity has too much play
- The tower is not adequately robust

Before you contact the manufacturer concerning certain mistakes, please measure the following parameters and report them to the manufacturer:

1. How high is the wind speed
2. How high is the tower

3. Details on the installation location and its surrounding
4. Disconnect the three cores of the wind turbine from the charge controller and measure the AC voltage between each phase, from phase 1 to 2, from 2 to 3 and from 3 to phase 1. During constant wind conditions they should be nearly the same.
5. Measure the battery voltage
6. Which devices are connected to the battery
7. Are there any solar panels connected to the charge controller and which power (in Wp) and off-load voltage do these solar panels have.

Checkup and maintenance

You should check up your wind turbine regularly in order to have fun with your turbine for a longer period.

The first checkup should be made on the first day after installation, then after one week and then after three months. After that, you can checkup your turbine in longer intervals.

Near coasts, you should do it every 6th month because of the higher salt content in the air, inside the country you should make a checkup once a year or after heavy storms. The best time to make a checkup is after winter time.

The following points should be made during checkup:

- Look for the vibrations atop the tower
- Check if the tower still is positioned vertically and if all wiring is tight
- Does the wind turbine turn easily into the wind
- Are the rotor blades still balanced well?
- When there is a damage at the blades, the wind turbine has to be stopped immediately. Take care if there are any small clefts or if anything is breaking off the edge of the blade.
- Are all screws still fastened to the generator?
- Look carefully towards the cables, that there is no chafe mark recognizable.

Maintenance of the wind turbine

At car component shops, there is a subsoil protection wax available which is transparent and yellow-colored. Take an old cloth and spray the wax onto it, then clean the turbine. The wax coating protects the wind turbine against weather influences and ultraviolet light. Also clean the rotor blades and the spinner. The smoother a rotor blade is polished the better the wind turbine works. During winter time, snow can hardly adherence on the blades.

Warranty

Ruihua guarantees that this device has no material damages within 12 months after purchase, which could influence the function of the wind turbine. Should there occur any damages during this period, you will have to inform Zhejiang Ruihua immediately. Ruihua will then proof your warranty claim and will repair the device or will send you new spare parts. Precondition for warranty claims is that the product was used appropriately and that the

customer has followed the manual's instructions, that also includes the checkup and maintenance of the product.

Responsibility is excluded for damages which result directly or indirectly from the wind turbine. Damages caused by force majeure like heavy storms, hail, flooding or lightning etc. are also excluded from responsibility of Ruihua .

When the wind turbine or its components have to be rebuilt and decomposed for checkup, repair, change or replacement because of warranty claims, then these costs have to be paid by the customer. Zhejiang Ruihua decides whether a wind turbine has to be repaired or replaced by a new one.

Apart from that the general terms and conditions of Zhejiang Ruihua are valid.

The company
Zhejiang Ruihua Machinery Co.Ltd
Linshan Yuyao
Zhejiang 315460
China

declares in an exclusive responsibility that the wind turbines of the series HF-VWG, black, VWA in 300 up to 3000 Watt and the charge controllers HK W6S for the series VWG2008 and following up to VWG 9008, on which this declaration relates to, are concordant with the following guidelines and norms:

EN 61000-6-1: 2007

EN 61000-6-3: 2007

EN 61000-3-2: 2006

EN 61000-3-3: 2006

The company named above keeps documents for proof of security purpose compliancy.

Ningbo China, the 30/07/2008