# On-Grid control System Manual

**(Designed for On Grid Power System)**

**Please read the manual carefully before operation!**

# INDEX

## 1. Summary

**1.1.** This control system is composed of a separate controller and a separate dump load / diversion load. The two units work together to form a complete wind turbine grid control system. This control system is designed for easy operation with added protection functions.

**1.2.** This control system is used to convert the three phase variable AC power from the wind turbine to the controller and rectified to DC voltage, then connected to the grid-tie inverter.

**1.3.** Controller has built-in double over-voltage protection function: when the wind turbine voltage exceeds the dump load voltage setting value, then the dump load will activate, unloading the extra power to the PWM dump load, in the same time there are rated power output to inverter. (Please notice, the PWM dump load will only unload the extra power.). When the PWM dump load shuts down, the controller will switch to brake resistance and stop the turbine. At the same time there will be no power to transmit to the grid tie inverter. The inverter will not transmit power to the utility power system. This two over-voltage protection to the grid tie inverter avoids a burn-out of the grid tie inverter. Most grid tie inverters do not have this over-voltage function.

**1.4.** This controller can optimize utilized power electronics. When the wind turbine voltage exceeds the dump load voltage setting value, the dump load will only unload the extra power (i.e. higher than the setting power). It doesn't cut off the controller output power to the grid tie inverter. When the PWM dump load is in activation, there is still full current and voltage to the utility power grid.

**1.5.** Anti-Islanding: The brake is engaged to stop the wind turbine when the controller detects the utility power grid failure. When our controller detects the grid power failure the controller will switch to the resistance brake and will wait for Grid Voltage.. This is very important in the whole grid tie system to ensure the safety. If there is no Anti-Isolation protection, it will back feed the grid. Our Anti-Isolation provides double protection.

**1.6.** The dump load is composed of groups of resistors.

**1.7.** The controller has built-in automatic electric brake (the function is completed via brake resistance). The controller also has a manual electric brake which is convenient for installation and maintenance.

**1.8.** The 5KW-20KW units are equipped with a lightening arrestor to prevent lighting strike. We can also include this feature on those wind turbines below the 5KW, as a special order.

**1.9.** LED'S showing DC output voltage.

**1.10.** Prewired.

**1.11.** In order for the controller system to be suitable for different specification grid tie inverter(s), the maximum output voltage of controller can be set per customer requirements.

**1.12.** A manual brake switch is provided.

**1.13.** Controller has a built-in fuse which protects the grid tie inverter from damage due to over voltage.

**1.14.** Controller has a built-in temperature controlling fan.

**1.15.** The controller has LED indicator lights.

## 2. Control system picture (View P1,P2,P3,P4)

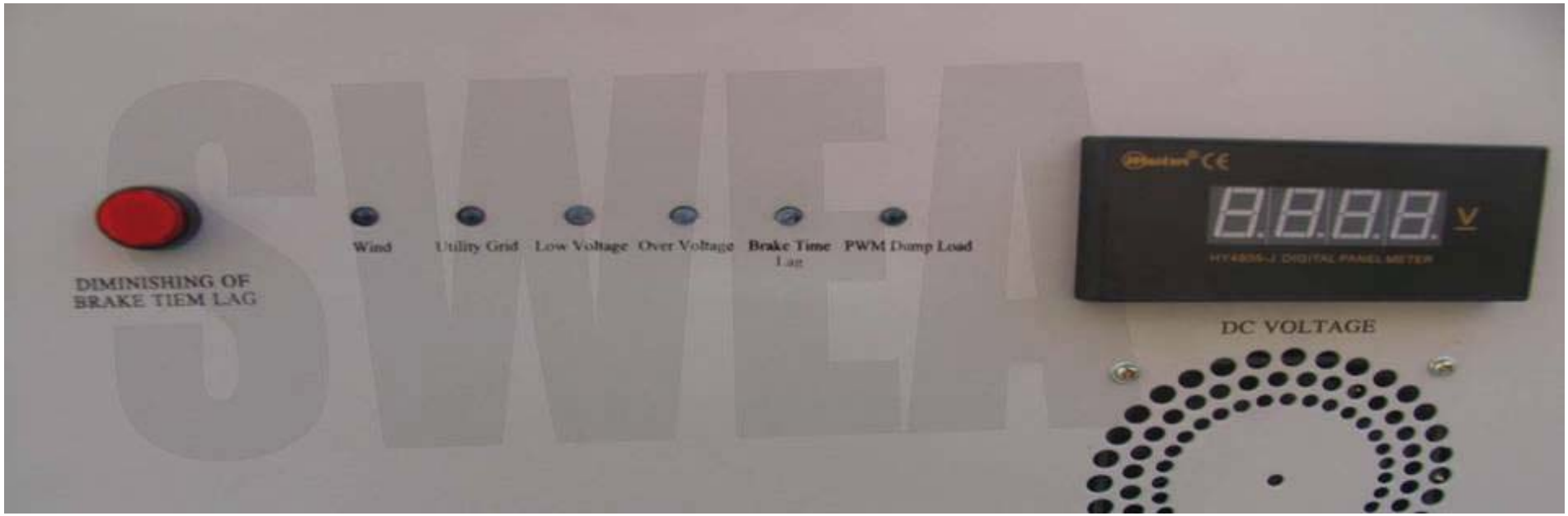
**P1. Control System**

**P2. Inside of control system**


**P3. Controller Panel**

**P4. Dump Load**

## 3.LED Indicator Lights, and Control Button (View P5,P6,P7)




**P5. Front Panel of Controller**

**Wind:** Wind turbine input signal indicator light, Light turns Green when controller is on (when the mill blades are spinning).

**Utility Grid:** Utility power grid input signal indicator light (green when there is grid power being transmitted to controller).

**Low voltage:** Lower-voltage indicator light is off under normal working conditions. It is Yellow when the output voltage is below the low voltage setting value. The low voltage value can be set as per customer requirements.

**Over voltage:** Over-voltage indicator light is off under normal working conditions. It is Yellow when the output voltage is higher than the brake voltage set value .If the indicator light is Yellow, the machine is in brake mode. The value can be set per customer requirement (this value is approximately 30V higher than the value of the maximum output voltage).

**Brake time Lag:** It is off under normal working conditions. The Over-Voltage indicator light will be Yellow when the output voltage is higher than the brake voltage set value. At this time, the Brake Time Lag indicator is also Yellow to show the wind turbine has braked. The controller will break off when the wind turbine brake time exceeds the set brake time.

**PWM Dump load:** PWM dump load indicator light is Off under normal working conditions. It will be Yellow when the output voltage is higher than the maximum output voltage set value. PWM dump load is in operation, but the controller will still power the voltage to grid tie inverter (this voltage is the brake voltage set value). The grid tie inverter can still transmit the power to the utility power grid system. This point is very important as it optimizes the power electronics utilization and not waste wind turbine production power.

**Diminishing of Braked Time Lag:** When the wind turbine has braked and you want to operate the turbine, press the panel button. The controller will remove the brake and the wind turbine will start to operate.(**Caution**: Do not keep pressing the button "Diminishing Of braked Time Lag ", or keeping pressing will make the controller burned.)

**DC Voltage Meter:** Output voltage indicator meter. LED showing output voltage.

**Manual Brake:** Manual electronic brake switch.

**Run:** Wind turbine is in normal operation.

**Stop:** Wind turbine brake applied electronically by manual brake switch.

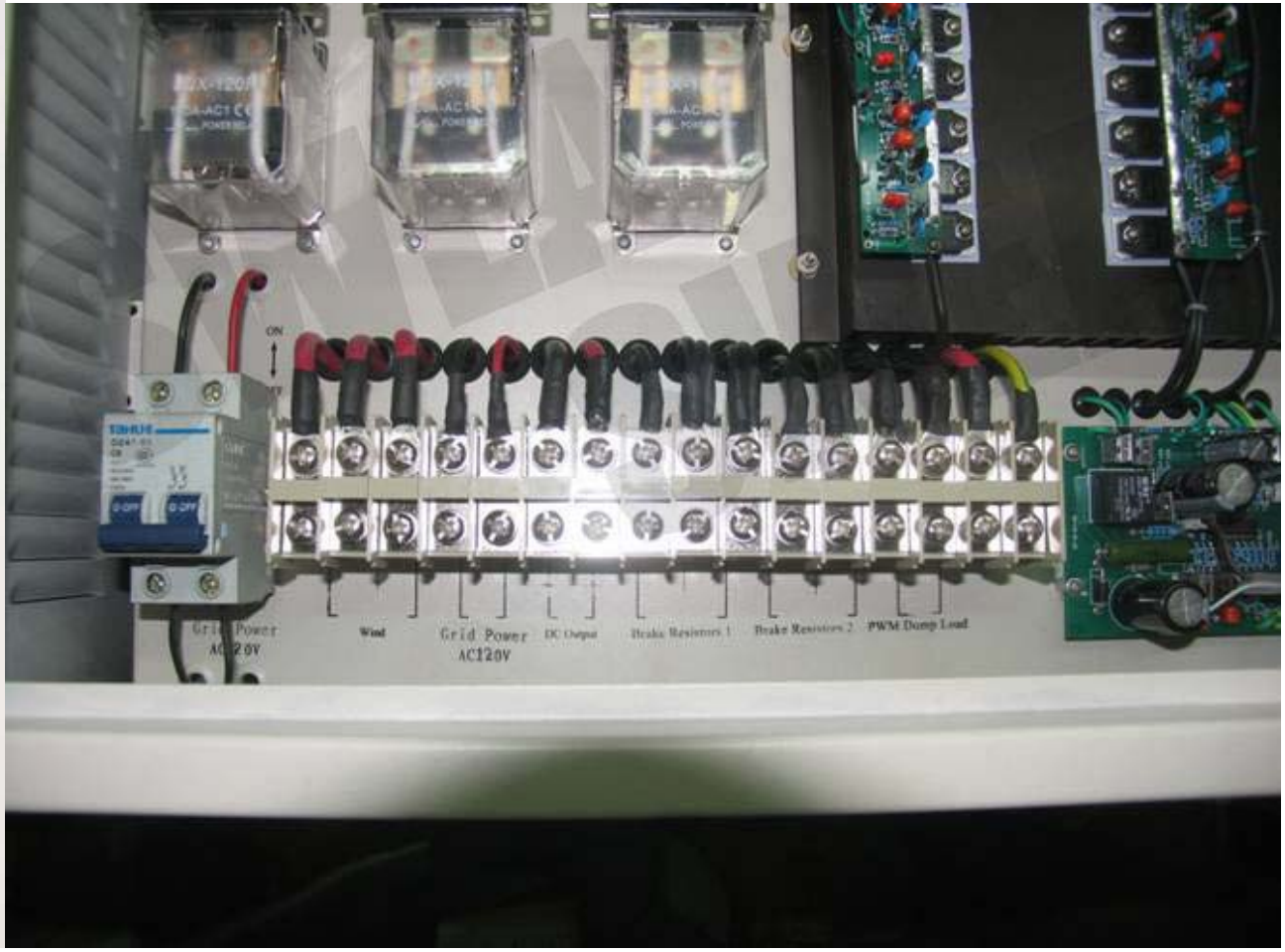
***REMARK:*** **3.1.** There are two ways to turn the brake off:

**3.1.1 Automatically:** The brake can be turned off automatically by the brake time set value.

**3.1.2 Manually:** By pressing the switch manually, the controller will turn off the brake and the wind turbine will return to normal working conditions.

**3.2** When the wind turbine brake has been engaged the DC Voltage Meter is not the controller output voltage value at this time. The DC Voltage Meter will indicate the controller capacitance double end voltage will dissipate to 0 Volts


**P6. Manual Brake On**




**P7. Control Panel Connections**

## 4. Control panel switch and connection terminal description ( View P3)

### 4.1 Grid Power Switch

**ON:** Controller under normal working conditions

**Off:** Controller brake applied ( buy resistance load )

### 4.2 Lightning Arrestor Switch

**ON:** Lightning arrestor under working conditions

**OFF:** Lightning arrestor off

**4.3 Fuse:** Check fuse with OHM meter and replace if necessary with same value.

**4.4 Wind:** Wind turbine 3-phase wires do not have a specific polarity.

**4.5 Grid inverter:** Verify neutral and positive connections to breaker panel.

**4.6 DC output:** Rectified DC from controller. Note polarity in to Grid Inverter.

**4.7 Brake Resistors 1:** Brake Resistors 1'S 3 connection terminal, polarity not applicable.

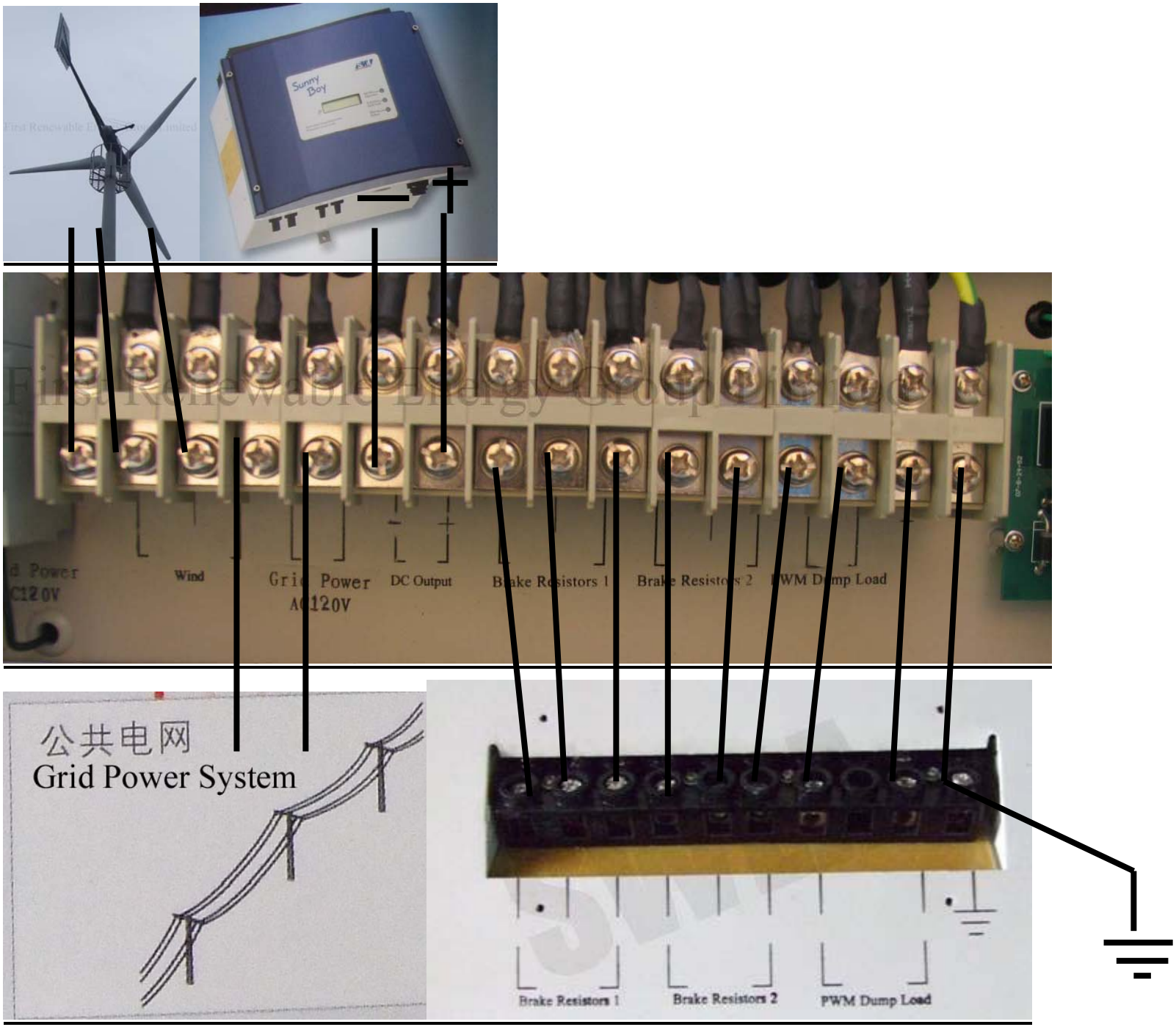
**4.8 Brake Resistors 2:** **B**rake Resistors 2 'S 3 connection terminal, polarity not applicable.

**4.9 PWM dump load:** PWM dump load connectors, polarity not applicable.

**4.10 ⏚:** Separate Copper Ground Stake at least 6' deep to ground controller (do not use neutral in power panel).

***REMARK:*** There is only one set of brake Resistors for wind turbines below the 5KW.

## 5. Wiring terminal(s) diagram （View P8）



***CAUTION:*** **1. Please note positive and negative connections of grid inverter.**

**2. The wind turbine , brake resistors and dump load – polarity not applicable.**

## 6.Product specification

| Model number | C1000G | C2000G | C3000G | C5000G | C10000G | C20000G |
|---|---|---|---|---|---|---|
| Wind turbine rated power(W) | 1000 | 2000 | 3000 | 5000 | 10000 | 20000 |
| Control system function | | Rectify ,control, dump load, brake, over-voltage function, anti-isolation | | | | |
| Dump Load DC voltage (default ) | 110V | 380V | 380V | 380V | 380V | 380V/510V |
| Braked voltage（DC V）(default ) | 160V | 410±5V | 410±5V | 410±5V | 410±5V | 410/570±5V |
| Braked timing（minutes）(default ) | 20 | 20 | 20 | 20 | 20 | 20 |
| Low voltage indication（V）(default ) | ≤30V | ≤200V | ≤200V | ≤200V | ≤200V | ≤200V |
| Fuse (A) | 16A | 16A | 16A | 40A | 80A | 80A |
| Grid voltage | | 220V/50HZ（240V/50HZ，120V/60HZ or other）<br>Make it according to grid power of installation site, please confirm with us when placing the order. | | | | |

***REMARK:***

**6.1.** We can custom make the 4 operating parameters: Dump Load DC voltage, brake voltage, brake time, and low-voltage indicators. Please confirm with us before placing order.

**6.2.** We don't recommend using the 2KW wind turbine as a grid-tie unit because it is not economical.

## 7. Connection sequence:

**Please connect the wires to appropriate terminals:**

**7.1** Connect PWM dump load to controller.

**7.2** Connect brake resistors to controller.

**7.3** Connect grid tie inverter to controller.

**7.4** Connect to utility grid power to controller.

**7.5** Connect wind turbine to controller.

## 8. Connection method:

**8.1.** Place all of the brake resistors switches to "Stop" position;

**8.2.** Turn off grid power breaker switch before connecting wires to controller. Appropriate disconnect recommended.

**8.3.** There are (3) wind turbine output wires. On grid inverter connection DC wires (positive and negative). Brake Resistors-two groups of (3)wires

( units smaller than 5KW- only one group of (3) wires). PWM dump load connection wires and ground wires.

**8.4.** Push in on front door lock and turn handle to open.

**8.5.** Run each wire separately to through- hole of controller bottom.

**8.6.** As per the above drawing and the wiring terminals, connect every group of wires to the proper terminals.

**Caution: 1.)** Please pay attention to positive and negative grid tie inverter connection, otherwise the controller may be severely damaged.

**2.)** Secure all wires.

## 9. Operation procedures:

**9.1.** Check all wiring carefully before putting unit into operation. Turn controller switch to ON position and at the same time, place brake resistor to Run position.

**9.2.** Check the front panel indicator lights.

**9.3.** Place the grid power system switch to OFF position and the brake resistor to Stop position when maintenance work is required.

**9.4.** The wind indicator light will show green and utility grid will also be green when the wind turbine is working normally.

**9.5.** The "Lower Voltage" will be yellow when the wind turbine output voltage is higher than the lower voltage set value. The "Lower Voltage" indicator light is not on when the wind turbine output voltage is lower than the lower voltage set value.

**9.6.** The "Over Voltage" indicator light will be yellow when the wind turbine output voltage is higher than the brake voltage set value. The wind turbine will slow and stop. The "Over Voltage" indicator light is not on when the wind turbine output voltage is lower than the brake voltage.

**9.7.** If Over Voltage indicator light is ON, this means the wind turbine is in braking mode. The brake Time Lag will also be Yellow for a short time. When "brake Time Lag" indicator light time exceeds brake time set value, the controller will automatically turn brake off, and wind turbine will return to normal operation.

**9.8.** When the wind turbine output voltage is higher than the dump load voltage set value, "PWM dump load" indicator light will turn Yellow. PWM dump load will unload the extra power from the wind turbine. When the wind turbine output voltage is lower than maximum output voltage set value, "PWM dump load" indicator light is not ON.

***REMARKS:*** 1. In extremely low wind conditions there will be no power generation and all indicator lights will be off.

2. Caution!! Apply dump load, resistor load, and disconnect all power before doing any maintenance on wind turbine.

## *10. CAUTION:*

**10.1.** Do not open panel door when wind turbine is in operation.

**10.2.** Place grid power system switch to OFF position and the brake resistor to Stop position before changing the fuse, then check the fuse carefully. Change if necessary. Refer to specification table for the fuse specification.

**10.3.** Connect all accessories per drawing.

**10.4.** We have considered all of the possible accidents in the design of wind turbines and taken relevant protective measures, but frequently wrong connection will damage controllers; for example: grid tie inverter polarity connection is reverse.

**10.5.** All of the connection wires must be reliable.
**10.6.** The controller must be grounded.
**10.7.** Forbidden the grid tie inverter input terminal polarity is reversed.
**10.8.** Forbidden locate in flammable and explosive place, it should be out of the reach of children.
**10.9.** Users should take caution when doing repairs in case wind turbine can't be recovered and bring loss to you.

**11. Using environment:**

**11.1.** Place the controller cabinet in a clean, dry, ventilated environment area.
**11.2.** Avoid direct sunshine and damp areas.
**11.3.** Dump load should be place on the ventilation side.
**11.4.** The dump load dissipates heat so it should be placed out of the reach of children.
**11.5.** Do not place around or near flammable or explosive equipment.

**12. Remark Grid Inverter**

**Please refer to the grid tie inverter manual for inverter installation, operation and maintenance.**

**13 . Trouble Shooting analysis and solution.**

| Item | Problem | Problem analysis | Solution |
|---|---|---|---|
| 1 | Wind / No Wind | 1．Blades not spinning | 1：Lack of wind or brake turned on |
| | | | 2：Controller "OFF "position, or braked switch in OFF position |
| | | 2．Generator connection wires are loose | Check connection and look for any corrosion |
| 2 | Utility grid LED'S light's OFF | Grid power switch is Off | Check Panel Breaker or Sub-Panel Fuses |
| | | Major Turbine Problem | Switch off wind turbine manually and grid tie inverter |
| 3 | Problems not covered | Contact Dealer | Stop wind turbine. Take pictures of major damage to controller or turbine and send to Dealer. |