Gaia-Wind
GENERATING BETTER VALUE

# USER MANUAL
## Gaia-Wind 11 kW Turbine



Your own
# Wind Turbine


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# Health and Safety Information

**Ensure that these instructions are read thoroughly and understood. It is essential that they are retained, along with the remainder of the manual, as they contain important safety information that must be adhered to.**

Gaia-Wind Ltd. strongly recommends that all servicing & maintenance procedures other than cursory visual inspection be carried out by adequately trained and experienced personnel. Personnel deemed to be adequately qualified will;

- Be specifically trained to work at heights, ideally with a “BWEA Working at Height Certificate” or equivalent, using peak-less climbing helmet, safety harness with double lanyards and shock absorber, work positioning device, tower rescue kit, high visibility vest and steel toe cap boots.
- Have experienced working on the Gaia-Wind 11kW Turbine
- Ensure that only one person is permitted inside of the working basket at any one time
- Ensure that a proper and comprehensive risk assessment has been carried out prior to starting any work

Further advice to the turbine owner;

- Alterations to the control parameters can only be made by Gaia-Wind or a Gaia-Wind accredited servicing company
- In the event of abnormal noise or unusual operation being observed turn-off the turbine and contact Gaia-Wind or a Gaia-Wind accredited servicing company
- Shut off the turbine should ice accumulate on the blades
- Do not paint the blades or the turbine as this will degrade the coating on the blade surface
- If in doubt on any procedural issues contact Gaia-Wind or a Gaia-Wind accredited servicing company.

# Introduction

# 1. Introduction

## 1.1. Welcome Note

Thank you for choosing to purchase a Gaia-Wind 11 kW Wind Turbine!

Gaia-Wind are delighted that you have decided to install our small-wind turbine. We believe that with 'Your Own Wind Turbine' you will very quickly notice the benefits gained by your home or business. The turbine allows you to substantially reduce your annual energy bills and take sizeable steps towards lowering your carbon-footprint and achieving energy sustainability.

This document has been written specifically with the turbine user in mind. It is therefore strongly recommended that you read this manual carefully, and ensure that it is retained for future reference.

The manual provides a comprehensive overview of the turbine operating procedures and the control system. This will allow you to monitor the turbine whilst it is in operation and determine how much electricity you are generating, and thus how much money you are saving. In addition you can determine the equivalent carbon dioxide savings that you will achieve.

Please take careful note of the health and safety information summarised on the opening page. If you have any additional concerns on the health and safety aspects of the turbine, please contact Gaia-Wind.

We would like to congratulate you once again on your purchase, and hope that you enjoy 'Generating Better Value' with your own Gaia-Wind turbine.

Regards,

Gaia –Wind

Independent Energy – Environmentally Friendly Energy

## 1.2. Introduction to the Turbine

The Gaia-Wind turbine is in the 'small wind turbine category' and has a rated output of 11kW. It produces an energy yield that is practical for supplying electricity to premises such as private houses, farms, offices, small businesses and public buildings where the primary goal is to either reduce the amount of electricity imported or generate specifically for export to the grid.

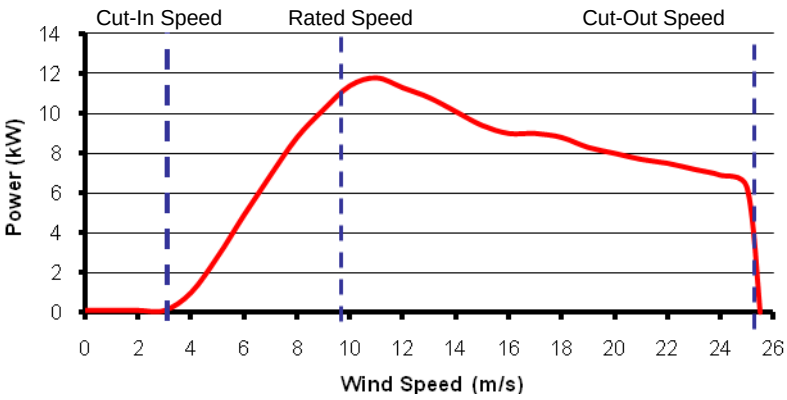
The turbine has been developed according to 'Danish design'; the design basis for most of the large commercial turbines used today. Like its bigger relatives, it has a slow rotation speed which is independent of the wind speed. It also incorporates many of the control and safety features from the large turbines.

The Gaia-Wind turbine is configured to give an optimal yield in moderate wind speed sites i.e. those with an 'annual average wind speed' in the range of 4.5-7.5 m/s. As such it complements the wind conditions found in many rural areas of mainland Britain. Components used in a Gaia-Wind turbine have been carefully selected for their quality, reliability and low maintenance.

The outstanding electricity production in moderate wind speeds, typically 30.000 kWh per year, is due to the large rotor. With a 13 metre rotor diameter the Gaia-Wind 11 kW sweeps an area of 133 square metres which is more than double that of most competing machines.

## 1.3. Turbine Specifications

The power output of a wind turbine varies with the wind speed. This is represented by a turbine power curve. Figure 1.1 below represents the power curve for the 50Hz version of the Gaia-Wind 11kW turbine. This curve provides a good indication of what the electrical power output of the turbine will be over a range of wind speeds.




With its large rotor diameter, an attribute of the Gaia-Wind turbine is high performance in moderate wind speeds.

The key-points of the power curve are outlined in the table below;

| | |
|---|---|
| **Cut-In Speed**<br><br>**3.5 m/s** | The minimum wind speed at which the turbine will deliver useful power. |

| | |
|---|---|
| **Rated Speed**<br><br>**9.5 m/s** | The wind speed at which the rated power, 11kW, is reached. |
| **Cut-Out Speed**<br><br>**25.0 m/s** | The maximum wind speed at which the turbine is permitted to deliver power. The operating range of a turbine is limited due to engineering design and safety constraints. The cut-out speed for the turbine is 25 m/s, although wind speeds this high are rare. |

| **Turbine Specifications** |
|---|
| See Annex 2, "Technical Data" |

## 1.4. Three Level Safety Features

Safety features are a vitally important aspect of any turbine design. The Gaia-Wind turbine has a number of safety features that ensure that rotor speed and power generation are kept under control. There are three distinct levels of protection;

| | |
|---|---|
| **Base Level** | **Passive**<br><br>The design of the blades introduces a gradual stalling effect as wind speeds rise above 9 m/s, which limit power output from the turbines. |

| | |
|---|---|
| **Secondary Level** | **Controller Initiated (Active)**<br><br>At wind speeds above 25 m/s the turbine controller automatically activates the mechanical brake. This stops the turbine running. The brake is automatically released when the wind speed drops below an average of 18 m/s over a period of 10 minutes.<br><br>The mechanical brake is also activated in case of a fault in the electrical grid, excessive vibrations, or over speeding of the rotor or generator. |
| **Tertiary Level** | **Passive**<br><br>In the extremely unlikely event that neither the base nor secondary level safety mechanisms stop the turbine, centripetally activated aerodynamic brakes, concealed in the rotor tip, are released. The effect of this is to spoil the aerodynamic lift of the rotor and hence stop it rotating. |

In addition there is an emergency stop function on the turbine controller. At any time the user can override the turbine control system and stop the turbine. More details can be found in section 6 of this manual.

## 1.5. Low Noise Design

As with all rotating machinery, some noise will be produced. Minimising this effect is a key objective for Gaia-Wind's engineers.

The principal source of noise originates from the turbine blades, and this 'aerodynamic noise' increases exponentially with the rotational speed of the blades. The constant and low rotational speed of the Gaia-Wind turbine makes it among the quietest in its class. In practice the turbine noise is often masked by background noises such as wind or traffic.

The table below provides indicative noise levels at various distances from the base of the turbine. The data is derived from independent measurements on several Gaia-Wind turbines.

| Noise Level | dB (A) | Comparator |
|---|---|---|
| At 30 m | 50 | Conversational Speech<br>Car at 100 m Driving at 40 mph |
| At 60 m | 45 | Living Room |
| Over 100 m | < 40 | Rural Night-Time Background |

## 1.6. Accreditations

The Gaia-Wind 11 kW turbine has received the UK Clear Skies accreditation, accreditation number WT5038. This denotes that the turbine is eligible for all grant schemes for small wind turbines.

The Gaia-Wind 11 kW turbine has the Danish Type Certificate RISØDTU 2009-01.

# Installing your Gaia-Wind Turbine

# 2. Installing Your Gaia-Wind Turbine

## 2.1. Pre-Installation Instructions

Suitable locations for your turbine will have been discussed with a Gaia-Wind representative prior to installation. The final location will take into account the local topography and proximity to obstacles, such as trees and nearby buildings. Also safety issues related to the proximity of roads, overhead lines, or public spaces will have been taken into account.

Prior to the installation of your turbine it is necessary to obtain planning consent from the relevant authorities.

Customers can apply for planning directly or use a consultant to apply on their behalf. In each case Gaia-Wind will provide support.

If any, planning restrictions are most commonly imposed on the basis of anticipated noise emission and visual impact on the landscape.

At the time of signing the contract with Gaia-Wind you will be provided with a list of requirements. Requirements will depend on your degree of direct involvement with the project but could include; digging the foundation hole, contracting a foundation builder, digging a cable trench, providing a three-phase grid-connection with import/export meter, achieving planning consent and ensuring suitable access for a crane and for the delivery lorry. You must fulfil these obligations prior to the agreed installation day. This will be covered in the contract.

## 2.2. The Installation Day

The installation of a Gaia-Wind Turbine must be done either by Gaia-Wind or through a Gaia-Wind accredited installer. Please contact Gaia-Wind if you want to check/verify whether your contact person is an accredited Gaia-Wind installer. The installation of the turbine should normally take only one day. The Installation Team will consist of two engineers, a crane driver and an electrician depending on circumstances. One of the engineers will be introduced as Installation Manager and this person will be in charge of everything that takes place that day. All people on site should follow swiftly the instructions given by this person. All questions and remarks should be directed to the Installation Manager.

**It should be noted that installation is dependent on suitable weather, ground, and wind conditions.**

There are 4 main components to the installation of the turbine;

1. Foundation preparation
2. Electrical installation
3. Mechanical installation
4. Commissioning

It may be more economic for the customer to arrange a contract for foundation works independently. However there are strict requirements and guidelines relating to the foundations that must be considered during construction. The foundation specifications must be obtained from Gaia Wind and followed strictly.

## Step 1 – Foundations

The Gaia-Wind turbine foundation has a footprint of approximately 5 meters square. The foundation is composed of multiple layers of steel reinforcement mesh bound together with braces to form a steel frame that will form the base of the tower. The metalwork is placed inside the excavated hole and levelled, before being filled with concrete.

Foundation preparations are required to be completed a minimum of 10 days in advance of the installation date. This is to ensure adequate curing of the concrete. Also the controller stand will be cast in the concrete during the foundation work. On the installation day the controller will be mounted on this stand.

**Gaia-Wind maintain the right to refuse installation of the turbine on the grounds of safety if it has been determined that the foundation or electrical preparation work is unsatisfactory, or when proper and safe site access has not been provided**

# Step 2 – Delivery and Unloading

The Gaia-Wind turbine is delivered on a single lorry. The delivery will consist of

- Multi part tower; both lattice and tubular towers arrive in several sections to be assembled in-situ
- Ladder and Working Basket
- Turbine blade and hub
- Pre-assembled and tested nacelle
- Pallet of loose items; fasteners and fittings
- Controller

All the above items are carefully offloaded from the truck with a crane by the Installation Team.

## Step 3 – Assembly

The tower sections are assembled.

The nacelle is mounted onto the top section of the tower

Ladder sections and working basket are fixed onto the tower

The rotor assembly is mounted onto the main shaft.

## Step 4 – Raising the Turbine

The turbine is raised by the crane.

Once vertical the tower is securely fixed to the foundation steelwork. The tower will be carefully levelled to ensure it is in an exactly vertical position.

# Step 5 – Commissioning & Starting the Turbine

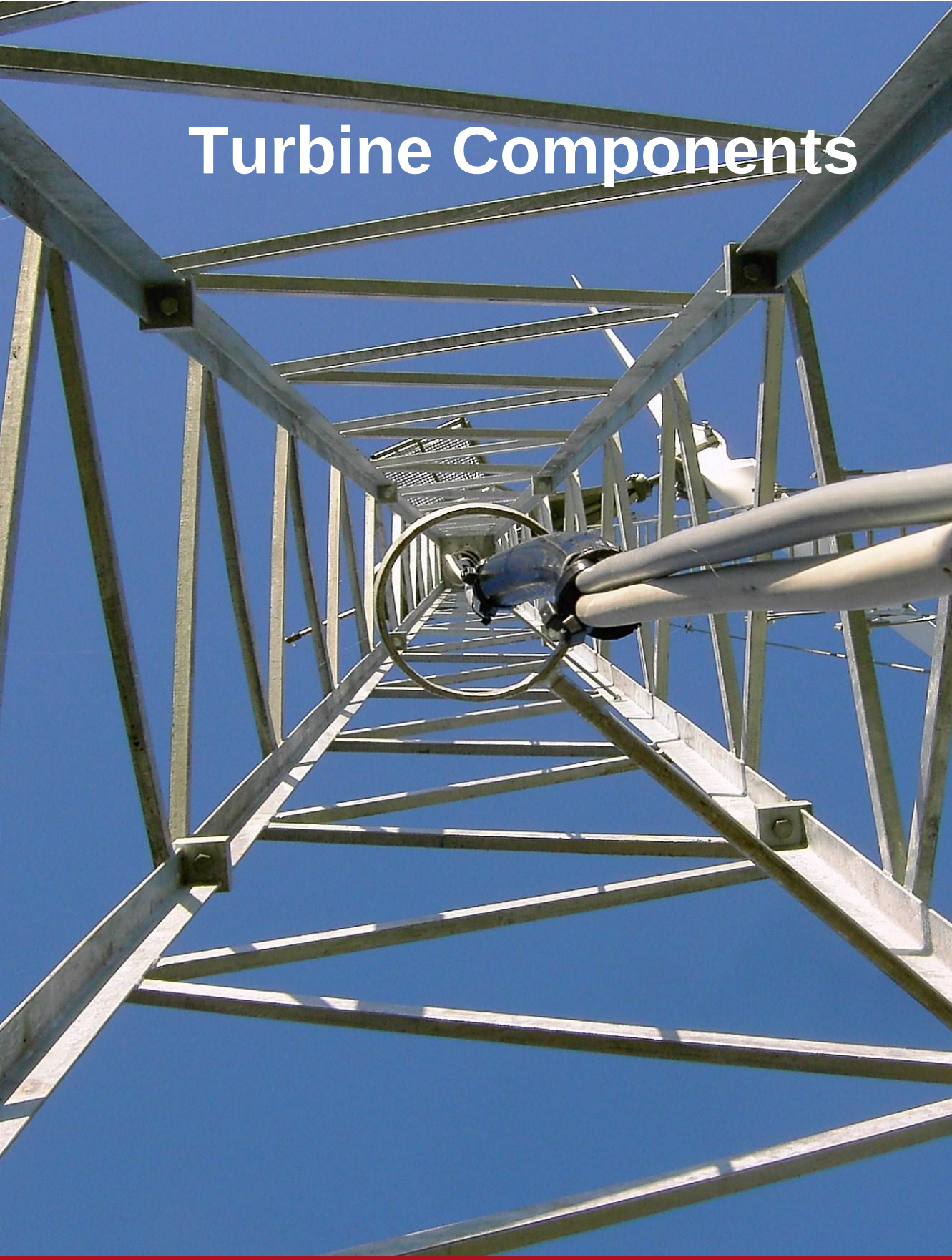
Once fully erected and fastened to the foundation, the turbine commissioning procedure takes place. Upon completion of all commissioning checks the turbine can be started and your turbine will begin to generate your own electricity.

## 2.3. First Days of Operation

During the first days of operation the turbine may be a 'bit stiff' and may require higher wind speeds to start (i.e. 4.5 - 5 m/s to start instead of the normal 3.5 m/s). Typically the brake can 'stick' a bit and also the yaw bearing will initially need more force to turn. After several days running the turbine the stiffness disappears and the turbine will start, yaw and run smoothly.

**During the first days of operation the turbine will need higher winds to start. This 'stiffness' disappears after several full days of running.**

# Turbine Components



# 3. Turbine Components

## 3.1. Complete Turbine

The diagram below shows the Gaia-Wind 11kW Turbine, indicating the location of the principal components. Please note that although the diagram shows a lattice tower, the drawing is consistent for the tubular tower.

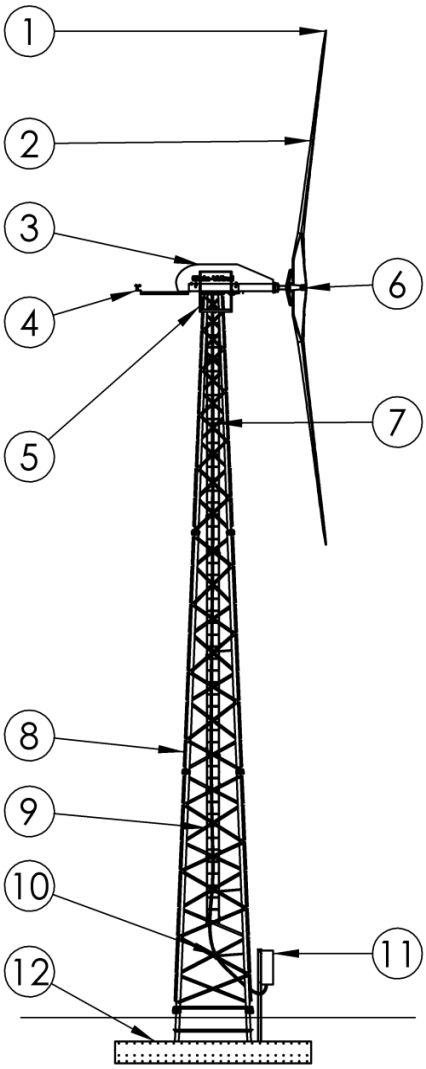



**Figure 3.1: Main Components**

1. Blade Tip
2. Rotor Blade
3. Nacelle
4. Anemometer
5. Working Basket
6. Hub Fork
7. Cable Guide
8. Tower (Lattice)
9. Ladder
10. Cable Twist Sensor
11. Controller
12. Foundation

## 3.2. Nacelle

The nacelle of the turbine refers to the housing that contains all of the drive train and machinery necessary for the conversion of the incoming wind to electrical energy. The principle components included within the nacelle are the main bearing, shaft, gearbox, brake, sensor equipment, and the generator. All these components are protected underneath the Nacelle cover. Figure 3.1 shows schematically the location of these components within the nacelle.

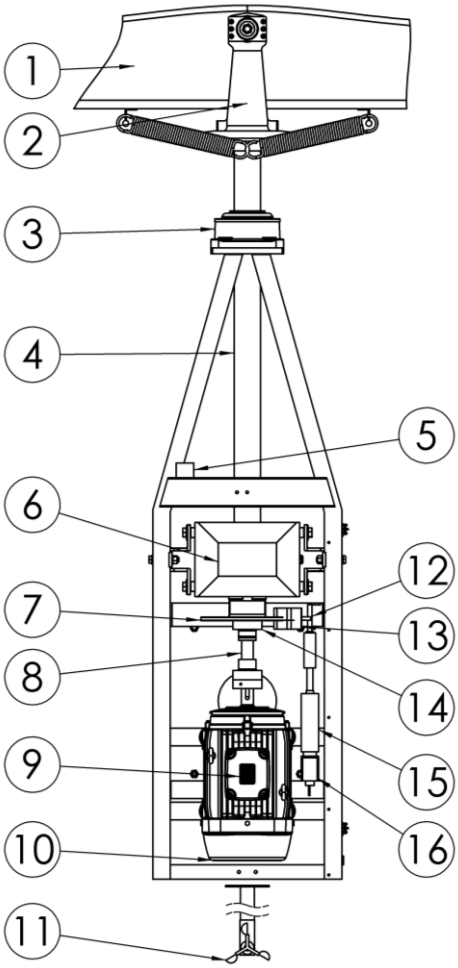



**Figure 3.2: Nacelle Components**

1. Rotor Blade
2. Hub fork
3. Main Bearing
4. Main shaft
5. Vibration Sensor
6. Gearbox
7. Brake Disc
8. Flexible Coupling
9. Generator
10. Generator RPM Sensor
11. Anemometer
12. Brake Sensor
13. Mechanical Brake
14. Rotor RPM Sensor
15. Retaining Magnet
16. Spindle motor

## 3.3. Generator

The Gaia-wind turbine uses a 3-phase 11 kW induction generator. This generator is renowned for its robustness and reliability, and is particularly well suited for utility grid connection.

## 3.4. Braking System

The brake is the active part of the turbine protection system. The Gaia-Wind turbine employs two independent braking procedures.

### 3.4.1. Mechanical Brake

The mechanical brake is located along the turbine drive-train, on the high speed shaft, just where it emerges from the gearbox. This brake operates in a similar manner to that of a disc brake on a car - a caliper pushes brake pads onto a steel disc that rotates with the turbine shaft. The main elements of this system; the caliper, brake disc, and retaining magnet, can be seen in figures 3.2 (above), and 3.3 (right). The brake operation is 'fail safe' if the electricity is disconnected, a spring will engage the brake and stop the turbine.

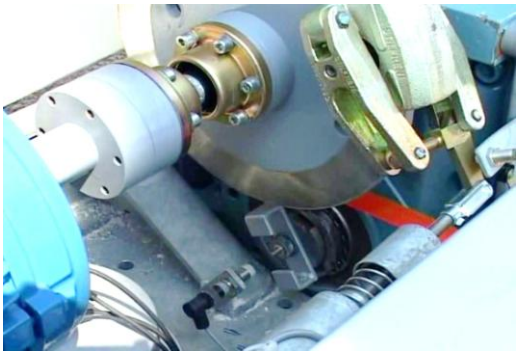


**Figure 3.3: Gaia-Wind Mechanical Brake**

The turbine's automatic controller has accurately set time limits for braking procedures and in all normal situations the mechanical brake

will stop the turbine quickly. However under extreme circumstances, it is possible that the turbine fails to stop which may occur for example in the event of excessive wear on the pads. If this event should occur the turbine tip brakes will perform the braking of the turbine, see section below.



### 3.4.2. Tip-Brakes

In the event that the mechanical brake should fail to stop the turbine within sufficient time, the tip-brakes will deploy. These are centripetally activated aerodynamic brakes, concealed in the blades. In this instance the blade tips rotate through 90 degrees, spoiling the rotor's aerodynamic properties, and subsequently causing the rotor to stop.

**Figure 3.4: Deployed Tip-Brake**

In the unlikely event that the tip brakes deploy, you should contact Gaia-Wind or your accredited Gaia-Wind

**Figure 3.5: Re-setting Tip-Brakes**

installer in order to arrange for the tip brake to be safely reset. Since this involves climbing the tower and working at height using special equipment this task should be undertaken only by personnel with the appropriate training and safety equipment.

**Contact Gaia-Wind or your accredited Gaia-Wind installer in order to arrange for the tip brake to be safely reset. DO NOT attempt to perform this task yourself as it requires specialist training and equipment.**

## 3.5. Anemometer

An anemometer is located on the upwind side of the nacelle. The purpose of this device is to measure the wind speed at the turbine hub-height. The wind speed measurements recorded by the anemometer are used by the controller to monitor and control the turbine, mainly during start-up and shut down.

**Figure 3.6: Anemometer**

## 3.6. Tower

There are two tower types available for the Gaia-Wind 11 kW Turbine - traditional lattice and tubular.

The traditional lattice tower is composed of welded galvanised steel profiles and is mounted on 4 legs that are embedded in the concrete foundation. The principal advantage of this design is less material, and hence reduced cost.

The tower can also be supplied as a tubular structure. This tower is conically shaped, increasing in diameter towards the base. This increases structural integrity and makes an elegant presentation.

**Figure 3.7: Turbine Towers, Lattice (Left) and Tubular (Right)**

Aside from the issue of cost, the main difference between the two tower types is aesthetics. Both the tubular and lattice tower are designed to cause minimal visual intrusion on the landscape. The sleek tubular tower compliments modern structures, and when viewed at a distance, the open structure of the lattice tower causes the outline to fade.

## 3.7. Rotor Blades

The rotor blades are constructed of the composite material GRP (Glass Fibre Reinforced Polyester). There are many advantages for the use of GRP for this purpose, principally a good strength to weight ratio and resistance to degradation from environmental factors.

# Controller and Operating Panel

# 4. Controller and Operating Panel

To immediately stop the turbine press the red button on the left hand side of the cabinet (See Section 6.3).

## 4.1. Introduction

This section gives a brief overview of the Gaia-Wind 11 kW Wind turbine controller and operating panel. The controller is essential for ensuring the efficient and safe operation of the turbine. All procedures are controlled automatically based upon signals from various sensors throughout the turbine. User intervention is only required when errors have occurred.

To open the controller cabinet use the supplied key; inserting into the 2 keyholes at the top and bottom of the left hand side of the cabinet door. Push in firmly and turn clock-wise to release the latch on each. The door should then easily swing open. Be careful to hold the door to prevent the wind catching it.

**Figure 4.1: Controller Cabinet**

- **DO NOT open the control cabinet door in wet conditions**
- **There are no user serviceable parts inside the cabinet**
- **Customers should only touch operating panel keypad (see Section 4.2)**
- **DO NOT place any metal objects in or near cabinet**
- **If you see any sign of water in the cabinet, isolate the controller and do not operate. Contact Gaia-Wind or your accredited Gaia-Wind installer.**

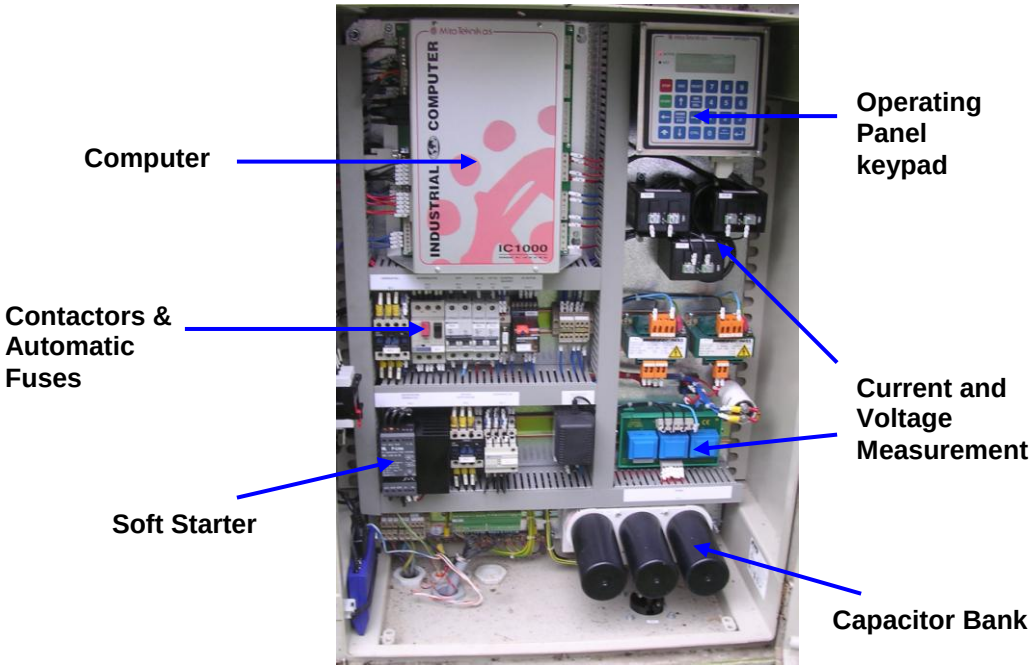



**Figure 4.1: Turbine Controller Cabinet**

All of the turbine's necessary electrical switchgear, fuses, contactors and connectors are housed in a weatherproof unit located at the foot of the tower. The interior of the controller cabinet can be seen in figure 4.1.

The controller also allows for the monitoring of the turbine performance. Instantaneous and time averaged readings relating to energy production, wind speed, and power output can be accessed through the operating panel. Daily energy production is archived by the controller for one month back. The total monthly production is stored for a period of 12 months, and total yearly production is archived for 20 years.

The controller will produce an error message should a fault be detected in the normal running of the turbine. Details of the error will appear on the operating panel. The most common errors and the recommended actions are detailed in section 5.

## 4.2. Operating Panel

The IC-1000 operating panel includes a screen and keypad. The keys are activated by pressing down on the relevant symbol. A successful Keypad entry is signalled by the illumination of the LED labelled 'Key', accompanied by an electronic beep. Figure 4.2 displays the operating panel.

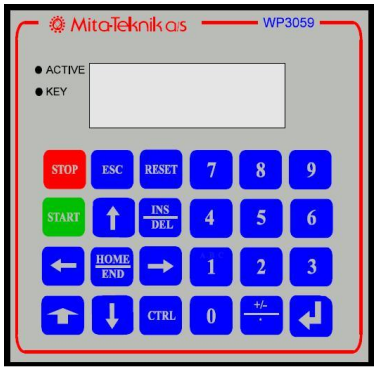
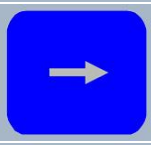
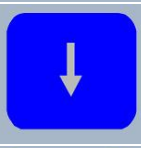



**Figure 4.2: The Gaia-Wind Operating Panel**

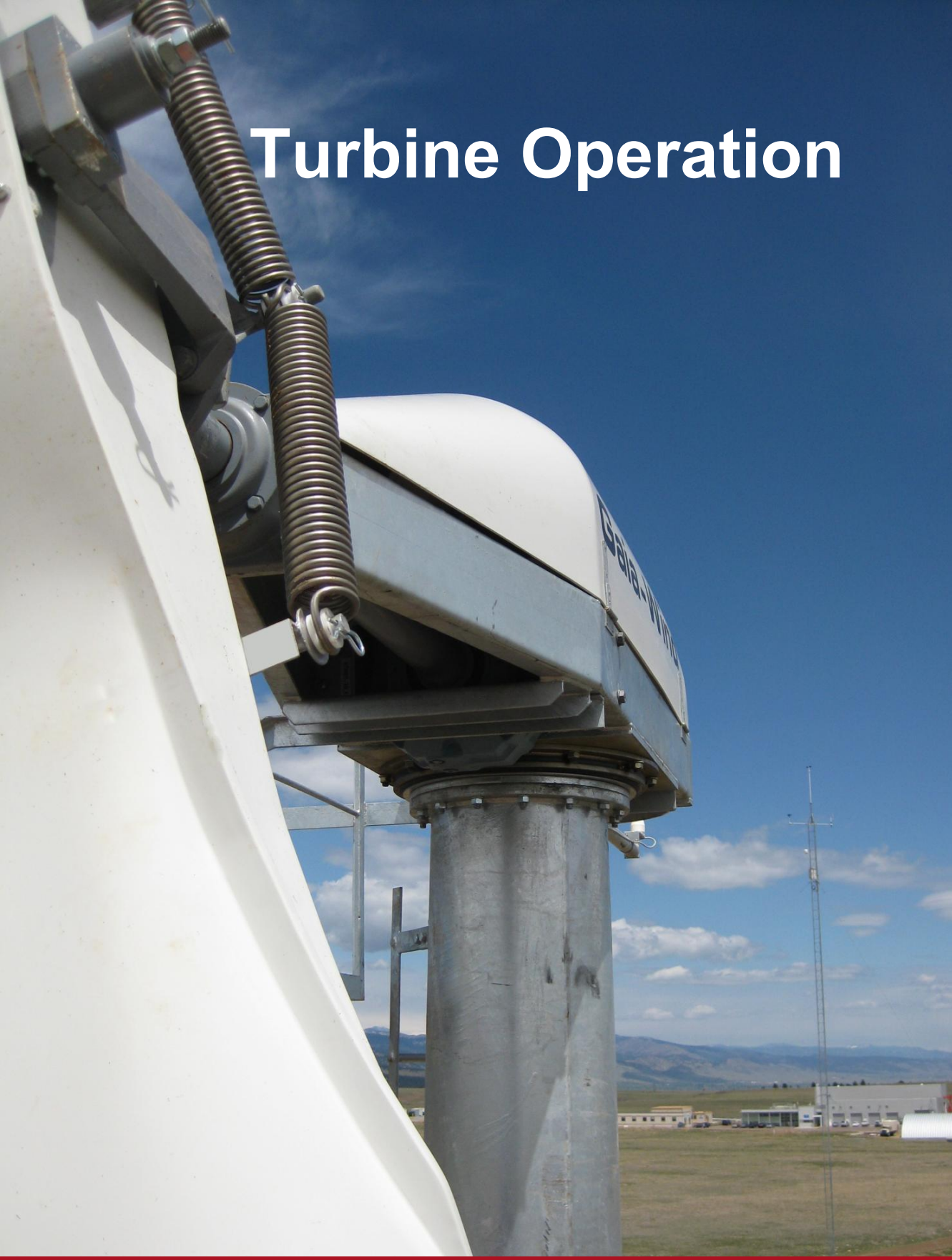
The operating panel has 8 main menus corresponding to different aspects of turbine control. Submenus exist within each of these menus. Navigation between all menus is achieved using the keypad.

The information below details the primary operating panel entry functions.

| Keypad | Function |
|---|---|
|   | Stop the turbine |
|   | Release the brake and start the turbine |
|  | Move cursor line up |
|  | Navigate to next menu |
|  | Navigate to previous menu |
|  | Move cursor line down |
|   | Reset, erase error status |
|   | Shift to last menu line |
|   | Leave a submenu |

| | |
|---|---|
|   | Leave all submenus |
|  | Enter |

# Turbine Operation



# 5. Turbine Operation

## 5.1. Introduction

This section will explain how to navigate the menus of the operating panel and monitor the data relating to the performance of the turbine. This is achieved using the operating panel functions outlined in section 4.2.

**The Start Menu (Section 5.2) is the only menu which can be viewed without gaining access. Accessing any other menu requires "Access Rights", see Section 5.2.2**

## 5.2. Start Menu

### 5.2.1. Overview

The most convenient menu is the start menu. This menu shows real time and time-averaged information and displays the current status of the turbine. The status will show whether there is an error with the turbine, or whether it is running free of errors, see Figure 5.1 (below).

Note that the backlight of the screen illuminates when any key is pressed making the screen easier to read, especially in low light or at night. The backlight will switch off when the keypad has not been pressed for a short period.

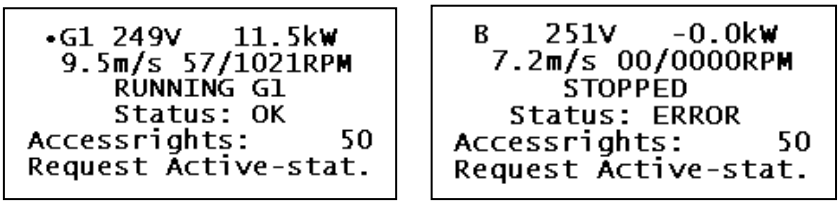



**Figure 5.1: Start Menu – Running (Left), Braked (Right)**

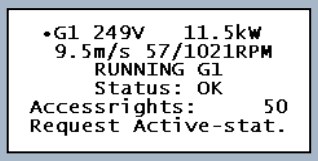
| **First Line** | |
|---|---|
| **B** | The brake is engaged |
| **G1** | Indicates that the generator is 'cut-in' (connected to the grid. |
| **249 V** | Grid voltage (average per phase) |
| **11.5 kW** | Average power output over 30 seconds |
| **Second Line** | |
| **9.5 m/s** | Average wind speed over 30 seconds |
| **57/1021 rpm** | Rotor/Generator speeds |
| **Third Line** | |
| The third line indicates the most recent event registered by the turbine. In the example above this is the cut-in of the generator (left) and stopping of the turbine (right) | |

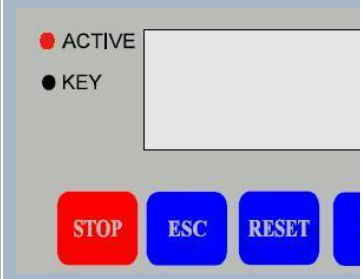
| Fourth Line |
| --- |
| This shows the status of the turbine. The display in figure 5.1 (left) indicates that the system is OK, i.e. there are no errors in the turbine.<br><br>Alternative status messages that may appear in this line include, “Error”, and “Warning”, see figure 5.1 (right). Further information regarding errors is included in section 5.3 of this document. |
| **Fifth & Sixth Lines** |
| The fifth and sixth lines indicate the level of access rights and active status request. Access rights and active status must be attained in order to use the operating panel. Normal Users will have access level 50.<br>If access rights and active status are not obtained, only the start menu will be visible and navigation to other menus prohibited. See the section 5.2.2 on access rights and active status for further details. |

### 5.2.2. Access Rights and Active Status

The Start Menu displays the lines, ‘Access Rights’, and ‘Request Active Status’. Permission to use the operating panel can only be acquired if the access rights and active status are obtained. The following steps should be followed in order to attain access rights and active status.

| Acquiring Access Rights & Active Status | | |
|---|---|---|
| **Step 1** | Ensure that the operating panel is displaying the Start Menu. |  |
| **Step 2** | Scroll down to the menu until the cursor line indicates “Access Rights”<br><br>The cursor is indicated by an underscore.<br><br>Press enter on the keypad. |  **Scroll down**<br>  <br>  **Enter** |

| | | |
|---|---|---|
| **Step 3** | The screen display will change to that on the right. Enter the default user code: **123**, using the numbers on the operating panel, and confirm by pressing enter.<br><br>The display will return to the start menu, with Accessrights 50. |  <br>  **Enter**<br><br>  |
| **Step 4** | Navigate the start menu down until the cursor indicates, “Request active-stat”<br><br>Press enter on the keypad |  **Scroll down**<br><br>  **Enter** |
| **Step 5** | Enter the user ID: **1** and Confirm by pressing enter on the keypad<br><br>The screen will revert back to the start menu with both access rights and active status. |  **Enter**<br><br>  |

| | | |
|---|---|---|
| **Step 6** | Ensure that the LED labelled ‘Active’ on the top right hand side of the keypad is illuminated. This confirms that active status has been granted. |  |

**It is important that prior to leaving the turbine, that the access rights and active status are disabled. Therefore the following procedure should be followed upon completion of using the controller.**

| Releasing Active Status & Access Rights | | |
|---|---|---|
| **Step 1** | Ensure that the operating panel display shows the Start Menu. | •G1 249V 11.5kW<br>9.5m/s 57/1021RPM<br>RUNNING G1<br>Status: OK<br>Accessrights: 50<br>Release Active-stat. |
| **Step 2** | Navigate the start menu down until the cursor indicates, “Release active-stat”<br>Press enter on the keypad<br><br>The display remains on the start menu, with active status released | •G1 249V 11.5kW<br>9.5m/s 57/1021RPM<br>RUNNING G1<br>Status: OK<br>Accessrights: 50<br>Release Active-stat.<br><br>  **Enter**<br><br>•G1 249V 11.5kW<br>9.5m/s 57/1021RPM<br>RUNNING G1<br>Status: OK<br>Accessrights: 50<br>Request Active-stat. |
| **Step 3** | Navigate the start menu to the line “Access Rights”.<br><br>Press enter on the keypad **two times**. | •G1 249V 11.5kW<br>9.5m/s 57/1021RPM<br>RUNNING G1<br>Status: OK<br>Accessrights: 50<br>Request Active-stat.<br><br>  **Enter** |
| **Step 4** | The display will revert to the original start menu. You are now logged out of the turbine. | •G1 249V 11.5kW<br>9.5m/s 57/1021RPM<br>RUNNING G1<br>Status: OK<br>Accessrights: 0<br>Request Active-stat. |

## 5.3. Error menu

### 5.3.1. Overview

The turbine is equipped with numerous sensors. These sensors continuously monitor the turbine and the information they record is used by the controller.

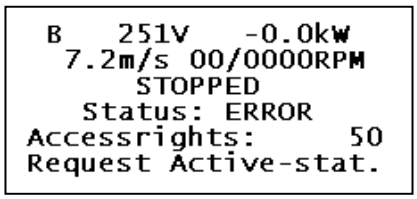



**Figure 5.2: Start Menu Indicating Errors**

When the sensors detect an error, the controller will automatically stop the turbine. Confirmation of the error is indicated on the start menu under status, see figure 5.2. By accessing the error menu the source of the error can be obtained, see section 5.3.2.

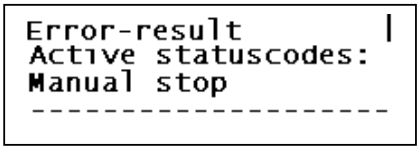



**Figure 5.3: Error Menu**

The error menu on the operating panel contains the following menu lines,

**First Line**

Error Result: Press enter on this line to access the Error Results Menu

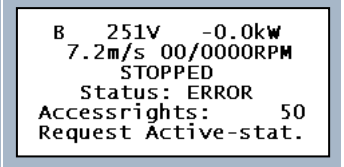
**Second Line**

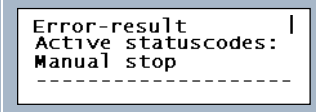
This line gives all active status codes

| Third Line |
|---|

Displays the most recently activated error. N.B. the error in figure 5.3 indicates that the turbine has been manually stopped. This is one example of an error message. An overview of errors is detailed in **Annex 3.**

### 5.3.2. Accessing the Error Menu

| Accessing the Error Menu | | |
|---|---|---|
| **Step 1** | Ensure that the Start Menu is displayed on the operating panel.<br><br>If you have not done so, obtain Access Rights and Active Status before continuing. See Section 5.2 for details. |  |
| **Step 2** | Scroll down the menu line until the cursor is on the fourth line “Status: Error”.<br><br>Press enter on the operating panel. |  **Scroll down**<br><br>  **Enter** |

| | | |
|---|---|---|
| **Step 3** | The error menu is displayed on the operating panel screen. It shows all active status codes. |  |
| **Step 4** | Scroll onto the error and press enter to gain more information on the error. This will detail the date and time at which the error occurred. | |
| **Step 5** | Revert back to the start menu by pressing escape. |  **Escape** |

### 5.3.3. Error Types

A Status Code is an error code which becomes active when a particular error occurs or if the controller detects that a certain parameter has been exceeded. For example, if the grid voltage is too high, if there is a loss of mains supply or if the rotor or generator speeds are excessive. For each status code a set of parameters determines the consequences of the code activation/ error which can include stopping the turbine, re-setting the error after a delay etc. Each status code will be dealt with depending on its assigned re-set level.

To obtain information about a given status code, place the cursor at the code and press ENTER.

There are three error re-set levels; Auto, Manual and Remote, classified as follows;

### Auto (A)

The active status code is automatically reset by the controller of the turbine when the conditions for resetting are present, in other words when the original reason for its activation has stabilised and is no longer present. Alternatively, the status code may be reset manually or by remote control by users with a password level higher than that indicated in the status code.

### Manual (M)

The active status code can be reset by the user via the operating panel by users with a password level equal to or higher than the one indicated in the status code.

### Remote (R)

The status code may be reset manually or by remote control only by users with a password level higher than that indicated in the status code

The table in Annex 3 gives a full list of potential error messages. Each error is accompanied by a short description and indentified as Auto, Manual or Remote reset and also given a re-set delay and required password level to be able to re-set. Instructions on how to manually reset errors are detailed in section 5.3.4 below.

**Although it is possible to manually reset many of the errors in Annex 3, please read and adhere to the instructions for each error. This is essential for ensuring the continued performance of your turbine.**

### 5.3.4. Resetting of Errors

The turbine will only operate when no error signals are detected. Therefore errors must be reset to resume turbine operation. The method for resetting errors is dependent on the type of error. The following procedure should be followed to reset manual errors.

| Resetting Error Menu | | |
|---|---|---|
| **Step 1** | Ensure that the Start Menu is displayed on the operating panel.<br><br>If you have not done so, obtain Access Rights and Active Status. See Section 5.2 for details. |  |
| **Step 2** | Scroll down to the menu line until the cursor is on the fourth line “Status”. Press enter on the keypad. |  **Scroll down**<br>  **Enter** |
| **Step 3** | The screen displays the recent active errors. N.B. if no information can be seen then there are no active errors.<br><br>Navigate through the error list using the cursor arrows. |  **Scroll down**<br>  **Scroll up** |

**If any errors re-appear after resetting, exercise caution before resetting the turbine again. If the error persists then please contact Gaia-Wind.**

| | | |
|---|---|---|
| **Step 4** | In the error menu press the 'reset' button on the keypad. The error messages will be erased. If the messages are not erased, then the error has not been corrected. |  Reset |
| **Step 5** | Press the escape button to return to the main menu. |  **Escape** |
| **Step 6** | The turbine will start automatically within 60 seconds subject to sufficient wind. Alternatively, the turbine can be started immediately by pressing the start button. |  **Start** |
| **Step 7** | Release access rights and active status if finished operating the turbine. | **See section 5.2.2** |

## 5.4. Status Menu

### 5.4.1. Overview

The status menu provides a useful tool for viewing data relating to a range of performance characteristics, such as production data. The data can be reviewed over a range of time-frames, including daily, monthly, and yearly.

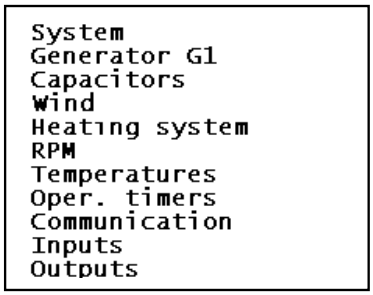
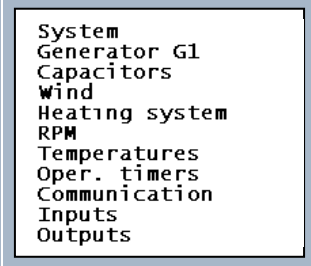



**Figure 5.4: Status Menu**

The submenus of the status menu are shown in figure 5.4. The submenus are accessed by pressing enter on the keypad when the cursor is on the relevant menu line.

| **Accessing the Status Menu** | | |
|---|---|---|
| **Step 1** | Ensure that the Start Menu is displayed on the keypad.<br><br>If you have not done so, obtain Access Rights and Active Status before continuing. See section 5.2.2 for details | •G1 249V 11.5kW<br>9.5m/s 57/1021RPM<br>RUNNING G1<br>Status: OK<br>Accessrights: 50<br>Release Active-stat. |

| | | |
|---|---|---|
| **Step 2** | Toggle through the menus using the cursor directions buttons until the heading displays ‘Status’. |  **Toggle Left**<br>  **Toggle Right** |
| **Step 3** | The Status menu is displayed on the keypad screen.<br><br>Revert back to the start menu by toggling left or right. |  |

### 5.4.2. System Submenus

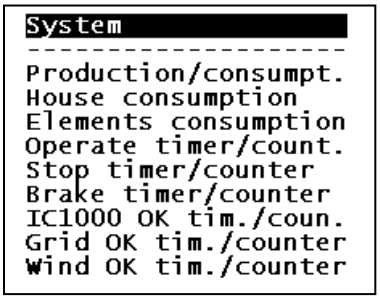


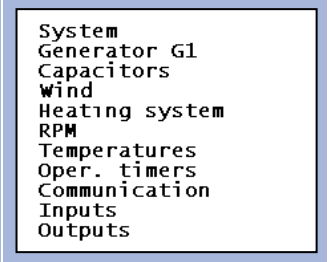
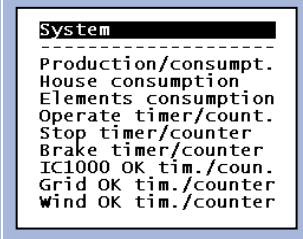

**Figure 5.5: System Submenu**

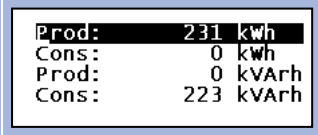
To access the system submenu press enter on the first line of the Status menu “System”. The result will generate the display shown in figure 5.5 (left).

The information below describes the data contained in each of the menu lines.

| System Submenu Lines | |
|---|---|
| **Production and Consumption** | Production of the turbine. The total kilowatt hours produced by the turbine will be counted and recorded. Pressing enter once again on this line enables data to be viewed from the previous month, 12 months, and 20 years. |
| **Operation timer / counter** | Counts the number of hours of production from the turbine. |
| **Stop timer / counter** | Counts the hours and times the turbine has been stopped. |
| **Brake timer / counter** | Counts the hours and times that the turbine brake has been activated. |
| **IC-1000 OK timer / counter** | Counts the hours and times that the IC-1000 control unit has been switched on. |
| **Grid OK timer / counter** | This counts the hours and times that the grid has been OK |

### 5.4.3. System Production

| Accessing System Production | | |
|---|---|---|
| **Step 1** | Ensure that the Status Menu is displayed on the keypad screen, see section 5.4.1.<br><br>Press enter on the Menu Line 'System'.<br><br>The system submenu will appear on the screen. |  <br>  **Enter**<br>  |
| **Step 2** | Navigate to the submenu line, 'prod./consump.', and press enter. |  **Scroll Down**<br>  **Enter** |
| **Step 3** | The display should give a selection of time frames over which to view data.<br><br>Scroll to the desired time frame and press enter. |  |

| | | |
|---|---|---|
| **Step 4** | The final screen shows the production data. The important information here is the top line, the energy produced by the turbine. |  |
| **Step 5** | To return to the previous menu press escape.<br><br>To return to the Status menu, hold control and escape. |  Return to Submenu<br>  Return to Status Menu |

### 5.4.4. Wind Submenu

This menu provides a more comprehensive indication of the wind speeds on site. This includes the instantaneous (unaveraged) and the winds speed averaged over both the last 30 seconds and 10 minutes.

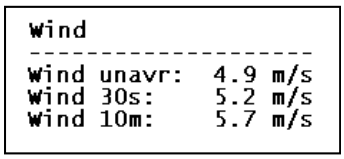



**Figure 5.7: System Menu**

Access this menu by pressing enter on the keypad in the menu line ‘Wind’.

### 5.4.5. RPM Submenu

This menu simply displays the current speed, revolutions per minute of the turbine rotor and of the generator. Access this menu by pressing enter on the keypad in the menu line ‘RPM’.

# Operating Procedures

# 6. Operating Procedures

## 6.1. Auto-Start

Auto-start refers to the process by which the turbine starts automatically when the control measures a pre-defined wind speed of at least 3.5 metres per second for 30 seconds. This is the 'cut-in' speed, and is the point at which the turbine will start to generate electricity. Through a 'soft-starter' the controller uses the generator as a motor to bring the rotor up to the operating speed.

Auto-start enables maximum exploitation of lower wind speeds and hence greatest electrical energy production.

## 6.2. Automatic Shutdown

### 6.2.1. Max Wind

The turbine will shutdown automatically when the wind speed registered by the anemometer is too high. This is important to protect components such as the rotor and drive train from excessive stress.

The controller automatically shuts-down the turbine in the following conditions;

- An average wind speed over a period of 10 minutes is 20 m/s or over
- The wind speed exceeds 25 m/s

### 6.2.2. Rotor Over-Speed

Rotor over-speed is when the rotor speed is greater than the rated speed. For the Gaia-Wind turbine the rated rotor speed is nominally 56 rpm but can vary between 55 and 57rpm.

There are two defining conditions of rotor over-speed;

- At 10% above the rated rotor speed (62 RPM) the mechanical brake is activated
- At 15% above the rated rotor speed (65 RPM) the aerodynamic tip-brakes are activated

Following shutdown due to rotor overspeed the tip brakes may need to be reset. You should contact Gaia-Wind or a Gaia-Wind accredited servicing company.

Generator overspeed is when the generator rpm sensor detects speed greater than 1116 rpm.

### 6.2.3. Generator Over-Charge

The turbine brake is activated if the recorded power output of the generator is large. This is referred to as 'over-charge' and is necessary to protect the generator from damage. The conditions are;

- An average power output of 15 kW averaged over a 10 minute period
- The generator power exceeds 18 kW

### 6.2.4. Minimum Power

If the turbine power output is less than 0.1kW over a period of one minute the generator will ‘cut-out’, i.e. it will stop producing. Under these circumstances the rotor will continue to rotate without producing electrical energy, ‘freewheeling’. This will continue until favourable conditions for generation are resumed.

### 6.2.5. Vibrations

A vibration sensor is situated inside the nacelle. If the sensor records excessive vibrations, the controller will engage the brake to stop the turbine. Excessive vibrations are displayed as an error message on the operating panel.

### 6.2.6. Cable Twist

The turbine extracts the maximum energy possible from the wind by automatically seeking its direction. This is known as free yaw. A consequence of this free yaw design is that the cables that extend down the tower can twist in either direction. The turbine is equipped with a cable-twist sensor and the controller will stop the turbine if cable-twist becomes excessive. The cables must be untwisted manually and this should be done by an accredited service engineer.

**Figure 6.1: Cable-Twist Arm and Sensor**

## 6.3. Emergency and Manual Stop

The information above details the conditions by which the turbine will stop automatically. However in the interest of safety the turbine can be stopped immediately by pressing the emergency stop button on the exterior of the controller, figure 6.3. When the emergency stop button is pressed it will physically lock in the stopped position. The button should be released by giving it a slight counter-clockwise rotation and the button will pop out.

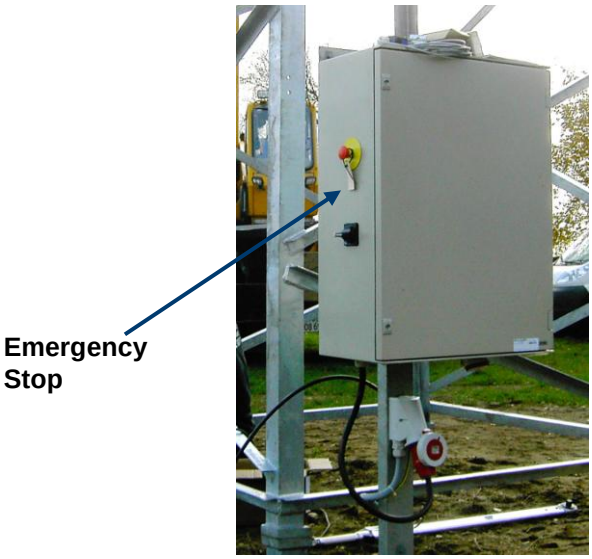



**Figure 6.3: Emergency Stop Button**

Manually stopping the turbine is achieved by pressing the Stop button on the operating panel.


**Figure 6.2: Stop Button**

Subsequent to pressing the Stop button, a 'manual stop' error message will appear on the operating panel display. This error must be reset to restart the turbine, see resetting errors in section 5.3.4.

Please note that it is not necessary to gain active status to stop the turbine this way. Immediately upon pressing stop the mechanical break is activated and the rotor speed will decrease until stationary.

## 6.4. Braking Procedure

The results of a completed braking procedure are a stationary rotor and generator.

The brake pads are designated as ‘wearing parts’. Over time the pads will require replacement. In the event of excessive wear on the brake pads an error will be registered by the turbine controller.

After the brake brings the turbine to a stop the controller will automatically attempt to align the turbine blades horizontally. This is known as ‘blade-parking’, and ensures that the blades are placed in the optimal position for avoiding uneven wind loading on the rotor, Figure 6.4.

**Figure 6.4: Parked Rotor Blades**

# Servicing and Maintenance

# 7. Servicing and Maintenance

## 7.1. User Maintenance

### 7.1.1. Resetting Errors

As detailed previously, when the turbine sensors detect an error, the controller will automatically stop the turbine. Information relating to the error will be displayed in the operating panel display.

Potential error messages are catalogued in the Annex 3. Each error is categorised under auto, manual or remote reset and includes explicit instructions for the appropriate actions that should be performed in each case, see section 5.3.3 for details.

### 7.1.2. Visual Inspections

It is advisable to perform brief periodic inspections of the turbine, in particular following severe winds. This should consist of a visual check for loose bolts and connectors, visual inspection of the whole turbine and listening for any unusual noises or vibrations.

Should such an inspection identify any potential faults with your turbine then contact Gaia-Wind or a Gaia-Wind representative immediately.

## 7.2. Servicing intervals

The information below details the servicing requirements for the Gaia-Wind 11 kW turbine. All servicing activities must be performed by a Gaia-Wind accredited service engineer.

### 7.2.1. Three Month Service

A full inspection must be performed three months after the installation of the turbine. The turbine operation and control system will be checked. Additionally all bolt connections are tightened and the levelling of the tower will be inspected.

### 7.2.2. Annual Service

It is necessary that a full inspection of the turbine is performed at least once a year. This annual check-up must be performed by an accredited service engineer.

This check-up will commonly involve tightening of bolts, replenishment of lubricants and oil, and visual checks for any excessive wear or damage to the turbine.

During the annual service the performance of the turbine will be checked and any error messages will be evaluated. This information and a record of the required work and use of consumables and replacement parts during the service will be issued to the customer.

## 7.3. Replacement Parts

The Gaia-Wind 11 kW turbine is designed to have a minimum lifetime of 20 years. However, some of the parts will require replacement during this time period. These components are known as wearing parts, and include the rubber mountings for the gearbox and for the generator, hub bushings, and brake pads. The wearing parts will be checked during servicing according to the instructions in the servicing manual.

Scheduled gearbox oil changes will be made every 3 – 5 years.

# 8. Frequently Asked Questions

| | |
|---|---|
| Does the turbine have lightning protection? | The turbine tower is connected to a dedicated earth electrode. This acts to protect the turbine in the event of a direct lightning strike. |
| What should I do if ice forms on the turbine blades? | The turbine should be manually turned off to prevent potential injury from flying ice. See section 6.3 on manually stopping the turbine. |
| Why is my turbine not generating any electricity despite good wind conditions? | The turbine has been switched off<br><br>There is an error in the turbine, refer to section 5.3 of this manual,<br><br>The wind speed is too high, and the turbine has shut-down for safety reasons. |
| Is it necessary that a turbine inspection is undertaken after subjection to severe wind conditions (over 25 m/s)? | The turbine should not be damaged by such an event. Even so, a brief inspection of the exterior is encouraged, (See section 7.1) |

| | |
|---|---|
| Why is it that I cannot use the control menus in order to observe my turbine performance? | Active status has not been granted, see Section 5.2 for instructions,<br><br>The necessary level of access rights has not been attained, see Section 5.2 for details<br><br>Somebody with higher access rights has active status of the turbine, possibly remotely through a modem |

# Index

# Annex 1 – Glossary of Terms

| | |
|---|---|
| **Anemometer** | The anemometer is a device used for measuring the instantaneous wind speed. |
| **Bearing** | In the wind turbine the function of the bearing is to allow the shaft to rotate freely. |
| **Cut-In Speed** | This is the wind speed at which the turbine will start to deliver electrical power. Cut-in will occur when the speed of the generator achieves its synchronous speed. |
| **Cut–Out Speed** | The maximum wind speed at which the turbine is permitted to deliver power. The operating range of a turbine is limited due to engineering design and safety constraints. The cut-out speed for the turbine is 25 m/s, although wind speeds this high are rare. |
| **Distribution Network** | This is the low and medium voltage (under 33 kV) that typically connects into homes and businesses. |
| **Distribution Network Operator** | The companies which operate the Distribution Network in the UK. |
| **Downwind** | This refers to a wind turbine in which the hub and blades point away from the wind direction. The opposite of an upwind turbine. |

| | |
|---|---|
| **Freewheeling** | The wind turbine is said to 'freewheel' when it is not connected to a load but continues to rotate. |
| **Gearbox** | A mechanical system used to match the slow rotational speed of the rotor to the high rotational speed of the generator. |
| **Horizontal Axis Wind Turbine** | This is a standard in wind turbine design. The shaft is parallel to the ground and the rotor area is perpendicular to the ground. |
| **Hub** | The centre of the rotor of the wind turbine. The purpose of the hub is to hold the blades in place and attached to the turbine shaft. |
| **Induction Motor** | An AC motor in which the rotating part has no windings and brushes on it. |
| **Kilowatt Hour (kWh)** | The kilo-watt-hour is the standard unit for measuring electric energy in the UK. 1 kWh is equivalent to the energy consumed by a 1 kW device operating for 1 hour. Note that this is equivalent to a 3 kW device operating for 20 minutes |
| **Leading Edge** | The edge of the blade that faces towards the direction of rotation |

| | |
|---|---|
| **Nacelle** | Housing that contains all of the components necessary for the conversion of wind energy to electrical energy. The important components include the bearings, shafts, gear box, brake, and generator |
| **Rotor** | The name given to the assembly of the blade and hub in a wind turbine. |
| **RPM** | Revolutions Per Minute. This is the number of times a shaft completes one full revolution during one minute. |
| **Main Shaft** | The purpose of the main shaft is to transfer the power from the rotor to the gearbox. |
| **Start-Up** | This is the wind speed at which the turbine rotor will commence rotating. This does not mean that the turbine will produce any electrical output; which will occur at the Cut-In speed. |
| **Tip** | The end of a turbine blade furthest away from the hub. |
| **Torque** | The measure of turning force. |
| **Tower** | The structure that supports the rotor and nacelle. |

| | |
|---|---|
| **Wind Turbine** | A device that transfers the kinetic energy from the wind to an electrical power output, |
| **Yawing** | Yawing is the rotation of the nacelle around the tower. |

# Annex 2 – Technical Data

| General | |
|---|---|
| **Type** | Gaia-Wind 11kW |
| **Hub Height** | 18.3 m |
| **Yaw System** | Free Yaw |
| **Cut-In Wind Speed** | 3.5 m/s |
| **Rated Wind Speed** | 9.5 m/s |
| **Cut-out Wind Speed** | 25 m/s |
| **Rated Power** | 11 kW |
| **Nacelle Weight** | 900 kg |
| **Operating Temperature** | -20 → 50 deg C |

| Rotor | |
|---|---|
| **Diameter** | 13.0 m |
| **Blade Material** | Glass Fibre Reinforced Polyester (GRP) |
| **Nominal Speed** | 56 rpm |
| **Weight** | 200 kg |
| **Power Regulation** | Stall Regulated |
| **Air Brake** | Tip brakes, centripetal activation |

| Generator | |
|---|---|
| Type | 3-phase induction generator, 400 V, 50Hz, Marine Grade |
| Nominal Power | 11 kW |
| Weight | 138 kg |

| Gear | |
|---|---|
| Transmission Ratio | 1 : 18 |
| Lubrication | Centrifugal |
| Weight | 143 kg |

| Mechanical Brake | |
|---|---|
| System | Calliper Brake Disc |
| Location | High-Speed Shaft |

| Tower | |
|---|---|
| Height | 18.0 m |
| Weight | Lattice - 1600 kg<br>Tubular Tower - 2200 kg |

# Annex 3 – Error Message Status Codes

*Error Reset Types; **A** denotes Auto, **M** denotes Manual & **R** denotes Remote*

| Status Code | Error Message | Description | Error Reset Type | Required password level | Reset Delay | Instructions |
|---|---|---|---|---|---|---|
| 0 | System OK | No errors. Turbine operational | A | 50 | 0s | No Action required |
| 5 | Vibration | Vibrations detected within the nacelle | M | 50 | 0s | Contact Gaia-Wind or your turbine servicing company |
| 7 | Turbine is Serviced | Turbine is in service mode | M | 80 | 0s | Contact Gaia-Wind or your turbine servicing company |
| 11 | Stop via communication | Stop command received via modem or direct link. | R | 50 | 0s | Contact Gaia-Wind or your turbine servicing company |
| 13 | Manual Stop | The turbine has been stopped manually via the STOP button on the turbine operating panel | M | 50 | 0s | Reset error and restart turbine |
| 18 | Emergency stop | Emergency stop button has been activated | M | 50 | 0s | First check for good reason for Emergency Stop activation. Once satisfied, release emergency stop and reset. |
| 23 | Repeating error | An error code has been recorded too many times | M | 50 | 0s | Contact Gaia-wind or your turbine servicing company |
| 29 | New Program | The program firmware has been updated | M | 50 | 0s | Contact Gaia-wind or your turbine servicing company |
| 38 | Alarm Call Test | Alarm call test in the Service Menu is set to ON. | R | 50 | 0s | Contact Gaia-wind or your turbine servicing company |
| 39 | Division by zero | Parameter error value | M | 50 | 0s | Contact Gaia-wind or your turbine servicing company |
| 40 | Parameter Crash | Parameter crash due to flat battery. Battery must be replaced and all parameters set to default values | M | 50 | 0s | Contact Gaia-wind or your turbine servicing company |
| 42 | Internal Battery Low | Battery needs replaced | M | 50 | 0s | Contact Gaia-wind or your turbine servicing company |
| 45 | Main ctrl. Supply | There has been a power failure in the mains supply and the turbine controller has reboot. | A | 50 | 10s | Error will be reset automatically when mains supply is detected after a delay of 3 minutes. |
| 51 | DSP Watchdog | DSP processor is rebooting | A | 50 | 0s | No Action required |

| Status Code | Error Message | Description | Error Type | 50 | | Instructions |
|---|---|---|---|---|---|---|
| 53 | Main ctrl. Watchdog | The main controller is rebooting | A | 50 | 10s | No Action required |
| 55 | Main ctrl. Man. Reboot | The controller has been reset manually by the user. | A | 50 | 10s | No Action required |
| 99 | Parkmaster stop | The park control has sent a command to stop the turbine. The status code is reset when the park control sends a start command | R | 50 | 0s | No Action required |
| 100 | Repeated grid error | Errors relating to the voltage and frequency of the mains supply have been occurring too often | M | 50 | 0s | Contact Gaia-Wind or your turbine servicing company |
| 102 | Phase drop | No voltage in one or more phases | A | 50 | 3m | Error will be reset when the voltage is detected |
| 103 | Vector surge | The phase angle has changed by more than 3°. | A | 50 | 10s | Automatic reset when phase angle is smaller than 3°. |
| 110 | Voltage high | The grid voltage has exceeded the maximum limit. | A | 50 | 3m | The error will be reset when the grid voltage is OK. |
| 111 | Voltage low | The grid voltage has dropped below the minimum limit. | A | 50 | 3m | The error will be reset when the grid voltage is OK. |
| 120 | Frequency high | The grid frequency has exceeded the maximum limit. | A | 50 | 3m | The error will be reset when the grid frequency is OK. |
| 121 | Frequency low | The grid frequency has dropped below the minimum limit | A | 50 | 3m | The error will be reset when the grid frequency is OK. |
| 130 | L1-L2-L3 120° | The phase angle between the L1, L2, and L3, is larger than 6° | A | 50 | 10s | The error will be reset when the phase angles are OK |
| 138 | Grid Param. Warning | Internal Calculations | M | 50 | 0s | Contact Gaia-Wind or your turbine servicing company |
| 139 | Grid Param Stop | Internal Calculations | M | 50 | 0s | Contact Gaia-Wind or your turbine servicing company |
| 227 | Anemometer defect | Anemometer recording wind speed below 2 m/s, with turbine output power over 1 kW. | A | 50 | 1m | The error will be reset automatically when the wind speed recorded over 30 seconds averages the start wind speed (3 m/s). |
| 240 | Awaiting Wind | The wind sped is too low and freewheeling is disabled | M | 50 | 0s | No Action required |

| Status Code | Error Message | Description | Error Type | 50 | | Instructions |
|---|---|---|---|---|---|---|
| 250 | Wind > max | The recorded wind speed averages 20 m/s over a 10 minute period **or** the wind speed is higher than 25 m/s. | A | 50 | *600s | The error will be automatically reset when the wind speed is below an average of 18 m/s over a 10 minutes period. |
| 300 | (G) tacho defect | The generator speed is below 100 RPM, when the rotor speed is above 8 RPM | M | 50 | 0s | Reset error. If error persists, then contact Gaia-wind or your turbine servicing company. |
| 302 | (R) tacho defect | Rotor speed is below 2 RPM while the generator speed is greater then 600 RPM. | M | 50 | 0s | Reset error. If error persists, then contact Gaia-wind or your turbine servicing company. |
| 311 | Rotor overspeed | The rotor speed exceeds the maximum rotor speed (62 RPM). | M | 50 | 0s | Contact Gaia-Wind or your turbine servicing company |
| 312 | (G) overspeed | The generator speed exceeds the maximum generator speed. | M | 50 | 0s | Contact Gaia-Wind or your turbine servicing company |
| 314 | Free wheeling oversp | The rotor speed exceeds the maximum rotor speed (62 RPM) before the generator has 'cut-in'. Most commonly the result of a large gust of wind. | M | 50 | 0s | Reset error. If error persists, then contact Gaia-wind or your turbine servicing company. |
| 415 | Brake pads worn | Warning that the brake pads are worn out and should be replaced. | M | 50 | 0s | Contact Gaia-Wind or your turbine servicing company |
| 416 | Replace brake pads | The brake pads worn error has occurred four times. | M | 50 | 0s | Contact Gaia-Wind or your turbine servicing company |
| 421 | Brake not released | The brake has not released | M | 50 | 0s | Reset error. If error persists, then contact Gaia-wind or your turbine servicing company. |
| 434 | B200 brake time>max | The turbine braking procedure took longer than 10 seconds. | M | 50 | 0s | Contact Gaia-Wind or your local servicing company |
| 501 | Power consumption | The turbine consumes more than limit of 5 kW of power | M | 50 | 0s | Reset error. If error persists, then contact Gaia-wind or your turbine servicing company |
| 521 | (G) hot | The generator temperature is too high | A | 50 | 1h | Reset when generator temperature<br><br>decreases |

| Status Code | Error Message | Description | Error Type | 50 | | Instructions |
|---|---|---|---|---|---|---|
| 530 | (G) power too high | Production from the generator exceeds a value of 15 kW, averaged over a period of 10 minutes. | A | 50 | 10m | The error will be automatically reset when the wind speed is below an average of 18 m/s over a 10 minutes period. |
| 537 | (G) peak power | Production from the generator exceeds the peak value of 18 kW. | A | 50 | 10m | The error will be automatically reset when the wind speed is below an average of 18 m/s over a 10 minutes period. |
| 601 | Current asymmetry | The power from one phase deviates by more than 25% compared with the other phases. | M | 50 | 0s | Contact Gaia-Wind or your turbine servicing company |
| 607 | Auto. motorstart | The turbine motor start has been activated more than 20 times. | M | 50 | 30s | Reset error. If error persists, then contact Gaia-wind or your turbine servicing company. |
| 609 | Thyrister Block hot | Thyristor block temperature > *Set stat. 609 xx°C | A | 50 | 0s | Automatic reset when thyristor block temperature < Clr stat. 609 °C |
| 651 | Cut in 0>G1 | Cut in time of G1 via WP4060 increases *0>G1 xxS (30 sec.). | A | 50 | 30s | No Action required |
| 662 | WP4060 error | Cut in error. The status code is not tested when output 524 (G1 contactor) is low, or when output 525 (generator bypass) is high. | A | 50 | 10s | Automatic reset when the turbine is not moving (rpm = 0). |
| 722 | Cable twisted | The cable twist sensor has been activated. | M | 50 | 0s | Contact Gaia-Wind or your servicing company |
| 1311 | Coupling (G) gearbox | Ratio between the RPM of the generator and rotor does not match the gear ratio (+/- 2) | M | 50 | 0s | Reset error. If error persists, then contact Gaia-wind or your turbine servicing company. |
| 1544 | PT100 defective | A connection to one of the PT100 sensors is defect. | A | 50 | 0s | Contact Gaia-Wind or your servicing company |

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GENERATING BETTER VALUE

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