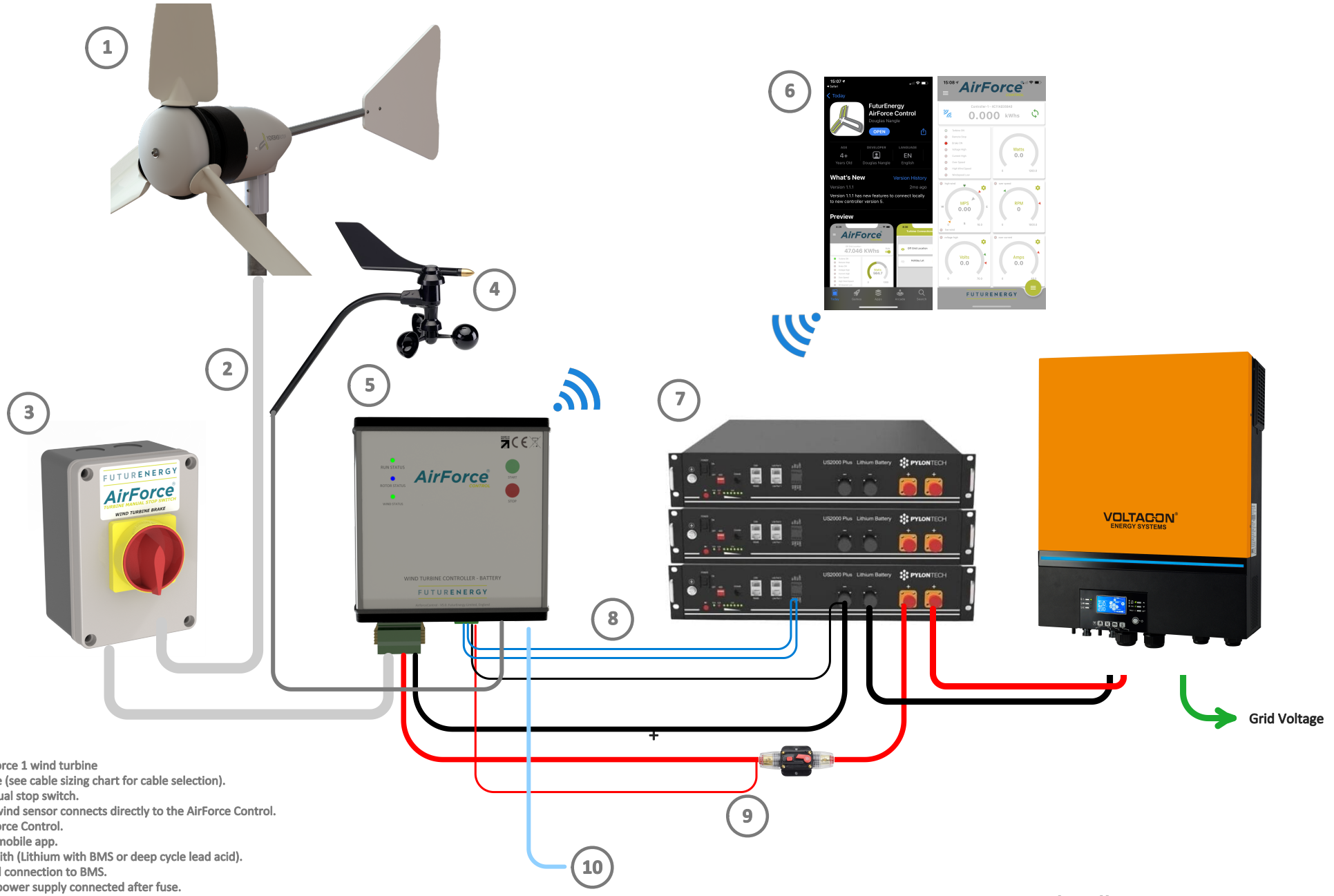
VOLTACON®
ENERGY SYSTEMS
Airforce Control (v5) Installation And Operating Instructions



1. FuturEnergy AirForce 1 wind turbine
2. Three phase cable (see cable sizing chart for cable selection).
3. FuturEnergy manual stop switch.
4. Tower mounted wind sensor connects directly to the AirForce Control.
5. FuturEnergy AirForce Control.
6. AirForce Control mobile app.
7. Battery storage with (Lithium with BMS or deep cycle lead acid).
8. 'No-Charge' signal connection to BMS.
9. AirForce Control power supply connected after fuse.
10. Ethernet cable connection.
11. Inverter, either grid connected or off-grid system.

Typical Full System Arrangement

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1 Positioning and mounting

The controller should be mounted indoors, it is not designed for unprotected outdoor use. Position the controller close to the battery equipment so that the DC power lines from the controller are short (a few meters or less). A wall bracket is supplied for mounting the controller to a wall. The bracket has a marked area and available screw for connecting the controller to protective earth. Earthing the controller is mandatory for safety as the controller case and mounting bracket are metal (the casing is neither connected to positive or negative circuits internally). Earthing the controller case will also improve the function of the controller if interference from other electrical equipment is causing issues such as turbine rotor speed measurement when the turbine is not running. The controller is sensitive and is capable of measuring 50hz mains frequency (as a rotor speed) if interference is present.

2 Cable Selection

Cable section for the whole turbine system is very important. Insufficiently sized cable will result in loss of energy / voltage drop over the cable. Excessive voltage drop will also result in the turbine operating at a higher rotation speed and a loss of efficiency and power generated. A cable sizing chart is available for the cable section but for example a 100m cable run from the turbine using 6mm² will result in a 9.5% loss of energy. A better cable selection in this instance would be 16mm² which would have losses at around 3.5% (based on a 48v system). When large cables are to be used it may become difficult to connect such cables to the controller or other turbine components - it is acceptable to reduce the cable size immediately before the connection using suitable terminals / junction box to a size such as 6 or 10mm². The important point is that the bulk of the cable run is done using the substantial cable.

3 DC Fuse

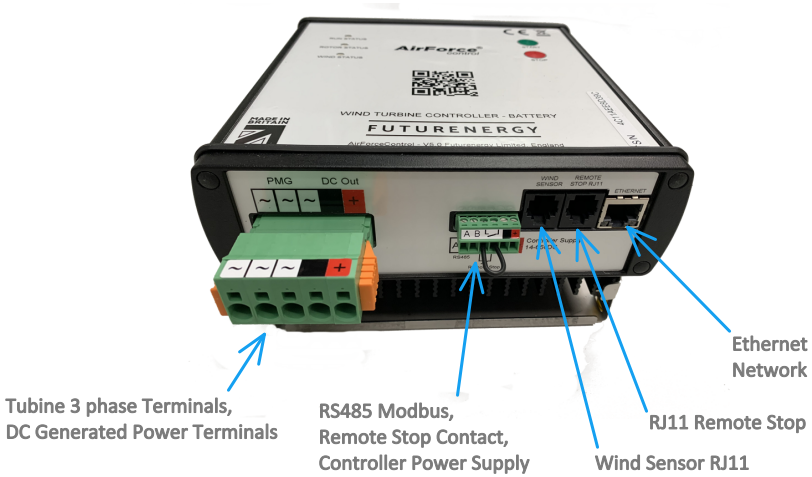
A fuse should be placed on the positive DC line from the controller to battery. The size of this fuse should be 50amps, it will protect the battery from a short circuit caused by cable damage. The controller power supply should be connected after the fuse (on the side of the controller, not directly to the battery). It is important that if the fuse should fail then the controller power supply is also cut-off. The controller will apply the brake to the turbine when power is lost.

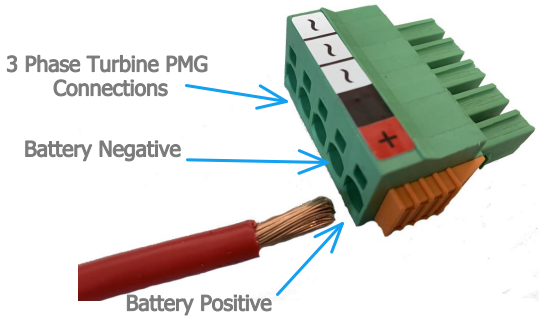
4 Generated Power Connector

Be very careful that the positive and negative battery cables are in the correct connector position - reverse polarity will cause severe damage.

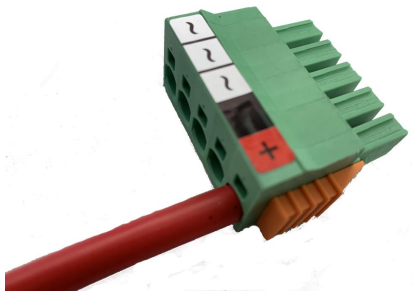
The main generated power connector on the controller is capable of accepting 6 and 10mm² cable (10mm² is recommended for local short cable runs to the main 3 phase cable and battery terminals). No tools are required to fit a cable into the main power connector. Strip 15mm of cable insulator and push the cable into the connector. The connector has spring loaded terminals inside - once the cable has been inserted no copper conductor should be visible. Test the connection by pulling on the cable - it should not be possible to pull the cable out. The images below show 10mm² cable installation. Inserting cables into the connector should be done with the connector not inserted into the controller socket. Be very careful that the positive and negative battery cables are in the correct connector position - reverse polarity will cause severe damage.

To remove a cable from the connector a small flat screwdriver is required. Insert and push the tool into the connector opening above the cable entry. Pushing the tool in will open the spring connector and allow the cable to be pulled from the connector. Remove the plug from the controller before removing cables so that undue force is not applied to the controller circuit board that the connector socket is attached to.





Strip cable insulation for 15mm



Push cable into strung recepitcal

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5 Powering the controller

The smaller plug connector has three connection functions; controller power supply (powers the controller, not generated power), remote stop contact and RS485 data. The controller can be powered with DC voltage between 16 and 65 VDC. Normally this power is from the battery system but it could be from a mains to DC power adaptor. At 16 VDC the controller requires 250 milliamps (0.25 amps) or 4 watts of power with the turbine brake released and 50 milliamps (0.05 amps) or 0.8 watts of power with the brake applied. Ensure that the polarity of the power supply is correct to avoid damaging the controller. The plug and base of the controller is clearly marked. When powered by the battery it is important that the positive cable is not connected directly to the battery terminal, the power cable should be connected to the controller side of the system fuse so that if the fuse should fail then the power supply to the controller is also cut-off resulting in the turbine brake being applied.

6 Remote Stop contact

The 'remote-stop' connections on the small cable connector are used to connect to lithium battery BMS (battery management systems). This contact is NC (normally closed) meaning that unless the circuit between the 2 connector terminals is closed, the turbine controller will not release the brake. Lithium battery systems have strict operating parameters and if a BMS is available it should be used - it may mean that an available relay on the battery BMS is programmed to close with reference to 'No-Charge'. The PylonTech battery typically has terminals with the required 'No -Charge' signal as standard. If no connection is used then a link wire should be installed on the controller connector terminals to close the circuit.

7 Internet connection

To set controller parameters and use the remote monitoring features it is required to either connect the controller to the internet or use a modern Apple or Android mobile phone. If the controller is not to be internet connected then monitoring via mobile phone will be restricted to the local radio reception area. Internet connected controllers can be monitored from remote locations by use of the Futurenergy Cloud data service. The controller has preset default settings suitable for most 48v battery systems however voltage settings should be reviewed as these depend on the battery type in the system.

The best way to connect the controller to the provided cloud service is by using an Ethernet cable to the building's internet router. This is also the easiest method as no configuration is required. It is also possible to connect the controller via WiFi, to do this a mobile phone is required with the FuturEnergy AirForceControl app installed. The app is used to input the WiFi SSID and password to enable the internet connection.
(Currently the mobile app is being updated - the Apple version has the ability to connect to the controller directly without the controller being connected to the internet. The Android version will be updated soon. In the meantime it is recommended that an Ethernet cable is used to the local router).

8 RS485 Connection

The controller is capable of connecting to equipment that use a RS485 data network. Such systems may be BMS systems that provide a central point of data on larger systems or industrial control systems that require the information. The small plug connector has marked A & B terminals for connection to RS485 networks.

9 Wind Sensor Connection

The supplied wind sensor should be installed near the turbine (preferably on the turbine tower with 1m clearance from the turbine rotor blades in accordance with the sensors instruction manual. The sensor has a supplied cable length of 12 meters which may not be long enough for the installation. The cable can be extended by using an extension cable and plug / socket couplers purchased from FuturEnergy or by cutting the cable and extending with a length of simular cable. Weather proof juction boxes should be used to protect the cable extenders or joins if located outside.

Plug the cable into the marked socket on the controller.

10 Powering Up

Inserting the small connector plug into the controller socket will power-up the controller. Inserting the main generation power plug, wind sensor and Ethernet cables with the controller power-up is acceptable.

The controller has a memory of the turbine run state and will revert to that state on power-up. When first powering-up use the turbine manual stop switch to apply a brake if turbine operation is not yet required.

11 Getting the app

There are 2 ways to connect, view and set parameters in the controller. The phone app is the most convienient method however if a suitable phone is not available, and with the controller connected to the internet using an Ethernet cable, the web page portal can be used. As soon as the controller is internet connected it will be logged as a connected controller on the cloud service and will be available to connect to. The portal web page address is airforcecontrol.com

To get the phone app either use the QRcodes below (new phones will link to the app store if the carmera is used to focus on the codes). You can also find the app on the app stores by searching for 'Futurenergy AirforceControl'

Download on the App Store

GET IT ON Google Play

Use these QR codes to link to the App download or search for Futurenergy AirforceControl on the app store.

www.airforcecontrol.com

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12 Connecting with the app

With the controller power-up and the app loaded onto a mobile phone - start the app. Open the app main menu by either swiping from the left of the screen or by pressing one of the two menu buttons.

If the controller is internet connected with an Ethernet cable press the **+ Add Turbine** button and add the require details. Aternativley, press the **Scan Add New** button. This will use BlueTooth on your phone to scan for available Airforce Controllers. Multiple controllers will be added as connections if more than one controller is installed.

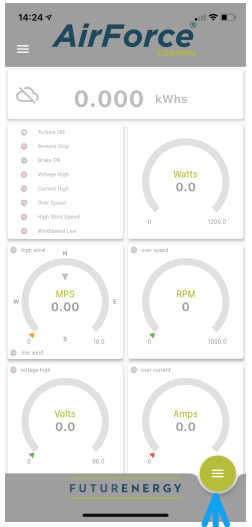
A message will appear informing that a controller has been found and added to connections. If no controller is found make sure the controller is powered and in-range with the phones BlueTooth function, also check Bluetooth is enabled on the phone.

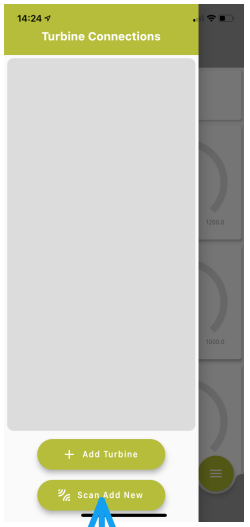
Close the message and the menu. Re-open the menu and the controller connection will be listed.

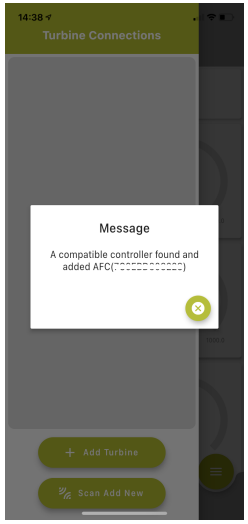
On the listed controller press the BlueTooth (BLE) connect button to connect. Use this button to reconnect when required.

Once connected the radio icon will be visible indicating connection. Also the RUN status LED on the front of the controller will flash blue.

If only local app connection is required then no cloud registration is required and the connection will not require a username or password. To use the app remotely or the web page portal, the controller must be connected to the internet using an Ethernet cable. Registration can only be completed when the controller is connected to the cloud service.



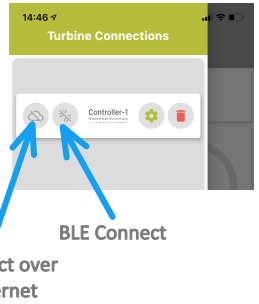


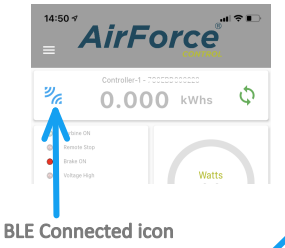


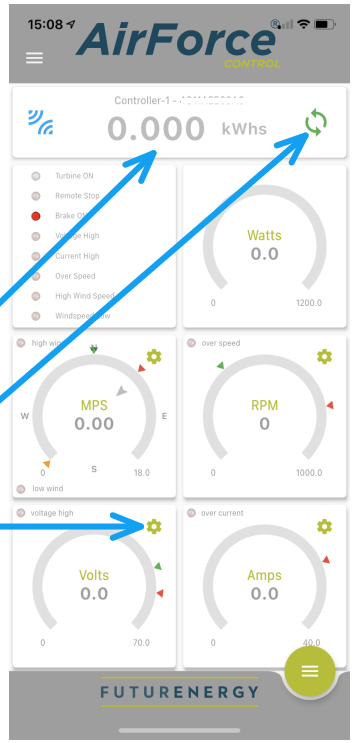
13 Changing controller parameters

Once the app is succesfully connected to the controller the following settings can be changed.

In some of the data display panels a settings icon is available to change related settings.







- **Minimum wind speed** (Minimum wind speed to the turbine to be able to run. Default 0 mps)
- **Maximum wind speed** (Wind speed at which the turbine will be stopped. Default 12 mps)
- **Restart wind speed** (After high wind speed the wind speed must drop below this value. Default 9 mps)
- **Maximum voltage** (Voltage at which the turbine will be stopped (battery fully charged). Default 65.0 v)
- **Restart voltage** (Voltage at which the turbine will be restarted. Default 50.0 v)
- **Maximum rotor RPM** (Turbine will be stopped if maximum RPM breached. Default 800 rpm)
- **Turbine restart delay** (Delay in seconds before restarts. Default 60 seconds)
- **Number of generator poles** (Default value 12, no change required for Futurenergy Turbines)
- **Maximum current** (Turbine will be stopped if maximum current breached. Default 30 amps)

13 Connecting with the portal

It is also possible to monitor and change parameters using a computer but only if the controller is internet connected using an Ethernet cable. The serial number from the controller is required which is marked on the front of the controller case.

Initial connection will require registration with the input of a username and password of your choice. If registration has already been completed using the mobile phone app then you do not need to re-register and the username and password already chosen will work.

If wind speed data is not diplaying when connected then open the menu on the web page and go to preferences and change the wind speed units and save preferances.

www.airforcecontrol.com

14 Controller

The turbine can be stopped and started using the buttons marked on the front face as well as from the mobile app / web page or by the remote stop signal.

Run Status LED indications

- Solid GREEN - Turbine ON (In run mode)
- Flashing RED - Turbine ON / PROHIBITED (In rum mode but turbine stopped due to parameter)
- Flashing with BLUE - BLE Connected (mobile phone is connected to the controller)

Rotor Status LED indications

- LED OFF - No rotor speed detected
- Pulsing BLUE - Rotor speed detected but low RPM
- Pulsing GREEN - Rotor speed detected normal RPM
- Pulsing RED - Fast rotor speed detected.
- Solid RED - Rotor brake is ON

Wind Status LED indications

- LED OFF - No wind speed detected
- Pulsing BLUE - low wind speed
- Pulsing GREEN - moderate wind speed
- Pulsing RED - High wind speed
- Flashing RED - under or over wind speed settings