Safety Instructions:

ATTENTION: Your BlackMax is designed as a DIY off-grid power system, similar to a super-sized camping system. To safely install your system the following requirements must be followed.

1) The BlackMax is heavy (164kg if two batteries are installed). Use proper lifting technique and equipment to position it. Note that the batteries can be removed for transportation (each battery weighs 41kg)
2) It is a plug and play system. All connections on the 230 volt side use standard household plugs (10amp output and 15amp generator inlet).
3) The BlackMax must not be connected to mains power. It can only be connected to a small generator via a 15amp extension lead.
4) The BlackMax is not to be modified to hard-wire it to a property unless the work is carried out by a licensed electrician.
5) The solar PV panels should be installed in a safe manner. If you have trouble assembling an IKEA bookcase then you should consider whether you are the right person to assemble your solar panel array.
6) The maximum voltage of the solar PV panel array must be less than 100 Volts DC for the BlackMax. This allows two standard 60-cell solar panels to be connected in series, as their combined maximum voltage is <100Vdc. Additional panels connected in parallel do not increase the voltage.
7) Larger 72-cell solar panels can be used in place of 60-cell panels in warmer climates (areas where palm trees can grow)
8) The BlackMax unit should remain locked with the key out of reach of children.
9) Modifications to the BlackMax or supplied cables will affect the warranty.

Physical Specifications:

Weight: 165kg with 2 Batteries installed (each battery weighs 41kg)
Dimensions: 938mm H x 700mm W x 460mm D
Overview:

Your BlackMax is an ideal solution if you want to power a small outlying area that is not connected to the grid.

It can be installed by any competent person, without the need for an electrician or solar installer.

Use it where you want a continuous supply of electricity without needing a generator running all the time. It can power typical tools found in a shed and also keep the fridge cold. Solar panels generate the electricity and the battery keeps everything running at night.

The solar panels need to be installed in a sunny area, with all of them facing in the same direction. Even if only part of one of the panels is shaded, all the panels will generate far less electricity than normal.

The BlackMax unit can be located either inside or outside. If it is outside then it needs to be in a shaded area.

How it works:

During the day electricity is generated by the solar panels. This electricity supplies the loads that are plugged into the BlackMax’s power outlet. Excess electricity is used to charge the battery. During the night, when the solar panels stop generating electricity, the load is supplied from the battery. A generator (available as an option) can be plugged in to support the BlackMax during periods of above average load.

Loads

Optional generator

BlackMax unit

Solar PV array
The BlackMax unit incorporates an inverter (3.3kVA Alino by Outback Power), one or two 4.0kWh “Troppo” Lithium LFP (LiFePo) batteries and several displays and plug connectors in a single transportable weatherproof enclosure.

All electrical connections are made via plugs, making the system to be a DIY install by anyone.
AC side of the BlackMax:

- Power outlet plug – 10amp
- Power inlet plug – 15amp
- Key for front door

**Power Meter:**
Shows the power being used by the loads plugged into the 10amp Power Output plug
- AC Voltage
- AC Current (Amps)
- AC Power (Watts)

- Power inlet – breaker
- Power outlet – RCBO

DC side of BlackMax:

- 5 volt USB charger (twin)
- 12 volt power plug

**DC Power & Energy Meter:**
Shows the battery voltage, current and power. Also shows the cumulative energy delivered FROM the battery.

**NOTE:** only shows current when battery is discharging

- Solar DC Isolator
- Solar input from PV panels
Seven steps to an easy install:

Follow these 7 steps to ensure a quick and successful install of your BlackMax system. The steps are explained in more detail in the following sections:

1. Start by making sure the BlackMax is the right sized system for you. It is designed for shed-type loads, including a small fridge. It is not sized to run an air-conditioner. It is not designed to be connected to the electricity grid. Your supplier can answer your questions; otherwise you can contact RedEarth directly on (07) 3279 6707.

2. Order the BlackMax system from your supplier. You will need to decide if you want the 6 or 8 solar panel option. There is an additional electrical box that is supplied for the 8-panel system. Once it arrives confirm that you have received everything you need for the install.

3. Decide where the solar panels will be installed and then position the BlackMax unit in its location, ideally within 8 meters of the solar array, and in the shade.

4. Install the solar panels and connect them to the BlackMax.

5. Turn on the BlackMax and confirm that it is operating correctly.

6. Test the backup generator operation, if available.

7. Monitor the performance of your BlackMax. You will learn how much power and energy your various pieces of equipment use by observing the displays on the system. If you draw too much energy from the battery, it will shut down and a manual restart will be required.

STEP 1: Make sure the BlackMax is the right system for you

The BlackMax is for use in off-grid applications and cannot be plugged into the electricity grid. It is designed for powering shed-type loads including a small fridge.

The most common issue that can occur after installed is that the BlackMax is connected to a load that uses more electricity than the system is designed to provide. This means a generator is will be required to make the missing electricity.

RedEarth does have larger power systems to run a home with air-conditioning, or a home that is connected to the electricity grid. Contact RedEarth on (07) 3279 6707.

The BlackMax is supplied in two main configurations,

1) **BlackMax only**: If you will be supplying the solar panels yourself then the system will arrive bolted to a small wooden pallet, along with a cable set to connect the solar panels.

2) **BlackMax with Solar panels**: This is the complete package, and you will receive a larger pallet, which includes the solar panels, cables, rails and parts to mount the Solar panels on a tin roof. A 6-solar panel kit is standard; an 8-panel option is available at additional cost.

A number of options are available for the BlackMax apart from the 8-panel solar kit including a Honda EU22i generator or an additional battery if only one was ordered initially.
STEP 2: Confirm you have everything you need for the install

Your main task during the installation of the BlackMax system will be mounting and wiring up the solar panels. The BackMax system itself arrives ready-to-run.

Note: The complete system can be tested before installation of the solar panels. The panels can be placed on the ground and plugged into the BlackMax unit. (see image below) This will ensure you understand how to connect the panels, without initially being concerned with mounting the solar panels.

To install the BlackMax system you will need the following items:

1. BlackMax Power system. (includes built-in inverter and either 1 or 2 batteries, as ordered)
2. Manuals (located inside the unit)
   a. This user manual
   b. Alino inverter manual
   c. Battery manual, MSDS and Battery warranty statement
   d. PV installation instructions
   e. Factory certification (including serial numbers)
   f. Shortcut to failure article (for some light reading)
3. Solar panels (2, 4 or 6). 8 panels can be used if you ordered the optional 8 panel kit.
4. Cable set for connecting the solar panels to the BlackMax. These are supplied with your system. For 6-panel system (3 x twin cables with MC4 plugs); for the 8-panel system (4 x twin cables with MC4 plugs plus a combiner box)
5. Solar panel mounting system. There are a range of methods for securing the panels, including mounting them at ground level. If you ordered solar panels then your BlackMax will come with a solar panel mounting system suitable for tin roofs.
6. Hand tools to install the solar panels and cables. Note that the BlackMax is supplied charged and can be used to power hand tools during installation without needing to have the solar panels connected or a generator running.

7. 15amp extension lead, for connecting a generator. (supplied)

8. Generator (optional). A Honda EU22i can be supplied as an option.

9. Hand trolley to move the system around (one can be supplied as an option)

The BlackMax can be transported on a pickup or trailer. If it has two batteries installed it weighs 165kg. The batteries (43kg each) can be removed if necessary through a cut-out under the lid. Note that the “full house” system with solar panels is delivered on a pallet that is 1.65m long, 1.1m wide and 1.1m high and weighs up to 300kg. The weight depends on the options selected.

**STEP 3: Install the BlackMax**

NOTE: Please call RedEarth if you have questions during installation. Tech support 0487 002 451

The BlackMax should be placed within 8 meters of the solar panels. An optional 6 meter extension cable is available if the panels are further away. Note that the longer the cables are the greater the voltage drop, which reduces the energy from the solar panels.

The IP rating of the system is IP43 and is suitable for outside installation. If outside it must be in a shaded area. (See table for an explanation of IP ratings)

A hand trolley can be used to move the BlackMax around. It is available as an option from RedEarth when the “full house” system is ordered.
Cooling air flow passes up through the base of the system and then out the back and top. Do not block the air vents otherwise the system will overheat and shutdown. Once the system cools down again it can be restarted. The flow of air is assisted by an electric fan connected to one of the rear vents. It is controlled by a temperature switch. This is adjustable and set to 25degC in the factory.

The controls of the inverter can be accessed through the front cover, without needing to open the main door.

The door should remain locked with the key out of reach of children.

To avoid the potential of the unit tipping over it should be secured to the ground using the holes in the feet.

**STEP 4: Install the Solar panels and connect them to the BlackMax**

**WARNING:** The Solar DC Isolator on the BlackMax must be in the off position before any solar panels are connected.

Installing the solar panels involves both mechanically securing the panels as well as electrically connecting the panels to the BlackMax.

**Electrical connection overview:**

Understanding the electrical layout will help you decide where to install the solar panels.

The solar panels need to be connected two in series to form a “string” (see right). This provides the right amount of voltage for the BlackMax.

Each “string” of 2 panels is then connected in parallel to increase the size of the solar array.

6-Panel wiring using the supplied triple plugs

---

BlackMax 9
8-panel wiring using the supplied combiner box

Mechanical installation of the solar panels:
Refer to the separate brochure included with your BlackMax, “Guidelines for installing DIY small solar system – EnergyStuff”.

Electrical connection of the solar panels:
Follow the connection sequence below to complete the electrical connection.

1. Place the BlackMax in its final position.
2. Make sure the Solar DC Isolator is switched off.
3. Check the distance from the BlackMax to the triple plug combiners (for a 6 panel system) or the combiner box (for the 8 panel system) is less than the length of the 8 meter twin extension cable provided.
4. Connect the triple plug or combiner box to the BlackMax using the 8 meter twin extension cable supplied.
5. If installing the 8-panel system, then fix the Combiner Box to the wall using the external mountings supplied on the rear of the box – DO NOT PENETRATE BACK OF COMBINER BOX as this will reduce the IP rating and may let water in.
6. Connect the provided single strand extension cables between the triple plug/combiner box and each “string” of solar panels (one set of twin wires per string)
7. These extension cables are of different lengths. Connect the closest “string” of panels with the shortest cable.
8. After completion of all connections tuck the excess cable away under the panels.
9. Turn on the DC Solar Isolator on the BlackMax.

Combiner box for 8-panel system, with extension cable pre-wired
Turn on the BlackMax to confirm that it is operating correctly and to become familiar with the controls and displays.

The included manual for the Alino inverter provides additional information on the inverter.

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**Quick Start Guide**

1. **Open the lid and check that the battery switches built into the top of the batteries are ON.** (blue light will be on). Close the lid.

2. **Turn ON the Battery Isolator Switch** (located on the right side the BlackMax). The Battery Status Monitor display will turn on.

3. **Check the battery voltage on the display.** 53 volts is close to full and 48 volts is almost empty.

4. **Connect the Solar panels to the BlackMax,** as described in the manual. Then turn ON the Solar DC Isolator. (red & yellow rotary switch)

5. **Go to the front of the BlackMax; under the plastic cover,** turn ON the inverter by pushing the green button for 5 seconds. See label on the front of the inverter for more information (open the door if required)

6. **Turn on the Power OUT (RCBO) switch** under the cover on the left side of the BlackMax. The Power Usage Meter (AC) will also turn on showing the AC voltage, current and power usage.

7. **Plug your loads into the 10amp power point.** Observe the power draw of your equipment (green number on the AC Display). If the load goes above 2400 Watts the inverter will begin beeping. Reduce the load otherwise the inverter will shutdown.

8. **The Generator input plug is only required if the batteries become discharged.**
There are two displays on outside of the BlackMax, one for the DC (battery) side and one for the AC (power point) side. These are in addition to the display on the inverter itself.

### Power Usage Meter (AC)
1. Turn on the Inverter and the **Power OUT (RCBO)**
2. The display turns on and shows the inverter voltage, current and power being delivered to the loads.
3. Pressing the SAM-OK button on the bottom left changes the display to show Power factor, Cumulative operating hours and cumulative AC energy delivered (kWh). The cumulative energy and operating hours measurement is retained when the display is turned off.
4. Refer to the OEM manual for additional details.
5. If more than 2400 Watts of load is connected the inverter will begin beeping. This indicates an overload condition. Reduce the load!

### Battery Status Monitor
1. The display shows the battery voltage, current, power and energy.
   - **Battery voltage**: When above 53 volts the battery is close to full and below 48 volts it is almost empty.
   - **Battery current**: Shows the current being drawn FROM the battery. Note it does not show the current when the battery is being charged.
   - **Battery power**: Measured in Watts. This will be higher than the Watts indicated on the AC Power Usage meter as there are losses when the inverter inverts the DC power to AC power.
   - **Battery energy**: This is the cumulative energy delivered FROM the battery in kWh. Therefore it operates as an “odometer” for the battery. It does retain the last energy reading even if the BlackMax is turned off. It can be reset to zero using the small button on the right side of the display. Note: it does not record energy supplied TO the battery.
Test the optional use of a backup generator if available.

When the generator is connected the battery will be charged as a priority. Other loads will also be powered by the generator at the same time. If the other loads are too high the generator may become overloaded. Reduce your other loads while the battery is being charged.

The generator is only needed if the battery becomes depleted and it is dark (ie the solar panels are not charging the battery). If the BlackMax shuts down during the night, then it will automatically begin recharging itself in the morning when the sun comes up.

Running the generator for an hour is usually enough if you are having a big night. The solar will recharge the batteries in the morning.

The typical small generator has 15A outlets (Honda eu20i shown at left) A 15A extension lead is provided to connect it to the BlackMax. A matching 15A inlet is provided on the BlackMax. A 15A inlet is also fitted to remind users that the BlackMax can not be connected to the electricity grid.

STEP 6: Test the operation of the optional generator

Generator usage

A generator can be used if the batteries become depleted and you do not want to wait until the solar panels start recharging the battery in the morning.

1. Switch OFF the Solar DC Isolator on the right side of the BlackMax. This allows the generator to charge the battery.
2. Plug the generator into the 15A INPUT socket on the BlackMax (use the extension lead provided, or similar) Note that a 10A plug will not fit.
3. Start your generator and let it warm up for a couple of minutes.
4. Turn on the switch Generator IN (MCB) and the generator will begin charging the battery AND supplying your loads.
   • Note: The size of the generator will affect how much load can be connected during battery charging. The battery charger draws 5.5Aac (1.2kW). RedEarth can provide a Honda EU22i generator which can charge the battery and run a 700W load at the same time.
   • Every hour of run-time will charge the battery by 25% (for single Troppo battery)
5. Once the generator has charged the battery for sufficient time (e.g. 1-2 hours) switch the Solar DC Isolator back ON. The solar panels will takeover again.
Monitor the performance of your BlackMax during ongoing use. You will learn how much power your equipment uses by observing the displays on the system.

If you have any questions, contact RedEarth Tech Support on 0487 002 451.

The BlackMax can provide 2,600 Watts continuous output before it begins beeping (complaining). If it overloads and shuts down, reduce the load and wait for it to automatically restart within a minute.

The surge capacity of the inverter is 6000VA for 0.5 seconds.

Typical loads for equipment you might find in your workshop are shown below. (maybe not the CPAP machine)
BlackMax technical specifications:

**What is inside the box?**

- **Troppo lithium batteries (LFP chemistry)**
  - Advanced self-managed battery management system 4.0kWh each

- **Power inlet plug – 15amp**
- **Power outlet plug – 10amp**
- **RCBO switch – 10amp outlet**
- **Lid hinges open to access batteries**
- **Ventilation fan + additional 2 vents**
- **USB power supply**
- **12V power supply**
- **Battery monitor**
- **Lifting handle**
- **Solar PV Isolator**
- **R2D2 feet – with 8mm holes to either mount wheels or attach it to the floor**
- **Ventilation inlets in the base of the system**

**Inverter:**
- 3300VA ALINO by OutBack
- 48Vdc
- Off-grid only

**Access window**

**Inverter controls**

**48Vdc to 12Vdc converter**

**Battery shunt 48Vdc**

**Manual holder**

**Missile switch**
The BlackMax uses the APCU 3348 inverter, listed in the right column of the tables below.

### Alino Specifications

#### Parameters

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<th>Models</th>
<th>Parameters</th>
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<th>APCU 2648</th>
<th>APCU 3348</th>
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<tbody>
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<td>Type</td>
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<td>Single-phase solar conditioning unit</td>
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<td>Charging Modes</td>
<td>Four modes (Solar absorption, Regeneration, Battery, Forced)</td>
<td>Four modes (Solar absorption, Regeneration, Battery, Forced)</td>
<td>Four modes (Solar absorption, Regeneration, Battery, Forced)</td>
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<td>Battery High Cut-Off</td>
<td>&gt;120°C</td>
<td>&gt;40°C</td>
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<td>AVR Output Range</td>
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<td>43.5V Dropout</td>
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<td>Low Battery Load Cut-Off</td>
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<td>Low Load Reconnect</td>
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<td>Short Circuit</td>
<td>One retry followed by permanent shutdown: 0.2sec ON and 10sec OFF</td>
<td>One retry followed by permanent shutdown: 0.2sec ON and 10sec OFF</td>
<td>One retry followed by permanent shutdown: 0.2sec ON and 10sec OFF</td>
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<td>Overload Cut-Off</td>
<td>Three retries followed by permanent shutdown: 110-125%/60sec ON and 10sec OFF, 125-150%/10sec ON and 10sec OFF, 150-200%/3sec ON and 10sec OFF, 200-300%/0.5sec ON and 10sec OFF, &gt;300%/0.2sec ON and 10sec OFF</td>
<td>Three retries followed by permanent shutdown: 110-125%/60sec ON and 10sec OFF, 125-150%/10sec ON and 10sec OFF, 150-200%/3sec ON and 10sec OFF, 200-300%/0.5sec ON and 10sec OFF, &gt;300%/0.2sec ON and 10sec OFF</td>
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#### Electrical—Inverter (Cont.)

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<th>APCU 3348</th>
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<td>&lt; 180% of nominal power output and manual reset after 30 minutes</td>
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<td>IP21</td>
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<td></td>
<td>Environmental Protection</td>
<td>IP21</td>
<td>IP21</td>
<td>IP21</td>
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</table>

#### Electrical—PCU

<table>
<thead>
<tr>
<th>Models</th>
<th>Parameters</th>
<th>APCU 1424</th>
<th>APCU 2648</th>
<th>APCU 3348</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mode of Operation</td>
<td>Solar priority, selectable through front panel</td>
<td>Solar priority, selectable through front panel</td>
<td>Solar priority, selectable through front panel</td>
</tr>
<tr>
<td></td>
<td>Self Consumption (Sleep Mode Inactive)</td>
<td>&lt;2W</td>
<td>&lt;5W</td>
<td>&lt;5W</td>
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<tr>
<td></td>
<td>Self Consumption (Sleep Mode Active)</td>
<td>&lt;1W</td>
<td>&lt;10W</td>
<td>&lt;10W</td>
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<tr>
<td></td>
<td>No Load Shutdown (Sleep Mode Active)</td>
<td>&lt;3%</td>
<td>&lt;2%</td>
<td>&lt;2%</td>
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<tr>
<td></td>
<td>No Load Recovery Time</td>
<td>4sec</td>
<td>4sec</td>
<td>4sec</td>
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</tbody>
</table>
RedEarth also provides several options for the BlackMax system:

- The complete system including PV panels and mounting parts
- 8 panel expansion option
- 6-meter extension cable for PV panels
- Honda EU22i generator
- Hand trolley to move the BlackMax into position
- Earth stake (and MEN link) – can only be installed by a licensed electrician
- Multi-meter with AC/DC current measurement

Contact RedEarth Energy Storage:

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