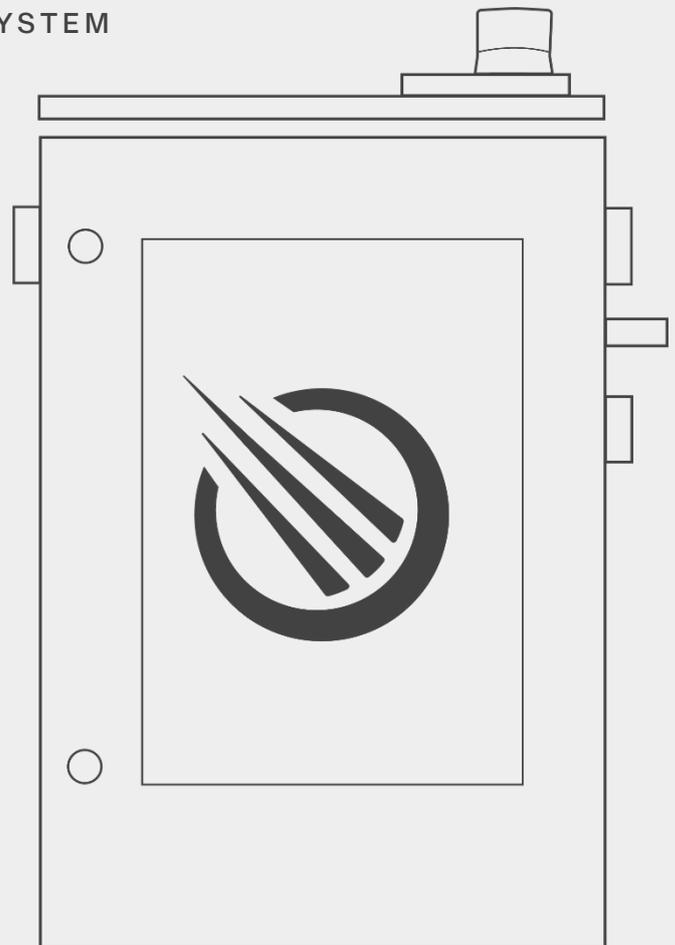


# Installation and Operation Manual

# BlackMax

OFF-GRID AND ON-GRID BATTERY SYSTEM



The first Australian-made off-grid battery energy storage system approved by the Clean Energy Council, now with new and improved features.



# Safety instructions

**⚠ WARNING:** Working on the inside of the BlackMax system is restricted to qualified personnel. RedEarth recommend installation by licensed electricians only.

**⚠** The wiring diagrams and installation instructions are given as a guide only and compliance to appropriate standards is the responsibility of the installer. Relevant standards are listed below:

AS/NZS 3000:2018	Wiring rules
AS/NZS 5033:2021	Installation and safety requirements for photovoltaic (PV) arrays
AS/NZS 4509.2:2012	Stand-alone power systems-Design
AS/NZS 1170.2:2021	Structural design actions-Wind actions
AS/NZS1768:2021	Lightning protection
AS/NZS 3008.1.2:2017	Electrical installations – Selection of cables
AS/NZS 5139:2019	Electrical installations-Safety of battery systems for use with power conversion equipment

**⚠** The BlackMax must only be installed by suitably qualified personnel who have read and are familiar with its operation and hazards.

**⚡** The BlackMax must only be installed by suitably qualified personnel who have read and are familiar with its operation and hazards.

**i** This manual covers all following model numbers: BMX-104, BMX-108, BMX-112.

**i** In our efforts towards constant product enhancement, this document is subject to change at any time. Please visit [www.redearth.energy](http://www.redearth.energy) and download the appropriate and latest version manual.

## Lifting hazard

The BlackMax is heavy. Observe proper lifting techniques. To reduce the weight the Troppo batteries can be removed via the panel in the rear of the system.

## Fire

The BlackMax uses RedEarth's Troppo battery. This is a lithium-iron-phosphate based battery (LFP). It is the safest lithium chemistry. However, in the case of a fire the following steps should be taken. A dry agent fire extinguisher should be readily available and used. DO NOT use water. Evacuate the area and call emergency services. Toxic gas may be produced if the battery catches fire.

**Note:** The SDS document for the Troppo Battery can be found at [www.redearth.energy](http://www.redearth.energy)

## Damaged battery

Do not use a damaged battery. Batteries should only be disposed of at an appropriate recycling centre. Please contact RedEarth for advice.

## SHUTDOWN PROCEDURE

- ① Press the On/Off button on side of inverter
- ② Switch OFF on all AC circuit breakers
- ③ Switch OFF the SOLAR D.C. ISOLATOR
- ④ Switch OFF the BATTERY SYSTEM D.C. ISOLATOR



**WARNING**  
BATTERY SYSTEM D.C. ISOLATOR  
DOES NOT DE-ENERGISE THE  
BATTERY SYSTEM AND BATTERY  
SYSTEM CABLING

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# Overview

RedEarth's **updated BlackMax** battery system is a complete ready-to-run energy storage system for off-grid and on-grid applications. It is available as either a battery system alone or as a complete PowerStation kit including solar panels and solar panel mounting equipment, all on two pallets. As an Australian-made product built in Brisbane, RedEarth can provide best-in-class support for BlackMax owners and installers.

The battery system arrives fully assembled and factory tested. It includes a 6kVA hybrid inverter with two built-in single string MPPTs for connecting solar panels. It can be supplied with up to three (3) of RedEarth's Troppo lithium batteries (12.3kWh total). Note that to use the full power available from the inverter at least 2 Troppo batteries are required.

The BlackMax system is designed to be installed either inside or outside, ideally in a shaded area. All switchgear required for installation is built in. No need to screw switches to the wall.

A typical installation of the BlackMax with solar panels, will require the electrical connection of:

1. **Solar:** Directly connect the solar arrays to the two built-in PV MCBs with pre-terminated MC4 plugs inside the system. (do not exceed 500Vmax on the PV arrays)
2. **Load:** There are two GPO power points on the system to plug loads into directly (one 15amp & one 10amp) or hard-wire an external sub-board to the terminal block inside the BlackMax (to access the full 6kVA of power available)
3. **Earth and MEN link:** These need to be in place as required by national standards.
4. **Generator or grid:** Directly connect a hard-wired generator. The generator can be set up for either manual or 2-wire auto start. Note: it is mandatory to test that the generator works with the BlackMax during installation. Instead of a generator a single-phase grid supply can be connected to the same hard-wire terminal blocks to achieve generator like performance from your grid supply.
  - **Note:** As an alternative to a generator or grid supply, a different AC-coupled renewable energy source can be connected to the generator terminals in the BlackMax. This could be an additional Solar PV inverter or Micro-Inverter system. The BlackMax needs to be pre-configured for one of these options. By default, the BlackMax is set up for a generator. Therefore, please inform RedEarth before connecting the system to an alternative renewable energy source.

There are several ways to monitor the BlackMax.

- Local monitoring via the battery SOC meter (state-of-charge) on the top of the unit.
- The two Power meters on the side of the unit. One shows power in from the generator and the other shows total power out of the inverter to the loads.
- Flashing orange light. This turns on when the SOC drops below the set point (it is factory-set to 20%).
- Remote monitoring: The BlackMax includes an industrial grade monitoring kit to enable remote monitoring and control capabilities. To activate this service, the owner needs to enrol in RedEarth's Optimum program which includes ongoing monitoring of the BlackMax system by RedEarth. Note that this requires mobile phone coverage or another source of internet (e.g., Starlink, which RedEarth can assist with).
- RedEarth's EMU app. Once remote monitoring is activated the BlackMax can be monitored from the customer's mobile phone.

**Note:** The BlackMax is not designed to act as a main switchboard for the premises, as it does not include space for additional main and customer circuit breakers or RCDs. The MEN link and Earth connection need to be in place at the premises as required by national standards.

**Qualified installation person (installer)**

The installation tasks described in this manual should be carried out by a suitably qualified and skilled electrician with adequate skills, qualifications, and experience. They should:

- Have a thorough understanding of operations, design, and installation principles of on- and off-grid electrical systems.
- Have a thorough understanding of the risks and dangers associated with installing and using electrical equipment.
- Hold all local, state and country-based qualifications to carry out such work.
- Adhere to all safety and installations requirements contained in this manual.
- To claim the STC's available for the solar panels they must be an accredited installer



# Dimensions



The BlackMax weighs 176kg when fully loaded with three (3) Troppo batteries. Each battery weighs 43kg and can be removed for ease of handling. The empty BlackMax weighs 74kg.

# Description of the BlackMax

## Opening the BlackMax

RedEarth’s BlackMax energy storage system can be accessed via the top (lid) or the front door.

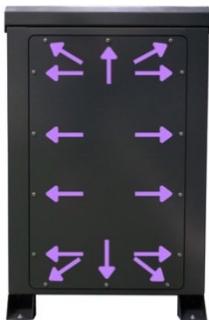
To open the lid, 2 screws (one from each side) must be removed and then the lid can be lifted and pivoted on the rear hinge.

To access from the front, there are 2 locks on the front door. The key to open these locks comes tied to the left handle and must be kept out of the reach of children.



## Inside layout

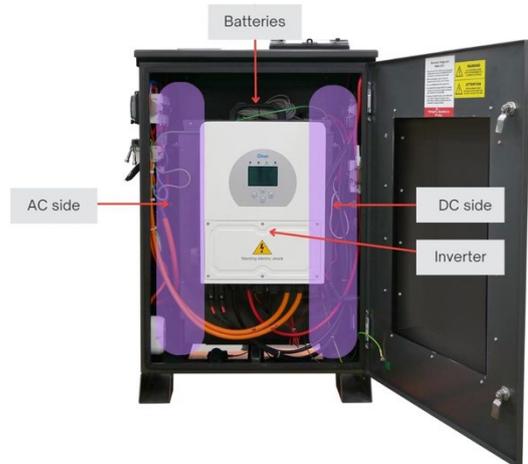
The BlackMax is divided internally into four main areas, The AC electrical switchgear, the DC electrical switchgear, the inverter, and the battery area.



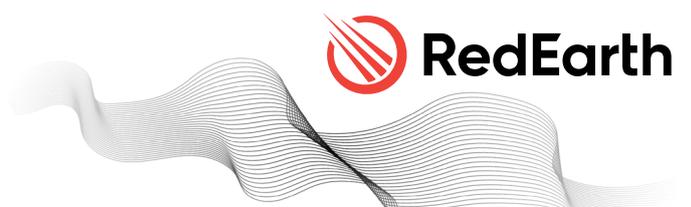
Opening the front door provides access to the AC side, inverter area, and DC side. To access the AC or DC side, you will have to remove the clear plastic safety covers that are held in place by 3 nuts.

**Note:** Do not over tighten the nuts holding the clear plastic cover in place as they will crack under pressure.

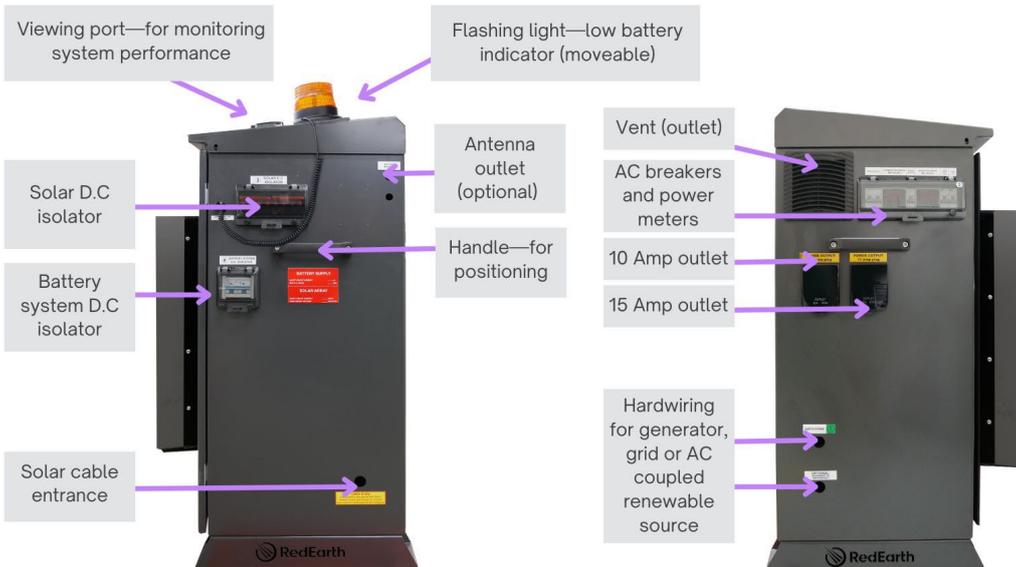
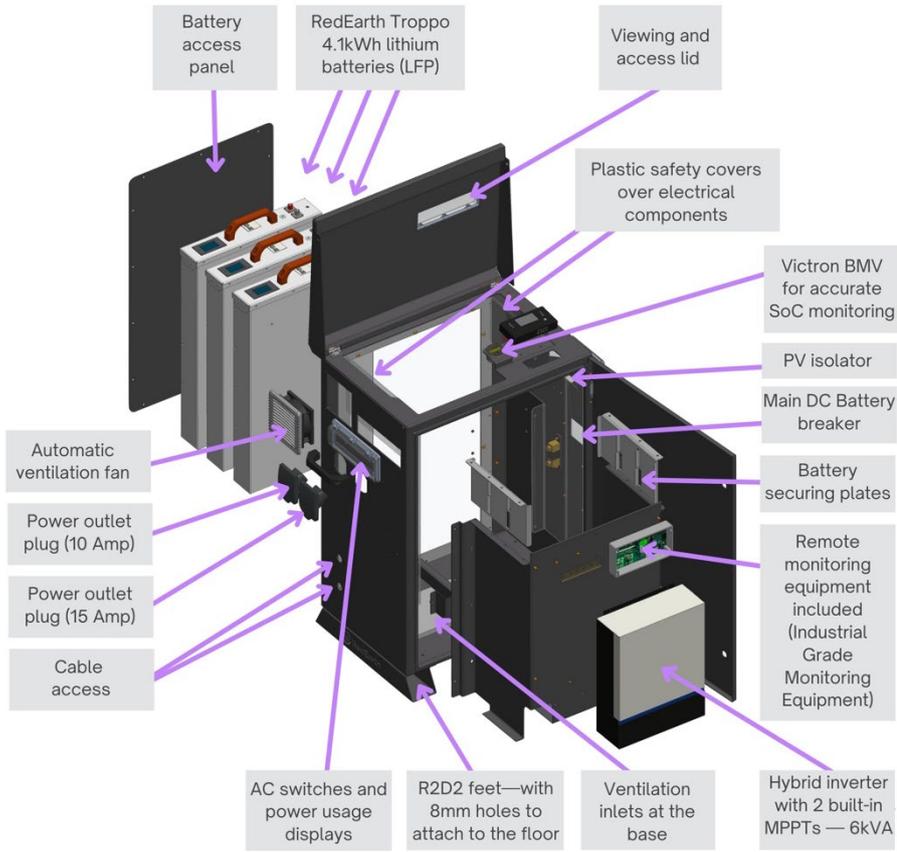
To access the battery area, either open the top lid or remove the screws holding the rear panel in place. Removing and replacing batteries is easiest via this rear panel.



## BlackMax Components



The main components of the BlackMax includes the hybrid inverter one, two or three lithium Troppo batteries and the pre-wired enclosure containing all the other electrical components as shown in the picture below.



## Parts kit

The BlackMax system is supplied with a parts kit containing all the addition items needed to complete the installation.



## Complete BlackMax PowerStation kit (option)

RedEarth also provides a convenient BlackMax PowerStation kit. This includes the BlackMax on a small pallet and the solar panels as well as all mounting equipment for a typical tin roof on a second pallet as shown.

The PowerStation kit includes the following items,

- BlackMax (with 1, 2 or 3 Troppo lithium batteries)
- 15A lead for connecting a typical small generator.
- Note that no generator is provided however RedEarth can recommend some models that work with the BlackMax.
- Solar Panels (up to 18 x 400W panels = 7.2kW) subject to change as panel sizes continue to increase
- Clenergy solar panel mounting hardware and rails for tin roof along with required PV cables.
  - The list below shows the parts included for an order with 16 solar panels.
  - The PV rails are cut in half to be 2.1m long (additional PV rail splices are included)
- Dimensions for the solar panel kit pallet (1.2m wide x 2.1m long x 1.4m high)
- Weight of solar panel kit pallet weight = 450kg (16 panels)



WIISE	SKU	Description	Oty.	Unit
CH001010	SKU	BlackMax 16 Panels Mounting Kit—Tin Roof		
1377	SKU-001	SPLICE PLATE, PV-EZRACK, SUITS ECO RAIL	16.	EA
1378	SKU-002	TIN INTERFACE KIT	40.	EA
1379	SKU-003	CABLE CLIP, PV-EZRACK FOR PV PANELS, HOLDS 2 CABLES, BOX OF 900	64.	EA
1380	SKU-004	CLAMP, UNIVERSAL MID/END WITH GROUNDING CLIP	50.	EA
1382	SKU-006	GROUNDING LUG, PV-EZRACK	6.	EA
1384	SKU-008	RAIL, PV-EZRACK ECO 4200MM LONG ALU/STEEL, BUNDLE OF 90	9.	EA
1394	SKU-018	SWITCH, ZJ BENY DC ISOLATOR 32A 4 POLE 1200V	1.	EA
1395	SKU-019	COVER, ZJ BENY ISOLATOR	1.	EA
1134	CON-015	CONNECTOR, MC4 BRANCH MALE	1.	EA
1135	CON-016	CONNECTOR, MC4 BRANCH CONNECTOR FEMALE	1.	EA
1961	CON-017	CONNECTOR, MC4 STANDARD MALE & FEMALE (1 x BAG = 5)	10.	EA
1078	CBL-021	CABLE, 2C x 4MM2 DC SOLAR (9PV-1F), 0.9/1.8KV	25	P/M
1095	CBL-038	CABLE, 4MM2 SINGLE CORE DC SOLAR (PV-1F)	25	P/M
1297	PLT-002	PALLET, WOOD 2100MM x 1170MM (BlackMax with PV only)	1	EA

## Installation

### 7 steps to complete your BlackMax installation:

1. Transporting the BlackMax
2. Positioning the BlackMax
3. Solar array sizing
4. Electrical connections to the BlackMax
5. Commissioning the BlackMax
6. Monitoring and communication
7. Finalising installation and customer handover

### Step 1. Transporting the BlackMax

The BlackMax system is supplied on a pallet in one of two configurations (just the BlackMax on a small pallet or as a complete PowerStation kit on a larger pallet) as shown below.

The BlackMax weighs 203 kg (with 3 batteries installed). Each battery weighs 43kg. The solar panel kit with 16 solar panel weighs 450 kg shown below.

RedEarth's BlackMax comes fitted with two handles to help with handling. However, it is a heavy unit and should be handled with a transportation device such as a hand trolley. (**Note:** if using a hand trolley, you may need to click the bottom vents back into place after finishing using the trolley).

The lithium batteries can also be removed via the panel in the rear of the BlackMax, and replaced once the system is in position. Each Troppo battery module weighs 43kg. The empty BlackMax weighs 74kg.



**WARNING: Personal Injury**  
Use safe lifting techniques and standard safety equipment when working with this equipment



## Step 2. Positioning the BlackMax

The BlackMax is designed to be a freestanding weatherproof system (suitable for outdoor locations).

It is recommended to locate the system in a shaded area to reduce the chances of overheating. It should also be placed close to the solar panels to minimise voltage drop and power loss.

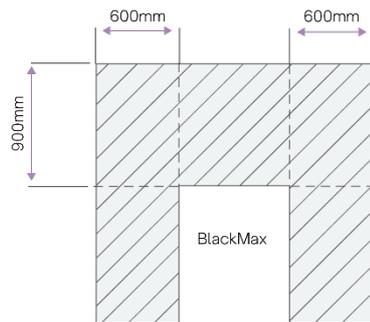
The BlackMax can be secured to the ground via the four holes in the feet of the system. This can be done with the Dynabolts, or screws supplied in the Parts kit, or other material appropriate fixings.

### Clearance:

Allow 600mm spacing on both sides of the BlackMax.

If positioning the BlackMax against the wall of a habitable room, then the clearance requirements are as per AS5139 and shown at right, must be observed. In addition, the wall should be made of non-flammable material, if it is a habitable room.

Note: If the BlackMax is placed at least 300mm off the wall of any building, then these requirements of



**BlackMax Minimum  
Clearance**



AS5139 do not apply.

### Ventilation:

Cooling air flow passes up through the vents in the base of the system and then out the fan located on the top left-hand side of the unit. Do not block the air vents as the system may overheat and shutdown. If the BlackMax does shutdown because of overheating, it will automatically restart once it cools down again. The fan is controlled by a temperature switch set to 25°C in the factory, which can be adjusted on site.

### Step 3. Solar array sizing and layout

The PV Array should be designed and installed in accordance with AS/NZS 5033 and the latest CEC Installation guidelines.

Caution should be taken in selecting PV panels and the wiring method to ensure the rated Open Circuit Voltage (Voc) and Short Circuit Current (Isc) is not exceeded (factoring in the coldest and hottest expected ambient temperatures).

The maximum Voc for the BlackMax is 500Vdc. This usually means a maximum 9 panels in series when using typical 400 Watt panels.

The maximum Isc is 19.5 amps. This means a maximum of one string in parallel when using typical solar panels. (<15.6A per panel taking into consideration the 1.25x derating factor of Isc, used in Australia)

Note that the BlackMax has two MPPTs, so PV panels can be installed facing in two different directions.



**Example calculation of maximum number of solar panels in the array:**

Below are the specifications of a typical 400W panel that RedEarth supplies in the complete BlackMax PowerStation kit (as of December 2023).

Electrical characteristics 400W panel	Mono-Crystalline Module (HiE-S____UF)	
Maximum Rating Power (Pm)	W	400
Open Circuit Voltage (VoC)	V	49.5
Short Circuit Current (Isc)	A	10.12
Maximum Power Voltage (Vmp)	V	41
Maximum Power Current (Imp)	A	9.76
Module Efficiency	%	21.3
Maximum System Voltage	V	DC 1,500
Temperature Coefficient of Pmax	% / °C	-0.340
Temperature Coefficient of Voc	% / °C	-0.270
Temperature Coefficient of Isc	% / °C	+0.040

**Maximum number of panels in series (Max. PV array voltage):**

For the 400W panel shown above, Isc is 10.12 Amps at 25degC. If the highest expected temperature is 50degC then the temperature correction is +25degC x +0.040% = +1.00%. This means that at 50degC the loc is 1.00% higher than at 25degC = 1.010 x 10.12 = 10.22Amps.

As the temperature increases the loc Increases which is why the highest temperature is important for loc calculations.

The Isc rating of the BlackMax Is 19.5A per MPPT. In Australia the Isc rating is decreased by 1.25x to get the usable Isc. This means a maximum of 19.5/1.25 = 15.6 Amps Is allowed according to the Australian standards.

This means that a maximum of one (1) string can be connected in parallel.

**Total maximum number of panels:**

This means that a total of 18 x 400W panels with these specifications can be connected to the BlackMax. This is 18 x 400W = 7.2kW.

To achieve closer to the maximum 7800W rating of the BlackMax inverter is recommended to seek lower voltage panels that remain within the short circuit current limit of 15.6A Isc.

An example of this is the Tindo Karra 410W, specs below:

Electrical Characteristics			
108 Cell Module		Karra – 410G2H	
Item	Unit	*STC	*NMOT



Max. power (Pmax)	Wp	410	301
Max. power voltage (Vmp)	V	31.11	28.6
Max. power current (Imp)	A	13.18	10.5
Open circuit voltage (Voc)	V	37.11	34.3
Short circuit current (Isc)	A	13.93	11.3
Panel efficiency	%	20.6	
Positive power tolerance	W	0 + ~ 5	

\*STC (Standard Test Condition): 1,000 W/m<sup>2</sup>, AM 1.5, 25°C/ \*NMOT (Nominal Module Operating Temperature): 800W/m<sup>2</sup>, 20°C, wind speed 1m/s, Tolerance of Pmax, Voc & Isc ± 3% within each watt class at STC.



**WARNING**

The Solar DC circuit breaker on the BlackMax must be in the off position before any solar panels are connected

## Step 4. Electrical Connections

- i** *Before any electrical connections are made, check all internal electrical connections are secure and have not come loose during transport.*
- i** *Ensure that all breakers, as well as those supplying power to the unit, are turned OFF.*

### 4.1 Overview of the connection layout

To access the full 6kVA power of the BlackMax the load needs to be hard wired to terminals inside the unit, usually via an external switchboard. The two power points are rated at 15A (3.6kW) and 10 amps (max. 2.4kW).

**Earthing the Unit:** The unit should be earthed to an appropriate earth stake. The earth cable can be connected to the earth bar (or terminal block) inside the unit with the cable passed out through the second 25mm gland on the lower left side of the BlackMax. Alternatively, the BlackMax can be earthed via an external switchboard with an Earth stake installed.

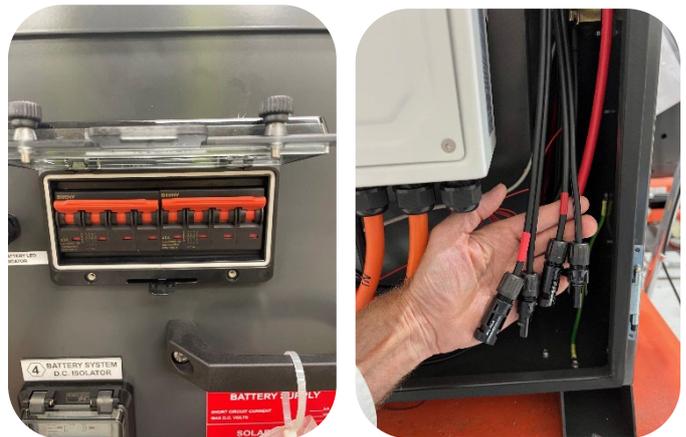
**MEN Link:** There is a MEN link installed in the BlackMax. If an external switchboard contains a MEN link, then the one inside the BlackMax should be removed & the BlackMax hard wired to the main switchboard.

The generator should be hard-wired to the terminal block inside the unit. Alternatively, an AC coupled renewables sources or the grid connection can be hard-wired to the same terminal block inside the unit. Please note, the BlackMax doesn't support the concurrent operation of a generator and either the grid supply or an AC-coupled renewable energy source. The inverter needs to be pre-configured for one of these options. By default, the BlackMax is set up for a generator. Therefore, please inform RedEarth before connecting the system to an alternative renewable energy source. See section 4.5 AC Source Connection below.

### 4.2 Solar array connection

For ease of installation, the BlackMax comes with its own PV isolation MCBs and pre-terminated MC4 connectors on the inside of the unit, as shown.

To connect the solar power, take the two cables coming from each Solar array, insert the unterminated cables through the hole on the right side of the system using a 25mm weatherproof gland from the Parts kit. Then terminate the correct MC4's on the cables once it is inside the unit. Suitable MC4 connectors are included in the Parts kit. Next, check for correct polarity and Voc at the isolator terminals. Then, with the BlackMax PV breaker still in the off position connect the PV cables from the solar array to the pre-terminated MC4 cables inside the unit. The PV array is now ready to be used.



- i** *When exposed to light, photovoltaic (PV) array supplies D.C. voltage to the Inverter.*
- i** *Installing a PV array with voltage or current values above the inverter rating will damage the BlackMax unit and will void the warranty.*

### 4.3 Battery connection

The RedEarth Troppo batteries are shipped inside the unit and can be found in the rear section of the BlackMax. For transportation or maintenance or to add an additional Troppo battery, the batteries can be accessed from the top by lifting the lid, or from the rear by removing the rear panel.

### Removing or Installing a TROPPO:



**01.** Remove the battery cables by pressing the button on the side of the terminal and pull it straight up. **NOTE:** When installing the battery cable, simply push it onto the terminal until you hear a click.



**05.** Slide out one battery at a time. Be careful handling as each battery weighs 42 kilograms.



**02.** Remove the bolt that holds the earth cable to the battery.



**04.** Remove the battery locating plates.



**03.** Remove the bolts that hold the back-plate in place.

To install a battery, follow this process in reverse.

**i** **ATTENTION**  
If the battery polarity is connected incorrectly, it will damage the BlackMax system.

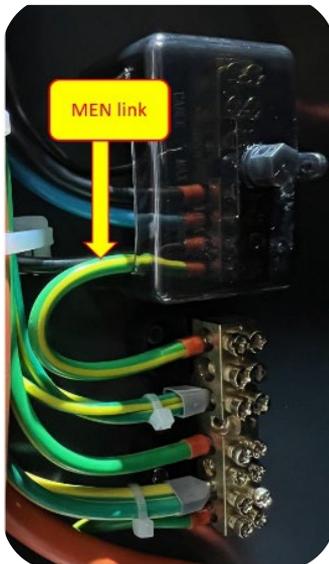
### 4.4 Load connection

There are two ways to connect the loads.

First, via the external 15A and 10A power points. Simply plug in a device to the GPO's labelled Power Output. Note that each plug can also accept 10A plugs. Note also that this output is limited to 15 Amps (approximately 3.6kW) and 10A (approximately 2.4kW).



Alternatively, an external switchboard can be hard-wired to the BlackMax by attaching the active, neutral and earth to the terminal's blocks labelled "Loads" on the inside of the unit. See pictures at right. This provides access to the full 6kVA rating of the BlackMax. An example of an external generator connected to the BlackMax is shown here.



*If the BlackMax is hardwired into a switchboard, RedEarth recommends it be connected to an appropriately rated circuit breaker. This MCB should be installed on the far left- hand side of the switches on the DIN rail inside the switchboard. It should also contain the MEN link and a suitable Earth. The MEN link inside the BlackMax is then removed (see image).*



**NOTE:** This Switchboard must contain all necessary stickers and traffolytes, i.e., PV and ES. These can be found in the Parts Kit box.

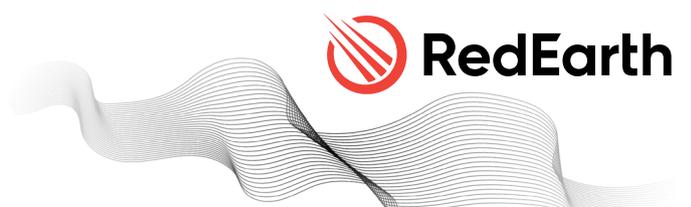
Loads		GEN		
ACTIVE	NEUTRAL	EARTH	NEUTRAL	ACTIVE
				AUTO START

### 4.5 AC source connection

There are several options for connecting AC sources to the BlackMax. A unique feature of the BlackMax is that the generator input port is very versatile and can also be factory configured to act as an AC output port.



#### 4.5.1 Generator solar connection—to generator terminals inside the BlackMax



As the BlackMax is often installed as an entirely off-grid system it is strongly recommended to have a generator available to provide extra energy during periods of extended overcast conditions or heavy usage.

A generator can be used to run the loads and charge the batteries if they become depleted during the night, and you do not want to wait until the morning for the solar panels to start recharging the batteries. You can also top up your batteries with the generator if you are expecting poor weather conditions or heavy usage.

Note that the default battery charging rate is set to 1.5kW. This can be adjusted depending on the size of the generator available. Max. 40A constant P/through.

The generator is hardwired to the BlackMax. Simply connect the active, neutral and earth from the generator to these terminal blocks, via a 25mm gland from the Parts kit. This allows up to 6kVA to be provided by the generator, assuming it is of sufficient size. See the Commissioning Section - Step 5 below to adjust the amount of power the BlackMax will draw from the generator. An optional generator auto-start feature is available in the BlackMax if the generator is set-up for 2-wire auto-start, see Section 4.6 below.

The following generator specifications must also be met for a guaranteed compatibility with the inverter. Ideally an Inverter-Generator is used as these provide more stable output power. RedEarth can also recommend generators that work with the BlackMax.

- Generator waveform THD: < 10%.
- Generator Vrms range: 180 ~ 264Vac
- Generator voltage crest factor (Vpeak/Vrms): < 1.6
- Generator peak voltage: <380V
- Frequency range: 45Hz ~ 55Hz
- Frequency slew rate: <0.3Hz/sec

#### 4.5.2 Grid connection—to generator terminals inside the BlackMax

When connecting the grid to your BlackMax it is best to think of the grid supply like a generator. When connecting the grid like a generator the grid will run between a pre-determined battery voltage range. In other words, the grid will begin charging automatically when the batteries are low, and automatically stop when the batteries return to a healthy state of charge. When connecting the grid in this form, no extra connection work is required, simply connect the grid into the same generator terminals.

**NOTE:** The grid is limited to 1.5KW by default, if you wish to increase this, please contact RedEarth or follow the steps outlined later in the manual. See section "Adjusting the inverter parameters".



#### 4.5.3 AC-coupled solar inverter connection—to generator terminals inside the BlackMax

Instead of a generator (or the grid) an extra AC-coupled renewables source, like a Fronius inverter can be used. This may be of interest in remote sites where supplying diesel generators with fuel is too expensive or difficult.

Having oversized PV generation capacity means that even in overcast periods there is enough PV being generated to keep the site operating without the need for diesel generator backup. Note that additional battery capacity may be required.

In this case it is important you adjust the system configuration as by default the BlackMax will expect a generator connection. To accommodate this change, follow the steps outlined in section "Adjusting the inverter parameters" or contact RedEarth support before connecting any alternative AC Source. Select "Micro Inv Input". This setting utilizes generator input port as a micro-inverter for grid inverter input (AC coupled). This is compatible with all frequency shiftable "grid-tied" inverters.



#### 4.5.4 Smart load output connection

**Don't have a generator or an AC coupled source? Don't fret, we can customise this port to add more value to your BlackMax System.**

The generator input terminals can also be configured to act as a controlled AC output. It could be used to run an air-conditioner and be switched off once the battery reaches a pre-set state-of-charge.

**Smart Load Output Mode:**

This mode activates when battery SOC and PV power surpass user-set thresholds. For example. Turn on your air conditioning system: ON at 100%, OFF at 95%. In this example you're aircon turns on automatically when PV power exceeds 500W and battery SOC is 100% and turns off automatically when battery SOC is below 95%.



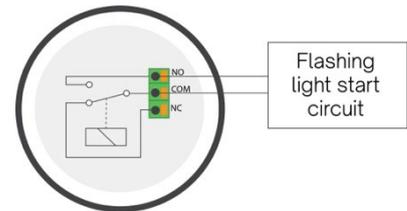
Like connecting an AC Coupled Source - it is important to adjust the system configuration during installation as by default the BlackMax will expect a generator connection.

To accommodate this change, follow the steps outlined in section "Adjusting the inverter parameters" or contact RedEarth support before connecting any additional AC Source.

**4.6 Flashing light connection (and generator auto-start connection)**

**Flashing light to indicate low battery SOC:**

The BlackMax comes with a pre-wired orange light that begins flashing when the state-of-charge (SOC) of the battery drops to 20% or the battery voltage drops below 51 volts, whichever comes first.

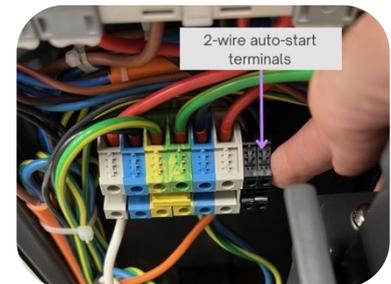


This is meant as a signal that it is time for the user to either reduce their loads until the sun returns in the morning or to start their generator now. If an auto-start generator is connected, then it should have already started before the orange light starts flashing. If it has not, then there may be an issue with the generator (e.g., starter battery is flat).

The flashing light will continue until the battery reaches an SOC of 40% or 54.0 volts at which point the battery will usually have enough charge to continue until the sun comes up in the morning. The generator can be run as long as desired, remembering that it will typically charge the batteries at 1.5kW. So, if the generator runs for 2 hours it will add 3kWh to the batteries.

**Generator 2-wire auto-start (dry contact):**

In addition to the flashing light a 2-wire auto start cable can be installed to automate the generator running. This requires a suitable generator with 2-wire auto-start feature. The flashing light will remain available as we provide two dry-contact points in the BlackMax.



This is done by inserting the two wires from the generator auto-start into the NO and COM terminals marked "Generator Auto Start".

A 2-wire auto-start cable is not supplied by RedEarth.

*Tip: When using an AutoStart generator, install a small battery charger on the generators battery so it does not discharge over time. Otherwise, the generator should be operated each week to charge the starter battery. RedEarth can supply a suitable charger for an additional cost.*

**4.7 Remote monitoring system—connection (optional)**

When the BlackMax was initially purchased, the monitoring device will already be installed, setup and tested in the factory. Remote monitoring allows the BlackMax to be monitored from anywhere using RedEarth's EMU app. **Note that it requires mobile phone coverage to work.** Another internet source can be used, e.g., local WiFi from Starlink, which RedEarth can assist with. 4G can be used if you join Optimum via the RedEarth EMU app.

See image on right of a BlackMax with the remote monitoring equipment installed and a guide to where to run the antenna cable.



To finalise installation of the remote monitoring system:

1. Position the antenna in an area that maximises reception of the mobile phone signal. The antenna is already connected to the BlackMax.
2. Have the customer register their BlackMax by scanning the QR code on the outside of the BlackMax. This allows them to setup their monitoring as explained in Section 6. Monitoring the BlackMax. Once this is done and the start-up procedure has been completed, call RedEarth – Tech Support to confirm that remote monitoring is working. Note that an Installer login is available in addition to customer logins.
3. Sign up for RedEarth's Optimum service to enable monitoring—This comes with a monthly fee to cover the ongoing monitoring data costs (3/4G SIM). It also includes monitoring by RedEarth to provide additional peace-of-mind and to simplify any required trouble shooting. Finally, the customer becomes a member of the RedEarth community and as such can choose to receive regular updates relevant to their electricity usage.



## Step 5. Commissioning the BlackMax

### Turning ON the BlackMax

To **turn on** the BlackMax follow the steps below:

1. Open the lid (remove the two screws at the front left and right first), switch ON the battery breakers on the top of each Troppo battery. The LED and display on each battery will come on. Check that the battery voltage on the displays is reading between 48 and 55 volts. Close the lid.
2. Switch ON the BATTERY SYSTEM D.C. ISOLATOR (#4), found on the right side of the unit. The Victron battery monitor on the top of the system will come on at this time as it is monitoring the overall DC battery status. It indicates the state-of-charge (SOC) of the batteries. It provides the most accurate readings of SOC. Note that when the system is initially installed it may take a few days for the SOC to calibrate, which occurs once the system has gone through a few charge-discharge cycles. This also applies if an extra battery has been added to the system later (In this case also don't forget to update the battery size in the Victron monitor so it can calculate SOC correctly, see instructions in the *Adjusting the Inverter Parameters* in the section below)
3. Switch ON the SOLAR D.C. ISOLATORS (#3), found on the right side of the unit. and check the PV isolator on the left side of the Inverter
4. Turn ON the AC circuit breakers (#2), found on the left side of the unit. The GENERATOR USAGE METER (AC) will only come on if there is power available from a generator or the grid.
5. Open the front door (using the supplied tool to open the two locks) Press the "On/Off" button (#1) on the left hand side of the inverter. The display in the centre of the inverter should soon reflect "ON" in the middle. Please note, it may take 2-3 minutes for the inverter to begin inverting. Once the inverter has started up fully the INVERTER USAGE METER (AC) display on the left side of the unit will turn on showing the AC voltage that the BlackMax is producing together with the current and Watts going to the load. (either via the GPOs or a hard-wired switchboard)



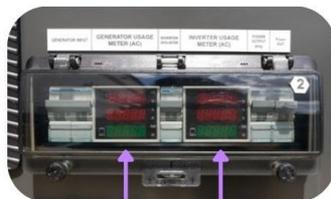
05. Press the "On/Off" button on the left hand side of the inverter



01. Read battery voltage here



02. Switch up to turn on



04. Display showing power going into the BlackMax from a generator. Only on when generator is connected



03. Switch up

### Shutdown procedure

The **shutdown procedure** is the reverse of the “turn on” procedure and is shown below. This procedure label can be found attached to the lid of the BlackMax.

1. Press the “On/Off” button (#1) on the left-hand side of the inverter. Button is OUT when system is OFF.
2. Turn OFF all AC circuit breakers (#2), found on the left side of the unit.
3. Switch OFF the SOLAR D.C. ISOLATORS (#3), found on the right side of the unit.
4. Switch OFF the BATTERY SYSTEM D.C. ISOLATOR (#4), found on the right side of the unit.

The battery breaker on top of each battery does not have to be turned off if the BATTERY SYSTEM D.C. breaker is already off. However, it is recommended to turn them off for long term storage (up to 6 months).

*Tip: If the BlackMax is put into storage, after 6 months the system should be restarted to recharge the batteries (e.g., via a generator).*

**SHUTDOWN PROCEDURE**

- ① Press the On/Off button on side of inverter
- ② Switch OFF on all AC circuit breakers
- ③ Switch OFF the SOLAR D.C. ISOLATOR
- ④ Switch OFF the BATTERY SYSTEM D.C. ISOLATOR

**WARNING**

BATTERY SYSTEM D.C. ISOLATOR DOES NOT DE-ENERGISE THE BATTERY SYSTEM AND BATTERY SYSTEM CABLING

### Adjusting the inverter parameters

The BlackMax has been commissioned and tested in RedEarth’s factory.

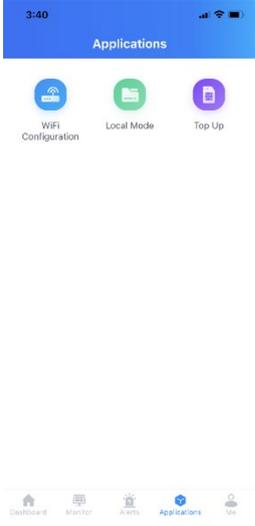
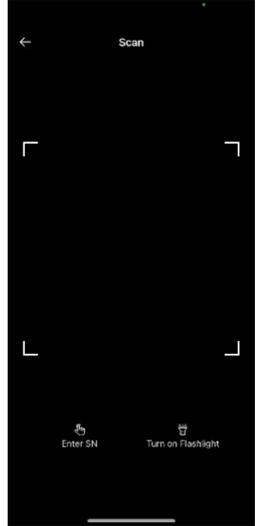
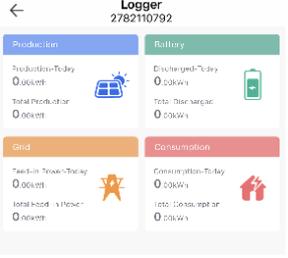
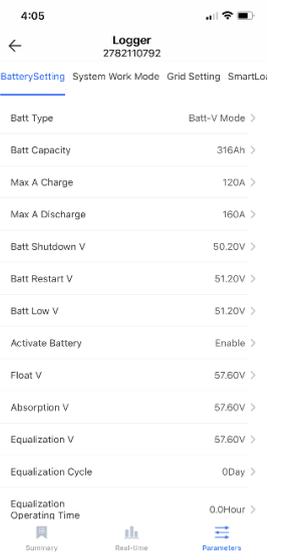
Only minor parameter adjustments may be required:

The most feature rich method of updating any settings on the BlackMax is through the SolarMan smart application. Similar results can be achieved via the screen directly on the BlackMax however the most efficient method is to use this application in Local Mode



### How to Access Local Mode

To access Local Mode follow the steps below:

<p>1. Once logged in, navigate to the "Applications Tab and select "Local Mode" (Green Button).</p> 	<p>2. Once logged in, navigate to the "Applications Tab and select "Local Mode" (Green Button).</p> 	<p>3. You will then be prompted to scan the small QR code located on the wifi dongle at the bottom of the inverter, or enter the logger serial number located on the BlackMax install card.</p> <p>4. After connecting you will see some summary data</p> 	<p>5. To view real-time data select "Real time".</p> <p>6. To adjust parameters locally, select "Parameters"</p> 
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### Standard Settings

If for any reason your inverter has been reset, or you have accidentally changed settings and wish to return them to the RedEarth Default you can do so by entering the following settings for each section.

**Battery Setting-1** Read Successfully Read from 2023/11/13 16:55:51 UTC+10:00 Collapse ^

Batt Type: <input type="text" value="Batt-V Mode"/>	Battery Capacity: <input type="text" value="237"/> Ah	Float V: <input type="text" value="57.6"/> V
Absorption V: <input type="text" value="57.6"/> V	Equalization V: <input type="text" value="57.6"/> V	Equalization Cycle: <input type="text" value="0"/> D
Equalization Operating Time: <input type="text" value="0"/> h/2	Batt Empty V: <input type="text" value="50.2"/> V	Batt Resistance : <input type="text" value="0"/> mΩ
Batt Charge Efficiency: <input type="text" value="96"/> %	TEMPCO: <input type="text" value="0"/> -mV/°C/Cell	

**Battery Setting-2** Set Successfully Set from 2023/11/13 16:53:42 UTC+10:00 Collapse ^

Max A Charge: <input type="text" value="90"/> A	Max A Discharge: <input type="text" value="120"/> A	Batt Shutdown V: <input type="text" value="50.2"/> V
Batt Restart V: <input type="text" value="51.2"/> V	Batt Low V: <input type="text" value="51.2"/> V	Activate Battery: <input type="text" value="Enable"/>
Disable float charge: <input type="text" value="Disable"/>		

**Battery Setting-3** Read Successfully Set from 2023/11/13 16:53:12 UTC+10:00 Collapse ^

Grid Charge: <input type="text" value="Disable"/>	Gen Charge: <input type="text" value="Enable"/>	Grid Signal: <input type="text" value="Disable"/>
Gen Signal: <input type="text" value="Enable"/>	Gen Start V: <input type="text" value="51"/> V	Gen Charge Ampere: <input type="text" value="30"/> A
Gen Force: <input type="text" value="Disable"/>		

**System Work Mode-1** Read Successfully Read from 2023/11/13 11:46:07 UTC+10:00 Collapse ^

System Work Mode: <input type="text" value="Zero Export to Load"/>	Solar Sell: <input type="text" value="Disable"/>	Setup: <input checked="" type="checkbox"/> Monday <input checked="" type="checkbox"/> Tuesday <input checked="" type="checkbox"/> Wednesday <input checked="" type="checkbox"/> Thursday <input checked="" type="checkbox"/> Friday <input checked="" type="checkbox"/> Saturday <input checked="" type="checkbox"/> Sunday
Max Sell Power: <input type="text" value="6000"/> W	Max Solar Power: <input type="text" value="6500"/>	Energy Pattern: <input type="text" value="Batt First"/>
Zero export power: <input type="text" value="20"/>		



**SmartLoad**

SmartLoad Setup: Generator Input

AC Couple On Grid Side: Disable

GEN connect to Grid input: Disable

AC Couple On Load Side: Disable

Read Successfully Read from 2023/11/14 16:28:52 UTC+10:00 [Collapse](#)

Read Setup

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**System Work Mode-2**

Time of Use

	Grid Charge	Gen	Start Time		End Time		Power	Batt	
Time 1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0	0	23	55	1500	W	53.8
Time 2	<input type="checkbox"/>	<input type="checkbox"/>	23	55	9	0	6000	W	49
Time 3	<input type="checkbox"/>	<input type="checkbox"/>	9	0	13	0	6000	W	49
Time 4	<input type="checkbox"/>	<input type="checkbox"/>	13	0	17	0	6000	W	49
Time 5	<input type="checkbox"/>	<input type="checkbox"/>	17	0	21	0	6000	W	49
Time 6	<input type="checkbox"/>	<input type="checkbox"/>	21	0	0	0	6000	W	49

Set Successfully Set from 2023/11/13 20:09:12 UTC+10:00 [Collapse](#)

Read Setup

### Adjusting Generator Charge Rate

To adjust the generator limit you must adjust two parameters.

1. Adjust the Power in section "Time 1", this will adjust how much the generator can be used to feed any loads if the battery is full.

**System Work Mode-2**

Time of Use

	Grid Charge	Gen	Start Time		End Time		Power	Batt	
Time 1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0	0	23	55	1500	W	53.8
Time 2	<input type="checkbox"/>	<input type="checkbox"/>	23	55	9	0	6000	W	49
Time 3	<input type="checkbox"/>	<input type="checkbox"/>	9	0	13	0	6000	W	49
Time 4	<input type="checkbox"/>	<input type="checkbox"/>	13	0	17	0	6000	W	49
Time 5	<input type="checkbox"/>	<input type="checkbox"/>	17	0	21	0	6000	W	49
Time 6	<input type="checkbox"/>	<input type="checkbox"/>	21	0	0	0	6000	W	49

Set Successfully Set from 2023/11/13 20:09:12 UTC+10:00 [Collapse](#)

Read Setup

2. Adjust the "Gen Charge Amperes" setting, this will adjust the number of Amps in which the generator will be allowed to charge the battery.

**Battery Setting-3**

Grid Charge: Disable

Gen Signal: Enable

Gen Force: Disable

Gen Charge: Enable

Gen Start V:  V

Grid Signal: Disable

Gen Charge Ampere:  A

Set Successfully Set from 2023/11/13 16:53:12 UTC+10:00 [Collapse](#)

Read Setup

### SMART LOAD SETUP

The generator input port can be reconfigured as either a smart load output port or as an AC-coupled renewable energy input port.

#### Smart Load Output (e.g., to connect an air-conditioner)

To convert the generator port to a smart load output (disabling generator functionality), navigate to the smart load setting panel and adjust the smart load setup dropdown to read "Smart Load Output".



The screenshot shows the 'SmartLoad Setting' panel. At the top right, it says 'Read Successfully' and 'Read from 2023/11/14 16:34:46 UTC+10:00' with a 'Collapse' link. The 'SmartLoad Setup:' dropdown is set to 'SmartLoad Output'. Below it, the 'on Grid always on:' dropdown is set to 'Disable'. There are two input fields: 'OFF Volt:' with a value of '51' and 'ON V:' with a value of '52'. At the bottom right, there are 'Read' and 'Setup' buttons.

For the Smart Load Output, there are several simple parameters to tune it to the customers’ requirements:

**Smart Load OFF Batt:**

This is the Battery SOC at which the Smart load switches off. (e.g. air-conditioner turns off)

**Smart Load ON Batt:**

This is the Battery SOC at which the Smart load switches on simultaneously, turning on the load. (e.g. air-conditioner turns on)

**On Grid always on:**

Clicking "on Grid always on" activates the smart load when the grid is present.

**AC-coupled renewable input port** (e.g. to connect an extra PV inverter)

To convert the generator port to a smart load output (disabling generator functionality), navigate to the SmartLoad Setting panel and adjust the Smart Load Setup dropdown to read "Micro Inv Input".

The screenshot shows the 'SmartLoad Setting' panel with the 'SmartLoad Setup:' dropdown set to 'Micro Inv Input'. Below it, the 'MI export to Grid cutoff:' dropdown is set to 'Disable'. There are three input fields: 'OFF Volt:' with a value of '51', 'ON V:' with a value of '52', and 'AC\_couple\_Frz\_High:' with a value of '55' and 'R/W' label. At the bottom right, there are 'Read' and 'Setup' buttons.

There are some simple parameters to tune the AC-coupled renewables input port to your customer's requirements:

**Micro Inv Input OFF:**

Microinverter or grid-tied inverter shuts down when battery SOC exceeds this set value.

**Micro Inv Input ON:**

Microinverter or grid-tied inverter starts working when battery SOC is lower than this set value.

**AC Couple Fre High:**

If "Micro Inv input" is chosen, microinverter output power decreases linearly as battery SOC approaches this set value (OFF).

When battery SOC equals the set value (OFF), system frequency becomes the set value (AC couple Fre high), and the Microinverter stops working.

Stops exporting power produced by the microinverter to the grid.

**MI Export to Grid Cutoff**

Enabling this setting allows you to adjust the level of export to the grid when the batteries are full from the renewable AC Source.

**NOTE:** Changes to the BlackMax settings must be done by a trained/qualified person. If in doubt, contact RedEarth Support



## BlackMax Fault Codes

Error code	Description	Solutions
F08	GFDI _Relay_Failure	<ol style="list-style-type: none"> <li>1. When inverter is in Split phase(120/240Vac) or three-phase system (120/208Vac) system, the backup load port N line needs to connect ground;</li> <li>2. If the fault still exists, please contact us for help.</li> </ol>
F13	Working mode change	<ol style="list-style-type: none"> <li>1. When the grid type and frequency changed it will report F13;</li> <li>2. When the battery mode was changed to “No battery” mode, it will report F13;</li> <li>3. For some old FW version, it will report F13 when the system work mode changed;</li> <li>4. Generally, it will disappear automatically when shows F13;</li> <li>5. If still same, and turn off the DC switch and AC switch and wait for one minute and then turn on the DC/AC switch;</li> <li>6. Seek help from us, if cannot go back to normal state.</li> </ol>
F18	AC over current fault of hardware	<p>AC side over current fault</p> <ol style="list-style-type: none"> <li>1. Please check whether the backup load power and common load power are within the range;</li> <li>2. Restart and check whether it is in normal;</li> <li>3. Seek help from us, if cannot go back to normal state.</li> </ol>
F20	DC over current fault of the hardware	<p>DC side over current fault</p> <ol style="list-style-type: none"> <li>1. Check PV module connect and battery connect;</li> <li>2. When in the off-grid mode, the inverter startup with big power load, it may report F20. Please reduce the load power connected;</li> <li>3. Turn off the DC switch and AC switch and then wait one minute,then turn on the DC/AC switch again;</li> <li>4. Seek help from us, if cannot go back to normal state.</li> </ol>
F22	Tz_EmergStop_Fault	Please contact your installer for help.
F23	AC leakage current is transient over current	<p>Leakage current fault</p> <ol style="list-style-type: none"> <li>1. Check PV side cable ground connection.</li> <li>2. Restart the system 2-3 times.</li> <li>3. If the fault still exists, please contact us for help.</li> </ol>
F24	DC insulation impedance failure	<p>PV isolation resistance is too low</p> <ol style="list-style-type: none"> <li>1. Check the connection of PV panels and inverter is firmly and correctly;</li> <li>2. Check whether the PE cable of inverter is connected to ground;</li> <li>3. Seek help from us, if cannot go back to normal state.</li> </ol>
F26	The DC busbar is unbalanced	<ol style="list-style-type: none"> <li>1. Please wait for a while and check whether it is normal;</li> <li>2. When the hybrid in split phase mode, and the load of L1 and load of L2 is big different, it will report the F26.</li> <li>3. Restart the system 2-3 times.</li> <li>4. Seek help from us, if cannot go back to normal state.</li> </ol>
F29	Parallel CANBus fault	<ol style="list-style-type: none"> <li>1. When in parallel mode, check the parallel communication cable connection and hybrid inverter communication address setting;</li> <li>2. During the parallel system startup period, inverters will report F29. when all inverters are in ON status, it will disappear automatically;</li> <li>3. If the fault still exists, please contact us for help.</li> </ol>
F34	ACOvercurrent fault	<ol style="list-style-type: none"> <li>1. Check the backup load connected, make sure it is in allowed power range;</li> <li>2. If the fault still exists, please contact us for help.</li> </ol>
F35	No AC grid	<p>No Utility</p> <ol style="list-style-type: none"> <li>1. Please confirm grid is lost or not;</li> <li>2. Check the grid connection is good or not;</li> <li>3. Check the switch between inverter and grid is on or not;</li> <li>4. Seek help from us, if cannot go back to normal state.</li> </ol>
F41	Parallel system stop	<ol style="list-style-type: none"> <li>1. Check the hybrid inverter working status. If there's 1 pcs hybrid inverter is in OFF status, the other hybrid inverters may report F41 fault in parallel system.</li> <li>2. If the fault still exists, please contact us for help.</li> </ol>
F42	AC line low voltage	<p>Grid voltage fault</p> <ol style="list-style-type: none"> <li>1. Check the AC voltage is in the range of standard voltage in specification;</li> <li>2. Check whether grid AC cables are firmly and correctly connected;</li> <li>3. Seek help from us, if cannot go back to normal state.</li> </ol>

F47	AC over frequency	Grid frequency out of range 1. Check the frequency is in the range of specification or not; 2. Check whether AC cables are firmly and correctly connected; 3. Seek help from us, if cannot go back to normal state.
F48	AC lower frequency	Grid frequency out of range 1. Check the frequency is in the range of specification or not; 2. Check whether AC cables are firmly and correctly connected; 3. Seek help from us, if can not go back to normal state.
F56	DC busbar voltage is too low	Battery voltage low 1. Check whether battery voltage is too low; 2. If the battery voltage is too low, using PV or grid to charge the battery; 3. Seek help from us, if can not go back to normal state.
F58	BMS communication fault	1. It tells the communication between hybrid inverter and battery BMS disconnected when "BMS_Err-Stop" is active; 2. If don't want to see this happen, you can disable "BMS_Err-Stop" item on the LCD; 3. If the fault still exists, please contact us for help.
F63	ARC fault	1. ARC fault detection is only for US market; 2. Check PV module cable connection and clear the fault; 3. Seek help from us, if cannot go back to normal state.
F64	Heat sink high temperature failure	Heat sink temperature is too high 1. Check whether the work environment temperature is too high; 2. Turn off the inverter for 10mins and restart; 3. Seek help from us, if cannot go back to normal state.

### Victron BMV setup - State-of-charge measurement

The Victron BMV provides the most accurate state of charge measurement of the batteries. It uses a shunt to measure the current flowing into and out of the battery, rather than just relying on the battery voltage.

For it to provide the correct readings the battery size needs to be entered correctly. This is done in the factory, however if an additional battery is added later then this value will need to be updated.

In addition, the Victron BMV will need to calibrate itself over a couple of charge-discharge cycles to be completely accurate after the initial installation.

The procedure to change the Battery capacity is most easily done by using the VictronConnect App.

The table shows the settings to apply for the BlackMax.

Review the Victron BMV manual provided in the Parts kit for additional details.



Battery settings	
Battery capacity	<ul style="list-style-type: none"> <li>80Ah: One Troppo battery</li> <li>160Ah: Two Troppo batteries</li> <li>240Ah: Three Troppo batteries</li> </ul>
Charging voltage	57.6V
Discharge floor	0%
Tail current	4.00%
Charged detection time	3m
Peukert exponent	1.05
Charge efficiency factor	96%
Current threshold	0.10A
Time-to-go averaging period	3m
Battery starts synchronised Battery SOC after a reset will be 100	<input type="checkbox"/>
State-of-Charge Manually set the current state of charge	30%. Manually set SOC to initial state-of-charge (usually 30% from the factory)
Synchronise SOC to 100%	No need to synchronise. Can be done if the batteries are known to be full.

### Fan Control Adjustment

The thermostat that controls the fan operation is located inside the unit near the fan. This automatically starts the fans once the temperature rises above the set-point. This set-point can easily be adjusted with a small screwdriver. It is set to 25° Celsius in the factory. Turn this screw until the fan comes on then reset it to 25° Celsius, or the desired setting.



### Test the operation of the backup generator, if available.

If the customer has a generator, now is the time to test that it charges the BlackMax, and to demonstrate this to the customer.

Many future issues can be avoided if the customer's generator is tested during installation to confirm that it syncs with the inverter and charges the batteries.

Note: 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. The amount of load that will be drawn by the generator is dependant on the configuration of the BlackMax (Default Max 1.5KW), please ensure this is set appropriately as if the other loads are too high the generator may become overloaded, and if set to low, the generator will be underutilised. If the generator starts due to low SOC it is always recommended to reduce your other loads while the battery is being charged.

The 'GENERATOR USAGE METER (AC)' on the right side of the system shows the load the generator is supplying. The power display in Watts can be used to ensure that the generator does not become overloaded.



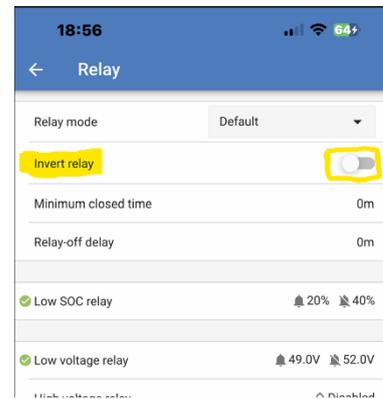
The generator is only needed if the battery becomes depleted. This usually occurs when after the sun has gone down, and the solar panels are not charging the battery. If the BlackMax shuts down during the night, then it will automatically begin recharging itself in the morning when the sun comes up.

NOTE: When using the grid instead of a generator the 'GENERATOR USAGE METER (AC)' display will remain on. The current reading will however show 0amps unless the grid is called upon (e.g. low soc), or is force enabled through settings. Note: in the event of a blackout this screen will turn off and no power will be available from the grid until the blackout passes,

### Flashing light alert

The flashing light will come on when the State-of-charge (SOC) of the battery drops to 20% or the battery voltage drops below 51 volts, whichever comes first. The flashing light will continue until the battery reaches an SOC of 40% or 53.8 volts.

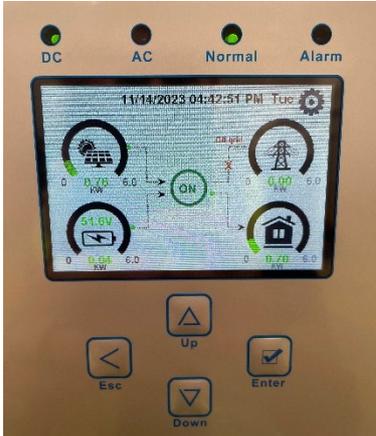
During installation this can only be tested if the battery voltage or SOC drops below these settings, which may not occur while the installer is onsite. A partial test can be conducted by logging into the VictronConnect app and manually closing the **Invert relay** switch. This will start the light flashing.



### Generator 2-wire auto-start

If the generator 2-wire auto-start option has been installed during installation at the customer's site, then it will be necessary to confirm the generator auto starts during installation. To do this complete the following steps to force start the generator.

**Step 1.** Select the Settings menu in the top right of the home screen, if you are not at this screen press "Esc" repeatedly until you return home.



**Step 2.** Then select Battery Settings



**Step 3.** Navigate to page 2 with the down arrow:



**Step 4.** Enable "Gen Force" and press the tick.



**Step 5.** Press escape, shortly you will hear a click which is the generator autostart contactor closing, you will then see a generator appear on the home screen and the generator should start. If you have any issues, contact RedEarth support.



## Step 6. Monitoring the BlackMax

There are currently two ways to monitor the BlackMax.

1. Locally via the screen on the front of the Inverter
2. Remote monitoring via the RedEarth EMU App (Optional)

### OPTION 1. The BlackMax displays:

The BlackMax includes 4 on-board displays to monitor and control the system.

These are the Inverter display and Victron BMV display in the lid and the two load monitors on the left side of the system.

#### Inverter display

The Inverter display also allows parameters to be adjusted. Icons represent the different operating modes and arrows indicate the direction of power flow. Below are a few images illustrating some of the most common operating situations. A detailed explanation of the display icons can be found in the SUN-6K Inverter manual in the Parts kit included with your system.

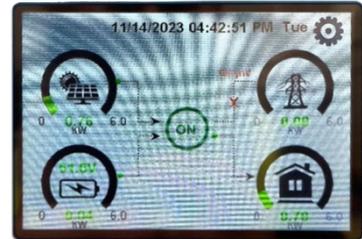
1. Home screen



2. Generator summary



3. Load summary



4. Solar summary

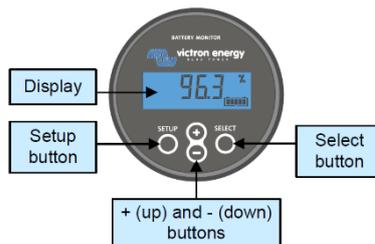


5. Battery summary



**Victron SOC display**

The Victron display is set to show the State-of-charge (SOC) in the factory. It can show a number of different battery parameters by pressing the '+' and '-' buttons.



BMV head unit display and buttons.



**AC power displays**

The two AC displays on the right side of the system show the AC power coming out of and going into the unit.

When power is available the display turns on.

The normal display shows the AC voltage, the AC current and the total power in Watts.

If the SAM-CK button on the bottom left of the display is pressed, then the display changes to showing Power factor, cumulative operating hours and cumulative AC energy delivered (in kWh). The cumulative AC energy and operating hours are retained even when the display is turned off.



## OPTION 2. Remote monitoring via RedEarth’s EMU app

Monitoring your system is done via RedEarth’s EMU app. To setup monitoring follow the steps below.

Scan the QR code sticker attached on your system. It looks like this:



Scanning the code will take you to the RedEarth customer portal. Enter the information requested and register your warranty to get the most from your investment in your BlackMax as well as RedEarth’s PPP.

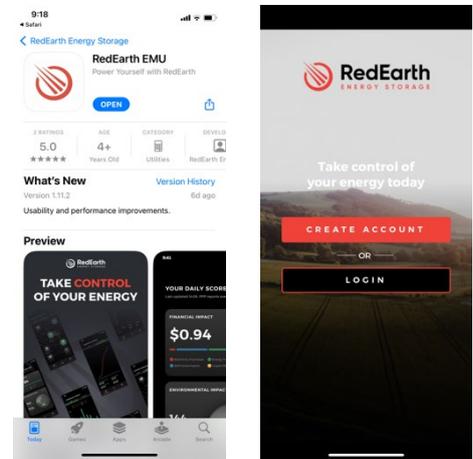
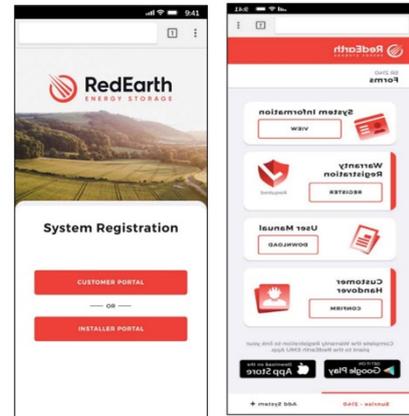
After completing the warranty registration, you can easily create an account on the RedEarth EMU app with the same email and start viewing your system straight away.

If you have any issues email [support@redearth.energy](mailto:support@redearth.energy) or call RedEarth tech support number: 1800 733 637

Click on the Google Play or App Store icons to download the RedEarth EMU app.

Create your account and RedEarth will immediately send a confirmation email to your email account.

Now you are good to go!



## Step 7. Finalising installation and customer handover

Before handing over the system, go through the following items and be sure that they have been completed.

- Check for proper weatherproof seals on all entry glands to the BlackMax, including PV cables, earth, antenna if supplied, and load or generator if hard-wired, otherwise close these holes with the covers supplied in the Parts kit.
- Check that the system is correctly earthed, either via the customer’s local earth or through a locally installed earth stake.
- A MEN link is installed as required.
- All cable connections are tight.
- Ensure that the two protective plastic covers are in place over the AC and DC wiring.
- Explain to the customer how the system operates and how to operate it (also see User Manual)
  - Demonstrate starting and stopping the system.
  - Explain the monitoring displays
    - Main inverter display in the lid



- Victron state-of-charge meter in the lid. (option to show them the Victron Bluetooth monitoring App)
- Internal Battery display readings
- Left side displays - explaining and demonstrating AC power OUT and IN readings. Connect a range of loads to demonstrate their different power consumption.
- Demonstrate the customers generator charging the BlackMax (also confirms that the customers generator is suitable). Confirm that the charge rate is set correctly for the generator available. The default setting is 1.5kW. Explain to the customer that if other loads are on while the generator is charging the battery then these will be additional load on the generator, which may overload a smaller generator.
- If remote monitoring is installed, assist the customer to download the RedEarth EMU app on their mobile phone and register their system and warranty using the QR code on the side of the system.
- Check screws holding the lid down are in place. Check the vents and fans are properly attached.
- Provide all Manuals, documents, and spare parts to the customer.
- The system is now ready for handover.

# FAQs and Trouble shooting

## 1. “I lost power!” What should I do?

R: The most likely reason for this is that the battery has reached the low SOC limit and has stopped inverting (producing 240V power). In this situation, turn the system off, start the generator, turn your BlackMax on again as recommended in the “Shutdown and Start-up” procedure in this manual. HOWEVER, be sure to leave the Power OUT breaker turned off. This will allow all the power generated to go directly to the battery and not to the load. Let the batteries charge for 15 minutes and then turn on the main breaker.

**NOTE:** You can turn the main breaker on again but be careful not to use more than is being produced. This will lead to draining the batteries even more and possibly damaging them.

If you do not have a generator, then wait until there is PV power available. The inverter will automatically recharge the battery and turn back on once the battery is at a safe level.

## 2. What happens if my Troppo batteries go completely flat, with no lights on the battery itself?

R: This will happen if the BlackMax is re-started and the battery not immediately charged. Contact RedEarth’s technical support on 1800 733 637.

**NOTE:** This system will still work in Emergency Power Mode – meaning that limited power will be available when the solar panel are in sunlight.

## 3. My Generator is not charging the batteries. What does this mean?

R: The first and most obvious thing to check in this situation is that the Power IN breaker is turned on. If so, the power produced by the generator might not be within the inverter’s acceptable range. Look at the generator requirements in Attachment C of the installation manual. Some cheap generators do not produce power of sufficient quality to charge the batteries, even though they can still run simple loads like fans and heaters. Another possibility is that the generator is supplying power to the loads and there is not enough to recharge the batteries. Try turning off the Power OUT breaker for a while and see if the batteries are now taking charge.

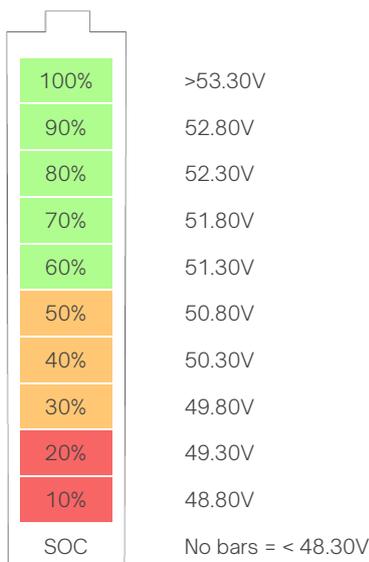
## 4. How do I know if the battery is full/empty?

Because the Troppo batteries don’t interact/communicate with the inverter, the SOC is a calculation based on voltage parameters. What this means is that the SOC is not always accurate.

The best way of estimating the SOC of the batteries is by analysing the Voltage. In the example on the right, if the battery has about 53V, the SOC is neat to 100% (blue arrow). Or, if at 48V, the SOC is below 6% (red arrow).

With a range between 64 and 45 Volts, identify the SOC according to Appendix A in this manual.

**Troppo-4841**  
State-of-charge (SOC) vs. battery voltage (with no load)



# Services and options available for the BlackMax

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RedEarth can provide several options for the BlackMax.

- Additional Troppo batteries - up to the maximum of three for the BlackMax (12.3kWh nominal)
- Remote monitoring option (if not ordered with the initial purchase) - requires additional hardware and mobile phone coverage.
  - RedEarth keeps an eye on your system. This service comes with a monthly fee.
  - It includes membership of RedEarth Optimum which provides quarterly advice on how your system is performing.
- BlackMax Power Station Kit: PV panels, racking and pre-terminated PV cables
- Information on suitable Generators (including with 2-wire auto start)



RedEarth has additional information on the website: [www.redearth.energy](http://www.redearth.energy).

## RedEarth contact details

RedEarth Energy Storage Ltd.  
15 Fienta Place, Darra,  
Brisbane, QLD 4076  
Australia

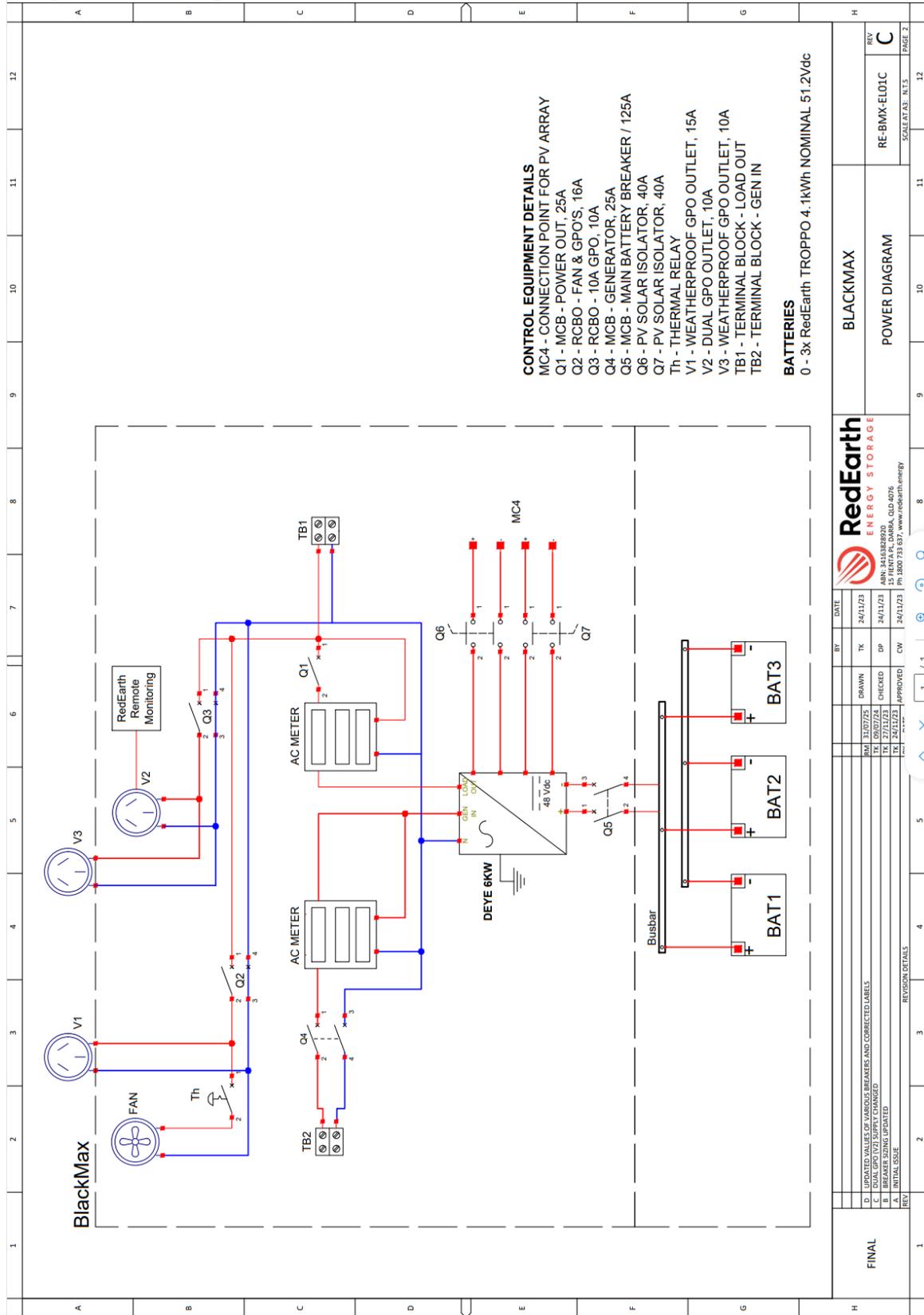
**RedEarth office: (press '2' for Tech support)**  
(07) 3279 6707  
1800 733 637

**Technical support: (Note: if you pre-book your approximate installation time then you will get through without delay)**  
0487 002 451

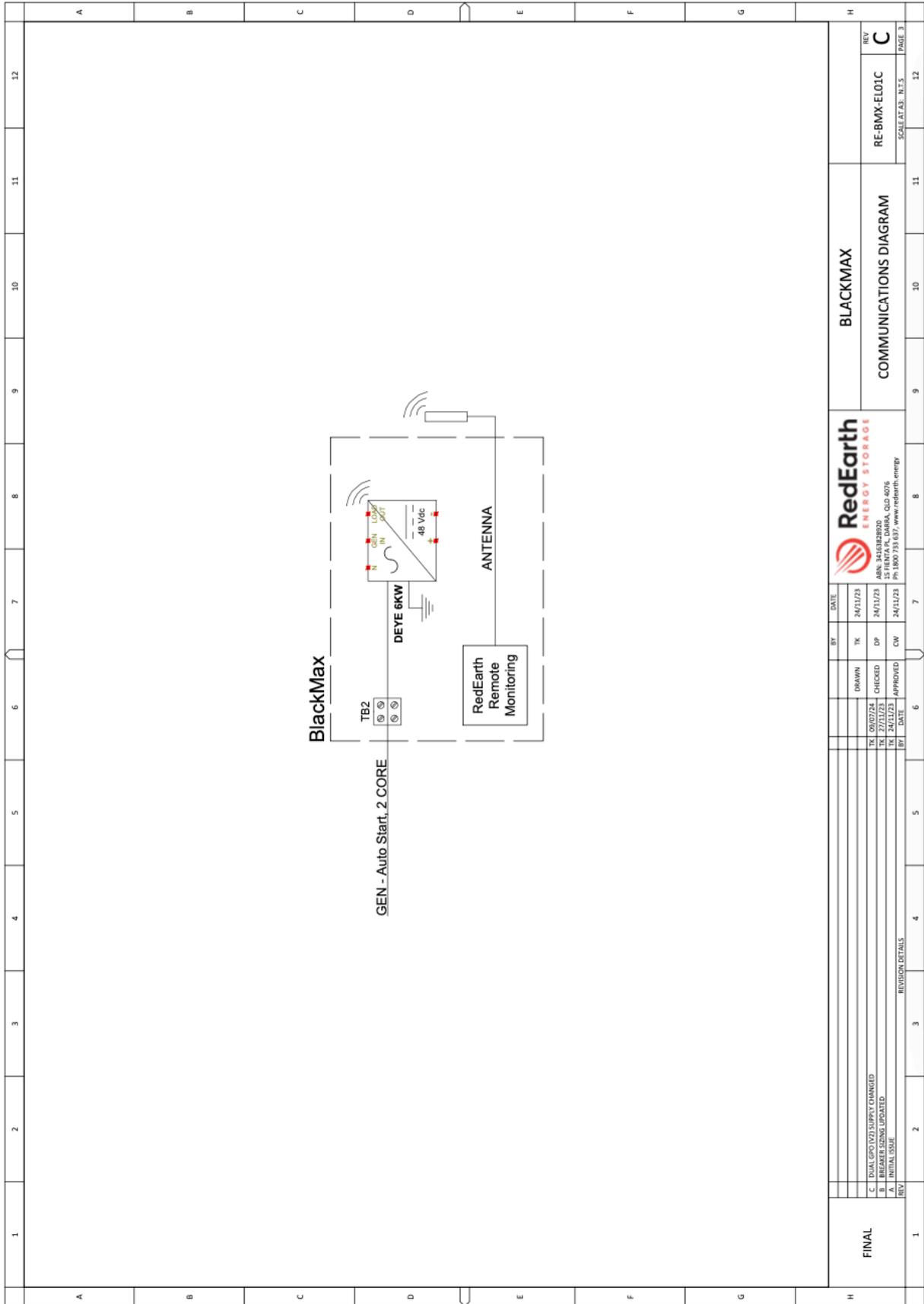
**Email:**  
[support@redearth.energy](mailto:support@redearth.energy)

# Appendix A.

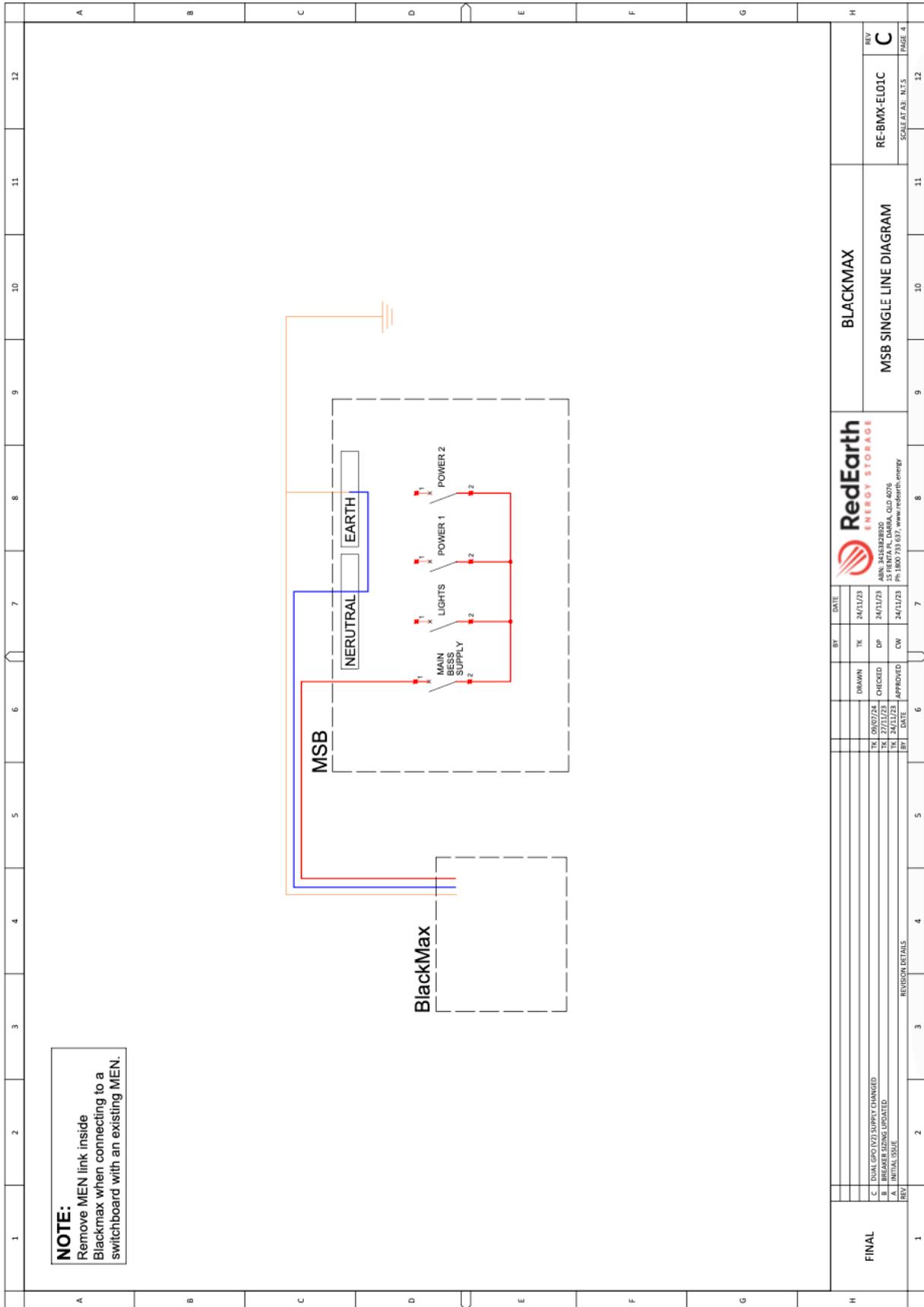
## Single Line Diagram: Power



# Single Line Diagram: Communications



# Single Line Diagram: Generic Main Switchboard



# Appendix B.

## Technical Specifications: BlackMax

BlackMax Model	6kW 1-phase BMX-6-1xx
Battery capacity of BlackMax system (Troppos)	1 to 3
Battery capacity of BlackMax system (kWh nominal)	4.1 to 12.3
Inverter model	6K-SG04LP1-AU
Battery data	
Battery type	Tropo 4841 LFP self-managed lithium
Battery capacity (nominal)	4.1kWh per Troppo battery
Battery operating voltage range (V)	48-57.6V
Maximum charging current (A)	135A
Maximum discharging current (A)	135A
PV string input data	
Maximum allowable PV (W)	12000W
Maximum usable PV (W)	9000W
Maximum PV input voltage (V)	500V
MPPT range (V)	150 to 425V
Start-up voltage (V)	125V
PV input current (A)	13A+13A
Maximum PV Isc (A)	19.5A+19.5A
No. of MPPT trackers	2
No. of strings per MPPT tracker	1+1
AC output data	
Rated AC output and UPS power (W)	6,000
Maximum AC output power (W)	6,000
Peak power (off-grid)	2 times of rated power, 10 S
Rated AC output current (A)	26.1A
Maximum AC output current (A)	26.1A

Maximum continuous AC passthrough (A) * When installed in the BlackMax system AC passthrough is current limited to 25A	40A*
Generator Total Harmonic Distortion (THDi)	<3% (of nominal power)
Power factor	0.8 leading to 0.8 lagging
Output frequency and voltage	50Hz; 230V/400V, 240/415V
Grid connection type	Single phase L/N/E
<b>Protection</b>	
Integrated	Anti-islanding Protection, Surge protection, Output Shorted Protection, PV String Input Reverse Polarity Protection, Output Over Current Protection, Insulation Resistor Detection, Residual Current Monitoring Unit
Over voltage category	DC Type II / AC Type III
<b>Certifications and standards</b>	
Grid regulation	AS/NZS 4777.2
EMC / Safety regulation	IEC/EN 61000-6-1/2/3/4, IEC/EN 62109-1, IEC/EN 62109-2
<b>General data</b>	
Operating temperature range (°C)	-40~60°C, 45°C derating
Cooling	Smart cooling with temperature-controlled fans
Weight of BlackMax battery enclosure (excluding batteries) (kg)	74
Size of BlackMax battery enclosure (mm)	750W x 1028H x 602D
Protection degree of BlackMax system	IP43
RedEarth Warranty	10 years (AU & NZ and South Pacific region)

## Technical Specifications: RedEarth Troppo-4841 battery

The table below includes all the specifications of the Troppo battery that need to be understood. It also includes additional information to help the installer to understand the specifications and parameters of the battery. More detailed information on specific settings required for common hybrid inverters and MPPTs are available separately.

The TROPPO battery incorporates a self-managed BMS that does not require communication with the inverter/charger to operate. It does however require the inverter/charger settings to be within the specifications of the battery as listed below.

Electrical characteristics	Installer information
<b>Nominal capacity</b> 4.1kWh / 79.8Ah	79.8Ah x 51.2Vdc (nominal battery voltage) = 4,086Wh (approx. 4.1kWh) 16S21P = 336 x 3,800mAh cells
<b>Useable capacity</b> 3.69kWh (90% of nominal capacity)	<u>Useable capacity</u> is the capacity available when operating the battery within the normal voltage range of the connected inverter/charger. (e.g. 48.0-57.6Vdc) <u>Nominal capacity</u> is the capacity when the battery is operated from its lowest shutdown voltage up to its maximum charge voltage in a laboratory environment. (40.0-58.4Vdc)
<b>Nominal DC voltage</b> 51.2V	3.2V per cell (LFP type) x 16 cells in series (16S) = 51.2Vdc
<b>Maximum discharge current</b> 63A (Limited by circuit breaker)	63A 2-pole MCB protects battery and cabling. K-curve breaker characteristic (e.g., thermal shutdown in 3-60 mins at 75 amps)
<b>Recommended continuous discharge current</b> 40amps (C2)	Recommend C2 rate to get maximum life from LFP chemistry optimised to provide maximum energy = 79.8Ah x 0.5 = 40amps dc for longest life.
<b>Maximum charge current</b> 63A (Limited by circuit breaker)	BMS over charging current protection is set at 78amps +/-8amps however the 63amp K-curve MCB will switch off as designed.
<b>Recommended continuous charge current</b> 16A	For maximum life it is recommended to charge at below 40% of C2 rate = 16amps (C2 rate = 79.8Ah x 0.5 = 40amps dc)
<b>Maximum power on discharge (kW)</b> approx. 3kW	Maximum 63amps x ~50 volts = approx. 3,000 Watts per Troppo battery
<b>Recommended operating voltage range</b> 48.0 - 57.6 Vdc	48.0Vdc ensures the inverter stops supplying loads before the battery shuts down internally. 57.6Vdc is required for the balancing circuit inside the BMS to balance all the cell strings at the top of charge.
<b>Charge / discharge cycles of certified 3,800mAh cells at 1C rate (to 80% residual capacity)</b> 2,000@100% DoD / 4,000@80% DoD / 7,000@50% DoD @25°C operating temp.	4000 cycles = 10.9 years at 80% daily DoD (Depth of Discharge) when charging and discharging at 1C rate (79.8amps). This is for the cells used in the Troppo battery.
<b>Projected MWh delivered over battery lifetime</b> 11.77 MWh at 80% DoD (to 80% SOH)	= 4000 cycles x 4.086kWh x 80%doD x 90% av. SOH = 11.77MWh (Note: average SOH over 10 years is (100%+80%)/2=90%) (SOH-State of Health)
<b>Round trip efficiency</b> >96%	Minimal battery losses and therefore minimal internal heat generation in normal operation
<b>Parallel connection</b> from 4.1kWh to 100kWh+	Ask RedEarth for advice and support
<b>Series connection</b> Not designed for series connection	Only designed to operate in nominal 48Vdc systems- ask RedEarth for support
<b>Expected calendar Life @25°C</b> >10 years when used as per warranty terms	RedEarth warranty 10 years - see warranty document for details
Display and LED light characteristics	Installer information
<b>Blue LED light</b> Battery ON indicator	This LED indicates that the battery is on and that the BMS has not shutdown due to low battery voltage. Note that the light includes a momentary switch that is not used in the current version of the Troppo battery
<b>Display description</b> Shows real-time battery status as well as life-time cumulative kWh	This display shows the battery voltage as well as the real-time discharging/charging current and rate (in kW). The arrows indicate charging (IN) and discharging (OUT). The display also includes a life-time kWh measurement. This is a cumulative measurement of the total kWh discharged from the battery. It is measured using an internal shunt. The cumulative hours is the total hours it has been running.
<b>Display operation</b> ON/OFF button on the display	The display light can be turned off if desired by pushing the button on the right side of the display face. Note that this display system is completely independent of the battery BMS. If it fails, it will not affect the functioning of the battery. The blue LED light will continue to function as normal.
<b>Display SOC indicator</b> Indicates SOC (<48.3V=0 bars >53.3V=10bars)	This indicator of battery SOC is solely based on the battery voltage. When the voltage is at or below 48.3V then none of the 10 bars are lit. For each 0.5V above 48.3V one extra bar is lit until all 10 bars are lit at 53.3Vdc. Note that charging and discharging rates will affect the voltage reading of the battery. For this reason, the SOC display is only an indicator.

Environmental characteristics	Installer information
<b>Ambient temperature vs. cell temperature</b>	The ambient temperature is not necessarily the cell temperature. The BMS monitors the cell temperature to decide if the cells are within their design operating range.
<b>Operating temperature range – Discharging</b> Discharge -20°C to 60°C (+/-5°C)	The BMS shuts down discharge when the internal cell temperature sensor measures outside this temperature range. This is an abnormal situation and requires investigation. As such the battery requires a manual restart before it can be operated again.
<b>Operating temperature range – Charging</b> Charge: 0°C to 50°C (+/-5°C)	The BMS shuts down charging when the internal cell temperature sensor measures outside this temperature range. It will automatically restart once the temperature sensor measurement moves back into the range 5°C to 50°C (+/-5°C)
<b>Cooling</b> Natural convection	No fans. Install in a shaded area
Physical characteristics	Installer information
<b>Battery mounting options</b> In a standard 19" rack or free-standing horizontally, vertically or on either side	RedEarth can provide pre-wired VAULT battery racks. RedEarth also has a range of certified fully pre-wired inverter battery systems for both on- and off-grid applications.
<b>Battery securing mounts for 19" racks</b> Removable "wings" supplied if required	Bolt-on wings provided to secure the battery in any standard 19" rack. Note that the rack needs to be at least an 800mm deep design. The wings can be connected in two orientations, either flush with the faceplate or set back from the face plate, when they are turned around. This allows the Troppo to be installed in an 800mm deep 19' rack.
<b>Battery terminal connections</b> Amphenol Surlok 100A Non Keyed	Connectors are rated to 100A if 16mm <sup>2</sup> battery cable is used, and 120A if 25mm <sup>2</sup> batt cable is used. (Note: 63A MCB and the BMS prevents current reaching this level)
<b>Battery circuit breaker</b> 2-Pole 63A 360VDC (K-Curve)	2-pole 63A 600Vdc (K-curve)
<b>Battery dimensions</b> 725mm D (including handle) x 438mm W x 88mm H (2RU)	Fits into a 19" rack (2RU high) and 800mm deep
<b>Battery weight</b> 42.5kg	Handle is rated to 80kg
<b>IP rating</b> IP40	Ingress Protection IP40: <u>1st number (solids)</u> - 4 = protected from wires > 1mm (this is related to the Amphenol connector) <u>2nd number (liquids)</u> - 0 = not protected
Safety parameters and certification	Installer information
<b>Short-circuit current</b> 400 amps per battery in parallel	1) max BMS discharge protection = 400A (<0.1 seconds) 1) K-curve 63A MCB = 8-14In = 504-882 amps (<0.01 seconds)
<b>Lithium Composition</b> Lithium Ferro Phosphate (LiFePO <sub>4</sub> or LFP)	Safest lithium chemistry (LFP) .....Note: e.g. LG uses NMC lithium which has higher energy density but is not as stable.
<b>Certification - TROPPO 4841 Battery</b> IEC:62619:2017 & UN38.3	Approved for use and transportation in Australia. Required certification for installers
<b>Certification - LiFePO<sub>4</sub> 3,800mAh Cell</b> IEC:62619:2017, UN38.3	3,800mAh Cell used in the Troppo battery is certified by TuV specifically for RedEarth
<b>CEC listing</b> Yes	Approved for use in Australia
Battery Management System (BMS) protection settings	Installer information
<b>Battery type and number of cells in series</b> LiFePO <sub>4</sub> (16S)	Custom BMS designed and built to RedEarth specifications
<b>BMS Over-Volt cut off</b> 58.4Vdc	Maintain battery between 48.0 & 57.6 Vdc. There is very little remaining energy in the battery below 48.0Vdc
<b>BMS Under-Volt cut off</b> 40V	Battery will switch off internally - follow Flat Battery Restart procedure to restart the battery
<b>Charging over-current protection</b> 78±8A	BMS will shutdown charging above this level
<b>Discharge over-current protection (2 levels)</b> 250±60A(20-400mS) & 400±100A(10-100mS)	Two over-current protection levels: 250+/-60A delay 20-400mSec 400+/-100A delay 10-100mSec
<b>Inverter capacitors -starting capability</b> 14,600uF	A single TROPPO battery can provide the surge current needed to start an inverter with up to 14,600uF of capacitors on the DC side.
<b>High temperature - discharge protection</b> 60±5°C	Battery will not discharge if both temperature sensors in the cell pack are reading above this temperature
<b>High temperature - charge protection</b> 50±5°C	Battery will not charge if either one of the two temperature sensors in the cell pack are reading above this temperature
<b>Low temperature - discharge protection</b> -20±5°C	Battery will stop discharging if one of the two temperature sensors reads below this temperature
<b>Low temperature - charge protection</b> 0±5°C	Battery will stop charging if temp sensors reads below this temperature - This is a required feature of all installed battery systems

<b>Cell balancing method</b>	Top balancing (i.e. during charging once each row of cells reaches 3.65V)
Passive equalisation at 57.6Vdc	
<b>Note:</b> In our efforts towards constant product enhancement this specification is subject to change to at anytime without notice	

Short-circuit Current (I <sub>sc</sub> )	
1x	0.4 kA
2x	0.8 kA
3x	1.2 kA
4x	1.6 kA
5x	2.0 kA
6x	2.4 kA
7x	2.8 kA
8x	3.2 kA

UN Number	
	3481





**Power yourself.**