

Installation and Operation Manual

BushChook

- Whole home backup option
- On-grid and off-grid homes
- 1-phase and 3-phase homes



RedEarth's BushChook systems offer Australian-made scalability, making them an excellent and enduring investment for your home. **Available in both single and three-phase configurations**, the BushChook provides a range of power outputs tailored to accommodate your specific needs.



Safety instructions

Symbol	Explanation
	Indicates additional information, emphasized contents or tips that may be helpful.
	Caution, risk of electric shock.
	Caution, risk of danger.
	Do not touch live parts until 10 minutes after disconnection from the power sources.

 **WARNING:** Working on the inside of the BushChook 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 BushChook must only be installed by suitably qualified personnel who have read and are familiar with its operation and hazards.

 The battery provided with this system must only be charged by the Deye inverter or the V2G (vehicle to grid) charger supplied by RedEarth. Do not attempt to charge the batteries with any other charging device or connect any devices directly to the DC battery bus unless approved by RedEarth.

 In the event of a fire evacuate the area and call emergency services. A dry agent fire extinguisher should be readily available and used. DO NOT use water. MSDS document is provided with the system and can be found at www.redearth.energy

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

 A battery can present a risk of electrical shock and high short-circuit current. The following precautions should be observed when working on batteries:

- Remove watches, rings, and other metal objects.
- Use tools with insulated handles.

Disconnect charging source prior to connecting or disconnecting battery terminals.

 In our efforts towards constant product enhancement, this document is subject to change at any time. Please visit www.redearth.energy and download the appropriate and latest version manual.

Lifting hazard

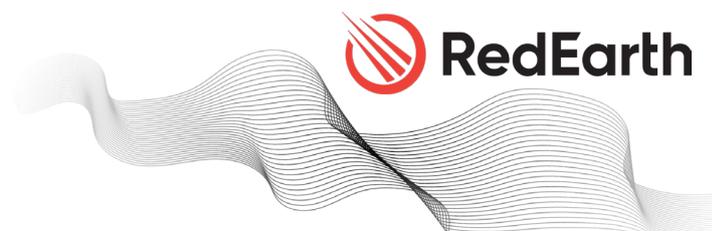
The BushChook is heavy. Observe proper lifting techniques. To reduce the weight the Troppo batteries can be removed.

Fire

The BushChook 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

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Overview

RedEarth's BushChook home battery system is your complete solution for both on-grid and off-grid homes. There are models for both single-phase (5kW, 8kW and 10kW) and three-phase (12kW) homes.

BushChook is an all-in-one battery system designed to be very easy to install. As an Australian-made product built in Brisbane, RedEarth provides best-in-class support for BushChook owners and installers.

The system, including solar panels, generates and stores electricity for use day and night, and includes a whole-home backup capability so that customer's loads remain powered during any blackout (load dependent).

For the homeowner it minimises electricity bills, optimises electricity usage (including electric vehicle charging) and reduces the homes carbon footprint.

RedEarth also provides the option of ongoing manufacturer support and benefits for 10 years after the BushChook has been installed by joining RedEarth's Optimum program.

RedEarth's Optimum program also provides access to RedEarth's PPP (Private Power Plant), to generate additional income such as through Energy Trading or Smart EV charging. Contact RedEarth for additional information.

The BushChook battery system is monitored and controlled via RedEarth's EMU app, available for both Apple and Android phones.

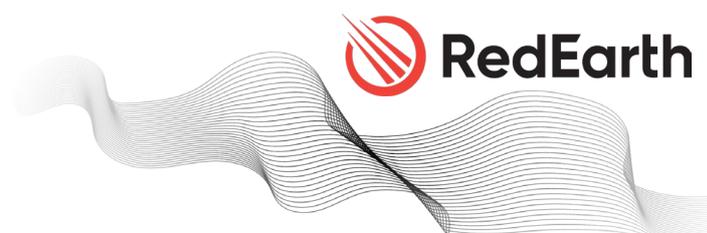


Installation features:

- The BushChook system can easily be retrofitted to an existing PV solar system that may already be installed at the home.
- Solar panels: Up to 24kW of panels can be connected to the 12kW 3-phase BushChook and 20kW of panels to the 10kW 1-phase BushChook. This is usually enough to meet the needs of a typical home as well as charge an electric vehicle using only electricity generated at home.
- The BushChook is designed so that additional batteries can easily be added in the future, right up to eight batteries with a total of 32.8kWh. Buy what is needed now, and add more later as demand grows, e.g., an electric vehicle is purchased.

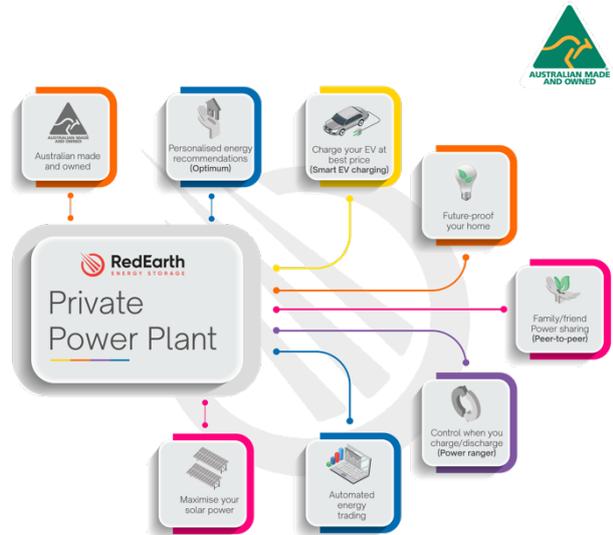
RedEarth's Private Power Plant (PPP)

Transforming your home into a more valuable and lucrative investment is easily achievable through the integration of RedEarth systems and proprietary Private Power Plant (PPP). As we step into an electrified future, homes need to be ready. By harnessing the untapped potential of your rooftop, you can generate up to three times the amount of solar energy needed to power your residence or business. The result? Your property becomes your very own Private Power



Plant, RedEarth’s ground-breaking innovation that offers a myriad of advantages.

With RedEarth systems installed, you not only gain access to a continuous source of renewable energy but also create an additional revenue stream by feeding surplus energy back into the grid. This not only offsets your energy costs but could even turn a profit. Additionally, you contribute to a sustainable future by significantly reducing energy waste and, over time, effectively eliminating power bills. The decision to "RedEarth-ify" your home is not just an investment in the present but a forward-thinking step towards financial security, eco-friendliness, and long-term value enhancement for your property.

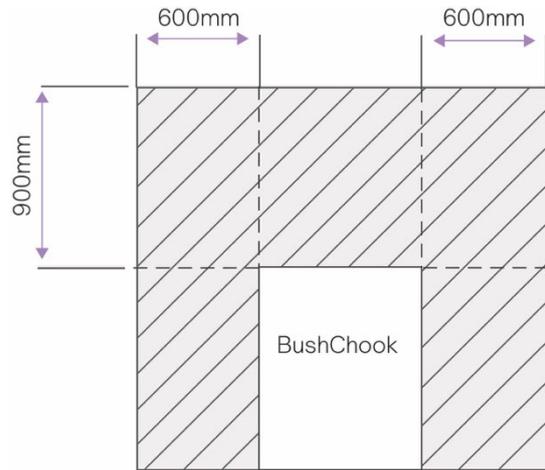
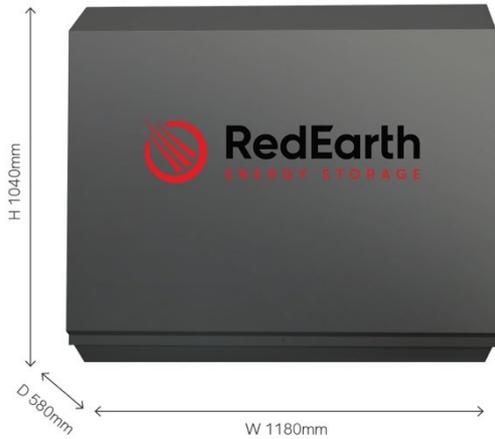
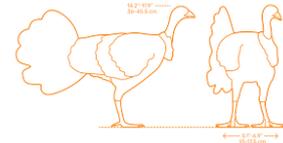


RedEarth offers its PPP to generate more value for BushChook battery system owners than is generally available from other battery systems which do not offer an ongoing support program like RedEarth's Optimum. Contact RedEarth for more details.

BushChook is fully certified to AS4777.2:2020 & IEC62109.1&2 & AS60950.1 and conforms to the Australian Battery Safety Guide.



Dimensions and positioning information



BushChook weight, size, and IP rating:

- 465kg with 8 x TROPPO Lithium batteries (42.5kg per battery)
- 125kg complete without batteries.
- 1040H x 1180W x 580D [mm]

Positioning information summary:

Minimum clearance around BushChook where no windows doors etc are allowed. According to AS/NZS 5139. **Note:** if the system is >300mm off the wall then this does not apply. The BushChook system should be installed in a shaded area.

Single-Phase 5KW system BC-5-1xx model numbers:	Single-Phase 8KW system BC-8-1xx model numbers:	Single-Phase 10KW system BC-10-1xx model numbers:	Three-Phase 12kW system BC-12-3xx model numbers:
BC-5-108 (x2 battery = 8.2kWh nominal)	BC-8-112 (x3 battery = 12.3kWh nominal)	BC-10-116 (x4 battery = 16.4kWh nominal)	BC-12-316 (x4 battery = 16.4kWh nominal)
BC-5-112 (x3 battery = 12.3kWh nominal)	BC-8-116 (x4 battery = 16.4kWh nominal)	BC-10-120 (x5 battery = 20.5kWh nominal)	BC-12-320 (x5 battery = 20.5kWh nominal)
BC-5-116 (x4 battery = 16.4kWh nominal)	BC-8-120 (x5 battery = 20.5kWh nominal)	BC-10-124 (x6 battery = 24.6kWh nominal)	BC-12-324 (x6 battery = 24.6kWh nominal)
BC-5-120 (x5 battery = 20.5kWh nominal)	BC-8-124 (x6 battery = 24.6kWh nominal)	BC-10-128 (x7 battery = 28.7kWh nominal)	BC-12-328 (x7 battery = 28.7kWh nominal)
BC-5-120 (x5 battery = 20.5kWh nominal)	BC-8-128 (x7 battery = 28.7kWh nominal)	BC-10-132 (x8 battery = 32.8kWh nominal)	BC-12-332 (x8 battery = 32.8kWh nominal)
BC-5-124 (x6 battery = 24.6kWh nominal)	BC-8-132 (x8 battery = 32.8kWh nominal)		
BC-5-128 (x7 battery = 28.7kWh nominal)			
BC-5-132 (x8 battery = 32.8kWh nominal)			



Overview of the installation tasks

A typical complete installation of the BushChook home battery will require the electrical connection of the following items. If the home is only off-grid then there is no need to connect the grid or the feed-in meter/CT, but a backup generator will very likely be required.

Note: Differences between 1-phase and 3-phase systems are highlighted where necessary.

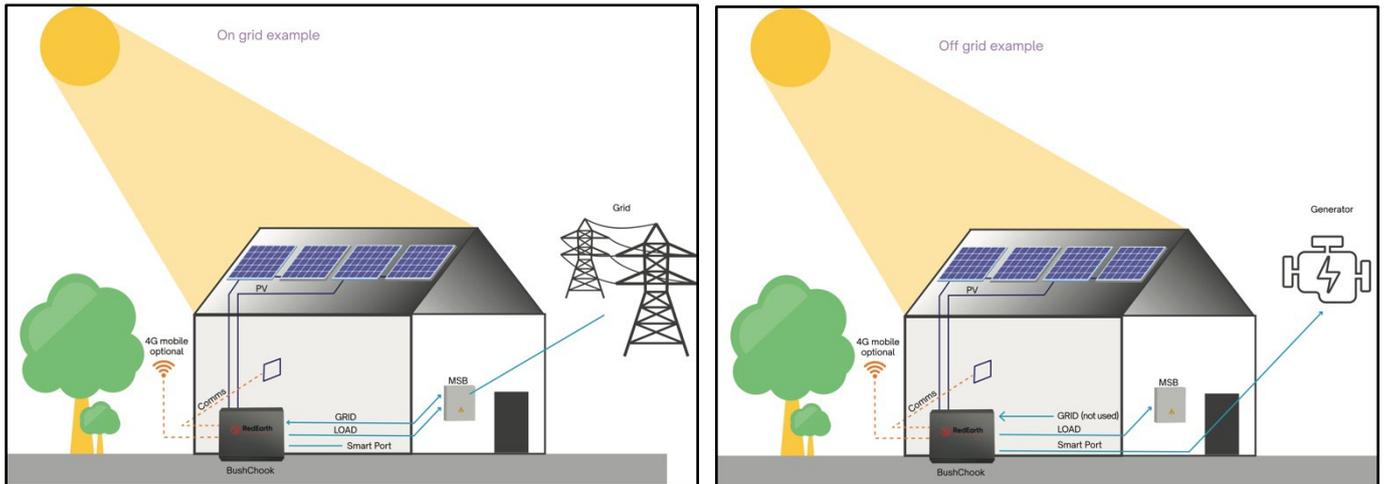
1. **Grid:** AC cables run from the MSB (Main switchboard) directly to the grid terminals inside the BushChook system. In 3-phase system observe the correct phase rotation.
2. **Feed-in Meter/CT** (supplied) Required for on-grid systems that are not installed as whole home backup. It is installed in the MSB and connected to the BushChook system via a Cat5/6 cable or similar (not supplied). *The information from this meter affects the operation of the BushChook system, make sure both the wires and CT are connected the right way around.*
 - o In addition to the Feed-in meter the MSB will also require a MCB to be installed to allow the BushChook system to be isolated, for example to work on the MSB.
3. **Load:** AC cables from the MSB directly to the Load terminals inside the BushChook system.
 - o **Note:** The BushChook system is designed as a whole home backup system, however if the loads in a particular house are greater than the capacity of the BushChook system then the loads inside the MSB will need to be split to ensure that the backed-up circuits do not overload the BushChook system.
 - o The BushChook 3-phase is rated at 12kW and the 1-phase at either 10kW, 8kW or 5kW, depending on which system was ordered. Loads such as pool pumps and under floor heating should probably not be backed up.
 - o Putting too many loads on the backed-up circuit can also empty the battery quickly during an outage. In this case additional battery capacity may be required. Note that the BushChook has a multi-purpose SMART Port that can act as a Smart load which can be programmed to turn off at a pre-determined battery state-of-charge (SOC) leaving the remainder of the battery capacity for more critical loads. see details below under **Optional - SMART Port connection**.
4. **Solar:**

Specification	5kW 1-Phase BushChook	8kW 1-Phase BushChook	10kW 1-Phase BushChook	12kW 3-Phase BushChook
Number of MPPTs	2	2	3	2
String Configuration	1+1	2+2	2+2+2	2+1
Total arrays accepted	Up to 2	Up to 4	Up to 6	Up to 3
Maximum String Voltage	500Vdc	500Vdc	500Vdc	800Vdc (600Vdc for residential installation)

For example, the 5kW 1-phase accepts up to 4 arrays where each tracker accepts two strings in parallel with a maximum string voltage of 500Vdc.



5. **Batteries:** The BushChook is pre-wired for up to eight Troppo batteries. Each Troppo battery has a nominal capacity of 4.1kWh. The batteries need to be installed and plugged in.
6. **Remote monitoring:** The BushChook system needs to be connected to the internet to provide its full capabilities. Note this applies to both on-grid and off-grid Installations. If no Internet connection is available, then no remote monitoring is available for the BushChook system. RedEarth provides 4G internet during the first 3-month trial of any BushChook installation. After the 3-month trial the customer can choose to join RedEarth's Optimum Customer Support program, and the 4G internet option will continue, otherwise the customer can provide their own internet if they want remote monitoring.
 - A cell phone booster option is also possible in areas with poor mobile phone coverage. Contact RedEarth for details.
 - Hard-wired internet cable from the home internet router to the BushChook system can be installed if available. This provides the most robust communication link versus a Wi-Fi or 4G signal.
7. **Optional - SMART Port connection:** The BushChook system has a third AC connection option, the SMART Port that can perform different functions depending on how it is configured. It can connect an auto-start generator, but it can alternatively be configured to either connect and manage a separate AC-coupled PV inverter OR it can power a "smart load" such as a pool heater or crypto miner. See notes below. ***By Default, the SMART port is configured to operate a Backup Generator, please notify RedEarth at the time of sale, or installation if you wish to adjust this.***
 - **Smart Load:** If connecting a smart load, run your designated smart circuit into the ac breaker labelled Smart / Gen. This load will run when the batteries are above a programmed state of charge, and power down when the batteries fall below this SOC. For example, an air-conditioned could be powered via this SMART Port so that in a power outage it will continue running until the battery reaches a pre-programmed SOC. The SMART port can also be configured to always provide power to this circuit when the grid is connected, independent of the battery SOC.
 - **AC Coupled Solar:** An AC coupled solar Inverter or micro-inverter can be connected into the terminal labelled ***Smart / Gen terminal***. This opens up the opportunity to redirect the output of an existing PV system to this port, allowing it to be controlled by the BushChook system. Note: It is important that the shutoff frequencies are set appropriately so that the BushChook system can correctly manage this extra AC-coupled PV system (consult RedEarth tech support), and it is also essential that the AC coupled PV does not exceed a 1:1 relationship to the BushChook inverter size (5kW, 8kW or 10kW for 1-phase or 12KW for 3-phase).
 - **Generator:** The SMART port is set to generator in the default configuration of the BushChook. This mode will automatically call your generator when the SOC reaches a lower SOC (battery voltage setting), this will then stop the generator when the SOC reaches the higher SOC (battery voltage setting), If you require assistance adjusting these two set points contact RedEarth tech support. The BushChook includes a 2-wire generator auto-start feature. See Section 4.6 for details.



Key additional tasks to complete the installation include;

1. **Book the install with RedEarth:** When you know the installation date, book the time with RedEarth so that they are sure to be there to help you and also confirm that the system and the remote monitoring is properly setup.
2. **Optional - receive training on the BushChook system at RedEarth's facility In Brisbane.** It is also possible for RedEarth to provide training at reseller/installer facilities.
3. **Adjusting the programming of the BushChook inverter** for the customer's specific requirements. (e.g. adjust the level of grid-feed allowed by the utility or modifying the SMART Port function). Use the **Solarman Smart APP** operating in local mode to access these settings. See STEP 6 - Commissioning the System
4. **Handover to the customer:** this includes demonstrating what circuits are backed up during an electricity outage (by actually turning off the grid supply) as well as demonstrating how the backup generator works (if one is installed) and confirming that it charges the battery system.
5. **Customer to scan the QR code:** This is important for the customer to be able to monitor their system on RedEarth's EMU app as well as access the benefits of RedEarth's Optimum and Private Power Plant features. It also registers the warranty.



Note: The BushChook is not designed to act as the customers MSB as it does not include space for additional main & customer circuit breakers or RCDs. RCD's must be installed in the MSB as required by AS4777.2:2020.

Internal Components Description

Opening the BushChook

RedEarth's BushChook Home battery system can be accessed by removing the lid. To do this, remove the nine (9) screws with a Philips screwdriver (PH2), lift and pull the cover away from the unit and place in a safe location.

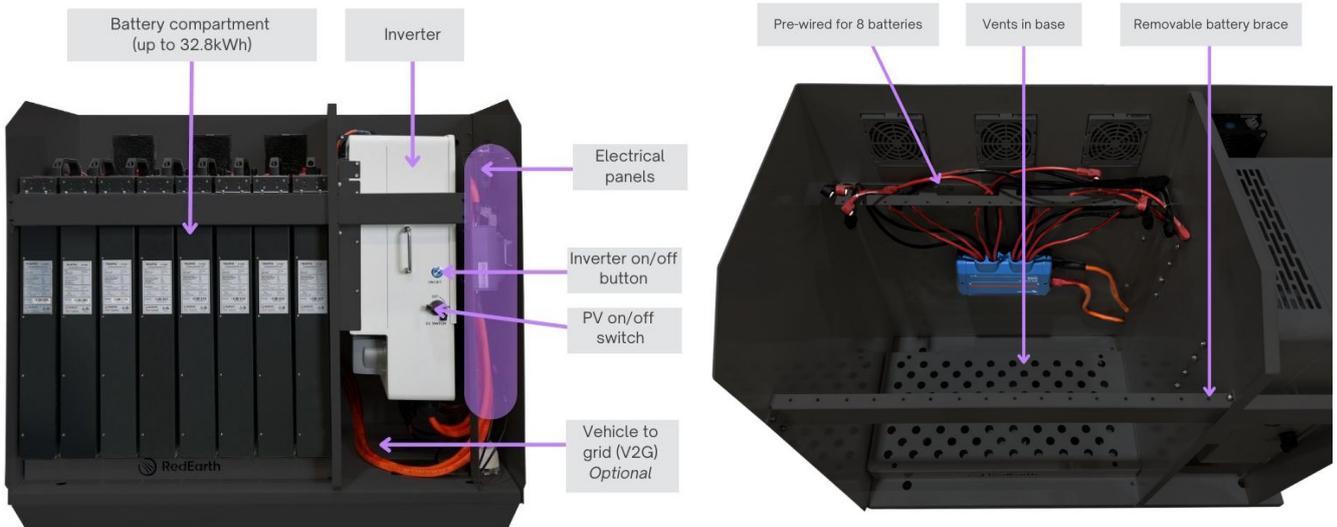


Removal of the cover must only be done by qualified personnel.



Inside Layout

The BushChook is divided into three main areas. On the Lefthand side (LHS) are the batteries, in the middle is the Inverter and on the Righthand Side (RHS) are the electrical components and cable connection points for installation. Prior to leaving the factory the system is tested. It leaves the factory with the inverter cabling fully connected and ready-to-run. The batteries are usually removed for transportation.



Battery area

Up to 8 x RedEarth Troppo-4841 Lithium batteries can be installed in the BushChook.

All eight sets of battery cables are pre-wired into the system. This makes it very easy to add additional batteries in the future.

Note that the battery modules are usually shipped separately and installed during installation.



Inverter area

Here you will find the Deye Inverter (5KW, 8KW, 10kW or 12KW). All the connections to it are already made to the inverter and the fans are pre-wired, so there is no installation wiring to be done in this area.

Electrical panel area

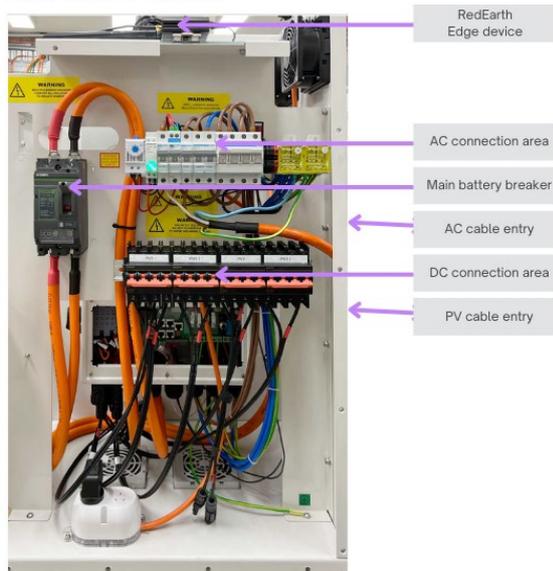
This area is designed for easy access to all the switchgear and wiring, like a typical switchboard.

To access this panel to right-side cover of the BushChook system is removed. Here you will find all the protection devices and the connection points needed to wire in the system during installation.

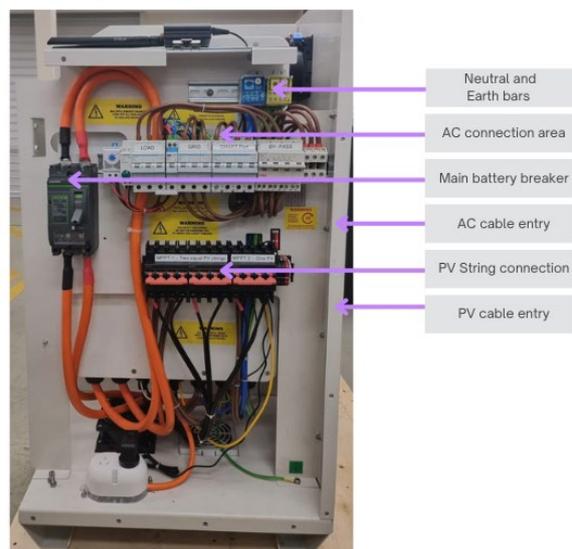
There are labels to clearly identify where cables are connected during installation.

Note that the wiring and switchgear for the three-phase and single-phase panels is different.

8kW 1-phase system



12kW 3-phase system



Parts kit and documentation:

The BushChook is supplied with documentation and a parts kit box to complete the installation.

Documentation

- BushChook installation manual
- BushChook user manual
- BushChook identification sheet (serial #s etc)
- Feed-in meter manual (Eastron)
- Inverter manual – Deye
- MSDS – Troppo battery

Parts Kit Box:

- Documentation listed above.
- Feed-in meter (Eastron 1-ph or 3-ph version) for installation in the switch board plus CTs to connect to the meter (one for 1-ph and three for 3-ph). Note that a Cat5/6 cable or similar to connect the feed-In meter back to the BushChook system is NOT supplied and needs to be provided by the installer.
- Stickers and Traffolytes required to complete the installation.
- 4 x Dynabolts for securing the BushChook system to the ground.
- 2x M16 Gland for the comms antenna
- 6x M25 glands (suitable for sealing around 25mm flexible conduit)
- Suitable circuit breakers for installation into the switchboard to isolate the BushChook when required. (1-phase 1 x 40A or 50A 2-pole, 3-phase 2 x 40A 3-pole)

Installation: 8 steps for installation and customer handover

The BushChook system is designed to be easy to install. It includes prewired connection points and comprehensive labelling and parts kit to simplify the installation.

Technical support is available directly from RedEarth during installation if required. Contact details are included at the back of this manual.

8 steps to complete your BushChook installation:

1. Transporting – getting the BushChook to site.
2. Positioning – the BushChook in its final location
3. Solar Installation – including bringing the PV cabling to the BushChook system.
4. Electrical connections – at the BushChook system and the house switch board
5. Understanding turn on/shutdown procedures.
6. Commissioning the system – turning on and programming and confirming system operation
7. Activating remote Monitoring and Communications – contact RedEarth to confirm remote operation.
8. Customer Handover – including scanning the QR code and their access to the EMU app.

Step 1. Transporting

The BushChook system is usually supplied on a pallet, with the batteries in separate cardboard boxes. It has been factory tested; however, the batteries are usually subsequently removed for transportation. Without batteries but with all other components in place the 8kW 1-phase system weighs 115kg and the 12kW 3-phase system weighs 125kg.

The BushChook 8kW 1-phase system weighs 455kg when filled with 8 lithium batteries. The BushChook 12kW 3-phase weighs 465kg when filled with 8 Troppo batteries.

The image shows a BushChook with batteries packed separately as well as a second pallet of solar panels in a trailer.



WARNING: Personal Injury

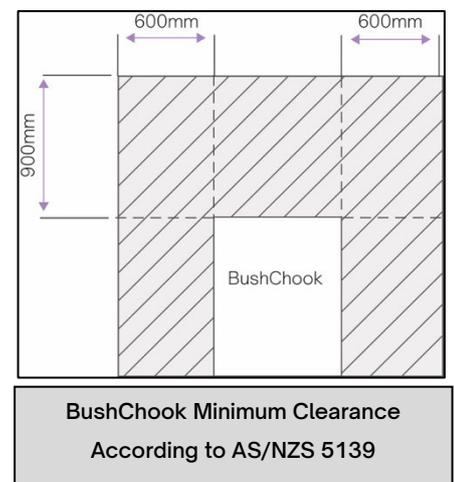
Use safe lifting techniques and standard safety equipment when transporting and installing the BushChook system.

Step 2. Positioning

The BushChook is designed as a freestanding weatherproof system (IP43). It should be installed in a shaded area to minimise the chance of overheating. If the system overheats past 45degC the power output will start to derate until it reaches 60degC at which point it will shut down. (Once the system cools down again it will restart automatically).

The BushChook system should be located at least 100mm off the wall to allow for proper ventilation through the rear vents. If possible, it should be placed closer to the solar panels and the main switchboard to minimise cable run length and voltage drop/power loss.

- If the system is installed within 300mm of a wall then, to comply with Australian standards for a house, allow space around the system as shown in the image at right (no doors or windows within the shaded area).
- Note: the material that the wall is made of (its flammability) can influence the allowed positioning, however, if the BushChook system is installed >300mm off the wall then the type of material is no longer relevant. This is a specific advantage of the BushChook system over some competitor's products which must be attached to the wall.



Cooling air flow passes up through vents in the base of the BushChook system and then out through fans at the rear. The fans are controlled by an adjustable temperature switch set to 25°C in the factory. Do not block any vents or airflow access to the base as otherwise the system will overheat and shutdown.

Once the assembled BushChook enclosure is placed in position, and before installing batteries, it should be secured to the ground via the holes in the base using the supplied Dynabolts or material appropriate fixings.

Note: BushChook can be installed indoors. however, proper additional ventilation must be installed according to AS/NZS 5139.

Note: Minimum distance between the wall and the back of the BushChook is 100mm

Step 3. Solar installation

PV Racking & Solar panels 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 Open Circuit Voltage (V_{oc}) and Short Circuit Current (I_{sc}) ratings are not exceeded.



3.1 PV String configuration

String voltage overview:

Specifications of a typical 400W Solar panel are listed below. If the maximum string voltage is 500V then the maximum number of panels that can be connected in series is nine, in an area where the temperature may drop to 0degC during the day.

This is because the VoC increases from 49.5V to 52.8Vdc at 0degC.

This is calculated as follows:

25degrees (difference from 25degC to lowest expected temp of 0degC) x -0.270%/degC = 6.75% voltage Increase from 49.5V. Therefore, the maximum panel voltage that can be expected = 49.5 x 1.0675 = 52.8Vdc. So only nine panels can be connected In series to stay under 500Vdc maximum.

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

Optional BushChook 5kW 1-phase system

This 5kW system is offered if the customer already has an existing solar system and the DNSP only allows up to 10kW of total inverter size to be connected at the premises.

A maximum of 10kW of PV can be connected to the x2 MPPTs. Each MPPT can have only one string connected to it as shown in the table below. This could be two strings of 9 x 400W panels, with each string going into one of the MPPTs.

Note also that the maximum PV voltage at the lowest expected temperature must be below 500Vdc.

PV String Input Data for 5kW BushChook 1-Phase	
Max allowable PV (W)	10,000W
Max usable PV (W)	7,500W
PV input voltage (V)	370V (125V~500V)
MPPT range (V)	150~425V
Full load DC voltage range	300~425V
Start-up voltage (V)	125V
PV input current (A)	13A+13A
Max. PV Isc(A)	19.5A+19.5A
No. of MPPT trackers	2
No. of strings per MPPT tracker	1+1

BushChook 8kW 1-phase system:

A maximum of 16kW of PV can be connected to the x2 MPPTs. Each MPPT can have two strings connected in parallel as shown in the table below. These parallel strings must be the same length and be oriented in the same direction.

A typical PV string layout using the 400W panels described above would allow a maximum of 36 panels to be connected and still claim the STCs. These could be laid out as 2 strings of 9 panels in parallel going to one MPPT and another 2 strings of 9 panels in parallel going to the other MPPT*.

*Note: a maximum of 9 panels are able to be connected in series given a Max. DC input voltage of 500V.

PV String Input Data for 8kW BushChook 1-Phase	
Max allowable PV (W)	16,000W
Max usable PV (W)	12,000W
Max. DC input voltage (V)	500
Start-up voltage (V)	125
MPPT voltage range (V)	150-425
Max. operating PV input current (A)	26+26
Max. input short-circuit current (A)	34+34
No. of MPPT trackers/ No. of string per MPPT tracker	2/2+2

BushChook 10kW 1-phase system

A maximum of 20kW of PV can be connected to the x3 MPPTs. Each MPPT can have two strings connected in parallel as shown in the table below. These parallel strings must be the same length and be oriented in the same direction. These could be laid out as three instances of 2 strings of 8 panels in parallel with each instance going to a MPPT (giving 19.2kW).

PV String Input Data for 10kW BushChook 1-Phase	
Max allowable PV (W)	20,000W
Max. usable PV (W)	15,000W
Max. DC input voltage (V)	500V
Start-up voltage (V)	125V
MPPT voltage range (V)	150-425V
Max. operating PV input current (A)	26+26+26A
Max. input short-circuit current (A)	44+44+44A
No. of MPPT trackers/ No. of string per MPPT tracker	3/2+2+2

BushChook 12kW 3-phase system:

A maximum of 24kW of PV can be connected to the x2 MPPTs, however this is configured with one string going to the first MPPT and two equal length and parallel strings going to the second MPPT. Note that with this Inverter the maximum PV voltage is 800V. The installer needs to follow the current rules for residential homes.

PV String Input Data for 12kW BushChook 3-Phase	
Max allowable PV (W)	24,000W
Max usable PV (W)	18,000W
PV input voltage (V)	550V (160V-800V)
MPPT range (V)	200V-650V
Start-up voltage (V)	160V
PV input current (A)	26A+13A
Max. PV Isc(A)	39A+19.5A
No. of MPPT trackers	2
No. of strings per MPPT tracker	2+1

If the limit is 600Vdc then a typical PV string layout using the 400W panels described above would allow a maximum of 45 panels to be connected and still claim the STCs. However, with a maximum PV string voltage of 600V, only up to 11 panels could be connected in series.

These could be laid out as 2 strings of 11 panels in parallel going to the higher rated MPPT, and 1 string of 11 panels going to the other MPPT. In this case a maximum of 33x400W of this specification panels could be connected = 13.2kW of PV panels.

Note that there are panels with other specifications that may be more suitable for a particular site.

3.2 PV Isolators

The PV isolation is provided by built-in MCBs. The number of MCBs depends on the size of the BushChook system. 5kW (2 strings and 2 MCBs), 8kW (4 strings and 4 MCBs), 10kW (6 strings and 3 MCBs) or 12kW (3 strings and 3 MCBs). See image at right for the 12kW 3-phase system. The individual PV cables are brought into the rear of the unit and connected to the MCBs.



It is important to connect PV strings of equal length and orientation when 2strings are going into one MPPT.



Note: PV modules must have an IEC61730 Class A rating



Note: Ensure that the array is within the inverter specification and that the polarity of the array is correct.



Note: PV array must be floating (must not be grounded)

Step 4. Electrical connections

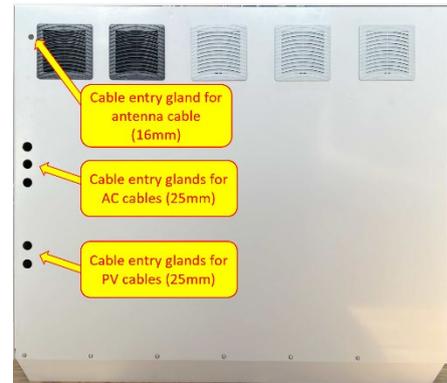


Before any electrical connections are made, check all internal connections in the BushChook are secure and have not come loose during transport.



*Ensure that all breakers and isolators, as well as those supplying power to the unit, **are turned OFF.***

All cable entry points for the AC, PV and any communication cables are made via the 25mm gland/entry points on the rear of the system, as shown at right. Use the 25mm glands that are supplied in the parts kit. These glands are designed to accept flexible 25mm conduit directly. The 16mm gland is for the antenna of the RedEarth monitoring device.



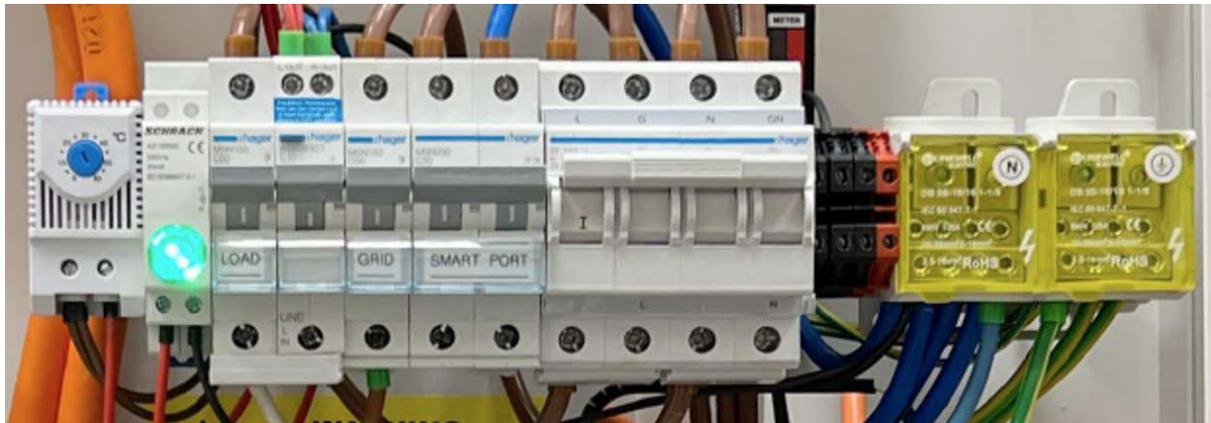
The BushChook system must be hardwired to a remote switchboard, which contains a MEN link and an earth stake.

To begin, remove the lid of the unit as explained in “Opening the BushChook” section. Next remove the right-side panel. This will provide direct access to all the switchgear and all the connection points needed for installation.

4.1 Grid, Load and Smart Port connection

MCBs and terminal blocks are installed and pre-wired on a single DIN rail to simplify making all the GRID, LOAD and SMART PORT connections during installation. They are labelled as shown below.

1-phase AC:



3-phase AC:



The Terminal Block labelled as GRID connects the BushChook directly to the Grid in the MSB. Note: In off-grid Installations this connection is not required

The Terminal Block labelled as LOAD identifies the connection point that remains live during a Black-out. Do not overload the LOAD circuit with too many circuits in the MSB. Depending on the inverter size the BushChook can support 5kW, 8kW, 10kW or 12kW of power from the battery.

The terminal block labelled SMART Port has three different options. It can be used to connect either a generator, AC coupled solar or a smart load.

Generator Port: The generator setting is the default configuration of the BushChook. This mode will automatically call your generator when the SOC reaches a lower SOC (battery voltage setting), this will then stop the generator when the SOC reaches the higher SOC (battery voltage setting), If you require assistance adjusting these two set points contact RedEarth tech support. The BushChook includes a 2-wire generator auto-start feature. See Section 4.6 for details.

AC Coupled Solar: An AC coupled solar inverter or micro-inverter can be connected into the MCB labelled SMART Port. This opens the opportunity to redirect the output of an existing PV system to this port, allowing it to be controlled by the BushChook system. Note: It is important that the shutoff frequencies are set appropriately so that the BushChook system can correctly manage this extra AC-coupled PV system (consult RedEarth tech support), and it is also essential that the AC coupled PV does not exceed a 1:1 relationship to the BushChook Inverter size (5kW, 8kW, or 10kW for 1-phase or 12KW for 3-phase).

Smart Load: If connecting a smart load, run your designated smart circuit into the ac breaker labelled SMART Port. This load will run when the batteries are above a programmed state of charge, and power down when the batteries fall below this SOC. For example, an air-conditioned could be powered via this SMART Port so that in a power outage it will continue running until the battery reaches a pre-programmed SOC. The SMART port can also be configured to always provide power to this circuit when the grid is connected, independent of the battery SOC.

If you require assistance adjusting these set points, contact RedEarth tech support. To connect the AC cables to the system, pass them through the upper 25mm holes in the rear of the BushChook (the glands provided which are designed to seal around 25mm flexible conduit). Secure the ends of the cable into the correct terminal blocks.

The cables for connecting the MSB to the Grid, SMART PORT and LOAD terminals must be sized to support the constant rating of the 5, 8 or 12KW inverter according to AS/NZS 3008.1.1:2017. All cables must be sized to appropriate Australian standards. 40A or 50A MCBs are installed in the BushChook.



Note: Earth connection must be made to the same switchboard as the power cables.



Note: This system complies to IEC 62109-2 clause 13.9 for earth fault monitoring.

4.2 Main Switchboard wiring & Feed-in Meter Installation

4.2.1 Whole home backup (requires sufficient inverter size)

If the whole home is being backed up by the BushChook (all circuits - like what happens in an off-grid installation) then there is no need to separate the circuits in the switchboard. Also, the CT built into the BushChook inverter is used and there is no need for an external CT/Feed-in meter to be installed. There is also no need to separate the circuits in the switchboard. Only one step is required;

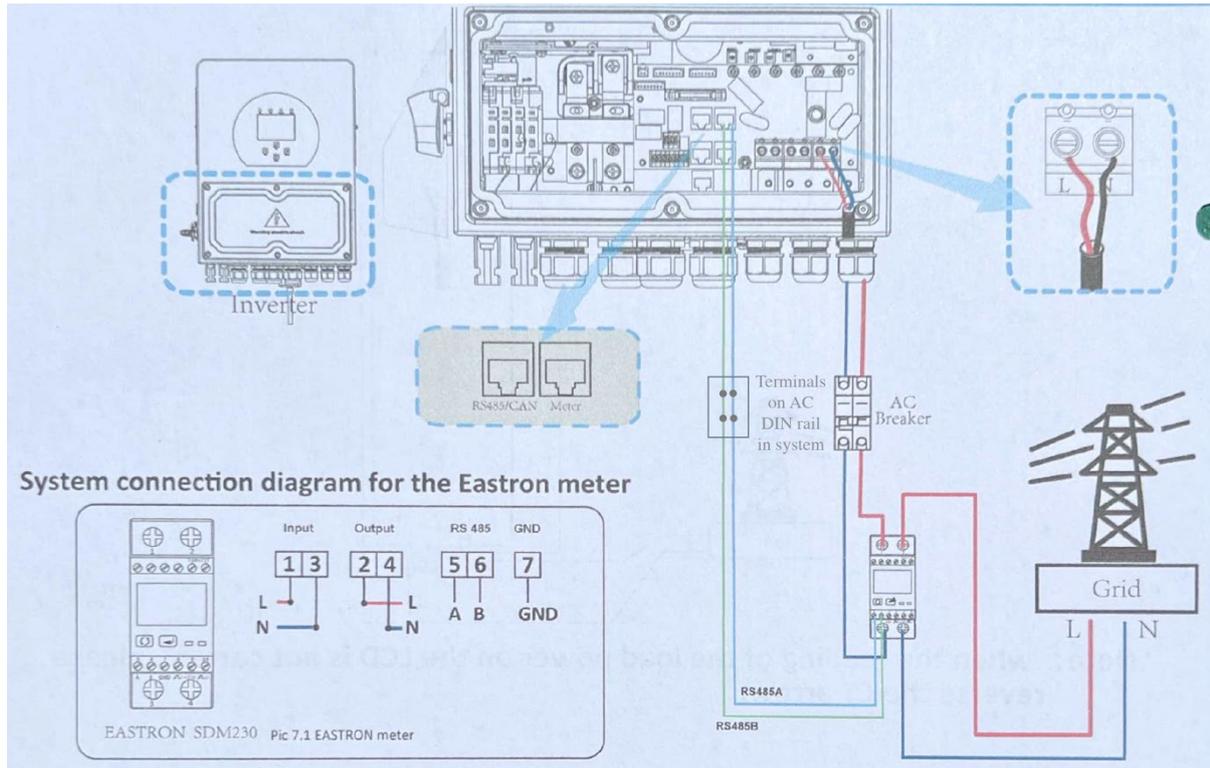
- Installation of a double pole MCB breaker (1-phase) or 2 x 3-pole MCBs for the 3-phase installation, to isolate the BushChook system if work is being done in the switch board.

4.2.2 Partial home backup

Three tasks must be completed in the switch board for a complete BushChook installation when partial home backup is implemented:

Note: Refer to the SLD diagrams in Appendix A for additional information.

- Separation of the circuits in the main switchboard into
 - LOAD circuits that are backed up during an outage and,
 - Loads that are unsupported during an outage (e.g. pool heating, electric floor heating etc)
- Installation of a the supplied double pole MCB breaker (1-phase) or 2 x 3-pole MCBs for the 3-phase installation, to isolate the BushChook system if work is being done in the switch board.
- Installation of the supplied Feed-in meter: (Eastron) and CT (1-phase has one CT, 3-phase has 3 CTs) and connection of an associated CAT5/6 cable from the feed-in meter back to the BushChook system (not supplied). The manual for the feed-in meter is included in the parts kit.

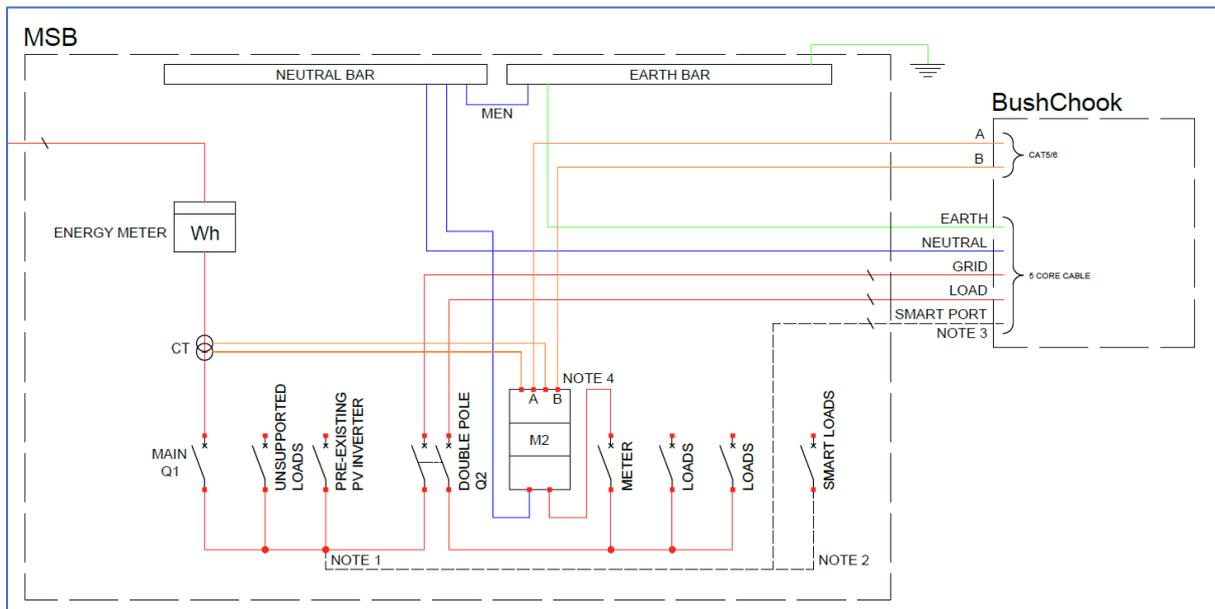
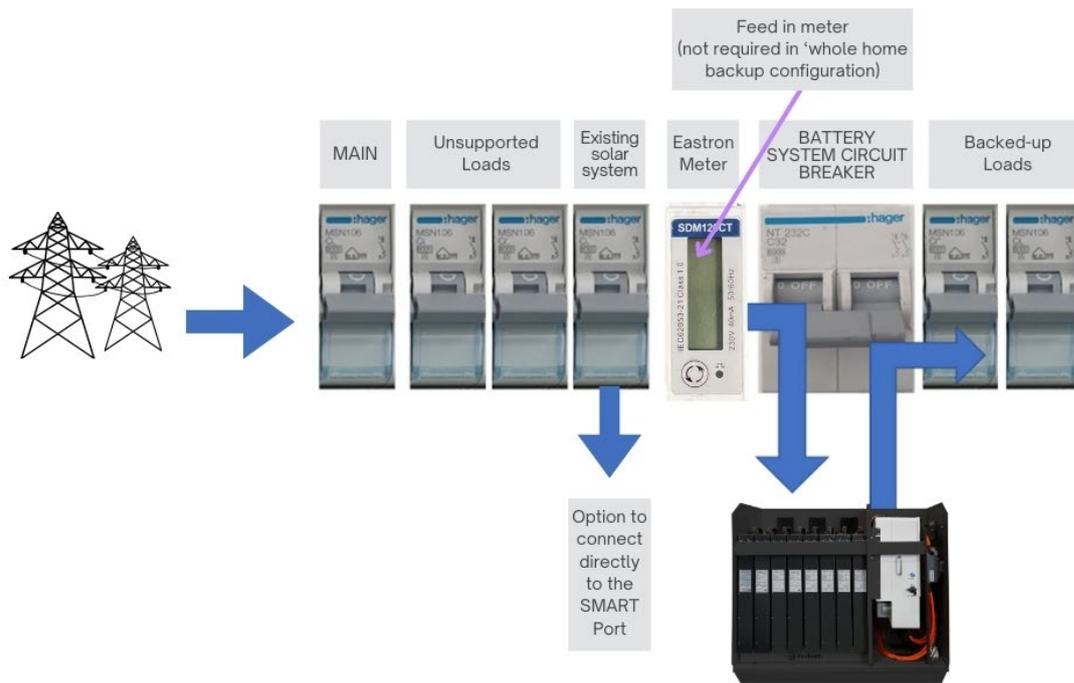


For ease of comprehension, install the BushChook system isolator (MCB) between the unsupported loads and the backed-up loads, as shown below. Then all the backed-up loads can be put on the right-side of the BushChook system isolator.

After the installation of the BushChook, the Main Switchboard of the property should look something like this (1-phase example shown). The two key components related to the BushChook system are identified below:

- “BATTERY SYSTEM CIRCUIT BREAKER”: Isolates the BushChook from the Switchboard, which is required if for example work is to be done on the Switchboard. At all other times this switch remains on. In the 3-phase installation there are 2 x 3-pole switches required (included in the Parts kit).
- BushChook Feed-in Meter: The CT connected to this meter measures the amount of power exported to or imported from the grid. Note that the CT needs to be connected at the incoming grid connection. Note: If the installation is setup as whole home backup, then the CT is not required as the CT built into the BushChook inverter is used instead. Also, this meter is also not required in an off-grid installation.
- Optional SMART Port MCB - if used. Note, any existing PV Inverter can be connected to the Smart port of the BushChook to allow greater control of its operation and also to keep it operational during any grid outage. In this case it needs to be isolated from the unsupported load bus. (note that this option is not suitable for all existing PV inverters)

During a blackout the loads connected to the LOAD terminal of the BushChook system will keep functioning. The non-essential loads will turn off until grid power is restored. Note that if too many loads are on the LOAD circuit the battery could run flat quite quickly or the backup circuit could become overloaded and turn off temporarily.



4.3 Battery connection

The BushChook has been tested and commissioned at the RedEarth factory. The batteries are then removed for transportation/positioning. Follow the procedure below to correctly re-install the batteries.

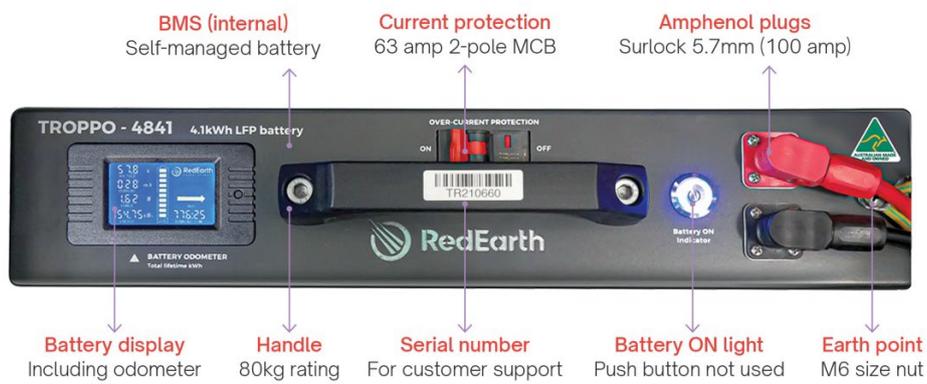




This BushChook system operates at 48Vdc nominal, and batteries are connected in parallel to increase capacity, maintaining 48Vdc nominal.

Procedure to install batteries:

1. Ensure the MAIN BATTERY BREAKER on the right side of the BushChook is turned OFF. (MCCB breaker)
2. Take the batteries out of the transport boxes and place them next to the BushChook system. Turn all the batteries on using the 2-pole switch on the top of each battery to confirm that they are all at a similar voltage (+/- 0.3 volts). The voltage can be read on each battery display as shown below. Ideally, they should all read above 53.0 volts. Turn the batteries off again.



3. On the BushChook system remove the front cross bar by undoing the 4x6mm nuts and install the Troppo batteries with the display towards the front. Start loading the batteries from the left-most position first.
4. Reinstall the cross bar and install screws in the wings of the batteries to hold the batteries in place. It is not necessary to install these screws if the batteries are equally spaced to allow ventilation between batteries.
5. Plug the battery cables into the batteries, being careful that red goes to red and black goes to black. To attach battery cables to the battery terminal, simply push it onto the terminal until you hear a click. To remove the battery cables, press the button on the side of the terminal and pull it straight up with a slight wiggle.
Note: if the system is not full of batteries, then some of the battery cables will remain unconnected. These are available for connecting additional batteries in the future. This is what makes RedEarth BushChook system genuinely battery ready.
6. Turn the breakers on top of each battery on. You will notice some crossflow of electricity as the batteries balance with each other.
7. The battery bank is now ready to be used. The MAIN BATTERY BREAKER can be turned on when you are ready to turn on the system.



4.4 Earth Fault Alarm

The Earth fault alarm is built into the system. If an earth fault is detected, then a loud audible alarm will sound. The end customer needs to contact the installer to investigate the PV installation. If the customer has signed up to RedEarth Optimum, then the alarm signal will also be sent to RedEarth.

4.5 Solar connection

The BushChook systems each have two Maximum Power Point Trackers (MPPTs) The PV string configuration is explained previously in Step 3.

To connect the solar arrays, run the pairs of unterminated PV cables into the lower set of 25mm holes in the rear of the BushChook (The glands provided in the parts kit are designed to seal around 25mm flexible conduit). Next check for correct polarity and V_{OC} , then terminate the cables into the appropriate MCB (follow the labelling).

Note: finally ensure that the PV isolator built into the inverter is in the ON position. It is located on the left side of the inverter below the ON/OFF



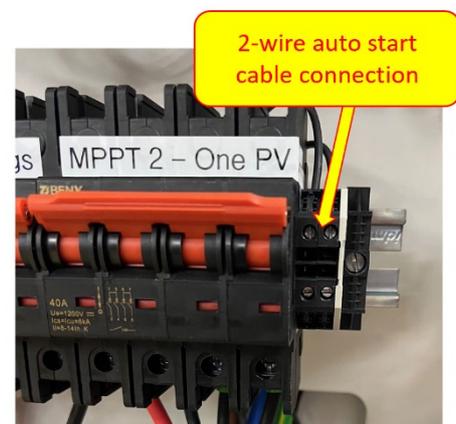
button, as shown here.

4.6 Connecting the BushChook in an Off-Grid Installation

When connecting the BushChook in an off-grid installation, the same process as above is followed, however there is no grid to connect to or feed-in meter to install.

This means simply connect the loads to the LOAD terminal and the generator to the SMART Port (Smart / Gen) terminal. To benefit from the auto start feature the generator needs to be 2-wire auto-start capable. The two wires are then connected to the terminals inside the cabinet. These are located on the right side of the AC DIN rail.

If the generator is not auto-start capable then it must be manually started and stopped when the batteries depleted.



Step 5. Understanding the Turn ON/SHUTDOWN Procedure

Before starting up the BushChook confirm the following items have been completed:

- The PV cables have the correct polarity and are correctly connected to the MCBs provided, particularly any parallel strings going into the same MPPT.
- GRID, LOAD and SMART Port cables are securely connected. The system is correctly earthed and a MEN link is in place in the switchboard.
- Proper weatherproof seals are installed on all cable entry glands of the BushChook System.
- The battery terminal connections on the Main Battery MCCB are tight. (Check after transportation)
- The 4G antenna is positioned in a good reception area (if it is to be used)

To **Turn ON** the unit for the first time, follow the steps below:

- 1 Switch ON all battery breakers on top of each Troppo battery
- 2 Switch ON the BATTERY SYSTEM D.C. ISOLATOR
- 3 Switch ON all the MCB SOLAR D.C. ISOLATORS. Also ensure the PV Isolator on the left-side of the inverter is in the ON position.
- 4 Ensure the on/off button on the left side of the inverter is ON (in)
- 5 Ensure the Bypass switch is in the Normal Operation position (upwards = (I))
- 6 Turn ON all AC circuit breakers and wait for the system to start up (approx. 5 minutes)

The **Shutdown Procedure** is the reverse of the “turn on” procedure and is shown below. This procedure can be found on the traffolyte label on the RHS of the unit.

- 1 Turn OFF all AC circuit breakers (#1). It is not necessary to turn off the inverter via the push button on the left side of the inverter (with the blue light).
- 2 Switch OFF the SOLAR D.C. ISOLATORS (#2). It is not necessary to turn off the PV Isolator on the left side of the inverter.
- 3 Switch OFF the BATTERY SYSTEM D.C. ISOLATOR (#3). It is not necessary to turn off the individual battery breakers on each battery unless the system will be off for over three months.

SHUTDOWN PROCEDURE

- ① **Switch OFF all AC circuit breakers**
- ② **Switch OFF all SOLAR D.C. ISOLATORS**
- ③ **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

Step 6: Commissioning the system

The BushChook is commissioned and tested in RedEarth’s factory to confirm correct operation of the system prior to shipment.

The RedEarth settings can be accessed via the Local-mode login on the Solarman APP that can be downloaded from the app stores.

The installer will need to confirm inverter settings and complete on-site parameter adjustments (e.g., Export limitation, connection to the customer’s Wi-Fi or changing the Australia A to B or C setting depending on where the system is being installed in Australia).

This involves the following steps, which are detailed after this list.

1. **Power up the BushChook System.** Note that the inverter takes up to 5 minutes to fully start-up when the system is initially powered up. (You may hear a number of relays clicking during start-up).
2. **Access the BushChook inverter via the Solarman APP, using local mode.** Note that you can also use the display panel on the front of the inverter to adjust all the settings (installer login). however, this is less readily accessible in the BushChook system. Refer to Chapter 5 of the Deye Hybrid Inverter manual for details on adjusting settings using the display panel on the inverter.
3. **Confirm the inverter initial configuration including regional settings** and make any adjustments required.
4. **Fault codes table. Correct any faults that occur.**
5. **Test and confirm the operation of the whole system** – including Backup mode (by turning off the main breaker of the house) also test the operation of the By-pass switch.

Commissioning steps details are explained below.

6.1 Power up the BushChook system

Follow the procedure outlined in Step 5 “Understanding the Turn ON/Shutdown procedure” above. While it is powering up, which can take 5 minutes, the Solarman APP can be downloaded which is needed for accessing the inverter in Local mode. (see step 2 below). Note: during powerup you may hear several relays clicking inside the system.

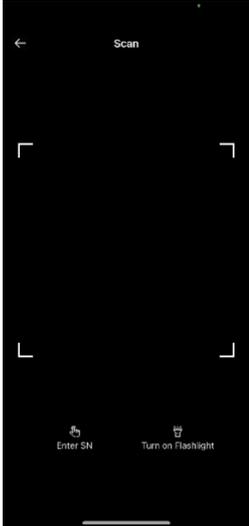
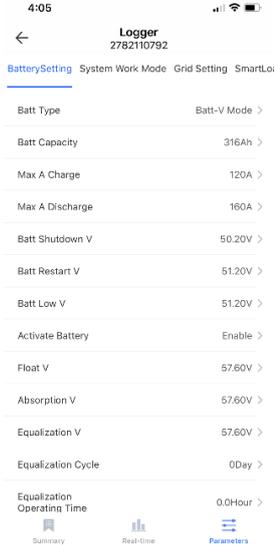
6.2 Access the inverter via the Solarman APP, using Local Mode.

The BushChook 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 BushChook is through the SolarMan smart application.

Similar results can be achieved via the screen directly on the BushChook however the most efficient method is to use this application in Local Mode.

<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 BushChook 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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6.3 Confirm the Inverter Initial configuration including regional settings

Standard Settings

The standard factory settings are shown below.

These can be reviewed to confirm the settings are suitable for the Installation site, including Australia A, B or C (for grid-connected systems)

Note: Max solar power setting depends on BushChook model/PV actually installed



Battery Setting

Set Successfully Set from 2023/11/22 14:20:45 UTC+10:00 Collapse ^

Batt Type: <input type="text" value="Batt-V Mode"/>	Battery Capacity: <input type="text" value="632"/> Ah	Max A Charge: <input type="text" value="240"/> A
Max A Discharge: <input type="text" value="240"/> A	Batt Shutdown V: <input type="text" value="48.5"/> V	Batt Restart V: <input type="text" value="51"/> V
Batt Low V: <input type="text" value="50"/> V	Activate Battery: <input type="text" value="Enable"/>	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"/> Day
Equalization Operating Time: <input type="text" value="0"/> Hour	Grid Charge: <input type="text" value="Enable"/>	Gen Charge: <input type="text" value="Disable"/>
Grid Signal: <input type="text" value="Enable"/>	Gen Signal: <input type="text" value="Enable"/>	Grid Start V: <input type="text" value="49"/> V
Grid Charge Ampere: <input type="text" value="240"/> A	Batt Empty V: <input type="text" value="49"/> V	Gen Max Run Time: <input type="text" value="24"/> h
Gen Down Time: <input type="text" value="0"/> h	Batt Charge Efficiency: <input type="text" value="96"/> %	Batt Resistance: <input type="text" value="0"/> mΩ
TEMPCO: <input type="text" value="0"/> -mV/°C		

System Work Mode-1

Read Successfully Read from 2023/11/18 21:17:21 UTC+10:00 Collapse ^

System Work Mode: <input type="text" value="Zero Export To CT"/>	Solar Sell: <input type="text" value="Enable"/>	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 solar power: <input type="text" value="12000"/> W	Max Sell Power: <input type="text" value="12000"/> W	Energy Pattern: <input type="text" value="Load First"/>
Zero export power: <input type="text" value="20"/> W		

SmartLoad Read Successfully Read from 2023/11/14 16:28:52 UTC+10:00 Collapse ^

SmartLoad Setup: <input type="text" value="Generator Input"/>	GEN connect to Grid Input: <input type="text" value="Disable"/>	AC Couple On Load Side: <input type="text" value="Disable"/>
AC Couple On Grid Side: <input type="text" value="Disable"/>		



System Work Mode-2 Set Successfully Set from 2023/11/22 14:20:37 UTC+10:00 [Collapse ^](#)

Time of Use

	Grid Charge	Gen	Start Time	End Time	Power	Batt
Time 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	0 h 0 m	23 h 55 m	12000 W	49.5 V
Time 2	<input type="checkbox"/>	<input type="checkbox"/>	23 h 55 m	9 h 0 m	12000 W	49 V
Time 3	<input type="checkbox"/>	<input type="checkbox"/>	9 h 0 m	13 h 0 m	12000 W	49 V
Time 4	<input type="checkbox"/>	<input type="checkbox"/>	13 h 0 m	17 h 0 m	12000 W	49 V
Time 5	<input type="checkbox"/>	<input type="checkbox"/>	17 h 0 m	21 h 0 m	12000 W	49 V
Time 6	<input type="checkbox"/>	<input type="checkbox"/>	21 h 0 m	0 h 0 m	12000 W	49 V

[Read](#) [Setup](#)

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

SmartLoad Setup: GEN connect to Grid input: [Disable ^](#) AC Couple On Load Side: [Disable ^](#)

Generator Input: [Generator Input ^](#) AC Couple On Grid Side: [Disable ^](#)

[Read](#) [Setup](#)

Adjusting Generator Charge Rate

This is usually only required if the BushChook is installed off-grid. 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 Set Successfully Set from 2023/11/13 20:09:12 UTC+10:00 [Collapse ^](#)

Time of Use

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

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

Grid Charge: [Disable ^](#) Gen Charge: [Enable ^](#) Grid Signal: [Disable ^](#)

Gen Signal: [Enable ^](#) Gen Start V: V Gen Charge Amperes: A

Gen Force: [Disable ^](#)

[Read](#) [Setup](#)



SMART PORT SETUP



The generator input port (SMART 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 indicates 'Read Successfully' with a timestamp 'Read from 2023/11/14 16:34:46 UTC+10:00' and 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', both followed by a 'v' unit. 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 or existing PV inverter)

To convert the generator port (SMART 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 "Micro Inv Input".

The screenshot shows the 'SmartLoad Setting' panel. At the top right, it indicates 'Read Successfully' with a timestamp 'Read from 2023/11/14 16:34:46 UTC+10:00' and a 'Collapse' link. The 'SmartLoad Setup:' dropdown is set to 'MicroInv 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'. The 'AC_couple_Frz_High:' field has 'R/W' next to it. 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 because of charging from the renewable AC Source.

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

6.4 BushChook Fault Codes

Error code	Description	Solutions
F08	GFDI _Relay Failure	<ol style="list-style-type: none"> 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; 2. If the fault still exists, please contact us for help.
F13	Working mode change	<ol style="list-style-type: none"> 1. When the grid type and frequency changed it will report F13; 2. When the battery mode was changed to "No battery" mode, it will report F13; 3. For some old FW version, it will report F13 when the system work mode changed; 4. Generally, it will disappear automatically when shows F13; 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; 6. Seek help from us, if cannot go back to normal state.
F18	AC over current fault of hardware	<p>AC side over current fault</p> <ol style="list-style-type: none"> 1. Please check whether the backup load power and common load power are within the range; 2. Restart and check whether it is in normal; 3. Seek help from us, if cannot go back to normal state.
F20	DC over current fault of the hardware	<p>DC side over current fault</p> <ol style="list-style-type: none"> 1. Check PV module connect and battery connect; 2. When in the off-grid mode, the inverter startup with big power load, it may report F20. Please reduce the load power connected; 3. Turn off the DC switch and AC switch and then wait one minute, then turn on the DC/AC switch again; 4. Seek help from us, if cannot go back to normal state.
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"> 1. Check PV side cable ground connection. 2. Restart the system 2~3 times. 3. If the fault still exists, please contact us for help.
F24	DC insulation impedance failure	<p>PV isolation resistance is too low</p> <ol style="list-style-type: none"> 1. Check the connection of PV panels and inverter is firmly and correctly; 2. Check whether the PE cable of inverter is connected to ground; 3. Seek help from us, if cannot go back to normal state.
F26	The DC busbar is unbalanced	<ol style="list-style-type: none"> 1. Please wait for a while and check whether it is normal; 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. 3. Restart the system 2~3 times. 4. Seek help from us, if cannot go back to normal state.



F29	Parallel CANBus fault	<ol style="list-style-type: none"> 1. When in parallel mode, check the parallel communication cable connection and hybrid inverter communication address setting; 2. During the parallel system startup period, inverters will report F29. when all inverters are in ON status, it will disappear automatically; 3. If the fault still exists, please contact us for help.
F34	AC Overcurrent fault	<ol style="list-style-type: none"> 1. Check the backup load connected, make sure it is in allowed power range; 2. If the fault still exists, please contact us for help.
F35	No AC grid	<p>No Utility</p> <ol style="list-style-type: none"> 1. Please confirm grid is lost or not; 2. Check the grid connection is good or not; 3. Check the switch between inverter and grid is on or not; 4. Seek help from us, if cannot go back to normal state.
F41	Parallel system stop	<ol style="list-style-type: none"> 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. 2. If the fault still exists, please contact us for help.
F42	AC line low voltage	<p>Grid voltage fault</p> <ol style="list-style-type: none"> 1. Check the AC voltage is in the range of standard voltage in specification; 2. Check whether grid AC cables are firmly and correctly connected; 3. Seek help from us, if cannot go back to normal state.
F47	AC over frequency	<p>Grid frequency out of range</p> <ol style="list-style-type: none"> 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	<p>Grid frequency out of range</p> <ol style="list-style-type: none"> 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	<p>Battery voltage low</p> <ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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	<p>Heat sink temperature is too high</p> <ol style="list-style-type: none"> 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.



6.5 Test the operation of the complete system prior to handover to the customer.

This includes confirming that;

- The BushChook is generating PV, charging the batteries, and supplying the loads.
- also, that the Bypass switch works, by actually switching to Bypass mode and confirming the operation.
- also, confirm that the Backup function works as expected (for on-grid applications). This means that you MUST turn off the main house breaker and confirm the correct circuits are operating in Backup mode. (e.g., fridge & home Wi-Fi)

6.5.1 Normal operation

In this operation mode the BushChook will use solar, battery and grid, depending on the situation.

All of the breakers and isolators should be in the ON position and the Bypass switch should be in the up position (I).

6.5.2 Bypass Operation

In the By-pass operation mode, the system will completely bypass the inverter and battery, and the grid will provide power directly to the LOAD.

For this to occur, all breakers and isolators should be turned OFF and then the By-pass Switch should be switched into the downwards position (II)



Note: The breaker in the switchboard (labelled “BATTERY SYSTEM CIRCUIT BREAKER”) must always remain tuned on during normal and Bypass operation.



Note: With the BYAPASS SWITCH In the middle position, all Backup circuits will lose power. This is not a normal operating position for BYPASS switch

6.5.3 Fan Control Adjustment

The thermostat is located inside the unit. 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^o Celsius in the factory. The fan operation can be tested by turning down the blue dial with a small screwdriver until the fans start. Return the setting to 25^o Celsius after the test.



Step 7. Activating Remote Monitoring and Communications

The BushChook system is supplied with RedEarth’s **monitoring** device (RUT) for remote monitoring and control.

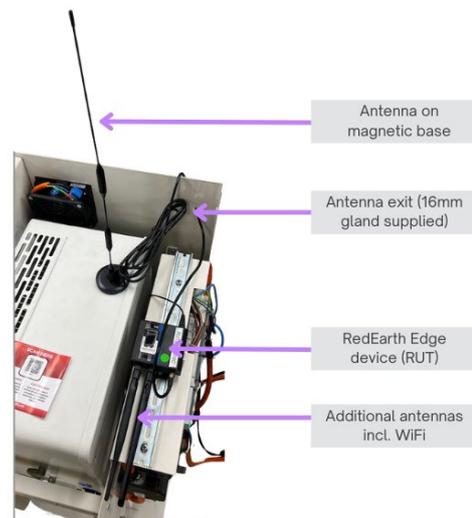
There are currently three options to connect the **monitoring device (RUT)** to the internet to enable remote access to the BushChook.

Note: All of these require the customer to first scan the QR code on the outside of the BushChook system and register their system.

1. Use RedEarth’s supplied 4G monitoring that is included inside the RUT.
 - Note that this option is active for the first 3 months after Installation, after which it will remain active if the customer joins RedEarth’s **Optimum** Support program.
 - If the customer chooses not to join Optimum, then they will need to provide their own internet if they wish to continue monitoring their system. The two options below are available to achieve this.
2. Connect the RUT to the customer’s Wi-Fi (signal strength dependent)
3. Hardwire the RUT to the customer’s LAN. This is the most reliable option of the three.

The RUT with 4G option requires positioning the supplied antenna in a good 4G reception area. If installing in a closed area like a shed, remember to check the 4G signal with the shed doors closed as this will affect the strength of the signal, otherwise position the supplied antenna outside. Pass the antenna cable through the 16mm hole in the rear of the BushChook. Use the supplied 16mm gland to seal around the cable.

Remote monitoring and control are then available via RedEarth’s EMU APP once the customer completes registration by scanning the QR code and filling in their details. This also registers their warranty.



Step 8: Customer Handover

Handover to customer

1. Have the customer scan the QR code and register their system. This allows them to monitor their system once they have downloaded the RedEarth EMU app. It also registers their warranty.
2. Confirm that the customer has downloaded the RedEarth EMU APP and is logged-in, otherwise provide the customer’s contact details to RedEarth to complete onboarding the customer at a later time.
3. Explain to the customer how the system operates and demonstrate what happens during an outage, by turning off the Main grid breaker to the house and observing the Backup operation. (for on-grid installations) Confirm that the correct circuits are supported. (Note that there may be a short delay before the Backup circuits activate after the grid is disconnected from the home)

4. Also demonstrate the operation and effect of the By-pass switch, which isolates the battery from the customers home.
5. Show the customer the isolation switches for the BushChook which you have installed in their Switchboard.
6. Obtain any customer signatures required for claiming STC's
7. Confirm that the customer has scanned the QR code and entered their details. Without doing this it is difficult for RedEarth to provide technical support and the installer will be required to provide all support.

Services and options available for your BushChook

Options for your BushChook:

RedEarth can provide several options for the BushChook system.

- Additional Troppo batteries - up to a maximum of eight for the BushChook (32.8kWh nominal)
- V2G – Vehicle to Grid - from your EV to your BushChook system to the grid (EV requires a GPO)
- Remote display for your kitchen bench top (in development)

Services for your BushChook:

As a RedEarth BushChook system owner you have the choice of joining our customer community.

You just need to sign up to our **Optimum** Support service via the EMU app that you use to monitor your system.

Once you are registered in Optimum you will receive the following benefits;

- Access to RedEarth's 4G monitoring service if required (on-grid or off-grid)
- Review of your current electricity provider and recommendations for better offers in the market. Our customers have saved \$150-\$200 per year on average. (if you are on-grid)
- Remote monitoring service by RedEarth, providing peace of mind that someone is watching your system. (on-grid and off-grid)
- Access to RedEarth's PPP (Private Power Plant) and the stream of financial benefits available to you, including energy trading (if suitable for your circumstances) Peer-to-peer trading, smart EV charging etc. These services can be controlled from RedEarth's EMU app.
- Purchase additional Troppo batteries for system expansion as required, for example if you purchase an electric vehicle.
- You also receive regular relevant communications from RedEarth. For example, information on government rebates.



Technical support

Technical Support

RedEarth's technical support team are available to provide assistance and guidance during installation.

In order to receive onsite technical support, please contact our team prior to the installation date to ensure availability. Direct communication with us is possible from Monday to Friday, between 8am and 5pm.

If you require assistance outside of these hours, please make arrangements with our friendly tech support staff.

To reach our customer service and tech support team, you can contact:

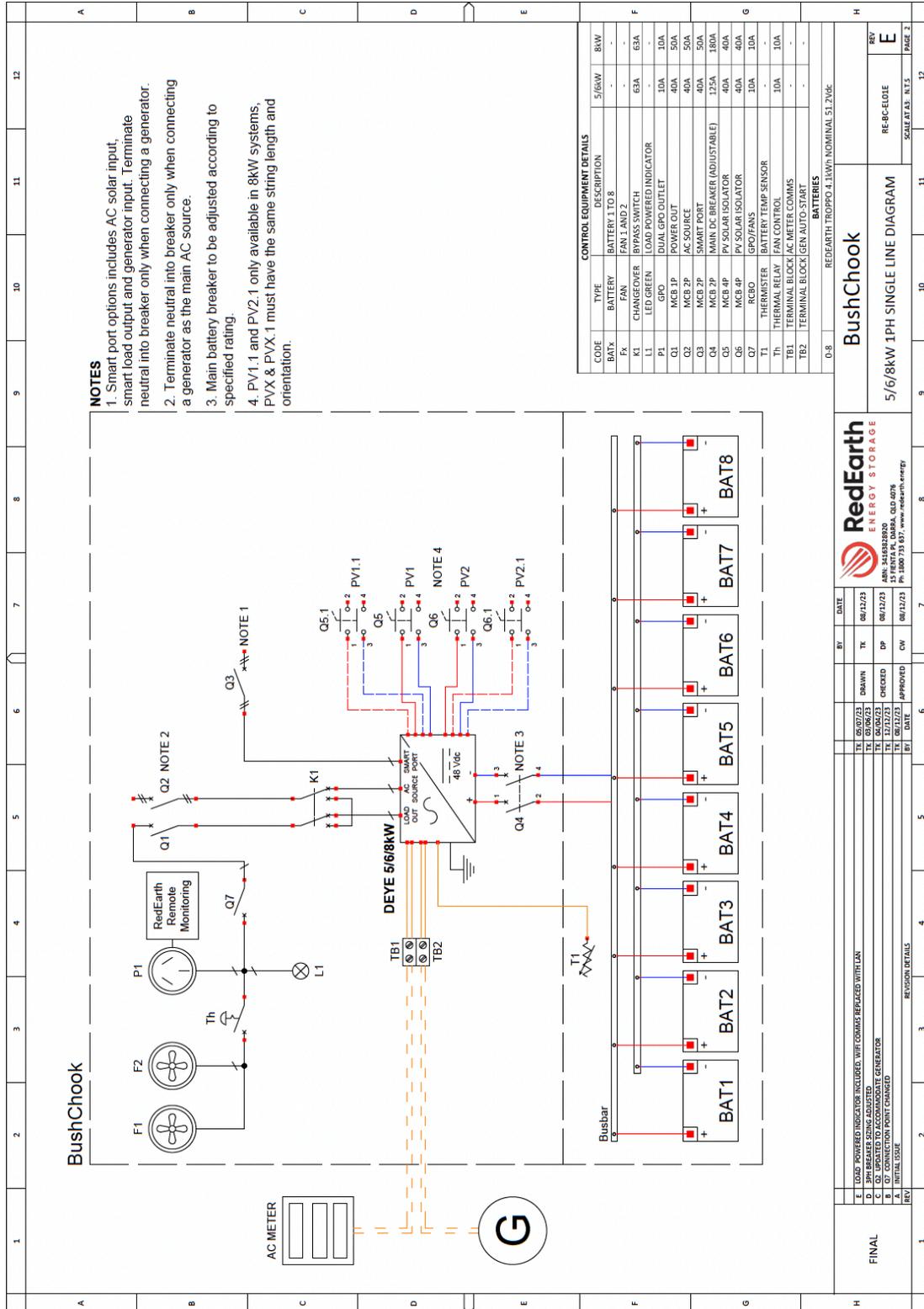
- RedEarth office: Dial 1800 733 637 and press Option 2. If our support team are currently engaged in other calls or on-site visits, kindly leave a short message to ensure a prompt call back.
- Your state BDM (Business Development Manager): Contact the respective BDM based on your state (VIC / NSW / SA / QLD / WA / NT / ACT / TAS).
- Additionally, you can email support@redearth.energy. You will receive a ticket number, ensuring your place in the queue. These emails are addressed within 24 business hours.

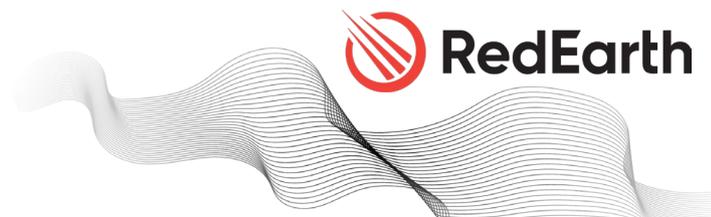
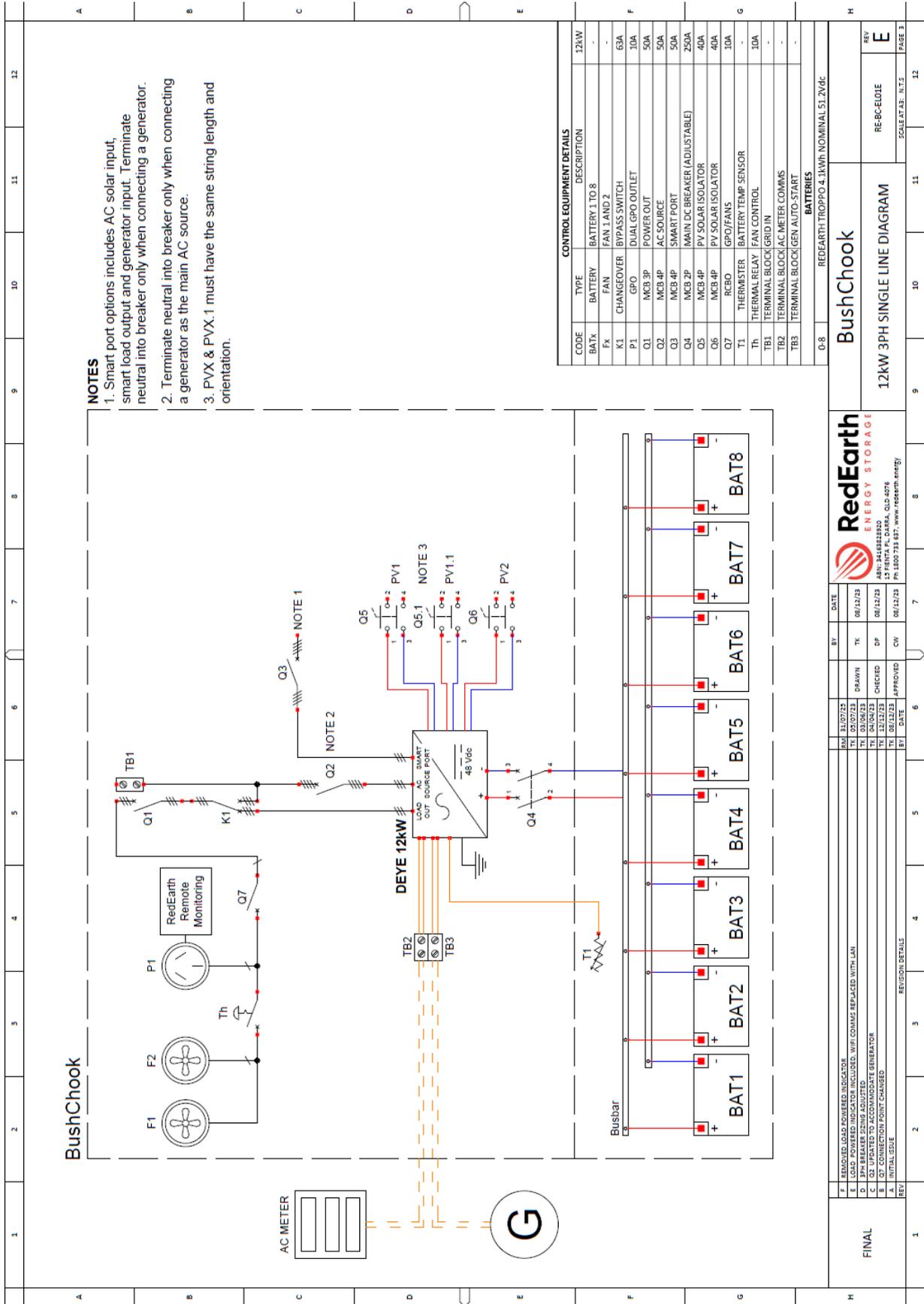
Warranties and claims

Melinda Ashdown: melinda@redearth.energy or call 0439 473 698

Appendix A

Single Line Diagram—Power (1-phase and 3-phase versions)





REV	DATE	BY	DATE
F	31/07/23	TK	08/12/23
E	05/07/23	TK	08/12/23
D	04/04/23	TK	08/12/23
C	04/04/23	TK	08/12/23
B	12/12/23	TK	08/12/23
A	08/12/23	TK	08/12/23

REMOVED LOAD POWERED INDICATOR
 LOAD POWERED INDICATOR INCLUDED, WIFI COMMS REPLACED WITH LAN
 DEYE 12kW INVERTER REPLACED WITH 12kW INVERTER
 Q2 UPDATED TO ACCOMMODATE GENERATOR
 Q7 CONNECTION POINT CHANGED
 INITIAL ISSUE

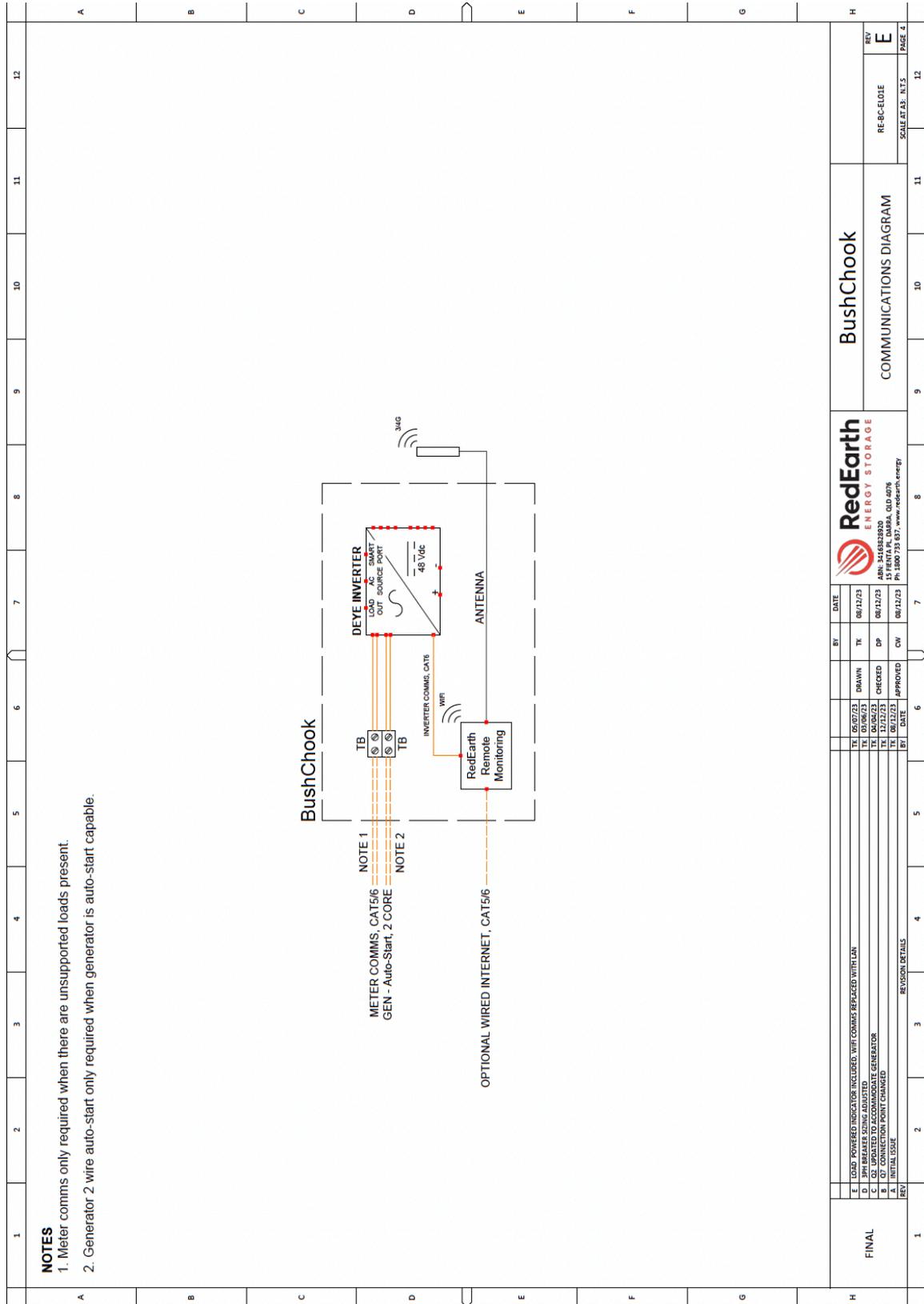
REV	DATE	BY	DATE
1	08/12/23	TK	08/12/23

REV	DESCRIPTION
1	INITIAL ISSUE

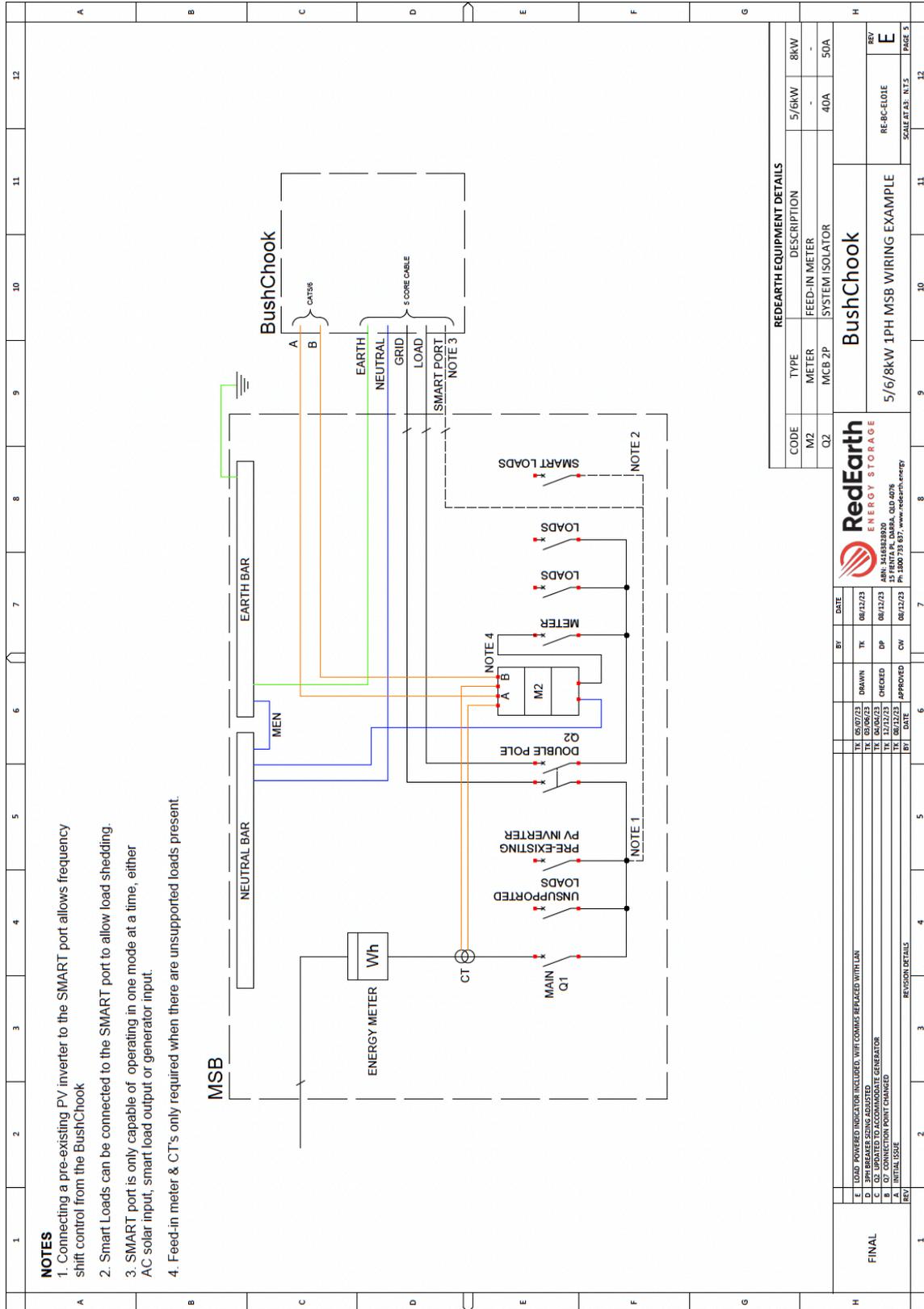
REV	DESCRIPTION
1	INITIAL ISSUE

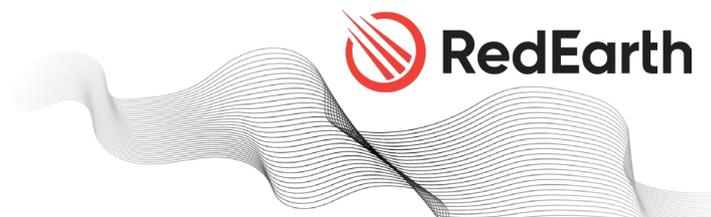
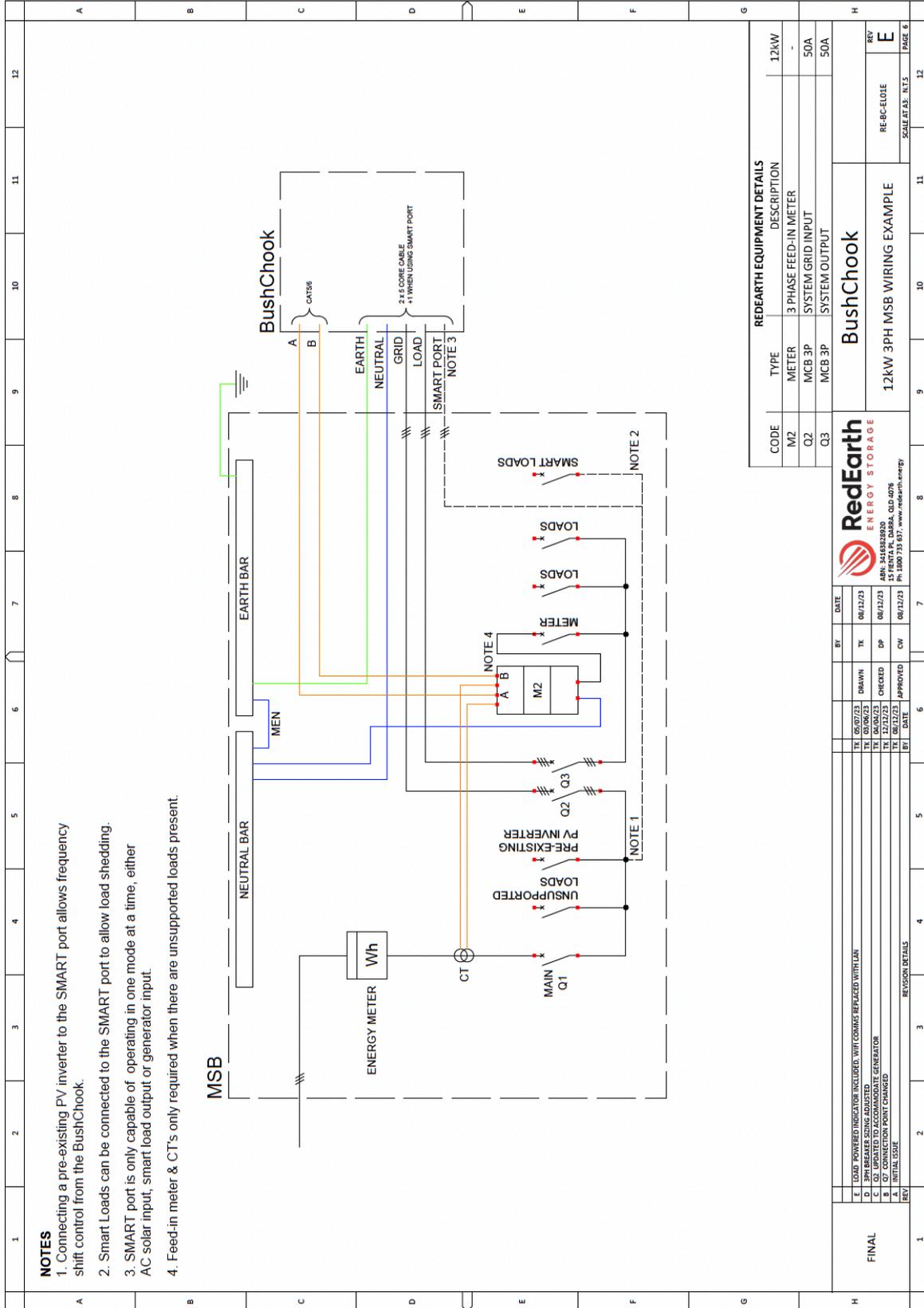
REV	DESCRIPTION
1	INITIAL ISSUE

Single Line Diagram—Communications (1-phase and 3-phase are the same)



Single Line Diagram—Main Switchboard (1-phase and 3-phase versions)





Appendix B

Technical Specifications - BushChook systems

BushChook Model	5kW 1-phase BC-5-1xx	8kW 1-phase BC-8-1xx	10kW 1-phase BC-10-1xx	12kW 3-phase BC-12-3xx
Battery capacity of BushChook system	2 to 8	3 to 8	4 to 8	4 to 8
Battery capacity of BushChook system (kWh)	8.2 to 32.8	12.3 to 32.8	16.4 to 32.8	16.4 to 32.8
Inverter model	5K-SG04LP1-AU	8K-SG05LP1-AU	10KSG02LP1-AU	12K-SG04LP3-AU
Battery data				
Battery type	Troppo 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)	120A	190A	220A	240A
Maximum discharging current (A)	120A	190A	220A	240A
PV string input data				
Maximum allowable PV (W)	10,000W	16,000W	20000W	24,000W
Maximum usable PV (W)	7,500W	12,000W	15,000W	18,000W
Maximum PV input voltage (V)	500V	500V	500V	800V
MPPT range (V)	150 to 425V	150 to 425V	150 to 425V	200V to 650V
Start-up voltage (V)	125V	125V	125V	160V
PV input current (A)	13A+13A	26A+26A	26+26+26	26A+13A
Maximum PV Isc (A)	19.5A+19.5A	39A+39A	44+44+44	39A+19.5A
No. of MPPT trackers	2	2	3	2
No. of strings per MPPT tracker	1+1	2+2	2+2+2	2+1
AC output data				
Rated AC output and UPS power (W)	5,000	8,000	9999	12,000
Maximum AC output power (W)	5,000	8,000	9999	12,000
Peak power (off-grid)	2 times of rated power, 10 S			
Rated AC output current (A)	21.7A	34.8A	43.5	17.4A
Maximum AC output current (A)	21.7A	34.8A	43.5	17.4A
Maximum three-phase unbalanced output	N/A	N/A	N/A	26.1A
Maximum continuous AC passthrough (A)	35A*	50A*	60A*	45A*
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			Three phase 3L/N/E
Protection				

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			
Certifications and standards				
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			
General data				
Operating temperature range (°C)	-40~60°C, 45°C derating			
Cooling	Smart cooling with temperature-controlled fans			
Weight of BushChook system (excl batteries)	109	115	130	136
Size of BushChook system (mm)	1180W x 1040H x 580D			
Protection degree of BushChook system	IP43			
RedEarth Warranty	10 years (AU & NZ and South Pacific region)			

* The BushChook system is designed to only use the RedEarth Troppo-4841 lithium-ion battery (LFP).

** The Nominal Energy Capacity depends on the number of Troppo-4841 batteries installed in the BushChook system. The model numbers reflect the total battery capacity installed in the system.

Troppo-4841 battery specifications

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
Nominal capacity 4.1kWh / 79.8Ah	79.8Ah x 51.2Vdc (nominal battery voltage) = 4,086Wh (approx. 4.1kWh) 16S21P = 336 x 3,800mAh cells
Useable capacity 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)
Nominal DC voltage 51.2V	3.2V per cell (LFP type) x 16 cells in series (16S) = 51.2Vdc
Maximum discharge current 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)
Recommended continuous discharge current 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.
Maximum charge current 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.
Recommended continuous charge current 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)
Maximum power on discharge (kW) approx. 3kW	Maximum 63amps x ~50 volts = approx. 3,000 Watts per Troppo battery
Recommended operating voltage range 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.
Charge / discharge cycles of certified 3,800mAh cells at 1C rate (to 80% residual capacity) 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.
Projected MWh delivered over battery lifetime 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)
Round trip efficiency >96%	Minimal battery losses and therefore minimal internal heat generation in normal operation
Parallel connection from 4.1kWh to 100kWh+	Ask RedEarth for advice and support
Series connection Not designed for series connection	Only designed to operate in nominal 48Vdc systems- ask RedEarth for support
Expected calendar Life @25°C >10 years when used as per warranty terms	RedEarth warranty 10 years - see warranty document for details
Display and LED light characteristics	Installer information
Blue LED light 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
Display description 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.
Display operation 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.
Display SOC indicator 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
Ambient temperature vs. cell temperature	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.
Operating temperature range – Discharging 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.
Operating temperature range – Charging 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)
Cooling Natural convection	No fans. Install in a shaded area
Physical characteristics	Installer information
Battery mounting options 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.
Battery securing mounts for 19" racks 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.
Battery terminal connections Amphenol Surtok 100A Non Keyed	Connectors are rated to 100A if 16mm ² battery cable is used, and 120A if 25mm ² batt cable is used. (Note: 63A MCB and the BMS prevents current reaching this level)
Battery circuit breaker 2-Pole 63A 360VDC (K-Curve)	2-pole 63A 600Vdc (K-curve)
Battery dimensions 725mm D (including handle) x 438mm W x 88mm H (2RU)	Fits into a 19" rack (2RU high) and 800mm deep
Battery weight 42.5kg	Handle is rated to 80kg
IP rating 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
Short-circuit current 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)
Lithium Composition Lithium Ferro Phosphate (LiFePO ₄ or LFP)	Safest lithium chemistry (LFP)Note: e.g. LG uses NMC lithium which has higher energy density but is not as stable.
Certification - TROPPO 4841 Battery IEC:62619:2017 & UN38.3	Approved for use and transportation in Australia. Required certification for installers
Certification - LiFePO₄ 3,800mAh Cell IEC:62619:2017, UN38.3	3,800mAh Cell used in the Troppo battery is certified by TuV specifically for RedEarth
CEC listing Yes	Approved for use in Australia
Battery Management System (BMS) protection settings	Installer information
Battery type and number of cells in series LiFePO ₄ (16S)	Custom BMS designed and built to RedEarth specifications
BMS Over-Volt cut off 58.4Vdc	Maintain battery between 48.0 & 57.6 Vdc. There is very little remaining energy in the battery below 48.0Vdc
BMS Under-Volt cut off 40V	Battery will switch off internally - follow Flat Battery Restart procedure to restart the battery
Charging over-current protection 78±8A	BMS will shutdown charging above this level
Discharge over-current protection (2 levels) 250±60A(20-400mS) & 400±100A(10-100mS)	Two over-current protection levels: 250+/-60A delay 20-400mSec 400+/-100A delay 10-100mSec



Inverter capacitors -starting capability 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.
High temperature - discharge protection 60±5°C	Battery will not discharge if both temperature sensors in the cell pack are reading above this temperature
High temperature - charge protection 50±5°C	Battery will not charge if either one of the two temperature sensors in the cell pack are reading above this temperature
Low temperature - discharge protection -20±5°C	Battery will stop discharging if one of the two temperature sensors reads below this temperature
Low temperature - charge protection 0±5°C	Battery will stop charging if temp sensors reads below this temperature - This is a required feature of all installed battery systems
Cell balancing method Passive equalisation at 57.6Vdc	Top balancing (i.e. during charging once each row of cells reaches 3.65V)
Note: In our efforts towards constant product enhancement this specification is subject to change to at anytime without notice	

Short-circuit Current (I _{sc})	
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.