



Allied Solar

AS2.5 / 4.2

Installation, Operation and Maintenance Manual



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1 Legal Provisions

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2 General Information

2.1 Overview

Thank you for choosing an Allied Solar off grid solar system. The unit is factory assembled as a ready to go energy storage system and is designed for simple DIY installation for providing solar energy for your home, caravan, shed, cabin or remote equipment.

The Allied Solar off grid solar systems are pre-assembled, integrated, battery energy storage systems and complies with the following guides, codes and standards:

- AS/NZS 4509.1 Stand-alone power systems - Safety and installation
- AS/NZS 4509.2 Stand-alone power systems - System design
- AS/NZS 5033 Installation of photovoltaic (PV) arrays

Installation is simple with the unit rated for either indoor or out-door use and its smart looking, slim line design means it can be installed against the home in a convenient location. The unit is designed to be essentially plug and play and can be installed by a competent person without the need for an electrical licence.

The AS2.5 and AS4.2a are designed for 4 or 6 solar panels of 250 to 500 watts although fewer or more panels may be connected if required. Speak to Allied Solar for information about installing additional solar panels. With 6 x 450W panels connected (2.7kW of PV) your system will provide around 12kWhr of energy per day during sunny summer days and around 6.7 kWh on overcast winter days (less on very overcast days).

The AS2.5 and AS4.2a include a backup generator interface which can start a standard 2-wire start generator and switch the load over to the generator if the batteries are depleted or the system is switched to Generator mode. The system will switch the generator off and revert back to solar/ batteries when the battery level goes above 15% or the system is switched back to “Auto”. There is a time delay of a few seconds when switching from one source to another.

Generator Smart Start: The AS2.5 and AS4.2a can monitor your normal night time battery use and use this information to predict if the batteries could run low during the night. This could happen if it's been a very overcast day or the evening energy use has been higher than normal. If the system predicts that the batteries may run low then it will start and switch over to the generator until it predicts that the batteries will last the rest of the night. By doing this the system will run the generator in the late afternoon or evening for a few hours instead of starting it in the middle of the night or early morning which could disturb the peace.

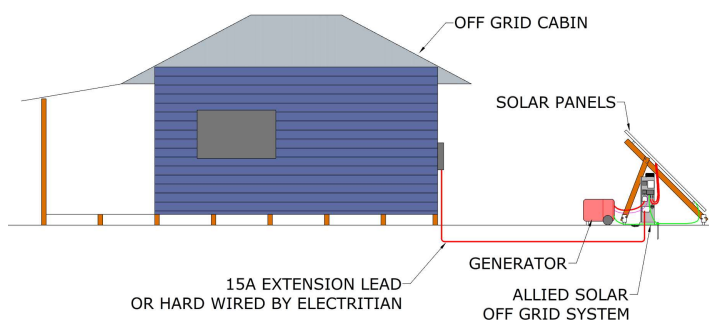


Figure 2-1 Typical Installation

2.2 External Features of the Off Grid Solar Unit

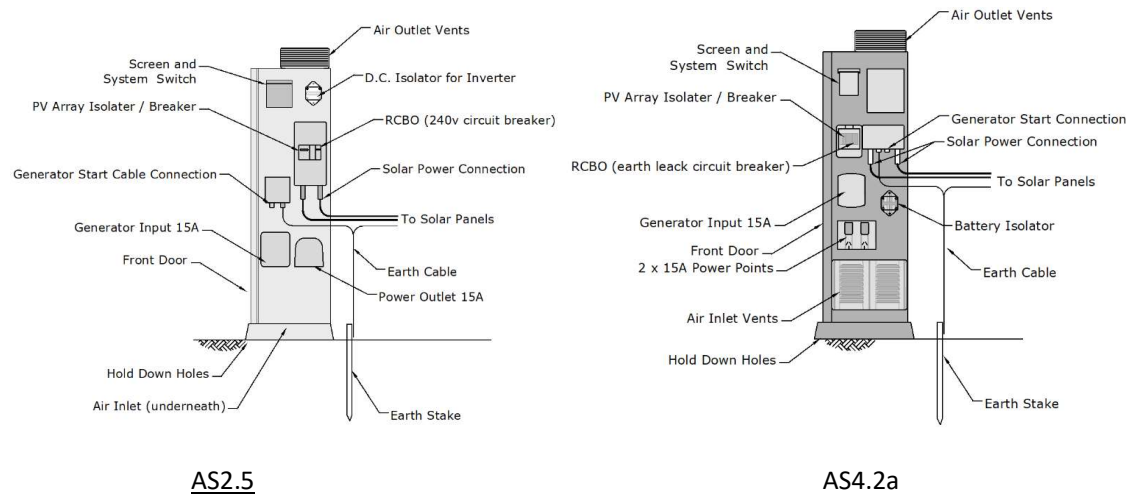


Figure 2-2 Side view of AS2.5 and AS4.2a

1. **Air Outlet Vents:** The unit has cooling air flowing in the mesh screen underneath and out of the vents at the top. Care should be taken to ensure these vents are not obstructed or blocked in any way.
2. **Screen Switch and Buttons:** The display shows key data such as battery level, current and cell voltages as well as any system faults. The switch is used to change the mode between Auto / Off and Generator. In Auto mode the system selects between using the batteries and inverter or switching to the generator. Off mode switches the inverter and generator off if it is an auto-start generator. In Off mode the system will connect any power source from the Generator Input through to the 15A power points (such as a manual start generator or mains power). Gen mode switches to the generator.
3. **PV Array Isolator / Breaker:** The PV Array Main Switch disconnects the solar panels from the components inside the system. Always disconnect the solar panels before opening the unit.
4. **DC Isolator:** This will disconnect the positive side of the battery from the inverter in the AS2.5 and disconnects the battery from both the charger and inverter in the AS4.2a. These switches do not disconnect the power coming in from the solar panels and the PV Array Isolator must also be switched off to de-energise the system.
5. **Solar Power Connection:** The solar panel strings are to be wired according to the PV wiring diagram and the 10m PV extension cables plug into these input connectors. There are male and female plugs for the positive and negative leads.
6. **Generator Input:** A 15A extension lead plugs in here from a generator or mains 15A GPO. When the batteries run low the loads connected to the system are switched to this power source. If this power source is an Auto start Generator then the Generator Start connector can be used to start the generator.
7. **Front Door:** provides access to the internal components of the off grid cabinet. Follow the guidelines when accessing the inside of the compartment.

8. **Generator start cable connection:** plugs into the generator and provides a start signal to the generator (voltage free relay contacts close to start the generator). A 10m cable can be provided with the 2 pin aviation plug connector.
9. **Power Outlet:** is 1 x 15A GPO for the AS2.5 and 2 x 15A GPO's for the AS4.2a. The outlet is protected by 25A breaker and residual current device (RCD). The outlet is connected to the inverter during normal operations and is switched to the generator / mains power when the AS2.5 switches to generator mode. There is a delay of a few seconds when switching from one power source to the other where there is no power available at the outlet.
10. **Earth cable:** The coil of earth cable is to connect to the earth stake. It is important that the earth wiring is completed correctly to ensure the earth leakage protection device (RCD) works correctly and helps protect people from electrocution. Refer to the installation section.
11. **Hold down bolt holes:** for securing the off grid cabinet to the ground and prevent from being knocked over. The unit can also be secured to a wall using the bolt holes in the back of the unit near the top corners.
12. **Air inlet:** is located under the cabinet between the legs in the AS2.5 and on the sides of the cabinet for the AS4.2a. Ensure there is good air flow to the vents and they do not become blocked.
13. **Earth stake:** must be hammered into the ground near the load (cabin, caravan, house..). Ensure the earth cable is not damaged and remains connected to the off grid cabinet.

2.3 Internal Features of the Off Grid Solar Unit

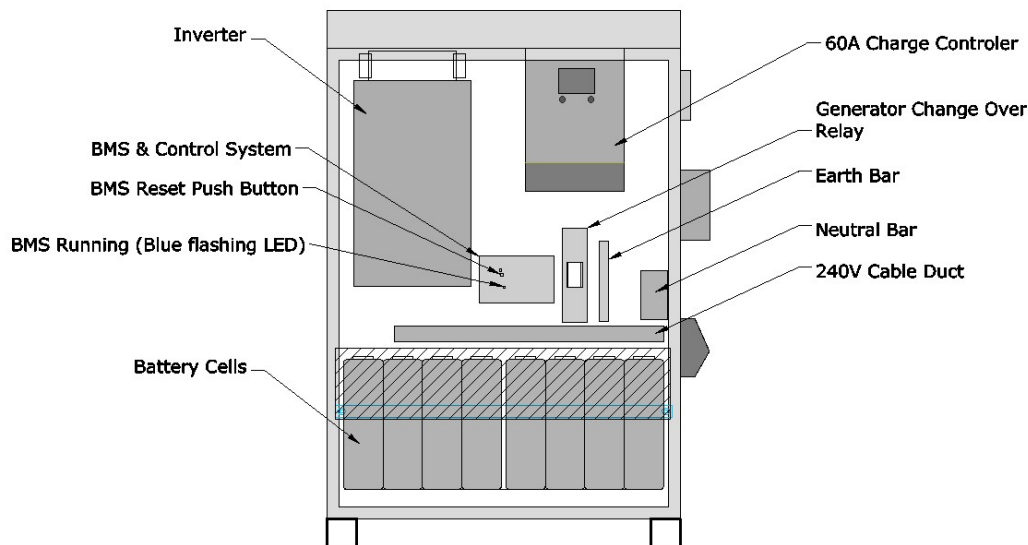


Figure 2-3 Inside view

1. **Inverter:** 3kW (6kW peak) pure sine wave inverter.
2. **Battery Management and Control System:** The Battery Management System (BMS) monitors each battery cell and prevents over-charge, over-discharge and over current. It monitors temperatures and battery level and balances the cells (top balance). This is not to be disconnected. If there is a fault with the battery pack the unit must be returned to Allied Solar for repair. The BMS has a blue flashing LED to indicate proper operation and an audible beep to indicate a fault. There is a reset

button that may be used to try and clear a fault. If resetting the unit does not clear the fault then call Allied Solar for assistance.

3. **Battery Cells:** are Lithium Iron Phosphate cells (LiFe PO₄). These cells contain hazardous substances and must not be punctured or dismantled. Refer to the MSDS or contact Allied Solar if a spillage occurs.
4. **Charge Controller:** This display will show PV voltage and current, battery voltage and charging current from the controller, battery type (must be set to 'user') and charging mode. Note also that the battery level shown on this display is based on battery voltage and is not accurate. Do not change any settings on the charge controller.
5. **Generator change over:** This is a relay that switches the power going to the GPO from the Battery / Inverter to the 15A power input (Generator or mains) power.

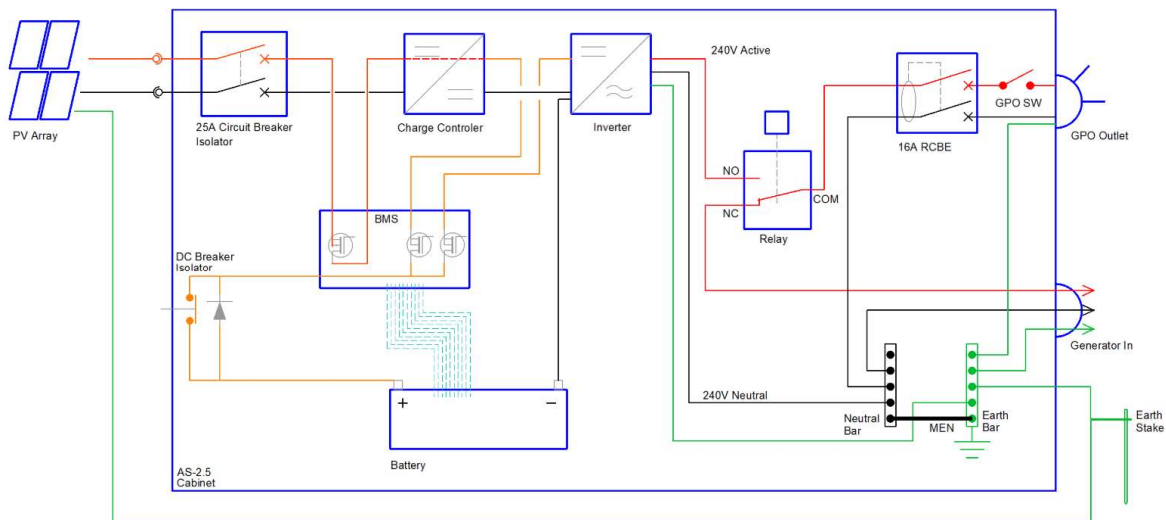


Figure 2-4 AS4.2 Schematic

3 Installation

Before installation check all equipment for any transportation damage and take photos of any visible transportation damage to packaging or equipment.

1. Check the packaging and cabinet for any transportation damage.
2. Check wiring to ensure there are no loose connections. (refer to PPE requirements for entering the cabinet and ensure the cabinet is shut down)
3. Check vents are intact.
4. Check panels (if included) are not broken or scratched.
5. Check Solar Panel rails (if included) are not bent or dented.
6. Check the packing list to ensure all components are accounted for.

Installation consists of:

- Install the solar panel framing on the roof or other support structure.
- Install the solar panels onto the framing.
- Connect the solar panels according to the wiring diagram and labelling.
- Install the AS2.5 or AS4.2a unit

- Install the generator and plug into the AS2.5 or AS4.2a
- Plug the load into the AS2.5 or AS4.2a power outlet and switch it on.

3.1 Solar Panel Installation

- Install solar panels and mounting system according to the manufacturer information.
- Solar panels mounted on roofs should have between 50mm and 100mm gap between the panels and the roof. The panels should be more than 200mm from any edge.
- Ideally the panels will face north.
- Keep way from any shading. If there is shade on any part of any panel it will significantly reduce the performance of that string of panels. Place panels where they won't be shaded by vent pipes, trees or aerials.
- If you have purchased panels with your kit they will be labelled according to Figure 3-1 or Figure 3-2.
- If you are using your own panels then **label the panels and wires** according to the appropriate figure for 4 or 6 panels. Label the panels clearly before mounting them – It will make the wiring on the roof much easier.
- Install the framing and panels according to the Titan Solar – Solar Roof Mounting System manual.
 - Assemble the PV rails using the splice plates provided. For the 6 panel kit each rail consists of 3 x 2.1m lengths and two splice plates.
 - Mark the alignment of the battens under the tin using a string line or chalk line following the line of existing roof screws.
 - Install the Aluminium Tin Roof L feet using the new roof screws and in new positions along the roof batten (don't remove any existing roof bolts). Place the L feet / hooks 500mm from each end and approx. 1100mm apart (maximum 1200 apart).
 - Install the grounding clips under the panels at each mid clamp along one of the rails.

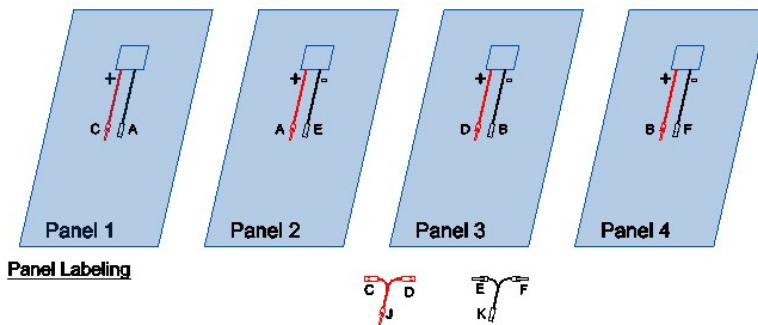


Figure 3-1 Panel Labelling Guide – 4 panels

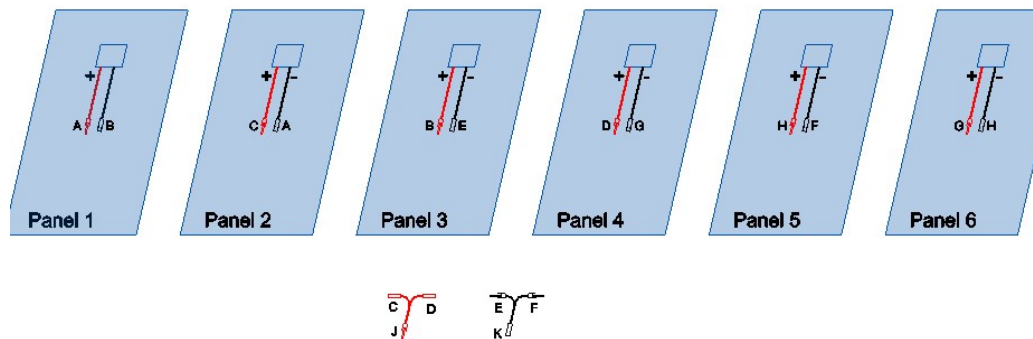


Figure 3-2 Panel Labelling Guide - 6 Panels

3.2 Solar Cables

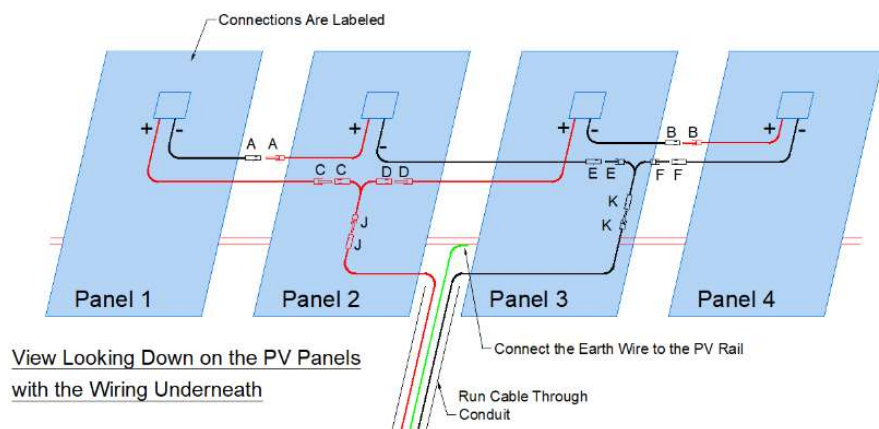


Figure 3-3 PV Panel Wiring – 4 Panels

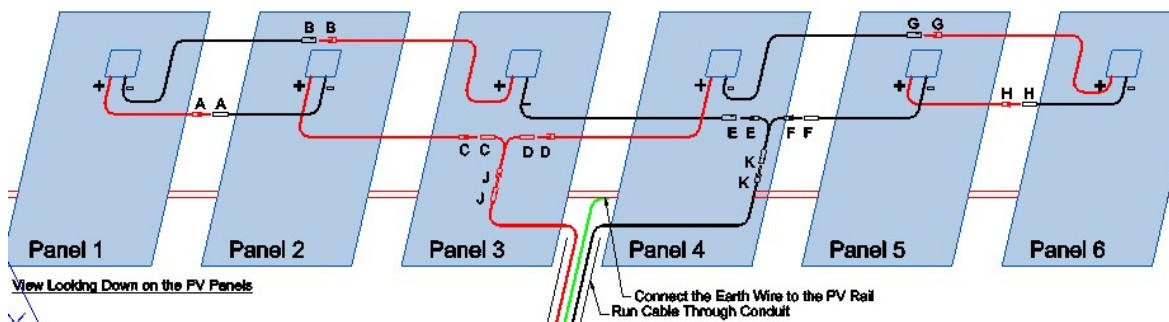


Figure 3-4 PV Panel Wiring - 6 Panels

Connect the PV panels together in two strings of 2 panels, as shown in Figure 3-3 or Figure 3-4. The panels and cables are labelled.

If you have a multi meter check the voltage of each string to ensure each string has a similar voltage and the same polarity. Check the voltages at C and E for string 1 and at D and F for string 2 before plugging into the Y joiners. Also check that the resistance from each connector (C, H, G and F) to the framing is high (more than 120kΩ).

The cables are to be installed in conduit where they are accessible (within reach of the ground) and where they are exposed to sunlight (not shaded by the panels or in the ceiling) except for the last 200mm where they plug into the cabinet.

If using the boot to enter the ceiling space (refer to Figure 3-5) then place the boot under one of the panels to help protect the entry from the weather and sun (do this before installing the panel).

Run the PV cables and earth wire from the Allied Solar AS2.5 to the solar panels on the roof placing the cables in conduit in exposed locations.

Connect the earth cable to the PV rail (the one with the grounding clips) using the grounding lug provided. The other end is to be connected to the earth stake.

Secure the cables and conduit using clamps and cable ties provided.

Ensure the cables are not touching any sharp edges, are not under tension and have mechanical protection.

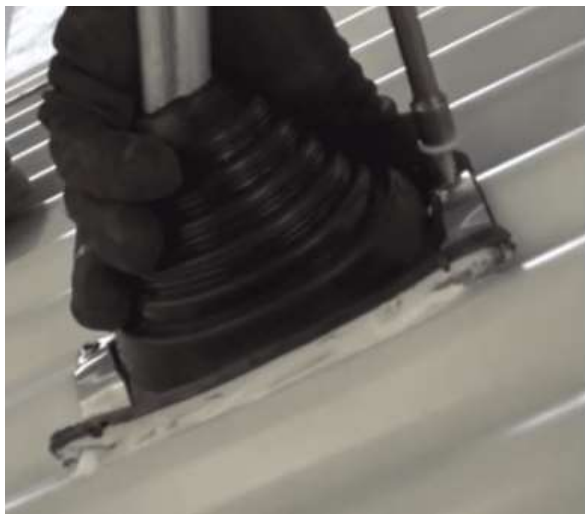


Figure 3-5 Roof Cable Entry Boot

3.3 Allied Solar Cabinet Installation

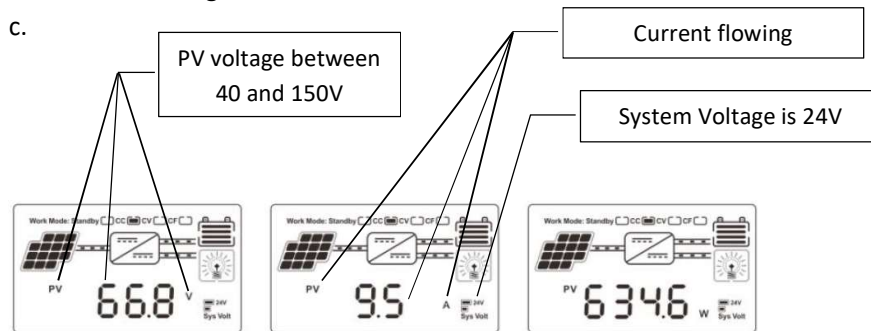
The cabinet is rated for outdoor use, however, to obtain optimum performance and service life, it is recommended to install the cabinet in a cool dry place away from direct sunlight, humidity and dust. Lower operating temperatures increase the life expectancy of the system.

1. Install the cabinet on a solid level surface. It can be left free standing or the cabinet can be secured to a wall or the ground to prevent the possibility of it being knocked over. There are holes in the feet and brackets for the top of the cabinet for securing the unit in place if required.
2. The AS2.5 and AS4.2a produce heat when operating – Ensure there is sufficient ventilation around the unit (more than 500m³/hour or a room larger than 4m x 6m x 2m, or an air-conditioned room).
3. Ensure the unit is not exposed to excessive dust.
4. Ensure the unit is protected from damage / impact from moving vehicles and the like.
5. Ensure the inlet vent under, or on the side of the unit, and the outlet vents at the top, are not blocked and that leaves and debris are prevented from accumulating and blocking any vents.
6. Ensure there will be no water jets from sprinklers or hoses that may impinge on the cabinet.
7. Hammer the earth stake into the ground near the cabinet and connect the earth wires from the cabinet and the solar panels. Ensure the stake is positioned such that it is not a trip hazard. Ensure the cabin, caravan, tiny house or cottage is also earthed or the frame is connected to the earth stake using 4mm earth cable.
8. Ensure the RCD, the PV Array Main Switch and the system switch are all off.
9. Connect the solar panel extension cables to the solar inputs on the side of the cabinet.

3.4 Commissioning

1. Complete the installation checklist in Figure 3-6
2. Ensure the system is shut down – especially the Battery Isolator and the system switch are off.
3. Switch the PV Array Main Switch on (switch is in the window on the side of the cabinet).

4. Switch on the battery isolator
5. Switch the system switch to GEN (system switch is under the display cover).
6. Check the screen of the charge controller inside the cabinet to ensure the PV voltage is between 40 and 150 volts. You may need to press the select button to scroll through the various screens. If the voltage is incorrect or if the screen has gone blank then switch off the PV CB's immediately and check the wiring.
7. Check the charge controller is operating correctly by scrolling through the screens and checking:
 - a. PV voltage is between 40 and 150 volts while operating.
 - b. PV Current is greater than 0.
 - c.



8. Check that the batteries are charging.
9. Ensure there is nothing inside the cabinet that may impede air flow.
10. Close the door of the cabinet.
11. Switch the system switch to 'ON'.
12. Turn on the RCD in the window cover on the side of the cabinet (switch in the up position)
13. Ensure the RCD does not trip.
14. Connect your load to the 15A power point.
15. Switch the power point on.
16. Check that the power switches on and that the RCD does not trip. If the RCD trips there could be a fault in the load wiring and you should call an electrician to check the load wiring (cabin, caravan or house).

3.5 Generator Installation

Install the generator in accordance with the installation manual for the generator.

Run the "generator start cable" and a 15A extension lead from the Allied Solar Cabinet to the generator.

Switch the generator to Auto ready for starting automatically.

To check the change-over function, Turn the system switch to the "Generator" setting and check that the generator starts and the system switches the load over to the generator after a few seconds.

3.6 Specifications

Following is a list of specifications and settings for the Allied Solar AS2.5. These settings should already be programmed into the unit.

General	AS2.5	AS4.2a	
Output power (maximum continuous)	3000	3000W	W
Voltage	240	240	V AC
Frequency	50	50	Hz
Current (maximum continuous)	13	13	A
Phases	1	1	
Ambient temperature range*	-5 to 45	-5 to 45	C
Altitude	0 – 3000	0 – 3000	m
Batteries	Calb CA100	Calb L173F163	
Capacity	100	163	Ah
Nominal Voltage	25.6	25.6	V
Capacity (100%)	2.56	4.17	kWh
Capacity (working range 90%)	2.43	3.75	kWh
Fully charged Voltage	27.8	27.8	V
Fully discharged Voltage	21.0	21.0	V
Working temperature range	0 to 45	0 to 45	Deg C
Solar Panels			
Recommend: 6 panels – Canadian Solar CSI-CS-450MS			
Number of inputs	1	1	
Number of strings per input	Max 4	Max 4	
Voc per string	47– 120	47– 120	V
Charge Controller	e-Smart3	e-Smart3	
Maximum charging current	60	60	A
Battery type	“User”	“User”	
Maximum Voc (string)	120	120	V
Load type	On	On	
System Voltage	24	24	V
Inverter			
Voltage	220 – 240	220 – 240	V ac
Power (Peak)	6000	6000	W
Power (Continuous)	3000	3000	W
Back-up power supply (Generator / mains)			
Voltage	220 – 240	220 – 240	V ac
Plug / Lead Rating	15	15	A
AS2.5 Dimensions			
Weight	70	68	kg
Height	92	92	cm
Width	71	68	cm
Depth	26	26	cm

*System may be de-rated at higher temperatures

3.7 Installation Checklist

Following are the installation checks that are to be completed prior to switching the system on.

Fill out the check list to confirm that the installation is complete, compliant and safe to switch on and operate. Photograph the completed checklist and forward a copy to Allied Solar to obtain your full warranty.

Invoice Number:		
Name:		
Serial Number		
PV Rails:		
All of the L feet are screwed into roof battens and are evenly spaced (max 1200 apart)	Y / N / NA	
PV rails and any splice plates are bolted tight.	Y / N / NA	
Earth plates are used on each panel.	Y / N / NA	
End clamps are straight and not angled up or down	Y / N / NA	
Mid clamps are snug between panels with no more than 1mm gap between edge of panel and mid clamp.	Y / N / NA	
Mid clamps are bolted tight and all panels are secure.	Y / N / NA	
Earth cable is clamped to the PV rail with the earth plates on.	Y / N	
PV Cables:		
PV cable and earth cable are not exposed to direct sunlight and are not accessible or are enclosed in conduit (except for the last 200mm at the connection to the cabinet).	Y / N	
If the roof entry boot is used then it is installed under a panel and in accordance with the manufacturer's instructions and sealed.	Y / N	
PV cables and earth cable are kept away from sharp edges.	Y / N	
PV cables and earth cables are secured in place. (cable ties / conduit), protected from damage and not under tension.	Y / N	
Cabinet:		
Cabinet will not be subject to water jets or strong sprays (sprinkler systems)	Y / N	
Cabinet is on a level concrete or wooden surface or similar and secured to prevent it from being knocked over.	Y / N	
Cabinet is not blocking any corridors or door way.	Y / N	
Cabinet is not under stairs.	Y / N	
The cabinet is not in an enclosed space that would restrict cooling. The cabinet vents are not blocked.	Y / N	
The earth stake is imbedded into the ground and connected to the PV array and the cabinet or the earth cable has a good ground connection.	Y / N	
All plug connections are secure and in good condition.	Y / N	

Figure 3-6 Installation Checklist

4 Operation

The system should be primarily operated using the small silver toggle switch under the display to switch the system between Auto (on the left) to OFF (in the middle) to Gen (to the right) and also the switch on the 15A power points. Operation of the other breakers and isolators are generally not required.

4.1 Switching the System On

When switching the system on for the first time, complete the installation checklist and follow the steps below.

1. Check the system switch in the display cover is in the 'OFF' position.
2. Press the left button in the display and check the battery level and voltages. Check for any error messages on each screen.
3. Ensure the door of the system is closed
4. Switch the Battery Isolator on (yellow tab is pushed up).
5. Switch the PV Array Main Switch on (on the side of the cabinet)
6. Switch the system on (switch in the display cover to "Auto")
7. Check the RCD switch is on (in the up position)
8. Connect the load.
9. Switch the 15A power point on.

4.2 Shutting down the system

To switch the system off move the silver toggle switch under the display to the off position. Use this mode if the solar panels are going to be disconnected as the system uses minimum power in this mode (less than 0.1 mA) so the batteries can last several years in storage in this mode.

Follow this procedure to switch off and isolate the system for any maintenance or repair work.

1. Switch the Generator to the off position and unplug the generator.
2. Switch the PV Array Main Switch to the OFF position (down)
3. Switch the load off at the GPO switch
4. Switch the system to "Off"(The switch in the display cover to middle position) .
5. Turn the battery isolator off (Side of the cabinet)

4.3 Transfer to Generator mode

Transferring to generator mode can be useful to conserve battery power during over cast days so that the system can operate on batteries over night when it is less desirable to have the generator running.

Simply switch the system switch to the generator mode on the side of the cabinet under the display. The system should start the generator and switch over automatically. To switch back to batteries/ solar simply turn the switch back to "Auto".

4.4 Predict Mode

In predict mode the system will calculate if there is enough battery capacity to run through the night based on past battery usage. If the system predicts a shortfall, it will start the generator early (in the late afternoon or evening) and run the generator until it calculates that there is enough battery energy to get through the rest of the night. In this way the generator is run in the evening instead of the early hours of the morning which could disturb the peace.

To turn the predict mode on, press the left button on the display until the 'Section 4 – Status' screen is displayed. The predict section is displayed on lines 2, 3 and 4 of this screen. Press the right button to turn the predict function 'ON' or 'OFF'. The numbers displayed on lines 3 and 4 are the predicted battery levels for the next 12 hours.

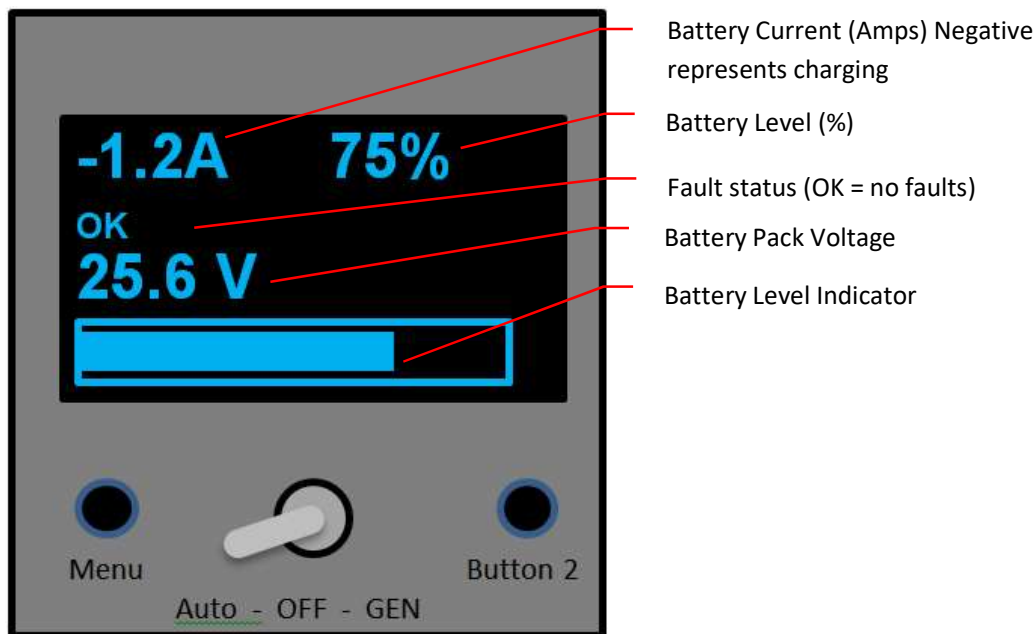
4.5 Isolate power supply

To isolate the supply of power from the system, switch the power off at the power outlet and disconnect the plug from the GPO.

4.6 Display

The system includes a combined Battery Management and Energy Management System (BMS and EMS). The display for the system is under the cover on the side of the cabinet. The display will switch off after 1 minute of inactivity. To switch it on, simply press the menu button.

Screen 1:



The first screen shows the main system status levels in large bold font.

The Battery current is positive for discharging current and negative if the battery is charging.

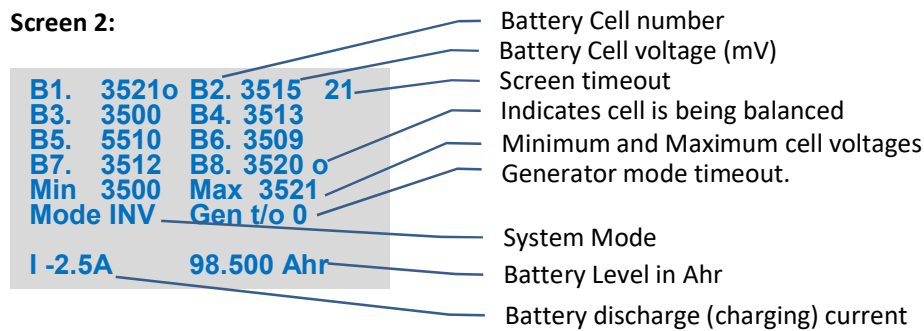
The battery level is shown as a percentage in the top right and as a bar graph at the bottom of the screen

The Fault status will display OK if there are no faults detected and will display a short fault description if there is a fault detected.

The Voltage is the current system voltage

The Menu button switches the display on and toggles between displays.

The system switch is in the middle below the screen and is used to switch the system between modes if required.

Screen 2:


The first 4 lines display the battery cell number, the cell voltage in millivolts and whether the cell is currently being balanced. In the top right is also the screen time out which counts to 60 and then switches the screen off.

The Modes of the system are: Inv = the system is operating off the batteries and inverter. Off = the system switch is in the OFF position, GEN = the system is currently switched to the generator.

Gen t/o is a timer to prevent the generator from starting and stopping too often. If the system automatically switches to generator mode then it stays in generator mode for a minimum of 15 minutes. This counter will count down to 0 before the system can automatically switch the generator off and go back to inverter mode. This timer does not affect the manual operation of the generator when using the switch and the generator will switch off if the system switch is toggled from Auto to Gen then back to Auto.

I is the amps going into or out of the battery. -ve number indicates the battery is being charged.

Ahr is a more precise output of the battery level.

Screen 3 – Registers:

3. Registers: PCLSG -CLS-0	
Charge	-----
Load	-----
Errors	-----
Run	-----
Wires	-----
BMS	-----
Bal	-----

This screen can be used for troubleshooting and shows some of the main system conditions or errors

Line 1 shows which parts of the system are currently switched On. PCLSG is a reminder for:

- P = Precharge circuits on;
- C = Charger is switched on;
- L = Load (Inverter) is switched on;
- S = Solar PV is switched on;
- G = Generator ON signal;
- A dash (-) means that component is off. The above window shows Precharge is off. The charger and Inverter and Solar Panel inputs are On. Generator start signal is off.

The remaining lines are for various registers that record system conditions. The condition is represented by either a '-' or a '1' with - meaning it's inactive and a 1 meaning the condition is active.

Charge and Load Conditions (lines 2 and 3):

1. MOSFET Temperature High
2. Battery Temperature High
3. Battery Temperature Low
4. Battery Voltage High
5. Battery Voltage Low
6. System switch is OFF
7. PV MOSFET Temperature is High
8. Battery is disconnected

Errors:

1. BMS Chip Temperature fault.
2. Load / Charge MOSFET temperature sensor fault
3. Current Sense reference point sensor fault.
4. Battery Temperature sensor fault
5. Current measurement out of range.
6. PV MOSFET temperature sensor fault
7. Shunt temperature sensor fault

Run:

1. System Setup fault.
2. Communications Fault
3. Broken Wire (cell voltage reading) fault.
4. BMS Chip measurement faults.
5. Battery Cell Voltage Low.

- 6. Battery Level Low
- 7. Charge / Load MOSFET temperature High
- 8. Battery disconnected.

Wires:

This line indicates which battery cell wire is broken (if any).

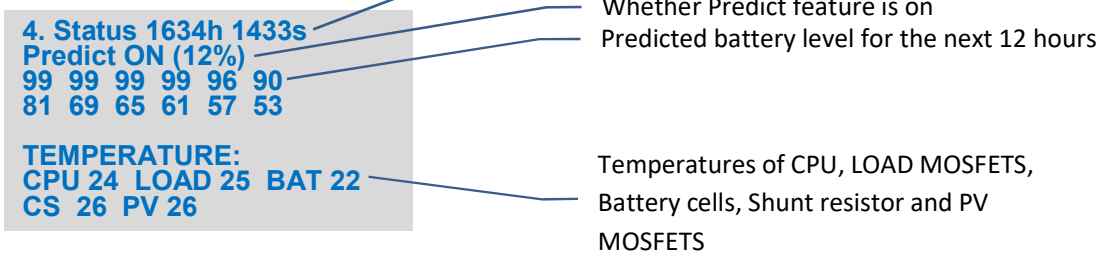
BMS:

Displays the Battery Management Chip's Error Register.

BAL:

Shows which cells (if any) are currently being balanced.

Screen 4. Status



The screenshot shows the following text:

```

4. Status 1634h 1433s
Predict ON (12%)
99 99 99 99 96 90
81 69 65 61 57 53

TEMPERATURE:
CPU 24 LOAD 25 BAT 22
CS 26 PV 26
  
```

Callouts from the right side of the image point to the following elements:

- Line 1: How long the system has been running for (hours and seconds)
- Line 2: Whether Predict feature is on
- Line 3: Predicted battery level for the next 12 hours
- Line 4: Temperatures of CPU, LOAD MOSFETS, Battery cells, Shunt resistor and PV MOSFETS

The status line shows how long the system has been running for. This will reset if the software re-starts.

The system has a predict mode that can be switched on or off here using button 2.

The predict function keeps track of the average hourly battery use throughout the day and uses this information to predict the battery level over the next 12 hours. The predicted battery levels, for each hour, for the next 12 hours, are shown underneath. It also shows at what level the system will switch off the inverter (and start the generator if an auto start generator is connected).

If the predict mode is on and the system calculates that the batteries will run low then the system will switch over to generator mode early and stay in generator mode until it calculates that it can get through the next 12 hours on batteries.

Screen 5:

Screen 5 displays the various settings of the system and the software version loaded onto the controller

```
SETTINGS: Ver 1.8E-d
V.bal 3450 V.hh 3600
I.sf 157.40 V.hr 3500
V.ll 3030 V.lr 3080
Delta 20
MOS.hh 353 MOS.hr 328
CHARGE 318 315 276 273
LOAD 328 323 268 263
```

Ver = software version loaded onto the BMS.

Vbal = the voltage level where cell balancing starts.

V.hh is the Hi Hi voltage level for any one battery cell. The system should never get to this voltage but if it did the BMS would switch the solar panels off to prevent over charging.

V.hR If the system switched the solar panels off on over voltage then they will switch back on again when it drops below this voltage.

I.sf are factors used when calculating the system current. There is a scale factor (157) and a Drift factor (40). The system may update these automatically to correct for calculation errors.

V.ll is the low low voltage of the battery cells. If the voltage drops below this level then the system switches off. V.lr is the voltage where the system will recover and switch back on.

Delta is the maximum differential in the cell voltages (in mV) before cell balancing is allowed.

MOS.hh and MOS.hr are the temperatures (in Kelvin) where the system switches off MOSFETS to protect them (hh) and switches them back on (hr)

CHARGE ... These are the battery temperature ranges (in kelvin) where battery charging is allowed. There is a LL level, below which charging stops. A LR level above which charging is allowed again. HR level, below which charging is allowed. A HH level above which charging is prevented.

LOAD – These are the battery cell temperature ranges (in Kelvin) where discharging is allowed – Similar to the charging ranges.

5 Maintenance

Monthly Inspection:

1. Check to ensure vents (underneath and the sides at the top) are not blocked by any leaves or debris.
2. Check the cabinet for any signs of moisture ingress or rust and fix any points of water ingress.
3. Check through the screens to ensure there are no error messages.
4. Check the PV panels for debris, leaves or bird droppings

6 Fault Finding:

Always make sure the inverter is shut down before opening the cabinet by switching the system switch to GEN mode.

1. No Power.
 - 1.1. Check the silver system switch in the display area is switched to Auto (to the left)
 - 1.2. Check the system screens to see if there are any errors.
 - 1.3. Check the system is in INV mode (Screen 2).
 - 1.4. Check the Registers screen to see if there is a fault in the “LOAD” row
 - 1.5. Check that the outlet switch is on at the power point (Slide switch down)
 - 1.6. Check that the RCBO, in the window on the side, is on (lifted up)
 - 1.7. Check the battery isolator switch is on (lifted up).
 - 1.8. Check the Inverter is switched on (inside the cabinet on the underside of the black box the red switch should be lifted up at the end closest to you).
 - 1.9. Check the batteries have sufficient energy (above 7%)
2. Battery Not charging
 - 2.1. Check the silver system switch in the display area is switched to Auto (to the left) or GEN (to the right)
 - 2.2. Check the PV Array Isolator / Breaker is on.
 - 2.3. Check the PV panels are connected
 - 2.4. Check the Solar charger inside the cabinet is on (display turns on when the buttons are pressed)
 - 2.5. Check whether the solar charger is charging (PV Amps or Battery Amps are greater than 0)
 - 2.6. Check the Solar Charger System Voltage reads 24V (refer section 3.4).
 - 2.7. Check the registers screen to see if there is a fault in the “Charge” row. If there is a fault – refer to the ‘screen – Registers’ section to see if the problem can be identified.
3. Stuck in GEN mode
 - 3.1. Switch to GEN mode using the silver switch then back to AUTO mode.
 - 3.2. Check the Registers screen to see if there is a fault on the ‘LOAD’ row. If there is a fault – refer to the ‘screen – Registers’ section to see if the problem can be identified.
4. Battery Level very low
 - 4.1. If the battery level has become very low and the system has shut down on low battery level then pressing the Reset button on the BMS unit will allow the charger to start again and allow charging of the battery for a short period. This may need to be repeated if the system trips out again on low battery level again.
 - 4.2. Check that the Solar Charger System Voltage reads 24V (refer section 3.4). If it is reading 12v Sys Volt then the battery voltage is too low and cannot be charged by the system. Switch the system to OFF and contact Allied Solar. The system will need to be charged manually to above 19V so that the charger recognises the system as a 24V system. Once the system voltage is above 19V, press reset on the BMS to re-start the system. Check that the charger recognises the system as 24V.
5. If the fault cannot be found then re-starting the BMS may clear the fault. This can be done by pressing the small button on the front of the BMS box inside the cabinet.
6. If you hear a beep coming from the system then that indicates there is an error and the system needs attention to determine the cause of the error.

7 Warnings

7.1 Dangerous voltages

There are dangerous voltages inside the cabinet while it is switched on. Do not open the Allied Solar cabinet unless the system is switched off. Follow the Shutdown instructions to turn the system off.

7.2 Installation Work

The installation of solar panels requires skill in mounting the PV panel framing, installing the solar panels and running the electrical wires. If you are not confident that you have the necessary skills then Allied Solar recommends the unit is installed by a qualified solar installer or someone with experience in electrical work and who has read and understood this manual and associated documents.

7.3 Battery Pack

Do not dismantle the battery pack. The battery pack is not a serviceable item and the unit must be returned to the factory if there are problems with the battery pack. Do not remove the battery pack covers, bus bars, BMS or any other fittings on the battery pack. Do not tamper with the battery cells in any way. If the cells are damaged then turn the system off by following the shut down procedures, if safe to do so, refer to the battery MSDS and call Allied Solar.

WARNING: Lithium Battery Hazard

CAUTION: Do not dispose of batteries in a fire. The batteries may explode.

CAUTION: Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes. It is toxic.

7.4 Arc Flash

Arc flash is a large energy discharge in the form of an electric arc and can cause serious injury and burns from flash energy and blast of molten/vaporised metal. The batteries in your cabinet are capable of delivering over 5,000A which could result in a large energy discharge and harmful arc flash.

Arc flashes can result from loose cables, components, tools or jewellery creating a short during maintenance or from a failure.

Under no circumstance should maintenance work be performed on the battery pack and the battery pack should always remain covered.

While performing any other work inside the cabinet:

- Do not remove the protective cover over the batteries.
- Wear appropriate PPE including safety glasses, insulating gloves and long sleeve non-flammable shirt.
- Remove any jewellery such as bracelets, rings, necklaces, watches and metallic pens. Ensure you are not wearing any other conductive items.
- Disconnect the battery pack using the circuit breaker.
- Ensure all tools are insulated as far as practical using electrical tape.
- Contact Allied Solar for assistance.

7.5 Solar Panel Wiring

Pay special attention to the wiring of the solar panels. The panels must be wired in the configuration shown. If you are un-sure please contact Allied Solar.

Do not disconnect solar cable connectors under load. Always turn the PV Array Main Switch off on the side of the cabinet before unplugging any solar cables or connectors.

7.6 Power Continuity

The power supplied by the Allied Solar AS2.5 and AS4.2a Systems will be disrupted from time to time as a result of:

- Switching to or from back-up Generator (5 to 10 seconds) or when the batteries empty with no back-up generator (off until the batteries re-charge to 10%);
- Over-loading of the Inverter (off for 3 seconds or until the inverter is reset)
- Hi or low temperatures (off until the unit cools down or switches to generator).

If a smooth un-interruptible power supply is required then consider incorporating a UPS into your setup.

7.7 Water

Do not direct any water jets onto the unit. Water jets such as sprinklers, reticulation or hoses must not be directed at the unit. The unit is rated for normal weather conditions only. If water should enter the unit due to water jets then disconnect any external supplies (such as generator), Switch the batteries off using the external battery switch. Call Allied Solar for assistance.

7.8 Connected Load

Do not over-load the inverter. The inverter is rated at 3000W continuous and 6000W peak power. Over 3000W the inverter will alarm and shut down. Switching on electric motors (such as vacuum cleaners, pumps or power tools) will draw up to seven times the running power during start-up and can easily cause overload shutdown.

7.9 Fire

In the event of fire the unit can emit toxic fumes from the battery cells and other equipment – Do not breathe in any fumes. Use a dry powder fire extinguisher to put out any fire. Hose down surrounding areas. Do not use water on the batteries or anywhere inside the unit. Breathing apparatus should be worn in this situation. Refer to the MSDS for more information.

7.10 Direct Sun

Your Allied Solar AS2.5 or AS4.2a system will perform best and last longer if it is located away from direct sunlight. Higher temperatures reduce the life of the capacitors within the equipment and equipment such as the inverter and charge controller may be de-rated at higher temperatures.

7.11 Inverter Frequency

The inverter frequency is not referenced to a precision clock. This means that devices with clocks that use the grid frequency as a clock source (i.e. some microwaves, fridges, alarm clocks, power point timer switches etc) will become inaccurate and the time displayed could drift by several minutes per day.