SOLATHERM

Power Control Equipment

Model:

PV360R

Heating with Secondary Output
Power Control Equipment (PCE)

PV DIRECT Ready

PV DC Electric Hot Water

Owner Manual

1/52 Barnett Ave, Glynde SA 5070
Phone (08) 8337 8881
www.solatherm.com.au

ATTENTION

The Solatherm controller and water heater vessel must be installed by an authorised person and the installation must comply with all the relevant Australian Standards, local and industry regulations.

ATTENTION

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.

Children should be supervised to ensure that they do not play with the appliance

WARNING

Once installed the hot water tank is powered by TWO SOURCES of Power Supply, both sources must be isolated before working on the appliance.

Before commencement of any service work on the hot water circuit, including work that partially or completely drains the storage vessel, ensure all electrical supplies, the Photovoltaic array and AC connection have been disconnected as per the System Shutdown procedure in this manual.

PV ARRAY WARNING

When the photovoltaic array is exposed to light, it supplies a d.c. voltage to the PCE.

WARNING

The controller is only to be connected to a hot water cylinder specifically designed and configured for use with the Solatherm DC controller (P.C.E.). It is not for retrofit.

WARNING

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

WARNING

DANGER the operation of the thermal cut out indicates a possibly dangerous situation. The water heater must be inspected by a qualified person before the OTC is reset.

PV ARRAY WARNING

Designed for maximum array power of 10kW. Current must not exceed 25 Amps, array design must not exceed 2 strings. Voltage must not exceed 600V
Max power should not be exceeded.

WARNING

The controller has no user serviceable parts. Opening the cover will void warranty and may expose dangerous voltages.

Removal of the covers on the storage water vessel will expose live electrical wiring. Covers must only be removed by an authorised service person and only once dual supply power has been isolated.

ATTENTION

Ensure all glands from the control box are firmly tightened to ensure ingress protection.

ELECTRICAL WARNING

All electrical work and permanent wiring must be carried out by a qualified person and in accordance with all current relevant Australian installation standards and local authority requirements.

Means for disconnection must be incorporated in the fixed wiring in accordance with the wiring rules.

<u>All</u> electrical connections must be terminated before switching any component on. The power to the Solatherm solar control unit and water heater must NOT be switched on until the water heater is completely filled with water and all air bled from the system.

Symbol Glossary

Symbols Used			
	Refer to the operating instructions		Caution, risk of danger
	Protective conductor terminal		Caution, risk of electric shock
	Positive conductor		Negative conductor
	Class II Double Insulated		

Contents

PV360R-Draft V6

About

The Solatherm control unit regulates DC electricity generated by a photovoltaic array and applies it to a resistive heating element, located in a storage hot water vessel, to generate hot water. The microprocessor constantly monitors the water temperature in the storage vessel and energizes the heating element when sufficient power is available from the array and the water stored in the vessel is below the set temperature. When the temperature is reached the unit will turn the element off until the water temperature falls.

Once the water is up to temperature, Solatherm units with diversion are able to divert surplus power for another purpose such as to an inverter, battery management system or DC appliance, subject to the correct input voltage and current requirements for the device and array configuration. The controller monitors the temperature of the stored water to ensure maximum hot water is maintained.

Solatherm Control Units are independent from the grid and require no mains power connection to operate, hence, the unit will only operate and display user information when there is sufficient energy from the sun. It is normal for the LCD display and lights to flicker or not fully display in low light conditions.

During periods of low solar input where there is insufficient power available to heat the stored water to 60^0C the independent 240V AC boost element will top up the temperature of the water in the storage vessel.

> NB: Generally, the independent AC boost element is connected to an off peak (controlled load) power supply. If only peak is available it is recommended to install a din rail timer and set a heating period during the early evening and/or early morning depending on the household demand. If the water in the storage vessel is higher than the 60^0C thermostat setting the unit will not draw any power as there is no need. If the water is below 60^0C during the set periods the boost element will top up the temperature to ensure hot water is available. The boost element heats approximately 50L of water. Connection via a timer will maximise solar gain during the day, minimise energy consumption and allow for ease of use. High usage households may require extended boost periods or continuous mains connection to meet high demand.

Display

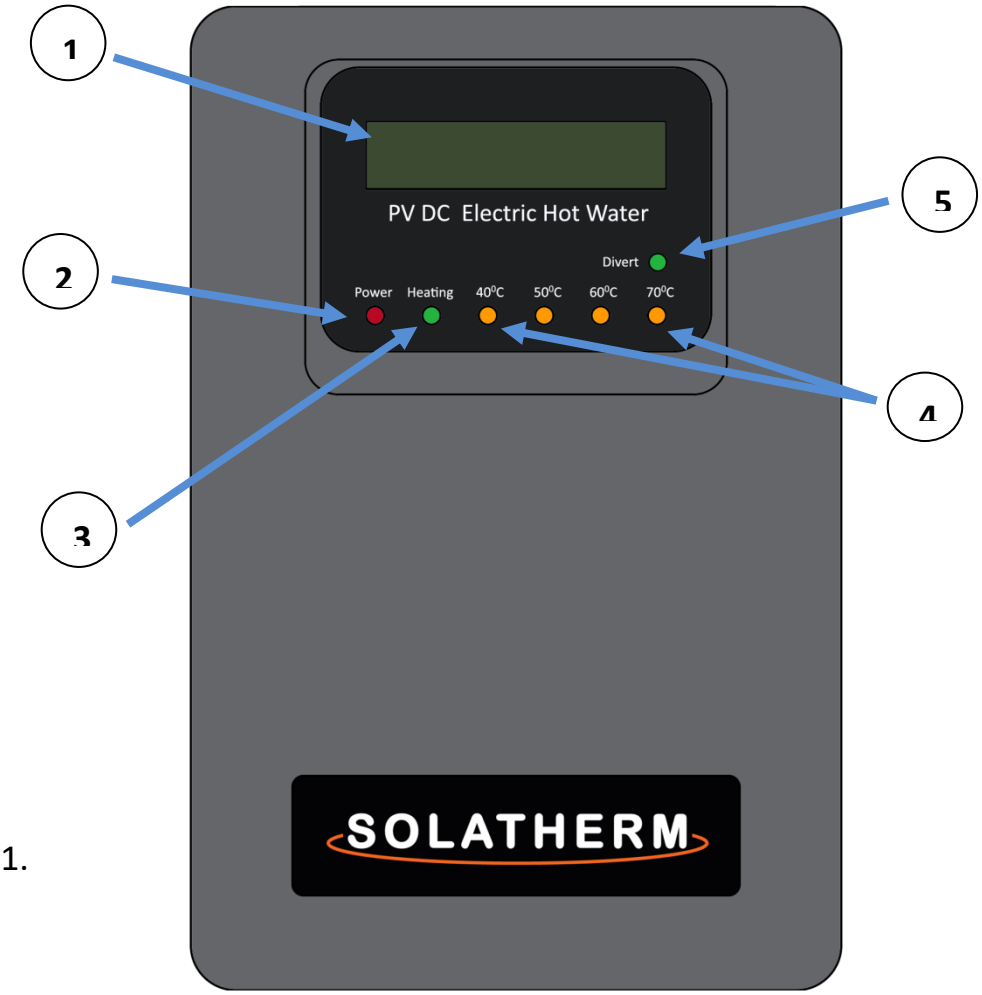
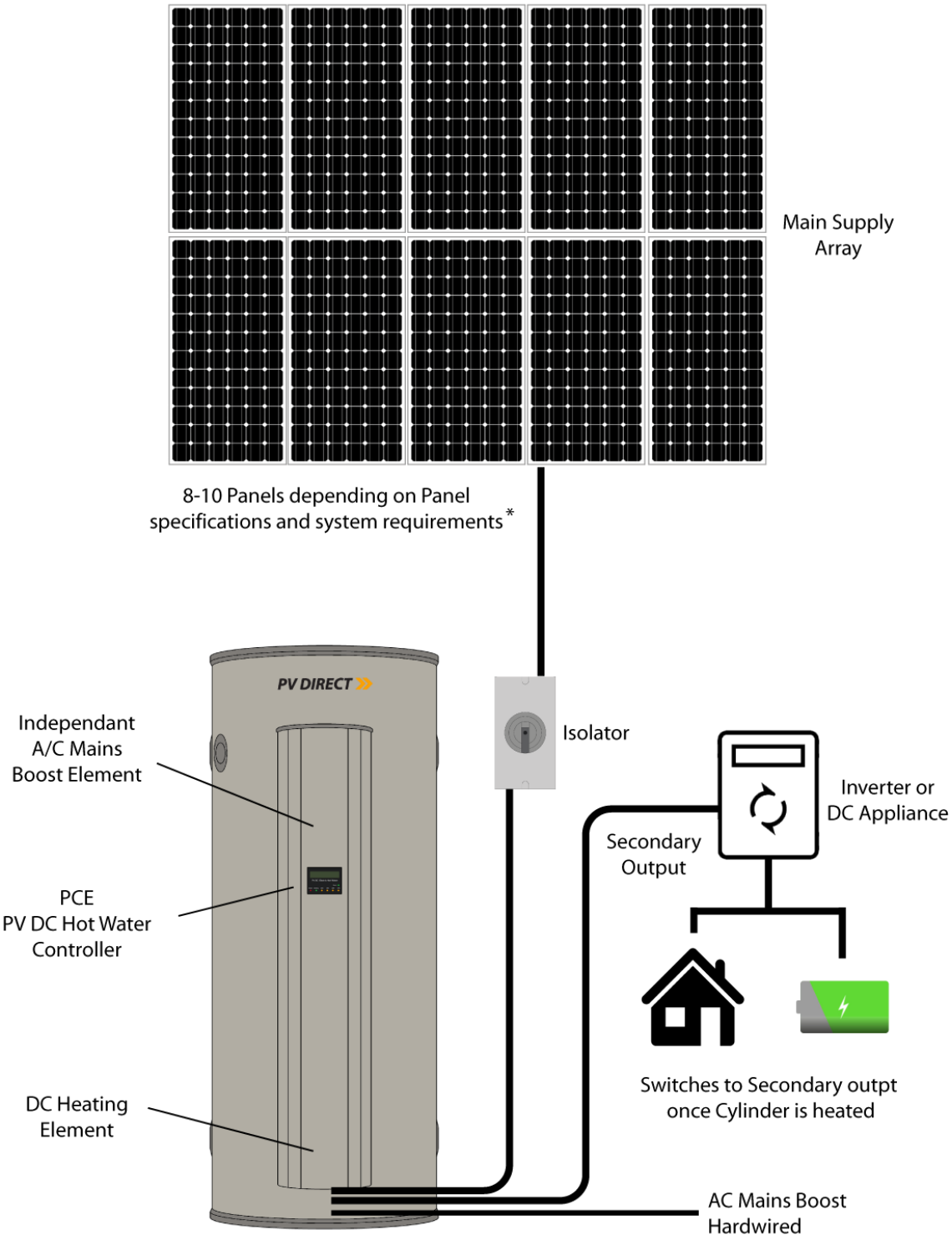


Figure 1.

Solatherm Control Units are independent from the grid and require no mains power connection to operate, hence, the unit will only operate and display user information when there is sufficient energy from the sun. It is normal for the LCD display and lights to flicker or not fully display in low light conditions.

1	LCD Display	Scrolling display showing the array voltage and when the heating element is activated, the current and power. The second line shows the kW/h consumed for the day and the total kW/h consumption.
2	Power	LED illuminated red when the main array is connected and supplying power to the unit. In low light conditions this light may be the only LED lit or flashing.
3	Heating	LED illuminated green when the controller has energized the heating element.
4	40^0-70^0C	LED's illuminated orange - an approximate indication of the average temperature of the water stored in the storage vessel.
5	Divert LED	Green LED will illuminate when the heating element is switched off and the secondary output is switched on.

Basic System Configuration



*Depending on total power limitations or installation requirements

Figure 2.

Start-up Procedure

NOTE: ENSURE HOT WATER VESSEL IS COMPLETELY FILLED WITH WATER BEFORE COMENCING START UP PROCEDURE.

1. Ensure storage cylinder is full.
2. Turn on Isolator. RED LED POWER LIGHT SHOULD BE ON. The LCD will illuminate and start to indicate incoming power (providing supply voltage is over 120 Volts). The controller should show start up information as it runs through a power up test sequence. When test is complete LCD will display system voltage etc.
3. After the start up sequence is complete the green divert LED will light glow and connect to the inverter until sufficient power is available to commence heating. Note: The controller has several built-in time delays of up to 1.5 minutes, to allow for power stabilisation.
4. Turn on 240V AC Booster breaker switch in household fuse box.

System Shutdown

1. Turn off main array isolator (lock switch if required)
2. Controller should now be off, red light and LCD display should be off.
3. Turn off 240V AC Booster isolator and breaker switch in household fuse box.
4. System should now be electrically isolated.

Maintenance

1. There are no serviceable components
2. There is no preventative maintenance required.
3. There are no replaceable parts in the controller.
4. Controller can be wiped with a damp cloth if required.

Frequently Asked Questions

Q: The controller LCD and lights are flashing or resetting in the morning, during the day or at the end of the day?

A: The Solatherm control unit is powered by the photovoltaic array. There is no connection to mains/grid power required for standard operation. The controller will only operate when sufficient energy is available from the sun. In low light, such as in cloudy conditions, early in the morning or at the end of the day, it is normal for the controller to flicker and dim and/or reset if there is inadequate sunlight intensity to generate sufficient stable power for operation.

Q: My LCD show 0 Watts but the sun is out?

A:

1. The water in the storage tank is up to temperature.
   Dependent on the factory set temperature 60^0C or 70^0C.
2. During periods of low light intensity such as, early morning, late evening or in dark cloud the main array may not be able to produce the minimum amount of power needed. The controller requires a stable 250 Watts to be available when the element is energized to commence heating. The green heating light will flick approximately every 25 seconds as the controller is testing the amount of power available from the array.

Q: The heating light has been on all day but there is no hot water at the end of the day?

A:

1. The hot water produced has been consumed during the day.
2. If the display is showing 0 Watts with the heating light on there may be a fault with the element or the over temperature cut out. Please contact your installer.

Q: Run out of hot water or warm water only.

A:

1. The hot water produced has been consumed during the day.
2. Not enough solar input during the day. Ensure booster is connected and the AC boost timer settings are correct for the household demand or season.

Q: I can see the second output is active but I have no hot water?

1. A: There is a fault with one of the temperature sensors and the controller is in divert mode by default. The temperature lights on the controller will be flashing with a fault. Please call your installer.

Troubleshooting

All observations for potential faults need to be conducted in clear daylight conditions.

Observation	Fault
Dim/flickering LCD display & lights	Should this occur in bright sunshine please contact your installer. No Fault if seen in low light conditions. Re-check in brighter conditions. Please see note in Frequently Asked Questions
LCD continually resets with 35 second timer	During Periods of low light, the LCD display may be observed resetting in a loop until there is sufficient power from the array to maintain stability.
Flashing temperature lights (Orange LEDs)	Fault with storage water temperature sensor or internal temperature of the enclosure is too high e.g. Controller mounted in full direct sunshine or over voltage from array.
No heating light (Green heating LED)	Element not powered. The controller will only energise the element when there is enough solar energy available and the storage water temperature is below the set point. If clear conditions, the water is cold and no green light appears, contact your installer. Also see FAQ.
Heating light on but no hot water. (Green Heating LED)	Not enough heating time has passed. Allow more time for heating. If light is on but LCD display shows no Power (Watt) figure contact your installer. Possible Element Fault.
Flick of green light (Green Heating LED)	Approximately every 20 seconds. This is the unit testing the power available. A high voltage may display but no current may be available. Not enough sunlight to engage element.
No power light. (Red LED)	Not enough power being produced by the main array. If in sunny clear conditions contact your installer.
No temperature lights (Orange LEDs)	Average water storage temperature is below 32 degrees Celsius

Installation Instructions

Wiring Diagram - Controller

WARNING INCORRECT POLARITY WILL DAMAGE THE CONTROLLER
NO WARRANTY FOR POLARITY DAMAGE

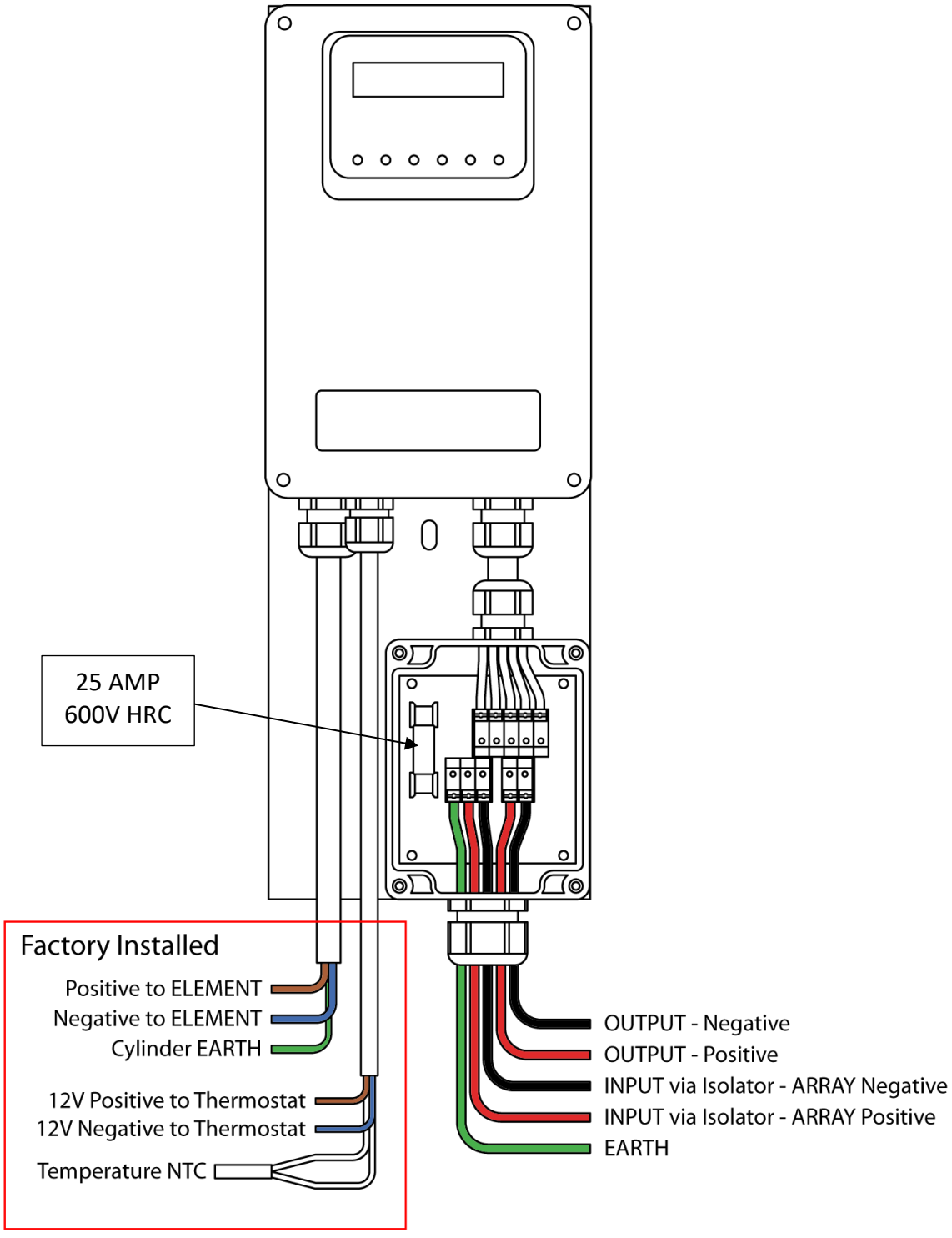


Figure 3.

Cylinder mounted PCE controller

Choose a suitable location, giving consideration to the following:

1. Vertical position of cylinder and controller consideration to cable length and PV main array isolator location and diversion requirements.
2. It is important to mount the controller out of the direct sunlight as it will make visual reading of the LCD display difficult.
3. The control box is factory mounted to the storage vessel.

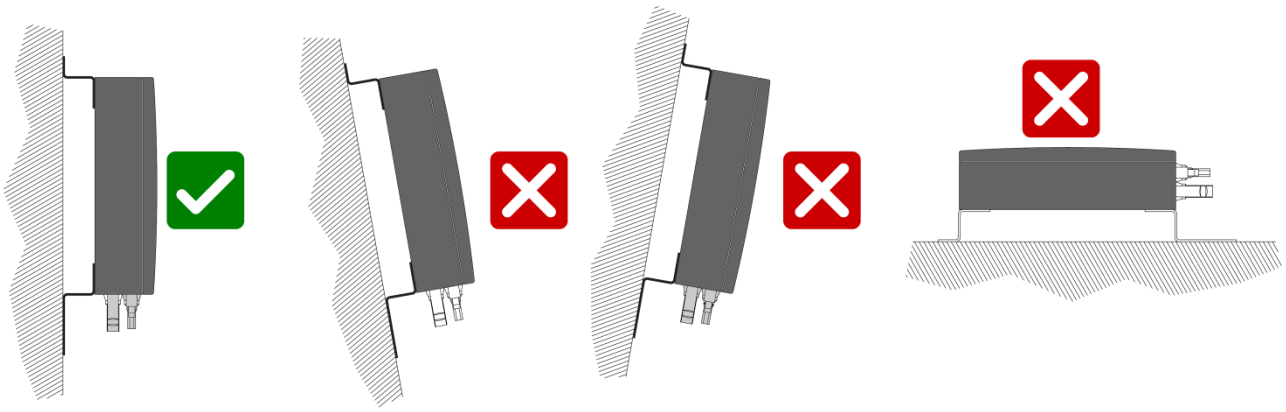


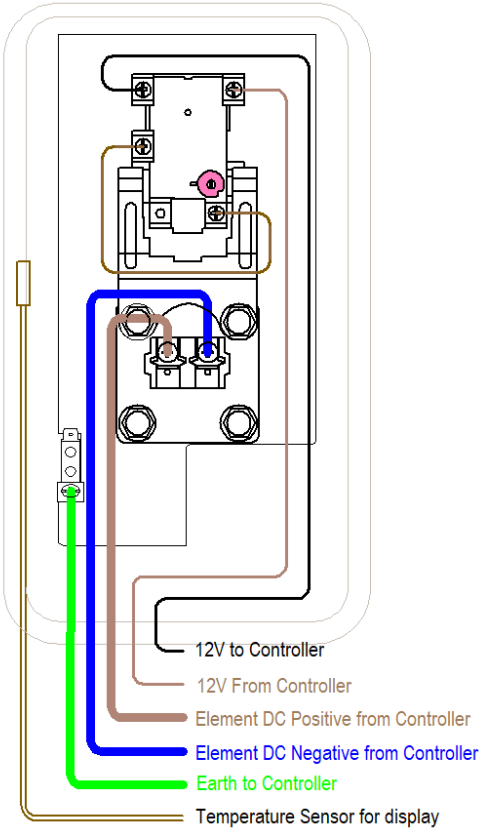
Figure 4

Continued.

Connection: Controller to Storage Water Vessel

1. The control unit is designed to be connected to a specifically made storage hot water cylinder with array matched heating element.

2. The output cable from the control unit is factory connected to the lower DC element and thermostat on the storage cylinder. No further connections in the lower thermostat pocket are required during installation.



3. The thermostat is factory set to 65 degrees. If the thermostat temperature needs to be adjusted. Ensure isolator is off, remove lower DC element cover and adjust the thermostat as required.

4. Ensure Lower Thermostat which is spring located onto vessel surface has not been disturbed during installation and is sitting in place and secure. Re-install DC element cover (Figure 2). Re energise the isolator.

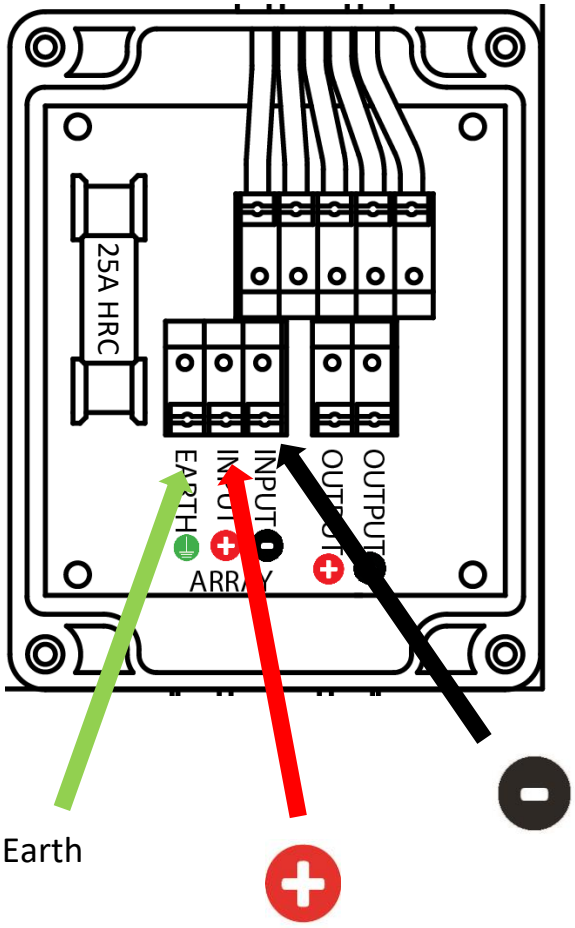
The OTC is only activated by overheating of the storage vessel which indicates a potential system fault. The system must be inspected by an authorized person should the OTC activate before being reset.

Connection - Main Array Input

1. An isolating switch in accordance with clause 4.8.2.3 AS/NZS 3000:2018 shall be installed for the connection to the control unit located on the water heater.
2. Remove the 4 screws on the connecter enclosure (figure 3) to expose the connection terminals.
3. Connect an appropriate PV rated cable from the wall mounted isolator into connector box as per PV installation regulations. The cable must be suitable for the array the system the control unit is connected to, this is usually 4mm2 twin. Bootlace the end of each cable with the supplied bootlace using a suitable bootlace crimping tool. Fit each cable through the multi hole grommet. Connect each wire to the correct terminal block as per markings located on the circuit board (figure 8). Depress orange tab to allow easier installation of the bootlace into the connector and ensure the connector is settled and release the tab. Ensure cable is locked, retained, located and fully embedded correctly in the terminal block.
4. The positive wire from the array isolator (array positive) is connected to the array input positive on the connector board.
5. The negative wire from the isolator (array negative) is connected to the input negative on the connector board.
6. The earth from the array in the isolation is connected to the array earth on the connector board. Earth from the cylinder that loops via controller to the Array must be connected to house ground point. The installer must ensure that the earth connection complies with the relevant installation standards.
7. Ensure Polarity on the connections is correct. TEST the polarity at the test point located on the connection board (figure 12) **BEFORE INSTALLTION OF THE 25AMP (600V) HRC FUSE**. Ensure to connect the earth from the connection board to the earth point from the main array frame within the Isolator.
8. Test voltage from array at the test points. Confirm correct for controller model and cylinder element.
9. Turn Isolator off. (Ensure no DC Power at controller)
10. Insert the fuse into controller input only when ready to commission - See commissioning Start up pg 19.
11. Reinstall connector enclosure lid, tighten screws. Ensure enclosure seal is in place.
12. Energise system once cylinder is full and ready to be commissioned - See commissioning Start up pg 19.

Ensure polarity at the test points is correct before proceeding further.

TURN ISOLATOR ON AND TEST CORRECT POLARITY TO CONFIRM BEFORE INSTALLING FUSE AND PROCEEDING.



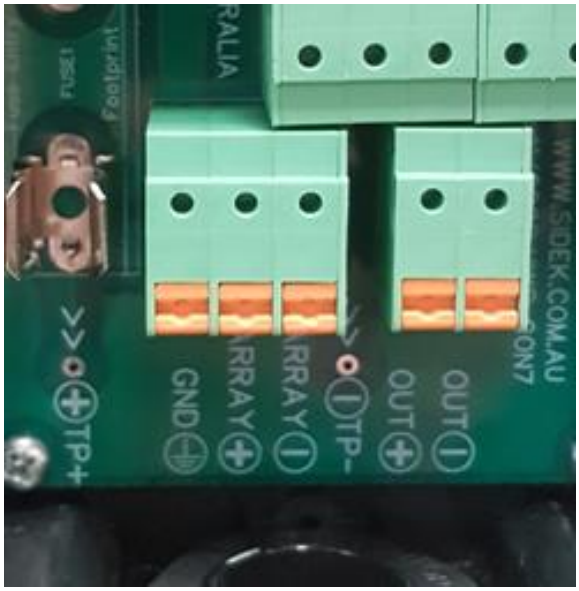


Figure 8

Earth

Positive from wall mounted isolator (From Array)

Negative from wall mounted isolator (From Array)

Incorrect polarity will void the warranty.

Connection - Secondary Output

1. Suitable cable can be connected to the secondary output in the connection box to connect with a secondary suitable DC device such as an inverter. Ensure any device connecter is compatible with the array size installed.
2. On the connection board, note the positive and negative output connection on the lower RH connector block.
3. Bootlace the cable ends and pass through the multicore grommet. Depress the orange tab to allow easier insertion of the bootlace into the terminal block.
4. The maximum output cable length to the DC device is 15 metres.

See Wiring Diagram - Controller - Figure 3 and Figure 9.

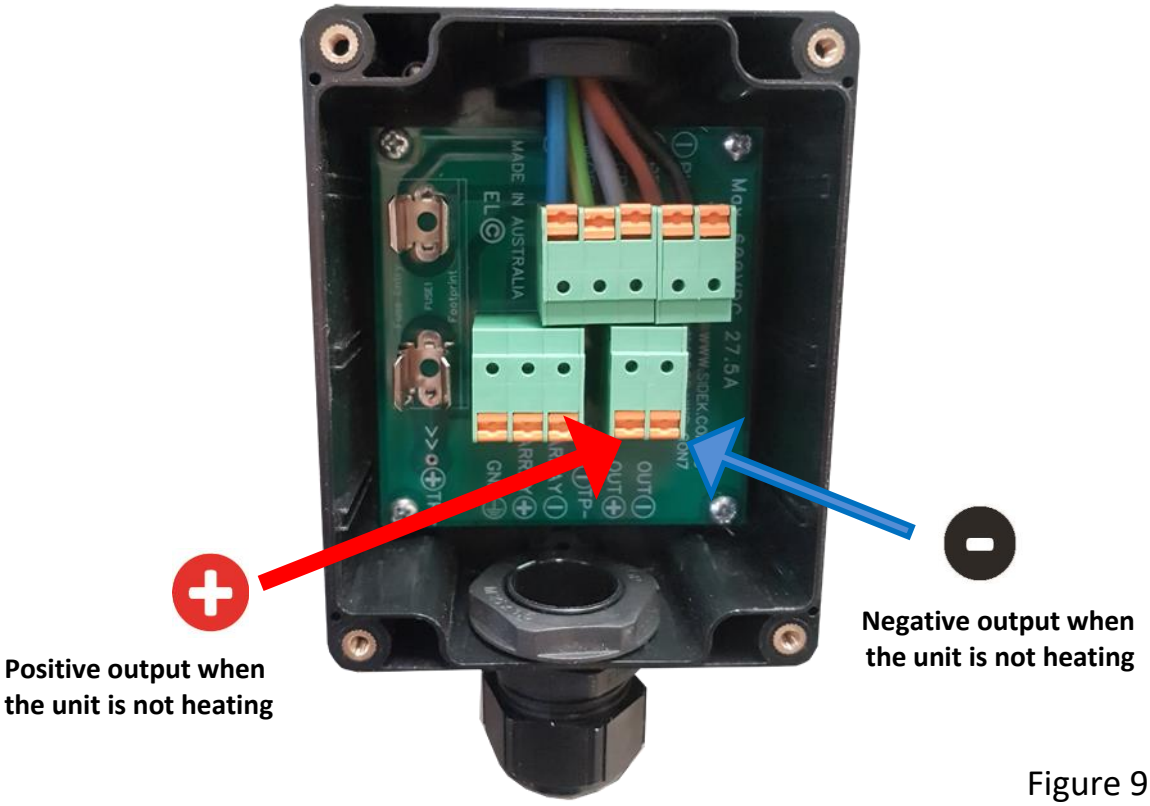


Figure 9

ON THE ROOF

The main array must be installed to Australian standards and all relevant local authority requirements by an authorised installer. Consideration must given to the position of the isolator in relation to the final controller position. The main array must be earthed with the earth cable into the isolator. An isolating switch in accordance with clause 4.8.2.3 AS/NZS 3000:2018 shall be installed for the water heater.

Panel Configuration

The PV controller is designed to operate with a heating element that is matched with number of PV panels and string configuration. Depending on the system element the array can be strung as a single sting or a parallel string of 3-10 panels per string. The supply from the main array must be tested and identified to be strung correctly with the correct number of panels to suit the matched controller and element. See table 1 & 2 below and controller data spec sheet to identify model fitted. Terminate main array into isolator testing and ensuring **TERMINATED POLARITY IS CORRECT**. **INCORRECT POLARITY WILL CAUSE FAILURE OF THE CONTROLLER.** The controller will show fault and not engage where 600 Volts is exceeded.

CROSSED CONNECTION MAY RESULT IN FAILURE OF THE CONTROLLER!
Damage to reversed polarity connection will not be covered by warranty

Single String

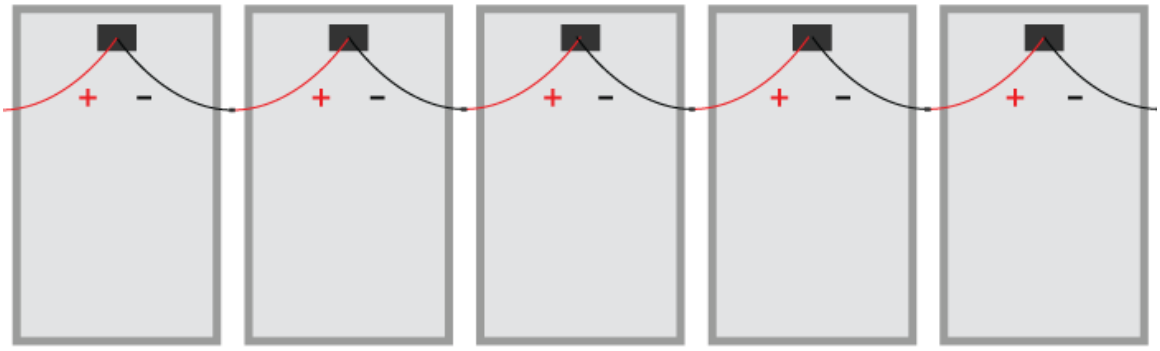


Figure 10

Array Size needs to be Matched to element size	Element - Nominal output	
Nominal Input 4.4kW - VOC 323V 1 Strings of 10 panels = Total 10 panels	1S10P	3720 W
Nominal Input 3.5kW - VOC 260 V 1 Strings of 8 Panels = Total 10 panels	1S8P	3070 W
Nominal Input 3.5kW - VOC 230 V 1 Strings of 6 Panels = Total 12 panels	1S6P	2210 W

Table 1

Parallel String

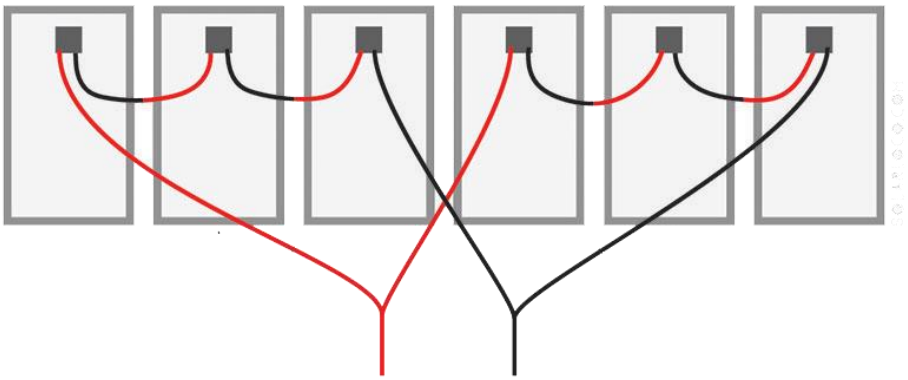


Figure 11

Array Size needs to be Matched to element size	Element - Nominal output	
Nominal Input 2.3kW - VOC 152 V 2 Strings of 4 panels = Total 8 panels	2S4P	1940 W
Nominal Input 2.9kW - VOC 190 V 2 Strings of 5 Panels = Total 10 panels	2S5P	2645 W
Nominal Input 3.5kW - VOC 230 V 2 Strings of 6 Panels = Total 12 panels	2S6P	3160 W

Table 2

Commissioning Start Up

1. **Ensure polarity at test points in connection box is correct before proceeding further.**

2. **Ensure fuse is <u>not installed</u>** TURN ISOLATOR ON AND TEST CORRECT POLARITY TO CONFIRM BEFORE PROCEEDING.

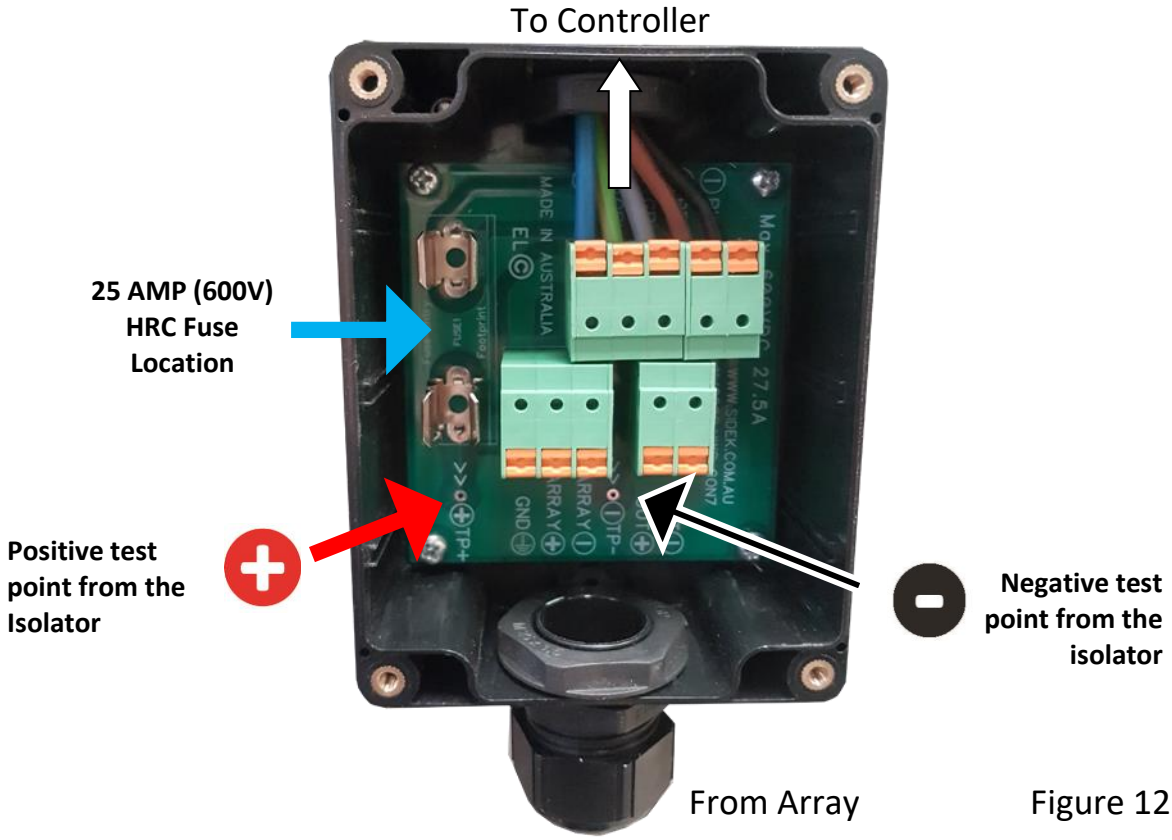


Figure 12

3. **Test voltage from array. Confirm correct for element model.**
4. If correct, turn off isolator, install Fuse.
5. Turn on isolator.
6. RED LED POWER LIGHT SHOULD BE ON. The controller should show start up information as it runs through a power up test sequence. When test is complete LCD will display system voltage etc. (providing array voltage is over 120 Volts)
7. After the start up sequence is complete the green divert LED will light up if sufficient power is available. Note: The controller has several built-in time delays of up to 1.5 minutes, to allow for power stabilisation. Some models will start on divert for 30min prior to heating. See supplement.
8. Test and record data on the Commissioning sheet in this booklet and make a copy for submission to Solatherm. Form A

Shut down Procedure

1. Turn off main array Isolator (lock switch if required)
2. Controller should now have no information displayed and is OFF.
3. Turn off 240V AC Booster Isolator and breaker switch in household fuse box.

Warranty

Solatherm PV360R Controller The warranty covered by this document is for the Solatherm control unit and directly related components specified below only. For warranty on other items that are part of the system, such as, installation components, storage water vessel and photovoltaic collectors, please see the relevant manufactures warranty booklet. Contact warranty@solatherm.com.au		
Domestic[1]	Controller	5 Years Replacement from date of installation
	Labour	1 Year
	Components [3]	1 year
Commercial [2]	Controller	3 Years Replacement from date of installation
	Labour	1 Year
	Components [3]	1 year

This booklet must be fully completed and retained with proof of purchase and all COC's for warranty.

Warranty Definitions

Our goods come with guarantees that cannot be excluded under the Australian Consumer Law. You are entitled to a replacement or refund for a major failure and compensation for any other reasonably foreseeable loss or damage. You are also entitled to have the goods repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure.

(1) Domestic usage is defined as a single-family domestic home with a setting of less than 75^0C. (2) Commercial encompasses all other applications. (3) Components include dedicated DC heating element, PV Over Temperature Cut Out & temperature sensor

Warranty Conditions

1. Installation must be undertaken by licensed installers; photovoltaic accredited Electrician, licensed plumber and must be in conformance with all installation instructions supplied with the system and must conform with all regulatory and statutory requirements relevant to the state where the system is installed.
2. Proof of Purchase must be retained by the owner as this will be required should any warranty work need to be carried out on your system.
3. The option to replace or repair a failed component is at the sole discretion of Solatherm.
4. Where any part is repaired or replaced the duration of the original warranty period is still applicable. The repaired or replacement component does not carry a new warranty.
5. The warranty only applies directly to the Solatherm control unit and directly related parts as specified not to other general plumbing or electrical components used during installation or to meet regulatory requirements. The main photovoltaic array collectors and storage water vessel will have their own manufacturers warranties which are separate to this document
6. Systems installed outside of the metropolitan area may be subject to freight costs and additional labour costs.

7. The system installed must be sized in accordance with manufacturers guidelines.
8. Any repair under warranty must be approved by Solatherm prior to the repair or all costs are bore by the person who contracted the repair.

Warranty Exclusions

The following exclusions may cause the Solatherm warranty period to become invalid and/or may incur a service charge and/or cost of parts used during repairs.

1. Accidental damage to the Controller or any component including; Acts of God, failure due to misuse, incorrect installation, unauthorised attempts to repair the system.
2. Where there is nothing wrong with the control unit and the problems relates to incorrect installation or abnormal conditions such as incorrect array configuration or reverse polarity and or faulty electrical connection.
3. Where the unit is not installed according to Solatherm installation guidelines or instructions booklet.
4. Where there are claims for damage to walls or any other installation damage directly or indirectly related to the installation of the system.
5. If the enclosure has been opened all warranty is void.
6. If the commissioning form is not completed or filled out incorrectly warranty is void.
7. COC's must be completed, signed and available for verification. Non-compliant installations will void warranty.

Warranty Contact

Solatherm / Sidek Manufacturing Pty Ltd
1/52 Barnett Ave
Glynde SA 5070
E: warranty@solatherm.com.au
T: 1300 965 948

Commissioning

System Information - Form A

Owner's Name			
Installation Address			
Suburb	State	Post Code	
Telephone M:	E:		
System Purchased from			
Installer's Name	Installation Date		
Contact Number	CEC Number		
Job Number			
Type of Installation New Replacement	Unit Type Replaced		

DC PV Hot Water Controller

Controller Model	Serial Number		
All Output Connections terminated		Y/N	
Cylinder Full of Water?		Y/N	
Storage Cylinder Earthed?		Y/N	
VOC at Isolator V	Is DC Voltage with in operating limits of the controller?	Y/N	
Energise Main Array, System initialises?		Y/N	
Voltage on Display V	Watts Shown		W
Heating light on? Y/N	Diversion Light Operates	Y/N	
Power as expected?		Y/N	

Boost Element

AC Boost Element connected?		Y/N	
AC Voltage V	AC Current		A
Does Booster Energise ?		Y/N	

Main Array - On the roof

No. Of Collectors		No. Of Strings	
PV Collector Brand		PV Collector Model	
Collector Size (Watt)		System Voltage Shown	
PV Array Azimuth		PV Array Pitch	
PV Array Total	kW	DC Isolator Type	
DC Cable size		Array Earthed?	Y/N

Main Array (On the Ground)

Polarity Main Array at Isolator Correct	Y/N
WARNING INCORRECT POLARITY WILL DAMAGE THE CONTROLLER - NO WARRANTY FOR POLARITY DAMAGE	

Does The Array have any Shading?	Y/N
Is the Array installed to AS5033 and CEC Guidelines?	Y/N
Is the controller switch gear and cabling installed to AS3000 and CEC guidelines?	Y/N
Are all serial numbers recorded	Y/N
Are all labels installed as per AS4777.1	Y/N
Have all roof tiles/iron sheets been re-installed?	Y/N
Have all the required customer signature fields been signed?	Y/N
Is the array installed as per installation advise form? (Form 2)	Y/N
If not describe why?	

Installer Certification

I hereby certify that this system has been installed according to all relevant regulatory and statutory requirements and in accordance with Solatherm Installation Instructions.

Name

COC Accreditation Number

Signature

Date

Owner Declaration

I have received the installations booklet and owner manual Y/N

The system has been installed at the above property and all customer details are correct. I am happy with the installation quality and approve the location of the solar equipment. I am satisfied that the roof is suitable to accommodate the array over the life its intended.

Signature

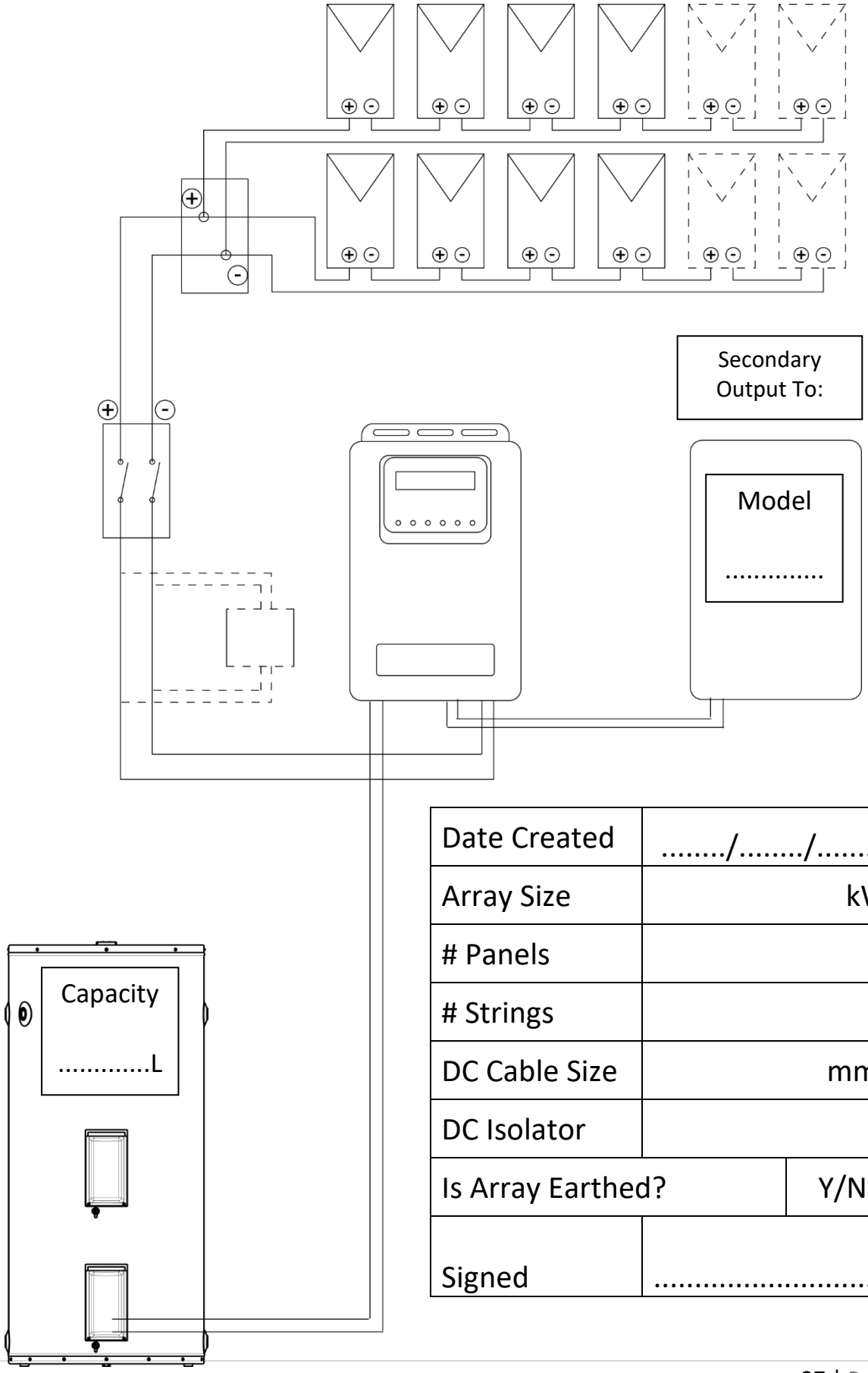
Date

This booklet must be fully completed and retained with proof of purchase and all COC's for warranty.

Form A - Page 2 of 2

System Diagram

This diagram must be fully completed and retained with all COC's for service personnel.



Date Created	...../...../.....
Array Size	kW
# Panels	
# Strings	
DC Cable Size	mm^2
DC Isolator	
Is Array Earthed?	Y/N
Signed	.....

Technical Data

PV String Input Data			
Max. DC Input Power	10 kW	Array Strings	1 or 2
Max. DC Input Voltage	600 VDC	String Configuration	Single or Parallel
Max. Input Current	25.0 A	Input Reverse Polarity Protection	NO
Max. Output	10 kW	Max. Output Current	25.0 A
Input Fuse (Single String)	16 AMP (600V) HRC	Input Reverse Polarity Protection	No
Input Fuse (Parallel String)	25 AMP (600V) HRC	Input Over Voltage Protection	YES

General Data			
Operating Temp. Range	-20^{0}C to + 50^{0}C	Dimensions (H*W*D)	220x145x70 mm
Relative Humidity	0-100%	Protection Degree	IP65
Operating Altitude	< 4000m	Safety Regulation	IEC 62109
Cooling	Natural Convection	Pollution Degree	PD3
Weight	2.3 kg	Overvoltage Category	OVC II
Environment	Outdoor	Location Classification	Suitable for Wet areas
Environment	Outdoor	Location Classification	Suitable for Wet areas
Start-up Voltage	70V	Factory Set Shut temp	65^{0}C
Heating Start Power	250 W		
User Interface	LCD & LED Indication	Country of Manufacture	Australia

Supplied Cabling Data			
Main Array	Wired Connection		
Element Cable	3 x 4mm^2	NTC Cable	2 x 0.75mm^2
Secondary Output Cable	3 x 4mm^2	Cable Insulation	Flex PVC UV Stable
Insulation Type	Flex PVC UV Stable	Insulation Rating	0.6/1kV
Conduit	25mm OD x 19mm ID UV Stable PV Approved		

Nominal Single Panel Data			
Nom. Panel Voltage VOC	44 V Max.	Nom. Max. Power Voltage (V)	32.5 V
Short Circuit Current Isc	11.0 A Max.	Max. Power Current (A)	11.0 A