



POWEROPTIMAL  
THE FUTURE OF ENERGY

# POWEROPTIMAL ELON 100

## PowerOptimal Elon 100 Installation Guide

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Enquiries: [info@poweroptimal.com](mailto:info@poweroptimal.com)  
Address: PO Box 39521  
Capricorn Square  
7948  
Cape Town



## SAFETY WARNING

- **Installation of the Elon 100 should ONLY be performed by an electrical contractor registered with the Department of Labour** (the so-called “wireman’s licence”) and strictly according to the installation instructions in this manual. **The electrician should provide you with a Certificate of Compliance (CoC) once installation is completed.**
- We strongly recommend that you use a reputable and experienced solar photovoltaic (PV) system installer to install your solar PV modules.
- **Solar PV modules exposed to the sun are live** (i.e. will produce electricity) and can give an electric shock. Special care should be taken and only trained solar PV installers should install the modules.
- **Do not attempt to** alter or service the electrical installation, or open the Elon 100 unit or controller for any purpose.
- Use the Elon 100 **only for its intended purpose.**
- **Always** make sure that every wiring connection is **properly tightened.**
- **Do not earth** either of the solar module wires (but do earth the frames).
- All installation wiring should be at least 2.5mm<sup>2</sup>.
- Avoid coiling, since DC switching can create damaging spikes.
- Keep all wires as short as possible.

**Refer to the PowerOptimal website for the full  
Elon 100 Installation & User Manual:**



**[www.poweroptimal.com/manuals](http://www.poweroptimal.com/manuals)**

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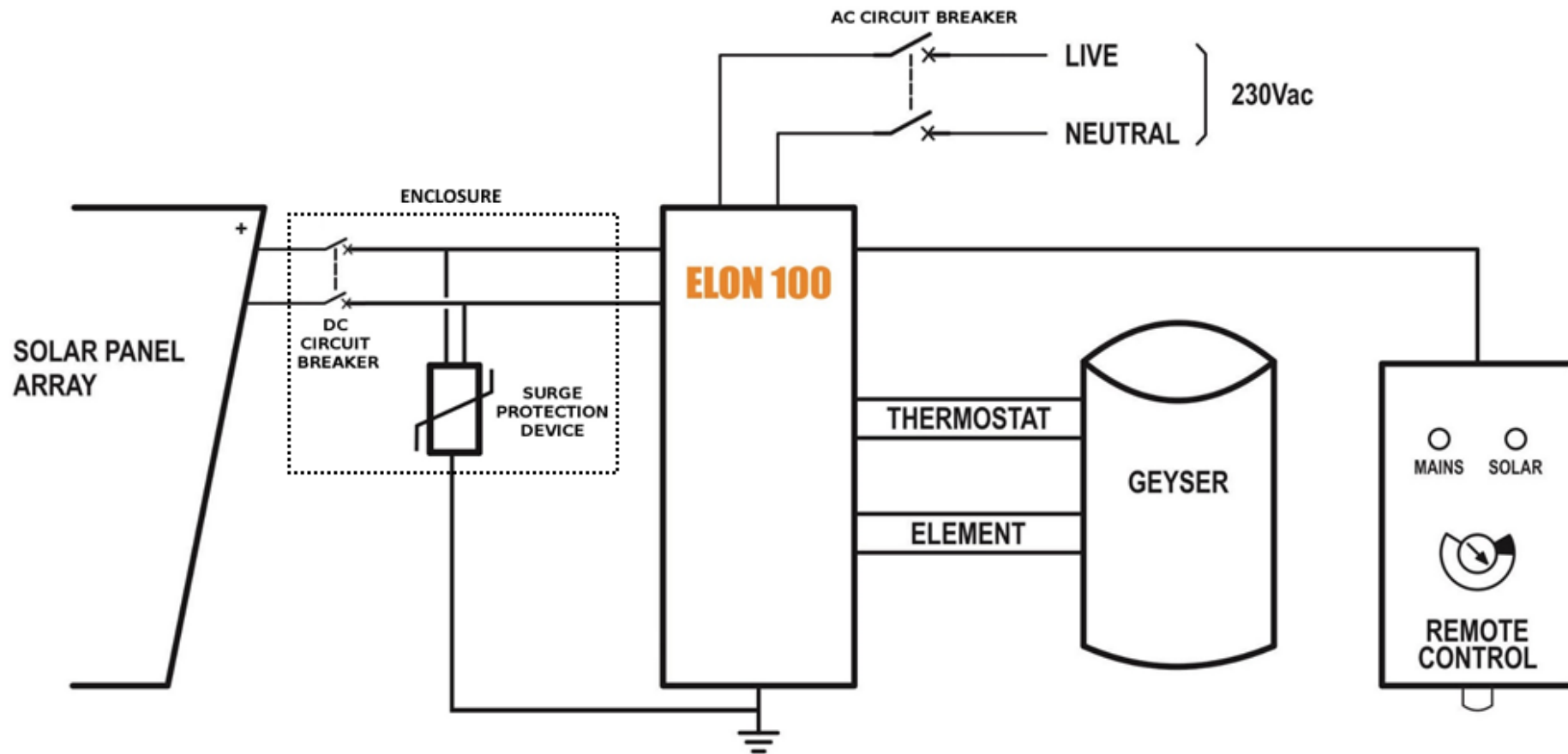
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## 1. Required tools

The following tools are required for the installation. Use insulated tools wherever applicable.

- Solar modules (mounting) - *please refer to solar module / mounting installation instructions – the below is only a guideline:*
  - Cordless screwdriver with bits
  - Drill
  - Set of drill bits (wood, steel, stone)
  - Set of screwdrivers
  - Set of Allen (hex) keys
  - Tape measure
  - Grinder (tile roof installations)
  - Permanent marker
  - Chalk
  - Hammer
- Solar modules (electrical):
  - AC/DC Clamp meter
  - Side-cutting pliers
  - Screwdriver set
  - Crimping tool
  - 4 mm<sup>2</sup> wire (double insulated) (or other size as determined by solar PV voltage and wire length)
  - Cable ties
- Elon 100 - *the following additional tools:*
  - Drill or punch (to make holes for glands)
  - 4 mm<sup>2</sup> wire (2-core Norsk or Surfex wire is recommended)

## 2. Basic wiring diagram



**Note:** Both AC & DC circuit breakers should be installed within 1.5m of the geyser (water heater), line of sight.

### 3. Solar PV array installation

Modules should only be installed by a trained solar PV installation technician. Array position and orientation have a major impact on power production (see Appendix A).

Review the instructions from your solar PV module supplier / manufacturer on installation.



**Please note:** A South African standard for low voltage embedded generation installations is being developed (SANS 10142:3). In the absence of this standard, your solar PV installation technician should follow SANS 10142:1 (Standard for low voltage installations), and can refer to interim guidelines in anticipation of the SANS 10142:3 standard – see for example the document provided by PQRS:

<http://pqrs.co.za/wp-content/uploads/2016/01/PV-System-Interim-Guidelines-Good-Practice-for-Solar-PV-Installations-South-Africa-.pdf>

SAPVIA (South African Photovoltaic Industry Association) has made available an excellent guide to solar PV installations. See:

<https://www.pvgreencard.co.za/Solar%20PV%20Guidelines%20-%20Digital%20Spread%20High-res.pdf>

The below installation steps are a general guide only – refer to the abovementioned standards and guidelines.

1. A very important starting point is safety gear: ensure that all installers wear a helmet and insulated safety gloves, as well as fall protection safety gear if work will be done on a roof or elevated area.
2. The solar PV array should only consist of one string of 3 to 6 modules (60-cell) or 3 to 5 modules (72 cell) in series, or two parallel strings of 8 (2 x 4) or 10 (2 x 5) modules. **Do not exceed the DC voltage or current ratings of the Elon 100 (220V DC and 20A DC) under any circumstances.**
3. Attach bracket / mounting structure to roof. Use mounting structure recommended by solar module supplier for roof type and size of solar modules.
4. Fix the solar PV modules to the mounting structure whilst connecting the module cables to each other.
5. If practical, cover the modules to ensure that there is no potential for electric shock whilst installing the system.
6. Ground the mounting structure only.
7. Install the wiring from the solar PV array to the Elon 100 unit in the ceiling space. Ensure circuit breakers / isolators are in the “Open” position. Installation of a Surge Protective Device (SPD) between the solar PV array and the Elon 100 is recommended.
8. **Last step** is to connect the array to the rest of the wiring, making sure that both the positive and negative wires are fully isolated from ground and keeping circuit breakers / isolators in the “Open” position.

**Some “DO’s & DON’T’s” when installing solar PV arrays:**

*Your solar PV installer should not make any of these basic mistakes, but they are listed here just in case.*

1. DO earth the PV array structure.
2. DO isolate the wires from the PV array structure.
3. DON’T use different sizes, types or specifications of modules together in the same string or array.
4. DON’T install solar arrays where they will be partially shaded during any season of the year if it can be avoided at all.
5. DO install the arrays so that there is space for inspection or maintenance when needed.
6. DO use cabling of the correct size for your solar array.
7. DON’T install the solar array flush with your rooftop. Use struts / brackets that ensure an unrestricted air gap of at least 40 mm between the roof and the modules.
8. DON’T walk on the modules.
9. DO ensure that connectors are kept clean and away from water.
10. DON’T leave exposed modules in short circuit.
11. DO ensure that all connectors are securely fastened.
12. DON’T exceed the voltage ratings of any components.
13. DO properly route and secure all cables.
14. DON’T coil cables.

## 4. Elon 100 installation

1. Isolate the geyser – switch off the geyser circuit breaker at the main electrical distribution board (DB) AND switch off the geyser isolator at the geyser.
2. Confirm with a multimeter that there is no voltage across the wires.
3. Install circuit breaker (or isolator and fuse) for solar PV (DC) supply. Also install AC supply isolator / circuit breaker if there is none. **NB** Ensure that the DC circuit breaker is rated for the DC voltage and current of the installed solar PV array.
4. The circuit breakers / isolators must be installed within 1.5m of the geyser, and must be line of sight / visible (i.e. do not install them at the back of the geyser).
5. The DC wires must not be earthed – i.e. they must be fully isolated from earth. Do NOT test with a Megger.
6. Keep the DC wires as short as possible.
7. Avoid any coils in DC wires.
8. Recommended wiring size is 4 mm<sup>2</sup>. 2-core Norsk or Surfex wire is recommended. Shield can be earthed to PV array structure.
9. Install the Elon 100 unit according to wiring diagram (see Section 2).
  - a. Mount the Elon 100 unit close to the geyser and protect from outside elements.
  - b. Mount the controller (remote control) inside or next to the main DB in the house.
  - c. Connect the Elon 100 and thermostat **last**.

**Note:** As per the wiring diagram, the thermostat and element should be connected to the Elon SEPARATELY (independently). For TSE and Thermowatt (RTS) thermostats, connect the Elon directly to the two screw terminals and short the two male terminals at the bottom together, using the bridging wire with female connectors supplied with the Elon 100 (Figures 2.1 and 2.2). (Less than 20 mA DC current will flow through this wire – it is a sensing current only.) There must be no connection between the thermostat and the element.



Figure 2.1 Bridging wire for TSE & Thermowatt thermostats



Figure 2.2 Bridging wire fitted to TSE Thermostat



- d. Connect the two element terminals directly to the connectors marked “element” on the Elon. For flange-type elements, use the supplied wiring with element adapter (see Figures 2.3 and 2.4). Make sure that the element adapter fits tightly into the element. If the fit is not tight, remove the plastic cover and crimp the female terminals as required.



Figure 2.3 Element adapter



Figure 2.4 Element adapter fitted to flange-type element









- e. Slide the thermostat (with bridging wire installed) into the pocket in the element as deep as it can go.
- f. Set the thermostat to the desired temperature (**55 °C maximum**).
10. Attach installation diagram sticker (as provided) close by the geyser in a clearly visible position. **(Do not attach it directly to the geyser, as it will disappear if the geyser is replaced.)**
11. Once installation is complete, switch on the AC & DC circuit breakers / isolators, remove the covering from the solar modules and switch on the geyser circuit breaker at the main DB.
12. Check that Elon 100 unit is operational (refer to LED lights on controller – see below).
  - a. Confirm solar PV array supply voltage and DC power to geyser when thermostat is closed. The Elon 100 will switch DC power to the geyser approximately 10 to 15 seconds after DC power to the Elon has been switched on (if there is enough sunlight). (If thermostat is not closed, open hot water tap in house until it closes.)
  - b. Test mains override by pressing and holding the override button for **5 seconds**. The red light should start flashing (except if geyser is already at thermostat setpoint temperature). **NOTE THAT THE ELON WILL NOT SWITCH TO MAINS WITHIN 5 MINUTES OF MAINS POWER SWITCH-ON OR RECONNECTION.** This is to allow grid power to stabilize after a power failure.
  - c. Confirm that no power is supplied to geyser element when thermostat is open (turn thermostat set point to lowest setting).
13. Set efficiency to desired level on controller.

**Note:** if doing any maintenance, rewiring or disconnecting the Elon 100 or geyser element for any reason, it is good practice to **first switch off both the AC & DC circuit breakers / isolators, and then disconnect one of the wires between the Elon 100 and thermostat before disconnecting the rest of the wires.**

The **Mains & solar indicator lights** indicate the following conditions:

Lights	Meaning
Mains ( <b>red</b> ) light flashing	Grid / mains electricity is being used to heat water
Solar ( <b>green</b> ) light flashing	Solar power is being used to heat water. Rate of flashing indicates rate of solar energy supply
<b>Red &amp; green</b> alternating	No power is being supplied to the geyser element. (Either the water is on temperature already, or the unit is in solar mode and there is not sufficient sunlight)
<b>Red</b> or <b>green</b> flashing very fast	Isolation fault (contact electrician)
<b>Red</b> light <b>ON</b>	Solar power switched off (only grid power allowed to geyser). Press and hold override button for <b>15 seconds</b> to switch solar power on and off.
Both lights <b>OFF</b>	No power to unit (e.g. no sun and a power failure, or no sun and geyser breaker at DB board is switched off)


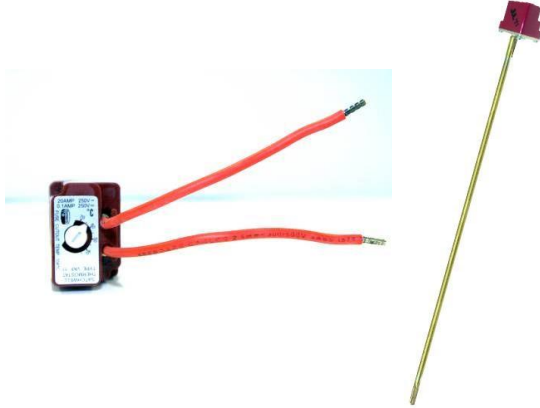
#### Controller settings for switching off solar or grid power to electric geyser

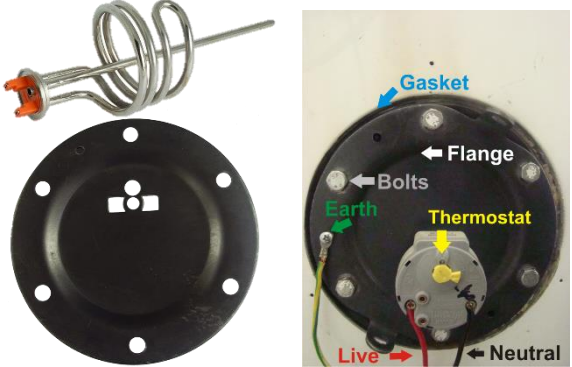

Desired state	Actions	DB board geyser switch	Controller dial position	Lights
 <b>Solar ON</b>  <b>Grid ON</b>	This is the default state.	ON	Anywhere outside the "Solar Only" zone	Normal operation (green and/or red flashing or both off)
 <b>Solar ON</b>  <b>Grid OFF</b>	Turn controller dial anti-clockwise to the "Solar Only" zone indicated on the controller. <b>Note:</b> can still boost with grid power for one heating cycle by pressing the Override button for <b>5s</b> .	ON	In the "Solar Only" zone	Green flashing or both lights off. Red would flash if override button has been used.
 <b>Solar OFF</b>  <b>Grid ON</b>	Press Override button for 15s until the red light switches on permanently. Grid power is now always ON (24 hours per day).	ON	Anywhere outside the "Solar Only" zone	Red light on
 <b>Solar OFF</b>  <b>Grid OFF</b>	Turn efficiency dial all the way anti-clockwise into the "Solar Only" zone. Press Override button for <b>15s</b> until the red light switches on permanently.	ON	In the "Solar Only" zone	Red light on

## 5. Element installation (retrofit)

If you need to exchange the element on an existing geyser, please follow the instructions provided by the element supplier.

There are two main types of geyser **heating elements**: **screw-in** and **flange type**. There are also two main types of **thermostats**: **VKF-11** and **TSE**. The below table provides a guide to Elon compatibility with the different elements and thermostats.

Element type	Compatible thermostat type	Comments
<p>Screw-in element:</p> 	<p>VKF-11 thermostat:</p> 	<p>Element &amp; thermostat have separate electrical connections, so each can be connected (wired) separately to the Elon. Thus, <b>this element-thermostat combination is directly compatible with the Elon</b>. (No need to use the bridging wire or element adapter supplied with the Elon unit.)</p> <p>The thermostat pocket in the element is the right size for the VKF-11 thermostat.</p>

Element type	Compatible thermostat type	Comments
<p>Spiral element (flange type) with smaller diameter thermostat pocket:</p> 	<p>TSE thermostat:      Thermowatt (RTS) thermostat:</p> 	<p>The spiral element generally has a smaller thermostat pocket than the screw-in element. The TSE and Thermowatt (RTS) thermostats fit into this smaller pocket. The VKF-11 thermostat requires a larger pocket and does not fit into standard spiral element pockets.</p> <p>The TSE and Thermowatt thermostats normally clip directly into the element, but this won't be the case when the Elon is connected.</p> <p><b>Use the bridging wire and element adapter supplied with the Elon (see Figures 2.1 to 2.4 above) to connect the Elon to these thermostats and elements.</b></p>

## 6. Controller settings for switching off solar or grid power to electric geyser

**Note:** see full Installation & User manual for a detailed guide on operating the Elon 100 controller.

Desired state	Actions	DB board geyser switch	Controller dial position	Lights
<b>Solar ON, grid ON</b>	This is the default state.	ON	Anywhere outside of the "Solar Only" zone	Normal operation (green and/or red flashing or both off)
<b>Solar ON, grid OFF</b>  (Note: can still boost with grid power for one cycle by pressing the Override button for 5s.)	Turn controller dial anti-clockwise to the "Solar Only" zone indicated on the controller.	ON	In the "Solar Only" zone	Green flashing or both lights off. Red would flash if override button has been used.
<b>Solar OFF, grid ON</b>	Press Override button for 15s until the red light switches on permanently.	ON	Anywhere outside of the "Solar Only" zone	Red light on
<b>Solar OFF, grid OFF</b>	Press Override button for 15s until the red light switches on permanently.	ON	In the "Solar Only" zone	Red light on

