APEX

# APEX SGS

## Solar Hot Water Controller

## Technical Manual


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# 1. INTRODUCTION

Optimise your hot water generation with the latest technology.

- Ideal for urban use or off -grid applications (runs both on and off -grid).
- Monitor and control your Apex SGS on any compatible browser
- Fully customizable according to your hot water needs.
- Unaffected by load-shedding and grid outages.

The Apex SGS is the heart of a water heating system – intelligently heating water in a standard electric hot water cylinder from the sun's energy. The SGS controls and manages the system, providing historical and up to the minute information on status and performance via its web app. Through considering factors beyond just temperature, the system makes intelligent decisions – ensuring that minimal grid power is used. When both grid and solar power sources are available, the system favours solar as its power source, ensuring maximum savings.

## 1.1 CONTENTS OF THE BOX

Inside the box you should find:

- 1x Apex SGS controller
- 1x mounting bracket
- 1x securing screw
- 1x pair MC4 connectors

Note: your required temperature probe is supplied separately (see Ordering Information on page 6).

## 1.2 DEVICE DOCUMENTATION

Apex SGS documentation includes this manual and its datasheet sheet.
All latest version documents can be downloaded from: **www.ApexSolar.Tech**

## 1.3 ABOUT THIS MANUAL

This manual describes the correct use and features of the Apex SGS. It includes technical data as well as user instructions and specifications to provide information about its correct functioning.

This document is subject to regular updates. The contents of this manual might change partially or completely, and it is the responsibility of the user to make sure that they are using the latest version which is available at www.ApexSolar.Tech.

**Apex reserves the right to modify the manual without prior notice.**

## DESCRIPTION

The APEX SGS is the heart of a residential water heating system, intelligently heating water in any standard electric cylinder or hot water system from the sun's energy. The device controls and manages the system, providing historical and up to the minute status and performance information via Apex's fleet.apexsolar.tech monitoring portal or the local hotspot's user interface. By considering factors beyond just temperature, the system makes intelligent decisions ensuring that minimal grid power is used. When both grid and solar power sources are available, the system favours solar as its power source, ensuring maximum savings.

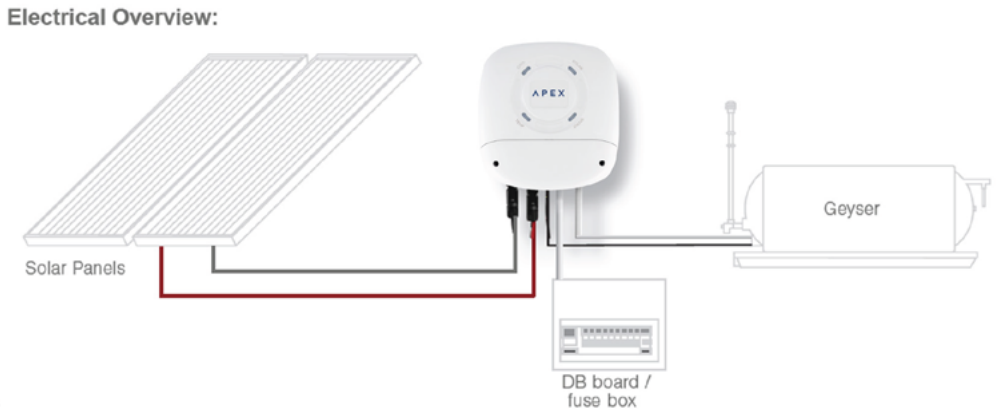



Figure 1. SGS PV hot water controller system overview

## 2. TECHNICAL SPECIFICATIONS

| Description | Specification |
|---|---|
| **AC INPUT** | |
| Voltage | 230V AC |
| Frequency | 50 Hz |
| Current | 21A |
| Connection | 3 x 4mm2 Screw Terminals |
| Installation Pre-requisites | AC MCB and local Isolation point (not supplied) |
| AC Detection | Yes |
| **AC MODE OUTPUT** | |
| Voltage | 230V AC |
| Frequency | 50 Hz |
| Current | 21A |
| **SOLAR INPUT** | |
| Input Voltage Range | 125V - 230V DC (Absolute maximums) |
| Maximum Input Current | 15A |
| Maximum Solar Power Conversion | 1500W |
| MPPT Range | 168 - 230V DC |
| Connection | MC4 Solar Connectors |
| Installation Pre-requisites | External AC and PV Isolators |
| Maximum Solar Array Size | 2.5kWp (Note voltage and current limits) |
| **SOLAR MODE OUTPUT** | |
| Voltage | 40-230$^{Vrms}$ Modulated DC |
| Max Current | 15A |
| **SUPPORTED IMMERSION ELEMENTS** | |
| Max Voltage | 230V |
| Power | 2000W - 4600W |
| Element Resistance | 10Ω - 27Ω |
| Connection at Device | 3 x 4mm2 Screw Terminals |
| Connection at Element | 2 + Earth |
| **TEMPERATURE SENSOR** | |
| Measurement Range | 10°C to 85°C |
| Accuracy | +-2°C |
| Type | Analog (K-Type) |
| Cable Length | 10, 15, 20 and 30m (see ordering information) |
| Connector | Terminal (PCB Mounted) |

## COMMUNICATIONS

| | |
|---|---|
| Wi-Fi | 802.11 b/g/n |
| Remote Updates (Firmware Over the Air) | Ability to update firmware remotely |

## MECHANICAL SPECIFICATIONS

| | |
|---|---|
| Dimensions (Length X Breadth X Depth) | 210mm x 225mm x 84mm |
| Cooling | Natural Convection |
| Cable Strain Relief | Integrated for AC cables and thermal probe |
| Ingress Protection | IP2X |
| Terminal Access | Removable cover |

## INSTALLATION SPECIFICATIONS

| | |
|---|---|
| Mounting | Vertical only |
| Environment | Indoor Use only. Not for in-roof installation. |
| Fasteners | Wall plugs with pozi screws |

## CERTIFICATION AND COMPLIANCE

| | |
|---|---|
| RF | EN 300-328, Designed to IEC 60730 |
| EMC | EN 301489-1, Designed to IEC 60730 |
| ICASA | RF approved |
| NRCS | RCC 2112093 |
| Safety | IEC 60950-1 Electrical Safety |
| | IEC 60730-1 Automated electrical controls |

## ENVIROMENTAL CONDITIONS

| | |
|---|---|
| Maximum Ambient Temperature | 0°C to +30°C full output, limited output up to +50°C |
| Relative Humidity | 0 % - 80% |
| Operating Altitude | 0.....2000m |

## DEVICE SAFETY FEATURES

| | |
|---|---|
| Device Over-Temperature Shutdown | 75°C |
| Over Current Protection | Fuse (1 x AC and 1 x DC) |
| Solar Reverse Polarity Protection | No |
| Grid feedback Safety | Relay based power path management |

## USER SAFETY FEATURES

| | |
|---|---|
| Earth Leakage Detection | Residual Current Detection |
| Anti-legionella | Purge |

## USER INTERFACE

| | |
|---|---|
| On Device | RGB Digital LED x 4 + local access point |
| Remote | Web browser Apex Fleet (fleet.apexsolar.tech) |
| Settable Temperature Range | +30°C to +65°C (Software) |

## 3. SAFETY INSTRUCTIONS

Please read and follow all the below safety instructions and precautions before installation and use of the Apex SGS.

### 3.1 SYMBOLS

The following symbols are used in this manual to highlight and emphasize important information.
The general meanings of the symbols used in the manual, and those present on the device, are as follows:


General Caution


Prohibited


General Electrical Hazard


Direct Current


Information


Reinforced Insulation

### 3.2 PURPOSE

These safety instructions are intended to highlight risks and dangers of improper installation, commissioning and use of the SGS Device.

### 3.3 TRANSPORT DAMAGE CHECK

Immediately after receiving the package, make sure that the packaging and the device have no signs of damage.
If the packaging shows any sign of damage or impact, damage of the SGS should be suspected and it should not be installed. If this occurs, please contact Apex customer service.

### 3.4 STAFF

This system should be installed, handled and replaced solely by qualified personnel.

Qualification of the staff mentioned herein must meet all the safety-related standards, regulations and legislation applicable to the installation and operation of this system in the country concerned.

### 3.5 SPECIAL HAZARDS

The Apex SGS is designed to form part of a domestic electrical installation. Applicable safety measures must be observed, and any additional safety requirements should be specified by the company who has installed or configured the system.

The responsibility to select qualified staff lies with the company that the staff work for. It is also the responsibility of the company to assess the ability of the worker to carry out any kind of work and ensure their safety. Staff must comply with workplace health and safety regulations. It is the responsibility of the company to provide their staff with the training necessary for handling electrical devices and to make sure that they familiarize themselves with the contents of this user manual.

Dangerous voltages may be present in the system and any physical contact could cause serious injury or death. Please ensure that all covers are securely fastened and that only qualified staff service the Apex SGS. Ensure that the system is switched off or disconnected during handling.

## 3.6 INSTALLATION LOCATION

The Apex SGS may only be installed indoors, vertically secured onto a firm surface and be protected from water, excessive dust, corrosion and humidity. It should never be installed directly below a hot water cylinder or in any location where a potential water leak could occur.

See section 5 for more info.

## 3.7 ALTERATIONS

It is strictly prohibited to carry out any alteration or modification to the Apex SGS or any of its accessories.

## 3.8 CLEANING AND MAINTENANCE

Cleaning and maintenance should only be carried out with the Apex SGS disconnected from the grid and PV supplies. Before taking any action, make sure that the system has been correctly disconnected by deactivating the circuit breakers and or isolators that power it. To clean the SGS, wipe the exterior surface with a damp (not wet) soft, non-abrasive cloth. Pay attention to the cooling slots and any dust build-up thereon which may affect the ability of the SGS to dissipate heat generated.

Do not try to repair the device yourself in case of any malfunction. If the need arises, contact Apex customer service. The system does not require any special maintenance, except for standard physical cleaning to ensure good air flow and the maintenance required by any electrical device connected with screws and terminals that need to be tightened.

## 3.9 GENERAL HAZARDS RESULTING FROM NON-COMPLIANCE WITH SAFETY STANDARDS

The technology employed in the manufacturing of the Apex SGS ensures safe handling and operation. Nonetheless, the system might pose hazards if it is used by unqualified staff or handled in a way that is not specified in this user manual.

Any person in charge of the installation, commissioning, maintenance, or replacement of a Apex SGS must first read and understand this user manual, especially the safety recommendations and shall be trained to do so.

## 3.10 GENERAL SAFETY REQUIREMENTS

Operator: The person in charge of handling the electrical device is responsible for the safety of persons and property.

Insulate all the system's power conducting components which could cause injuries while carrying out the work. Confirm that dangerous areas are clearly marked and access is restricted.

Avoid accidental re-connection of the system using signs, isolating locks and closing or blocking the work site. Accidental reconnection may cause serious injuries or death.

Determine conclusively, using a voltmeter, that there is no voltage in the system before commencing work. Check all the terminals to make sure that there is no voltage in the system, on both AC and DC power interfaces.

## 3.11 LOCAL REQUIREMENTS

In all cases, local regulations shall be followed and take preference over this manual or other documents related to the Apex SGS. No part of this manual shall supersede any local laws, bylaws or other regulations. These include but are not limited to: earthing, temperature settings, local electrical isolation requirements and so on.

## 3.12 OTHER CONSIDERATIONS

This device is exclusively designed to manage a hot water cylinder to be powered by either the grid, a solar array or both and is to be installed in a domestic setting.

The Apex SGS should only be used for this purpose. Apex is not liable for any damages caused by inappropriate installation, use or maintenance of the system.

To ensure safe use, the Apex SGS must only be used in compliance with the instructions in this manual. Legal and safety regulations must also be adhered to, to ensure correct use.

# 4. DEVICE DESCRIPTION

## 4.1 OVERVIEW AND DESCRIPTION


Figure 2. SGS PV System.

**LEDs:**
The front cover of the SGS features a set of multicolour LEDs which are designed to indicate the state of operation or errors.

**GRID:**
Indicates the status of the grid connection.

**SOLAR:**
Indicates the status of the PV / Solar connection.

**STATUS:**
Indicates the overall system status of the SGS itself.

**TEMP:**
Indicates the temperature status of the hot water cylinder (heating/cooling)

**FRONT**
Figure 2 shows the front of the Apex SGS which has the following features:

The SGS's front fascia consists of 4 state indicating multicolour LEDs. Below the LEDs is the cover over the terminal chamber where all the cables terminate, which is secured with 2 Philips head screws.

**REAR**
The SGS's rear cover features a slotted vent system which facilitates airflow to cool the heat generating components. It is designed to be mounted to the supplied bracket with unimpeded airflow all around.

The terminal chamber cover should only be removed by electricians and accredited installers who have correctly isolated the system as described in the "Installation" section of this manual.

## 4.2 ELECTRICAL INTERFACES

The SGS has 4 electrical interfaces:

**Grid**
This is the electrical interface to the grid supply. This supply specification depends on the element in the hot water cylinder being supplied. The SGS can supply up to 21A at 230V AC or a 4.5kW element..

**Hot water cylinder's element**
This is the interface to which the hot water cylinder's element connects and is marked "L" and "N" on the main PCB.

**PV**
This is the electrical interface to the PV (Solar) supply. The SGS accepts a single string of PV modules with a Vmp between 168 and 230VDC with a maximum Isc of 15A and is connected with "MC4" connectors. The SGS will not convert more than 1500W of PV power.

**Temperature Sensor**
This is the temperature sensor which the SGS uses to regulate the temperature of the hot water cylinder.

## 4.3 IDENTIFICATION

Each SGS is uniquely identified by its serial number. This is printed on the packaging and on the product label on the side of the unit.

## 4.4 APEX OS

Your SGS runs Apex's proprietary ApexOS software, which provides a multitude of features and benefits. These include:

- A local user web-based interface which does not require a network or internet connection
- Device management
- Communications management of Wi-Fi, MQTT, Azure, Modbus and other protocols / interfaces.
- Local and over-the-air Firmware management
- VPN infrastructure which allows secure remote management and control of the device, both individually and as fleets.
- Apex Cloud services which provide remote services such as Virtual Power Plants, fleet control and other features.

# 5. INSTALLATION

## 5.1 SAFETY AND ISOLATION

As the SGS is installed into a building's electrical infrastructure and has both AC and DC power supplies, it is necessary to ensure that the installation area is secured and safe before beginning the installation.

To install the SGS, follow these steps:

Begin by making sure that the AC supply is fully isolated, either at the main breaker, RCD or dedicated isolation device. Then ensure that the DC PV supply is also fully isolated. Ensure that supplies are locked out to prevent accidental reconnection, as necessary.

## 5.2 INSTALLATION OF THE SGS

Note that the SGS will generate some heat and it is necessary to take that into consideration when choosing your installation location.

To begin your SGS installation, locate a suitable position for it which fulfils all the following criteria:

- A firm, even vertical surface
- A location that is fully indoors
- Free from excessive dust and moisture
- Has free airflow and at least 300mm clearance all around
- Is not subjected to heat generated by another device (eg: above a cooker or directly adjacent to the hot water cylinder)
- It may not be mounted inside a cupboard or other place without free air flow
- Is within reach of the 10m temperature probe's maximum length

Do not mount the SGS directly below the hot water cylinder where it may be splashed by a leak or in the case of maintenance work.

The SGS may not be mounted horizontally or at an oblique angle. It must be mounted with the terminal chamber at the bottom of the font cover (ie: correctly rotated)

The SGS may not be installed within the ceiling or roof cavity.

Mount the supplied bracket with suitable fixings to the identified surface and, having done so, ensure that it is firm and secure.

Attach the SGS to its bracket by positioning it over the hooks and sliding it downwards. There should be a small gap between the bracket and the rear surface of the SGS's housing to allow for sufficient air flow.

## 5.3 ELECTRICAL INSTALLATION

Depending on whether this is a new or existing hot water controller installation, follower either the steps labelled "Existing installations" or "New installations" below.

Note that the SGS can be used offgrid, without an AC supply. In this case, ignore instructions relating to the AC supply below, leaving the AC Supply terminals open.

Note that, depending on where the SGS is mounted, the following steps may differ.

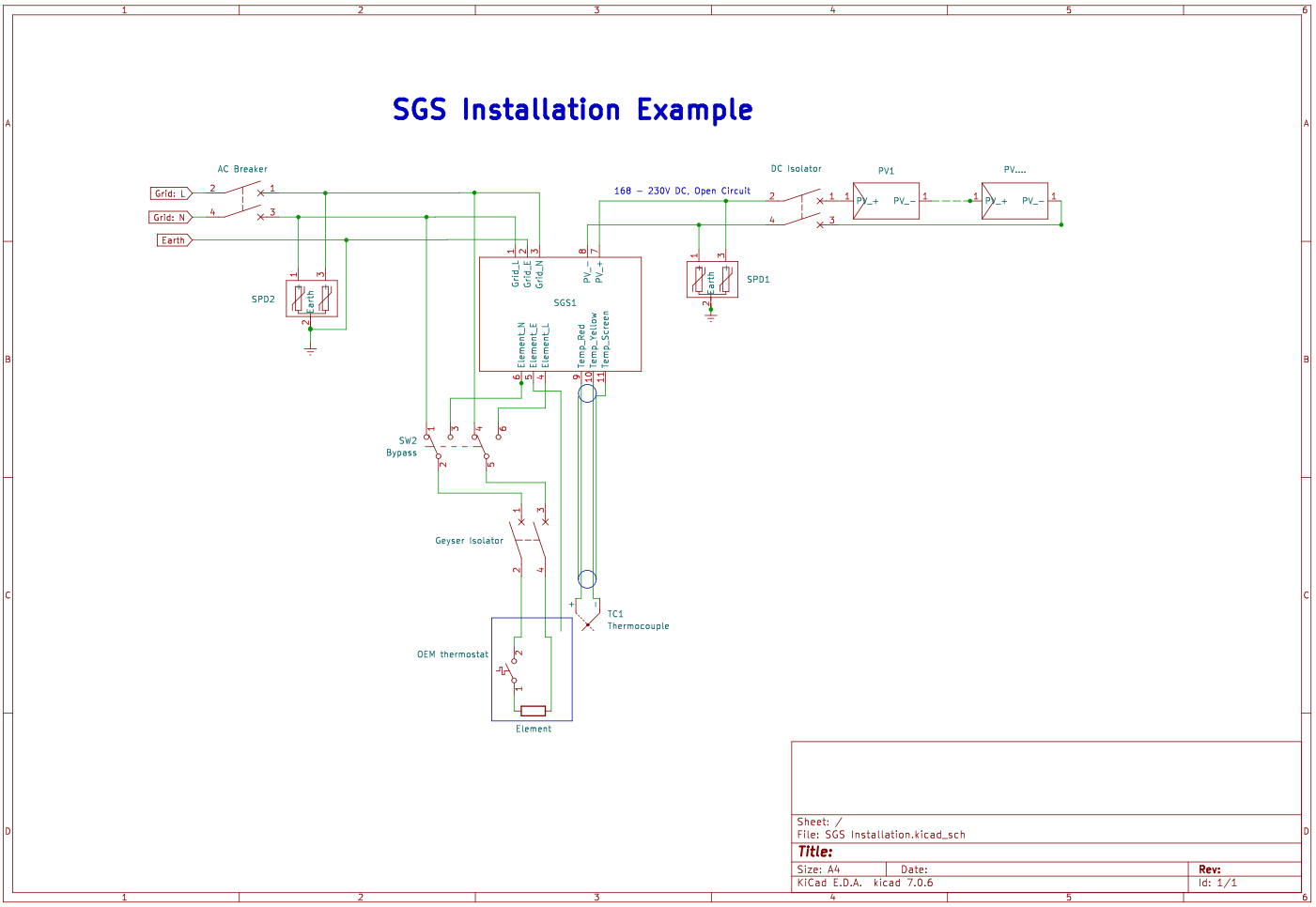



Figure 3. SGS Electrical Installation Overview.

The SGS shall be installed with all the relevant electrical protection and isolation. In particular, AC and DC protection and local isolation is required, as well as AC and DC surge protection. Figure 3 shows a typical electrical layout.

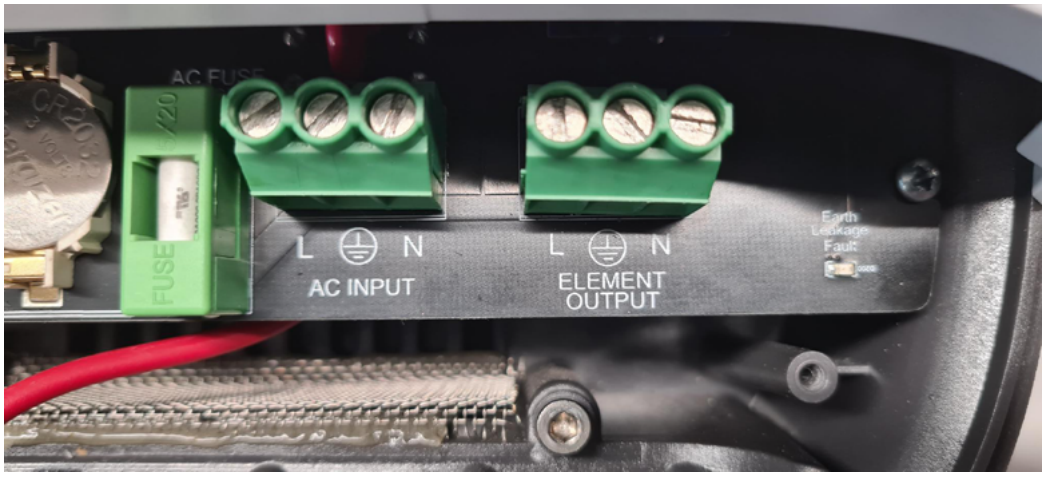



Figure 4. SGS AC Input (Left) And Element Output (Right)

## EXISTING INSTALLATIONS

**AC Supply to SGS**

Remove the power cable feeding the existing hot water cylinder from the terminations inside the hot water cylinder's terminal chamber or local isolator at the hot water cylinder, according to local regulations. This cable then becomes the power supply to the SGS and is terminated at the "L", "N" and earth (AC INPUT) terminals on the PC board. Ensure that the Live, Neutral and Earth conductors are all connected securely and according to the labels.

**SGS to hot water cylinder supply**

Run a new cable of suitable cross section from the 2 terminals marked "L", "N" and earth (ELEMENT OUTPUT) terminal of the SGS's PC board to the location where the first cable was disconnected from the Hot water cylinder's terminal chamber or the local isolator, depending on local regulations. Ensure that the Live, Neutral and Earth conductors are all connected securely and according to the labels on the Apex SGS and the hot water cylinder.

## NEW INSTALLATIONS

**AC Supply to SGS**

Connect a supply from a suitably sized dedicated circuit breaker in the distribution board with a suitable cross section cable to the SGS. This cable is the power supply to the SGS and is terminated at the "L", "N" and earth (AC INPUT) terminals on the PC board. Ensure that the Live, Neutral and Earth conductors are all connected securely and according to the labels on the PC board.

**SGS to hot water cylinder supply**

Run a cable of suitable cross section from the terminals marked "L", "N" and earth (ELEMENT OUTPUT) of the SGS's PC board to the Hot water cylinder's terminal chamber or the local isolator, depending on local regulations. Ensure that the Live, Neutral and Earth conductors are all connected securely and according to the labels on the SGS and the Hot water cylinder.

Ensure that the hot water controller is fully earthed, according to local regulations.

Ensure that the hot water cylinder's thermostat is correctly connected into the circuit, as per the manufacturer's instructions. This is an important safety device and may not be omitted.

### DC PV Supply:

The DC supply shall be isolatable locally at the SGS for both safety and convenience. This can be done either with a suitably rated double-pole DC circuit breaker or isolator, with a rating of at least 250V and 16A DC.

Note that if a DC breaker is used in this location, it is not possible for it to trip on over-current events, since the PV string cannot generate enough current beyond its operational curve to do so.

The Apex SGS should only be connected to a single, series connected string with a Short Circuit current (Isc) of not more than 15A. 2 parallel strings of panels are only allowed when they are of the "High voltage" type, with a short circuit current of less than 7A per string.

Before connection, check the polarity of the incoming PV supply with a suitable DC test instrument to ensure that the Apex SGS is not exposed to reverse polarity. Then, with the PV Array exposed to full sunlight, check that the PV voltage is within the allowable limits of 168V DC – 230V DC. Ensure that the DC cables are correctly terminated into original Staubli MC4 connectors only.


Figure 5. SGS DC Input

Now connect the DC PV power supply to the MC4 connectors on the SGS. (See Fig. 5)

Ensure that the SGS is protected with Surge Protection Devices (SPD's) on both the AC and DC supply interfaces.

### Temperature Sensor

The SGS is supplied with a temperature sensor designed to fit inside the thermal pocket of the hot water cylinder, next to (with) the existing thermostat.

The probe is made from industrial grade K-type thermocouple wire with our patented, proprietary temperature sensor. It consists of k-type wire leading to the SGS and a thin (delicate) copper strip, used for conducting heat to the junction.

Installing the collar is an easy process. Start at the hot water cylinder and work towards the SGS. With the power to the hot water cylinder switched off, remove the standard hot water cylinder thermostat and feed the copper strip into the thermostat pocket, all the way up to the collar.

Then feed the hot water cylinder thermostat through the centre of the probe collar into the hot water cylinder pocket and push it all the way in until the current carrying contacts of the thermostat mate with the hot water cylinder.

Be careful not to damage the probe or its insulation as you push the thermostat into place. It is important that the temperature probe is correctly installed so that it cannot be accidentally removed, thus causing an incorrect temperature reading.

From there, the probe wire can be fed to the SGS, avoiding other cables as far as possible to minimise electrical noise being induced.

Set the hot water cylinder thermostat to maximum (usually 70 degrees). The SGS is in charge of temperature setpoints and the thermostat now only acts as a fail safe.

The SGS can heat water to scalding temperatures. Depending on the installation, a mixing valve may be required to regulate the temperature to safe levels at the points of use. Consult local regulations.

The SGS can heat water to scalding temperatures. Depending on the installation, a mixing valve may be required to regulate the temperature to safe levels at the points of use. Consult local regulations.

At the bottom left of the SGS's PC board is a 3-pin spring terminal.
Push the temperature probe wires into that terminal in the order that follows from left to right:
Red, Yellow, Black (screen). (fig. 7)

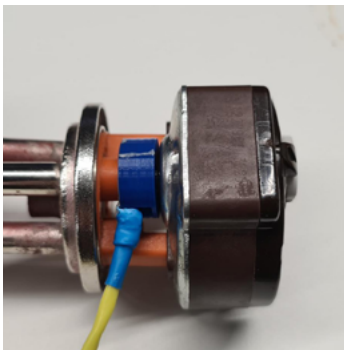


Figure 6. Temperature Sensor Installation


Figure 7. Temperature Sensor's Connections To The SGS PCB

Now connect the other end of the probe's cable to the SGS's PCB as shown in Figure 7.

The temperature probe is available in 10, 15, 20 and 30m lengths.. Longer (or shorter) lengths can be manufactured to order but need to be carefully routed to avoid electrical noise being induced. Always take care how you route the cable away from other cables and electrical devices. Should spurious readings occur, check your routing and move it away from all other cables. In general, the shorter the cable the better the reliability of the reading.

## 5.4 POWERING UP THE SGS

Begin with the hot water cylinder switched on at its local isolator. Since the SGS can be run on either power supply, its power-up sequence is not critical. However, powering up DC first allows its presence to be verified.

The lights on the front of the SGS should illuminate if correct. Now power up the AC interface.

Note that if the SGS does not power up from the PV interface alone it is possible that the PV supply polarity is not correct or that there is insufficient power available on the panels.

## 5.5 SYSTEM RUNNING

Your SGS will now be functional and create hot water with the default settings. No further intervention is required if you do not require special features, different settings, or monitoring.

The factory temperature settings are as follows:

| | |
|---|---|
| AC setpoint | 50°C |
| Solar setpoint | 70°C |
| Boost setpoint | 60°C |

These settings can be changed by connecting the SGS to a mobile device (see section 7).

If you require special features, different settings, or monitoring, please proceed to **Chapter 6: Commissioning**.

**Note: it is recommended that an internet connection is used and commissioned as it enables full diagnostics and configuration of the device. Alternatively, the local hotspot's web page can also be used to monitor and control the device (see section 7.2)**

# 6. COMMISSIONING & OPERATION

## 6.1 COMMISSIONING

The SGS is designed to assume temperature control of the hot water cylinder to which it is connected and operates autonomously. However, the original thermal cut-out device shall remain in place to ensure that, in the unlikely event of a failure of the SGS, the system will remain below dangerous temperature levels. To do this, set the original mechanical thermostat to the maximum setting it allows. However, always keep in mind local regulations which may determine the maximum allowable temperatures. Fit a mixing valve to ensure that the water is a safe temperature at the point of use.

## 6.2 OPERATING MODES

The SGS will try to reach the pre-configured temperature set point using the power sources available to it.
In general, the PV interface is prioritised, and the SGS will first use that. If it is not able to heat the water with the PV source, it will then use the grid source (if available).

Never power up a hot water cylinder without water in it.

### Basic Use Cases (On-Grid installation):

**When only the AC connection is on**
- SGS will be on and will heat from grid.

**When the AC connection is on and sufficient solar power is available**
- SGS will be on and will heat from solar.

**When the AC connection is on, but insufficient solar power is available**
- SGS will be on and will heat from grid.

**When the AC connection is off and sufficient solar power is available**
- SGS will be on and will heat from solar.

**When AC connection is off and insufficient solar power is available**
- SGS system will shut down.

### Basic Use Cases (Off-Grid installation):

**When sufficient solar power is available**
- SGS will be on and can heat.

**When insufficient solar power is available**
- SGS will be off and will not heat.

**A generator may also be used on the input, in which case the SGS will behave as described in the On-grid use case.**

## 6.4 LED STATUS INDICATORS

The SGS uses the front panel LEDs to indicate its status.
4 multicolour indicators are used and their colours designate the following possible statuses:

| Temp LED | Solar LED | Grid LED | Status LED (2 colour Flash) | |
|---|---|---|---|---|
| Heating | Solar heating | Grid heating | Normal | AP mode |
| At setpoint | Grid mode | Solar mode | Normal | Wi-Fi connected |
| Cooling | Solar off | Grid off | Error | AP mode |
| | | | Error | Wi-Fi connected |

## 6.5 FAULT FINDING

If the SGS does not work correctly or displays a fault is present with the Status LED, it is necessary to correct an abnormal occurrence. All error status messages are available in the User App. Once an error is corrected, reset the fault by turning off / on both PV and AC together.
The following table shows monitored faults which can occur and possible solutions:

| Error | Name | Description | Action |
|---|---|---|---|
| 0 | No Error | System normal | N/A |
| 2 | PV over voltage | DC input voltage too high | Too many PV panels in series |
| 3 | Leakage detected | RCD has detected leakage current | Check for electrical faults, particularly at the hot water cylinder element. |
| 4 | Water over temp | Over max Temperature detected | Return for repair |
| 5 | No temp probe detected | Temperature probe is not connected | Connect probe |
| 6 | Temperature error | Implausible temperature reading | Check probe installation |
| 7 | Safety cut out activated | Temp or RCM safety active | Check for faults |
| 8 | Thermal cut out | Max temperature limit reached | Check system |
| 9 | NTC fault | SGS Internal over-temperature | System too hot, check operating environment |
| 10 | Relay fault | Relay fault detected in SGS | Return for repair |

If a fault recurs after rectifying possible causes and resetting the device, power down and discontinue use of your SGS and contact our Support department.

## 6.6 OTHER ERRORS

Besides the errors specifically listed above, the following errors may also occur:

**Fuses:**
The Apex SGS has 2 fuses inside, 1 each for the AC and DC supplies. Should either supply fail to correctly power up the unit, check these 2 fuses on the main board. (See Figure 8 below).

Fuses should only be replaced with the original size / specification devices. Failure to do so could result in dangerous electrical failure and will invalidate any warranty claim.


Figure 8. AC Fuse

**Temperature Probe:**
Due to the nature of the probe, it is important that it is very carefully handled, installed and well routed. In particular, ensure that the probe fits the thermal pocket and that it is not too tight or too loose. If the probe is damaged, the Apex SGS will enter an error state which can be identified by the red "Temp Error" LED just right of the probe's PCB connector. If this LED illuminates, it is likely that the probe is damaged. Remove the probe and inspect it for insulation damage and, if necessary, replace it.

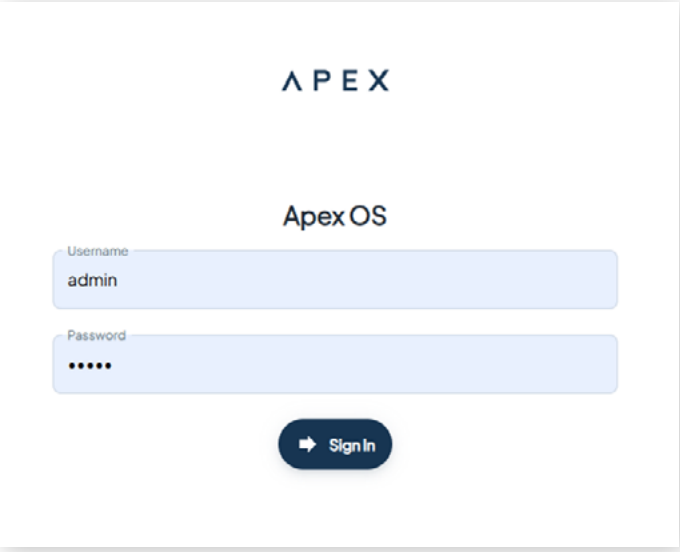
**Leakage Current:**
The SGS is fitted with a residual current sensor. It is designed to detect current leakage on the output above 30mA, and it will shut the Apex SGS down into a safe state. In such circumstances, the DC array, hot water cylinder and AC supply should be treated with great care and the fault located and corrected urgently.

# 7. MOBILE APPLICATIONS & WIFI CONNECTIVITY

## 7.1 LOCAL USER INTERFACE

ApexOS – the SGS's operating system - contains a local browser-based user interface which is independent of any local network or internet availability. This local user interface is available through the Wi-Fi hotspot hosted on the SGS.

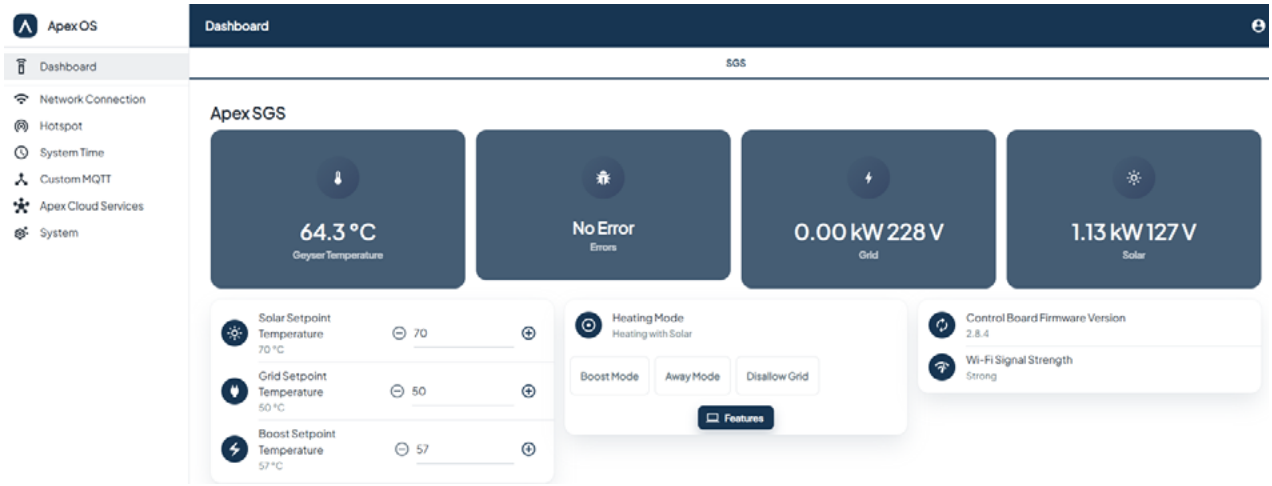
An SGS always has its own Wi-Fi hotspot active (even if it is also connected to another Wi-Fi network). The hotspot can be utilized by browsing available Wi-Fi hotspots with a mobile device and searching for one with a name that contains "APEX-AP" and the SGS's serial number, for example APEX-AP-Hxxxxxxx. Select the hotspot that corresponds to your device; the password is 123456789. Once you have joined that network, open a web browser and navigate to http://192.168.4.1 which will take you to this login page:




The credentials are:

| | |
|---|---|
| Devices pre Nov 24: | |
| User Name: | admin |
| Password: | admin |
| | |
| Devices post-Nov 24: | |
| User Name: | guest |
| Password: | hotwater |

After login, you will see this page. The dashboard gives the user all the basic live information about the device.




You can also control the device, set new temperature setpoints, manage local access and configure network settings – all without an internet connection.

## 7.2.1 WEB APP AND REMOTE ACCESS

The Apex SGS needs to be connected to a local Wi-Fi network with internet access for the remote monitoring and control Web App to work. In the side bar of the local web page, navigate to "Network Connection". From there, click on Scan networks to view the networks visible to the SGS. Select the chosen Wi-Fi network and type in its password and click save.

The Status LED on the Apex SGS will alternately flash Blue and the colour corresponding to its status to indicate that it has successfully joined the hotspot and can access the Apex cloud server. The network connection can also be confirmed by viewing the Wi-Fi status tab. The local interface will now also be available on the local LAN network at the SGS's assigned network IP address, shown on your Network Interface page. Note that the IP address may change from time to time unless you set a static IP address.

## 7.2 WEB APP INTRODUCTION

The Apex SGS can be configured and monitored via the included cloud application, which works on Android, iOS and desktop computers. The applications can be viewed as web pages or installed and work just as any other app. To start using your remote control and monitoring, navigate to fleet.apexsolar.tech. If you do not have an account, create one at https://fleet.apexsolar.tech/accounts/signup

**Installing the Apex SGS's WebApp:**
After opening the link in a mobile device's web browser, depending on your browser / device, you can install the Web app to your home screen, just like any other app. The process for this varies from browser to browser, but the general idea is the same. Here are the instructions for popular web browsers.
After loading the link in the browser:

**Firefox:**
You'll see a "home" icon with a plus (+) icon inside it – this is the "Add to Home screen" icon. Tapping this will show a confirmation banner and then tapping the banner's big "+ ADD TO HOME SCREEN" button completes the action, adding the app to the Home screen.

**Samsung Internet:**
You'll see a circular icon with a downward facing arrow next to the address bar. Tapping the icon will show a confirmation banner. Tap the "+ ADD TO HOME SCREEN" button to add the app to your home screen.
Chrome for Android:
You'll see an install banner pop up asking whether you want to add this app to your Home screen. If you choose not to add it to your Home screen at this point, you can do so later using the "Add to Home Screen" icon in the main Chrome menu.

**Apple and iOS**
On Apple's iOS (including iPhoneOS and iPadOS), the Safari browser supports web apps. To add a web app to your home screen, tap the sharing button (Square and arrow sharing icon) at the bottom of the screen, which opens the sharing panel. Among the options is the "Add to Home Screen" option. Choosing "Add to Home Screen" opens the confirmation dialog box, which both confirms that the user wants to add the app to the home screen and lets them customize its name.

Tap "Add" and the app is now included on the home screen. You'll see a circular icon with a downward facing arrow next to the address bar. Tapping the icon will show a confirmation banner. Tap the "+ ADD TO HOME SCREEN" button to add the app to your home screen. You'll see an install banner pop up asking whether you want to add this app to your Home screen. If you choose not to add it to your Home screen at this point, you can do so later using the "Add to Home Screen" icon in the main Chrome menu.

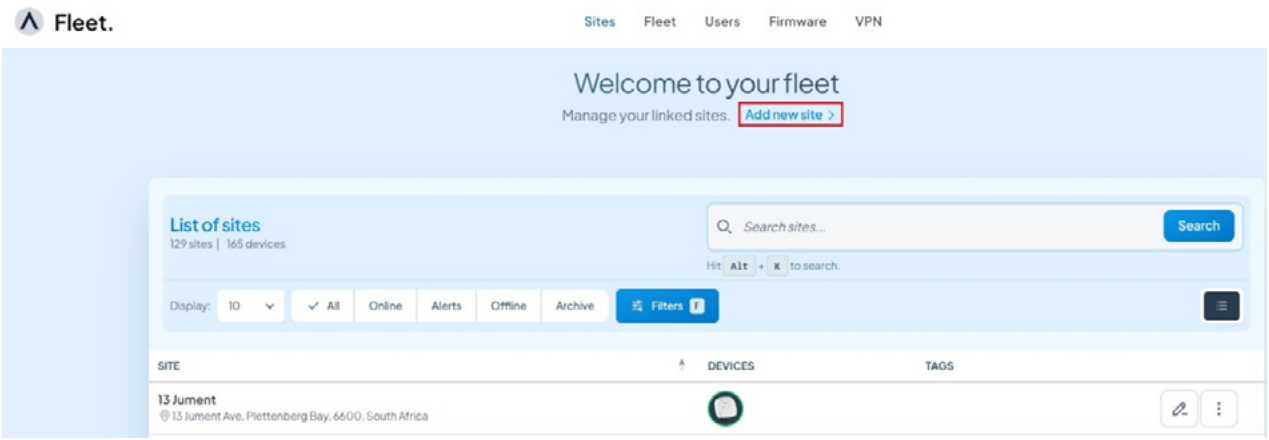
Using the 3 dot drop-down, tap "Install app" in the menu list.

## 7.3 INSTALLERS REMOTE MONITORING

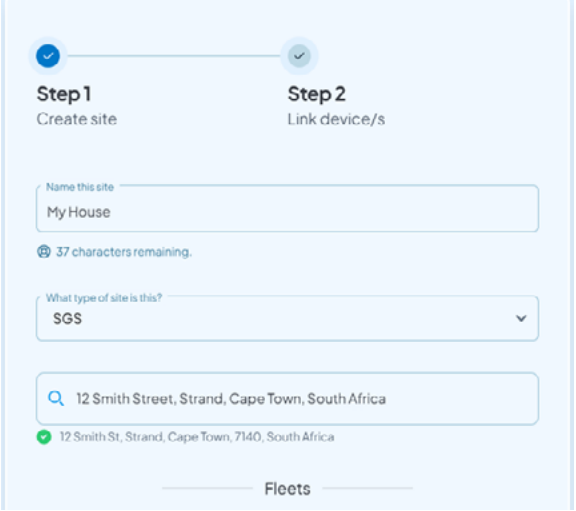
The same web app is used for installers and users, though with varying permissions. All functions detailed in the users remote monitoring section in the following chapter apply to the installers remote monitoring. The site needs be enrolled by a qualified installer. An Installer needs to have an account registered here https://fleet.apexsolar.tech/accounts/signup  to be created on the Apex SGS's server once they have been accredited, with a username and password.

### 7.3.1 CREATING A SITE:

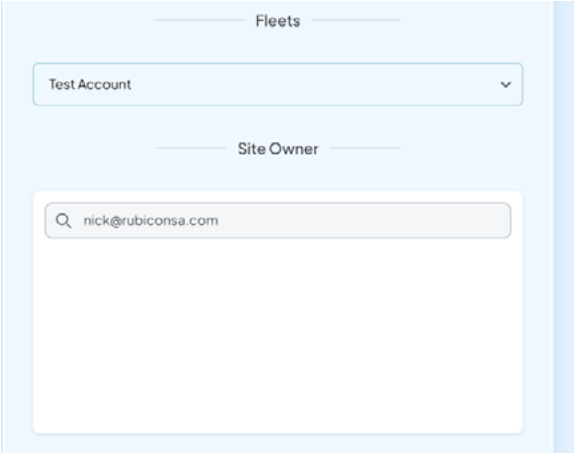
Once you have a user account, create a new site for the device to be added to.



Follow the prompts to complete the site information.

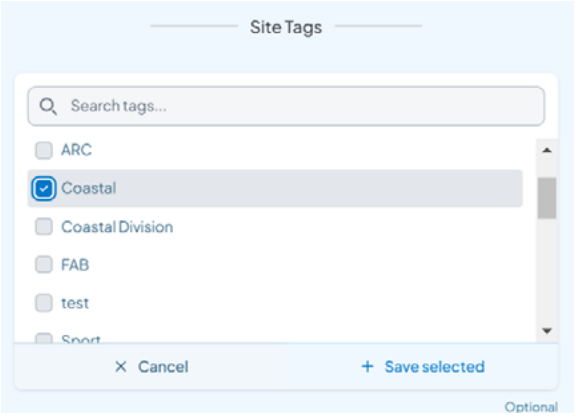



You can also add this Site to one of your "Fleets" – for example, you might have a Fleet called "SGSs in Western Cape" and another called "SGSs in Eastern Cape" to help manage the sites you are responsible for.

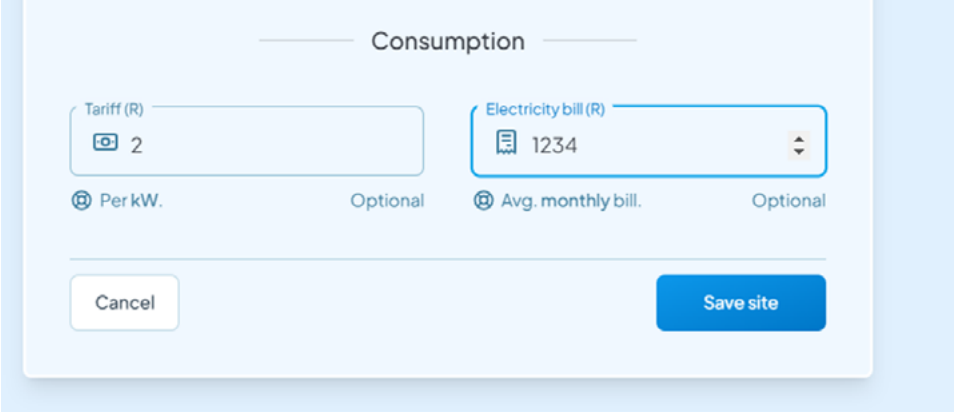



Add a site Owner's email address.  You can add more users later if needed.

Add any Tags you wish – these will help you group or search for sites.

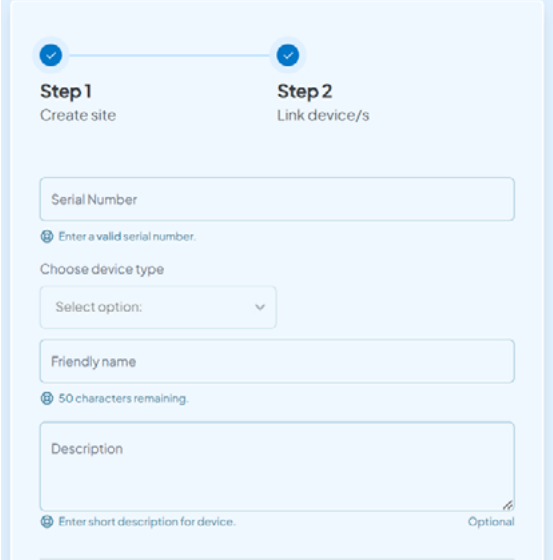


Enter your tariff and consumption information.




### 7.3.2 ENROLLING A DEVICE:

Once the site information has been entered, click in the "Save Site" button and move to the next page to add your device to that site. Now enter your device's serial number exactly as it appears on the product label. For example, H1234555



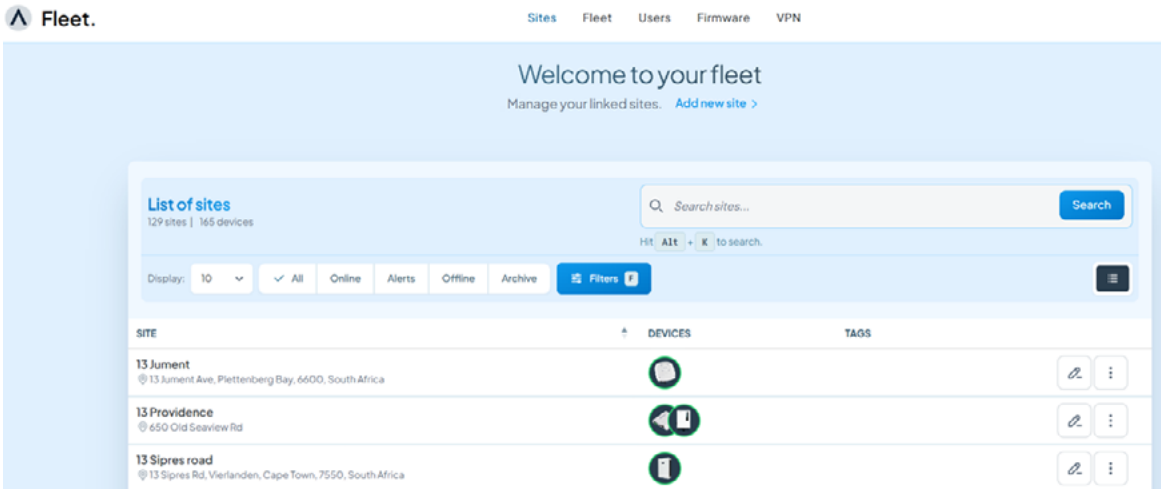

Choose "SGS" as the device type.

Add a "Friendly name" to help you uniquely identify this device – for example "Granny's Flat".
You may also enter a description of the device for your own reference. Click Save.

Congratulations! Your site is completed!

## 7.4 SITE LIST

You will now see your newly create site in your site list, similar to the list below:




You can search for sites, filter by various criteria and see at a glance which devices are online, which or are offline and easily edit the site information from the list.

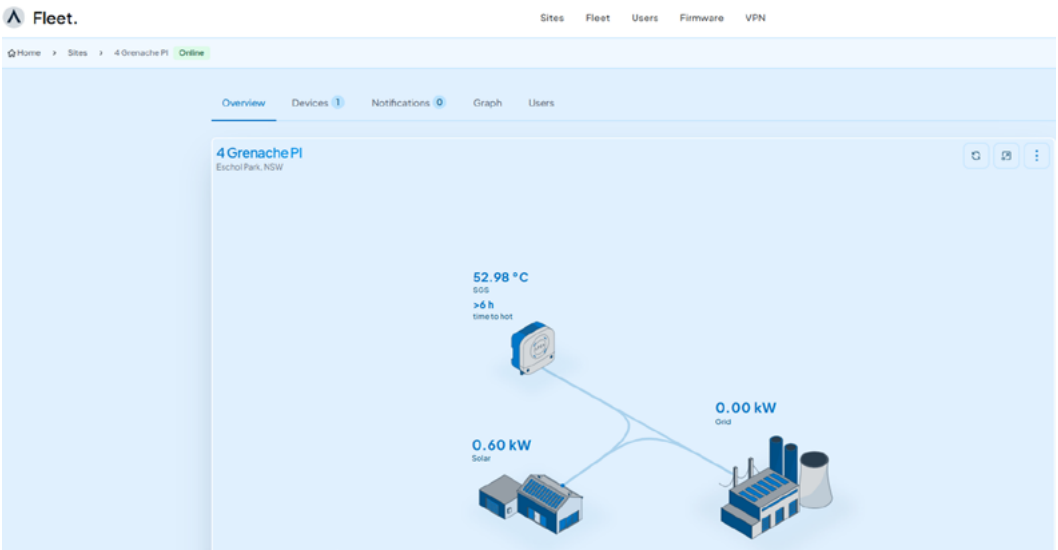
## 7.5 SITE VIEW

### 7.5.1: OVERVIEW

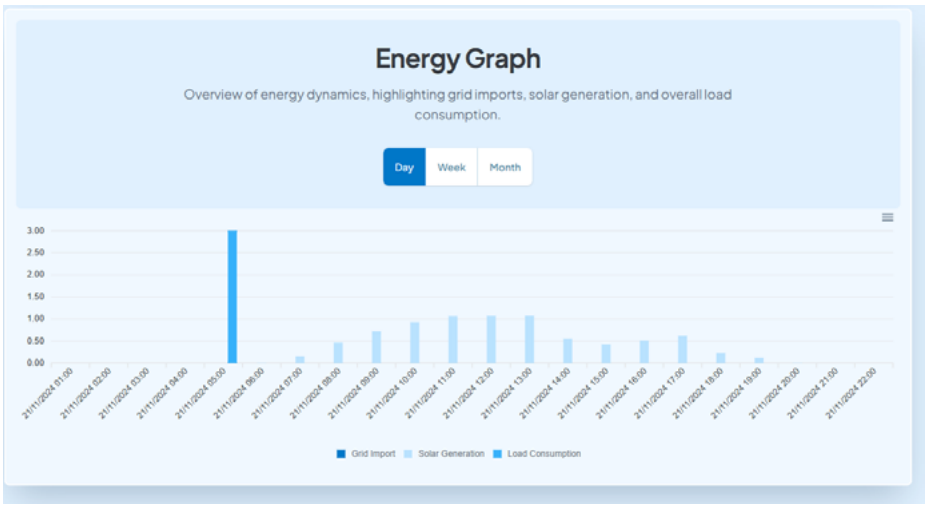
Click on your chosen site in the list to enter it.

Flow:

The overview of the site shows what we call the "Flow" which gives an animated view of the live energy flow. You can also see your device's temperature, instantaneous power values and various other pieces of live information.

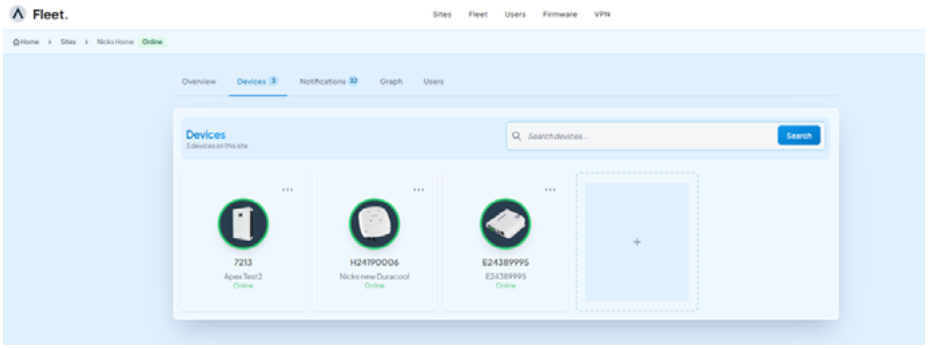


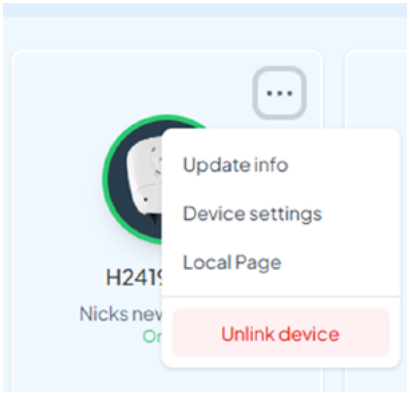
**Energy Graphs:**
At a glance, you can see a representation your site's energy consumption, grid purchase and Solar generation with the Energy Graph tool. It can be on a Day, Week or Month basis – simply select your preference.




## 7.5.2: DEVICES

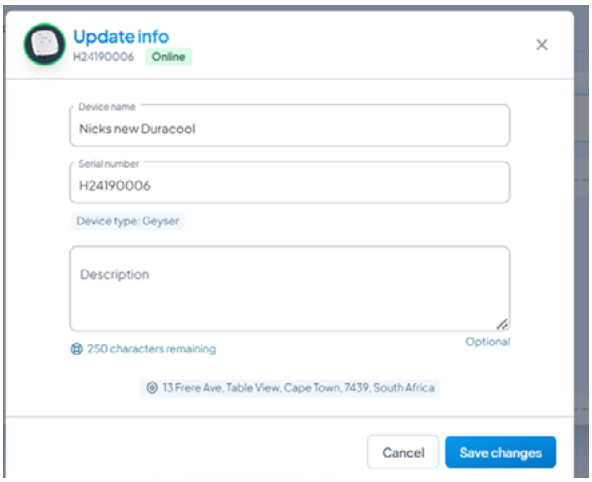
Clicking on the Devices tab at the top takes you to the graphical view of all the devices installed on this site.



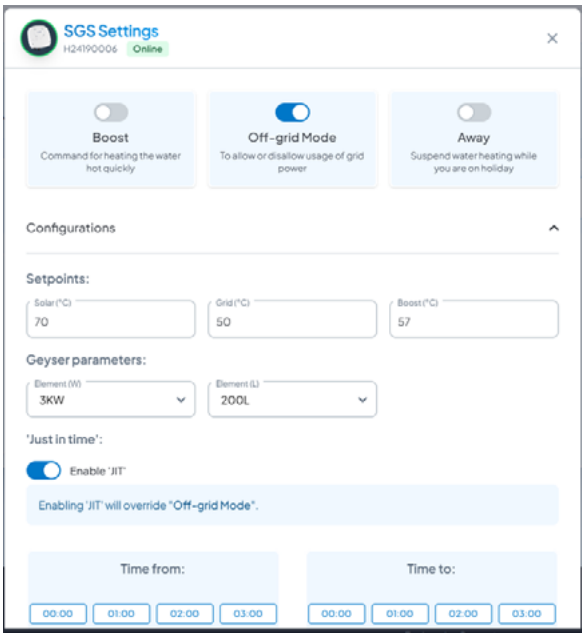




From each icon you can select the 3 dots in the top right corner. In the menu you, you can:

1) Edit / update the device information




2) Change its settings



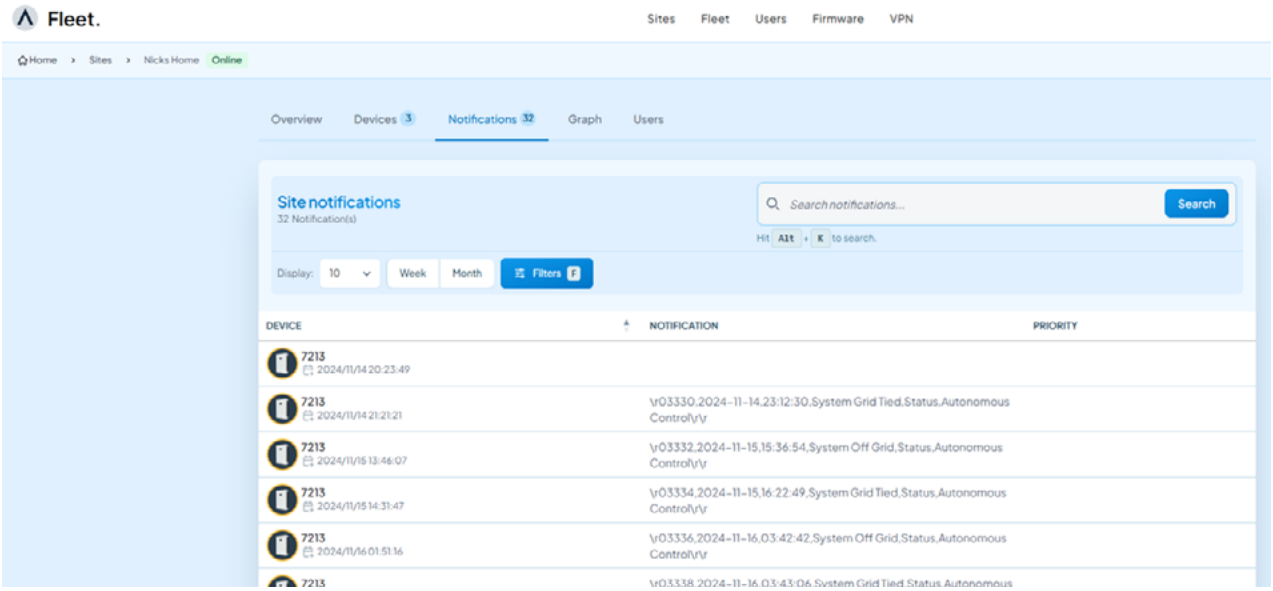

(More detail in Section 8)

3) Open its local page (as per section 7.1).
ApexOS includes powerful VPN functionality which allows us to manage and build networks of devices. This functionality gives you remote access to the device's local page from anywhere in the world.

4) Unlink this device from this site.

### 7.5.3 NOTIFICATIONS TAB

The notifications tab contains all the notifications that the devices on this site have generated.



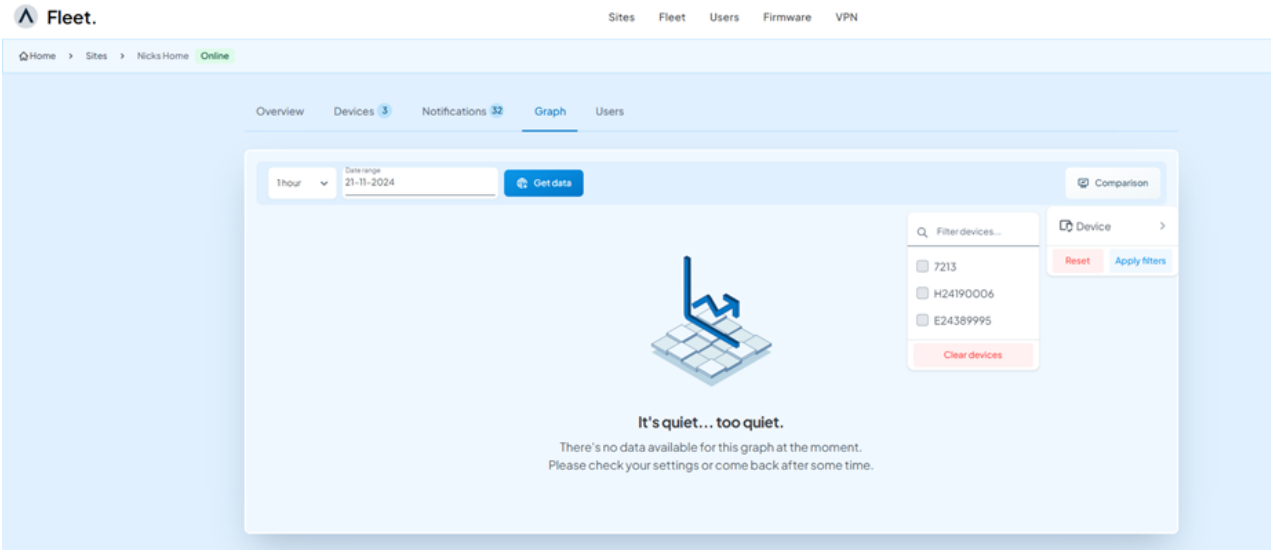

Notifications can be searched or filtered.

### 7.5.4 GRAPH TAB

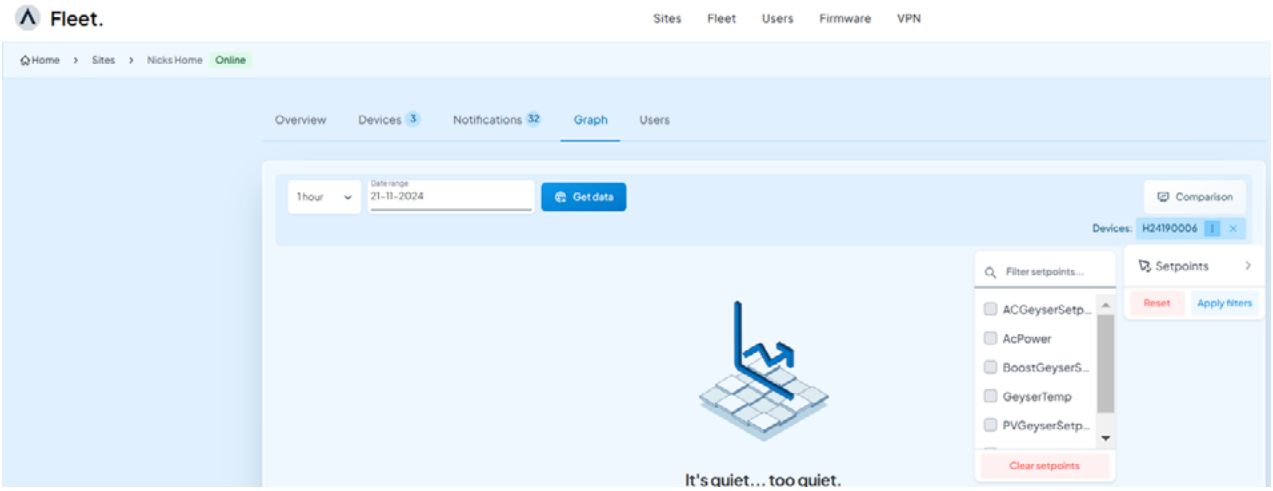
All the telemetry that is sent from the device can be graphed. For instance, you might like to graph the power or hot water temperature – or perhaps both at the same time.

To set up a graph:

Select which device/s you want to graph and then click apply filters.

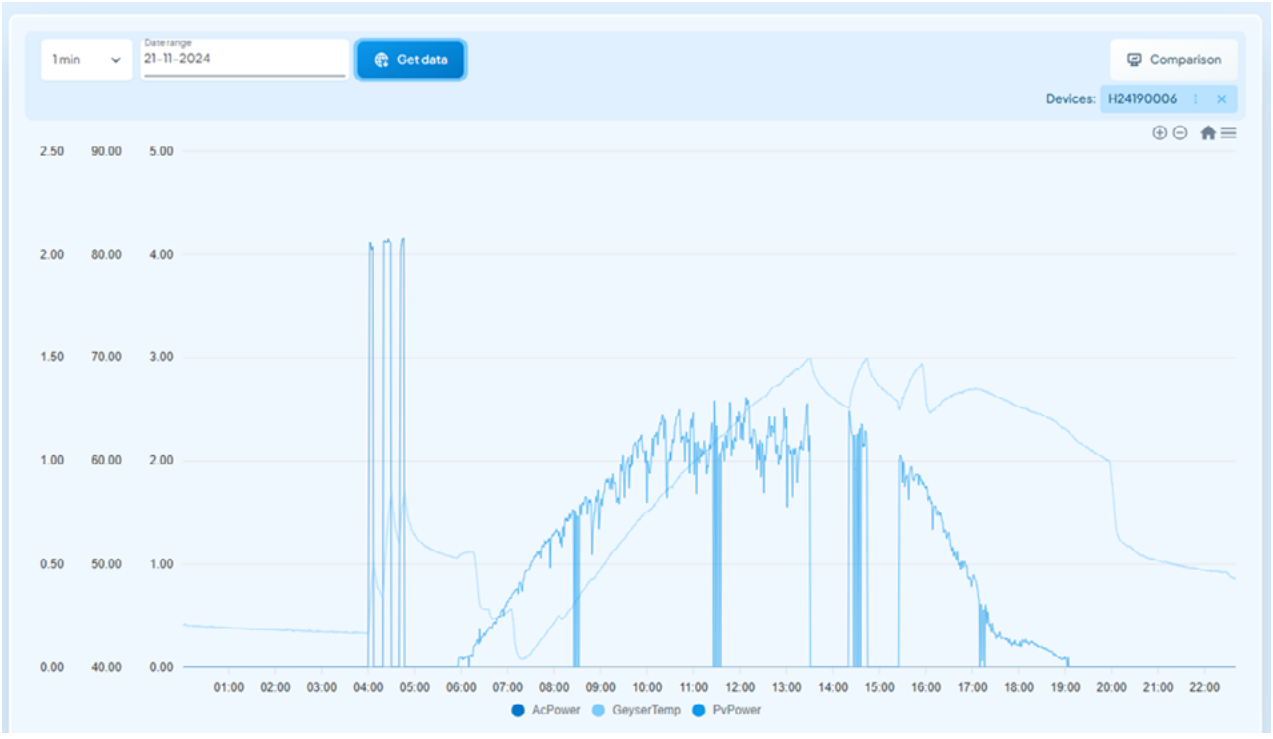


Now configure which datapoints you want to graph for that device by clicking the 3 dots next to its serial number and selecting "setpoints":



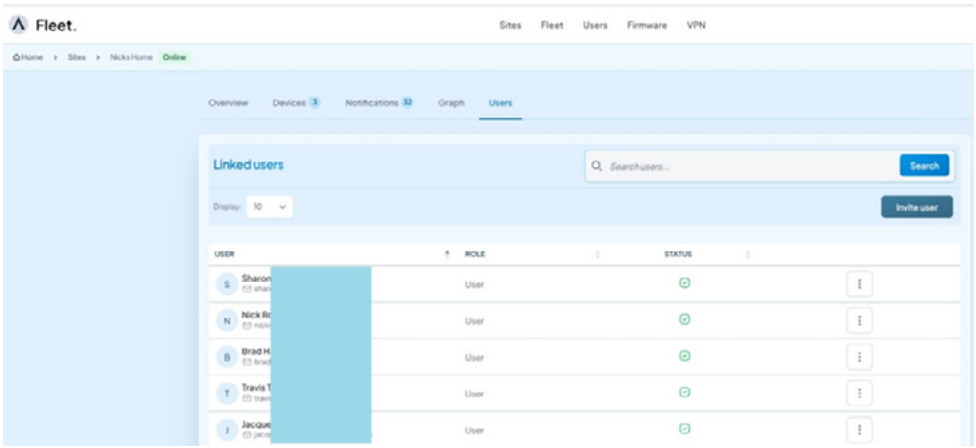

Once you've selected what you require, select Apply filters.

Now, choose your date range and data resolution. If you're not sure, start with today and 1 minute. Then click "Get Data" to generate your graphs. Each plot can be turned off but clicking on the label at the bottom.



### 7.5.5 USERS TAB

The Users tab lets you add or remote site users.




To invite someone new – whether they have a Fleet account or not – click Invite User and type in their details. They will receive an email notification giving them access to the site.

## 8.0 SETTINGS

To change your site's settings, navigate to the Devices tab and click the 3 dots on the device you want to edit. Now select Device Settings.
You can now interact with your device:

**Boost:**
The Apex SGS will heat the water to the Boost setpoint in the shortest possible time, which will use AC power. Tap again to deactivate Boost.
Off Grid Mode:
This disables the use of grid power for heating your water, even if it is available. Tap again to deactivate. (Note: It is not necessary to select "Off Grid" for the device to work without a grid connection – this is automatic).

**Away:**
This will stop heating your water from all sources until deselected and the SGS is in standby. Tap again to deactivate Away mode.

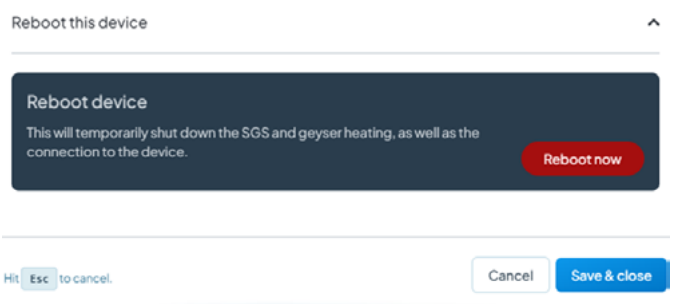
**Setpoints:**
You can change the temperature setpoints for Grid, Solar and Boost modes here.
Note: It is recommended that you select a higher temperature for your PV than your grid. This will ensure that you maximise your PV consumption and therefore your savings.

**Parameters:**
The element size and cylinder capacity are set to assist the SGS to make certain calculations.

**Just in time:**
This feature give the user 2 "critical times" in their day when the SGS understands that is must always have water at the Boost temperature. This is useful if the weather is poor, for example, and you wish to use all the PV energy you can, but perhaps you still do not achieve your desired temperature. The SGS will intelligently decide to use grid power at the last possible time in order to have it hot in time for your critical time. It will perform 1 single boost cycle, reach the Boost setpoint and then return to normal operating mode.


**Do not use AC times:**
The feature allows you to set a time band when the SGS will never use grid power. This is sometimes useful overnight, for example. Select the start and end times of the time band you do not with to use AC power.


**Reboot this device:**
Should you wish to remotely reboot / reset your SGS, you can do so with this function




Don't forget to click "Save and Close" after you've changed any settings.

## ORDERING INFORMATION

| Part Number | Description |
|---|---|
| H20P100 | Apex SGS controller, with 20m probe. |
| FG-ED-00 | Apex SGS controller. Excludes probe. |
| FG-TP-AA | Apex SGS Temperature probe, 10m |
| FG-TP-AB | Apex SGS Temperature probe, 15m |
| FG-TP-AC | Apex SGS Temperature probe, 20m |
| FG-TP-AD | Apex SGS Temperature probe, 30m |

## WARRANTY

The Apex SGS is warranted to be free from defects for a period of 2 years from purchase, subject to Apex's Warranty terms and conditions, a copy of which is available at: www.ApexSolar.Tech

## SUPPORT

You can contact our support centre for technical assistance with this product or the associated services.

## PRODUCT SUPPORT

When contacting Product Support via telephone or email please provide the following information for the fastest possible service:

- Type of Inverter
- Serial number
- Battery type
- Battery bank capacity
- Battery bank voltage
- Communications type used
- A description of the event or problem
- Edge device serial number (available on product label on the under side of the Edge Device)

## CONTACT DETAILS

Telephone: +27 (0) 80 782 4266
Online: https://www.rubiconsa.com/pages/support
Email: support@rubiconsa.com
Address: Rubicon SA
1B Hansen Close,
Richmond Park,
Cape Town,
South Africa

You can reach technical support by telephone directly Monday to Friday between 08h00 and 17h00 (GMT +2 hours). Queries outside of these hours should be directed to support@rubiconsa.com and will be answered at the earliest opportunity. When contacting technical support, please ensure that you have the above listed information available.