

APEX

SOLAR GEYSER SYSTEM (SGS)

Technical Manual

The Apex SGS is the heart of a water heating system – intelligently heating water in a standard electric geyser 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.

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.



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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 geyser 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 system
- 1x mounting bracket
- 1x securing screw
- 1x temperature probe
- 1x pair MC4 connectors

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.

Electrical Overview:

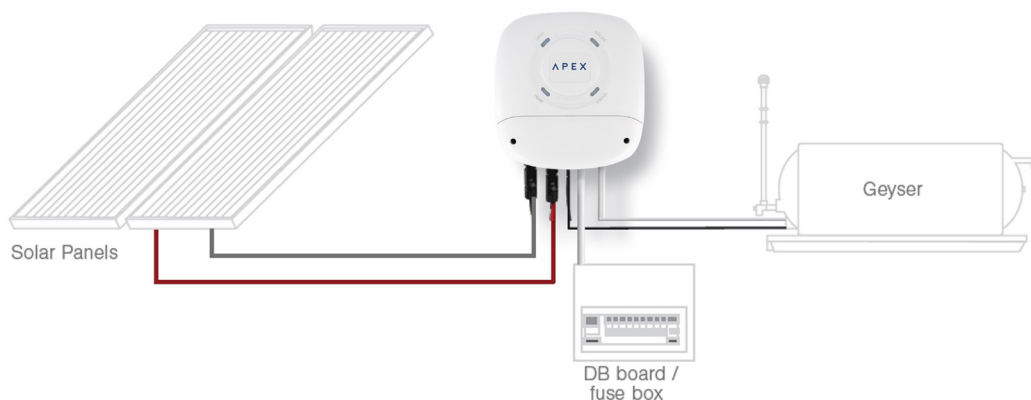


Figure 1. SGS PV Geyser System Overview Typical Installation.

2. TECHNICAL SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

Parameter	Specification
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AC INPUT

Voltage	230V AC
Frequency	50 Hz
Current	15A
Connection	3 x 4mm ² 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	15A

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 ^{V_{rms}} Modulated DC
Current	15A

GEYSER ELEMENT

Max Voltage	230V
Power	2000W - 3000W
Element Resistance	17Ω - 27Ω
Connection at Device	3 x 4mm ² 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	10m
Connector	Push 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

ENVIRONMENTAL 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
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DEVICE SAFETY FEATURES

On Device	RGB Digital LED x 4 + local access point
Remote	Web browser
Settable Temperature Range	+30°C to +70°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 geyser 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 PRECAUTIONS

Lighting Preventions Precautions

1. Surge Protection:

Install surge protectors in conjunction with your system to safeguard against sudden voltage spikes caused by lightning strikes.

2. Grounding:

Ensure proper grounding for all components of the system.

3. Isolation Devices:

Incorporate isolation devices, such as isolators or surge protection devices, to limit the spread of electrical surges within the system.

4. Lightning Rods:

Consider installing lightning rods on structures where your system is mounted.

Moisture & Water Prevention

5. Proper Ventilation:

While sealing against moisture is essential, also ensure proper ventilation to prevent the accumulation of humidity within enclosures.

6. Elevated Installations:

Install the SGS devices at an elevated height when possible, particularly in areas prone to flooding or standing water.

7. Indoors:

Ensure the units is installed indoors and not exposed to external environmental conditions.

Pollution Precautions

8. Air Filtration:

Consider installing air filtration systems in areas prone to high levels of dust or pollutants. Excessive pollution could damage the SGS device.

9. Anti-Static Measures:

In environments with static electricity concerns, implement anti-static measures to reduce the attraction and accumulation of dust on the SGS device.

Environmental Temperature Control

10. Operating Temperature Range:

Adhere to the specified operating temperature range of 0-40 degrees celsius for the SGS device.

Cooling Systems:

In installations where ambient temperatures may exceed the recommended range, consider implementing additional cooling systems, such as air conditioners or heat exchangers.

Transportation Requirements

11. Ensure no heavy packaging is placed on top of the device.

12. If external temperatures exceed general conditions, consider using a temperature-controlled transportation.

13. Ensure that there is no excessive shock and vibrations during transit.

14. Ensure that the device is transported in a closed off area from external environmental conditions.

Storage Requirements

1. Dry and Cool Environment:
2. Store the SGS device in a dry and cool environment to prevent the risk of moisture-related damage and to avoid overheating.
3. Protection from Extreme Temperatures: Avoid exposing the SGS device to extreme temperatures, both hot and cold. If necessary, use climate-controlled storage facilities to maintain a consistent temperature.
4. Secure Storage: Store the SGS device in secure areas to prevent unauthorized access, theft, or tampering.
5. Store devices in locations where they are less likely to be subject to physical damage.

Avoiding Direct Sunlight:

1. Keep the SGS device away from direct sunlight to prevent overheating and potential damage to sensitive components.
2. Shelving and Racking: Use appropriate shelving and racking systems to store devices securely avoid damage.

Consumer Product Safety Hazard Warnings

Warning: Arcing

Do not disconnect under load. This may result in damage to the SGS Device.

Warning: Avoid DIY Electrical Work

To ensure your safety and the proper functioning of your SGS device, it is crucial to heed the following warning regarding DIY electrical work:

1. Risk of Injury and Damage: Qualified Professionals Only: Electrical installations and repairs should only be conducted by qualified and licensed electricians. Attempting DIY electrical work can lead to serious injury, electric shock, or fire hazards.
2. Manufacturer's Warranty: Unauthorized modifications or tampering with the SGS device's electrical components may void the manufacturer's warranty. Any issues arising from DIY electrical work will not be covered under warranty.
3. Legal Compliance: DIY electrical work may violate local electrical codes and regulations. Failure to comply with these standards can lead to legal consequences and compromise your insurance coverage.
4. Risk of Fire Hazard: Improperly executed electrical work can cause overheating, sparking, or short circuits, leading to a potential fire hazard. Only licensed professionals are trained to mitigate and prevent these risks.

Use Authorized Service Centres: For any repairs or modifications required for this SGS device, utilize authorized service centres recommended by the manufacturer. They have the expertise and genuine replacement parts to ensure the safety and optimal performance of your device.

Warning: Avoid Water Exposure

To safeguard yourself and the proper functioning of the SGS device, please be aware of the following caution regarding water exposure:

Risk of Electric Shock and Damage:

1. **Keep Dry:** This SGS device is not water-resistant. Avoid exposing it to water, liquids, or damp environments. Water contact can result in electric shock or permanent damage to the device.
2. **No Immersion:** Do not immerse the SGS device in water or any other liquids. Submerging the device can lead to a short circuit, electric shock, and irreparable damage.
3. **Caution with Wet Hands:** Refrain from operating the SGS device with wet hands or in wet conditions. Moisture on your hands may conduct electricity and increase the risk of electric shock.

Ignoring this warning may lead to electric shock, damage to the SGS device, or pose a safety hazard. Keep the device dry and exercise caution to ensure safe and optimal performance.

Device Fault: Action To Be Taken

In the event of a fault (overload, short circuit, total failure) of the device please do the following:

1. **Isolate the supplies to the device:** switch off the main grid power that is supplying the device as well as the PV power (if installed) supplying the device. Both isolation devices are required to be within arm's reach of the SGS.
2. Call your electrician or registered installer to safely uninstall the device.
3. Contact Apex for next steps regarding repairs to the device.

3.12 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.

3.13 OTHER CONSIDERATIONS

This device is exclusively designed to manage a hot water geyser, 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 Geyser 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 geyser. (Heating / Cooling)

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.

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.



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 geyser being supplied. The SGS can supply up to a 3KW element, up to 15A at 230V AC.

Geyser Element

This is the interface to which the geyser 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 between 110 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 geyser.

4.3 IDENTIFICATION

The SGS is shown in Figure 2. Each SGS is uniquely identified by its MAC address. This is visible as the Wi-Fi hotspot name when the device is in hotspot mode.

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.

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 front cover (ie: correctly rotated.)



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 front 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.

5.2 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 geyser)
- 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.

5.3 ELECTRICAL INSTALLATION

Depending on whether this is a new or existing geyser installation, follow 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.

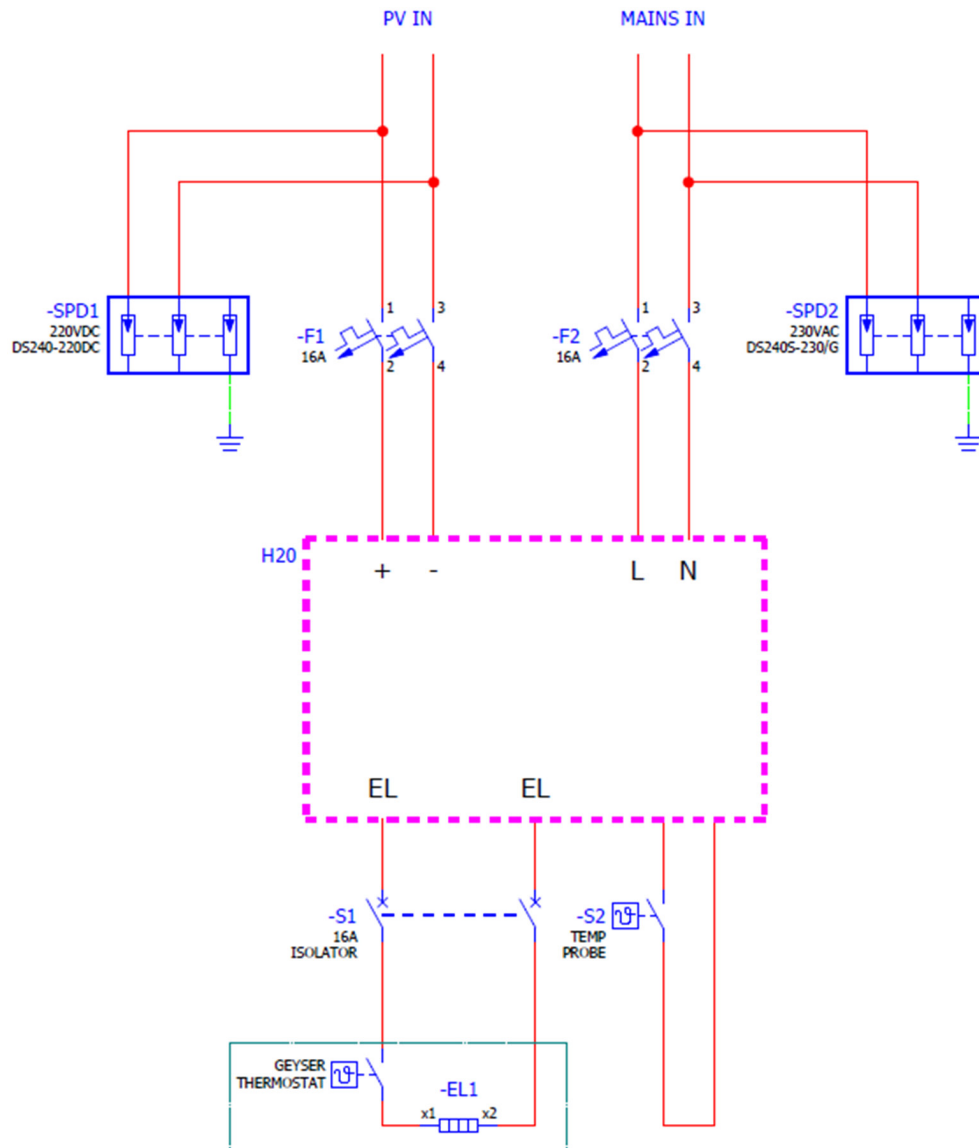


Figure 3. SGS Electrical Installation Overview.

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.

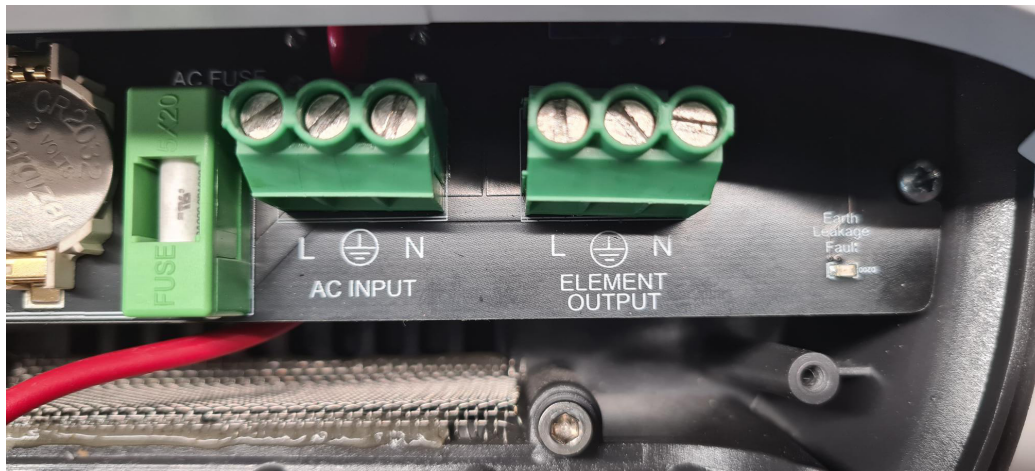


Figure 4. SGS AC Input (Left) And Element Output (Right)

EXISTING INSTALLATIONS

AC Supply to SGS

Remove the power cable feeding the existing geyser from the terminations inside the geyser’s terminal chamber or local isolator at the geyser, 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 Geyser 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 Geyser’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 Geyser.

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 Geyser 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 Geyser’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 Geyser.



Ensure that the Geyser is fully earthed, according to local regulations.



Ensure that the geyser’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 120 – 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 geyser, 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 geyser and work towards the SGS. With the power to the geyser switched off, remove the standard geyser thermostat and feed the copper strip into the thermostat pocket, all the way up to the collar.

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

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 geyser 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.

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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

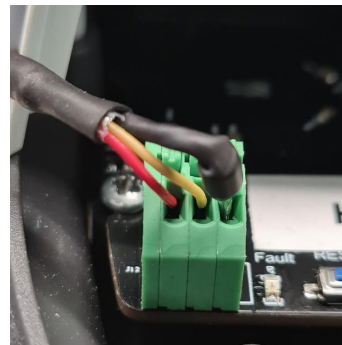


Figure 7. Temperature Sensor's Connections To The SGS PCB

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



The supplied temperature probe is 10m long. 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 geyser 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.

6. COMMISSIONING & OPERATION

6.1 COMMISSIONING

The SGS is designed to assume temperature control of the geyser 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 geyser 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.

6.3 DEFAULT SETTINGS

The SGS can work directly out of the box with no further settings or internet connection.

The factory temperature settings are as follows and can be changes by connecting the SGS to a mobile device (see section 7):

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

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)

6.4 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 geyser 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, geyser and AC supply should be treated with great care and the fault located and corrected urgently.

6.7 SERVICE, SUPPORT AND REPAIRS

If the SGS is damaged, becomes faulty or in any way fails to work correctly, it will require repairs by Apex.

To request support or an RMA number please go to: www.ApexSolar.Tech

7. MOBILE APPLICATIONS & WIFI CONNECTIVITY

7.1 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.

It can be found at: www.ApexSolar.Tech

Installing the Apex SGS's App:

After opening the provided 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:

ANDROID DEVICES**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.

Note that in Android 8 and higher an "Add to Home screen" permission request will be shown first.

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.

Other Browsers

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

IOS DEVICES

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.

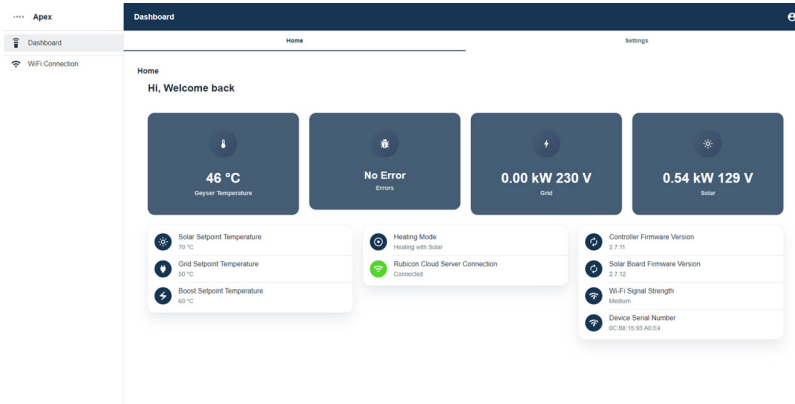
7.2 CONNECTIVITY

A new Apex SGS will start up with its own Wi-Fi hotspot active and this is indicated by the Status LED on the SGS alternately turning off and then displaying the status colour, about once per second.

The hotspot can be identified by browsing available Wi-Fi hotspots with a mobile device and searching for one with a name that contains "SGS" and the SGS's MAC address, For example SGS_aa94bc5633.

Select the hotspot that corresponds to that name; the password is 123456789. Once you have joined that network, open a browser and navigate to <http://192.168.4.1>

The username and password are "guest" and "guest".

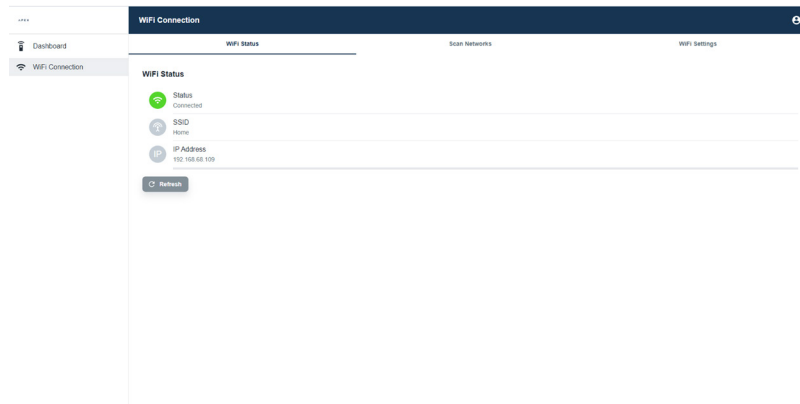


Once in the webpage, the dashboard is the default page from which one can see geyser temperature and a few pieces of live telemetry.

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 Web App to work. In the side bar, navigate to “Wi-Fi Connection”. From there, click on Scan networks to allow the device to be connected to the Wi-Fi. 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. You can now use the Web App and you are now connected to the cloud (but not yet provisioned). Connection can be confirmed by viewing the Wi-Fi status tab. The local portal will now also be available at the IP address shown on your page. Please note that the IP address does change from time to time unless you set a static IP address.



To start using the Web app, navigate to <https://Monitor.ApexSolar.Tech> and sign in (or create an account if not done so already).

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 to be enrolled by a qualified installer.

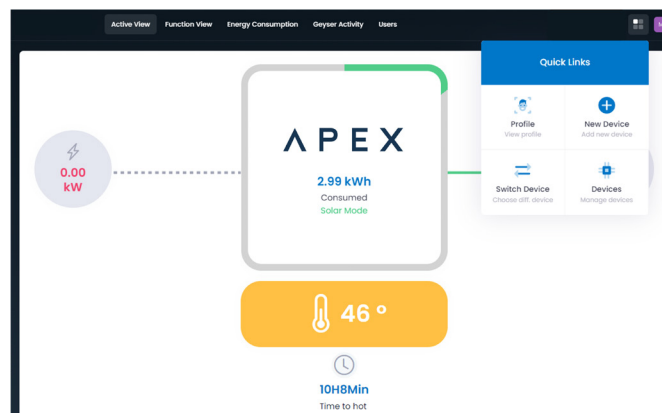
An Installer needs to have an account registered on <https://Monitor.ApexSolar.Tech> to be created on the Apex SGS’s server once they have been accredited, with a username and password.

To register as a qualified installer, contact our support via support@rubiconsa.com

Once accredited, an installer can enrol a site by logging in with the credentials you were supplied.

7.3.1 ENROLLING A DEVICE

Once the installers account has been created, the installer can sign in and is able to enrol a new device. At the top right of the page, click the four-square-icon (Quick Links), then click New Device.



The enrolment information can be entered into the form as shown. The device ID is found on the local portal of the SGS in the Dashboard at the bottom right. Enter the Device Type, Device ID and a meaningful Device Name.

Enroll Device
✕

Device Type

Device ID

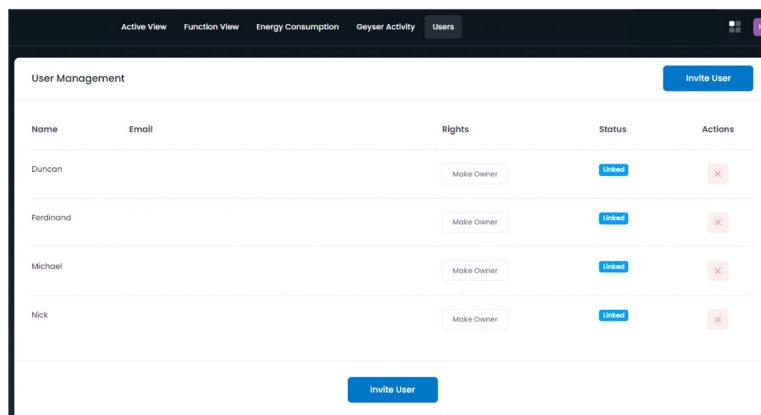
Device Name

Cancel
Add

Once the device has been successfully added, you'll be able to view its live and historical telemetry.

7.3.2 INVITING A USER

Once enrolled, a device can be shared with a user by navigating to the Users page. By clicking Invite User, you will be able to enter the user's email address and send an invite to them. They will receive a welcome email which they can follow to set up an account and view the site.

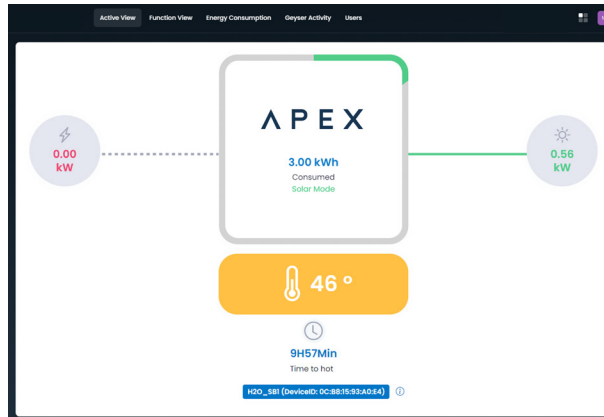


7.4 USER'S REMOTE MONITORING

Apex SGS is managed, monitored and controlled with the SGS web app.

The Application requires an Apex SGS's user to have been enrolled by a Qualified Installer and have the site shared with them before they can view the site. Please contact your installer or Apex's Support if you have not yet been enrolled. Once they have been enrolled, a new Apex SGS owner's installer can share this link and they can then open it with their mobile device's browser.

<https://Monitor.ApexSolar.Tech>



Menu: Active Menu

The primary view of your Apex SGS is the “Active View”. This gives an overview of the status of the device, including current active power sources, geyser temperature and overall status. The Active View is shown below. In the centre, there is an energy counter in kWh that shows the total energy used to heat the geyser that day. The green/grey pie graph around the centre depicts the quantity of that energy derived from solar (green) vs from grid (grey).



Menu: Function

The Function View is where you can interact with your Apex SGS.

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.

Turn Grid Off:

This disables the use of grid power for heating your water, even if it is available. Tap again to deactivate.

Away:

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

Notifications:

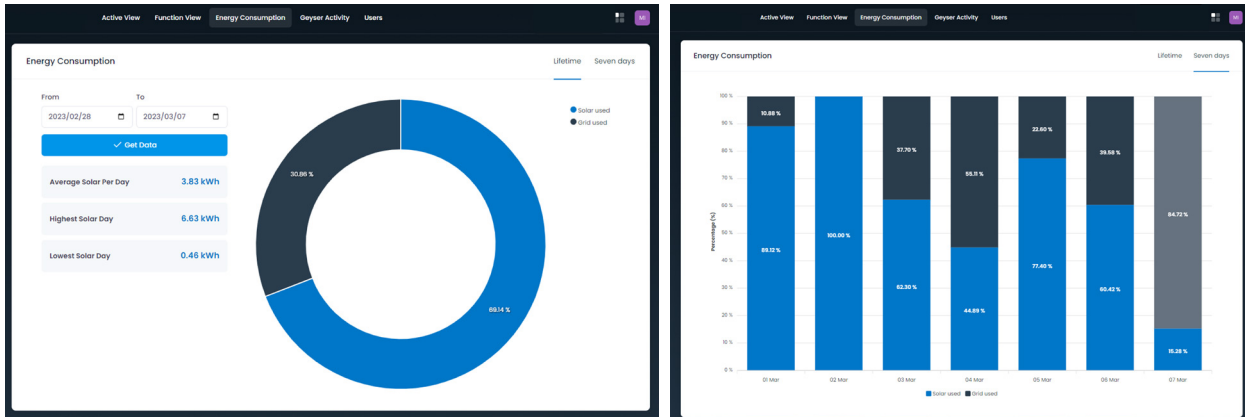
All errors or other notifications will be displayed here.

Settings:

You can change the temperature setpoints for Grid, Solar and Boost modes here.

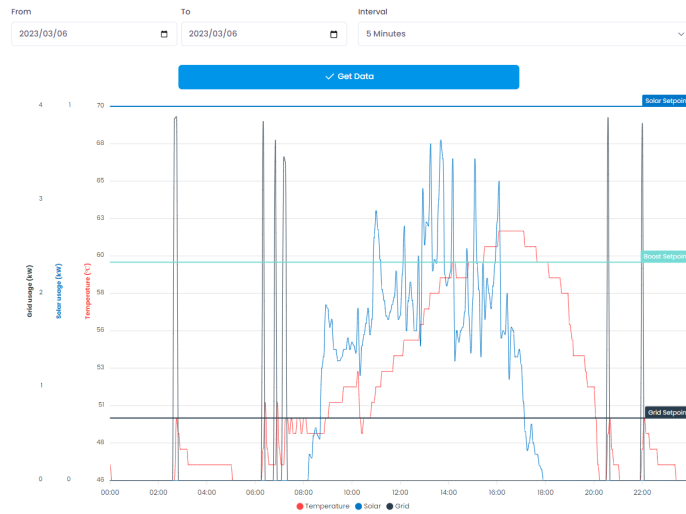
Support:

Contact Apex for support from here.



Menu: Energy Consumption

This view allows you to visualise your energy usage statistics by the different modes, filtered by your preferred period. To view the graph, select a start and end date and then tap Get Data. It is also possible to view the last 7 days' history in bar graph format by tapping the Seven Days tab.



Menu: Geyser Activity

The Geyser Activity view enables the user to view the geyser's temperature and heating cycles by source graphically over a period. To create a graph, select start and end dates and then tap Get Data. Once the graph is displayed, you can turn each power source's activity on or off by tapping either the grid or solar icons.

8. ORDERING INFORMATION

Part Number	Description
FG-ED-OO	Apex Solar Geyser System 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

9. WARRANTY

The Apex SGS is warranted to be free from defects for a period of 1 year from purchase, subject to Apex's Warranty terms and conditions, a copy of which is available at: www.ApexSolar.Tech

10. SUPPORT

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

10.1 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)

10.2 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.