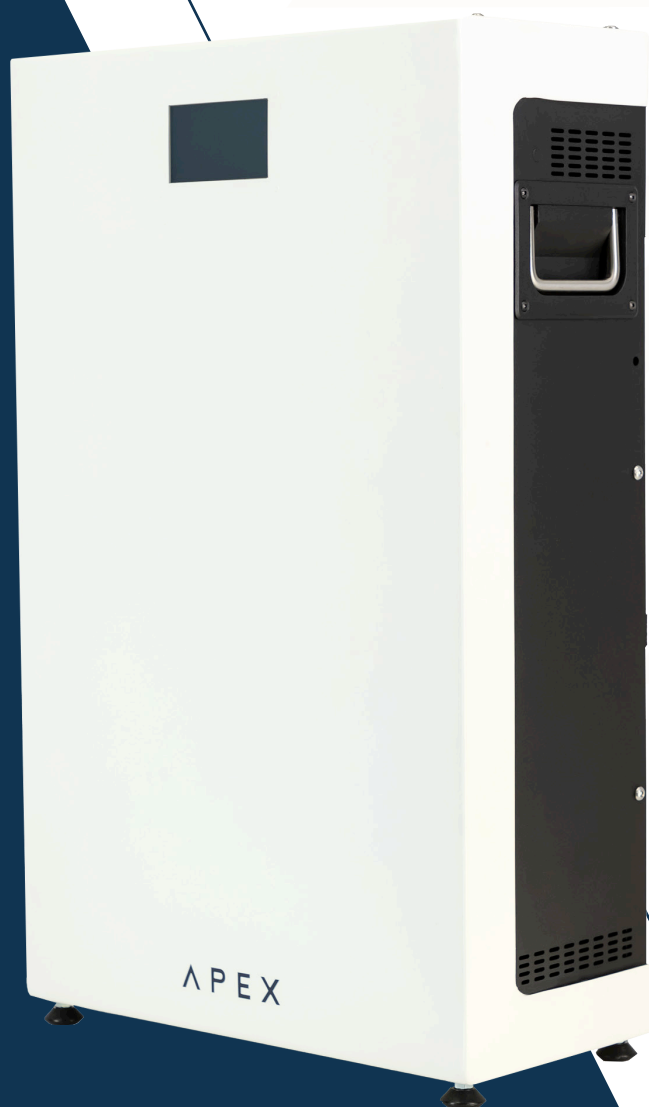


APEX



B12K

11.7KWH 51.2V
Technical Manual

12KWH Lithium Battery

Lithium-Ion Energy storage for residential and light commercial applications.

- Ideal for urban use in on or off-grid applications.
- Monitor and control your Apex B12K on any compatible browser.
- Compact and energy dense.
- State of the art BMS for cell and system management.

The APEX B12k Lithium Ion Battery is designed for use in demanding on and off grid applications. The stylish design, colorful display and small footprint make it at home in any setting. Designed with as top priority, the BMS manages all aspects of the device, including temperature, current, multiple voltages and more. Making use of APEX's renowned FET Block technology, the B12k's robust protection systems can connect and disconnect the battery from loads or supplies when it needs to with reliability and safety.

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1. INTRODUCTION

Lithium-Ion Energy storage for residential and light commercial applications.

- Ideal for urban use in on or off-grid applications.
- Monitor and control your Apex B12K on any compatible browser.
- Compact and energy dense.
- State of the art BMS for cell and system management.

The APEX B12K Lithium-Ion battery is designed for use in demanding on and off-grid applications. The stylish design, colorful display and small footprint make it at home in any setting. Designed with safety as top priority, the BMS manages all aspects of the device, including temperature, current, multiple voltages and more. Making use of APEX's renowned FET Block technology, the B12K's robust protection systems can connect and disconnect the battery from loads or supplies when it needs to with reliability and safety.

1.1 CONTENTS OF THE BOX

Inside the box you should find:

- 1 x Apex B12K battery

1.2 DEVICE DOCUMENTATION

Apex B12K documentation includes this manual, its datasheet and the warranty terms.

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 B12K battery. 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.

2. TECHNICAL SPECIFICATIONS

Parameter	Specification
-----------	---------------

GENERAL PARAMETERS

Nominal Voltage	51.2V DC
Total Capacity (When New)	11.7kWH
Available Capacity (When New)	> 11kWH
Maximum Charge Current	230A
Maximum Discharge Current	230A
Max. Charge C-Rate:	1C
Max. Discharge C-Rate:	1C
DC Connection	2 x M10 brass stud terminals
Storage SoC	30 - 50%
Transportation SoC	30 - 50%
Chemistry	LFP
Life Expectancy	> 7000 cycles @ 1C, 90% DOD, 25°C
Performance Warranty	> 6000 cycles @ 1C, 90% DOD, 25°C, min 70% SOH
	10 Years

COMMUNICATIONS

Network Connection	1 x Ethernet, RJ45
CAN Connections	2 x RJ45 (2 separate busses)
Remote Updates (Firmware Over The Air)	Ability to update firmware remotely

MECHANICAL SPECIFICATIONS

Dimensions (Length X Breadth X Depth)	450mm x 730mm x 220mm
Cooling	Natural Convection
Weight	100kg
Ingress Protection	IP20
Terminal Access	Removable cover

INSTALLATION SPECIFICATIONS

Mounting	Vertical only
Environment	Indoor use only. Not for outdoor installation.
Method	Floor standing only

ENVIRONMENTAL CONDITIONS

Maximum Permissible Ambient Temperature Range	0°C to +45°C
Relative Humidity	0 % - 80% non-condensing
Operating Altitude	0...2000m

Parameter	Specification
-----------	---------------

DEVICE SAFETY FEATURES

Device Over-Temperature Shutdown	BMS over temperature and cell overtemperature
Cell Over And Under Voltage Protection	Yes
Overcurrent Protection	Software, Fuse

USER INTERFACE

On Device	Color LCD
Remote Interface	Web browser

3. SAFETY INSTRUCTIONS

Please read and follow all the below safety instructions and precautions before installation and use of the Apex B12K battery.

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 B12K battery.

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 B12K 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.



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.

3.5 SPECIAL HAZARDS

The Apex B12K 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.



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 B12K. Ensure that the system is switched off or disconnected during handling.

3.6 INSTALLATION LOCATION

The Apex B12K may only be installed indoors, placed onto a firm surface and be protected from water, excessive dust, corrosion and humidity. It should never be installed in any location where a potential water leak could occur. *See section 5 for detailed installation information.*

3.7 ALTERATIONS



It is strictly prohibited to carry out any alteration or modification to the Apex B12K or any of its accessories.

3.8 CLEANING AND MAINTENANCE

Cleaning and maintenance should only be carried out with the Apex B12K disconnected from the load and charger. Before taking any action, make sure that the system has been correctly isolated by opening the electrical isolators or fuse protection. To clean the B12K, 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 B12K 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 B12K 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 an Apex B12K 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.

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 B12K. No part of this manual shall supersede any local laws, bylaws or other regulations. These include but are not limited to: earthing, installation rules, local electrical isolation requirements and so on.

3.12 OTHER CONSIDERATIONS

This device is exclusively designed to store energy provided by either the grid, a solar array or both via appropriate, approved charging devices or inverters and is to be installed in a domestic or light commercial setting.

The Apex B12K 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 B12K 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.

3.13 LITHIUM BATTERY SAFETY

This battery is built using high quality Lithium Iron Phosphate cells. This is a very stable and safe chemistry and the cells have multiple integrated safety mechanisms. All batteries have risks associated with them due to the energy stored within them. However, this table shows the results of tests of the behavior of these cells when intentionally exposed to abnormal conditions.

DEVICE SAFETY FEATURES

Scenario	Behavior
Over Discharge	No explosion, no fire, no leakage
Over Charge	No explosion, no fire
Short Circuit	No explosion, no fire
Drop Test	No explosion, no fire, no leakage
Heating	No explosion, no fire
Extrusion	No explosion, no fire
Seawater Immersion	No explosion, no fire
Temperature Cycling	No explosion, no fire, no leakage
Low Pressure	No explosion, no fire, no leakage
Thermal Runaway	No explosion, no fire

Note: APEX stresses that these are controlled tests and should not be repeated. These conditions and behaviors are not in any way warranted but are provided as an indication of general safety mechanisms built into the cells.

4. DEVICE DESCRIPTION

4.1 OVERVIEW AND DESCRIPTION

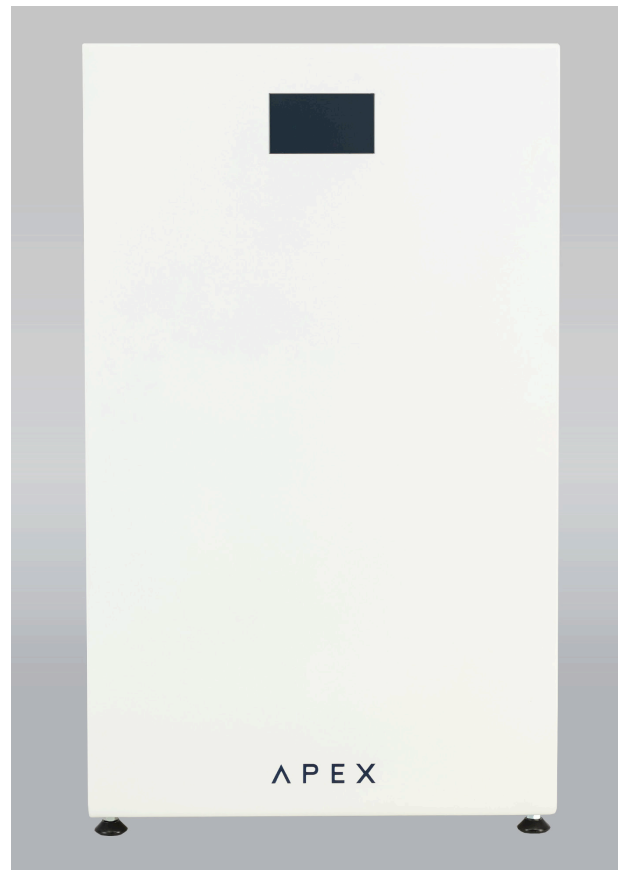


Figure 2 : Front Of Battery



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 B12K has 4 electrical interfaces:

Main Power Terminals:

2 10mm studs are the main power carrying electrical Interface to the load and charger / inverter. This interface is designed to supply or receive power at a maximum rate of 1C or 230A, and at a nominal voltage of 52V.

CAN Bus:

The battery is fitted with 2 CAN interfaces and is designed to communicate with its charge controller / load / inverter via CAN bus. This allows the battery to control the charge and discharge rates and share various parameters such as state of charge with other equipment. The last battery will be connected to the inverter with the "OUT" port. In the case where more than one battery is connected in parallel, they are connected on a CAN bus for the purposes of aggregation of communication with the load / charger.

Network:

The Apex B12K can connect to a standard 100 base-T Ethernet network for remote access and monitoring using an RJ45 connector. The network requires transparent internet connectivity and a DHCP server.

4.3 IDENTIFICATION

The B12K is shown in Figure 2. Each B12K is uniquely identified by its serial number which is placed on the product label, on the side of the device.

5. INSTALLATION

5.1 SAFETY AND IMPORTANT INSTALL INFO



As the B12K is installed into a building's electrical infrastructure, it is necessary to ensure that the installation area is secured and safe before beginning the installation.



The B12K may not be mounted horizontally or at an oblique angle. It must be mounted with the terminal chamber at the top of the front cover (ie: correctly rotated).



The B12K may not be installed within a ceiling or roof cavity.

5.2 INSTALLATION OF THE B12K

To begin your B12K installation, locate a suitable position for it which fulfils all of the following criteria:

The B12K shall be installed with all the relevant electrical protection and isolation.

DC over-current protection and local isolation is required – a fuse disconnecter is recommended.

- A firm, even floor surface.
- A location that is fully indoors.
- Free from excessive dust and moisture.
- Free from external heat sources.
- Has free airflow and at least 300mm clearance all around.
- Is not subjected to heat generated by another device.
(eg: near a cooker or directly adjacent to another heat source)
- It may not be mounted inside a cupboard or other place without free air flow.

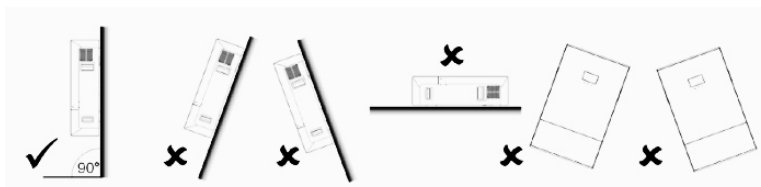


Figure 3. B12K Typical Installation,
Connected With A Fuse Disconnecter

5.3 ELECTRICAL INSTALLATION

NEW INSTALLATIONS

DC Supply To The B12K

Connect the inverter with a cable having a cross section suitable for carrying 230A or more to the B12K, via the external fuse protection. This cable carries high current and care should be taken in sizing it as well as all crimps and terminations. It is important that the nuts on the B12K's M10 terminals are fully tightened to 21nM.

Internet Communications

The device can be remotely monitored and managed by making use of the included internet monitoring service. To use the service, connect the battery to an internet connected network with a standard Ethernet patch cable.

CAN Communications

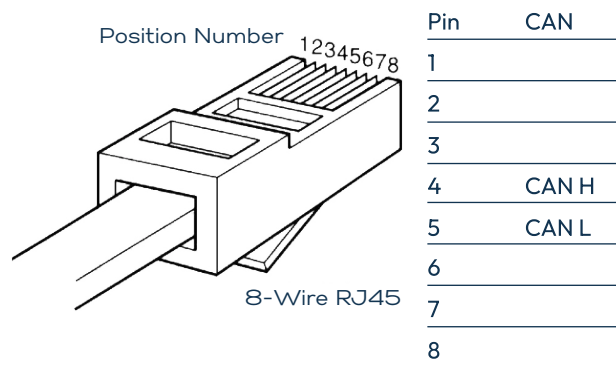
2 separate CAN communications busses are integrated into the battery. These busses have 2 primary purposes:

- Connecting a B12K battery to the inverter.
- Connecting multiple batteries to each other to aggregate communications to the inverter.

To establish communications to the inverter:

- 1) Ensure that the inverter is on the verified compatible list.
- 2) Connect the inverter to the OUT port using the correct cable for your equipment. See pinout below.

Note: It is not necessary to terminate the battery end of the bus with a termination resistor, as it is done for you. However, depending on the inverter used, it may be necessary to terminate the bus on that end of the cable.



To establish communications between batteries:

- 1) Connect the OUT port of the first battery to the IN port of the next, using a standard premade Ethernet patch cables. See pinout below for use in the case that you need to manufacture your own.

Note: It is not necessary to terminate either of the battery CAN busses with a termination resistor, as it is done for you.



6. COMMISSIONING & OPERATION

6.1 COMMISSIONING

The B-12K is designed to manage the characteristics of its charging and discharging by transmitting charge targets and status information to the load to ensure that it can avoid undesirable conditions such as over current, over temperature, over discharge and so on. In the event of a failure of the CAN communications, the internal BMS protection mechanisms will ensure that any dangerous conditions are stopped, using the internal battery disconnection mechanism.

6.2 COMMUNICATION CONNECTIONS

The B-12K is designed to manage the characteristics of its charging and discharging by transmitting charge targets and status information to the load to ensure that it can avoid undesirable conditions such as over current, over temperature, over discharge and so on. In the event of a failure of the CAN communications, the internal BMS protection mechanisms will ensure that any dangerous conditions are stopped, using the internal battery disconnection mechanism.



Ensure that the communications are correctly connected between batteries and to the inverter.

CAN Bus is used to connect multiple batteries together, as well as to the inverter.

To connect your batteries together into a single bank, refer to the Installation section of this guide.

Connect a cable from the battery's CAN port to that of the inverter. Depending on which inverter is used, it may be necessary to crimp your own cable according to the pinouts shown in section 5. For APEX inverters, a standard Ethernet patch cable can be used.

Refer to the "Installation" section.

It is not necessary to configure CAN addresses on the batteries – this is done automatically for you.

6.3 LCD DISPLAY

The B12K uses a touch sensitive display to indicate its status, provide information and to change settings or parameters.

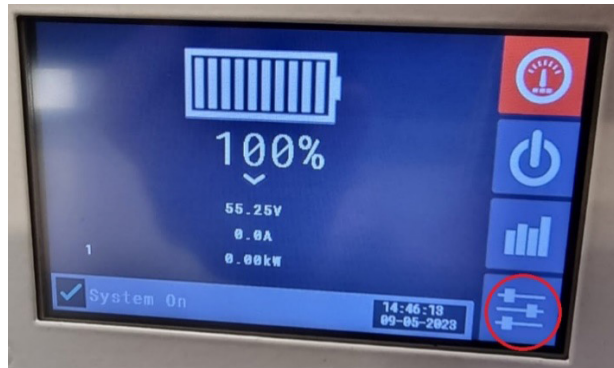
6.4 DEFAULT SETTINGS

Depending on the inverter, the B-12K can work directly out of the box with no communications Settings required.

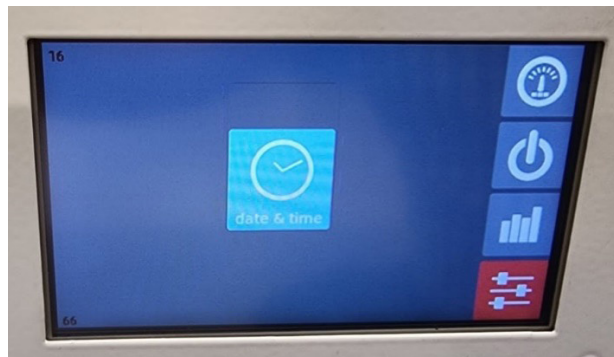
6.5 DATE AND TIME

The B12K uses a touch sensitive display to indicate its status, provide information and to change settings or parameters.

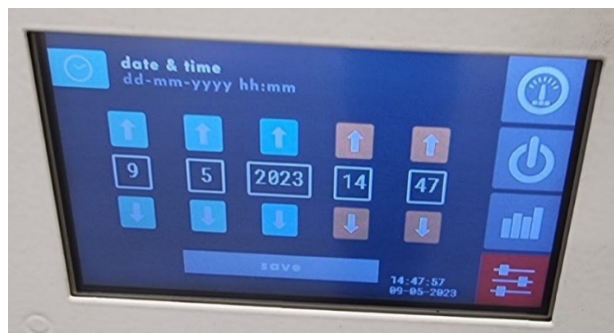
Please set the Clock before use. This allows you to accurately log and trace events on your battery.



Open the Settings menu, Select Date and Time.



Adjust the time and calendar as required.



6.6 PRE-CHARGE

The battery contains a special pre-charge circuit which provides a controlled way to charge the large capacitors on the inverter's DC bus.

During startup, the pre-charge circuit will limit the output current to 7A. If the output voltage increases to within 2.5V of the pack voltage it will transition to system on mode.

If the output voltage doesn't reach the target in 1 minute, the battery will return to System Off mode.

6.7 STARTUP

To command the battery to connect to the load and or charger:

- 1) Turn on the power switch on the top of the battery, under the terminal cover. The display will now start.



- 2) From the main screen, select the Power icon on the right.



In the Power control screen, press the Start / Stop button.



The battery will attempt to pre-charge the inverter DC bus capacitors. If this operation is completed successfully, the FET switches will close, allowing current to both enter and leave the battery.

6.8 REPORTS AND LOGS

The battery maintains a set of logs and can graph various properties. To access these, click on the Reports icon on the front screen.

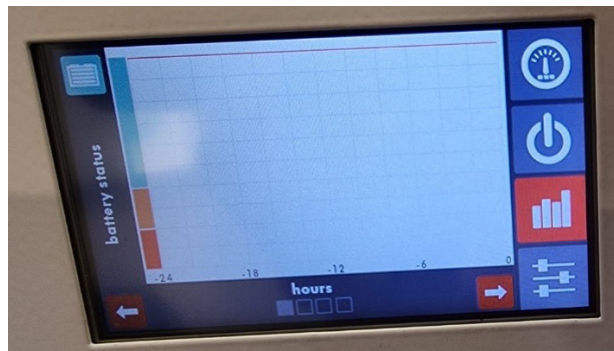


You can now Select one of the following:
Event Logs:



This list is a log of all the system events. It is useful for finding the cause of system faults or errors

Battery Status Graph:



This graph plots the status of the battery over the last 24 hours.

Parallel Information:

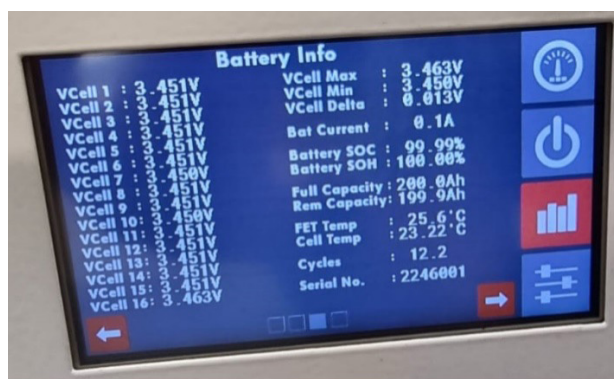


Use this screen to monitor the entire battery bank of an installation.

Total capacity, remaining capacity, number of batteries and their CAN ID's can be found here.

Useful information about the cell voltages is also available here.

Battery Information:



View the detailed information of a specific battery here.

This shows Current, Voltage, full and remaining capacity, state of health, internal temperature measurements, number of cycles and all the cell voltages.

6.9 FAULT FINDING

If the B12K does not work correctly or displays a fault on the display, it is necessary to correct an abnormal occurrence before restarting. All error status messages are available in the User App or on the local display. Once an error is corrected, the fault will automatically clear and the battery will restart.

The following table shows monitored faults which can occur and possible corrective actions:

Error	Name	Description	Action
0	No Error	System normal	N/A
1	Cell Over Voltage	A cell has exceeded 3.7V	Correct external overcharge cause
2	Cell Under Voltage	Battery voltage too low (empty)	Recharge battery
3	Over Current	Too much current from load or charger	Decrease load or charge current
4	FET Over Temperature	FET block over temperature	Decrease load / charge current Ensure environment complies
5	Battery Over Temperature	Cells have exceeded maximum temperature	Decrease charge or load current Ensure environment complies

If a fault recurs after rectifying possible causes, power down and discontinue use of your B12K and contact our Support department.

6.10 OTHER ERRORS

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

Fuse:

The Apex B12K contains a fuse inside. Should it fail to supply power correctly, check the fuse under the rear cover.



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

Pre-charge circuit:

During startup, the pre-charge circuit will limit the output current to 7A. If the output voltage increases to within 2.5V of the pack voltage it will transition to system on mode.

If the output voltage doesn't reach the target in 1 minute, the battery will return to System Off mode.

This same logic is also employed after an over-current event. The battery will go to startup mode which will attempt to pre-charge to inverter bus. If a short is still present it will fail to pre-charge and turn off.

6.11 SERVICE, SUPPORT AND REPAIRS

If the B12K 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

6.12 WARRANTY

The Apex B12K's Warranty and Warranty terms and conditions are available at: www.ApexSolar.Tech

7. MOBILE APPLICATIONS & WIFI CONNECTIVITY

7.1 APP INTRODUCTION

The Apex B12K can be configured and monitored via the included cloud application, which works on Android, iOS and desktop computers. The application 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 B12K 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.

7.1.1 WEB APP AND REMOTE ACCESS

The Apex B12K needs to be connected to a local network with internet access for the Web App to work.

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

7.2 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.

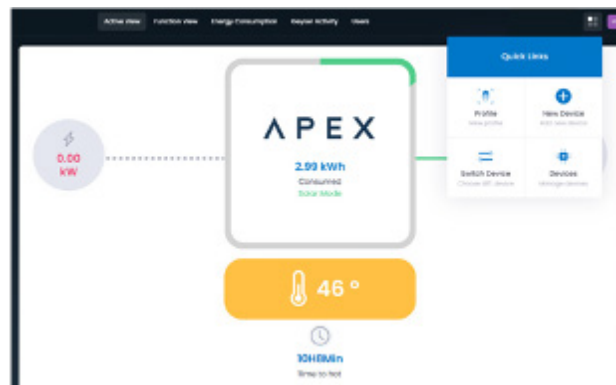
An Installer needs to have an account registered on <https://Monitor.ApexSolar.Tech> to be created on the Apex SGS's server once they have been accredited, with a username and password.

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

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

7.2.1 ENROLLING A DEVICE

Login to the portal. 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 B12K in the Dashboard at the bottom right. Enter the Device Type, Device ID and a meaningful Device Name.

Enroll Device

Device Type

Geyser

Device ID

Hxxxxxxx

Device Name

Granny's Geyser

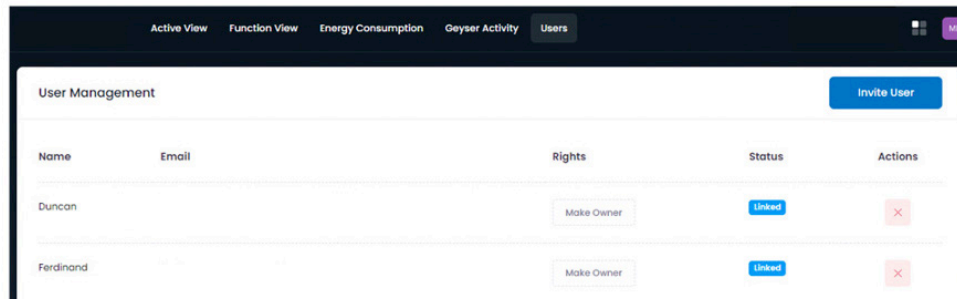
Cancel

Add

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

7.2.2 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.



7.3 USER'S REMOTE MONITORING

Apex B12K is managed, monitored, and controlled with the B12K web app.

The Application requires an Apex B12K'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 B12K owner's installer can share this link and they can then open it with their mobile device's browser.

<https://Monitor.ApexSolar.Tech>

The primary view of your Apex B12K is the "Active View". This gives an overview of the status of the device, including current, SoC, voltage and overall status.

The Function View is where you can interact with your Apex B12K.

Notifications:

All errors or other notifications will be displayed here.

Settings:

You can change the battery's date and time here.

Support:

Contact Apex for support from here.

8. CONTACT US

For more or updated information, new products and technical support please visit:

www.ApexSolar.Tech