APOLLO 2.0

NEXT GENERATION AUTOMATED CALIBRATION SYSTEM

User Manual

INTRODUCTION

The Apollo Calibration System is designed for testing and calibration of Sirius Energy Storage Modules and issuing test reports of tests performed on the modules. The key feature of this equipment is its energy saving capability while testing and calibration without using any external power.

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1. SAFETY INSTRUCTIONS

This manual contains instructions for unpacking, mounting, installation and operation of Apollo. Please read this manual carefully before operating the system and follow all warnings and safety instructions to prevent accidents. The Apollo must be installed by qualified and trained personnel only.

1.1 Symbols Convention:

Safety instructions and general information that appears in this manual are described.

⚠	**Caution!** ''Caution" indicates hazardous situation which, if not avoided could result in minor or moderate injury.

⚠	**Warning!** ''Warning" indicates hazardous situation which, if not avoided could result in major injury.

⚡	**Danger!** ''Danger" indicates hazardous situation which, if not avoided could result in serious injury or death.

⚠	**Note!** 'Note" provides tip that are valuable for optimal operation of your product.

1.2 Qualified Installer:

Selling and installation of this product is only through the Company's Resellers who are trained on installation, operation and maintenance of the Apollo.

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1. Safety Instructions
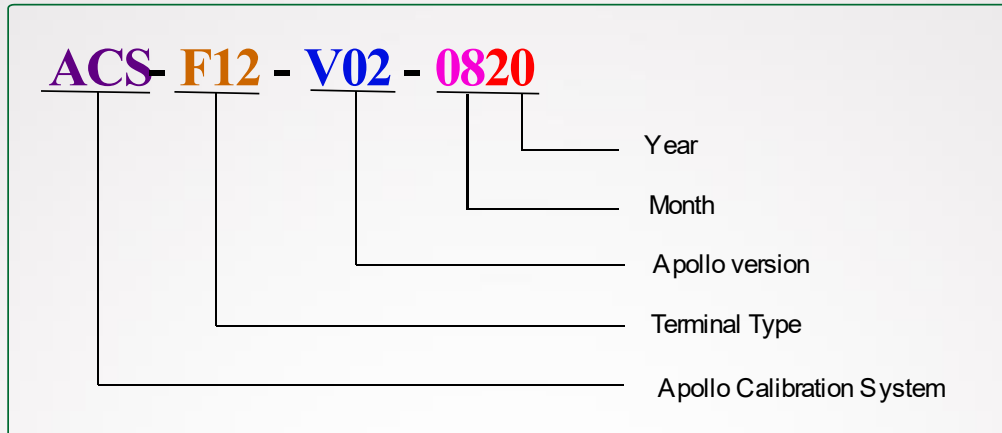
1.3 Safety Precautions:

This Apollo is designed to provide years of trouble-free operation. Proper handling is required to avoid any damage. The following safety precautions should be observed for safe use.

- ✓ Always wear proper personal protective equipment (eyes protection, gloves and safety shoes).

- ✓ Always make sure Apollo is set as recommended.

- ✓ Do not subject the Apollo to strong impact.

- ✓ Do not dispose the Apollo in a fire.

- ✓ Do not operate the Apollo above the specified voltage.

- ✓ Under no circumstances must the charging current exceed 80A.

- ✓ Under no circumstances must the discharging current exceed 80A.

- ✓ Do not expose the Apollo to temperature in excess of 60°C.

- ✓ Do not disassemble the Apollo under any circumstances.

- ✓ Do not expose the Apollo to moisture or liquids.

- ✓ Ensure precautions to prevent short-circuit under all circumstances.

- ✓ Do not connect or disconnect terminals from the Sirius Module without first disconnecting the Apollo.

- ✓ Do not touch the terminals with conductors while the Apollo is charging/discharging. Serious burns, shock, or material fusing may occur.

- ✓ Protect surrounding electrical components from incidental contact.

- ✓ When connecting to external devices ensure that galvanic isolation does not exceed 1000V.

- ✓ In case the Apollo is physically damaged due to any event, do not install and energize the Apollo under any circumstances and immediately contact your Reseller.

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2. PRODUCT INTRODUCTION

2.1 Part Number:

ACS- F12 - V02 - 0820

- Year
- Month
- Apollo version
- Terminal Type
- Apollo Calibration System

2.2 Product Overview:

2.2.1 Appearance:

The appearance of the Apollo is shown in figure 1:

Figure 1. Apollo 2.0 Appearance

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2. Product Introduction

2.2.2 Mechanical Drawings:
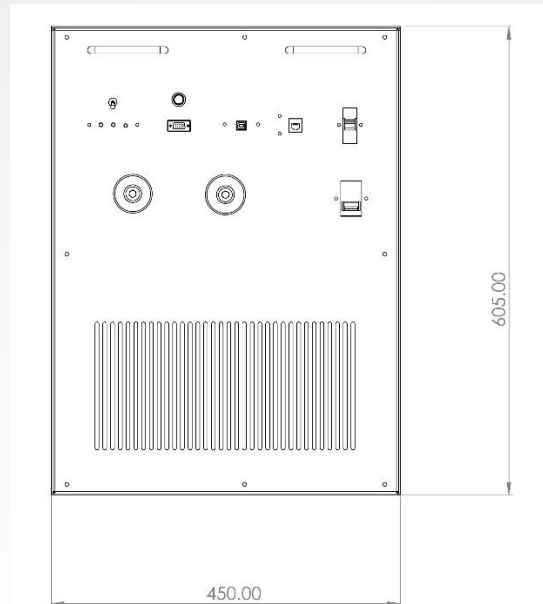
Figure 2. Front View

Figure 3. Backside View

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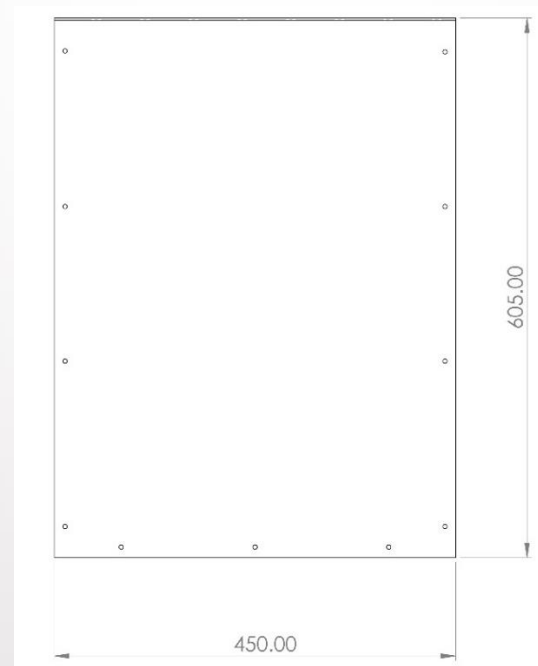
2. Product Introduction
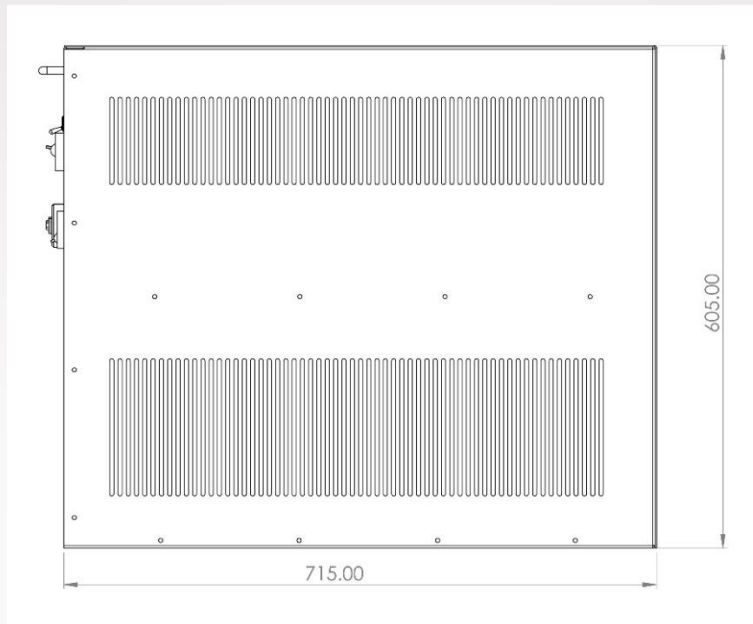
Figure 4. Side View

Figure 5. Isometric View

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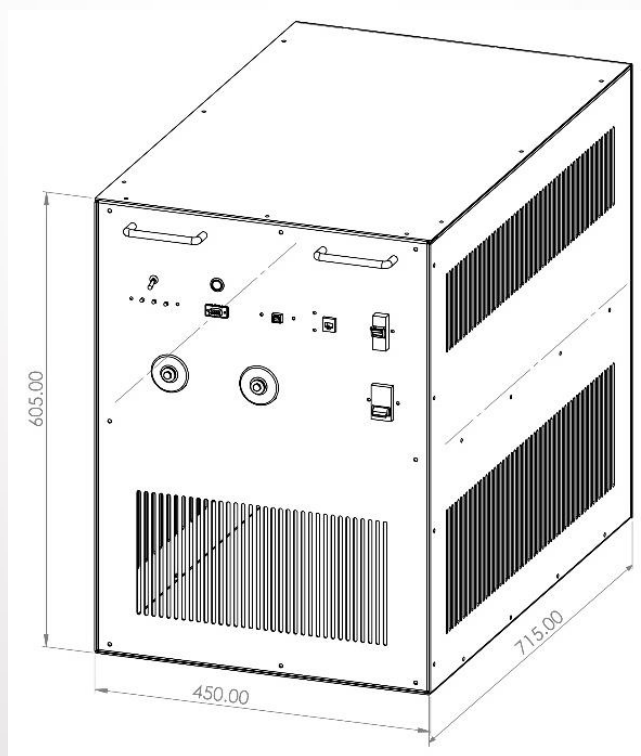
2. Product Introduction

2.2.3   Dimensions and Weight:

Width	450 mm
Length	715 mm
Height	605 mm

Table 1. Dimensions

2.3   Front Panel Description:
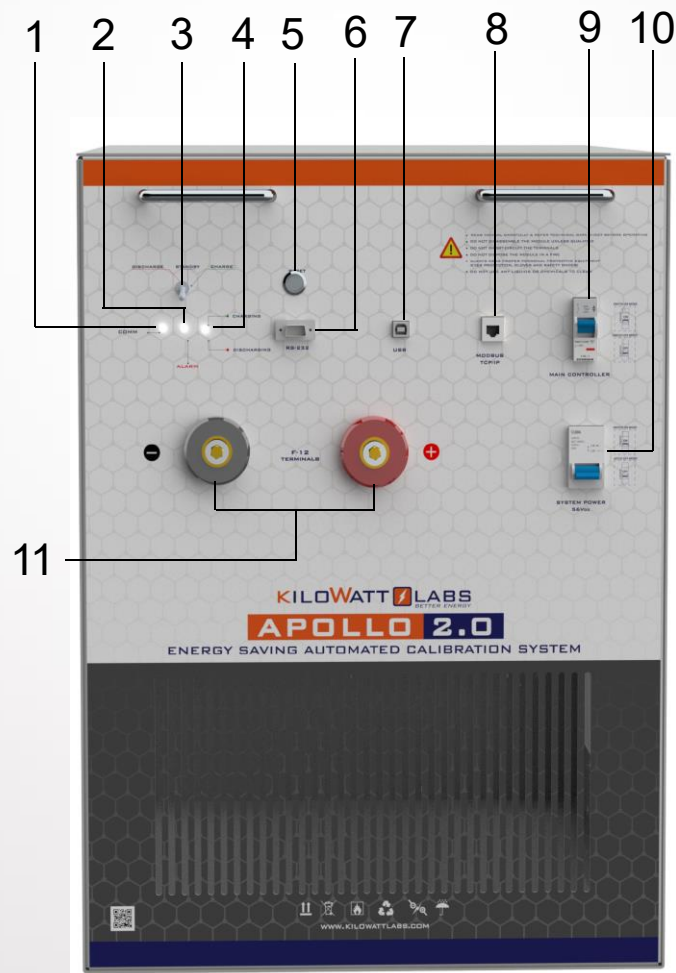
Figure 6. Front Panel Description

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2. Product Introduction

1. Comm Status LED

COMM Status LED indicates the communication status.

Color	Status	Indication
Green	Blinking	The Apollo is communicating with Apollo software.
Green	Steady	The Apollo is on standby mode.

2. LED Alarm Indicator

LED alarm indicator will be blinking every 1sec if over-current, over- voltage, under-voltage, or over-temperature occurs. If the Apollo voltage drops below 56V or exceeds 59V, alarm will be activated. If the Apollo temperature reaches 45°C, built-in fan will automatically turn ON until it falls back to 35°C. If in case the temperature continuously rises up to 60°C, alarm will be activated and calibration will stop.

3. Switch

It is used to manually select charging or discharging operation with default current of 10A. To start operation, user needs to press Set Button. *Feature available upon customer request.*

4. Charging/Discharging LED Indicator

The color of the LED indicates the Apollo status.

Color	Indication
Green	The Apollo is charging.
Red	The Apollo is discharging.

5. Set Button

Set Button is a push button used to start the Apollo charging or discharging operation. *Feature available upon customer request.*

6. RS 232 Port

RS 232 is a connector for monitoring, testing, and calibrating Sirius Module using Apollo software. *Feature available upon customer request.*

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7. USB Port

This is a COMM connector for monitoring, testing, and calibrating Sirius Module using Apollo software. FTDi chip is used for this USB. *Feature available upon customer request.*

8. MODBUS TCP/IP Port

MODBUS TCP/IP is a connector recommended to use for monitoring, testing, and calibrating Sirius Module using Apollo software. User should have compatible host PC IP address to be in same network with Apollo System.

Host PC Static IP: 10.10.10.100 (Suggested IP address)
Host PC Subnet Mask: 255.255.255.0 (Suggested Subnet Mask)

9. Main Controller Breaker

10A Main Controller breaker is used to power ON the Apollo. It also acts as a second line of protection, if the circuit fails to protect the Apollo from over current, the circuit breaker will trip.

10. System Power Breaker

100A, 220V System Power Breaker is used to activate the Apollo terminals.

11. F12 Terminals

These are the output terminals of the Apollo having electronic switch protection that is limited to 100VDC only. F12 terminals are used to connect the Apollo to the Sirius Module. The red one is the positive terminal (+) and the black one is the negative terminal (-). The terminal is SSR (Solid State Relay) protected. SSR will start to decrease the pulse width in case of over-voltage or under-voltage while charging or discharging.

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3. MODULE INSTALLATION

3.1 Inspection:

Inspect the shipping carton for visible damage including cracks, dents, deformation and other visible abnormalities prior to unpacking the Apollo. Document (photograph) any damage and report this to your Reseller as well as to the shipping agent immediately. Remove the Apollo from the shipping carton and retain the shipping materials until the unit has been inspected and is determined to be operational.

3.2 Safety Gear:

Installation must strictly follow the national safety regulations in compliance with the enclosure, installation, creepage, clearance, casualty, markings and segregation requirements of the end-use application. Installation must be performed by professional installers only. Switch OFF the system and check for hazardous voltages before altering any connection! Apollo must be handled only by qualified and trained personnel. Installation should not exert bending or twisting torque to the Apollo enclosure.

> ⚠️ **Note!**
> **Read the safety Instruction section before installation.**

3.3 Unpacking and Contents Check:

Check the contents of the package.

Figure 7a) Apollo 2.0   *7b) Ethernet Cable*

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4. ELECTRICAL INSTALLATION

4.1 Connecting Apollo to Sirius Module:

For charging and discharging operation, please follow the below connections of Apollo to Sirius Module.

Recommended:

Apollo Voltage: 56V-59V

Apollo Charging/Discharging Current: 10A-80A

Module Voltage: 12V, 24V, 48V
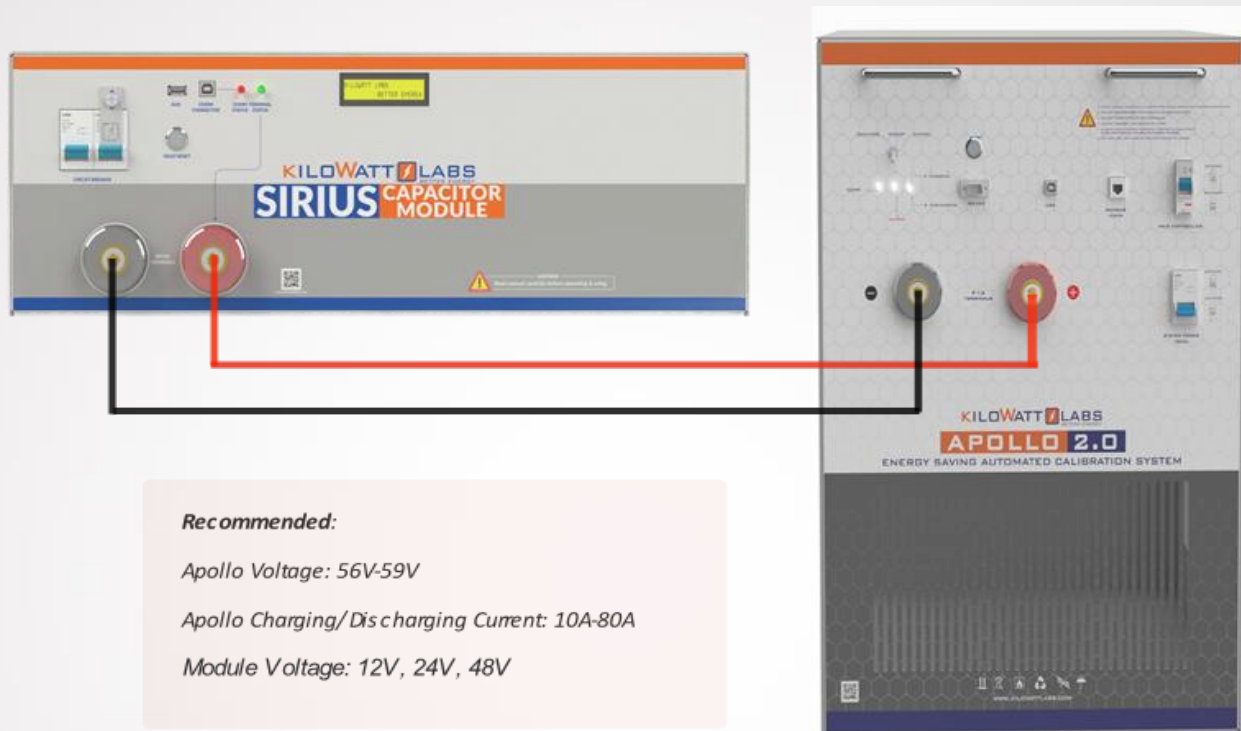
Figure 8. Connection of Apollo to Sirius Module

- Connect positive and negative terminals of Apollo to the positive and negative terminals of the Sirius Module respectively.
- Turn ON the Module Circuit breaker.
- Make sure to activate the Module by turning ON the power switch to get the output from the terminal.
- Turn ON the Main Controller breaker of the Apollo.
- Turn ON the System Power breaker to activate the terminals of the Apollo.
- After calibration is done, turn OFF first the Apollo before turning OFF the Sirius Module and safely remove the connection of the Module from the Apollo.

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5. OPERATION PROCEDURES

Apollo VIEW lets the user communicate with Apollo Calibration System over TCP/IP over ethernet interface, also establish communication with Sirius Modules over serial by USB interface and RS 232 interface. For proper communication, users should do couple of simple network configuration steps:

Installing Apollo VIEW Installer and Required Drivers

Apollo Calibration system needs host PC to Sirius Module communication over serial, for this purpose required drivers should be installed completely. All the required drivers and Apollo VIEW desktop application can be installed by Apollo VIEW installer which can be downloadable over https://www.amberandwaseem.com/. Whenever installer finishes installing, Apollo VIEW application will appear on host PC desktop and ready to run.

5.1 Apollo Configuration:

Follow the steps below to switch ON the Apollo.

Step 1: Connecting the Load:

Connect the negative and positive terminals of the Apollo to the negative and positive terminals of the Sirius Module respectively.

Step 2: Apollo Start-Up:

1. Turn **ON** the Main Controller breaker by pushing the operating lever upwards. Figure 9 shows that the Apollo is turned **ON**.

Figure 9. Main Controller Switch turned ON

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2. Turn ON the 100A System Power breaker on the front panel to activate the terminals of the Apollo.

3. Comm Status LED and Alarm LED are ON while Apollo is initializing. Apollo is ready for operation when the Alarm LED turns OFF and Comm Status is still ON.

Note!
Due to shipping laws and regulations, the Apollo may be shipped in partial State of Charge.

Step 3: Apollo Shut-Down:

1. Turn OFF the System Power breaker to deactivate Apollo terminals.

2. Turn OFF the Apollo by moving the Main Controller breaker button to the OFF position.

3. Make sure every indicator on the Apollo is OFF.

Note!
Always turn OFF the Apollo when not in use because it is Self-Powered. If left ON, the self-discharge rate will increase.

5.2 Software Configuration:

To configure Apollo VIEW application, please follow the steps below.

1. Install the Apollo VIEW application on your system.

2. Connect the Apollo 2.0 to PC using Ethernet cable (recommended).

3. Connect the PC to the Sirius Module using COMM connector USB cable.

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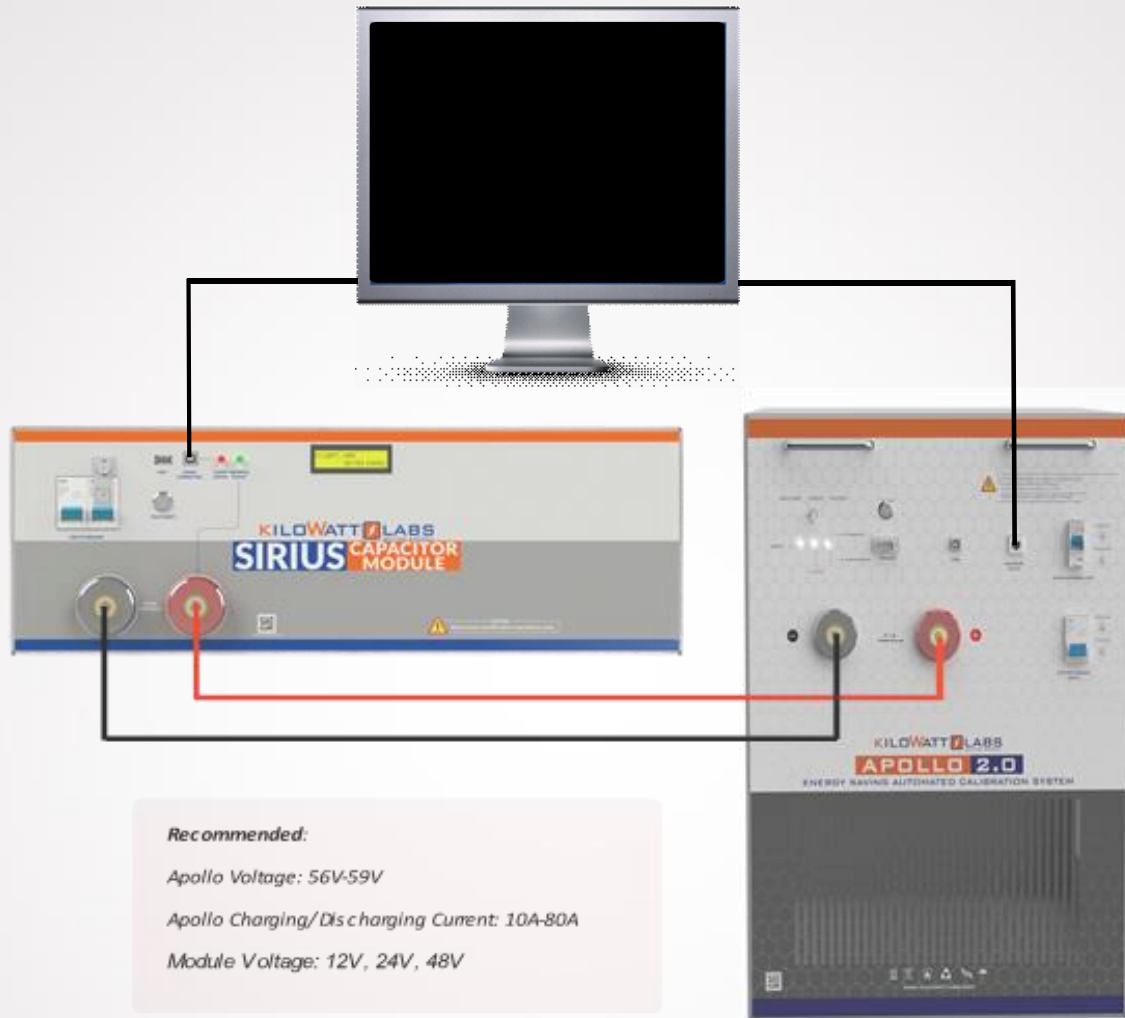
Figure 10. Connection of Apollo to PC and Sirius Module

4. Turn ON the Sirius Module and activate it by pressing the fault reset button on front panel.

5. Wait till the LCD screen on the Module displays initial values.

6. Turn ON the Apollo by moving the Main Controller breaker button to the ON position.

7. On your PC, double click on the Apollo VIEW application to execute it.

8. On the first execution of the Apollo View, the application will request some important information about user, for report generation and E-mail notifications. See Figure 11.

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→ User name (Tester name)
→ Company Name
→ E-mail (this e-mail will be used for notifications)

Figure 11. Apollo VIEW start-up

9. Apollo VIEW will execute system identification routine to understand the status of the Apollo Calibration System. Regarding the result of identification, system can suggest different actions to user. Application will collect information about Apollo System (communication status), user data and host PC data as shown in Figure 12.

Figure 12. Apollo Communication Status

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5. Operation Procedures

10. When the connection between PC and Apollo is established successfully, application proceed to Main

    User Interface as shown in Figure 13.
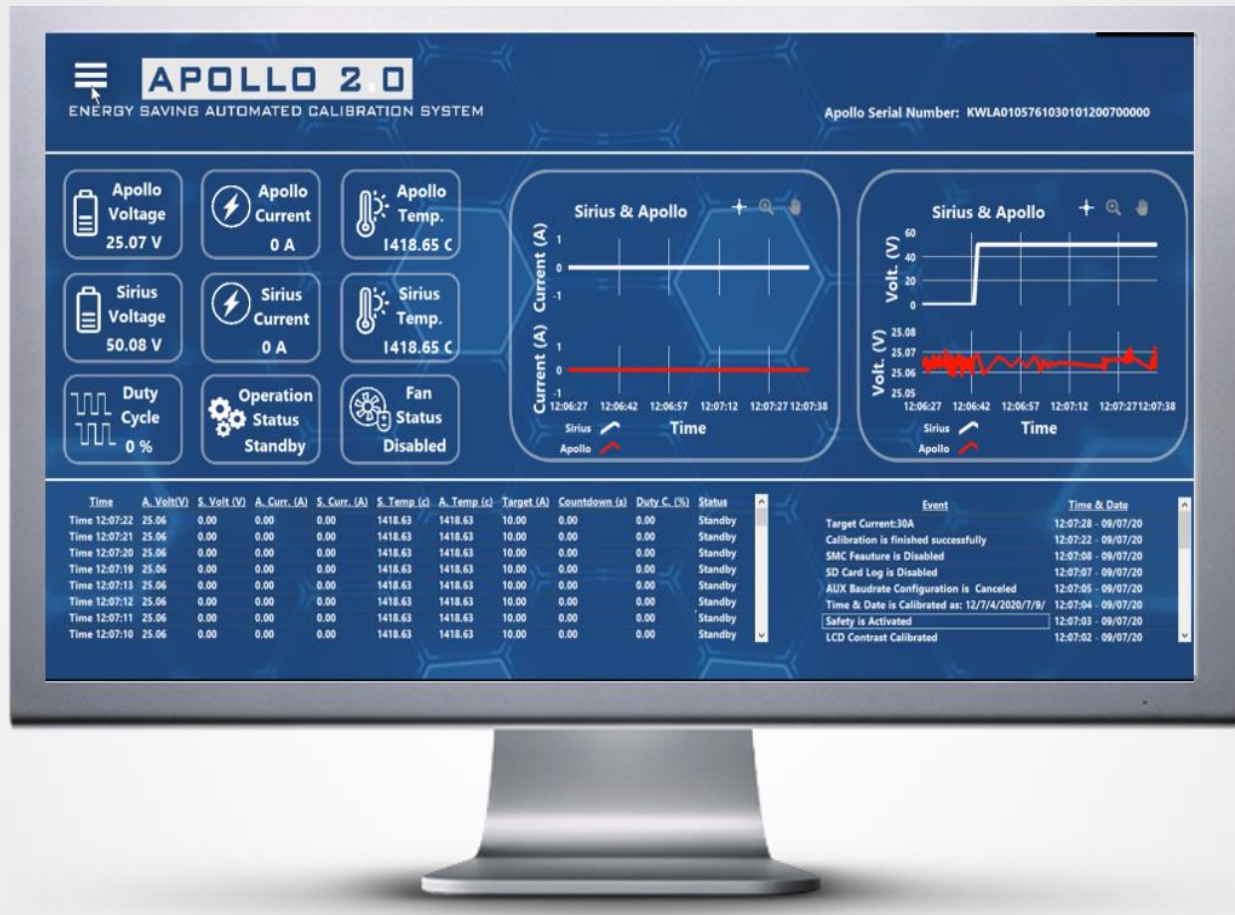
Figure 13. Apollo VIEW Main User Interface

11. If there is a communication error, application will request action from user to repeat identification
    routine or termination.

12. While getting measurement, COMM LED of the Apollo should blink every 1 second. If blinking has
    stopped, it will represent measurement interrupt or technical issues.

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5. Operation Procedures

5.3 Apollo View Testing and Calibration Procedure

Apollo VIEW application provides comprehensive measurements and analyses about both Apollo system and UUT which can be energy storage modules compatible with Apollo system specs.

Apollo VIEW application runs complex and high resolution PWM and PID algorithms to control charge and discharge current regarding users target current decision. While controlling all PWM cycles, also it will calibrate Sirius Energy Storage Modules automatically. At the end of each calibration, Apollo VIEW will create extensive reports and logs to understand system conditions.

Please follow the below steps for testing and calibration of Sirius Modules using Apollo VIEW:

Step 1: Connect the Apollo to PC and Sirius Module as shown in Figure 10.

Step 2: When the connection is established successfully, application will proceed to Main User Interface.

Step 3: Select the Multifunctional Operation on the upper left corner of the Apollo VIEW as shown in the figure below:

Figure 14. Apollo VIEW

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5. Operation Procedures

Apollo View Multifunctional Button Details

- **Charge Button**

By clicking this button, application will start charging operation. Users should be sure they select proper current target and timeout duration. If user did not do any selection:

      Default target current: 10A

      Default timeout duration 10 seconds

- **Discharge Button**

By clicking this button, application will start discharging operation. Users should be sure they already selected proper current target and timeout duration. If user did not do any selection:

      Default target current: 10A

      Default timeout duration 10 seconds

- **Target Button**

By clicking this button, user will have additional display that can select target current for both charge & discharge operation.
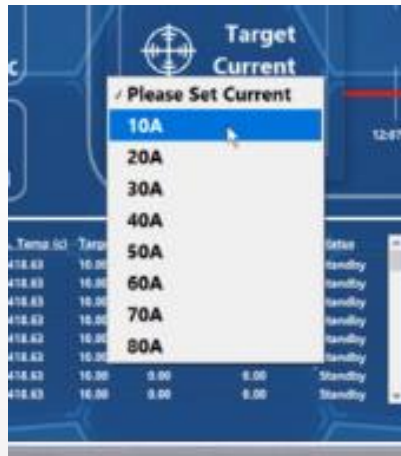
Figure 15. Target Current Selection

- **Time Button**

By clicking this button, user will have additional display that can define timeout duration as seconds.

- **Settings Button**

By clicking this button, user will have additional display that can configure which calibrations will be enabled while charging or discharging session.

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- **Reset Calibration Button**

While working with Apollo VIEW and Apollo System, there can be glitches or mismeasurements and calibration can be faulty. In that case users can reset previous calibration by clicking this button.

- **Refresh Button**

Apollo VIEW establishes USB communication between host PC and Sirius Module whenever application starts running. If there is any corruption in USB communication, users can check USB cable connection and press this button to refresh USB communication. USB communication is vital for calibrating Sirius Modules.

- **Reports Button**

By clicking this button, application will show the folder on windows explorer that contains all the reports belongs to charging & discharging session and events.

- **Buzzer Button**

By clicking this button, user will ping built-in buzzer which buzzes whenever any operation starts and finish. Buzzer can be critical to understand status of Apollo System.

- **Fan ON & OFF Button**

By clicking this button, user can enable or disable built-in fan to take under control temperature of Apollo System.

- **Update Button**

By clicking this button, user can modify user data which includes; user name, company name and user email.

Step 4: Choose the operation needed. Selecting the Charge button means charging the Sirius Module while discharging the Apollo. Whereas selecting Discharge button means discharging the Sirius Module while charging the Apollo.

> ⚠️ **Warning!**
> **While Charging or Discharging operation, do not turn OFF System breaker of Apollo or Sirius Module breaker.**

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5. Operation Procedures

Step 5: During the charging or discharging operation, Apollo System will display all the details of both Sirius Module and Apollo as shown in Figure 16.
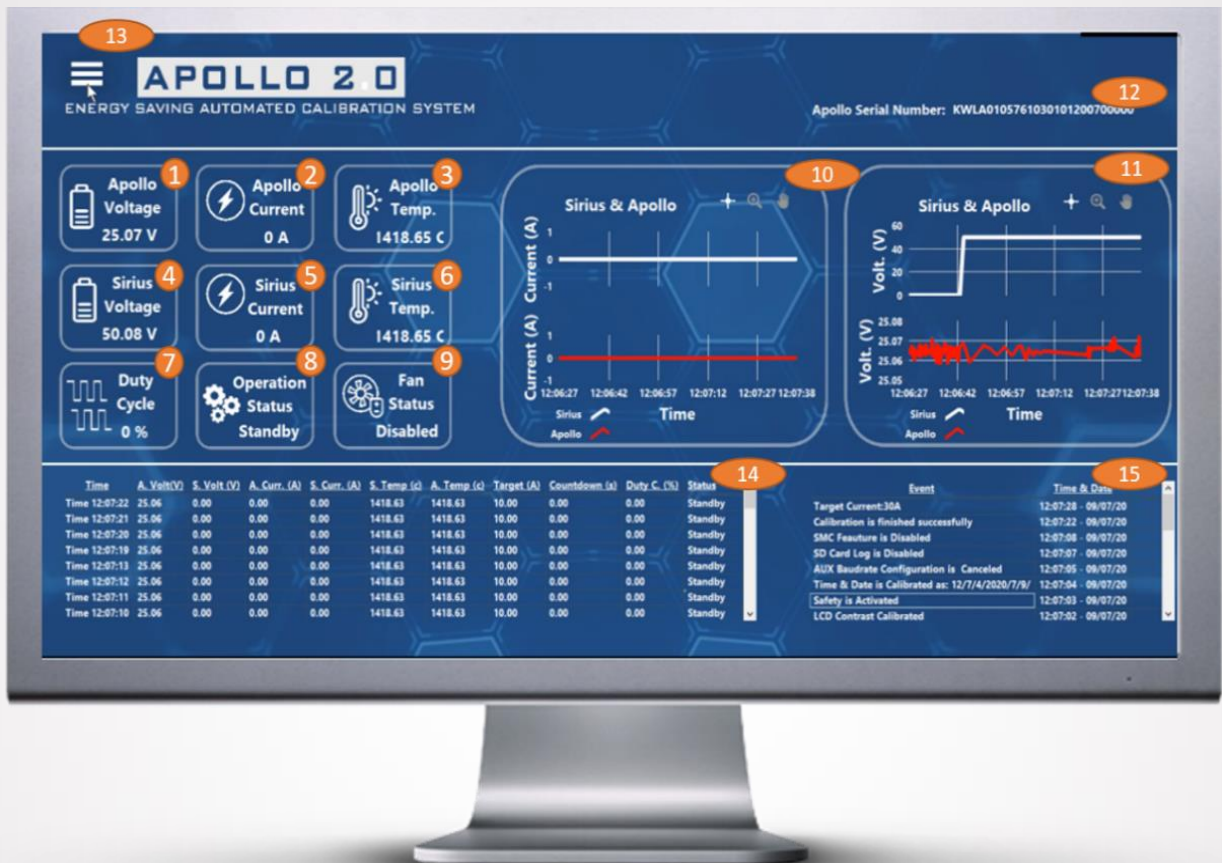
Figure 16. Apollo System Details

1. **Apollo Voltage.**

This is the voltage of the internal Supercapacitors of the Apollo System. This voltage level should be much bigger than UUT (Sirius Voltage) to act on charge and discharge safely. Suggested Apollo Voltage should be between 56V and 59V.

2. **Apollo Current.**

Apollo terminal current will increase or decrease while charging or discharging operation. This measurement will always behave parallel with Sirius current measurement.

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3. **Sirius Voltage (UUT).**

Sirius Voltage is terminal voltage of UUT or Sirius Energy Storage which can be 48V, 24V and 12V range. If any another module than Sirius Module is used as UUT, users should be careful regarding their UUT specs.

4. **Sirius Current (UUT).**

Sirius current will be controlled by PWM and PID algorithm while charge and discharge sessions. This current will be safely increased till measurement reach users target value later it will be stable during timeout period. This value will be safely decreased till Sirius current measurement reaches 0A.

5. **Sirius Temperature (UUT).**

Sirius System terminal temperature value can increase quickly or slowly regarding the target current and environment. In case of high temperature environment or high current operation, users can enable built in fan.

6. **Duty Cycle.**

Apollo VIEW controls PWM duty cycles by customized PID algorithms to reach users target current while charge or discharge operation. This parameter will increase until system reach target current, later duty cycle will go zero percent safely.

7. **Operation Status.**

This parameter lets users know if the Apollo is in charging or discharging mode.

8. **Fan Status.**

Apollo System has built in fan which can be enabled by users in case of need. This parameter will show whether fan is enabled or not.

9. **Current Measurement Graph**

This graph shows the real-time data of both Sirius Module and Apollo System current measurement at their terminals. Graph will show the trend of current measurements while charging and discharging. At every new operation, graph history will be refreshed.

10. **Voltage Measurement Graph**

This graph shows the real-time data of both Sirius Module and Apollo System voltage measurement at their terminals. Graph will show the trend of voltage measurements while charging and discharging. At every new operation, graph history will be refreshed.

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5. Operation Procedures

11. Apollo Serial Number

Each Apollo System has unique serial number which represents:

- Capacity
- Voltage rating
- Voltage range
- Controller type
- Communication type
- Display Type
- Production year, month

12. Multi-functional Operation Button

This button will show all the operational abilities of Apollo VIEW. User needs to press that button in case of any operation like:

- Selecting target current
- Selecting timeout duration
- Configuring calibration settings
- Selecting operation (charge or discharge)
- Checking reports

13. Operation Session Table

This table will show all the vital measurements while any charging and discharging sessions. This table will be logged as excel file at the end of charge or discharge operation for further post processing. Before every new operation, this table will be refreshed automatically.

14. Operation Events Table

This table will show:

- Any event which is triggered by user action.
- Charge & Discharge operation processes and steps.
- Calibration status and results.

This table will be logged as excel file at the end of charge or discharge operation for further post processing. Before every new operation, this table will be refreshed automatically.

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6. APOLLO RECOVERY

When the Apollo voltage drops below a certain threshold, the control electronics will turn OFF. Please

contact your Reseller to recover the Apollo.

> ⚠️ **Warning!**
>
> **Do not use any Power Supply to recover the Apollo.**

> ⚠️ **Warning!**
>
> **Do not try to charge on the terminals to recover the Apollo.**

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7. AUTOMATIC SAFETY ALARM

The Apollo VIEW application runs complex and high resolution PWM and PID algorithms to control charge and discharge current in order to prevent damage to itself and to the connected equipment.

Cause of Alarm	Description
Over-Current	When the Apollo has an Over-current fault, a light indicator in front panel of the Apollo will turn ON and gradually decreasing the current until zero.
Apollo Charge Full	When the Apollo reaches the maximum rated charge 59V during Discharging operation, a light indicator in front panel of the Apollo will turn ON and Apollo will cancel the operation by gradually decreasing the current until zero. Apollo Discharging operation will then be disabled and only Charging operation is allowed.
Apollo Low Charge	When the Apollo reaches the minimum rated discharge 56V, a light indicator in front panel of the Apollo will turn ON and Apollo will cancel the operation by gradually decreasing the current until zero. Apollo Charging operation will then be disabled and only Discharging operation is allowed.
Over-Temperature	Apollo has built-in fans that will automatically turn ON when the temperature reaches 45°C and will turn OFF when its temperature decreases to 35°C. If temperature continuously increase and reaches 60°C, a light indicator on front panel of the Apollo will turn ON and gradually decreasing the current until zero.

Table 2. Safety Alarms

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8. TROUBLESHOOTING

Check the indicators on the front panel to determine the state of the Apollo. A warning state is triggered when a condition, such as voltage, current or temperature is beyond design limitations.

The possible cause of alarm are as follows:

Warning Messages	Description	Trouble Shooting
Over-Voltage	Over-voltage occurs when the Apollo voltage goes higher than 59V.	Choose charge operation with low current like 10A until the voltage level is getting on suggested range.
Low voltage	Low-voltage occurs when the Apollo voltage goes lower than 56V.	Choose discharge operation with low current like 10A until the voltage level is getting on suggested range.

Table 3. Trouble Shooting

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9. FEATURES

9.1 Key Features:

1. Testing and automated calibration of Sirius Modules without using any external power with auto-generation of datalogging reports.

2. Detection and safe cancel of operation during system alarms.

3. Charging & discharging period can be defined by user with selectable target current options (10A,20A,30A,40A,50A,60,70,80A).

4. Apollo2.0 is designed to test and calibrate Sirius Modules with voltage 12V, 24V and 48V.

5. Long service life.

9.2 Physical features:

1. Electronic switch is used to control the terminals of Apollo which responds faster than any control methods.

2. Apollo has embedded functionality in the event of:

   - High Terminal Voltage

   - Low Terminal Voltage

   - High Terminal Current

   - High Ambient Temperature

3. Front panel of Apollo has System Power breaker that controls the status of its terminals for protection.

4. Front panel of Apollo also has 3 LEDs for letting user know the status of Apollo like:

   - Communication LED (Green): Blinking while communicating.

   - Alarm LED(Red): In case of any excessive current, voltage or temperature.

   - LED status: Green if Apollo is charging and Red if Apollo is discharging.

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9. Features

9.3 Technical Features:

1. Apollo has one processor for alarm monitoring, communication and datalogging features.

2. Mobile (without any grid connection) charging and discharging station for 12V,24V, and 48V energy storage modules with safe PID and PWM algorithms.

3. Compatible with Windows 7 and newer OS versions.

4. Auto E-mail notifications.

5. User interface with real-time data acquisition and graphs, data logging and event logging.

6. Internal logged data can be easily extracted over Apollo VIEW Monitoring application or it can also be collected through email.

7. Apollo has one of the best ADC to increase measurement accuracy.

8. Apollo VIEW application runs complex and high resolution PWM and PID algorithms to control charge and discharge current regarding users target current decision. While controlling all PWM cycles, also it will calibrate Sirius Energy Storage Modules automatically.

9. Apollo can establish communication over serial by USB interface, MODBUS TCP/IP interface and RS 232 interface to communicate with Host PC for:

   - Measurement Monitoring

   - Alarm Monitoring

   - System Configuration

   - Measurement Calibration

   - Manual/Auto Data Logging

   - Statistical Analyzing/ Graphical result

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10 SHELF LIFE, MAINTENANCE, DISPOSAL

10.1 Shelf Life:

Shelf life is the life of the Apollo in years from the date it is manufactured to the time it is first operated.

The shelf life of supercapacitor cell is 10 years.

10.2 Maintenance:

The Apollo does not require periodic maintenance.

10.3 Disposal:

Dispose according to local regulation.

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11. TEST PROCEDURES

11.1 Efficiency Test:

Efficiency test is performed to evaluate the performance of the Apollo. There are three factors to be considered in the design of the test cycle for efficiency.

- How to charge and discharge the Apollo.

- At what voltage to start and end the charge/discharge?

- At which points to do the measurement.

Test Equipment:

- Sirius Module that can be used to charge and discharge the Apollo.

Test Temperature:

- Room temperature 23°C ±2°C.

- Temperature controlled chamber can be used if testing at any environment other than room temperature.

Test Current:

- Different current within the maximum limit specified by the test equipment manufacturer can be applied to the test.

Test Process:
Step 1. Charge Cycle:

- Charge Apollo to its maximum voltage. Charging the Apollo means discharging the Sirius Module.

- Record test time, test current, and voltage of the Apollo at the start of the test (t1, Ii, Vi).

Step 2. Discharge Cycle:

- Discharge Apollo to its minimum voltage. Discharging the Apollo means charging the Sirius Module.

- Record test time, test current, and voltage of the Apollo at the start of the test (t2, Io, Vo).

Step 2. Efficiency Test:

$$\text{Efficiency} = \left[\frac{\text{total discharge energy (Po)}}{\text{total charge energy (Pi)}} \right] \times 100$$

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12. APOLLO SPECIFICATIONS

PERFORMANCE SPECIFICATIONS	Voltage (Nominal)	57.6Vdc
	Maximum Charge Voltage	59Vdc
	Discharge Cut-Off Voltage	56Vdc
	Total Energy	5.95kWh
	Maximum Charge Current	80A
	Maximum Discharge Current	80A
ENVIRONMENTAL SPECIFICATIONS	Cell Operating Temperature[1]	-30 °C to 80 °C
	Operating Humidity	Non-Condensing
MECHANICAL SPECIFICATIONS	Dimensions (w × d × h) mm	450 x 715 x 605
	Weight (Kg)	—
	Apollo Casing Material	GI powdered
	Terminal Type	F12
SMART FEATURES	Communication and Connectivity	USB / Ethernet/ RS 232 Port
	Alarm	LED indicator alarm in the event of Over/under-Voltage, Over-Current, Over Temperature
APOLLOVIEW SOFTWARE	Apollo and Sirius Module Monitoring	Current, Voltage, Temperatures, Graphs
	System Monitoring	Apollo Monitoring (charging and discharging)
APOLLO SERVICE LIFE	Projected Cycle Life[2,3]	1 million cycles
	Projected Calendar Life[3,4]	45 years
	Shelf Life[5]	10 years
	Warehousing	Can be stored at any SOC without affecting cycle life

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12. Apollo Specifications

	Over/under voltage	Hardware and Software protection
SAFETY PERFORMANCE	Over Current	Hardware and Software protection
	Over temperature	Hardware and Software protection
	Additional Safety	10A Circuit breaker + 100A DC Circuit Beaker + SSR protection
COMPLIANCE[6] INFORMATION	EN55032:2015, EN55024:2010, EN61000-4-2:2009, EN61000 EN61000:2008+A2:2010	
PRECAUTIONS	Alarm	In case of alarm, immediately rectify/attend to the cause of the alarm.
	Physical Damage	In case the Apollo is physically damaged due to any event, do not install and energize the module under any circumstances and contact your Reseller.
	Short Circuit	Ensure precautions to prevent short-circuit under all circumstances.
	Galvanic isolation	When connecting to external devices ensure that galvanic isolation does not exceed 1000V.
	Charge/Discharge Current	Under no circumstances must the charge/ discharge current exceed 80A.
	Charging Voltage	Under no circumstances must the charging voltage exceed $59V_{dc}$ for more than 60 seconds.

[1]The temperature range indicates the range in which the supercapacitor cells can operate. The performance of the cells may vary if they are continuously operated outside a temperature range of -10ºC to 55ºC, and/or at C-rates higher than the maximum charge/discharge rate specified in this spec sheet. The operating temperature range of the module varies based on the application. If the module is to be operated continuously outside a temperature range of -10ºC to 55ºC, and/or at C-rates higher than the maximum charge/discharge rate specified in the spec sheet, please consult Kilowatt Labs or its Reseller prior to deploying.
[2]Projected life of supercapacitor cells. Cycle life will vary if cycled more than 4 times a day.
[3]Additional terms and conditions, including a limited warranty, will apply at the time of purchase.
[4]Projected Calendar life of supercapacitor cells from the date of first operation.
[5]Shelf life is the life of the module (in years) from the date it is manufactured to the time it is first operated
[6]CE certification is completed for supercapacitor cells.
Product dimensions are for reference only unless otherwise identified and may change without notice.
For critical applications, please contact your Reseller.

Table 4. Apollo Specifications

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13. DEFINITION OF TERMS

- **PID** - Proportional Integral Derivative.

- **PWM** – Pulse Width Modulation. This technique was used to control the output power of the Apollo in order to attain the target current.

- **UUT** – Unit Under Test. This is the battery being tested or calibrated. In this manual, it refers to Sirius Modules with voltage 12V, 24V, or 48V.

- **SSR** – Solid State Relay. This is an electronic device that switches ON and OFF when voltage is applied across its control terminals.

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14. FAQs

Q. How to determine the current status (charging/discharging)?

A. When the current value on the Sirius Module is negative it means the Apollo is charging and when it is positive, it means the Apollo is discharging. Also, LED status on front panel of the Apollo is Green if operation is charging, and Red if operation is discharging.

Q. If we leave the Apollo turned ON when it reaches 54V or below, what will happen?

A. The Apollo will not allow charging operation. User should charge the Apollo through Discharging operation till it reaches suggested voltage range.

Q. What will happen if the Apollo is totally empty?

A. Please contact your Reseller to recover the Apollo.

Q. Is it possible to connect Apollo with other chemical batteries?

A. Apollo can be used with other chemical batteries for charging and discharging operation but it will not calibrate the battery since there is no installed software on it.

Q. What kind of issues can happen about firewall and antivirus programs?

A. There will be no problem as far as the software run as administrator.

Q. How to troubleshoot the communication between the Apollo and PC?

A. If you face any communication difficulties between the Apollo and PC please troubleshoot as follows: User should have compatible host pc IP address to be in same network with Apollo System. User should change their ethernet network IP address as 10.10.10.x statically. X is anything between 0 to 255 except
       Host PC Static IP: 10.10.10.100 (Suggested IP address)
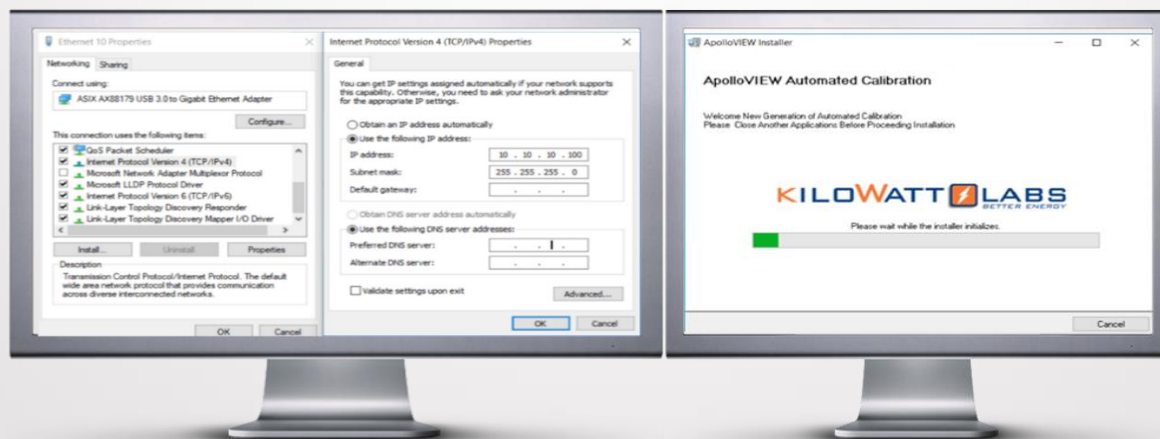   Host PC Subnet Mask: 255.255.255.0 (Suggested Subnet Mask)

Figure 17. Communication between Apollo and PC

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