

SIRIUS CAPACITOR MODULE

User Manual

Model number: 3550-192-B-2C-TM-SD-A-G

Version 1.0; Release Date: September 2019



Introduction

The Sirius Capacitor Module (“Sirius”) is supercapacitor-based storage that uses supercapacitors as storage cells instead of chemical cells. Kilowatt Labs’ proprietary balancing, control and charge retention algorithms control the operation of the supercapacitor-based modules, making Sirius a safe, efficient and effective alternative to chemical batteries wherever chemical batteries are deployed.

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1. Safety Instructions:

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

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 or death.



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 Safety Precautions:

The Sirius Modules are designed to provide years of trouble-free operation. Proper handling is required to avoid damage to the Module. In particular the following precautions should be observed.

- **Personal Safety:**

- Always wear proper personal protective equipment (eyes protection, gloves and safety shoes).
- Always make sure charger is set as recommended.
- Always make sure chargers are disconnected while working on Modules.

- **Module Safety:**

- Do not subject the Module to strong impact.
- Do not crush or puncture the Module.

- Do not dispose the Module in a fire.
- Do not charge the Module when the temperature is below -30°C .
- Do not charge the Module when temperature is above 80°C .
- Do not operate the Module above the specified voltage.
- Under no circumstances charge/discharge the Module at more than 35A.
- Under no circumstance must the charging voltage exceed $216 V_{\text{dc}}$ for more than 60 seconds.
- Do not expose the Module to temperatures in excess of 80°C .
- Do not place the Module near a heat source, such as a fireplace.
- Do not disassemble the Module under any circumstances.
- Do not touch the Module with wet hands.
- Do not expose the Module to moisture or liquids.
- Keep the Module away from children and animals.
- Ensure precautions to prevent short-circuit under all circumstances.
- Do not connect or disconnect terminals from the Module without first disconnecting the load.
- Do not touch the terminals with conductors while the Module is charged. 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.
- Do not use the Module in open-environment, in rain or in a place exposed to water and other liquids.
- Do not subject the Module to high pressure.
- It is not recommended to stack more than 2 Modules.
- Do not step on the Module.
- Do not drop the Module. Internal damage may occur that will not be visible.
- Do not stack Modules once they have been removed from the packaging, instead the Modules should be placed on shelving.
- In case the Module is physically damaged due to any event, do not install and energize the Module under any circumstances and immediately contact your Reseller.

1.3 Modules Connection Safety Precautions:

- All Modules must be at 100% SOC before connecting in Series or in Parallel.
- The maximum number of Modules that can be connected in series is 2 with Module Combiner.
- Do not connect more than 2 Modules in Series.
- Modules cannot be connected in Series-Parallel combination under any circumstance.



Note!

If you want to connect more than 2 Modules in Series, please contact your Reseller.

1.4 Shipping:

Sirius Capacitor Modules are shipped out via Air and Sea.

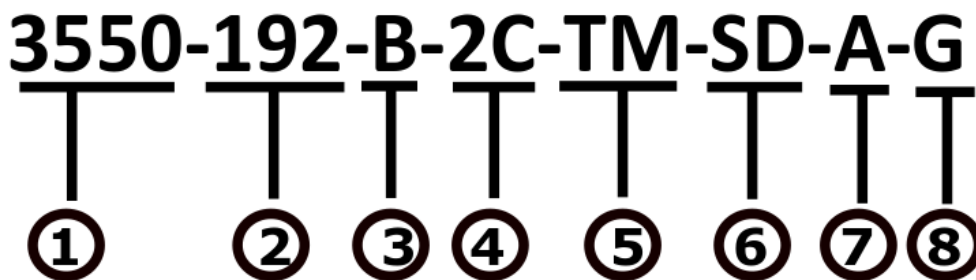
- If the Modules are shipped via Air, please follow the instructions given below:
 - Carefully remove the nails from all the four sides of the wooden box and open it.
 - Remove the foam and shrink wrap and open the carton box and lift the Module manually.
- If the Modules are shipped via Sea, please follow the instructions below:
 - Carefully remove the Module from the pallets after cutting the packing strip holding the Modules to the shipping pallets.
 - Open the carton box and lift the Module manually.

1.5 Qualified Installer:

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

2. Product Introduction:

2.1 Product Part Number:

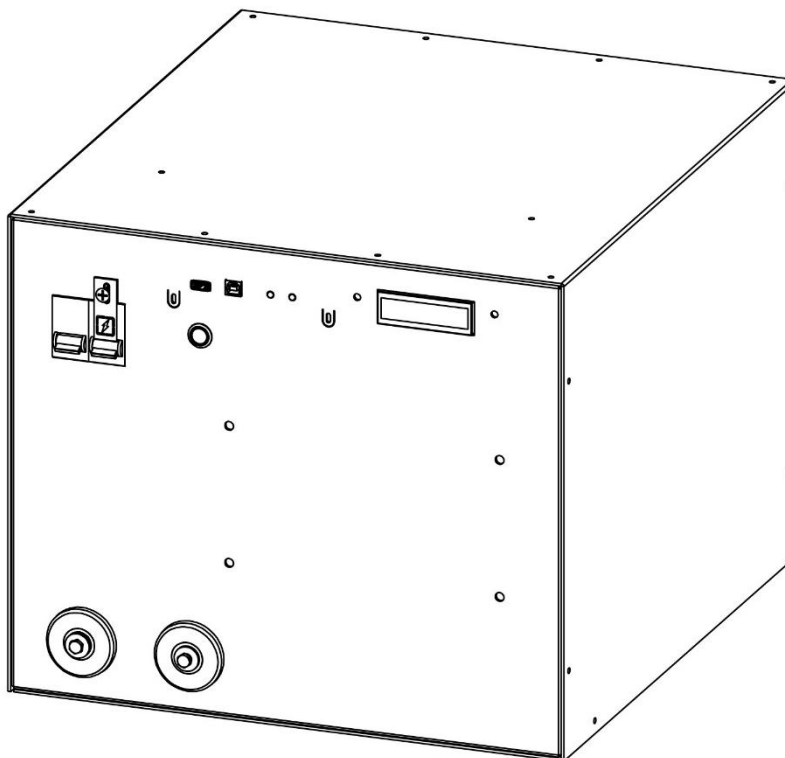


- 1) Capacity of Module in Wh
- 2) Nominal Voltage of the Module
- 3) Terminals are on the Front Side
- 4) Maximum Charge Rate of the Module
- 5) Total Monitoring
- 6) With Safety
- 7) With Alarm
- 8) General Module

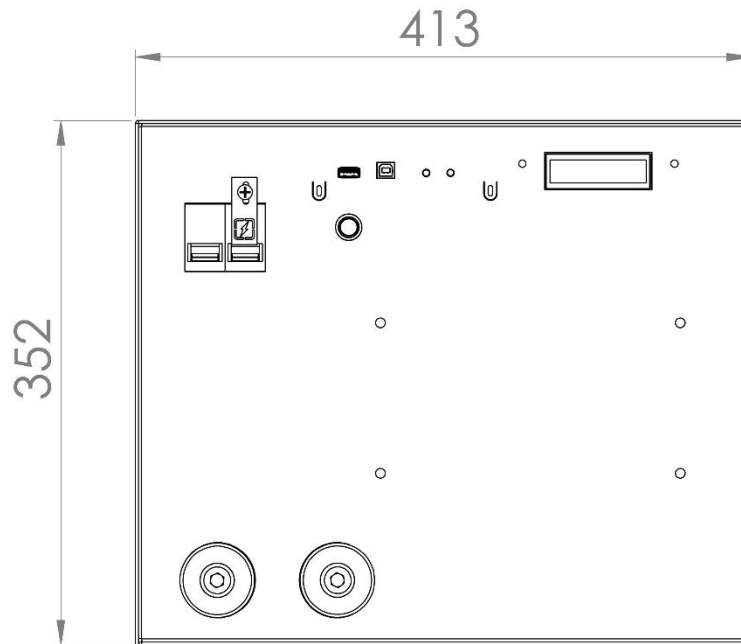
2.2 Product Overview:

2.2.1 Appearance:

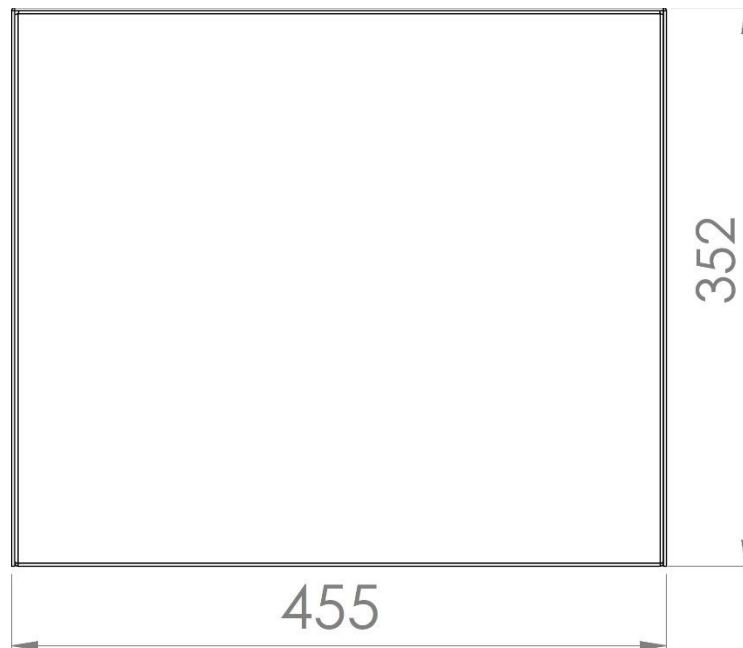
The appearance of the Sirius Module is shown below:



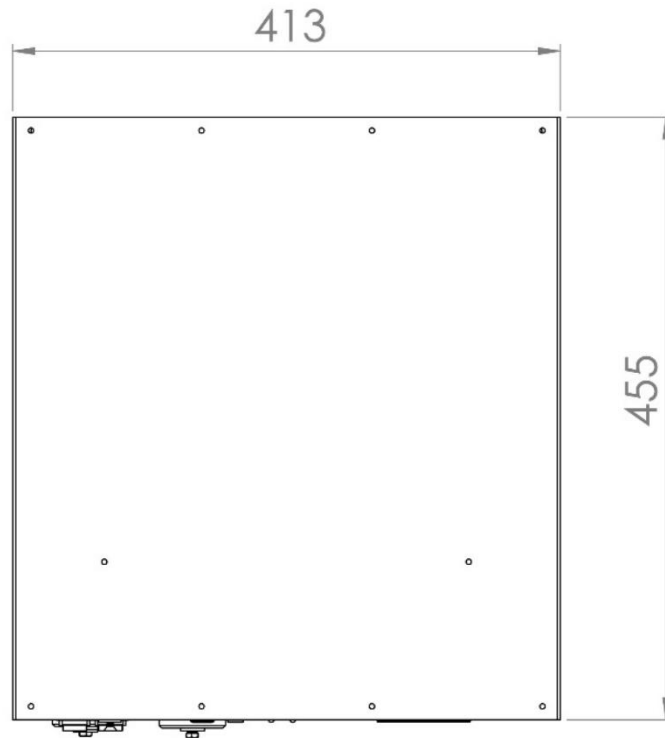
2.2.2 Mechanical Drawings:



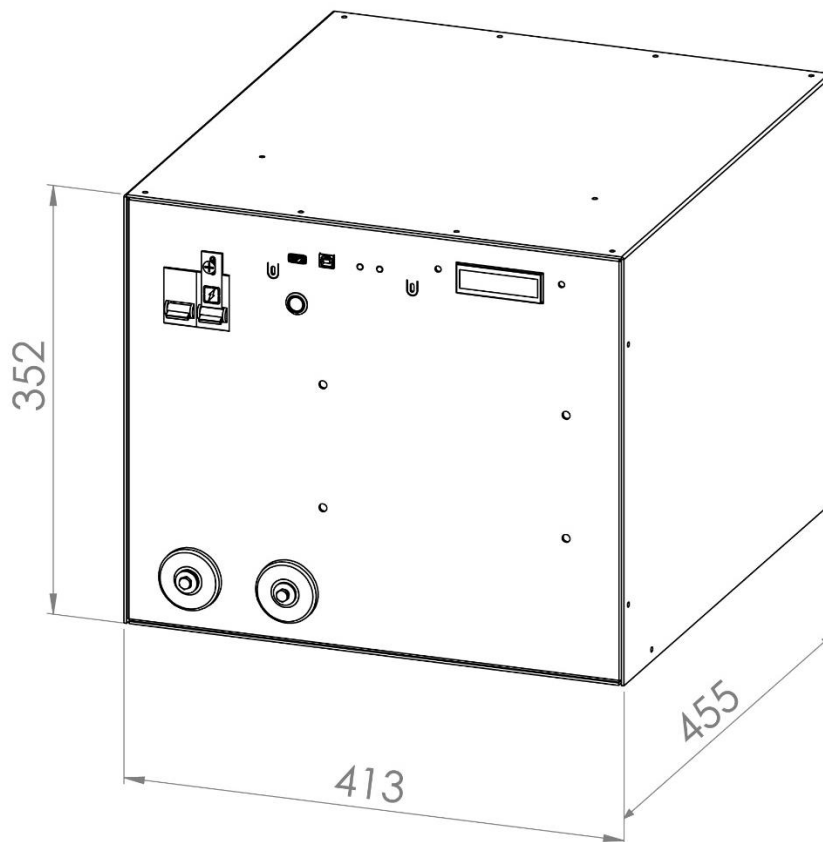
Front View



Side View



Top View

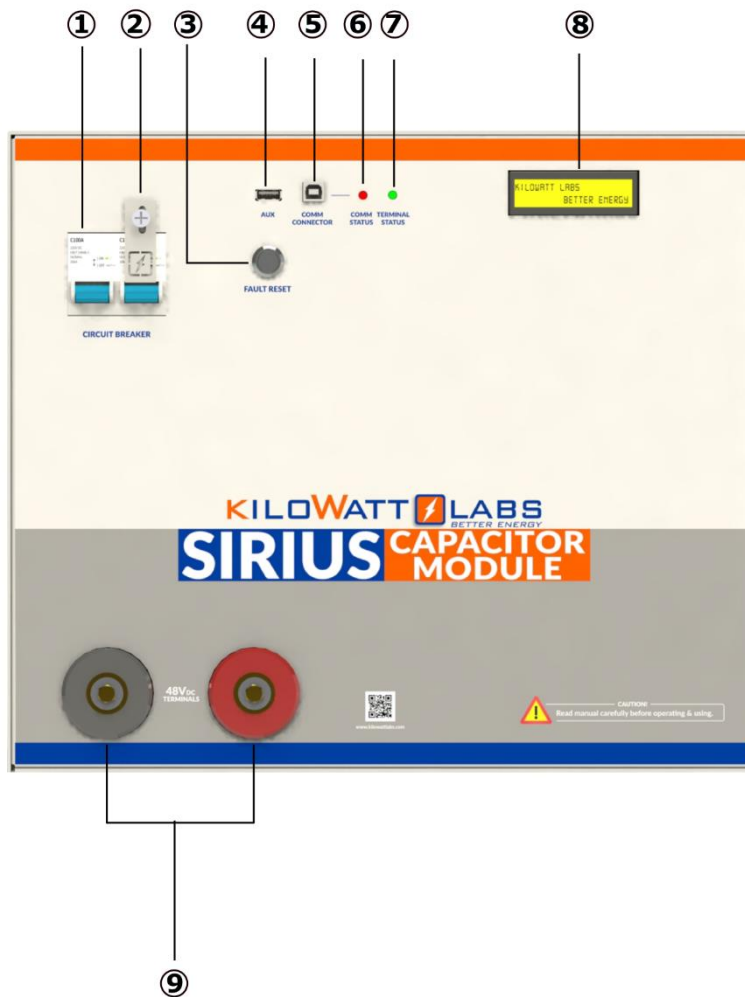


Isometric View

2.2.3 Dimensions and Weight:

Width	413 mm
Depth	455 mm
Height	352 mm

2.3 Product Description:



Object	Mark	Description
1	Circuit Breaker	C100A Circuit breaker for switch ON/OFF Module.
2	Bypass Circuit Breaker	C100A Circuit breaker for bypassing electronic switch.
3	Fault Reset	Fault Reset Button
4	Aux	Auxiliary USB
5	Comm Connector	Communication Connector USB
6	Comm Status	Communication Status LED

7	Terminal Status	Terminal Status LED
8	LCD	(16×2) LCD
9	F12 terminals	Terminals

1. Circuit Breaker:

Circuit breaker is used to power ON the Module. It also acts as a second line of protection, if the circuit fails to protect the Module from over current, the circuit breaker will trip.

2. Bypass Circuit Breaker:

The Bypass Circuit breaker is used to bypass electronic switch. It is used for Series connection and recovery of the Module.

3. Fault Reset:

Fault Reset is a push button which is used to turn ON the terminals manually after it turns OFF due to any error.

The additional features of fault reset are as follows:

- a) Hold fault reset for 3 seconds to reset fault if there is/are any.
- b) Press fault reset button to check the state of charge and instantaneous power.
- c) We can set the Current reading to zero.

- To make the current zero, follow the steps below:

→ When current is not zero, the LCD will display the following message.



→ To make the current zero, hold the fault reset button for 3 seconds and the LCD will display the following message.



This means that the current is now zero.

To return back to the normal screen, press the fault reset button once more or leave the Module idle for 5 seconds.



Note!

Make sure that there are no external loads or charger before setting the current to zero.

4. Auxiliary USB:

This is an auxiliary connector with isolated UART or Serial Communication for wireless monitoring, Module Combiner and future functions.

5. COMM Connector USB:

This is a COMM connector to monitor the Module using the Sirius software. FTDi chip is used for this USB.

6. COMM Status LED:

COMM Status LED indicates the communication status.

- **LED Status Indication:**

Color	Status	Indication
Red	Blinking	Control Module is communicating with Sirius VIEW Software.
Red	Steady	Control Module is not communicating with Sirius VIEW Software.
Red	Dimming	Module is in power down state.

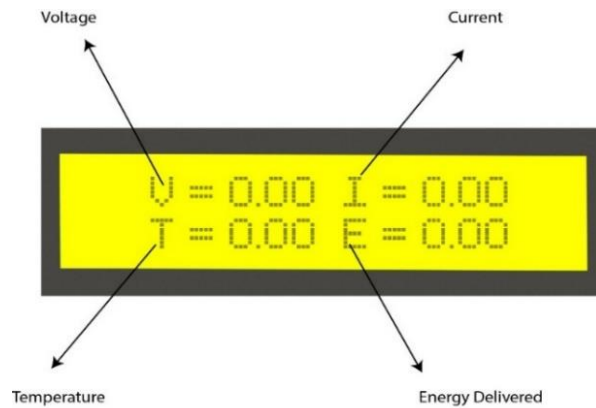
7. Terminal Status LED:

Terminal status LED indicates the F12 terminal status.

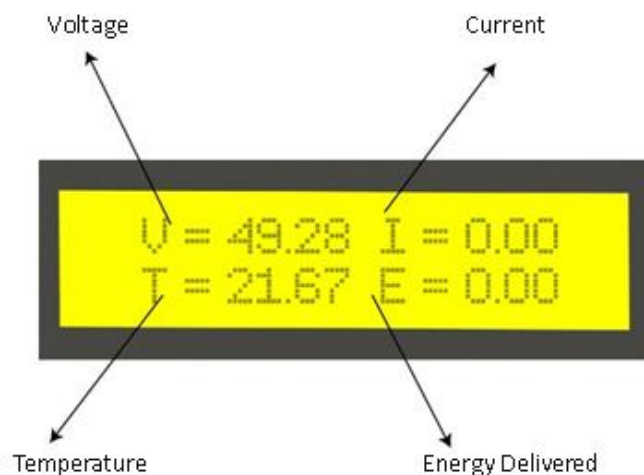
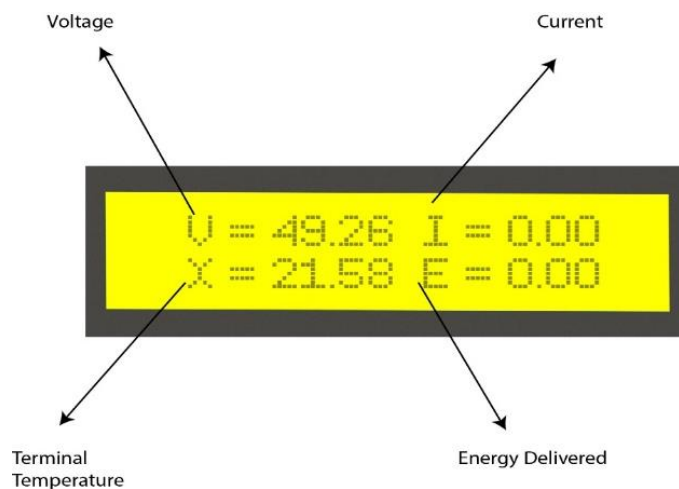
Color	Status	Indication
Green	ON	The F12 terminal is active
Green	OFF	The F12 terminal is not active.

8. LCD Description:

→ Once the power is switched ON from the circuit breaker, the Module gets power and the LCD shows the following message after 3 seconds under normal operation:



→ After 1 second, the following two LCD screens get switched with each other.



9. F12 Terminals:

These are the output terminals of the Module having electronic switch protection that is limited to 100VDC only. F12 terminals are used to connect the load or charger to the Module. There are also

positive and negative cables in the jumper cable set. The **red** one is positive (+), the **black** one is negative (-).



Never connect the red cable to the negative terminal of the Module.

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 Module. Document (photograph) any damage and report this to your Reseller as well as to the shipping agent immediately. Remove the Module 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! Sirius Modules must be handled only by qualified and trained personnel. Installation should not exert bending or twisting torque to the Module enclosure.



Note!
Read the safety Instruction section before installation.

3.3 Unpacking and Contents Check:

Check the contents of the package.



1) Sirius Capacitor Module: 3.55KWh198VDC

3) USB Cable A-B

2) Screws × 2

4) Washers × 4

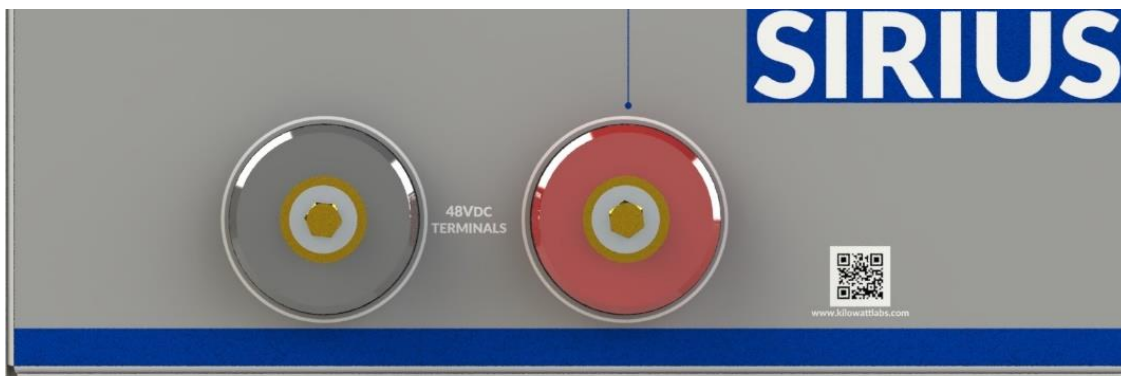
4. Operation Procedures:

4.1 Module Configuration:

Follow the steps below to switch ON the Module.

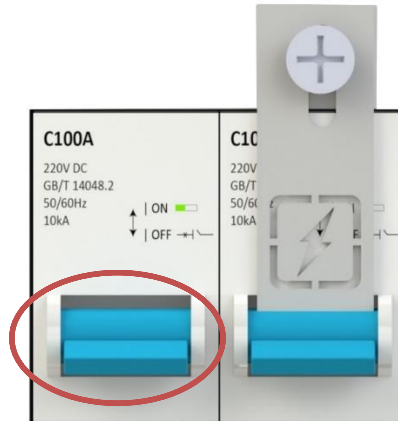
Step 1: Connecting the Load:

Connect the F12 terminals of the Module to the load. F12 terminals are shown in picture below:

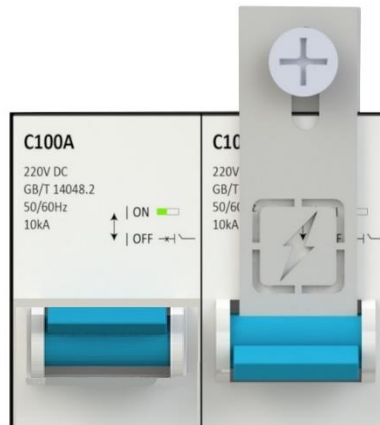


Step 2: Module Start-Up:

1. Turn **ON** the Circuit breaker by pushing the Blue button upwards as shown in the picture below:



2. The picture below shows that the Module is turned **ON**.



Note!

Use the Bypass circuit breaker button to connect the Modules in Series and for recovery purpose.

3. Wait till the LCD screen on the Module displays initial values.
4. Be sure you are able to see the terminal status LED **OFF**.
5. Press and hold the fault reset button, after 3 seconds the terminal status LED will change to Green.
6. Release the fault reset button.




Note!

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

Step 3: Module Shut-Down:

1. Press and hold the fault reset button to turn **OFF** the terminal. After 3 seconds the terminal status LED will go **OFF**.
2. Make sure every indicator on the Module is **OFF**.
3. Turn **OFF** the Module by moving the Circuit breaker button to the **OFF** position.



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

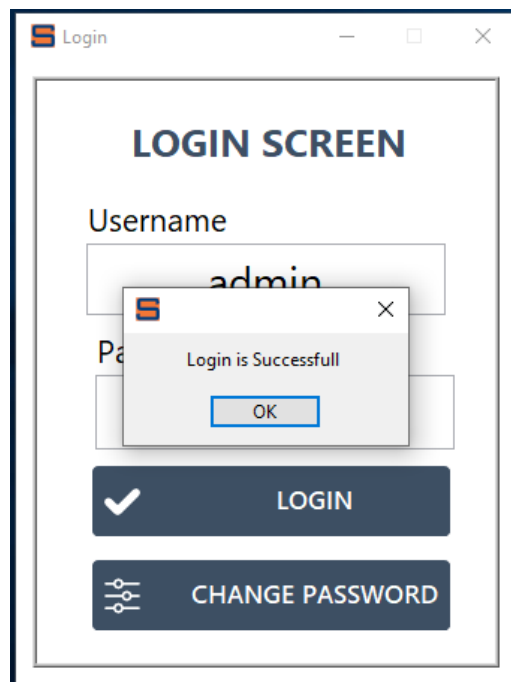
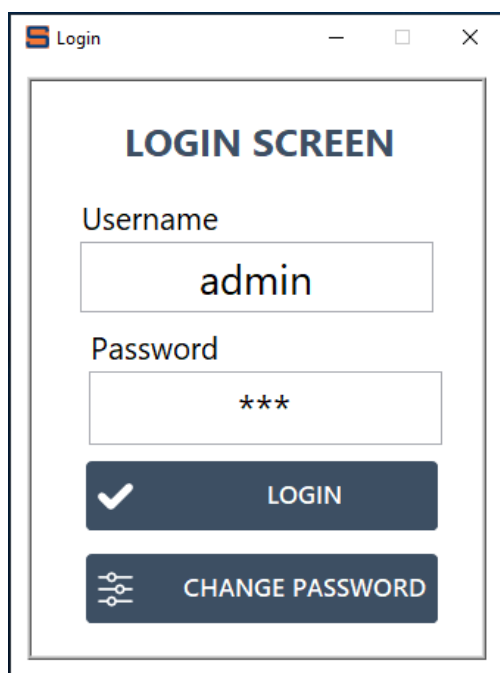
4.2 Software Configuration:

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

1. Install the Sirius VIEW application on your system.
2. Connect the USB cable to the COMM connector USB slot to start communication and monitoring.
3. Turn on the Sirius Module by pressing the fault reset button on front panel.
4. Wait till the LCD screen on the Module displays initial values.
5. Double click on the Sirius VIEW application to execute it.
6. When the Log-In appears, Sirius VIEW, enter the default username and password as shown below.

Default Username: admin

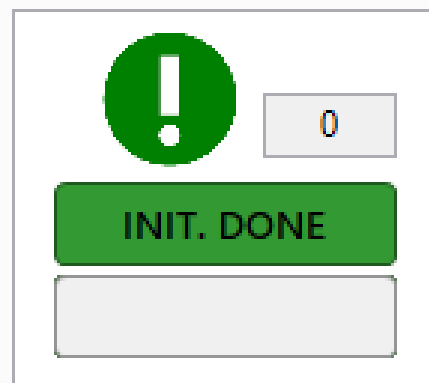
Default Password:123



7. Select Sirius VIEW as shown below and left click.



8. Follow instructions and press Run button on interface. (Auto Pop-up dialogs).
9. When the connection between PC and Module is established successfully, INIT.LED will be constantly turned ON.



10. For getting measurement, press RUN button.
11. If there is any problem during connection, check USB cable and ensure the Module is working properly.
12. While getting measurement, MEASURING LED should blink every 1 second. If blinking has stopped, it will represent measurement interrupt or technical issues.
13. While getting measurement, COMM LED on front panel of the Module will blink.



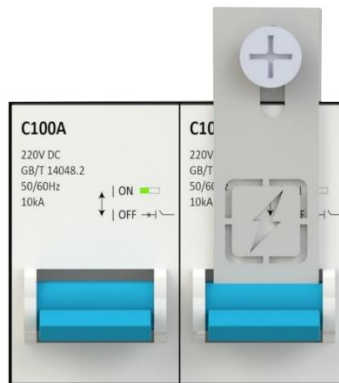
Note!

Please read the Application manual to configure the software thoroughly. The Application manual is downloaded automatically when you install Sirius VIEW application.

5. Recovery Procedure:

When the Module voltage drops below a certain threshold, the control electronics turn **OFF**. To restart the control electronics, follow the steps below.

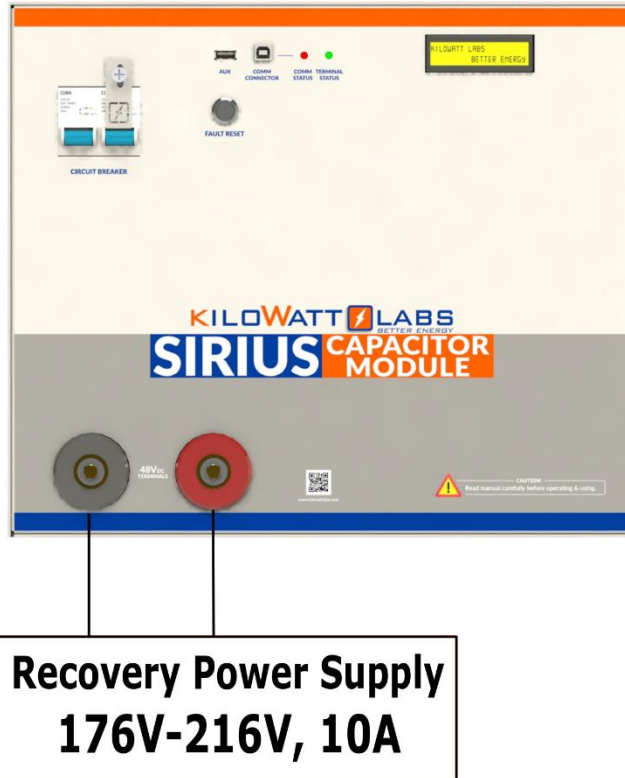
1. Use the Bypass circuit breaker to turn the Module **ON** as shown below.



2. A power supply having voltage range of 44V_{dc} to 54V_{dc} and current range of 1A to 10A will be required.
3. Connect the **positive** terminal of the power supply to the **positive** terminal of the F12 terminal and **negative** terminal of the power supply to the **negative** terminal of the F12 terminal.
4. Remove the lock screw from the Bypass Circuit breaker with the help of screw driver.
5. Once the connection is done, turn **ON** the circuit breaker as shown below. The Module will recharge and the control electronics will turn **ON**.



6. The event may take several minutes depending on the power supply used.
7. At this stage, remove the power supply and leave the Module for normal recharge.



- **Recommended Charger for Recovery:**

Maximum Current	10 A
Recommended Voltage	176V-216V



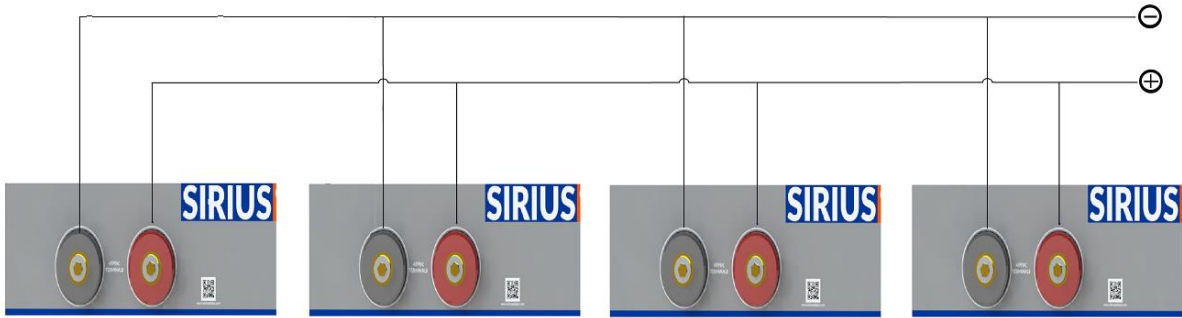
Caution!
Do not use more than 10A to recover the Module.

6. Parallel Connection of Sirius Modules:


Any number of Modules can be connected in parallel.

- **Steps to Connect Modules in Parallel:**


Refer to the parallel combination of the Sirius Modules as shown below and make your connection accordingly.



- Connect the **positive (+)** of the **F12 Terminal** of all Modules.
- Connect the **negative (-)** of the **F12 Terminal** of all Modules.
- Take out the output positive and output negative from the respective common point.




Note!
Switch ON only the Circuit breaker when connecting in Parallel.









Caution!
Charge all the Modules to 100% SOC or same voltage level before connecting them in Parallel.

7. Automatic Safety Shutdown:

The Module will automatically shut down under any excessive use conditions in order to prevent damage to itself and to the connected equipment. Specified limits for excessive current, high voltage and low voltage are provided in Module's technical data sheet.

Cause of Shutdown	LCD Warning Message	Description
Over-Current (OCD)		When the Module has an Over-current fault, the counter counts for 5 seconds and if the current does not drop lower than the cut-off and count down has reached to zero, the buzzer alarms and the electronic switch will shut-down.

Module Charge Full		<p>When the Module voltage reaches the maximum voltage, the electronic switch will shut down. This means that each cell from the Module has reached to maximum rated charge.</p>
		<p>The event will be repeated if the charger is still ON and operating in the same condition, the buzzer alarms and LCD will show the warning message.</p>
Low Charge Module		<p>When the Module is in standby mode and it reaches the minimum voltage, the LCD will display this message every 30 seconds.</p>
		<p>When the Module is connected to a load and it reaches the minimum voltage, the buzzer alarms, electronic switch will shut down and LCD will display the message.</p>
Over- Temperature		<p>When the Module has an Over-Temperature fault, the buzzer alarms, the electronic switch will shut down and LCD will display the message.</p>
Terminal Over- Temperature		<p>When the Module has a terminal Over-Temperature fault, the buzzer alarms, the electronic switch will shut down and LCD will display the message. This means that electronic switch has reached 80°C.</p>

8. Trouble Shooting:

Check the indicators on the front panel to determine the state of the Module. A warning state is triggered when a condition, such as voltage, current or temperature, is beyond design limitations. When the Module falls outside prescribed limits, it enters a warning state. When a warning is reported, the Module immediately stops operation.

The possible warning messages are as follows:

Warning Messages	Description	Trouble Shooting
Over-Current (OC)	OC occurs when the current goes above 37A or when the Module is short-circuited. In this event, the electronic switch will shut down.	Switch OFF the circuit breaker and check the continuity across the Module terminals to find whether there is a short circuit. In case of a short circuit, check the operating circuitry and clear the short circuit.
Over-Temperature (OT)	OT occurs when the Module temperature goes above 80°C. In this event, the electronic switch will shut down.	Shut down the Module and check the surrounding temperature and ensure the ambient temperature is less than 80°C. If not leave the Module to cool till the temperature comes below 80°C. Now, turn ON the circuit breaker.
Remove Module Charger/ Connect Module Charger	This happens when there is some residual current. In this event, the Module gives alarm for full charge or low charge and the charger/discharger is also disconnected but the electronic switch is not activated.	In Sirius VIEW application, select Sirius Config then go to Calibrate Zero Current. Press Calibrate. If you see “No load current is set successfully”, it means the current is set to zero.

9. Features:

9.1 Key Features:

- Low power consumption.
- Accurate SOC estimation.
- Detection of circuit board errors.
- Long service life.

9.2 Physical features:

1. Electronic switch is used to control the terminals in Sirius Module. It has more life period than AC or DC contactors and responds faster than any control methods.
2. Sirius Module has embedded functionality in the event of:
 - High Terminal Voltage
 - Low Terminal Voltage
 - High Terminal Current
 - High Ambient Temperature
 - High Module Temperature
3. Front panel of Sirius Module has LCD and Fault Reset Button. The fault reset button acts as a

multifunction button for monitoring and configuration. By using Reset fault Button and LCD user can:

- Turn ON/OFF terminals of Module.
 - Read Cell Voltages, Instantaneous Power, SOC, Terminal Voltage, Terminal Current, Terminal Temperature and Ambient Temperature.
 - Recalibrating Current Measurement by configuring zero current values.
 - Activating Terminals to make Module more secure at first operation.
 - Snooze alarms in case of repeating Module alarms.
4. LCD contrast can be configured anytime over Sirius VIEW Monitoring application.
 5. Sirius Module can be used with Power Save Mode, this feature can be activated by Sirius VIEW Monitoring application.
 6. Front panel of Sirius Module also has 2 LEDs for letting user know the status of Module like
 - Communication LED (Red): Blinking while communicating.
 - Terminal LED(Green): Active while terminal is ON, Inactive while terminal is OFF.

9.3 Technical Features:

1. Sirius Module has one processor for alarm monitoring, communication and datalogging features.
2. Sirius Module has internal memory card that is logging every 10 seconds value of:
 - Terminal Voltage
 - Terminal Current
 - Module SOC
 - Ambient Temperature
 - Terminal Temperature
 - Time Stamp
3. Internal logged data can be easily extracted over Sirius VIEW Monitoring application. Size of internal memory is 8GB and Module can keep logging 30 days of data without any interruption.
4. User can delete and read SD card memory over Sirius VIEW Monitoring Application.
5. Sirius Module has one of the best ADC to increase measurement accuracy up to 6 μ V level.
6. Sirius Module has advanced algorithm to control Module in safest way. This algorithm can be upgraded by user with updating firmware of Sirius Module over Sirius VIEW Monitoring.
7. Sirius Module firmware can be customized easily based on user needs.
8. Sirius Module has USB interface to communicate with Host PC for:

- Measurement Monitoring
- Alarm Monitoring
- System Configuration
- Measurement Calibration
- Manual/Auto Data Logging\Module firmware updating
- Internal SD card reading/refreshing
- Statistical Analyzing/ Graphical result

10. Shelf Life:

Shelf life is the life of the Module in years from the date it is manufactured to the time it is first operated. The shelf life of supercapacitor cell is 10 years.

11. Maintenance:

The Sirius Module does not require periodic maintenance.

12. Disposal:

Dispose according to local regulation.