Flexible Battery Charger (FBC) System Installation Manual

FBC-1501: 15 kW, 1 Output
FBC-1503: 15 kW, 3 Outputs
FBC-3001: 30 kW, 1 Output
FBC-3002: 30 kW, 2 Outputs
FBC-3003: 30 kW, 3 Outputs

GCT Doc. Control No.: 713419
Doc. Rev.: 01

NOTE: Illustrations are used for reference only and can differ slightly from the actual product. However, key components addressed in this information are represented as accurately as possible.

Revision History

Date	Revision	Prepared By	Reviewed By	Description
27 May 2024	01	GS	JP	Initial Release

Owner's Record

Model

Flexible Battery Charger (FBC) System:

- ☐ FBC-1501: 15 kW, 1 Output
- ☐ FBC-1503: 15 kW, 3 Outputs
- ☐ FBC-3001: 30 kW, 1 Output
- ☐ FBC-3002: 30 kW, 2 Outputs
- ☐ FBC-3003: 30 kW, 3 Outputs

Serial Number: _____

Purchase Date: _____

Output Power: _____

Customer Support

To ensure excellent service, please write down the FBC system's serial number in the owner's record above and have it available when contacting Green Cubes customer support. The serial number can be found on the nameplate on the back side of the FBC system.

Customer Service

For Service: 765-831-8009
service@greencubes.com

For Parts

parts@greencubes.com

Table of Contents

1. General

1.1. Danger, Warning and Caution Symbols

The Flexible Battery Charger (FBC) is designed with safety as the highest priority. Installation must comply with all local codes and the following safety precautions must be read and observed.

Remember, whenever you see:

DANGER!

Be alert for an imminently hazardous situation which, if not avoided, will result in DEATH or SERIOUS INJURY.

Risk of Electric Shock. Do not connect to a circuit operating at more than 150 volts to ground.

WARNING!

Be alert for a potentially hazardous situation which, if not avoided, could result in DEATH or SERIOUS INJURY.

CAUTION!

Be alert for a potentially hazardous situation which, if not avoided, may result in MINOR or MODERATE INJURY.

NOTE:

Be alert against UNSAFE PRACTICES or for the RISK of MECHANICAL DAMAGE.

1.2. Safety Precautions

BEFORE YOU BEGIN:

- Read this entire manual and cautionary markings and warning labels on the FBC system cabinet.
- Ensure you also read the **IMPORTANT SAFETY INSTRUCTIONS** below.
- Installing or servicing this charger must be done by qualified personnel **ONLY**.

⚠ DANGER!

ELECTRIC SHOCK CAN KILL!

Risk of Electric Shock. Do not connect to a circuit operating at more than 150 volts to ground.

Touching live electrical parts can cause fatal shocks or severe burns. The battery terminals are always electrically live, and the output circuit is live whenever the battery is connected or being charged. The input power circuitry and internal circuits are live whenever input power is on. An incorrectly installed or improperly grounded charger is a hazard.

1.3. Safety Instructions

- Ground the FBC system properly with a grounding conductor of a size equal to or larger than that recommended by local electrical codes or the installation section of this manual.
- **DO NOT** touch the uninsulated portion of the output battery connector or an uninsulated battery terminal.
- Only qualified service personnel may remove the panels on the FBC system. There are no user serviceable parts inside this unit. Refer all servicing to qualified service personnel. Opening the system or attempted installation or repair by other than qualified service personnel voids the warranty.
- Disconnect battery charger from the battery and follow Lockout/Tagout procedure before servicing the FBC charger system.
- Do not expose to rain or perform installation/service/repair work when in standing water.
- To stop a charge in progress, press the stop button on the front panel, then disconnect the battery charge cable to prevent arcing or burning of the charger connections.

Safety Instructions (continued)

■ The charging cables must be sized for the full rated current of the FBC system and inspected frequently for wear, cuts and abrasion. Do not use worn, damaged, undersized, or poorly spliced cable.

■ The FBC system charging connector is subject to normal wear and tear and may be damaged by misuse or abuse. Frequently inspect the connector for cracking, pitting of contacts, fraying of wires or signs of connector fatigue. Replace damaged charging connectors immediately.

⚠ WARNING!

■ Personal protective equipment must be used when and where required.

■ **DO NOT** install or place unit on, over or near combustible surfaces.

■ **DO NOT** install unit near flammables.

■ Install the FBC system in a well ventilated area.

■ **DO NOT** overload building wiring - ensure power supply system is properly sized, rated and protected to handle this unit. Use only on circuits provided with the minimum wire size specified in the installation section of this manual.

■ Protective barriers should be installed in charging equipment locations prone to damage from equipment traffic.

■ **DO NOT** install unit where it will be exposed to water or condensation.

■ To avoid shock hazard, only install cables approved by Green Cubes Technology for indoor use.

■ **DO NOT** subject the cable or coupler to damage or stress. **DO NOT** step on the coupler cable.

■ **DO NOT** hang from or swing on the coupler cable.

■ **DO NOT** disassemble the Flexible Battery Charger (FBC) system.

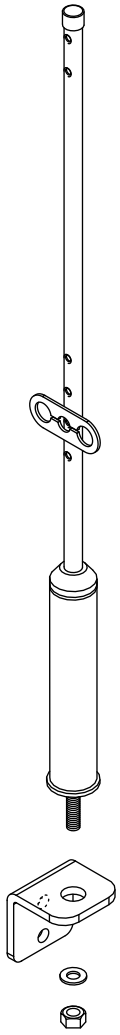
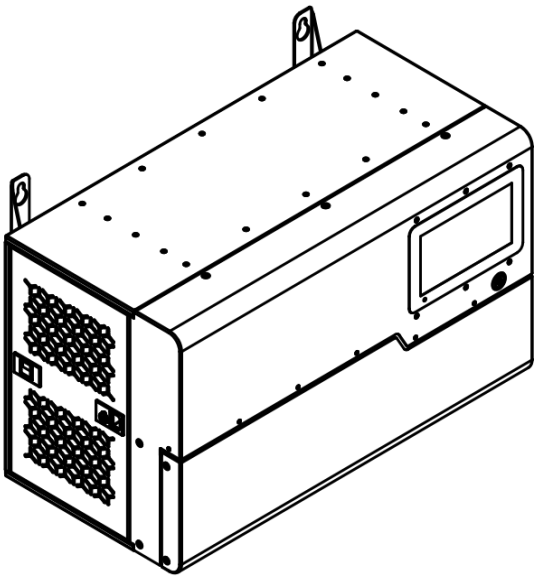
■ During installation, follow the National Electrical Code (NEC) and local codes. NEC and local codes take precedence.

■ The charger must be properly connected to mains protective earth to ensure protection from electrical hazards,

2. Installation Procedure

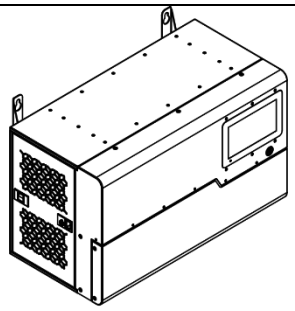
2.1. Parts List (Wall Mount)

NOTE: One Pogo Stick Basic-40" (Sackett Part Number 5079) and Pogo Stick Mounting Bracket (Sackett Part Number B802327) is required for each battery output cable assembled.

	
Pogo Stick Basic-40 (with wall bracket) Part Number 960008	Charger System Part Numbers: FBC-1501: 15 kW, 1 Output FBC-1503: 15 kW, 3 Outputs FBC-3001: 30 kW, 1 Output FBC-3002: 30 kW, 2 Outputs FBC-3003: 30 kW, 3 Outputs

2.2. Parts List (Pedestal Mount)

NOTE: One Pedestal Charger Stand (Sackett Part Number B-VCS) is required for the Flexible Battery Charger System and two Pogo Sticks Basic-40" (Sackett Part Number 1769). Two Pogo Sticks Basic-40" (Part Number 1769) is required for the first two battery output cables assembled. One Pogo Pole-86" (Sackett Part Number 808078A) is required for the third output cable assembled.

<table>
<tr><td>  </td><td>Charger System Part Numbers:
FBC-1501: 15 kW, 1 Output
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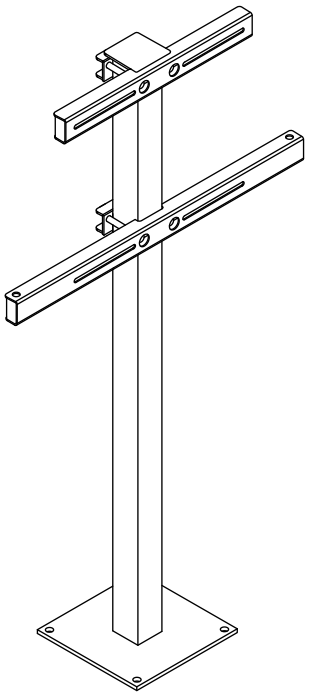
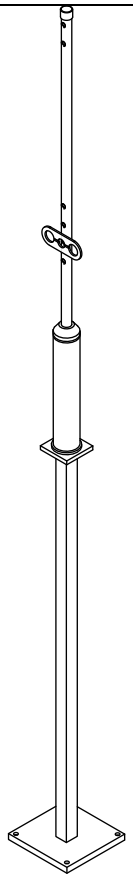
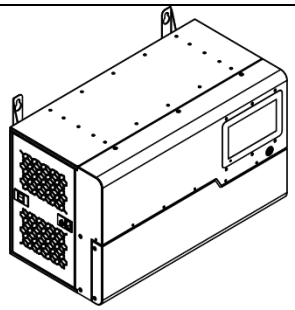
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Pogo Stick Basic-40"
(with charger stand bracket)
Part Number 960005</td><td>Pedestal Charger Stand
(Single Charger)
Part Number 960006</td><td>Pogo Pole-40"
(with stand alone stand)
Part Number 960009</td></tr>
</table>

2.3. Parts List (Additional Pedestal Mount Options)

NOTE: Dual Pedestal Charger Stand (Sackett Part Number B-VCS) is required for two Flexible Battery Charger Systems and one Pogo Sticks Basic-40” (Sackett Part Number 1769). Two Pogo Sticks Basic-40” (Part Number 1769) is required for the first two battery output cables assembled. One Pogo Pole-86” (Sackett Part Number 808078A) is required for the third output cable assembled.

<table>
<tr><td>  </td><td>Charger System Part Numbers:
FBC-1501: 15 kW, 1 Output
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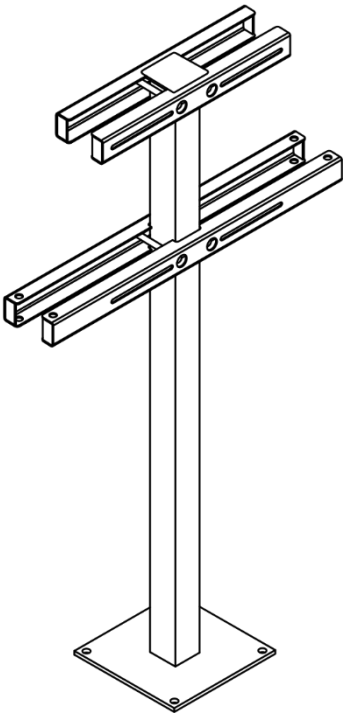
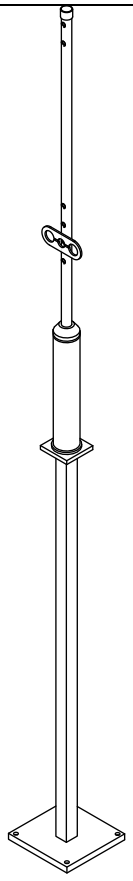
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Pogo Stick Basic-40”
(with charger stand bracket)
Part Number 960005</td><td>Pedestal Charger Stand
(Back to Back Charger)
Part Number 960007</td><td>Pogo Pole-40”
(with stand alone stand)
Part Number 960009</td></tr>
</table>

2.4. Introduction

The Flexible Battery Charger (FBC) system is an, intelligent charger system that ranges in power from 15kW for lower-duty equipment to 30kW for the hardest-working equipment. The FBC system offers a wide array of features that include:

- Fast charging
- Small and Compact design
- Same form factor for 15 kW and 30 kW
- 2x15kW Power Modules
- Up to three outputs, 5 different configurations
- 3 different charged simultaneously
- ~97% efficiency
- Low input current distortion
- Color Touchscreen Display and IoT communication
- Wall or Stand Mounted Installation
- NEMA 1 Enclosure Rating

2.5. Product Specifications

Mechanical Information	
Dimensions	23.6 x 13.8 x 11.8 in (599.4 x 350.5 x 299.7 mm)
Weight	Charger with 15kW configuration- 77 lbs (35 kg) Charger with 30kW configuration- 99 lbs (45 kg)
AC Input Connector	Phoenix Contact P/N: 1932504 6AWG 4core, Lmin > 1.8m
DC Output Connector	OEM specific with 4/0 AWG wire
Battery Types	Lithium Ion
Battery Pack Sizes	Suitable for GCT FBP series Battery pack
Environmental Information	
Ingress Protection/Enclosure Rating	IP21 (NEMA 1)
Operating Temperature	-20°C to +50°C (-4°F to 122°F)
Storage Temperature	-40°C to +80°C (-40°F to 176°F)
Relative Humidity	Max. 85%

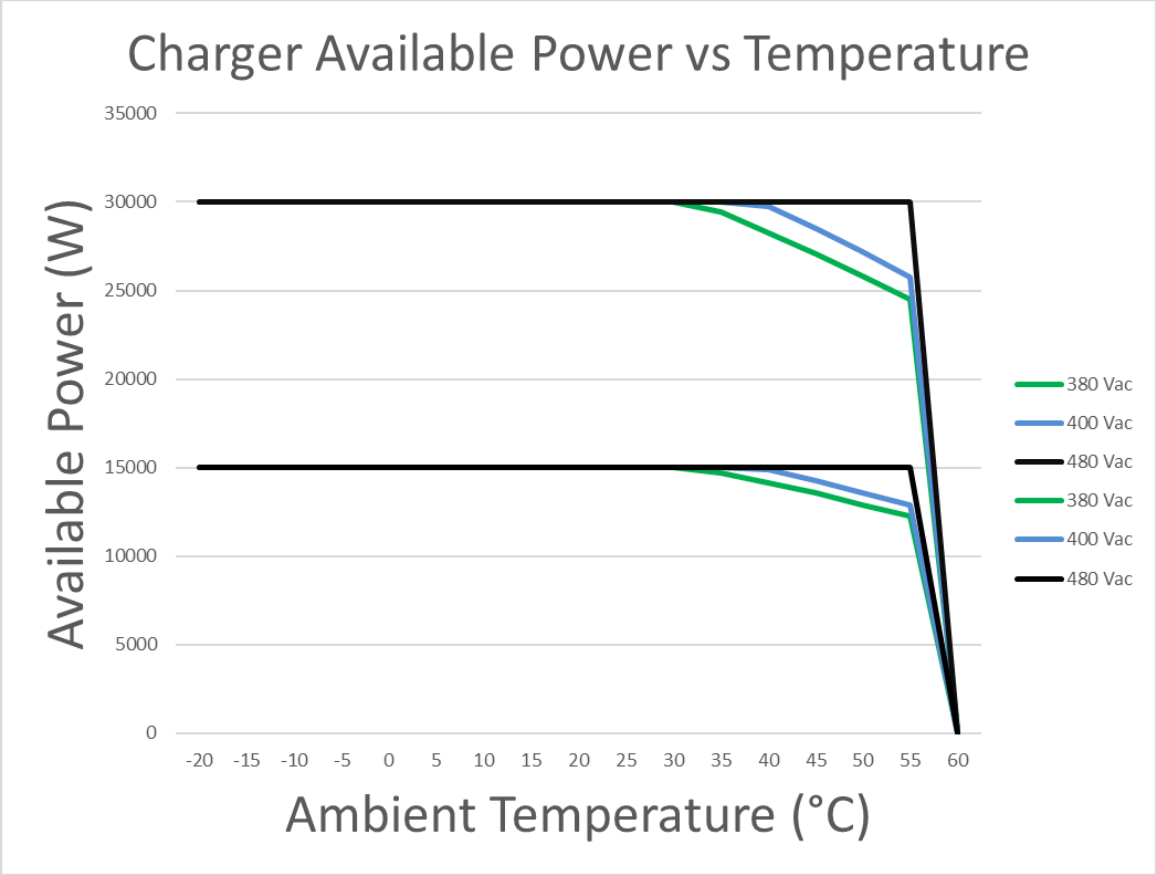
Product Specifications (continued)

AC Input	
Rated AC Input Voltage	380 – 480 VAC, 3-phase (3W+Protective Earth)
Maximum AC Input current	50 Amps
AC Input Frequency	47 – 63 Hz
Rated AC Input Frequency	50/60 Hz
Rated AC Power Factor	PF > 0.99; iTHD < 5%

Model Information

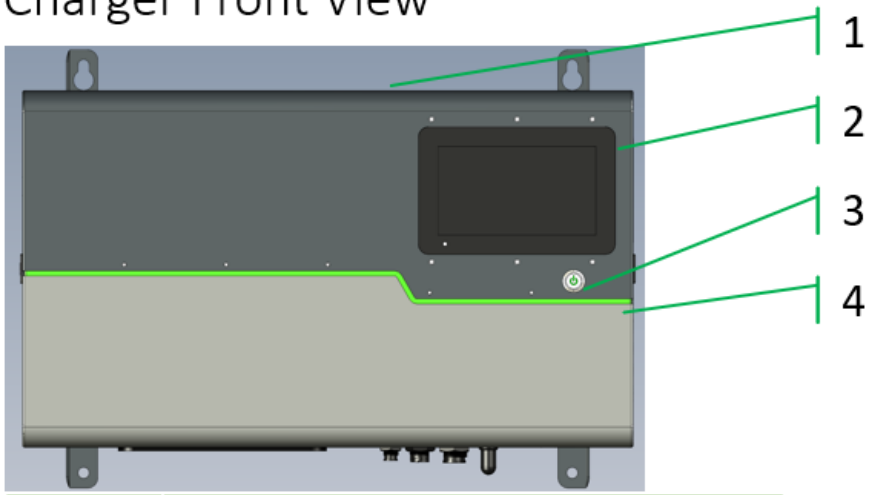
Models	Power Output	Outputs	Nominal Battery Voltage	Maximum Output Current	Anderson Euro Connector	Cable
FBC-1501	15 kW	1	24	300A	A320	4/0
	15 kW	1	36	300A	A320	4/0
	15 kW	1	48	300A	A320	4/0
FBC-1503	15 kW	3	24	100A	A320	2/0
FBC-3001	30 kW	1	36	320A	A320	4/0
	30 kW	1	48	320A	A320	4/0
	30 kW	1	80	300A	A320	4/0
FBC-3002	30 kW	2	36	300A	A320	4/0
	30 kW	2	48	300A	A320	4/0
FBC-3003	30 kW	3	36	200A	A320	2/0
	30 kW	3	48	200A	A320	2/0

2.5.1. Charger Derating Feature



2.6. System Overview

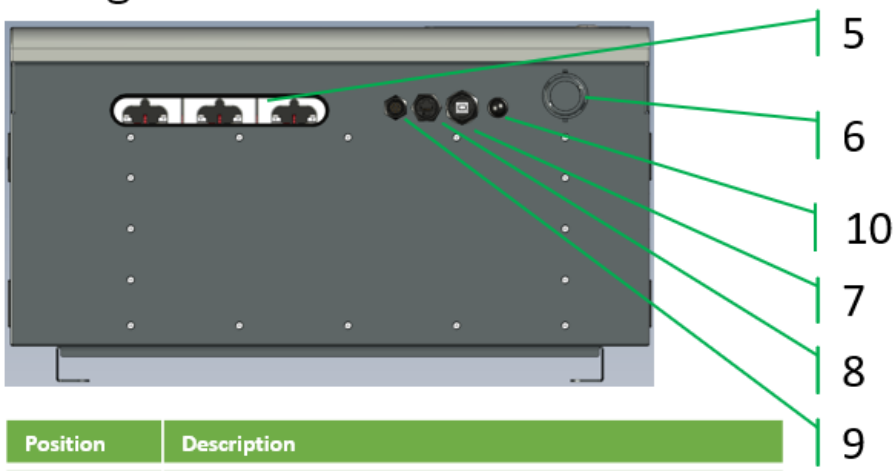
Charger Front View



Position	Description
1	Charger Housing
2	Touch Screen Display Controller
3	ON/OFF Button
4	Front Panel Door *

* Detachable for Input and Output cabling configuration.

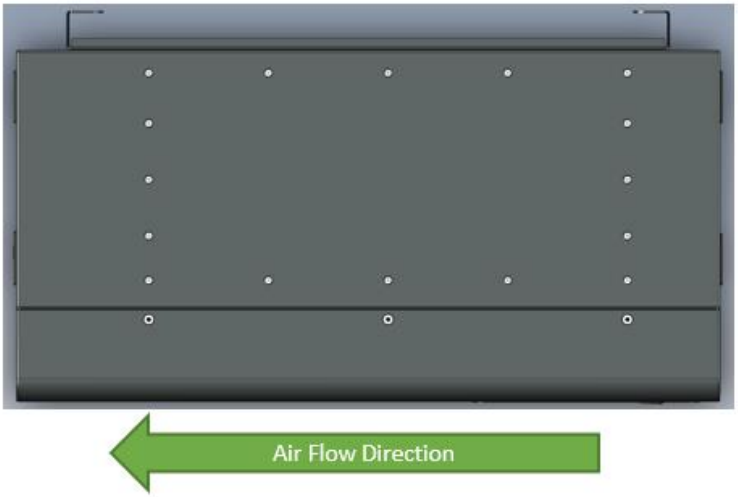
Charger Bottom View



Position	Description
5	Charger Output bay (Battery Cable and Signals)
6	3phase Input Entry
7	USB 2.0 Type B port
8	Ethernet port
9	8-pin Accessory Signal Connector port
10	WIFI Antenna

System Overview (continued)

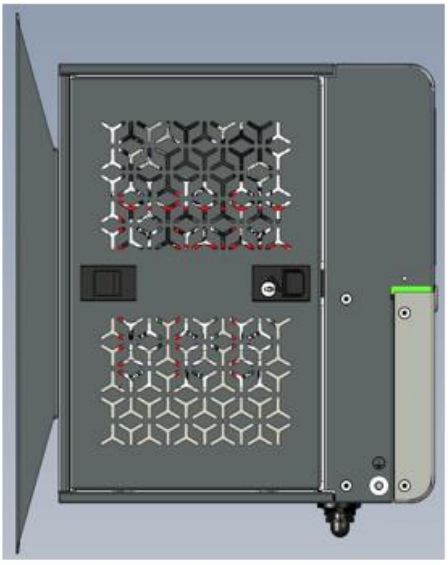
Charger Top View

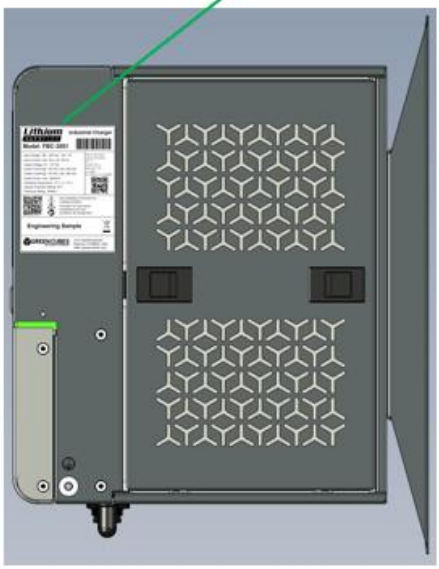


Position	Description
11	Product label

11

Charger Side View



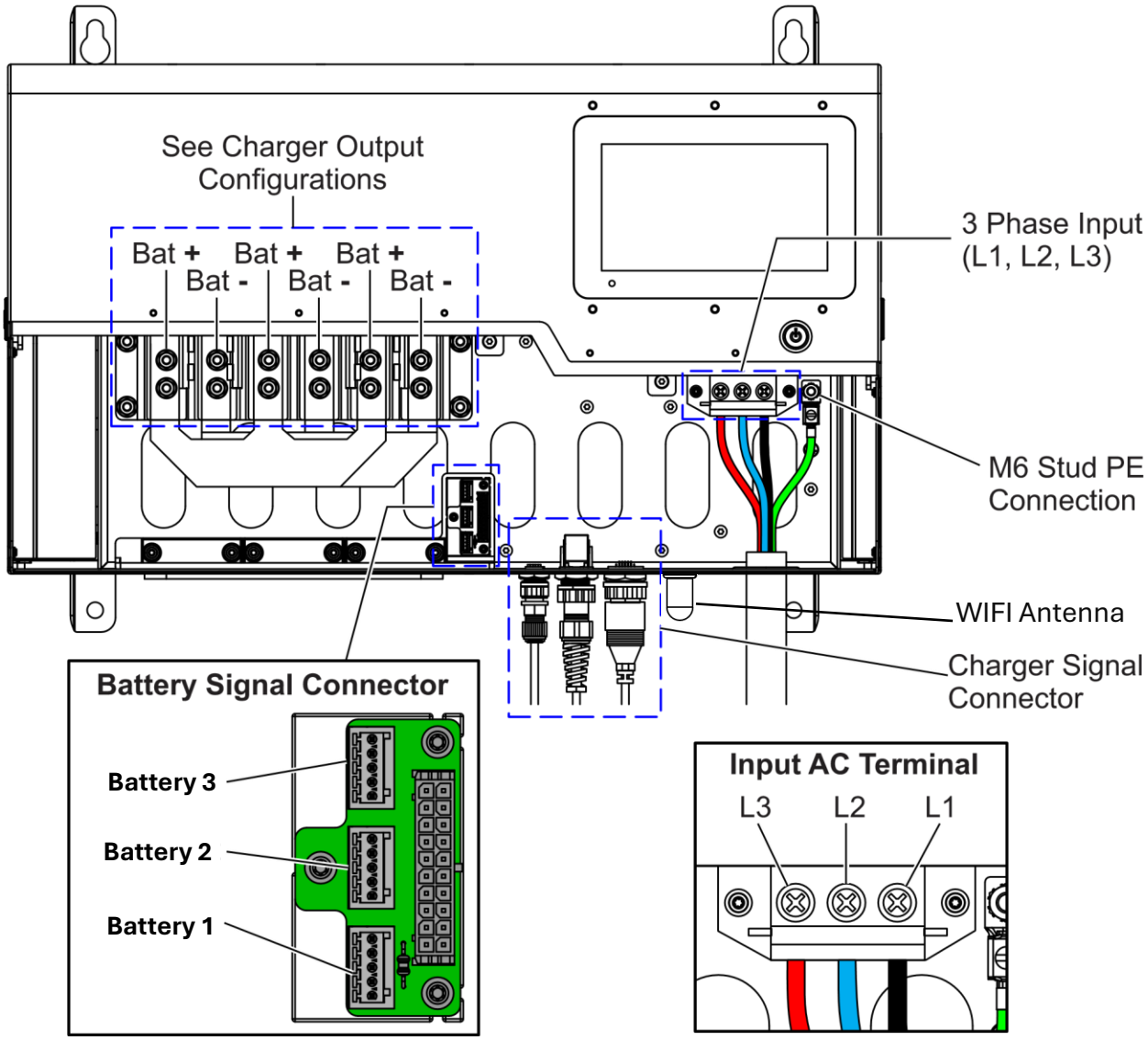


Left Side View = Air Exhaust

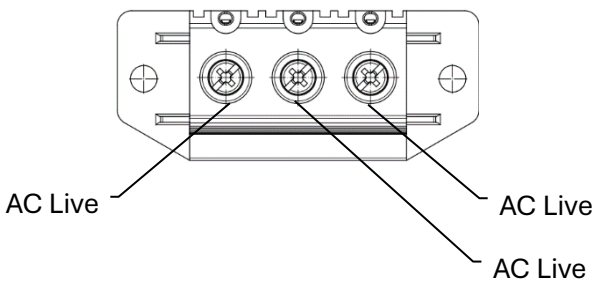
Right Side View = Air Intake

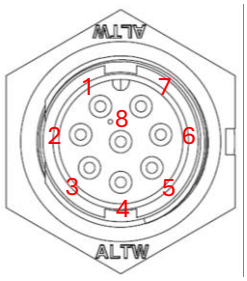
*Door can be detached for Power Expansion.

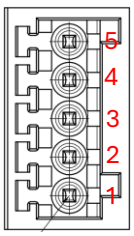
System Overview (continued)



Port	Voltage / Current Rating	MPN Connector	MPN Mating Part	MFN
Input AC terminal	1000 V, 125 A	1932504	N/A	Phoenix Contact
Input PE terminal	M6 Ring Lug, Built-in on the Charger	KPA4C	N/A	Hubbell
Input AC Connector	Max. 480 Vac, 63A	User Defined	User Defined	
Input AC Cable	Typ. AWG6 4C, max. O.D. = 27mm	User Defined	User Defined	
Input AC Cable Crimp Terminal	-	FSD84-18-C or equivalent	N/A	Panduit or equivalent
USB 2.0 Type B port	-	UB-20PMFP-LC7001	UB-20AFMM-LL7AXX	Amphenol LTW
Ethernet Port	-	RCP-5SPFFH-TCU7001	RCP-5SAMMM-TLM7BXX	Amphenol LTW
8-pin Accessory Signal Connector port	5A	BD-08PMMS-LC7001	BD-08AFFM-LL6AXX	Amphenol LTW
Battery Signal Connector	160 V, 4A	1881587	1881354	Phoenix Contact

<table>
<tr><th>Port</th><th>MPN Connector</th><th>Pin Assignment</th></tr>
<tr><td>Input AC terminal</td><td>1932504</td><td>Top View
 

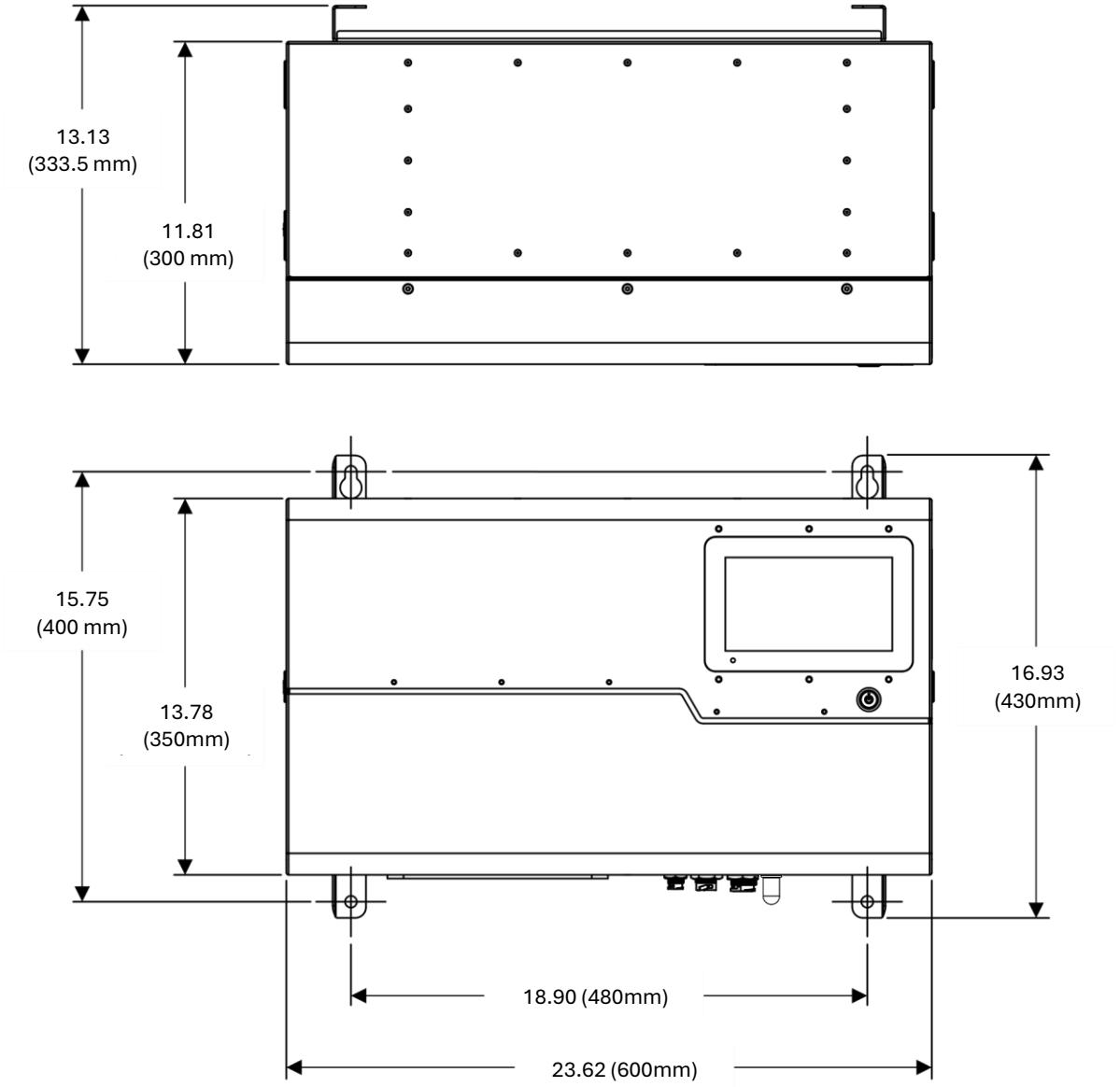
Top View</td></tr>
<tr><td>Input PE terminal</td><td>KPA4C</td><td>M6 Ring Lug, Built-in on the Charger</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>USB 2.0 Type B port</td><td>UB-20PMFP-LC7001</td><td>Standard</td></tr>
<tr><td>Ethernet Port</td><td>RCP-5SPFFH-TCU7001</td><td>Standard</td></tr>
<tr><td>8-pin Accessory Signal Connector port</td><td>BD-08PMMS-LC7001</td><td> 

<table><tr><th>Pin</th><th>Desciption</th></tr><tr><td>1</td><td>S_AUX1_NO</td></tr><tr><td>2</td><td>S_AUX1_COM</td></tr><tr><td>3</td><td>S_AUX1_NC</td></tr><tr><td>4</td><td>S_AUX_IN</td></tr><tr><td>5</td><td>S_AUX2_NO</td></tr><tr><td>6</td><td>S_AUX2_COM</td></tr><tr><td>7</td><td>S_AUX2_NC</td></tr><tr><td>8</td><td>S_AUX_IN_RTN</td></tr></table></td></tr>
<tr><td>Battery Signal Connector</td><td>1881587</td><td> 

<table><tr><th>Pin</th><th>Desciption</th></tr><tr><td>1</td><td>S_BATx_BAT+</td></tr><tr><td>2</td><td>S_BATx_Charger Detect</td></tr><tr><td>3</td><td>NC</td></tr><tr><td>4</td><td>S_BATx_CANH</td></tr><tr><td>5</td><td>S_BATx_CANL</td></tr></table></td></tr>
</table>

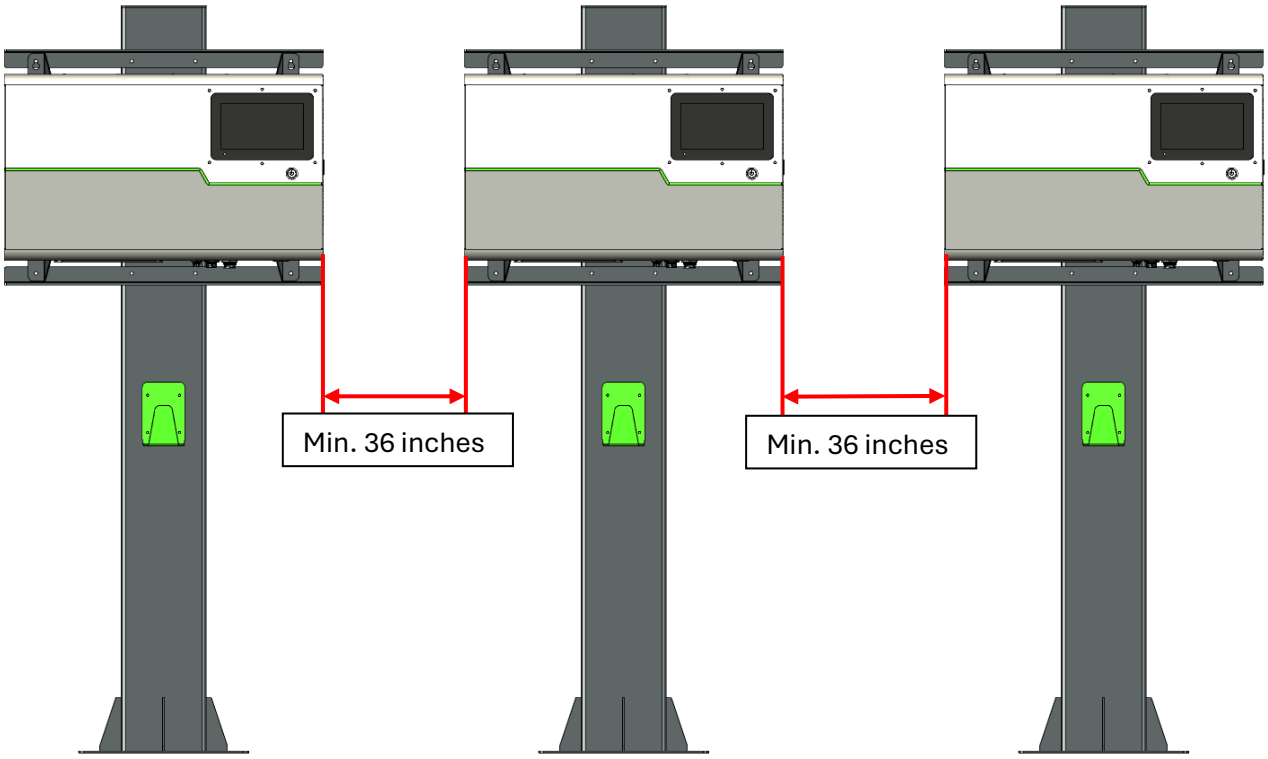
2.7. Charger Dimensions and Site Preparation

Refer to Safety Precautions (section 1.2) regarding considerations for the FBC system charging site. See the Figure below which indicates the locations for the four mounting screws/bolts. The wall mount dimensions are 18.9 (480 mm) and 15.75 (400 mm) on centers.



2.8. Minimum distance / keep out area around charger

There must be a minimum distance left clear around the charger to perform maintenance on the charger 36 inches (864 mm) on the right side, 24 inches (580 mm) on the left side of the charger.



Sample image of Charger Spacing.

2.9. Wall Mounting Procedure

The FBC systems are designed for wall mounting. Refer to Product Specifications (section 2.5) for your charger's weight to determine the correct mounting hardware.

NOTE: The steps shown in this procedure will reflect a single battery charge configuration.

However, the FBC system is capable of a double or triple battery charger configuration as well. See Section 2.12 (Charger Output Configurations) for charger output configuration options.

1. Refer to section 2.7 (Charger Dimensions and Site Preparations) for mounting dimensions to a concrete or cinder block wall surface.

2. Locate an area for the FBC system with enough physical clearance for safe equipment operation and personnel safety.

CAUTION: Ensure the charger is located in a well ventilated area free of flammables.

3. Using the dimensions from Section 2.3, locate and mark the fastener holes on the wall.

4. Using the appropriate masonry bit, drill (4) fastener holes.

5. With help, position the FBC system on the wall and secure the unit using (4) Tapcon screws and (4) washers. See Figure 2.8.1.

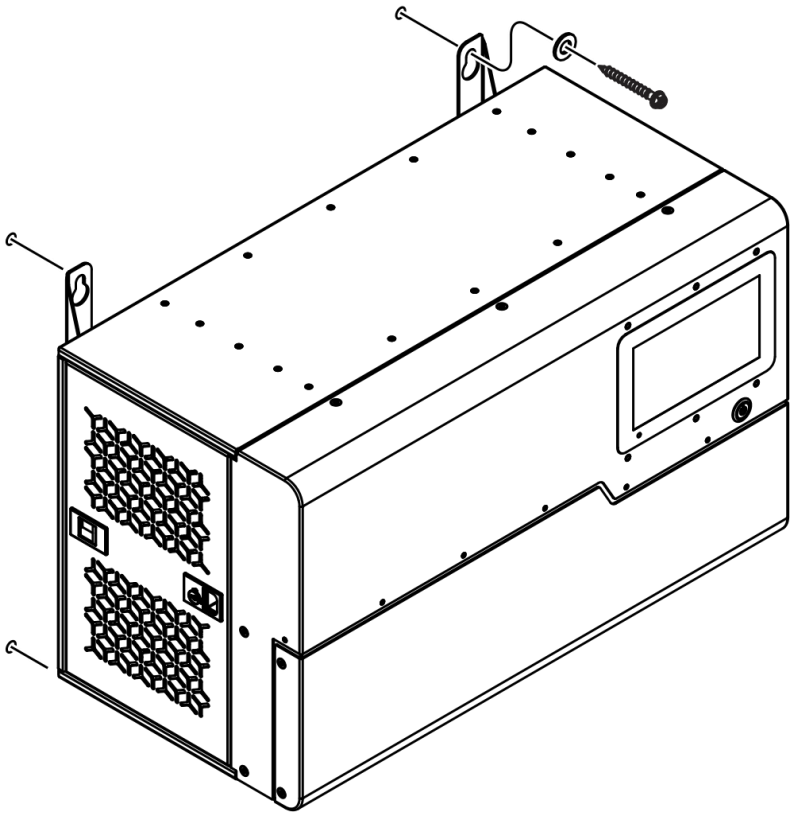


Figure 2.8.1

Wall Mounting Procedure (continued)

6. Using the Pogo Stick mounting bracket, locate and mark the drill mounting holes on the left or right side of the FBC system. See the figure below.

NOTE: Locate the pogo stick mounting bracket at a minimum distance of 6.0 in (152.4 mm) from the FBC charger system on the left or right side.

7. Using the appropriate masonry drill bit, drill (2) fastener holes for the pogo stick mounting bracket.

8. Position the pogo stick mounting bracket on the wall and secure it using (2) Tapcon screws and (2) washers (Figure 2.8.2).

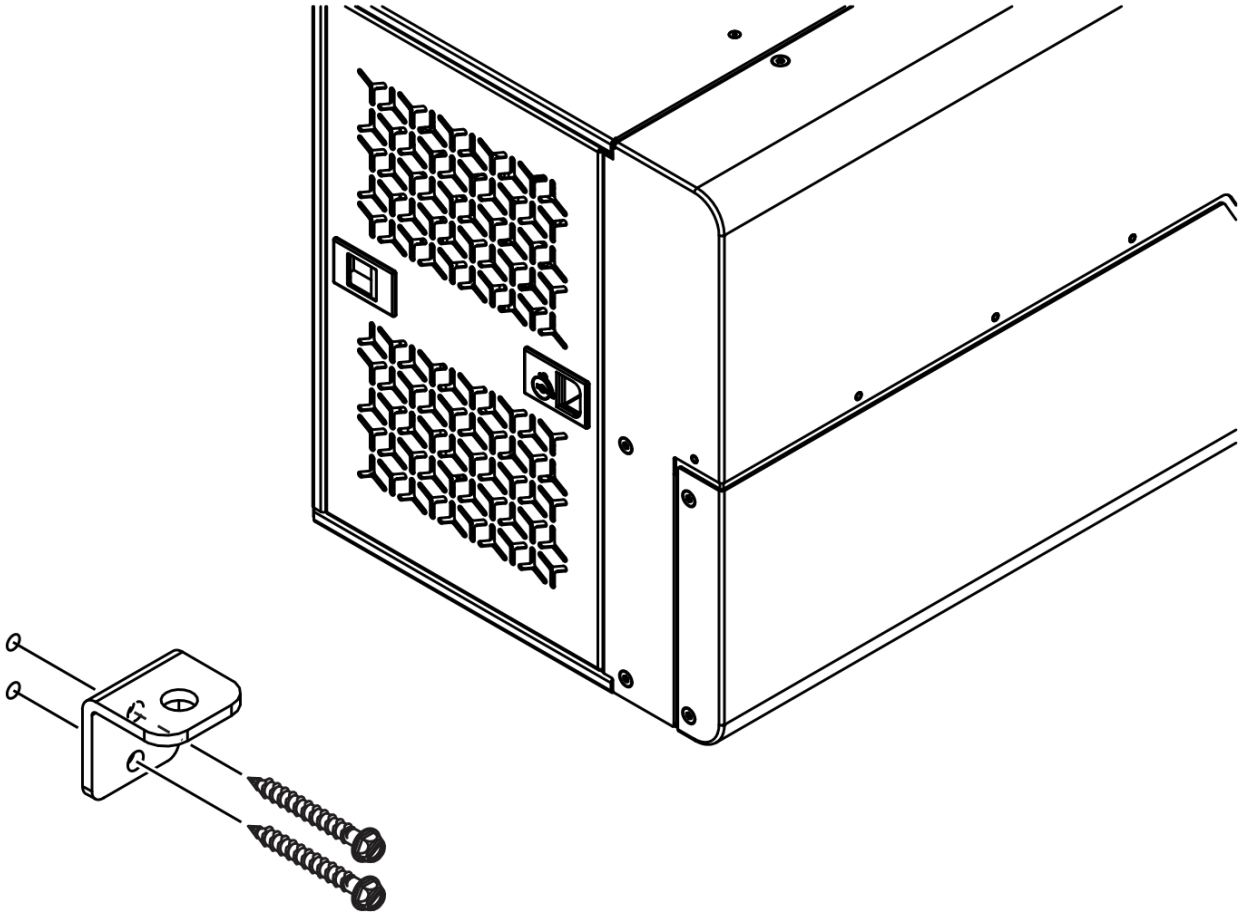


Figure 2.8.2

9. Using the provided fasteners, secure the pogo stick to the pogo stick mounting bracket.

NOTE: A "Pogo Stick is a spring-loaded cable support and retractor that keeps the cables off the floor. It allows the charger cables to be extended to reach equipment to be charged.

Wall Mounting Procedure (continued)

10. **NOTE:** For two charging cables, mount a pogo stick and pogo mounting stick bracket on the left and right sides of FBC system. For three charging cables, mount the third pogo stick and mounting bracket 5 ft (1.524 m) away from the charger. Depending on equipment charging station location. See Figure 2.7.3.

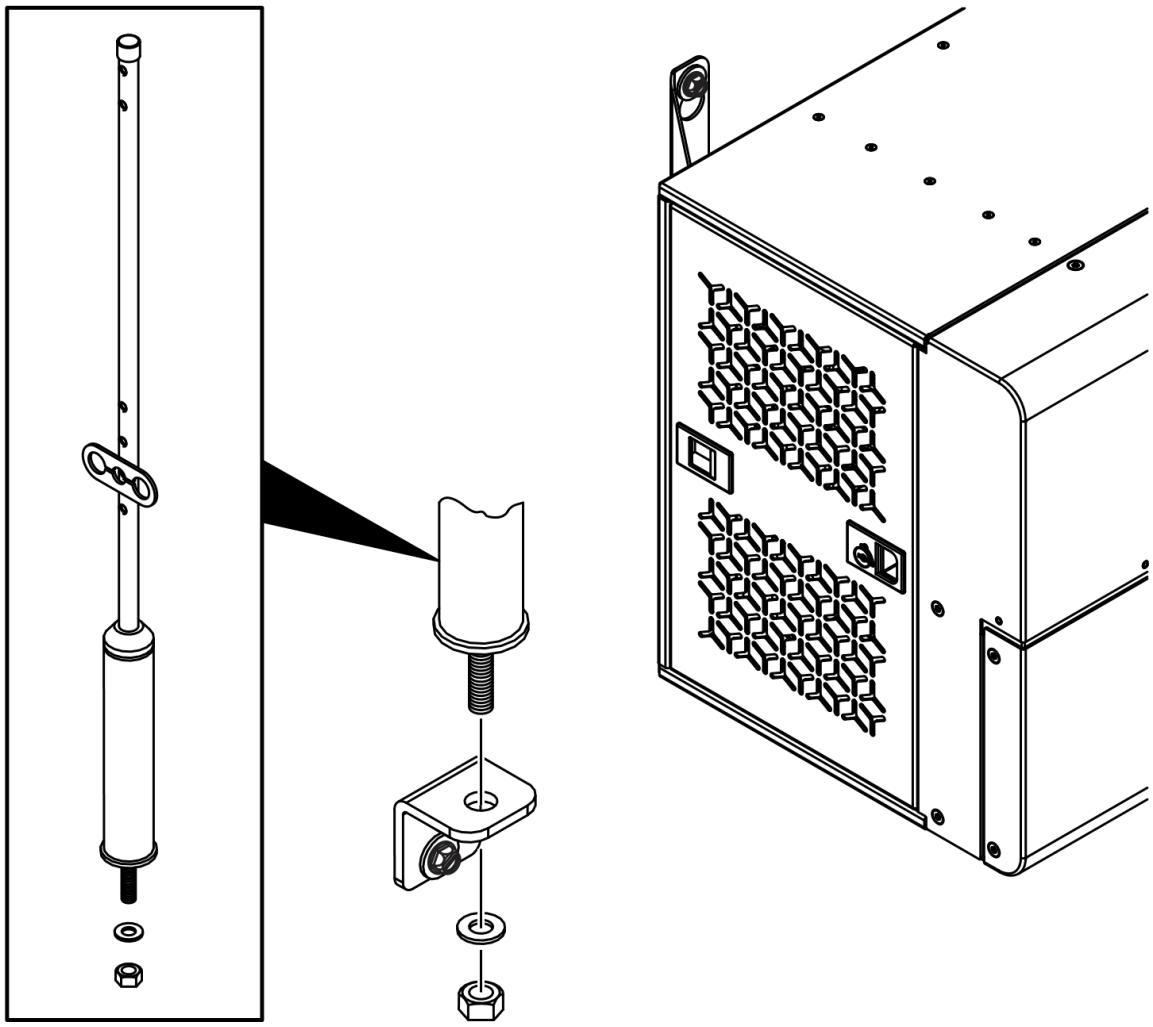


Figure 2.8.3

Wall Mounting Procedure (continued)

11. **CAUTION:** When routing the output cables to the pogo stick, ensure the cable loop is shortened to prevent a cable pinch point that will cause an electric arc. See Figure 2.8.4 for correct cable routing.

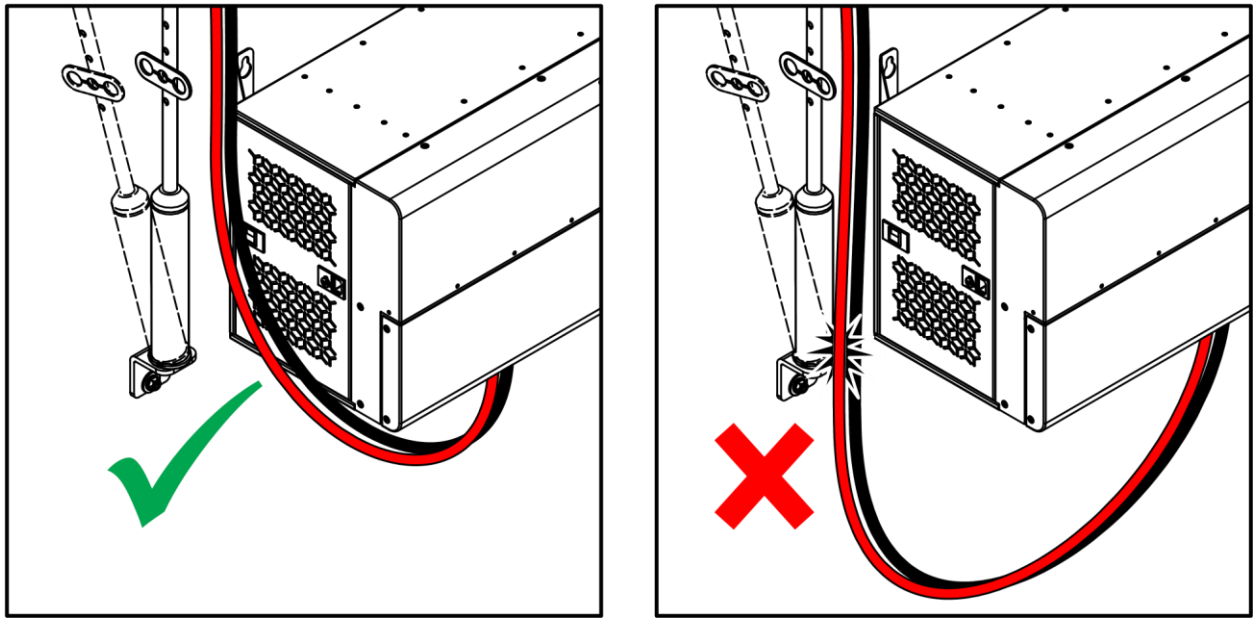


Figure 2.8.4

2.10. Pedestal Mounting Procedure

The FBC systems are designed for pedestal mounting as well. Refer to section 2.7 (Charger Dimensions and Site Preparations) for mounting dimensions to a pedestal stand.

NOTE: The steps shown in this procedure will reflect a single battery charge configuration.

However, the FBC system is capable of a double or triple battery charger configuration as well. See Section 2.12 (Charger Output Configurations) for charger output configuration options.

1. Locate an area for the pedestal on a flat concrete floor with enough physical clearance for safe equipment operation and personnel safety.

CAUTION: Ensure the charger is located in a well ventilated area free of flammables.

2. Using the dimensions from the base of the pedestal, locate and mark the mounting holes on the floor.

3. Using the appropriate masonry bit, drill the appropriate number of fastener holes.

4. Position the pedestal over the drilled holes. Using (4) Tapcon screws and (4) washers, secure the pedestal to the floor (Figure 2.9.1).

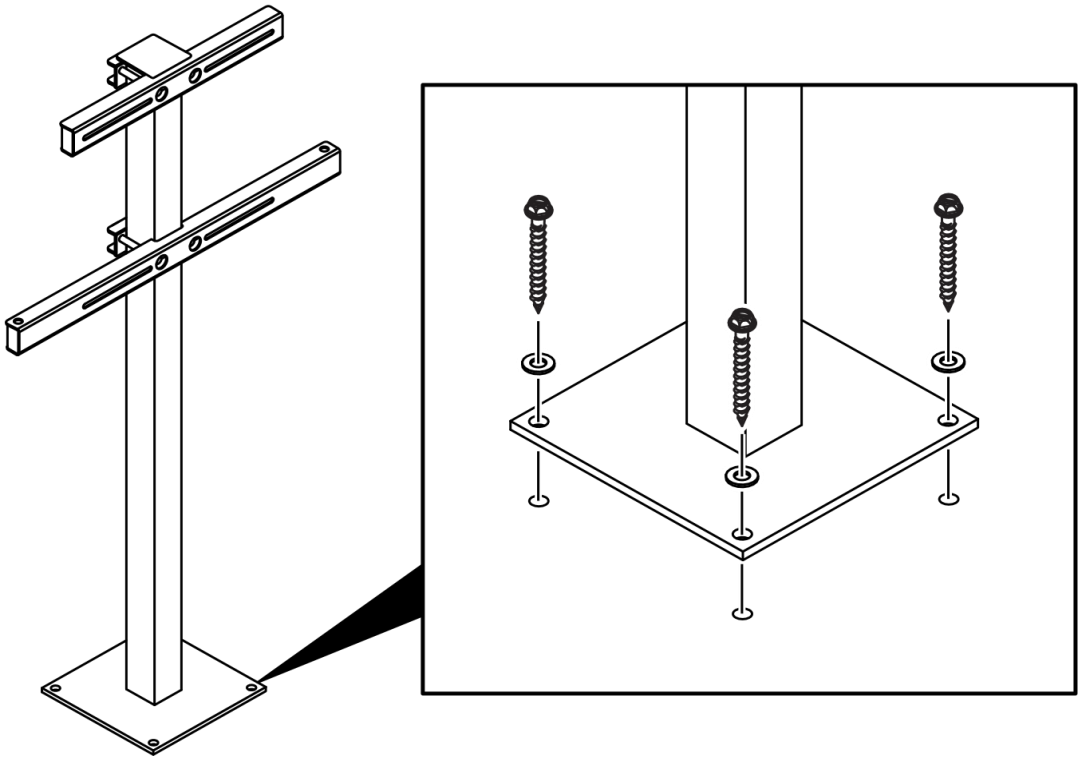


Figure 2.9.1

Pedestal Mounting Procedure (continued)

5. Position the FBC system on the pedestal and secure the unit using (4) 5/16” x 1” hex head screws, (8) 7/16” flat washers and (4) 7/16” lock washers (Figure 2.9.2).

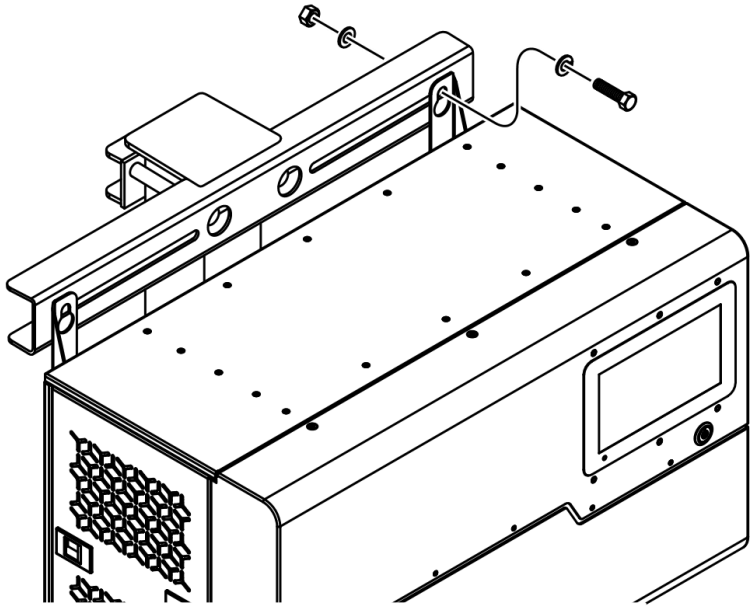


Figure 2.9.2

6. Using the provided fasteners, secure the pogo stick bracket to the hole in the pedestal bracket on the left or right side of the FBC system (Figure 2.9.3).

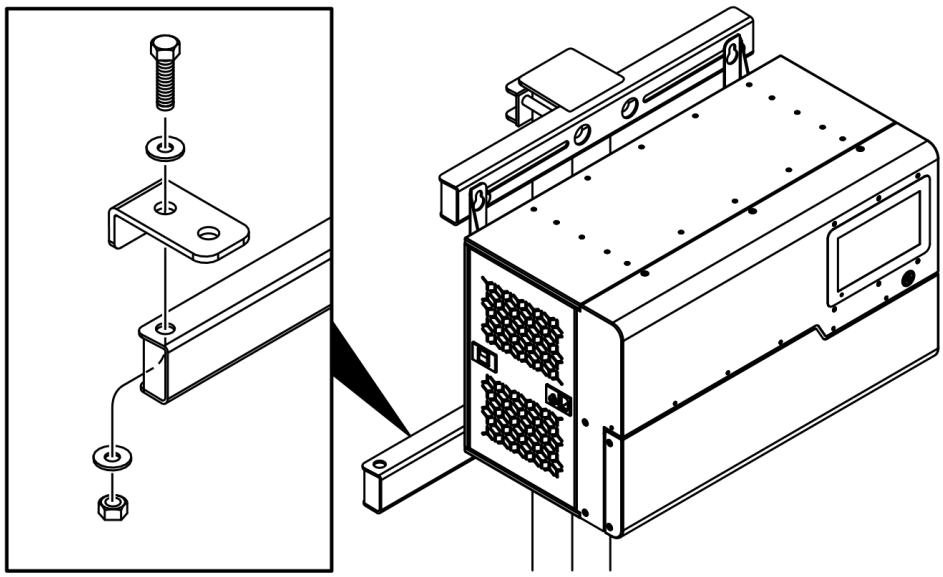


Figure 2.9.3

Pedestal Mounting Procedure (continued)

7. Secure the pogo stick to bracket with the provided hardware as shown in Figure 2.9.4.

NOTE: A "Pogo Stick is a spring-loaded cable support and retractor that keeps the cables off the floor. It allows the charger cables to be extended to reach equipment to be charged.

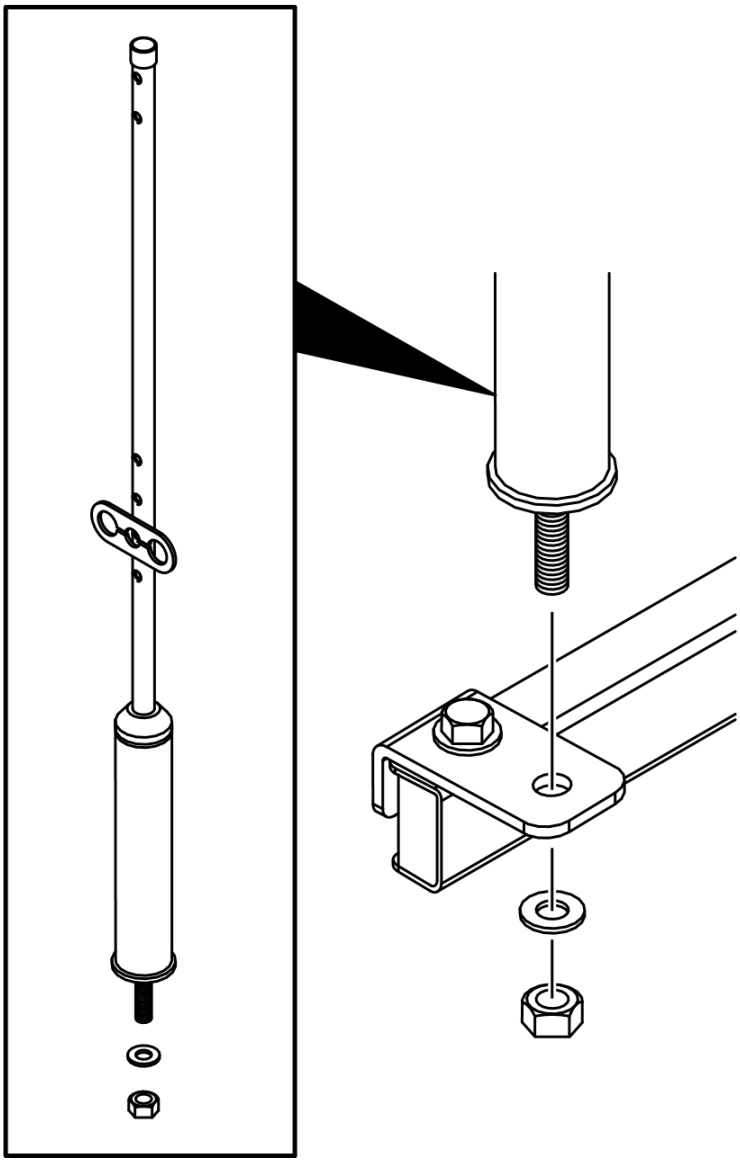


Figure 2.9.4

Pedestal Mounting Procedure (continued)

8. **NOTE**: For two charging cables, mount a pogo stick to the left and right sides of FBC system. For three charging cables, mount the third charging cable on Pogo Pole-86” 5 ft (1.524 m) away from the pogo stick mounted on the left or right side of the FBC system. See Figure 2.9.5.

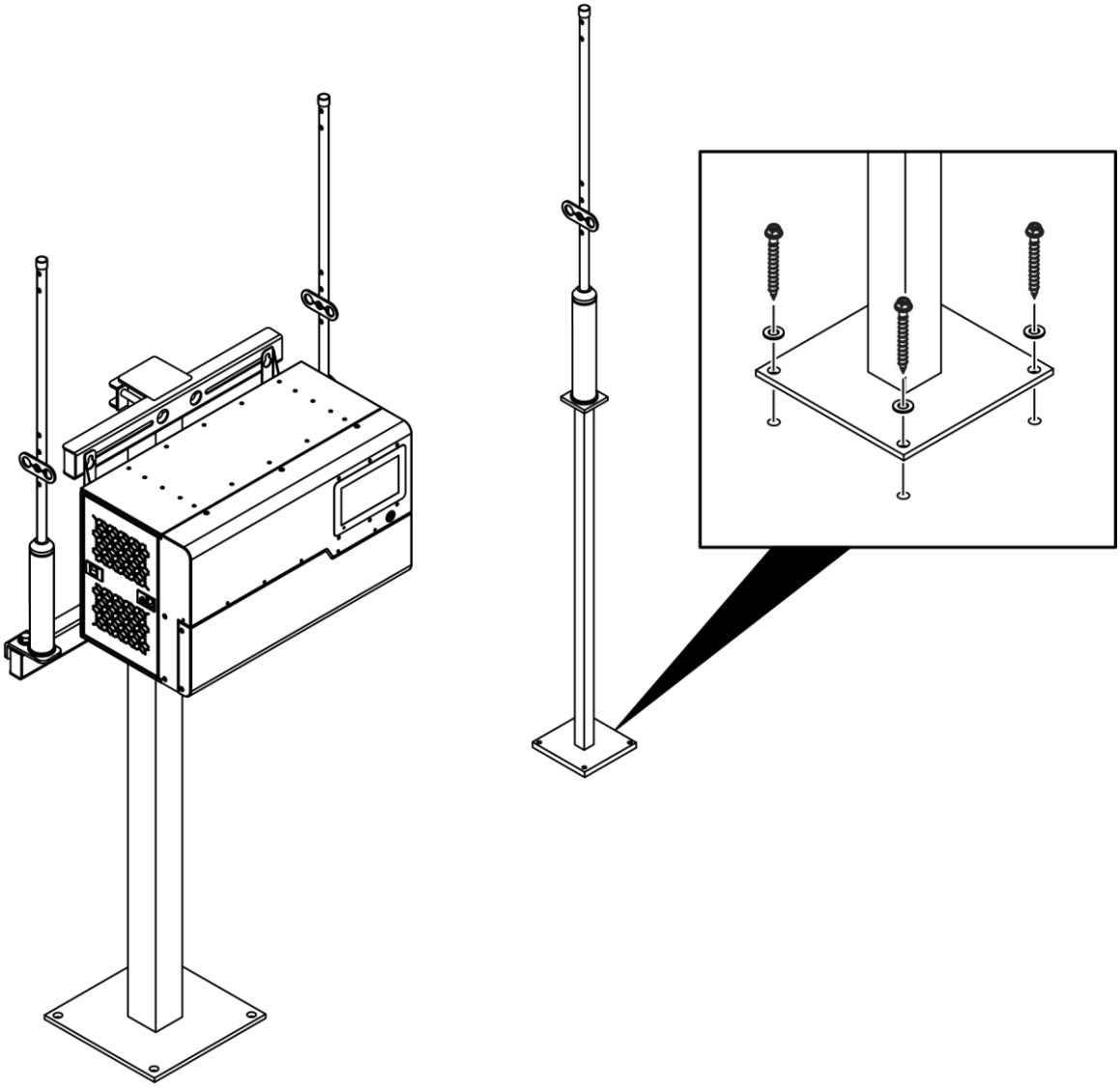


Figure 2.9.5

Pedestal Mounting Procedure (continued)

9. **CAUTION**: When routing the output cables to the pogo stick, ensure the cable loop is shortened to prevent a cable pinch point that will cause an electric arc. See Figure 2.9.6 for correct cable routing.

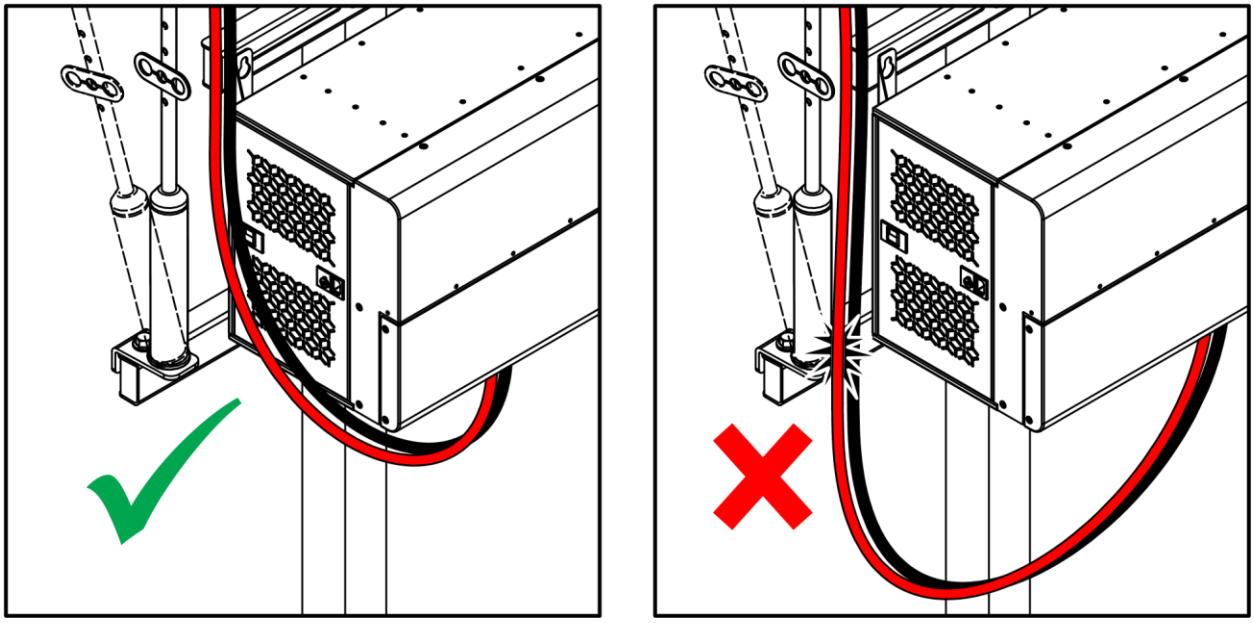


Figure 2.9.6

2.11. Input Wiring

WARNING: AC utility power to the FBC system must be installed by an experienced and licensed electrician, subject to all applicable national and local electrical code requirements.

DANGER: The FBC system access covers **DOES NOT** have interlocks that disable power when the covers are removed. AC power is always present in the cabinet unless the AC supply breaker is switched off or tripped. Battery voltage is also present in the FBC system whenever any equipment is connected.

DANGER: The FBC system **MUST** be connected directly to the breaker box via electrical conduit. The use of plugs or cords is unsafe and **NOT** allowed.

1. Remove the (4) screws securing the front access panel and remove the panel (Figure 2.10.1).

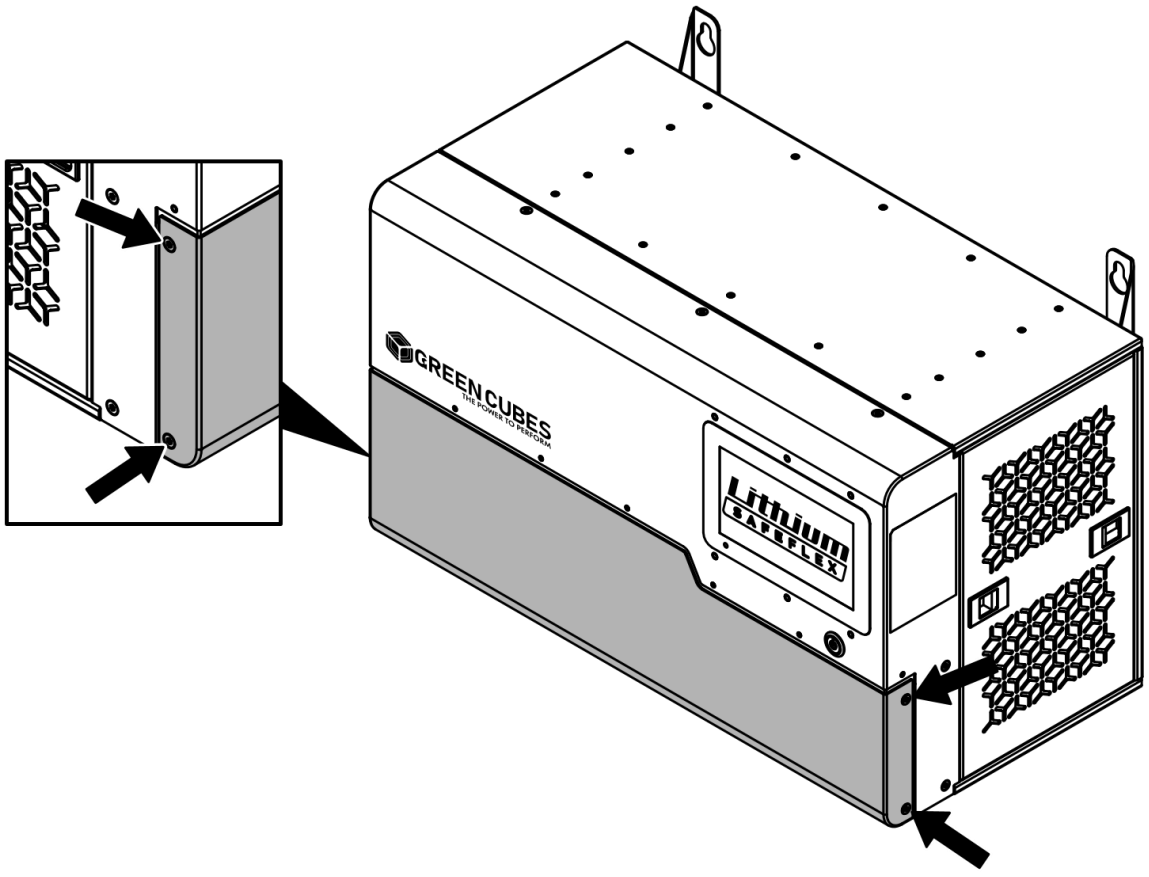


Figure 2.10.1

Input Wiring (continued)

2. Remove the (3) fasteners securing the input wire terminal block cover and remove the cover as shown in the Figure 2.10.2.

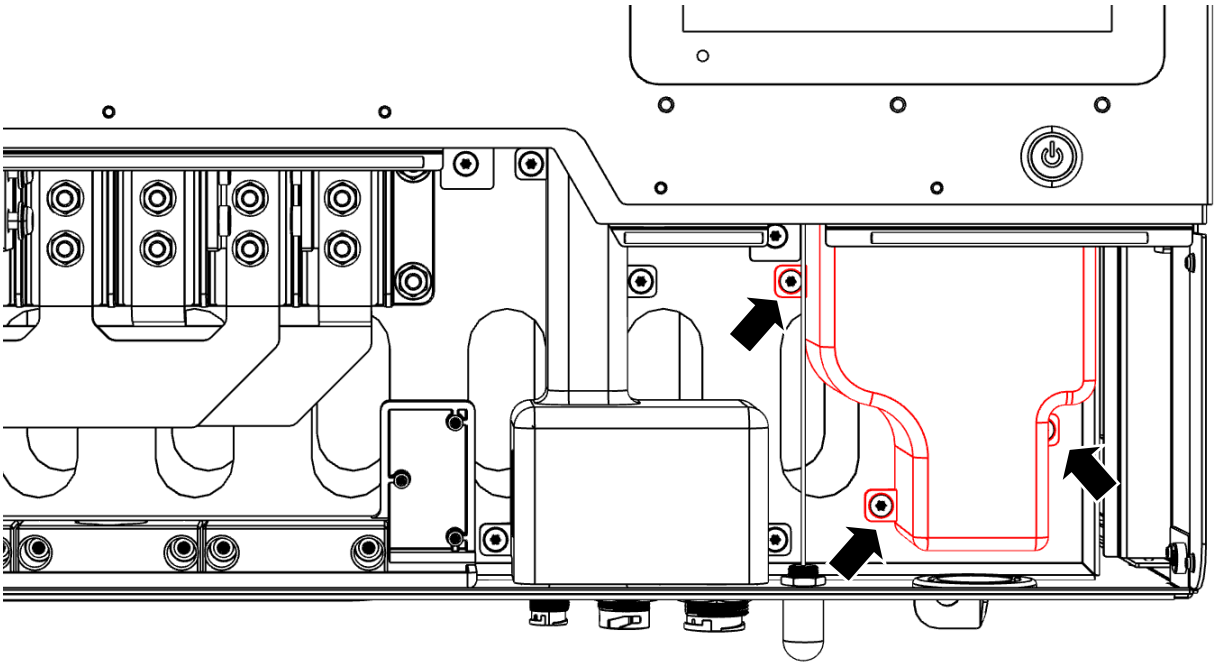


Figure 2.10.2

3. Remove the 1” diameter knock-out from the bottom of the FBC system cabinet as shown in the figure 2.9.3.

NOTE: The opening in the cabinet will accept a 3/4 inch conduit.

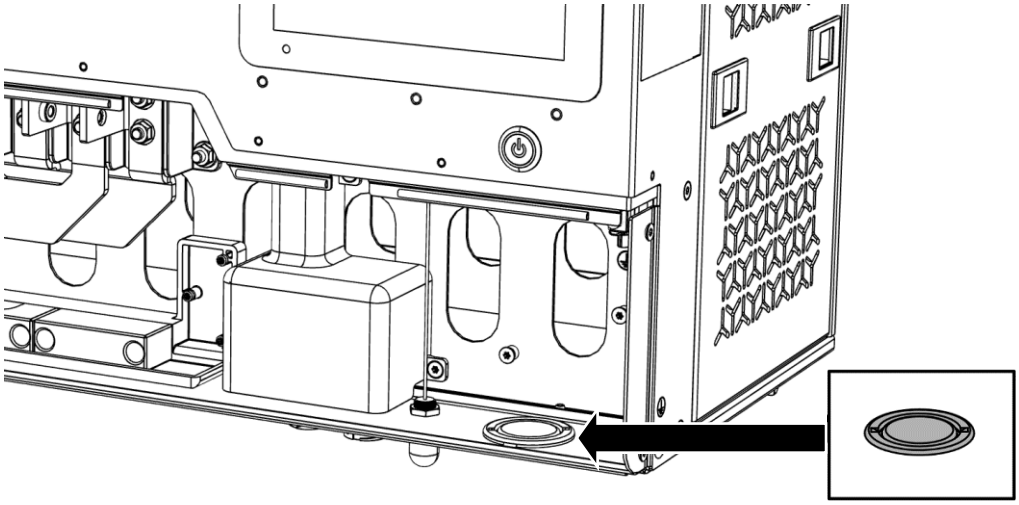


Figure 2.10.3

Input Wiring (continued)

4. Install the conduit and feed the input cable into the cabinet as shown in Figure 2.10.4.

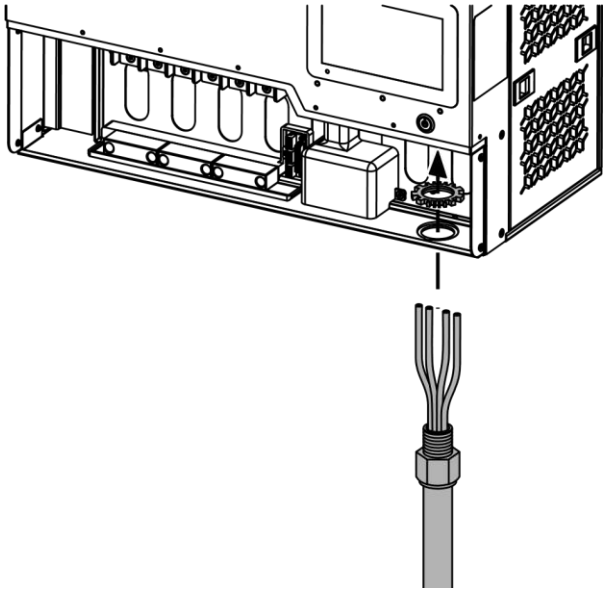


Figure 2.10.4

5. Terminate the input wires to the terminal block and ground lug (Figure 2.10.5).

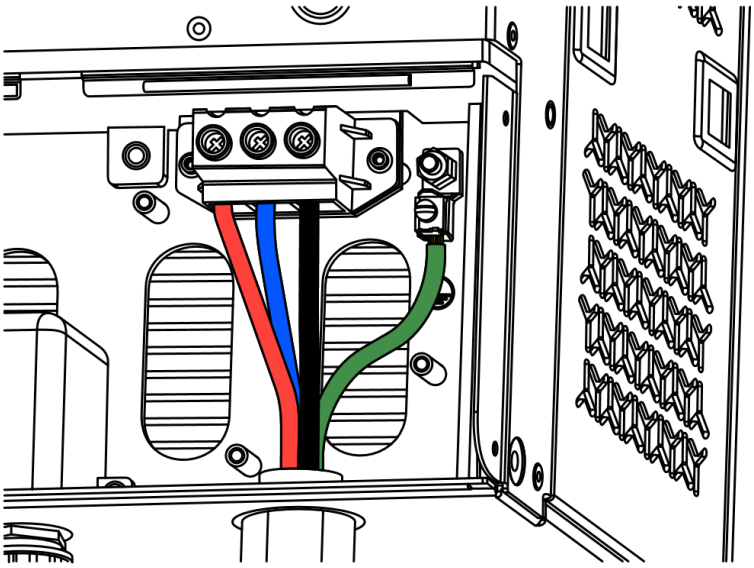


Figure 2.10.5

The charger must be properly connected to mains protective earth to ensure protection from electrical hazards,

Input Wiring (continued)

6. Install the previously removed terminal block cover (Figure 2.9.6)

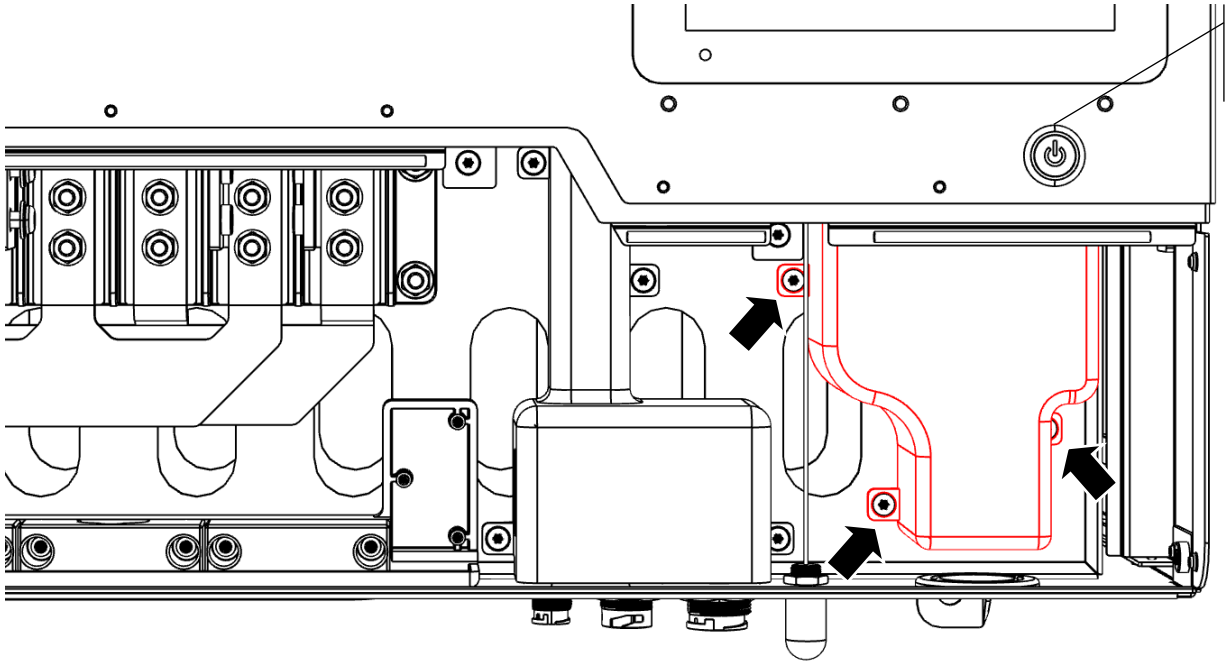


Figure 2.10.6

2.12. ON / OFF Button

ON/OFF Power button can be use for resetting the charger without restarting the 3phase AC supply.

2.13. Charger Output Configurations

1. Select the charger cable configuration per your FBC system shown in figures 2.11.1 through 2.11.5.

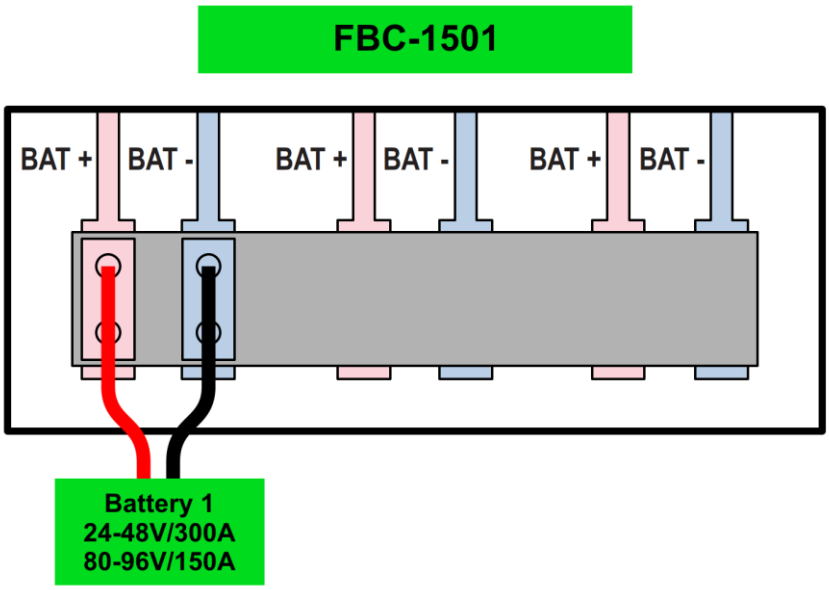


Figure 2.11.1

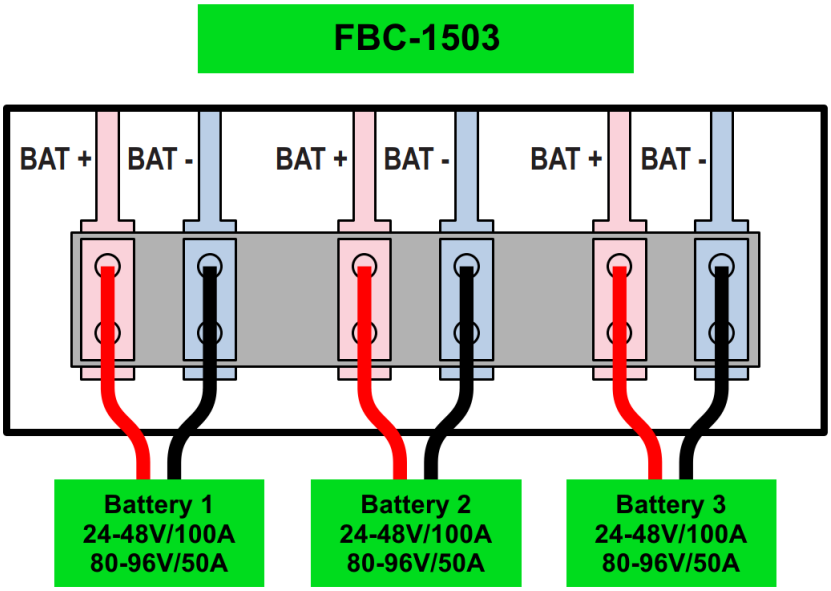


Figure 2.11.2

Charger Output Configurations (continued)

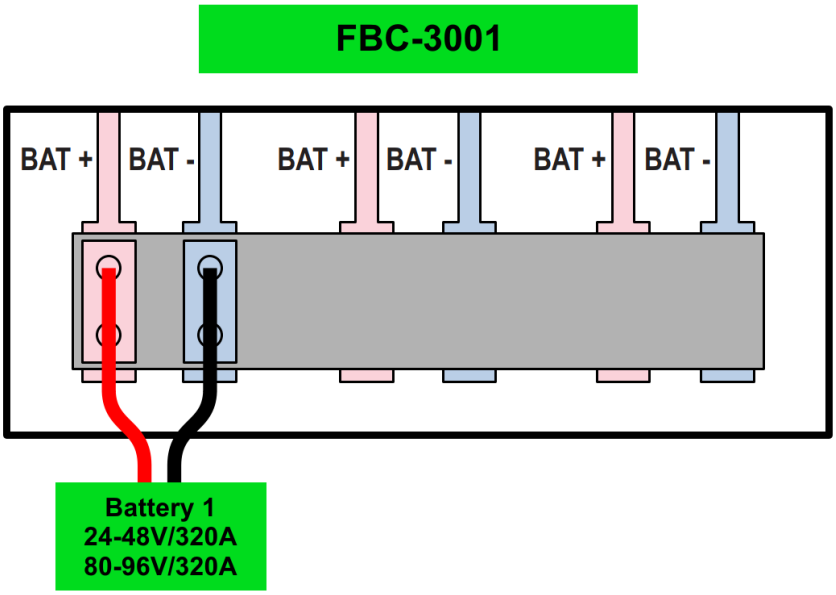


Figure 2.11.3

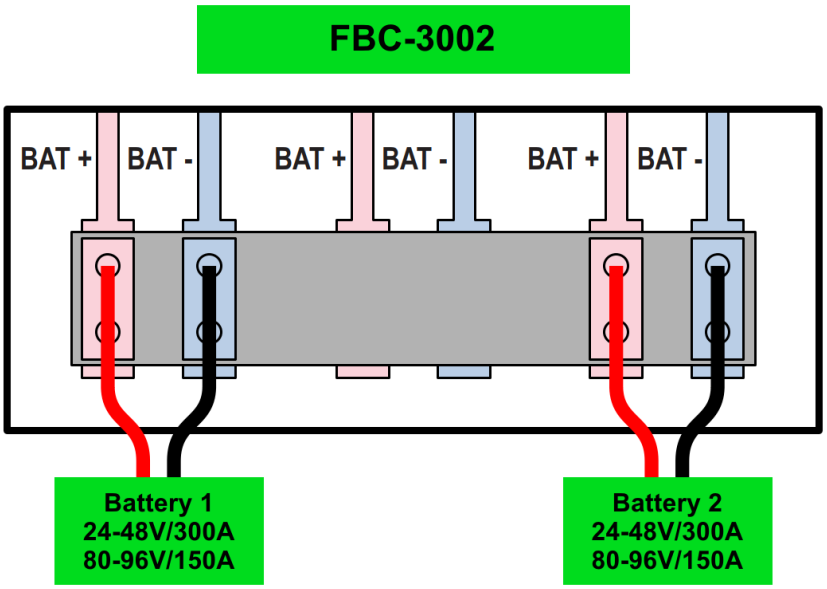


Figure 2.11.4

Charger Output Configurations (continued)

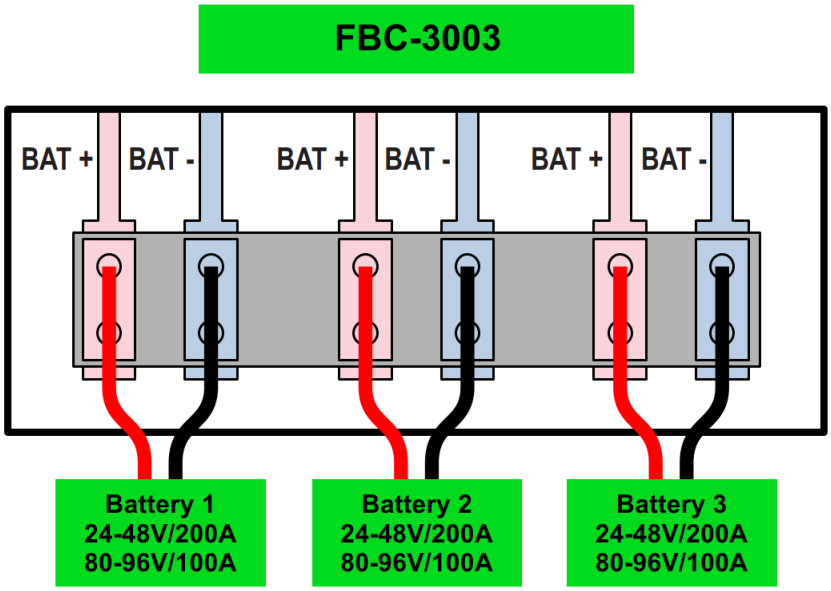


Figure 2.11.5

2.14. Terminate Charger Output Cables

WARNING: AC utility power to the FBC system must be installed by an experienced and licensed electrician, subject to all applicable national and local electrical code requirements.

DANGER: The FBC system **MUST** be connected directly to the breaker box via electrical conduit. The use of plugs or cords is unsafe and **NOT** allowed.

DANGER: The FBC system access cover **DOES NOT** have an interlock that disable power when the cover is removed. AC power is always present in the cabinet unless the AC supply breaker is switched off or tripped. Battery voltage is also present in the FBC system whenever any equipment is connected.

1. With the access panel removed, feed the charger cable/cables through the bottom access slot and terminate the positive and negative cable leads with the provided fasteners as shown in Figures 2.12.1 through 2.12.4.

2. Ensure the terminated charger leads are properly connected to prevent electrical arcing between the cable leads inside the FBC cabinet.

NOTE: See figures 2.12.1 through 2.12.4 for the correct charger cable termination according to the FBC model and number of charger cable outputs.

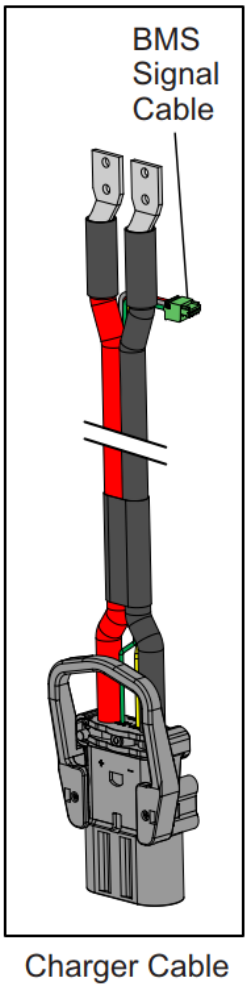
NOTE: Torque requirement for mounting the output charging cable to Output busbar is min. **7.7 N·m.**

NOTE: Bolts and Nuts for Output Busbar and Output Charging Cable

For Model FBC-3001 or FBC-1501, The recommended M6 Hex Head Bolt with Spring and Flat Washer to be used is MPN: HXNP3-SUS-M6-20 from Misumi

For Model FBC-3002, FBC-3003, FBC-1503, The recommended M6 Hex nuts with flange and serrations, to be used is MPN: 5401000 from Bossard.

Terminate Charger Output Cables (continued)



Charger Cable

Part Number
416661 (FBC DC CABLE,4/0,LOWPRO,10')
416662 (FBC DC CABLE,2/0,LOWPRO,10')
416662 (FBC DC CABLE,2/0,LOWPRO,16')

Figure 2.12.1

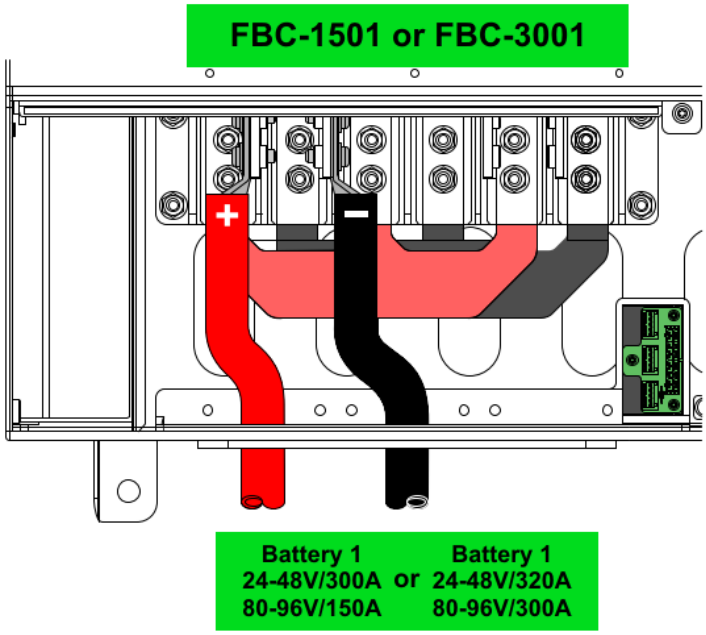
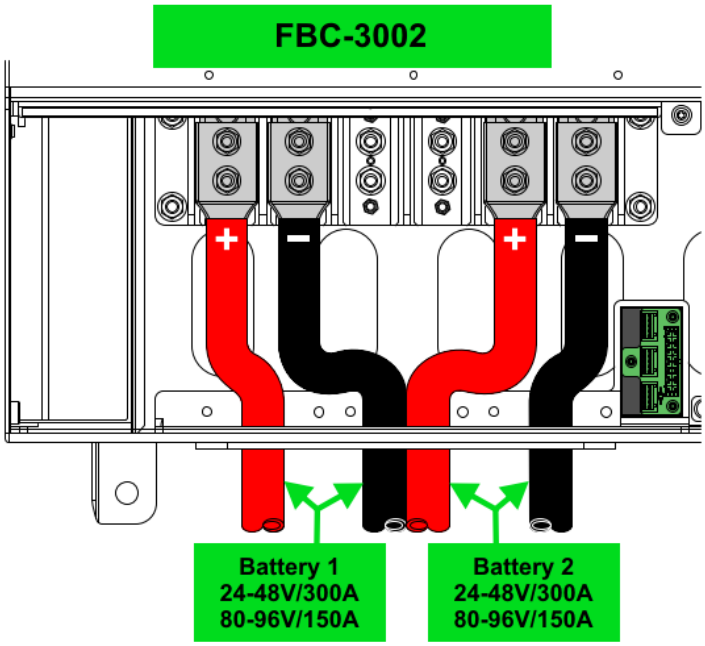


Figure 2.12.2



NOTE: Torque requirement for mounting the output charging cable to Output busbar is min. 7.7 N·m.

Terminate Charger Output Cables (continued)

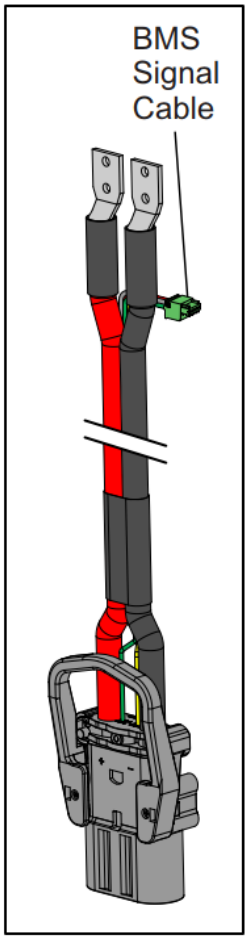


Figure 2.12.3

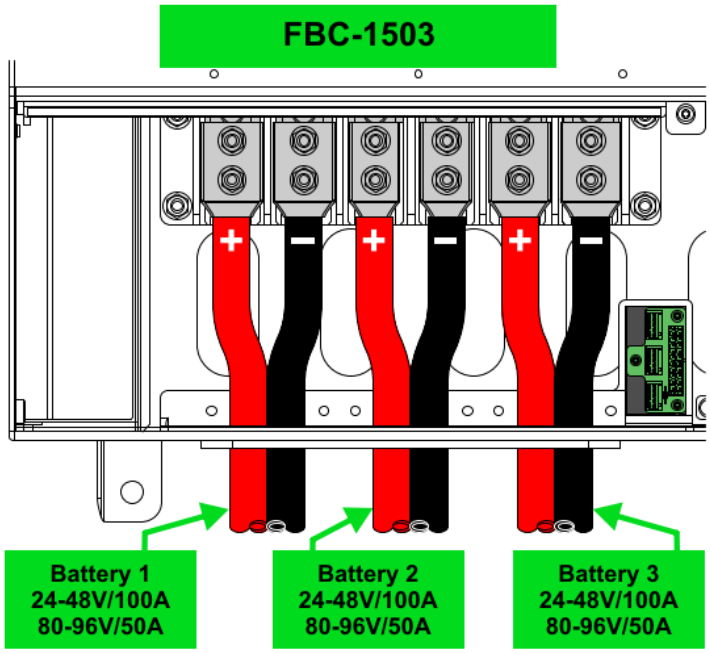
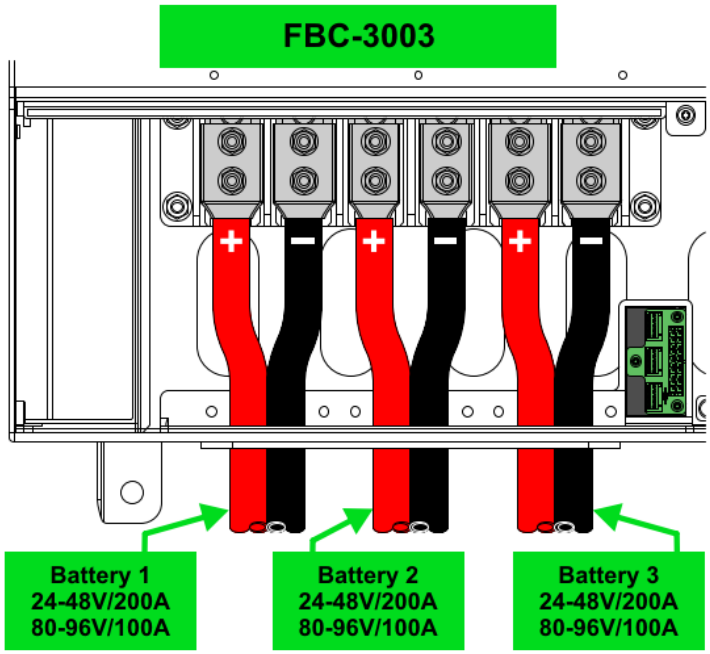


Figure 2.12.4



Part Number
416661 (FBC DC CABLE,4/0,LOWPRO,10')
416662 (FBC DC CABLE,2/0,LOWPRO,10')
416662 (FBC DC CABLE,2/0,LOWPRO,16')

NOTE: Torque requirement for mounting the output charging cable to Output busbar is min. 7.7 N·m.

Terminate Charger Output Cables (continued)

3. Connect the Battery Monitoring System (BMS) signal cable/cables according to the FBC model and number of charger cable outputs. See figure 2.12.5.

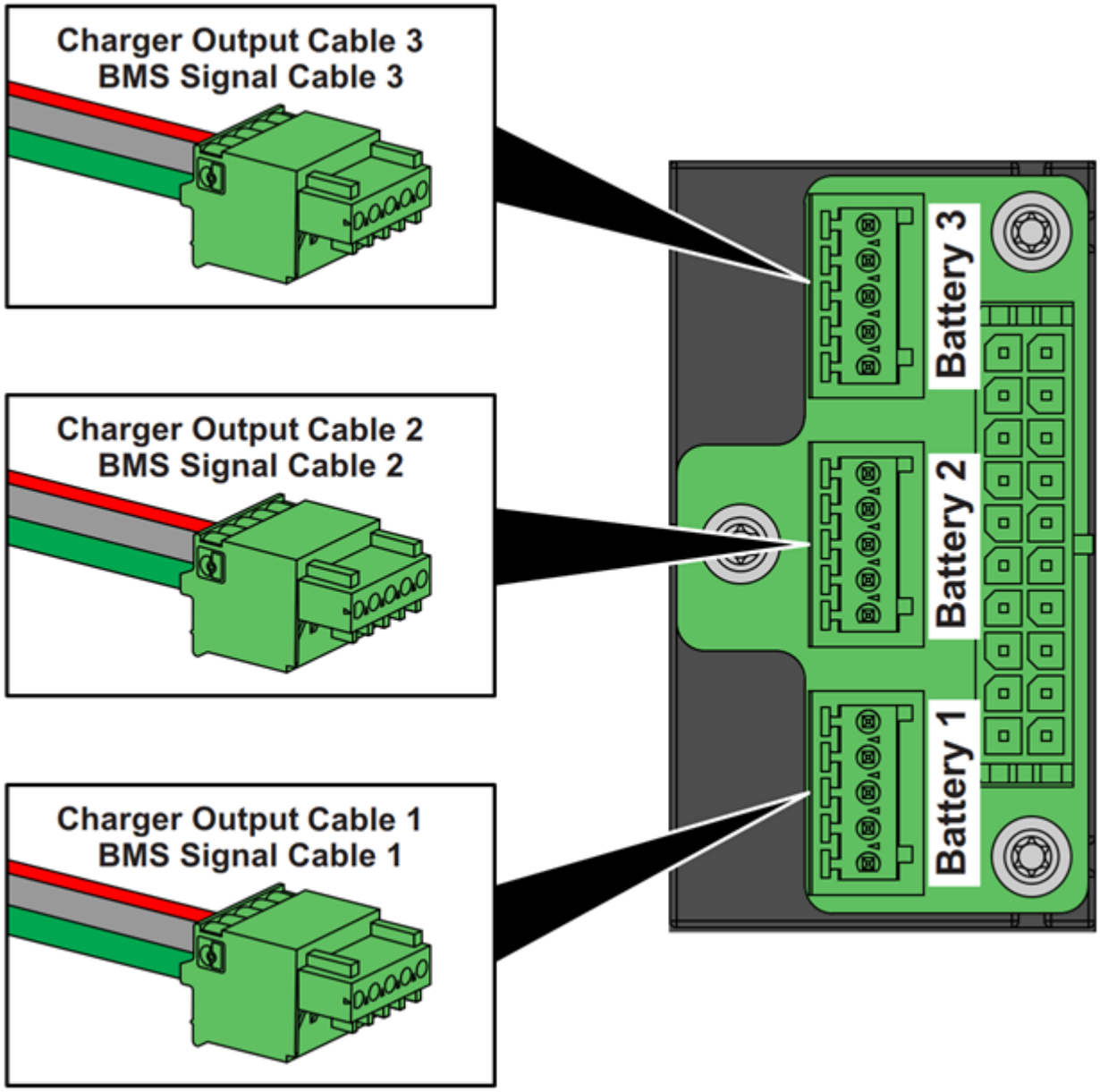


Figure 2.12.5

Terminate Charger Output Cables (continued)

4. Secure the charger output cable/cables with the provided strain relief clamps and fasteners according to the FBC model and number of charger cable outputs. See Figure 2.12.6.

NOTE: To ensure the proper location of the connected BMS signal cable, see Figure 2.12.6.

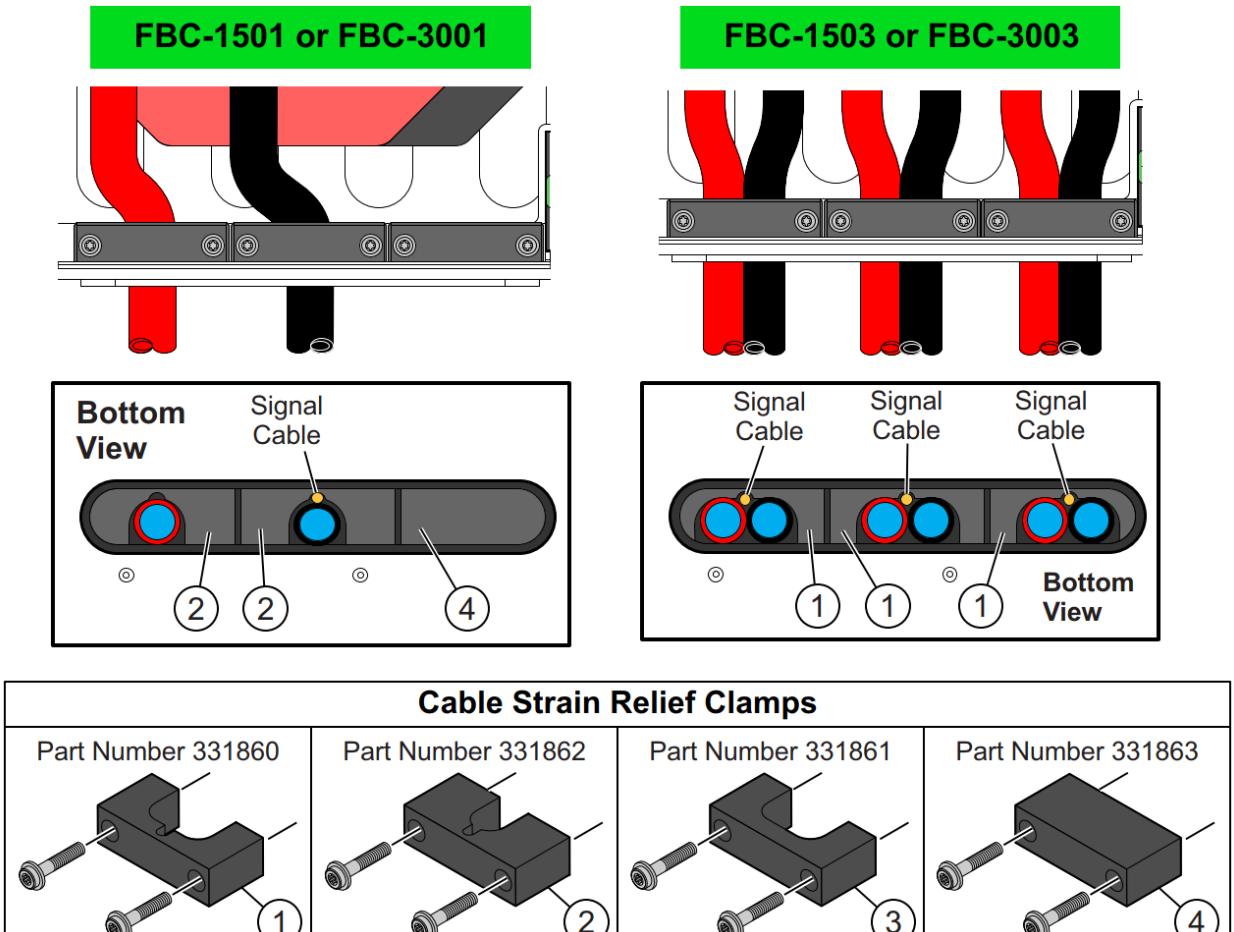


Figure 2.12.6.

Terminate Charger Output Cables (continued)

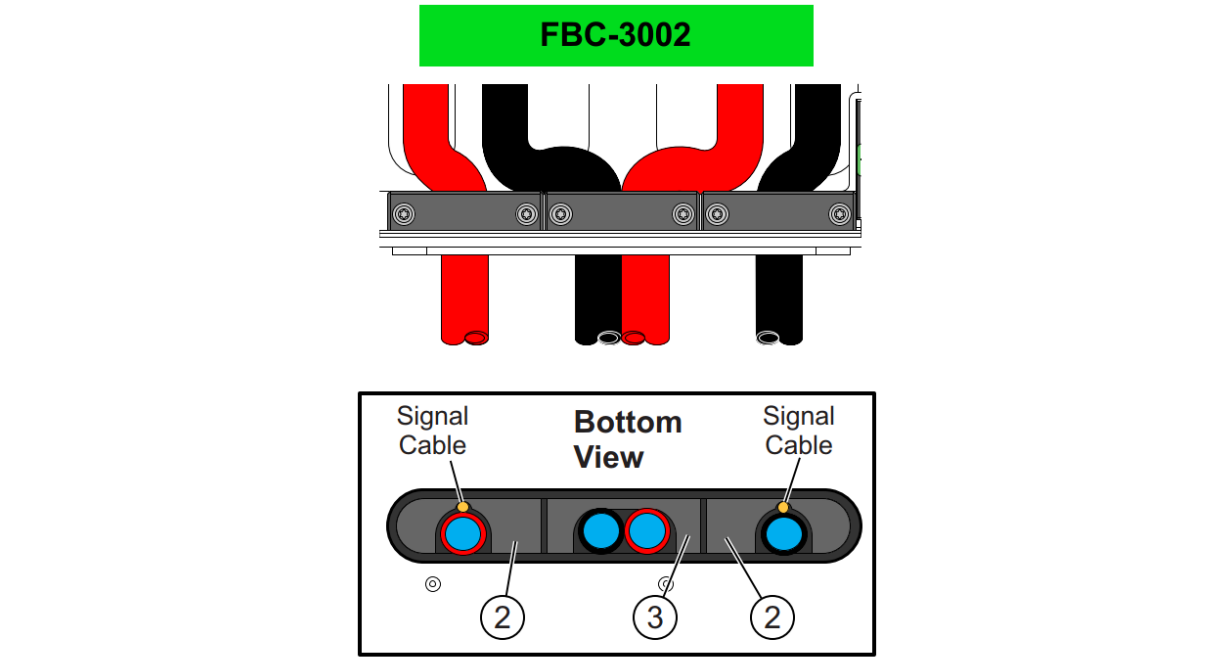
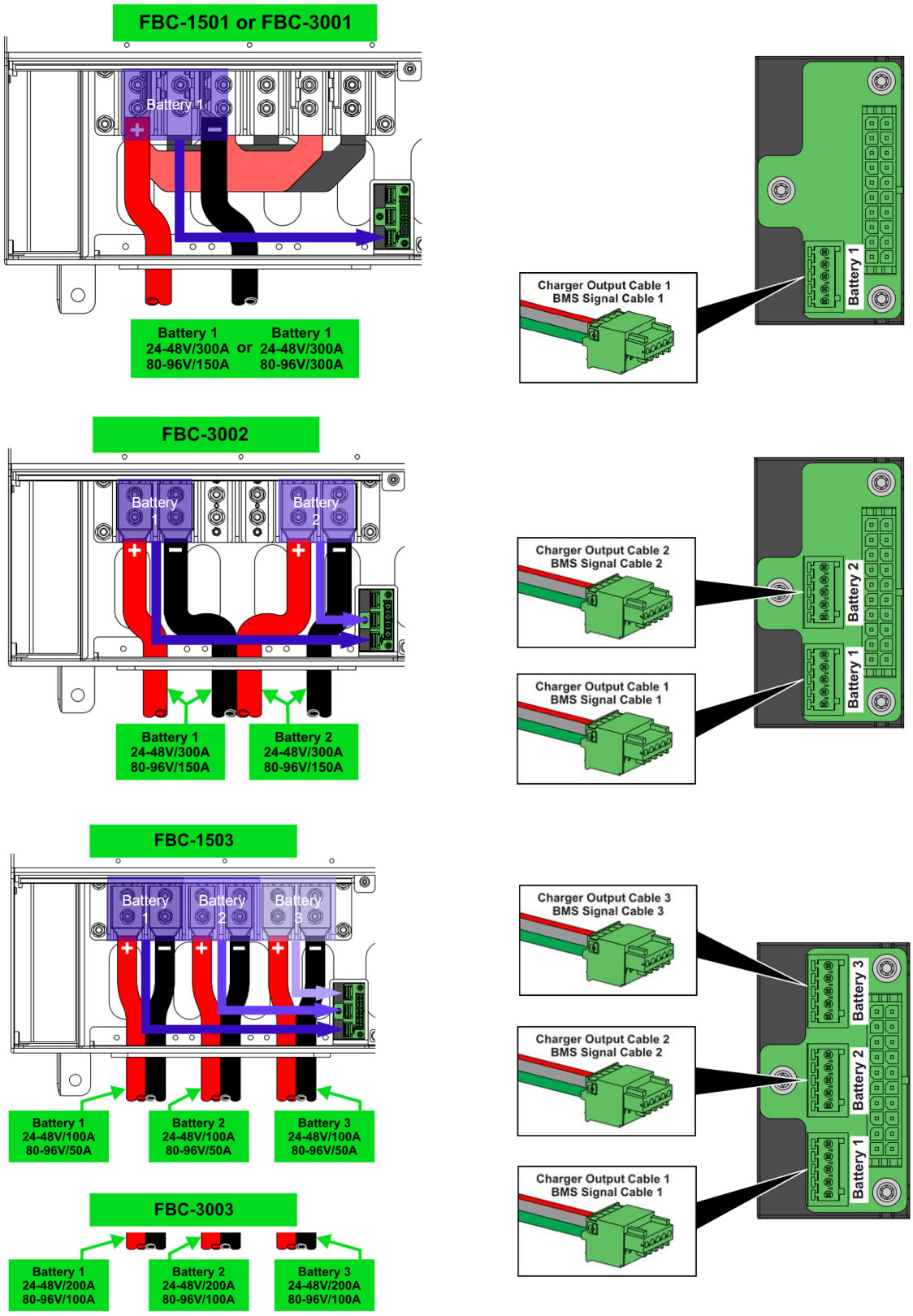


Figure 2.12.6. (continued)

5. Install and secure the access panel with the previously removed fasteners.

Min. Torque requirement is 1.6 N.m.

Terminate Charger Output Cables (continued)



3. Charger Display Operation

Main Menu screen gives access to the **Setup** screen, **Diagnostics** and **Charger Log**.

1. When the charger is activated the **Welcome** screen (Figure 3.1.1) will display until the **Menu** screen (Figure 3.1.2) is displayed.

Figure 3.1.1

2. Select **Menu** from the **Home** screen. See Figure 3.1.2.

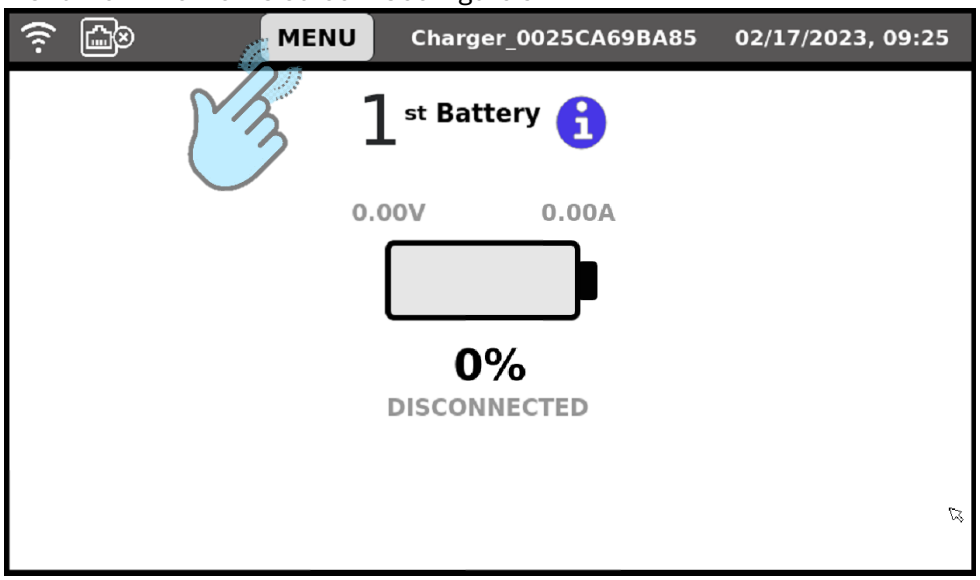


Figure 3.1.2

Charger Setup (continued)

3. Enter the password in the **Password** screen and select **Enter**. See Figure 3.1.3.

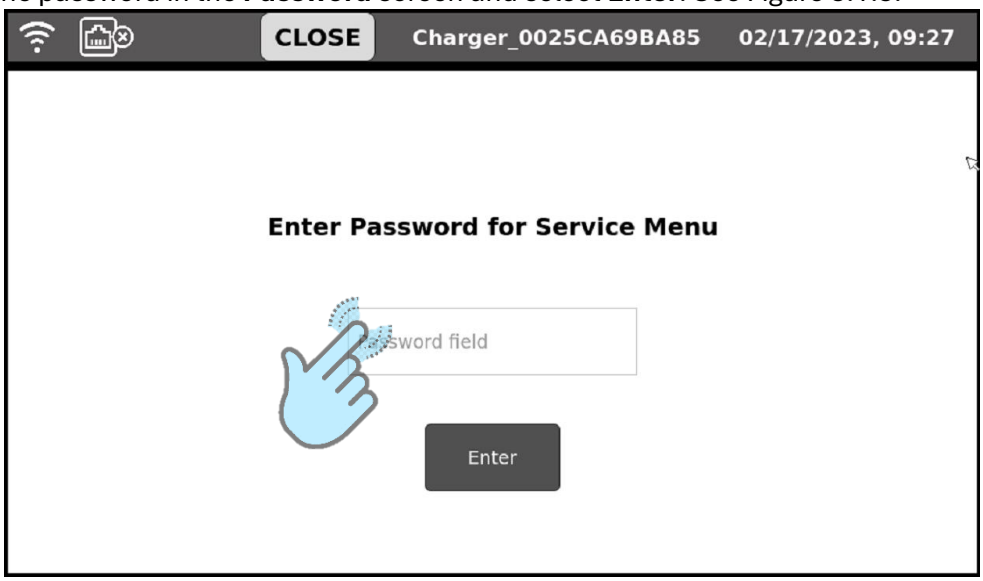


Figure 3.1.3

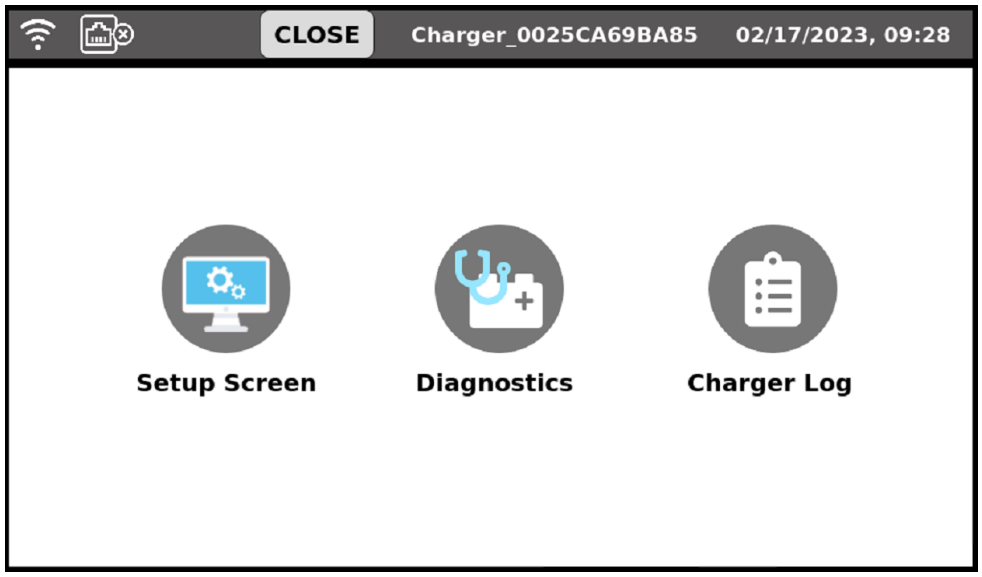


Figure 3.1.4

3.1. Setup Screen

- From the **Main Menu** Screen, select **Setup Screen** to access **Network**, **Battery**, **Charging,** and **OTA**.

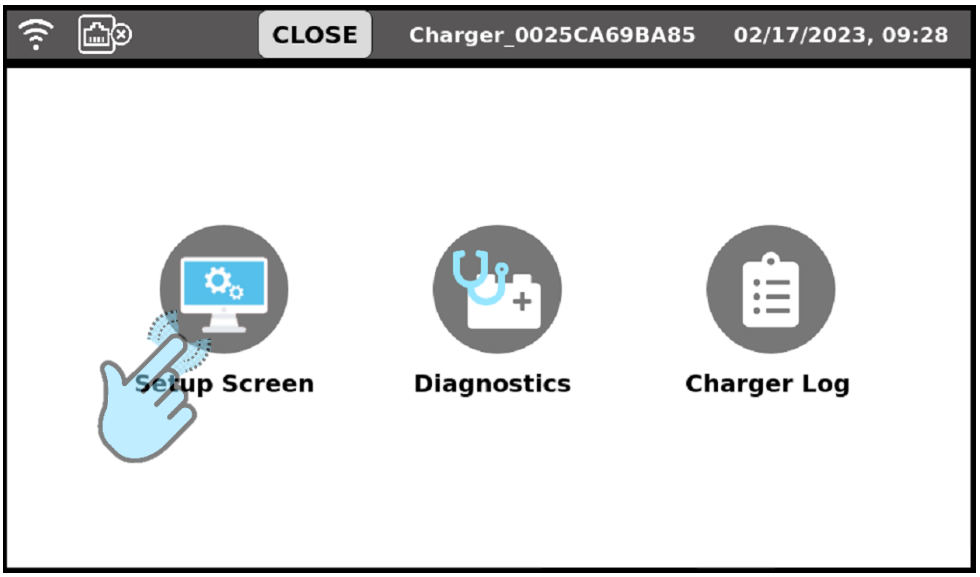


Figure 3.1.6

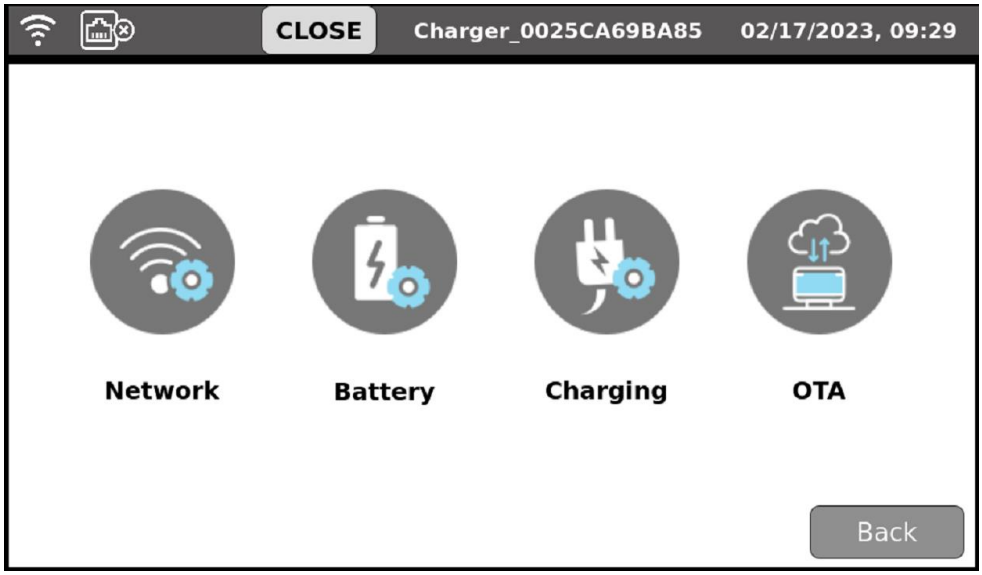


Figure 3.1.7

3.1.1. Setup Screen → Network → WiFi

- Select **WiFi** from the **Setup** screen.
- Select Appropriate **Wi-Fi Name** from the **WiFi List**.
- Enter the Wi-FI password.
- Click on **Connect** to complete Wi-Fi setup.
- Click on the **Back** button to navigate to the **Main Menu** screen.

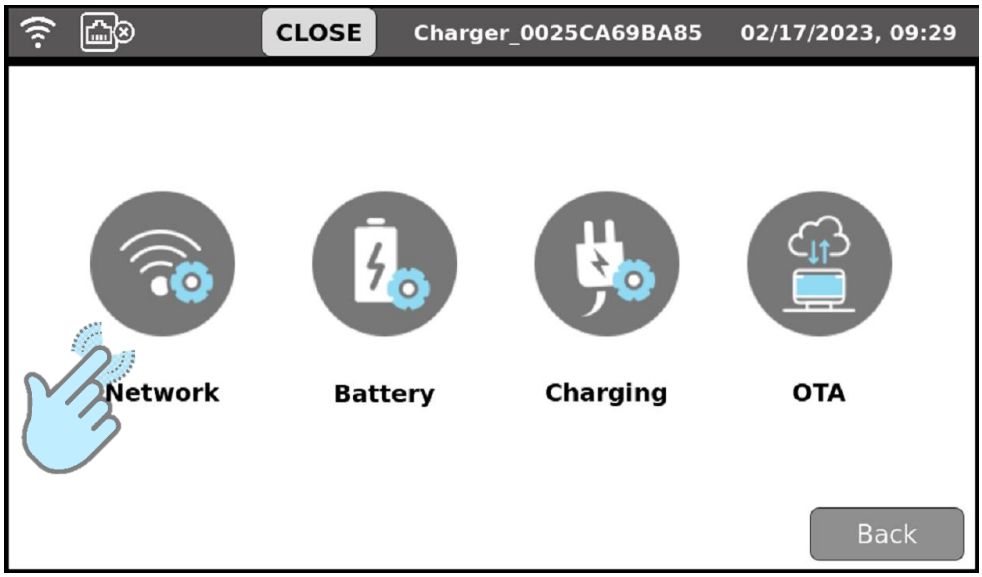


Figure 3.1.8

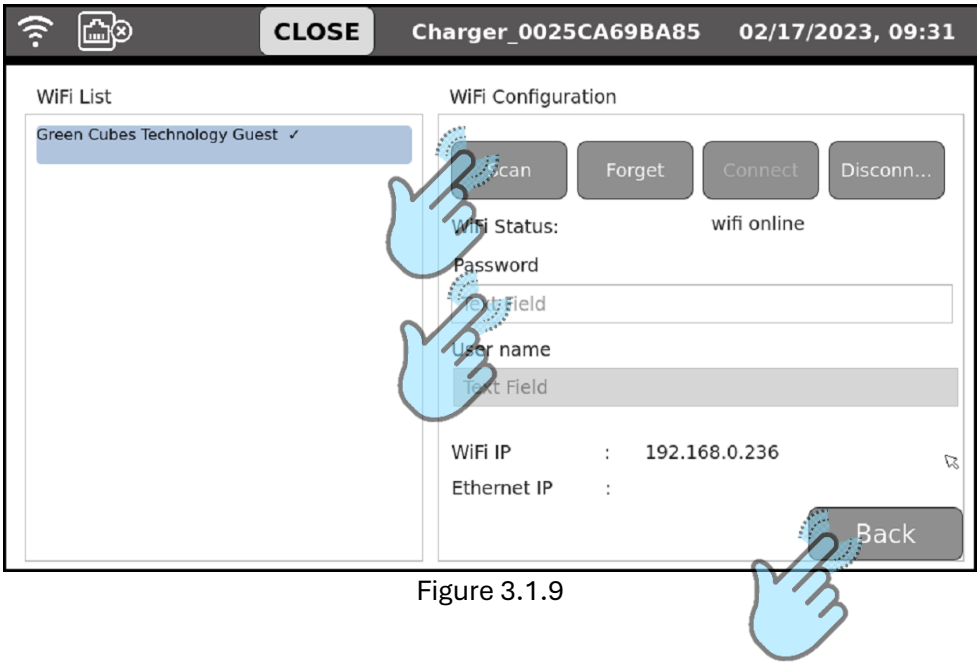
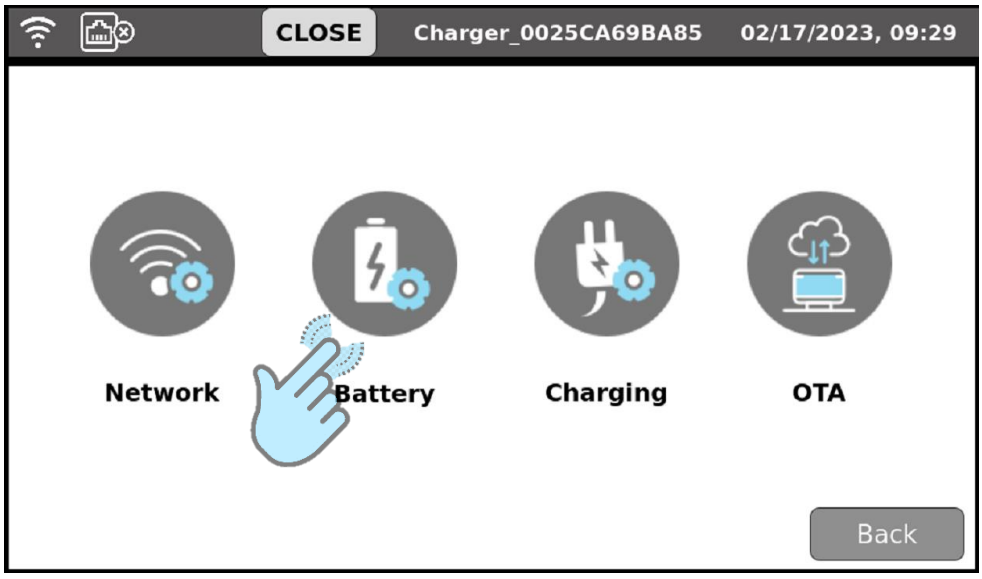


Figure 3.1.9

3.1.2. Setup Screen → Battery

- Select Battery from the **Setup** screen.

This is only information of the Battery pack information



Non-Functional button.

Figure 3.1.9

3.1.3. Setup Screen → Charging

- Select Charging from the **Setup** screen.

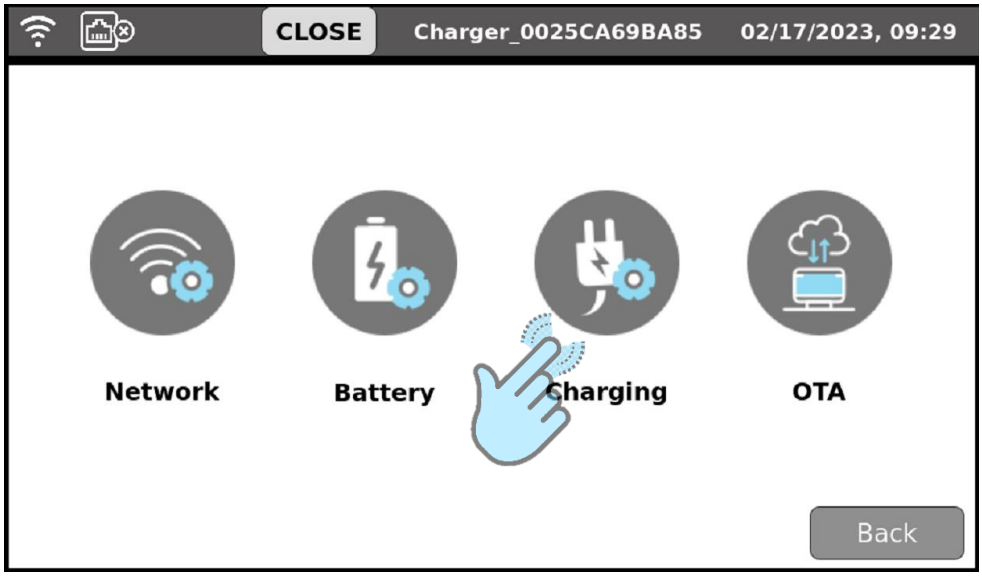


Figure 3.1.10

3.1.3.1. Setup → Charging → On/Off Control

- Charge **Start Delay** time and **End Delay** time. **Default**: Disable
  NOTE: If applicable, enter time for both fields.
- **Restart charging at mains failure**. **Default**: Non Functional
- **Enable Aurostart charge** . **Default:** Enabled
- **Enable Auto update**. **Default**: Disable
- Click on **Save**.
- Click on the **Back** button to navigate to the **Main Menu** screen.

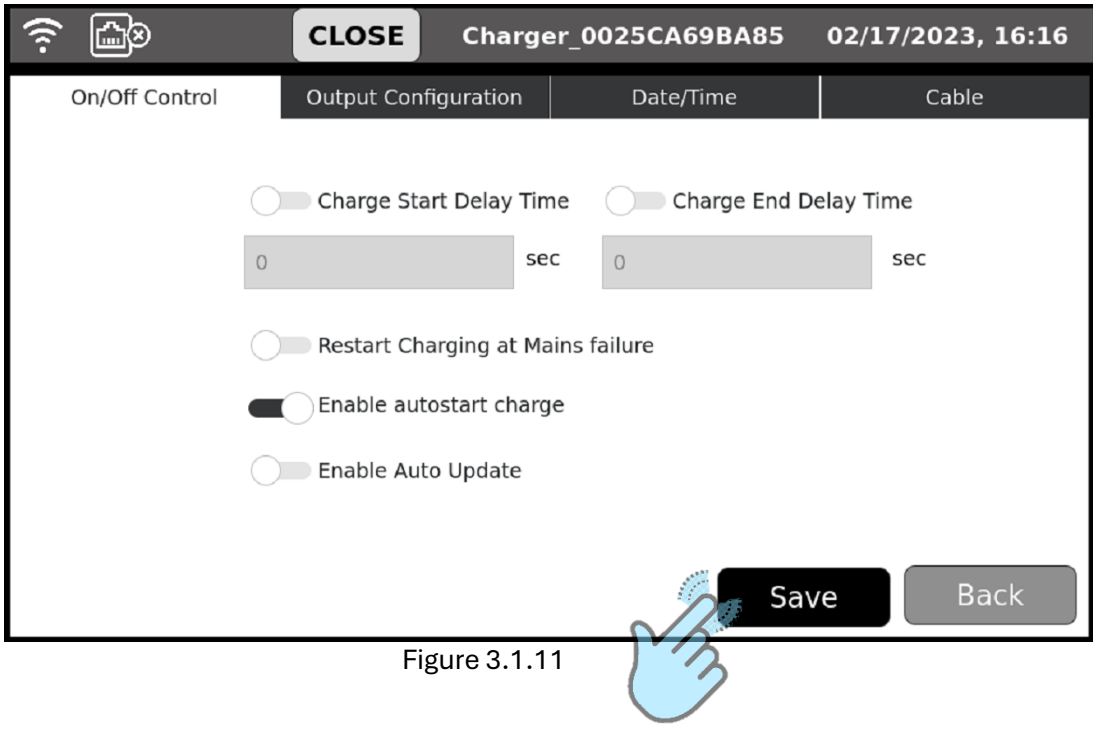


Figure 3.1.11

3.1.3.2. Setup → Charging → Output Configuration

- Select Output Configuration from the Charging screen.

This is only information of the Charger Output Configuration

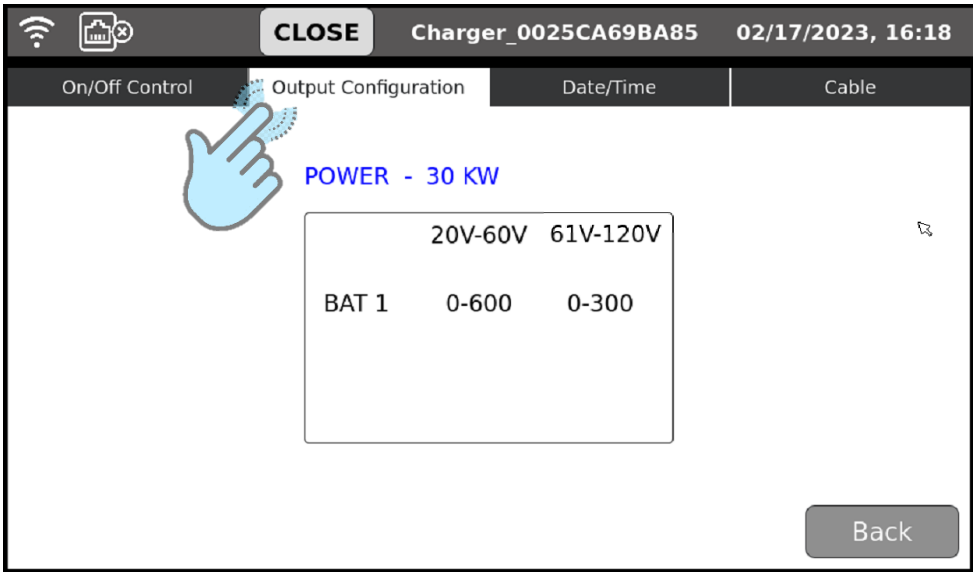


Figure 3.1.12

3.1.3.3. Setup → Charging → Date/Time

- Enable/Disable Automatic Date and Time. **Default**: Enable "

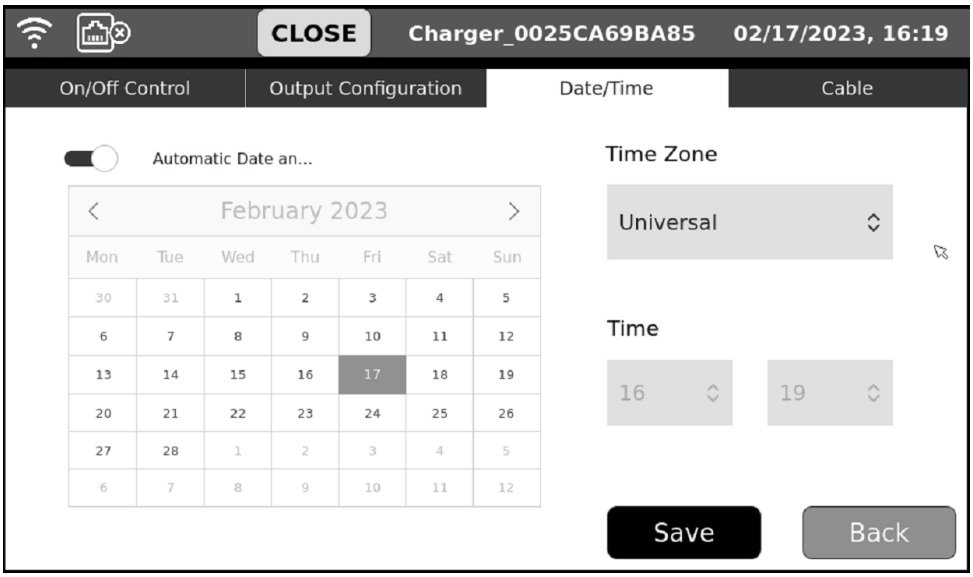


Figure 3.1.13

3.1.3.4. Setup → Charging → Cable

- Select Cable from the Charging screen.
- Enter cable length (in meters).
- Select Cable type (AWG) from drop down list.

NOTE: If the charger has 3 batteries connected, the appropriate cable length and AWG must be entered for each battery.

- Click on Save button.
- Click on the Back button to navigate to the Main Menu screen.

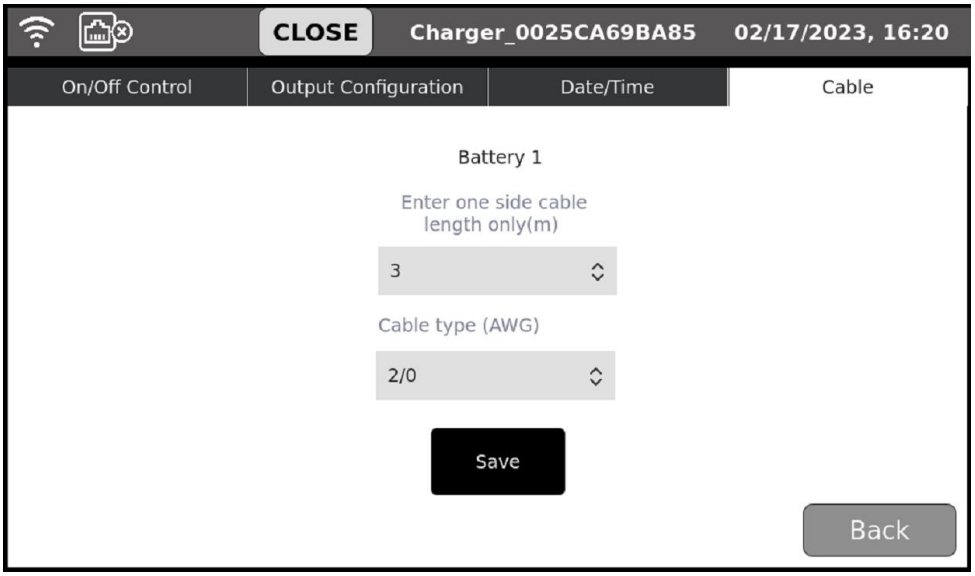


Figure 3.1.14

3.1.4. Setup Screen → OTA Screen

- Select OTA (Over The Air) from the **Setup** screen.

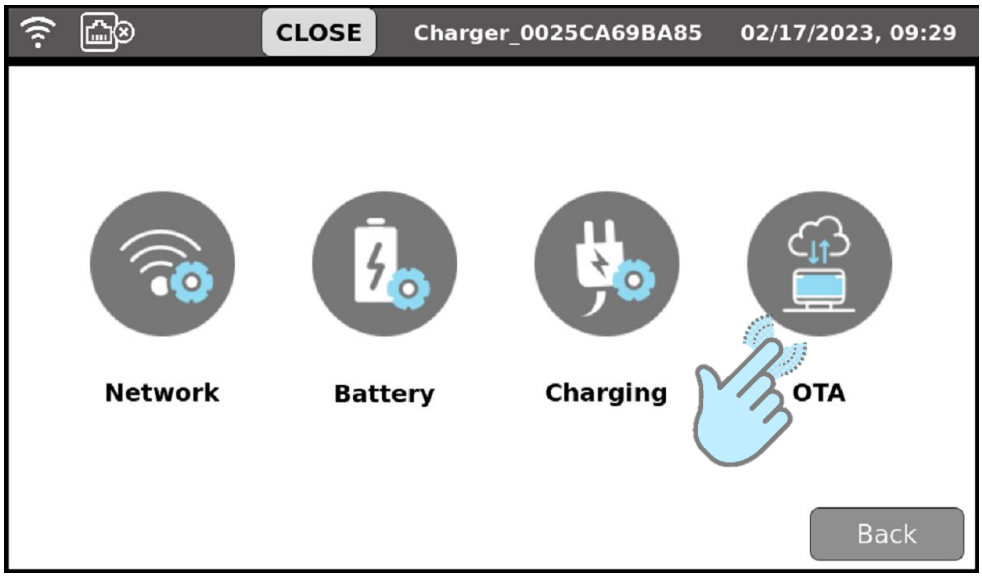


Figure 3.1.15

3.1.4.1. Setup Screen → OTA → Raven

- Raven update button with Software version of update is mentioned below the button.
- Click on the **Back** button to navigate to the **Main Menu** screen.

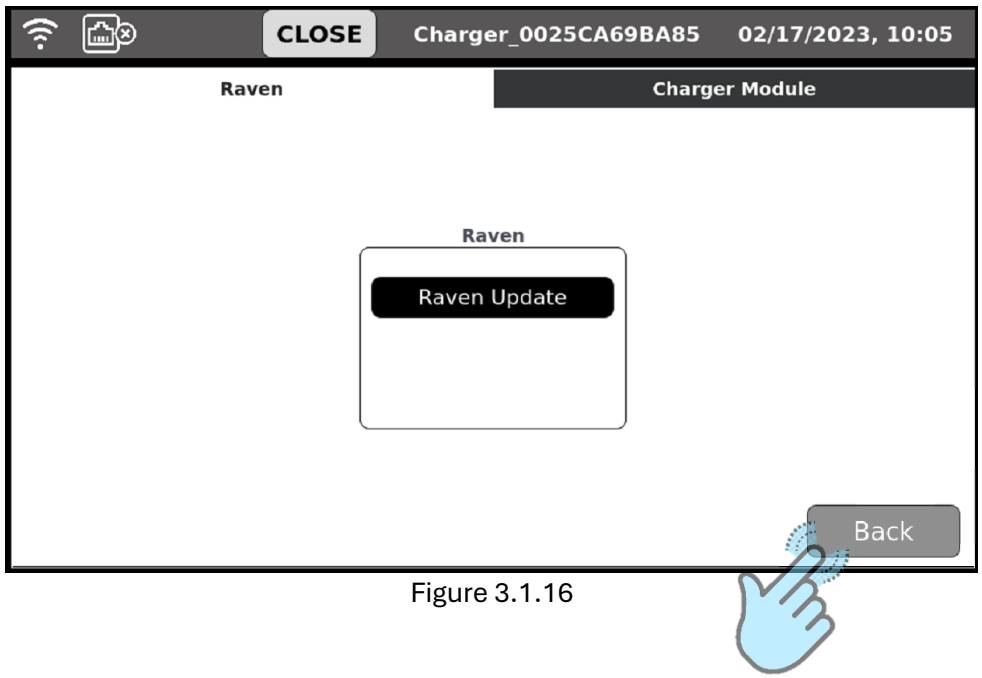


Figure 3.1.16

3.1.4.2. Setup Screen → OTA → Charger Module

- **Power Module** has **PFC** and **LLC update**.
- **CAN Bridge** has **CAN Bridge update**.
- The software version is listed below each button.
- Click on the **Back** button to navigate to the **Main Menu** screen.

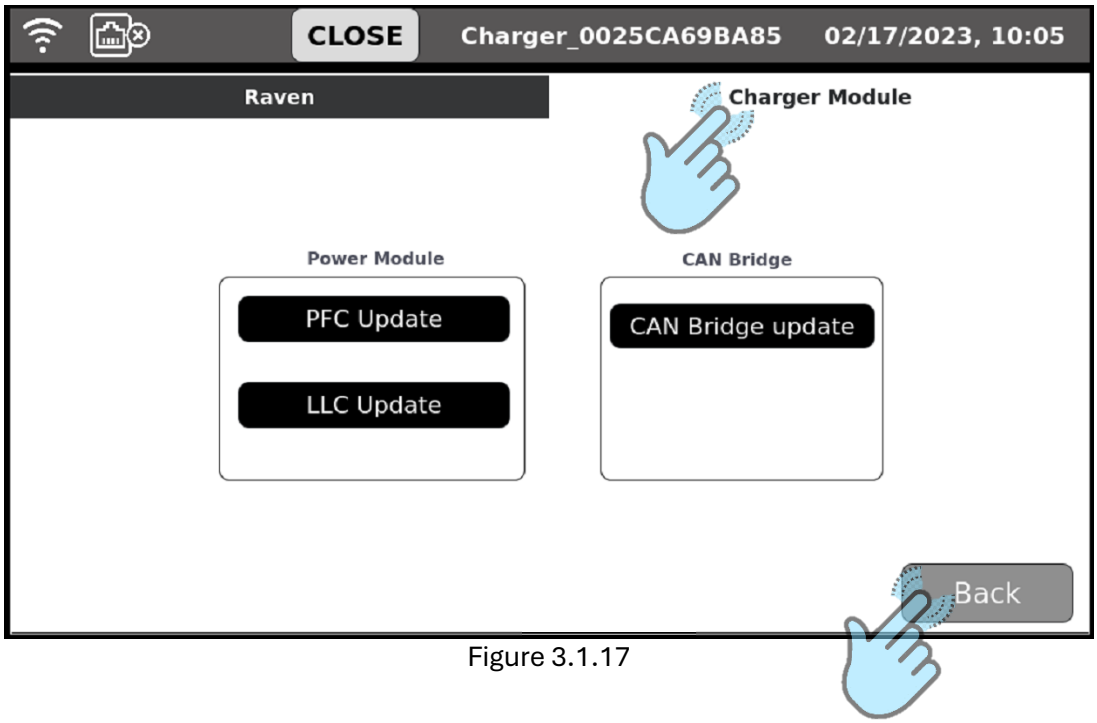


Figure 3.1.17

3.2. Diagnostic Screen

- From the **Main Menu** Screen, select **Diagnostic Screen** to access **Charger**, **Battery Calibration**, **and Charger Diagnostic**.

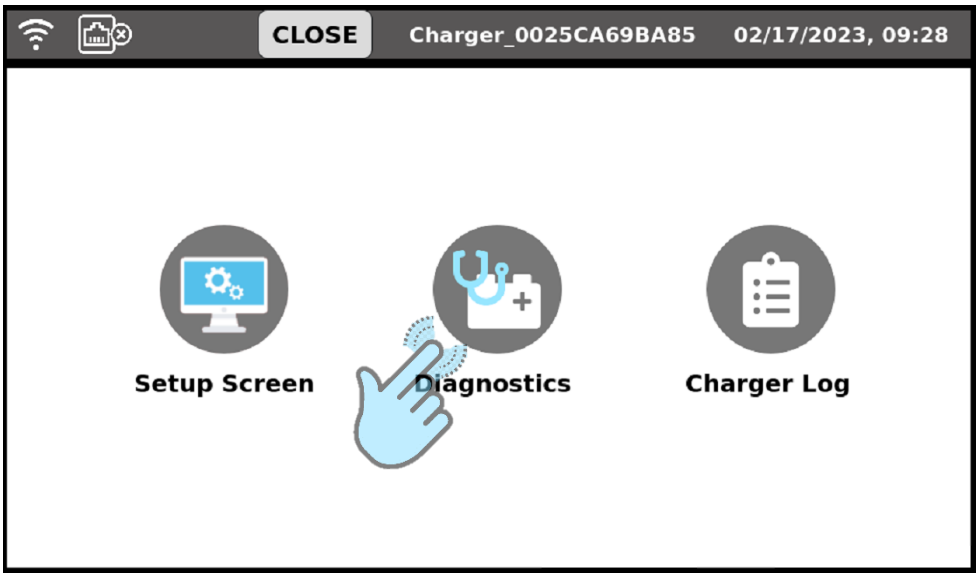


Figure 3.1.18

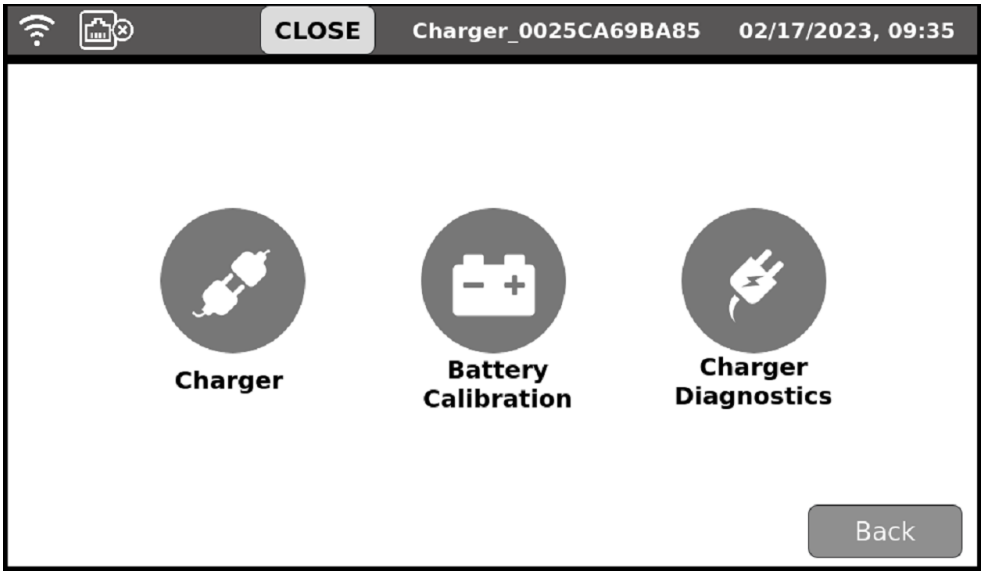


Figure 3.1.19

3.2.1. Diagnostic → Charger

- Select **Charger** from the **Diagnostic** screen which contains Charger Information and Input Wire Gauge Calibration.

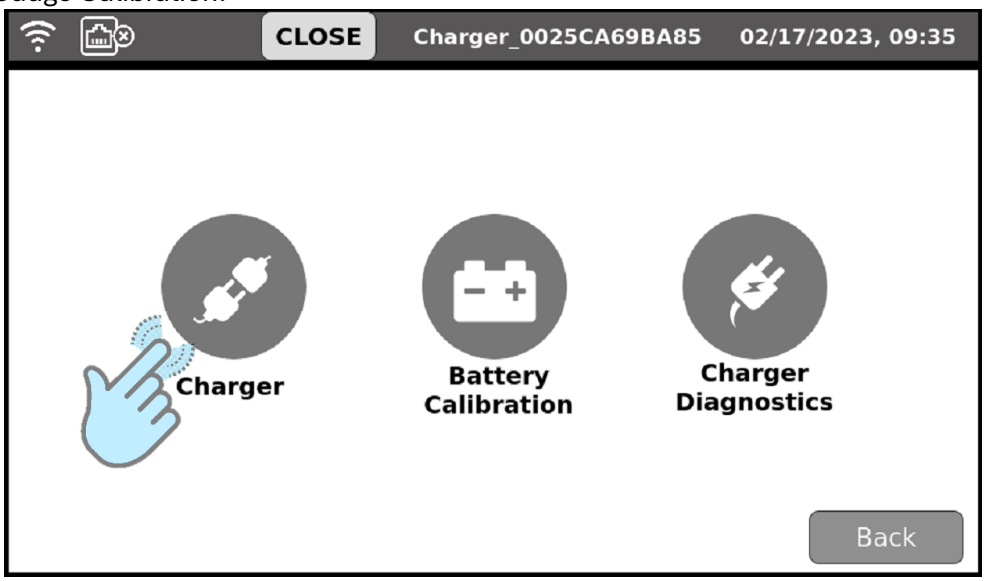


Figure 3.1.20

3.2.1.1. Diagnostic →Charger Screen → I/O Parameters

- Contains the information of the Modules Parameters (Voltage, Current, Power and No. of Module)
- Click on “More Info” for additional information (Temperature, Fan Speed and more).

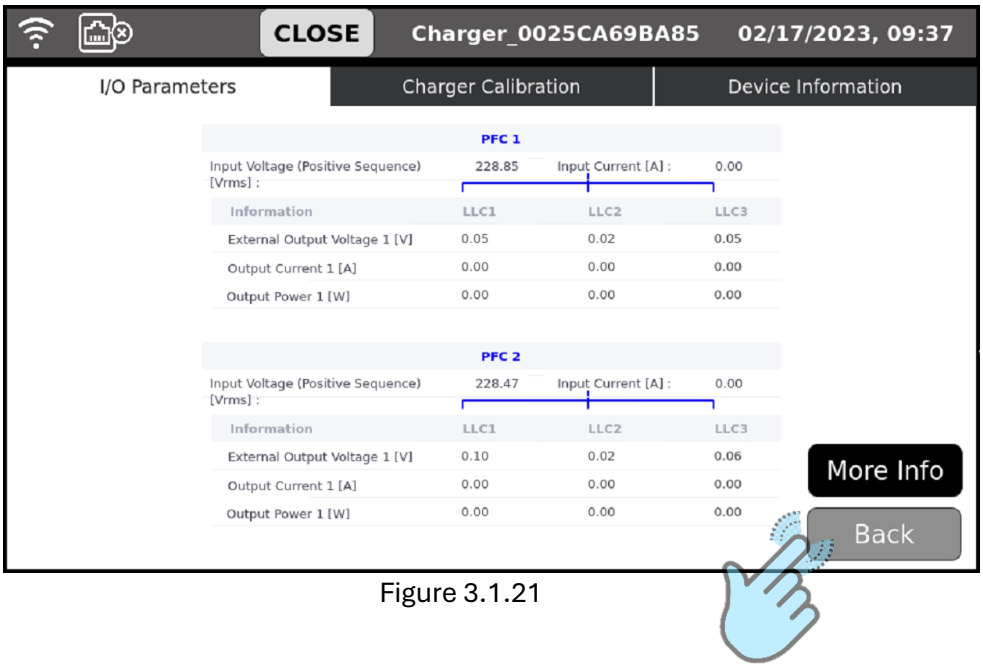


Figure 3.1.21

3.2.1.2. Diagnostic →Charger Screen → Charger Calibration

- This parameter is used to calibrate with the 3phase Input Wire Gauge Installation.
- Select 3phase Input Cable Wire Gauge from the Charger Calibration screen.
- Select Cable type (AWG) from drop down list and press Save button.

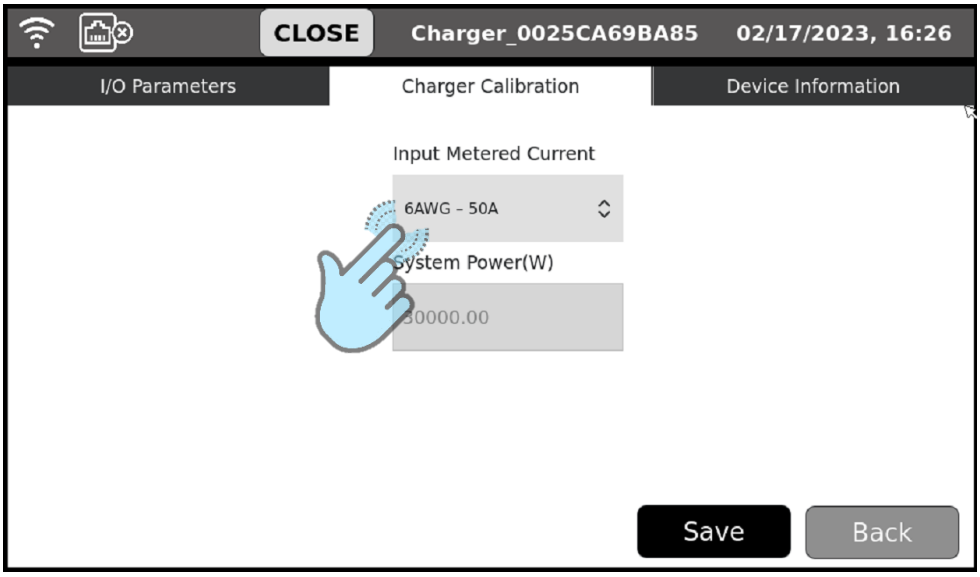


Figure 3.1.22

3.2.1.3. Diagnostic →Charger Screen → Device Information

- Select Nick Name and enter desired Charger Name and press Save button.
- Contains the information of the Charger and Modules HW and SW version.

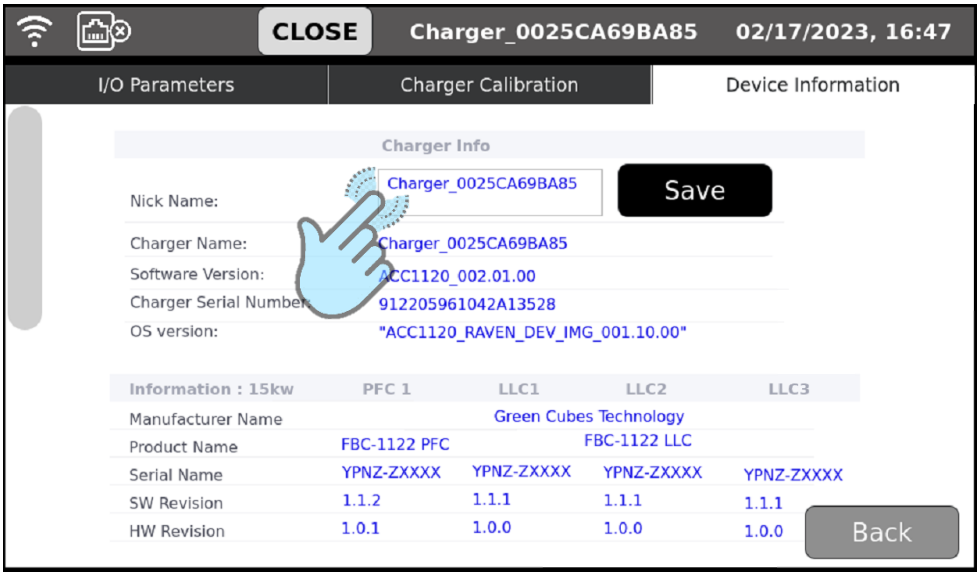


Figure 3.1.23

3.2.2. Diagnostic → Battery Calibration

- Non Functional button

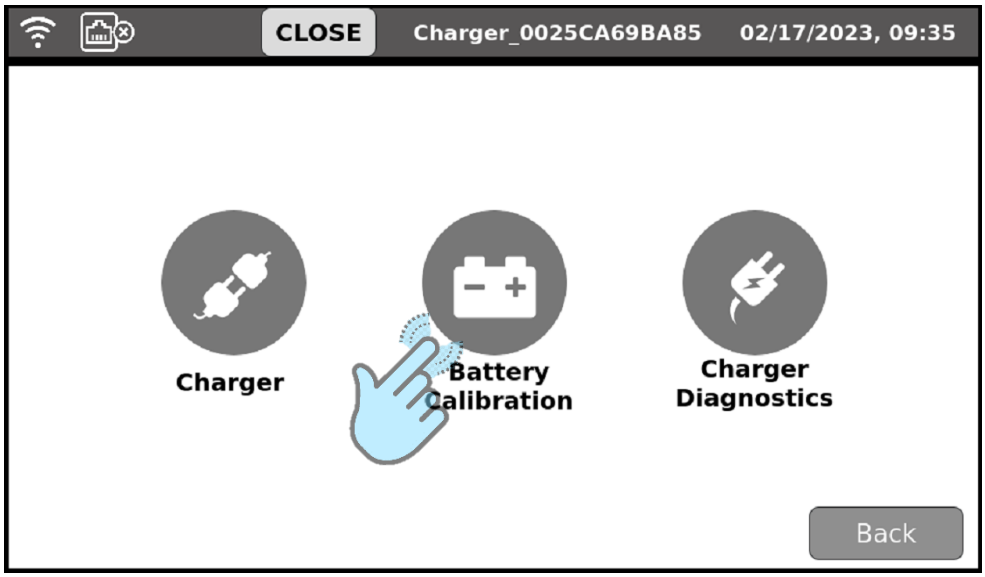


Figure 3.1.24

3.2.3. Diagnostic → Charger Diagnostics

- This is used to check the live and history error of the Charger.

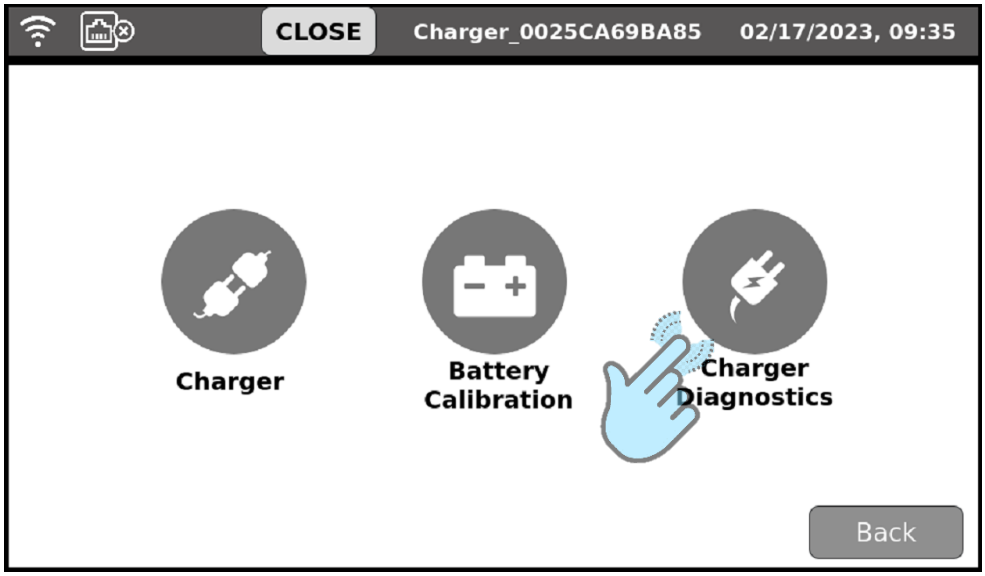


Figure 3.1.25

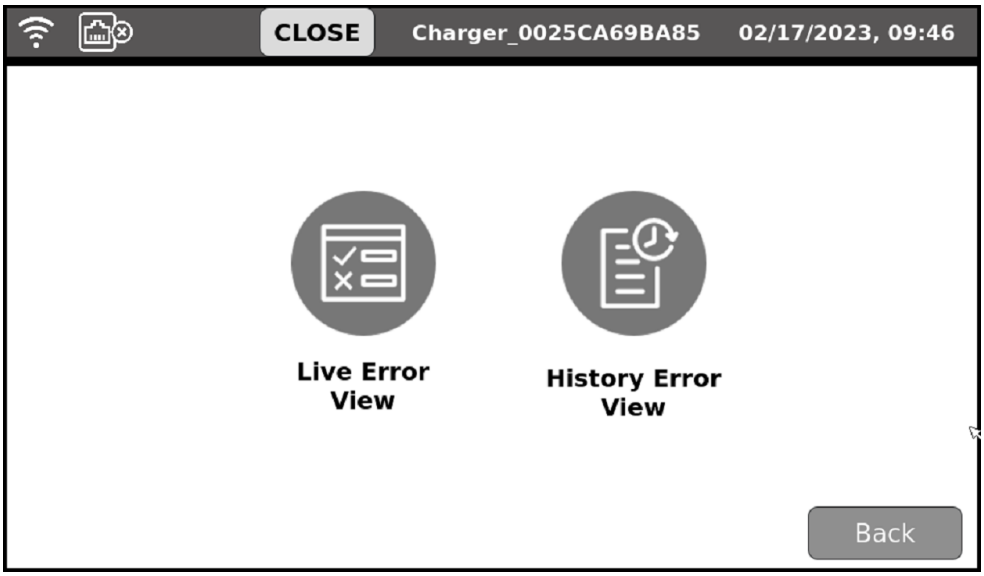


Figure 3.1.26

3.2.3.1. Diagnostic →Charger Diagnostics → Live Error View

- This contains the information of current errors encountered by the Charger.

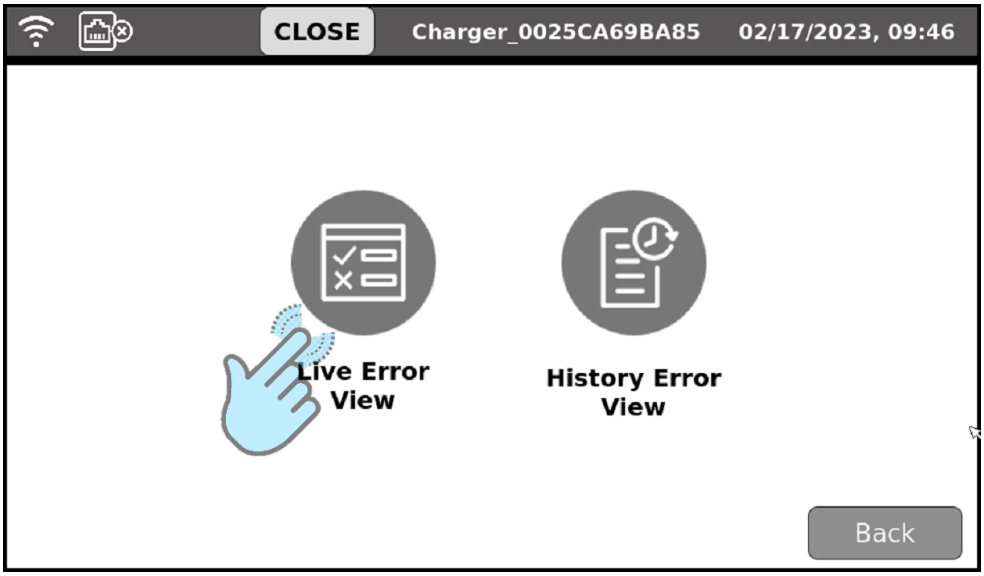


Figure 3.1.27

3.2.3.1.1. Diagnostic →Charger Diagnostics → Live Error View →LLC Faults

- List of Faults reported from the LLC circuit of the Charger's Module.
- 15kW Model shows 3 columns of dots while 30kW Model shows 6 columns of dots, This signifies the number of LLC mainboards

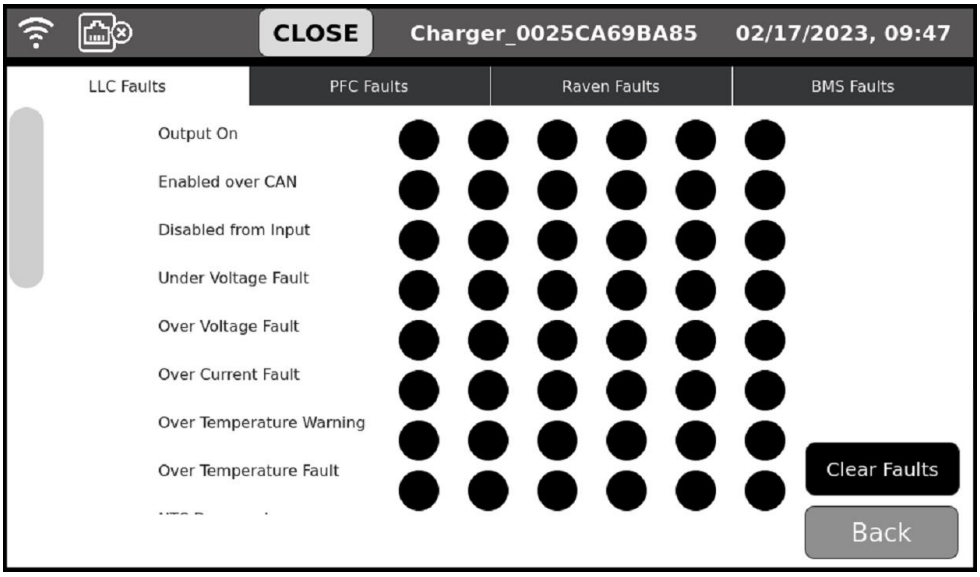


Figure 3.1.28

See Section 4 for detailed Fault and Troubleshooting.

3.2.3.1.2. Diagnostic →Charger Diagnostics → Live Error View →PFC Faults

- List of Faults reported from the PFC circuit of the Charger's Module.
- 15kW Model shows 1 column of dots while 30kW Model shows 2 columns of dots, This signifies the number of Modules.

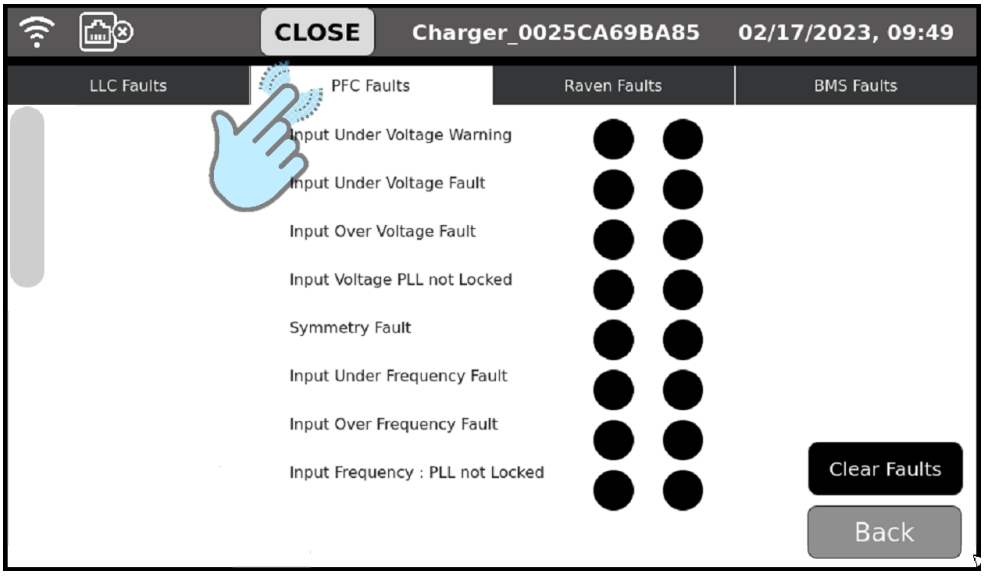


Figure 3.1.29

See Section 4 for detailed Fault and Troubleshooting.

3.2.3.1.3. Diagnostic →Charger Diagnostics → Live Error View →Raven Faults

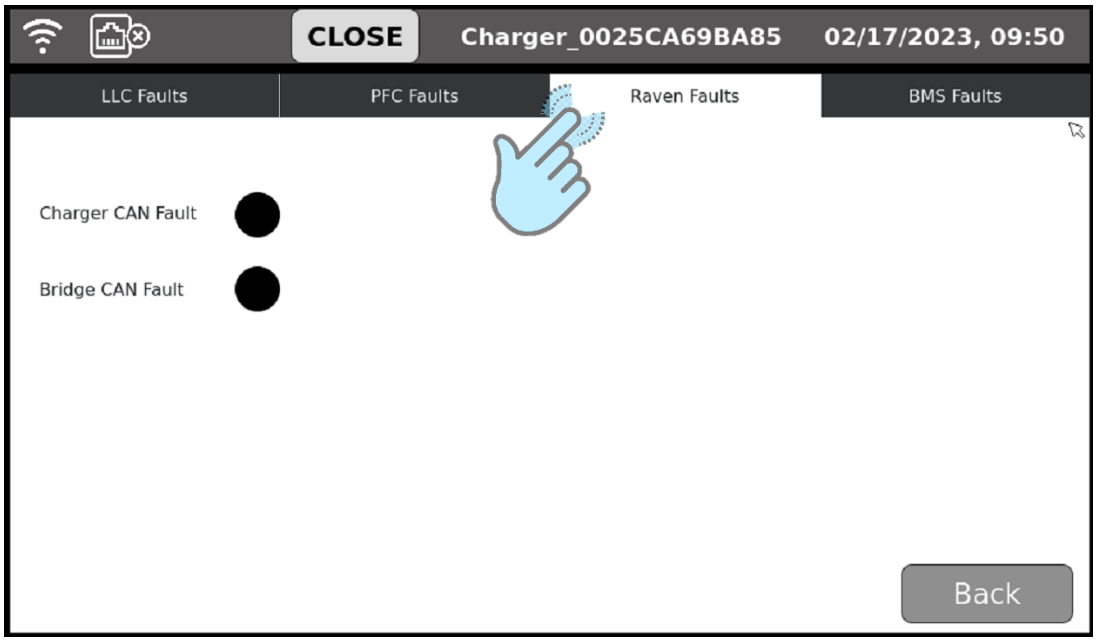


Figure 3.1.30

See Section 4 for detailed Fault and Troubleshooting.

3.2.3.1.4. Diagnostic →Charger Diagnostics → Live Error View →BMS Faults

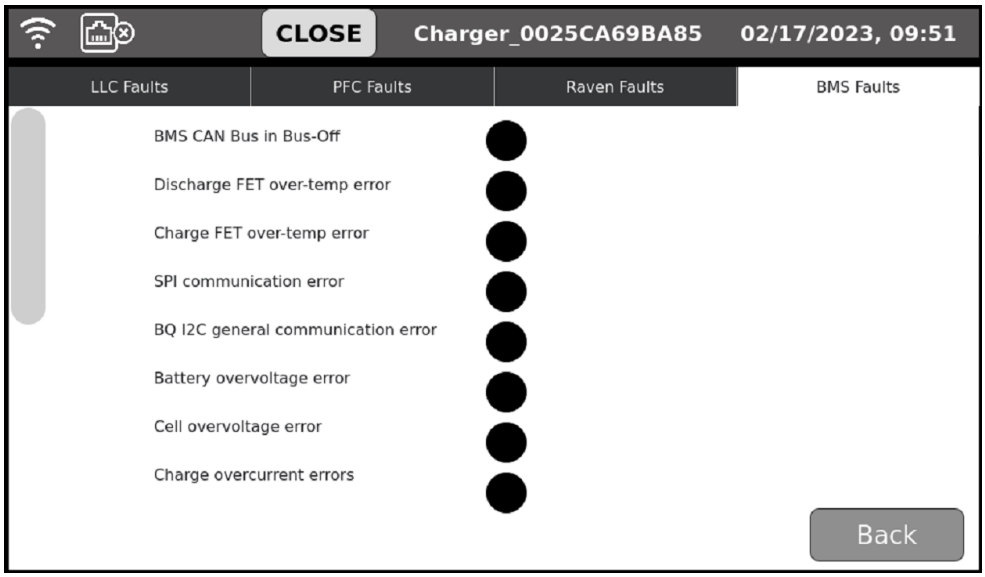


Figure 3.1.31

See Section 4 for detailed Fault and Troubleshooting.

3.2.3.2. Diagnostic →Charger Diagnostics → History Error View

- This contains the information of historical errors encountered by the Charger since operation by dates.

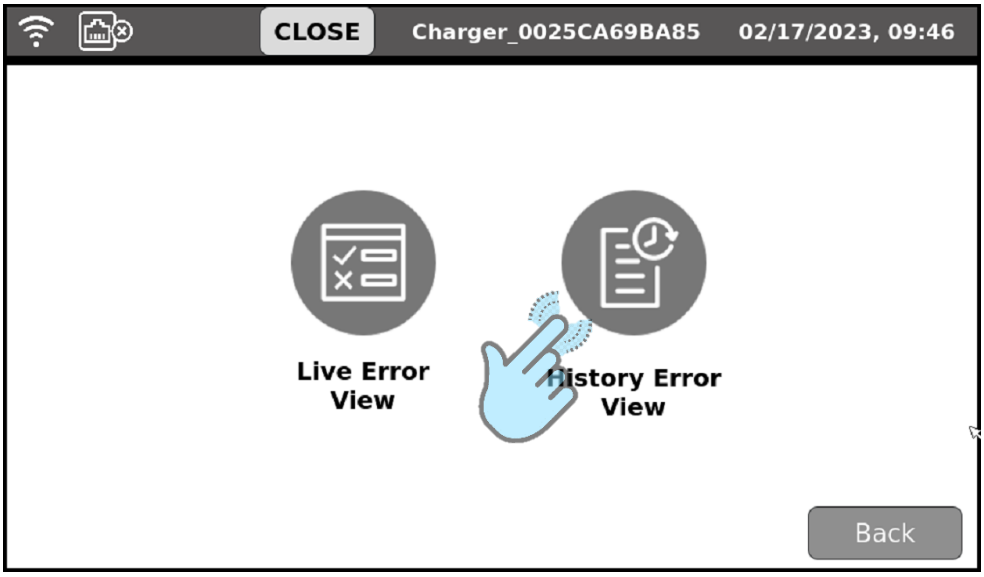


Figure 3.1.32

- Select target Start and End date then press Read Button

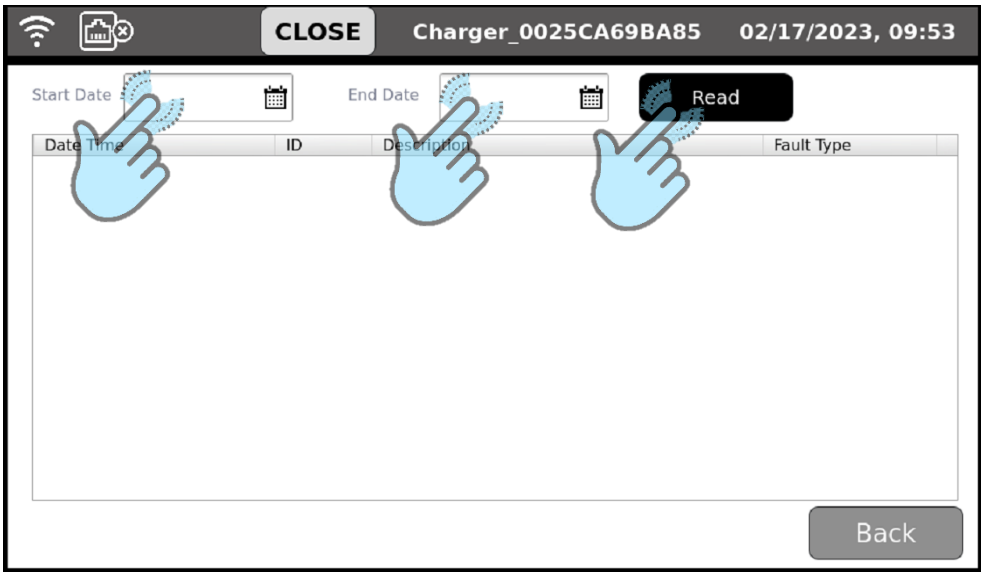


Figure 3.1.33

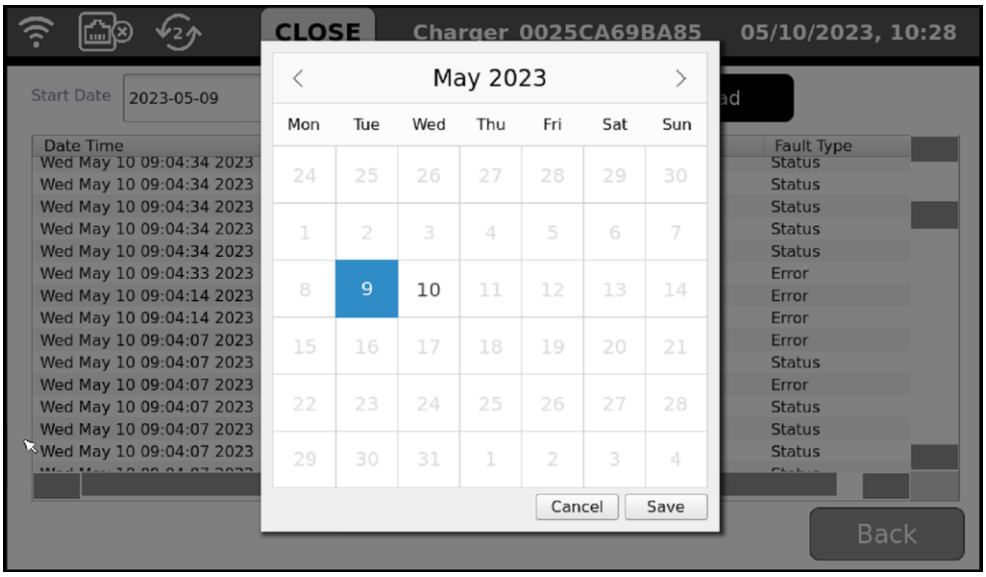


Figure 3.1.34

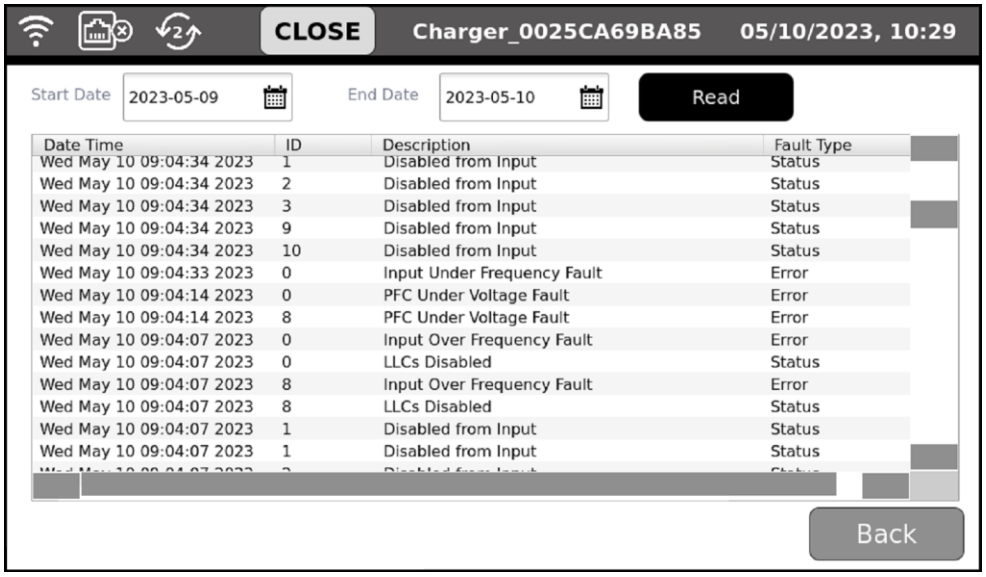
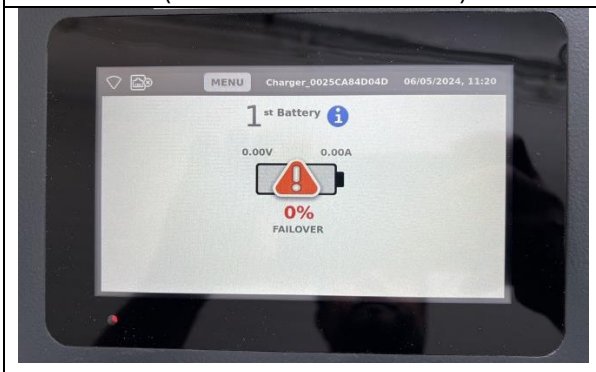
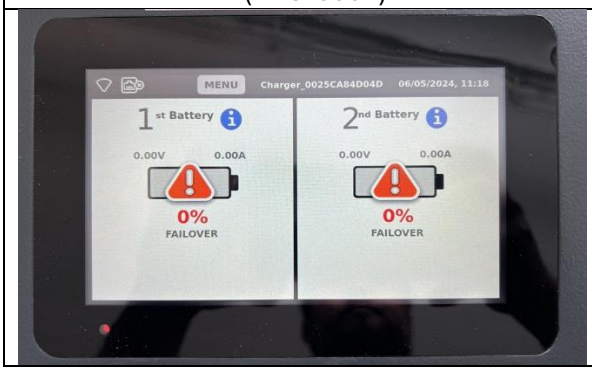


Figure 3.1.35

4. Troubleshooting

If a fault or error is flag on the Home screen as per below image.

Single Output Configuration (FBC-1501 or FBC-3001)	Three Output Configuration (FBC-1503 or FBC-3003)
	

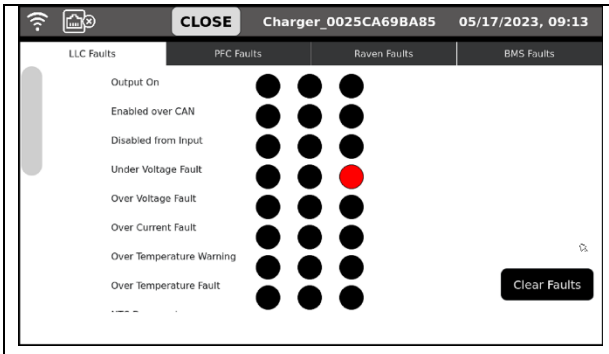
Dual Output Configuration (FBC-3002)	
	

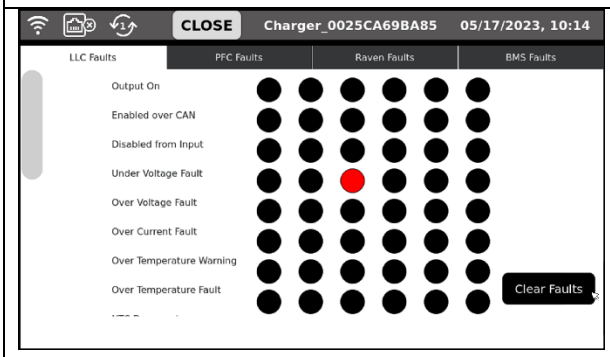
Note: in General if there are Configuration change or Fault that persist.

It is recommended to perform an Input 3phase recycle to the Charger.

Kindly note if the Downstream Circuit breaker is tripping, then kindly check for Green Cubes Service Technician for Technical Support.

Click on the  and it will show the Live View Error Screen





Sample Fault:

Under Voltage Fault on **LLC position 3**

For 15kW model: 3 columns of dots are the LLC position 1,2 and 3 (left to right).

For 30kW model: 6 columns of dots are the LLC position 1,2,3,4,5 and 6 (left to right).

Fault is indicated by the red circle.

Press **Clear Faults** button to removed the error.

If Fault or error is persistent see next sections for detailed fault description and solutions and call for Technical Support.

4.1. LLC Faults

Parameter	Description	Code Source	Corrective Action
Output On	Normal Charging Operation.		None
Enabled over CAN	Normal Charging Operation.		None
Disable from Input	Disabled by PFC.	Error on the PFC circuit.	Check PFC Fault status Or Fuse open on Input Board. Request RMA of the Charger.
Under Voltage Fault	The output voltage fell below the expected level.	Usually External Issue. Sustained short in battery.	Press Clear fault, if persist check Battery pack, otherwise there is an internal fault on the Charger Module. if persist Request RMA of the Charger Module..
Over Voltage Fault	An overvoltage has occurred on the output.	Charger Output has seen more than: 66V for Voltage Setpoint <= 60V 132V for Voltage Setpoint >= 60V	Press Clear fault, if persist check Battery pack, otherwise there is an internal fault on the Charger Module. if persist Request RMA of the Charger Module
Over Current Fault	An over current event has occurred.	Usually External Issue. Sustained short in battery.	Press Clear fault, if persist check Battery pack, otherwise there is an internal fault on the Charger Module. if persist Request RMA of the Charger Module
Over Temperature Warning	Internal Temperature Sensor see above the Warning level.	Reasons vary. Dusty Filter, Too High Ambient	Check Air input filter. Only warning and charger continues to operate.

Parameter	Description	Code Source	Corrective Action
Over Temperature Fault	Internal Temperature Sensor see above the Fault level.	Reasons vary. Dusty Filter, Too High Ambient	Check Air input filter. Press Clear fault. if persist Request RMA of the Charger Module
NTC Damaged	Internal NTC components is detected as open.	Internal Hardware Failure	Charger continues to operate. if persist Request RMA of the Charger Module
Internal Aux Fault	Internal aux is failing to deliver the required voltage, Occurs in case of an internal hardware failure.	Internal Hardware Failure	Press Clear fault, if persist Request RMA of the Charger Module
Isolation Fault	Output to Chassis isolation has failed	Internal Hardware Failure	Press Clear fault, if persist Request RMA of the Charger Module
Relay Fault	The internal voltage and the external voltage deviate more than expected. Occurs in case of a failed relay.	Internal Hardware Failure	Press Clear fault, if persist Request RMA of the Charger Module
Output Balance Fault	Internal balance fault between both LLC branches. Occurs in case of an internal hardware failure.	Internal Hardware Failure	Press Clear fault, if persist Request RMA of the Charger Module
Startup Timeout Fault	The converter has not been able to reach the setpoint in sufficient amount of time. Occurs in case of an internal hardware failure.	Internal Hardware Failure	Press Clear fault, if persist Request RMA of the Charger Module

Parameter	Description	Code Source	Corrective Action
Battery OVP	Battery voltage above acceptable limit.	Charger Output has seen more than: 63V for Voltage Setpoint <= 60V 126V for Voltage Setpoint >= 60V	Press Clear fault, if persist check Battery pack, otherwise there is an internal fault on the Charger Module. if persist Request RMA of the Charger Module
Battery UVP	Battery voltage below acceptable limit.	Usually External Issue. Sustained short in battery.	Press Clear fault, if persist check Battery pack, otherwise there is an internal fault on the Charger Module. if persist Request RMA of the Charger Module
Battery voltage not constant	External voltage is changing faster than expected and does not match previous value anymore.	External Issue. Probably, an unstable battery connection. Unlikely to occur. But detection is critical to avoid hardware damage (melting of output relays)	Press Clear fault, Check cabling to battery. otherwise there is an internal fault on the Charger Module. if persist Request RMA of the Charger Module
Battery voltage out of range	The programmed setpoint and the external voltage from the battery pack do not match.	Configuration or External Issue.	Press Clear fault, Check battery pack and Charger configuration. otherwise there is an internal fault on the Charger Module. if persist Request RMA of the Charger Module
Derating Active	Internal Temperature Sensor see above the Warning level.	Reasons vary. Dusty Filter, Too High Ambient	Check Air input filter. Only an indicator and charger continues to operate.
Derating Warning	Internal Temperature Sensor see above the Fault level.	Reasons vary. Dusty Filter, Too High Ambient	Check Air input filter. Only warning and charger continues to operate.

4.2. PFC Faults

Parameter	Description	Code Source	Corrective Action
Input Under Voltage Warning	Input Line voltage below warning limit.	External	Only warning and charger continues to operate.
Input Under Voltage Fault	Input Line voltage below operating limit.	External Or Fuse open on Input Board	Check 3phase AC line connection. Should restart automatically when conditions restored. if persist Request RMA of the Charger
Input Over Voltage Fault	Input Line voltage above operating limit.	External	Check 3phase AC line connection. Should restart automatically when conditions restored. if persist Request RMA of the Charger
Input Voltage PLL not locked	Grid unstable and PLL cannot lock onto the input line voltage. This occurs in case of strong harmonics on the grid.	External	Check 3phase AC line connection. Should restart automatically when conditions restored. if persist Request RMA of the Charger
Symmetry Fault	Occurs in case of an asymmetric grid, e.g., if one phase has lower voltage than other phases.	External Or Fuse open on Input Board	Check if the cables are properly connected Should restart automatically when conditions restored. if persist Request RMA of the Charger
Input Under Frequency Fault	Input Line Frequency below operating limit.	External Or Fuse open on Input Board	Check 3phase AC line connection. Should restart automatically when conditions restored. if persist Request RMA of the Charger

Parameter	Description	Code Source	Corrective Action
Input Over Frequency Fault	Input Line Frequency above operating limit.	External	Check 3phase AC line connection. Should restart automatically when conditions restored. if persist Request RMA of the Charger
Input Frequency PLL not locked	Grid unstable and PLL cannot lock onto the input line frequency. This occurs in case of strong harmonics on the grid.	External	Check 3phase AC line connection. Should restart automatically when conditions restored. if persist Request RMA of the Charger
Output Under Voltage Fault	Asserted if PFC output voltage below operating limit, continues operation only LLCs are disabled.	Internal	Press Clear fault, if persist replace Charger Module. if persist Request RMA of the Charger Module.
Cold Fault	Asserted if PFC output voltage lower than AC rectified (no AC connection), PFC is disabled.	Internal	Press Clear fault, If persist Request RMA of the Charger.
LLCs Disabled	Asserted if LLC enable pin is low	Internal	Press Clear fault, If persist Request RMA of the Charger Module.
Current Limit Active	Power is being limited due to the input current.	External	Check 3phase AC line connection. Or 3phase Input Cable Wire Gauge from the Charger Calibration screen. If persist Request RMA of the Charger.
Temperature Limit Active	Power is being limited due to high temperature.	Reasons vary. Dusty Filter, Too High Ambient	Check Air Input Filter.

Parameter	Description	Code Source	Corrective Action
Over Temperature Warning	Internal Temperature Sensor see above the Warning level.	Reasons vary. Dusty Filter, Too High Ambient	Check Air input filter. Only warning and charger continues to operate.
Over Temperature Fault	Internal Temperature Sensor see above the Fault level.	Reasons vary. Dusty Filter, Too High Ambient	Check Air input filter. Press Clear fault. If persist Request RMA of the Charger Module.
NTC Damaged	Internal NTC components is detected as open.	Internal Hardware Failure	Charger continues to operate. If persist Request RMA of the Charger Module.
Under Speed Warning	Asserted if fan speed below warning level	Reasons vary. Dusty Filter, Too High Ambient	Check Air Input Filter.
Under Speed Fault	Asserted if fan speed below fault level	Reasons vary. Dusty Filter, Too High Ambient	Check Air Input Filter. Press Clear fault, If persist Request RMA of the Charger Module.
Filter Clearance Warning	Internal Temperature Sensor see above the Fault level.	Reasons vary. Dusty Filter, Too High Ambient	Check Air input filter. Only warning and charger continues to operate.

4.3. Raven Faults

Parameter	Description	Code Source	Corrective Action
Charger CAN Fault	Asserted if Internal CAN communication is disconnected.	Module	Module CAN termination DIP switch is not properly set. Check GCT Document: 714043.
		Internal	Charger have Internal CAN communication issue. Call for Technical Support.
Bridge CAN Fault	Asserted if BMS CAN communication is disconnected.	Internal	Charger have Internal BMS CAN Bridge communication issue. Call for Technical Support.
		External	Check Battery pack CAN Bus and Signal wires connection to the charger. Call for Technical Support.

4.4. BMS Faults

Parameter	Description	Code Source	Corrective Action
BMS CAN Bus in Bus-off	Asserted if BMS CAN communication is disconnected.	External	Check Battery pack CAN Bus and Signal wires connection to the charger.
Discharge FET over-temp error	Asserted by the battery pack internal fault reporting	Battery pack	Check Battery pack for persistent behavior, Call for Technical Support.
Charge FET over-temp error	Asserted by the battery pack internal fault reporting	Battery pack	Check Battery pack for persistent behavior, Call for Technical Support.
SPI communication error	Asserted by the battery pack internal fault reporting	Battery pack	Check Battery pack for persistent behavior, Call for Technical Support.
BQ I2C general communication error	Asserted by the battery pack internal fault reporting	Battery pack	Check Battery pack for persistent behavior, Call for Technical Support.
Battery overvoltage error	Asserted by the battery pack internal fault reporting	Battery pack	Check Battery pack for persistent behavior, Call for Technical Support.
Cell overvoltage error	Asserted by the battery pack internal fault reporting	Battery pack	Check Battery pack for persistent behavior, Call for Technical Support.
Charge overcurrent error	Asserted by the battery pack internal fault reporting	Battery pack	Check Battery pack for persistent behavior, Call for Technical Support.

Parameter	Description	Code Source	Corrective Action
Discharge overcurrent error	Asserted by the battery pack internal fault reporting	Battery pack	Check Battery pack for persistent behavior, Call for Technical Support.
Charge over-temp error	Asserted by the battery pack internal fault reporting	Battery pack	Check Battery pack for persistent behavior, Call for Technical Support.
Discharge over-temp error	Asserted by the battery pack internal fault reporting	Battery pack	Check Battery pack for persistent behavior, Call for Technical Support.
BQ I2C slave address error	Asserted by the battery pack internal fault reporting	Battery pack	Check Battery pack for persistent behavior, Call for Technical Support.
Charge under-temp error	Asserted by the battery pack internal fault reporting	Battery pack	Check Battery pack for persistent behavior, Call for Technical Support.
Discharge under-temp error	Asserted by the battery pack internal fault reporting	Battery pack	Check Battery pack for persistent behavior, Call for Technical Support.
Invalid configuration file	Asserted by the battery pack internal fault reporting	Battery pack	Check Battery pack for persistent behavior, Call for Technical Support.

4.5. Additional Messages

Parameter	Description	Code Source	Corrective Action
Disconnected	Message does not change when a battery pack is connected	Output Charging cable	Check Output Charging cable for Signal Connectors (Bat+, Charge _Detect, CAN H/L).
Minimum Battery Terminal voltage not detected	Prompted when Charger have not seen the battery pack voltage.	Output Charging cable	Check Output Charging cable for Signal Connectors (Bat+, Charge _Detect, CAN H/L).
		Battery pack	Battery pack internal contactor is open.
		Module	Check if Module addressing is correct. Check GCT Document: 714043.
Fail Over	Asserted if Internal CAN communication is disconnected.	Module	Module CAN termination DIP switch is not properly set. Check GCT Document: 714043.
		Internal	Charger have Internal CAN communication issue. Call for Technical Support.

5. Maintenance

It is recommended to perform a maintenance of cleaning the Air Inlet and Outlet of the Charger.

Once a month or if necessary.