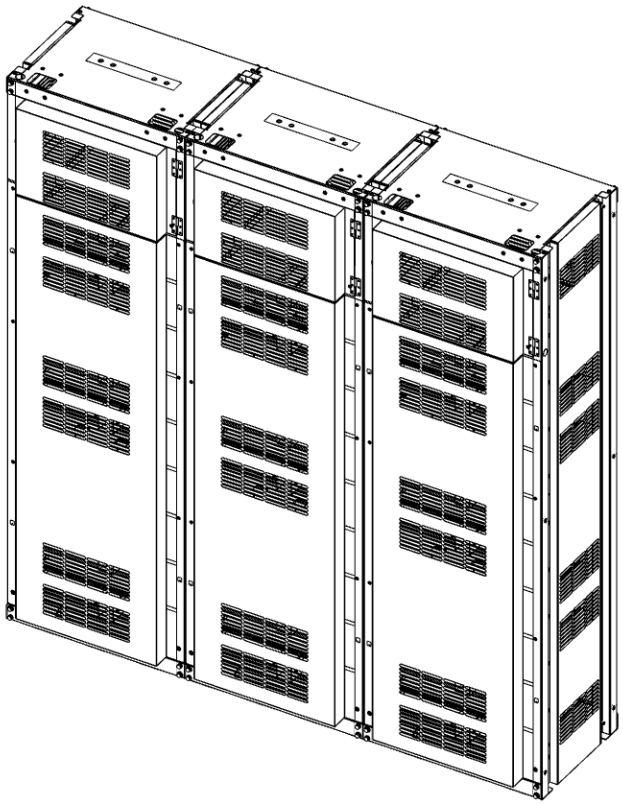
LIB System for UPS – U6A4

Installation Manual for End Customers (136S, 128S, 112S, 104S, 96S, 80S)



Safety Instructions

Read and follow these instructions!

The following precautions are intended to ensure the user's safety and to prevent equipment and property damage. Before installing, handling, or operating this product, be sure to read all safety instructions in this document for proper installation.

DANGER

Failure to comply with the instructions that have this symbol may result in a serious accident, causing death or a severe injury.

WARNING

Failure to comply with the instructions that have this symbol may result in a serious accident, causing a severe injury.

CAUTION

Failure to comply with the instructions that have this symbol may result in minor or moderate injury.

NOTICE

Provides information considered important but not hazard-related. The information relates mainly to equipment or property damage if not followed.

Important

Indicates valuable tips for optimal installation and proper operation of the product.

General Instructions

Be aware that a battery system presents a serious risk of electrical shock, arc flash, and other hazards when not switched or operated as described in this manual and other supplemental documentation. Follow all safety precautions while installing, handling, or operating any part of the battery system.

- Remove watches, jewelry, rings, and other metallic items.
- Use tools with insulated switches to avoid inadvertent short circuits.
- Wear proper personal protective equipment.
- Do not rest or place tools or any other metal parts on any component of the battery system.
- Disconnect the charging source and/or load before connecting or disconnecting power terminals.
- Use proper lifting means when moving batteries.
- Batteries must be switched, transported and recycled or discarded in accordance with federal, state and local regulations. Refer to the Appendix in this manual for more details on disposal and recycling.
- Do not open or mutilate the batteries.
- Only authorized, properly trained and qualified technicians should perform maintenance.
- Only qualified personnel who are familiar with the batteries and safety precautions should installer maintain the battery system.
- Do not allow unauthorized personnel to contact the batteries.

	**DANGER**
	Failure to comply with the instructions that have this symbol may result in a serious accident, causing death or severe injury.

Safety Precautions

The following precautions provide general safety guidelines that should be followed when working with or near the Energy Storage System (ESS). Complete safety parameters and procedures are site-specific and should be developed by the customer for the installation site.

- Review and refer to all safety warnings and cautions in this manual before installation.
- Build a clear, permanent, restricted access area around the system.
- Only authorized, adequately trained electrical operators should be able to access the system.

The interior design of this equipment must be considered a “no-go area” except for non-qualified personnel who are familiar with the batteries and safety precautions,” depending on the location. Consult local codes and applicable rules and regulations to determine permit requirements. If required, mark enclosures appropriately before beginning work.

The 	***NOTICE***
	This product shall be installed in a restricted access area where only the qualified personnel who are trained and have the knowledge of the product and the related safety precautions of the installation manual. “Restricted access area” is area accessible only to the electrically skilled persons and electrically instructed persons with the proper authorization.

Disclaimer

Samsung SDI is given an exemption from warranty for defect and performance in the event of a battery failure for the following reasons, and consequent costs and liabilities are the responsibility of the user.

1) Faults resulting from not following the manuals (Battery Specification, Installation Manual, Operation and Maintenance Manual, Safety & Operation Checksheet) provided by Samsung SDI
2) Battery faults resulting from inadequate storage and transportation
3) Battery faults resulting from arbitrary installation without following the Installation Manual
4) Direct/indirect battery faults resulting from not following Operation and Maintenance Manual
5) Battery faults resulting from operation without installation inspection or operation approval of Samsung SDI
6) Inadequate battery operation or mishandling
7) Operation of the battery system under an inadequate air-conditioning system
8) Disassembly or modification of the battery system by an unauthorized engineer
9) Product damage caused by unforeseen natural disasters
10) Product damage caused by abnormal installation & operating environments including flooding & condensation
11) Use the battery system for purposes that have not been discussed in advance
12) Distribution of the battery system under conditions that have not been discussed and approved by Samsung SDI

Recycling & Disposal Guide

If the battery to be disposed is reused (including disassembly and repair), distributed, or arbitrarily disposed without notice, the customer shall take all necessary measures at the request of the SDI and compensate the SDI for all damages caused by the act above.

Battery System Handling Instructions

1) It is strictly prohibited to disassemble/modify the products without the consent of Samsung SDI.

2) It is strictly prohibited to use the battery system for purposes that have not been agreed in advance. Samsung SDI is not responsible for any consequent tangible/intangible losses.

3) In the area where UL1973 certification is applied, To prevent the battery damage from experiencing transient voltage surges, protective devices such as a SPD shall be installed in system. And the protective devices require a regular inspection. If the device starts protection operation, discontinue battery use and inspect the entire system. If no abnormality is found, battery use can be re-continued. The SPD should be a product acquired UL1449 certification and shall meet the following specifications.

- SPD should be used as type 1. In the OVCIII area, Battery system should be lowered to OVCII

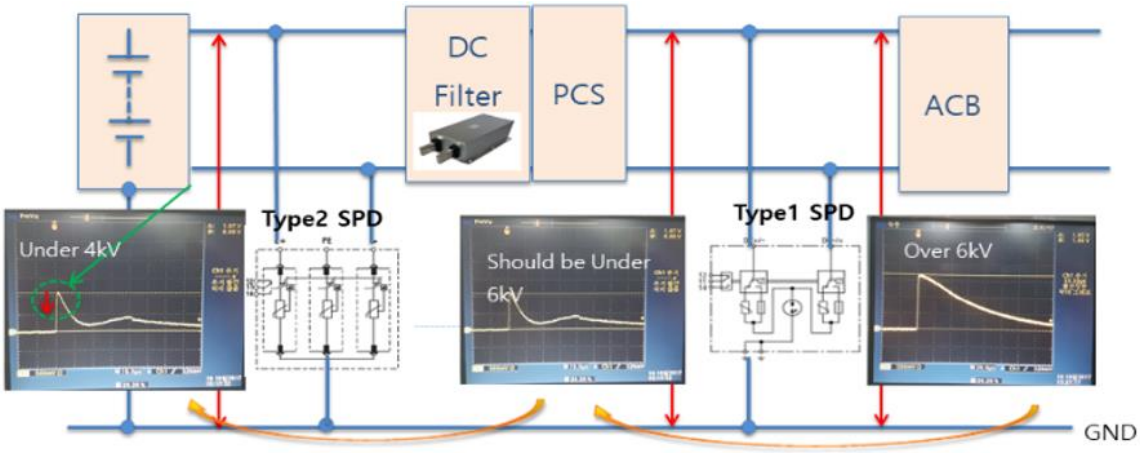
- Whether it is applied to AC or DC stage, SPD should be applied to lower DC transient voltage to less than 4,000V.

- VPR(Voltage Protection Rating) : 4,000V (So that the DC transient voltage does not exceed 4000 V.)

- MCOV(The maximum continuous operating voltage) : 600V or higher

- I_N (Nominal discharge current) : 10kA or higher

- SCCR(Short circuit current rating test) : 25kA or higher



Personnel and Equipment Warnings

Personnel in contact with the battery system should be aware of the following hazards:

WARNING—SHOCK HAZARD

Do not make contact with high voltage system connectors or terminals. Do not open the enclosure doors unless proper lock out/tag out procedures and related trainings have been followed in accordance with the local codes and regulations.

WARNING—ARC FLASH HAZARD

There is an arc flash hazard associated with all electrical equipment. There is a serious risk of arc flash relating to any equipment modification (e.g. opening doors). Serious injuries can occur in arc flash incidents. Appropriate training is required in accordance with local codes and regulations.

WARNING—FIRE HAZARD

Fire may occur under certain fault conditions.

In case of fire involving electrical equipment, use only carbon dioxide fire extinguishers or those approved for use in fighting electrical fires.

CAUTION—PINCH POINTS

Multiple pinch points are present in most system components. Be aware that there is a serious risk of injury while working around and in equipment enclosures.

CAUTION—STATIC SENSITIVE

Electronic appliances can be damaged by electrostatic discharge. Proper handling procedures are required. Be sure to wear a grounded anti-static wrist strap and to discharge static electricity by touching a grounded surface near the equipment before touching any system components.

Dangerous Voltages

DANGER

The Energy Storage System (ESS) is powered by multiple power sources. Hazardous voltages may be present in the equipment even when it does not appear operational. The user is responsible for ensuring that all cautions and warnings in this manual are understood with no exceptions. Failure to do so may result in serious injury or death. Follow all manufacturer-published safety procedures.

Electrical equipment can present a risk of electrical shock and can cause an arc flash. The following precautions must be observed when working on or around electrical equipment:

- Remove watches, jewelry, rings, and other metallic items.
- Use tools with insulated switches to avoid inadvertent short circuits.
- Wear proper personal protective equipment.

Lock Out/Tag Out Guidelines

DANGER

Follow all applicable lock out/tag out (LOTO) procedures at all times. Failure to follow proper lock out/tag out procedures may result in serious injury or death.

With power applied to the ESS, hazardous voltages are present on some components. To prevent death or injury, do not touch any components within the enclosure unless specifically directed to do so. To reduce the risk of electrical shock, make sure that all equipment is properly grounded. For more information, refer to 3.1 Grounding the Battery in this manual.

WARNING

Enclosure doors must remain closed except when access to the enclosure interior is required. If possible, personnel should keep a safe distance from enclosures whenever the equipment is energized. Always comply with local, state, and national lock out/tag out guidelines when working with or near the ESS. The LOTO procedures must meet or exceed the requirements of all guidelines presented in Samsung SDI safety documentation. Follow all requirements and recommendations in this manual before entering potentially hazardous areas or beginning work on the ESS.

- Identify and wear proper personal protective equipment.
- Identify and remove all power and stored energy sources. Then, open all MCCBs and confirm that the voltage on the high voltage DC battery bus is zero.
- Apply appropriate LOTO devices (not Samsung SDI scope). When applying a LOTO device to the ESS, do not touch anything within the enclosure except as specifically directed in the work procedures.
- Complete the site-specific lock out/tag out procedures and safety checklist before beginning any work.

General Warnings

DANGER

When energized, the equipment presents a potential hazard of electric shock, death, and burn. Only authorized personnel who are thoroughly familiar with the equipment and adequately trained shall install, operate, and maintain this equipment.

DANGER

To avoid death, personal injury, or damage to the product, follow all safety procedures as regulated by local, state, and federal Environmental Health and Safety (EHS) guidelines.

DANGER

To minimize exposure to hazards such as electrical shock, death, and burns, approved grounding practices and procedures described in this document must be strictly followed.

WARNING

To avoid personal injury and damage to equipment, personnel must adhere to the site protocol concerning working at heights.

WARNING

To avoid personal injury or equipment damage caused by equipment malfunction, only authorized, qualified, and trained personnel should modify any hardware or software component in the battery system.

WARNING

Always ensure that applicable standards and regulations are followed and only properly certified equipment is used as a critical component of a safety system. Never assume that a safety-critical control loop is functioning correctly.

Personal Protective Equipment (PPE)

Please be aware that batteries have a risk of electric shocks including high short-circuit current. Follow all the safety precautions when operating the battery system. Personnel must wear appropriate PPE according to the following section when installing and maintaining the system. The presented results of arc flash calculation are theoretical values and the calculation is based on the 1P configuration. Therefore, one-level-higher PPE should be applied when actually working with the system.

In order to reduce the risks of arc flash, each battery module is equipped with a fusible link inside, and fast-acting fuses are mounted on the BCU (+) and (-). Arc flash risks are analyzed using the peak current and arc time that are measured through a rack-level assessment, and protective measures are recommended accordingly.

Arc Flash Calculations and Short Circuit Current

Arc energy values are estimated with the Direct-Current Incident Energy Calculations method referenced in Informative Annex D of NFPA 70E Standard for Electrical Safety in the Workplace.

Fault current will be reduced at EOL (SOH 80%), so the arcing time will increase but the cell impedance will increase about 20%. As a result, the arc energy value will be similar.

The L/R time constant simulation results are as follows:

- **BOL**: 136S configuration = 33.0 µH / 73.3 mΩ, 128S configuration = 33.0 µH / 69.3 mΩ
- **EOL**: 136S configuration = 33.0 µH / 85.6 mΩ, 128S configuration = 33.0 µH / 80.9 mΩ

[Table 1] Arc Energy Calculation

U6A4 136S		**Unit**	**Derived**	**Rack (BOL, 100% SOC, 100% SOH)**	**Rack (EOL, 100% SOC, 80% SOH)**
V_{sys}	System voltage	V	Measured	571.2	571.2
R_{sys}	Impedance	Ω	Calculation	0.0733	0.0856
I_{bf}	Fault current	A	Calculation, Vsys/Rsys	7,793	6,673
I_{arc}	Arcing current	A	Calculation, Ibf/2	3,896	3,336
T_{arc}	Arcing time	Sec	Measured	0.0005	0.0006
IEm	**Arc Energy at 18”**	**Cal/cm²**	**Calculation**	**0.005323**	**0.005470**

U6A4 128S		**Unit**	**Derived**	**Rack (BOL, 100% SOC, 100% SOH)**	**Rack (EOL, 100% SOC, 80% SOH)**
V_{sys}	System voltage	V	Measured	537.6	537.6
R_{sys}	Impedance	Ω	Calculation	0.0693	0.0809
I_{bf}	Fault current	A	Calculation, Vsys/Rsys	7,758	6,645
I_{arc}	Arcing current	A	Calculation, Ibf/2	3,879	3,323
T_{arc}	Arcing time	Sec	Measured	0.0005	0.0006
IEm	**Arc Energy at 18”**	**Cal/cm²**	**Calculation**	**0.004988**	**0.005127**

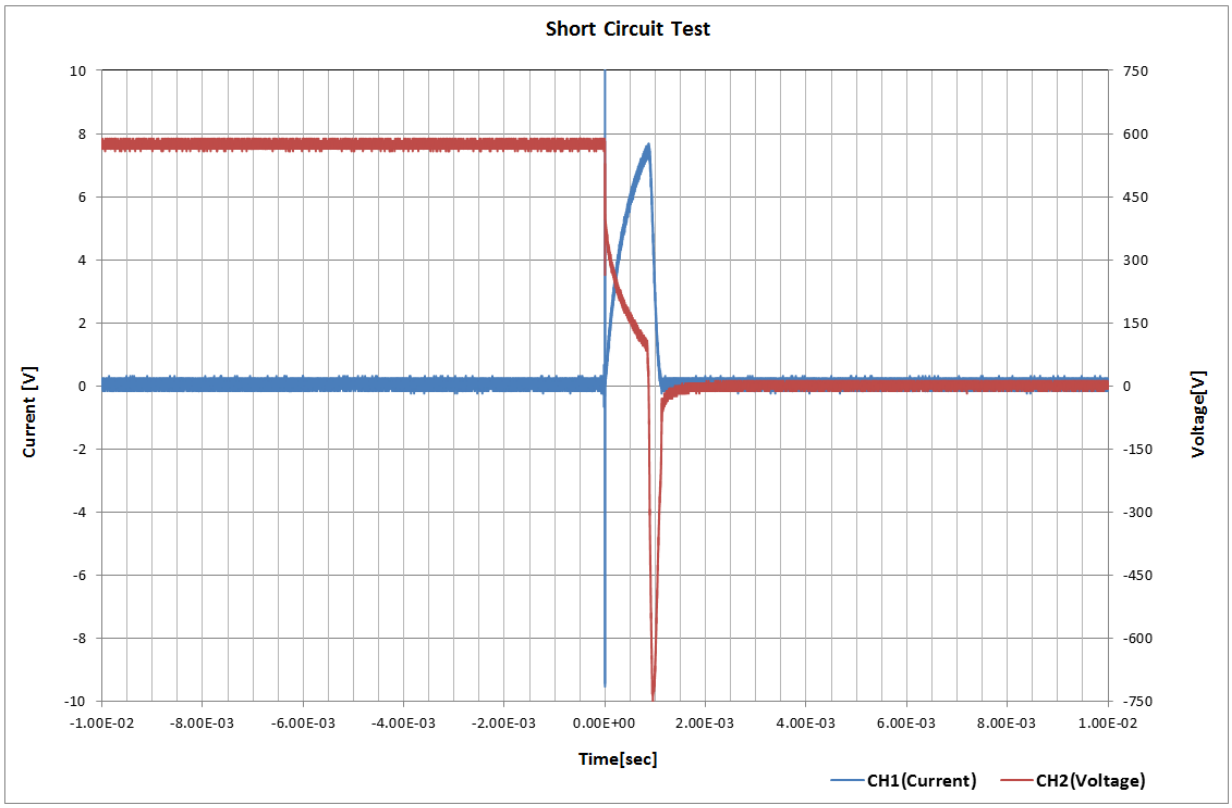
The 136S configuration is assumed to estimate the worst-case scenario.

Arc flash related calculations based on this battery system are as follows:

- Bolted fault current (I_{bf}): 7,793 A
- 1/2 Bolted fault current (1/2 I_{bf}): 3,896 A
- Protective device clearing time (T_{arc}): 0.5 ms
- Protective device current interrupt capability (i^2t): 110000A^2s
- Estimated DC arc flash incident energy at the maximum power point (IE_m): 0.005323cal/cm^2

Actual external short circuit current and arcing time is measured as shown below.

- Current limiting component: 500A rated fuse (Mersen PC33UD69V500TF)
- Peak current: 7.68 kA
- Total Clearing time: 1.4 ms



Approach Boundaries to Live Parts for Shock Protection

Refer the NFPA 70E Tables 130.4(D)(b) for DC System

Arc flash boundary : 1.2m (Under 600V System)

But in case of Event Live Parts are in Enclosure. The Opening increases the energy. recommended Arc Flash Boundary 3.0m(10feet)

For systems that are 600Volts are less, The Arc Flash Boundary shall be a min of 4feet. An engineering analysis must be performed to determine the Arc Flash Boundary for systems that are above 600Volts
That's the distance where a worker without appropriate PPE would receive second-degree burns.
Sometimes this boundary is the furthest one from the exposed equipment, other times the limited approach boundary is the furthest out. When the arc flash boundary is the furthest away, it becomes the line no one should pass without training and PPE. If the limited approach boundary is further out, then that should be treated as the line no one should pass without training and PPE.

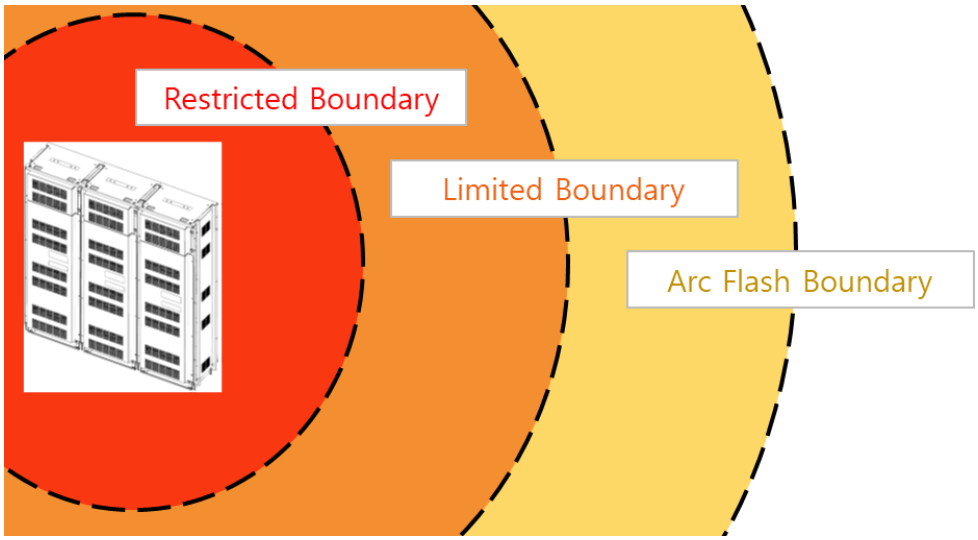
Limited approach boundary : 1.0m by table(DC 301V~1kV)

Within this boundary, it is still possible to be exposed to a shock hazard. Appropriate PPE should be worn by qualified workers in the limited space (space between the limited approach boundary and the restricted boundary). Non-qualified workers should stay outside of this boundary unless wearing proper PPE and being escorted by a worker with specialized training.

Restricted boundary : 0.3m by table(DC 301V~1kV)

The area closest to the live, exposed equipment is within the restricted boundary. In order to pass this boundary, you

must be a qualified worker with the proper training and PPE. If you need to perform work on the energized equipment, y ou may also need a work permit and documentation.



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1. About this Manual

This section describes the purpose, audience, organization, revision history, and acronyms and abbreviations.

1.1 Purpose

The purpose of this manual is to provide the user with information required for the safe and successful installation of this product.

The instructions within this manual are based on assembly of a three-cabinet system. Other configurations are possible, and the instructions can be reduced or expanded to accommodate installation of those alternate system configurations.

1.2 Target Audience

This manual is intended for system installers and operators who will install and configure this product.

1.3 Organization

This manual is composed of the following main sections:

- Section 1, “About this Manual” provides an outline of this document.
- Section 2, “Product Description,” describes the major components that make up the battery system and the main interfaces of each of these components.
- Section 3, “Installing the Product” explains how to install the product.

1.4 Revision History

Rev.	Description	Author	Date
0.0	First Draft		2025.04.28
0.1	Typo corrected		2025.06.18

1.5 Acronyms and Abbreviations

The following acronyms and abbreviations are used in this manual.

Abbreviations	Full Name
AED	Automated External Defibrillator
BCU	Battery Control Unit
BMS	Battery Management System
CC-CV	Constant Current-Constant Voltage
EHS	Environmental Health and Safety
EODV	End of Discharge Voltage
ESS	Energy Storage System
LOTO	Lock Out / Tag Out
MCCB	Molded Case Circuit Breaker
OTP	Overtemperature Protection
OVP	Overvoltage Protection
PCS	Power Conversion System
SMPS	Switched Mode Power Supply
SOC	State Of Charge
SOH	State Of Health
UTP	Undertemperature Protection
UVP	Undervoltage Protection
UPS	Uninterruptible Power Supply

2. Product Description

Before installing the battery system, all users must be familiar with its components.

2.1 Major Components

Samsung SDI's Lithium Ion Battery System is comprised of the following components:

- Battery Module (Type A / Type B)
- BCU
- Rack BMS (embedded in BCU)
- Rack Frame
- SMPS Assembly (Type A / Type B)
- System BMS (embedded in SMPS Assembly Type A)

Refer to the "Product Specification" document for detailed specifications of the components.

Component for UL	Model No.	Note
67Ah Cell	CM0630R0002A	
67Ah 8S1P Battery Module Type A	EM2031AE003A	EM2031AE001A for Customer Group B
67Ah 8S1P Battery Module Type B	EM2031AE004A	EM2031AE002A for Customer Group B
String Management Unit (SMU)	V049-0011AA or V049-0036AA	UL
SMPS Assembly 3 Phase Type A	V044-0006AA	3 Phase AC input, System BMS
SMPS Assembly 3 Phase Type B	SJ94-00238B	3 Phase AC input, no System BMS
SMPS Assembly 1 Phase Type A	V044-0004AA	1 Phase AC input, System BMS
SMPS Assembly 1 Phase Type B	V044-0005AA	1 Phase AC input, no System BMS
Rack Frame	V808-00068A	Black For general customer

Component for CE	Model No.	Note
67Ah Cell	CM0630R0002A	
67Ah 8S1P Battery Module Type A	EM2031AE003A	EM2031AE001A for Customer Group B
67Ah 8S1P Battery Module Type B	EM2031AE004A	EM2031AE002A for Customer Group B
String Management Unit (SMU)	V049-0012AA or V049-0035AA	CE
SMPS Assembly 3 Phase Type A	V044-0006AA	3 Phase AC input, System BMS
SMPS Assembly 3 Phase Type B	SJ94-00238B	3 Phase AC input, no System BMS
SMPS Assembly 1 Phase Type A	V044-0004AA	1 Phase AC input, System BMS
SMPS Assembly 1 Phase Type B	V044-0005AA	1 Phase AC input, no System BMS
Rack Frame	V808-0101BA	Black For general customer

2.1.1 Battery Module (Type A / Type B)

The battery module is the most basic component of the Battery System and it includes serially-connected/parallel-connected battery cells that store the electrochemical energy and a module BMS. The module BMS measures the battery characteristics such as cell voltage and temperature, and monitor the status of each battery. The module BMS digitizes the measured voltage and temperature of each cell, delivers the data to the rack BMS, and receives a command from the rack BMS to control cell balancing. The module BMS communicates with the rack BMS in the SMU via UART interface.

There are two types of battery modules depending on the position of terminal's polarity. A Type A module has its positive (+) terminal is on the right side (when looking from the front), whereas a Type B module has its positive (+) terminal on the left side.

Customer Group A
Type A: EM2031AE003A
Type B: EM2031AE004A

Customer Group B
Type A: EM2031AE001A
Type B: EM2031AE002A

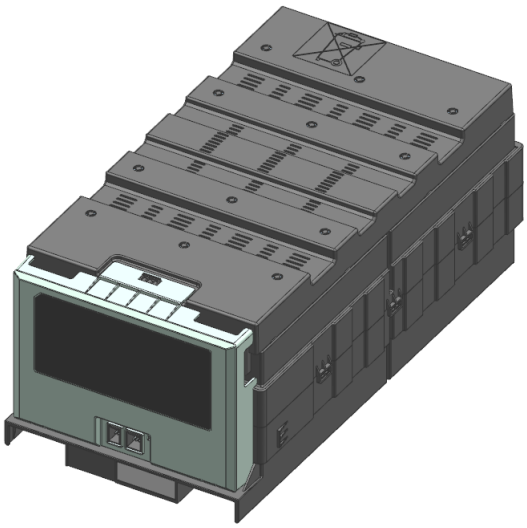
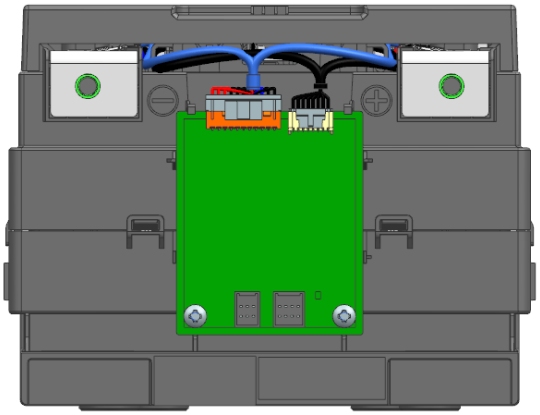
Battery Module Type A (Isometric View)	**Battery Module Type A (Front cover removed)**
	

Figure 2-1: Battery Module Type A

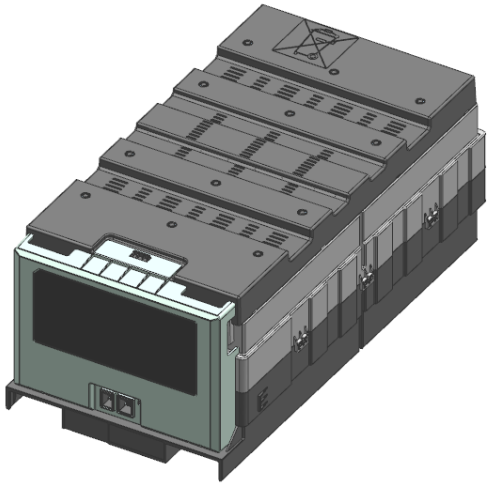
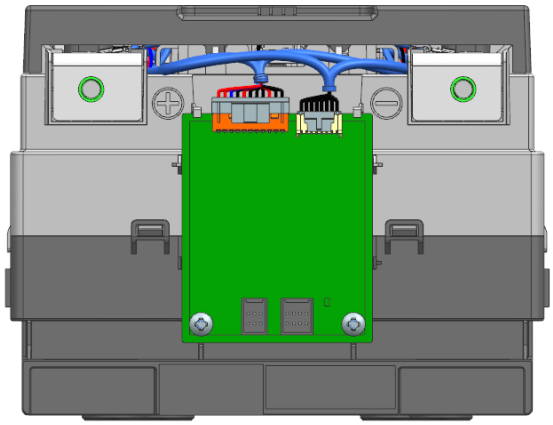
Battery Module Type B (Isometric View)	Battery Module Type B (Front cover removed)
	

Figure 2-2: Battery Module Type B

2.1.2 BCU (Battery Control Unit)

The BCU collects all data and status information from the modules that reside in the same string and it also controls the main power line switch and enables cell balancing. The BCU calculates the SOC and SOH of the battery system. Key components in the BCU include the Rack BMS, a MCCB, and a shunt resistor to measure the rack current. The Rack BMS is the main string-level controller that collects all data from the Module BMS, measures the string voltage and current, determines the state of the battery string, and controls the MCCB.

Customer Group A
CE: V049-0012AA or V049-0035AA
UL: V049-0011AA or V049-0036AA

Customer Group B
CE: V049-0012BA
UL: V049-0011BA

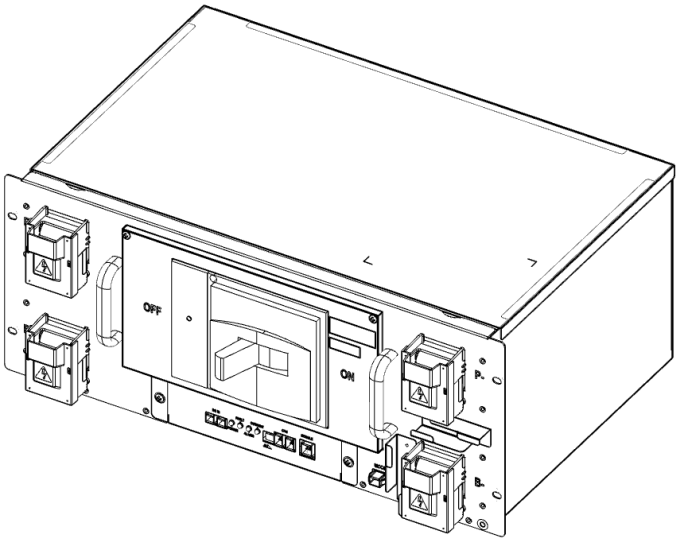


Figure 2-3: BCU

The BCU provides an optional, auxiliary breaker switch that can be connected to the building monitoring system, if desired.

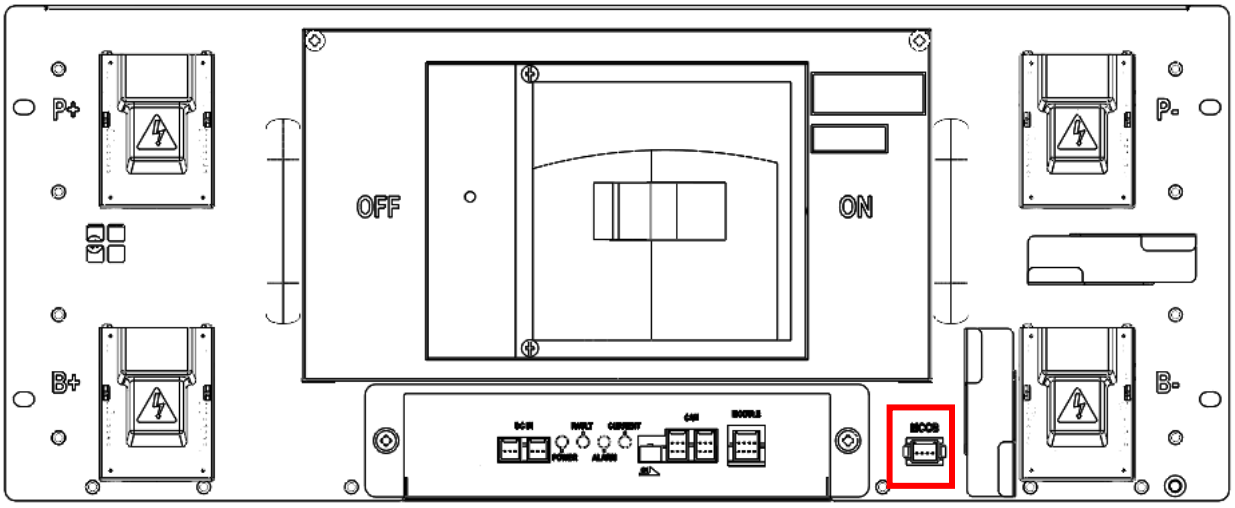


Figure 2-4: Optional Auxiliary Breaker Switch

The P+ and P- terminal blocks connect to the DC link from the UPS. The B+ and B- terminal blocks connect internal to the string before the MCCB. Cables that connect between the BCU and the Battery Modules are provided as part of Samsung SDI's scope of supply. The system integrator is responsible for sourcing the cable and lug terminals that connect to the P+ and P- terminal blocks; these should be selected according to the terminal block's size and material.

Figure 2-5: Terminal Block Isometric View

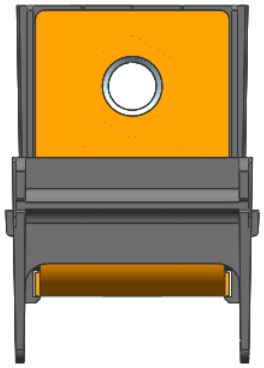
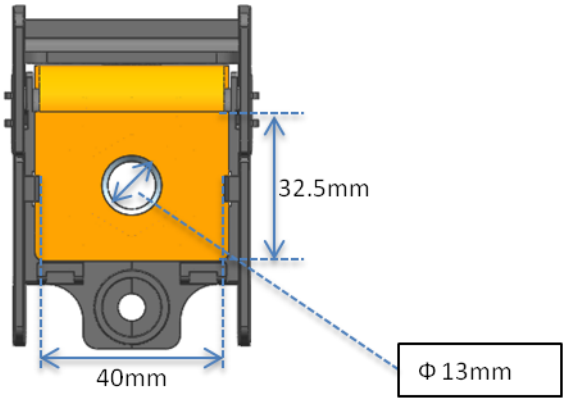
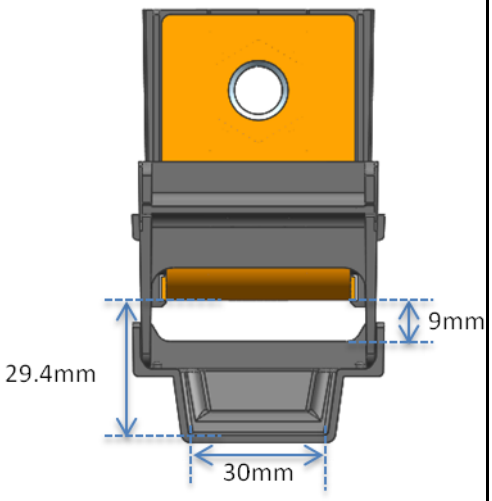
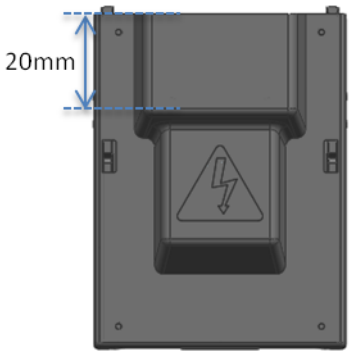
	Top View	Front View
COVER OPEN		
COVER CLOSED		

Figure 2-6: Terminal Block Front / Top View (Cover Opened/Closed)

Table 2-1: Terminal Block Description

Item	Detail	Description
Conducting Material	Cu	C1100
Insulating Material (Guide)	PA66	GF25%
Insulating Material (Cover)	PC	
Conductive Area	32.5mm x 40.0mm	
Rated Current	473A	Calculated in accordance with DIN 43670 MELSON & BOTH equation

Table 2-2: Cable and lug terminal requirements

Terminal Name	Wire No.	Terminal Type	Description
P+	300 sq mm or thicker	M12 Single Hole Lug Terminal	Connects to DC link positive
P-	300 sq mm or thicker	M12 Single Hole Lug Terminal	Connects to DC link negative

Refer to 3.9.10 DC Link Cable Connection for more details

NOTICE

- It is recommended to use the wire 300sq to operate rated power. Depending on the actual load, it is also allowed to use thinner wires under the user's responsibility.

2.1.3 SMPS Assembly (Type A / Type B)

Customer Group A
3-Phase Type A (with System BMS): V044-0006AA
3-Phase Type B (without System BMS): SJ94-00238B
1-Phase Type A (with System BMS): V044-0004AA
1-Phase Type B (without System BMS): V044-0005AA

Customer Group B
3-Phase Type A (with System BMS): V044-0006BA
1-Phase Type A (with System BMS): V044-0004BA

The SMPS Assembly houses both the System BMS (if Type A) and redundant SMPS units, which accepts external AC power and converts to DC control power used by the System BMS and BCU. Two options are available for the SMPS depending on the AC input range and cabling: 3-Phase AC and 1-Phase AC. The System BMS assembly provides data to the external systems (i.e. building management system, UPS, etc.) while controlling and monitoring all connected Rack BMS units. The max number of racks that can be controlled by a single System BMS in a battery bank is 20.

There are two types of SMPS Assembly: Type A includes the System BMS and Type B excludes the System BMS.

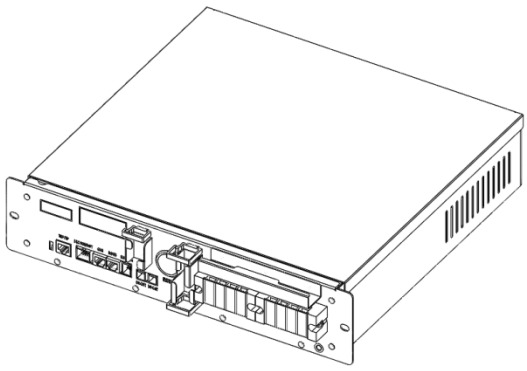
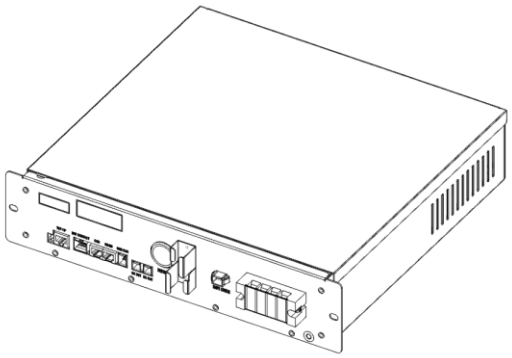
SMPS Assembly with 3 Phase AC Input	SMPS Assembly with 1 Phase AC Input
	
Type A (with System BMS)	

Figure 2-7: SMPS Assembly Type A

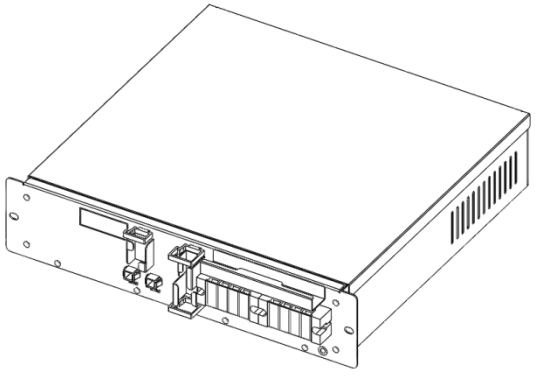
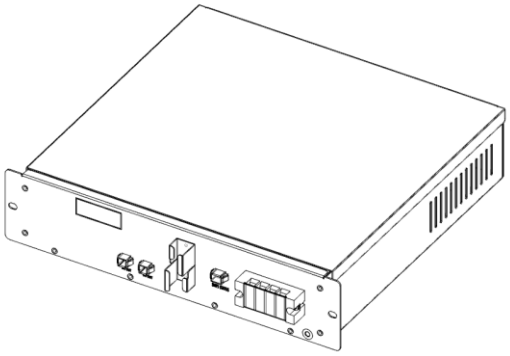
SMPS Assembly with 3 Phase AC Input	SMPS Assembly with 1 Phase AC Input
	
Type B (without System BMS)	

Figure 2-8: SMPS Assembly Type B

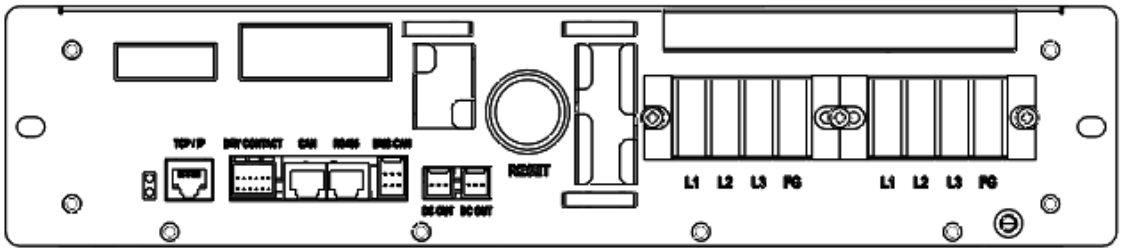


Figure 2-9: Front View of SMPS Assembly Type A, 3-Phase AC Input

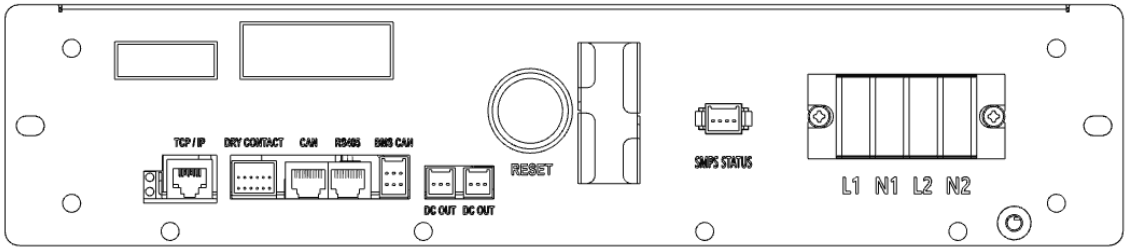


Figure 2-10: Front View of SMPS Assembly Type A, 1-Phase AC Input

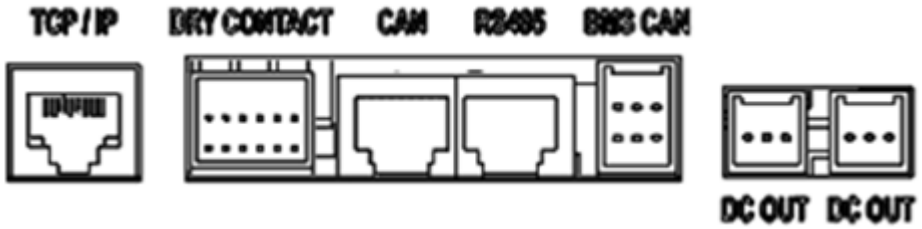


Figure 2-11: SMPS Assembly Type A – System BMS Connections

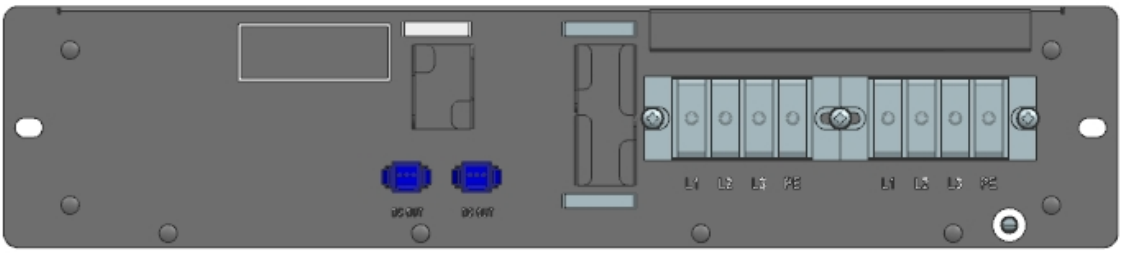


Figure 2-12: Front View of SMPS Assembly Type B, 1-Phase Input

2.1.4 Rack Frame

Customer Group A
- CE: V808-0101BA, Black.
- UL: V808-00068A, Black.

Customer Group B
- CE: V808-0100BA, White.
- UL: V808-00066A, White.

The Rack Frame is used to mount the modules, the BCU, and the SMPS Assembly, and also provides ground connections for the BCU and the SMPS Assembly.

Grounding cable/busbar for the rack frame is necessary for the BCU and the SMPS Assembly as they are grounded to the rack frame when installed.

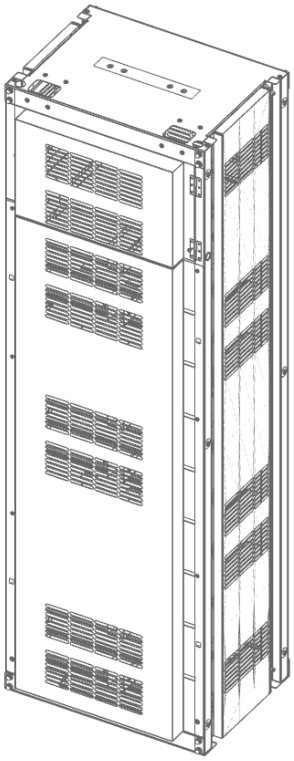


Figure 2-13: Rack Frame

2.2 Product Specification

Table 2-3: Battery System General Specification

No.	Item		Specification	Remarks
1	Dimension [mm (inch)]	BCU	583 x 359.6 x 235.6 (22.95 x 14.16 x 9.28)	
		Battery Module	403.5 x 214 x163 (15.89 x 8.43 x 6.42)	Type A and Type B
		SMPS Assembly 3 phase	397.4 x 355.6 x 85.5 (15.64 x 14 x 3.37)	Type A and Type B
		SMPS Assembly 1 phase	397.4 x 355.6 x 85.5 (15.64 x 14 x 3.37)	Type A and Type B
		Rack Frame	650 x 530 x 2055 (25.59 x 20.87 x 80.91)	
2	Weight [kg(lb)]	BCU	About 18 (40)	
		Battery Module	About 16.5 (36)	Type A and Type B
		SMPS Assembly	About 5 (11)	Type A and Type B
		Rack Frame	About 163.4 (360)	
		136S Battery System	About 510 (1124)	
		128S Battery System	About 493 (1087)	
		112S Battery System	About 459 (1012)	
		104S Battery System	About 442 (974)	
		96S Battery System	About 425 (937)	
		80S Battery System	About 391 (862)	
3	Minimum String Capacity		67 Ah	1/3C (22.3A) charge and discharge @ 25°C
4	Recommended Operation Temperature		23 ± 5°C	
5	Recommended Operation Humidity		Less than 60% RH	Noncondensing
6	Storage & Maximum Operating Altitude		2,000m or less	
7	Storage Temperature		Refer the Operation and Maintenance Manual	
8	Storage Humidity		Refer the Operation and Maintenance Manual	
9	Recommended Storage Period		Less than 6 months	
10	Communication (Internal)		Differential UART, 2 Mbps	BCU – Battery Module
11	Communication (External)1		Modbus RS485	UPS – SMPS Assembly No Support Multi-drop Communication
12	Communication (External)2		Modbus TCP/IP	UPS – SMPS Assembly
13	Communication (External)3		Dry contact	UPS – SMPS Assembly
14	IP rating		IP20	
15	Protective Class		I	

Table 2-4: 136S String Specification

No.	Item	Specification	Remarks
1	Number of Modules	17	8 Type A 9 Type B
2	Nominal Capacity	34.6kWh	1/3C @ 25°C
3	Nominal Voltage[1]	516.8V DC	3.8V/cell
4	Maximum Voltage[1]	571.2V DC	4.2V/cell
5	Discharging Method #1	Constant Power	
	Discharging Method #2	Constant Current	Max 450A
	End of Discharge Voltage[1]	408V DC	3.0V/cell
	Recommended End of Discharge Voltage[1]	435.2V DC	3.2V/cell
	Standard Discharging Current[1]	22.3A	1/3C @ 25°C
	Rated Continuous Discharge Power[1]	183.6kW(CP mode)	Peak 450A @ EODV
6	Charging Method	CC-CV, Floating	
	Floating Charging Voltage[1]	571.2V DC	4.2V/cell
	Standard Charging Current[1]	22.3A	1/3C
	Maximum Peak Charging Current[1]	250A	2 second pulse
	Maximum Continuous Charging Current[1]	67A	1C

[1] Specified voltage and current must be satisfied in all load and charging conditions.

NOTICE

Notice: After a full discharge at maximum continuous discharge power, cool the battery for at least 12 hours before another discharge in order to avoid over-temperature protection. Immediate recharging is allowed with standard charging current. For optimal performance, wait until the battery temperature returns to at least ±3°C within the room temperature.(Ex, for using maximum current discharging after maximum current charging(1C), cool the battery for at least 12hours after charging in order to avoid over-temperature protection)

Table 2-5: 128S String Specification

No.	Item	Specification	Remarks
1	Number of Modules	16	8 Type A 8 Type B
2	Nominal Capacity	32.6kWh	1/3C @ 25°C
3	Nominal Voltage[1]	486.4V DC	3.8V/cell
4	Maximum Voltage[1]	537.6V DC	4.2V/cell
5	Discharging Method #1	Constant Power	
	Discharging Method #2	Constant Current	Max 450A
	End of Discharge Voltage[1]	384V DC	3.0V/cell
	Recommended End of Discharge Voltage[1]	409.6V DC	3.2V/cell
	Standard Discharging Current[1]	22.3A	1/3C @ 25°C
	Rated Continuous Discharge Power[1]	173kW(CP mode)	Peak 450A @ EODV
6	Charging Method	CC-CV, Floating	
	Floating Charging Voltage[1]	537.6V DC	4.2V/cell
	Standard Charging Current[1]	22.3A	1/3C
	Maximum Peak Charging Current[1]	250A	2 second pulse
	Maximum Continuous Charging Current[1]	67A	1C

[1] Specified voltage and current must be satisfied in all load and charging conditions.

NOTICE

Notice: After a full discharge at maximum continuous discharge power, cool the battery for at least 12 hours before another discharge in order to avoid over-temperature protection. Immediate recharging is allowed with standard charging current. For optimal performance, wait until the battery temperature returns to at least ±3°C within the room temperature.(Ex, for using maximum current discharging after maximum current charging(1C), cool the battery for at least 12hours after charging in order to avoid over-temperature protection)

Table 2-6: 112S String Specification

No.	Item	Specification	Remarks
1	Number of Modules	14	6 Type A 8 Type B
2	Nominal Capacity	28.5kWh	1/3C @ 25°C
3	Nominal Voltage[1]	425.6V DC	3.8V/cell
4	Maximum Voltage[1]	470.4V DC	4.2V/cell
5	Discharging Method #1	Constant Power	
	Discharging Method #2	Constant Current	Max 450A
	End of Discharge Voltage[1]	336V DC	3.0V/cell
	Recommended End of Discharge Voltage[1]	358.4V DC	3.2V/cell
	Standard Discharging Current[1]	22.3A	1/3C @ 25°C
	Rated Continuous Discharge Power[1]	151kW(CP mode)	Peak 450A @ EODV
6	Charging Method	CC-CV, Floating	
	Floating Charging Voltage[1]	470.4V DC	4.2V/cell
	Standard Charging Current[1]	22.3A	1/3C
	Maximum Peak Charging Current[1]	250A	2 second pulse
	Maximum Continuous Charging Current[1]	67A	1C

[1] Specified voltage and current must be satisfied in all load and charging conditions.

NOTICE

Notice: After a full discharge at maximum continuous discharge power, cool the battery for at least 12 hours before another discharge in order to avoid over-temperature protection. Immediate recharging is allowed with standard charging current. For optimal performance, wait until the battery temperature returns to at least ±3°C within the room temperature.(Ex, for using maximum current discharging after maximum current charging(1C), cool the battery for at least 12hours after charging in order to avoid over-temperature protection)

Table 2-7: 104S String Specification

No.	Item	Specification	Remarks
1	Number of Modules	13	6 Type A 7 Type B
2	Nominal Capacity	26.5kWh	1/3C @ 25°C
3	Nominal Voltage[1]	395.2V DC	3.8V/cell
4	Maximum Voltage[1]	436.8V DC	4.2V/cell
5	Discharging Method #1	Constant Power	
	Discharging Method #2	Constant Current	Max 450A
	End of Discharge Voltage[1]	312V DC	3.0V/cell
	Recommended End of Discharge Voltage[1]	332.8V DC	3.2V/cell
	Standard Discharging Current[1]	22.3A	1/3C @ 25°C
	Rated Continuous Discharge Power[1]	140kW(CP mode)	Peak 450A @ EODV
6	Charging Method	CC-CV, Floating	
	Floating Charging Voltage[1]	436.8V DC	4.2V/cell
	Standard Charging Current[1]	22.3A	1/3C
	Maximum Peak Charging Current[1]	250A	2 second pulse
	Maximum Continuous Charging Current[1]	67A	1C

[1] Specified voltage and current must be satisfied in all load and charging conditions.

NOTICE

Notice: After a full discharge at maximum continuous discharge power, cool the battery for at least 12 hours before another discharge in order to avoid over-temperature protection. Immediate recharging is allowed with standard charging current. For optimal performance, wait until the battery temperature returns to at least ±3°C within the room temperature.(Ex, for using maximum current discharging after maximum current charging(1C), cool the battery for at least 12hours after charging in order to avoid over-temperature protection)

Table 2-8: 96S String Specification(CE only)

No.	Item	Specification	Remarks
1	Number of Modules	12	6 Type A 6 Type B
2	Nominal Capacity	24.4kWh	1/3C @ 25°C
3	Nominal Voltage[1]	364.8V DC	3.8V/cell
4	Maximum Voltage[1]	403.2V DC	4.2V/cell
5	Discharging Method #1	Constant Power	
	Discharging Method #2	Constant Current	Max 450A
	End of Discharge Voltage[1]	288V DC	3.0V/cell
	Recommended End of Discharge Voltage[1]	307.2V DC	3.2V/cell
	Standard Discharging Current[1]	22.3A	1/3C @ 25°C
	Rated Continuous Discharge Power[1]	130kW(CP mode)	Peak 450A @ EODV
6	Charging Method	CC-CV, Floating	
	Floating Charging Voltage[1]	336V DC	4.2V/cell
	Standard Charging Current[1]	22.3A	1/3C
	Maximum Peak Charging Current[1]	250A	2 second pulse
	Maximum Continuous Charging Current[1]	67A	1C

[1] Specified voltage and current must be satisfied in all load and charging conditions.

NOTICE

Notice: After a full discharge at maximum continuous discharge power, cool the battery for at least 12 hours before another discharge in order to avoid over-temperature protection. Immediate recharging is allowed with standard charging current. For optimal performance, wait until the battery temperature returns to at least ±3°C within the room temperature.(Ex, for using maximum current discharging after maximum current charging(1C), cool the battery for at least 12hours after charging in order to avoid over-temperature protection)

Table 2-9: 80S String Specification

No.	Item	Specification	Remarks
1	Number of Modules	10	4 Type A 6 Type B
2	Nominal Capacity	20.4kWh	1/3C @ 25°C
3	Nominal Voltage[1]	304V DC	3.8V/cell
4	Maximum Voltage[1]	336V DC	4.2V/cell
5	Discharging Method #1	Constant Power	
	Discharging Method #2	Constant Current	Max 450A
	End of Discharge Voltage[1]	240V DC	3.0V/cell
	Recommended End of Discharge Voltage[1]	256V DC	3.2V/cell
	Standard Discharging Current[1]	22.3A	1/3C @ 25°C
	Rated Continuous Discharge Power[1]	108kW(CP mode)	Peak 450A @ EODV
6	Charging Method	CC-CV, Floating	
	Floating Charging Voltage[1]	336V DC	4.2V/cell
	Standard Charging Current[1]	22.3A	1/3C
	Maximum Peak Charging Current[1]	250A	2 second pulse
	Maximum Continuous Charging Current[1]	67A	1C

[1] Specified voltage and current must be satisfied in all load and charging conditions.

NOTICE

Notice: After a full discharge at maximum continuous discharge power, cool the battery for at least 12 hours before another discharge in order to avoid over-temperature protection. Immediate recharging is allowed with standard charging current. For optimal performance, wait until the battery temperature returns to at least ±3°C within the room temperature.(Ex, for using maximum current discharging after maximum current charging(1C), cool the battery for at least 12hours after charging in order to avoid over-temperature protection)

Table 2-10: String Configurations

Configurations	1P136S	1P128S	1P112S	1P104S	1P96S	1P80S
Model Name	PHR3462-001A	PHR3262-001A	PHR2852-001A	PHR2652-001A	PHR2442-001A	PHR2042-001A
Nominal Energy (kWh)	34.6	32.6	28.5	26.5	24.4	20.4
Nominal Voltage (Vdc)	516.8	486.4	425.6	395.2	364.8	304
Nominal Capacity (Ah)	67	67	67	67	67	67
Recommended CC (A)	22.3	22.3	22.3	22.3	22.3	22.3
Recommended CV (Vdc)	571.2	537.6	470.4	436.8	403.2	336.0
End Charge Current (A)	3.35	3.35	3.35	3.35	3.35	3.35
Voltage Range (Vdc)	408.0 - 571.2	384.0 - 537.6	336.0 - 470.4	312 - 436.8	288 - 403.2	240 - 336
Number of Modules	17 Type A: 8 Type B: 9	16 Type A: 8 Type B: 8	14 Type A: 6 Type B: 8	13 Type A: 6 Type B: 7	12 Type A: 6 Type B: 6	10 Type A: 4 Type B: 6
Weight (kg)	510	493	459	442	425	391

2.3 System Block Diagram

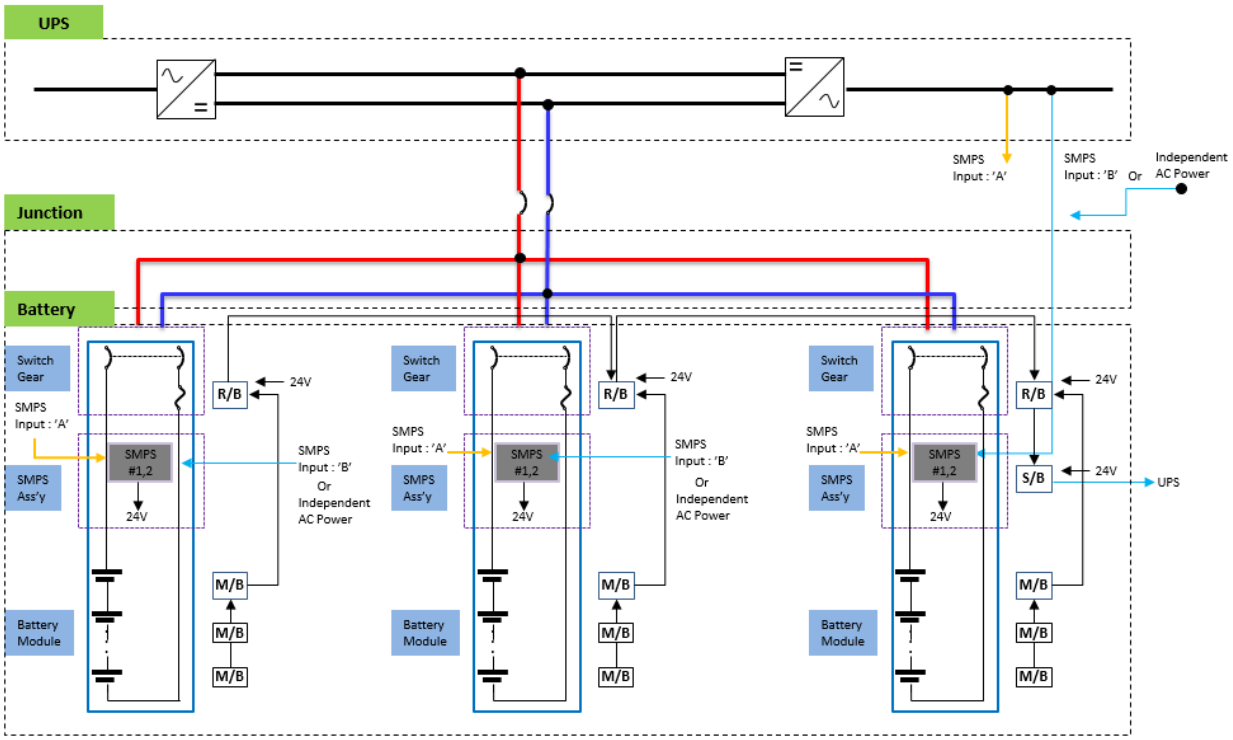


Figure 2-14: System Block Diagram

3. Installing the Product

This product is a battery system with more than 300V present when fully assembled. The installer must follow the general safety instructions and the requirements/recommendations described herein. This system must be installed by qualified and trained workers knowledgeable with the product and are familiar with the required instruments. Use appropriate lifting methods when moving the batteries.

WARNING

- The power terminal cover must be left in place on the power terminal of the tray for insulation.
- Use insulated tools (torque wrench, extension, socket, etc.).
- All the instruments must be insulated and no metal articles (e.g. watch, ring) should be present in the installation area.
- All power switches must be turned off and locked out/tagged out in advance.
- Prepare a CO_2 fire extinguisher, a first aid kit, and an AED (automated external defibrillator) before installation.

CAUTION

- If available, use a mechanical lift for lifting heavy (22 kg [50 lb.]) components. If there is no lift, two or three workers must move items weighing more than 22 kg (50 lb.).
- The ambient temperature range must be 23°C ± 5°C during installation.

NOTICE

- This product shall be installed in a restricted access area where only the qualified personnel who are trained and have the knowledge of the product and the related safety precautions of this Installation Manual.
- "Restricted access area" is area accessible only to the electrically skilled persons and electrically instructed persons with the proper authorization.

3.1 Grounding the Battery System

WARNING—SHOCK HAZARD

Verify with a voltmeter that no power is present on the system before beginning work on the battery system or other part of the UPS system. Use lock out/tag out procedures to secure the UPS and batteries Do not contact system connectors or terminals. Follow all applicable safety measures.

Follow all local and national codes and regulations.

Grounding methods and wiring must comply with NEC Article 250.

Grounding is required to prevent electric shock hazards and reduce and/or eliminate damage caused by electrical noise. Ground connections and ground wire routing vary significantly depending on system configuration and equipment layout. Samsung SDI battery systems provide a grounding strip on top of each rack. See Figure 3-143:Grounding Points (2EA)

3.2 Installation Procedure

This product must be installed by following the procedure specified below:

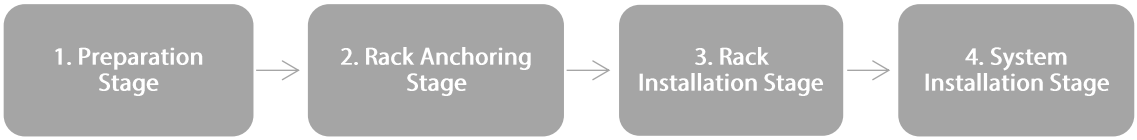


Figure 3-1: Installation Procedure

- **Preparation Stage**
  - Procedure
  - Unpacking
  - Ground Wire and Tools
  - Recommended Tools/Instruments
  - Appearance Inspection
- **Rack Anchoring Stage**
  - Transport the rack frame to the installation location after unpacking
  - Arrange the rack frame after checking the positions of holes in the frame and anchoring points
  - Perform the anchoring and ground connections
- **Rack Installation Stage**
  - Transport the battery modules to the installation location
  - Insert the BCU in the rack frame
  - Insert the SMPS Assembly in the rack frame
  - After all components are inserted in the rack frame, attach them to the rack frame
  - Place the battery modules in the rack frame
  - Connect the busbars
  - Connect the signal cables from BCU to module, and module to module
  - Connect the signal cables from BCU to BCU
- **System Installation Stage**
  - Connect the SMPS Assembly to AC power source
  - Prepare the items for BMS configuration
  - Configure the BMS
  - Perform installation checks

Estimated time for each step is listed in the table below:

Table 3-1: Estimated time for installation (based on 136S 3P installation)

No.	Step		Estimated Time (HH:MM)	Aggregated Time (HH:MM)
1	Unpacking		00:30	00:30
2	Inspection		01:00	01:30
3	Rack Anchoring		04:00	05:30
4	Rack Installation	Battery Module	00:20	05:50
		BCU	00:10	06:00
		SMPS Assembly	00:10	06:10
		Rack Fuse Assembly	00:30	06:40
		Busbar	01:00	07:40
		Signal Cables	00:20	08:00
		Power and Control Cables	00:20	08:20
		AC Input Installation	00:20	08:40
		Cable Installation	00:10	08:50
		BMS Configuration	00:10	09:00

3.3 Preparation Stage—Procedure

For the preparation stage, perform the following steps:

1. Create the installation plan and check the equipment and instruments for installation.
2. Check the arrival schedule of the parts required.
3. Unpack the equipment.
4. Inspect the equipment.

WARNING

- Do not wear watches, rings, jewelry, or any other metal objects.
- Wear electrically insulated gloves and safety shoes.

CAUTION

- Place the product in a dust-free place with the moisture level of below 60% and the temperature level of 23°C ± 5°C.
- Keep components out of direct sunlight.

3.4 Preparation Stage—Unpacking

Check the following parts during unpacking:

Table 3-2: Parts for 136S 3P Rack in case of Rack Fuse 1ea

No.	Items	Part No. (Group A, CE/UL) (Group B, CE/UL)	Amount (Unit: EA)	Remarks
1	RACK FRAME	V808-0101BA/ V808-00068A V808-0100BA/ V808-00066A	3	Black White
2	BATTERY MODULE Type A	EM2031AE003A EM2031AE001A	24	
3	BATTERY MODULE Type B	EM2031AE004A EM2031AE002A	27	
4	BCU	(V049-0012AA or V049-0035AA / V049-0011AA or V049-0036AA) (V049-0012BA/ V049-0011BA)	3	
5	SMPS ASSEMBLY Type A (WITH SYSTEM BMS ASSEMBLY)	V044-0004AA (1 Phase), V044-0006AA (3 phase) V044-0004BA (1 Phase), V044-0006BA (3 phase)	1	For Rack #1
6	SMPS ASSEMBLY Type B	V044-0005AA (1 phase), SJ94-00238B (3 phase)	2	For Rack #2, 3
7	BUSBAR M TO BCU	V050-00051A	6	Connect modules and BCU
8	BUS-BAR MAIN	SJ66-00863A	45	High current bus bar connection for modules
9	RACK FUSE BUSBAR_R_136S	SJ66-00868A	3	Connect between modules #8 and #9
10	RACK FUSE BUSBAR_L_136S	SJ66-00876A	3	Connect between modules #8 and #9
11	FUSE	3601-001835	3	Connect between modules #8 and #9
12	FUSE COVER #1	SJ63-00101A	3	Fuse cover for fuse between modules #8 and #9
13	WIRE ASSY RACK TO MODULE	V046-0005BA	3	Connect Battery Module #1 and BCU.
14	WIRE ASSY MODULE TO MODULE #1	SJ39-00673A	45	Signal Connection for Modules
15	WIRE ASSY RACK TO RACK #2	SJ39-00674A	2	Connect Rack between #1, #2 and #3.
16	WIRE ASSY RACK TO SYSTEM	SJ39-00719A	1	Connect the Rack BMS CAN connector in the BCU to the System BMS CAN connector in the SMPS ASSEMBLY.
17	WIRE ASSY RACK TO SMPS	SJ39-00718A	6	Connect the Rack BMS DC IN to SMPS ASSEMBLY DC OUT
18	WIRE ASSY MODULE TO MODULE #2	SJ39-00678A	3	Signal connection between modules #8 and #9
19	WIRE ASSY EARTH	SJ39-00725A	6	Connecting SMPS Assembly and BCU to Rack Frame.
20	SCREW M5 X 10	SJ60-00068A	30	Mounting BCU, SMPS, and WIRE ASSY EARTH to Rack Frame
21	SCREW M8 X 18	V701-00089A	102	Mounting Busbar to Module
22	SCREW M12 X 25	SJ60-00138A	12	Mounting Busbar to Switchgrear
23	SCREW M12 X 16	SJ60-00137A	6	Mounting Fuse Busbar to Fuse
24	SCREW M10 X 25	SJ60-00082A	12	Mounting Rack Frame to Rack Frame side by side
25	NUT M10	SJ81-01208A	12	Mounting Rack Frame to Rack Frame side by side
26	M10 FLAT WASHER	SJ60-00073A	12	Mounting Rack Frame to Rack Frame side by side
27	WIRE ASSY MCCB AUX	SJ39-00807A	3	Connect to MCCB Aux Contact
28	WIRE ASSY DRY CONTACT	SJ39-00808A	1	Connect to SMPS Assembly DRY CONTACT

Table 3-3: Parts for 136S 3P Rack in case of multiple Rack Fuse

No.	Items	Part No. (Group A, CE/UL) (Group B, CE/UL)	Amount (Unit: EA)	Remarks
1	RACK FRAME	V808-0101BA/ V808-00068A V808-0100BA/ V808-00066A	3	Black White
2	BATTERY MODULE Type A	EM2031AE003A EM2031AE001A	24	
3	BATTERY MODULE Type B	EM2031AE004A EM2031AE002A	27	
4	BCU	V049-0012AA/ V049-0011AA V049-0012BA/ V049-0011BA	3	
5	SMPS ASSEMBLY Type A (WITH SYSTEM BMS ASSEMBLY)	V044-0004AA (1 Phase), V044-0006AA (3 phase) V044-0004BA (1 Phase), V044-0006BA (3 phase)	1	For Rack #1
6	SMPS ASSEMBLY Type B	V044-0005AA (1 phase), SJ94-00238B (3 phase)	2	For Rack #2, 3
7	BUSBAR M TO BCU	V050-00051A	6	Connect modules and BCU
8	BUS-BAR MAIN	SJ66-00863A	39	High current bus bar connection for modules
9	RACK FUSE BUSBAR_R_136S	SJ66-00868A	3	Connect between modules #8 and #9
10	RACK FUSE BUSBAR_L_136S	SJ66-00876A	3	Connect between modules #8 and #9
11	FUSE	3601-001835	9	Connect between modules #5 and #6, between modules #8 and #9, and between modules #14 and #15
12	FUSE COVER #1	SJ63-00101A	3	Fuse cover for fuse between modules #8 and #9
13	FUSE COVER #2	V143-00002A	12	Fuse cover for fuse between modules #5 and #6, and between modules #14 and #15
14	FUSE BUSBAR LEFT UPPER	V050-00002A	3	Connect between modules #14 and #15
15	FUSE BUSBAR LEFT LOWER	V050-00001A	3	Connect between modules #14 and #15
16	FUSE BUSBAR RIGHT UPPER	V050-00003A	3	Connect between modules #5 and #6
17	FUSE BUSBAR RIGHT LOWER	V050-00004A	3	Connect between modules #5 and #6
18	WIRE ASSY RACK TO MODULE	V046-0005BA	3	Connect Battery Module #1 and BCU.
19	WIRE ASSY MODULE TO MODULE #1	SJ39-00673A	45	Signal Connection for Modules
20	WIRE ASSY RACK TO RACK #2	SJ39-00674A	2	Connect Rack between #1, #2 and #3.
21	WIRE ASSY RACK TO SYSTEM	SJ39-00719A	1	Connect the Rack BMS CAN connector in the BCU to the System BMS CAN connector in the SMPS ASSEMBLY.
22	WIRE ASSY RACK TO SMPS	SJ39-00718A	6	Connect the Rack BMS DC IN to SMPS ASSEMBLY DC OUT
23	WIRE ASSY MODULE TO MODULE #2	SJ39-00678A	3	Signal connection between modules #8 and #9
24	WIRE ASSY EARTH	SJ39-00725A	6	Connecting SMPS Assembly and BCU to Rack Frame.
25	SCREW M5 X 10	SJ60-00068A	30	Mounting BCU, SMPS, and WIRE ASSY EARTH to Rack Frame
26	SCREW M8 X 18	V701-00089A	102	Mounting Busbar to Module
27	SCREW M12 X 25	SJ60-00138A	12	Mounting Busbar to Switchgrear
28	SCREW M12 X 16	SJ60-00137A	18	Mounting Fuse Busbar to Fuse
29	SCREW M10 X 25	SJ60-00082A	12	Mounting Rack Frame to Rack Frame side by side
30	NUT M10	SJ81-01208A	12	Mounting Rack Frame to Rack Frame side by side
31	M10 FLAT WASHER	SJ60-00073A	12	Mounting Rack Frame to Rack Frame side by side
32	WIRE ASSY MCCB AUX	SJ39-00807A	3	Connect to MCCB Aux Contact
33	WIRE ASSY DRY CONTACT	SJ39-00808A	1	Connect to SMPS Assembly DRY CONTACT

3.5 Preparation Stage—Ground Wires and Tools

Ground wires and anchoring hardware for the racks must be provided by the installer (not included in Samsung SDI's scope of supply). Installer-supplied ground wires must meet the specifications below.
Refer to 3.1 Grounding the Battery System for further details on grounding.

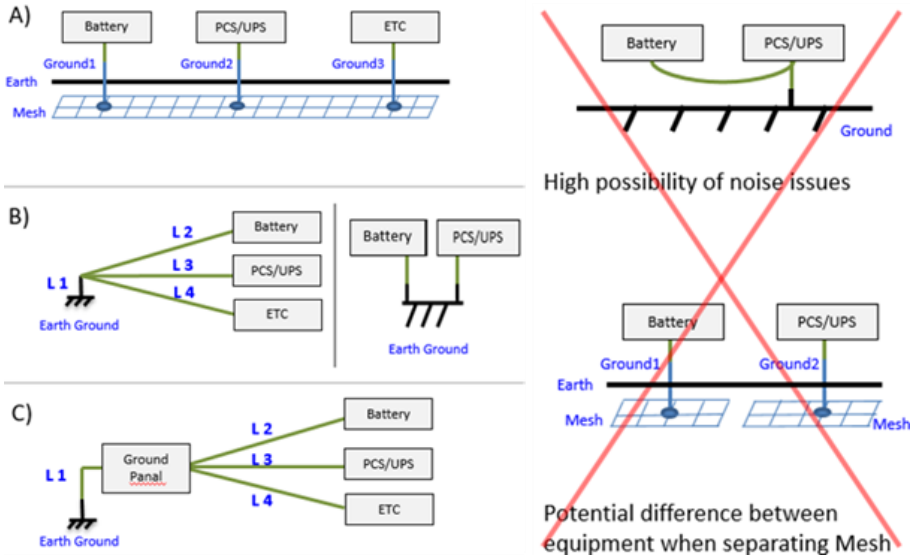
3.5.1 Ground Wires

Ground wires for the racks must be provided by the installer (not included in Samsung SDI's scope of supply). Use ground wire that is at least 70 mm^2. The ground wire specifications are:

Table 3-4: Ground Wire Specifications[1]

Wire No.	Terminal Type
70 sq mm or greater	M12 2 Hole Ring Terminal

CAUTION



Pay attention to the grounding cable length. L1 << L2, L3, L4

Each battery rack shall be grounded with at least 70sq mm wire or larger gauge for stable battery operation and operator safety. If there is a conflict between the manual and the local standard, the local standard prevails. Each battery rack shall be grounded separately from the UPS for reliable operation without being affected by UPS switching noises.

The battery shall operate under a floating principle. The SMPS AC-side ground and rack ground shall be separated.

[1] Not provided. Must be provided by the installer or customer.

3.5.2 Ground Wire Fastening Screws

Ground wire fastening screws for the racks must be provided by the installer (not included in Samsung SDI's scope of supply). Specifications for the ground wire fastening screws are:

Table 3-5: Ground Wire Fastener Specification[2]

Size	Hardness	Thread Pitch	Material
M12–30L	70 (Grade 7)	1.25 mm (0.05 in)	SS304

3.5.3 Rack Fasteners (Anchors)

Rack fastener/anchoring hardware for the racks must be provided by the installer (not included in Samsung SDI's scope of supply). Specifications for the rack fastener screws for anchoring the rack frame to the floor are:

Table 3-6: Rack Fastener Specifications[3]

Size	Hardness	Thread Pitch	Material
M16–L (Bottom Anchor)	70 (Grade 7)	2.0 mm (0.08 in)	SS304

3.5.4 Multiple Rack Fasteners

Rack fasteners are provided by Samsung SDI. Refer to Table 3-2: Parts for 136S 3P Rack for part number and quantities. Specifications for the rack fastener screws for installing multiple rack frames side-by-side are:

Table 3-7: Rack Fastener Specifications (Side by side)

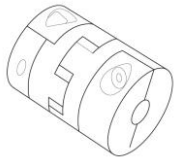
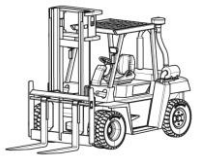
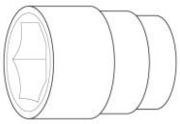
Size	Hardness	Thread Pitch	Material
M10–25L (Side)	70 (Grade 7)	1.5 mm (0.06 in)	SS304

[2] Not provided. Must be provided by the installer or customer.
[3] Not provided. Must be provided by the installer or customer.

3.6 Preparation Stage—Recommended Tools/Instruments

The installers must provide the following tools when installing the battery system (not provided within Samsung SDI's scope of supply):

Table 3-8: Recommended Tools and Instruments

No.	Items	Usage	Appearance
1	Power Screwdriver/Drill (Max torque: 26 Nm / 270 kgf·cm)	To fasten BCU and SMPS assemblies to the rack frames	
2	Torque Limiter	For use with torque wrench	
3	Phillips Screwdriver or Bit	To fasten BCU and SMPS assemblies to the rack frames (M5 Tip)	
4	Box Cutter	Opening boxes	
5	Forklift	Moving rack frames and pallets containing modules and BCU	
6	Insulated Torque Wrench	Installing a high-current cable (10-50 Nm / 100 - 500 kgf·cm)	
7	Insulated Sockets (13 mm, 17 mm, and 19 mm)	Installing power cables and busbars	
8	Insulated Extension for Socket	Installing a power cable	

No.	Items	Usage	Appearance
9	Inclinometer/Level	Installing a rack frame	
10	Battery Tester	Measure battery module's voltage and internal impedance. *[Hioki BT3554, Fluke BT521 or meters with the same or better voltage and resistance measurement resolution and accuracy is recommended.* *- Voltage resolution: 1mV* *- Voltage accuracy: ±0.1% of reading* *- Resistance resolution: 0.001mΩ* *- Resistance accuracy: ±1% of reading]* Battery tester is used to measure the contact resistance between bus bar and the joining terminal, if a dedicated resistance meter is unavailable.	
11	Resistance Meter	Measure the contact resistance between bus bar and the joining terminal *[Hioki RM3548 or meters with the same or better resistance measurement accuracy is recommended]*	

3.7 Preparation Stage—Visual Inspection

	CAUTION
	If any defects are found during the inspection, contact the local Samsung SDI customer service representative.

3.7.1 Inspection of the Rack Frame

After transporting the rack frame to the installation location, check for:

- Structural damage
- Paint peeling
- Damaged or protruding screws.

After completing the inspection, install or re-package the rack frame for protection during storage.

3.7.2 Inspection of the Battery Modules

After transporting the battery modules to the installation location, check for:

- Physical damage to the exterior
- Damaged or protruding screws
- Proper voltage and internal impedance of the battery modules using the battery tester

Table 3-9: Battery Module Voltage and Internal Impedance

No.	Items	Value
1	Voltage Check	28.712 - 29.104V
2	Internal Impedance Check	3.0 - 4.3 mΩ

After completing the inspection, install the battery modules in an already installed rack frame or return the battery module to its original packing for protection during storage. Note that all battery modules installed in the same rack frame shall measure within a < 300 mV range.

3.7.3 Inspecting the BCU

After transporting the BCU to its installation location, check for:

- Physical damage
- Paint peeling
- Damaged or protruding screws.

After completing the inspection, install the BCU in an already installed rack frame or return the BCU to its original packing for protection during storage.

3.7.4 Inspecting the SMPS Assembly

After transporting the SMPS Assembly to its installation location, check for:

- Physical damage
- Paint peeling
- Damaged or protruding screws.

After completing the inspection, install the SMPS Assembly in an already installed rack frame or return the SMPS Assembly to its original packing for protection during storage.

3.8 Rack Anchoring Stage

Install the rack frame on a hard, flat and level floor such as concrete. Use an inclinometer to confirm that the rack frame is perpendicular to the floor.

▶ **To attach the rack and perform the related works**

CAUTION

- Use a proper transportation method considering the weight of the rack frame when transporting it to installation location.
- Ensure that the safety of the working place is maintained.
- When using a forklift, lift the rack frame from the front.
- When a forklift cannot be used, use a mechanical lift or move it by hand with three or more people.
- Use lock washers to prevent bolts from loosening.
- Use an inclinometer or carpenter's level to ensure that the rack frame is perpendicular to the floor.

NOTICE

- Failure to anchor the rack frame on a flat and level surface may distort the rack frame after installing the racks side-by-side.
- Frame distortion may make the rack doors difficult or impossible to open.

NOTICE

- In seismically active areas, the front panel and the rear panel of the rack frame must be installed.

To anchor the racks in all four points, racks are recommended to be placed according to the workable distances listed in the table below. In seismically active areas, it is critical that all four anchor points of the rack are installed.

To reduce the product footprint, the racks can be installed side-by-side and rear-to-rear against a wall or next to another rack. In this case, only two anchor points on the front side of each rack can be installed. Proper cooling and ventilation of the installed area is recommended for racks installed with no side and rear clearance. The front side of the rack must be cleared for installation, maintenance, service access, ventilation, and cooling.

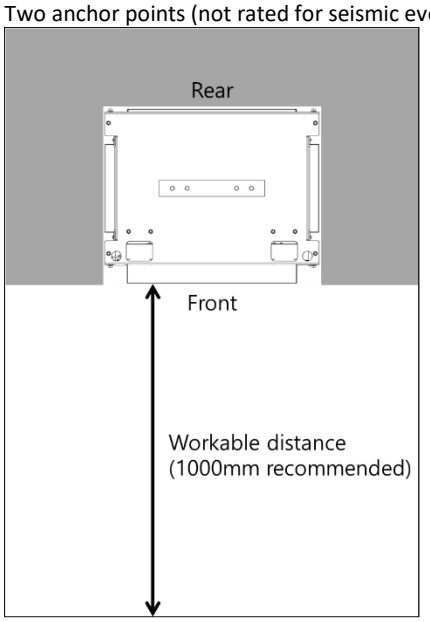
Clearance from the top of the rack frame is not required and the top of the rack frame can be covered to prevent any foreign objects from falling into the battery rack frame.

The workable distance of 800 mm listed in Table 3-9 is Samsung SDI's generic recommendation for rear/side clearance distances for any rack frame installation located in high seismic zones. As long as all four anchor points of the cabinet are secured during installation, reduced side/rear clearances are accepted by Samsung SDI.

Table 3-10: Rack Clearance Distances

Configuration	Required anchor points per rack	Clearance Distance (mm)			
		Side (end)	Side (adjacent)	Rear	Front
Single Rack	2 (Front) not rated for seismic event	0	n/a	0	Workable distance (1000 recommended)
	4 (All) – Telcordia Zone 4	Workable distance (800 recommended)	n/a	Workable distance (800 recommended)	Workable distance (1000 recommended)
Multiple Racks (Side-to-Side)	2 (Front) not rated for seismic event	0	0	0	Workable distance (1000 recommended)
	4 (All) – Telcordia Zone 4	Workable distance (800 recommended)	0	Workable distance (800 recommended)	Workable distance (1000 recommended)
Multiple Racks (Side-to-Side and Rear-to- Rear)	2 (Front) not rated for seismic event	0	0	0	Workable distance (1000 recommended)
	4 (All) – Telcordia Zone 4	Workable distance (800 recommended)	0	Workable distance (800 recommended)	Workable distance (1000 recommended)

Two anchor points (not rated for seismic event)



Four anchor points (Telcordia Zone 4)

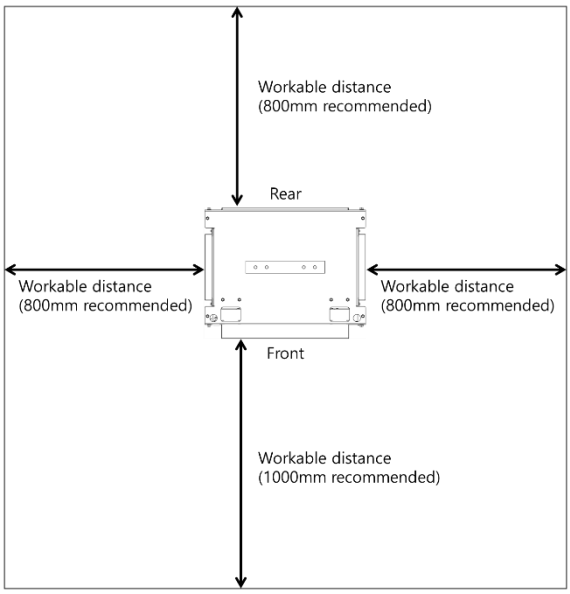
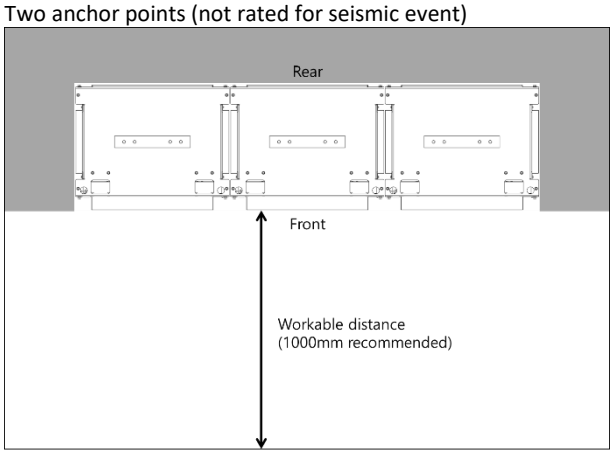


Figure 3-2: Clearance Distance for Single Rack Frame

Two anchor points (not rated for seismic event)



Four anchor points (Telcordia Zone 4)

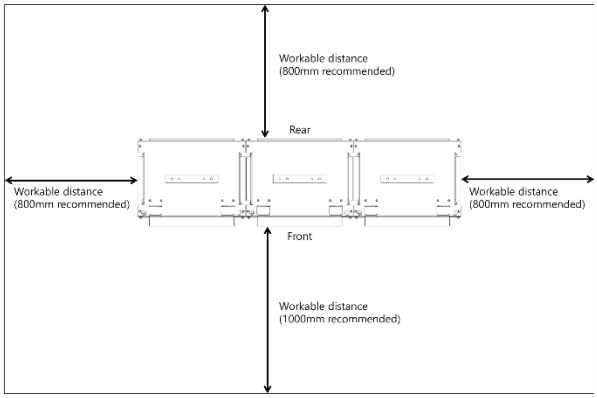
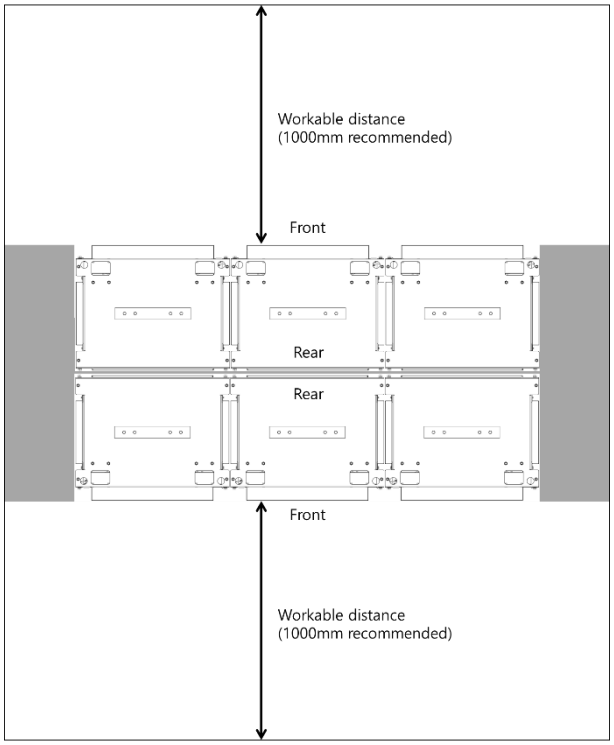


Figure 3-3: Clearance Distance for Multiple Rack Frames Installed Side-by-Side

Two anchor points (not rated for seismic event)



Four anchor points (Telcordia Zone 4)

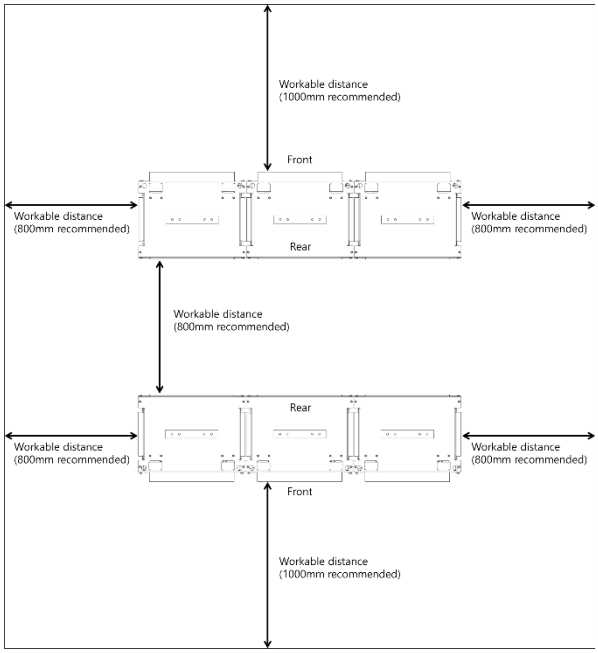


Figure 3-4: Clearance Distance for Multiple Rack Frames Installed Side-by-Side and Rear-to-Rear

1. After unpacking the rack frame, transport it to its installation location.
2. Remove the front panels, side panels(optional step), and rear panel from the rack frame. Unscrew the screws on each panel and lift the panel to undo the hooks to the frame on each panel. Do not misplace the screws, as they are needed after anchoring the rack frame when re-installing the panels.

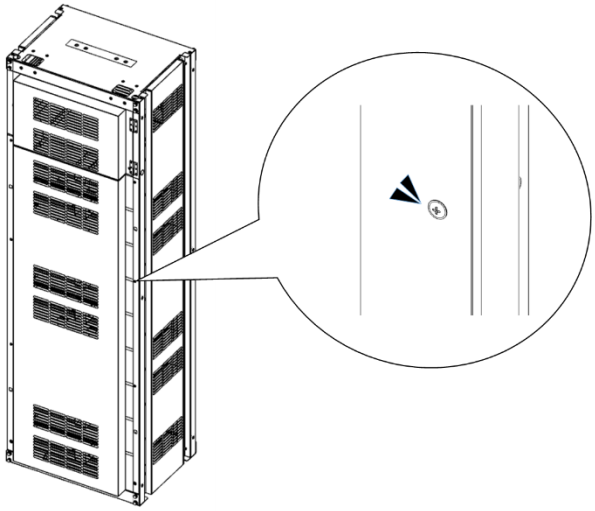


Figure 3-5: Front panel screws (QTY 8)

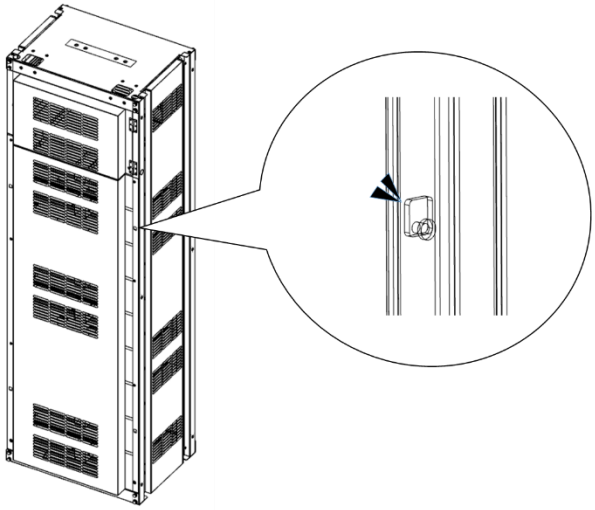


Figure 3-6: Front panel hooks (QTY 4)

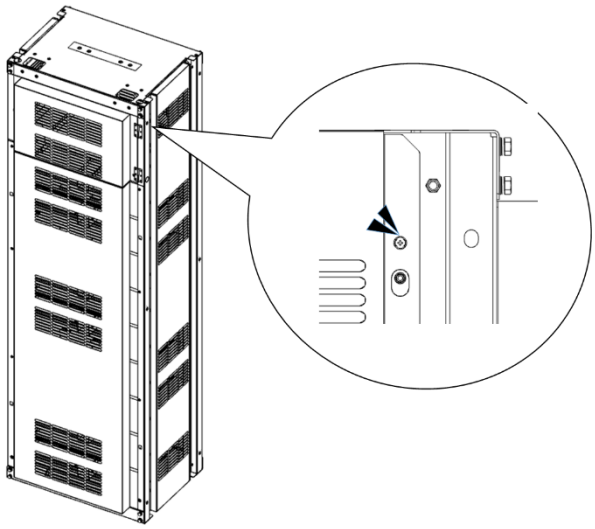


Figure 3-7: Side panel screws (QTY 6)

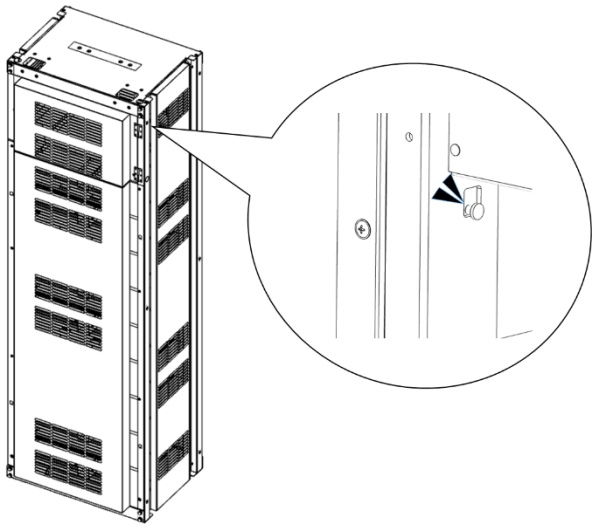


Figure 3-8: Side panel hooks (QTY 4)

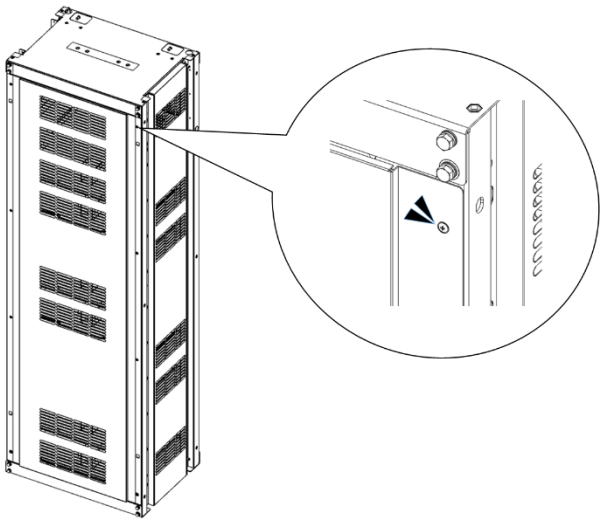


Figure 3-9: Rear panel screws (QTY 8)

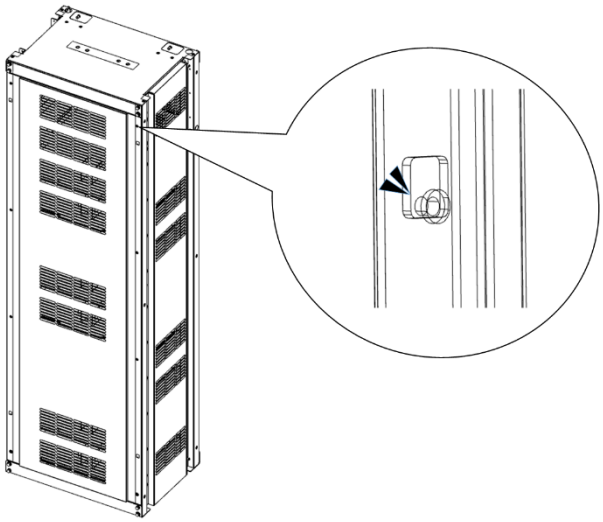


Figure 3-10: Rear panel hooks (QTY 4)

3. Arrange the rack frame after verifying that the holes in the frame and anchoring points are aligned.
4. Connect four anchoring points on the bottom of the rack.

⚠	***NOTICE***
	▪ Anchor the frame with M16 bolts and nuts (not provided by Samsung SDI). ▪ The fastening torque should be 140 Nm / 1,425 kgf·cm. ▪ Check the rack frame and other parts for distortion caused during unpacking.

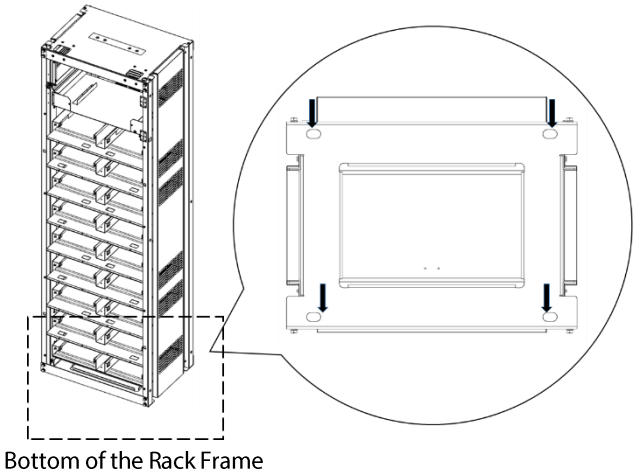


Figure 3-11: Rack Anchoring Points (QTY 4)

5. If applicable, connect multiple racks (side-by-side) together using M10 hardware through holes in the sides ("SCREW M10 X 25," "M10 FLAT WASHER" and "NUT M10"). Torque the bolts to 30 Nm (300 kgf·cm).

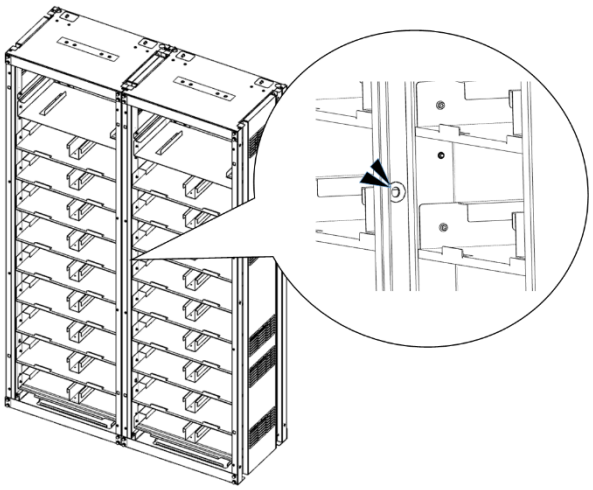


Figure 3-12: Holes on the sides of the rack (QTY 6)

6. Optional step: In case of removed side panels, re-attach the side panels on the outer rack frames using the provided M5 Screws for each side panel. Fasten the screws using a torque value of 2.94–3.92 Nm (30–40 kgf·cm). Make sure all the hooks are inserted to the slot and the panel is flush with the rack frame before screwing.

⚠	***NOTICE***
	In configurations where multiple racks (side-by-side) are used, reinstalling interior rack frame side panels is optional step.

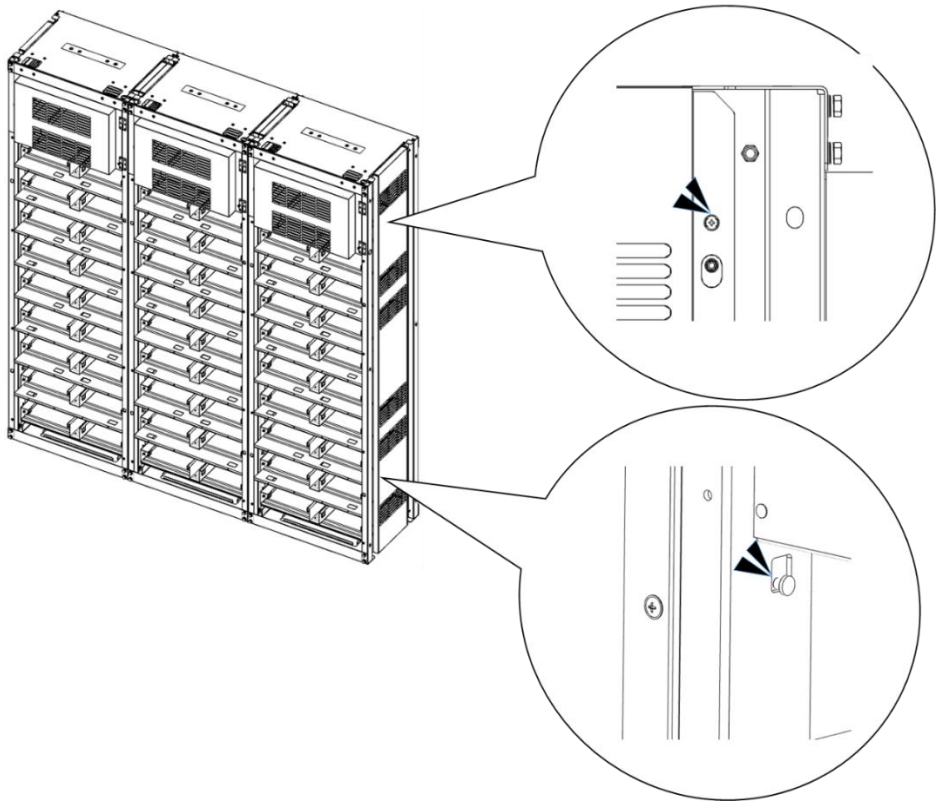


Figure 3-13: Reattaching the Side Panels (four hooks and six screws for each panel)

7. Reattach the rear panels to the rack frames using the Samsung SDI-provided M5 screws for each rear panel. Fasten the screws using a torque value of 2.94–3.92 Nm (30–40 kgf·cm). Make sure all the hooks are inserted to the slot and the panel is flush with the rack frame before screwing.

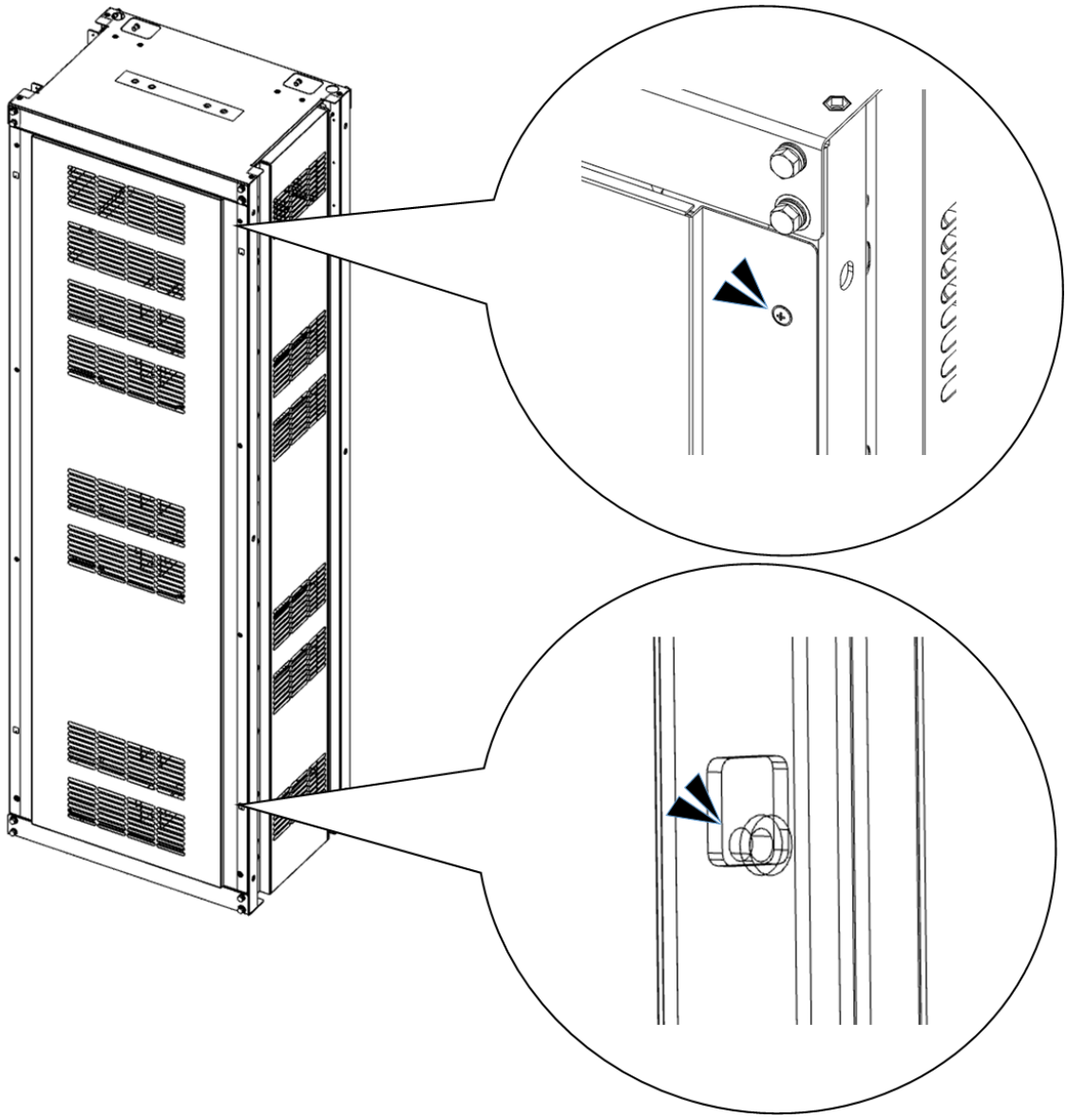


Figure 3-14: Reattaching the Rear Panels

8. Reattach the front panels after all steps above have been completed.

3.9 Equipment Installation Stage

	**WARNING**
	Arc Flash and Shock Hazard Insulated tools are required for any work on this energized equipment.

	**WARNING**
	Sharp Edges Wear gloves and other protective gear to prevent injury.

	**WARNING**
	Pinch Point Use caution when working in the enclosure to prevent injury.

	**CAUTION**
	Heavy Object Can cause muscle strain or back injury. Use lifting aids and proper lifting techniques when moving batteries and other heavy objects.

3.9.1 Front Door Removal

1. Open the front door of the panel using the provided key.

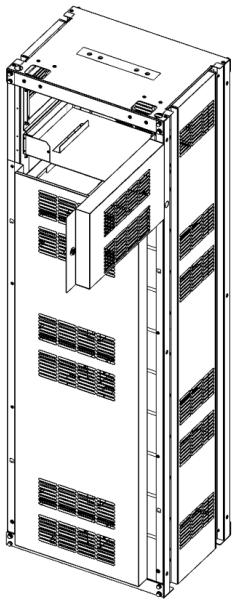


Figure 3-15: Front door ajar

2. Remove the earth cable connected to the front door. Do not misplace the two screws or the earth cable.

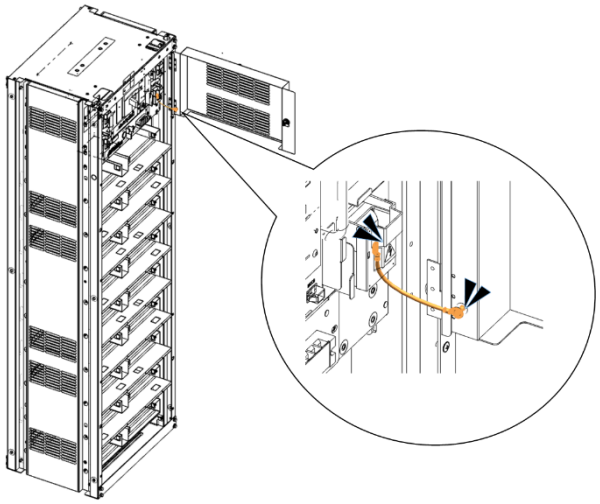


Figure 3-16: Removing the earth cable

3. Lift the front door to remove it from its hinge. Do not misplace the door.

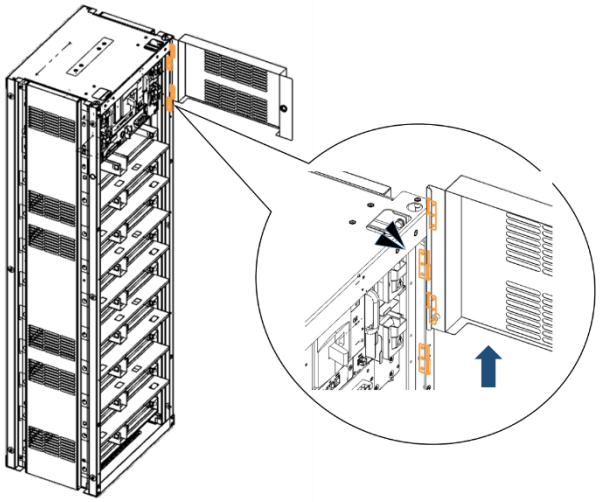


Figure 3-17: Removing the front door

4. If installing more than one rack, remove all the doors.

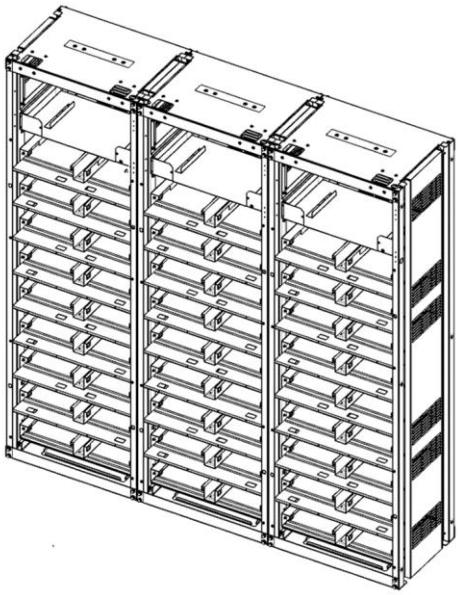


Figure 3-18: All doors and front panels removed.

3.9.2 BCU and SMPS Assembly Installation

	Important
	▪ Attach each BCU to its rack frame with four M5 x 10L screws. (Torque: 2.94–3.92 Nm [30–40 kgf·cm]) ▪ Verify that the torque setting is correct.

1. Insert the BCU through the front of the rack as shown in Figure 3-19: Inserting BCU. Insert all BCUs into all rack frames.

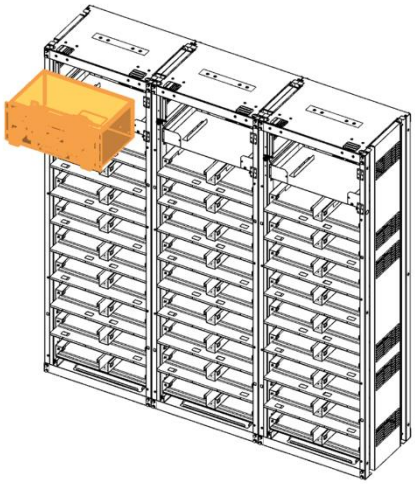


Figure 3-19: Inserting BCU

2. After all BCU's are inserted in the rack frames, attach each BCU to the rack frame with four M5 x 10L bolts. (Torque: 2.94–3.92 Nm [30–40 kgf·cm])

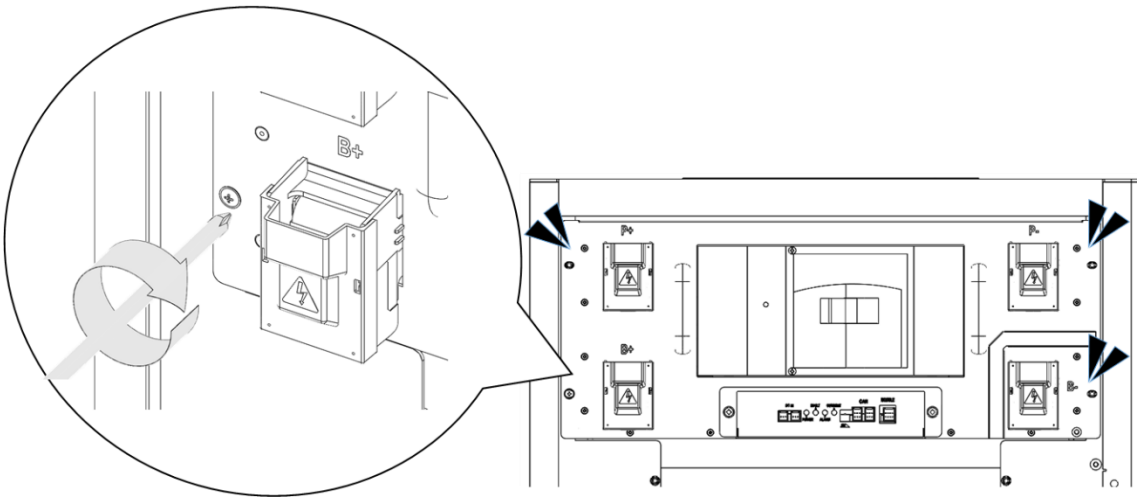


Figure 3-20: Attaching a BCU to a Rack Frame

3. After all BCU's are attached to the rack frames, connect the ground cable between the BCU and rack frame. Repeat for all BCUs.

	NOTICE
	▪ Connect a ground cable between the BCU and the Rack Frame (SCREW M5 x 10L). (Torque: 2.94–3.92 Nm [30–40 kgf·cm]) ▪ Verify that the torque setting is correct.

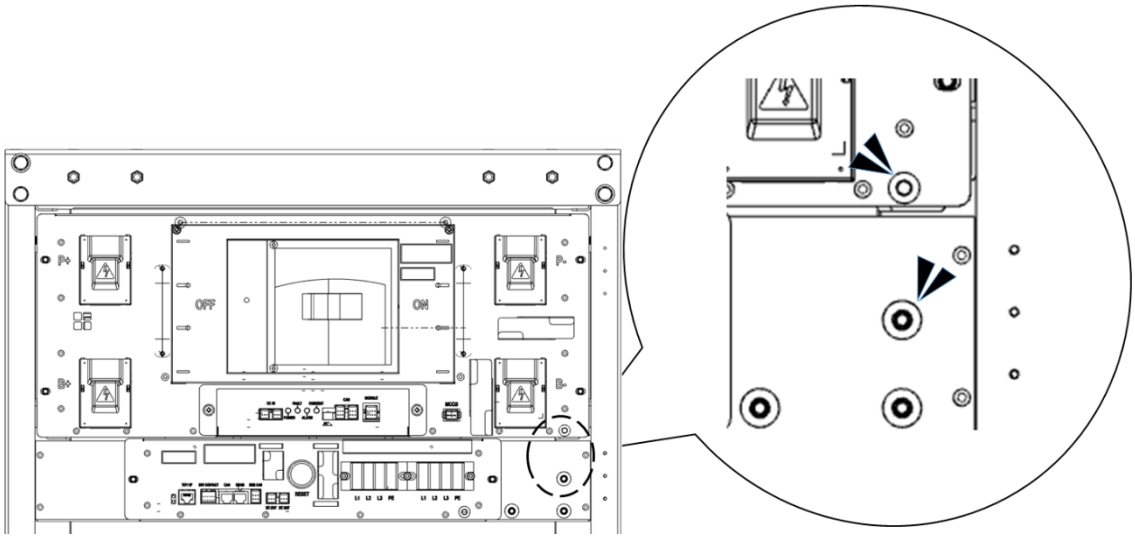


Figure 3-21: Ground Cable Connection to the BCU

4. Insert the SMPS Assembly into the rack frames as shown in Figure 3-22: Inserting SMPS Assembly.

	Important
	▪ Attach the inserted SMPS Assemblies to the rack frames by fastening each with four M5 x 10L screws (Torque: 2.94–3.92 Nm [30–40 kgf·cm]) ▪ Verify that the torque setting is correct.

5. Slide the SMPS Assembly into the rack frame on the shelf designated for the SMPS Assembly as shown below. Insert all SMPS Assemblies into all rack frames. Carefully note that the first or last rack frame is a Type A SMPS Assembly and the others are Type B.

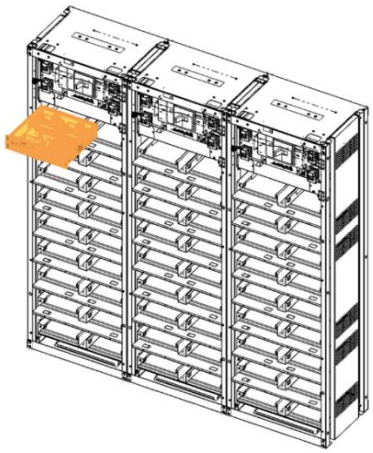


Figure 3-22: Inserting SMPS Assembly

6. After all SMPS Assemblies are inserted into the rack frames, attach them to the rack frame with screws (Torque: 2.94–3.92 Nm [30–40 kgf·cm])

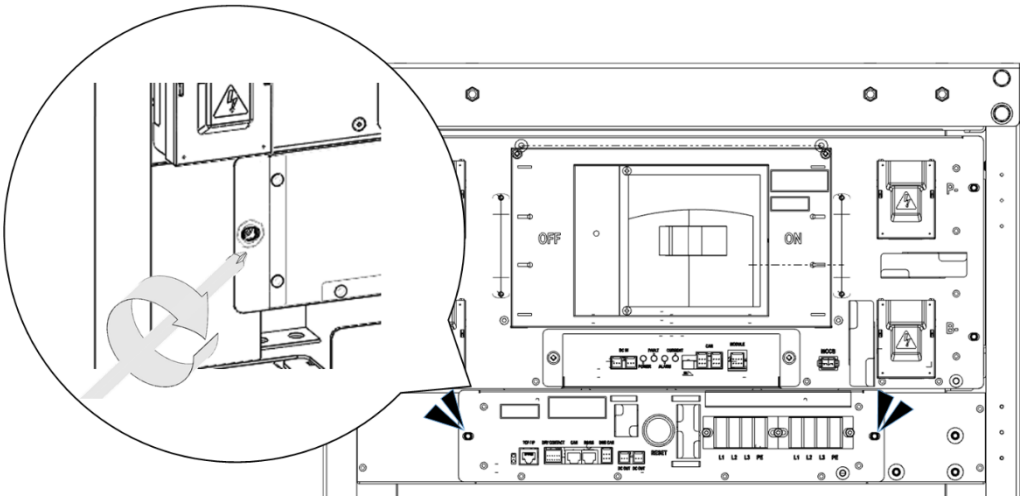


Figure 3-23: Attaching the SMPS Assembly

7. After all SMPS Assemblies are attached to the rack frames, connect the ground cables between the SMPS Assembly and the rack frame. Repeat for all SMPS Assemblies.

	NOTICE
	▪ Connect a ground cable between the SMPS Assembly and the Rack Frame with an M5 x 10L screw. (Torque: 2.94–3.92 Nm [30–40 kgf·cm]) ▪ Verify that the torque setting is correct.

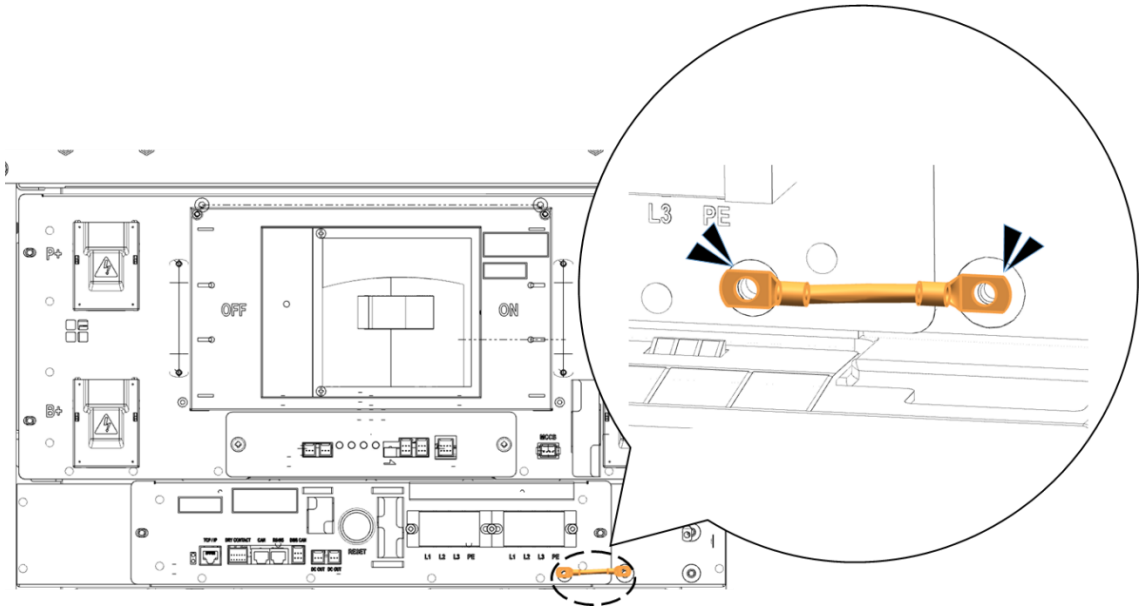


Figure 3-24: Ground Cable Connection to the SMPS Assembly

3.9.3 Battery Module Installation

1. Transport battery modules to the installation location.
2. Measure the battery module's voltage and internal impedance. All modules in one rack frame must be near the same state of charge. The battery modules must measure within 300 mV of each other and internal impedance difference of 1.3 mΩ. Refer to Table 3-8: Battery Module Voltage and Internal Impedance.
3. Place the battery modules in the rack frame.

	Important
	▪ Samsung SDI recommends installing Battery Modules in the upper shelves first and proceeding to the bottom. (Two Type B battery modules are inserted in the ninth shelf from the bottom.) ▪ Seventeen battery modules can be inserted into a rack frame as shown in Figure 3-27. ▪ Refer to Section 2.1.1 for information on the different battery module types.

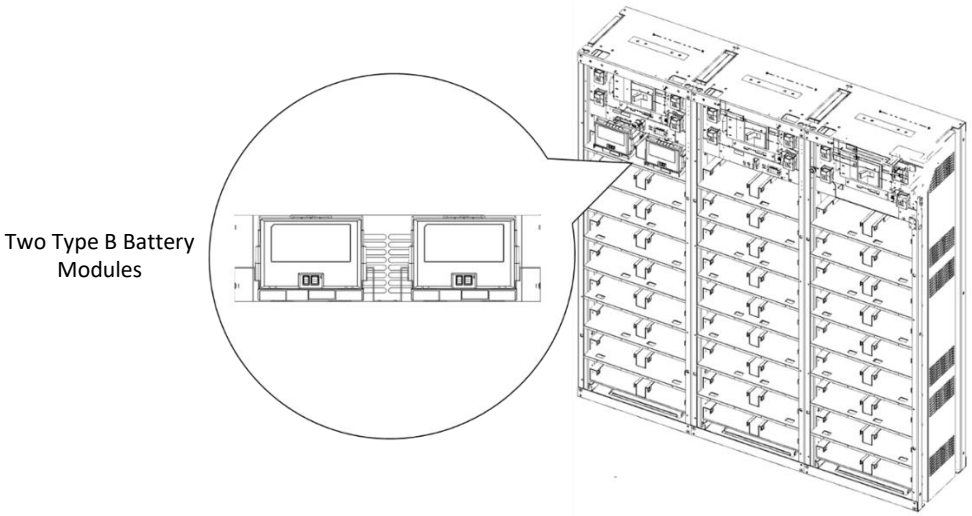


Figure 3-25: Insertion of Modules on the Ninth Shelf from the Bottom

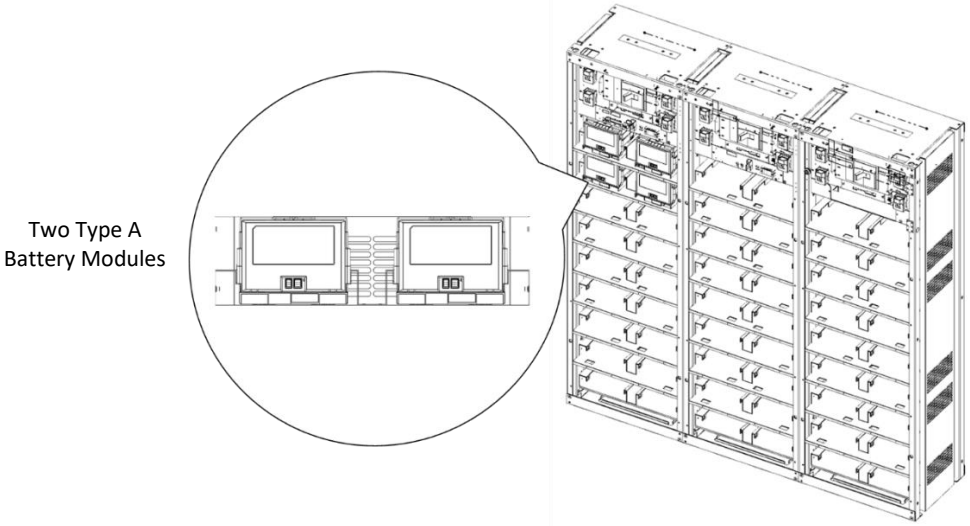


Figure 3-26: Battery Module Arrangement on the Eighth Shelf

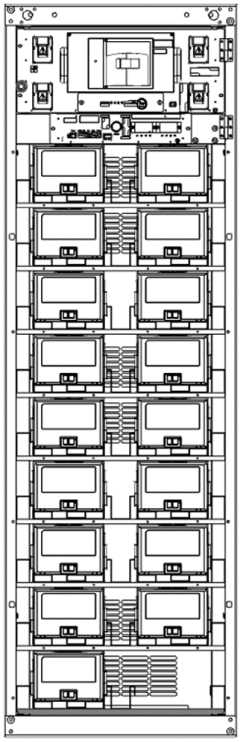


Figure 3-27: Battery Module Arrangement of 136S

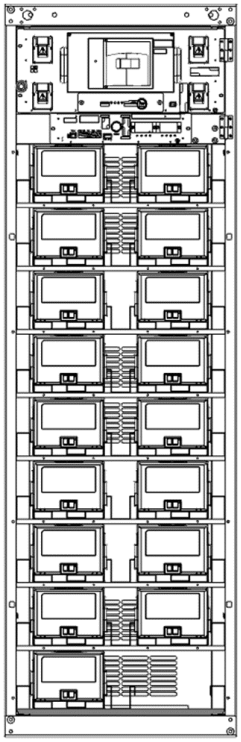


Figure 3-28 : Module Number of 136S

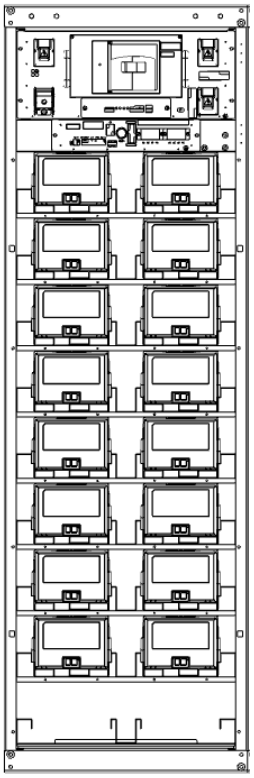


Figure 3-29: Battery Module Arrangement of 128S

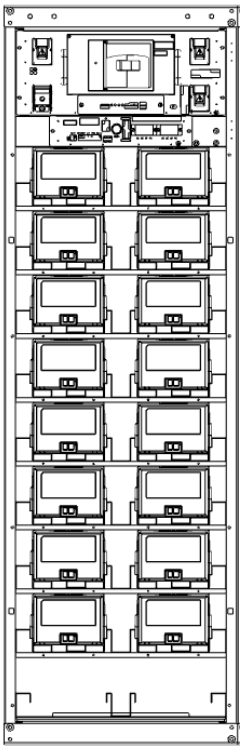


Figure 3-30 : Module Number of 128S

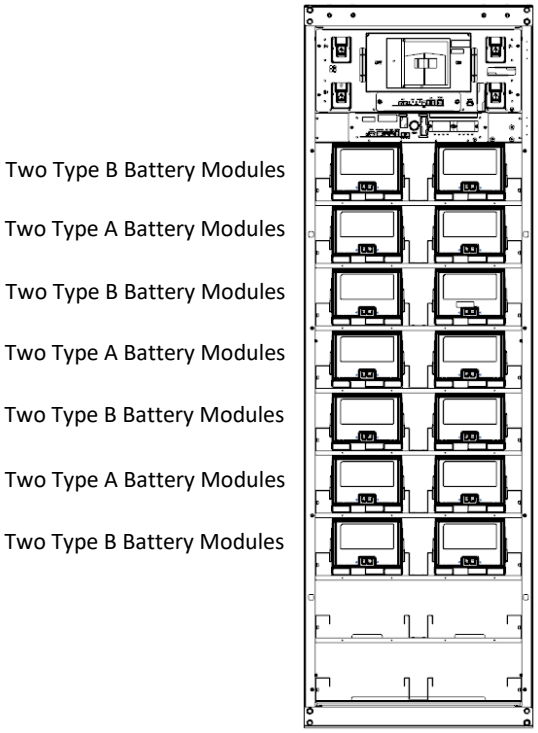


Figure 3-31: Module Number of 112S

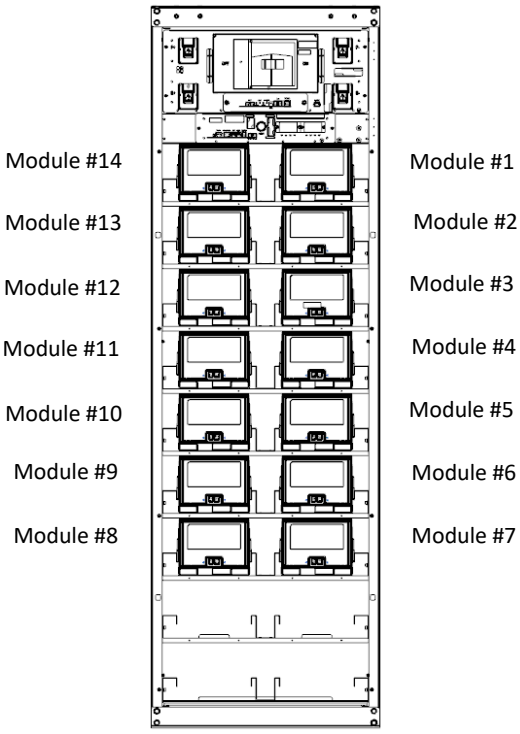


Figure 3-32 : Module Number of 112S

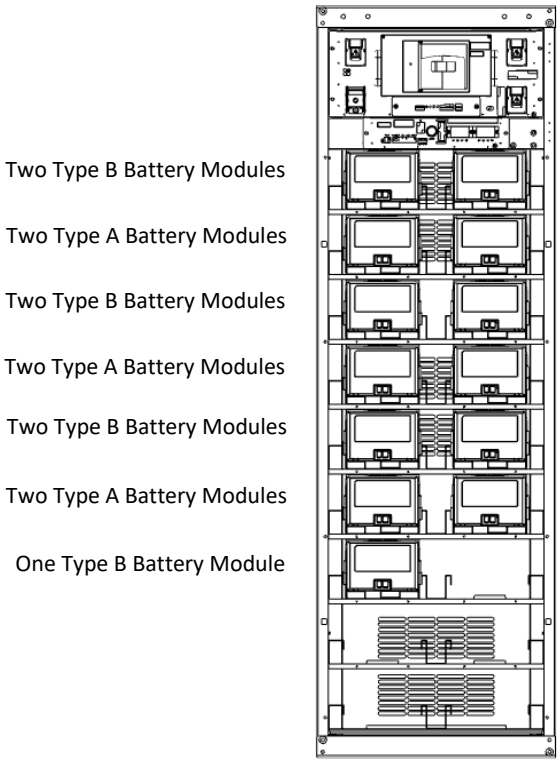


Figure 3-33: Battery Module Arrangement 0f 104S

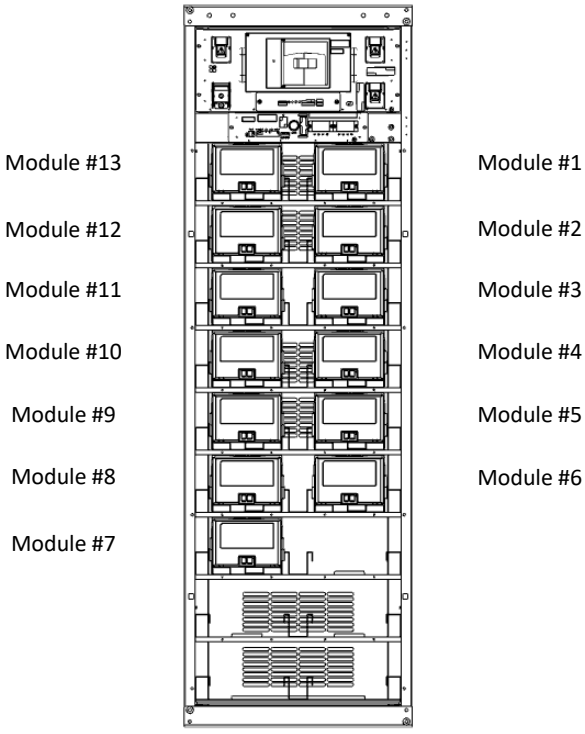


Figure 3-34: Module Number 0f 104S

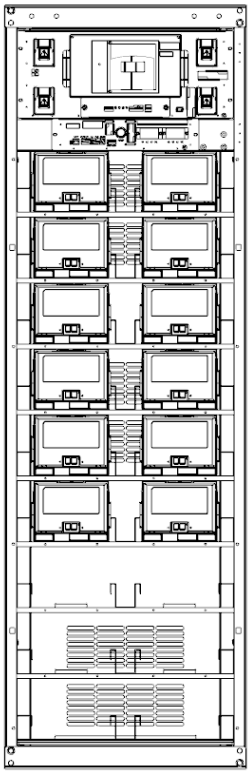


Figure 3-35: Battery Module Arrangement of 96S

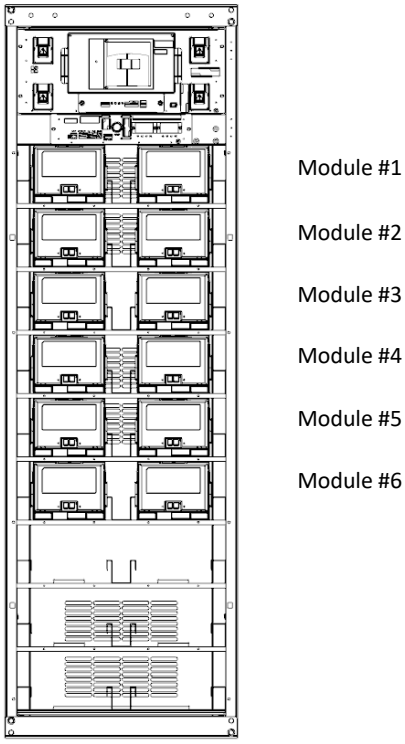


Figure 3-36 : Module Number of 96S

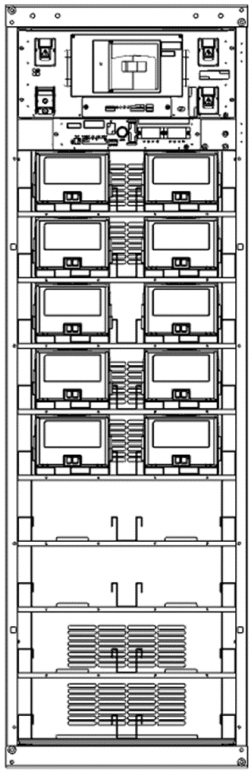


Figure 3-37: Battery Module Arrangement of 80S

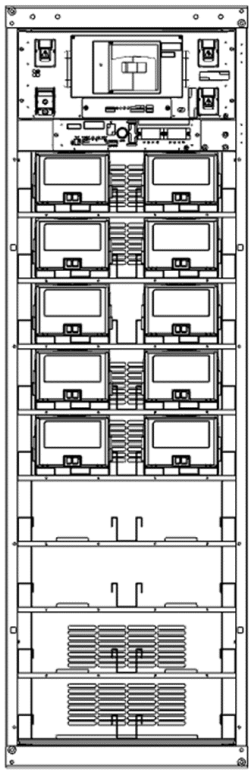


Figure 3-38 : Module Number of 80S

	Important
	▪ Samsung recommends installing modules from top to bottom. ▪ The bottom shelf (1st shelf) has one Type B module in the left slot, as shown in Figure 3-37.

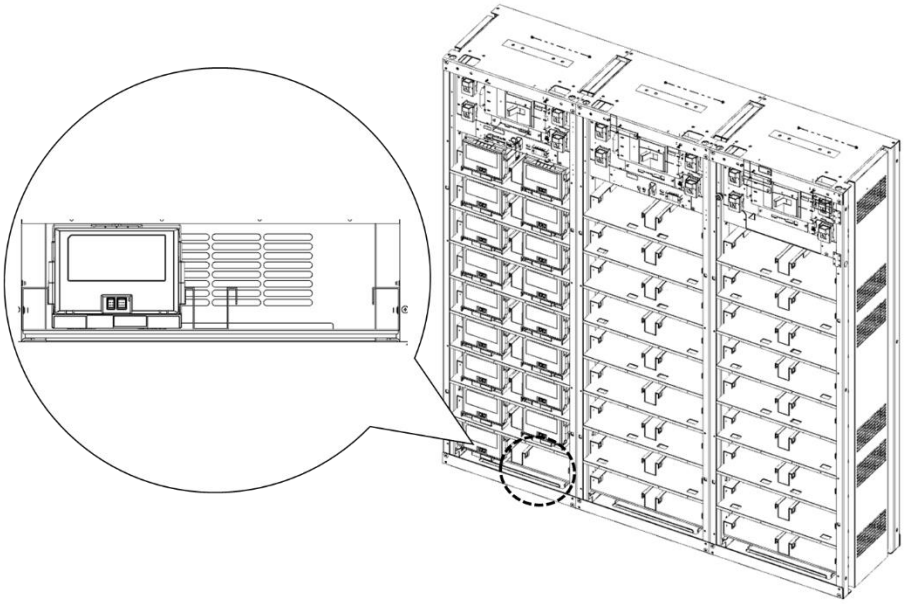


Figure 3-39 : Insertion of modules on 1st shelf (136S configuration)

3.9.4 Fuse-Busbar Assembly

Fuse-busbar assemblies must be assembled before installing them to the battery modules.
1ea or Multiple Optional

	NOTICE
	▪ The Rack Fuse Busbar Assembly is to be assembled at the installation location. ▪ Refer the 79page for installation location of 2cases(1 ea or multiple ea). ▪ M12 X 16L screws are used to assemble the busbars and fuse. ▪ The fastening torque should be 30 Nm (300 kgf·cm). ▪ After torqueing, I-mark the screws using a colored marker or a torque seal. ▪ When assembling the fuse, make sure the “red indicator arm” on the fuse is facing the front of the unit.

1. Assemble the Rack Fuse Busbar Assembly for 104S, 136S. Refer to Table 3-2 for the part number of the part. The Rack Fuse Busbar Assembly is comprised of one “RACKFUSE BUSBAR_R_136S”, one “RACKFUSE BUSBAR_L_136S”, two “SCREW M12 X 16”, one “FUSE COVER #1”, and one “FUSE.” ※ In case of 1ea Rack Fuse for 104S, In case of 136S

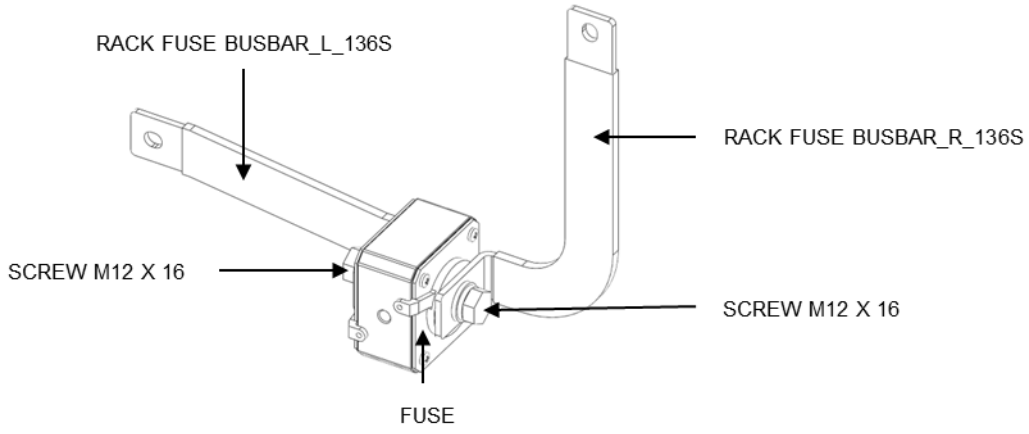


Figure 3-40: Rack Fuse Busbar Assembly

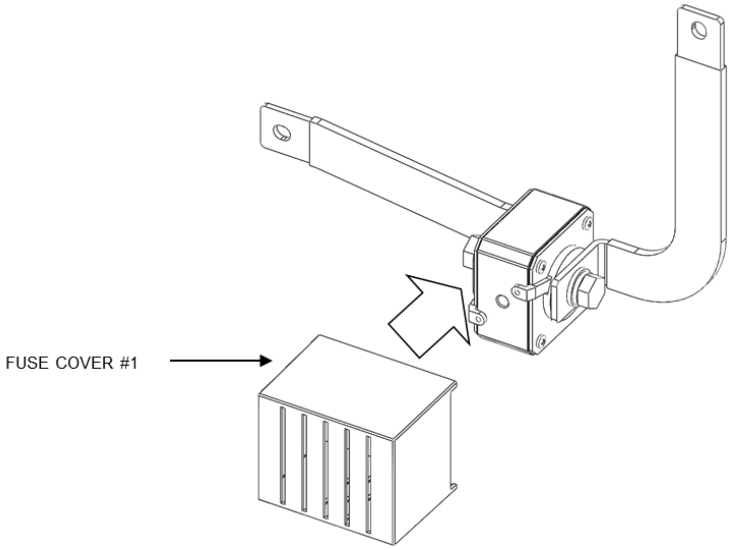


Figure 3-41: Rack Fuse Busbar Assembly (Fuse Cover)

2. Assemble the Fuse Busbar Left Assembly. The Fuse Busbar Left Assembly is comprised of one “FUSE BUSBAR LEFT UPPER”, one “FUSE BUSBAR LEFT LOWER”, two “SCREW M12 X 16”, two “FUSE COVER #2”, and one “FUSE.”

   ※ In case of multiple Rack Fuse for 136S, 128S, 112S, 104S, 96S, 80S

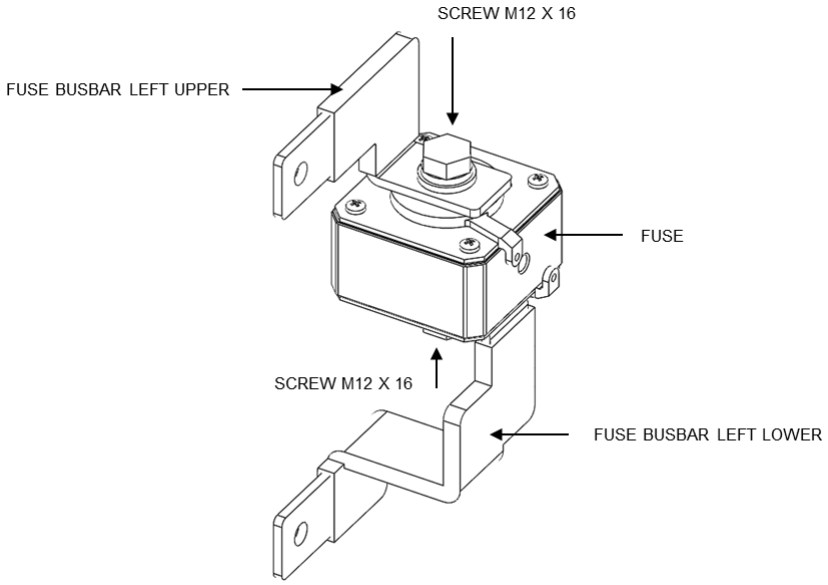


Figure 3-42: Fuse Busbar Left Assembly

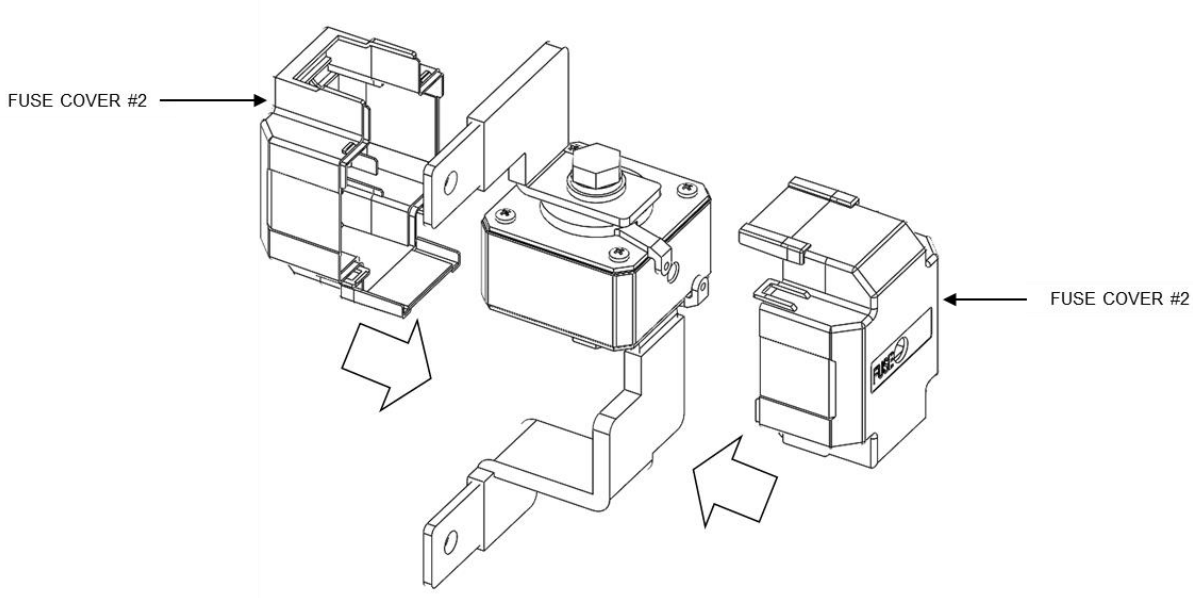


Figure 3-43: Fuse Busbar Left Assembly (Fuse Cover)

3. Assemble the Fuse Busbar Right Assembly for 80S, 112S. The Fuse Busbar Right Assembly is comprised of one “FUSE BUSBAR RIGHT UPPER”, one “FUSE BUSBAR RIGHT LOWER”, two “SCREW M12 X 16”, two “FUSE COVER #2”, and one “FUSE.”

   ※ In case of multiple Rack Fuse for 136S, 128S, 112S, 104S, 96S, 80S, In case of 1ea Rack Fuse 80S, 112S

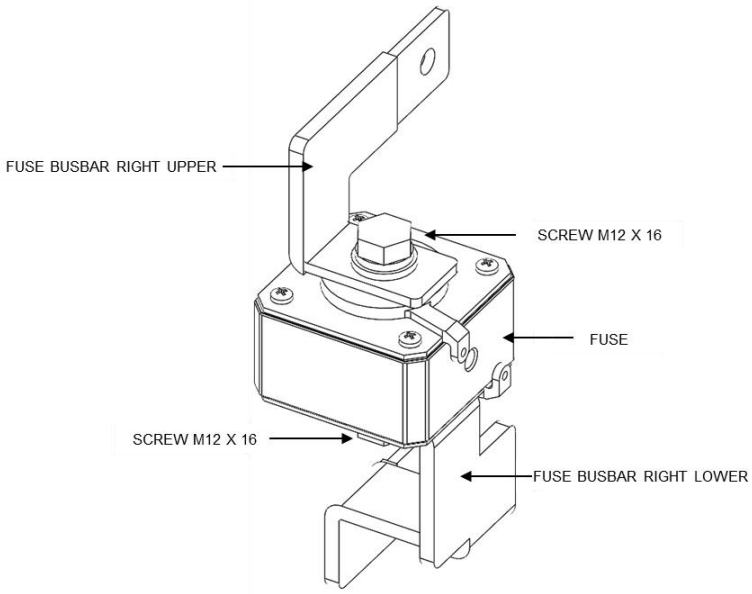


Figure 3-44: Fuse Busbar Right Assembly

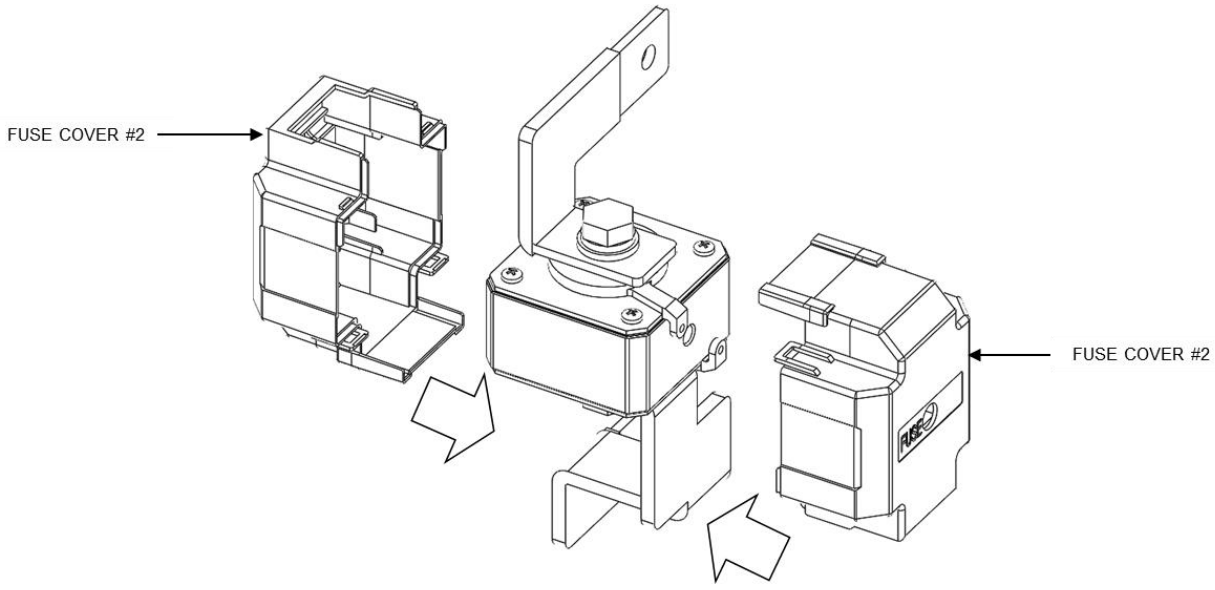


Figure 3-45: Fuse Busbar Right Assembly (Fuse Cover)

4. Assemble the Rack Fuse Busbar Assembly for 96S, 128S. The Rack Fuse Busbar Assembly is comprised of one “RACKFUSE BUSBAR_R_128S”, one “RACKFUSE BUSBAR_L_128S”, two “SCREW M12 X 16”, one “FUSE COVER #1”, and one “FUSE.”

※ In case of 128S, 96S

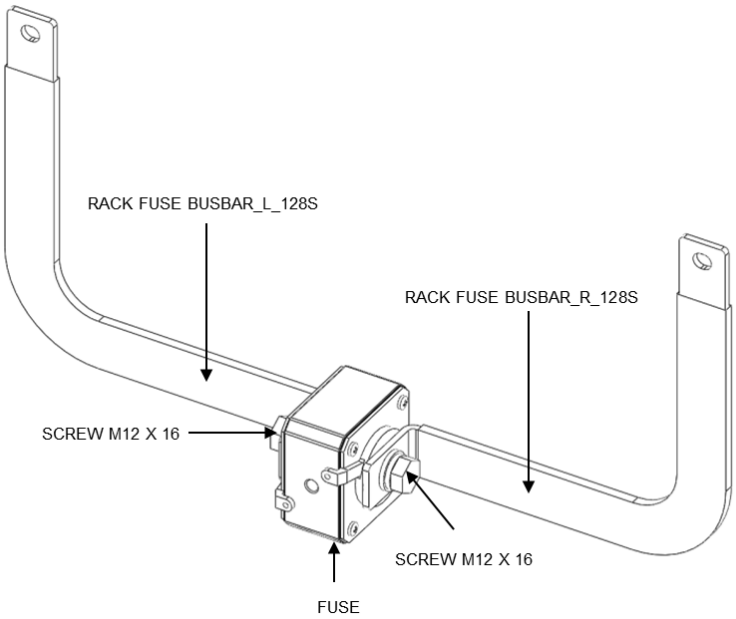


Figure 3-46: Rack Fuse Busbar Assembly

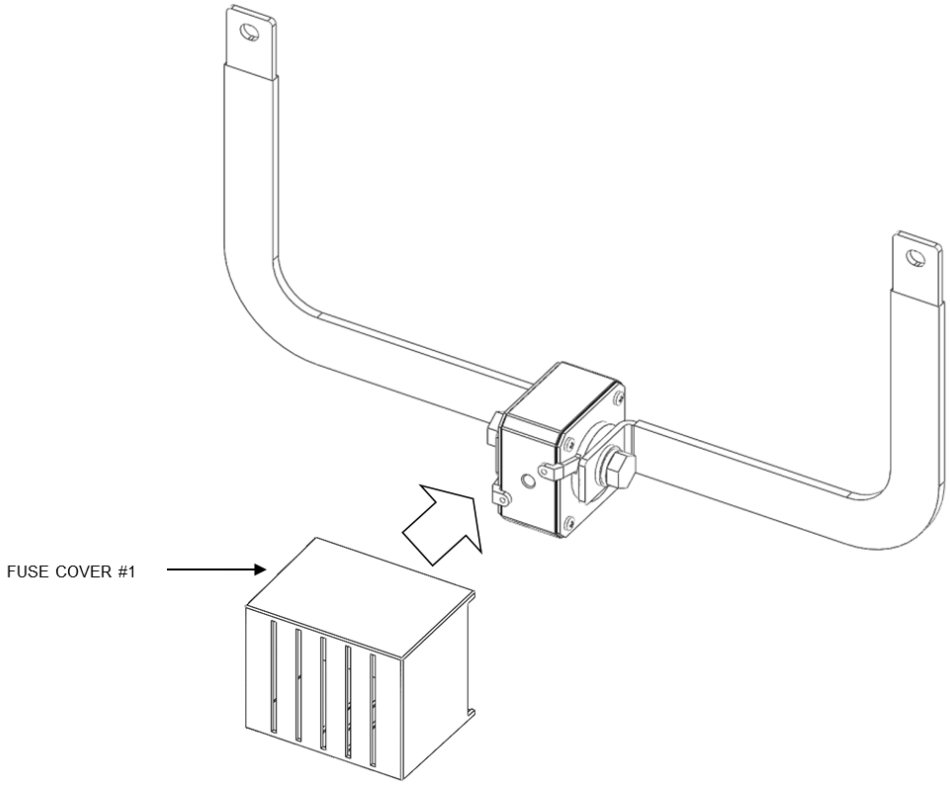
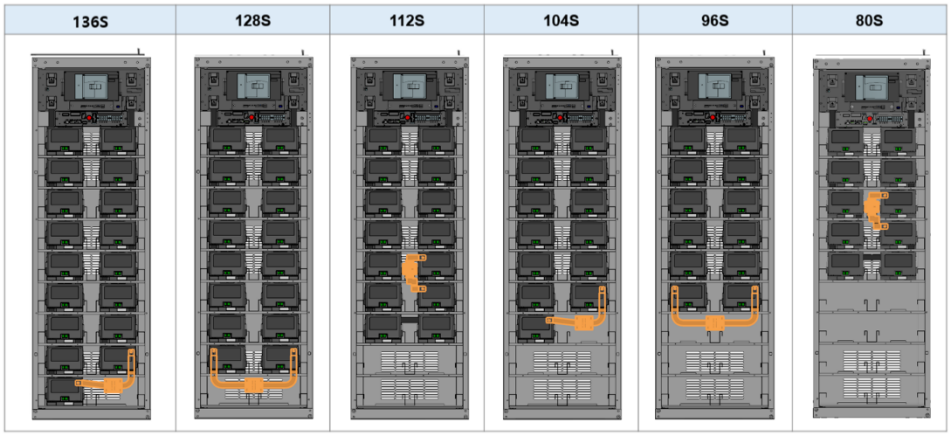


Figure 3-47: Rack Fuse Busbar Assembly (Fuse Cover)

The following notice indicates the installation location of the Rack Fuse Busbar Assemblies. It is important that the installer explicitly follows these guidelines.

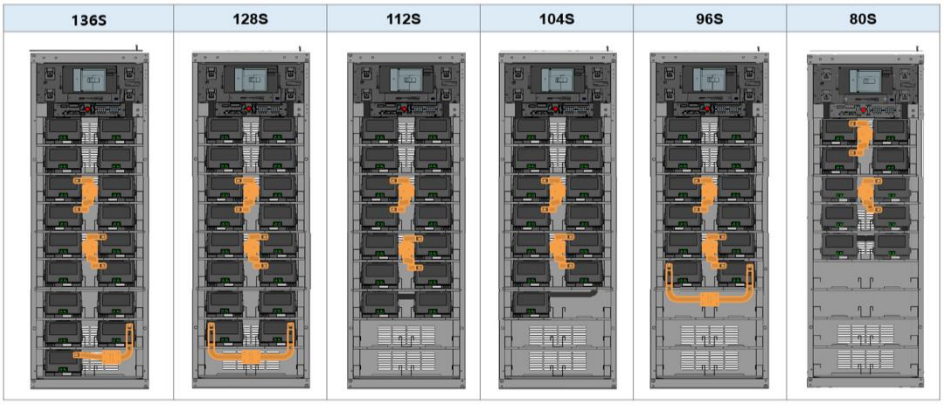
NOTICE

- Rack Fuse Busbar Assembly is assembled at the installation location like below.
  in case of 1ea
- 136S: Between Modules No. 8 and 9.
- 128S: Between Modules No. 8 and 9.
- 112S: Between Modules No. 5 and 6.
- 104S: Between Modules No. 6 and 7.
- 96S: Between Modules No. 6 and 7.
- 80S: Between Modules No. 3 and 4.



NOTICE

- Rack Fuse Busbar Assembly is assembled at the installation location like below.
  In case of multiple
- 136S: Between Modules No. 5 and 6, 8 and 9, 14 and 15.
- 128S: Between Modules No. 5 and 6, 8 and 9, 13 and 14.
- 112S: Between Modules No. 5 and 6, 11 and 12.
- 104S: Between Modules No. 5 and 6, 10 and 11.
- 96S: Between Modules No. 5 and 6, 6 and 7, 9 and 10.
- 80S: Between Modules No. 3 and 4, 9 and 10.



3.9.5 Power Busbar Installation

Connect the power busbars between modules.
Example for 136S with 1ea Fuse Assembly

Verify with a voltmeter that no power is present on the system. Use lock out/tag out procedures to isolate the UPS and battery.

	CAUTION
	▪ Follow the instructions to protect the module BMS against damage. ▪ Important: DO NOT deviate from the sequence of steps below. ▪ The system's voltage will increase proportionally as battery modules are connected. Exercise extreme caution prevent the terminals from contacting anything except their intended mounting points. ▪ Terminals and their connected wires have either positive or negative polarity (Positive: B+, P+; Negative: B-, P-). The polarity of a terminal or a wire connected to the terminal is on the front of each module and BCU. Exercise extreme caution to prevent the terminals and/or wires with opposite polarity from contacting with each other. ▪ It is recommended not to touch the battery positive (+) or negative (-) terminal for the batteries with rack frame. There is no evidence of dielectric breakdown because of electrical isolation between the battery positive (+) or negative (-) terminals and rack frame. However, it is recommended not to touch them for safety because It is possible to touch between battery positive (+) and negative (-) through the rack frame.

	NOTICE
	▪ Connect the power busbar with an M8 screw for battery module terminals ▪ The fastening torque should be 12.2–14.0 Nm (124–142 kgf·cm). ▪ Use an insulated torque wrench extension with a 13 mm socket. ▪ After torqueing, I-mark the screw using a colored marker or a torque seal.

	NOTICE
	▪ Connect the power busbar with an M12 screw for BCU terminals ▪ The fastening torque should be 30 Nm/300 kgf·cm. ▪ Use an insulated torque wrench extension with a 19 mm socket. ▪ After torqueing, I-mark the screw using a colored marker or a torque seal.

	Important
	▪ The power terminals, such as "B+," "B-," "P+," and "P-," of the module and BCU are covered with a power terminal cover to guard against inadvertent short circuit. ▪ At each step in this process, the cover must be removed prior to connecting a power busbarReattach the cover immediately after connecting the power busbars.

Important

- It is recommended to polish the joining surface of the bus bars prior to assembly. Polish the joining surface of the busbar with a fine abrasive material (grit 600 or higher) such as sandpaper or scrubbing pad. Polish until the surface is evenly scratched and the color is equivalent of “freshly polished” on color chart used in ASTM D-130 Copper Strip Corrosion Standards. Refer to Figure 3-46
- It is recommended to apply electrically conductive grease on the joining surface to reduce the contact resistance. After polishing the surface of the busbar, apply the grease on the busbar and spread it evenly and thinly on the surface using a wire brush or a dry cloth. Refer to Figure 3-47: Conductive Grease on Busbar for the application of the grease on the busbar.

NOTICE

- After polishing the busbar, wipe the surface clean of any metal shavings. Clean the surface with a dry cloth before assembling the busbar to the terminal.

NOTICE

- As a reference, grease used by Samsung SDI for internal testing is “Ox-Gard Anti-Oxidant Compound OX-400N”. Electrical conductivity, thermal and chemical characteristics of the grease must be properly checked and tested before use.
- When applying the grease, make sure there is none on the screw threads.

Figure 3-48: Copper Busbar Appearance

Figure 3-49: Conductive Grease on Busbar

	NOTICE
	▪ After connecting the busbar to the terminals (battery module, BCU, fuse), measure the contact resistance between the terminals and the busbars using a low resistance meter. Refer to Figure 3-48: Contact Resistance Probe Points (Battery Module Terminal to Busbar) for location of the measurement. Use similar probe locations for BCU terminal to busbar contact resistance, and fuse to busbar contact resistance. Make sure each probe is in contact with only the intended location. ▪ The contact resistance must be measured below 40 μΩ. It is recommended to keep the contact resistance in all terminals below 30 μΩ.

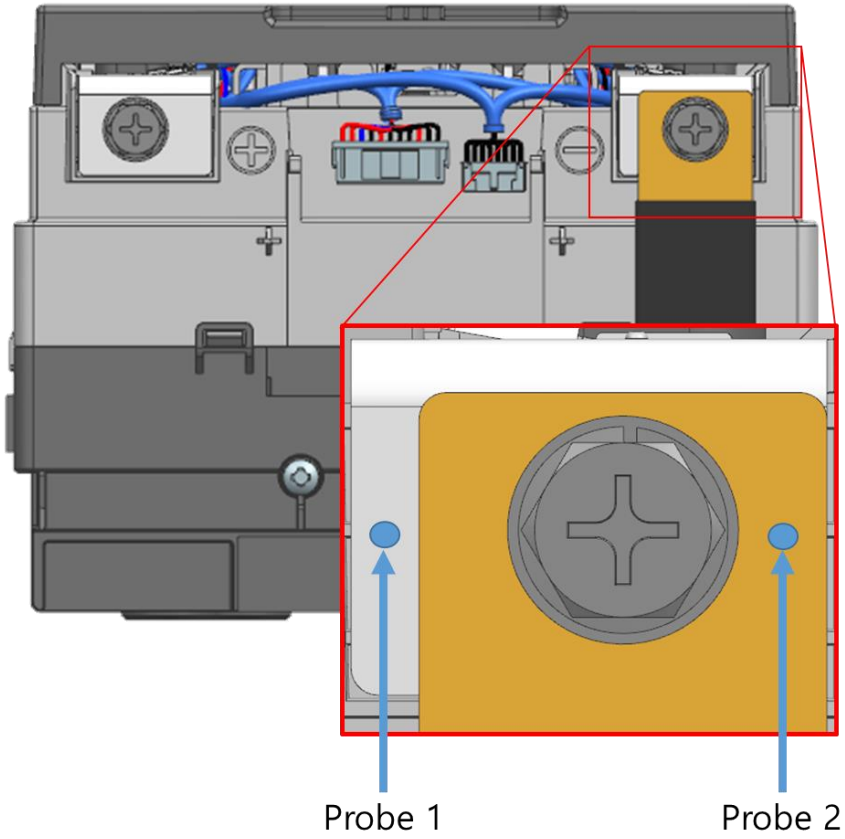


Figure 3-50: Contact Resistance Probe Points (Battery Module Terminal to Busbar)

5. Remove Battery Module #1's front cover and the BCU B- (negative) power terminal cover.

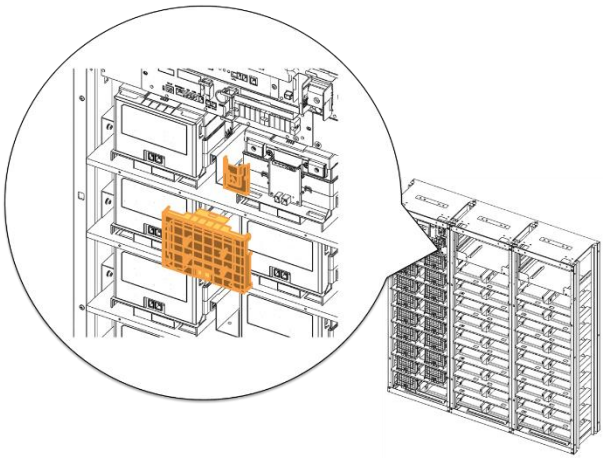


Figure 3-51: Removing the Module #1's Cover and BCU B- Power Terminal Cover

6. Connect BCU B- (negative) and Module #1 B- (negative) using "BUSBAR M TO BCU." The BCU B- terminal is connected using an M12 screw and Battery Module #1 B- terminal is connected using an M8 screw. Measure the contact resistance between the terminals and the busbar.

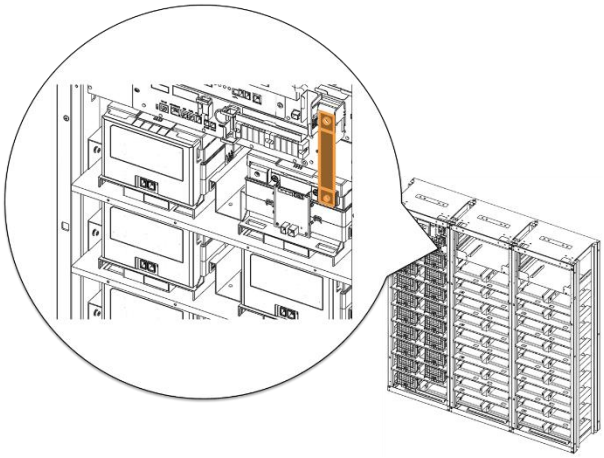


Figure 3-52: Connect BCU B- and Module #1 B-

7. Reattach BCU's B- power terminal cover.

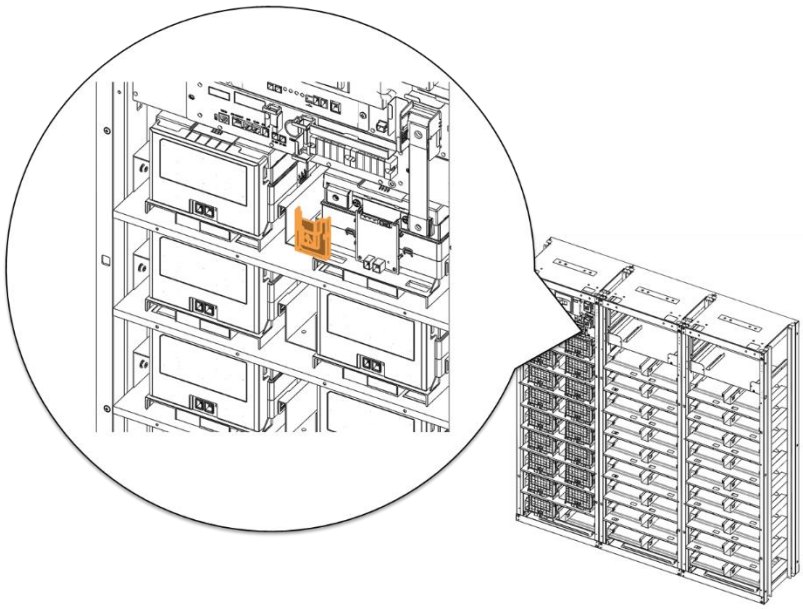


Figure 3-53: Restore BCU's B- Terminal

8. Remove Battery Module #2's front cover.

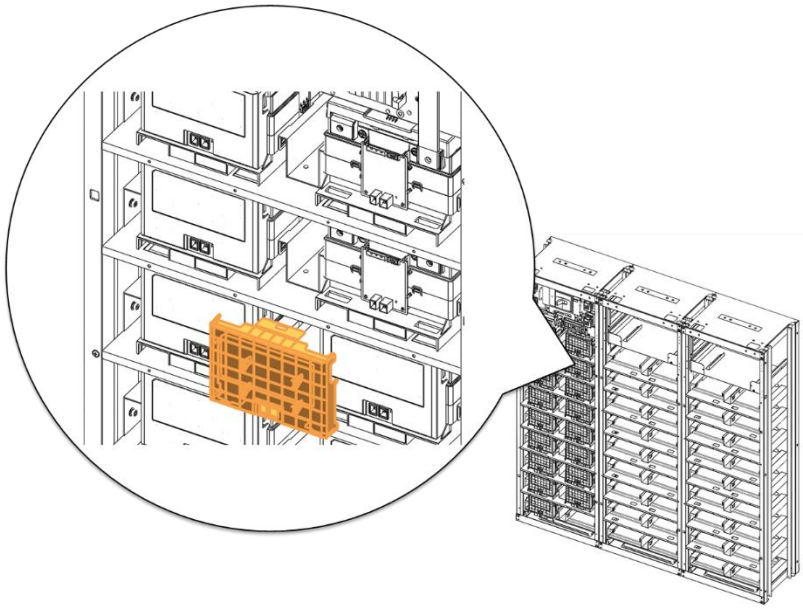


Figure 3-54: Remove Battery Module #2's Front Cover

9. Connect Battery Module #1 B+ (positive) and Module #2 B- (negative) using “BUS-BAR MAIN.” Connect using an M8 screw. Measure the contact resistance between the terminal and the busbar.

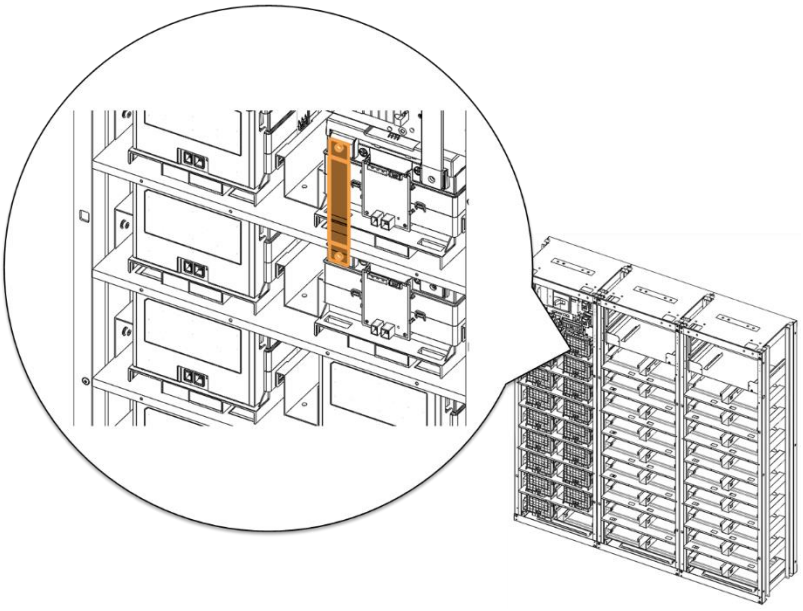


Figure 3-55: Connect Battery Module #1 B+ and Battery Module #2 B-.

10. Reattach Battery Module #1’s front cover and remove Battery Module #3’s front cover.

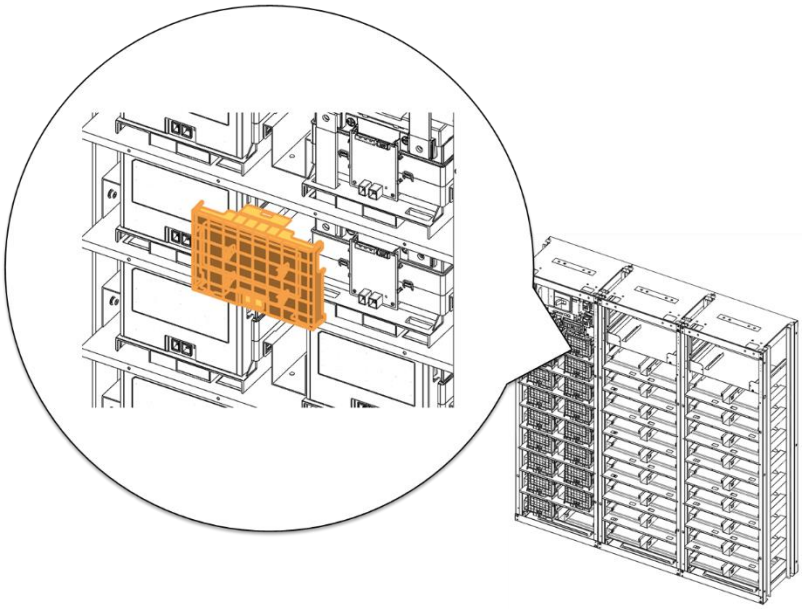


Figure 3-56: Reattach Battery Module #1’s Front Cover

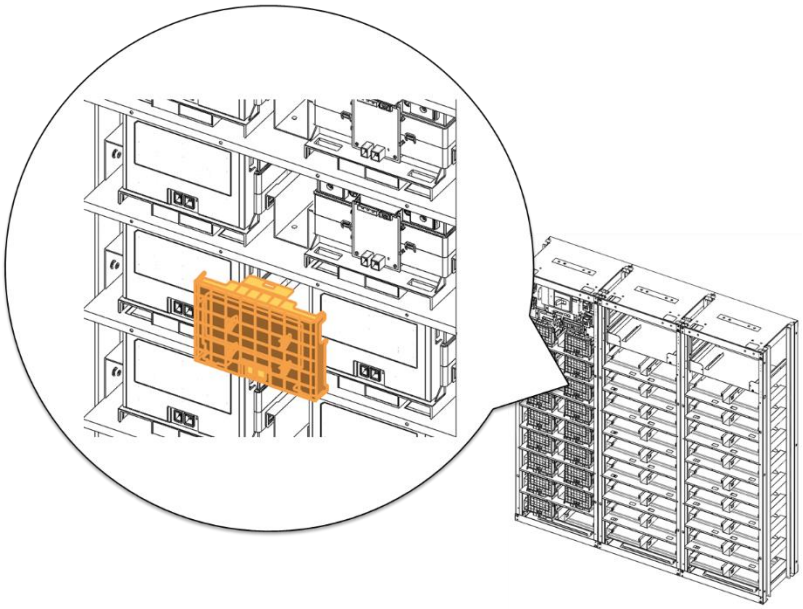


Figure 3-57: Remove Battery Module #2's Front Cover

11. Connect Battery Module #2 B+ (positive) and Battery Module #3 B- (negative) using "BUS-BAR MAIN." Connect using an M8 screw. Measure the contact resistance between the terminal and the busbar.

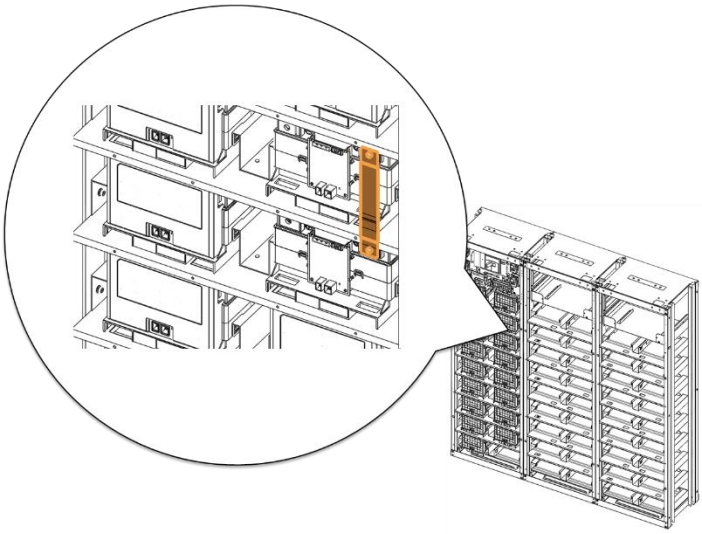


Figure 3-58: Connect Battery Module #2 B+ and Battery Module #3 B-.

12. Reattach Battery Module #2's front cover and remove Battery Module #4's front cover.

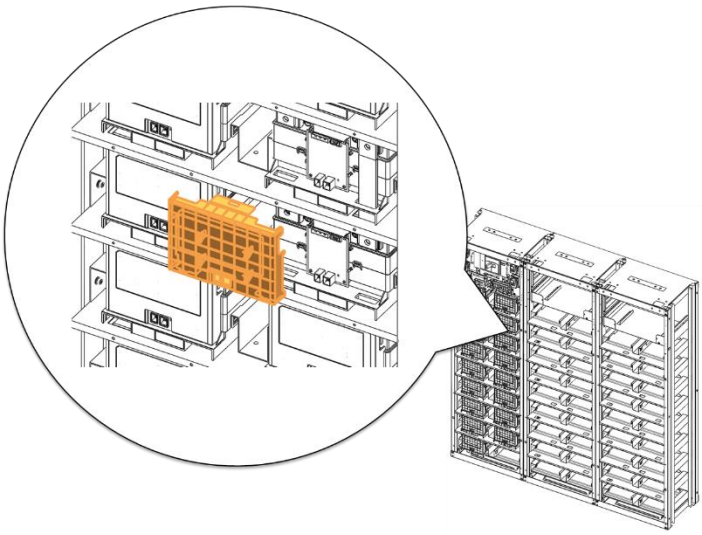


Figure 3-59: Reattach Battery Module #2's Front Cover

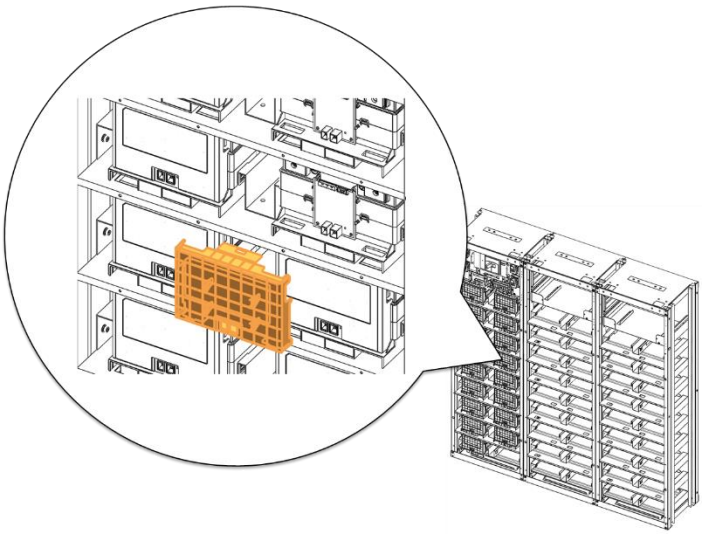


Figure 3-60: Remove Battery Module #4's Front Cover

13. Connect Battery Module #3 B+ (positive) and Module #4 B- (negative) using “BUS-BAR MAIN.” Connect using an M8 screw. Measure the contact resistance between the terminal and the busbar.

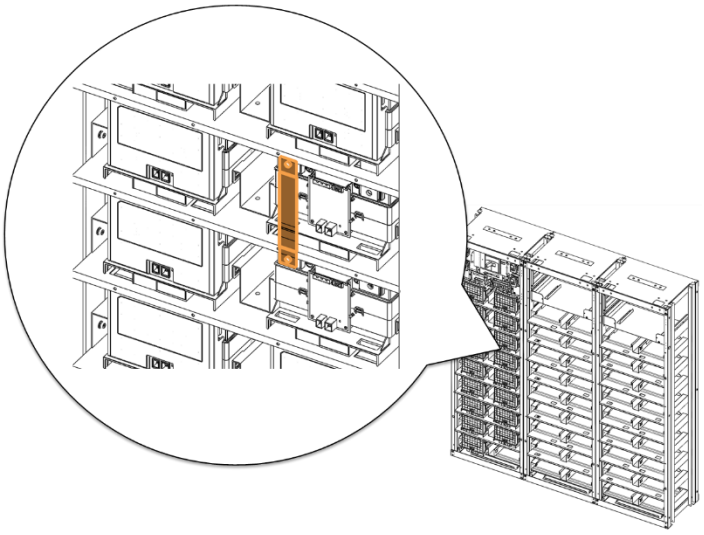


Figure 3-61: Connect Battery Module #3 B+ and Module #4 B-.

14. Reattach Battery Module #3’s front cover and remove Battery Module #5’s front cover.

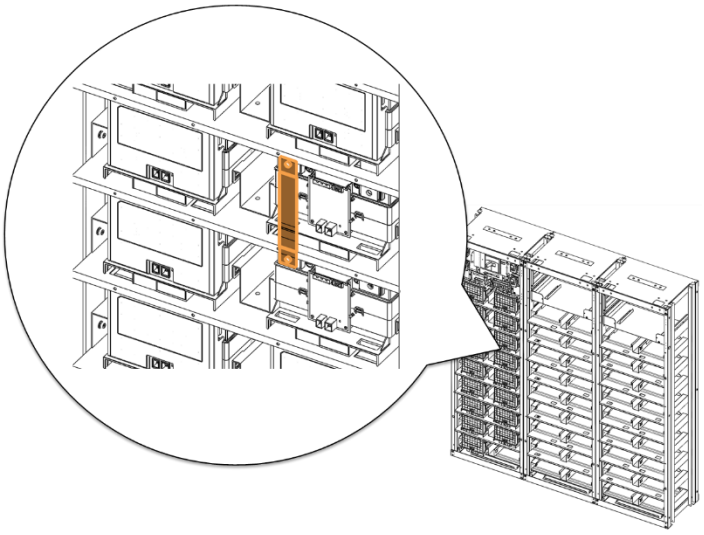


Figure 3-62: Reattach Battery Module #3’s Front Cover

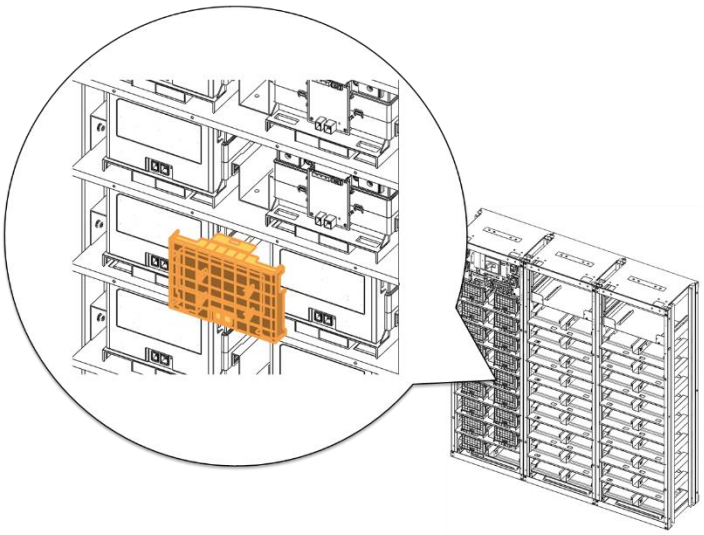


Figure 3-63: Remove Battery Module #5's Front Cover

15. Connect Battery Module #4 B+ (positive) and Battery Module #5 B- (negative) using "BUS-BAR MAIN." Connect using an M8 screw. Measure the contact resistance between the terminal and the busbar.

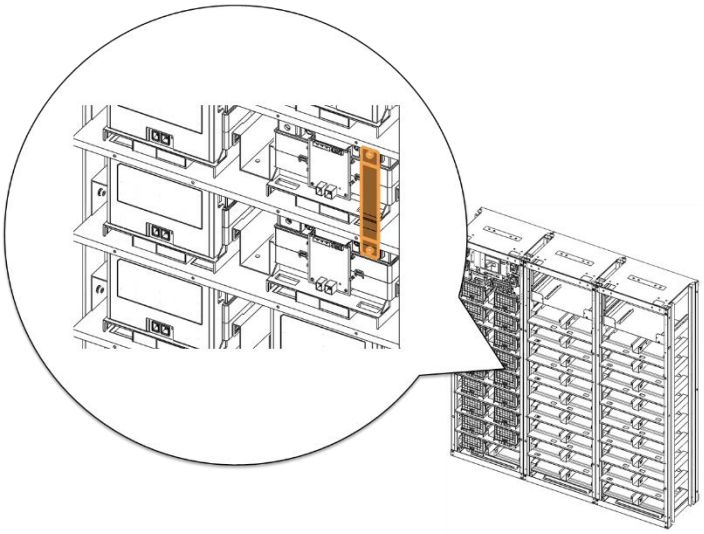


Figure 3-64: Connect Battery Module #4 B+ and Battery Module #5 B-.

16. Reattach Battery Module #4’s front cover and remove Battery Module #6’s front cover.

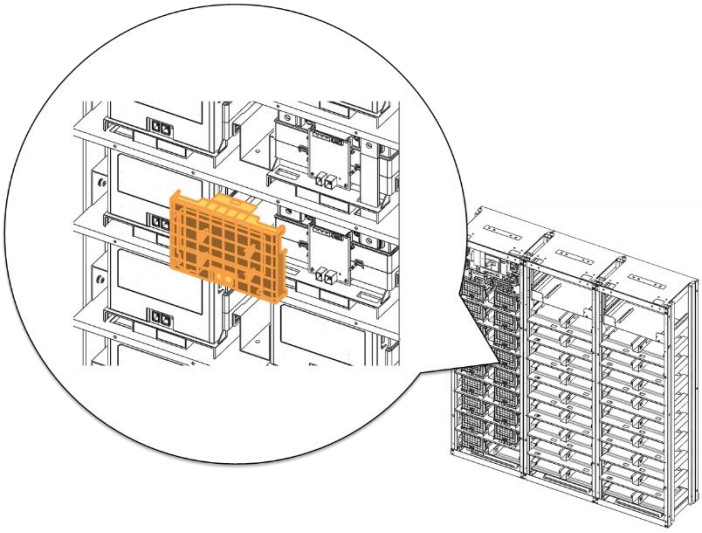


Figure 3-65: Reattach Battery Module #4’s Front Cover

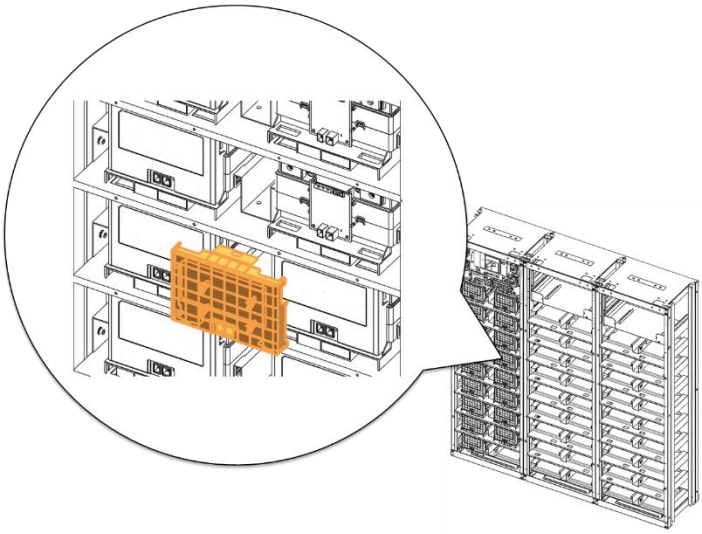


Figure 3-66: Remove Battery Module #6’s Front Cover

17. Connect Battery Module #5 B+ (positive) and Battery Module #6 B- (negative) using “BUS-BAR MAIN”. Connect using an M8 screw. Measure the contact resistance between the terminal and the busbar.

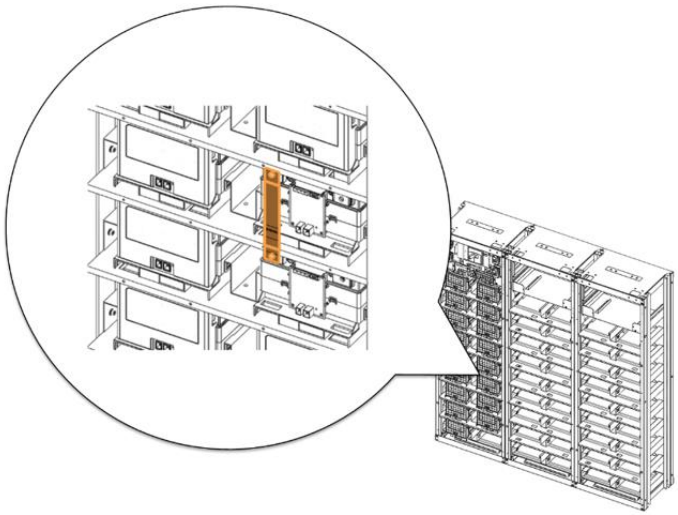


Figure 3-67: Connect Battery Module #5 B+ and Battery Module #6 B-.

18. Reattach Battery Module #5’s front cover and remove Battery Module #7’s front cover.

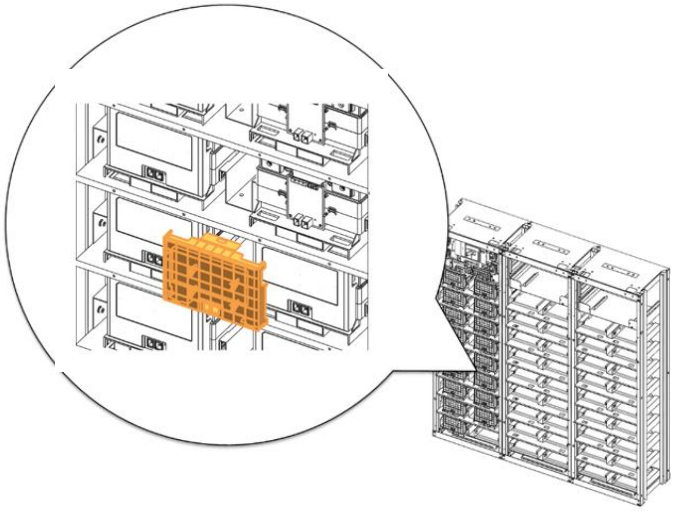


Figure 3-68: Reattach Battery Module #5’s Front Cover

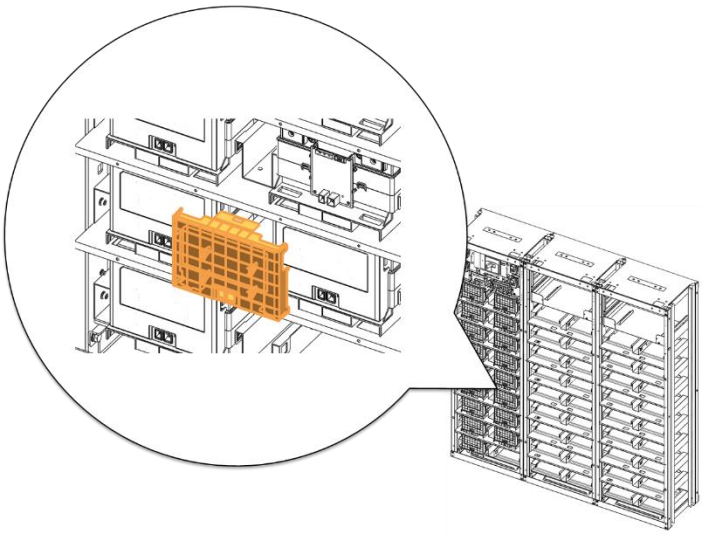


Figure 3-69: Remove Battery Module #7's Front Cover

19. Connect Battery Module #6 B+ (positive) and Battery Module #7 B- (negative) using "BUS-BAR MAIN." Connect using an M8 screw. Measure the contact resistance between the terminal and the busbar.

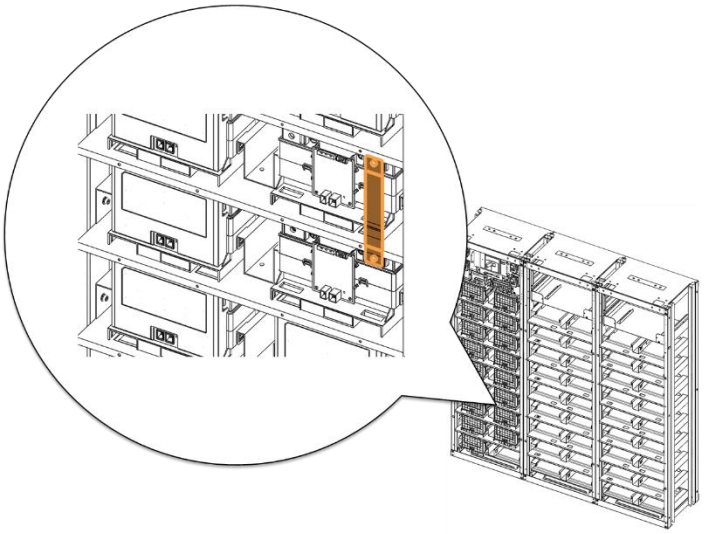


Figure 3-70: Connect Battery Module #6 B+ and Battery Module #7 B-

20. Reattach Battery Module #6’s front cover and remove Battery Module #8’s front cover.

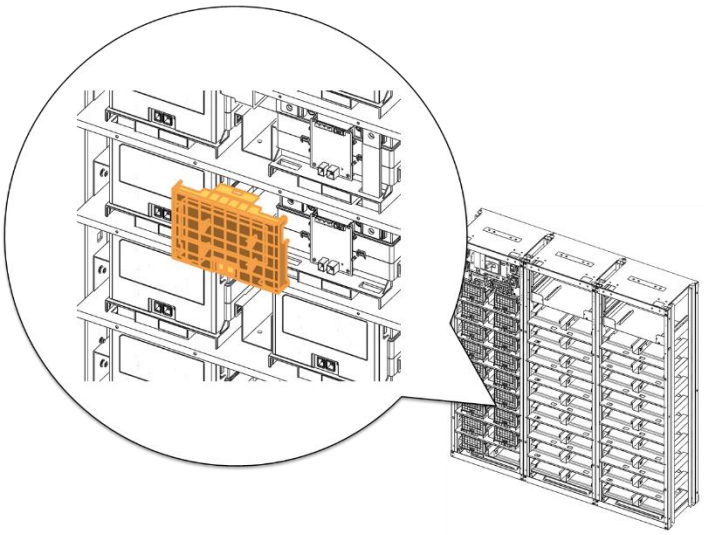


Figure 3-71: Reattach Battery Module #6’s Front Cover

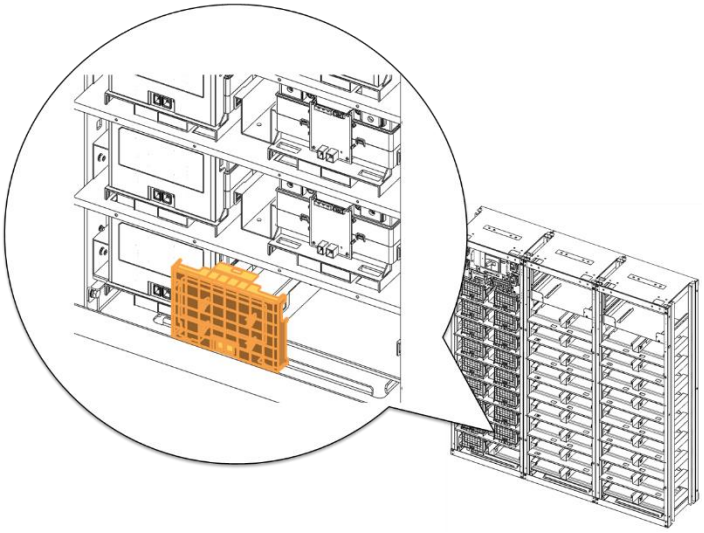


Figure 3-72: Remove Battery Module #8’s Front Cover

21. Connect Battery Module #7 B+ (positive) and Battery Module #8 B- (negative) using “BUS-BAR MAIN.” Connect using an M8 screw. Measure the contact resistance between the terminal and the busbar.

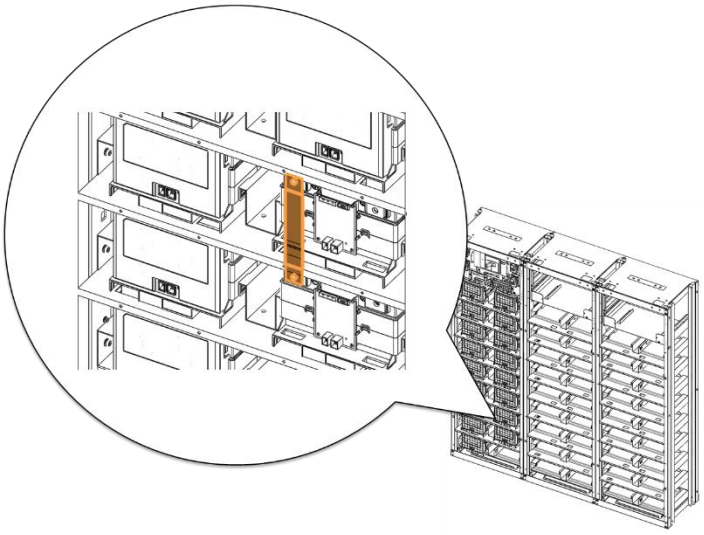


Figure 3-73: Connect Battery Module #7 B+ and Battery Module #8 B-

22. Reattach Battery Modules #7’s front cover and remove Battery Modules #9’s front cover.

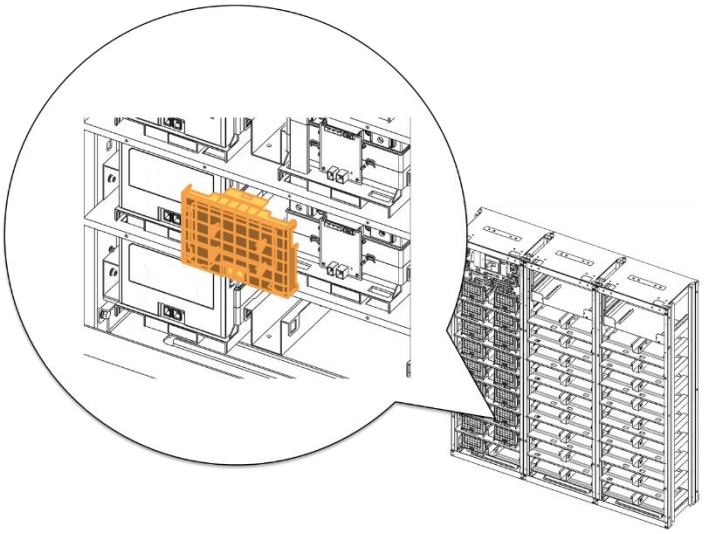


Figure 3-74: Reattach Battery Modules #7’s Front Cover

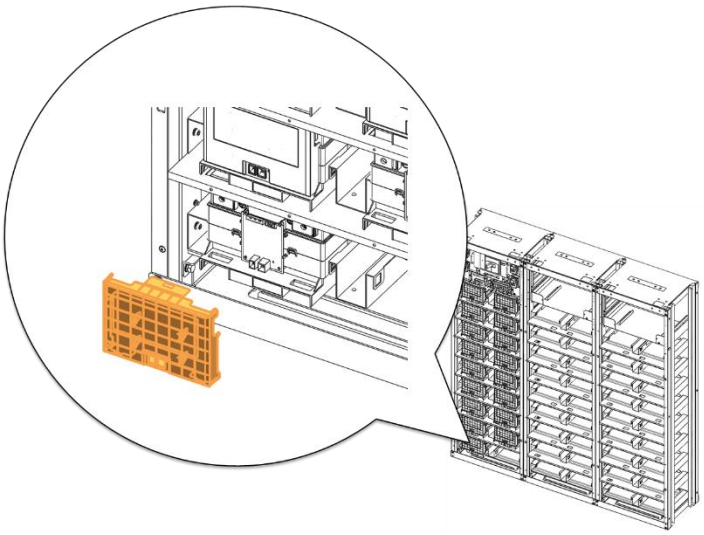


Figure 3-75: Remove Battery Modules #9's Front Cover

23. Connect Battery Module #8 B+ (positive) and Battery Module #9 B- (negative) using "RACK FUSE BUSBAR ASSEMBLY" Connect using an M8 screw. Measure the contact resistance between the terminal and the busbar.

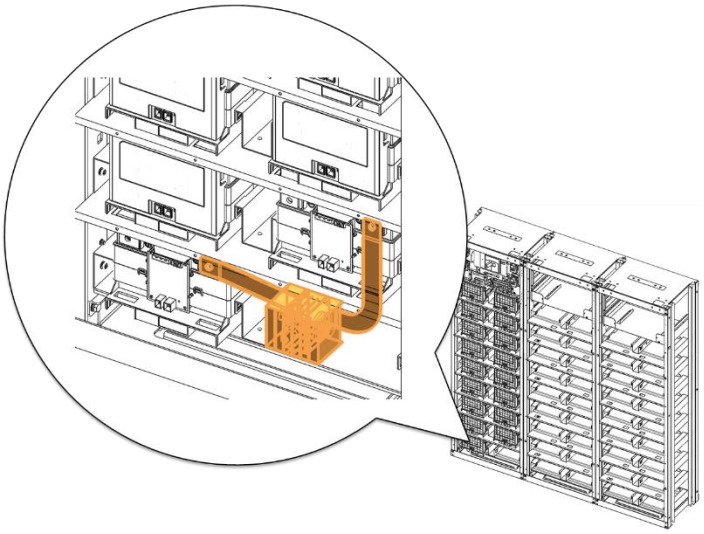


Figure 3-76: Connect Battery Module #8 B+ and Battery Module #9 B-.

24. Reattach Battery Module #8's front cover and remove Battery Module #10's front cover.

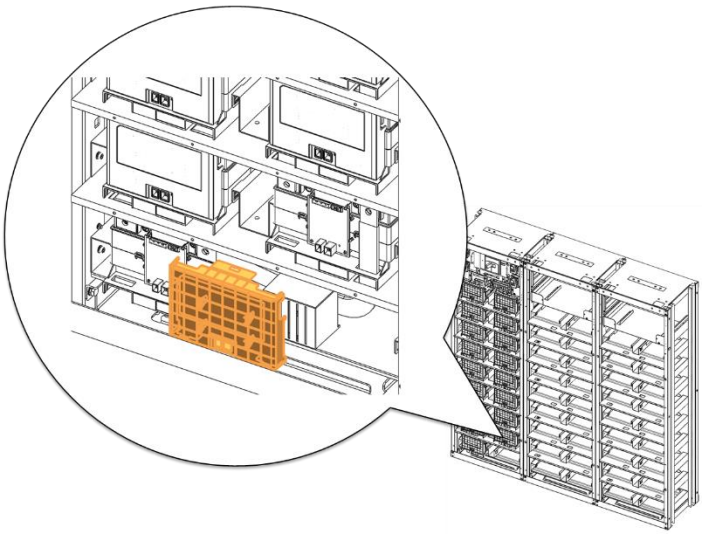


Figure 3-77: Reattach Battery Modules #8's Front Cover

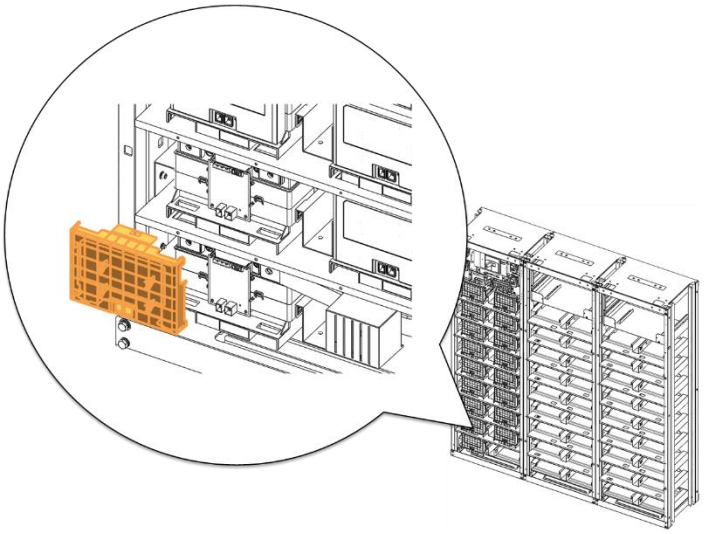


Figure 3-78: Remove Battery Modules #10's Front Cover

25. Connect Battery Module #9 B+ (positive) and Battery Module #10 B- (negative) using “BUS-BAR MAIN” Connect using an M8 screw. Measure the contact resistance between the terminal and the busbar.

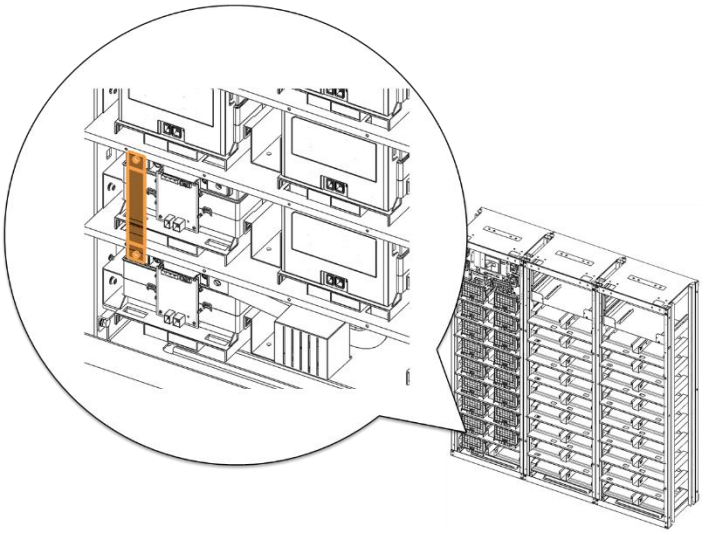


Figure 3-79 Connect Battery Module #9 B+ and Battery Module #10 B-.

26. Reattach Battery Module #9’s front cover and remove Battery Module #11’s front cover.

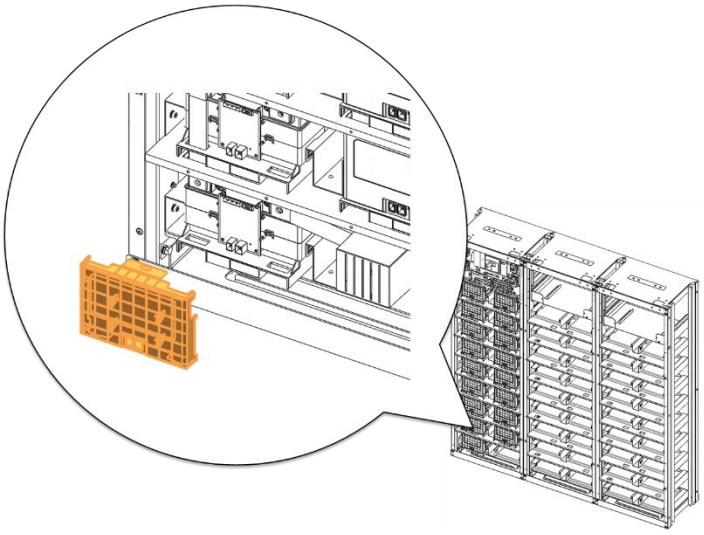


Figure 3-80: Reattach Battery Module #9’s Front Cover

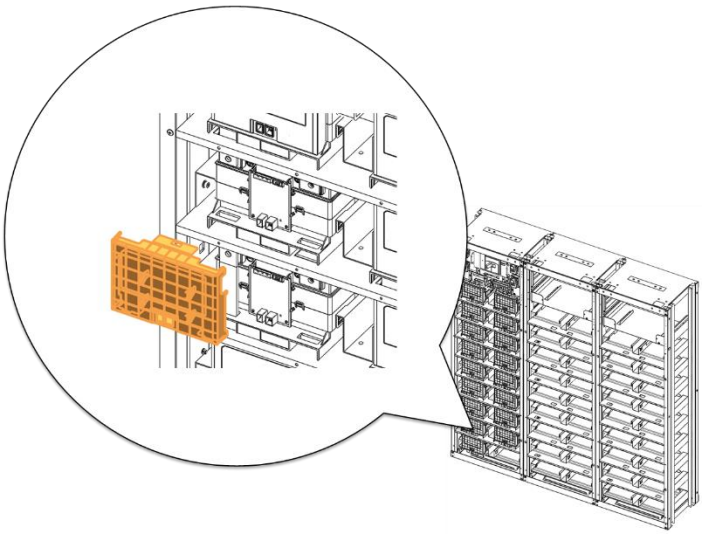


Figure 3-81: Remove Battery Module #11's Front Cover

27. Connect Battery Module #10 B+ (positive) and Battery Module #11 B- (negative) using "BUS-BAR MAIN." Connect using an M8 screw. Measure the contact resistance between the terminal and the busbar.

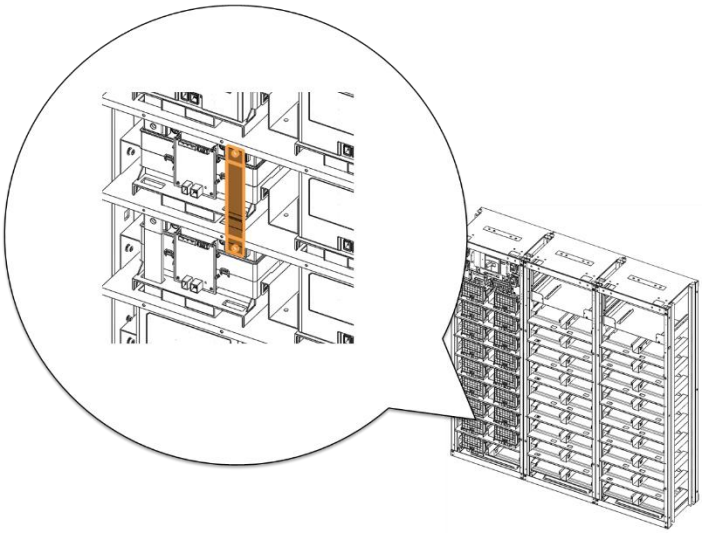


Figure 3-82: Connect Battery Module #10 B+ and Battery Module #11 B-.

28. Reattach Battery Module #10’s front cover and remove Module #12’s front cover.

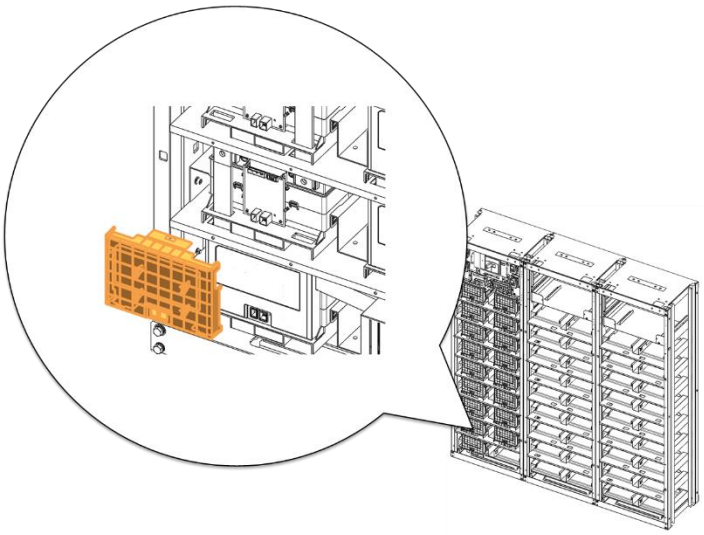


Figure 3-83: Reattach Battery Module #10’s Front Cover

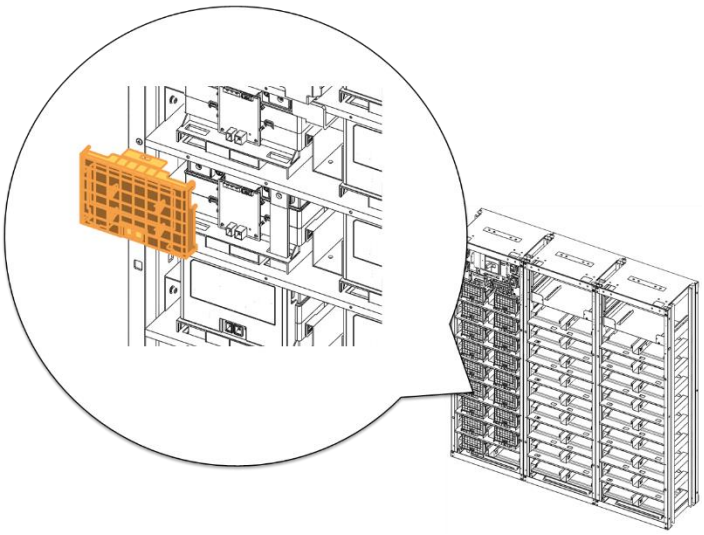


Figure 3-84: Remove Battery Module #12’s Front Cover

29. Connect Battery Module #11 B+ (positive) and Battery Module #12 B- (negative) using “BUS-BAR MAIN.” Connect using an M8 screw. Measure the contact resistance between the terminal and the busbar.

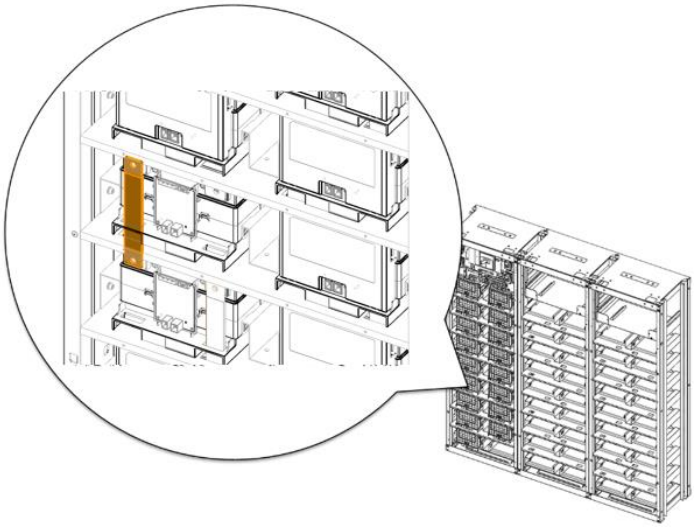


Figure 3-85: Connect Battery Module #11 B+ and Battery Module #12 B-.

30. Reattach Battery Module #11’s front cover and remove Battery Module #13’s front cover.

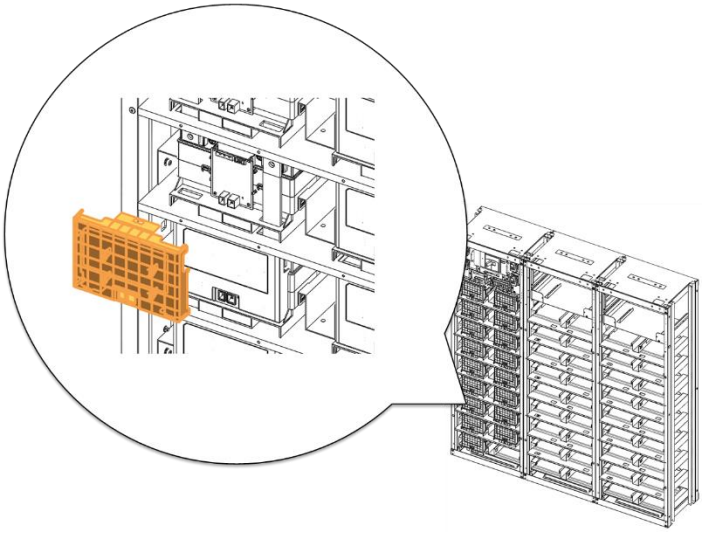


Figure 3-86: Reattach Module #11’s Front Cover

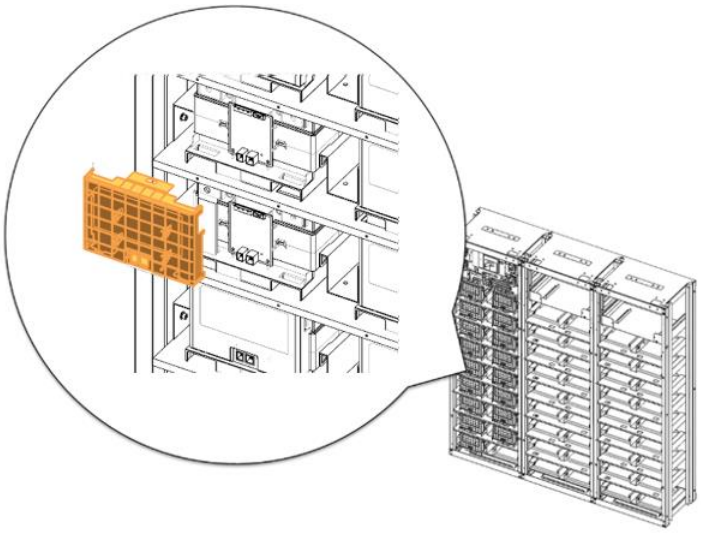


Figure 3-87: Remove Module #13's Front Cover

31. Connect Battery Module #12 B+ (positive) and Battery Module #13 B- (negative) using "BUS-BAR MAIN." Connect using an M8 screw. Measure the contact resistance between the terminal and the busbar.

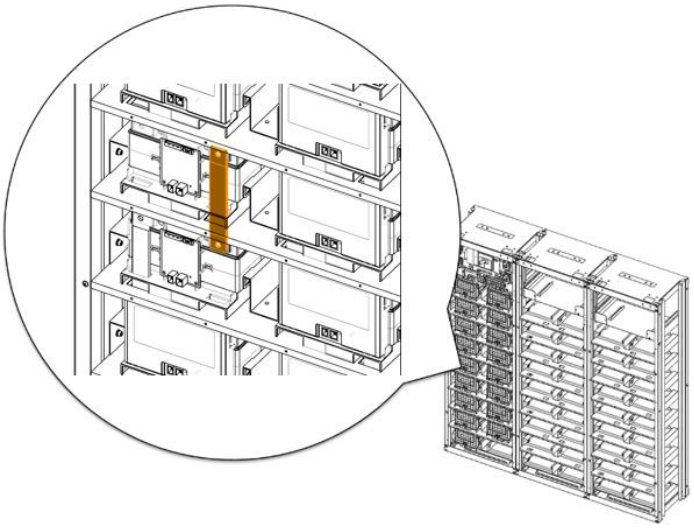


Figure 3-88: Connect Battery Module #12B+ and Battery Module #13 B-.

32. Reattach Battery Module #12’s front cover and remove Battery Module #14’s front cover.

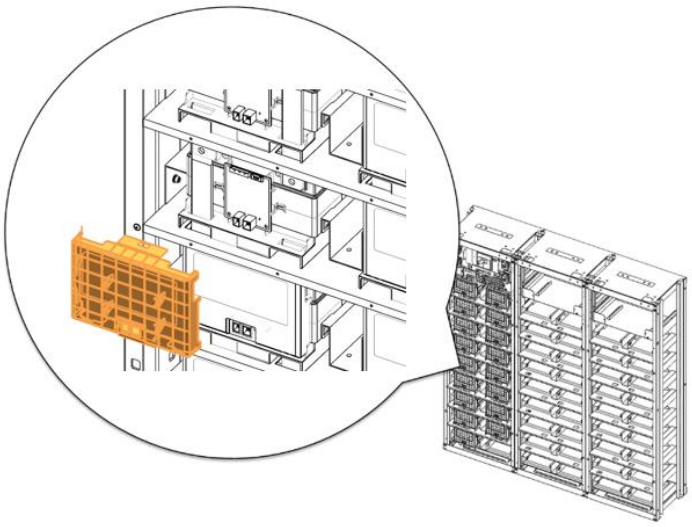


Figure 3-89: Reattach Module #12’s Front Cover

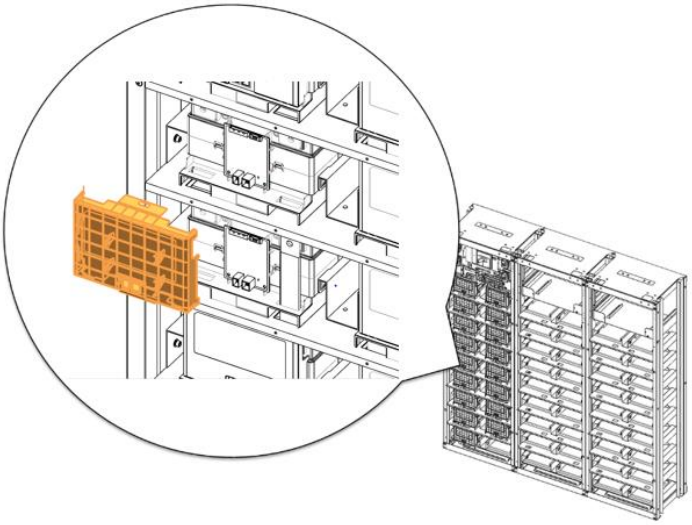


Figure 3-90: Remove Battery Module #14’s Front Cover

33. Connect Battery Module #13 B+ (positive) and Battery Module #14 B- (negative) using “BUS-BAR MAIN.” Connect using an M8 screw. Measure the contact resistance between the terminal and the busbar.

34.

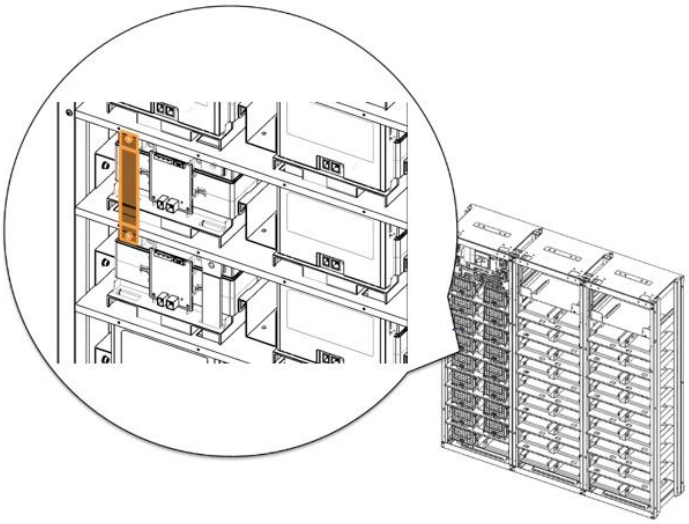


Figure 3-91: Connect Battery Module #13 B+ and Battery Module #14 B-.

35. Reattach Battery Module #13’s front cover and remove Battery Module #15’s front cover.

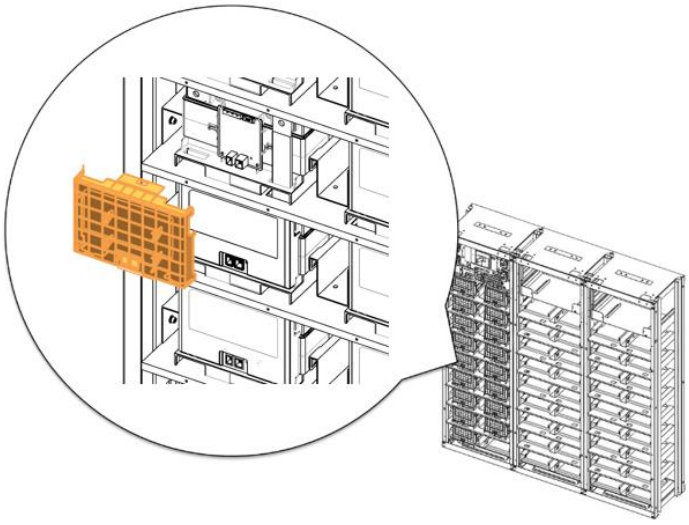


Figure 3-92: Reattach Battery Module #13’s Front Cover

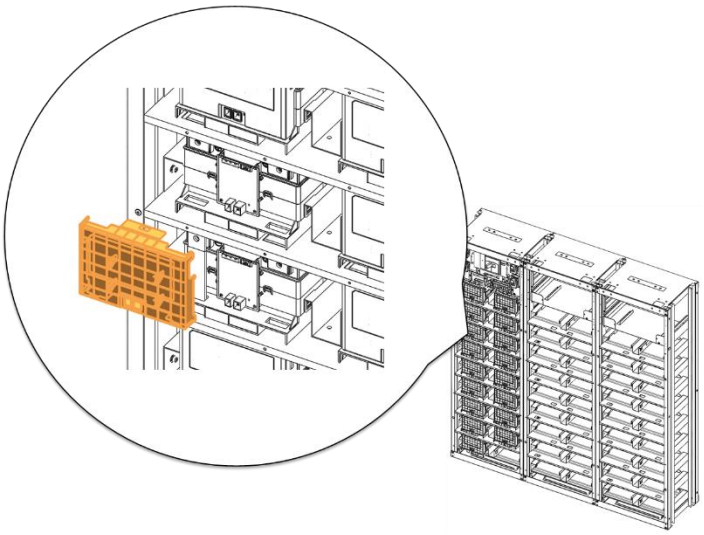


Figure 3-93: Remove Battery Module #15's Front Cover

36. Connect Battery Module #14 B+ (positive) and Battery Module #15 B- (negative) using "BUS-BAR MAIN." Connect using an M8 screw. Measure the contact resistance between the terminal and the busbar.

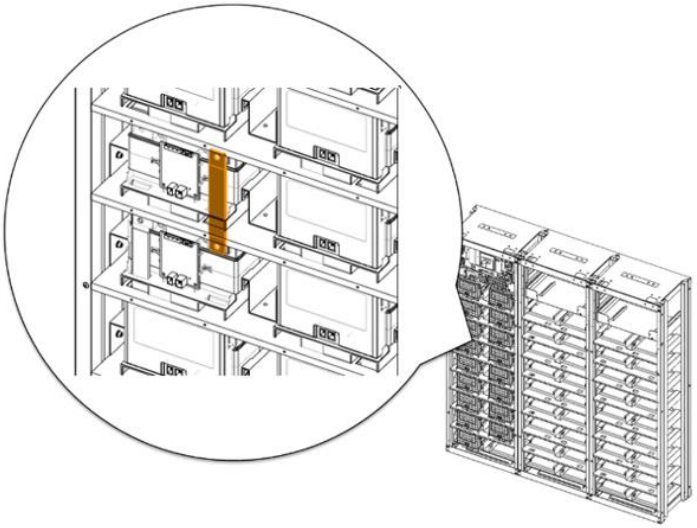


Figure 3-94: Connect Battery Module #14 B+ and Battery Module #15 B-.

37. Reattach Battery Module #14’s front cover and remove Battery Module #16’s front cover.

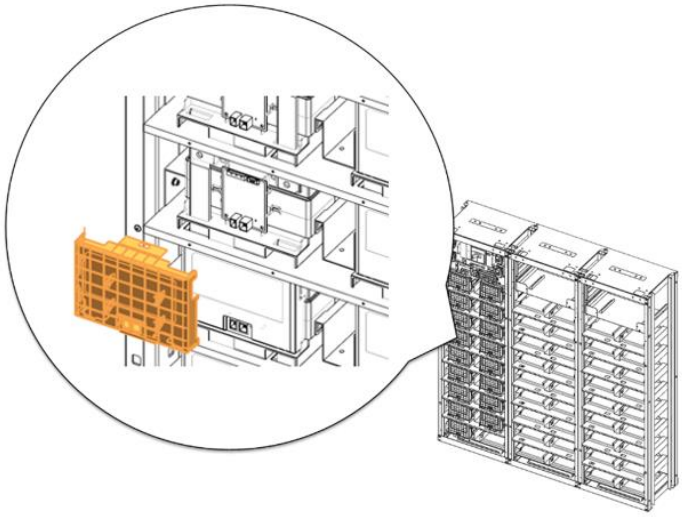


Figure 3-95: Reattach Battery Module #14’s Front Cover

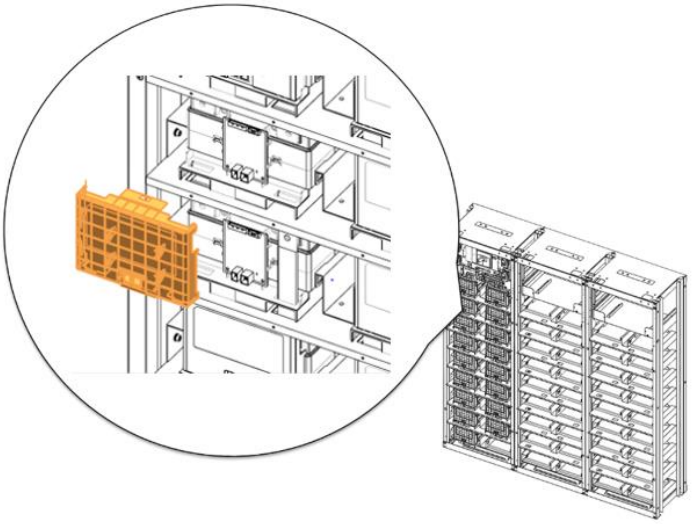


Figure 3-96: Remove Battery Module #16’s Front Cover

38. Connect Battery Module #15 B+ (positive) and Battery Module #16 B- (negative) using “BUS-BAR MAIN.” Connect using an M8 screw. Measure the contact resistance between the terminal and the busbar.

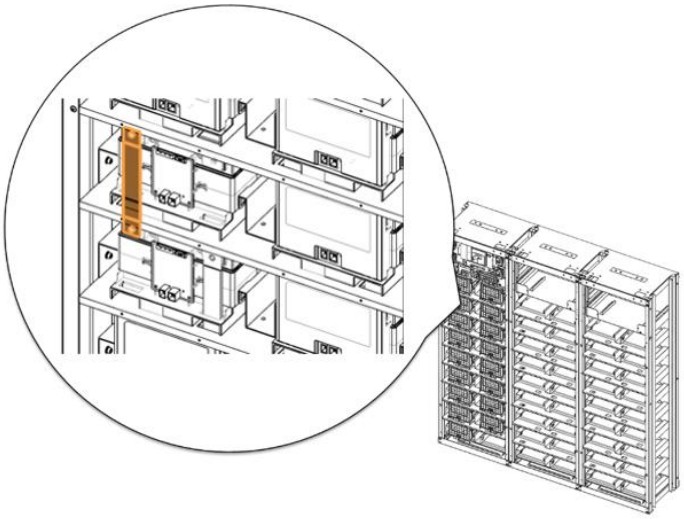


Figure 3-97: Connect Battery Module #15 B+ and Battery Module #16 B-.

39. Reattach Battery Module #15’s front cover and remove Battery Module #17’s front cover.

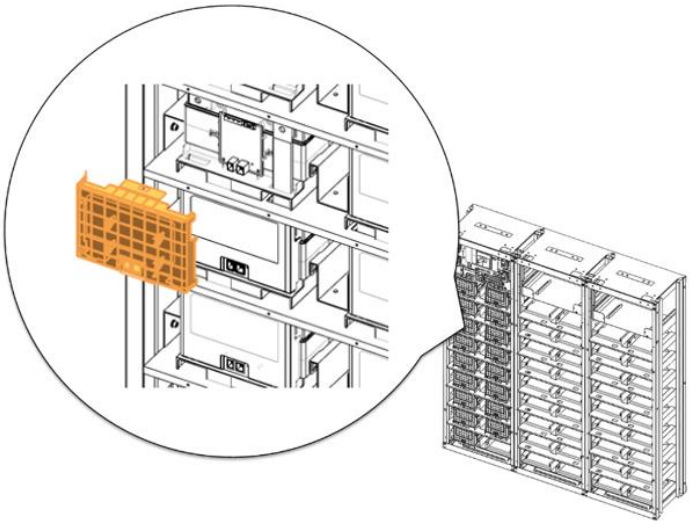


Figure 3-98: Reattach Battery Module #15’s Front Cover

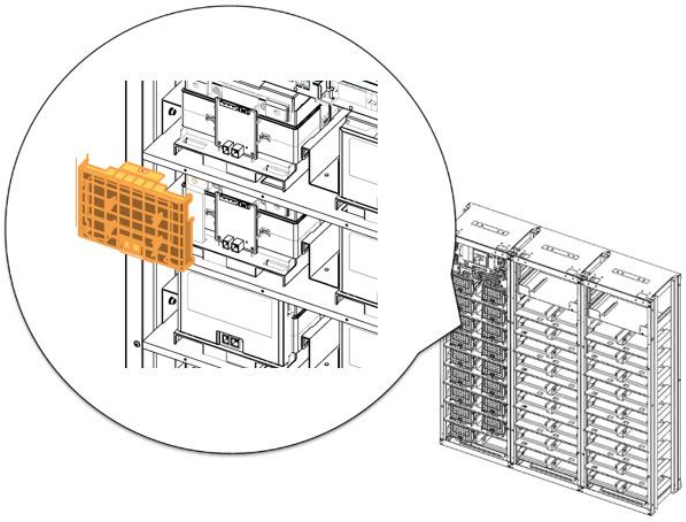


Figure 3-99: Remove Battery Module #17's Front Cover

40. Connect Battery Module #16 B+ (positive) and Battery Module #17 B- (negative) using "BUS-BAR MAIN". Connect using M8 screw. Measure the contact resistance between the terminal and the busbar.

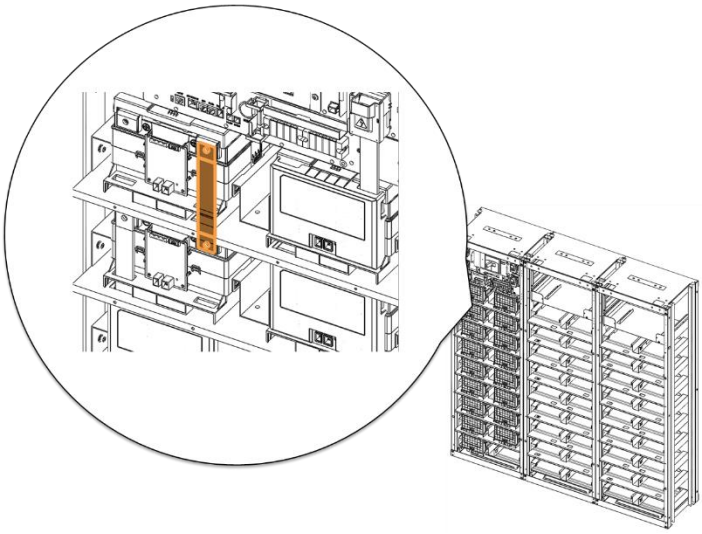


Figure 3-100: Connect Battery Module #16 B+ and Battery Module #17 B-.

41. Reattach Battery Module #16's front cover and remove BCU's B+ power terminal cover.

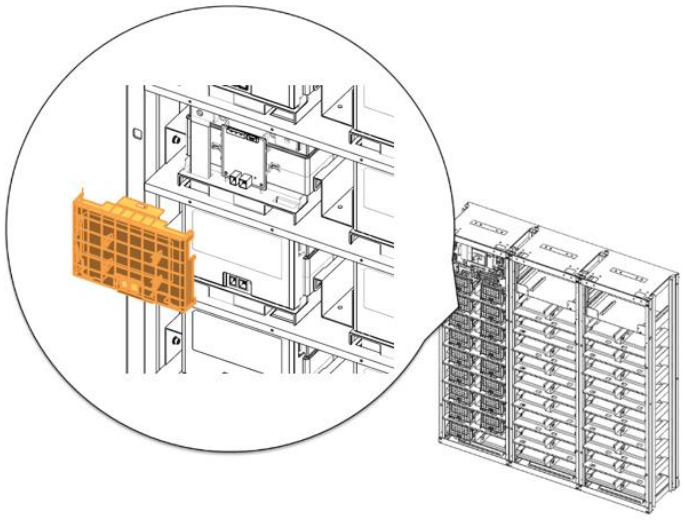


Figure 3-101: Reattach Battery Module #15's Front Cover

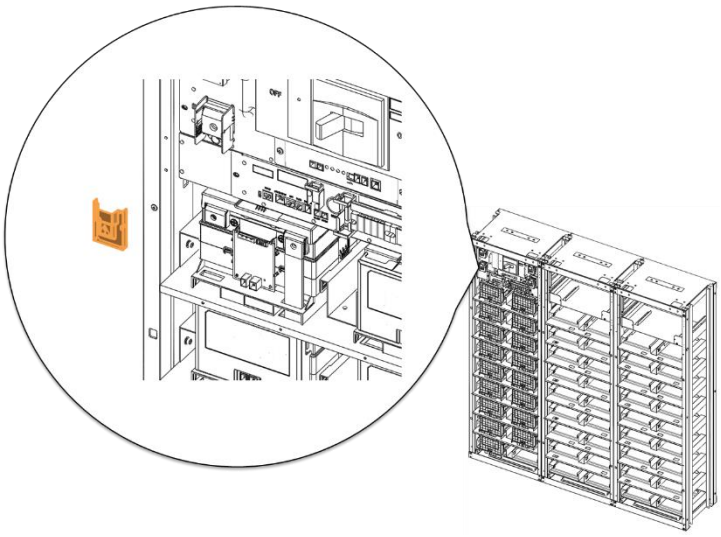


Figure 3-102: Remove BCU B+ Terminal Cover

42. Connect BCU B+ (positive) and Battery Module #17 B+ (positive) using “BUSBAR M TO BCU.” The BCU B+ terminal is connected using an M12xL25 screw and Module #17 B+ terminal is connected using an M8 screw. Measure the contact resistance between the terminal and the busbar.

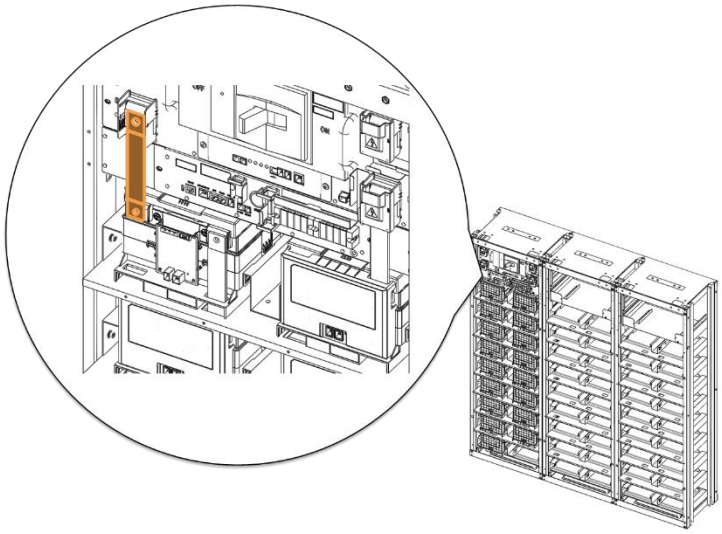


Figure 3-103: Connect BCU B+ and Module #17 B+.

43. Reattach Battery Module #17’s front cover and BCU B+ power terminal cover.

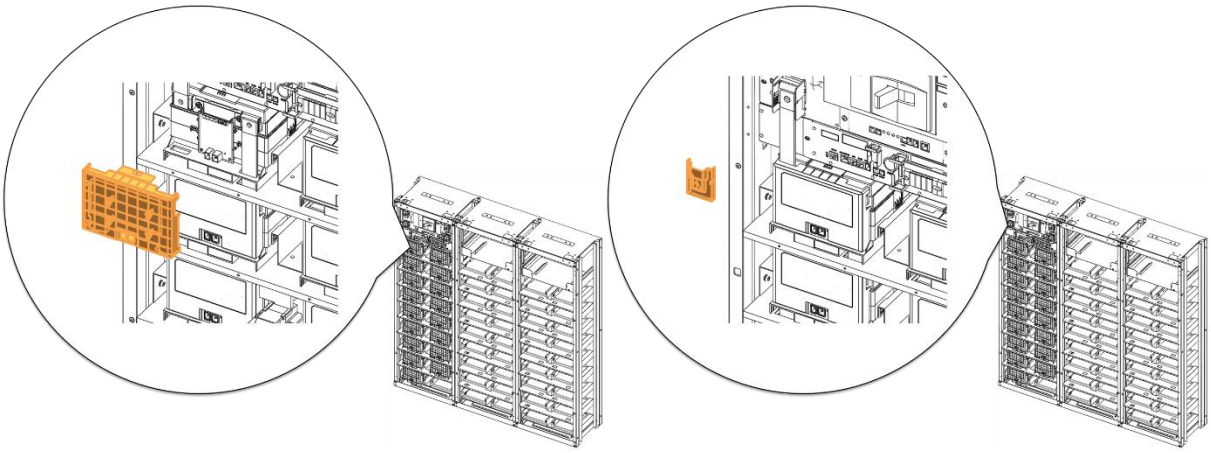


Figure 3-104: Reattach Battery Module #17’s Front Cover and BCU B+ Power Terminal Cover

3.9.6 Module and BCU Signal Cable Connection

Connect the signal cables for the BCU and the Module BMS for each module.

	NOTICE
	Use the proper signal cables as specified by the part numbers below.

	WARNING
	Rack BMS / Module BMS Damage Do not insert both ends of the signal cable WIRE ASSY MODULE TO MODULE #1 or WIRE ASSY MODULE TO MODULE #2 into the same battery module.

1. Connect the signal cable “WIRE ASSY RACK TO MODULE” between the BCU’s “MODULE” connector and Module #1’s “Right Connector”.

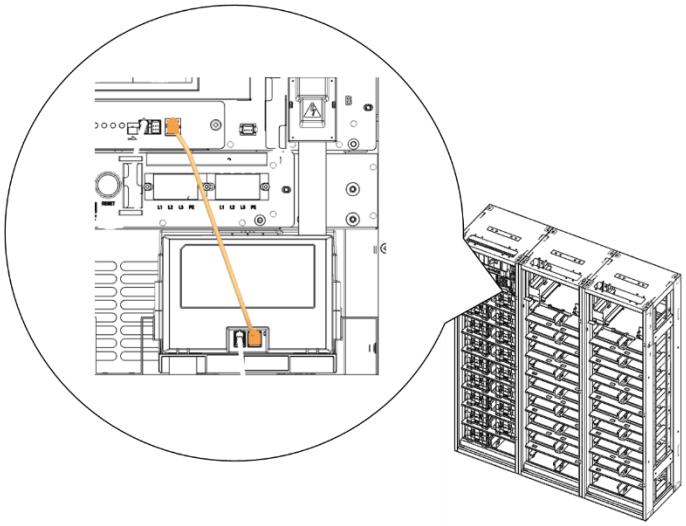


Figure 3-105: BCU to Module #1 Signal Cable

2. Connect the signal cable “WIRE ASSY MODULE TO MODULE #1" from Module #1’s “Left Connector” to Module #2’s “Right Connector.”

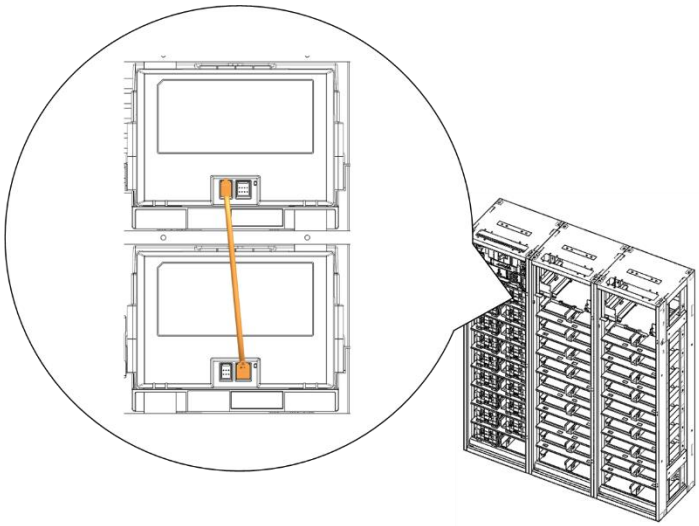


Figure 3-106: Module #1 to Module #2 Signal Cabling

3. Connect the signal cable “WIRE ASSY MODULE TO MODULE #1" from Module #2’s “Left Connector” to Module #3’s “Right Connector.”

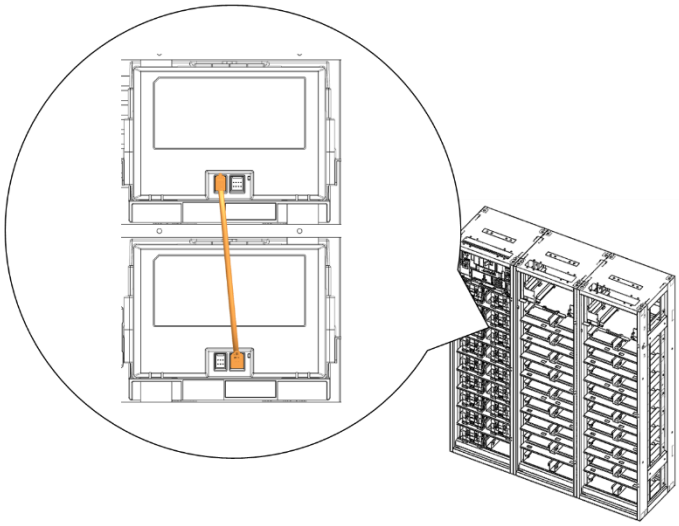


Figure 3-107: Module #2 to Module #3 Signal Cabling

4. Connect the signal cable “WIRE ASSY MODULE TO MODULE #1" from Module #3’s “Left Connector” to Module #4’s “Right Connector.”

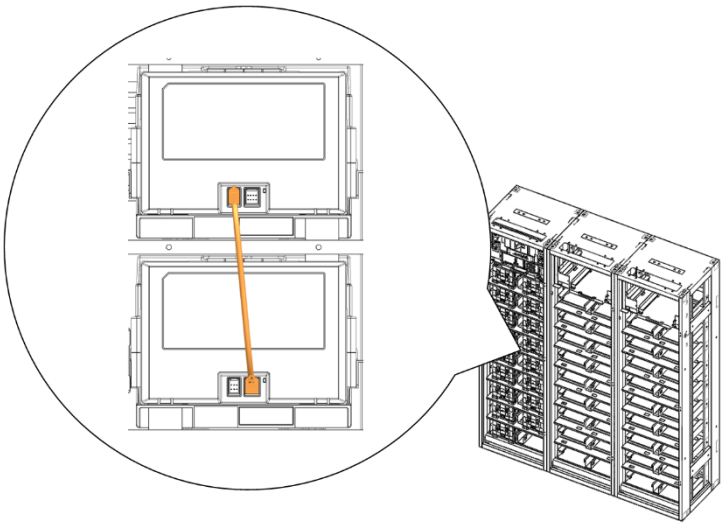


Figure 3-108: Module #3 to Module #4 Signal Cabling

5. Connect the signal cable “WIRE ASSY MODULE TO MODULE #1" from Module #4’s “Left Connector” to Module #5’s “Right Connector.”

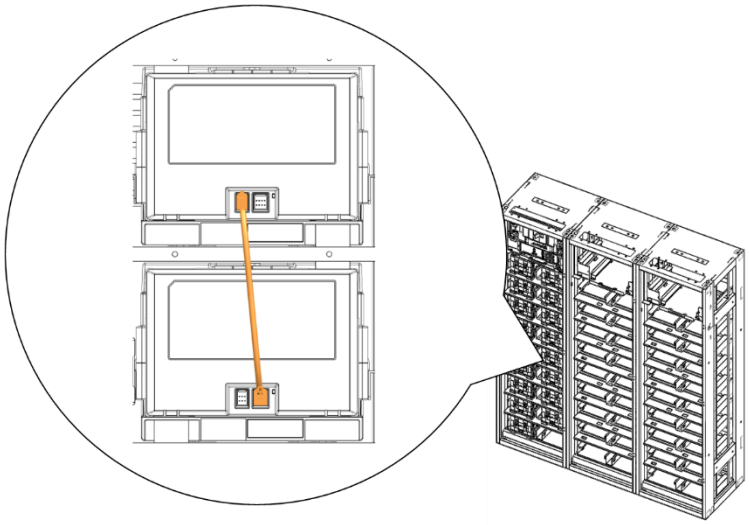


Figure 3-109: Module #4 to Module #5 Signal Cabling

6. Connect the signal cable “WIRE ASSY MODULE TO MODULE #1" from Module #5’s “Left Connector” to Module #6’s “Right Connector”.

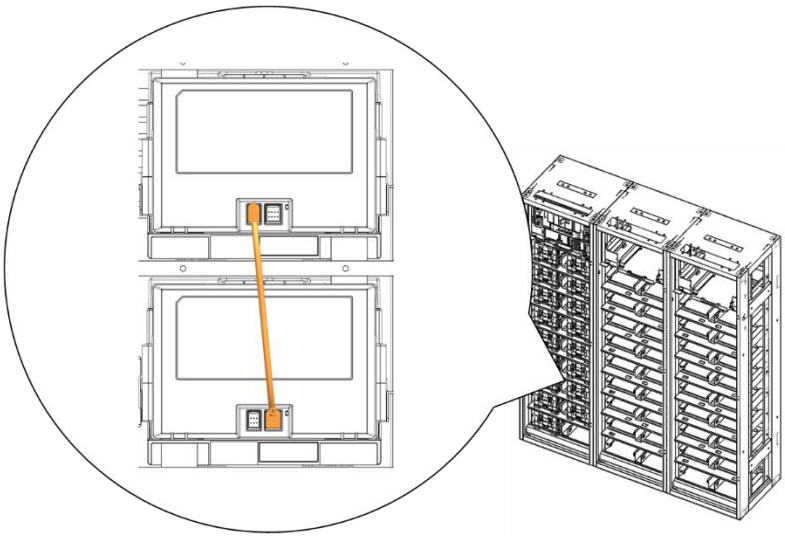


Figure 3-110: Module #5 to Module #6 Signal Cabling

7. Connect the signal cable “WIRE ASSY MODULE TO MODULE #1" from Module #6’s “Left Connector” to Module #7’s “Right Connector.”

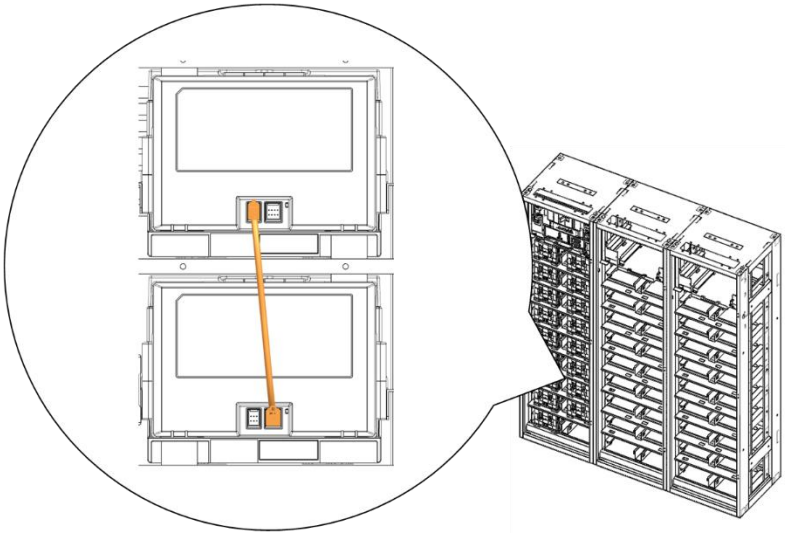


Figure 3-111: Module #6 to Module #7 Signal Cabling

8. Connect the signal cable “WIRE ASSY MODULE TO MODULE #1" from Module #7’s “Left connector” to Module #8’s “Right connector”.

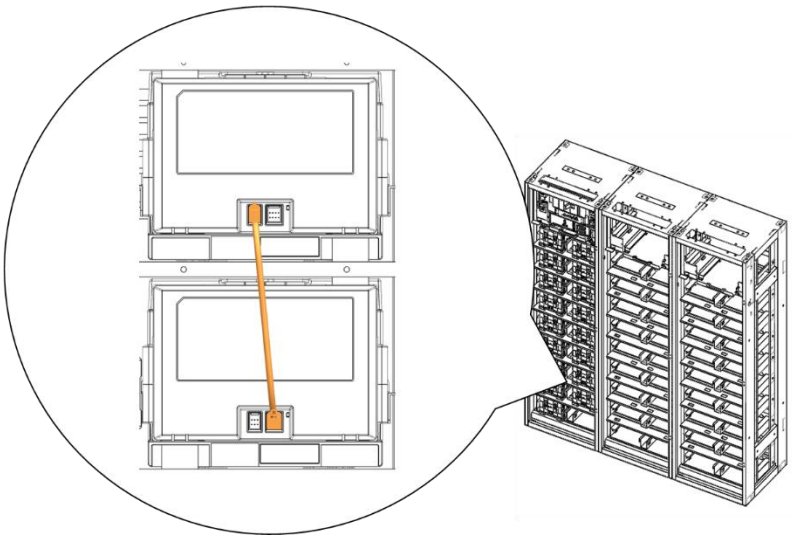


Figure 3-112: Module #7 to Module #8 Signal Cabling

9. Connect the signal cable “WIRE ASSY MODULE TO MODULE #2" from Module #8’s “Left Connector” to Module #9’s “Right Connector.”

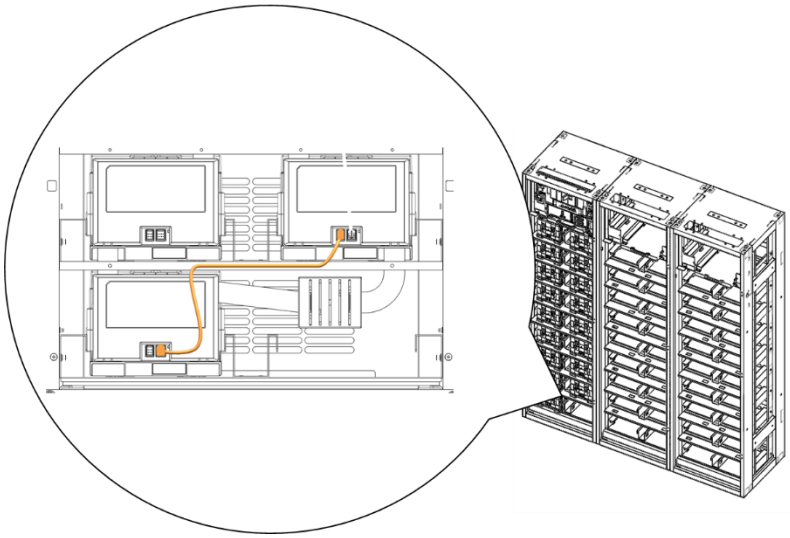


Figure 3-113: Module #8 to Module #9 Signal Cabling

10. Connect the signal cable “WIRE ASSY MODULE TO MODULE #1" from Module #9’s “Left Connector” to Module #10’s “Right Connector.”

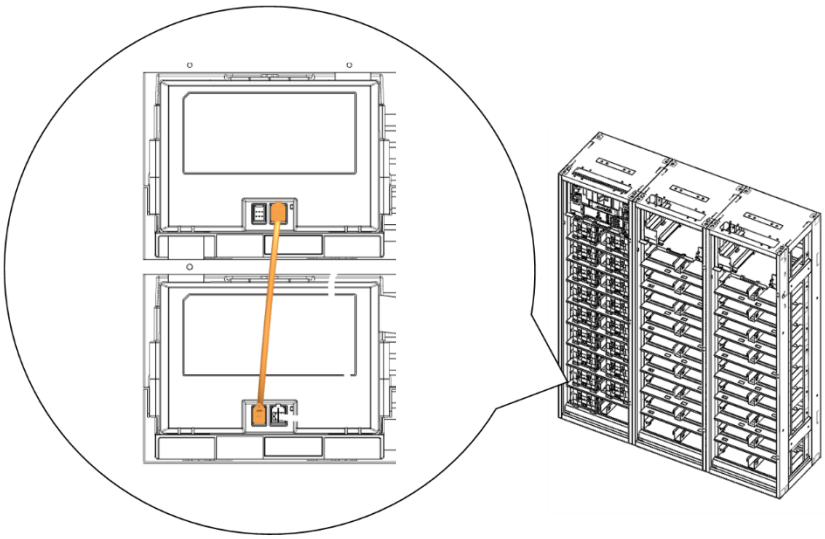


Figure 3-114: Module #9 to Module #10 Signal Cabling

11. Connect the signal cable “WIRE ASSY MODULE TO MODULE #1" from Module #10’s “Left Connector” to Module #11’s “Right Connector.”

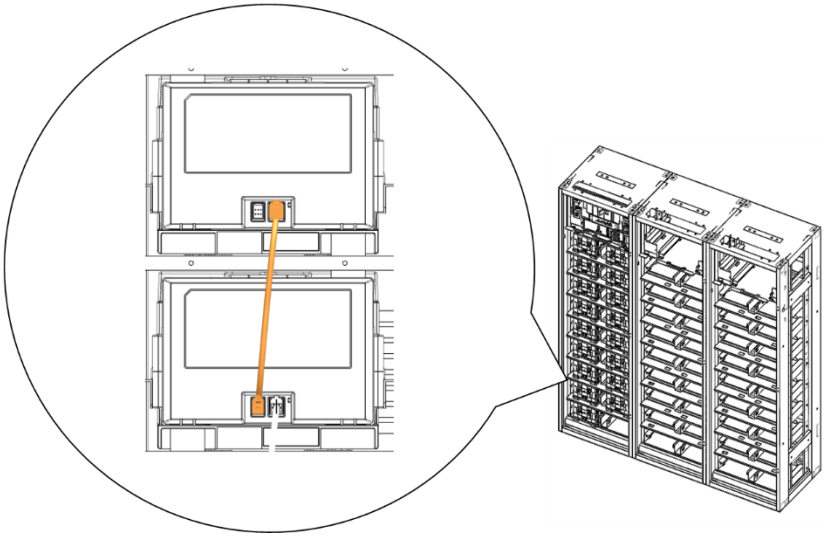


Figure 3-115: Module #10 to Module #11 Signal Cabling

12. Connect the signal cable “WIRE ASSY MODULE TO MODULE #1" from Module #11’s “Left Connector” to Module #12’s “Right Connector.”

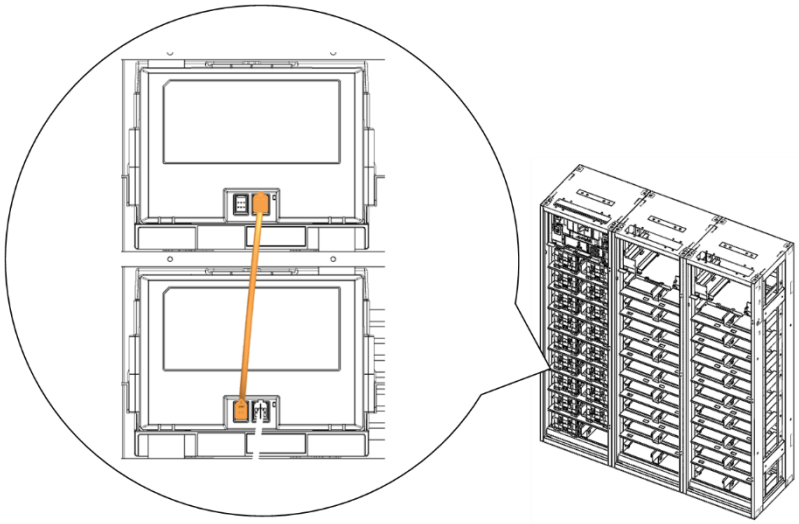


Figure 3-116: Module #11 to Module #12 Signal Cabling

13. Connect the signal cable “WIRE ASSY MODULE TO MODULE #1" from Module #12’s “Left Connector” to Module #13’s “Right Connector.”

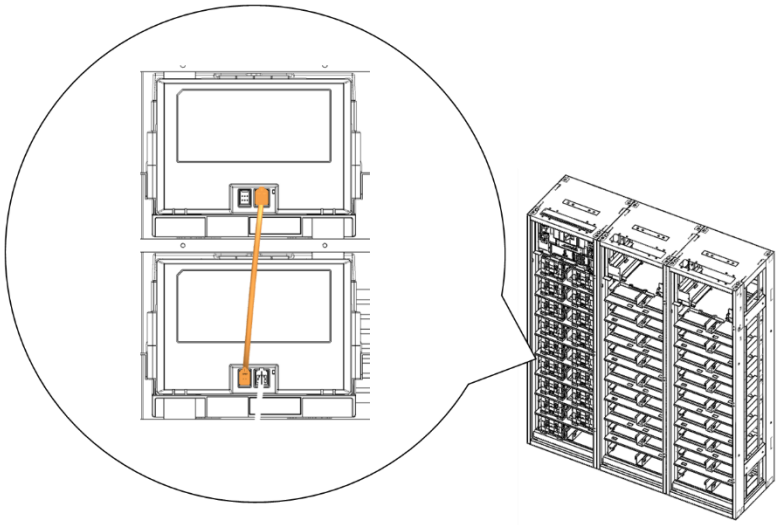


Figure 3-117: Module #12 to Module #13 Signal Cabling

14. Connect the signal cable “WIRE ASSY MODULE TO MODULE #1" from Module #13’s “Left Connector” to Module #14’s “Right Connector.”

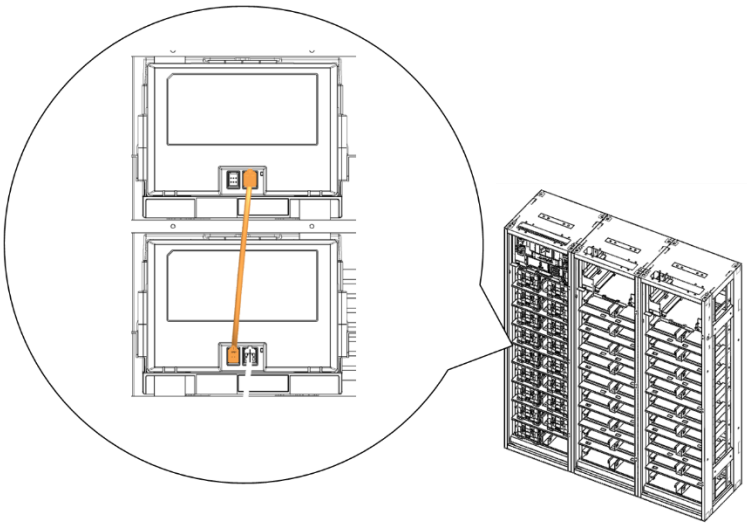


Figure 3-118: Module #13 to Module #14 Signal Cabling

15. Connect the signal cable “WIRE ASSY MODULE TO MODULE #1" from Module #14’s “Left Connector” to Module #15’s “Right Connector.”

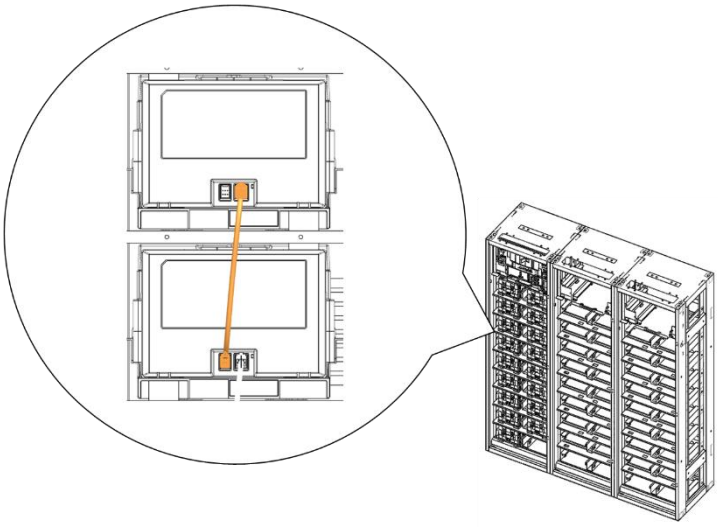


Figure 3-119: Module #14 to Module #15 Signal Cabling

16. Connect the signal cable “WIRE ASSY MODULE TO MODULE #1" from Module #15’s “Left Connector” to Module #16’s “Right Connector.”

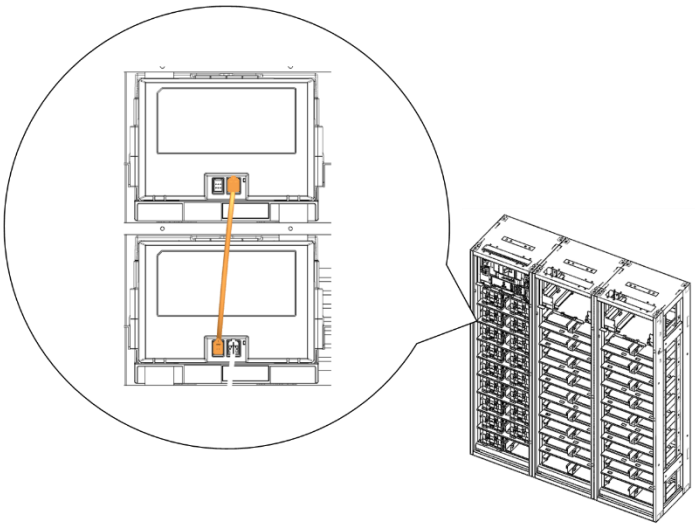


Figure 3-120: Module #15 to Module #16 Signal Cabling

17. Connect the signal cable “WIRE ASSY MODULE TO MODULE #1" from Module #16’s “Left Connector” to Module #17’s “Right Connector”.

No connection to Module #17 “Left Connector” is needed, leave empty.

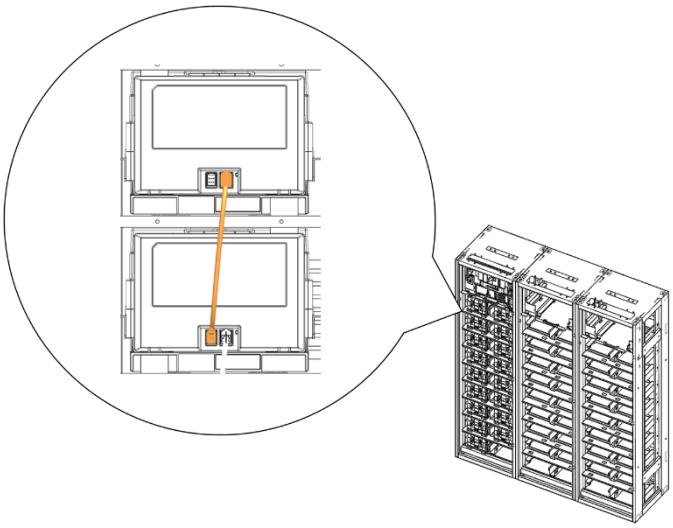


Figure 3-121: Module #16 to Module #17 Signal Cabling

18. For a multiple rack system, connect the signal cables “WIRE ASSY RACK TO RACK #2” between each rack’s BCU. Push the pre-punched hole to pass the signal cable through the circular hole in the side of the rack frame and through the opening above the top shelf of battery modules.

	NOTICE
	See the examples for correct signal cable wire connections for both left and right rack alignments.

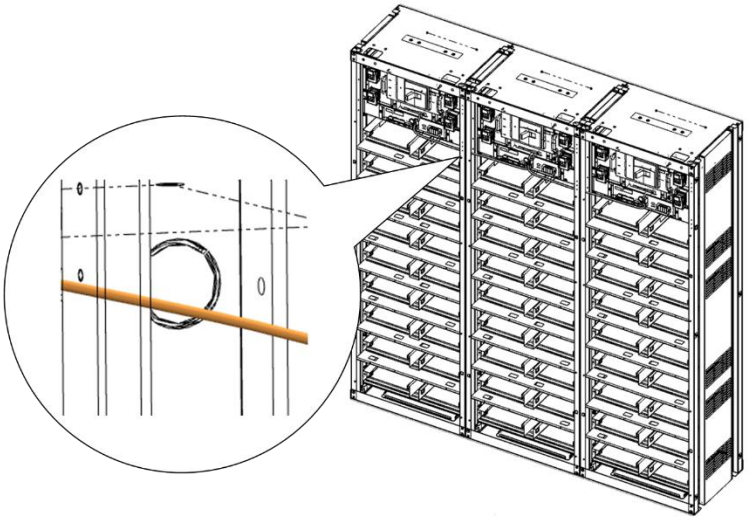


Figure 3-122: Pre-Punched Hole for Signal Cable

BCU-to-BCU Signal Cabling Connection Examples for Multiple Rack Systems (System BMS on the left)

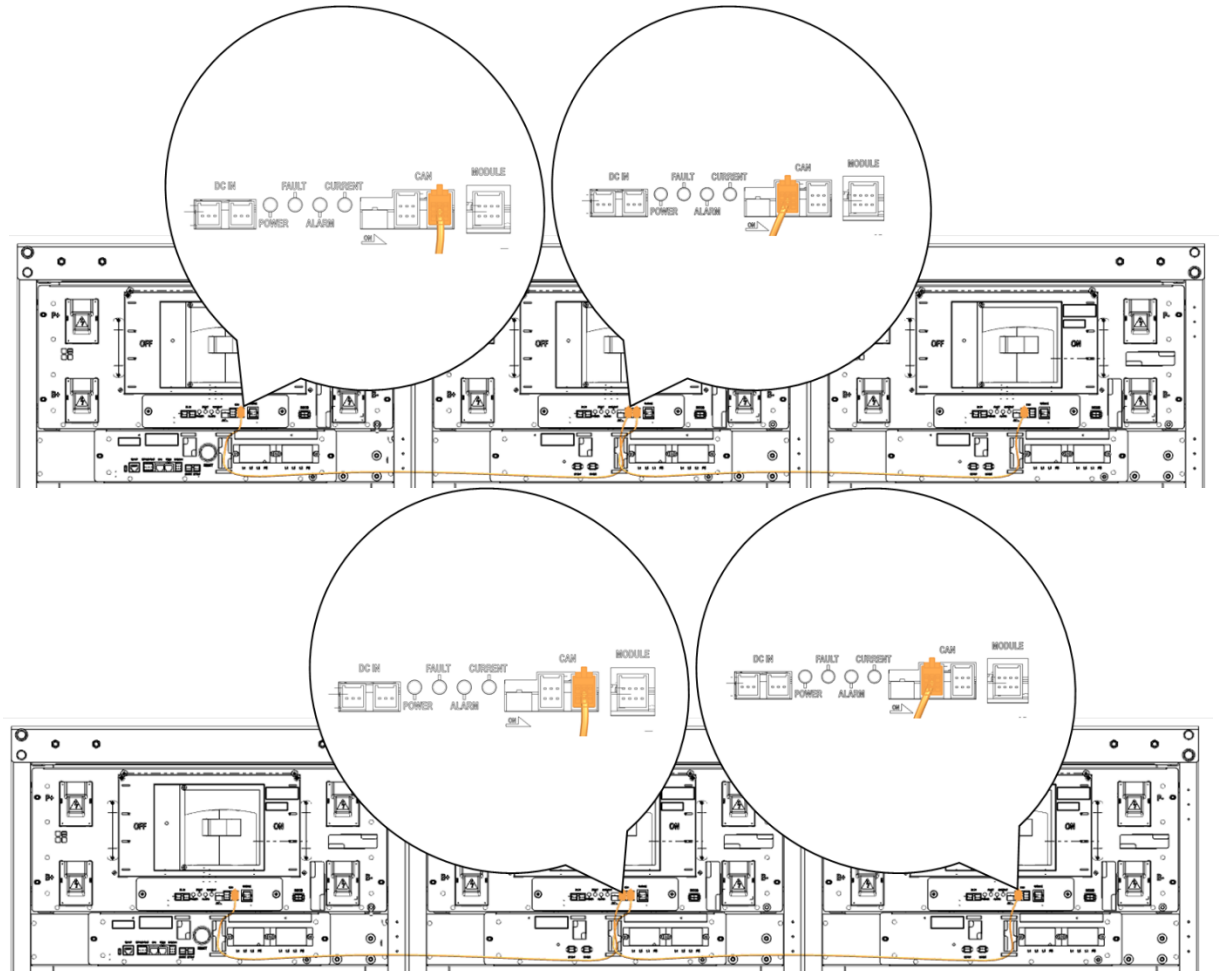


Figure 3-123: BCU-to-BCU Signal Cabling Connection Examples (System BMS on the left)

19. Turn the termination resistor switch ON for the last BCU in the CANbus loop.

When the termination resistor DIP switch is toggled to the right, it is ON (terminated). When the termination resistor DIP switch is toggled to the right, it is OFF (unterminated). Only the last rack in the battery bank has its termination resistor in the ON state, all other racks have their termination resistor in the OFF state.

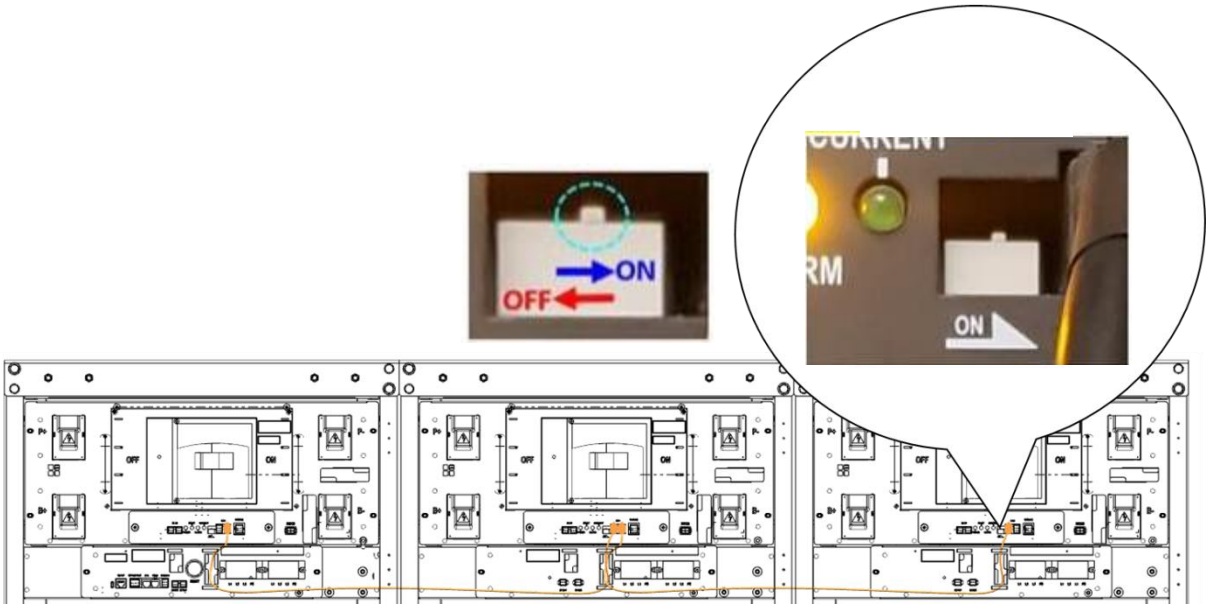


Figure 3-124: Termination Resistor Setting for Last BCU

	NOTICE
	Factory-provided cable lengths are adequate for systems with rack frames bolted together. Different configurations may require cable length modification.

3.9.7 SMPS Assembly and BCU Power Cable Connection

Connect the BCU DC power cables.

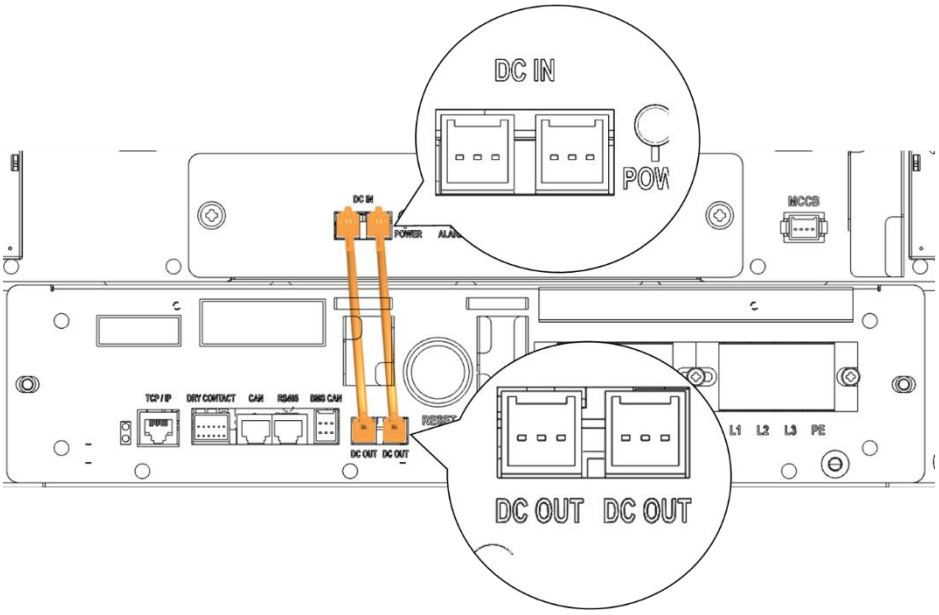


Figure 3-125: DC Power Cables from SMPS Assembly 3 Phase Type A to BCU

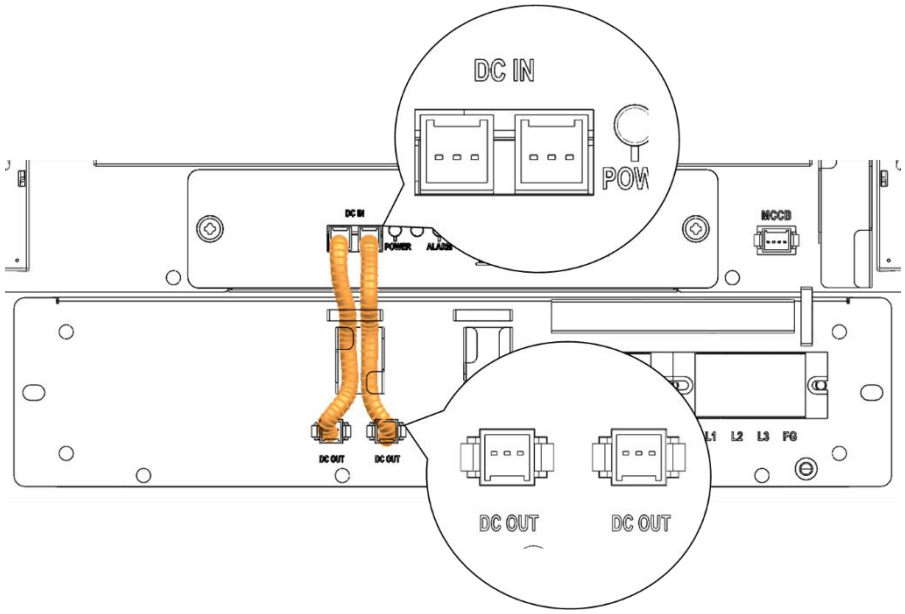


Figure 3-126: DC Power Cables from SMPS Assembly 3 Phase Type B to BCU

3.9.8 SMPS Assembly and BCU Signal Cable Connection

The following steps are only for SMPS Assembly Type A.

44. Connect the signal cable from the SMPS Assembly to BCU “WIRE ASSY RACK TO SYSTEM.”

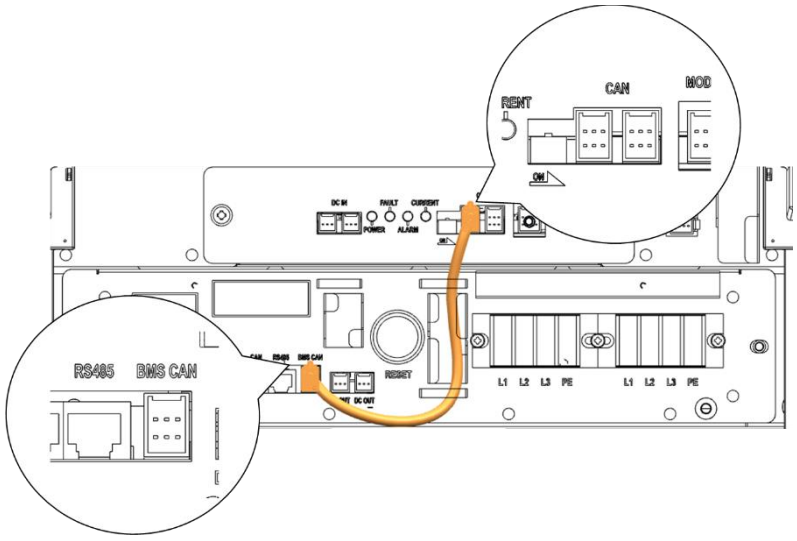


Figure 3-127: CAN Signal Cable Connection from SMPS Assembly 3 Phase Type A to BCU

45. Connect the MODBUS TCP/IP Cable[4] to the SMPS Assembly Type A “TCP/IP” connector (or MODBUS RS-485 Cable to “RS485” connector, if used).

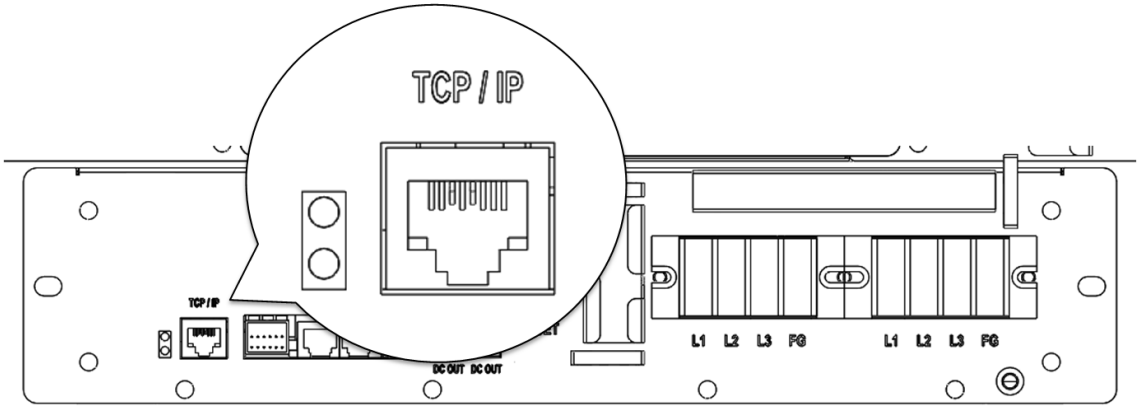


Figure 3-128: TCP/IP Cable Connection to SMPS Assembly

46. Connect the Dry Contact Cable to the SMPS Assembly Type A “Dry Contact” connector.

[4] Not factory-provided. Must be provided by the installer or customer.

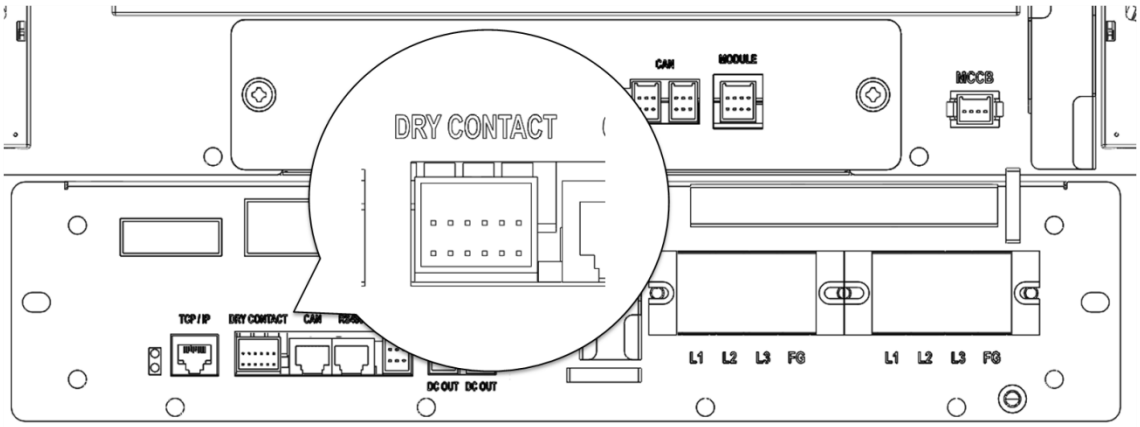


Figure 3-129: Dry Contact Cable Connection to SMPS Assembly

47. Optional: Connect the BCU MCCB Cable (not provided by Samsung SDI).

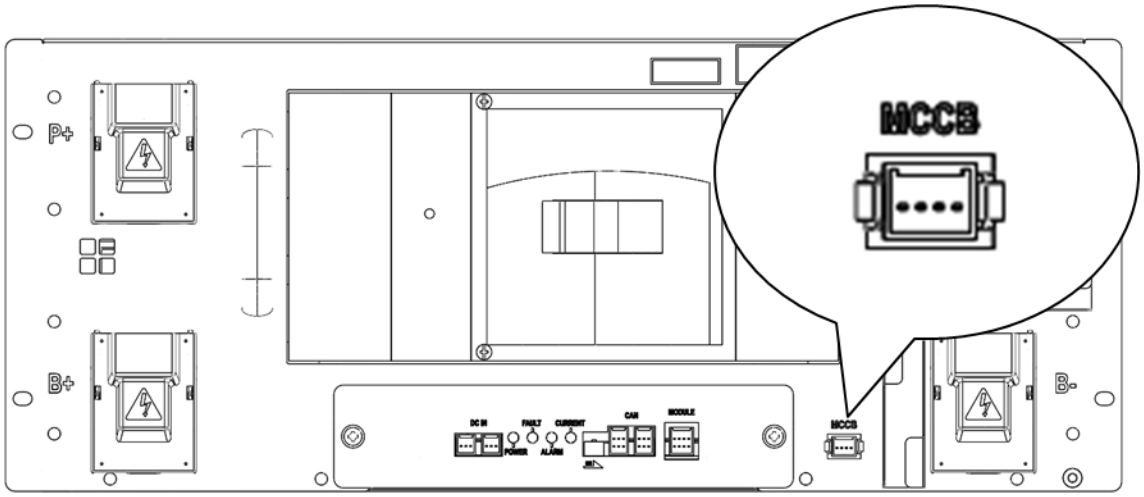


Figure 3-130: MCCB Optional Auxiliary Connection

3.9.9 SMPS Assembly AC Input Connection

48. Remove the protective covers from the AC input terminals.

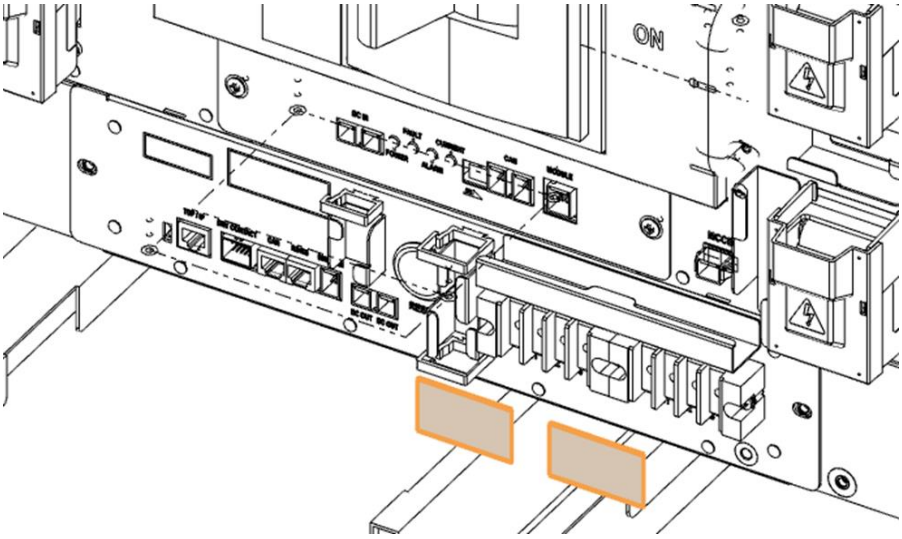


Figure 3-131: AC Input Terminals of SMPS Assembly 3 Phase Type A

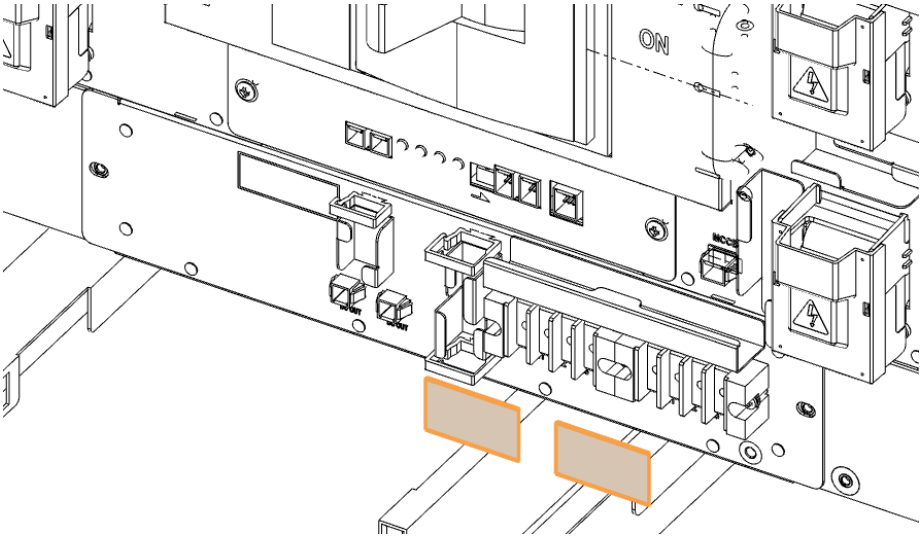


Figure 3-132: AC Input Terminals of SMPS Assembly 3 Phase Type B

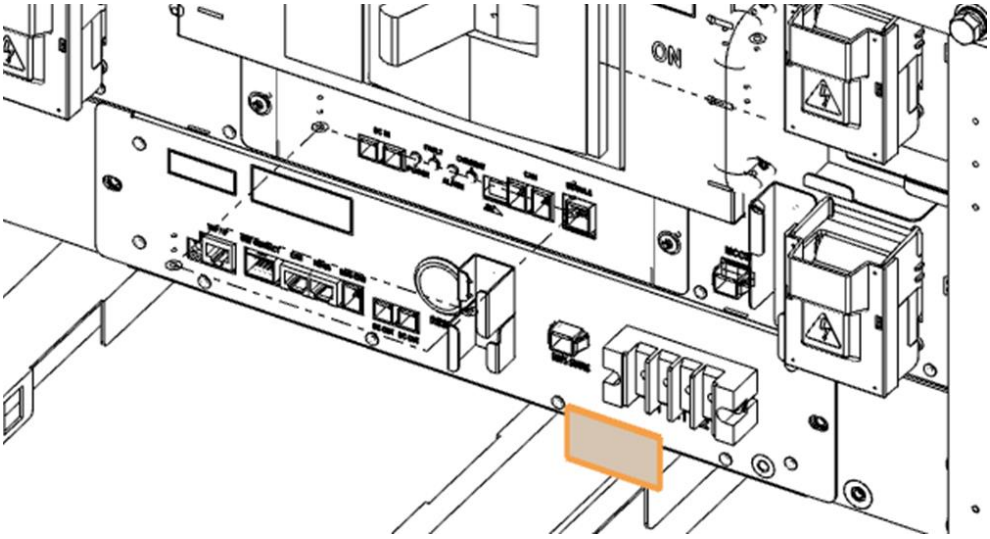


Figure 3-133: AC Input Terminals of SMPS Assembly 1 Phase Type A

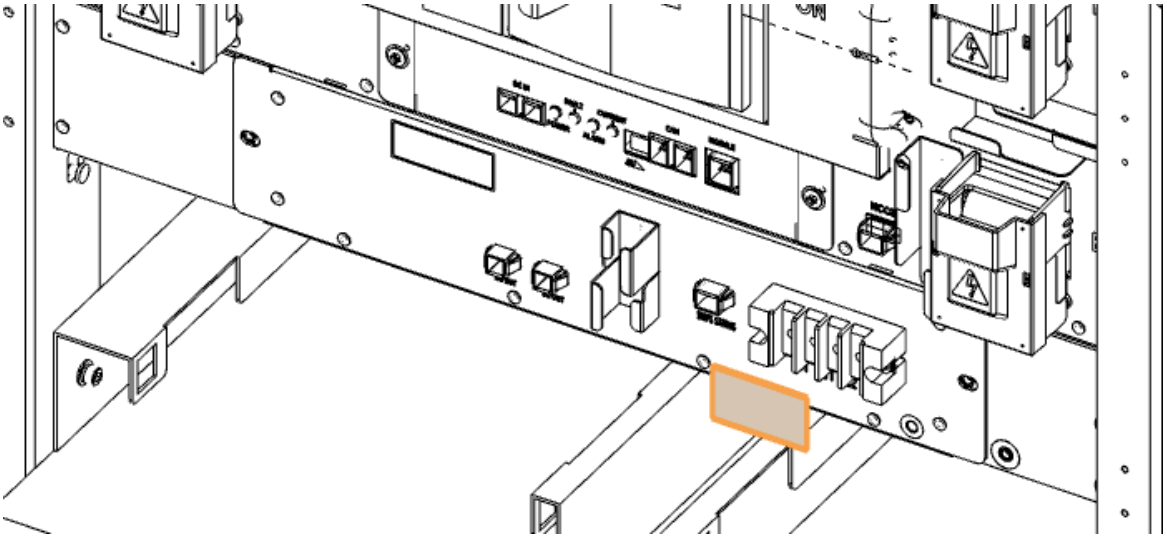


Figure 3-134: AC Input Terminals of SMPS Assembly 1 Phase Type B

49. Connect each AC input in the SMPS Assembly. Prior to connection, make sure the AC cables are not energized.[5]

Fasten the screws using a torque value of 1.274–1.667 Nm (13–17 kgf·cm).

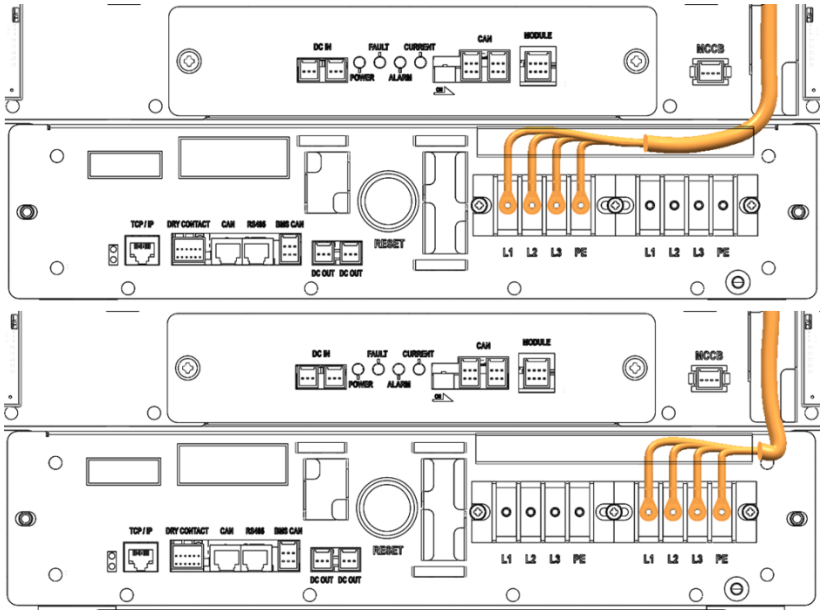


Figure 3-135: SMPS Assembly 3 Phase Type A - AC Input Terminals with Cables Attached

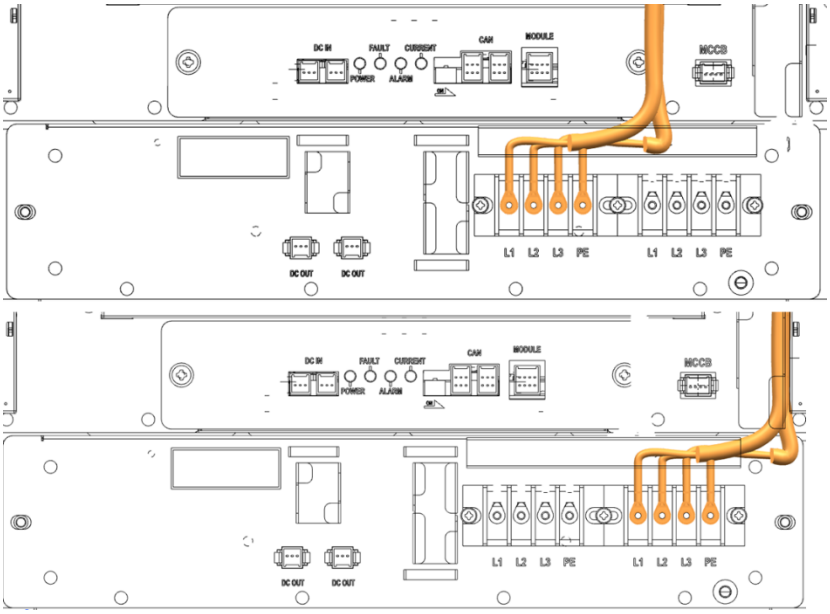


Figure 3-136: SMPS Assembly 3 Phase Type B - AC Input Terminals with Cables Attached

[5] AC Cables are not factory-provided. They must be provided by the installer or customer.

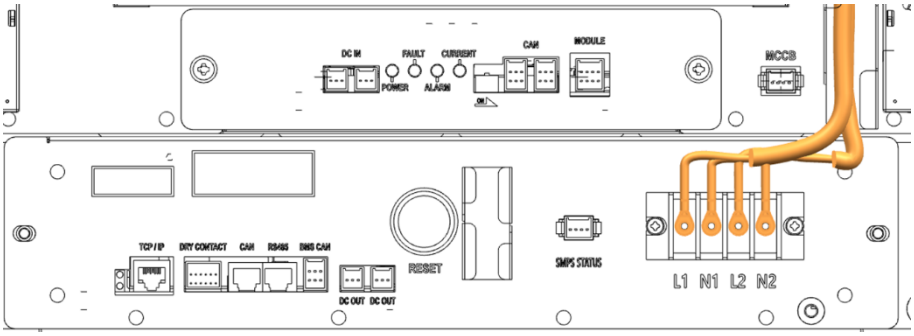


Figure 3-137: SMPS Assembly 1 Phase Type A - AC Input Terminals with Cables Attached

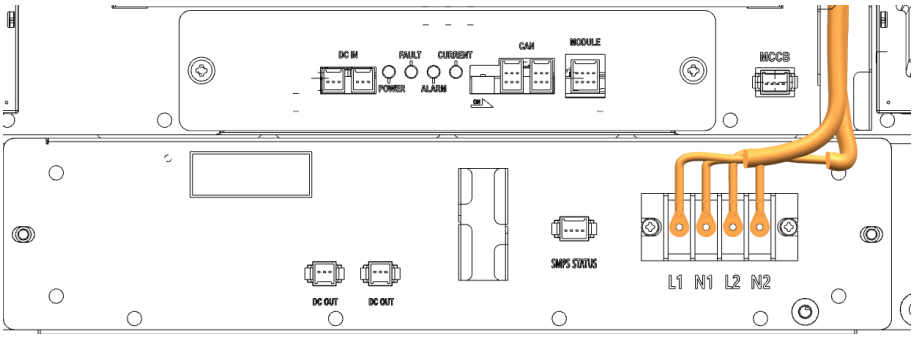


Figure 3-138: SMPS Assembly 1 Phase Type B - AC Input Terminals with Cables Attached

50. Reattach the protective covers to the AC input.

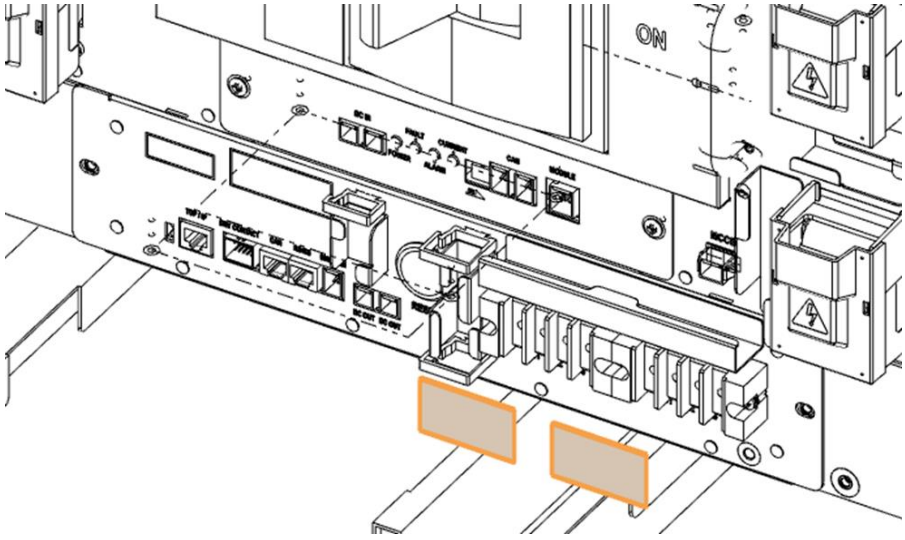


Figure 3-139: AC Input Terminals of SMPS Assembly 3 Phase Type A

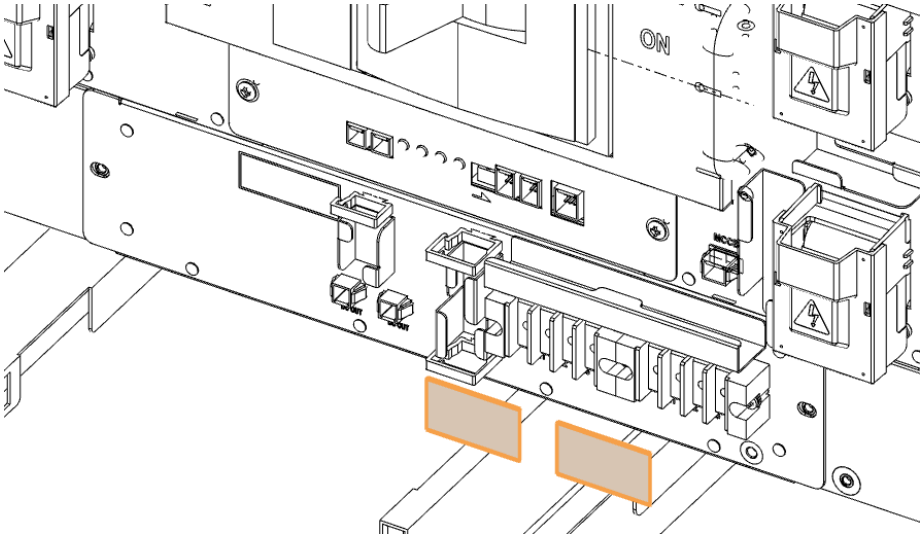


Figure 3-140: AC Input Terminals of SMPS Assembly 3 Phase Type B

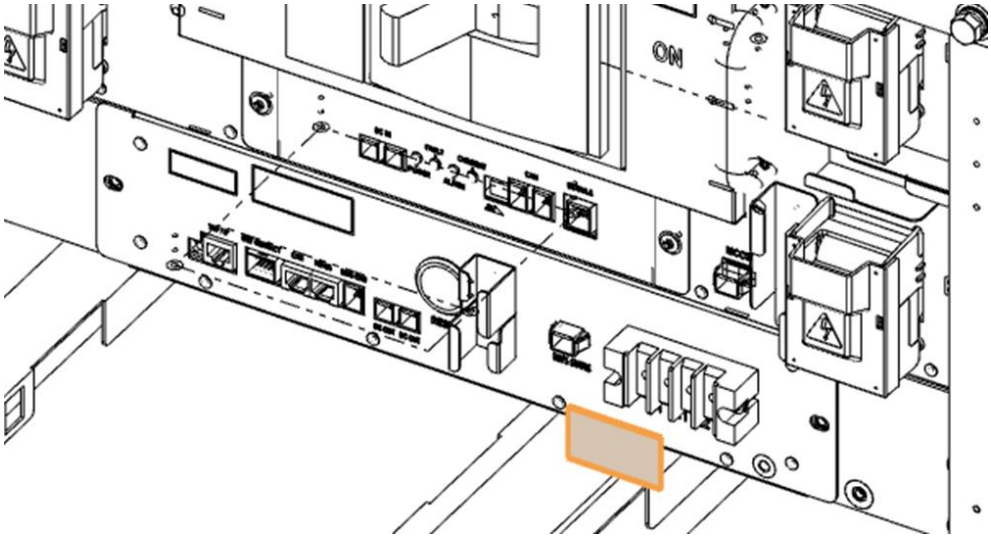


Figure 3-141: AC Input Terminals of SMPS Assembly 1 Phase Type A

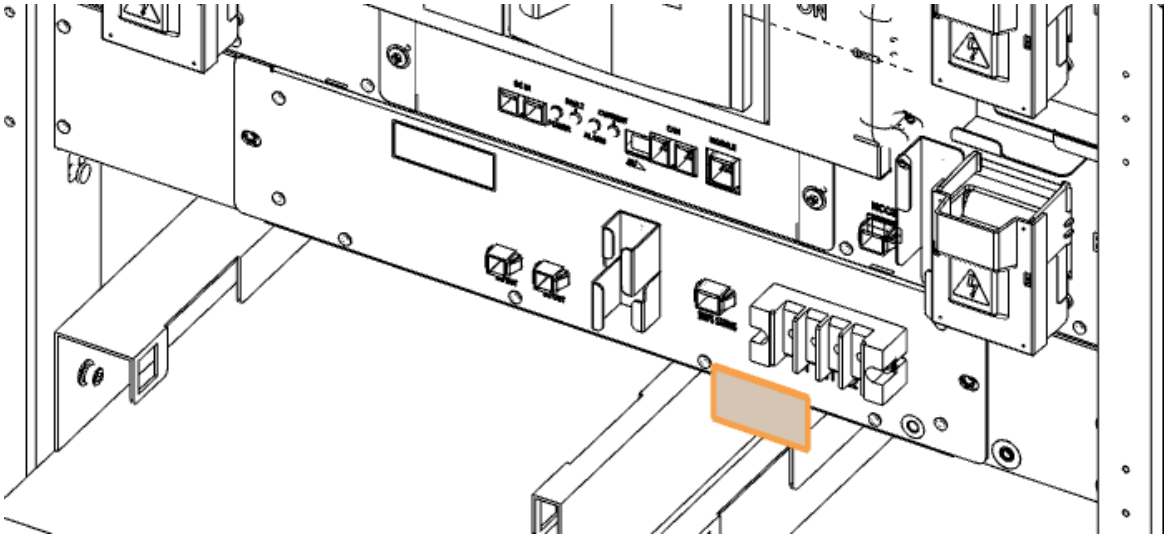


Figure 3-142: AC Input Terminals of SMPS Assembly 1 Phase Type B

3.9.10 DC Link Cable Connection

51. Connect a ground cable (not provided by Samsung SDI) to the rack frame.

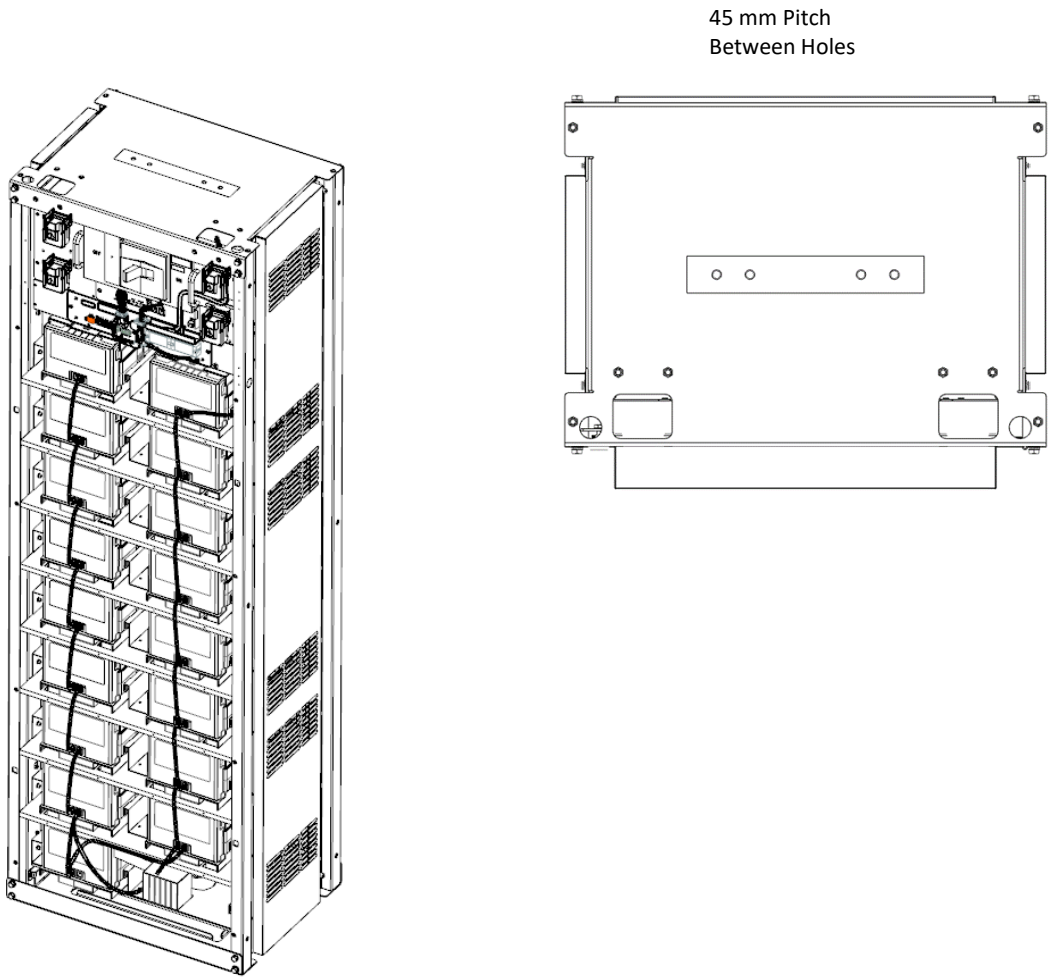


Figure 3-143: Grounding Points (4 EA)

⚠	***NOTICE***
	Connect the rack ground wire with an M12 screw. Rack ground screws and cables are not factory-provided and must be provided by the installer or customer. The fastening torque should be 30 Nm (300 kgf·cm).

52. Connect the DC link high-voltage terminals from the UPS.

	CAUTION
	Verify with a voltmeter that no power is present on the system. Disconnect all input power supplies. Use lock out/tag out procedures to secure the UPS and battery system before beginning this step. In this step, the battery and UPS are isolated by the BCU because the circuit breaker in the BCU is opened.

	NOTICE
	Connect the high-voltage terminals using an M12 bolt. The fastening torque should be 30 Nm (300 kgf·cm).

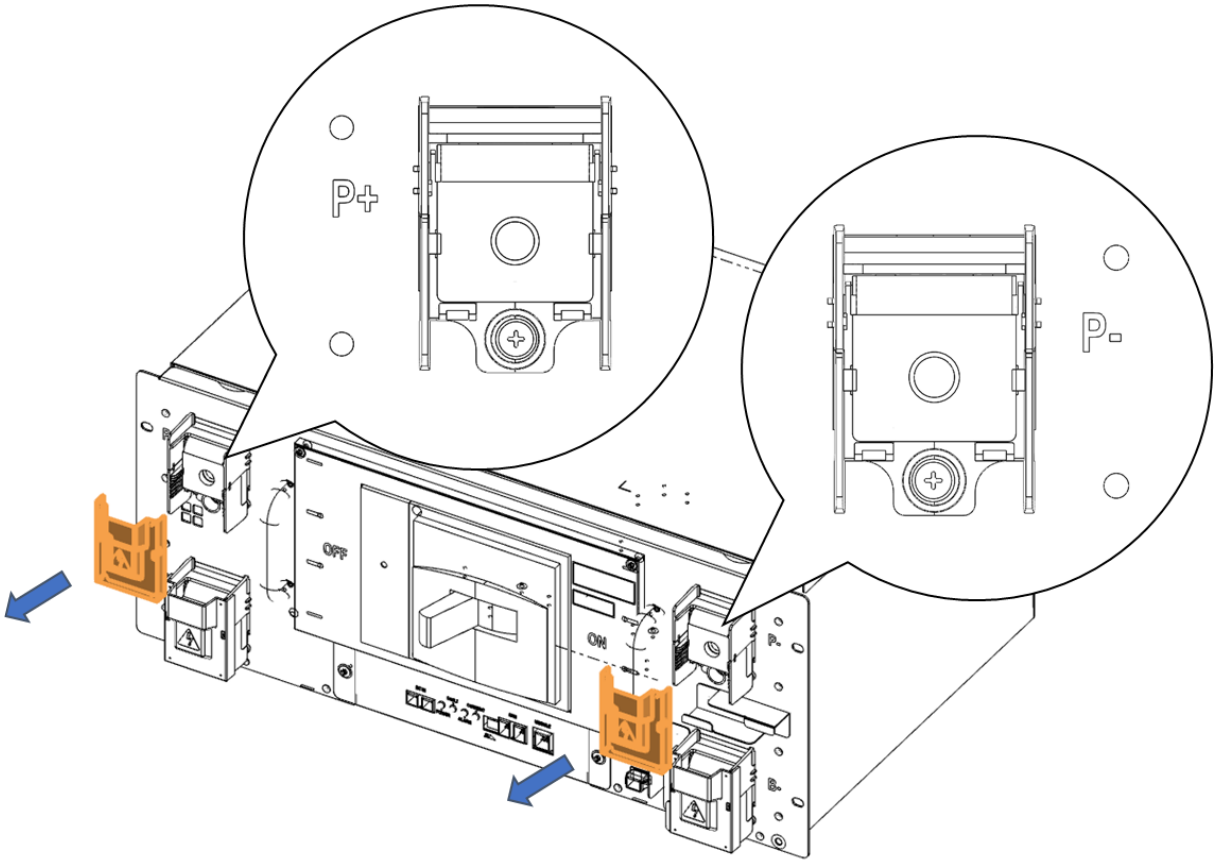
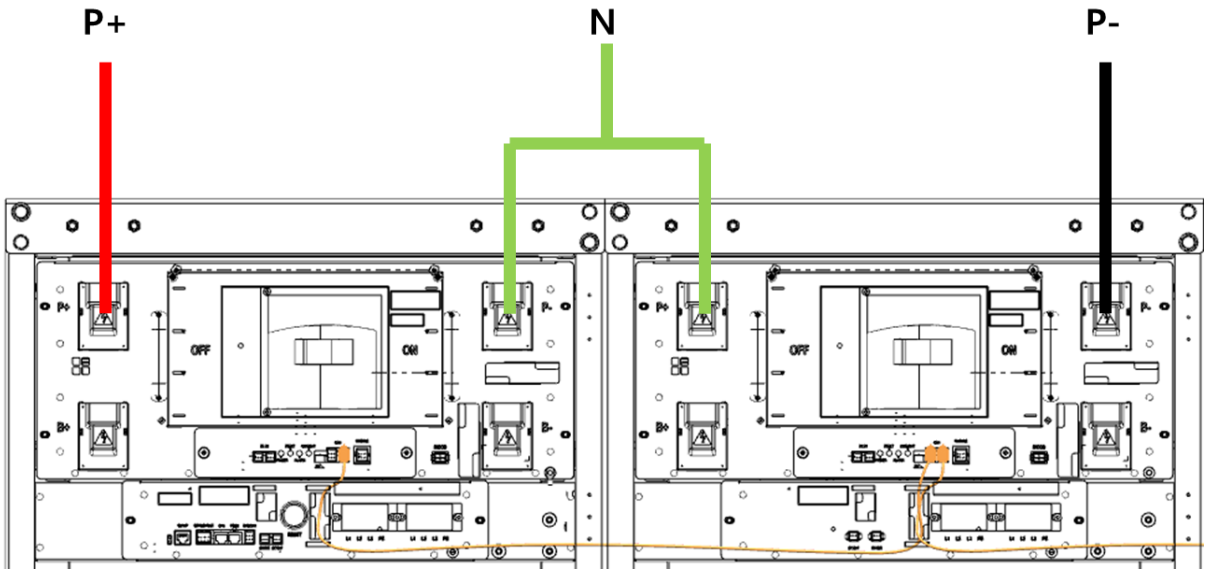


Figure 3-144: Connecting the DC Link High Current Terminals

53. Special case: if connecting the battery system in a three-wire system, connect two racks to the three-wire DC bus connection according to the diagram below. The System BMS must be specially configured to operate correctly with this connection.



After installation is complete, check the following:

- Bolt fastening condition
- Screw fastening torque by sampling
- High-voltage cable connection
- Module connections
- BCU connections

3.9.11 AC Input Commissioning

When the installation of the battery system is complete, the SMPS Assembly's AC inputs must be powered to turn the BMS on.

3.9.12 Communication Check

After installation, wiring, and configuration are completed, check the communication status by connecting the TCP/IP cable and run the MODBUS program to see whether the System BMS shows the data of the Rack BMS correctly.

3.9.12.1 PC IP Setting for Communication with the System BMS

⚠	***NOTICE***
	The following guide for IP setting is made for PCs that operate Microsoft® Windows® 7. Other versions of Windows may be different.

54. Checking the Data of the System BMS requires changing the IP settings in the notebook PC to be used.

55. Click the "**START**" button in the desktop's status bar (①) to open the Start menu.

56. Click "**Network**" (②). If "Network" menu is not available, click "Control Panel"

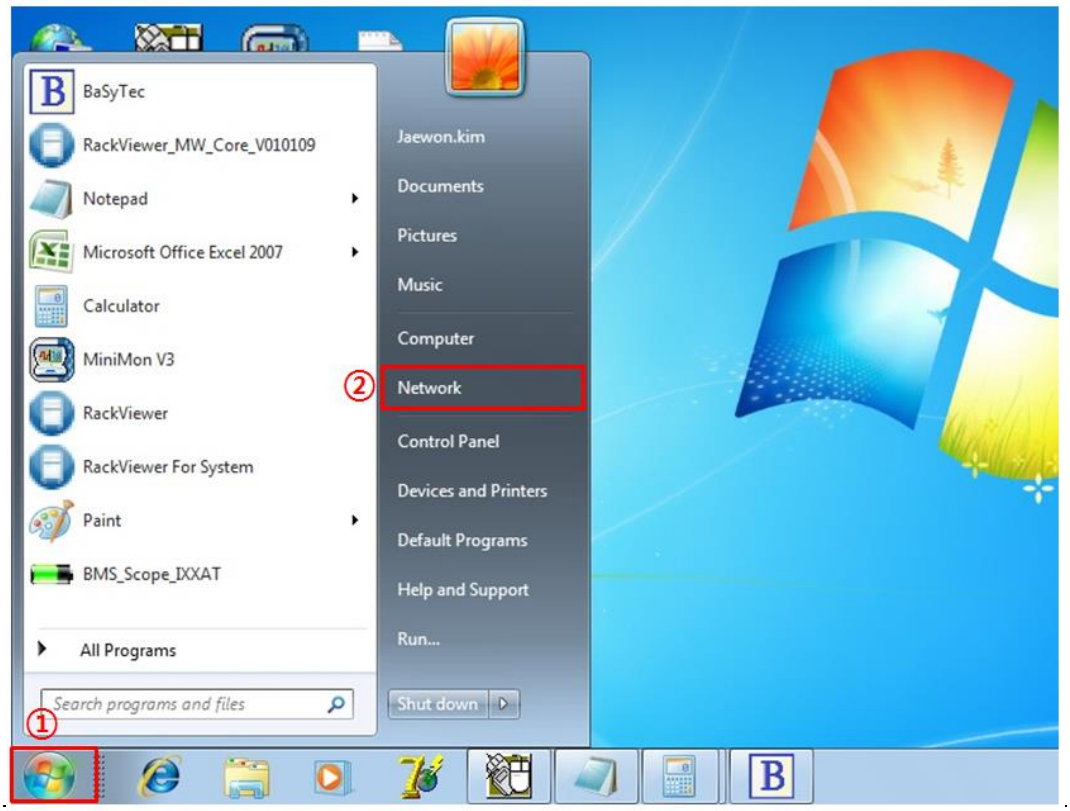


Figure 3-145: Open "Network"

57. When the Network window appears, click "**Network and Sharing Center**" (③).

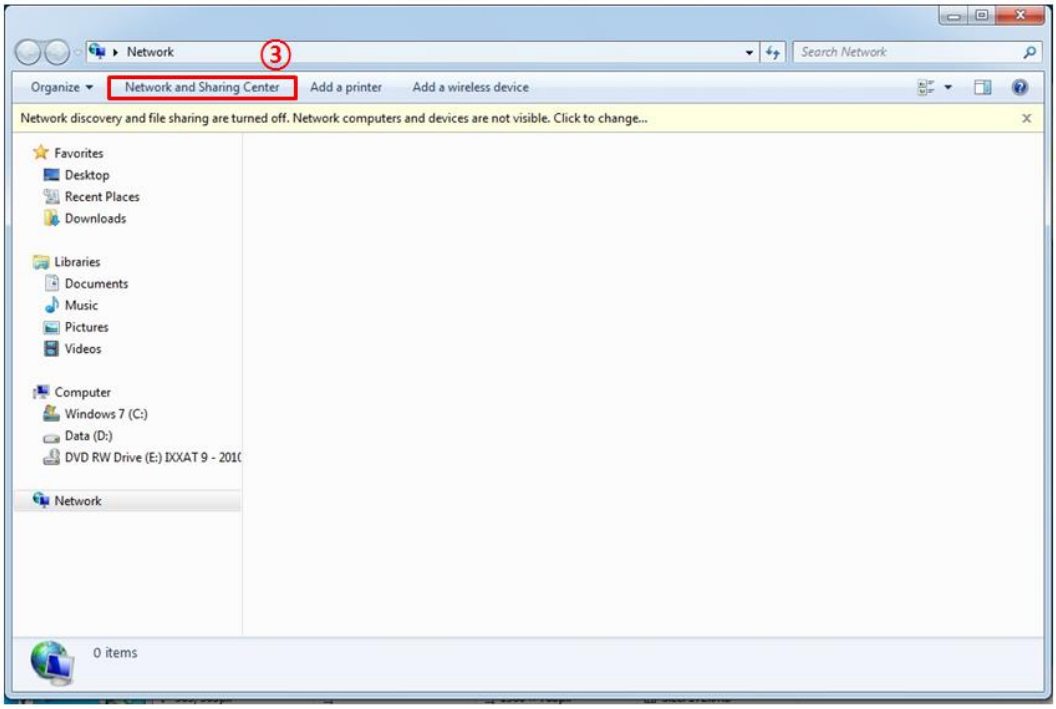


Figure 3-146: Open “Network and Sharing Center”

58. When the following window appears, click “**Change adapter settings**” (④).

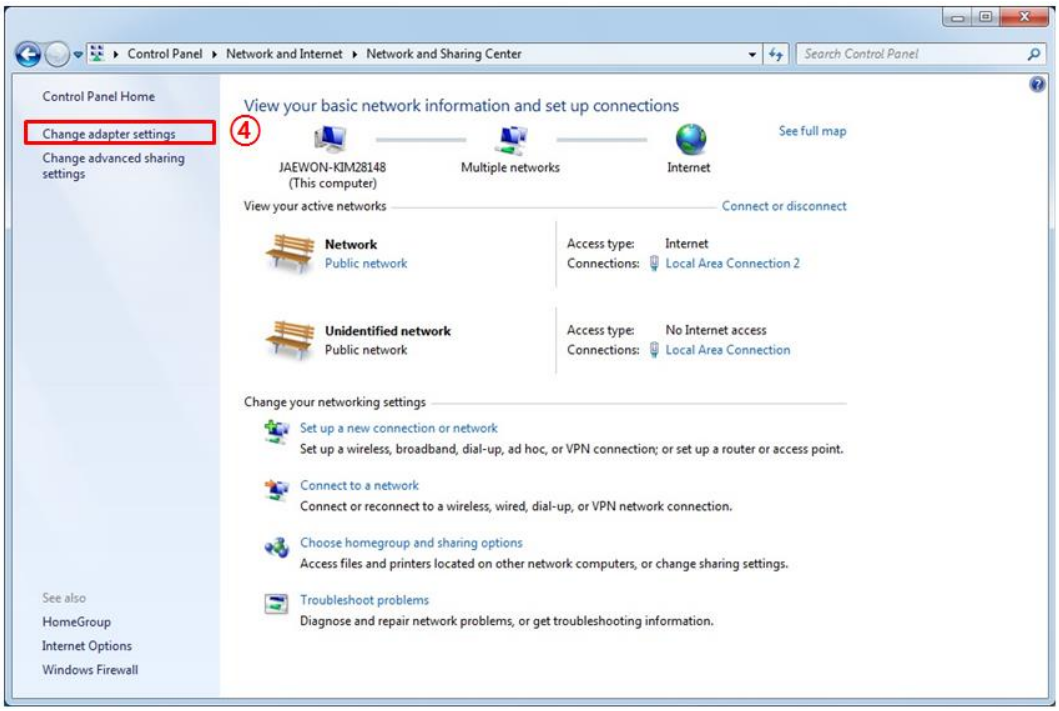


Figure 3-147: Open “Change adapter settings”

59. When the Network connections window appears, right-click "**Local Area Connection**"(⑤). When the popup menu appears, click "**Properties**" (⑥).

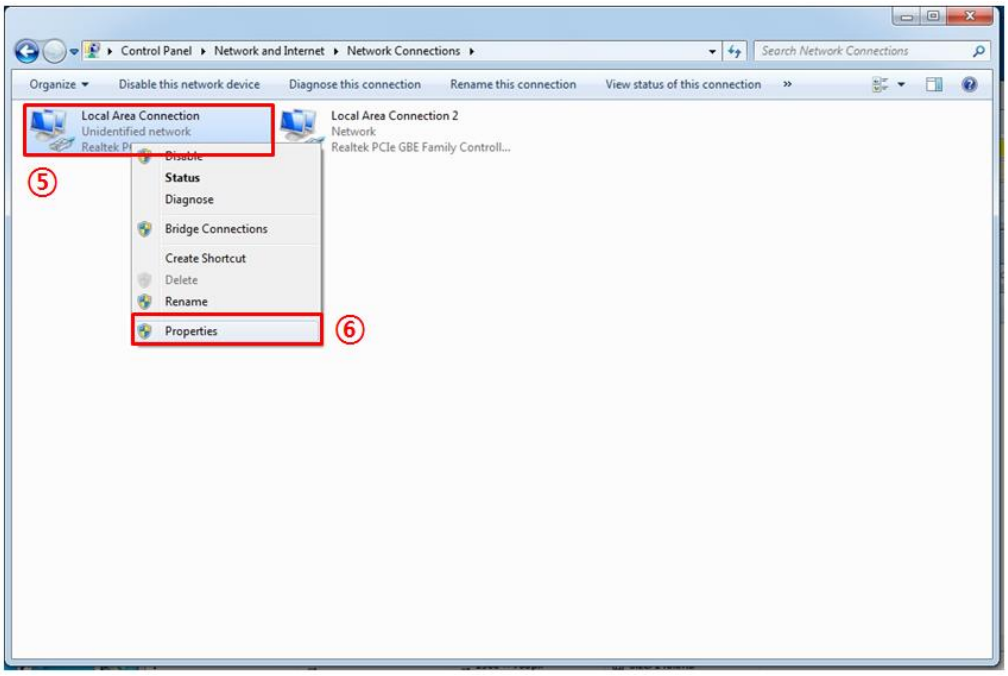


Figure 3-148: Open "Properties" for "Local Area Connection"

60. When the Local Area Connection Properties window appears, select "**Internet Protocol Version 4 (TCP/IPv4)**" (⑦) and then click "**Properties**" (⑧).

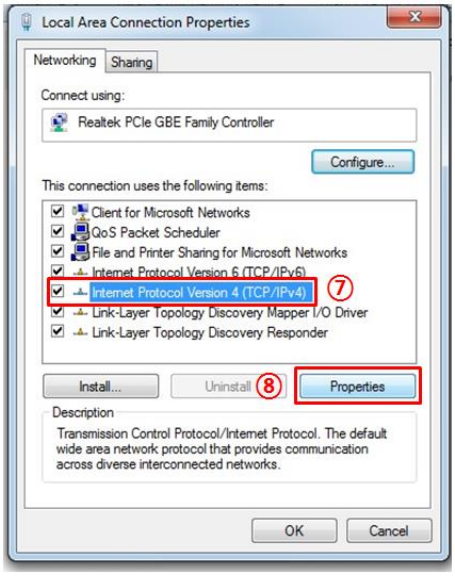


Figure 3-149: Open Properties for "Internet Protocol Version 4 (TCP/IPv4)"

61. When the following window appears, change the "**IP address**" that fits the network environment (⑨).

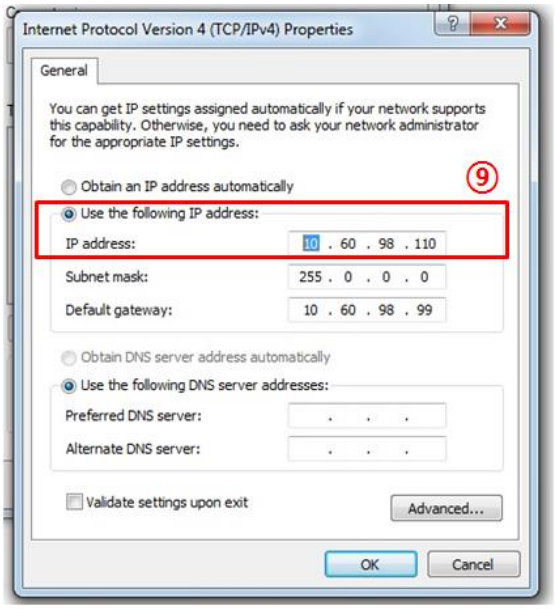


Figure 3-150: Setting the Computer's IP address

3.9.12.2 System BMS Data Check

62. Make sure the System BMS is connected to the same network as the computer running BATTMON.

63. Run “BATTMON.exe”

Figure 3-151: BATTMON Icon

64. Click “Monitor” under the SYSTEM BMS part.

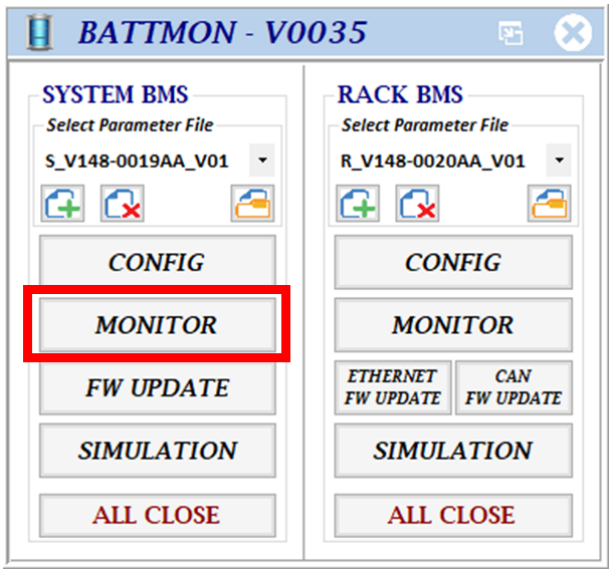


Figure 3-152: BATTMON Splash Window

65. Enter the TCP/IP settings according to the value set during the configuration. Click the “Connect” button.

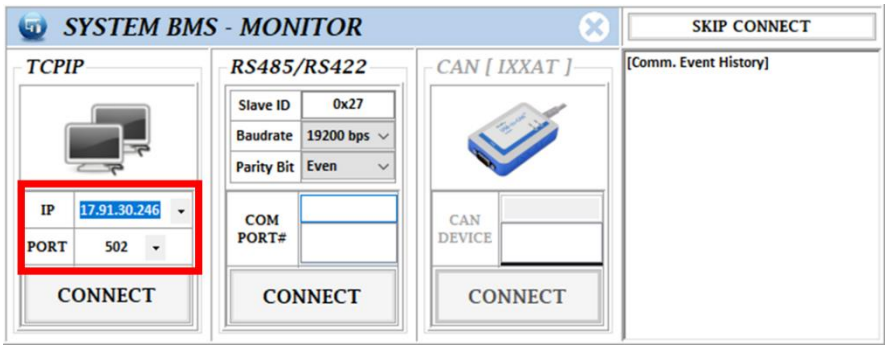


Figure 3-153: System BMS – Monitor Setting

All connected rack’s information and cell’s information can be seen in the monitoring window. If more than one rack is connected, set the “Display count of Rack” accordingly. Data logging to the computer is possible. Click “LOGGING [OFF]” to set the logging parameters.

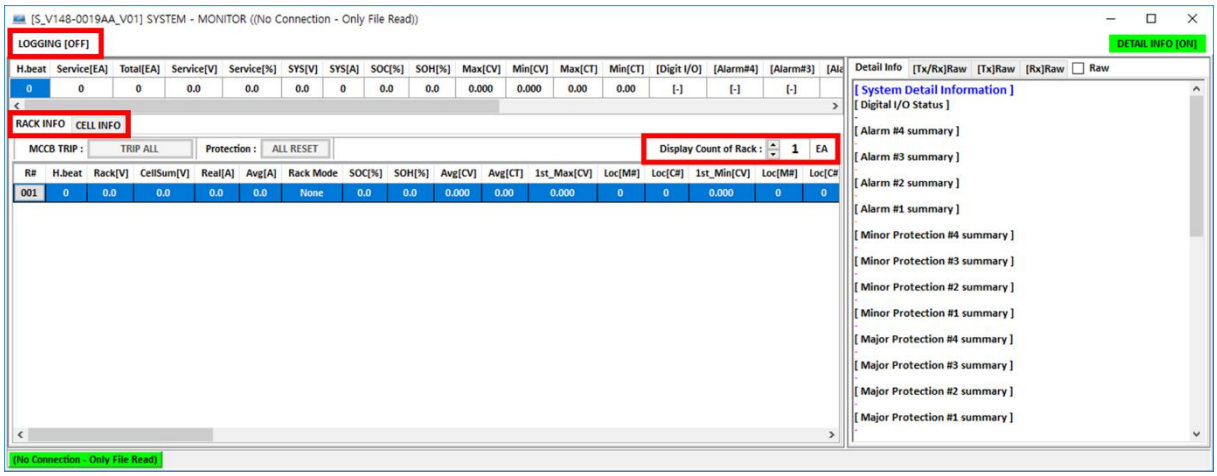


Figure 3-154: System and Rack Information

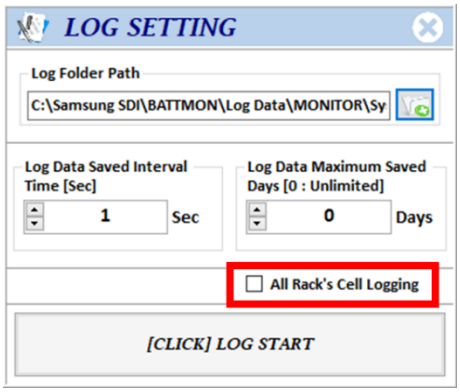


Figure 3-155: Log setting

Check the box for all rack's cell info log. Cell info is logged once every 30 seconds for each rack.

1. Select "CELL INFO" tab to monitor the cell information. Enter the number of module BMS set during the configuration in the display counter. If more than one rack is connected, cycle through each rack's CAN ID using the drop-down menu.

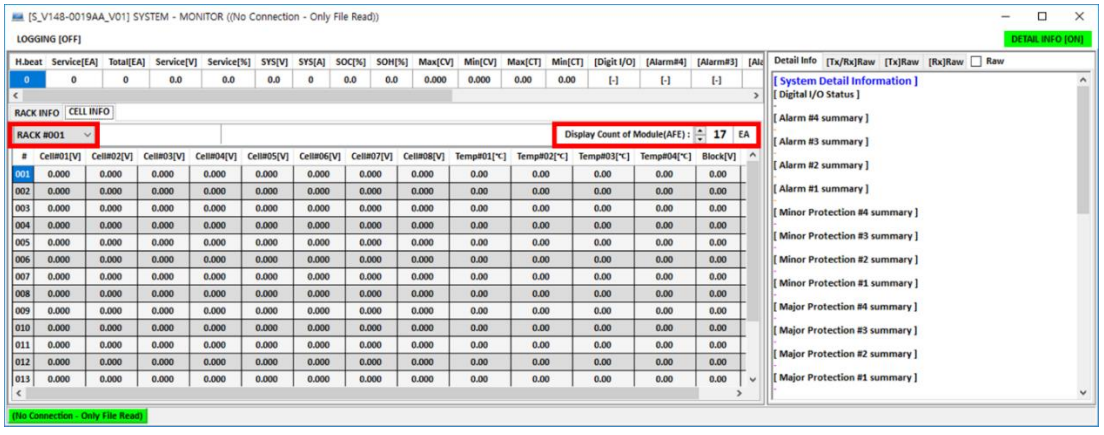


Figure 3-156: Cell Information.

3.9.13 Reinstall the Front Door

1. Reinstall the front door to cover the battery rack and prevent further access to high voltage parts of the BCU and SMPS Assembly.
2. Align the hinges on the rack frame and front door and slide the door down.

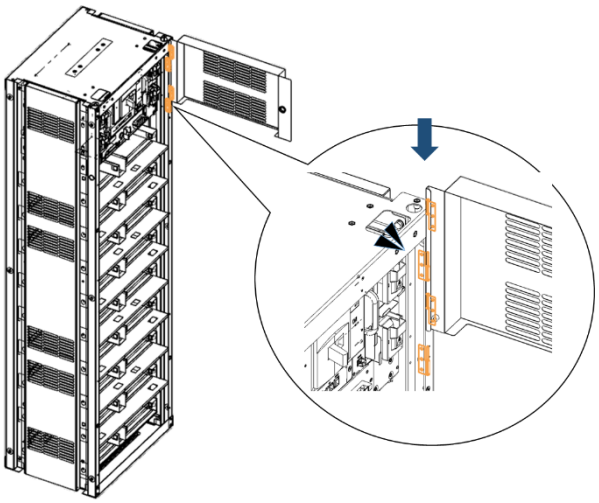


Figure 3-157: Reattaching the Front Door

3. Reattach the earth cable from the rack frame to the front door.

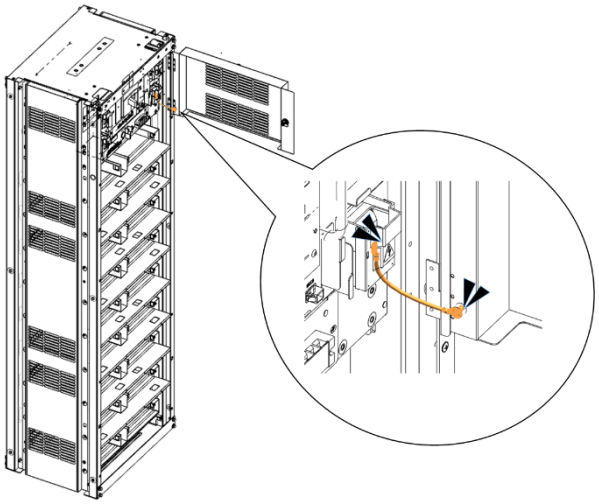


Figure 3-158: Reattaching the earth cable.

4. Close and lock the front door using the provided key. Do not misplace the key.

3.9.14 Reinstall the Front Panel

1. Reinstall the front panel to cover the battery rack and prevent further access to high voltage parts of the battery modules.
2. Locate the hooks that hold the front panel to the slots in the rack frame and insert the front panel to the rack frame. Make sure all the hooks are inserted to the slot and the panel is flush with the rack frame before screwing.

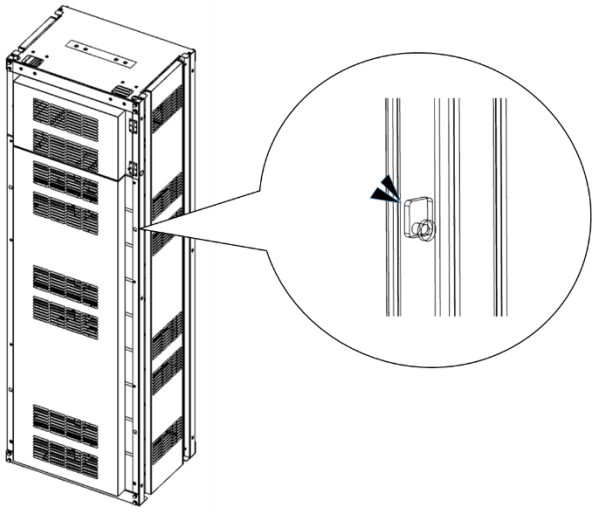


Figure 3-159: Front panel hooks (four)

3. Screw in the front panel using the Samsung SDI-provided M5 screws for each front panel. Fasten the screws using a torque value of 2.94–3.92 Nm (30–40 kgf·cm)

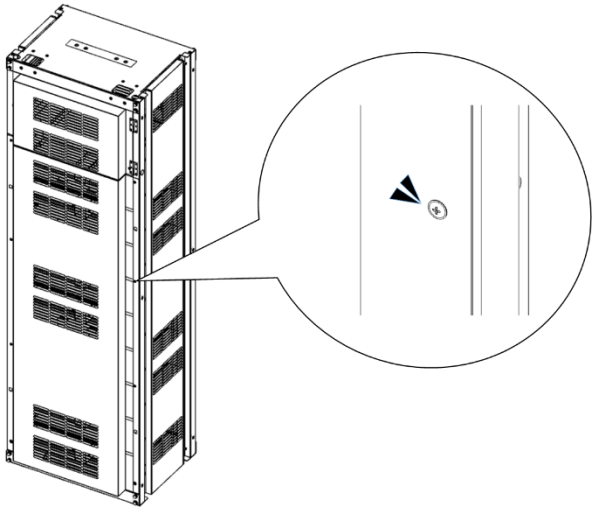


Figure 3-160: Front panel screws (eight)

3.9.15 Switching on the MCCB

After powering on the battery system's SMPS Assembly and BCU, and configuring the System BMS and the Rack BMS according to the installation, check the status LED panels to determine whether the system status is normal. Refer to the "Product Specification" and "Operation and Maintenance Manual" for information on the status LEDs.

	CAUTION
	Follow the instruction and guidelines for the UPS on how to safely connect the battery to the UPS before switching on the MCCB.

The MCCB in the BCU should always be in the "TRIP" position during installation and configuration.

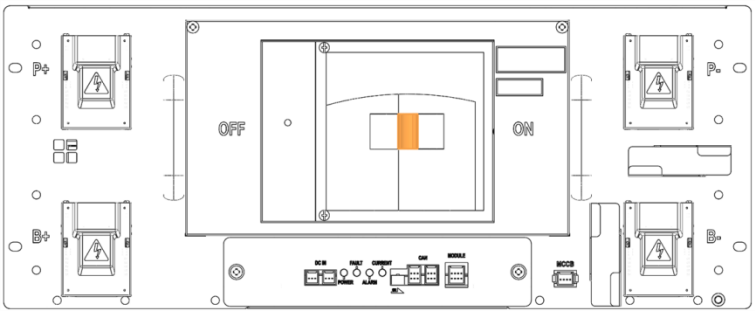


Figure 3-161: MCCB Handle in Trip Position

When installation and configuration is complete, and the battery is ready to connect to the high voltage DC battery bus, shift the handle of the MCCB to the "OFF" position.

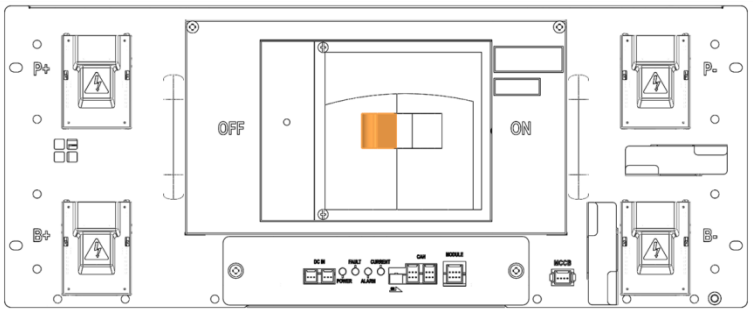


Figure 3-162: MCCB Handle in Off Position

Then, shift the handle to the "ON" position to connect the battery system to the UPS DC link.

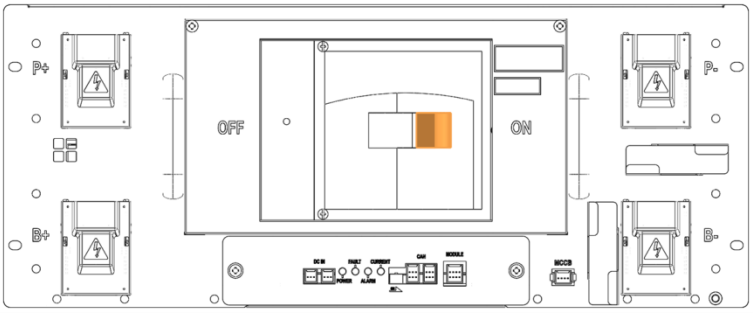


Figure 3-163: MCCB Handle in On Position

www.SamsungSDI.com