ENERGY STORAGE

SAMSUNG SDI | ENERGY STORAGE SYSTEM

Installation Manual

Vertical Connection



Read this manual carefully before beginning the installation and keep these instructions for future reference.

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Important Safety Instructions

Read and Follow These Instructions

The following precautions are intended to ensure your safety and prevent property damage. Before installing this product, be sure to read all safety instructions in this document for proper installation.

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

	**WARNING** Failure to comply with the instruction with this symbol may result in a serious accident, causing a severe injury.

	**CAUTION** Failure to comply with the instruction with this symbol may result in minor or moderate injury.

	***NOTICE*** Provides information considered important but not hazard-related. The information relates to property damage.

	**Important** Indicates valuable tips for optimum installation and operation of the product.

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General Instructions

Please be aware that a battery presents a risk of electrical shock including high short-circuit current. Follow all safety precautions while operating the batteries.

- Remove watches, rings, or other metal objects.
- Use tools with insulated handles in order to avoid inadvertent shorts.
- Wear rubber gloves and safety boots.
- Do not put tools or any metal parts on the top of the batteries.
- Disconnect charging source and load before connecting or disconnecting terminals.
- Use proper lifting means when moving batteries and wear all appropriate safety clothing and equipment.
- Batteries shall not be disposed arbitrarily. Do not dispose of the batteries in a fire because they could explode.
- Do not open or mutilate the batteries.
- Only an authorized, trained technician shall perform annual preventative maintenance.
- The installation and maintenance of the battery should be performed only by qualified personnel who are familiar with the batteries and safety precautions.
- Do not allow unauthorized personnel to approach the batteries.
- Enter an installation site after discharge is completed. Tray installation is a heavy work that requires two or three people or a lift to perform.

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Safety Precautions

The following list of precautions provides 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 wearing appropriate Personal Protective Equipment (PPE) should be able to access the system.

The interior design of this equipment must be able to consider 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.

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Personnel & Equipment Warnings

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



WARNING—SHOCK HAZARD

Do not come into contact with system connectors or terminals. Do not open the enclosure doors if proper LOTO procedures, PPE, and related trainings are not followed for the maintenance plan 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 PPE and training is required in accordance with local codes and regulations.



WARNING—FIRE HAZARD

Fire may occur under certain fault conditions.



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 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 you touch any system components.

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Dangerous Voltages



DANGER

The ESS is powered by multiple power sources. Hazardous voltages can be present in the equipment even when it does not appear operational. Make sure that you completely understand the cautions and warnings in this installation manual. 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 arc flash. The following precautions must be observed when working on or around electrical equipment:

- Remove watches, jewelry, rings, and other metallic objects.
- Use the tools with insulated handles.
- Safety clothing and shoes should comply with the PPE requirements specified by local codes and regulations.

Lock Out / Tag Out Guidelines



DANGER

Follow all the applicable Lock Out/Tag Out (LOTO) procedures at all times. If proper LOTO procedures are not followed, it may result in serious injury or death.
With power applied to the ESS, hazardous voltages are present on some components. To prevent accidental death or injury, do not touch any components within the enclosure unless you are specifically directed to do so. To reduce the risk of electrical shock, make sure that all equipment are properly grounded. For more information, refer to "Guide of grounding"



WARNING

Enclosure doors shall 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 re-energized. Always comply with local, state, and national Lock Out/Tag Out (LOTO)

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- Identify and wear protective clothing and shoes according to PPE.
- Identify and isolate all power and stored energy sources.
- Apply appropriate LOTO devices. When applying LOTO to the ESS, do not touch anything within the enclosure except as specifically directed in the work procedures.
- Complete the site-specific LOTO procedure and safety checklist before beginning work.

General Warnings



DANGER

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



DANGER

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



DANGER

To minimize hazard of electrical shock, death, or burn, approved grounding practices and procedures should be strictly followed.



WARNING

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



WARNING

To avoid personal injury or equipment damage caused by equipment malfunction, only adequately trained personnel should modify any programmable machine.



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.

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1 About This Manual

To make sure that you understand the proper procedures for safe operation, this section briefly describes the purpose, audience, organization, revision history, and acronyms & abbreviations.

1.1 Purpose

The purpose of this manual is to provide information for safe and successful install of the battery energy storage system of SAMSUNG SDI, including ME2, MM2f, MP3 platform.

1.2 Target Audience

This installation manual is for system administrator and operators who install and configure the battery energy storage system.

1.3 Structure of Manual

This manual is comprised of the following chapters:

- Chapter 1, “About this manual” introduces preliminary description about this document.
- Chapter 2, “General Specification for Major Components” describes the major components of the product and its packing specification.
- Chapter 3, “Personal Protection Equipment(PPE)” explains how to prepare the personal protection equipment during install.
- Chapter 4, “BESS Installation” describes how to install BESS from single rack to parallel racks to become a system.
- Chapter 5, “Installation of Rack Frame” explains how to install a rack frame.
- Chapter 6, “Installation of Single Rack” explains how to install a rack with battery and switchgear install.
- Chapter 7, “Installation of Parallel Racks” explains how to install rack and multi racks for system.
- Chapter 8, “System Integration” explains how to setup the communication of racks and monitoring setup.

본 문서는 삼성SDI의 자산이며 삼성SDI 제품의 기능, 사양, 설치, 작동 및 유지보수 목적으로만 제공됩니다. 삼성SDI의 사전승인 없이 본 문서에 포함된 정보의 전부 또는 일부를 무단으로 복사 또는 사용하거나, 제3자에게 공개, 배포, 제공하는 것은 엄격히 금지됩니다.
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1.4 Revision History

Rev.	Description	Prepared by	Date of issue
A	Initial release		

Approved by		
Name	Signature	Date of approval

1.5 Acronyms and Abbreviations

Abbrev.	Full Name	Abbrev.	Full Name
AED	Automated External Defibrillator	PCS	Power Conversion System
BMS	Battery Management System	PPE	Personal Protective Equipment
Comm	Communication	SG	Switchgear Assembly
EHS	Environmental Health and Safety	SMPS	Switched Mode Power Supply
EMS	Energy Management System	SOC	State Of Charge
ESS	Energy Storage System	SOH	State Of Health
HRC	Hazard Risk Categories	SW	Switch(Contactor)
LOTO	LOCK OUT/TAG OUT	UT	Under Temperature
OT	Over Temperature Protection	UVP	Under Voltage Protection
OVP	Over Voltage Protection		

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2 General Specification for Major Components

2.1 Major Components Specification

2.1.1 Module

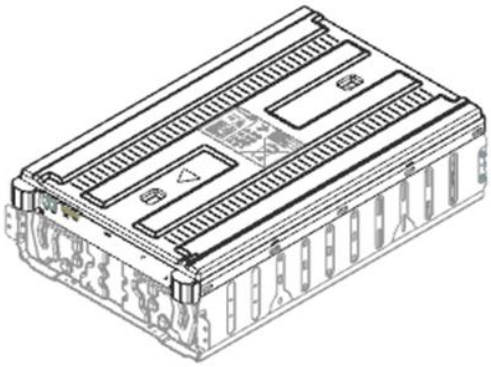
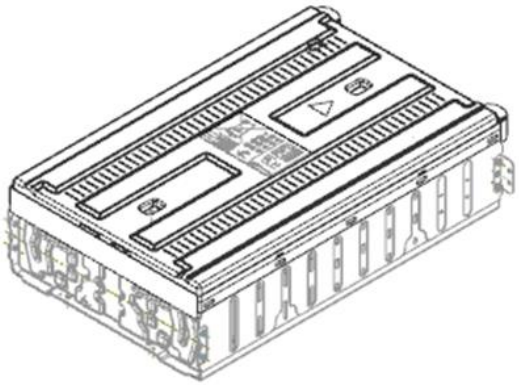
This is the most basic component, which contains the energy storing battery cells and a single module BMS. The module BMS integrated into the battery module monitors the status of each battery by measuring attributes such as cell voltage and cell temperature. The module BMS communicates with Rack BMS/Switchgear assembly over a rack-local UART interface. The Module BMS will deliver digitized measured voltage and temperature data to the Rack BMS and receive commands from Rack BMS to control cell balancing.

[Table 1] Module Specifications

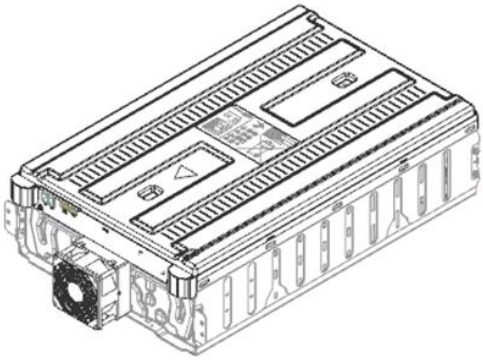
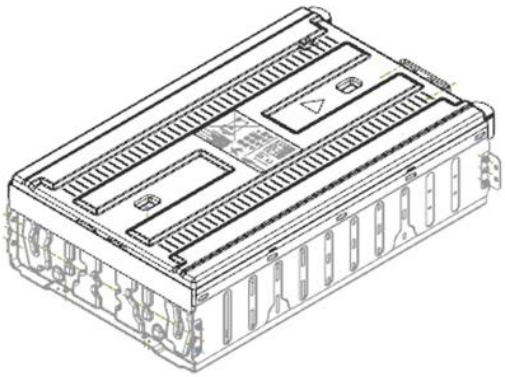
	E2	M2f	P3
Nominal capacity	94Ah	94Ah	78Ah
Nominal voltage	80.96V	80.96V	81.4V
Operating voltage	70.4 ~ 91.3V		68.2 ~ 90.2V
Storage condition	23±5℃ (Max -20 ~ 60℃ with further capacity degradation)		
Weight	52.5Kg	54Kg	54Kg
Dimension	370 x 588 x 160 mm		

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Module for E2

Front view of module	Rear view of module
	

Module for M2f/P3

Front view of module	Rear view of module
	

[Fig 1] Front and Rear View of Module

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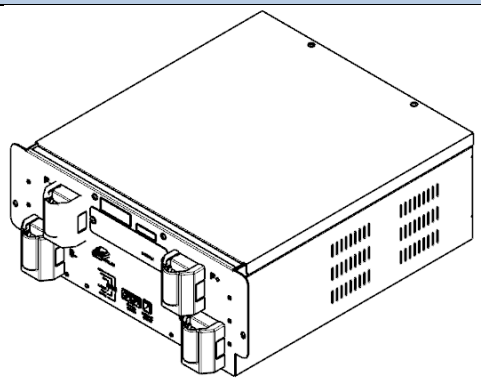
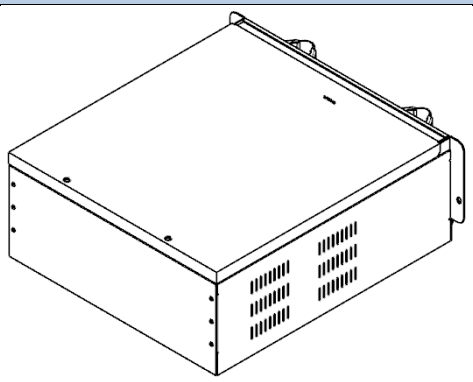
2.1.3 Switchgear

Switch gear contains protective fusing devices in order to prevent damage on cells from external short and equips DC-contactors which is controlled by rack BMS for controlling of the electrical connection of rack to the main DC-bus in case abnormal operating conditions. In addition, switch gear contains Rack BMS which collects all Module BMS information and reports this to System BMS via an internal CAN-Bus interface. The rack BMS also calculates the state of charge (SOC) and the state of health (SOH) of the rack. The rack BMS assembly requires a 24Vdc power source.

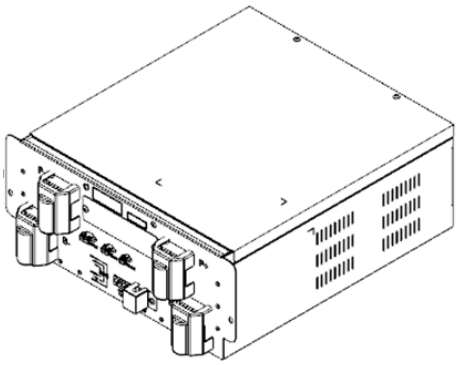
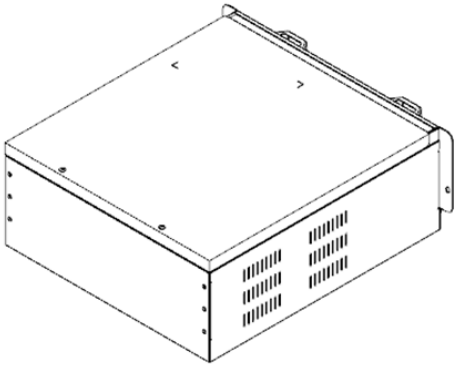
- Dimension : 418 x 415.6 x 160mm

본 문서는 삼성SDI의 자산이며 삼성SDI 제품의 기능, 사양, 설치, 작동 및 유지보수 목적으로만 제공됩니다. 삼성SDI의 사전승인 없이 본 문서에 포함된 정보의 전부 또는 일부를 무단으로 복사 또는 사용하거나, 제3자에게 공개, 배포, 제공하는 것은 엄격히 금지됩니다.
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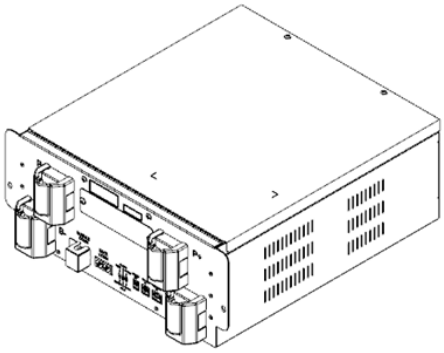
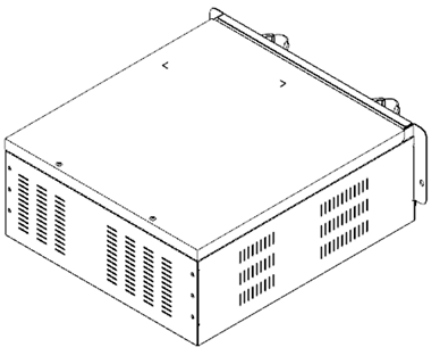
Switchgear for E2

Front view of E2 Switchgear	Rear view of E2 Switchgear
	

Switchgear for M2f

Front view of M2f Switchgear	Rear view of M2f Switchgear
	

Switchgear for P3

Front view of P3 Switchgear	Rear view of P3 Switchgear
	

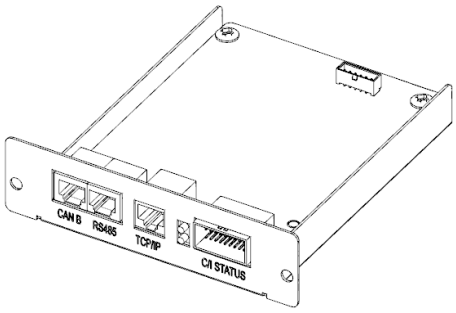
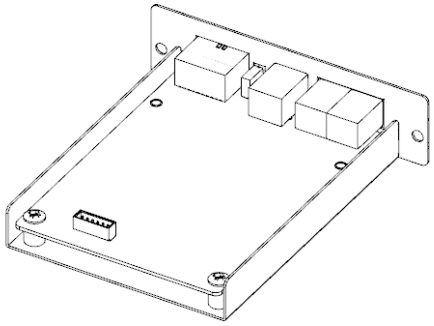
[Fig 2] Front and Rear View of Switchgear

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2.1.4 System BMS

The system BMS assembly provides data to the PCS (or EMS) while controlling and monitoring multiple racks up to 128 through MODBUS TCP/IP or MODBUS RTU. System BMS will be installed inside of the first switchgear.

- Dimension : 142 x 135 x 35mm

Front view of System BMS	Rear view of System BMS
	

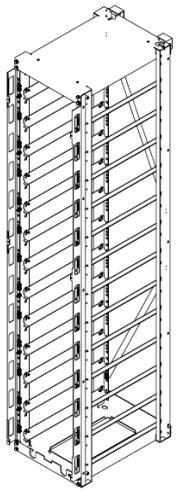
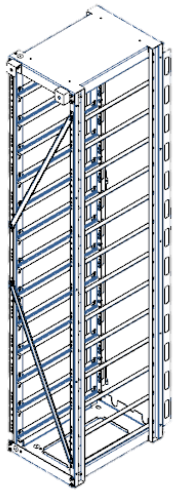
[Fig 3] Front and Rear View of System BMS

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2.1.5 Rack Frame

Rack frame is a metallic houses for containing battery modules and switchgear. Each rack frame requires #4 AWG squared wire ground connection secured at right bottom anchor or top side bonding location.

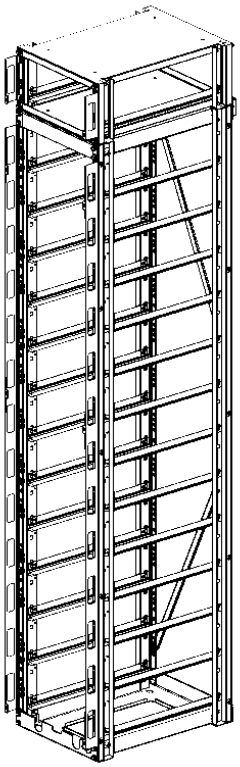
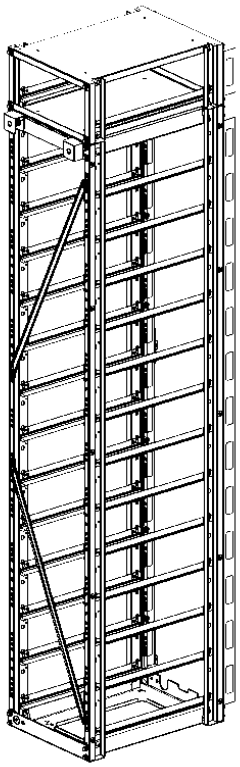
- Dimension : 442 x 702 x 1792mm (for 10Slots Rack Frame)
  442 x 702 x 1958mm (for 11Slots Rack Frame)
  442 x 702 x 2124mm (for 12Slots Rack Frame)
  442 x 702 x 2290mm (for 13Slots Rack Frame)

Front view of Rack Frame	Rear view of Rack Frame
	

[Fig 4] Front and Rear View of Rack Frame(13Slots)

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- Dimension : 442 x 692 x 2518mm (for 13+1 Slots Rack Frame) Single Rack
  876 x 692 x 2518mm (for 13+1 Slots Rack Frame) Dual Rack

Front view of Rack Frame	Rear view of Rack Frame
	

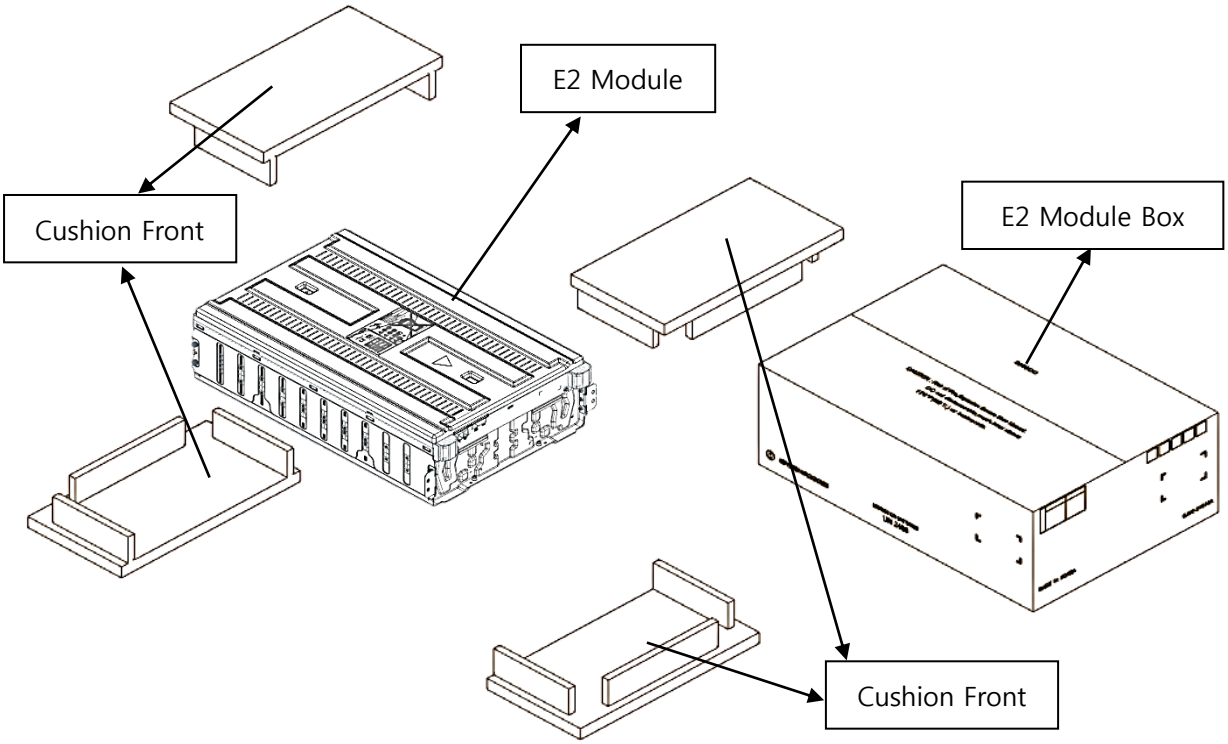
[Fig 5] Front and Rear View of Rack Frame (13+1Slots)

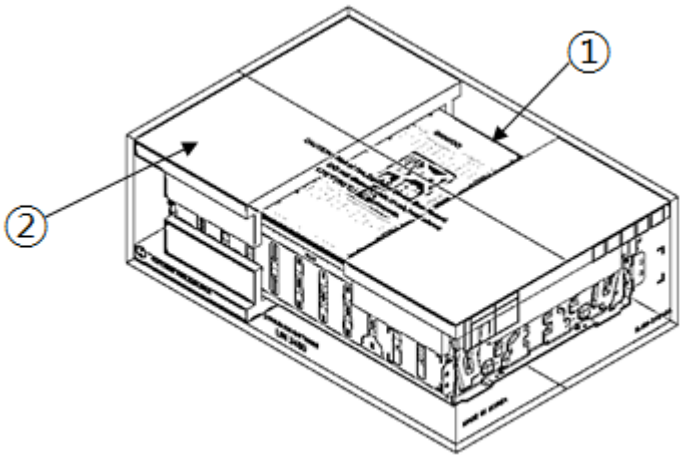
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2.2 Packing Specification

2.2.1 Module Packing

- E2 22S1P Module Packaging configuration



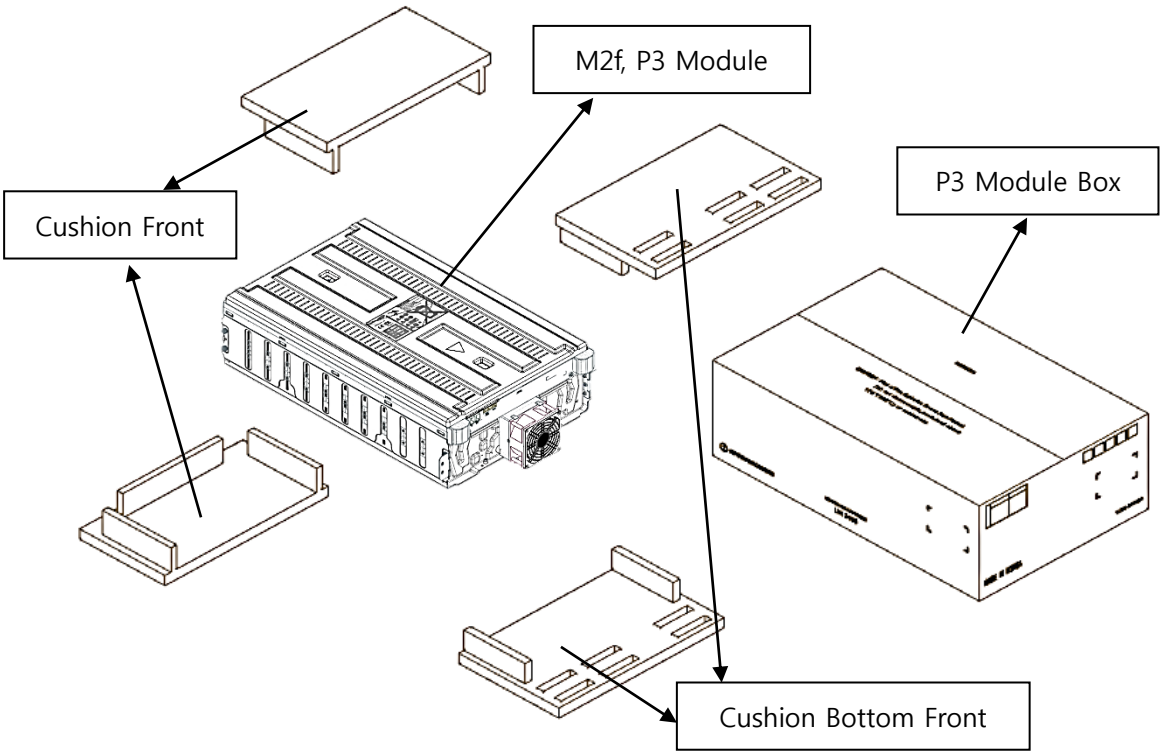


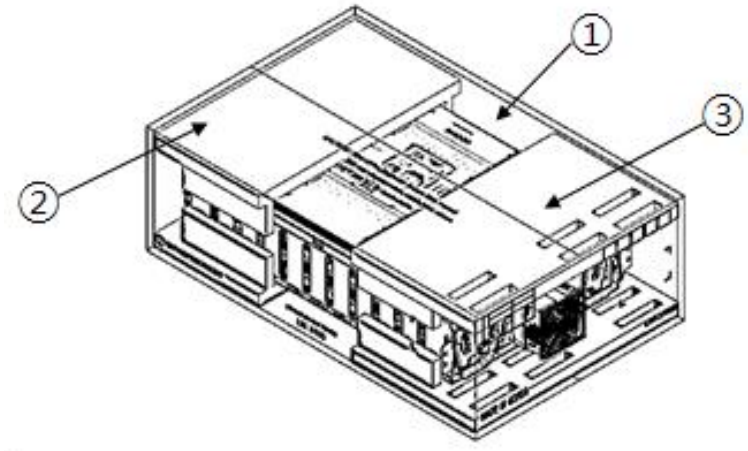
[Table 2] E2 22S1P Module Packaging configuration

No	Part Name	Dimension	Unit	PC	Material
1	Energy Module Box	W661 x L440 x H222(in)	mm	1	cardboard ,BA(KLB/3K/KLB)
2	Cushion Front	W440 x L230 x H85	mm	4	cardboard ,BA(KLB/3K/KLB)

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- M2f, P3 22S1P Module Packaging configuration



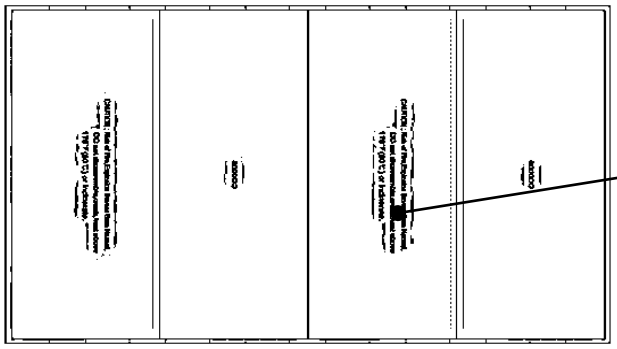


[Table 3] M2f, P3 22S1P Module Packaging configuration

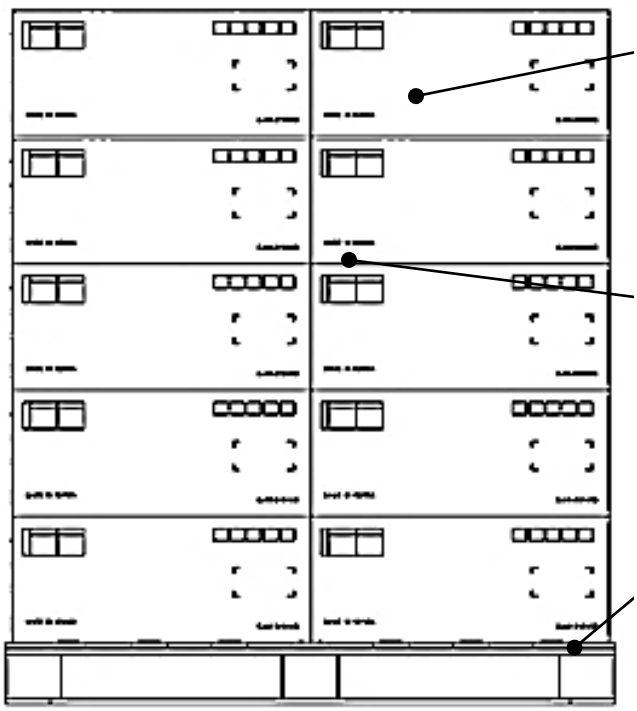
No	Part Name	Dimension	Unit	PC	Material
1	Power Module Box	W703 x L440 x H222(in)	mm	1	cardboard ,BA(KLB/3K/KLB)
2	Cushion Front	W445 x L270 x H75	mm	2	cardboard ,BA(KLB/3K/KLB)
3	Cushion Bottom Front	W440 x L230 x H85	mm	2	cardboard ,BA(KLB/3K/KLB)

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2.2.2 Module Pallet Specification



Vinyl Sheet	Unit	Value
Material	-	Poly Ethylene
Dimension	mm	T0.03*W2000*D2000



Band	Unit	Value
Material	-	Poly Propylene
Dimension	mm	T1.0, W18.0, 10.0Kg

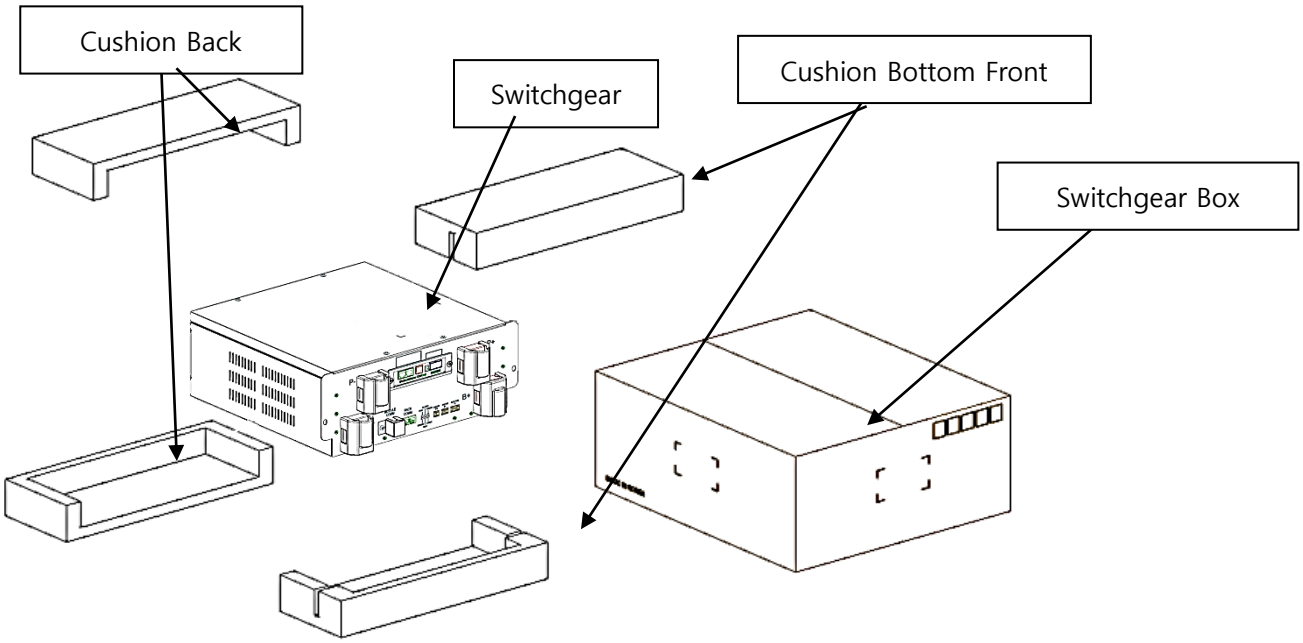
WRAP STRETCH FILM	Unit	Value
Material	-	Poly Ethylene
Dimension	mm	T0.02

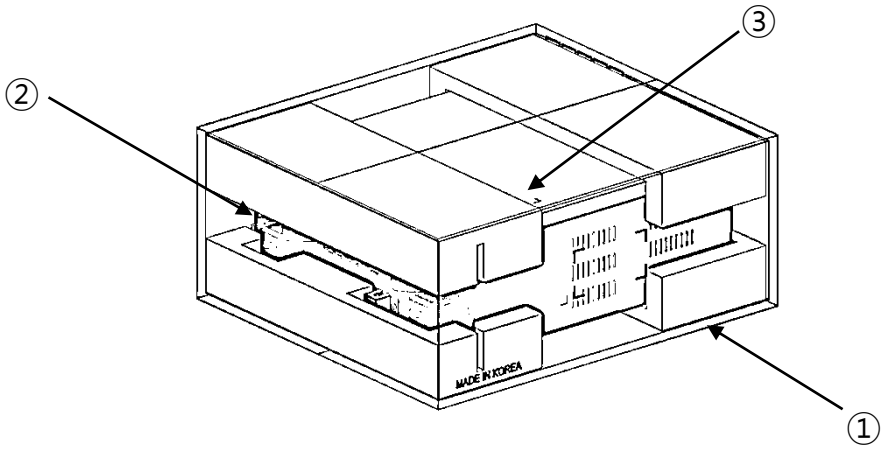
Pallet	Unit	Value
Material	-	LVL*
Dimension	mm	W930 x D730 x H127

* LVL : Laminated Veneer Lumber

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2.2.3 Switchgear Packing



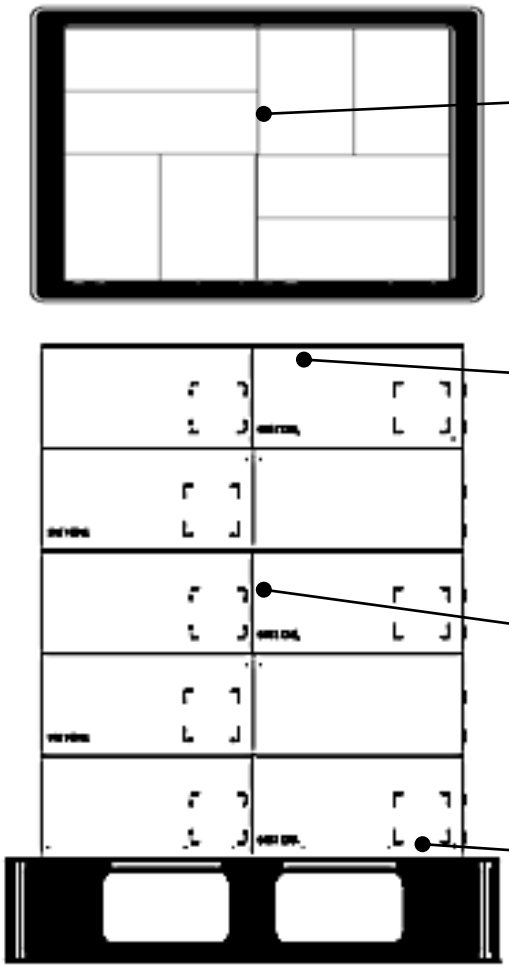


[Table 4] Switchgear Packaging configuration

No	Part Name	Dimension	Unit	PC	Material
1	Switchgear Box	W509 x L441 x H205(in)	mm	1	cardboard ,BA(KLB/3K/KLB)
2	Cushion Back	W440 x L160 x H70	mm	2	Pe-From
3	Cushion Bottom Front	W440 x L160 x H70	mm	2	Pe-From

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2.2.4 Switchgear Pallet Specification



Vinyl Sheet	Unit	Value
Material	-	Poly Ethylene
Dimension	mm	T0.03*W2000*D2000

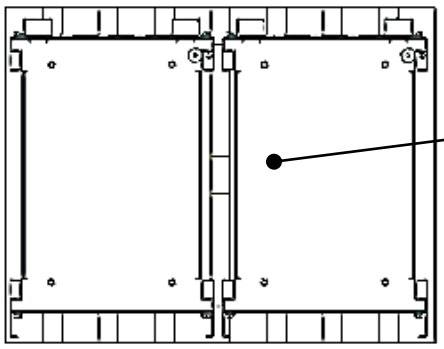
Band	Unit	Value
Material	-	Poly Propylene
Dimension	mm	T1.0, W18.0, 10.0Kg

WRAP STRETCH FILM	Unit	Value
Material	-	Poly Ethylene
Dimension	mm	T0.02

Pallet	Unit	Value
Material	-	Poly Propylene
Dimension	mm	W1000 x D1000 x H130

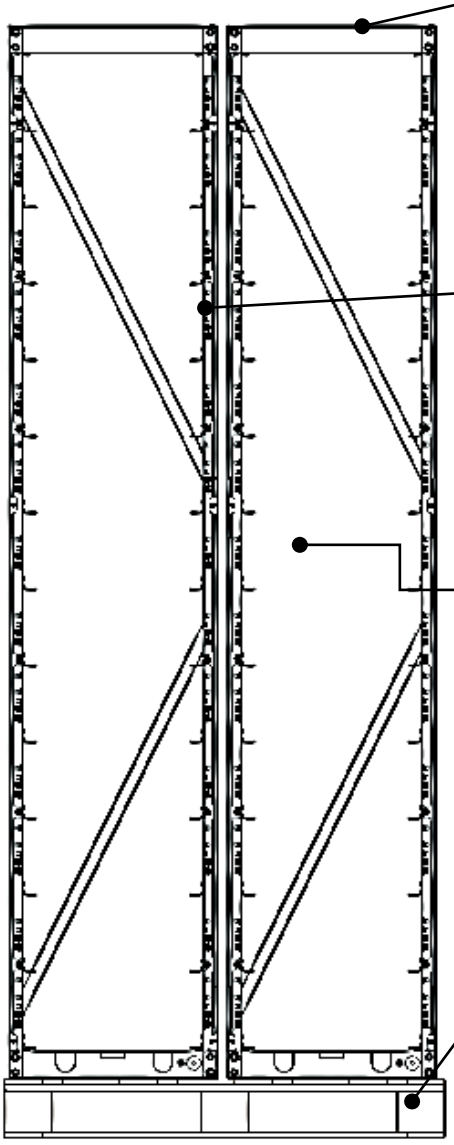
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2.2.5 Rack Frame Pallet Specification



Vinyl Sheet	Unit	Value
Material	-	Poly Ethylene
Dimension	mm	T0.03*W2000*D2000

Band	Unit	Value
Material	-	Poly Propylene
Dimension	mm	T1.0, W18.0, 10.0Kg



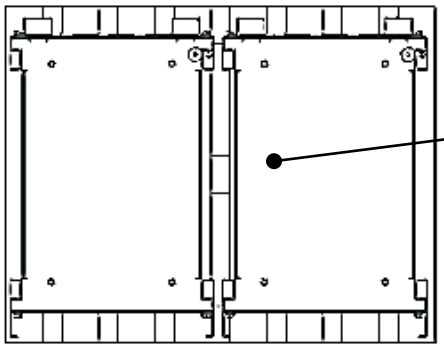
Cushion Pad	Unit	Value
Material	-	Pe-From
Dimension	mm	T10*W100*L200

WRAP STRETCH FILM	Unit	Value
Material	-	Poly Ethylene
Dimension	mm	T0.02

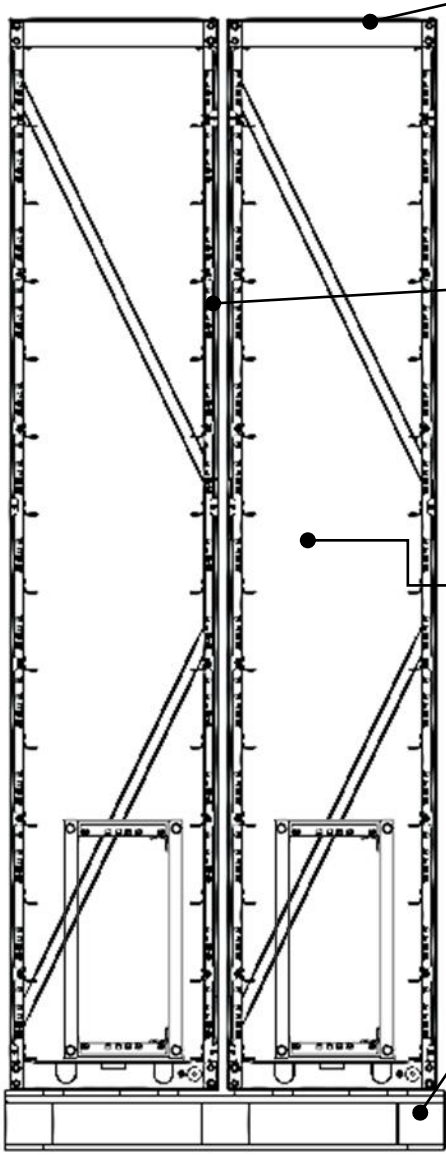
Pallet	Unit	Value
Material	-	LVL*
Dimension	mm	W980 x D750 x H135

* LVL : Laminated Veneer Lumber

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Vinyl Sheet	Unit	Value
Material	-	Poly Ethylene
Dimension	mm	T0.03*W2000*D2000



Band	Unit	Value
Material	-	Poly Propylene
Dimension	mm	T1.0, W18.0, 10.0Kg

Cushion Pad	Unit	Value
Material	-	Pe-From
Dimension	mm	T10*W100*L200

WRAP STRETCH FILM	Unit	Value
Material	-	Poly Ethylene
Dimension	mm	T0.02

Pallet	Unit	Value
Material	-	LVL*
Dimension	mm	W980 x D750 x H135

* LVL : Laminated Veneer Lumber

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3 Personal Protection Equipment(PPE)

Please be aware that a battery presents a risk of electrical shock including high short-circuit current. Follow all safety precautions while operating the batteries. During installation or maintenance the battery system, the worker shall be wear proper PPE accordance with below table

1) E2 264S

1. E2 Platform (264S)

		Calculation & Description	During installation			After installation		
			Module	Rack w/o S/G	Rack with S/G	Module	Rack w/o S/G	Rack with S/G
V_{sys}(V)	System Voltage	Battery OCV	78.85	946.19	946.19	90.88	1,090.58	1,090.58
R_{sys}(Ω)	Resistance	measured value	0.012	0.149	0.154	0.012	0.149	0.154
I_{bf}(A)	Fault current	Calculation : Vsys/Rsys	6,571	6,349	6,143	7,574	7,319	7,082
I_{arc}(A)	Arcing current	Calculation : 0.5 X Ibf	3,285	3,174	3,071	3,787	3,660	3,541
fuse i^2t		Derived from fusing graph	982,226	733,601	11,037	1,304,892	975,028	14,669
T_{arc} (sec)	Arcing time	Calculation : i2t/(Iarc)^2	0.0910	0.0728	0.0012	0.0910	0.0728	0.0012
IEm	**Arc Energy at 18" Distance [cal/cm^2]**		**0.11277**	**1.04607**	**0.01627**	**0.14982**	**1.39002**	**0.02161**
Distance (inch) for different arc energy (cal/cm^2)	PPE Category 0	1.2	5.5	16.8	2.1	6.4	19.4	2.4
	PPE Category 1	4	3.0	9.2	1.1	3.5	10.6	1.3
	PPE Category 2	8	2.1	6.5	0.8	2.5	7.5	0.9
	PPE Category 3	25	1.2	3.7	0.5	1.4	4.2	0.5
	PPE Category 4	40	1.0	2.9	0.4	1.1	3.4	0.4
Hazard Risk Category			1	2	1	1	2	1
PPE Category			1	2	1	1	2	1

2) M2f 264S (Including 286S)

1. M2f Platform (264S)

		Calculation & Description	During installation			After installation		
			Module	Rack w/o S/G	Rack with S/G	Module	Rack w/o S/G	Rack with S/G
V_{sys}(V)	System Voltage	Battery OCV	78.85	946.19	946.19	89.80	1,077.65	1,077.65
R_{sys}(Ω)	Resistance	measured value	0.011	0.131	0.136	0.011	0.131	0.136
I_{bf}(A)	Fault current	Calculation : Vsys/Rsys	7,509	7,221	6,956	8,553	8,226	7,924
I_{arc}(A)	Arcing current	Calculation : 0.5 X Ibf	3,755	3,610	3,478	4,276	4,113	3,962
fuse i^2t		Derived from fusing graph	338,349	250,284	14,151	438,898	324,827	18,365
T_{arc} (sec)	Arcing time	Calculation : i2t/(Iarc)^2	0.0240	0.0192	0.0012	0.0240	0.0192	0.0012
IEm	**Arc Energy at 18" Distance [cal/cm^2]**		**0.03399**	**0.31379**	**0.01842**	**0.04409**	**0.40714**	**0.02390**
Distance (inch) for different arc energy (cal/cm^2)	PPE Category 0	1.2	3.0	9.2	2.2	3.5	10.5	2.5
	PPE Category 1	4	1.7	5.0	1.2	1.9	5.7	1.4
	PPE Category 2	8	1.2	3.6	0.9	1.3	4.1	1.0
	PPE Category 3	25	0.7	2.0	0.5	0.8	2.3	0.6
	PPE Category 4	40	0.5	1.6	0.4	0.6	1.8	0.4
Hazard Risk Category			1	2	1	1	2	1
PPE Category			1	2	1	1	2	1

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3) P3 264S

1. P3 Platform (264S)

		Calculation & Description	During installation			After installation		
			Module	Rack w/o S/G	Rack with S/G	Module	Rack w/o S/G	Rack with S/G
V_{sys}(V)	System Voltage	Battery OCV	79.4	953.0	953.0	89.8	1,077.6	1,077.6
R_{sys}(Ω)	Resistance	measured value	0.010	0.122	0.127	0.010	0.122	0.127
I_{bf}(A)	Fault current	Calculation : Vsys/Rsys	8,022	7,783	7,477	9,071	8,801	8,456
I_{arc}(A)	Arcing current	Calculation : 0.5 X Ibf	4,011	3,891	3,739	4,536	4,400	4,228
fuse i^2t		Derived from fusing graph	386,078	290,740	16,354	493,710	371,793	20,913
T_{arc} (sec)	Arcing time	Calculation : i2t/(Iarc)^2	0.0240	0.0192	0.0012	0.0240	0.0192	0.0012
IEm	**Arc Energy at 18" Distance [cal/cm^2]**		**0.03657**	**0.34062**	**0.01994**	**0.04677**	**0.43558**	**0.02550**
Distance (inch) for different arc energy (cal/cm^2)	PPE Category 0	1.2	3.1	9.6	2.3	3.6	10.8	2.6
	PPE Category 1	4	1.7	5.3	1.3	1.9	5.9	1.4
	PPE Category 2	8	1.2	3.7	0.9	1.4	4.2	1.0
	PPE Category 3	25	0.7	2.1	0.5	0.8	2.4	0.6
	PPE Category 4	40	0.5	1.7	0.4	0.6	1.9	0.5
Hazard Risk Category			1	2	1	1	2	1
PPE Category			1	2	1	1	2	1

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4 BESS Installation

4.1 BESS Installation Procedure

- This battery system product must be installed in a difficult place of public access, and should be accessible only qualified personnel. Also put at all times locked when no one is allowed.
- The live parts of battery module are insulated by cover and it should be covered properly during whole installation process excepting power wiring connection.
- Use a CO2 fire extinguisher, a first-aid kit and AED before starting the installation. Installation environment must be maintained from 0% to 80% humidity (non-condensing) and at 23±5 degrees.
- In case conflict between installation manual and regional regulations, the regional regulation will be had the higher priority.
- Be aware of a battery can present a risk of electrical shock and high short circuit current, the workers should wear proper personnel protection equipment and should be follow installation manual during whole work process.

4.1.1 BESS Installation Procedure

As our product is a large battery system, its installation shall follow the General Safety Instructions. It shall be installed by a qualified, trained worker with safety uniform worn and applicable work instruments equipped. All the instruments used for the installation shall be insulated and there should not be any metal articles around the installation environment. When moving batteries, appropriate lifting method shall be used. When treating a Module which is a heavy article, there should be a lift exclusively for it. If there is no lift for it, two or three workers shall treat it in a group. Refer to verified battery pack for the installation. Here, all the switches and external power supplies including those of battery systems shall be turned OFF beforehand.

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4.1.2 Installation Process Overview

Installation procedure is divided in to four stages: Preparation, Rack anchoring, Rack installation, and System installation. Rack anchoring means placing and fixing a rack in a designated location. In the rack installation stage, wring of a module and Switchgear is performed. After rack installation is complete, in the System Installation stage, multiple numbers of racks and system BMS are installed and then BMS communication and operation are verified. When all of above operation is complete, installation of LIB Battery System is completed. Battery System and PCS are connected by an installation company thereafter. Overall installation sequences are summarized in table 5.

[Table 5] Installation sequences

	Item	Work procedure detail	Risk
Preparation	Counting of supplied part		
	Unpacking of part		Slashed by cutter Heavy weight
	Appearance inspection		
Rack frame installation	Placement of rack frame		Heavy weight Toppling
	Fix the rack frame		
	Grounding connection		
	Inspection		
Rack installation	Insert module into the rack frame (bottom to top)	Insert order : Bottom to top	Heavy weight Drop
	Insert switchgear into Rack frame		Drop
	Module & S/G fixation		
	Signal cable connect among modules	Connecting order : module#1 to last	
	Signal cable connect between S/G and modules		
	FAN power cable connect between modules		
	FAN power cable connect between S/G and modules		
	Power cable / bus-bar connect between modules	Disassemble insulation cover Bus-bar fixation	Electrical shock Electrical short from

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		Insulation covering again.	misconnection
	Power cable / bus-bar connect between B(+) of final module and B(+) of S/G	Disassemble insulation cover Bus-bar fixation Insulation covering again.	Electrical shock
	Connect a long power cable between B(-) of S/G and B(-) of module #1	Fixation B(-) of S/G first B(-) of module #1 fixation Insulation covering again.	Electrical shock
System installation	Connect communication cables between S/G		
	Connect 24V Aux power to each S/G		
	Connect 24V FAN power in to each S/G		
	Rack BMS ID writing		
	EEPROM setting for system BMS		
	Communication check for whole battery system		
	Connect communication cable between the System BMS and PCS		
	Communication check		
	End of installation		

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4.1.3 Recommended Tools and Device List

[Table 6] Installation equipment

No	Name of Tool	Use	Shape
1	Power Tool (Max torque : 27N.m/270kgf.cm)	Hold Module – Rack (5~6N.m / 50~60kgf.cm)	
2	Torque limiter	Use it with a torque wrench	
3	Hexagon Tip	Hold Module-Rack (4mm Tip)	
4	Cutter	Unpacking	
5	Forklift	Deliver Rack, Module, and Switch Gear	
6	Module Lift (Recommended)	Transport Module	
7	SG Programming Cable	Customer make THIS CABLE, and buy PS and CAN converter	
8	Insulated Torque wrench	Use to install high current cable	
9	Insulated socket	Use to install high current cable (Use 13mm socket)	
10	Insulated extension	Use to install high current cable	
11	Inclinometer/level	Use to installing rack frame	

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4.2 BESS Installation

Preparation

- Establish installation plan beforehand and check necessary equipment and instruments for installation and tracing the arrival schedule of parts.
- Counting arrived parts which the numbers are correct.
- Perform unpacking of parts
- Conduct appearance inspection including appearance of box.

[Work explanation & Storage environment]

- Conduct the appearance inspection and store the product in a “dust-free” place where it has less than 80% of moisture level and 23±5℃ temperatures and keeps out of the direct rays of the sun.

[PPE for Inspection]

- Without: Watch, Ring, Jewelry, Any metal objects

With: Gloves, Protection Shoes, and any other required safety equipment

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[Appearance inspection]

- Rack frame inspection
    - Check if there is any deformation on exterior
    - Check if paint is peeled
    - Check if the screw is damaged or comes out
    - Check if any other abnormality is existed.
- Module inspection
    - Check if there is any deformation on exterior.
    - Check if paint is peeled
    - Check if the screw is damaged or comes out
    - Check if any other abnormality is existed.
- Switchgear inspection
    - Check if there is any deformation on exterior.
    - Check if paint is peeled
    - Check if the screw is damaged or comes out
    - Check if any other abnormality is existed.
- System BMS inspection
    - Check if there is any deformation on exterior.
    - Check if paint is peeled
    - Check if the screw is damaged or comes out
    - Check if any other abnormality is existed.

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4.2.1 Installation of Rack Frame

- Placement of rack frame to the designated right position and horizontal to the floor
- Fix the rack frame through anchoring
- Make a ground connection
- Inspection after rack frame installation

4.2.2 Installation of Single Rack

- Transport modules to the installation place
- Place modules in front of rack frame
- Insert a system BMS in the switchgear
- Insert a switchgear in the designated location(top or bottom)
- After all modules are inserted in rack frame, fastens the modules in front
- After all switchgears are inserted in rack frame, fastens the switchgear in front
- Connect the signal cable between modules
- Connect the signal cable between module and switchgear
- Connect the fan power cable between modules
- Connect the fan power cable between module and switchgear
- Connect the power cable / bus-bar between modules
- Connect the power cable / bus-bar between module and switchgear

4.2.3 Installation of Parallel Racks

- Connect the communication cable between switchgears
- Connect the aux/fan power cable and supply the aux/fan power(24Vdc)
- Rack BMS ID writing

4.2.4 System Integration

- Connect the system BMS
- Proceed installation checkup and system BMS setting
- Install the rack frame covers (optional)
- Proceed the communication checkup
- Connect communication cable between the System BMS and PCS
- Communication check
- Connect the power cable, P+ / P- between switchgears and inverter interface

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5 Installation of Rack Frame

5.1 Rack Frame Anchoring

- Unpacking and transport a rack frame to the designated position with caution.
  - Work place shall be safe and no blocking material
  - Recommend to use forklift (or hand lift) during transportation due to heavy weight.

- Placement of the rack frame & anchoring
  - Rack frame should be placed horizontal to the floor.
  - Fixing holes of rack frame should be aligned with location of matched holes on wall & floor.
  - Anchoring 6 points on rack frame shall be fastened with M16~M18 bolt (not provided).
  - Required torque 1,000~10,000kgf.cm

[Work explanation]

Rack frame installation is to fix a rack frame on the designated place be sure to fix the frame horizontal to the floor while installation the rack.

[PPE for installation]

Without: Watch, Ring, Jewelry, Any metal objects.

With: Gloves, Protection shoes, Safety Helmet, and any other required safety equipment

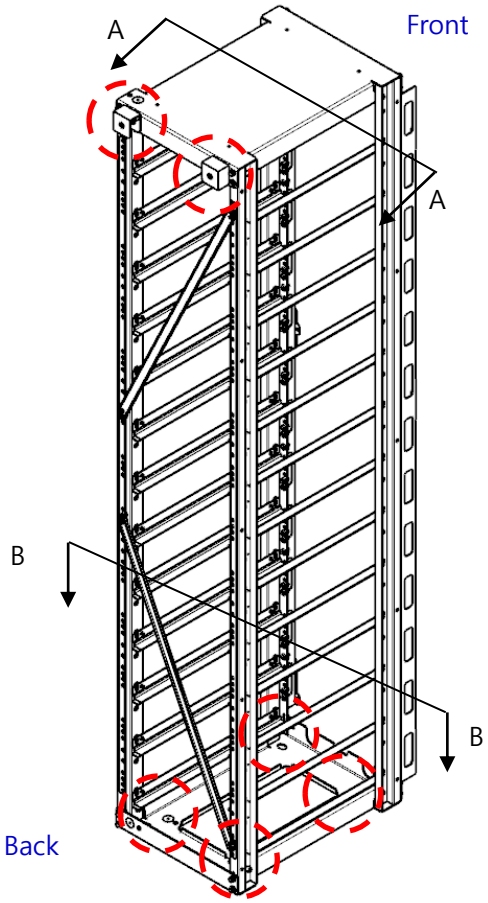
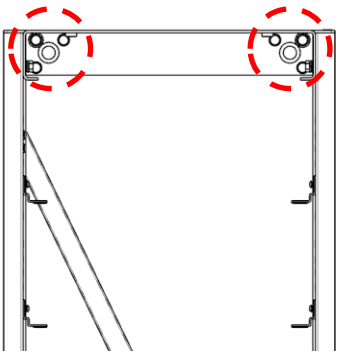
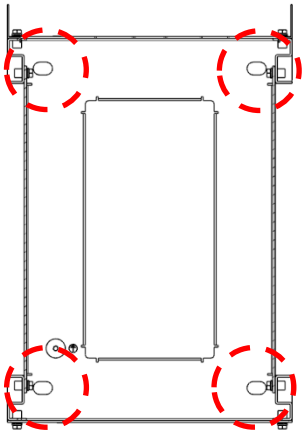
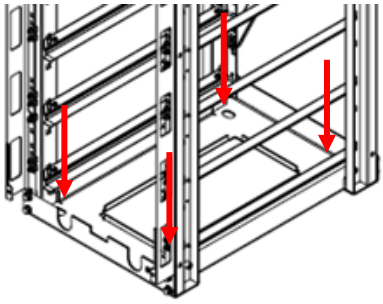
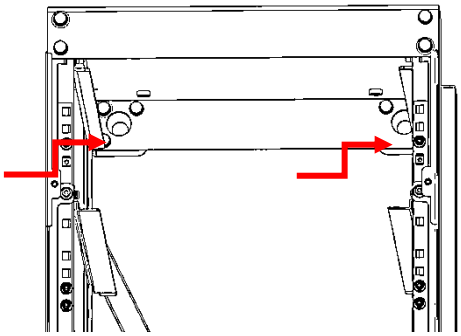
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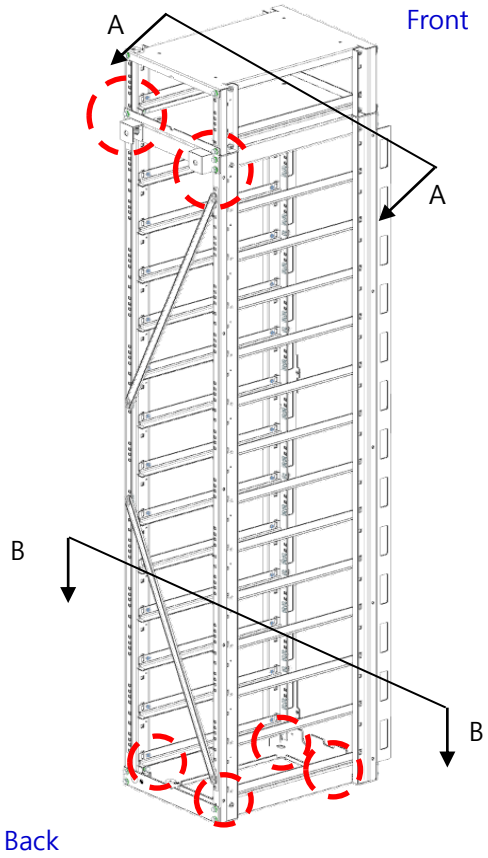
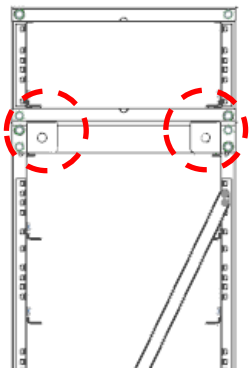
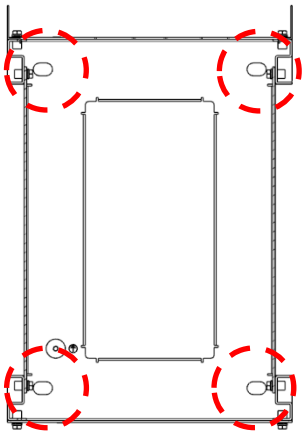
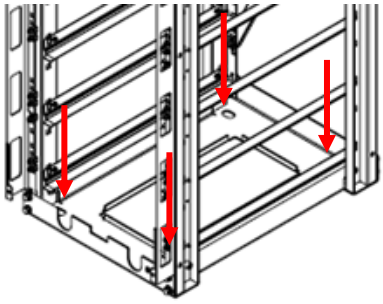
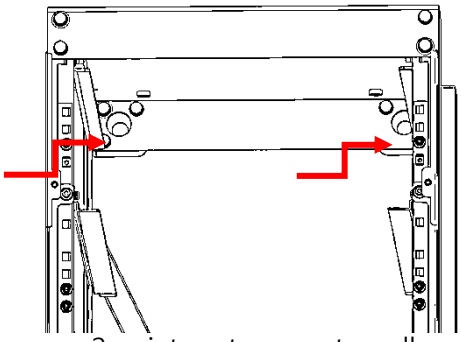




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Anchoring Points (total 6)	Section View
	 Section A - A  Section B - B
Anchoring Point Bottom	**Anchoring Point Rear**
 4 point on bottom to floor M16~M18 bolt, 1,000~10,000kgfcm	 2 point on top rear to wall M16~M18 bolt, 1,000~10,000kgfcm

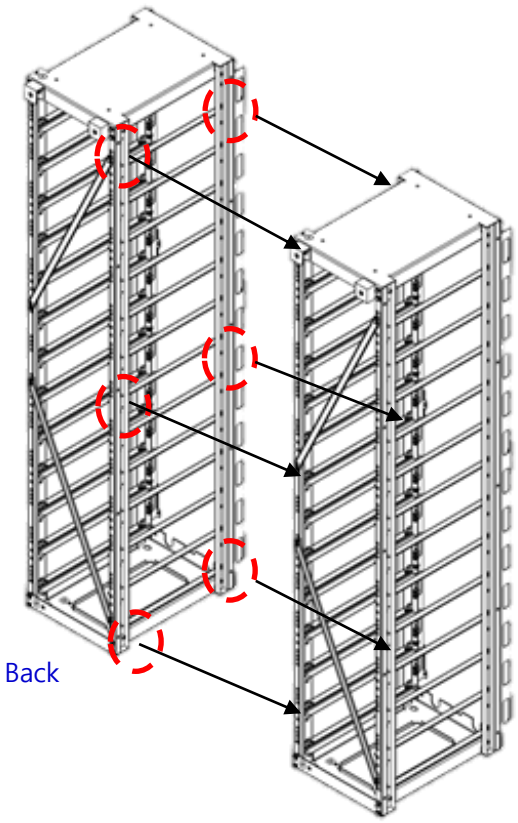
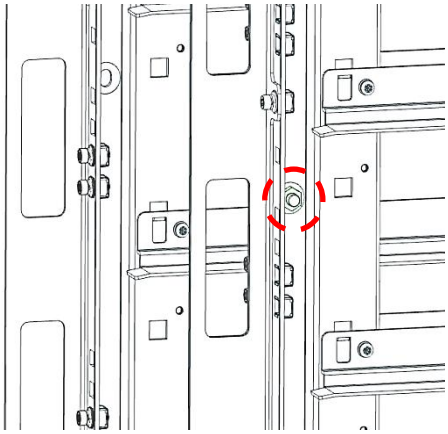
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Anchoring Points (total 6)	Section View
	 Section A - A  Section B - B
Anchoring Point Bottom	**Anchoring Point Rear**
 4 point on bottom to floor M16~M18 bolt, 1,000~10,000kgfcm	 2 point on top rear to wall M16~M18 bolt, 1,000~10,000kgfcm

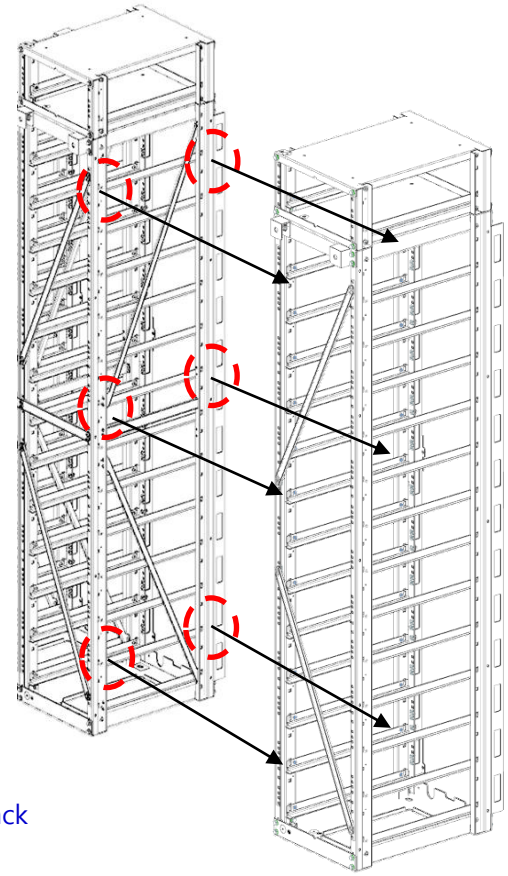
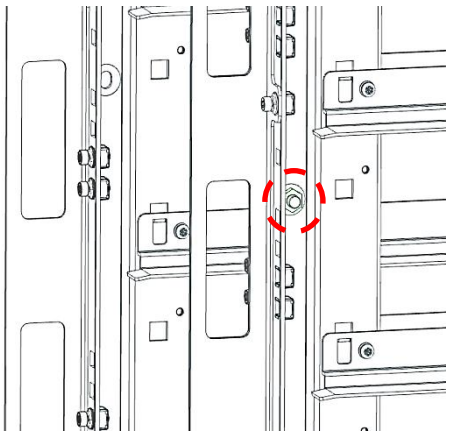
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5.2 Rack Frames Connection

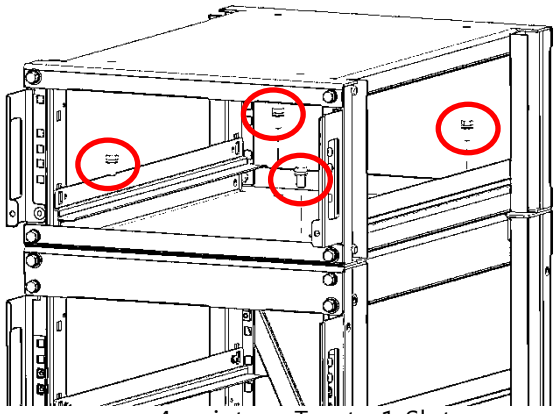
- Fastening between rack frames are required in order to hold rack frame tightly.
- Each rack frame provides 6~10 screw hole for M8 bolt and nut.
- M8 bolt & nut (excluding supply scope), Fastening torque 110–120 kgf·cm

Anchoring Points (Side to Side)	Detail View
	 M8 Bolt / Nut Fastening torque 110–120 kgf·cm

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Anchoring Points (Side to Side)	Detail View
 Back	 M8 Bolt / Nut Fastening torque 110–120 kgf·cm

Connect Single Rack + 1 Slot



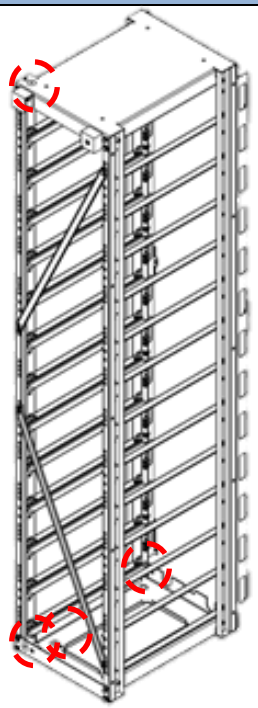
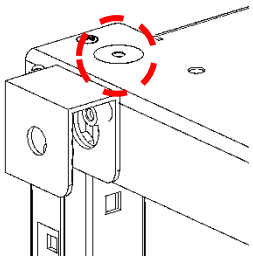
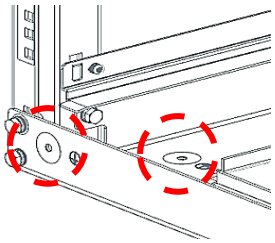
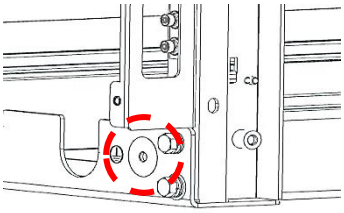
4 point on Top to 1 Slot

M10 Bolt(SJ60-00082A), 1,000~10,000kgfcm

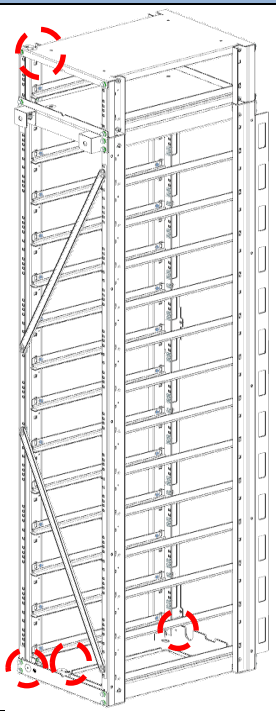
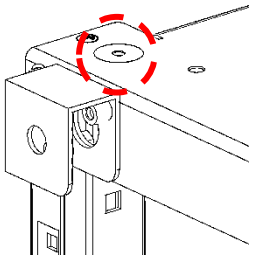
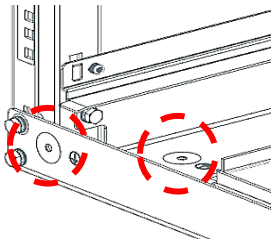
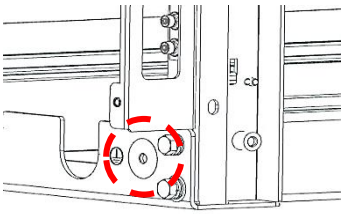
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5.3 Rack Frames Grounding

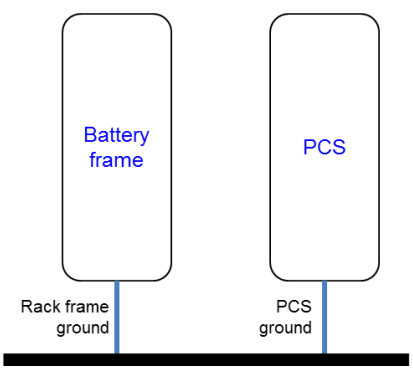
- Rack frame provides 4 masked holes for grounding connection (Top, Bottom and rear side)
- Connecting one on them to field ground through grounding wire (not included in supplied parts)
- The rack frame shall be grounded separately with PCS ground.
- #4 AWG squared ground wire is recommended and it shall follow the regional standard
- Connecting materials including wire and bolt is not containing in supplied scope.

Grounding Point	Detail View
	   Ground connection Using M8 bolt, Fastening torque 110–120 kgf·cm

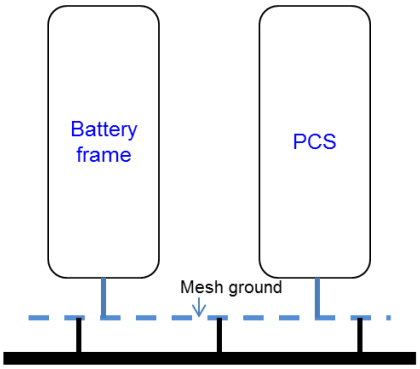
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Grounding Point	Detail View
	   Ground connection Using M8 bolt, Fastening torque 110–120 kgf·cm

[Recommended GND scheme]

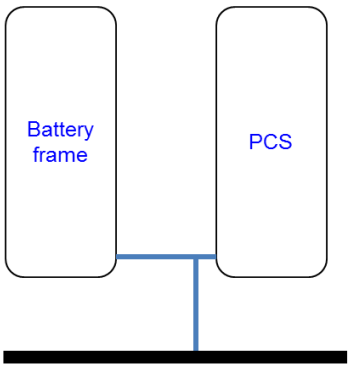


PCS and battery frame has grounded separately



Type B :
Grounding of PCS and battery frame are grounded through mesh ground.

[Avoid GND scheme]



Type C :
Grounding of PCS and battery frame are tied together.

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5.4 Inspection after rack frame installation

- Check whether rack frames are fixed vertical to the floor (using inclinometer)
- Check whether 6 anchoring points are fixed and fastening tightly
- Check whether ground connections are connected tightly.
- Check whether any abnormalities are observed.

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6 Installation of Single Rack

6.1 Single Rack Configuration

[Work explanation]

Insert modules and switchgear into the rack frame and make power and signal connection.

[PPE for installation]

Without : Watch, Ring, Jewelry, Any metal objects.

With : Gloves, Protection shoes, Safety Helmet. Safety goggle, and any other required safety equipment

[Cautions]



- Transport of modules to the installation place
  - Use appropriate transportation method considering the weight of module assembly
  - In case of transporting the modules by human force, at least two peoples are working together

- Insert modules into rack frame
  - Inserting orders : Bottom to top
  - The use of proper lifting equipment is recommended.
  - In case of using human force to inserting modules, the number of workers shall be more than two peoples in one group who fully understand safety regulations on handling the battery pack

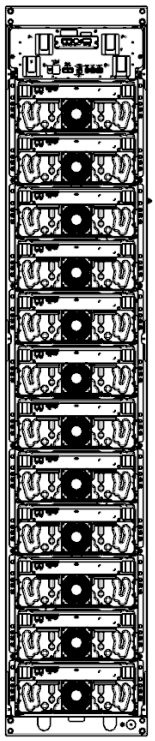
- Insert switchgear into rack frame
  - Insert a switchgear on the designated location
  - Insert a switchgear with System BMS shall be placed in the nearest rack frame with PCS/SCADA

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Module Insertion Order	Detail View

Inserting order

(Bottom to top)



Switchgear

Module #1

Module #2

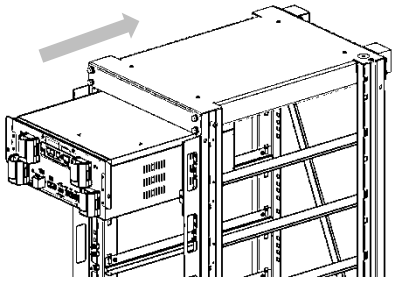
Module #09 for 198S

Module #10 for 220S

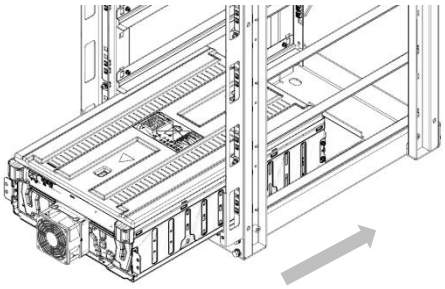
Module #11 for 242S

Module #12 for 264S

Switchgear Insertion



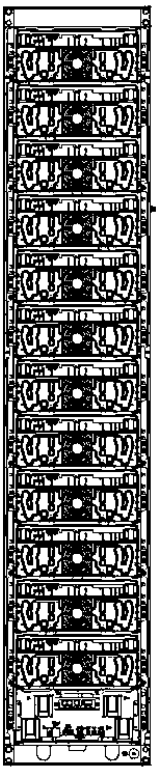
Module Insertion



Module Insertion Order	Detail View

Inserting order

(Bottom to top)



Module #13 for 286S

Module #12 for 264S

Module #11 for 242S

Module #10 for 220S

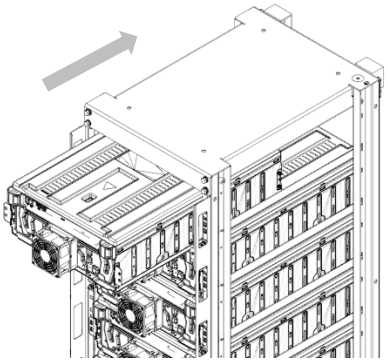
Module #09 for 198S

Module #2

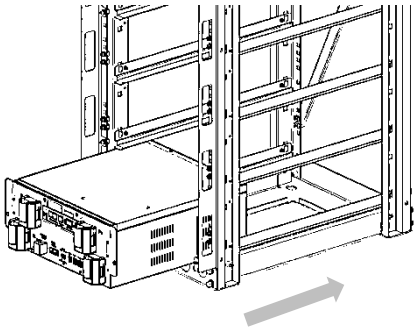
Module #1

Switchgear

Module Insertion



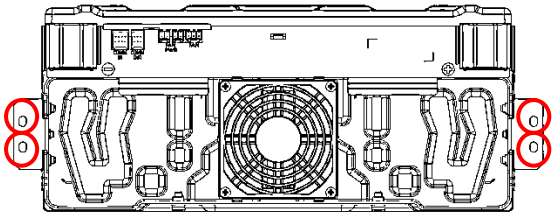
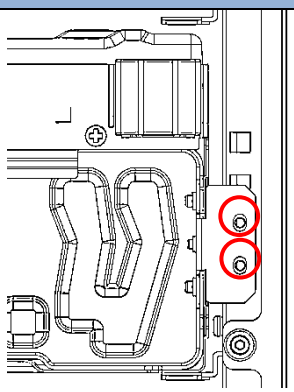
Switchgear Insertion



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6.2 Module Install

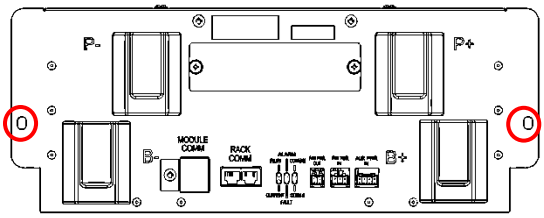
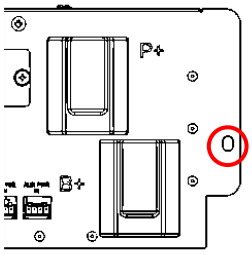
- After inserting all modules into rack frame, performs fastening operating to fix them to the rack frame
- 4 points for module fixation
- Before fastening the bolt, the alignment between holes on module and holes on rack frame
- Use M5 screw with 5.1~6.1N·m (50~60kgf·cm)

Locations of Module Mounting	
	
Module	Before fastening the schre, the alignment between holes need to be checked M5 screw, 5.1~6.1N·m (50~60kgf·cm)

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6.3 Switchgear Install

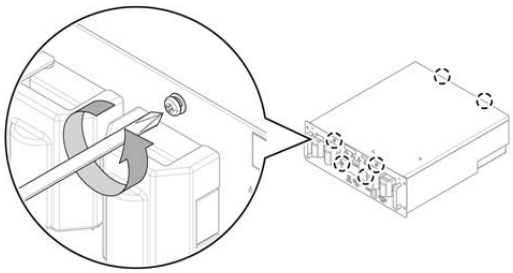
- After inserting all switchgear into rack frame, performs fastening operating to fix them to the rack frame
- 2 points for switchgear fixation
- Before fastening the bolt, the alignment between holes on module and holes on rack frame
- Use M5 screw with 5.1~6.1N·m (50~60kgf·cm)

Locations of Switchgear Mounting	
 Switch Gear	 Before fastening the schre, the alignment between holes need to be checked M5 screw, 5.1~6.1N·m (50~60kgf·cm)

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6.4 System BMS Install

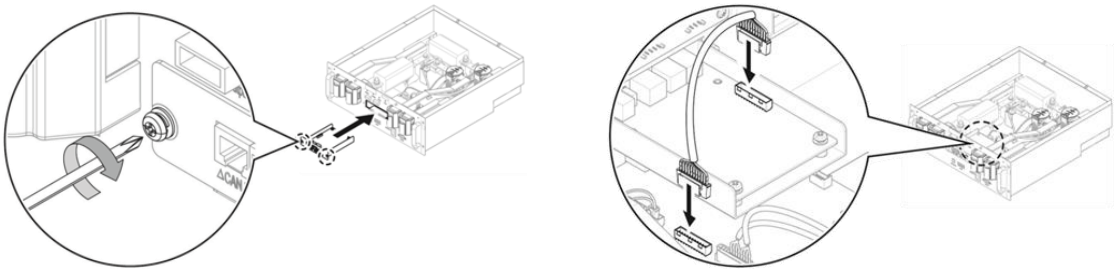
- Record the number of switchgear in which system BMS is to be inserted
- Remove 4(four) screws on the top cover of switchgear and 2(two) screws on the front of switchgear



[Fig 6] Unfastening screw from switchgear

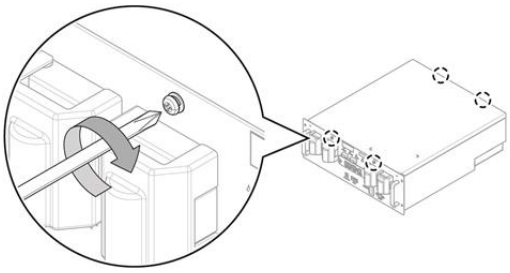
	Important
	▪ Insert System BMS into the first switchgear(into the #1 switchgear among total switchgear) in which the communication channel is to be made.

- Insert system BMS through the front of switchgear and attach it two screws
- (Torque : 0.5–0.8 N·m/5–8 kgf·cm)
- Connect the signal cable between system BMS and rack BMS in the switchgear



[Fig 7] Insertion of system BMS & connection of the signal cable

- Close the top cover of switchgear and attach it with 4(four) screws
- (Torque : 0.5–0.8 N·m/5–8 kgf·cm)



[Fig 8] Closing top cover

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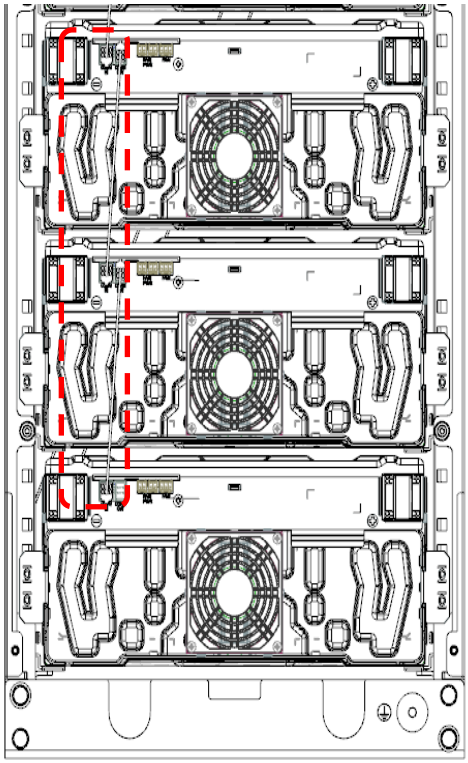
6.5 Communication Cable Wiring

6.5.1 Communication Cable Wiring(Module to Module)

- Connect signal cables for module BMS's for each modules. Use the same signal cable for connection of first module to final module. Repeat cabling from module #1 and module #2, to module #n-1 and module #n

	NOTICE
	Be sure to use the signal cables as the following guideline. They are designed to have optimized lengths at each step.

	WARNING
	Module BMS Damage Do not insert a single signal cable into the same Module Assembly.



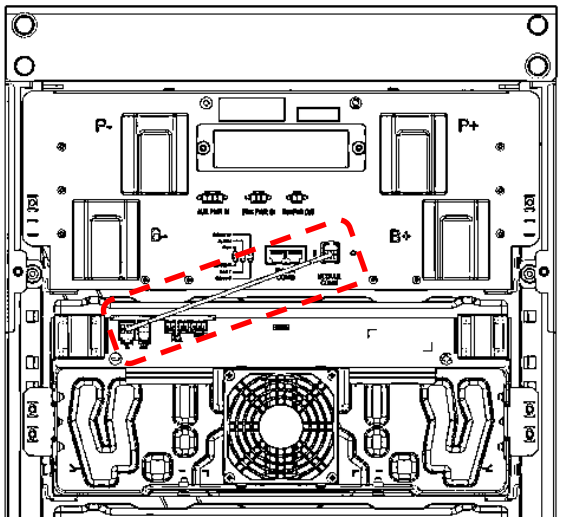
[Fig 9] Connection of signal cable between modules

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6.5.2 Communication Cable Wiring(Module to Switchgear)

- Connect the cable between switchgear and first module.

	NOTICE
⚠	Be sure to use the signal cables as the following guideline. They are designed to have optimized lengths at each step. **Please check this, the cable of module to module (SJ39-00673A) and the cable of Switchgear to module (SJ39-00760A) is different for E2 platform. The cable of 6 pin to 8 pin is module to module cable, but the cable of 8 pin to 8 pin is Switchgear to module cable. Please carefully check this to avoid misconnection these cables.**



[Fig 10] Connection of signal cable between module #1 and switchgear

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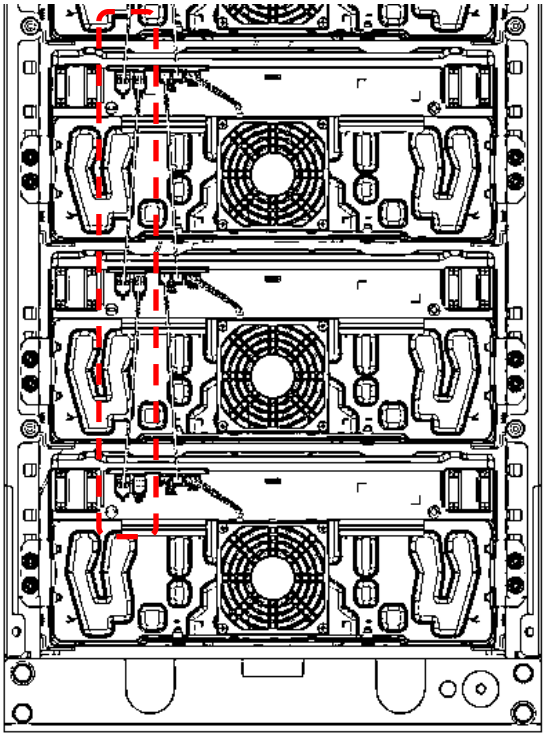
6.6 Fan Power Cable Wiring

6.6.1 Fan Power Cable Wiring(Module to Module)

- Connect fan power cables for module BMS's for each modules. Use the same signal cable for connection of first module to final module. Repeat cabling from module #1 and module #2, to module #n-1 and module #n

	NOTICE
	Be sure to use the fan power cables as the following guideline. They are designed to have optimized lengths at each step.

	WARNING
	Module BMS Damage Do not insert a single signal cable into the same Module Assembly.



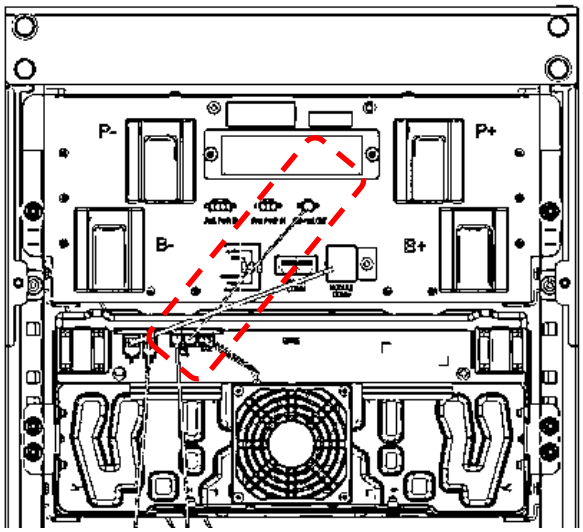
[Fig 11] Connection of fan power cable between modules

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6.6.2 Fan Power Cable Wiring(Module to Switchgear)

- Connect the cable between switchgear and first module.

	NOTICE
	Be sure to use the signal cables as the following guideline. They are designed to have optimized lengths at each step.



[Fig 12] Connection of signal cable between module #1 and switchgear

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6.7 Power Cable/Bus-bar Wiring

6.7.1 Power Cable/Bus-bar Wiring(Module to Module)

- Connect the power cable(E2)/bus-bar(M2f/P3) between modules

Verify for zero energy state or isolation between strings!

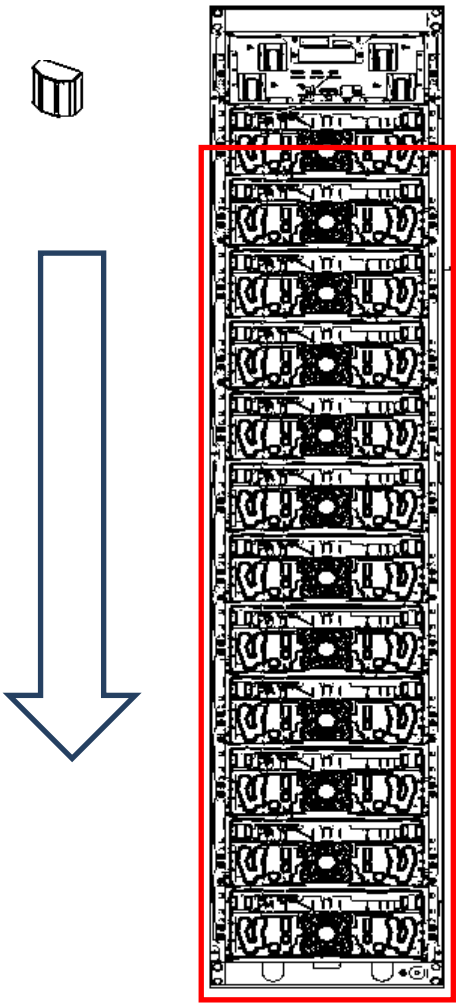
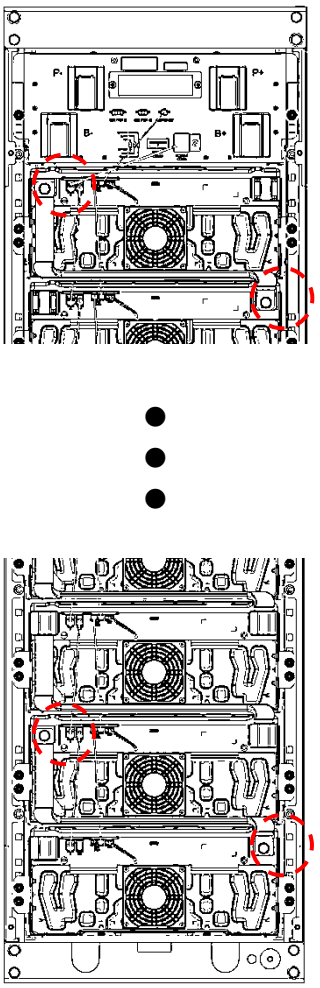
Make sure that PCS interface is LOTO'ed!

	CAUTION
	▪ Please follow the instruction steps to protect module BMS against damage. ▪ Important: DO NOT deviate from the sequence of steps below.

	NOTICE
	▪ Connect the power cable with an M8 screw. ▪ The fastening torque should be 8.16–11.94 N·m/80–117 kgf·cm. ▪ In this process, it is recommended to use an insulated extension torque wrench with a 13 mm socket.

	Important
	▪ Power terminals, such as "B+", "B-", "P+", and "P-", of module and switchgear are protected with the power terminal cover. ▪ The purpose of the power terminal cover is to prevent a short circuit. ▪ At each step in this process, remove the cover prior to connecting power cable and reinsert the cover immediately after connecting power cable. ▪ Connect the power cable between module #1 negative "B-" and module #2 positive "B+." (The example of connection is as shown in [Fig 12]) ▪ Repeat power cable connections from module #2 "B-"and module #3, to module #n-1 and module #n.

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	Connection among Modules
REMOVE THE TERMINAL CAP 	**Busbar** **Connecting Module to Module** 

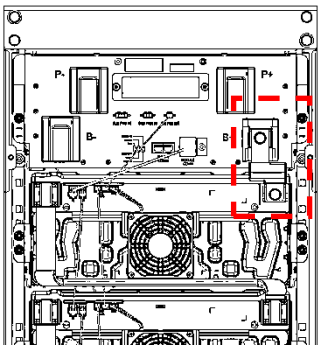
[Fig 13] Connection of rack power cable between modules

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6.7.2 Power Cable/Bus-bar Wiring(Module to Switchgear)

· Connect the power cable(E2)/bus-bar(M2f/P3) between switchgear to module

	Important
	▪ Connect the power cable between module #1 positive "B+", and switchgear negative "B+." (The example of connection is as shown in [Fig 13])

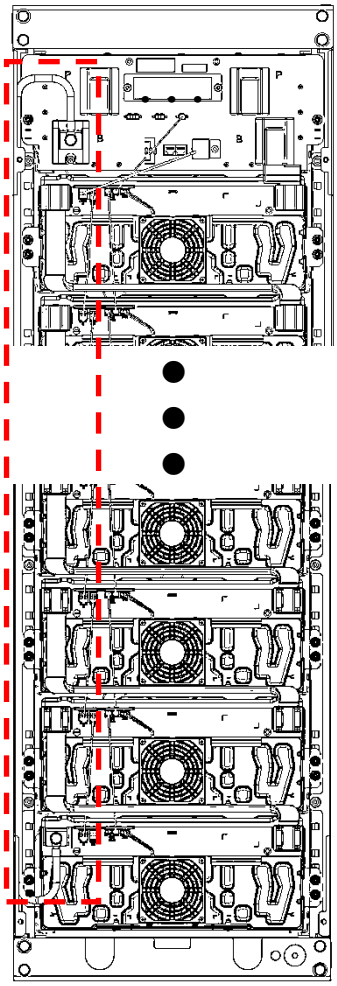


[Fig 14] Connection of rack power cable/bus-bar between modules#1 to switchgear

· Connect the long power cable between final module "B-" and switchgear "B-"

	CAUTION
	▪ Make sure that the long power cable remains LOTO'ed before this step. ▪ Make sure that a long DC power cable is not connected to module #n negative "B-", before this step. ▪ Proceed with I-Marking on bolts and nuts after tightening. ▪ The fastening torque should be 8.16–11.94 N·m/80–117 kgf·cm.
	Important
	▪ This is the final step for connecting the power wire. ▪ In this step, connect the power cable to the negative terminal "B-" of switchgear **before connecting it to the negative terminal "B-" of final module.** ▪ (The example of connection is as shown in [Fig 14]).

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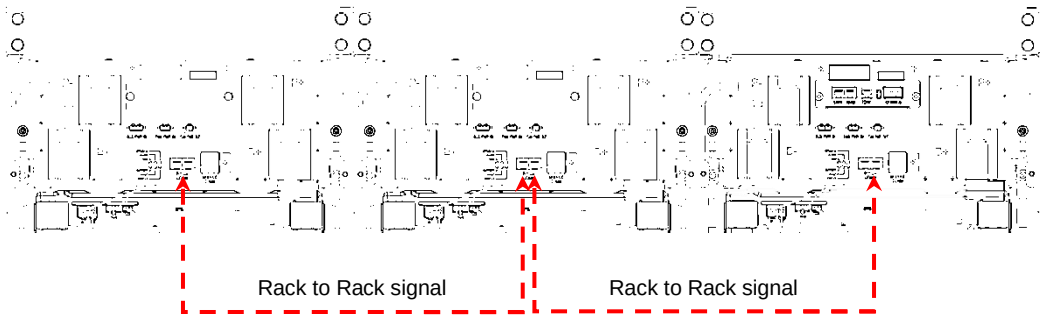
[Fig 15] Connection of rack power cable between final module to switchgear

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7 Installation of Parallel Racks

7.1 Communication Cable Wiring(Switchgear to Switchgear)

- Connect the communication cable between switchgears

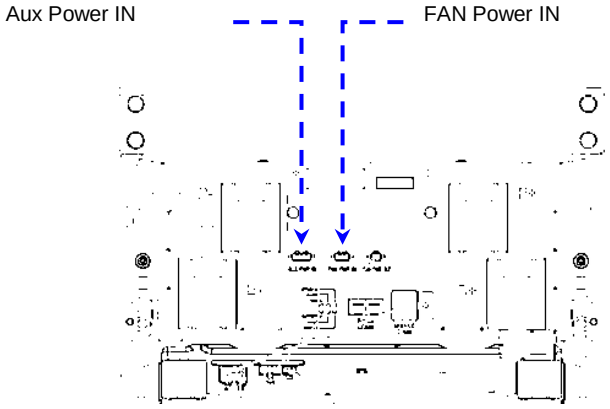


[Fig 16] Connection for switchgear to switchgear signal cable

	Important
	To connect the signal cables between switchgears: ▪ Connect the signal cable from #1 SG CAN B to #2 SG CAN B, and repeat to the end. ▪ Insert the terminating resistance (**4719-002545**) in the final SG CAN B.

7.2 Switchgear Aux. and Fan Power Cable Connection(24VDC)

- Supplying 24V Aux power and FAN power to each switch gear.



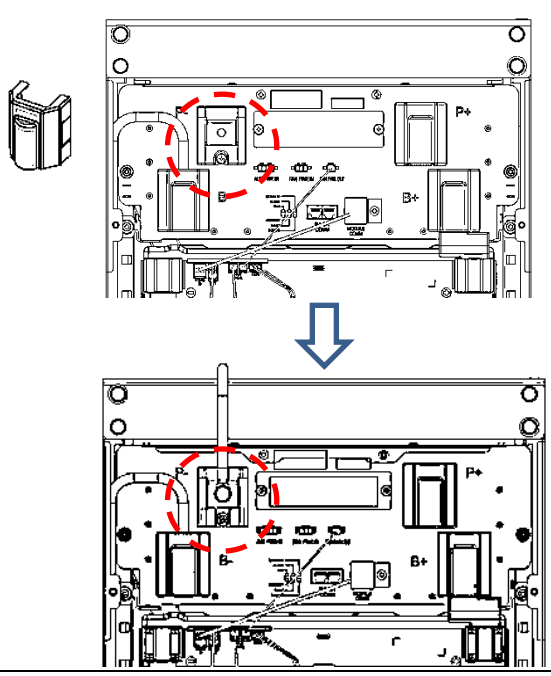
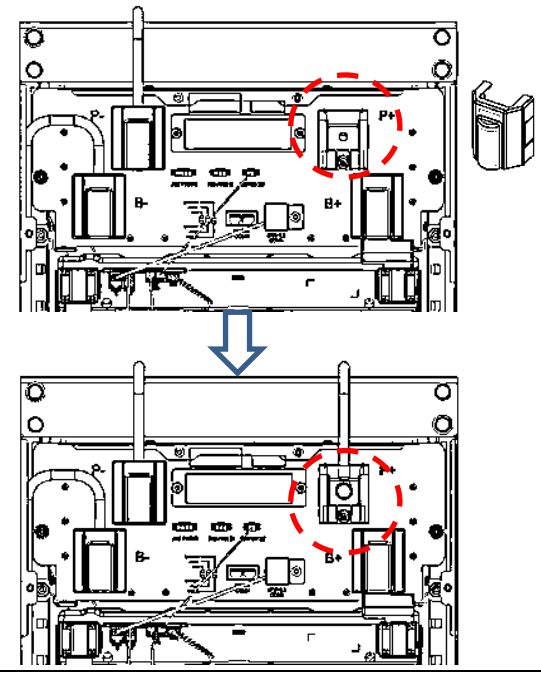
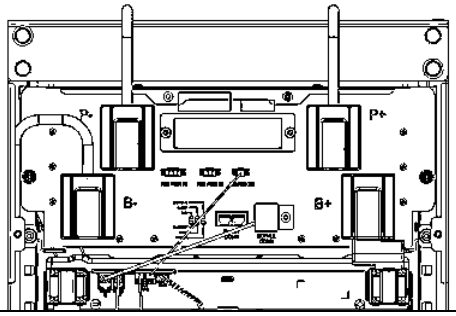
[Fig 17] Connecting the DC24V aux. power cable

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7.3 DC Power Cable Wiring

7.3.1 DC Power Cable Wiring(Switchgear Side)

- Connect bus-bar among modules and Switchgear.
- Connecting order :
  - Remove the terminal cap of switchgear P (-)
  - Connect the PCS power cable (-) to the switchgear P (-). .
  - Assemble the terminal cap on the switchgear P(-).
  - Be careful of short-circuit when connecting bus-bars.
  - Remove the terminal cap of switchgear P (+)
  - Connect the PCS power cable (+) to the switchgear P (+). .
  - Assemble the terminal cap on the switchgear P(+).
  - Please check once again the status of connection.

a. Connection PCS (-) Cable to S/G (P-)	B. Connection PCS (+) Cable to S/G (P+)
REMOVE THE TERMINAL CAP	**REMOVE THE TERMINAL CAP**
	
	

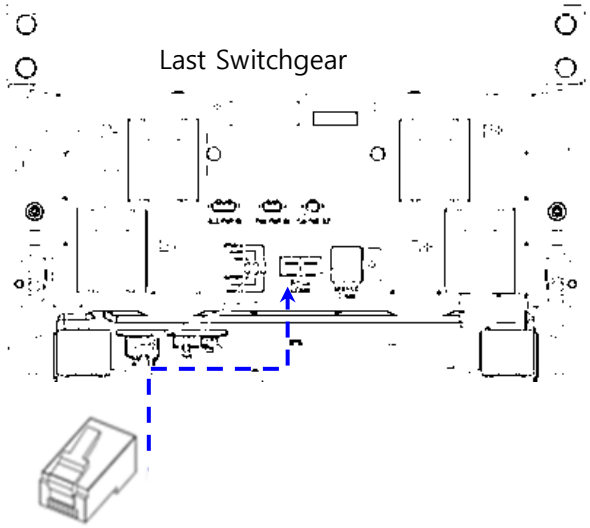
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7.3.2 DC Power Cable Wiring(DC Panel Side)

Refer the appendix J

7.4 Termination Resistor Connection

- Insert the terminating resistance (4719-002545) to the last installed SG CAN B.



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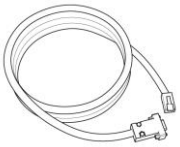
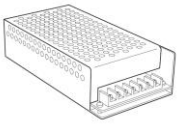
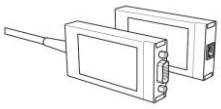
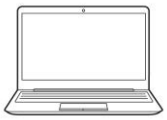
8 System Integration

8.1 Rack ID Setup

8.1.1 Preparation for Rack ID Write

- Required tool list for ID writing (Does not included in supplied parts)
- Generally this work is covered by Samsung SDI, otherwise please contact to SDI engineer.

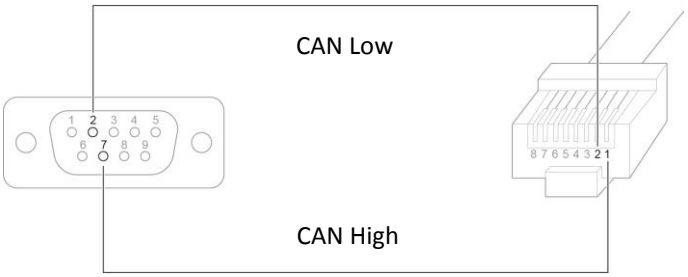
[Table 7] Required Items for ID Writing

No.	Items	Shape	Comments
1	**Power Supply cable to SG** (Connector: Can be connected to the SMPS terminal)		SG Power Supply –Connector (F31MSP-03V-KY, JST) -Receptacle (F31FSS-03V-KY, JST)
2	**ID Writer Cable** Connecting between Rack BMS and IXXAT (must be made by the customer as described below)		RJ45 (8 pin) and D-SUB female (9-pin)
3	**24Vdc SMPS (Power Supply)** (must be sourced by the customer)		Output 24 Vdc, 150 W, 6.3 A (max current)
4	**IXXAT** (must be sourced by the customer)		USB-to-CAN V2 (IXXAT)
5	**Notebook PC** English Language Window 7 recommended (must be sourced by the customer)		Service pack: SP1 Minimum hardware requirements • 1 GHz or faster with a 32-bit processor • 1 GB RAM (32-bit) or 2 GB RAM (64-bit) • 16 GB available hard disk (32-bit) or 20 GB (64-bit)

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NOTICE

- The ID writing cable must be made by the customer according to the following PIN map.



[Fig 18] Pin map for writing cable

[Table 8] Pins for a writing cable

Connector A	Pin No.	Connector B	Pin No.	Remarks
D-SUB(femail)	2	RJ45	2	CAN Low
	7		1	CAN High

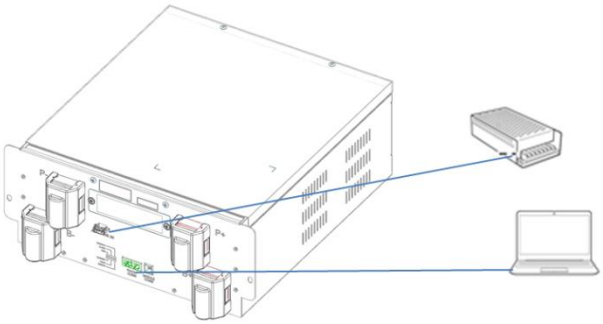
NOTICE

- A 120 Ω termination resistor shall be inserted between the pins for No 2 and No 7 in the D-SUB (Female).

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8.1.2 Rack ID Write

- Supply 24V external power to “Aux PWR IN” in Rack BMS using #1 and #3 in Table7
- Connect “Rack COMM” port and laptop using “ID Write Cable” listed in Table7
- Connection scheme



[Fig 19] Cable connection for ID writing

- Download the IXXAT installation driver from the website at http://www.ixxat.com/support/file-and-documents-download/drivers/vci-v3-driver-download and install the driver on your laptop computer. Run “rack viewer install for rack” after turning on the rack BMS



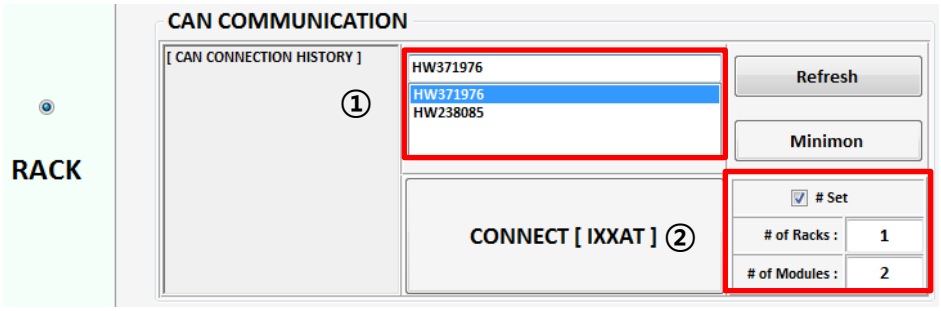
[Fig 20] System BMS monitoring program icon

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- When the RMBS installation window appears, identify and select the appropriate IXXAT HW number and click **START**(①). When connection is completed, the message, “CONNECTED” will appear. If any value change is required, double-click the cell in SETTING VALUE and enter the desired value and click **WRITE**(②)

	Important
	▪ **Check/Uncheck**: Used to select or unselect the items. ▪ **WRITE**: Used to write the displayed values displayed in SETTING VALUE for the selected item. When you click, the same value automatically appears in READ VALUE.

	CAUTION
	▪ If you cannot find any value in the box ②, restart the program.



[Fig 21] Rack BMS installation window

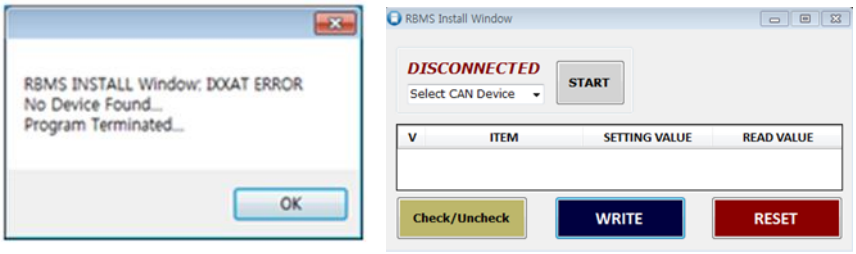


The device number comes from IXXAT when connected

[Fig 22] Displayed window when connected

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	NOTICE
	▪ When the IXXAT converter is not connected to your computer, the following warning message appears without any value for ITEM. ▪ For example, if you want to set the second Rack BMS, enter "2" in SETTING VALUE then CAN ID 2002 is written for the second Rack BMS.



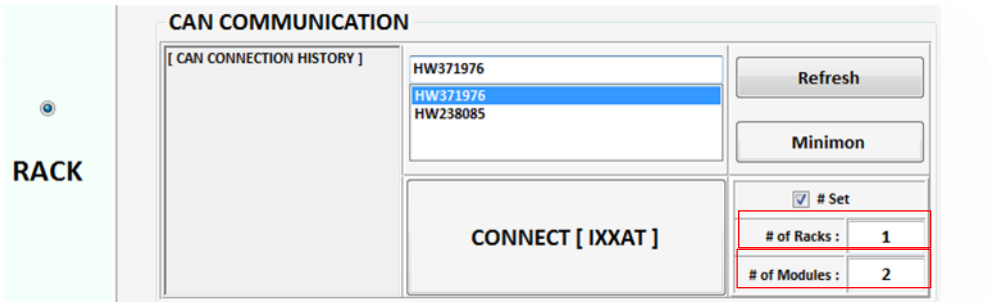
[Fig 23] Warning message when connection error

	Important
	▪ The number of Racks is the total number of strings installed. The possible range is 1–128. If the value exceeds the limit, the function cannot operate. ▪ For example, in case of the first Rack, the value is 1. This value depends on the order of Racks from System BMS. ▪ The number of Modules is the number of modules connected to the Rack BMS. Its possible range is 1–32. ▪ For example, in case of 264S 1P Rack, the value is "24." ▪ For example, if you want to set the second Rack BMS, enter "2" in SETTING VALUE then CAN ID 2002 is written for the second Rack BMS. ▪ To prevent a writing mistake, the following confirmation message appears after clicking **WRITE**.



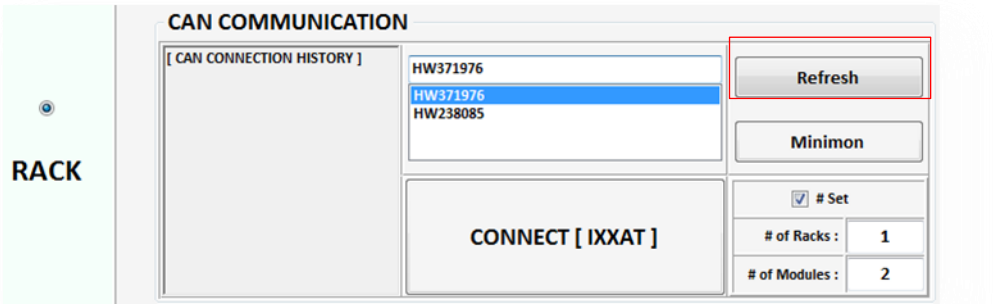
[Fig 24] Writing confirmation message

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[Fig 25] Case of rack & module range

- After writing, re-start the rack BMS. To re-start, turn off and on the power of system BMS, or click **REFRESH** for software reset.



[Fig 26] RESET button in installation window

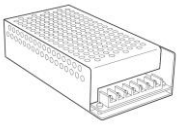
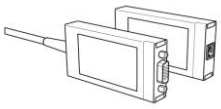
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8.2 System BMS EEPROM Setup

8.2.1 Preparation for System BMS EEPROM Setup

· Prepare the follow items and perform the ID writing for System BMS

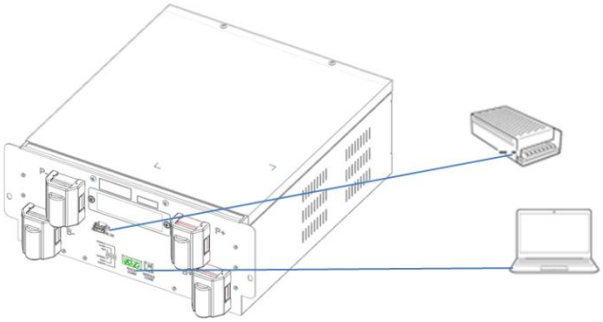
[Table 9] Required Items for ID Writing

No.	Items	Shape	Comments
1	**Power Supply cable to SG** (Connector: Can be connected to the SMPS terminal)		SG Power Supply –Connector (F31MSP-03V-KY, JST) -Receptacle (F31FSS-03V-KY, JST)
2	**ID Writer Cable** Connecting between Rack BMS and IXXAT (must be made by the customer as described below)		RJ45 (8 pin) and D-SUB female (9-pin)
3	**24Vdc SMPS (Power Supply)** (must be sourced by the customer)		Output 24 Vdc, 150 W, 6.3 A (max current)
4	**IXXAT** (must be sourced by the customer)		USB-to-CAN V2 (IXXAT)
5	**Notebook PC** English Language Window 7 recommended (must be sourced by the customer)		Service pack: SP1 Minimum hardware requirements • 1 GHz or faster with a 32-bit processor • 1 GB RAM (32-bit) or 2 GB RAM (64-bit) • 16 GB available hard disk (32-bit) or 20 GB (64-bit)

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8.2.2 System BMS EEPROM Setup

- Connect both the TCP/IP cable and CAN B cable from the system BMS to your computer as the figure below;

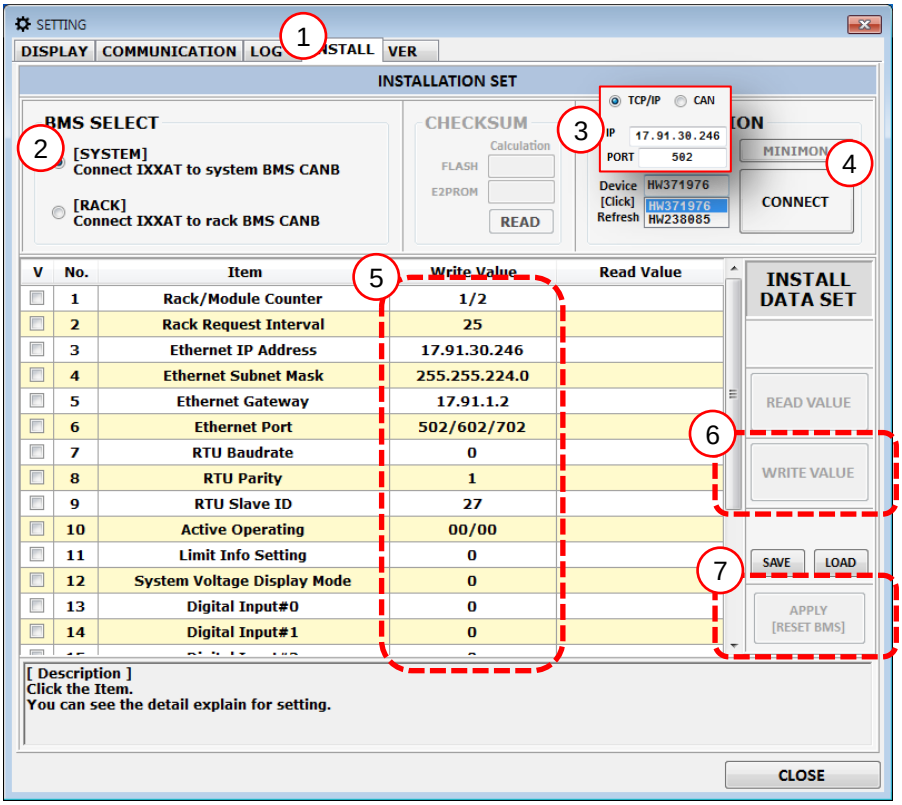


[Fig 27] Cable connection for BMS EEPROM setup

8.2.3 System BMS EEPROM Setup

- Execute “ELP_MON” icon in the desktop menu
- Select “INSTALL” tab and select System then check TCP/IP in Communication.
- Finally select connect
- Input proper value and push write value and check whether the read value is right.
- After that push apply button
- The setting value of system BMS shall be checked and confirmed by Samsung Engineer.

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[Fig 28] System BMS Installation Window

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[Table 10] System BMS Setting Value

No	Item	Default	Description
1	Rack /Module counter	1/2	1 : The number of Racks per system BMS 2 : The number of modules *2 per Rack
2	Rack Request interval	25	No need to change
3	Ethernet IP address	17.91.30.246	Change according to EMS setting
4	Ethernet subnet mask	255.255.224.0	Change according to EMS setting
5	Ethernet gateway	17.9.1.1.2	Change according to EMS setting
6	Ethernet port	502/602/702	No need to change
7	RTU Baud rate	0	0 : 19200 bps 1 : 9600 bps
8	RTU Parity	1	0 : None 1 : Even parity 2 : Odd parity
9	RTU Slave ID	27	BMS ID (Hex)
10	Active Operating	0/0	Minimum Rack count / Set differential voltage In case 4/10 means. Starting : Minimum 4 Racks shall be within the range of 10V of median voltage Operating : If the rack voltage is within 10V then DC contactor ON. Otherwise the Rack BMS will not close the DC contactor regardless command.
11	Limit info setting	0	Unit selection of Maximum Charge/Discharge current information in MODBUS protocol 0 : Power limit (100W/Unit) 1 : Current limit (1A/Unit)
12	System V display mode	0	The displayed value setting for voltage information in MODBUS 0 : Average 1 : Median 2 : Minimum
13	Digital input	NA	No need to change

* SDI recommends using “Active operating” in order to eliminate the risk of fuse blowing due to rush current. Setting value = Half of rack number / Voltage difference (10V)

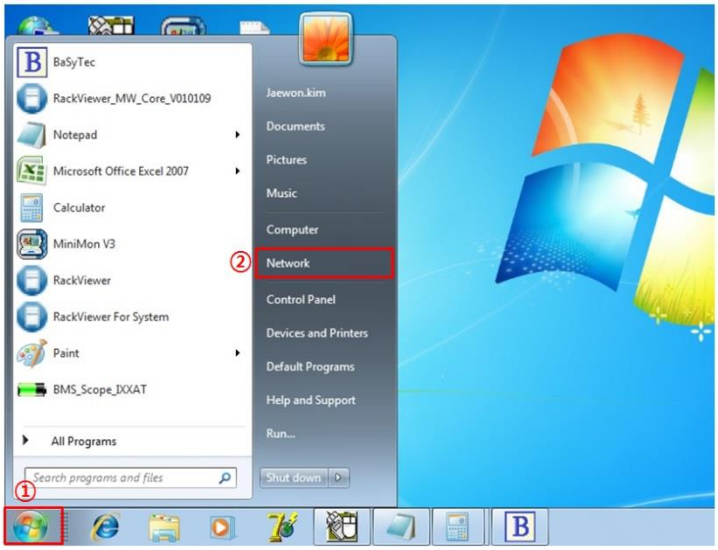
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8.3 System Communication Checkup

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 data of the System BMS shows the data of Rack BMS correctly.

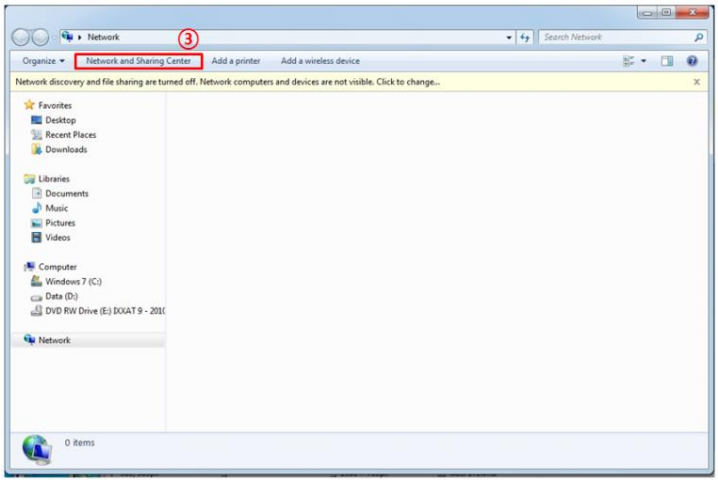
8.3.1 IP Setting (Laptop) for communication with System BMS

- Before checking the data of the BMS, change the IP settings in the notebook PC.
- IP configuration is as follows:
- If you click "**START**" in the desktop's status bar (①), the following pop-up window appears. Click "**Network**" (②).



[Fig 29] How to connect the Network

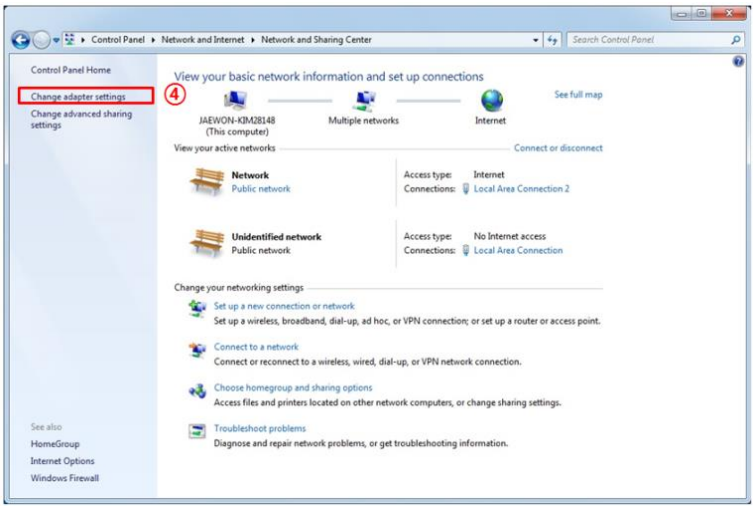
- When a network window appears, click "**Network and Sharing Center** (③)."



[Fig 30] How to connect the Network and sharing center

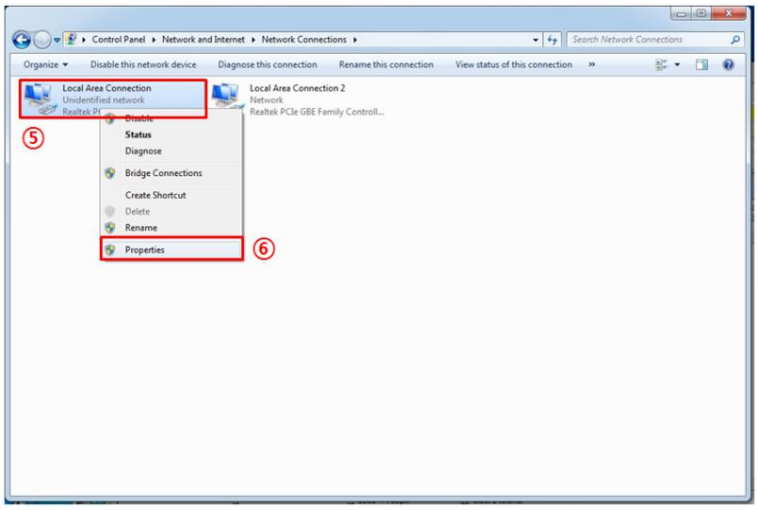
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· When the following window appears, click "**Change adapter settings** (④)."



[Fig 31] How to connect the Change adapter setting

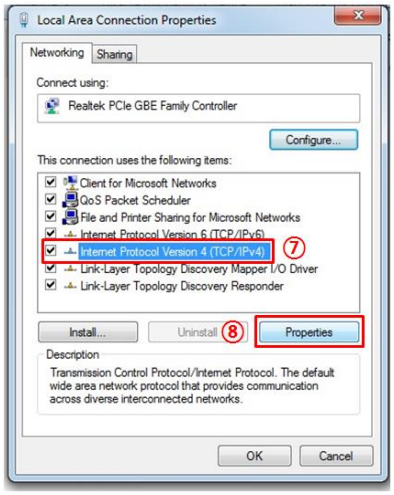
· When the network connections window appears, choose "**Local Area Connection"** and click the right button of the mouse (⑤). When the pop-up window appears, click "**Properties"** (⑥).



[Fig 32] How to connect the Properties for Local Area Connection

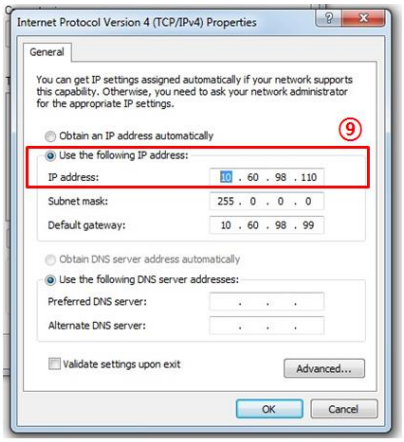
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· When the local area connection properties widow appears, select "Internet Protocol Version 4 (TCP/Pv4)" (⑦) and then click "Properties (⑧)."



[Fig 33] How to Connect the "Properties for Internet Protocol Version 4 (TCP/Pv4)"

· When the following window appears, change the "IP address" that fits your circumstances (⑨).

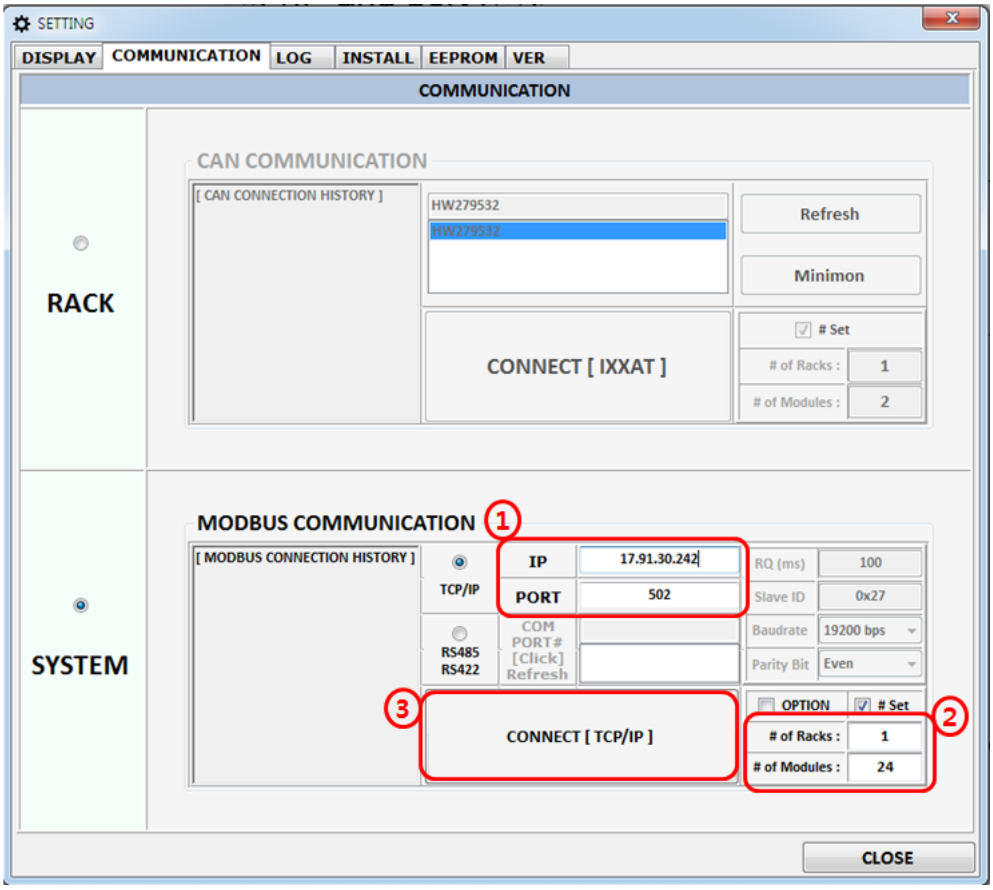


[Fig 34] How to set the IP address

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8.3.2 To check the data of System BMS

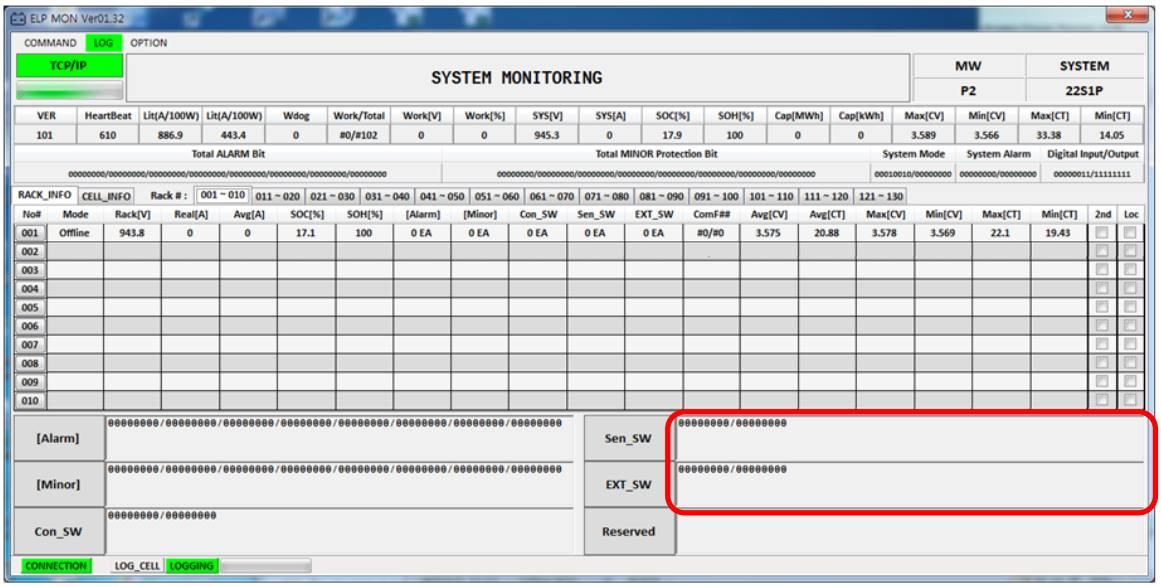
- Run “ELP_MON”
- Refer to the [Fig 34]
- When the following window appears, set the following items:
- Settings for TCP/IP and port (①)
- Number of racks per bank and total number of racks (②)
- Click Connect (③).



[Fig 35] Main window of ELP_MON

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- Then check all the data of the Rack in the following window.



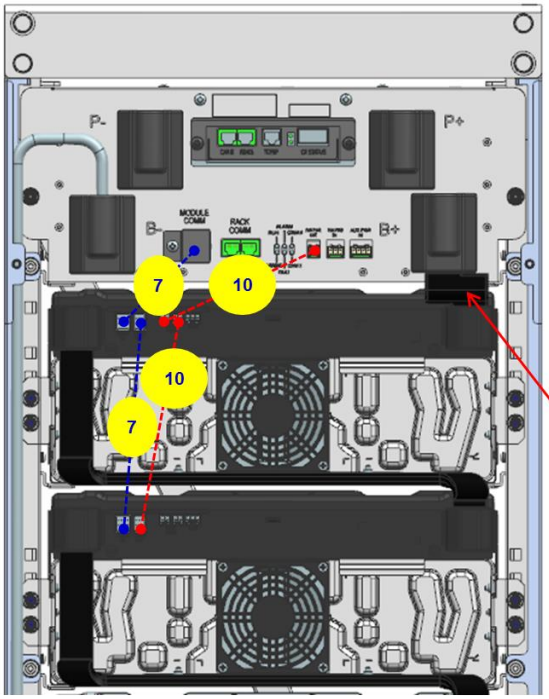
[Fig 36] Checking data of system BMS

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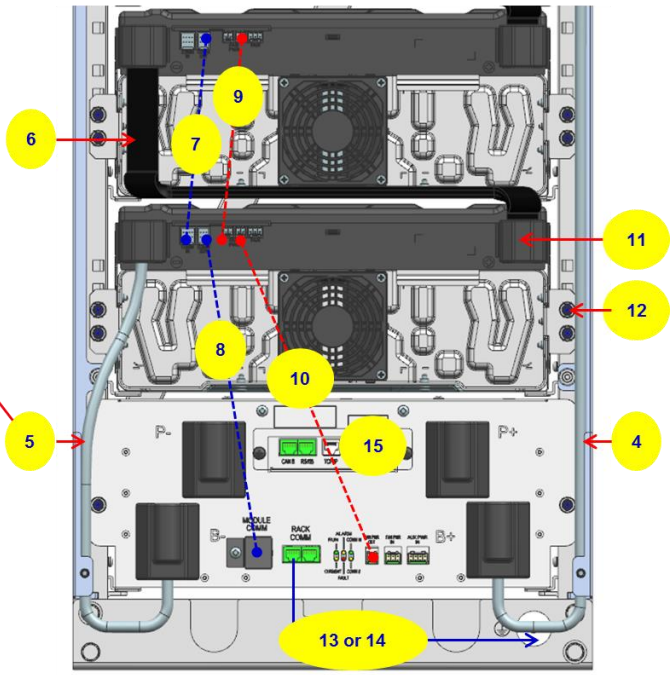
Appendix A. Standard supplied part list

The listed component code and quantity can be changed depending on battery configuration or any other reason.

- **Description of component**



[Switchgear Top]



[Switchgear Bottom]

- **Supplied quantity**

CASE A. Switchgear placed in Top position

			Quantity			
Category	No	Description	198 S	220 S	242 S	264 S
Module	1	Module	9	10	11	12
Switchgear	2	Switchgear	1	1	1	1
Rack frame	3	Rack frame	1	1	1	1
Power Connection	4	S/G to Module (Long)	1	1	1	1
	5	S/G to Module (Short)	1	1	1	1
	6	Module to Module	8	9	10	11
Wire harness	7	Module to Module (Signal)	9	10	11	12
	9	Module to Module (FAN)	9	10	11	12
Screw	11	Power cable fixation	22	24	26	28
	12	Module fixation	38	42	46	50
Wire harness	13	Rack to Rack Signal (560mm)	# of parallel connection - 1			
	14	Rack to Rack Signal (5000mm)	1 (Depending on Configuration)			
System BMS	15	System BMS	1 per Bank			
Termination	16	Terminal resistor	1 per Bank			

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CASE B. Switchgear placed in bottom position

			Quantity				
Category	No	Description	198 S	220 S	242 S	264 S	286S
Module	1	Module	9	10	11	12	13
Switchgear	2	Switchgear	1	1	1	1	1
Rack frame	3	Rack frame	1	1	1	1	1
Power cable	4	S/G to Module (Long)	1	1	1	1	1
	5	S/G to Module (Short)	1	1	1	1	1
	6	Module to Module	8	9	10	11	12
Wire harness	7	Module to Module (Signal)	8	9	10	11	12
	8	Module to Switchgear (Signal)	1	1	1	1	1
	9	Module to Module (FAN)	8	9	10	11	12
	10	Module to Switchgear (FAN)	1	1	1	1	1
Screw	11	Power cable fixation	22	24	26	28	30
	12	Module fixation	38	42	46	50	54
Wire harness	13	Rack to Rack Signal (560mm)	# of parallel connection – 1				
	14	Rack to Rack Signal (5000mm)	1 (Depending on Configuration)				
System BMS	15	System BMS	1 per Bank				
Termination	16	Terminal resistor	1 per Bank				

- **Code list**

No	Description		E2	M2f	P3
1	Module		ELPM762-00015	ELPM762-00018	ELPM632-00003
2	Switchgear		Varies with Project		
3	Rack frame	286S	SJ61-03365A(13 steps) , SJ61-03362A(1 step)		
		264S	SJ61-03288A		
		242S	SJ61-03287A		
		220S	SJ61-03283A		
		198S	SJ61-03284A		
4	S/G to Module (Long)	286S	SJ39-00659B		SJ39-00579A
		264S	SJ39-00659A		
		242S	SJ39-00410A		SJ39-00579B
		220S	SJ39-00349A		
		198S	SJ39-00656A		SJ39-00579C
5	S/G to Module (Short)	S/G Top	SJ39-00771A	SJ66-00883B	SJ66-00883A
		S/G Bottom		SJ39-00771A	SJ39-00785A
		286S			
6	Module to Module		SJ39-00771A	SJ66-00884B	SJ66-00884A

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7	Module to Module (Signal)		SJ39-00673A	
8	Module to S/G (Signal)	S/G Top	SJ39-00760A	SJ39-00673A
		S/G Bottom	SJ39-00784A	SJ39-00678A
		286S		
9	Module to Module (FAN)		SJ39-00759A	
10	Module to S/G (FAN)	S/G Top	SJ39-00759A	
		S/G Bottom	SJ39-00786A	
		286S		
11	Power cable fixation (Screw)		SJ81-01199A	
12	Module fixation (Screw)		SJ81-01115A	
13	Rack to Rack Signal (560mm)		SJ39-00559A	
14	Rack to Rack Signal (5000mm)		SJ39-00576A	
15	System BMS		SJ95-01013B	SJ92-01014A
16	Terminal resistor		4719-002545	

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