



# **Residential Energy Storage Unit**

## **For Photovoltaic Systems**

RESU 3.3  
RESU 6.5  
RESU 10

Installation Manual  
June 2016 | Revision 1

## **About this manual**

This manual describes how to install the LG Chem RESU<sup>®</sup> battery pack. Read this manual before you attempt to install the product, and follow the instructions throughout the installation process. If you are uncertain about any of the requirements, recommendations, or safety procedures described in this manual, contact LG Chem immediately for advice and clarification.

The information included in this manual is accurate at the time of publication. However, the product specifications are subject to change without prior notice. In addition, the illustrations in this manual are meant to help explain system configuration concepts and installation instructions. The illustrated items may differ from the actual items at the installation location.

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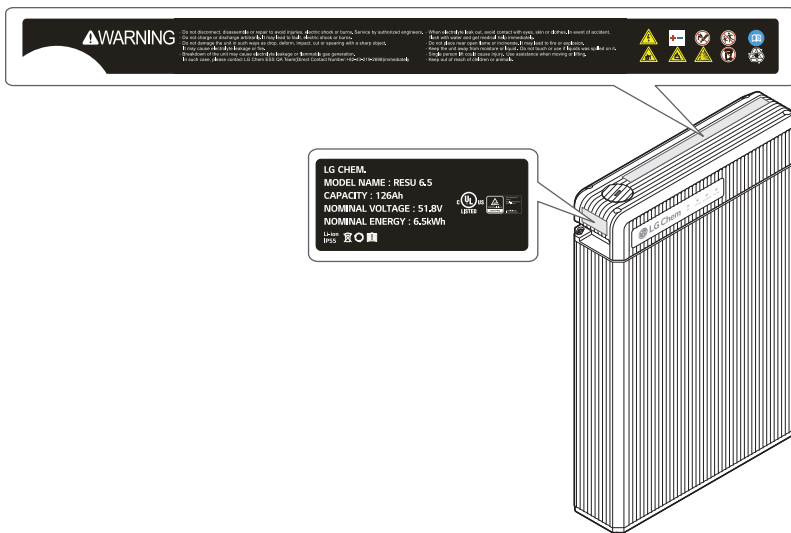
# 1 Safety

## NOTE

To use rechargeable batteries, you are required to comply with standard AS 4086.2 in Australia and VDE-AR-E2510-2 in Germany.

## 1.1 Symbols on product labels

The nameplate is attached to the left side of the battery pack, and the warning label is attached to the top.



This battery pack contains high voltage which can cause electric shock resulting in severe injury.



Make sure that the battery polarity is connected correctly.



Keep the battery pack away from open flame or ignition sources.



Keep the battery pack away from children.



Read the manual before installing and operating the battery pack.



The battery pack is heavy enough to cause severe injury.



The battery pack may leak corrosive electrolyte.



The battery pack may explode.



The battery pack should not be disposed with household waste at the end of its working life.



The battery pack should be disposed at a proper facility for environmentally safe recycling.

## 1.2 Safety instructions

For safety reasons, installers are responsible for familiarizing themselves with the contents of this manual and all warnings before performing installation.

### General safety precautions



#### **WARNING**

Failure to observe the precautions described in this section can cause serious injury to persons or damage to property.

Observe the following precautions:

- Risks of explosion
  - Do not subject the battery pack to strong impacts.
  - Do not crush or puncture the battery pack.
  - Do not dispose of the battery pack in a fire.
- Risks of fire
  - Do not expose the battery pack to temperatures in excess of 60°C.
  - Do not place the battery pack near a heat source, such as a fireplace.
  - Do not expose the battery pack to direct sunlight.
  - Do not allow the battery connectors to touch conductive objects such as wires.

- Risks of electric shock
  - Do not disassemble the battery pack.
  - Do not touch the battery pack with wet hands.
  - Do not expose the battery pack to moisture or liquids.
  - Keep the battery pack away from children and animals.
- Risks of damage to the battery pack
  - Do not allow the battery pack to come in contact with liquids.
  - Do not subject the battery pack to high pressures.
  - Do not place any objects on top of the battery pack.

### **Battery handling guide**

- Use the battery pack only as directed.
- Do not use the battery pack if it is defective, appears cracked, broken or otherwise damaged, or fails to operate.
- Do not attempt to open, disassemble, repair, tamper with, or modify the battery pack. The battery pack is not user serviceable.
- To protect the battery pack and its components from damage when transporting, handle with care.
- Do not impact, pull, drag or step on the battery pack. Do not subject it to any strong force.
- Do not insert foreign objects into any part of the battery pack.
- Do not use cleaning solvents to clean the battery pack.

### **1.3 Response to emergency situations**

The RESU battery pack comprises multiple batteries that are designed to prevent hazards resulting from failures. However, LG Chem cannot guarantee their absolute safety.

#### **Leaking batteries**

If the battery pack leaks electrolyte, avoid contact with the leaking liquid or gas. Electrolyte is corrosive and contact may cause skin irritation and chemical burns.

If one is exposed to the leaked substance, do these actions:

**Inhalation:** Evacuate the contaminated area, and seek medical attention immediately.

**Eye contact:** Rinse eyes with flowing water for 15 minutes, and seek medical attention immediately.

**Skin contact:** Wash the affected area thoroughly with soap and water, and seek medical attention immediately.

**Ingestion:** Induce vomiting, and seek medical attention immediately.

### Fire



In case there is a fire, always have an ABC or carbon dioxide extinguisher.

 **WARNING**

The battery pack may catch fire when heated above 150°C.

If a fire breaks out where the battery pack is installed, do these actions:

1. Extinguish the fire before the battery pack catches fire.
2. If it is impossible to extinguish the fire but you have time, move the battery pack to a safe area before it catches fire.
3. If the battery pack has caught fire, do not try to extinguish the fire. Evacuate people immediately.

 **WARNING**

If the battery catches fire, it will produce noxious and poisonous gases. Do not approach.

### Wet batteries

If the battery pack is wet or submerged in water, do not try to access it. Contact LG Chem or your distributor for technical assistance.



## Damaged batteries

Damaged batteries are dangerous and must be handled with extreme caution. They are not fit for use and may pose a danger to people or property.

If the battery pack seems to be damaged, pack it in its original container, and then return it to LG Chem or your distributor.

### CAUTION

Damaged batteries may leak electrolyte or produce flammable gas. If you suspect such damage, immediately contact LG Chem for advice and information.

## 1.4 Qualified installers

This manual and the tasks and procedures described herein are intended for use by skilled workers only. A skilled worker is defined as a trained and qualified electrician or installer who has all of the following skills and experience:

- Knowledge of the functional principles and operation of on-grid systems.
- Knowledge of the dangers and risks associated with installing and using electrical devices and acceptable mitigation methods.
- Knowledge of the installation of electrical devices
- Knowledge of and adherence to this manual and all safety precautions and best practices.

## 1.5 Contact information

Use the contacts below for technical assistance. These phone numbers are available only during business hours on weekdays.

	Telephone	Email
Europe	+49 (0)162 2970918	aburkert@lgchem.com
USA	+1 (0)248 808 0016	jturner@lgchem.com
Asia	+82 (0)43 219 2695	soongkyu@lgchem.com
Other regions	+82 (0)43 219 2695	soongkyu@lgchem.com

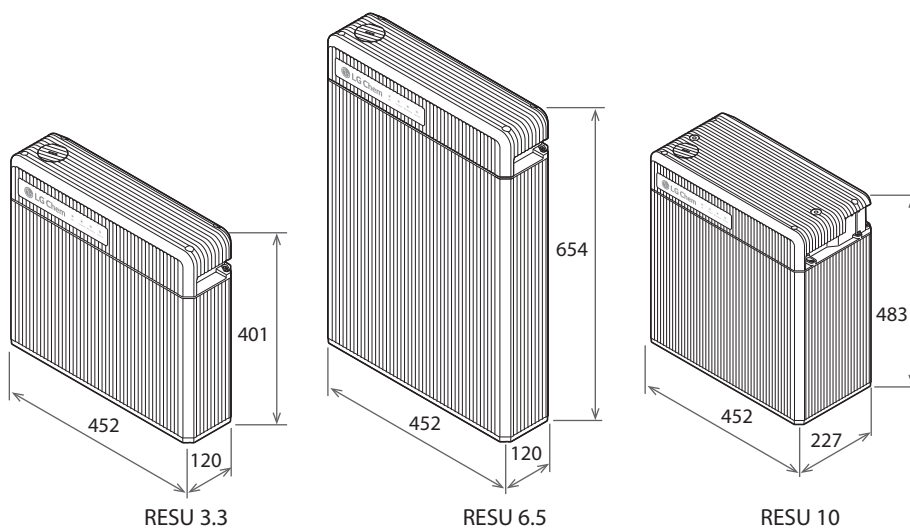
# 2 Product Introduction

## 2.1 Technical data

### Dimensions and weight

	RESU 3.3	RESU 6.5	RESU 10
Length	452 mm	452 mm	452 mm
Width	120 mm	120 mm	227 mm
Height	401 mm	654 mm	483 mm
Weight <sup>1</sup>	31 kg	52 kg	75 kg

<sup>1</sup>The weight varies slightly depending on the battery cell weights.



## Performance

	RESU 3.3	RESU 6.5	RESU 10
Nominal voltage	51.8 V	51.8 V	51.8 V
Operating voltage	42 to 58.8 V	42 to 58.8 V	42 to 58.8 V
Nominal capacity	63 A·h	126 A·h	189 A·h
Nominal energy	3.3 kW·h	6.5 kW·h	9.8 kW·h
Standard power	1.1 kW	2.2 kW	3.3 kW
Maximum power	3 kW	4.2 kW	5 kW
Peak power	3.3 kW	4.6 kW	7 kW
Maximum current	71.4 A at 42 V	100 A at 42 V	119 A at 42 V

## Charging cable requirements

Conductor cross-sectional area	33 to 50 mm <sup>2</sup>
Cable outer diameter	14 to 21 mm
Cable lug hole size	M8
Cable lug width	21 mm
Maximum cable length	5 m per cable

## Environmental requirements

Available operating temperature	-10 to 45 °C (14 to 113 °F)
Optimal operating temperature	15 to 30 °C (59 to 86 °F)
Storage temperature	-30 to 60 °C (-22 to 140 °F)
Humidity	5 to 95% (non-condensing)
Altitude	Below 2000 m

## 2.2 Features

The RESU® battery pack has the following features:

**Photovoltaic system:** This battery pack is designed for photovoltaic system compatibility.

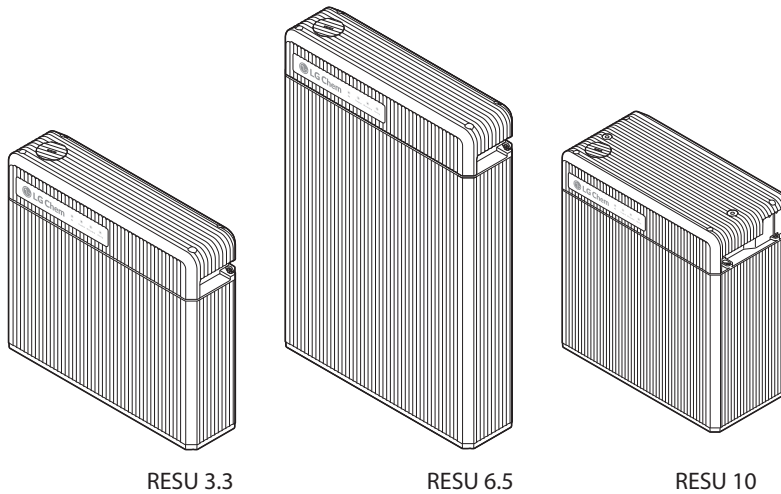
**Battery management system (BMS):** The battery pack's built-in BMS monitors its operation and prevents the battery from operating outside design

limitations. See **Troubleshooting** on page 30.

**Easy firmware update:** The BMS firmware can be updated to the latest version. See **Firmware Update** on page 31.

## 2.3 RESU lineup

There are three RESU battery pack models.



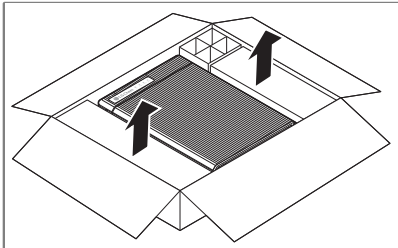
For details about these models, see **Technical data** on page 10.

# 3 Installation

 **WARNING**

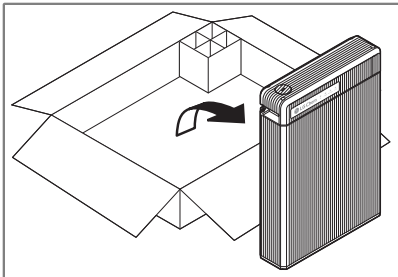
The battery pack is too heavy for one to carry. Make sure that two or more persons are available.

## 3.1 Unpacking the package

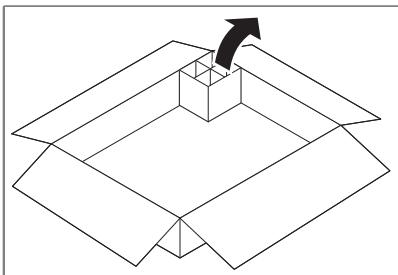


1. Cut the packing tape and open the carton.

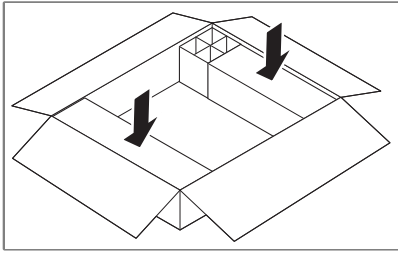
2. Remove the honeycomb cushioning pads.



3. Pull out the battery pack and stand it upright. Check if the battery pack is damaged.



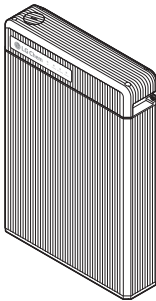
4. All the other items are contained in a box in one corner of the carton. Take them out and check if any item is missing. See **Package items** on page 14.



5. Replace the honeycomb cushioning pads. Keep the carton for future storage or transportation.

### 3.2 Package items

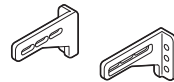
These items are included.



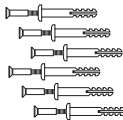
Battery pack



Cable grommets



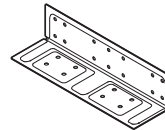
Mounting brackets



Screw anchors



Screws



Shelf (optional)

The following table lists the numbers of each item included.

Larger grommets for charging cables	2
Smaller grommets for other cables	3
Mounting brackets	2
M6 screw anchors	6
M5 screws	4

If anything is damaged or missing, contact LG Chem or your distributor.

### 3.3 Installation materials

These installation materials shall be prepared by installers.

- Charging cables
- Network cable
- Ground wire
- RJ45 plug
- Silicone sealant

### 3.4 Installation location

Make sure that the installation location meets the following conditions:

- The building is designed to withstand earthquakes.
- The location is far away from the sea, to avoid salt water and humidity.
- The floor is flat and level.
- There are no flammable or explosive materials nearby.
- The ambient temperature is between 15 and 30°C.
- The temperature and humidity stays at a constant level.
- There is minimal dust and dirt in the area.
- There are no corrosive gases present, including ammonia and acid vapor.

#### WARNING

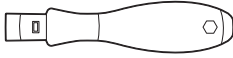
The RESU battery pack is designed to be waterproof and can be installed indoors as well as outdoors. However, if installed outdoors, do not allow the battery pack to be exposed to direct sunlight and moisture.

#### CAUTION

If the ambient temperature is outside the operating range, the battery pack stops operating to protect itself. The optimal temperature range for the battery pack to operate is 15°C to 30°C. Frequent exposure to harsh temperatures may deteriorate the performance and lifetime of the battery pack.

### 3.5 Tools

The following tools are required to install the battery pack:



Torque screwdriver



Phillips-screwdriver bit



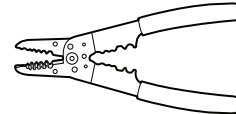
Hex-key bit



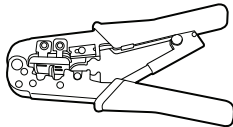
Phillips-head screwdriver



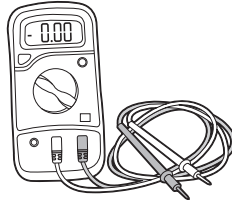
Flat-head screwdriver



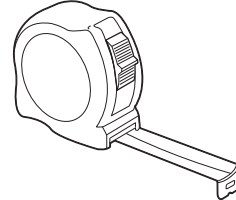
Wire stripper



Network crimper



Voltmeter



Tape measure



Drill

Use properly insulated tools to prevent accidental electric shock or short circuits. Use adjustable tools and measuring instruments that are certified for precision and accuracy.

### 3.6 Safety gear

Wear the following safety gear when dealing with the battery pack. Installers must meet the relevant requirements of international standards, such as IEC 60364, or the domestic legislation.





Insulated gloves

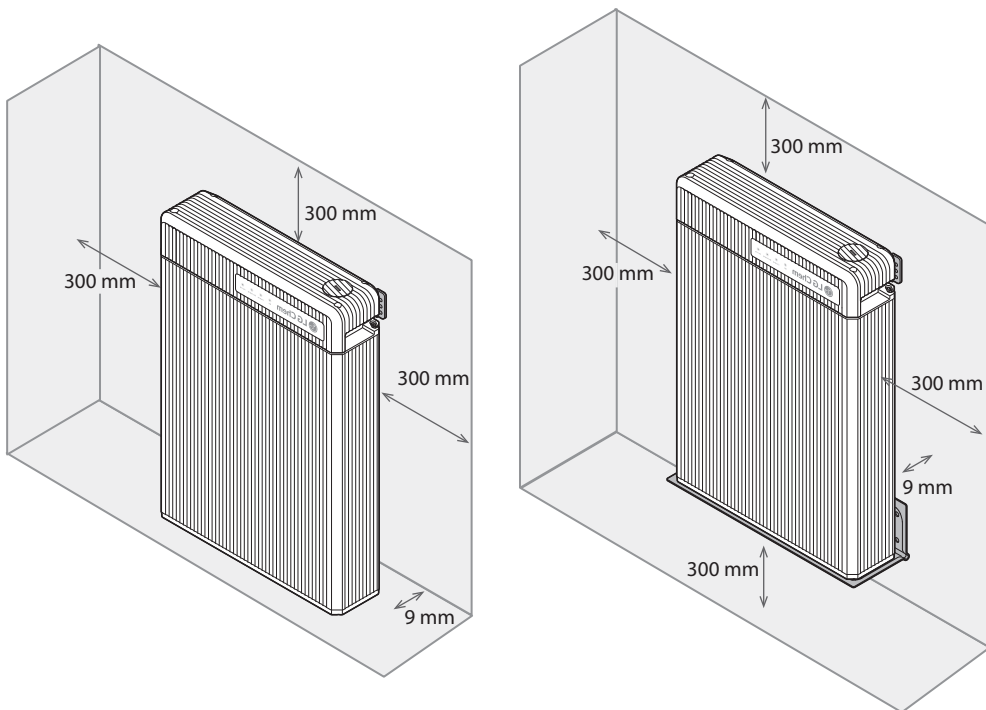


Safety goggles



Safety shoes

### 3.7 Installation clearance



Make sure to leave a space of at least 9 mm between the battery pack and the wall. A clearance of at least 9 mm must be left around the battery pack for proper cooling.

**NOTE**

The shelf for the RESU battery pack is sold separately.

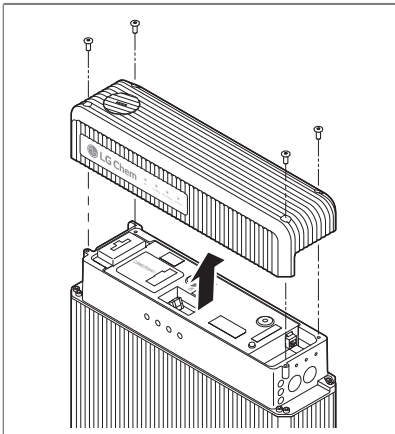
**⚠ CAUTION**

Make sure that the battery pack is always exposed to the ambient air. The battery pack is cooled by natural convection. If the battery pack is entirely or partially covered or shielded, it may cause the battery pack to stop operating.

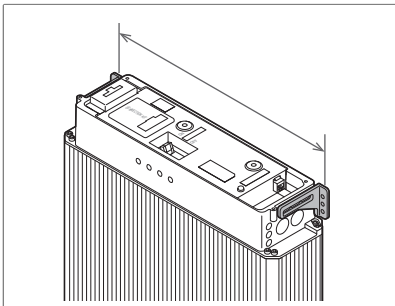
### 3.8 Securing the battery pack to a wall

Secure the battery pack to a wall to prevent the battery pack from moving. If the battery pack is installed above the floor or on a platform, make sure that the wall or platform is capable of supporting the battery pack's weight.

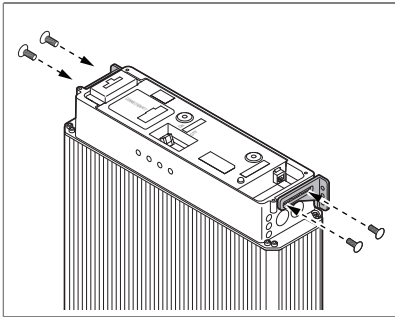
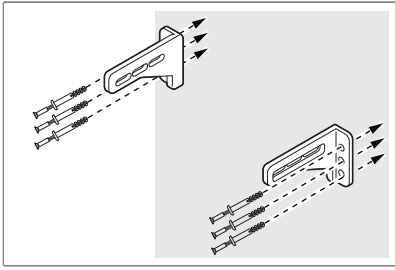
To mount the battery pack to a wall, take the following steps:



1. Remove the top cover. Loosen the four hex-socket screws at each corner of the top cover, and then pull it upwards.
2. Perform pre-installation checks described in **Checking before installation** on page 19.



3. Determine where the mounting brackets are to be placed.



4. Drill holes in the wall for M6 ( $\frac{1}{4}$  in) screw anchors. The drilling depth should be at least 50 mm.
5. Drive the screw anchors through the mounting brackets into the holes.
6. Tighten the screws to a torque of 5 N·m.
7. There are holes for mounting brackets on the top of the both sides of the battery pack. Secure the mounting brackets to the holes using the M5 screws. Tighten them to a torque of 5 N·m.

### 3.9 Checking before installation

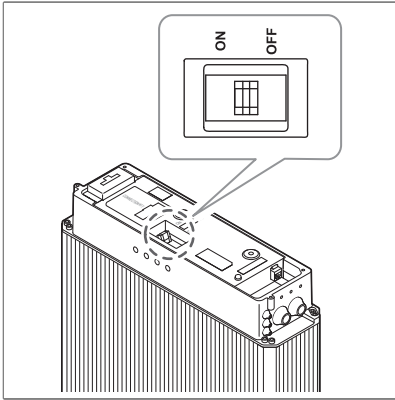
There are things to check before installing the battery pack to ensure that it has no defects.

**⚠ CAUTION**

Make sure that the inverter is turned off while checking the battery pack.

#### Circuit breaker switch

At the first installation, make sure that the circuit breaker switch is in the Trip position between the ON and OFF positions.

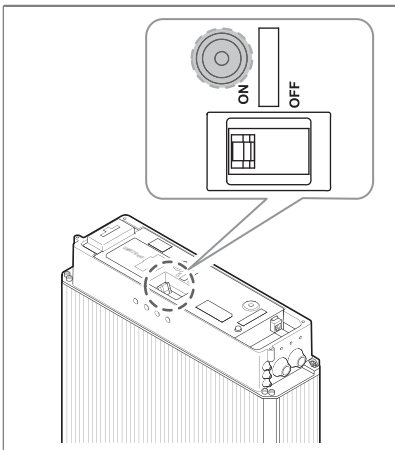


Move the circuit breaker switch to the ON position.

1. Push the circuit breaker switch to the OFF position.
2. Without releasing the grip, push it behind the OFF position until it cannot go any further.
3. Without releasing the grip, push it to the ON position.

If the switch moves by itself to any of the other positions, do not use the battery pack. Contact LG Chem or your distributor.

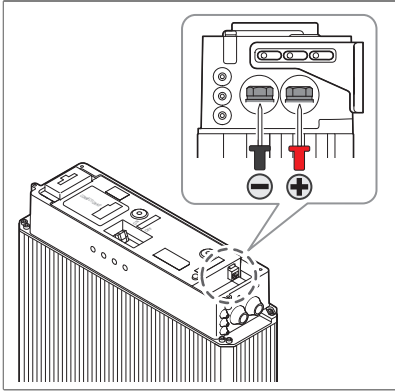
### Circuit breaker's trip button



Make sure that the circuit breaker switch is put in the ON position, and then press the circuit breaker's trip button. If the circuit breaker switch has not moved to the Trip position, do not use the battery pack. Contact LG Chem or your distributor.

## Voltage

Measure the voltage at the terminal block using a voltmeter.

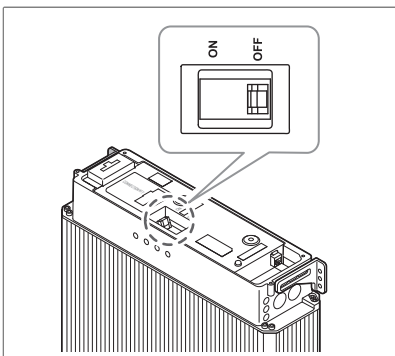


1. Make sure that the circuit breaker switch is put in the OFF position, and then measure the voltage. If the voltage is higher than 0 V, do not use the battery pack. Contact LG Chem or your distributor.
2. Move the circuit breaker switch to the ON position, and then measure the voltage. If the voltage is lower than 38 V, do not use the battery pack. Contact LG Chem or your distributor.

### 3.10 Connecting the battery pack to the inverter

#### WARNING

Make sure that the inverter is turned off before connecting the battery pack to the inverter.

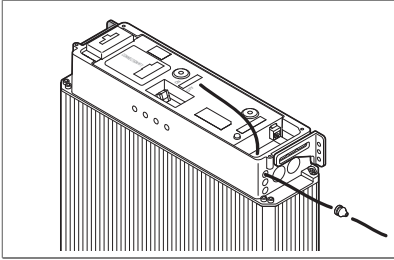


Before connecting the battery pack to the inverter, make sure that the circuit breaker switch is in the OFF or Trip position.

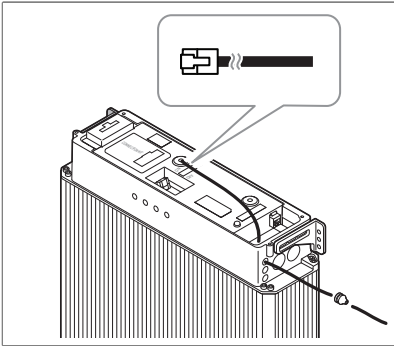
## Communication cable connection

### NOTE

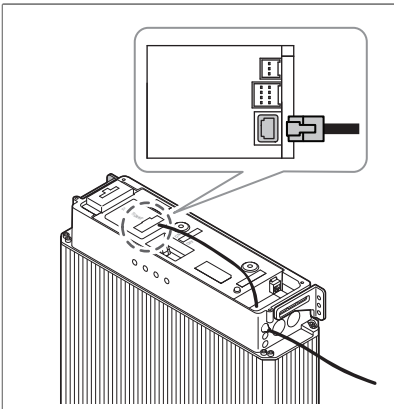
The battery pack must be connected to the inverter via a communication cable for proper operation.



1. The smaller grommet is too narrow for the RJ45 plug to pass through. Make sure that the communication cable from the inverter does not have an RJ45 plug at the end. Thread the communication cable through a smaller grommet and then through the top of the smaller holes.

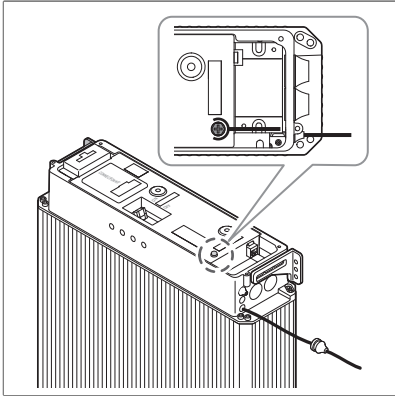


2. Attach an RJ45 plug to the communication cable using a wire stripper and network crimper.



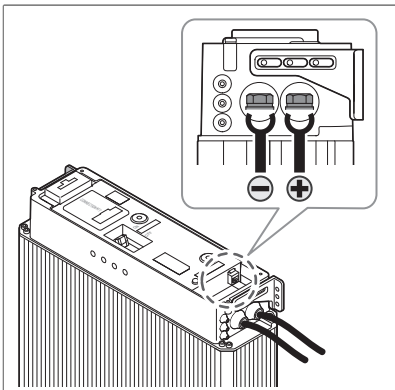
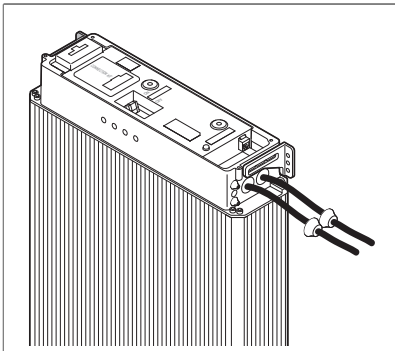
3. Connect the communication cable to the communication port.
4. Push the grommet into the hole.

## Ground wire connection



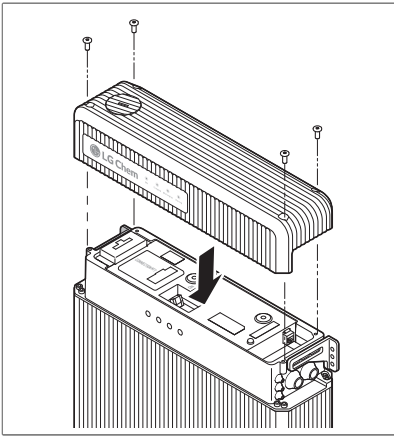
1. Thread the ground wire from the inverter through a smaller grommet and then through the bottom of the smaller holes.
2. Connect the ground wire to the ground screw, and tighten it to a torque of 4 N·m. The screw type is M5.
3. Push the grommet into the hole.

## Charging cables connection



1. Make sure that the cross-sectional area of the charging cables is 33 to 50 mm<sup>2</sup>. Thread the charging cables through each of the larger grommets and then through each of the larger holes.
2. Connect the charging cables to the terminal block.
  - a) Remove the terminal cover plate, which is placed over the terminal block to protect it.
  - b) Connect the negative cable (-) to the left terminal and the positive cable (+) to the right terminal. Tighten the hex-socket screws to a torque of 6 N·m.
  - c) Replace the terminal cover plate.
3. Push the grommets into the holes.

### 3.11 Finalizing installation

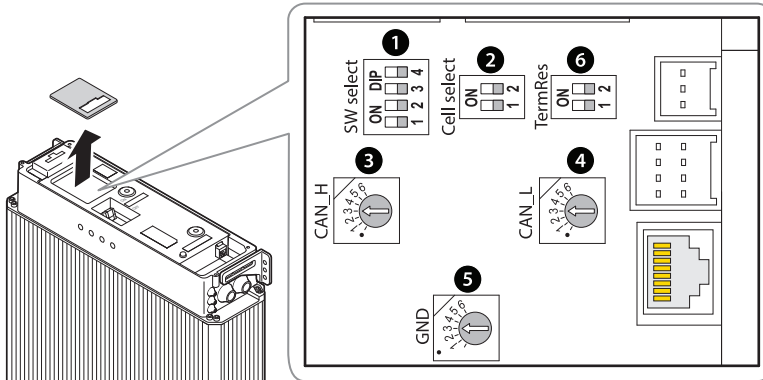


1. Stuff the smaller grommets left unused with an insulating material like silicone sealant, and then push them into the remaining holes.
2. Apply silicone sealant or putty around the cable at each grommet to prevent foreign materials from entering the battery pack.
3. Set the switches as described in **Setting rotary and DIP switches** on page 25.
4. Start the battery pack as described in **Starting the battery pack** on page 28.
5. Replace the top cover. Tighten the four screws at each corner of the top cover.



### 3.12 Setting rotary and DIP switches

Remove the switch cover by pulling it upwards. There are three DIP switches and three rotary switches.



Switch number	Type	Label	Default
1	DIP	SW select	0000 <sub>2</sub>
2	DIP	Cell select	00 <sub>2</sub>
3	Rotary	CAN_H	4
4	Rotary	CAN_L	5
5	Rotary	GND	2
6	DIP	Term Res	11 <sub>2</sub>

#### NOTE




If these switches are set incorrectly, communication with the inverter cannot be established.

#### Setting for communication interface



Use the SW select DIP switch to set what communication interface is used by the inverter. This switch is initially set to 0000<sub>2</sub>.

Any other than those given in the following table is regarded as an invalid setting.

Type	Value	Setting
LGC Solo	0001 <sub>2</sub>	
LGC Multi	0010 <sub>2</sub>	
LGC Smart	0011 <sub>2</sub>	

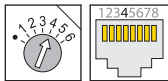
### Setting for battery cell type



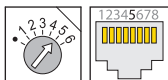
Make sure that the Cell select DIP switch is set to 00<sub>2</sub>.

Bit	On	Off
1	JP3	JH3
2	Unused	Unused

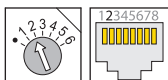
### Settings for CAN bus pins



Use the CAN\_H rotary switch to set which pin is used for CAN high signal by the inverter. This switch is initially set to 4.



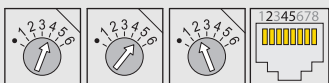
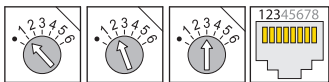
Use the CAN\_L rotary switch to set which pin is used for CAN low signal by the inverter. This switch is initially set to 5.



Use the GND rotary switch to set which pin is used for ground by the inverter. This switch is initially set to 2.

#### NOTE

Keep in mind that only 1 to 5 pins can be used.

	CAN_H	CAN_L	GND	Setting
<b>Example 1</b>	4	5	2	
<b>Example 2</b>	1	2	3	

## Setting for terminal resistors

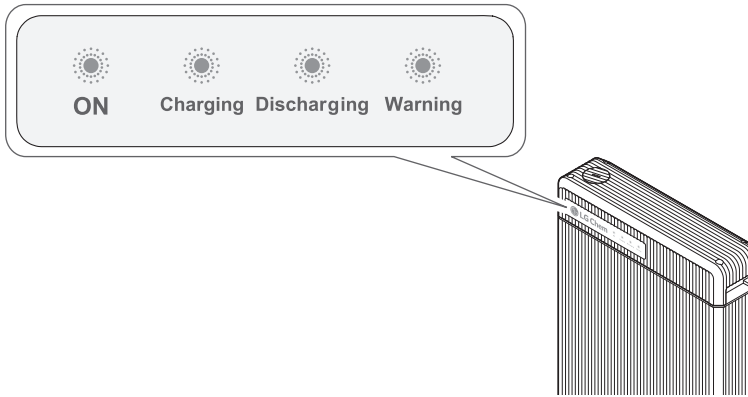


Make sure that the TermRes DIP switch is set to 11<sub>2</sub>.

Bit	On	Off
1	CAN terminal resistor attached	CAN terminal resistor unattached
2	Unused	Unused

# 4 Commissioning

## 4.1 LED indicators



The LED indicators on the front of the battery pack show its operating state:

**ON:** This indicator is lit when the circuit breaker switch is in the ON position.

**Charging:** This indicator is lit while the battery pack is charging.

**Discharging:** This indicator is lit while the battery pack is discharging.

**Warning:** This indicator is lit when the battery pack is in a warning state. See [Troubleshooting](#) on page 30.

## 4.2 Starting the battery pack

Put the battery pack in operation by taking these steps:

1. Move the circuit breaker switch to the ON position to turn on the battery pack.
2. Make sure that the ON indicator is lit. If it stays off, do not use the battery pack. Contact LG Chem or your distributor.
3. Turn on the inverter.

### NOTE

If communication with the inverter is not established within 10 minutes after the battery pack is turned on, the circuit breaker automatically trips.

### **4.3 Shutting down the battery pack**

To shut down the battery pack, take these steps:

1. Turn off the inverter.
2. Remove the top cover from the battery pack.
3. Turn off the battery pack by moving the circuit breaker switch to the OFF position.
4. Make sure that every LED indicator on the battery pack is off.
5. Replace the top cover.

# 5 Troubleshooting

Check the indicators on the front to determine the state of the battery pack. A warning state is triggered when a condition, such as with voltage or temperature, is beyond design limitations. The battery pack's BMS periodically reports its operating state to the inverter.

When the battery pack falls outside prescribed limits, it enters a warning state. When a warning is reported, the inverter immediately stops operation.

Use the monitoring software on the inverter to identify what caused the warning. The possible warning messages are as follows:

- Battery Over Voltage
- Battery Under Voltage
- Battery Over Temperature
- Battery Under Temperature
- Battery Discharge Over Current
- Battery Charge Over Current
- BMS Internal Communication
- Battery Cell Voltage Imbalance

The abnormal state is cleared when the battery pack recovers normal operation.

## NOTE

For a serious warning, if no proper corrective actions are taken by the inverter, the battery pack's circuit breaker automatically trips to protect itself.

## 6 Firmware Update

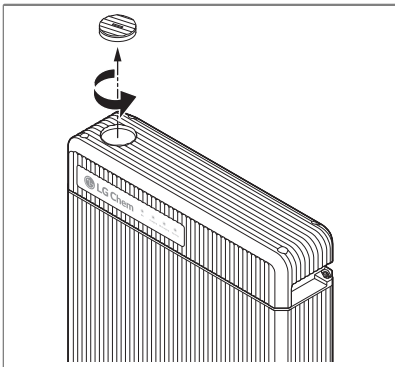
It is possible to update the BMS firmware. Use a memory card to update it. A new firmware may be available from LG Chem website or your distributor.

Prepare a memory card with these properties:

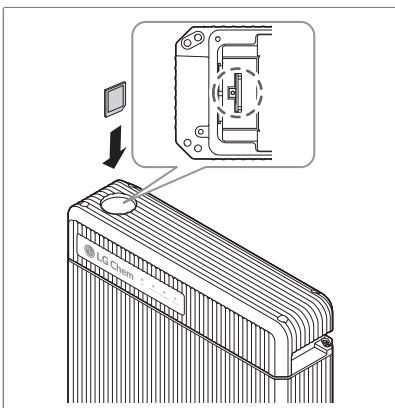
- The capacity of the memory card must not be greater than 32 GB.
- The memory card must be formatted in FAT16 or FAT32.
- It must have only one firmware file in the root directory.

For details about supported memory cards, see **Supported Memory Cards** on page 35.

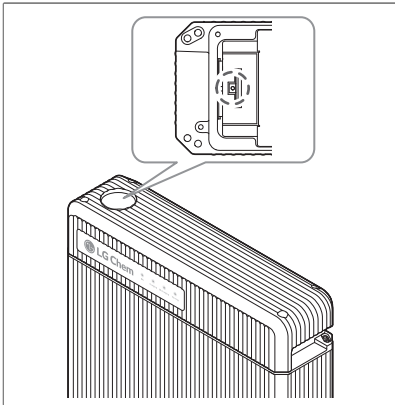
Take these steps to update the firmware:



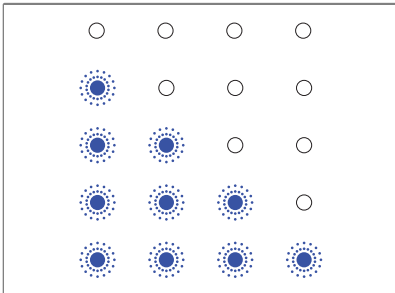
1. Turn off the inverter.
2. There is a round lid on the left part of the top cover, covering the memory card slot below it. Turn the lid counterclockwise and pull it upwards to remove it.
3. Insert the memory card into the memory card slot.



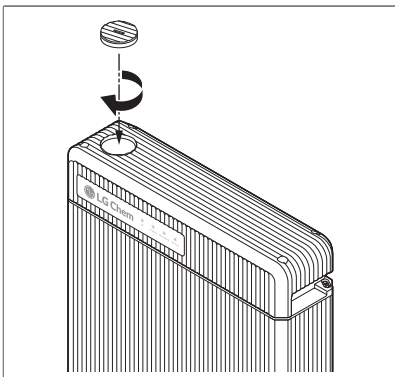
4. Insert the memory card into the memory card slot.



5. Press and hold the update button beside the memory card slot for more than 3 seconds.



6. The LED indicators flash in cycles until the firmware update is complete. Only the ON indicator is lit when the firmware update is successful. If it fails, the Warning indicator lights for two seconds. Check the memory card and try again. If it persistently fails, contact LG Chem or your distributor.



7. Replace the lid.
8. Turn on the inverter.



# 7 Warranty

LG Chem protects this product under warranty when this product is installed and used as detailed in this manual. Violating the installation procedure or using this product in any way not described in this manual immediately voids all warranties on this product.

LG Chem does not provide warranty coverage or assume any liability for direct or indirect damages or defects that result from the following causes:

- Improper transportation or storage
- Incorrect installation, wiring or handling
- Non-compliance with LG Chem's installation or operation manual
- Operating the product in an inappropriate environment
- Incorrect or inappropriate operation
- Insufficient ventilation
- Failure to adhere to safety warnings or instructions
- Repairs or modifications performed by unauthorized personnel
- Inverter failure or overcurrent.
- Force majeure events
- External influences, such as unusual physical or electrical stress.
- Use of an incompatible inverter

## 8 Regulatory Approvals

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Faradic charge efficiency (25°C/77°F)	99%
Battery round-trip efficiency (C/3, 25°C/77°F)	95%
Expected lifetime at 25°C/77°F	More than 10 years
Cycle life (90% DOD, 25°C/77°F)	6000 cycles
Cycle life (80% DOD, 25°C/77°F)	10000 cycles
Communication interface	CAN 2.0B
Cooling	Natural convection
Battery pack safety	CE, RCM, TUV (IEC 62619), UL 1973
Battery cell safety	UL 1642
UN number	UN 3480
Hazardous materials classification	Class 9
UN transportation testing requirements	UN 38.3
International protection marking	IP55

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# A Supported Memory Cards

Most memory cards can be used for firmware update. However, some memory cards may not be supported, depending on manufacturers and models. These memory cards are tested and guaranteed to work by LG Chem.

- SanDisk SDHC 4 GB
- SanDisk Ultra SDHC10 8 GB
- SanDisk Ultra MicroSD1 8 GB
- Transcend SDHC4 32 GB
- Transcend SDHC10 600x 32 GB
- Transcend Premium 400x MicroSD10 8 GB
- Transcend Premium 400x MicroSD10 16 GB
- Transcend Premium 400x MicroSD10 32 GB
- Toshiba Exceria MicroSD3 32 GB



Keep this manual for later use.

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LG Chem

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