

RELi<sup>3</sup>ON<sup>®</sup>

insight  
SERIES<sup>®</sup>

## USER AND INSTALLATION MANUAL



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## USE OF THIS MANUAL

This manual serves as a guideline for the safe and effective installation and operation of the following models:

BASE MODELS	LOW TEMPERATURE (LT) MODELS
48V030-GC2	48V030-GC2-LT
24V060-GC2	24V060-GC2-LT
12V120-GC2	12V120-GC2-LT

Scan the QR code to access the latest version of this manual or accessory manuals with instructions on how to wire them to the RELiON InSight batteries.





## 1. SAFETY INSTRUCTIONS

### IMPORTANT SAFETY INSTRUCTIONS SAVE THESE INSTRUCTIONS FOR FUTURE REFERENCE

#### 1.1. Warnings and symbols

Safety instructions and warnings are marked in this manual by the following pictograms:

 **CAUTION!** refers to special information, commands and prohibitions in order to prevent damage.

 **WARNING!** refers to possible injury to the user or installer or significant material damage to the RELiON InSight batteries if the installer / user does not (carefully) follow the stated procedures.

#### 1.2. General warnings

 **WARNING!**

The battery contains hazardous materials that are stored safely during normal use. Do not crush, open or drop the battery housing. Do not touch or ingest any of the released materials or inhale released gasses. Should skin contact, eye contact or inhalation nevertheless occur, take the necessary first aid measures immediately. Refer to the LiFePO<sub>4</sub> Safety Document, which is available on [www.relionbattery.com](http://www.relionbattery.com).

 **WARNING!**

Avoid short circuiting batteries as this may result in fire, explosion, electric shock or release of toxic gas. Use insulated tools only and keep metal objects away from the battery. Do not wear watches, bracelets, necklaces or other metal objects when working on the battery. In case of fire, take the necessary firefighting measures immediately. Refer to the LiFePO<sub>4</sub> Safety Document, which is available on [www.relionbattery.com](http://www.relionbattery.com).

**Note:** ensure access to this document and a class ABC fire extinguisher on premises.

 **WARNING!**

Short circuits, too deep discharges and too high charge currents will damage the battery and may result in fire, explosion, electric shock or release of toxic gas. When following the guidelines, the built-in Battery Management System (BMS) protects the battery from these dangers.

Never charge a battery:

- when the battery is damaged;
- when the battery was over-charged.

If in doubt, contact your RELiON dealer.

 **CAUTION!**

When transported, ensure that:

- the battery is in its original package or equivalent;
- the battery is in upright position;
- soft slings are used to avoid damage;
- the battery is only lifted at the handles;
- the battery is handled with care.

 **CAUTION!**

The voltage range (11.6 – 14.5V / 23 – 29V / 43 – 57V) is larger than you may expect from other battery types such as lead-acid batteries. Be aware that these voltages could exceed the permitted voltages of the connected load(s).

**⚠ WARNING REGARDING LIFE SUPPORT APPLICATIONS**

RELiON products are not designed to be used as component of medical equipment, unless negotiated in the form of a written agreement between customer and/or manufacturer and NAVICO GROUP. Such agreement will require the equipment manufacturer either to contract additional reliability testing of the RELiON parts and/or to commit to undertake such testing as a part of the manufacturing process. Furthermore, the manufacturer must agree to indemnify and not hold NAVICO GROUP responsible for any claims arising from the use of the RELiON parts in the life support equipment.

**1.3. Safety guidelines**

LiFePO<sub>4</sub> is an inherently safe chemistry. Refer to the LiFePO<sub>4</sub> Safety Document, which is available on [www.relionbattery.com](http://www.relionbattery.com), for more details. However, as with any electronics, safety measures should always be taken. Please adhere to the instructions within this manual for safe handling and operation.

- Use the RELiON InSight batteries following the instructions and specifications stated in this manual.
- Non-compliance with operating instructions, repairs made with other than original parts, or repairs made without authorization render the warranty.
- Connections and safety features must always comply with all local rules and regulations.
- Use connecting cables with an appropriate size and protection devices.
- Never use the RELiON InSight batteries in situations where there is danger of gas or dust explosion or potentially flammable products!
- Only use the RELiON InSight batteries in a technical correct condition.
- Switch off all charging systems and disconnect the RELiON InSight batteries from the electrical installation during maintenance and/or repair activities.
- Always wear protective gear when handling batteries
- Use a wrench with a rubber coated handle for operations.
- Do not place any objects on top of batteries.
- Move batteries using lifting strap brackets.
- Do not smoke and bring free flame sources near batteries.
- Do not install batteries in a zero-clearance compartment, overheating may result.
- Battery compartment and any material within two feet should be non-flammable.
- Keep sparks, flames and metal objects away from batteries.
- Regularly check that all cables are in good condition.
- Regularly verify that all cable connections are properly tightened.
- Have RELiON's LiFePO<sub>4</sub> Safety Document on premises.
- Have a Class ABC fire extinguisher on premises.

## 2. GENERAL INFORMATION

### 2.1. Liability

RELiON is a brand of Navico Group. Navico Group cannot be held liable for:

- Consequential damage resulting from the use of the RELiON InSight batteries.
- Possible errors in the included manual and the consequences of these.
- Use that is inconsistent with the purpose of the RELiON InSight batteries.

### 2.2. Warranty

The RELiON product warranty covers the RELiON InSight batteries as per the terms in the warranty conditions, on the condition that the product is installed and used according to the instructions in this manual. Installation or use that does not comply with these instructions may result in under performance, damage or failure of the product and may void this warranty. The warranty is limited to the cost of repair and/or replacement of the product. Costs of labor or shipping are not covered by this warranty. Please refer to the website for more details on Warranty terms and conditions.

We recommend you protect your investment and register your warranty at [www.relionbattery.com/warranty-registration](http://www.relionbattery.com/warranty-registration).

### 2.3. Cycle life and C-rate

The C-rate indicates how fast a battery can be (dis)charged. The capacity (C) of a battery is expressed in Ampere-hours (Ah) and the related charge/discharge capability is expressed in numbers that look like 1C, 2C, or C/2. A C-rate of C/2 is also known as 0.5C.

An example: a fully charged battery rated at C = 100Ah, provides 100A for one hour. The same battery discharging at C/2 provides 50A for two hours. At 2C it provides 200A for 30 minutes. Charge and discharge rates can have an impact on the number of charge cycles.

The RELiON InSight batteries provide 3500 cycles. To reach this number of cycles, we advise:

- an ambient temperature of 15 to 25°C [59 to 77°F]
- a relative humidity of 20 to 80%
- a maximum Depth Of Discharge (DOD) of 80%
- a maximum charge and a discharge rate of C/2. This corresponds to the following values:

MODEL	48V030-GC2 48V030-GC2-LT	24V060-GC2 24V060-GC2-LT	12V120-GC2 12V120-GC2-LT
Recommended charge current	≤ 15 A	≤ 30 A	≤ 60 A
Recommended discharge current	≤ 15 A	≤ 30A	≤ 60A

## 2.4. Disclaimer

Our products are subject to continual development and improvement. Therefore, additions or modifications to the products may cause changes to the technical data and functional specifications. No rights can be derived from this document. Please consult our online Terms & Conditions of Sale.

## 2.5. Identification labels

The serial number can be found on the long side of the battery.

The label located on the top of the battery contains technical information.

### CAUTION!

Never remove the labels. This will void the warranty.

## 2.6. Correct disposal of this product



This product is designed and manufactured with high quality materials and components, which can be recycled and reused. Act according to your local rules and do not dispose of your old products with your normal household waste. The correct disposal of your old product will help prevent potential negative consequences to the environment and human health.

### 3. PRODUCT DESCRIPTION

#### 3.1. Main parts

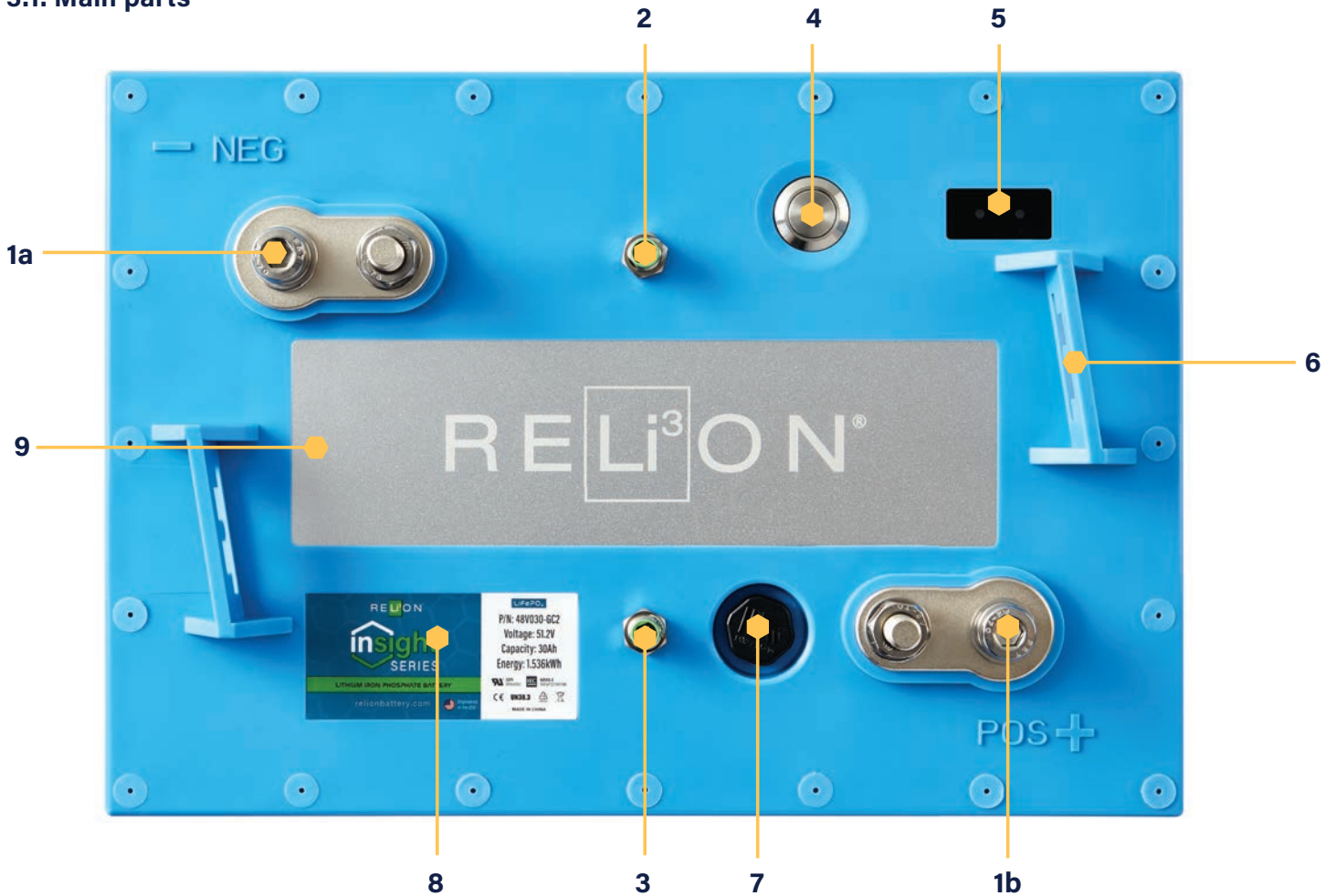


Figure 1 Overview of the RELiON InSight batteries

- 1 **a.** M8 negative terminals
- 1 **b.** M8 positive terminals  
(insert and stud connections have the same function)
- 2. CANbus IN connector
- 3. CANbus OUT connector
- 4. Power Button
- 5. SOC/Status LEDs
- 6. Provision for removable strap (x2)
- 7. Protective vent  
**Note:** Do not cover this opening.
- 8. Label
- 9. Heatsink (might get warm during operation)

### 3.2. LEDs

Two tri-colored LEDs on the cover are used to show the battery status and the SOC.

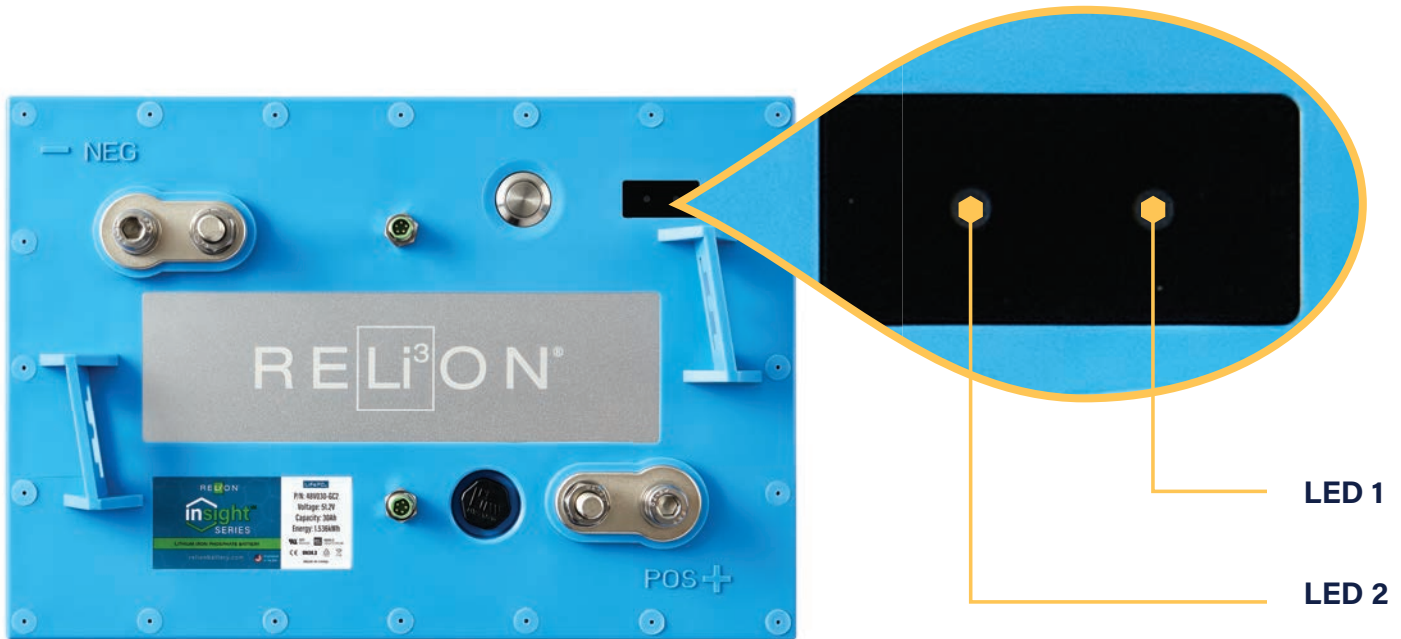


Figure 2: status LEDs

#### • Battery Status

MODE	LED 1	LED 2
Off	Off	Off
On	Flashing green (every 5 sec.)	Off
Charging	Off	Flashing green (every 2 sec.)
Undervoltage protection	Flashing red (every 5 sec.)	Off
Over discharge current protection	Solid green	Solid yellow
Temperature protection	Flashing green (every sec.)	Flashing red (every sec.)

#### • SOC (single tap the Power Button when the battery is on)

SOC	LED 1	LED 2
95% - 100%	Solid Green	Solid Green
75% - 95%	Solid Green	Flashing Green (every ½ sec.)
50% - 75%	Solid Green	Solid Yellow
30% - 50%	Solid Green	Flashing Yellow (every ½ sec.)
10% - 30%	Solid Green	Solid Red
0 - 10%	Solid Green	Flashing Red (every ½ sec.)



### 3.3. Power Button

The battery has a Power Button located next to the LEDs. This button is used to turn the battery on/off or reset the BMS, and to request to display the State Of Charge (SOC).

HOW TO	
Power on	Press and hold the Power Button for 6 seconds. Then release the button. After showing the SOC, LED1 will flash green.
Display SOC	When the battery is on, tap the Power Button once. The LEDs display the SOC for 6 seconds. See section 3.2
Power off	Tap, release, then press and hold the Power Button for 6 seconds. When both LEDs are solid red, release the button.
Reset BMS	Tap, release, then press and hold the Power Button for 2 seconds. When LED1 is solid red and LED2 is solid green, release the button. The battery will now restart the BMS (SOC is re-calculated and battery in- and output is closed and opened again).
Wake Up	Tap the Power Button twice to wake up from sleep or undervoltage protection (UVP) to start charging. This will initiate a 1-minute charge pickup window.

### 3.4. Operating modes

MODE	DESCRIPTION
Off	The battery ships in the off mode. There is no LED activity and no voltage at the terminals.
On – active	The battery is in active mode while being charged or discharged.
On – standby	The battery is in standby mode when the battery is ON but not being discharged or charged. While in standby mode, voltage is present at the terminals. When the battery is charged or discharged during standby mode, it will return to active mode. If a battery is in standby mode for more than 72 hours (24 hours for 12V battery) it will enter sleep mode.
Sleep and Pulse Recovery Operation (PRO)	The battery enters sleep mode either: <ul style="list-style-type: none"> <li>- When it is in standby mode for more than 72 hours (24 hours for 12V battery) without being discharged or charged. The LEDs are not illuminated.</li> <li>- If the Discharge Cut Off threshold is met. See chapter “SPECIFICATIONS” for the protection thresholds.</li> </ul> The battery will go into Pulse Recovery Operation (PRO) to preserve its energy and cycle between off and on (standby) as follows: the battery turns on (standby) periodically and LED1 flashes green when the battery is on. The PRO mode is interrupted automatically when a compatible battery charger is connected to the battery. The PRO mode can be interrupted manually by pressing the Power Button. A compatible battery charger must then be connected before the battery turns OFF again.
Undervoltage protection (UVP)	If any of the battery cells voltage is less than 2.8V, the battery will go into UVP protection mode. LED1 will flash red every 5 seconds. The battery will then move to off mode and charging could be resume by pushing the Power Button.

### 3.5. Battery Management System (BMS)

RELiON InSight batteries have a built-in Battery Management System (BMS). The BMS protects the battery by automatically disconnecting when thresholds are met. See chapter “SPECIFICATIONS” for the protection thresholds, and chapter TROUBLESHOOTING for details.

### 3.6. Charging guidelines

**Note:** Because the method of charging lead-acid batteries and lithium batteries differs, we strongly recommend using a Lithium battery charger to achieve the best performance.

To maximize performance and lifespan of the battery, follow the charging guidelines. Preferably select a Lithium charge profile. Otherwise select a GEL or AGM charge profile. Consult the user manual or manufacturer of the battery charger to ensure that the charger meets RELiON's charge parameters:

	48V	24V	12V
Peak Charge Voltage	57V	28.5V	14.3V
Float Voltage	54V	27V	13.5V

Do not use a sensor for temperature compensated charging. LiFePO4 batteries do not require temperature compensation.

#### 3.6.1. Prior to charge

Check the SOC. See section 3.2 for instructions on how to do this. To preserve its lifespan, charge the battery when the SOC is low.

#### 3.6.2 During charge

Check that charge current is being supplied, in one of the following ways:

- Battery LED indicators: The proper LED sequence be displayed: LED1 – Off, LED2 – flashing green (every 2 seconds).
- RELiON Battery Display Indicator (BDI): Check the accessory gauge to see that charge current is flowing and the SOC is increasing.
- Use a multimeter with amp clamp.

#### 3.6.3 Charge completion

Check to see if a charge was completed in one of the following ways:

- Battery LED indicators: check the SOC. See section 3.2 for instructions on how to do this.
- RELiON Battery Display Indicator (BDI): check the accessory gauge to see if the battery SOC reached 100%.

#### 3.6.4 Battery indicator

A voltage-based fuel gauge that is designed for lead-acid batteries will not accurately provide the SOC. Replace this type of fuel gauge with one that measures current rather than voltage. The BMS in the battery provides the SOC of the battery via CAN. Refer to the RELiON Battery CAN bus Specification Document for details.

RELiON offers optimized products to support the best integration and use of the batteries, such as:

PRODUCT #	PRODUCT NAME
BI-3140R-12	InSight 12V Fuel Gauge
BI-3140R-2448	InSight 24V and 48V Fuel Gauge
WIRE BI-3140-03	InSight Fuel Gauge Wire Harness with 3 m cable (6 and 9 m available)
RS-GC2-03	InSight Remote Power Switch with 3 m cable (6 and 9 m available)

For more information visit the website [www.relionbattery.com](http://www.relionbattery.com).

## 4. INSTALLATION

### 4.1. Unpacking

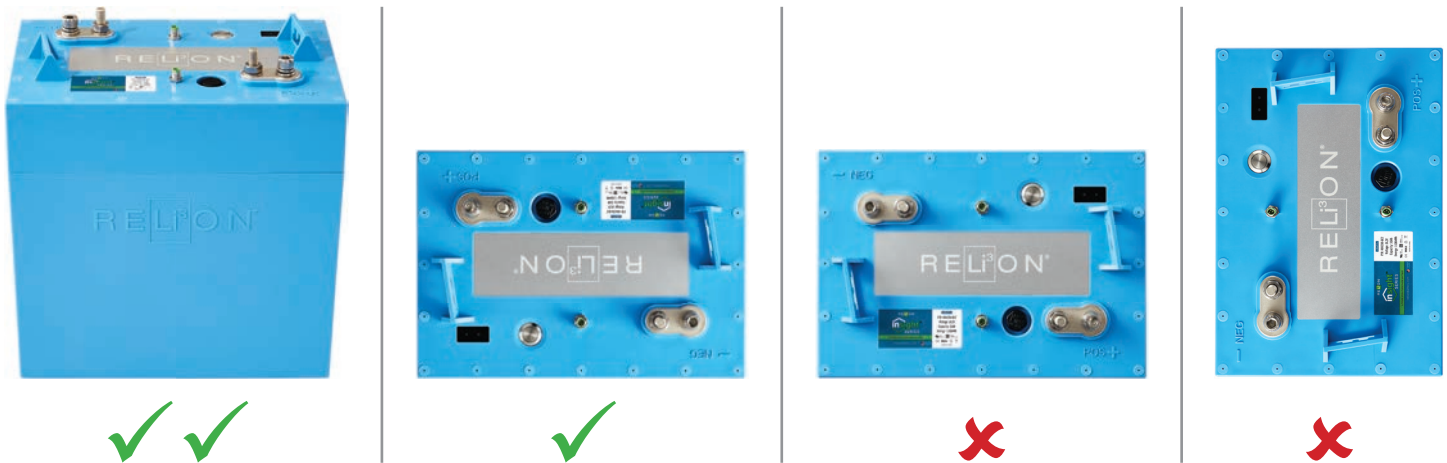
The delivery consists of the following parts:

1. Battery with 2x M8 bolt for screw connection
2. Power Button cover
3. CANBus jumper cable (for parallel connection)
4. CANBus connector cover x2
5. Flat washer x2
6. Spring washer x2
7. RELiON InSight Quick Install Guide

Never use a damaged battery. If in doubt, contact your RELiON dealer.

### 4.2. Location

- Install the RELiON InSight batteries preferably in a well-ventilated room.
- Keep the RELiON InSight batteries away from heat sources. See specifications for allowed operating temperatures.
- The RELiON InSight batteries can be installed in upright position, or on the long side of the case with the plus side up. Upright mounting is recommended.



- Keep at least 1cm [3/8"] between two Li-Ion batteries for air flow.
- The RELiON InSight batteries must be secured.

### 4.3. Materials needed

#### WARNING!

Always comply with all local rules and regulations.

- Properly sized DC wiring, based on the expected load of the system.
- Properly sized fuse, based on the wire size.

#### 4.4. Installation procedure for a single unit

- Step 1. Switch off all loads and charging equipment.
- Step 2. Check that the battery is off. See section 3.2 for instructions on how to do this.
- Step 3. Integrate a fuse holder in the positive (+) wire.
- Step 4. Connect the negative (-) and positive (+) cables to the battery terminals. Battery terminals must be torqued to 10 Nm using a torque wrench with 13mm socket hex bit.
- Step 5. Put the battery in place and secure it.
- Step 6. Connect the negative and positive cables to the device/busbars.
- Step 7. Check all wiring and connections.
- Step 8. Install the fuse
- Step 9. Press and hold the Power Button for 6 seconds to switch the battery on. Then release the button. After showing the SOC, LED1 will flash green.
- Step 10. Switch on some loads and verify that they are working.
- Step 11. Switch off the loads, switch on the charger and verify (charger status) that the battery is being charged.
- Step 12. The battery is now ready for operation.

#### About CANbus

Controller Area Network (CAN) bus is a communication protocol that enables devices to exchange information. For basic operation, connecting the CANbus cable is not required. A service engineer can use the CANbus cable to update or analyze the InSight batteries.

For optimal use, parallel connected InSight batteries can communicate with each other via CANbus cables. For details on how to interface to the CANbus and interpret the messages, consult the RELiON CANbus Specification document. For details on how to connect RELiON InSight batteries in parallel, consult the RELiON Building a Battery Bank document.

## 5. STORAGE AND CARE

If necessary, use a soft, clean cloth to clean the RELiON InSight batteries. Never use any liquids or acids.

The battery should be stored in a dry and well-ventilated environment. The rate of self-discharge is less than 3% per month. High or low ambient temperature affects the self-discharge rate of the batteries and natural aging.

If the battery will not be used for a period exceeding 3 months, we advise the following:

- If external AC power is available switch off all loads and switch on the charger. Apply a float voltage as specified in the following table.

MODEL	FLOAT VOLTAGE SETTING
12V	13.5V
24V	27V
48V	54V

- If no external AC power is available:
  - Charge the battery to > 80% of its capacity before storage.
  - Switch off the battery: tap, release, then press and hold the Power Button for 6 seconds.

### CAUTION!

In this setup the batteries can be kept at least 6 months without maintenance. However, it is highly recommended to charge the battery to over 80% of its capacity every 100 days.

## 6. TROUBLESHOOTING

If you cannot solve a problem using the fault-finding table, contact your RELiON dealer. Make sure you have the serial number at hand.

FAILURE	LED 1	LED 2	POSSIBLE CAUSE	WHAT TO DO
Battery is off	Off	Off	The battery switched off automatically after 72 hours of no use.	Switch it on: press and hold the Power Button for 6 seconds.
			A fuse has blown.	Check all (external) fuses and replace if necessary.
			A cable or cable connection is defective.	Check all (external) cables and their connections. Replace if necessary.
			Crossing a current, voltage or temperature threshold has triggered the battery to switch off.	When the conditions are safe again (that is, the thresholds are within limits), switch on the battery. Contact your RELiON dealer if the battery cannot be switched on or charged normally.
Battery not (dis) charging	Flash red	Off	Undervoltage protection (UVP) by BMS.	Tap the Power Button twice to wake up from UVP and charge the battery.
	Flash green	Off	Overvoltage protection by BMS.	No action required. The BMS will automatically reconnect when the highest cell voltage is less than 3.6V.
	Solid green	Solid yellow	Overcurrent protection by BMS.	During discharge: Immediately reduce load taken from the battery. During charge: Immediately adjust the charge current. The BMS allows the battery to resume normal operation after 30 seconds. This self-recovery will be disabled after 5 consecutive times. Reset the BMS to reset the protection: while the battery is on, tap and hold the Power Button for at least 2 seconds. When LED1 is red and LED2 is green, release the Power Button.
	Flash green	Flash red	Undertemperature protection by BMS (see chapter 7 for the thresholds).	Wait for the battery to warm up. The BMS will not allow charge current when the battery temperature is too low.
Overtemperature protection by BMS (see chapter 7 for the thresholds).			Wait for the battery to cool down. Ensure adequate ventilation and avoid direct sunlight.	

## 7. SPECIFICATIONS

### 7.1. General specifications

MODEL	48V030-GC2 48V030-GC2-LT	24V060-GC2 24V060-1-GC2-LT	12V120-1-GC2 12V120-1-GC2-LT
Nominal Voltage	51.2V	25.6V	12.8V
Cell Chemistry	LiFePO <sub>4</sub>	LiFePO <sub>4</sub>	LiFePO <sub>4</sub>
Cell Type	Prismatic	Prismatic	Prismatic
Ampere-hour Capacity	30Ah	60Ah	120Ah
Watt-hour Capacity	1.536kWh	1.536kWh	1.536kWh
Charge Efficiency	99%	99%	99%
Impedance (50% SOC, 1kHz)	<150mΩ	<150mΩ	<100mΩ
Cycles @ 80% DOD*	>3500	>3500	>3500

\*Cycle life strongly depends on the applied charging and discharging rates, see section 2.3.

Visit the required product page on the RELiON website and go to Specifications for Characteristics.

### 7.2. Charging specifications

MODEL	48V030-GC2 48V030-GC2-LT	24V060-GC2 24V060-1-GC2-LT	12V120-1-GC2 12V120-1-GC2-LT
Recommended Charge Current (single battery)	≤15A (0.5C)	≤30A (0.5C)	≤60A (0.5)
Continuous Charge Current	≤30A (1C)	≤60A (1C)	≤120A (1C)
Disconnect Charge Current (BMS will disconnect if exceeded)	I <sub>batt</sub> >30A, 5s I <sub>batt</sub> >50A, 0.5s	I <sub>batt</sub> >60A, 5s I <sub>batt</sub> >100A, 0.5s	I <sub>batt</sub> >120A, 5s I <sub>batt</sub> >200A, 0.5s
Peak Charge Voltage	57V	28.5V	14.3V
Float Voltage	54V	27V	13.5V
Overvoltage Protection	3.65V/cell 4s (58.4V)	3.65V/cell 4s (29.2V)	3.65V/cell 4s (14.6V)
Overvoltage Reconnect	3.4V/cell (54.4V)	3.4V/cell (27.2V)	3.4V/cell (13.6V)
Temperature Compensation Required	None	None	None

Visit the required product page on the RELiON website and go to Specifications for charge voltage characteristics at various rates.

### 7.3. Discharging specifications

MODEL	48V030-GC2	24V060-GC2	12V120-1-GC2
	48V030-GC2-LT	24V060-1-GC2-LT	12V120-1-GC2-LT
Recommended Continuous Discharge Current	45A	30A	60A
Maximum Continuous Discharge Current	100A	100A	120A
Peak Over Current	100A<I <sub>batt</sub> <120A, 10s 150A<I <sub>batt</sub> <180A, 5s 180A<I <sub>batt</sub> <250A, 2s I <sub>batt</sub> >250A, 0.5s	100A<I <sub>batt</sub> <200A, 50s 300A<I <sub>batt</sub> <360A, 5s 360A<I <sub>batt</sub> <500A, 2s I <sub>batt</sub> >500A, 0.5s	120A<I <sub>batt</sub> <300A, 10s 300A<I <sub>batt</sub> <360A, 2s 360A<I <sub>batt</sub> <500A, 1s I <sub>batt</sub> >500A, 0.5s
Short Circuit Protection	>350A	>500A	>500A
Discharge Cut Off Pulse Recovery Operation	Automatically under 2.9V/cell (46.4V)	Automatically under 2.9V/cell (23.2V)	Automatically under 2.9V/cell (11.6V)
Low Voltage Protection	2.8V/cell (44.8V)	2.8V/cell (22.4V)	2.8V/cell (11.2V)
Permanent Off Voltage*	1.8V/cell (28.8V)	1.8V/cell (14.4V)	1.8V/cell (7.2V)

**⚠ \*CAUTION!**

In case of long-term storage with a minimum SOC, the battery might reach a permanent off-state which cannot be recovered with a charging procedure. If this condition is met, contact Technical Support. See the back of the manual for contact information.

Visit the required product page on the RELiON website and go to Specifications for discharge voltage characteristics at various temperatures or rates.

### 7.4. Environmental specifications

ENVIRONMENTAL SPECIFICATIONS		
Charge Under Temperature	BASE MODELS:	0°C (32°F) for 2s. Auto-reset at 5°C (41°F).
	LOW TEMPERATURE (LT) MODELS:	-20°C (-4°F) for 2s. Auto-reset at -15°C (5°F). Auto-heating will be activated below 0°C.
Charge Over Temperature	55°C (131°F) for 2s. Auto-reset at 50°C (122°F).	
Discharge Under Temperature	-20°C (-4°F) for 2s. Auto-reset at -15°C (5°F).	
Discharge Over Temperature	55°C (131°F) for 2s. Auto-reset at 50°C (122°F).	
Operating Humidity Range	10% to 95% RH non-condensing	
Optimal Storage Temperature	10°C to 35°C (50°F to 95°F)	
Optimal Storage Humidity	15% to 90% RH	



## 7.5. Mechanical specifications

MODEL	ALL MODELS
BCI Size	GC2/GC8
Dimensions (L x W x H)	260 x 180 x 276 mm (10.2 x 7.1 x 10.9 in)
Weight	15.6 kg (34.4 lbs)
Case Material	ABS
Stud Terminal	M8 X 1.25 - 20
Insert Terminal	M8 X 1.25 - 20
Closing Torque	9-10 Nm (79.7-88.5 in-lbs)
Handles	Molded
Ingress Protection Marking	IP67

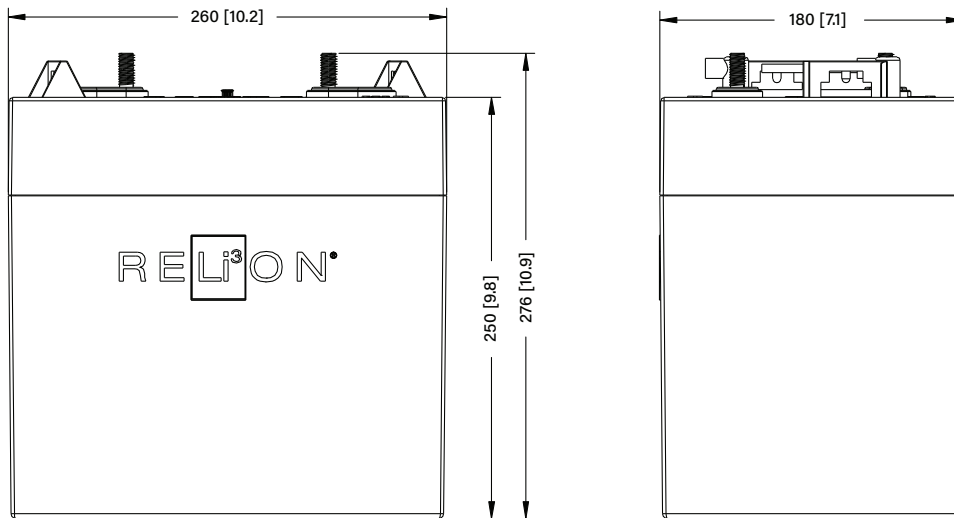


Figure 3 Dimensions shown in mm [in]

## RELION AND NAVICO GROUP TECHNICAL SUPPORT

If you have any technical questions, please contact at

### **USA and AMERICAs**

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