



USER MANUAL

EX-GC2-48036

DISCLAIMER

While every precaution has been taken to ensure the accuracy of the contents of this guide, Expion360 assumes no responsibility for errors or omissions. Note as well that specifications and product functionalities may change without notice.

IMPORTANT

Please be sure to read the manual in its entirety before using the products. Misuse may result in damaging the products, causing harm, or incurring serious injury. This manual will update periodically without notice. Instead of saving this manual, view it on the Solartex USA website for future updates and reference.

ABOUT US

- **Safety**

Expion360 lithium batteries use lithium iron phosphate (LiFePO₄/LFP) chemistry, which is the best choice for RV, marine, and off-grid power storage applications, because of its high degree of safety and long cycle life.

- **Quality**

With all the Li-ion manufacturers in the market, Expion360 strives to ensure that our products meet the highest quality standards to maintain our advantage over the competition. Expion360 battery uses cylindrical 26650, stainless steel encased LiFePO₄ cells. The cells are UL 1642 recognized (File No. MH64383). They are certified to the highest standard in safety and performance. Instead of soldering, all internal connections are mechanically fastened to reduce resistance and ensure long-term durability.

The Expion360 proprietary case contains internal structural support to protect the battery pack and BMS inside from the effects of vibration and movement. The innovative oversized terminals and bus bars provide substantial electrical connections to accommodate high ampacity cables.

Please Read Each Warning Carefully to Prevent Damage to the Unit and Injury to Operators.

Ignoring Warnings Voids Warranty.

WARNINGS:

- ⚠ DO NOT drop the battery.**
- ⚠ DO NOT cut open the battery.**
- ⚠ DO NOT short circuit the battery.**
- ⚠ DO NOT submerge the battery in water.**
- ⚠ DO NOT use the battery as a starter battery.**
- ⚠ DO NOT attempt to repair the battery if it malfunctions.**
- ⚠ DO NOT mix batteries of different ages, voltages, capacities, or manufactures.**
- ⚠ DO NOT ignore battery installation guidance.**
- ⚠ DO NOT undersize battery cables.**
- ⚠ DO NOT undersize the battery system.**
- ⚠ DO NOT connect EX-GC2 batteries in series.**
- ⚠ DO NOT connect more than FOUR batteries in parallel per string.**
- ⚠ DO NOT connect an unequal number of batteries in parallel on each string.**
- ⚠ DO NOT charge the battery with any profile other than 48V LFP.**
- ⚠ DO NOT charge the battery above 58.4V.**
- ⚠ DO NOT charge the battery at or below 32 °F.**
- ⚠ DO NOT charge the battery above its maximum charge rate.**
- ⚠ DO NOT discharge the battery below 40.8V.**
- ⚠ DO NOT discharge the battery at or below -4 °F.**
- ⚠ DO NOT discharge the battery above its maximum discharge rate.**
- ⚠ DO NOT connect the battery to any load while in long-term storage.**
- ⚠ DO NOT operate or store the battery outside the specifications of the manual.**

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1 Overview

The Expion360 GC2 LiFePO₄ (Lithium Iron Phosphate, LFP) SmartTalk Battery is specifically engineered for light electrical vehicle (LEV) and golf cart (GC) applications with Bluetooth functions. The Expion360 GC2 battery provides more than twice the continuous power and energy output of a lead-acid battery in the same size. With the Expion360 app, users are allowed to check the battery's health and conditions with ease.

Converting a lead-acid LEV or golf cart to lithium-ion is not a simple process, which may require modifications to the battery charger, motor controller, and motor. The Expion360 GC2 LFP battery is less than half of the weight of a GC2 lead-acid battery. The vehicle's handling will change, which may require modifications to the vehicle frame and suspension to maintain safety.

To prevent damage to the vehicle and injury to operators, please consult with dealers, reputable vehicle upfitters, or Expion360 technical support for any concerns.

This document provides guidance solely on the Expion360 GC2 battery in LEV and golf cart applications. For all other applications, please consult dealers or Expion360 technical support before installation.

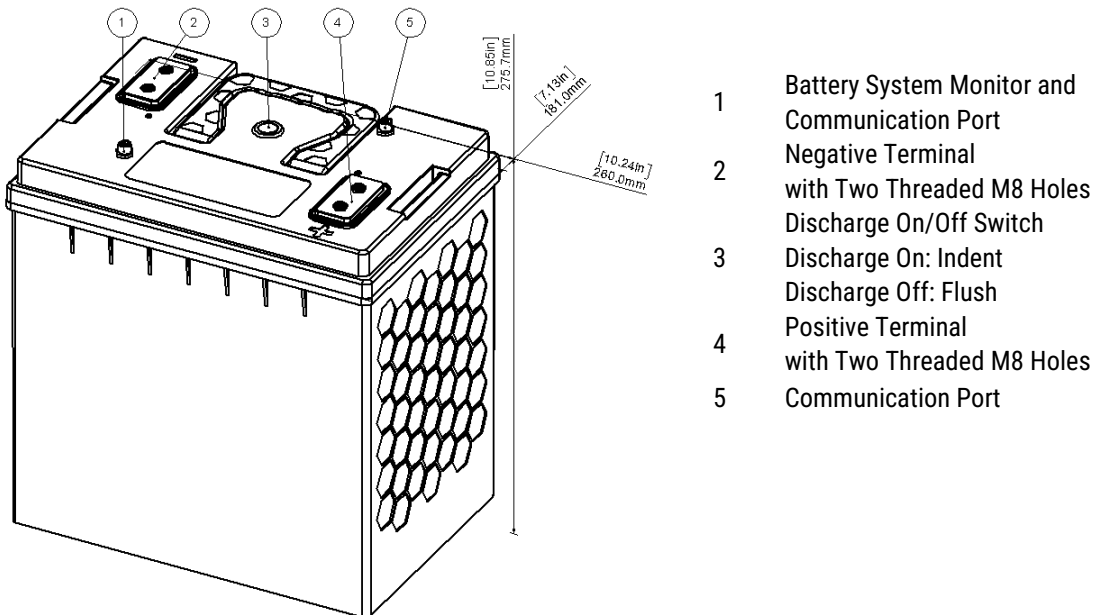
- **Required Tools**

Torque Wrench, 13mm Socket

- **Accessories**

Expion360 app, Communication cable, Battery system monitor (optional)

- **Diagram**



2 Battery Specifications

	Parameters	EX-GC2-48036	
Electrical	Battery Nominal Voltage	51.2 Vdc	
	Battery Rated Capacity (@ 0.2C, 25 °C)	36 Ah	
	Battery Rated Energy (@ 0.2C, 25 °C)	1843.2 Wh	
	Battery Internal Impedance (@ 1kHz AC, 25 °C)	≤50 mΩ	
	Battery Self-discharge Rate (@ 25 °C)	<5 % per month	
	Battery Cycle Life (80 % Capacity retention) (@ 0.2C / 1C, 25 °C, 100 % DoD)	>4000	
	Max. Parallel Connections (per string)	4	
	Communication	Bluetooth, CAN Bus, Display	
Mechanical	Battery Size	BCI GC2	
	Battery Dimensions (L. x W. x H.)	10.24 x 7.13 x 10.85 in (260 x 181 x 276 mm)	
	Battery Weight	38.5 lb (17.5 kg)	
	Case Material	ABS	
	Terminal Material	Brass	
	Terminal Thread	M 8 x 1.25 - 12	
	Terminal Torque	8 lb-ft (10 Nm)	
	Cell	LiFePO ₄	
Charge	Method	CC-CV	
	Voltage	Max. Range	56.8 Vdc to 58.4 Vdc
		Optimal Target	55.2 Vdc
		Protection	58.4 Vdc ± 0.8 Vdc
		Protection Release	53.6 Vdc ± 0.8 Vdc
	Current	Optimal	0.2C
		32 °F to 50 °F (0 °C to 10 °C)	<0.2C
		50 °F to 140 °F (10 °C to 60 °C)	<0.5C
		Max. Regen Protection	2C
		Protection Release Condition	72 A ± 3 % (10 s ± 0.5 s)
	Temp.	Operating	Remove load, release after 30s. After 10 consecutive protection events, release after 10min.
		Protection Release	32 °F ± 9 °F to 140 °F ± 9 °F (0 °C ± 5 °C to 60 °C ± 5 °C)
Protection Release Condition		40 °F ± 9 °F to 120 °F ± 9 °F (5 °C ± 5 °C to 50 °C ± 5 °C)	
Discharge	Voltage	Optimal Shut-off	44 Vdc
		Protection	40.8 Vdc ± 0.8 Vdc
		Protection Release	44.0 Vdc ± 0.8 Vdc
	Current	Optimal	1C
		Max. Continuous	2C
		Max. Pulse	3C
		Protection Release Condition	36 A
	Temp.	Operating	72 A ± 3 % (10 s ± 0.5 s)
		Protection Release	108 A ± 3 % (3 s ± 0.5 s)
		Protection Release Condition	Remove load, release after 30s. After 10 consecutive protection events, release after 30min or charge.
Temp.	Operating	-4 °F ± 9 °F to 150 °F ± 9 °F (-20 °C ± 5 °C to 65 °C ± 5 °C)	
	Protection Release	5 °F ± 9 °F to 130 °F ± 9 °F (-15 °C ± 5 °C to 55 °C ± 5 °C)	
	Protection Release Condition	Disconnect load. Temperature meets protection release conditions.	
Short	Short Circuit Release Condition	Remove load.	
Storage	Recommended Voltage	54.0 Vdc (about 50 % SoC)	
	1 month	-4 °F to 113 °F (-20 °C to 45 °C)	
	3 months	-4 °F to 95 °F (-20 °C to 35 °C)	
	6 months	-4 °F to 77 °F (-20 °C to 25 °C)	
	Maintenance	Discharge-charge cycle every 6 months.	

3 Battery System Sizing

DO NOT undersize the battery system.

Consider these three parameters when determining the size of the battery system.

- **Battery Rated Energy**

Golf carts can travel from 4 to 8 miles per kWh. One EX-GC2-48036 battery has a rated energy of 1.8kWh, so the equivalent range per battery is 7.2 to 14.4 miles.

Assume:

One EX-GC2-48036 battery can provide 10 miles of drivable distance

You plan to play an 18-hole course N times (N = 1, 2, 3, ...)

An 18-hole golf course is about a 10-mile drive

A one-way travel distance is D mi

*Number_of_batteries_1 = (D + 10*N + D)/10 mi*

E.g.:

You plan to play an 18-hole course 2 times

An 18-hole golf course is about 10 mi drive

A one-way travel distance is 6 mi

*Number_of_batteries_1 = (6 + 10*2 + 6)/10 mi = 3.20*

- **Battery Maximum Pulse Discharge Current**

Find the maximum **INPUT** pulse power on the motor or maximum **INPUT** pulse current on the motor controller.

Assume:

The maximum input pulse power on the motor is P_max

I_pulse = P_max/40.8V

Number_of_batteries_2 = I_pulse/108A

E.g.:

P_max = 16kW

I_pulse = 16000W/40.8V = 392A

Number_of_batteries_2 = 392A/108A = 3.63

- **Battery Maximum Continuous Discharge Current**

Find the rated **INPUT** power on the motor or rated **INPUT** current on the motor controller.

Assume:

The maximum input rated power on the motor is P_{rated}

$$I_{cont} = P_{rated}/40.8V$$

$$Number_of_batteries_3 = I_{cont}/72A$$

E.g.:

$$P_{rated} = 10kW$$

$$I_{cont} = 10000W/40.8V = 245A$$

$$Number_of_batteries_3 = 245A/72A = 3.40$$

Round up the maximum number of $Number_of_batteries_{1,2,3}$ to be the number of batteries for the battery system.

E.g.:

$$Number_of_batteries_1 = 3.20$$

$$Number_of_batteries_2 = 3.63$$

$$Number_of_batteries_3 = 3.40$$

The number of EX-GC2-48036 batteries for this installation is 4.

- **Quick Reference Sheet**

	Energy	Pulse Current	Continuous Current
Number of courses	N		
One-way distance	D		
Max pulse current		I_{pulse}	
Max continuous current			I_{cont}
Calculation result	Number_1 $= (D + 10*N + D)/10$	Number_2 $= I_{pulse}/108$	Number_3 $= I_{cont}/72$
Battery system size	Max (Number_1, Number_2, Number_3)		

The decision to expand the size of the existing battery system should be made early on. Check the cycle count of each battery on the Expion360 app.

Extra batteries can be added if the existing battery system cycle count is less than 50. However, the existing battery system may need to be reconfigured.

DO NOT add new batteries if the cycle count of the existing battery system exceeds 50 cycles.

4 Battery System Installation

Improper Battery System Installation Voids the Warranty

The depth of the battery terminal thread is about 12 mm. Consider this when determining the proper M8 bolt length to secure bus bars, cable lugs, and any washers that will be affixed to the terminal. Torque the screws to 8 lb-ft (96 lb-in).

Make sure the discharge switch is **OFF** when operating. Click on the switch to the **ON** position after completing installation. The battery can be charged regardless of the switch position.

Use **AT LEAST** 2 AWG cables when connecting multiple GC2 batteries for optimal performance. Make sure the battery cables are the same gauge, equal length, and as short as possible. Check the current of each battery on the Expion360 app. Make sure the difference between the current of each battery and the average current is within the 5% range of the average current. Otherwise, check the battery system wiring and make sure the system is installed correctly.

- **Series Installation:**

DO NOT connect EX-GC2 batteries in series.

- **Parallel Installation:**

Connecting batteries in parallel increases the continuous/pulse charge and discharge rates, as well as the battery system capacity. This leads to an extended range and the ability to operate a more powerful motor.

Up to 4 batteries may be connected in parallel on one string. To further increase the battery system's overall capacity, additional strings may be connected to a power distribution block using cables of equal length.

Avoid configuring the battery system with 5 batteries, due to balancing issues. Instead, configure the battery system with 4 or 6 batteries.

5 Charging

The optimal and maximum charge rates of a battery system are equal to the rates of an individual battery multiplied by the number of batteries connected in parallel.

E.g.:

A battery system has (4) 100 Ah batteries connected in parallel. The capacity of the battery system is 400 Ah. The optimal/maximum charge rate of a single Expion360 battery in this system is 20/50 A at 0.2/0.5C. The optimal/maximum charge rate of the battery system is 80/200 A (0.2/0.5C).

Use the optimal charge rate (0.2C) to prolong the battery's life. The battery system can be charged at a maximum charge rate of 0.5C for rapid charging if the temperature conditions listed in the [Battery Specifications](#) section are met. Never charge the battery system above the maximum charge rate. Please consult the [Battery Specifications](#) for information on the optimal and maximum charge rates of the battery in various temperature conditions.

If batteries have been discharged to 0% SoC, they must be recharged within one week to prevent damage to the batteries and avoid voiding the warranty.

- **Charger Options**

Expion360 GC2 batteries should be charged by a CC-CV two-stage LFP profile charger. The charge current/voltage should be in the listed range and never exceed the maximum charge current/voltage of the battery system. See [Battery Specifications](#) for details. It is recommended to charge the battery after use every time.

- **Charger Sizing**

Once the battery system has been appropriately sized, the specifications for the charger can be determined based on the preferred charge rate or time. A 5-hour charge time is recommended to maximize the life span of the battery.

Assume:

The desired charging time is $T = 8$ hours

The number of EX-GC2-48036 in the battery system is $N=4$

The rated energy/capacity of EX-GC2-48036 is 1.8kWh/36Ah

The 48V CC-CV LFP charger power and current are P_{chrg} and I_{chrg}

E.g.:

$$P_{\text{chrg}} = \text{Battery System Rated Energy} / T = 1800\text{Wh} * 4 / 8\text{h} = 900\text{W}$$

Or

$$I_{\text{chrg}} = \text{Battery System Rated Capacity} / T = 36\text{Ah} * 4 / 8\text{h} = 18\text{A}$$

The charger's calculated current must be lower than the maximum charging rate of the battery system.

6 Cycle Life

The battery is considered to reach the end-of-life (EoL) when the remaining available capacity is less than 80% of the original capacity. Many factors can affect battery cycle life, such as depth of discharge (DoD), charge/discharge rate, and temperature. Optimizing these factors can extend battery life.

- **DoD (Depth of Discharge):**

The cycle life is tested by cycling the batteries at 100% DoD. The optimal window for operating LFP batteries is between 20% and 80% DoD. To accommodate this, slightly oversize the battery system so that each cycle is about 80% DoD.

- **Operating Temperature Range:**

Operating the battery at extremely low or high temperatures will significantly decrease the battery cycle life. Make sure the battery system is ventilated or cooled at high temperatures and heated at low temperatures. Maximum battery life can be achieved when operating temperatures are as close to 77 °F (25 °C) as possible.

- **Charge/Discharge Rate:**

Charging and discharging the battery at higher than recommended rates will generate more heat within the cells. Since temperature is the primary factor that affects the cycle life, consider the charge/discharge specifications with regard given to ambient temperature extremes when configuring the battery power system. The specifications consider both safety and the maximum cycle life when recommending optimal parameters for the battery system.

- **Storage:**

Most users will see batteries in storage more often than active daily use. To prolong the battery life during periods of storage of one month or longer, please consider the storage conditions.

7 Storage

If batteries are fully discharged to 0% SoC, immediately charge the battery system to 50% or an open circuit voltage of about 55.2 Vdc and confirm that all positive and negative cables have been disconnected from the battery terminals. All batteries using LiFePO₄ chemistry will be permanently damaged if discharged to 0% SoC and left for over **one week**. This is not a design flaw but is an inherent characteristic among all Lithium Iron Phosphate batteries.

The Expion360 warranty excludes coverage for such damage due to neglect of the batteries by the end user.

Properly storing the battery system between 20% and 80% state-of-charge (SoC) will prolong the battery life. Completely discharge and charge the battery system every 6 months to extend the battery life.

For long term storage or when the minimum temperature is **BELOW FREEZING**, return the button switch to the flush position and isolate the battery system from any loads and charging sources. The BMS only measures the SoC of the battery pack during charging and discharging, and it cannot measure the battery self-discharge. Due to the inherent self-discharge of all batteries, it is advised to check the voltage periodically. If at any time the voltage is below 48 Vdc, check the battery system and make sure it is completely disconnected from any load. Charge the battery system to 50% and disconnect the charger. Isolate the batteries from the charger and load source.

Please follow the guidelines below for lengths of storage time and temperatures.

1 month:	20% - 80% SoC, -4 °F to 113 °F
3 months:	20% - 80% SoC, -4 °F to 95 °F
6 months:	50% SoC, -4 °F to 77 °F

For short term storage or when the minimum temperature is **ABOVE FREEZING**, return the button switch to the flush position and connect the system to a charger.

8 Protection

The Expion360 GC2 battery is purpose-built for golf carts and other LEVs and includes specialized features to ensure optimum performance and safety. The integrated BMS provides outstanding safety features, including multiple levels of protection for discharge current and regenerative braking. For details and troubleshooting, see Battery Specifications.

The regenerative brake has minimal benefit in terms of energy recovery for golf carts, instead, it may heat the batteries and potentially reduce the battery life. Choose a regen level that isn't too aggressive and strikes a balance between performance and comfort. If the regen level exceeds the maximum regen current and duration, BMS protection will activate, leading to a significant reduction in the vehicle's braking power. Please note, 10 protection events will temporarily lock the batteries. It is highly advised to test the system regen settings and validate the braking system before use. If needed, add more batteries to the battery system to accommodate higher regen current.

A braking resistor is an essential component of the golf cart braking system for safety. Serious injury or death may result from operating a golf cart without a braking resistor.

It's important to obtain expert assistance when converting a golf cart from a lead acid system to an LFP battery system.

9 Bluetooth and Expion360 App

The Expion360 app is available for download on both the Apple App Store and Google Play Store. Detailed instructions for the app can be found in the [Expion360 App Walkthrough](#).

To conserve energy, the Battery Bluetooth module will enter sleep mode after being idle for an hour. Charging, discharging, or toggling the On/Off switch will wake up the Bluetooth module.

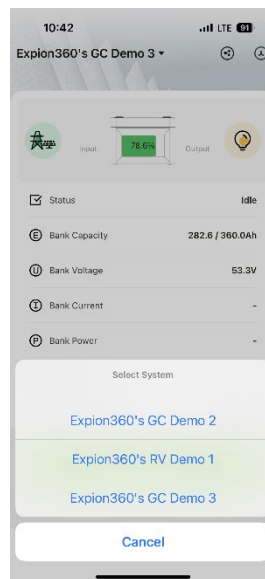
The number of devices that connect to the phone simultaneously will affect the battery life of the phone and the stability of Bluetooth connections. The stability of the Bluetooth connections can also be affected by the surroundings of the batteries. For example, a metal battery enclosure may weaken or disrupt Bluetooth signals.

Due to a limitation within the iOS and Android operating systems, the maximum number of devices that can connect to a cell phone simultaneously will differ. According to our testing, the iOS system can connect to 8 devices simultaneously, whereas Android is able to connect to 6 devices at a time. If more devices need to be connected, the battery system can

be configured as multiple battery sub-systems on the Expion360 app. These different sub-systems can be accessed from the app to display sub-system information when needed.

E.g.:

If you have a battery system that contains 16 batteries, your phone is not able to connect to them all simultaneously. You can separate the battery system into multiple battery sub-systems, virtually. Each battery sub-system represents one string of batteries. As depicted below, the battery system is separated into two battery sub-systems – GC Demo 2 and GC Demo 3. Each battery sub-system can be selected from the drop-down battery system list (top left corner) to activate the Bluetooth connections and display the sub-system information.



More details about battery sub-systems (strings) can be found at [Battery System Installation](#) and [Battery System Installation Guidance](#).