



EGUANA



Evolve LFP Installation & Startup Manual

- For use only with battery models
- Pylontech US3000 /US3000C

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions for the Eguana Evolve™ LFP, including the Power Control System (PCS) and base model battery cabinet installation and operation, herein defined as the ESS. The ESS is expandable with the addition of up to two more battery cabinets. Refer to this manual in Appendix A for more details if your system contains additional battery capacity beyond the base model. The ESS components described by this manual are intended to be used as part of an Energy Storage system and installed per all local building codes and regulations in addition to the National Electrical Code, ANSI/NFPA 70 (for US) and Canadian Electrical Code (for Canada).



CAUTION: Hazardous Voltages! This inverter contains hazardous voltage and energy that may be lethal. It may only be installed by qualified personnel who have read this manual and are familiar with its operation and hazards. The following safety procedures should be followed:

Only connect the PCS cabinet to a compatible electrical service as defined in the model specifications. The PCS must be connected to a dedicated branch circuit in the main electrical panel.

An external disconnect switch shall be provided in the end installation by others for the AC Grid output circuit.



CAUTION! This equipment contains high energy lithium batteries. Qualified and trained personnel should wear protective clothing and equipment when working inside the battery cabinet and/or with battery modules.



CAUTION! The batteries provided with this system must be charged only by the PCS included as part of the energy storage system. Do not attempt to charge batteries with any other charger device or connect any devices directly to the DC battery bus.

Ensure proper electrical grounding in accordance with code requirements.

Ensure proper airflow path for active cooling.

Never operate system in a manner not described by this manual.

Only qualified personnel should service this product.

Ensure all covers are securely fastened after installation is complete.

This product must be stored indoors in an environmentally conditioned location prior to installation, protected from rain and exposure to any hazardous chemicals.

Do not attempt to operate this product if there is any physical evidence of damage to any of the cabinets or internal components.



CAUTION! This equipment is heavy. Mechanical lifts are recommended for safe installation.

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1 Safety

This manual contains important instructions for the Eguana Evolve™ LFP. The components described by this manual are intended to be used as part of an energy storage system and installed per all local building codes and regulations in addition to the National Electrical Code, ANSI/NFPA 70 (for US) and Canadian Electrical Code (for Canada).

Throughout this manual, the following symbols will be used to highlight important information and procedures:

| Symbol | Definition | Symbol | Definition |
|---|--|---|--|
|  | WARNING! A dangerous voltage or other condition exists. Use extreme caution when performing these tasks. |  | Meter measurement required. |
|  | CAUTION! This information is critical to the safe installation and or operation of the inverter. Follow these instructions closely. |  | Torque rating critical to operation. |
|  | NOTE: This statement is important. Follow instructions closely. |  | Login to the remote monitoring system for operating status |

1.1 In case of emergency

In all cases:

- If safe to do so, switch off the AC breakers (external to the system).
- Contact the fire department or other required emergency response team.
- Evacuate the area, and if applicable, follow your emergency evacuation plan if others are in proximity to the installed location.

In case of fire:

- When safe, use a fire extinguisher suitable for use; including A, B, and C dry chemical fire extinguishers or carbon dioxide extinguishers.

In case of flooding:

- Stay out of water if any part of the system or wiring is submerged.
- Do not attempt to operate batteries that have been submerged in water even after they have been dried.

In case of unusual noise, smell or smoke:

- If safe to do so, ventilate the area.

1.2 Battery module safety precautions

This product is integrated with Pylontech US3000 / US3000C series battery modules. Refer to the Pylontech product manual for complete safety instructions regarding handling of battery modules.

1.3 General safety precautions

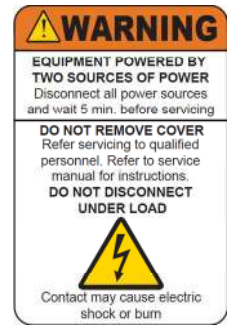


Important! Installation, service, and operating personnel must read this document in its entirety, and observe all safety and installation procedures as described in this manual. Never operate system in a manner not described by this manual.

Only qualified personnel should service this product.

Ensure all covers are securely fastened after installation is complete.

Personal Protective Equipment (PPE) in compliance with local work place safety standards must be worn when working inside the cabinet.



Risks of Fire

Do not expose the system to temperatures exceeding 60 degrees Celsius.

Avoid installation in direct sunlight.

Do not store objects on top of the cabinet.

Do not obstruct the airflow paths of the cabinet air intake.

Do not obstruct the exhaust of cabinet exhaust.

Do not store combustible objects and corrosive chemicals directly adjacent to the system.

Risks of Shock



WARNING! Hazardous Voltages. The Inverter contains hazardous voltage and energy that may be lethal. It may only be installed by qualified personnel who have read this manual and are familiar with its operation and hazards.



Only connect the PCS cabinet to a compatible electrical service as defined in the model specifications. The PCS must be connected to a dedicated branch circuit in the main electrical panel.

Ensure proper electrical grounding in accordance with code requirements.



CAUTION! Both AC and DC voltage sources are terminated inside this equipment. Each circuit must be individually disconnected before servicing

Risks of Damage

The PCS is configured for the Pylontech US3000 / US3000C battery module only. Do not attempt to connect any other battery to the system.

Do not connect any other loads directly to the battery power bus.

Do not drop, tip, or puncture the cabinet during transport and installation. Visible damage to the cabinet and/or internal components should be reported to the manufacturer immediately.

Do not store this system for periods longer than six months without a battery maintenance charge. This may result in permanent damage to the batteries.

1.4 Disposal and Recycling



Do not dispose of the system or any of the components within the cabinet. Batteries, electronics, cables, and metal parts are recyclable. Consult your municipal waste management authority to determine required methods of component recycling.

2 Introduction

2.1 About this Manual – Target Audience

This manual is intended to be used by qualified service and installation personnel for the purposes of product installation.

This manual contains instructions for the installation and start up sequence of the Eguana Evolve™ LFP; including the PCS and master battery cabinets. This product is permanently wired to the home electrical service, and must be installed by a licensed electrician only. The battery capacity of this system can be expanded by adding additional cabinets adjacent to the base battery cabinet. Refer to Appendix A for battery expansion installation instructions.

2.2 Installation Planning & System Commissioning - Supporting Documents

The Evolve LFP energy storage system is operated by the Evolve Hub. Please consult the Evolve Hub Installation Manual for full installation planning details, including conduit layout plans and sample single line diagrams for a complete solar plus storage system installation. The Evolve Hub installation manual also describes in more detail the various operating modes and configurations for AC coupled PV solar plus storage systems.

The Evolve Hub’s energy management system & gateway requires installer administration and device commissioning prior to operation of the Evolve LFP energy storage system. Refer to the Fleet Installer Administration Guide and the Evolve Hub Install and Commission Quick Guide for further details.

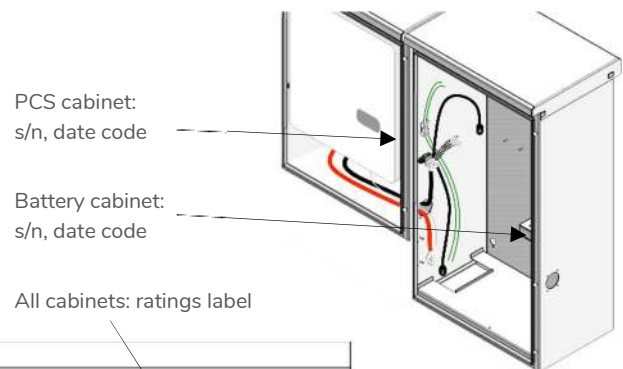
A complete list of Installer resources is available at www.eguanatech.com under the Evolve™ product banner.

2.3 Glossary

| Term | Definition | Term | Definition |
|------|--------------------------|---------|---------------------------------|
| AC | Alternating Current | LED | Light Emitting Diode |
| ARC | Auto Recovery Circuit | NC / NO | Normally Closed / Normally Open |
| CPU | Central Processing Unit | PCS | Power Control System (Inverter) |
| DC | Direct Current | PE | Protective Earth |
| EMS | Energy Management System | PV | Photo-Voltaic |
| ESD | Electrostatic Discharge | RF | Radio Frequency |
| ESS | Energy Storage System | SOC | State Of Charge (Battery) |
| GND | Ground | SOH | State of Health (Battery) |

2.4 Product markings

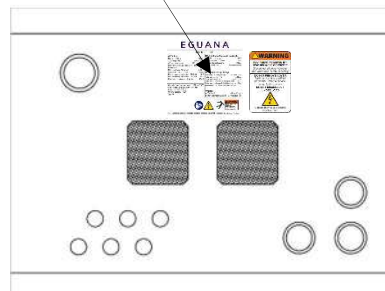
The ratings label is located on the bottom face of each cabinet. The serial number / date code labels for the system are located as shown (right) with the front covers removed.



2.5 Special tools & hardware

The following tools are required to complete the installation of the ESS:

- Torque wrench
- 17mm socket wrench (DC- main power connection).
- 10mm socket wrench (battery +/- module power connections).
- 3/8" socket wrench (DC+ main power connection).
- Load bearing hardware for wall bracket mounting. 5/16" (M8)



2.6 Initial Inspection of Material List – top level system components

The system components supplied with your Eguana Evolve™ LFP are shown below. Each component should be inspected visually for any damage that may have been caused by shipment. If damage is present, please contact your local distributor.

| Item | Eguana P/N | Description |
|------|------------------|--|
| 1 | ACB05U-LP | PCS cabinet (and cover) |
| 2 | ACB05-PB | Battery Cabinet (and cover) |
| 3 | - | Wall mount bracket |
| 4 | US3000C / US3000 | 4 battery modules (US3000C model shown). |
| 5 | LFP install kit | Assembly parts kit, cables, and manuals. |
| - | Evolve Hub | Not shown – this is an accessory. Model may vary. Refer to documentation included with the Evolve Hub as equipped. |

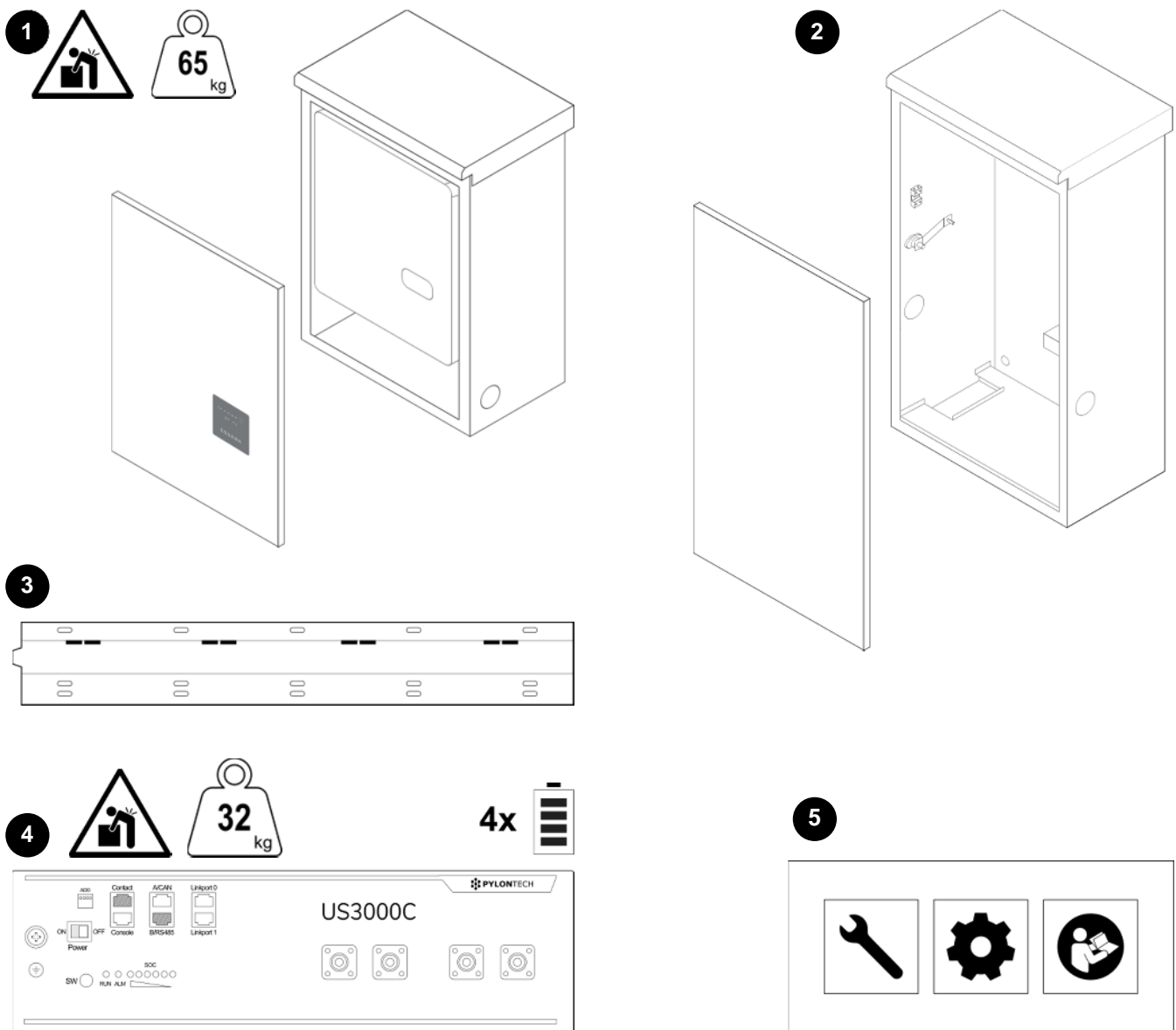


Figure 1: Top level system components.

2.6.1 LFP install kit – mechanical parts and manuals

| Item | Qty | Eguana P/N | Description |
|------------------------|-----|------------------|--|
| Battery Cabinet | | | |
| 1 | 1 | PB kit | Incl. cabinet coupler assembly, two levelling brackets, and two plugs |
| 2 | 1 | Breaker Assembly | DC breaker assembly |
| 3 | 8 | 801003794 | Adhesive backed battery module pads |
| 4 | 1 | 801003757 | Battery rack partition bracket (includes attached battery retaining clip 801003044) |
| PCS Cabinet | | | |
| 5 | 1 | LP kit | Incl. levelling bracket, cabinet coupler end plate, plug, and PCS-BMS communication cable. The PCS-BMS cable provided will match the battery type supplied with the equipment. |
| - | 1 | Doc 82013 | Evolve LFP Installation and Startup Manual |
| - | 1 | Doc 58159 | Evolve LFP System Owner's Manual |

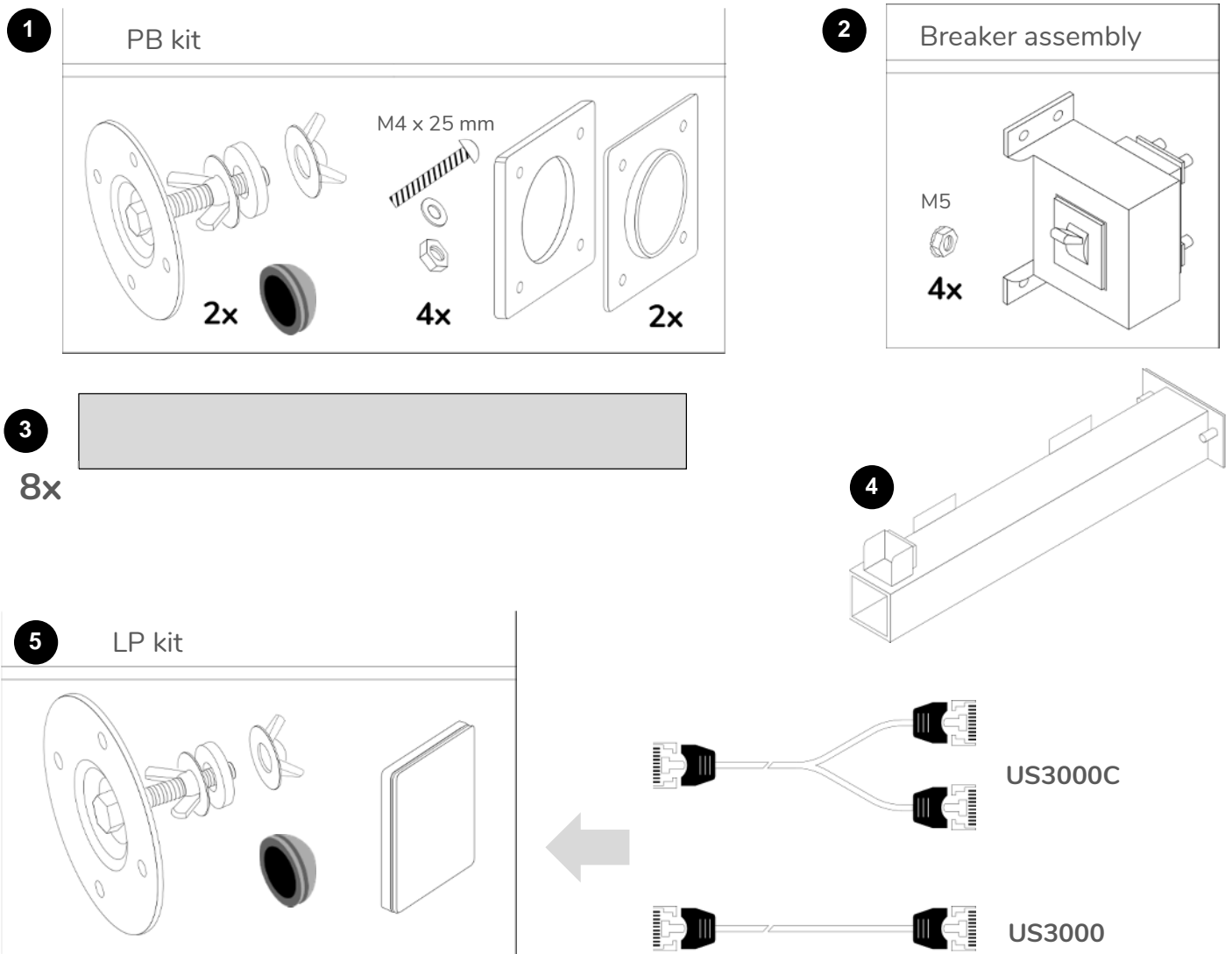


Figure 2: LFP install kit - mechanical parts.

2.6.2 LFP install kit – battery cables

| Item | Qty | Eguana P/N | Description | Pylon p/n |
|------|-----|------------|--------------------------------|--------------|
| 1 | 2 | 801003790 | DC- module jumper BLK 180 mm | WI0BSC1000B2 |
| 2 | 1 | 801003793 | DC- module jumper BLK 400 mm | WI0CUS300004 |
| 3 | 2 | 801003798 | DC- terminal jumper BLK 400 mm | WI0CUS300002 |
| 4 | 3 | 801003789 | DC+ module jumper RED 180 mm | WI0BSC100001 |
| 5 | 1 | 801003796 | DC+ terminal jumper RED 400 mm | WI0CUS300001 |
| 6 | 1 | 801003797 | DC+ terminal jumper RED 700 mm | WI0PUS300001 |
| 7 | 2 | 801003792 | BMS jumper short 210 mm | WI0SRJ458025 |
| 8 | 1 | 801003794 | BMS jumper long 700 mm | WI0SUS300002 |
| 9 | 4 | 801003791 | Chassis GND cable GRN/YEL 1 m | WI0GUS300001 |

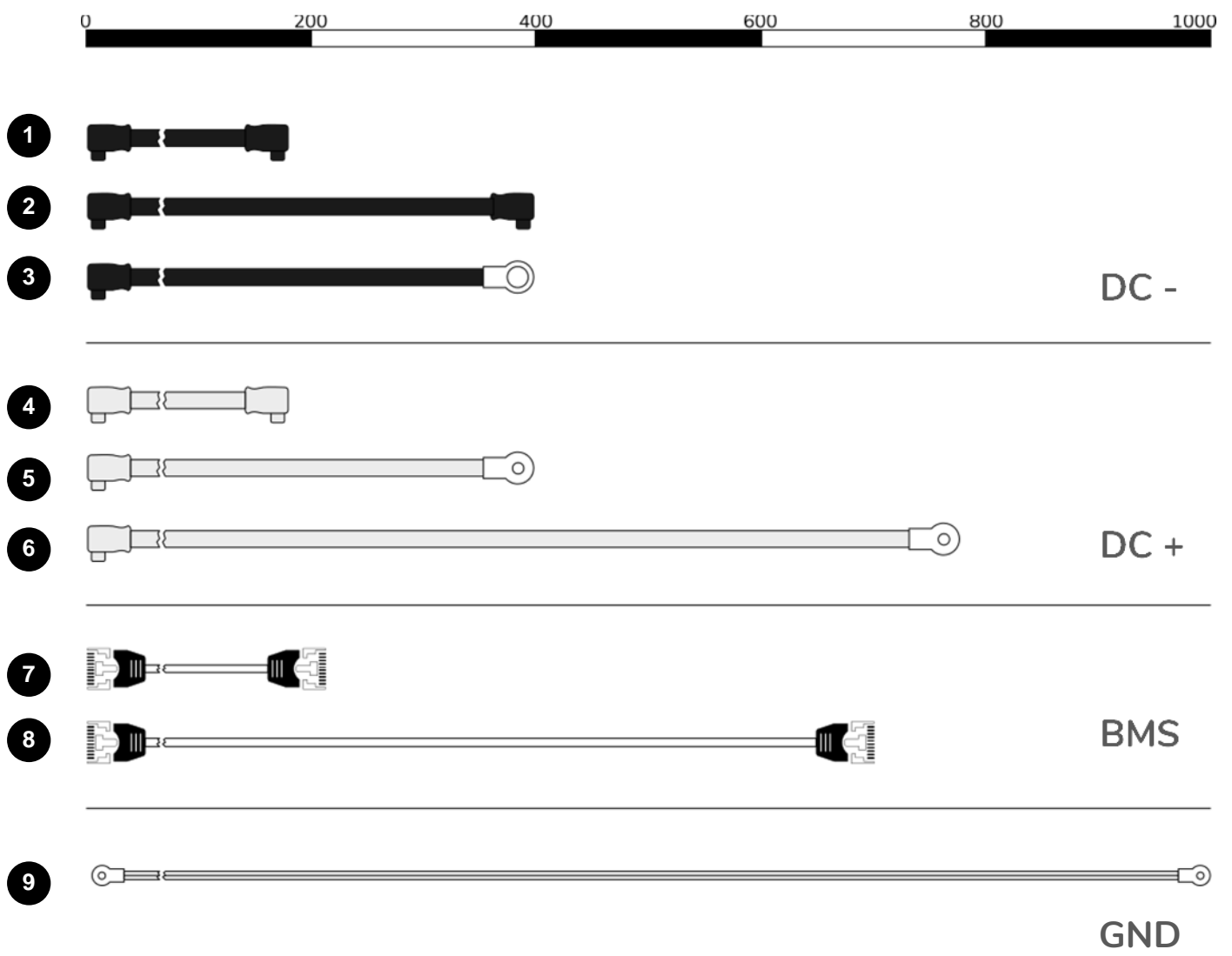


Figure 3: LFP install kit - battery cables.

3 Installation Site Preparation

Before installing the product, read all instructions and warnings in this manual.



CAUTION! All electrical installation work should be performed in accordance with local building and electrical codes.



WARNING! Isolate the PCS from all energy sources prior to electrical installation by means of disconnects, breakers or connectors. Failure to properly isolate either AC or DC sources may result in serious injury or death. This system will generate an AC voltage at the off-grid terminals when DC source is applied.



CAUTION! The PCS cabinet weighs up to 145 lbs. (65 kg), and the battery cabinet weighs up to 320 lbs. (145 kg) with four battery modules installed. **Handle with care.** The wall to which the system is mounted must be load-bearing rated according to the local building code. Mechanical lifts are recommended to position cabinets on the wall bracket.



NOTE: All interconnecting cables are limited in length, and designed specifically for adjacent cabinet mounting using the manufactured wall brackets.



CAUTION! Do not install in direct sunlight. Battery performance is dependent upon operating ambient temperature. Radiant heat absorbed in direct sunlight will greatly reduce the performance of the battery, and will prematurely cause degradation of the display indicator panel on the PCS cabinet. The battery modules are rated for operating temperature range between -10C to +50C. Indoor installation is recommended where ambient temperatures are outside of this range.



NOTE: The Evolve LFP energy storage system was not evaluated in seismic environments.

3.1 Overview of PCS and Battery components

1. The cabinets can be installed in an indoor and outdoor non-corrosive environment (not marine environment).
2. The forced air cooling of the PCS cabinet is designed to flow air from bottom to top.
3. The PCS and Battery cabinets are rated Type 3R.
4. Wall mounting hardware not included. The load-bearing wall bracket is provisioned for M8 hardware. Levelling brackets are provisioned for M5 hardware.

3.2 Installation Area Required to Wall Mount PCS and Battery:

The physical installation of the cabinets requires the layout planning and installation of the system components in the available installation space. The recommended installation height is driven by the viewing angle of the display panel on the PCS cabinet.

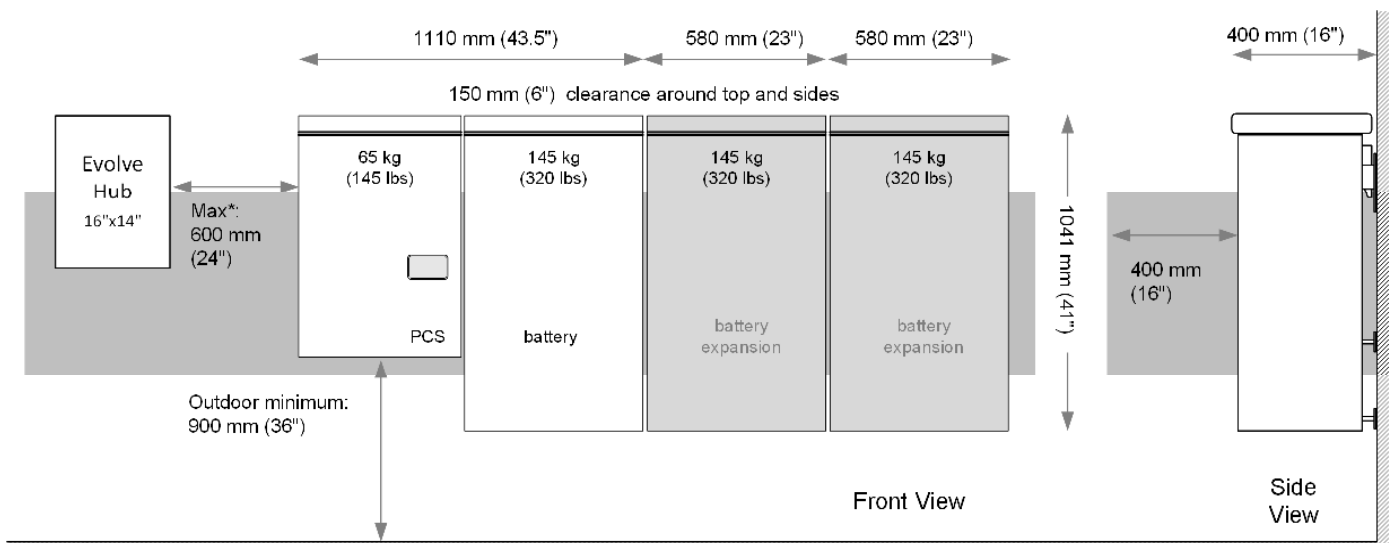


Figure 4: Installation clearances for the Evolve LFP energy storage system.

4 PCS and Battery Cabinet Wall-Mounting Instructions



1. Mount the wall bracket to the wall. Use the available slot pattern to mount to a load-bearing structure rated for the weight of the final system. The slots accommodate a M8 (5/16") bolt diameter.



IMPORTANT! Wall-stud mounting: A minimum of three wall studs spanned within the width of the mounting bracket are required. A minimum of two mounting bolts are required per stud (top/bottom).

2. (not shown) Remove the battery cabinet from the packaging, and stand the cabinet upright. Remove the front cover.
3. Mount the two leveling brackets to the back side of the cabinet. Each side of the cabinet must have a rubber washer in direct contact with the cabinet wall.
4. Lift the battery cabinet onto the wall mount bracket, aligning the wall hooks at the rear of the cabinet with the slots on the load-bearing face of the bracket.
5. Slide the battery cabinet towards the right end of the bracket to allow for clearance for the PCS cabinet.
6. From the rear side of the cabinet, adjust the outer wingnuts on the levelling brackets until the cabinet is vertically plumb (level) to the wall.

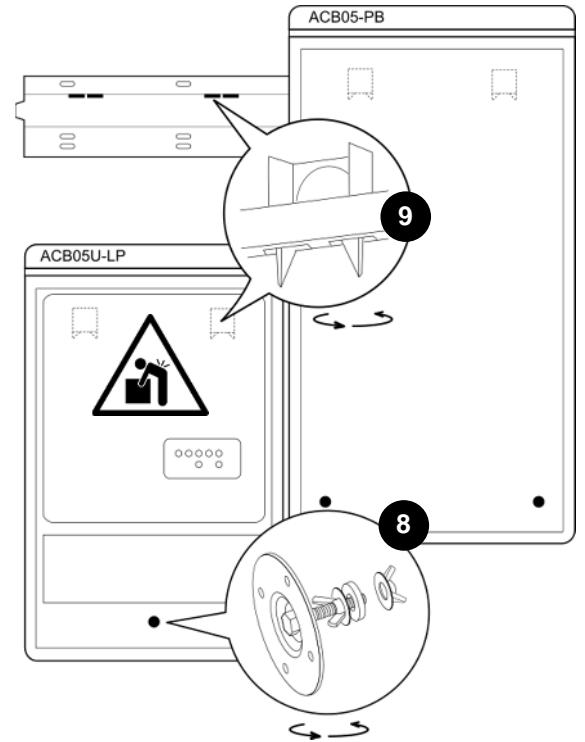
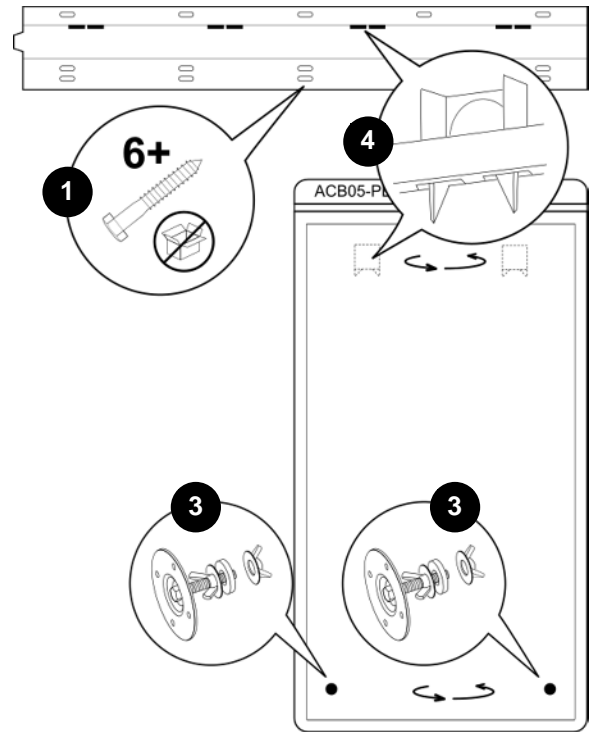
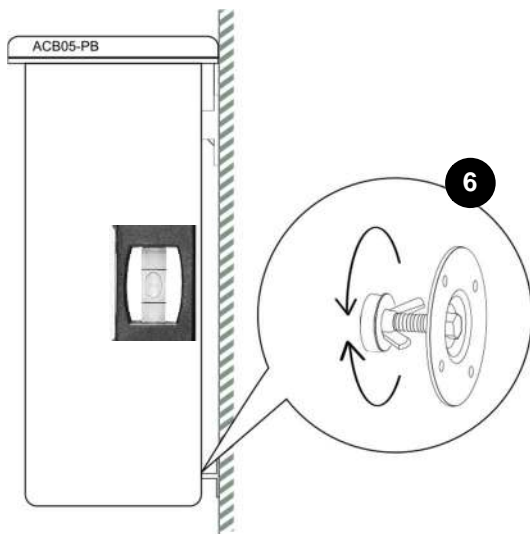


Figure 5: Wall-mounting the cabinets.

7. Remove the PCS cabinet from its packaging and stand upright. (not shown). Remove the front cover.
8. Assemble and mount the single lower-center leveling bracket as shown in steps 3 and 4 above.



CAUTION! The PCS cabinet is heavy. Mechanical lift or two persons recommended.

9. Lift the PCS cabinet onto the wall mounting bracket.
10. Slide the PCS cabinet to the left such that it aligns with the alignment tab on the mounting bracket.
11. From the rear side of the cabinet, adjust the outer wingnut on the single levelling bracket until the cabinet is vertically plumb (level) to the wall. (see image – step 6).
12. Insert the PCS cabinet coupling gasket between the two cabinets (lower-front). Slide the battery cabinet towards the left until mating to the gasket.
13. Place the coupling plate inside the PCS cabinet and insert the four mounting bolts and washers through to the battery cabinet side.
14. Place star washers on the bolts on the battery side of the cabinet.
15. Mount the battery cabinet side coupling plate, and fasten with the lock nuts. Torque to 10 – 15 in-lbs.



WARNING! The mounting bolts of the flange assembly are required to be fully secured, as they provide the chassis grounding for the battery cabinet. Torque nuts as specified in the specification tables provided in this manual.

16. **Continuity test:** Check the continuity between the cabinets using an Ohm meter. The test reading must be zero Ohms at a bare metal point inside each of the PCS and battery cabinets.

17. Install the cabinet coupler end plate (see- LP kit) to seal the hole on the battery cabinet.
18. Optional: (This is not a load bearing anchor – anchored conduit runs to the PCS are satisfactory). Install screws in leveling plates for PCS and battery cabinets by inserting a screwdriver through the hole on the backside of the cabinets.
19. Plug hole on back of cabinet using by inserting the hole plug from the front side.

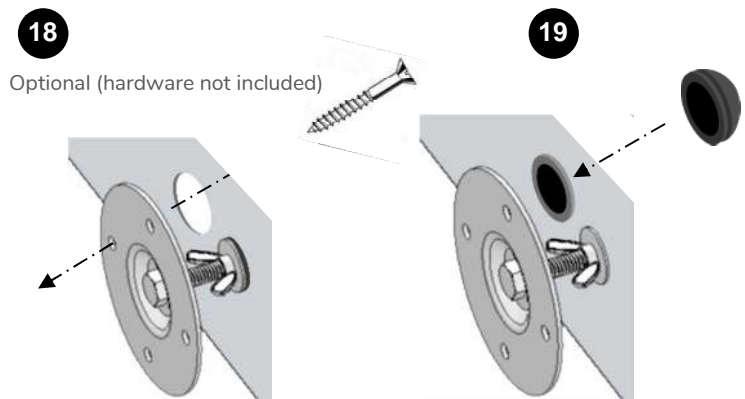
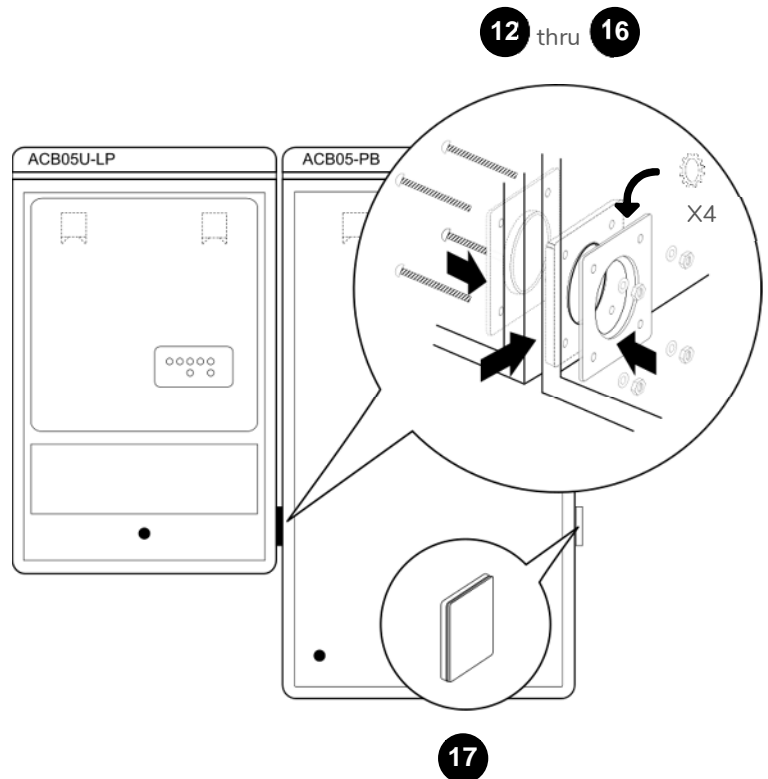
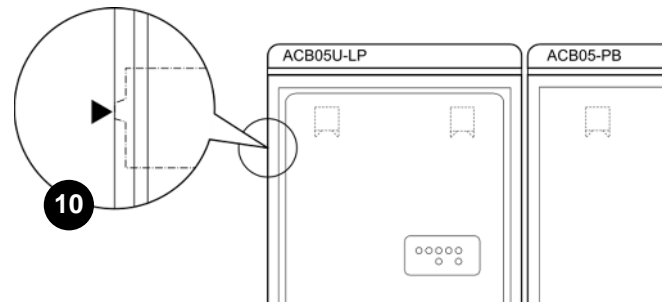


Figure 6: PCS cabinet and inter-cabinet coupler installation.

5 Battery Module Assembly

The following instructions include:

- Preparation and assembly of the battery cabinet modules and internal wiring.
- Interconnection of the PCS DC and communication cables to the battery cabinet.



Note: Overcurrent protection of the DC source is provided internally as part of the integrated battery system. No external DC disconnect is required.

5.1 Battery cabinet ground bus



CAUTION! A torque wrench is required to ensure the power cables are terminated to their specifications. Over-torque can damage the DC breaker and/or strip the threads on the copper bus bar posts. Under-torque can result in an arc fault hazard, and risk of fire. Damage as a result of improper termination is not covered by the manufacturer warranty.

1. Mount the four ground wires provided in the battery module grounding kit into the 4-position ground distribution block.

5.2 DC negative power terminal assembly

| Ref | P/N | Description | Pylon p/n label |
|-----|-------|-----------------------------------|-----------------|
| A3 | #3798 | DC- terminal jumper BLK 400 mm | WI0CUS300002 |
| P- | #2925 | PCS DC- power cable | - |

2. Route the DC negative power cable from the PCS through the cabinet port and mount to the DC negative power terminal.
3. Mount the two DC negative battery module power cables, referenced A3, (as provided in the battery cable kit) to the DC negative power terminal. Offset each power lug so that a flush electrical contact is made between each of the lugs.



4. Secure the DC negative power cables to the power terminal using the washer, lock washer, and hex nut provided. Torque the nut to 35 in/lbs.

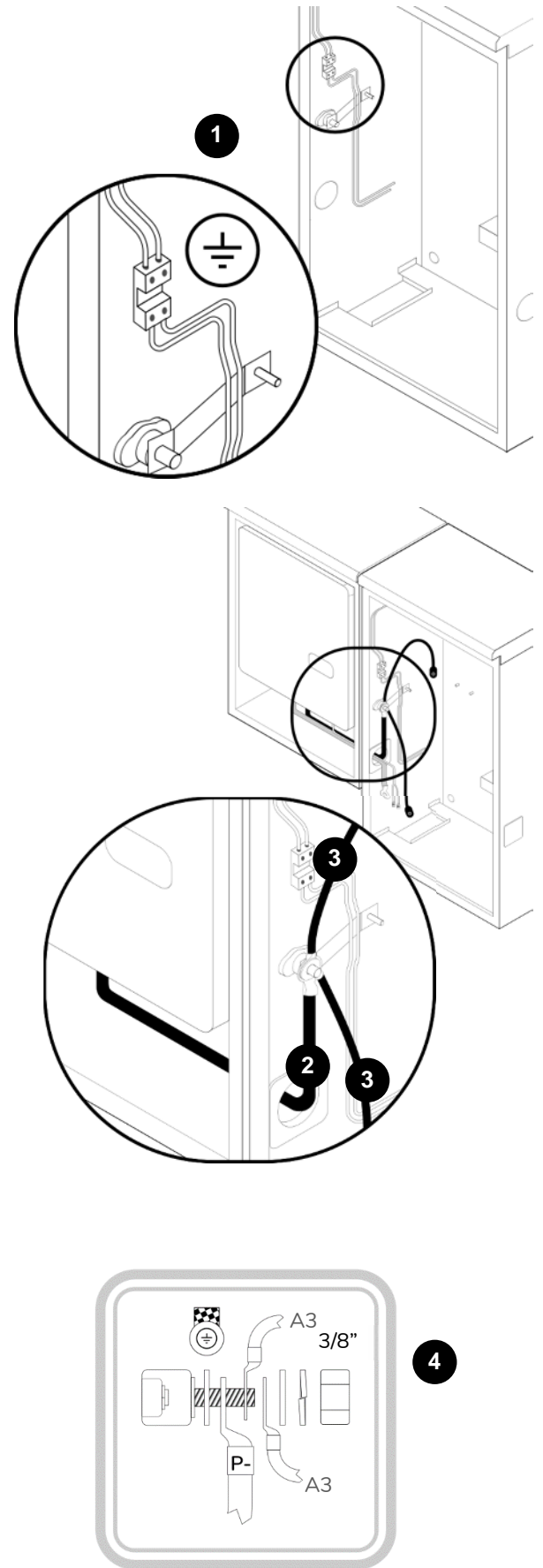


Figure 7: Battery cabinet ground wire and DC negative terminal assembly.

5.3 Preparing battery modules for installation

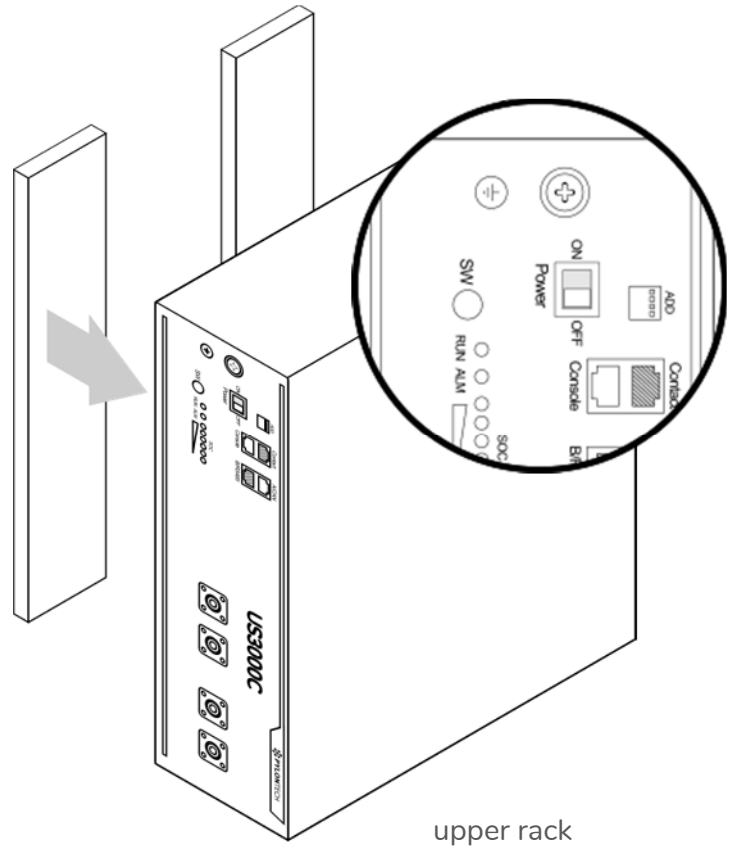
The PCS cabinet is not shown in the following steps.



CAUTION! Ensure the battery module power switches are in the OFF position throughout the following procedure.

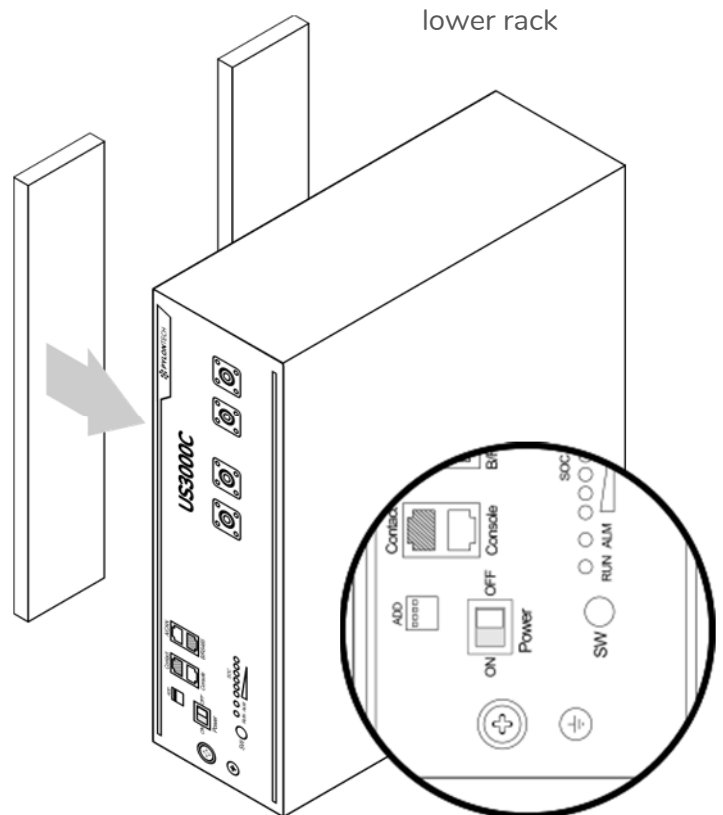


Note: Observe the rotation of the modules on the lower and upper racks. The lower rack is rotated such that the chassis ground terminal is at the bottom of the module, while the upper rack chassis ground terminal is at the top.



upper rack

1. (not shown) Remove a battery from its packaging. Remove the rackmount ears, if supplied with the battery.
2. Attach two adhesive-backed module pads (included in the battery module hardware kit) to the battery modules as shown. For the lower rack of modules, the pads are installed on the top face of the battery. For the upper rack, the pads are installed on the bottom face of the battery.



lower rack

Figure 9: Attaching adhesive pads to the battery modules.

5.4 Mounting and grounding the battery modules in the battery cabinet

1. Slide the lower rack battery into the cabinet as shown, and connect the ground cable to the ring terminal ground connector on the battery module as shown.
2. Push the module inward until making contact with the rear face of the cabinet.
3. Repeat steps 1 and 2 above with the 2nd lower rack module.
4. Mount the lower rack retaining clip.
5. Install the battery rack partition bracket as shown using the two M5 keys nuts provided.



Note: Remove the retaining clip from the bracket if mounted on the partition bracket before proceeding with the following steps:

6. Repeat steps 1 thru 3 above with the upper level battery rack.
7. Mount the two upper rack retaining clips.

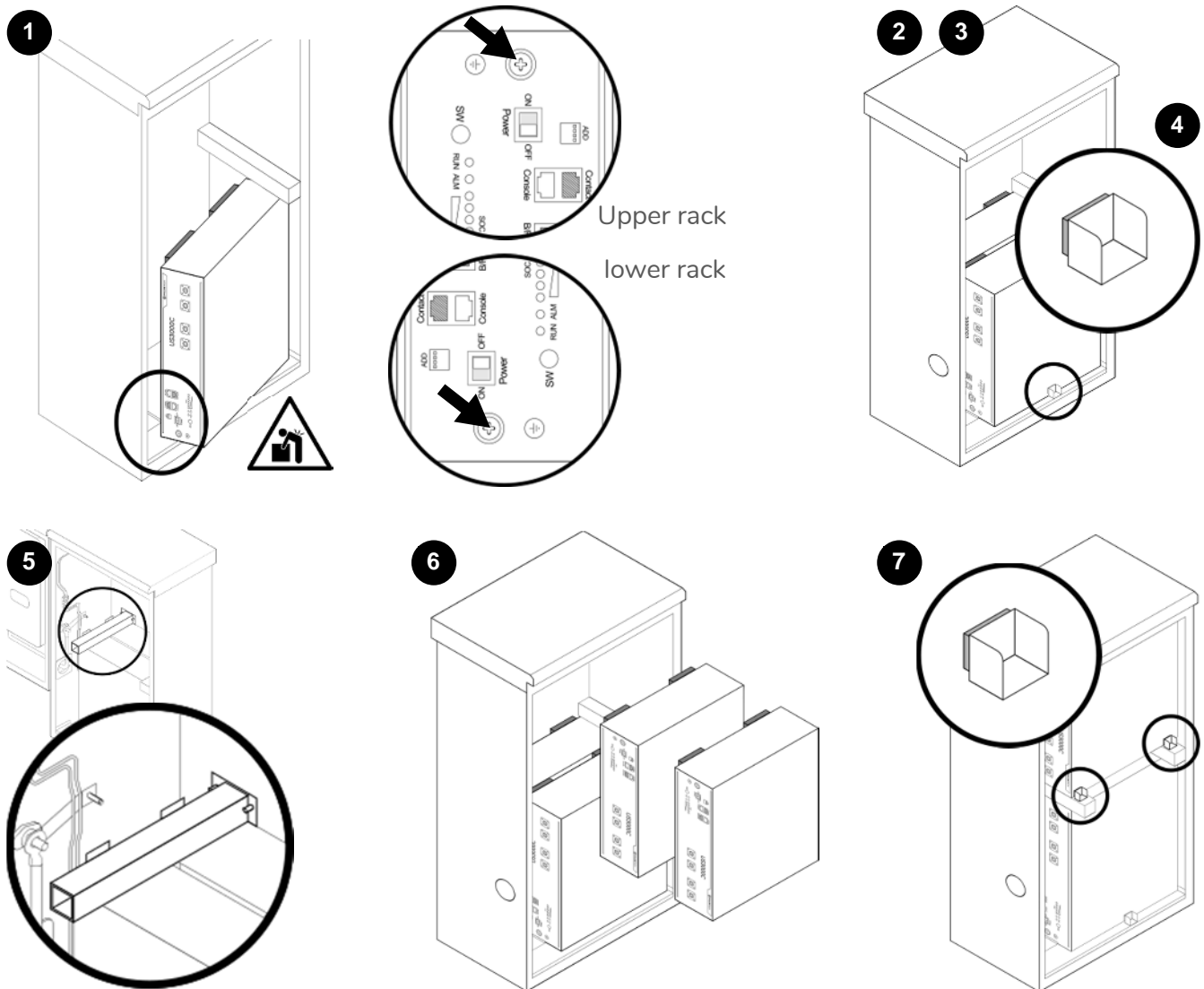


Figure 9: Installing and grounding the battery modules.

5.5 Wiring the battery modules

Follow the battery module power and communication jumper wiring below.

| Ref | P/N | Description | Pylon p/n label |
|-----|-------|---------------------------------|-----------------|
| A1 | #3790 | DC- module jumper BLK 180 mm | WI0BSC1000B2 |
| A2 | #3793 | DC- module jumper BLK 400 mm | WI0CUS300004 |
| B1 | #3789 | DC+ module jumper RED 180 mm | WI0BSC100001 |
| B2 | #3796 | DC+ breaker cable RED 400 mm | WI0CUS300001 |
| C1 | #3792 | BMS jumper short 210 mm | WI0SRJ458025 |
| C2 | #3794 | BMS jumper long 700 mm | WI0SUS300002 |

5.5.1 Battery module DC +/- jumper cable wiring

Install the cables in the following sequence as shown.

1. Terminate the two DC- module jumper cables referenced A1.
2. Terminate the DC- module jumper cable referenced A2.
3. Terminate the two DC+ module jumper cables referenced B1.
4. Terminate the DC+ module jumper cable referenced B2.

5.5.2 BMS communication jumper cable wiring

Install the cables in the following sequence.



IMPORTANT! All module interconnecting BMS jumpers terminate at the [Linkport] terminals. Note the Linkport reference, 0 and 1, for each port connection.

1. Terminate the BMS jumper cable C2 between batteries #2 - 3.
2. Terminate the BMS jumper cables C1 between batteries #1-2 and #3-4.

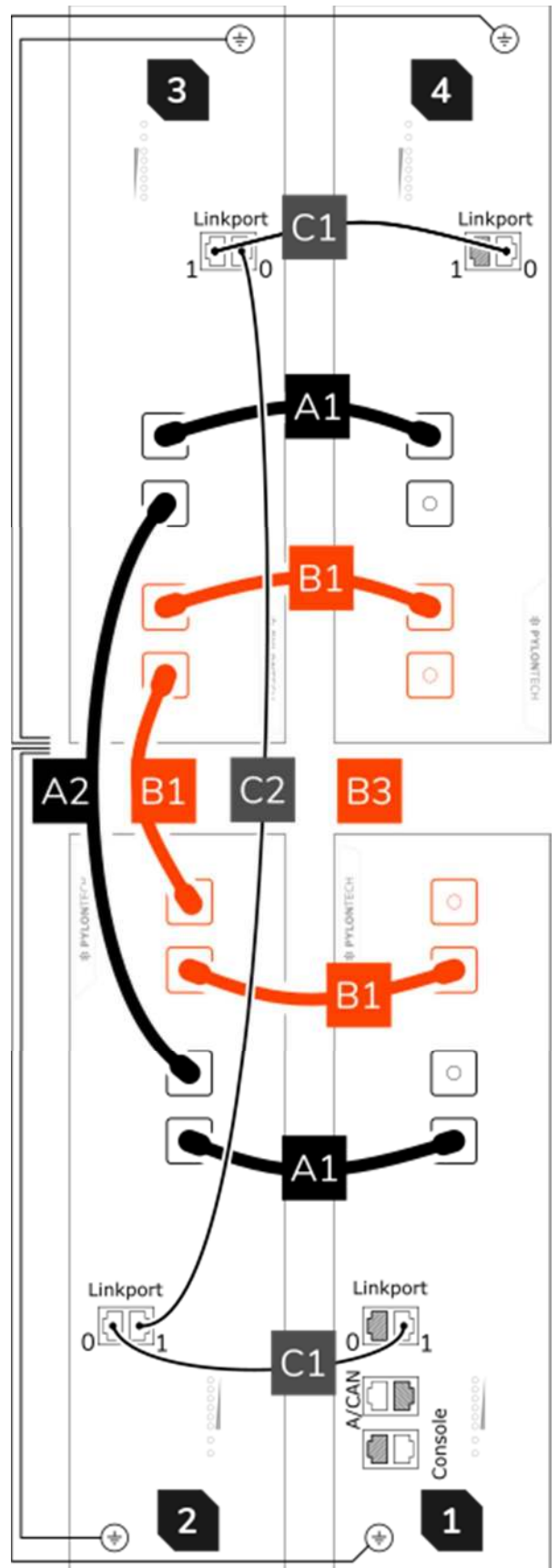


Figure 10: Installing the battery jumper cables.

5.5.3 PCS to BMS communication cable

This cable is specific to the battery model. Refer to the instruction that applies only to the battery module supplied.

1. Terminate the PCS-BMS cable in battery #1 as shown in figure 11. This battery is herein referred to as the “Master” battery module. All other modules sync to the master.

Model US3000: Terminate the PCS - BMS jumper cable in the [CAN] port of battery #1.

Model US3000C: Terminate the PCS – BMS / Console Y cable jumper in the [A/CAN] and [Console] ports of battery #1.

2. Route the other end of the cable through the PCS port hole and terminate in the cable in the [BMS OUT] port as shown in figure 11.
3. Terminate the two BMS jumper cables referenced C1 between batteries #1-2 and #3-4.

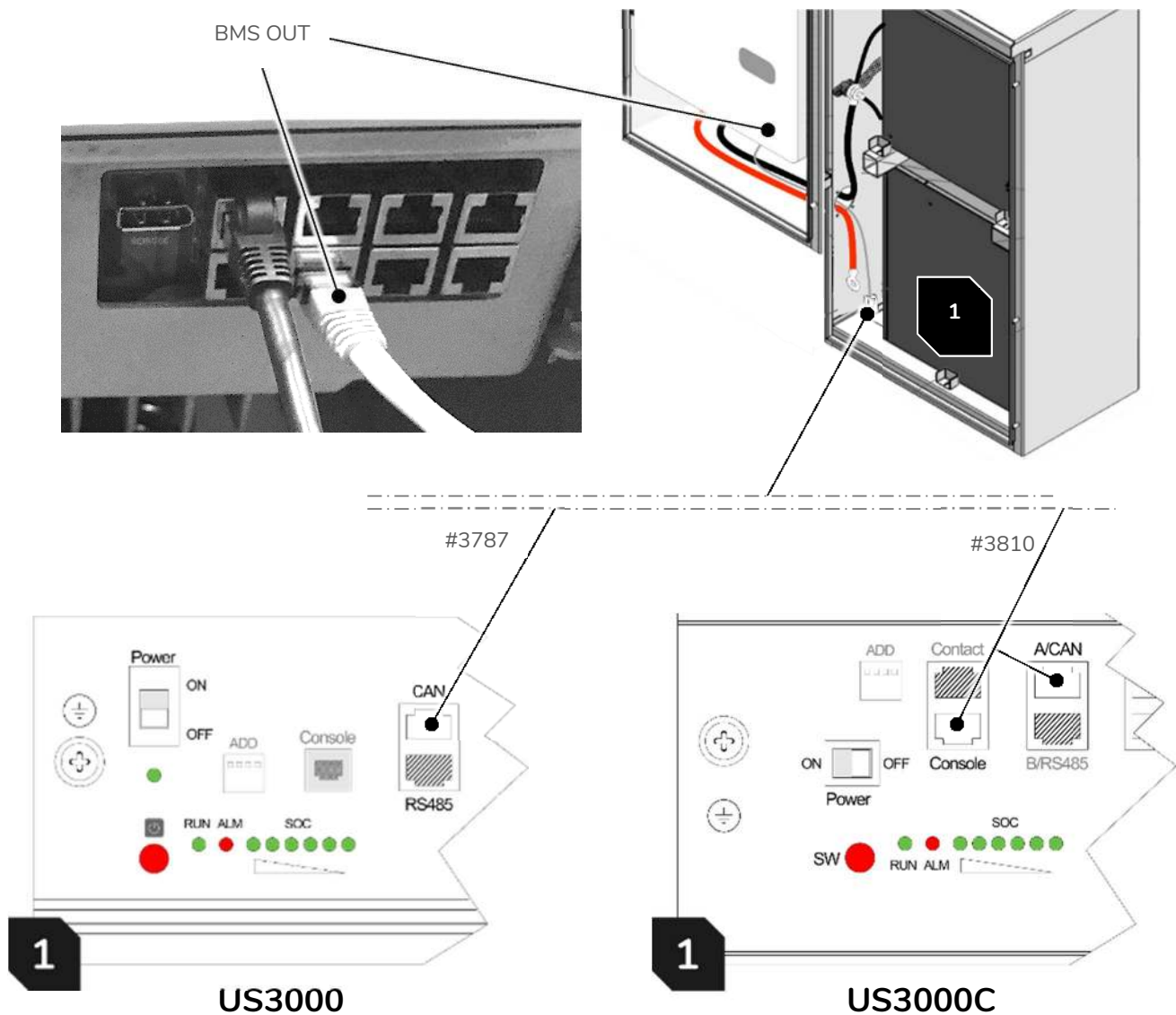


Figure 11: PCS to BMS communication cable connection.

5.6 DC- battery module to cabinet DC- connections



Note: This is a continuation from section 5.2. The cables referenced A3 should already be terminated at the cabinet DC-terminal.

| Ref | P/N | Description | Pylon p/n label |
|-----|-------|-----------------------------------|-----------------|
| A3 | #3798 | DC- terminal jumper BLK 400 mm | W10CUS300002 |

1. Connect the DC- power cables referenced A3 to the DC-terminals of batteries 1 and 4 as shown.

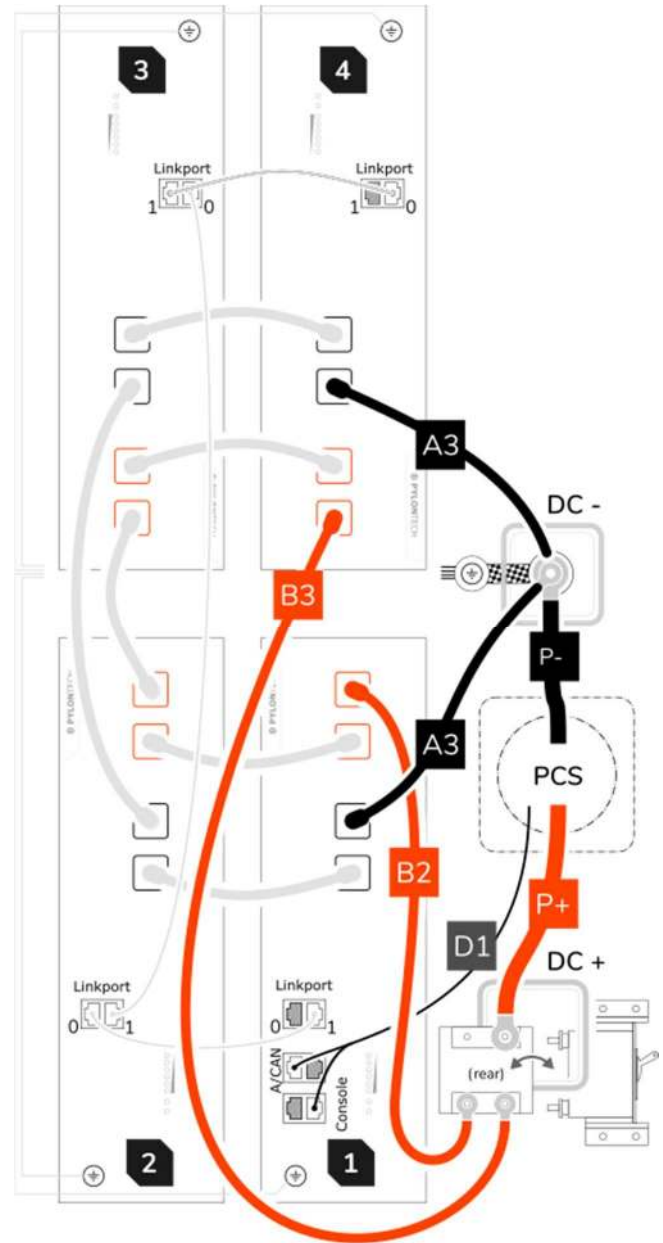


Figure 12: DC- battery module to DC- cabinet connections.

5.7 PCS DC+ power and breaker assembly wiring

| Ref | P/N | Description | Pylon p/n label |
|-----|-------|---------------------------------|-----------------|
| B2 | #3796 | DC+ breaker cable RED 400 mm | WI0CUS300001 |
| B3 | #3797 | DC+ breaker cable RED 780 mm | WI0PUS300001 |
| P+ | #2923 | PCS DC+ power cable | - |

1. Route the PCS DC+ power cable from the PCS through the cabinet coupling port.



2. Terminate the PCS DC+ cable, referenced [P+], at the top right busbar terminal of the DC breaker as shown. Torque to 15 in/lbs.

3. Terminate the DC+ power cables referenced B2 and B3 at the lower battery DC+ power posts as shown. Mount only one cable per post.
4. Mount the breaker assembly to the cabinet wall using the hardware provided.

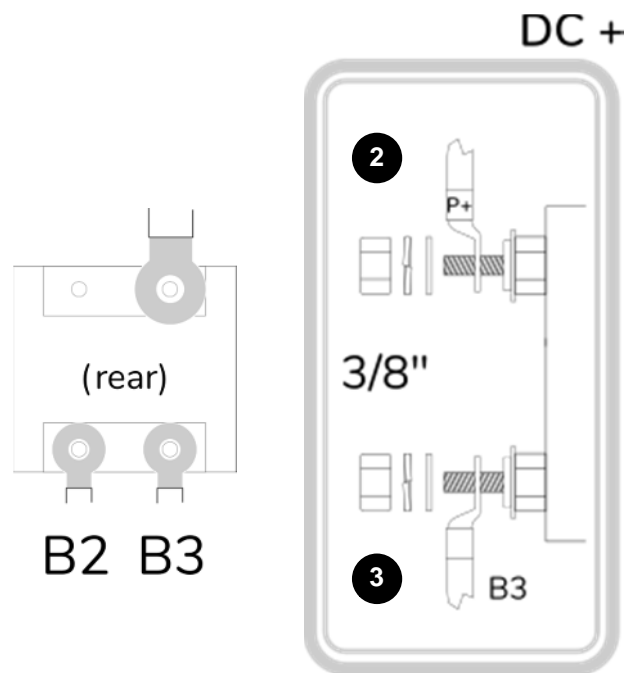
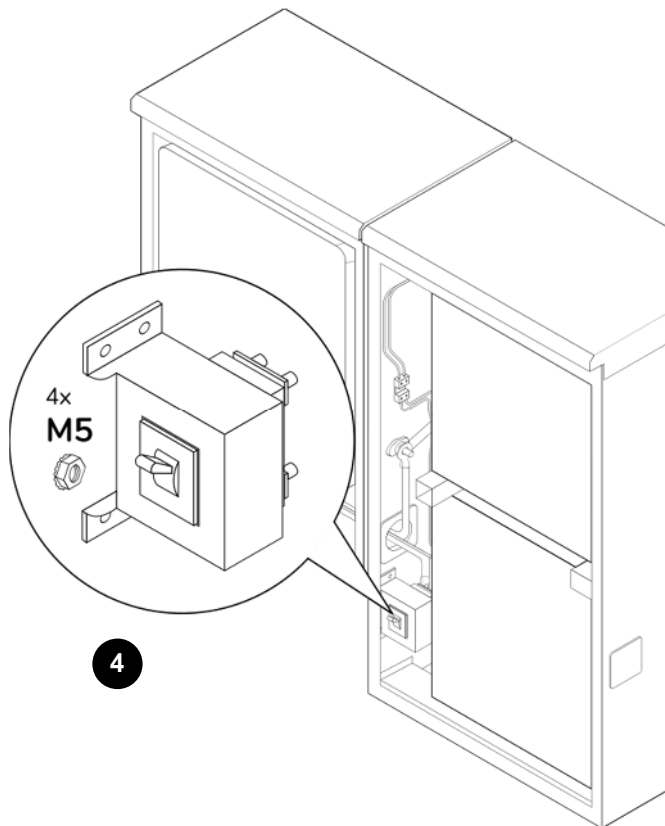
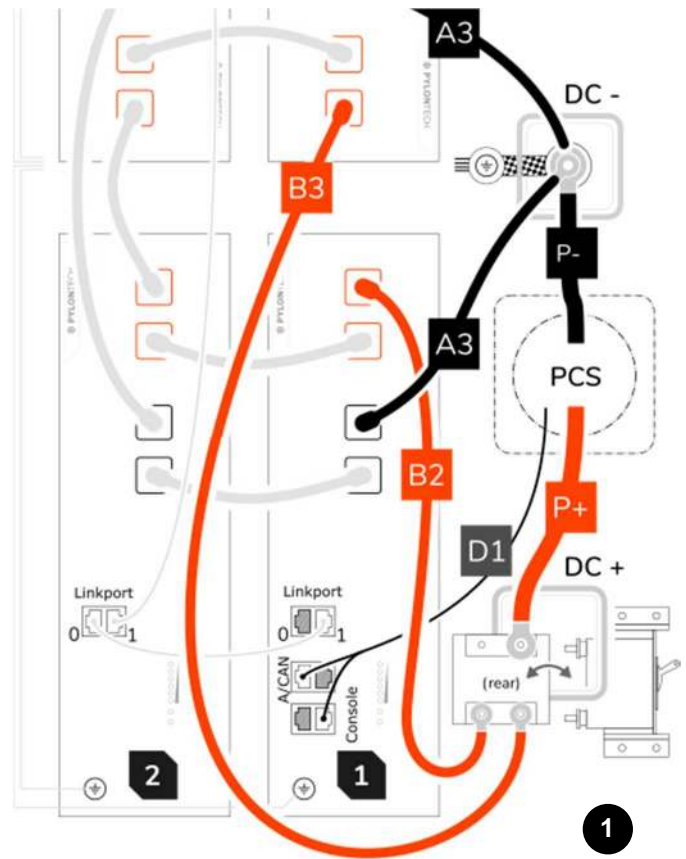


Figure 13: PCS DC+ power and breaker assembly wiring.

6 System Electrical Wiring



Note: This product is capable of providing utility interactive and islanded back up power, and can be AC coupled to a utility interactive photovoltaic inverter. Wiring methods must be in accordance with local electrical codes. The installer is responsible for ensuring that over-current protection is installed and sized appropriately for the AC grid and off-grid output circuits, in accordance with the National Electrical Code, ANSI/NFPA 70, Canadian Electrical Code and local codes.

All field wiring connections to the battery system are at the PCS cabinet only. Figure 14 indicates the knockout locations for conduit entry into the PCS, categorized as AC power and signal level circuits.



IMPORTANT! Drilling holes anywhere in the battery or PCS cabinet renders the warranty null and void. Use the knockouts provided at the bottom face of the PCS cabinet only! Do not drill holes anywhere in the battery system. Use conduit fitting reducers, if applicable.

PCS cabinet – bottom view

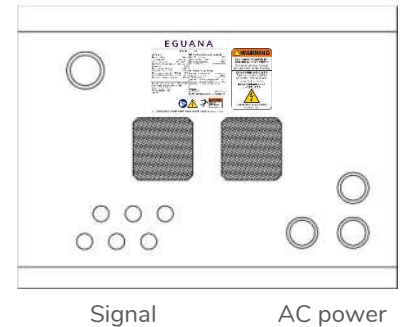


Figure 14: PCS knockout detail.

6.1 AC power connections

This battery system contains two independent AC power connection ports; one port dedicated for an electrical utility connection, marked “AC Grid”, the other port dedicated for backup operation, marked “AC Load”. This product’s primary application is intended for utility interconnection, and must be connected to a utility electrical service supplying split phase 240/120 Vac, 60 Hz. The backup operation of this product is a secondary application, and is intended to supply emergency backup operation only.



Note: The PCS provides galvanic separation between AC and DC Sources.



CAUTION! To reduce the risk of fire, connect only to a dedicated circuit provided with appropriate branch circuit over-current protection in accordance with local electrical codes.



WARNING! Improper connection of the wiring panel may result in equipment damage and cause personal injury. Disconnect all AC and DC Sources prior to installation.



CAUTION! The AC grid and load ports are independent circuits, controlled internally by an automatic bypass and transfer switch. Each port must be connected to electrically isolated panels. Do not tap line or neutral wires from the main electrical panel to the backup panel, as this may result in permanent damage to the product.

AC Grid Port:

1. Open the spring clamp terminals on the AC circuit board at the port marked “AC Grid”.
2. Terminate the AC grid connection wires as follows: “L_Grid” = Line, “N_Grid” = Neutral, and “PE” = Ground.
3. Close the spring clamp terminals, ensuring levers are fully engaged.

AC Load Port:

1. Open the spring clamp terminals on the AC circuit board at the port marked “AC Load”.
2. Terminate the wires at “L_AC load” (Line), “N_AC load” (neutral), and “PE_AC load” (protective earth).
3. Close the spring clamp terminals, ensuring levers are fully engaged.

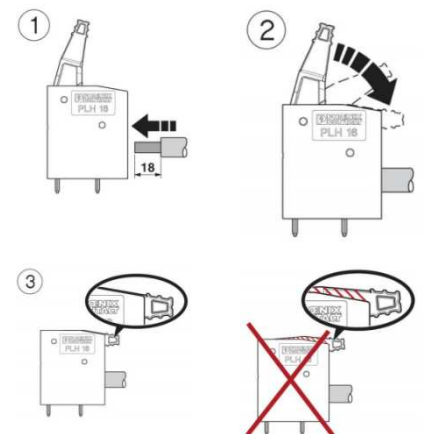
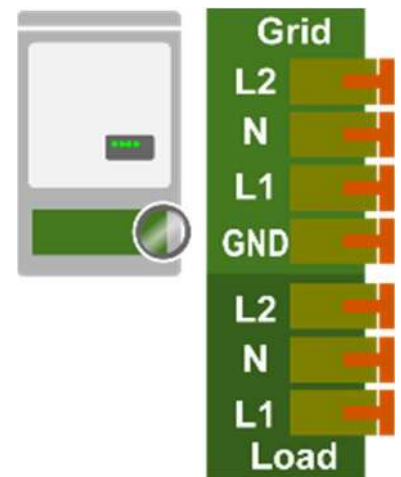


Figure 15: AC power connections.

6.2 Chassis Grounding

In this section, “Chassis Ground” is referred to as “ground” or “grounding” unless otherwise mentioned. The AC and DC grounding are intended to provide a low impedance signal path at all frequencies.

DC Ground Wiring Installation: The PCS cabinet is shipped with ungrounded DC power terminals within the inverter. However, the default setting for DC grounding is set for DC negative to ground. This is to indicate that the DC negative terminal of the inverter is grounded within the PCS system. The DC negative ground is completed once terminated in the master battery cabinet.

AC Ground Wiring Installation: The AC power grounding is achieved through the PE terminals of the AC grid connectors on the AC Filter Board, as shown in section 6.1.



Note: The field ground wire rating applies to the AC circuit only. The DC source loop is internal to the battery cabinet, and is rated accordingly.

Lightning Grounding: The inverter has built-in lightning protection. In order for the lightning protection to be effective, the grounding for lightning currents must be provided via low impedance path from AC Filter Board to System Ground and further to the building Ground/Earthing point.

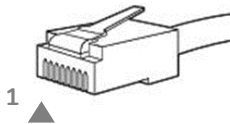
6.3 Communication Wiring to the Energy Management System – RJ45 Pin-out

The EMS panel supplied with the Evolve LFP includes a 10 ft factory prepared cable. Refer to the Evolve Hub installation manual supplied with your equipment for connection instructions to the EMS.



Note: The Evolve LFP communicates with the energy management system using the Modbus protocol over an RS-485 network. Shielded twisted pair cable is required. Should the installation require further separation between the EMS panel and the Evolve PCS cabinet (ACB05U-LP), a cable can be prepared using CAT 5 shielded wire, with an RJ-45 connector terminated at the PCS end only. Connect the shield to the EMS end only.

Terminate the cable as shown:



| EMS | PCS | PCS: RJ-45 Pin |
|----------|-----|----------------|
| G+shield | G | 3 |
| A | A | 4 |
| B | B | 5 |

Figure 16: EMS to PCS cable pin-out.

6.4 AK1 Evolve Hub control cable

Note: This cable is included with the Evolve Hub, identified in the material list as p/n #3653.

1. Plug in the #3653 AK1 cable harness from the Evolve Hub to the AK1 relay terminal block as shown in figure 17.
2. Refer to the Evolve Hub installation manual, section 4.2, for termination instructions within the Hub.

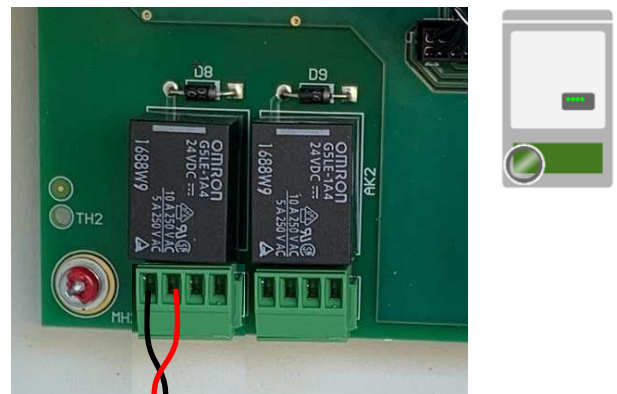


Figure 17: AK1 Evolve Hub control cable wiring.

7 Battery module BMS definitions and operating states

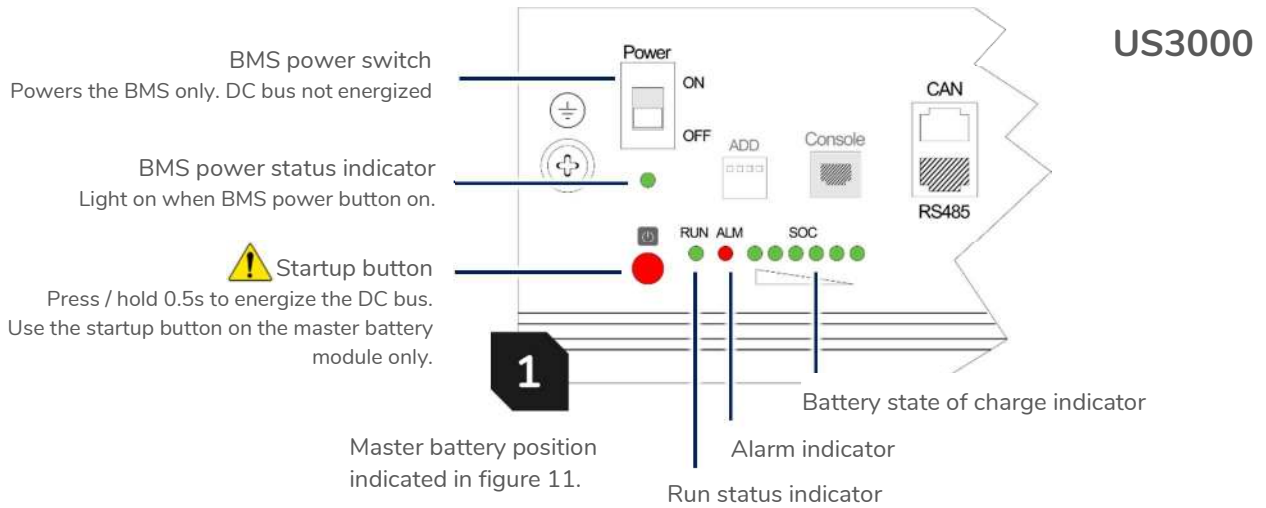


Figure 18: Pylontech US3000 BMS face plate.

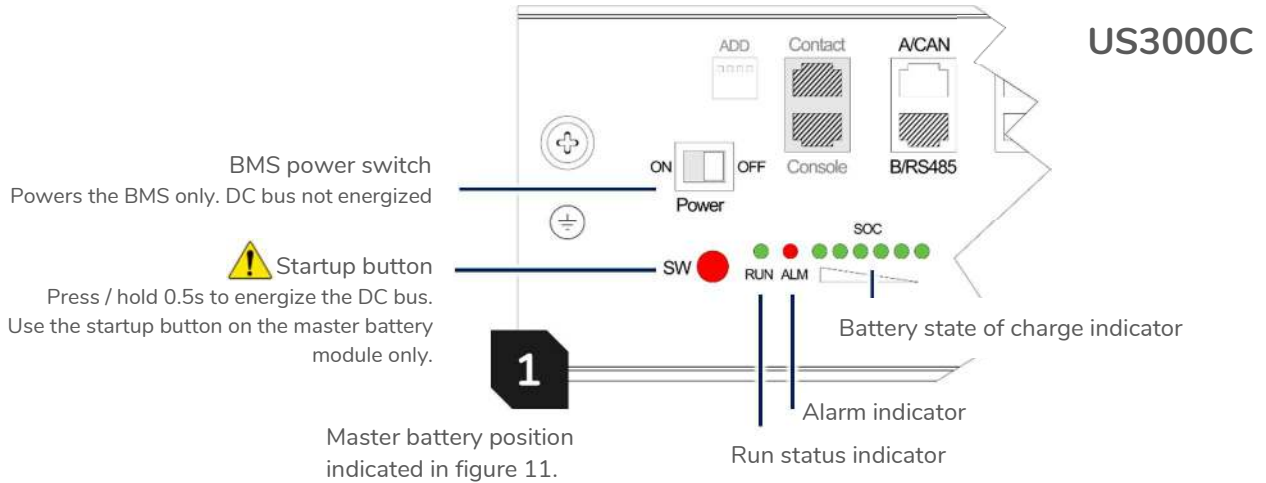
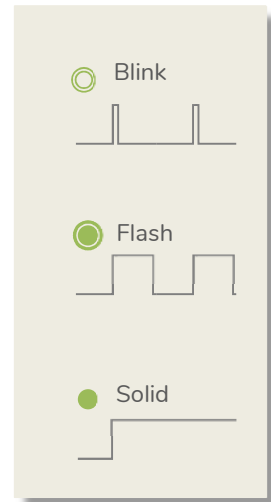


Figure 19: Pylontech US3000C BMS face plate.

| Condition | RUN | ALM | SOC. | Each LED represents 16.7% SOC |
|-------------------------------|-----|-----|---------------|--|
| Power ON | ● | ● | ● ● ● ● ● ● ● | Initializing after BMS power switch ON |
| Idle / Normal | ○ | ● | ● ● ● ● ● ● ● | |
| Charge | ● | ● | ● ● ● ● ● ● ● | Highest SOC flashes. ex) 50%. |
| Discharge | ○ | ● | ● ● ● ● ● ● ● | Show SOC. ex) 33%. |
| Alarm | ○ | ● | ● ● ● ● ● ● ● | All other LEDs as per operating condition. |
| System error/ Protect mode | ● | ● | ● ● ● ● ● ● ● | DC bus not energized. |



8 ESS startup procedure



CAUTION! Powering the ESS requires a specific start-up procedure. Please follow the steps below.



CAUTION! If the battery disconnect has been placed in the OFF position at any time during operation, wait one minute before returning to the ON position. Rapid cycling (less than one minute) of the battery disconnect can cause damage to the pre-charge circuit.



CAUTION! During the first start-up sequence after installation, the battery modules may require a battery maintenance cycle to balance the SOC. This maintenance cycle requires a grid connection so that the PCS can be commanded to charge the batteries. The PCS battery SOC alarm light will flash yellow if maintenance and/or other battery faults are present. This procedure may take from a few minutes to a few hours, depending on the difference in battery module SOC.

Refer to the BMS face plate in figure 15 that applies to the battery model supplied with the system.

1. Turn ON the BMS power switch to all battery modules in the cabinet.
2. Press and hold the Start button on the master battery module for 0.5 seconds. The master battery is the lower-front module in the battery cabinet. Wait for the battery module to initialize to the normal/idle state. See also figure 10, module position 1 for reference.
3. Turn ON the battery disconnect.
4. Turn ON the AC source disconnect and/or breaker at the electrical panel.

8.1 System operation



The ESS is fully automated. The EMS will be programmed to connect the system to the grid after AC and DC sources are applied. The operating states can also be viewed on the PCS display panel. For more details on system operation, refer to the Evolve ESS Owner's Manual.

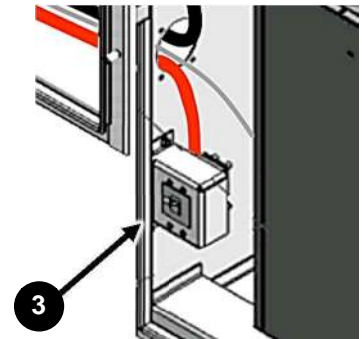
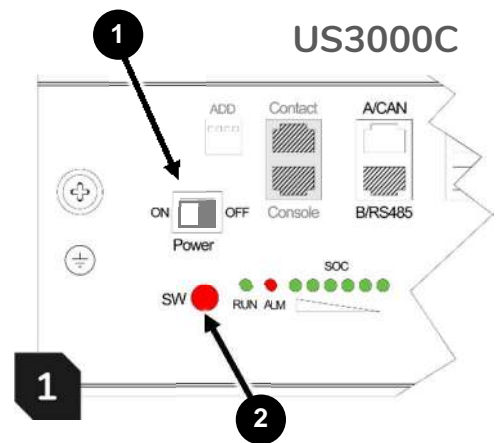
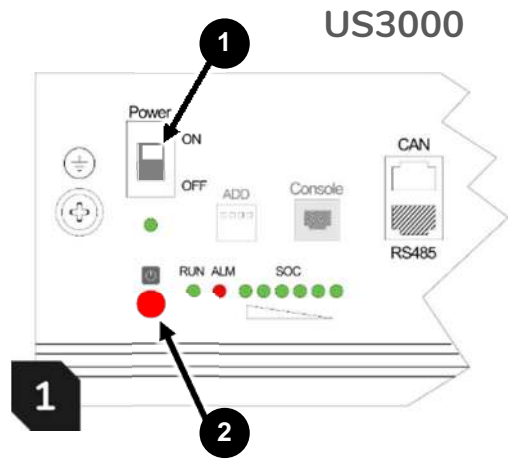


Figure 20: ESS startup procedure.

9 PCS Display Panel

9.1 LED Display Indicators

The PCS cabinet is equipped with a display panel that provides indication of the following:

- Battery Operating State
- PCS Operating State
- (out of) Service Indicator

Refer to section 9.2 for a complete definition of indicator states.

To conserve energy, the LEDs will turn off after 5 minutes from being activated. They can be re-activated by pressing the service button.

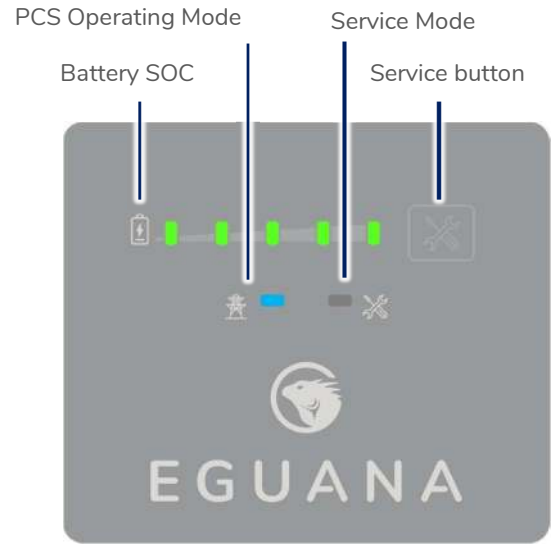













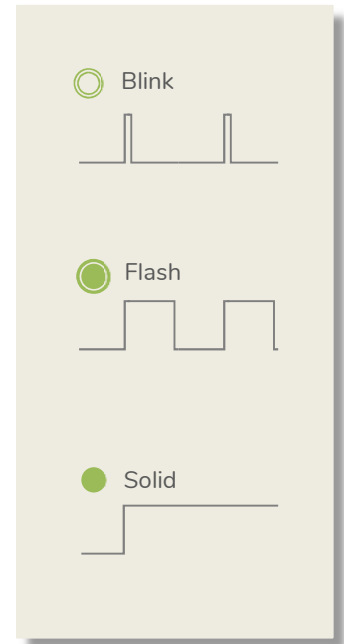


Figure 21: PCS display panel.

9.2 PCS display panel indicator summary

| LED | Mode | Definition |
|---|---|--|
|  |  | State of charge. Each LED represents 20% SOC. Solid = battery idle. |
| |  | Charge = flash right. Discharge = flash left. |
| |  | Low battery. |
|  |  | Sleep / Standby mode. |
| |  | Grid timing mode. |
| |  | Grid synchronization mode. Ten second test before grid connect mode. |
| |  | Grid connected mode. |
|  |  | System OK. |
| |  | System out of service. |
| |  | User initiated service mode. |



9.3 Service Button

The service button can be used to wake the LED display, and either place the system into or out of service mode, as well as cycle through various operating modes. If the system has gone into service mode, the user can attempt to bring the system back into normal operation using the service button.



Note: It is recommended to login to the EMS via web browser and retrieve the service code from the system prior to attempting to clear the service mode.

| Observed state | Action | Service button command |
|----------------------|--------------------|--------------------------|
| All panel lights off | Wake panel display | Press and release |
| Service light on | Exit service mode | Press and hold 5 seconds |

Refer to section 11 – Troubleshooting if the service button does not perform the action requested.

9.4 Backup Power Operation

This system will provide backup power to dedicated electrical circuits within the home via a permanently wired electrical sub-panel, referred to as the backup panel. Backup power is limited in rating and duration, both of which are dependent on the nature of the loads connected to the system, and the availability of the solar PV supply. This system is designed to reliably provide power to a refrigerator, home lighting, home electronics, and small appliances.



NOTE: This product is not an uninterrupted power source (UPS). Following a utility outage, a four second power interruption will occur before the backup power source commences. As a result of this interruption, a desktop or portable UPS is recommended if continuous operation is desired for any electronic devices.



IMPORTANT! Surge rated loads, i.e. power tools, portable air conditioners, may cause an overload shutdown. Equipment of this type that is connected to the backup panel should be inspected and tested regularly as per manufacturer suggested schedules. Permanent damage to the battery system and/or your equipment may occur if exposed to chronic overloading cycles.



IMPORTANT! Portable extension cords connected to a backup circuit should be limited to 10 meters.



IMPORTANT! This product does not support automatic gas generator integration. Do not attempt to connect a gas generator to the battery system. If generator support is required, consult your installer regarding a separate manual transfer to your backup electrical panel.



NOTE: The power output / surge rating will be further limited when the battery is below 10% SOC.

9.4.1 Backup Power Display Modes

| Display | Definition |
|---------|--|
| | Battery status LEDs indicate the following: <ul style="list-style-type: none"> Charge = flash right. Discharge = flash left. PCS and service lights off. |
| | Low SOC shutdown in backup mode. See section 9.5 to restart the system. |
| | Low SOC shutdown initiated while out of service. See troubleshooting – section 7, “service light on in backup mode”. |

9.5 Restarting the battery system after low battery shutdown

The system will shut down when the battery reaches a critically low-level during backup operation.

To restart the system:



IMPORTANT! Ensure there is adequate sunlight for the solar PV system to charge the battery before restarting the system. If the battery system is installed without a PV system connected to the backup panel, do not attempt to restart the system. Wait for the utility power to return.

1. Press and hold the service button for 5 seconds.



The backup power will restart, allowing the PV system to reconnect* and begin charging the battery. The system will continue to operate if the battery charges to its minimal normal operating range. If the battery does not charge within 15 minutes of restart, the system will shut down to preserve the battery.

*PV system reconnect time is approximately 5 minutes.



Note: If necessary, the load circuits can be shut off inside the backup panel to increase the battery charge rate. Do not shut off the PV circuit.

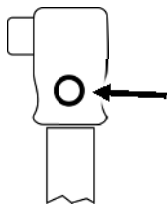
10 Maintenance

This is a maintenance free product. Regularly scheduled inspection of the airflow path for the active cooling fans on the bottom side of the PCS cabinet is all that is required. This inspection should occur on an annual basis, or coincide with PV inspection.

If the fan ventilation holes are obstructed with dust / debris, a soft-bristled brush can be used to wipe them clean. For heavy soiling use a soft, dry brush. Do not use any solvents, scouring, or corrosive materials to clean the unit. Never remove or unplug connections or plugs during cleaning.

11 Serviceable Parts – Battery module removal/replacement

The battery modules within the battery cabinet are removable and/or replaceable. To replace or remove the battery modules, follow the reverse instructions in section 5 of this manual.



DC module jumper cables

Press & hold the lock button to release the cable from the battery terminal.

12 Troubleshooting

System faults are reported and logged in the monitoring system. All fault logs are also accessible remotely by your installer.



IMPORTANT! Contact an Eguana service representative as recommended below only after any of the following conditions are present on the front display of the inverter panel, and the recommended actions do not resolve the issue.

| Condition | Definition |
|--|--|
| Service light ON in grid mode | System is prevented from normal operation due to internal fault. Notify service personnel. |
| Service light ON in backup mode | If the system faults into service in backup operating mode, there may be an overload condition which prevents the system from operating safely. If the battery charge level is greater than 20% (one or more Green LEDs), reduce the load by shutting off circuits in the backup electrical panel, then press and hold the service button 5 seconds to resume backup power operation. If the battery low SOC shutdown mode is displayed, shut off all load circuits (keep PV ON) in the backup panel, and do not attempt to resume backup operation until adequate sunlight is present to provide a solar charge of the battery. |
| All panel lights flashing | System is attempting to communicate with the battery modules. Notify service personnel if this condition persists more than 30 minutes. |
| All panel lights OFF after service button wake command | This indicates loss of both AC and DC power sources to the PCS. Check the circuit breaker in the main electrical panel for the energy storage system. |
| Online monitoring system not accessible | Check the internet connection. If connection is via wi-fi, reboot the wireless router, and make sure the login user and password have not been changed since time of original installation. Check power to the energy management system via the orange indicator light on the right side of the panel. Note: the energy management system may lose power after an extended utility outage where there is not enough solar generation to maintain battery system power. Note: monitoring system servers may occasionally be down for service. If first attempts are not successfully, try again the following day before contacting your installer. |

13 Specifications

Table 1: PCS Electrical / Mechanical Ratings

| Model | ACB05U-LP (contained in Evolve LFP) | | |
|--|---|---|---|
| | Grid : Charging | Grid : Discharging | Off Grid |
| Maximum DC Voltage | 80 V DC | | |
| Operating DC Voltage Range | 40 to 80 V DC | | |
| Operating DC Voltage Range at 100% Output Power | 40 to 80 V DC | | |
| Maximum DC Current | 100 A | 125 A | 125 A |
| AC Power Factor* | 0.8 lagging to 0.8 leading, adjustable | | N/A |
| Operating Voltage Range (default) | 105.6 to 132 V AC for L ₁ -N and L ₂ -N | | N/A |
| Operating Voltage Range (with ride-through) | 60.0 to 132 V AC for L ₁ -N and L ₂ -N | | |
| Operating Frequency Range (default) | 59.3 – 60.5 Hz | | N/A |
| Operating Frequency Range (with ride-through) | 50.0 – 66.0 Hz | | N/A |
| Number of Phases | Split Phase | | |
| Nominal Output Voltage* | 120 V AC for L ₁ -N and L ₂ -N or 240 V AC L ₁ -L ₂ | | |
| Normal Output Frequency* | 60 Hz | | |
| Maximum Continuous Output Current | 20.8 A for L ₁ and L ₂ | | |
| Maximum Continuous Output Power (total) | 5000 W | | |
| Maximum Allowed Overload Condition (as percentage of maximum continuous current) | 100% | 100% | 100-120 % - 30 minutes 120-170 % - 5 seconds |
| Maximum Output Overcurrent Protection | 60 A for AC Grid, 60 A for AC Load | | |
| Maximum AC Short-circuit Current | 404 Apk-pk (< 5 ms), 8.0 Arms | | |
| Maximum Synchronization In-rush Current | 1.7 Arms | | |
| Protective Class (I, II, or III) | Class I | | |
| Over-Voltage Category (OVC I, II, III, or IV) | OVC III | | |
| Pollution Degree | 3 | | |
| Lightning protection | IEEE 62.41.2, location category B, low exposure | | |
| Normal Operation Temperature Range / Humidity | -40 to +50 °C (limited by battery, see below) | | |
| Normal Operation Humidity | Max 95% (non-condensing) | | |
| Maximum Full Power Operating Ambient | 40 °C | 50 °C | |
| Enclosure Rating | Type 3R | | |
| Dimensions | 20.8"W x 30.8"H x 15.6"D (529 x 783 x 397 mm) | | |
| Weight | 145 lbs (65 kg) | | |
| Default Trip Limits: UL1741 (IEEE 1547.1) | | | |
| Low Volt Trip (adj.), Volts | Default | 110 V AC (L ₁ -N or L ₂ -N) | N/A |
| | Min/Max | 105 - 115 V AC (L ₁ -N or L ₂ -N) | N/A |
| Low Volt Trip (adj.), time | Default | 117 cycles (1.95 Sec.) | N/A |
| | Min/Max | 14 - 117 cycles (1.95 Sec.) | N/A |
| High Volt Trip (adj.), Volts | Default | 132 V AC (L ₁ -N or L ₂ -N) | N/A |
| | Min/Max | 125 - 132 V AC (L ₁ -N or L ₂ -N) | N/A |
| High Volt Trip (adj.) time | Default | 57 cycles (0.95 Sec.) | N/A |
| | Min/Max | 14 - 57 cycles (0.95 Sec.) | N/A |
| Undervoltage: (Very Low) Trip Limit | < 60 V AC (L ₁ -N or L ₂ -N) | | N/A |
| Undervoltage: (Very Low) Trip Time | ≤ 10 cycles (0.16 Sec) | | N/A |
| Overvoltage: (Very High) Trip Limit | > 144 V AC (L ₁ -N or L ₂ -N) | | N/A |
| Overvoltage: (Very High) Trip Time | ≤ 10 cycles (0.16 Sec) | | N/A |
| Under Frequency Trip Limits (Adjustable) | Min | 59.3 Hz | N/A |
| | Default | 59.3 Hz | N/A |
| | Max | 59.8 Hz | N/A |
| Over Frequency Trip Limits (Adjustable) | Min | 60.2 Hz | N/A |
| | Default | 60.5 Hz | N/A |
| | Max | 60.5 Hz | N/A |
| Frequency Trip Limit Accuracy | 0.1 Hz | | N/A |
| Frequency Trip Time Accuracy | 0.1 Sec | | N/A |
| Voltage Trip Limit Accuracy | 2% | | N/A |
| Voltage Trip Time Accuracy | 0.043 Sec | | N/A |
| Compliance | | | |
| Safety | UL 1741SA, UL 1998, UL 9540 | | |

Refer to section 13.1 for operating characteristics in compliance with the UL 1741 SA standard.

Table 2: PCS Field Wiring Ratings – AWG / Torque

| Field Wiring | Use Copper Wire Only, 90°C or higher rated | | |
|-------------------|--|---|---------------------------------|
| Terminal | Minimum Wire Size mm ² (AWG) | Maximum Wire Size mm ² (AWG) | Tightening Torque, Nm (in. lbs) |
| Ground Lug | 16 mm ² (6 AWG) | 16 mm ² (6 AWG) | 5.0 (45) |
| AC Grid Terminals | 10 mm ² (8 AWG) | 16 mm ² (6 AWG) | Push-lock spring cage |
| AC Load Terminals | 10 mm ² (8 AWG) | 16 mm ² (6 AWG) | Push-lock spring cage |
| PV Feed Through | 10 mm ² (8 AWG) | 16 mm ² (6 AWG) | Push-lock spring cage |

Table 3: Battery Cabinet Electrical / Mechanical Ratings

| Model | Battery Cabinet |
|--|--|
| | Evolve BC-P (contained in Evolve LFP) |
| Battery Mfr / model / chemistry | Pylontech / US3000, US3000C / Lithium Iron Phosphate |
| Maximum DC Voltage (Cabinet) | 80 V DC |
| Operating DC Voltage Range (Cabinet) | 0 to 80 V DC |
| DC Voltage Range at 100% Output Power | 44.5 to 53.5 Vdc |
| Max DC current rating / Recommended DC current rating | 125 A |
| Max wire size of main DC | 70 mm ² (AWG 2/0) |
| Circuit Breaker, Positive Pole | 180A or 175A, UL 489 |
| Max wire gauge of branch circuit | 50 mm ² (AWG1/0) |
| Grounding terminal, DC negative grounded | 70 mm ² (AWG 2/0) |
| Maximum Number of Battery Modules supported | US3000: 8 (4 per cabinet, maximum 2 cabinets) US3000C: 16 (4 per cabinet, maximum 4 cabinets) |
| Battery module capacity / Usable capacity (x4 modules) | 3.55 kWh / 3.2 kWh (14.2 / 12.8 kWh) |
| Maximum Continuous Output Power (total) | 5000 W |
| Normal Operation Temperature Range | 0 to +50 °C charge / -10 to +50 °C charge |
| Maximum Full Power Operating Ambient | 50 °C |
| Storage Temperature Range (| -20 to +60 °C |
| Enclosure Rating | Type 3R |
| Dimensions | 22.5"W x 41.0"H x 15.6"D (572 x 1041 x 397 mm) |
| Weight (including 4 battery modules) | 320 lbs (145 kg) |
| Compliance | |
| Safety | UL 9540, UL 1973 |

Table 4: Battery Cabinet Field Wiring Ratings – AWG / Torque

| Field Wiring | Use Copper Wire Only, 90°C or higher rated | | |
|--------------------------|--|---|---------------------------------|
| Terminal | Minimum Wire Size mm ² (AWG) | Maximum Wire Size mm ² (AWG) | Tightening Torque, Nm (in- lbs) |
| Ground Lug (internal) | - | 10 AWG home run per module | 1.7 (15) |
| PCS DC+ breaker terminal | - | 70 mm ² (2/0) included | 1.7 (15) |
| PCS DC- / field ground | - | 70 mm ² (2/0) included | 4.0 (35) |

13.1 UL 1741 SA Grid Support Utility Interactive Inverter Specifications

The PCS within this integrated storage product complies with the UL 1741 SA standard for grid support utility interactive inverters. These functions are intended to be either enabled or disabled in accordance with local utility interconnection requirements.

Table 5: UL1741 SA grid support functions.

| Grid Support Function Tested | Test Standard |
|---|---------------|
| Anti-Islanding protection – unintentional islanding with grid support functions enabled | UL 1741 SA 8 |
| Low/high voltage ride through | UL 1741 SA 9 |
| Low/high frequency ride through | UL 1741 SA 10 |
| Ramp rates | UL 1741 SA 11 |
| Reconnect by “Soft Start” | UL 1741 SA 11 |
| Specified power factor | UL 1741 SA 12 |
| Dynamic Volt/VAR operations | UL 1741 SA 13 |
| Frequency-Watt | UL 1741 SA 14 |
| Volt-Watt | UL 1741 SA 15 |

Table 7: SA9 Low and high voltage ride through settings.

| SA9 Low and High Voltage Ride Through - Rule 21 | | | | |
|--|--------------------------|--------------------------|-----------------------|------------------------------------|
| Region | Voltage Range [%Vnom] | RideThrough Duration [s] | Maximum Trip Time [s] | Operating Mode During Ride Through |
| High Voltage 2 (HV2) | $V > 120\%$ | N/A | 0.16 | N/A |
| High Voltage 1 (HV1) | $110\% < V \leq 120\%$ | 12 | 13 | Momentary Cessation (zero power) |
| Near Nominal (NN) | $88\% \leq V \leq 110\%$ | Indefinite | N/A | Continuous Operation |
| Low Voltage 1 (LV1) | $70\% \leq V < 88\%$ | 20 | 21 | Mandatory Operation |
| Low Voltage 2 (LV2) | $50\% \leq V < 70\%$ | 10 | 11 | Mandatory Operation |
| Low Voltage 3 (LV3) | $V < 50\%$ | 1 | 1.5 | Momentary Cessation (zero power) |
| SA9 Low and High Voltage Ride Through - Rule 14H | | | | |
| Region | Voltage Range [%Vnom] | RideThrough Duration [s] | Maximum Trip Time [s] | Operating Mode During Ride Through |
| Over Voltage 2 (OV2) | $V > 120\%$ | N/A | 0.16 | Cease to Energize |
| Over Voltage 1 (OV1) | $110\% < V \leq 120\%$ | 0.92 | 1 | Mandatory Operation (VW) |
| Continuous Operation (CO) | $88\% \leq V \leq 110\%$ | N/A | N/A | Continuous Operation (VW) |
| Under Voltage 1 (UV1) | $70\% \leq V < 88\%$ | 20 | 21 | Mandatory Operation |
| Under Voltage 2 (UV2) | $50\% \leq V < 70\%$ | 10 | 11 | Mandatory Operation |
| Under Voltage 3 (UV3) | $V < 50\%$ | 1 | 1.5 | Momentary Cessation (zero power) |
| Parameter | | Value for Rule 21 | | Value for Rule 14H |
| Nominal AC voltage [V] | | | | 120 |
| AC voltage accuracy [%Vnom or V] | | | | 1%, 1.2V |
| Voltage trip time accuracy [s] | | | | 0.043 |
| Minimum under-voltage [%Vnom] | | | | 50.0% |
| Maximum over-voltage [%Vnom] | | | | 120.0% |
| Default function status | | Enabled | | Enabled |

Table 8: SA10 Low and high frequency ride through settings.

| SA10 Low and High Frequency Ride Through - Rule 21 | | | | |
|---|-------------------------|--------------------------|-----------------------|------------------------------------|
| Region | Frequency Range [Hz] | RideThrough Duration [s] | Maximum Trip Time [s] | Operating Mode During Ride Through |
| High Frequency 2 (HF2) | $f > 62.0$ | N/A | 0.16 | N/A |
| High Frequency 1 (HF1) | $60.5 < f \leq 62.0$ | 299 | 300 | Mandatory Operation (FW) |
| Near Nominal (NN) | $58.5 \leq f \leq 60.5$ | Indefinite | Indefinite | Continuous Operation |
| Low Frequency 1 (LF1) | $57.0 \leq f < 58.5$ | 299 | 300 | Mandatory Operation |
| Low Frequency 2 (LF2) | $f < 57.0$ | N/A | 0.16 | N/A |
| SA10 Low and High Frequency Ride Through - Rule 14H: Oahu, Maui, Hawaii | | | | |
| Region | Frequency Range [Hz] | RideThrough Duration [s] | Maximum Trip Time [s] | Operating Mode During Ride Through |
| Over Frequency 2 (OF2) | $f > 64.0$ | N/A | 0.16 | N/A |
| Over Frequency 1 (OF1) | $63.0 < f \leq 64.0$ | 20 | 21 | Mandatory Operation (FW) |
| Continuous Operation (CO) | $57.0 \leq f \leq 63.0$ | Indefinite | Indefinite | Continuous Operation (FW) |
| Under Frequency 1 (UF1) | $56.0 \leq f < 57.0$ | 20 | 21 | Mandatory Operation |
| Under Frequency 2 (UF2) | $f < 56.0$ | N/A | 0.16 | N/A |
| SA10 Low and High Frequency Ride Through - Rule 14H: Lanai, Molokai | | | | |
| Region | Frequency Range [Hz] | RideThrough Duration [s] | Maximum Trip Time [s] | Operating Mode During Ride Through |
| Over Frequency 2 (OF2) | $f > 65.0$ | N/A | 0.16 | N/A |
| Over Frequency 1 (OF1) | $63.0 < f \leq 65.0$ | 20 | 21 | Mandatory Operation (FW) |
| Continuous Operation (CO) | $57.0 \leq f \leq 63.0$ | Indefinite | Indefinite | Continuous Operation (FW) |
| Under Frequency 1 (UF1) | $50.0 \leq f < 57.0$ | 20 | 21 | Mandatory Operation |
| Under Frequency 2 (UF2) | $f < 50.0$ | N/A | 0.16 | N/A |
| Parameter | | Value for Rule 21 | | Value for Rule 14H |
| Nominal frequency [V] | | | | 60 |
| AC frequency measurement accuracy [Hz] | | | | 0.02 |
| Frequency trip time accuracy [s] | | | | 0.1 |
| Minimum under-frequency [Hz] | | | | 50.0 |
| Maximum over-frequency [Hz] | | | | 66.0 |
| Maximum trip time [s] | | | | 1000.0 |
| Default function status | | Enabled | | Enabled |

Table 9: SA11 Ramp rate settings.

| SA11 Ramp Rates | | |
|---|-------------------|--------------------|
| Parameter | Value for Rule 21 | Value for Rule 14H |
| Output current rating for function [A] | 20.8 | |
| Minimum normal ramp up rate [%/rated/sec] | 1.0% | |
| Maximum normal ramp up rate [%/rated/sec] | 100.0% | |
| Minimum output current [A] | 0 | |
| Ramp rate accuracy [%/rated/sec] | N/A | |
| Minimum soft start ramp up rate [%/rated/sec] | 0.1% | |
| Maximum soft start ramp up rate [%/rated/sec] | 100.0% | |
| Default normal ramp up rate [%/rated/sec] | 100.0% | 100.0% |
| Default soft start ramp function status | Enabled | Enabled |
| Default soft start ramp up rate [%/rated/sec] | 2.0% | 0.33% |

Table 10: SA12 Specified power factor settings.

| SA12 Specified Power Factor | | |
|--|-------------------|--------------------|
| Parameter | Value for Rule 21 | Value for Rule 14H |
| Apparent power rating for function [VA] | 5000 | |
| Output power rating for function [W] | 5000 | |
| DC input voltage range with function enabled [V] | 40.0 - 80.0 | |
| Nominal AC voltage [V] | 120 | |
| AC voltage range with function enabled [V] | 105.6 - 132.0 | |
| AC voltage accuracy [%Vnom or V] | 1%, 1.2V | |
| DC voltage measurement accuracy [V] | 0.05 | |
| Active power range of function [W] | 1000 - 5000 | 250 - 5000 |
| Power Factor Accuracy | 0.01 | |
| Power Factor settling time [sec] | 5 | |
| Minimum inductive power factor | -0.8 | |
| Minimum capacitive power factor | 0.8 | |
| Mid inductive power factor | -0.9 | |
| Mid capacitive power factor | 0.9 | |
| Default function status | Disabled | Disabled |
| Power factor default | -0.95 | -0.95 |

Table 11: SA13 Volt VAR Mode

| SA13 Volt-VAR Mode | | |
|--|-------------------|--------------------|
| Parameter | Value for Rule 21 | Value for Rule 14H |
| Apparent power rating for function [VA] | 5000 | |
| Output power rating for function [W] | 5000 | |
| EUT input voltage range with function enabled [V] | 40.0 - 80.0 | |
| Nominal AC EPS voltage [V] | 120 | |
| AC EPS voltage range with function enabled [V] | 96.0 - 144.0 | |
| Reactive power accuracy [%Rated, VAR] | 5%, 250VAR | |
| Maximum ramp rate [VAR/s] | 500 | |
| Maximum rated reactive power production (capacitive, overexcited) [VAR] | 2200 | |
| Maximum rated reactive power production (inductive, underexcited) [VAR] | -2200 | |
| Minimum rated reactive power production (capacitive, overexcited) [VAR] | 250 | |
| Minimum rated reactive power production (inductive, underexcited) [VAR] | -250 | |
| Maximum slope [VAR/V] | 611 | |
| Deadband range [V] | 4.8 - 18.0 | |
| Time accuracy [s], related Tr-vv | 2 | |
| Settling time [s] | 3 | |
| Default function status | Enabled | Enabled |
| Default response time, ramp to Qmax,ind [s] | 10 | 10 |
| Default power prioritization | Q | Q |
| Default Voltage at Q1 [V] | 110.4 | 112.8 |
| Default max reactive power production setting [VAR], Q1 | 1500 | 2200 |
| Default voltage at Q2 [V] | 116.04 | 116.4 |
| Default reactive power setting at lower voltage deadband limit [VAR], Q2 | 0 | 0 |
| Default voltage at Q3 [V] | 123.96 | 123.6 |
| Default reactive power setting at upper voltage deadband limit [VAR], Q3 | 0 | 0 |
| Default voltage at Q4 [V] | 128.4 | 127.2 |
| Default max reactive power absorption setting [VAR], Q4 | -1500 | -2200 |

* Volt-VAR mode can function with active or reactive power priority. When an inverter is set in Volt-VAR mode with reactive power priority and the inverter's apparent power kVA limit is reached, active power is reduced to maintain reactive power production. When an inverter is set in Volt-VAR mode with active power priority and the inverter's apparent power kVA limit is reached, the reactive power is reduced to maximize active power production.

Table 12: SA14 Frequency-Watt settings.

| SA14 Frequency Watt | | |
|---|-------------------|--------------------|
| Parameter | Value for Rule 21 | Value for Rule 14H |
| Output power rating for function [W] | 5000 | |
| AC frequency range with function enabled [Hz] | 50.0 - 65.0 | |
| AC frequency measurement accuracy [Hz] | 0.02 | |
| P(f) accuracy [%Prated or W] | 2%, 100W | |
| Settling time [sec] | 3 | |
| Adjustment range of response time [s] | 0.5 - 5.0 | |
| Adjustment range of the start of frequency droop [Hz] | 60.016 - 63.0 | |
| Maximum slope of frequency droop [%Prated/Hz] | 100.0% | |
| Minimum slope of frequency droop [%Prated/Hz] | 23.8% | |
| Default function status | Enabled | Enabled |
| Default response time, ramp to 10% Prated [s] | 0.5 | 0.5 |
| Default start frequency [Hz] | 60.1 | 60.036 |
| Default slope of frequency droop [%Prated/Hz] | 50.0% | 41.7% |
| Default use of hysteresis (symmetric recovery) | Enabled | Enabled |
| Under-frequency response function status | Enabled | Disabled |
| Default under-frequency start [Hz] | 59.964 | N/A |
| Default slope of under-frequency droop [%Prated/Hz] | 50.0% | N/A |

Table 13: SA15 Volt-Watt Settings.

| SA15 Voltage Watt | | |
|--|-------------------|--------------------|
| Parameter | Value for Rule 21 | Value for Rule 14H |
| Output power rating for function [W] | 5000 | |
| AC voltage range with function enabled [V] | 120.0 - 132.0 | |
| Nominal AC voltage [V] | 120 | |
| AC voltage accuracy [%Vnom or V] | 1%, 1.2V | |
| Output power accuracy [%Prated or W] | 2%, 100W | |
| Time accuracy [s] | 2 | |
| Setting time [sec] | 3 | |
| Adjustment range of the start of active power reduction [V] | 122.4 - 127.2 | |
| Adjustment range of the stop of the curtailment function [V] | 121.2 - 127.2 | |
| Maximum Slope of active power reduction [%Prated/V] | 33.3% | |
| Minimum slope of active power reduction [%Prated/V] | 10.4% | |
| Range of adjustment of a delay before return to normal operation [sec] | 1.0 - 60.0 | |
| Adjustment range of the rate of return to normal operation [%Prated/sec] | 10.0 - 100.0% | |
| Default function status | Disabled | Disabled |
| Power duration reference | Pre-disturbance | Rated |
| Default response time, ramp to 10% Prated [s] | 1 | 10 |
| Default start voltage [V] | 127.2 | 127.2 |
| Default stop voltage [V] | 126.0 | 127.2 |
| Default active power slope [%Prated/V] | 20.8% | 20.8% |
| Default use of hysteresis (symmetric recovery) | Disabled | Enabled |
| Default delay before return to normal operation [s] | 1 | N/A |
| Default active power rate of return to normal operation [%Prated/s] | 100 | N/A |

13.2 Thermal performance: Charge / Discharge Curves

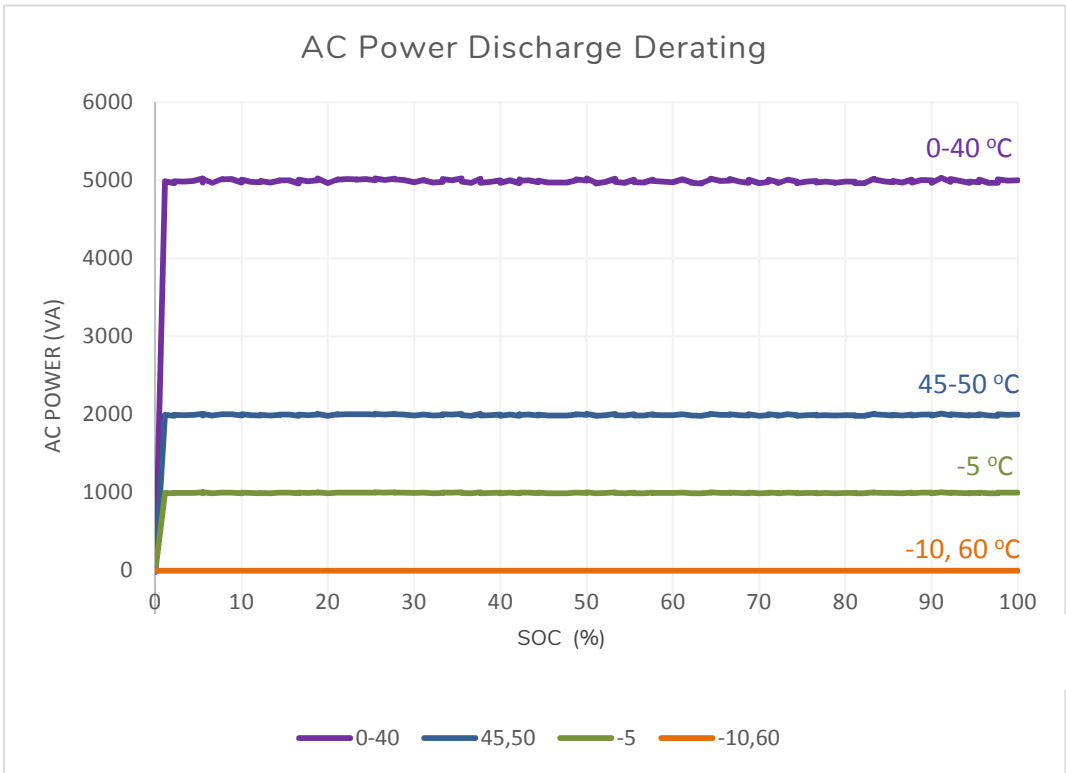
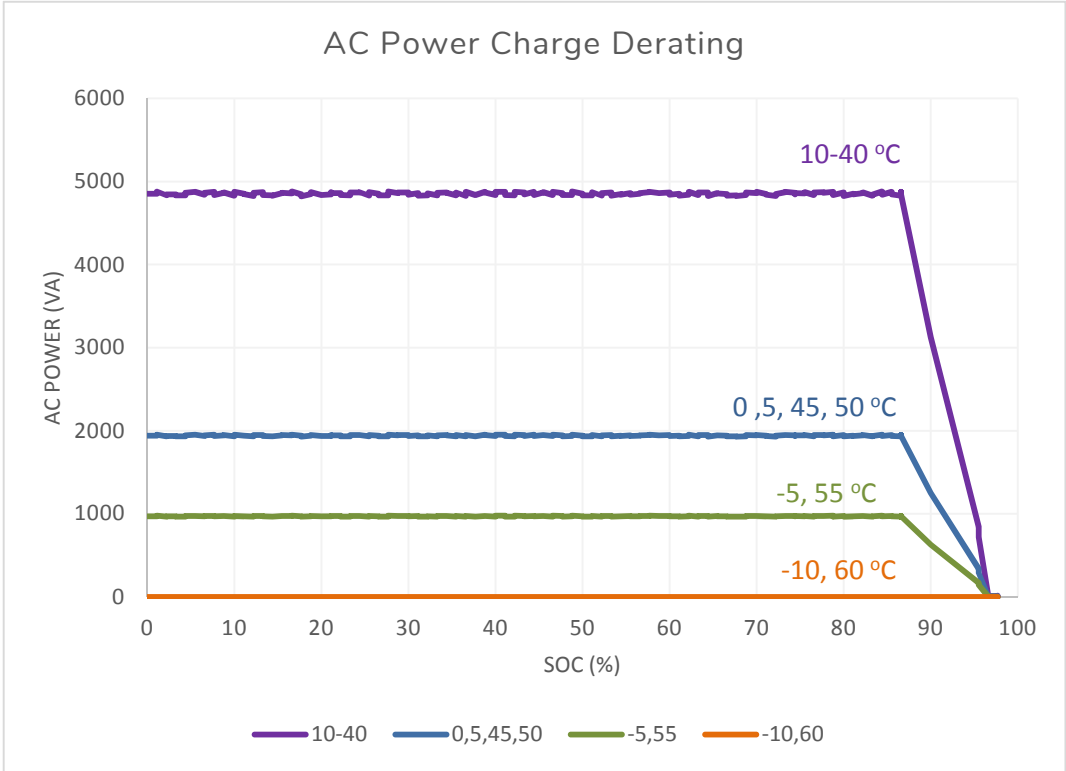


Figure 22: Energy storage system thermal derated charge and discharge curves with base battery cabinet including four Pylontech US3000 modules.

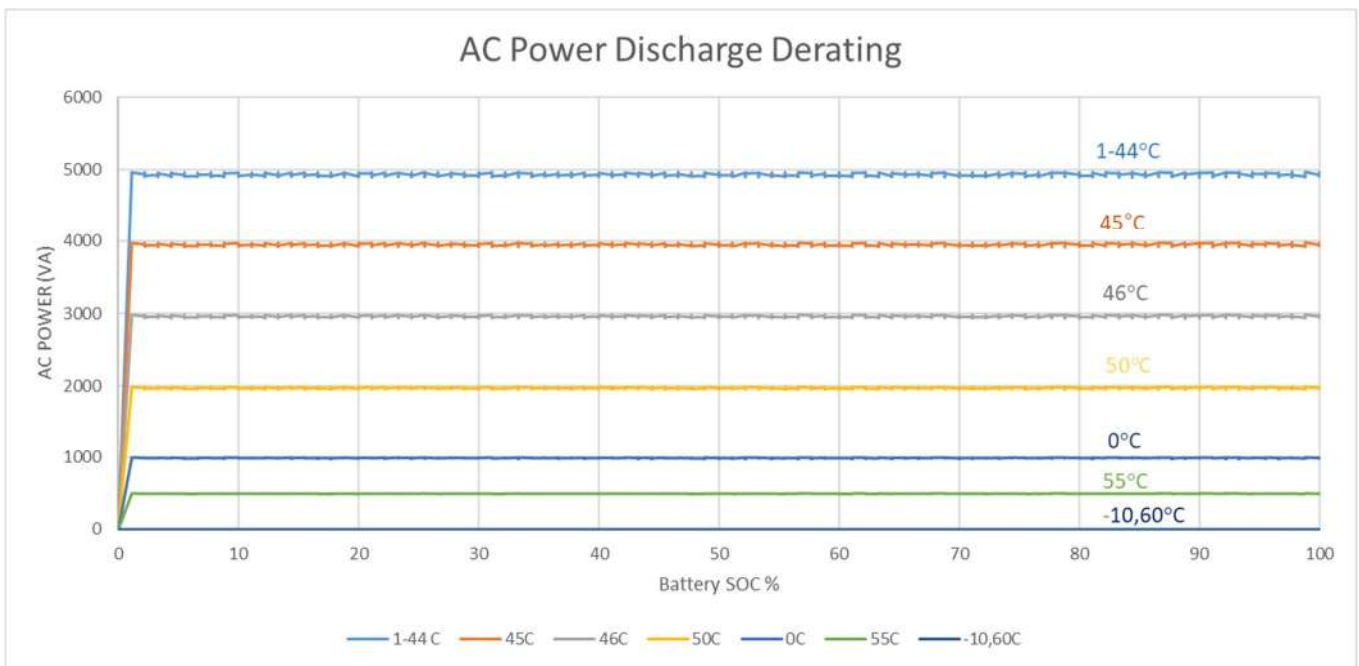
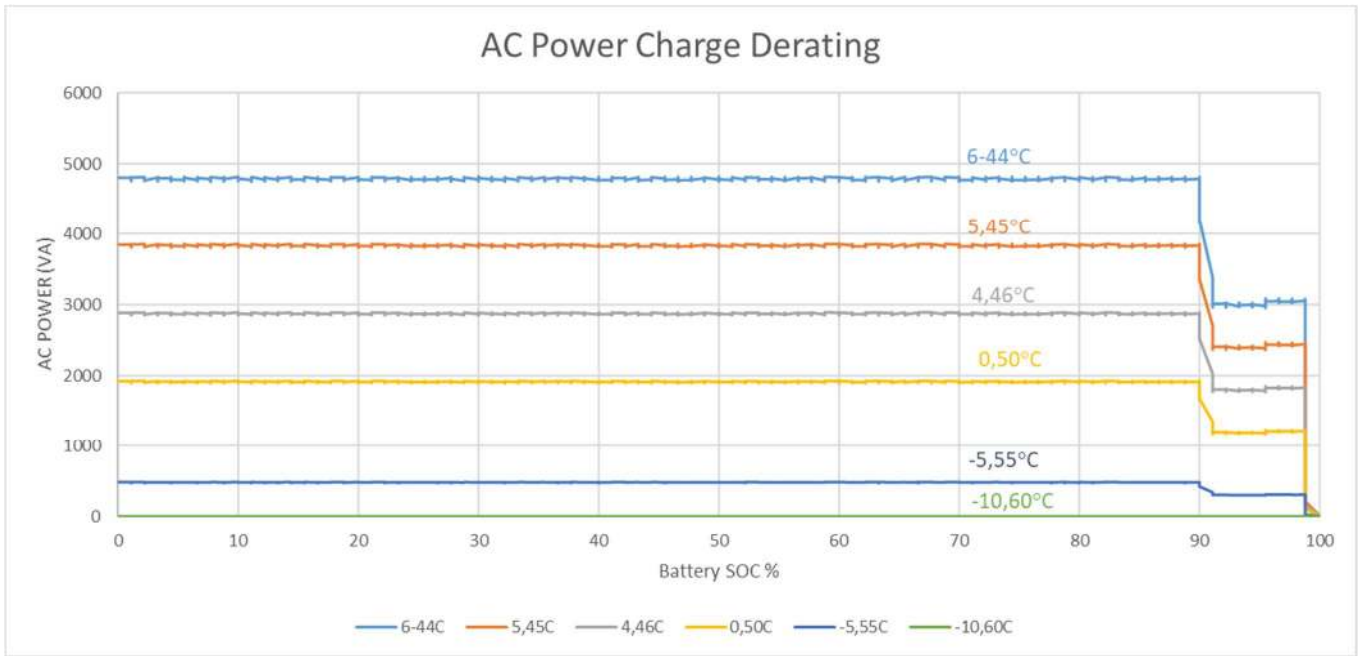


Figure 23: Energy storage system thermal derated charge and discharge curves with base battery cabinet including four Pylontech US3000C modules.

Appendix A: Battery Expansion Cabinet Installation – batteries #5 to #8

The Evolve LFP system supports up to two additional expansion cabinets. Where duplicated, the mechanical assembly and wiring instructions will be referenced to previous sections within this document. All instructions specific to the first expansion cabinet are documented below, with battery modules numbered 5 to 8 inclusively. Startup and operation, section 8, remains unchanged.

A.1 Initial Inspection of Material List – top level system components

The system components supplied with your Eguana Evolve™ LFP are shown below. Each component should be inspected visually for any damage that may have been caused by shipment. If damage is present, please contact your local distributor.

| Item | Eguana P/N | Description |
|------|---------------------------|--|
| 1 | ACB05-PB | Battery Cabinet (and cover) |
| 2 | - | Expansion wall mount bracket |
| 3 | US3000C / US3000 | 4 battery modules (US3000C model shown). |
| 4 | LFP expansion install kit | Assembly parts kit and cables. |

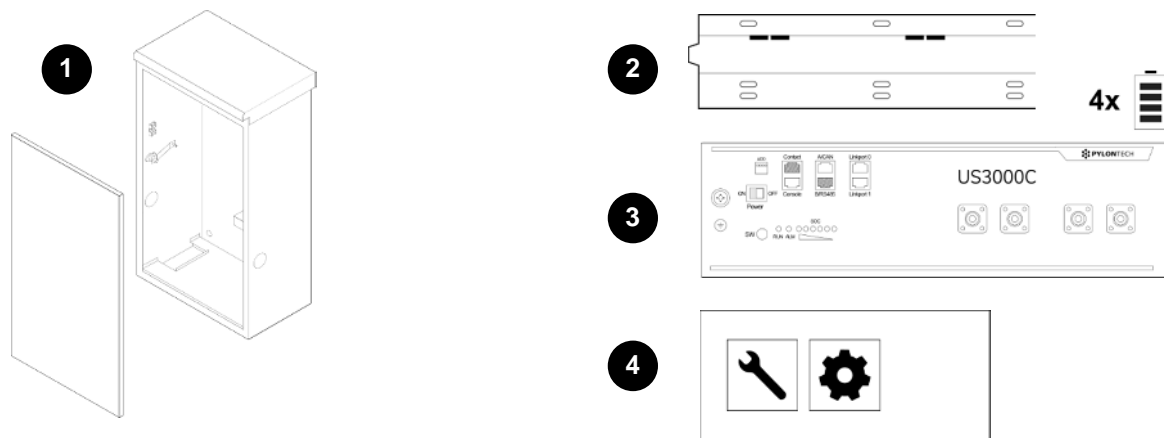


Figure 24: Expansion battery top level components.

2.6.1 LFP expansion install kit – mechanical parts

| Item | Qty | Eguana P/N | Description |
|------|-----|------------|---|
| 1 | 1 | PB kit | Incl. cabinet coupler assembly, two levelling brackets, and two plugs |
| 2 | 8 | | Adhesive backed battery module pads |
| 3 | 1 | | Battery rack partition bracket (includes attached battery retaining clip) |

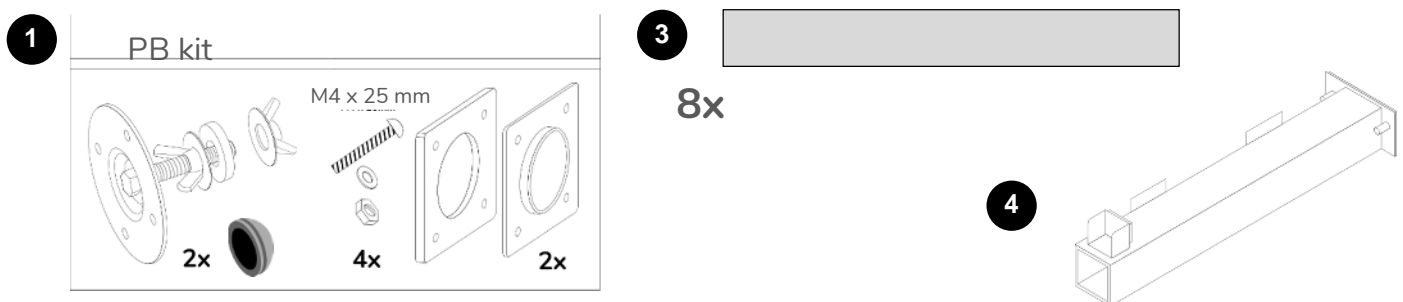


Figure 25: LFP expansion install kit - mechanical parts.

2.6.2 LFP install kit – battery cables

| Item | Qty | Eguana P/N | Description | Pylon p/n |
|------|-----|------------|--|--------------|
| 1 | 2 | 801003790 | DC- module jumper BLK 180 mm (2 spare) | WI0BSC1000B2 |
| 2 | 1 | 801003793 | DC- module jumper BLK 400 mm | WI0CUS300004 |
| 3 | 1 | 801003801 | DC- module jumper BLK 1100 mm | WI0CUS300008 |
| 4 | 1 | 801003802 | DC- terminal jumper BLK 1200 mm | WI0CUS300006 |
| 5 | 3 | 801003789 | DC+ module jumper RED 180 mm (1 spare) | WI0BSC100001 |
| 6 | 2 | 801003800 | DC+ module jumper RED 1100 mm | WI0CUS300007 |
| 7 | 2 | 801003799 | DC+ terminal jumper RED 1200 mm | WI0CUS300005 |
| 8 | 2 | 801003792 | BMS jumper short 210 mm | WI0SRJ458025 |
| 9 | 1 | 801003794 | BMS jumper medium 700 mm | WI0SUS300002 |
| 10 | 1 | 801003795 | BMS jumper long 1500 mm | WI0SRJ45815M |
| 11 | 4 | 801003791 | Chassis GND cable GRN/YEL 1 m | WI0GUS300001 |

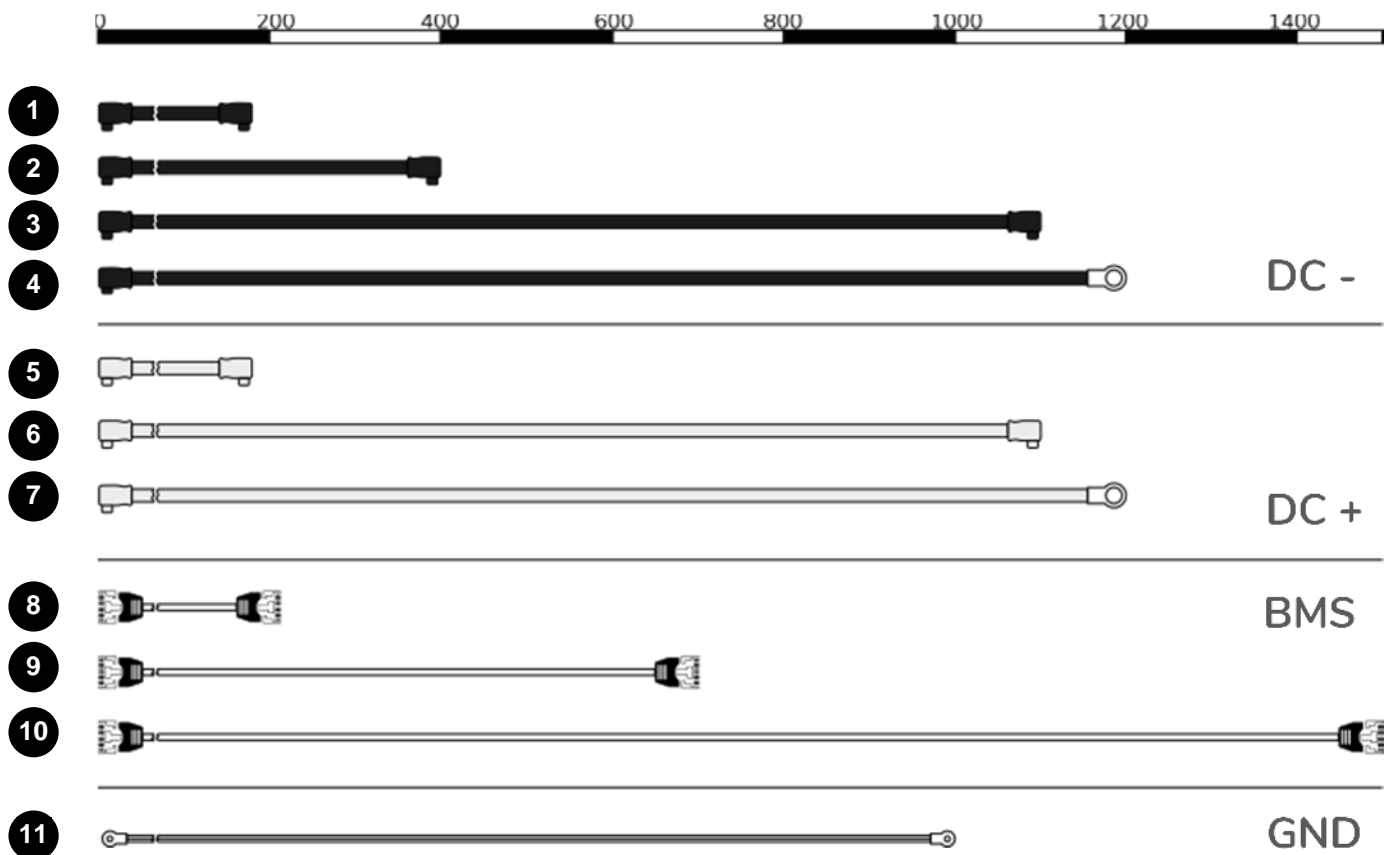


Figure 26: LFP expansion kit - battery cables.

A.2 Wall bracket installation

The expansion cabinet is included with a wall bracket extension that is secured to the base system's bracket.

1. Align the expansion bracket to the base bracket and secure with the mounting hardware provided.



2. **IMPORTANT!** Secure the bracket to the wall using a minimum of four 5/16" lag bolts in at least two wall studs.

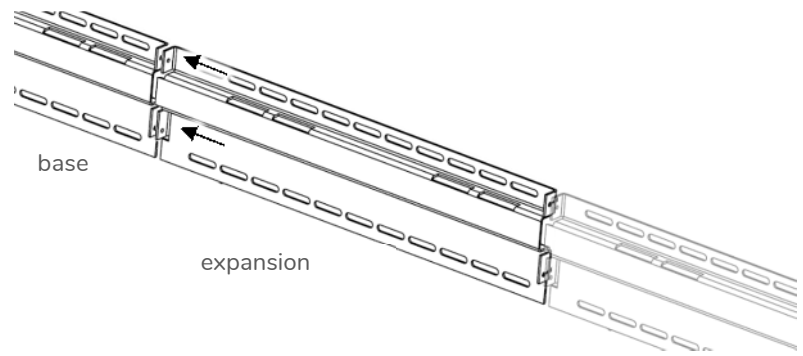


Figure 27: Expansion wall bracket installation.

A.3 Mounting the cabinet to the wall

1. Remove the cabinet coupling end plate from the lower right side of the base battery cabinet and install it on the lower right port hole of the expansion cabinet.
2. Follow the cabinet installation instructions in section 4 to secure the cabinet to the wall.

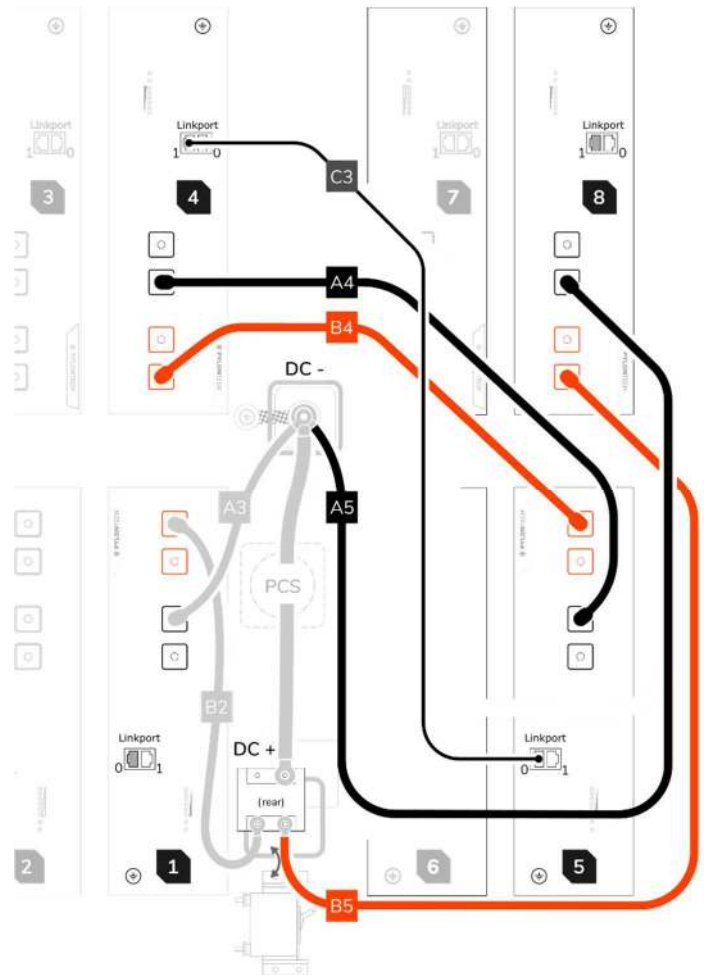
A.4 Battery module assembly

1. Follow the assembly instructions in section 5.2 through 5.4.
2. See section 5.5 (figure 12) – remove the lower DC- cable (referenced A3) from the DC- terminal, and replace with the cable referenced A5 in figure 25 below.

A.5 Battery module wiring

| Ref | P/N | Description | Pylon p/n |
|-----|-------|-----------------------------------|--------------|
| A4 | #3801 | DC- jumper cable BLK 1100 mm | W10CUS300008 |
| A5 | #3802 | DC- terminal cable BLK 1200 mm | W10CUS300006 |
| B4 | #3800 | DC+ jumper cable RED 1100 mm | W10CUS300007 |
| B5 | #3799 | DC+ breaker cable RED 1200 mm | W10CUS300005 |
| C3 | #3795 | BMS jumper cable 1500 mm | W10SRJ45815M |

1. Connect the internal power and communication jumper cables as shown in sections 5.5.1 and 5.5.2. Note the relative position of batteries 5 thru 8 as they mirror batteries 1 thru 4.
2. Route the DC power cables, referenced A4 and B4, through the coupling port and terminate them at battery #8.
3. Remove the DC+ breaker assembly.
4. Remove the DC+ cable referenced B3 (section 5.6, figure 12) and replace with the cable referenced B5 (shown right). Torque to 15 in-lbs.
5. Mount the DC+ breaker assembly.
6. Route the BMS jumper cable referenced C3 through the cabinet coupling port and terminate at the link port terminals at battery #4 and #5.



Appendix B: Electrical Block Diagram – Internal

The following table / diagram defines the internal electrical wiring of the Evolve LFP system, including the base and two additional expansion battery cabinets. The diagram is for illustrative purposes, and does not reflect the actual physical orientation of the battery modules within the cabinets.

| Ref | P/N | Description | Ref | P/N | Description |
|------------|-------|--------------------------------|------------|-------|-----------------------------------|
| A1 | #3790 | DC- module jumper BLK 180 mm | B1 | #3789 | DC+ module jumper RED 180 mm |
| A2 | #3793 | DC- module jumper BLK 400 mm | B2 | #3796 | DC+ breaker cable RED 400 mm |
| A3 | #3798 | DC- terminal jumper BLK 400 mm | | | |
| A3* | #3798 | DC- terminal jumper BLK 400 mm | B3* | #3797 | DC+ breaker cable RED 780 mm |
| A4* | #3801 | DC- jumper cable BLK 1100 mm | B4* | #3800 | DC+ jumper cable RED 1100 mm |
| A5* | #3802 | DC- terminal cable BLK 1200 mm | B5* | #3799 | DC+ breaker cable RED 1200 mm |
| A6* | TBD | | B6* | TBD | |
| C1 | #3792 | BMS jumper short 210 mm | D1 | #3810 | PCS-BMS “Y” CAN/Console 3000C |
| C2 | #3794 | BMS jumper long 700 mm | D1 | #3797 | PCS-BMS CAN only 3000 (not shown) |
| C3 | #3795 | BMS jumper cable 1500 mm | P- | #2925 | PCS DC- power cable |
| | | | P+ | #2923 | PCS DC+ power cable |

Note: DC power cables marked by an asterisk (*) in the table above indicate required modifications to the cable set used in the base battery cabinet. Only one set of “home run” DC power cables is used per complete system. For example: adding one expansion battery cabinet requires the replacement of [A3] / [B3] with [A5] / [B5] “home run” cables, and the addition of [A4] / [B4] “daisy chain” jumper cables.

Note: Battery module ground cables are one per battery, with a “home run” to the cabinet chassis ground terminal.

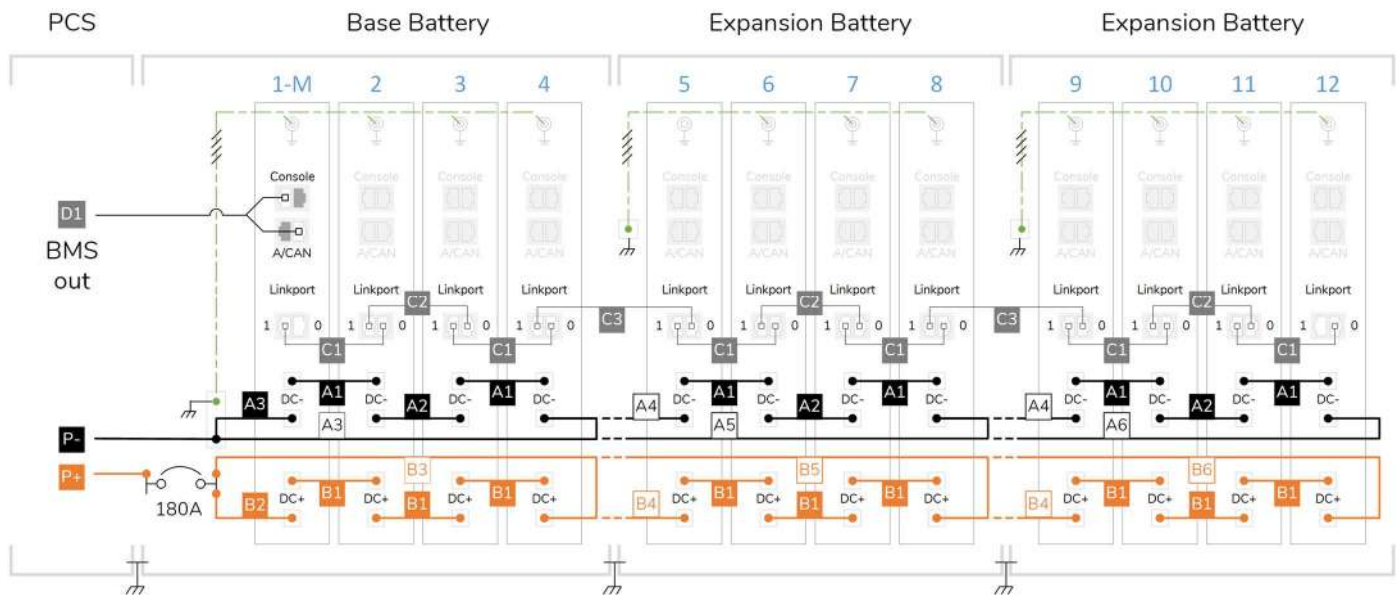


Figure 29: Evolve LFP electrical block diagram of internal system components.

INSTALLATION NOTES

