

Wiring Guide

Models Covered:

- PHI 3.5 Core Power
- PHI 2.7 Core Power

PHI 2.7 Lo-Profile, PHI 1.3 and PHI 675 battery models utilize Anderson Connectors for wiring connections. Refer to these batteries' manuals for more details regarding their connector types.

Maximum Continuous Current versus Surge Current

Depending on the electrical code of the local Authority Having Jurisdiction, use either the batteries' maximum continuous current rating or their surge rating when sizing electrical wires and/or bussbars.

Maximum Continuous Current – typical maximum current for charge and discharge

Surge Current – peak current for no greater than five seconds

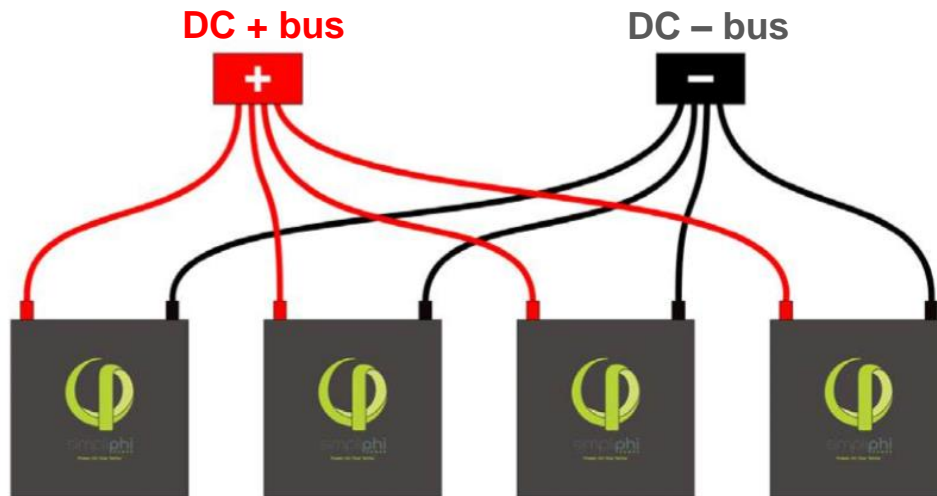
The quantities listed in the table below are for parallel connected batteries.

| Continuous & Surge Battery Ratings (Amps DC) | | | | | |
|---|-----|---------|------|---------|------|
| | | PHI 3.5 | | PHI 2.7 | |
| | QTY | 48V | 24V | 48V | 24V |
| Continuous | 1 | 34A | 45A | 26A | 45A |
| Surge | | 80A | 80A | 80A | 80A |
| Continuous | 2 | 68A | 90A | 52A | 90A |
| Surge | | 160A | 160A | 160A | 160A |
| Continuous | 3 | 102A | 135A | 78A | 135A |
| Surge | | 240A | 240A | 240A | 240A |
| Continuous | 4 | 136A | 180A | 104A | 180A |
| Surge | | 320A | 320A | 320A | 320A |
| Continuous | 5 | 170A | 225A | 130A | 225A |
| Surge | | 400A | 400A | 400A | 400A |

Refer to the National Electrical Code's Ampacity Table to determine wire sizing ([Appendix A](#)).

Wiring Tips

- PHI batteries must be wired in parallel only. Wiring in series will void the warranty and destroy the batteries.
- Wire lengths from PHI batteries should be identical in length and gauge in order to balance the load across all PHI batteries in the installation.
- **Identical wiring length is a critical feature of parallel power storage systems that must be adhered to throughout all parallel wiring instructions.**
- Wire lengths should be kept as short as practical.
- **3/8" (10 mm) lugs** match the PHI 3.5 and PHI 2.7's 3/8" (10 mm) terminal stud size.



- Wiring from PHI batteries to DC busbars should be sized at **2 AWG** or larger.
- SimpliPhi recommends using Arctic Ultraflex Blue wire from [Polarwire](#).
- Energy supplied by the battery is reduced as electrical current moves through wire. For lengths of battery cable greater than ~10 ft/3 m, ensure that the voltage drop is no greater than 3%.
- Wiring from the battery DC busbars to the equipment interface should be sized according to the interfacing equipment's specifications and appropriate code requirements.

Wiring Methods

- 1 - 8 PHI batteries can be wired directly to DC busbars in an inverter's power panel
 - See [Appendix B](#) for more details
- 6 - 20 PHI batteries can be wired to a DC combiner or panelboard
 - See [Appendix C](#) for more details
- 20+ PHI batteries can be connected using common bussing directly on the batteries' terminals



Sourcing DC Combiner Boxes, Panelboards and Busbars

- MidNite Solar produces the [MNBCB 1000/50 Battery Combiner](#)
- [Storm Power Components](#) produces a variety of combiners and custom bussing

Appendix A

National Electrical Code Allowable Ampacities of Insulated Conductors Rated 0-2000 Volts

As Excerpted from the 2002 National Electrical Code

Ampacities of Not More Than Three Current-Carrying Conductors in Raceway, Cable or Earth. Based on Ambient Temperature of 30°C (86°F)

| SIZE AWG OR kcmil | Copper Conductors | | | Aluminum Conductors | | | SIZE AWG OR kcmil | | |
|----------------------------|---------------------------------|---------------------|---------------------------------------|---|----------|--------------------|----------------------------|---------------------------------------|---|
| | Temperature Rating of Conductor | | | Temperature Rating of Conductor | | | | | |
| | 60°C | 75°C | 90°C | 60°C | 75°C | 90°C | | | |
| | TYPES | TYPES | TYPES | TYPES | TYPES | TYPES | | | |
| TW UF | RHW THW THWN | THHW XHHW USE | RHH RHW-2 XHHW XHHW-2 XHH | THHW THWN-2 THWN-2 THHN USE-2 | TW UF | RHW THW THWN | THHW XHHW USE | RHH RHW-2 XHHW XHHW-2 XHH | THHW THWN-2 THWN-2 THHN USE-2 |
| 14** | 20 | 20 | 25 | - | - | - | - | | |
| 12** | 25 | 25 | 30 | 20 | 20 | 25 | 12** | | |
| 10** | 30 | 35 | 40 | 25 | 30 | 35 | 10** | | |
| 8 | 40 | 50 | 55 | 30 | 40 | 45 | 8 | | |
| 6 | 55 | 65 | 75 | 40 | 50 | 60 | 6 | | |
| 4 | 70 | 85* | 95* | 55 | 65 | 75 | 4 | | |
| 3 | 85 | 100* | 110* | 65 | 75 | 85 | 3 | | |
| 2 | 95 | 115* | 130* | 75 | 90* | 100* | 2 | | |
| 1 | 110 | 130* | 150* | 85 | 100* | 115* | 1 | | |
| 1/0 | 125 | 150* | 170* | 100 | 120* | 135* | 1/0 | | |
| 2/0 | 145 | 175* | 195* | 115 | 135* | 150* | 2/0 | | |
| 3/0 | 165 | 200* | 225* | 130 | 155* | 175* | 3/0 | | |
| 4/0 | 195 | 230* | 260* | 150 | 180* | 205* | 4/0 | | |

Appendix B

From Magnum's [Mini Magnum Panel Owner's Manual](#):

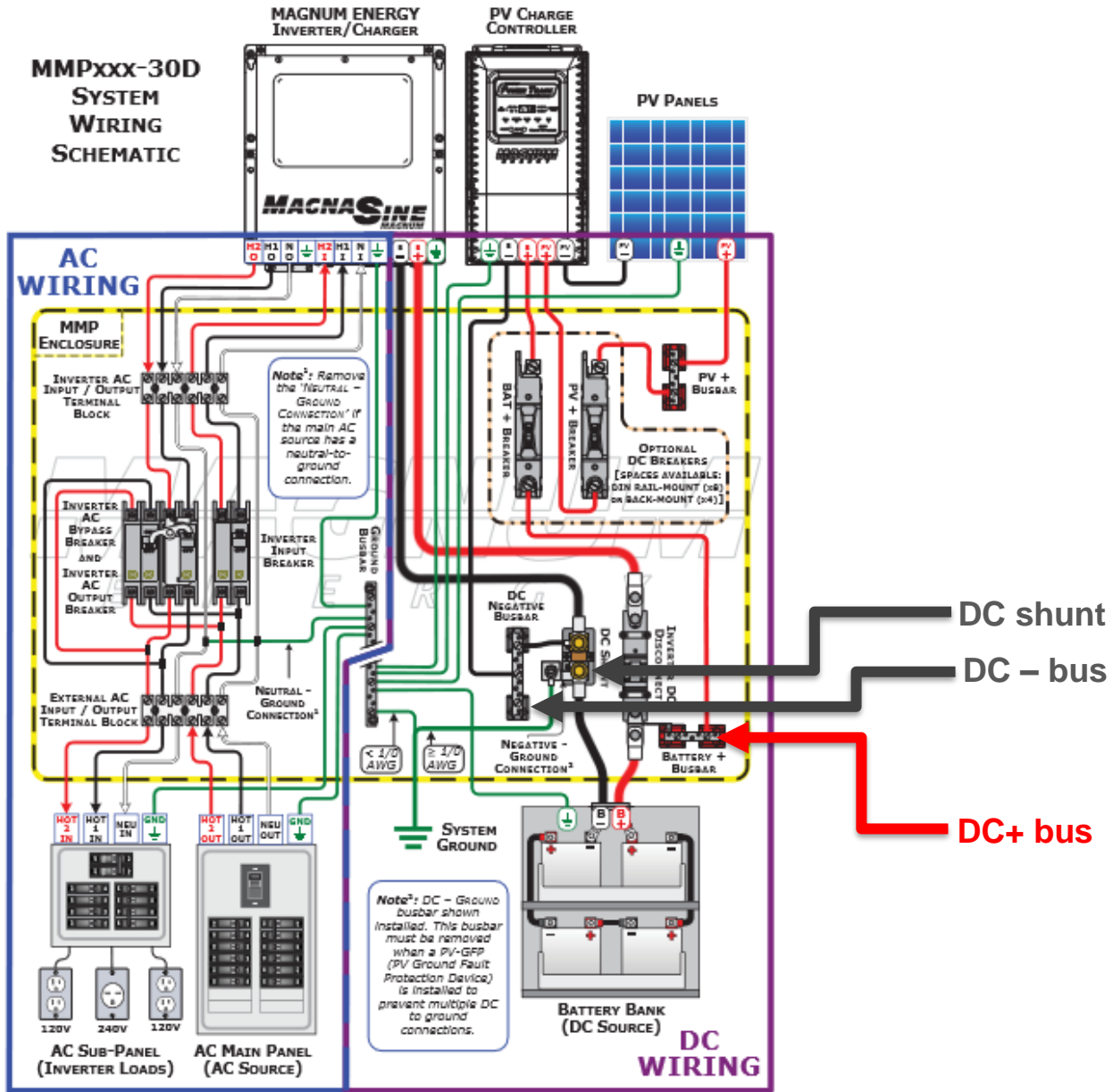
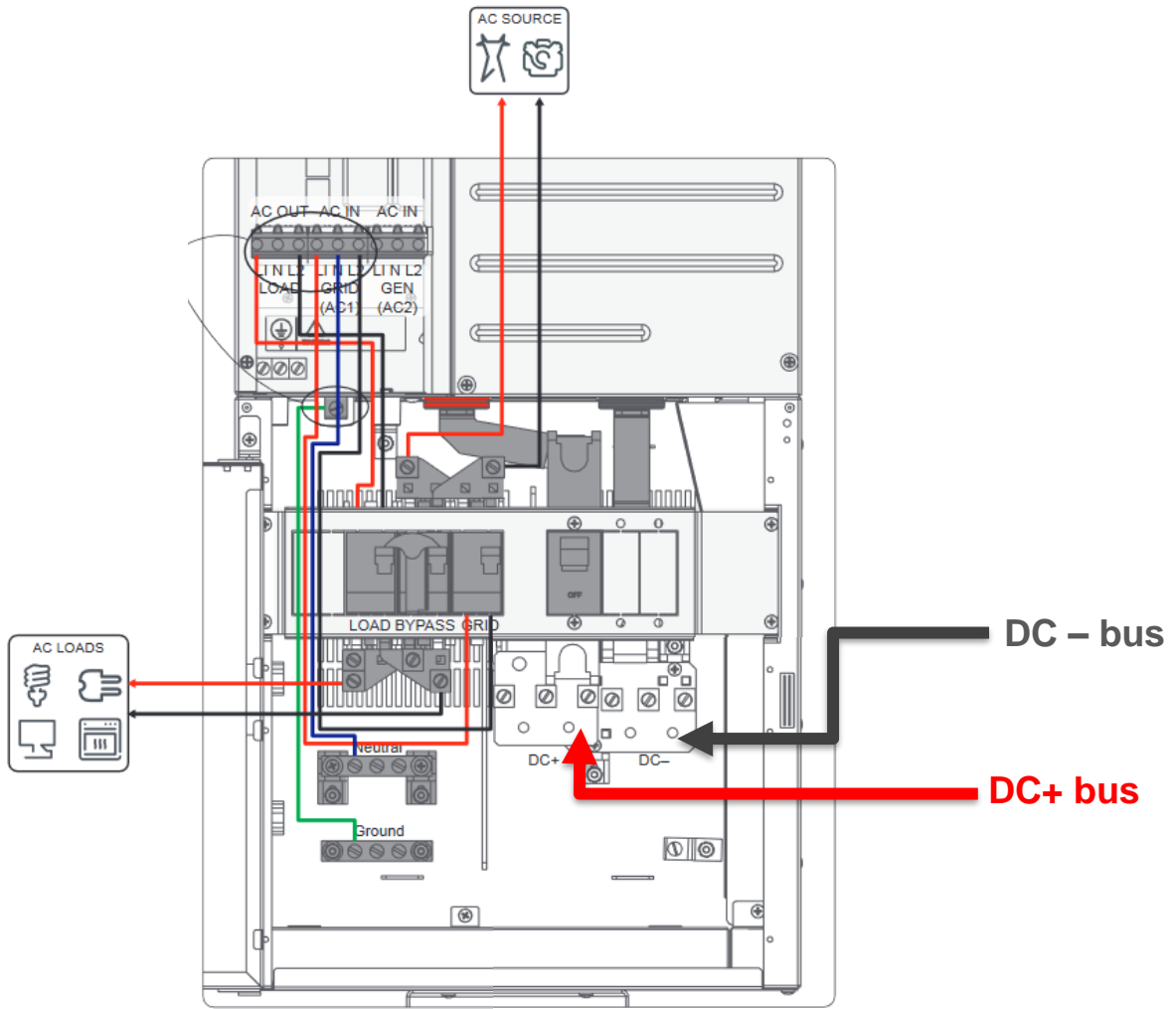


Figure 2-5, MMPxxx-30D System Wiring Diagram

Magnum's Mini Magnum Panel (MMP) includes a battery positive busbar and a DC negative busbar, both rated to handle **120 Amps each**. Each busbar includes seven total holes for screw type compression terminals (no ring lugs required): two holes are sized for **#14 to #1/0 AWG** wire and five are sized for **#14 to #6 AWG** wire. Note in the diagram above that the charge controller's BAT NEG wire lands on the DC Negative Busbar, and a short wire connects the DC Negative Busbar to the top of the DC Shunt.

If the DC Negative Busbar is utilized for battery paralleling, then the charge controller's BAT NEG wire should instead land at the top of the DC Shunt (along with the inverter's negative cable), and the short wire connecting the DC Negative Busbar to the DC Shunt should be moved so that the short wire lands at the bottom of the DC Shunt.

From Schneider Electric's [Conext XW+ MINI PDP Install Guide \(975-0735-01-01_Rev-B\)](#):



From OutBack Power's [GS Load Center Installation Manual](#):

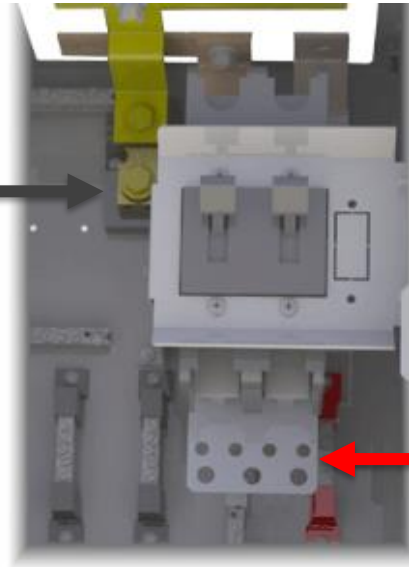
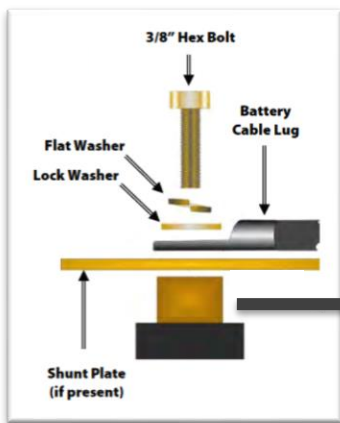
The OutBack GS Load Center includes a single pre-installed **500A dc/50 mV shunt** for landing negative battery cables. This shunt is located to the upper left of the main inverter disconnect. It is designed for several 3/8" (10 mm) ring lugs to be bolted to it. Up to two more shunts can be installed in the GS Load Center.

The GS Load Center for the OutBack Radian 8048 and 8048A includes a DC positive wiring plate* for landing positive battery cables. This plate must be ordered separately from OutBack ([Product Guide Catalog linked here](#)). The plate can be installed directly beneath the main inverter disconnects. It has **four 0.31" (8 mm) holes** and **three 0.4" (10 mm) holes**. It is intended for several ring lugs to be bolted to it.

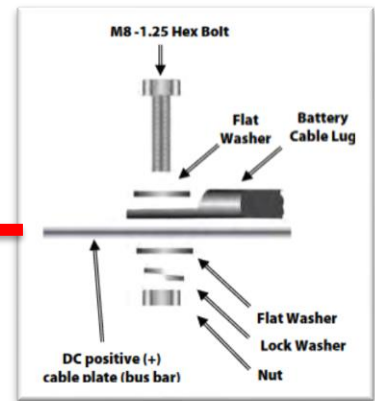
*The DC positive wiring plate is **not** included in the GS Load Center for the OutBack Radian 4048.

The illustration below shows the placement of the shunt and the DC Positive Plate, as well as the hardware installation order on the shunt and the DC Positive Plate. Do not install hardware in a different order from the illustration. The battery cable lug(s) must be the first item(s) installed. The first cable lug must make solid contact with the surface.

Hardware Connection to Shunt



Hardware Connection to DC + Plate



Size and Torque Requirements for Circuit Breakers and Bus Bars

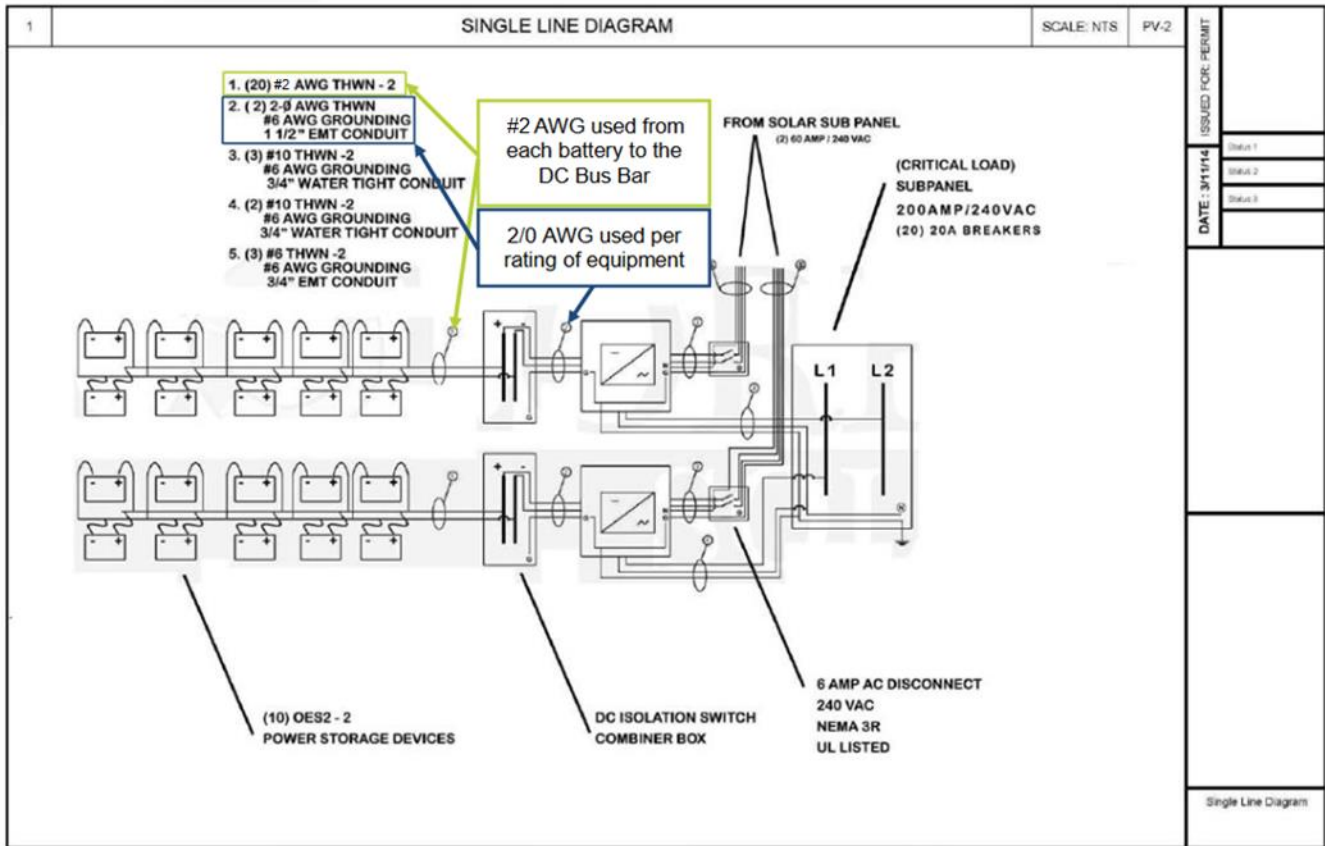
| Item | Terminal/Bolt Size | Torque Requirements |
|--------------------------------|--------------------|---------------------|
| Inverter Positive (+) Bus Bars | M8 | 60 in-lb (6.8 Nm) |
| Shunt Bolts | 3/8" | 60 in-lb (6.8 Nm) |
| DC Positive (+) Cable Plate | Top Holes (x3) | 60 in-lb (6.8 Nm) |
| | Bottom Holes (x7) | 50 in-lb (5.7 Nm) |
| Circuit Breaker Studs | M8 | 20 in-lb (2.3 Nm) |
| | 1/4" | 35 in-lb (4.0 Nm) |
| | 5/16" | 50 in-lb (5.7 Nm) |
| | 3/8" | 225 in-lb (25.5 Nm) |



NOTE: The DC Positive (+) Cable Plate (FW-BBUS) is not included with model GSLC175PV1-120/240 or model GSLC175PV1-230. It cannot be used with these models.

[OutBack FLEXware](#) 250, 500 and 1000 products can also be assembled to include DC busbars. These busbars do not come with the FLEXware; they must be ordered separately.

Appendix C



For Technical Support:

- Residential
- Commercial HV
- OEM-Interoperability