

Wiring Guide

This wiring guide is intended for PHI batteries with threaded studs. Smaller model PHI batteries utilize Anderson Connectors for wiring connections. Refer to the PHI battery manual or relevant specification sheet for more details regarding these 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 busbars.

Maximum Continuous Current – typical maximum current for charge and discharge
Surge Current – peak current for no greater than five seconds

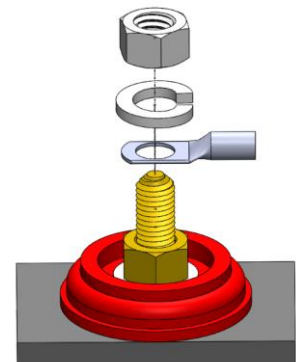
The quantities listed in the table below are for parallel connected batteries.

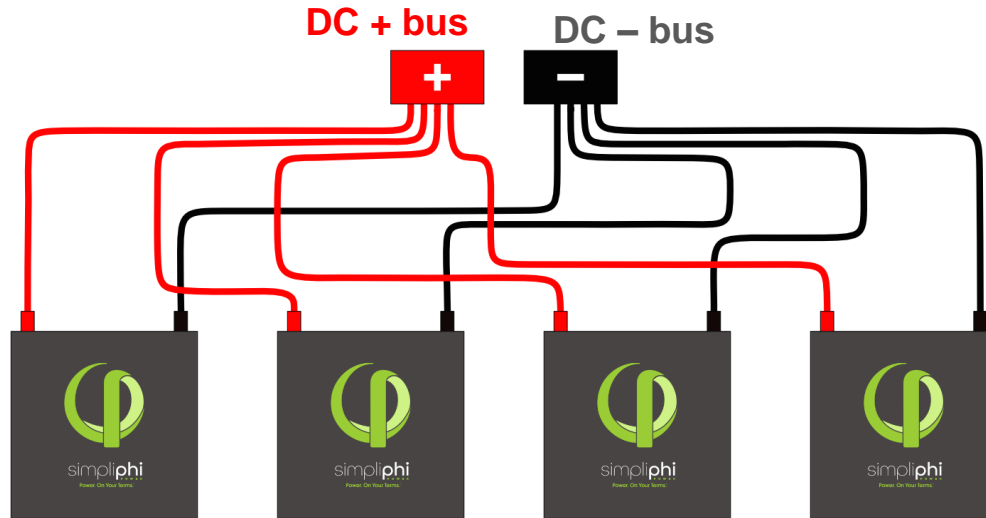
Continuous & Surge Battery Ratings (Amps DC)									
		PHI 3.8		PHI 2.9		PHI 3.5		PHI 2.7	
	QTY	48V	24V	48V	24V	48V	24V	48V	24V
Continuous	1	37.5A	45A	28.5A	45A	34A	45A	26A	45A
Surge		80A	80A	80A	80A	80A	80A	80A	80A
Continuous	2	75A	90A	57A	90A	68A	90A	52A	90A
Surge		160A	160A	160A	160A	160A	160A	160A	160A
Continuous	3	112.5A	135A	85.5A	135A	102A	135A	78A	135A
Surge		240A	240A	240A	240A	240A	240A	240A	240A
Continuous	4	150A	180A	114A	180A	136A	180A	104A	180A
Surge		320A	320A	320A	320A	320A	320A	320A	320A
Continuous	5	187.5A	225A	142.5A	225A	170A	225A	130A	225A
Surge		400A	400A	400A	400A	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 3.8, PHI 2.9, PHI 3.5 and PHI 2.7's 3/8" (10 mm) terminal stud size.
- **CRITICAL NOTE: No material (such as a washer) should be placed between the current carrying terminal and the cable lug or busbar. Doing so will void the warranty.**





- Wiring from individual PHI batteries to DC busbars should be sized at **6 AWG** minimum; **4 AWG** is most commonly used (wire sizing requirements may vary according to local electrical codes).
- 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 [MNLB Lithium Battery Combiner](#) (rated at 250 Amps max) and the [MNBCB 1000/50 Battery Combiner](#) (rated at 1,000 Amps max)
- [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 XHHW USE	THHW XHHW USE	RHH RHW-2 XHHW XHHW-2 XHH	THHW THWN-2 THW-2 THHN USE-2	TW UF	RHW THW THWN XHHW USE	RHH RHW-2 XHHW XHHW-2 XHH	THHW THWN-2 THW-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](#):

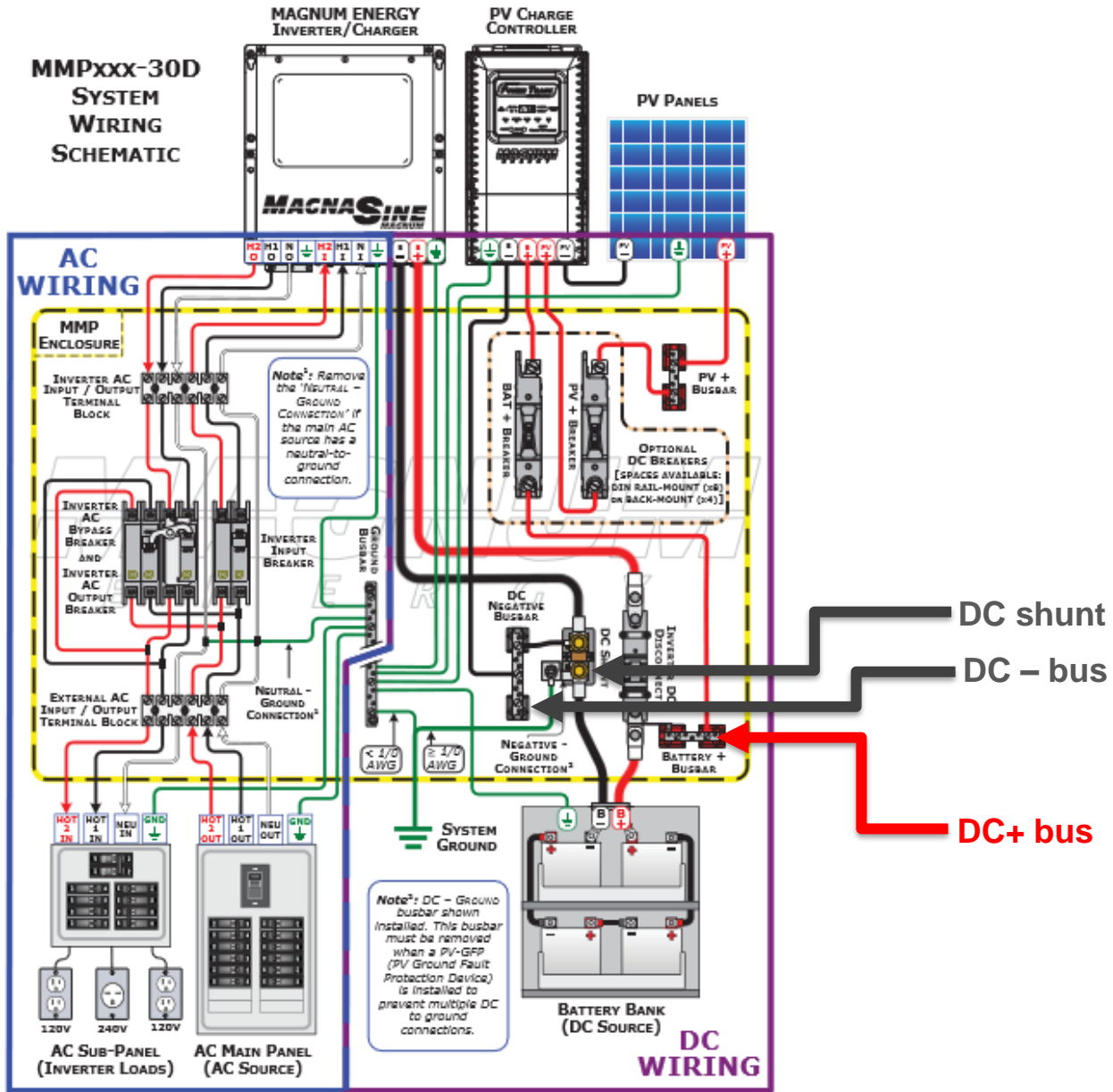
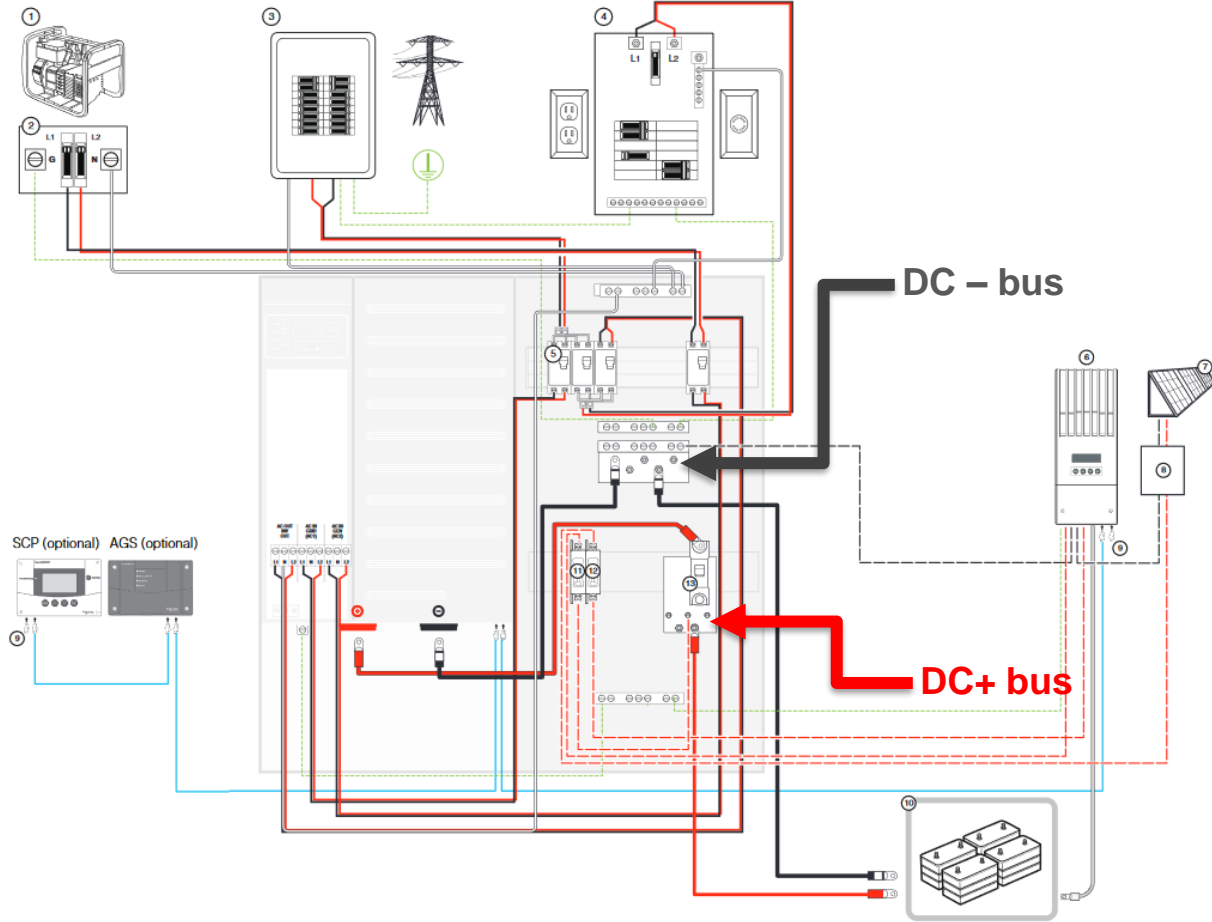


Figure 2-5, MMPxxx-30D System Wiring Diagram

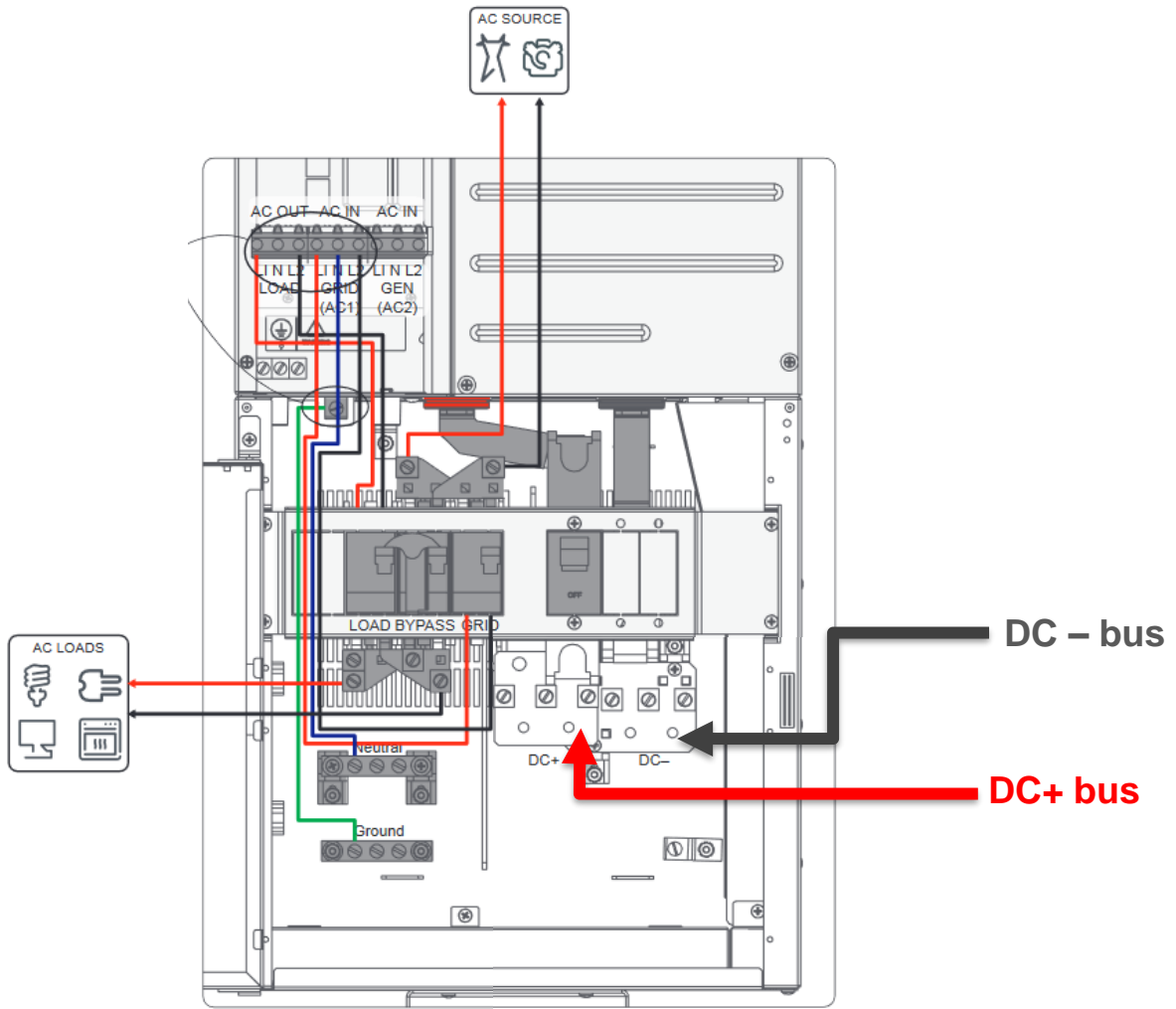
Magnum's Mini Magnum Panel (MMP) includes a battery positive busbar and a DC negative busbar, both rated to handle **120 Amps each**. Each busbar includes seven total holes for screw type compression terminals (no ring lugs required): two holes are sized for **#14 to #1/0 AWG** wire and five are sized 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+ Installation Guide \(975-0239-01-01_ Rev M\)](#):



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](#):

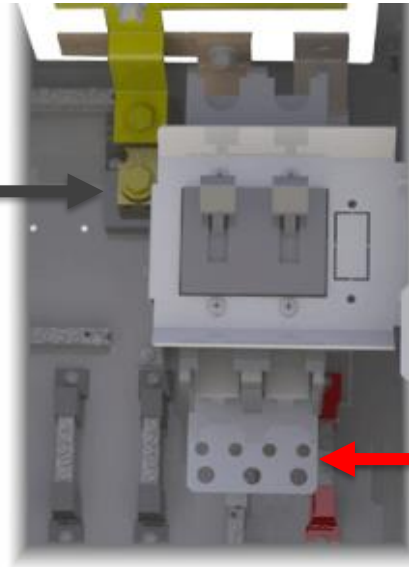
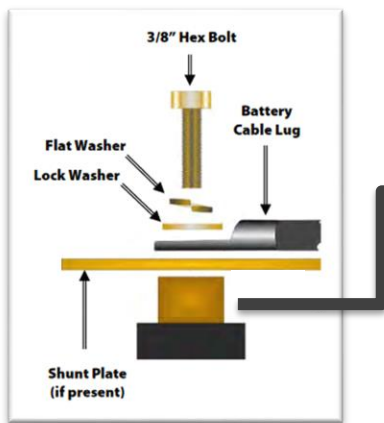
The OutBack GS Load Center includes a single pre-installed **500A dc/50 mV shunt** for landing negative battery cables. This shunt is located to the upper left of the main inverter disconnect. It is designed for several 3/8" (10 mm) ring lugs to be bolted to it. Up to two more shunts can be installed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

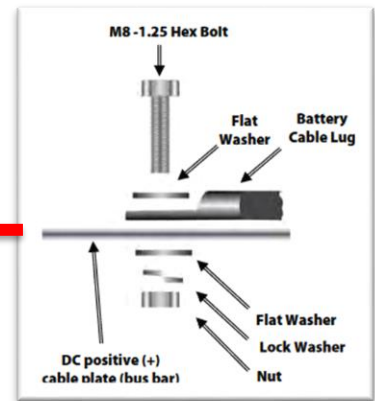
*The DC positive wiring plate is **not** included in the GS Load Center for the OutBack Radian 4048.

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

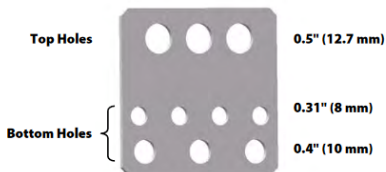


Hardware Connection to DC + Plate



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

