



SimpliPhi Power PHI Battery

INTEGRATION GUIDE: SCHNEIDER

Optimized Energy Storage & Management for Residential & Commercial Applications Utilizing Efficient, Safe, Non-Toxic, Energy Dense Lithium Ferrous Phosphate (LFP) Chemistry

SimpliPhi Your Energy Security and Independence

and gain control of your own power.

SimpliPhi helps you manage your power as a personal resource. Anytime, anywhere, SimpliPhi energy storage systems optimize integration of any power generation source – solar, wind, generator – on or off grid and protects your home and mission-critical business functions from power outages and intermittency. SimpliPhi storage technology eliminates operating temperature constraints, toxic coolants and the risk of thermal runaway. Safe lithium ferrous phosphate. No cobalt. No hazards.

SimpliPhi's battery technology utilizes the industry's most environmentally benign chemistry combined with proprietary architecture and power electronics (BMS) that eliminate the need for cooling or ventilation to create products that provide energy security and resiliency.

SimpliPhi Power offers proprietary, commercially available energy storage and management systems that are safe, non-toxic, reliable, durable, efficient, highly scalable, and economical over the lifetime of the PHI Battery.

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1.0 – Introduction

This integration guide covers the recommended set up and configuration of Schneider Electric equipment for optimizing performance with SimpliPhi PHI 3.8 kWh batteries. More information on SimpliPhi products can be found on our website: <https://simpliphipower.com/>.

Schneider Electric offers many products which are too numerous to be covered here. The specific Schneider products covered in this guide include, but are not limited to:

- Schneider Conext XW+ Inverter/Chargers
 - Conext XW Pro
 - Conext XW+ 6848 NA
 - Conext XW+ 5548 NA
- Schneider Conext MPPT Charge Controllers
 - Conext MPPT 60 150
 - Conext MPPT 80 600
- Schneider Conext Battery Monitor

2.0 – Charge Controller and Inverter Settings

Schneider Electric has performed qualification testing of the PHI 3.8 kWh battery with their equipment. Based on these combined tests and evaluations, the following parameters (refer to table below) have been established. More information on Schneider Electric products can be found on their website: <https://solar.schneider-electric.com/>.

3.0 – Battery Bank Sizing

A properly sized PHI battery bank should be sized to prevent any risk of over-discharge or over-charge. Depending on the specifications of the equipment used in the system, sizing the PHI battery bank based on these two criteria may yield different results. Therefore, the best practice is to calculate the PHI battery bank based on both criteria and use the greater of the two results as the minimum quantity. We can compare these two calculation methods assuming the nomenclature below:

- Battery rated continuous power = Bat_{kW}
- Inverter power full load = Inv_{kW}
- Inverter efficiency = Inv_{eff}
- Maximum battery charge current = $I_{BatChrgMax}$
- PV charge controller maximum = $I_{PVChrgMax}$
- Recommended minimum number of batteries = $B_{\#}$

Discharge equation: $B_{\#Inv} \geq Inv_{kW} / Inv_{eff} / Bat_{kW}$

Charge equation: $B_{\#PV} \geq I_{PVChrgMax} / I_{BatChrgMax}$

3.1 – Discharge Calculation: Inverter Power Bank Sizing

To protect against over-discharge (voiding the battery Warranty), the PHI battery bank should be sized to handle the inverter's "load rate": the amount of power that is potentially discharged from the battery bank to the loads.

Discharge Example: $B_{\#Inv} \geq Inv_{kW} / Inv_{eff} / Bat_{kWh}$

- Inverter is rated at 6.8 kW
- Inverter efficiency is 92.5%
- PHI 3.8 kWh-51.2V_{nom} battery is rated at 1.9 kW MAX Continuous Discharge Rate

$$B_{\#Inv} \geq 6.8 \text{ kW} / 0.925 / 1.9 \text{ kW} = 3.8$$

A properly sized PHI battery bank based on maximum discharge of the inverter would have a minimum of 4 batteries. This ensures no greater than C/2 battery load. If the PHI battery bank has fewer batteries than calculated, special care must be taken with the inverter settings to limit the load below the specified rating of the PHI battery. These settings are described in the following sections of this Integration Guide.

3.2 - Charge Calculation: Charge Controller Power Bank Sizing

To optimize solar harvesting, a properly sized PHI battery bank should be able to accept the maximum PV charge current. To determine the minimum number of PHI batteries required to optimize PV, consider the solar PV array size and the charge controller(s) potential charging output.

Charge Example: $B_{\#PV} \geq I_{PVChrgMax} / I_{BatChrgMax}$

- PHI 3.8-51.2V_{nom} battery is rated at 37.5A MAX Continuous Charge Rate
- Solar PV array is rated at 4,000 Watts
- PV charge controller max = 80A

The 4,000-Watt solar PV array has a maximum potential output current of 83.3 Amps DC at 48 Volts DC:
 $4,000 \text{ Watts} / 48 \text{ Volts} = 83.3 \text{ Amps}$.

However, the charge controller's 80A maximum output rating limits the solar PV array's output (through the charge controller) to 80 Amps. Because the charge controller's maximum output amps is *less than* the solar PV array's maximum potential output current, we'll use the charge controller's output current rating as the determining factor when calculating the battery bank's Charge Calculation:

$$B_{\#PV} \geq 80A / 37.5A = 2.13$$

A properly sized PHI battery bank based on available PV charge would have a minimum of 3 batteries. This maximizes the use of available PV while ensuring the batteries are never stressed by overcharging. If the PHI battery bank has fewer batteries than calculated, special care must be taken with the charge controller settings to limit the charge rate below the specified rating of the PHI battery. These settings are described in the following sections of this Integration Guide.

In summary: When comparing the same system using these two calculations for sizing the PHI battery bank, the minimum number of batteries should be the greater of the two results (Discharge Calculation & Charge Calculation). In this example, this translates into 4 PHI batteries in the system.

4.0 – Program Settings for PHI Batteries

In order to maintain the Warranty, it is critical to ensure that the appropriate settings for the desired Warranty are programmed in all of the system components. This section will cover the basic concepts and settings for Schneider Electric equipment.

4.1 – Depth of Discharge

In order to optimize performance and the life of your system and PHI batteries, SimpliPhi Power recommends programming the equipment settings for 80% Depth of Discharge (DoD). This enables the batteries to achieve the greatest expected 10,000 cycles. Greater DoD is possible but will result in reduced cycle life.



CAUTION: If a firmware update is executed on Schneider Electric equipment, ALL the settings must be reverified. The programmed settings shown in the following tables must be applied based on desired Warranty/Cycle life. The recommended is 80% depth of discharge.

4.2 – Inverter/Charger Settings

The Conext XW+ Inverter/Charger has a firmware limitation that creates a potential issue with Lithium-Ion batteries: the Low Battery Cut-Out Voltage (LBCO) setting is limited to 48V maximum. This value is below the recommended LBCO settings to maximize cycle-life of most Lithium-Ion batteries including PHI batteries. Per the Warranty, a 48V LBCO corresponds to 100% DoD and maintains a much more limited cycle life.

Until Schneider Electric releases updated firmware to adjust this setting above 48V, this issue can be largely mitigated by setting the “Recharge Volts” above the desired LBCO thresholds as outlined in Table 1.0 below. Therefore, systems that do not rely solely on renewable energy (i.e. grid tied systems, AGS systems) will typically start charging the batteries once the recharge voltage level is reached, preventing further discharge of the batteries and thus optimizing cycle-life.

Table 1.0 – Settings for SimpliPhi PHI 3.8 kWh 48V Battery w/Schneider Conext XW Pro & XW+ Inverters

Conext XW+ & XW Pro Settings	
Advanced Settings > Inverter Settings	
Low Battery Cut Out Voltage ¹	48
LBCO Hysteresis	2.0V
LBCO Delay	10 Sec
High Batt Cut Out	60V
Search Watts	Default
Search Delay	Default
Charger Settings > Custom Settings	
Batt Type	Custom
Lithium Ion	
Control	2StgNoFloat
Bulk Voltage	56V
MaxBulkCurrent (C/2) ²	37.5A (per PHI 3.8)
DisChgImax ²	80A (per PHI 3.8) (up to 500A per bank)
DisChgImax Timer	300 sec
Batt Capacity ²	75Ah (per PHI 3.8)
Max Charge Rate (C/2) ^{2,3}	37.5A (per PHI 3.8)
Default Batt Temp	Warm
Recharge Volts	50.4V
Absorb Time	.1 Hour (6 minutes)
Chg Block Start	Default
Chg Block Stop	Default

Notes:

- ¹ Maximum setting of 48V limited by some inverter firmware is below the recommended setting.
- ² Per PHI 3.8 kWh 48V battery – These settings are calculated by multiplying the nominal value per-battery value times the # of batteries. For other batteries, refer to the Warranty and Specification Sheet for the specific model. Refer to Charge Controller Bank Sizing under the “Battery Bank Sizing” section.
- ³ To calculate Max Bulk Current as a percentage, divide the calculated Max Bulk Current in Amps DC by the equipment’s maximum potential charging current:

Bat.QTY	PHI 3.8 / 48V (37.5ADC)	1 x XW+ 5548 (110ADC charger)	1 x XW+6848 (140ADC charger)
2	75A	68%	53%
3	112.5A	100%	80%
4	150A	100%	100%

- Levels are typical @ 25°C and may need adjusting at temperature extremes.
- When performing rapid deep charge/discharge cycles the battery should be allowed to "rest" 15 minutes in between.
- Always refer to the SimpliPhi Power Manual and Warranty for the specific PHI battery model.



CAUTION: When PHI battery quantities change, the capacity & charge/discharge current settings must to be reassessed. Failure to do so will void the Warranty.

4.3 – MPPT Charge Controller Settings

Solar charge controllers must be used in DC coupled systems to regulate the power produced by the PV array that is delivered to the batteries. Schneider Electric offers two different MPPT charge controllers, both of which are compatible with PHI batteries:

1. Conext MPPT 80 600
2. Conext MPPT 60 150

The 80 600 model is somewhat unique in that allows for larger strings of PV modules to be easily installed and connected to the PHI battery bank. Charge controller selection depends on the system size and personal preference; The recommended setpoints for either Schneider Electric charge controller are the same.

SimpliPhi Power recommends the 80% DoD settings in Table 2.0 below in order to maximize the Warranty. Additional settings are outlined based on Warranty and desired cycle life.

Table 2.0 - Settings for SimpliPhi PHI 3.8 kWh 24V & 48V Battery w/Schneider XW MPPT60/80

Conext MPPT60 / 80 Settings	
Advanced Settings > Charger Settings	
Batt Type	Custom
Custom Settings	
Eqlz Supt	Disabled
Bulk Voltage	28V / 56V
Absorb Voltage	28V / 56V
Float Voltage	27V / 54V
Batt Temp Comp	0mV/C
Batt Capacity ²	151Ah (per PHI 3.8 24V) / 75Ah (per PHI 3.8 48V)
Max Charge Rate (C/2) ^{2,3}	75A (per PHI 3.8 24V) / 37.5A (per PHI 3.8 48V)
Charge Cycle	3 Stage
ReCharge Volts	25.6V / 51.2V
Absorb Time	.1 Hours (6 minutes)
Default Batt Temp	Warm
Batt Voltage (Auto-detected)	24V / 48V
Aux Settings	
Not Used	
...	Default

Notes:

- ¹ Maximum setting of 48V limited by some inverter firmware is below the recommended setting.

- ² Per PHI 3.8 kWh 48V battery – These settings are calculated by multiplying the nominal value per-battery value times the # of batteries. For other batteries, refer to the Warranty and Specification Sheet for the specific model. Refer to Charge Controller Bank Sizing under the “Battery Bank Sizing” section.
- ³ To calculate Max Charge Rate as a percentage, divide the calculated Max Bulk Current in Amps DC by the equipment’s maximum potential charging current:

Bat QTY	PHI 3.8 / 24V (45ADC)	1 x MPPT 80 (80ADC charger)	PHI 3.8 / 48V (37.5ADC)	1 x MPPT 80 (80ADC charger)
2	90A	100%	75A	93%

- Levels are typical @ 25°C and may need adjusting at temperature extremes.
- When performing rapid deep charge/discharge cycles the battery should be allowed to “rest” 15 minutes in between.
- Always refer to the SimpliPhi Power Manual and Warranty for the specific PHI battery model.



CAUTION: When PHI battery quantities change, the capacity & charge/discharge current settings must be reassessed. Failure to do so will void the Warranty.

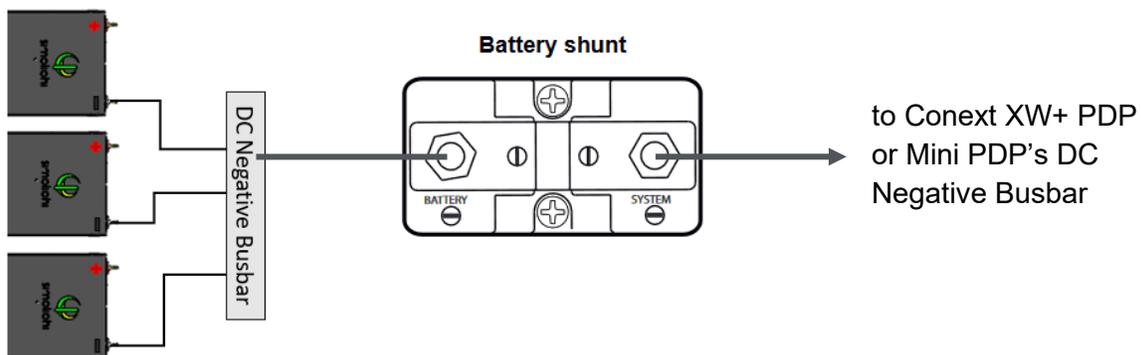
4.4 – Conext Battery Monitor Wiring & Settings

The Schneider Electric Conext™ Battery Monitor determines the connected battery bank’s state of charge (SOC). For the Battery Monitor to operate properly, adhere to the following wiring instructions:

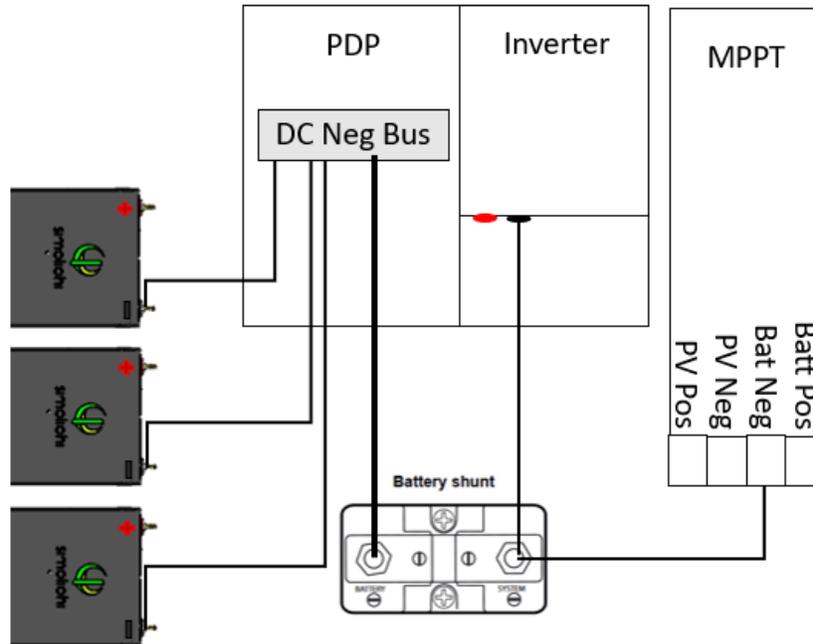
1. The battery monitor involves the routing of the system’s DC Negative wires “through” a battery shunt. On the shunt, one side is designated as the battery bank’s connection point and the other side is designated as the system’s connection point. The system connection point includes wiring from the inverter and charge controller(s).

Note: All DC Positive wiring is wired as usual; follow SimpliPhi and Schneider Electric’s relevant installation manuals for DC Positive wiring instructions.

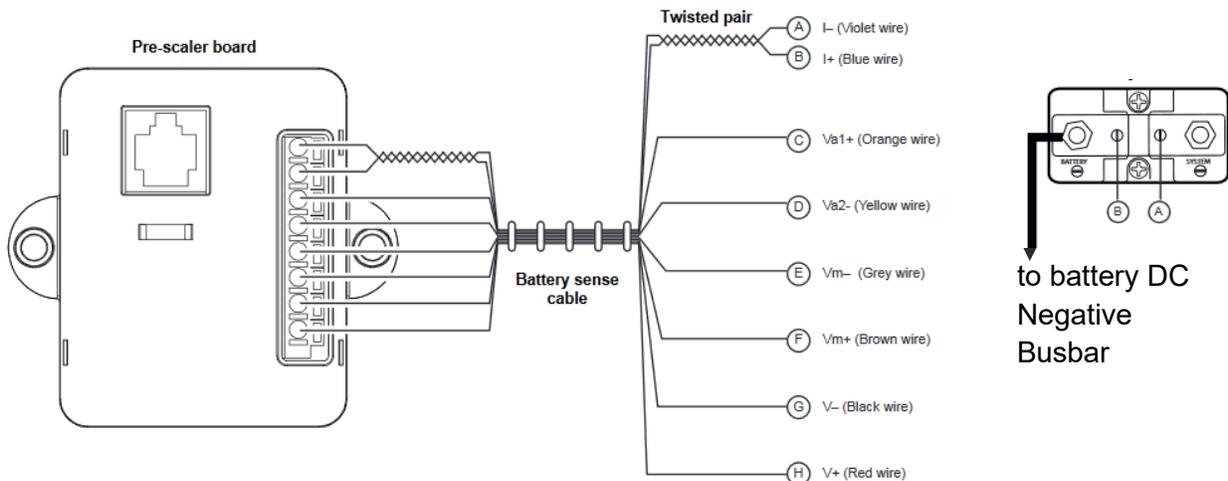
2. IF the PHI batteries are paralleled in a battery box, or using bussing directly on the batteries’ terminals, wire the battery bank to the battery shunt like so:



3. IF the PHI batteries are paralleled in the Schneider Conext’s Power Distribution Panel (PDP), then the inverter and charge controller(s) negative wiring must land directly on the shunt’s “system” connection point, like so:



4. To wire the Battery Monitor's pre-scaler board to the battery bank:
 - a. Do **not** connect the orange wire (Va1+) or the yellow wire (Va2-). Including these wires in the pre-scaler-to-battery connection will result in inaccurate Battery Monitor SoC calculations.
 - b. Wire the twisted pair (violet wire 1- and blue wire 1+) to the battery shunt. Notice connection points A and B as outlined in the [Battery Monitor Quickstart Guide](#):



- c. The pre-scaler's grey wire (Vm-) and black wire (V-) connect to the DC negative busbar paralleling the batteries in the PHI battery bank.
 - d. The pre-scaler's brown wire (Vm+) and red wire (V+) connect to the DC positive busbar paralleling the batteries in the PHI battery bank.
5. Do **not** connect the Battery Temperature Sensor; the PHI batteries' charging regimen does not involve any temperature compensation.

6. Wire the pre-scaler board to the battery monitor using the provided orange networking cable.
7. Include the battery monitor in the remainder of the Schneider system's network via the Xanbus networking cable.

Table 3.0 - Settings for SimpliPhi PHI 3.8 kWh 48V Battery w/Schneider Conext Battery Monitor

Conext Battery Monitor Settings	
Setting	Value
Capacity ²	75Ah (per PHI 3.8)
Discharge Rate	20 Hrs
Nominal Temp	67F
Shunt Amps	500
Shunt mV	50
Self Disch	< 1%/Month
Discharge Floor	20%
Float Voltage	53.32
Float Amps	2%
Auto Sync Time	240 Sec
Temp Unit	Celsius
Back Light Timer	30 Sec
Peukert Expo	1.05
Charge Eff Mode	Automatic
Temp Coeff	0.5Ah/degC
Default Temp	76 Deg F
Sync Sensitivity	5
Time Rem Filter	Faster



CAUTION: When PHI battery quantities change, the capacity & charge/discharge current settings must be reassessed. Failure to do so will void the Warranty.

4.4 – Conext Auto Generator Start (AGS) Settings

The Schneider Electric Conext™ Auto Generator Start (AGS) device allows for a connected generator to automatically start and stop according to battery voltage. Check with your generator manufacturer regarding the compatibility of your generator with this AGS device.

Table 4.0 – Settings for SimpliPhi PHI 3.8 kWh 48V Battery w/Schneider Conext AGS

Conext AGS Settings			
Advanced Settings > Cfg Trigger	80% DoD	90% DoD	100% DoD
Start DCV 30 sec	50.4V	49.8V	48.2V
Start DCV 15 min		Disabled	
Start DCV 2 hr		Disabled	
Start DCV 24 hr		Disabled	
Stop Float		Enabled	
Stop Absorb		Disabled	
Stop V		Disabled	
Temp1		Disabled	
Temp2		Disabled	
Load		Enabled if necessary ¹	
Strt Load		See Table 5.0	
Stop Load		(Start Load Value) – 1A	
Load Start Delay		0 s	
Start Soc		20%	
Stop Soc		90%	

- 1. Enable the **Load** trigger if the battery bank does not meet the Power Bank Sizing requirements outlined in Section 3.1.

The **Start Load** trigger enables the generator to start at a specified AC load (current draw) on the inverter. The current draw must be present for 5 minutes before the generator will start. The generator will assist the inverter with powering the AC load.

If the inverter(s) power rating exceeds the battery bank’s maximum instantaneous discharge rating (i.e. does not adhere to the sizing requirements outlined in Section 3.1 above), enable the **Load** start trigger to prevent the battery bank from over-discharging through the inverter to the loads.

1. First convert DC discharge current to DC watts. (AC and DC watts are the same)
2. Then apply the inverter efficiency.
3. Then convert AC watts to AC current.

Table 5.0 – Conversion from DC to AC Limit for 1 to 5 PHI 3.8 kWh 48V Batteries (37.5A DC limit per PHI battery)

A	B	C	D	E	F
# of Parallel Batteries	DC Current Limit	ADC x VDC (48)	WDC ÷ Inverter Efficiency (90% = .9)	Column D ÷ Inverter Voltage (120 or 240 VAC, dep. on inverter; 240 VAC used below)	Round down (only whole #s can be used as input)
1	37.5A	1,800 WDC	2,000 WAC	8.33 AAC	**
2	75A	3,600 WDC	4,000 WAC	16.67 AAC	16 AAC
3	112.5A	5,400 WDC	6,000 WAC	25 AAC	25 AAC
4	150A	7,200 WDC	8,000 WAC	33.33 AAC	33 AAC
5	187.5A	9,000 WDC	10,000 WAC	41.67 AAC	41 AAC

**10A is the minimum programmable value

5.0 – Specifications & Warranty

For your reference:

- See PHI 3.8 kWh 48V Specifications Sheet.
- See PHI 3.8 kWh 48V 10-Year Warranty; Failure to adhere to installation protocol will void Warranty.

6.0 – SimpliPhi Technical Support

For technical support related to your PHI 3.8 kWh 48V Battery (or other SimpliPhi Power products), please contact us directly at:

805.640.6700

techsupport@simpliphipower.com