

Enphase Microinverters AC Coupled to Battery Based Systems

Enphase is now supporting the use of Enphase Microinverters in battery based photovoltaic systems. This allows for Enphase microinverters to be used in off-grid and battery-based applications. In these applications, a battery based inverter is required to create a “micro-grid” that the Enphase microinverters can be connected to. This is generally referred to as AC coupling, because the Enphase Microinverters and the battery based inverters are “coupled” on their AC outputs.

While these systems are more complicated than traditional grid interconnected systems; they can provide power to remote applications, during power outages, and in emergency situations. Enphase Microinverters, when AC coupled to a battery based inverter system, can provide a value over other inverter technologies, because a microinverter system can be divided up into branch circuits to provide a tapered charge to the batteries. Also, Enphase microinverters offer the design flexibility, increased safety, and increased performance that comes with module level maximum power point tracking and monitoring.

A battery based application is generally much more complicated than a utility-interactive system, and requires a special knowledge base to be implemented successfully. There is a great deal of expertise that must be attained before installing battery based systems and AC Coupled systems. These systems should be installed by a qualified individual. This document is not meant to spell out all of the requirements and qualifications needed to install safe and reliable battery based systems, but does provide some particular details for designing AC coupled systems with Enphase Microinverters.

In all battery based systems, there are special considerations which must be taken to provide for safe and reliable operation. However, there are additional considerations when AC coupling Enphase Microinverter systems, including,

- The batteries must be prevented from overcharging. Overcharging batteries can damage the batteries and can potentially cause fires and catastrophic meltdowns. It is smart to provide redundant methods to regulate the charge to the battery.
- The Enphase Microinverters must never be connected to the output of an engine generator. This can cause damage to the microinverters and the generator.
- The Enphase Microinverter system must be designed to not exceed the pass through capabilities of the battery based inverter’s charging system.

Whenever working with batteries, precautions must be taken to ensure safety. This is particularly true of AC coupled systems, because traditional inverter chargers and charge controllers are not designed to regulate the charge from an AC coupled system. Therefore, special precautions must be taken to ensure that the batteries are not overcharged. This is generally done by shutting off the microinverter system when the batteries are charged. The best method to do this is to use a voltage controlled relay to shut off the Enphase Microinverter system at a voltage that is within the battery manufacturer’s limit. For more complicated systems, a series of relays can be used to taper the charge to the batteries.

As an additional level of protection to the batteries, a dump load can also be utilized to drain excess power out of the batteries in the case of overcharging. This can be accomplished by heating water or air with a listed and approved heating element.

Some battery based inverters use “frequency shifting” to regulate the charge on batteries. These inverters will shift the frequency to a range that is outside of the utility interactive inverters UL1741 frequency settings. Do not rely on this method of charge regulation alone! An Enphase microinverter system’s grid parameter settings can be adjusted remotely, and may be set outside of the window being used by the battery based inverter. For this reason, an additional voltage controlled relay should be utilized.

If an engine generator is present, the Enphase Microinverters should never be allowed to be connected to the same panel as the generator. When a generator is used to charge batteries in a battery based inverter system, the battery based inverter will also internally bypass the generator’s output to the back-up / emergency load panel that the Enphase microinverters will be feeding! This can cause damage to the generator and microinverters. Therefore, if a generator is used to charge batteries, methods must be utilized to ensure that the Enphase microinverters are shut-off when the generator is running. The best way to do this is to use a voltage controlled relay that is activated by the generator panel. A transfer switch can also be used to ensure that the generator is always isolated from the Enphase Microinverters.

The Power Room of an AC Coupled System with Enphase Microinverters, Courtesy of Magnum Energy



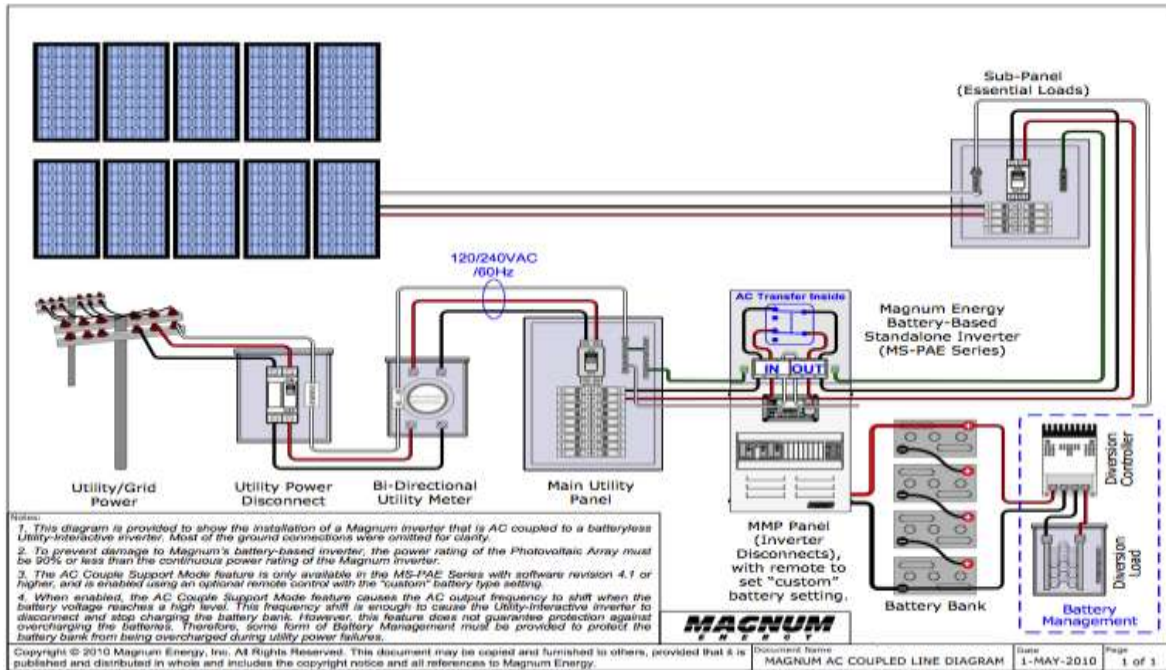
For additional resources on installing AC Coupled systems, you can reference your battery manufacturer and battery-based inverter manufacturer’s documentation. Enphase microinverters work with a number of battery based inverter manufactures and component manufacturers, like Magnum Energy, Outback Power Systems, MidNite Solar, SMA, and Schneider Electric. Many other documents, application notes, and schematics on AC Coupling can be found at the following company’s websites.

Magnum Energy <http://www.magnumenergy.com/Documents/DocsFront.htm>

Outback Power Systems <http://www.outbackpower.com/index.php/applications/ac-coupling>

MidNite Solar <http://www.midnitesolar.com/index.php>

Sample Schematic 1 of an AC Coupled System, Courtesy of Magnum Energy



Sample Schematic 2 of an AC Coupled System, Courtesy of Outback Power Systems

