Application Note

Offset Functionality in the Radian Series Inverter/Chargers

Models: GS8048A, GS7048E, GS4048A, GS3548E

Overview: Offset is a function of the Radian Series Inverter/Charger. The Offset function can reduce the amount of power provided by the utility. It is particularly useful in systems where the ability to sell energy back to the utility grid is limited or restricted. Offset is an automatic operation but there are settings that can maximize its effectiveness. Offset is strictly a function of DC voltage set points and the presence of AC loads on the inverter.

- Offset is not active in the following AC Input Modes: Generator, UPS, or Backup.

- Offset is available in the following AC Input Modes: Support, Grid Tied, Mini Grid, and Grid Zero.

There are four DC voltage set points used by the Offset function. They are the Absorb, Float, Equalize and Sell RE target voltages.

- **ABSORB FLOAT and EQUALIZE:** These are charging stages which operate at constant voltages using specified set points. When the inverter's internal charger is active, the inverter can use its AC input as a source to maintain these set points. Conversely if these set points are exceeded from another DC charging source, the inverter can export the energy to loads connected to the AC output in an effort maintain these set points.

- **Sell RE:** When the inverter's internal charger is inactive, the Sell RE voltage is the target voltage the inverter uses for Offset. NOTE: This is true even in systems that do not sell back to the grid. In a system that is unable to sell, the Sell RE voltage is the point that the Radian tries to maintain when a renewable source attempts to raise the battery to a higher voltage.

Offset operates best if the renewable source's target is set to a slightly higher voltage than that of the inverter's target DC set point. The adjustment of these voltage set points between different charging sources is what maximizes the Offset function. If the Radian is attempting to maintain the DC voltage at any one of these four voltages and a renewable source raises the DC voltage above the inverters set points, the Radian will send the excess energy to power the AC output loads. This "offsetting" will continue until the DC voltage drops below the voltage set point that the Radian is set to maintain (See Figure 1).

Value	Default	Minimum	Maximum
Absorb	57.6	44.0	64.0
Float	54.4	44.0	64.0
Equalization	58.4	44.0	64.0
Sell RE	52.0	44.0	64.0

Figure 1 – DC Voltage Defaults and Adjustment Range Values

Examples of the Offset function using Radian and a FLEXmax series charge controller

Scenario #1   A Charge Cycle

During a charge cycle any one of three voltage set points (Absorb, Float or Equalize) can be the target point. For this example the Radian is charging from the utility grid and the charge controller is charging from PV panels (solar electricity).

Once the target voltage is reached, both the Radian and the charge controller will only contribute the amount of current that it takes to maintain the target voltage. If the charge controller's target voltage is slightly higher than that of the inverter, the charge controller will continue to charge the batteries after the inverter's set point is achieved. Charging from the inverter will be reduced or stopped. But it gets better. When the inverter's target voltage is exceeded it will invert the excess power then use it to operate the AC loads. This action "offsets" the use of grid power. It causes PV output to be fully maximized, charging from the grid minimized, and the target voltage maintained. If an event such as clouding occurs, Offset will cease and the inverter's charger will maintain the battery target voltage.

Scenario #2   Sell RE as the target

If the inverter is not in a charge cycle the Sell RE set point will become the target voltage used during Offset. A common scenario would be sunlight striking a PV panel at first light in the morning. The FLEXmax charge controller will begin to charge the batteries. The target would be the chargers Absorb set point. The inverter/charger senses the DC voltage rise. Once above the Sell RE set point, the inverter converts DC to AC then uses it to power AC loads. The charge controller will harvest as much as possible in an attempt to reach its Absorb set point. Meanwhile the Radian will convert the same power and export it to supply energy to the AC loads. The Radian will stop offsetting if the DC voltage drops below the Sell RE set point.

Summary

Offset is a function of the inverter/charger and it relationship to the four target set points. It can maximize PV harvest and reduce dependence upon the grid. While the examples above demonstrate the Offset function using PV charge controllers as a charging source, Offset would function in the same manner using any energy source that can raise the DC bus voltage above the target set point.