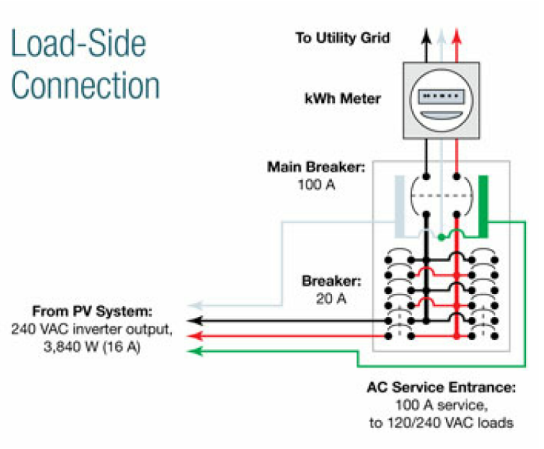
Bus Bar Calculations: Is Your Service Panel Large Enough for Your Inverter?

By Justine Sanchez

Oct/Nov 2011 (#145) pp. 30

homepower MAGAZINE

Grid-tied PV systems supply solar electricity to your home, and the inverter's AC output must be connected to the household wiring. This is usually accomplished by connecting the inverter output so that it back-feeds a circuit breaker in your main service panel (called a "load-side connection"). However, in most cases, the service panel was in place before the PV system was considered, and only the grid input into the home was considered. So when planning your PV system interconnection, make sure your connection does not violate *National Electrical Code (NEC)* requirements.



Backfeeding a circuit breaker with a PV system's output adds a second source feeding the bus bars in your service panel. A service panel's bus bars are rated to handle only up to a certain amperage. If the service panel/bus bars are not large enough, then bus bar overheating is possible. The bus bars in the service panel must be adequately protected, and it's the supply circuit breakers that limit the overall current on those bus bars. So along with the service panel/bus bar rating, the rating of the grid and inverter circuit breakers must be considered.

The *NEC* stipulates that the sum of the circuit breaker ratings feeding a bus bar can amount to 120% of the bus bar rating, but no higher. For example, if we have a 100- amp service panel, the bus bars are rated to handle 100 A. The sum of both of the circuit breakers (from the grid and from the inverter) can be no more than 120 A (100 A × 1.2 = 120 A). If we have a 100 A main breaker, then we are left with a maximum inverter output breaker rating of 20 A. Additionally, because in this example we are exceeding the service panel's rating, the *NEC* requires locating the inverter's breaker on the opposite end of the service panel from the grid's main breaker. This ensures that the current coming in from the grid and the PV system are distributed across the service panel bus bars, rather than concentrated on one area.

The inverter's output circuit breaker is sized so that the inverter's output is no more than 80% of the circuit breaker's rating. If our maximum inverter breaker is rated at 20 A, that means that the inverter output is limited to 16 A (20 A × 0.8 = 16 A). If the inverter output is 240 VAC, our maximum allowed inverter output is 3,840 watts (240 VAC × 16 A). You will not find an inverter rated at this exact value, so you will need to figure out what models will work. For this example, a 3,800 W inverter is appropriate; a 4,000 W model is not.

If the service panel is not large enough to accommodate the inverter, there are a few options. We can limit the PV system size, and the breaker, to fit within the limitations of the service panel. We can replace the service panel with a larger-amp unit. We can downsize the main breaker (although a household load analysis should be done to make sure that there won't be nuisance tripping of that breaker during normal conditions). Or we can connect the PV system via a supply-side connection (see *Code Corner* 135 for more information).

—*Justine Sanchez*