

## Advice to Power Users

This month we are going to have some fun taking wireless security systems to the next level. In this article, I will give you several ideas on how you can work out of the box with some of these technologies. A truly *totally wireless* security system will allow you to take your services anywhere the customer demands them.

A totally wireless system is a security system that not only has short-range wireless sensors and a control, but also integrates wireless power and central station reporting. This will allow us to provide remote security applications such as construction site, remote CCTV and rural security.

Recently, many parts of the United States experienced some of the worst winter storms in history, leaving people for weeks without power or phone service. Your customers can now have the extra security knowing that their security services will not be interrupted by these massive acts of nature.

### Electrical Power Is Everywhere You Are

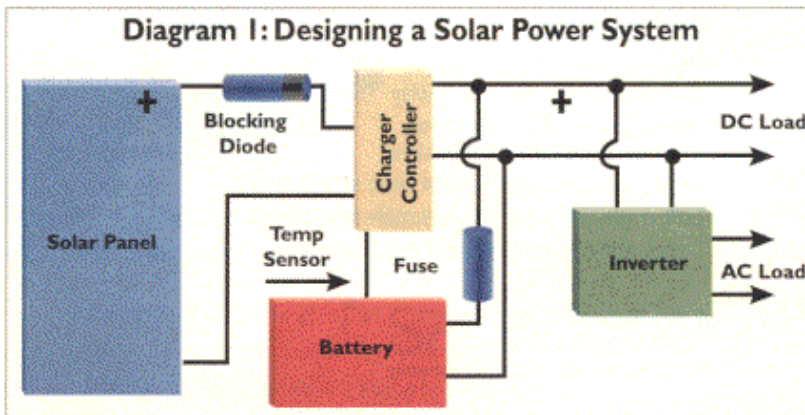
The first step in taking a wireless system to the next level is to have an alternate source of electrical power. In

this case, we are looking at solar electric technology, otherwise known as photovoltaic (PV) power from the sun. PV electrical power is clean and reasonably priced. It can be used to backup existing power sources or applied to areas where electricity is not economically available.

This article is designed as a starter project to get you familiar with some of the PV technology terms and design concerns. I will be referencing Web site locations for additional information. As always, check with solar equipment and alarm system manufacturers for specific application support.

Let us first look at some basic PV system components and some design guidelines. A PV solar system consists of three or four main components: a PV solar panel; a charger/controller for battery charging; an inverter if AC power is needed; and a battery for electrical storage (see *Diagram 1*). First, we have to ask ourselves a few application questions: Are we providing a battery backup system for available AC failure or a standalone DC or AC system?

If you can configure a low-current DC-only system, you will minimize the need for an AC inverter, thereby



Great care must be taken in the design of a solar power system in order to ensure that the system provides enough electricity for emergencies and to properly maintain the battery.



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### BOB'S TIPS

Here are 4 tips for solar-powered wireless systems:

- Calculate how much electricity the system needs.
- Find an alarm panel that can operate in DC mode only.
- Cover the solar panels completely when installing to avoid shock.
- Mount high-profile solar panels with security hardware to prevent theft.

keeping the size and cost of the PV panel and battery storage low. Since we are all familiar with low-voltage and battery technology, these stand-alone systems will be easy to apply once the PV systems basics are understood.

First, calculate how much power the PV solar system must supply to keep both the alarm system operating and the battery charge at full power.

Solar systems measure power in watts. The formula is POWER (Watts) = Current (Amps) X Voltage (Volts). Therefore, a 12V system, drawing a total of 200 mA, will need a total of 2.4 WH (watt-hours) or 57.6 WH/day from a solar panel at full *sunlight* in order to operate. Consider worst-case loads, which is a brief alarm period (6 minutes) or about 0.6 WH/day. These units, at first, may seem a little strange. However, stay tuned for more details we need to consider (see *Diagram 2*). I strongly recommend first using a PV system calculation sheet, that is provided by solar panel manufacturers.

Mount high-profile solar panels with security hardware to prevent

# Tech Talk

## With Bob Dolph

theft. Consider tamper circuits for the mounting fixture.

Check online geographic charts ([www.cetsolar.com/solarhowMain.htm](http://www.cetsolar.com/solarhowMain.htm)) for daily average sunlight levels. Fourteen hours of daylight may only equate to six hours of full sun.

Consider a PV panel that has a built-in blocking diode to protect battery current from feeding back into the panel at night. Shorting solar panel leads should not damage the panel. Some solar panels have up to a 20-year warranty

Certain types of solar panels have a break-in period of up to a few months in which up to 15 percent efficiency is lost. Most panel manufactures have a specified current output level.

Solar panel power drops as the temperature increases. The norm is room temperature or about 77° F. Consider Unisolar type panels for hot desert type environments. Efficiency can drop at much as 20 percent at 150° F.

Properly mounted panels should be able to withstand 125-mph winds and 1-inch hail. Consider lightning protection for high-profile mounted solar

panels. Mount the batteries upright. Size the battery for at least several days of cloudy winter weather operation. Do not consistently discharge below 50 percent of maximum capacity. Expect to replace the batteries about every three years to six years. Regular testing is suggested.

**CAUTION:** Make sure all batteries are fully charged BEFORE connecting parallel combinations. Battery capacity drops at low temperatures and can be reduced 75 percent at 40° E Keep batteries float charged at 100 percent for best performance.

### Install Systems With an Eye Toward Long Life

Shunting controller/chargers are important to prevent overcharging and will shunt out solar panel output when the batteries are fully charged. Shunts are designed to maintain batteries at a maximum charge level with float charging.

A built-in blocking diode keeps the solar panel from draining the batteries at night. Use a shunt-type charger controller, such as an ASC —12/4/AE ([www.specialtyconcepts.com](http://www.specialtyconcepts.com)) for proper battery charge level maintenance.

days of cloudy weather and low sunlight (winter months); efficiency compensation for solar and battery components (10 percent-40 percent loss) and average amount of full *sunlight* available daily (3-6 hours) per your site location.

I recommend contacting solar manufacturers such as Siemens Solar ([www.siemenssolar.com](http://www.siemenssolar.com)), BP Solar ([www.solarex.com](http://www.solarex.com)) and Atlanta Solar ([www.atlantasolar.com/alarm.html](http://www.atlantasolar.com/alarm.html)).

Another good solar information location is Sandia Labs' government site ([www.sandia.gov/pv/](http://www.sandia.gov/pv/)).

Locate an alarm panel manufacturer that can operate its system in a DC-only mode. Some alarm panels can be programmed to ignore AC-loss reporting. Look for panel and sensor

components that draw very little power. There are alarm panels and motion sensors that now operate on just a few milliamps.

For the less adventurous alarm dealer, check out Phantom Electron Corp. ([www.phantomelectron.com/02solarsecure.html](http://www.phantomelectron.com/02solarsecure.html)). The company recently patented a turnkey solar-powered alarm control unit (PVA510).

### Solar Panels Require Careful Installation

**CAUTION:** Solar panels can produce deadly current. Cover completely when installing. They are a current source, so handle them with care.

Mount solar panels with at least a 15° tilt angle. Adjust the angle per site latitude. Angling will help maintain efficiency by allowing dirt and rain to run off. Position the solar panel facing south (Northern Hemisphere). Avoid areas shaded by trees. Improper positioning and tilting can reduce PV panel efficiency up to 40 percent.

### Diagram 2: Calculations for a Solar-Powered Alarm System

Operating DC Load	$200\text{mA} \times 12\text{V} = 2.4\text{WH} \times 24 \text{ hours}$	57.6WH/day
Alarm DC Load	$500\text{mA} \times 12\text{V} = 6\text{WH} \times 0.1 \text{ hours (6 minutes)}$	0.6WH/day
Total Daily DC load	$57.6\text{WH/day} + 0.6\text{WH/day}$	58.2WH/day
Solar Panel Input	$(58.2\text{WH/day}) / (4.5 \text{ hrs/day of full sunlight}) \times 1.4$	18.1W
Daily Battery Size	$(58.2\text{WH/day} / 12 \text{ v}) \times 1.4$	6.8AH/day
4-Day Battery Size	$(6.8\text{AH/day} \times 4 \text{ days}) / 0.7 \text{ (70\% DOD)}$	38.8AH

panels.

### Follow These Tips for Proper Maintenance of Batteries

Deep discharge sealed lead acid AGM (absorbed glass matt)-type batteries are recommended. Don't use auto batteries. Adjust the controller/charger for AGM type batteries. You may need to use flood battery settings.

Provide a fuse on the battery posi-

tion. Consider battery temperature compensation and low-voltage disconnect (if not provided by alarm panel) options.

### Design Solar Systems for Practical Usage

In order to create a truly practical solar system, calculate factors such as:

maximum load conditions from siren and communication devices; battery capacity (amp-hours) for at least four