Lighting Up Outdoor Living Spaces

Easy-to-install low-voltage LED systems offer a lot of design flexibility

By Jason Russell

PHOTOS BY CALVIN RUSSELL AND JASON RUSSELL

Twenty-five years ago, there weren't many lighting options for adding some evening pizzazz to decks or outdoor living spaces. While I never personally included one on any of my projects, electrician-installed 120-volt AC systems were fairly common; I've torn out more than a few old decks with a line-voltage system, most with light fixtures that stopped working years ago. In some cases, the fixtures were full of water, basically health hazards and accidents waiting to happen.

When the first 12-volt DC systems were introduced, I jumped at the opportunity to include them in my designs, like most deck builders, because they didn't require conduit or an electrician to install it. But they were clunky-looking and difficult and time-consuming to hook up, or came with flimsy connectors that inevitably failed in a couple of years.

The weakest link in the first-generation low-voltage deck lighting systems was the bulb technology. Standard halogen, incandescent, or fluorescent bulbs don't last very long, especially in an exterior environment. And if you happen to touch a halogen bulb with bare hands during installation, that bulb's life expectancy is even more limited because you didn't give it the white-glove treatment (literally; oils from your skin left behind on the bulb's special heat-resistant quartz glass can start to etch it under high temperatures, creating hot spots that weaken the bulb). To accommodate these hot bulbs, fixtures had to be large, requiring large holes cut into the framing to make room for the light housing.

Enter LEDs (or light emitting diodes), which have revolutionized the way we see everything at night. This technology has made outdoor lighting systems more stable and the fixtures more compact. With a lifespan approaching 50,000 hours, an

LED fixture virtually guarantees that you will never have to worry about those lights for the life of the deck.

System Basics

Today's low-voltage lighting systems consist of three basic components. The first is the power supply, a low-voltage transformer that converts 120-volt AC power to 12-volt (or, for certain systems or situations, 24-volt) DC power. The second is the low-voltage wiring that connects the transformer to the lighting fixtures. And finally, there is the most visible part of the system: the LED light fixtures, which must be approved for use in wet locations.

When designing a lighting system, first decide how many light fixtures are wanted or needed and where they will be located. Drawing a simple diagram will go a long way when determining how much wire you will need and where you will need to run the wiring. But more importantly, you need to know the number of light fixtures in order to size the transformer.

Transformer. A simple rule of thumb when speccing the power supply for a system is to choose a transformer that has enough watts to power all the lights on the system. To figure this out, take the total watts of all the light fixtures and add them together. For example, if there are 25 lights total, with each light rated at 1 watt, you need a transformer that will power at least 25 watts. To be safe and provide a little reserve capacity, I'd use a minimum of a 50-watt transformer for this application. That's a small transformer, but this is a far lower power requirement than what is needed to drive older systems, in which even small incandescent or halogen fixtures with typical T5 wedge bulbs draw at least four watts and sometimes more than 10 watts for the same amount of lumens, or light output.

For safety, a transformer with a UL 1838 listing is limited to 15 volts output and 300 watts, which is plenty for most LED systems.

Figure 1. Most LED lighting systems can be powered by a 12-volt DC transformer, but some systems are designed to operate at 24 volts DC (A). This 24-volt DC unit has an external programmable photoelectric sensor (B).

I like to use transformers that have a photoelectric sensor, which gives you the option of activating the lights automatically when it gets dark enough. It also allows you to program how long the lights stay energized: from dusk to dawn, for four hours, for six hours, for eight hours, or off altogether. Transformer technology is improving all the time, and I expect to soon see ones that allow the loads to be split into multiple zones, which can then be controlled with a smartphone app and activated separately (**Figure 1**).

Make sure you consider your transformer location before installing it. Low-voltage lighting systems need a 120-volt power outlet for the transformer to plug into. If there isn't a GFCI line-voltage circuit nearby, you'll need to have an electrician install one. Also, if you put the transformer where it gets too much light at night from auxiliary lighting like outdoor flood lights or internal house lights, the photo-eye on the transformer may not activate the LED system. If this is the case, you may need to make a shield from some metal flashing to protect the photo-eye from receiving too much light.

Wiring. What makes low-voltage lighting so simple to install is the wiring, which consists of two wires that are usually bonded together as one in a waterproof, flexible direct-burial sheath (no conduit required). This cable comes in multiple gauges and can be split in half when necessary.

The size of wiring available in your region may vary depending on your weather conditions. Here in the mild Pacific Northwest, where 16-gauge and 12-gauge wire is widely available, I generally use 12-gauge wire. When I'm running more than 500 feet of cable (which is not common on a deck, though maybe more common when the system includes landscape lighting), I'll switch to even larger diameter 10-gauge cable for the supply lines to minimize voltage drop.

Most LED systems will operate fine on 12-gauge wire, with a single hook-up to the transformer. Some larger transformers have higher voltage poles to hook up wire to. For example, there might be 13.5-volt and 15-volt terminals on your

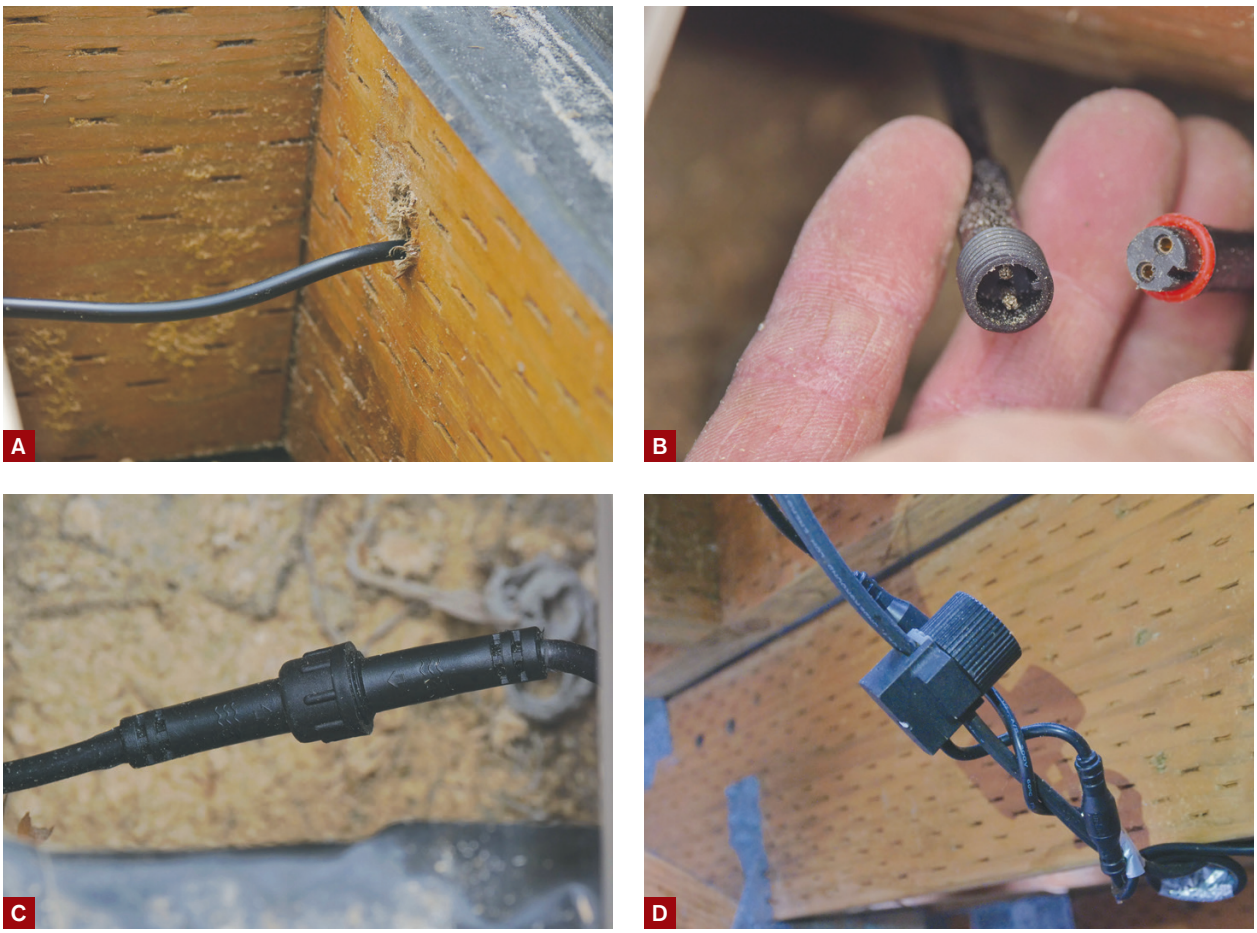

Figure 2. Low-voltage two-wire cable is UV-protected and weatherproof, so it doesn't have to be run in conduit (A). While there is no industry standard for fittings, companies like In-Lite offer high-quality waterproof cable connectors for extending lines (B, C), connecting fixtures to supply lines, and adding branch lines (D).

nominal 12-volt transformer. If you're not sure of the proper wiring configuration, consult the manufacturer in regards to wire thickness, length, and transformer size (**Figure 2**).

Fixtures

In general, I plan lighting so that it meets code, provides for task illumination, and—my favorite part—adds an element of pizzazz to the space, through a combination of decorative and accent lighting.

Code requirements. When there's a door leading out onto a deck that has access to grade, an exterior light controlled by an interior switch is required by code near the door. This is typically a line-voltage light fixture installed by an

Choosing Lighting Products

I've seen the low-voltage lighting market explode over the past 10 years, with product quality generally rising as competition has increased. Most of the major decking-products manufacturers have jumped into the lighting business, along with independent companies that specialize in outdoor lighting fixtures and accessories. Among my favorite products are the fixtures from In-Lite (in-lite.com) and Regal Ideas (regalideas.com) featured in this article. But there are inferior products on the market as well. How do I know? Because I've already done warranty replacements from installing a bargain light kit purchased off the internet to save a buck, and got burned. So be careful with those too-good-to-be-true online deals.

Some clients express an interest in solar, but I don't feel it is a long-term solution, and I don't care for the look of solar panels on top of every light. Besides their limited light output, the variety of fixtures is limited. For example, as far as I know, there are no small solar lights that can be installed in the face of a step or the edge of a deck, as shown in this article.

Figure 3. Measuring less than 1½ inches in diameter, small puck lights (A) are ideal for providing practical lighting in stair risers (B) and accent fascia lighting (C). When designing a system, be sure to provide task lighting to illuminate specific areas, such as dining tables and grills (D). Post-cap lighting adds both safety and style to outdoor areas (E, F).

electrician, but many clients like to coordinate the fixture style with the outdoor lighting package. At the same time, there needs to be at least one 120-volt GFCI-protected receptacle serving the deck.

General and task lighting. Grills, outdoor kitchens, and dining areas are among the spaces on a deck that require illumination. I put safety lighting—around stairs and other transitions, and near spas and hot tubs—in the same category. People need to be able to see what they're doing, but it's also a good idea not to overdo it with fixtures that are too bright. Separately-controlled circuits that can be dimmed are a good way to manage light levels in the various areas on a deck.

Decorative lighting. When considering the placement of decorative or accent lighting fixtures, you don't need to be traditional. I've seen many creative examples of lighting on floors of decks, up privacy walls, and under benches to create indirect lighting as well.

Decorative lighting can also serve a practical purpose. For example, I like to include multiple 1-inch round LED lights in my projects, using them on stairs and at transitions to highlight safe paths from upper to lower areas (**Figure 3**).

Once the transformer location and light-fixture locations have been determined and you know approximately how much wire will be needed, it's time to create a path from the transformer to each light location. Before installation, though, it's a good idea to test your light kit in place in the dark to make sure lights are spaced correctly and lighting levels are what you expect.

Installation

I pay a lot of attention to wire management, during and after installation. The

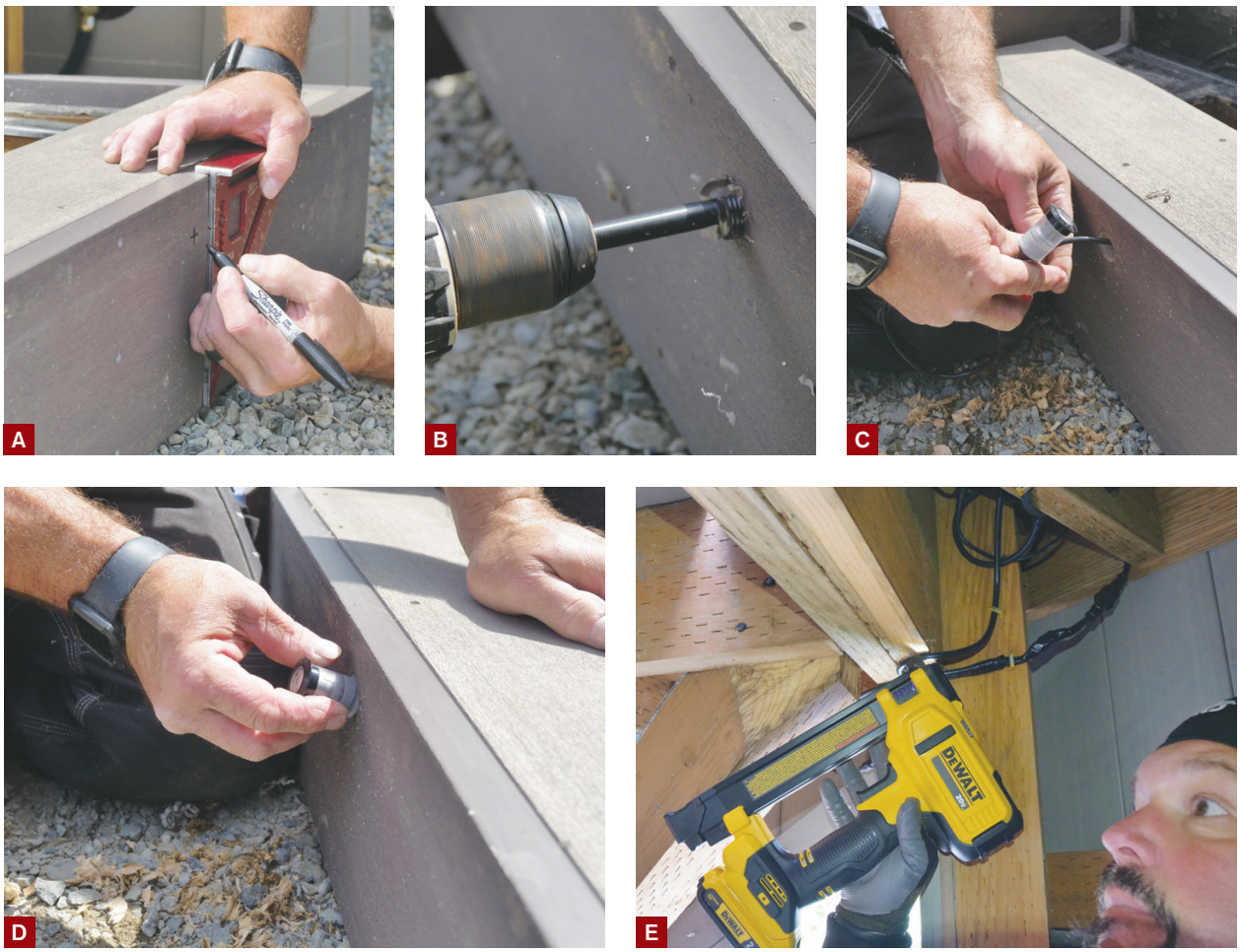

Figure 4. To install a puck light, the author lays out (A) and drills the proper diameter hole with a Forstner bit (B), which creates a clean hole in composite material. After connecting the fixture to supply wiring (C), he installs the fixture; friction holds it in place (D). A cordless stapler makes quick, neat work of running the wiring for the low-voltage system (E).

liberal use of cable zip ties and staples goes a long way toward keeping things looking tidy under the deck.

Cable staples can be tapped in manually, of course, but it's faster to use a staple gun. Arrow makes an inexpensive cable staple gun, the T-59, that looks similar to its standard T-50 stapler. Another option is DeWalt's new cordless cable staple gun, which I've just acquired. It runs on DeWalt's 20-volt platform and makes effortless and quick work of securing cable to the frame of a deck (**Figure 4**).

I start by connecting the cable to the transformer and testing each connection before I install the fixtures. This way, I can be certain each light works before installing it.

Low-voltage wire doesn't really have positive and negative sides, so if you cross over the polarity on every light, the lights will still work as long as you have a positive connection to each wire. The other cool thing about LED technology is that you only need to run one wire to make all the connections—you don't need to run multiple wires to make the lights emit the same amount of light. Everything is the same. The last light in the run will be the same brightness as the first as long as the transformer is rated for the proper amount of wattage to power the lights.

There are a number of ways to connect the lights to the power supply, depending on what is supplied to you from the manufacturer. My old way of hooking up lights was to either cut, splice, solder, and heat-shrink each connection, or to use heat-shrink crimp connectors and then heat-shrink over each set of connections. Both techniques are time consuming, but are better than twisting wires and using electrical tape.

For the past several years, however, I've been using In-Lite's cable and lighting system. Each light comes with a special connector that works with 12-gauge wire and larger. The connector has three stainless steel barbs in its base for each

Figure 5. One of the most striking lighting fixtures that the author has used on his projects is the CrystalRail system, from Regal Ideas, which consists of aluminum mounting brackets (A) with built-in LED lighting that connects to the deck's low-voltage system (B). The LED fixtures in the mounting bases illuminate tempered-glass panels that are part of the system, providing a dramatic nighttime look to the deck from all directions (C, D).

wire; the barbs pierce the wires to make a positive connection to both wires at the same time. Then dielectric grease encompasses each barb to ensure a long-term connection.

I like the In-Lite connectors because they provide a solid, positive connection that installs with minimal effort and doesn't compromise the integrity of the main wire—no splicing is required. The downside is they are slightly bulky, so plan to spend a couple of extra minutes organizing the connection points.

Beyond the Basics

If you want to create an amazing lighting experience on your client's deck, consider Regal Ideas CrystalRail. CrystalRail is a unique system in which special pods hold low-iron glass and emit light through it. At night, the glass glows blue, to incredible effect. Regal Ideas also sells traditional aluminum-framed glass systems that are lighted (**Figure 5**).

There are as many approaches to lighting up outdoor spaces as there are folks who build them. A good way to look for inspiration is by checking out what other builders are doing. On Instagram, see @infinitedecks for some alternative lighting for decks or @imaginedesignandbuild for complete landscape lighting solutions. Pinterest is another source for finding outdoor lighting inspiration. ❖

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