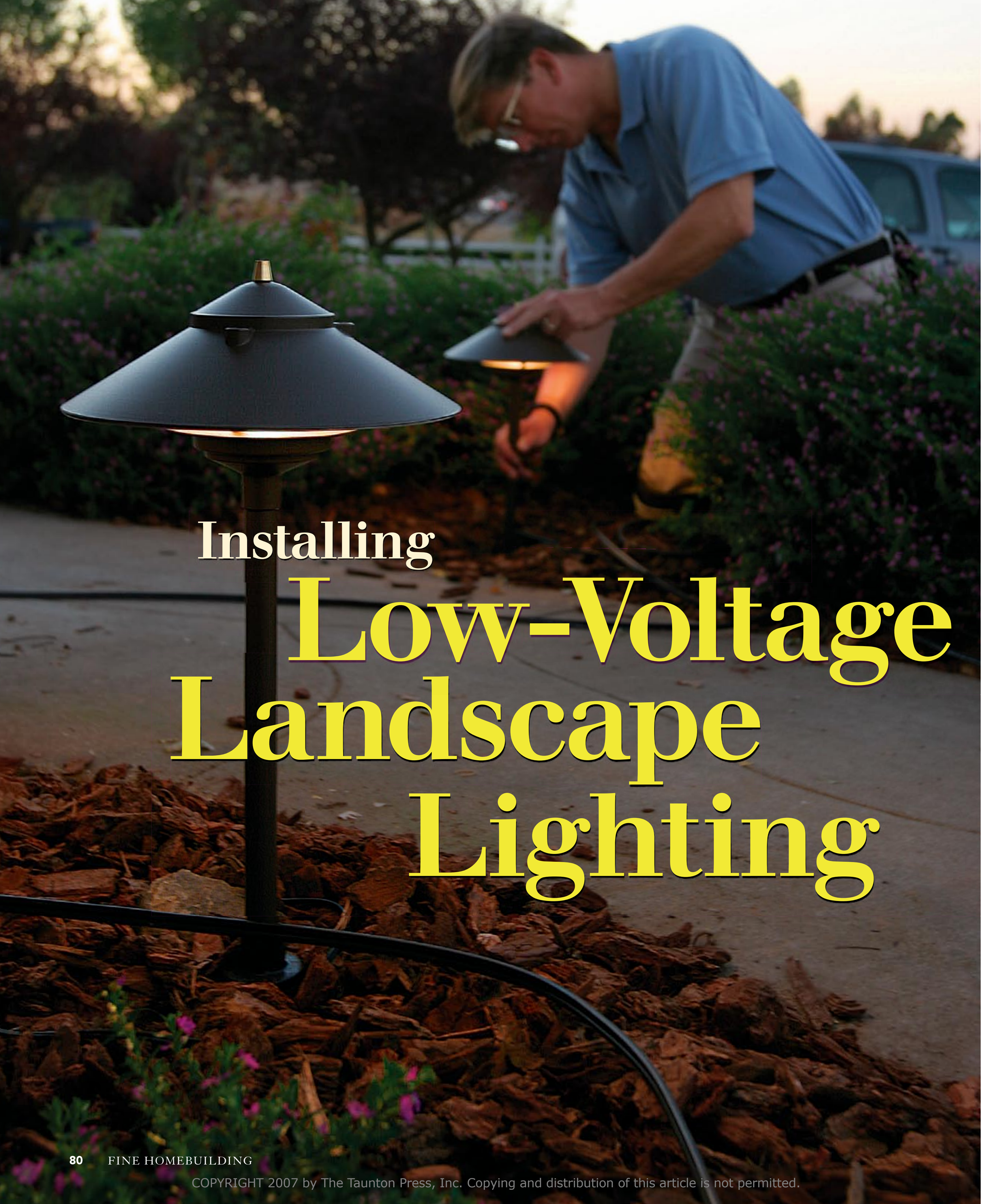


Installing Low-Voltage Landscape Lighting

Light show

All 12v lighting systems are safe, adaptable, and energy-efficient, but quality components and careful installation make the difference over the long haul

BY CLIFFORD A. POPEJOY

Landscape-lighting installation is easy—too easy, I think. Although the lighting might be sold as a foolproof product, I've removed more than a few systems that were wrecks, doomed from the start by poor hardware and inferior installations. If you invest in quality materials, choose durable fixtures, and take care during the installation process, your low-voltage system will look great, perform reliably, and be easy to modify.

Choose between line and low voltage

Landscape-lighting systems are divided into two types: line voltage and low voltage. Line-voltage systems operate at 120v, the same voltage found in a typical wall outlet. Low-voltage systems use a transformer to step down the voltage from 120v to a safer 12v.

As an electrician, I prefer to work with low-voltage landscape-lighting systems because they are a lot easier for me to install, and are safer and more flexible for homeowners to adjust and maintain on their own. Low-voltage cables are safe enough to be concealed with only a few inches of soil, mulch, or other ground cover. As a result, it's easy to move around light fixtures and wiring as the landscape matures or is altered.

Of course, low-voltage systems have some disadvantages as well. Because the transformer puts out a limited amount of power, you can't place dozens of lights on a low-voltage circuit. And although effective lighting can be accomplished with 10w, 15w, or 20w lamps, low-voltage setups don't lend themselves to high-wattage fixtures. Also, if long distances are involved—more than 100 ft. between the transformer and the farthest fixture—the wire's resistance can cause a significant reduction in the voltage reaching the distant fixtures. This line loss can leave the light from those lamps noticeably dim and yellowish. However, it's not hard to design and install a system to overcome voltage drop (sidebar, pp. 82-83).

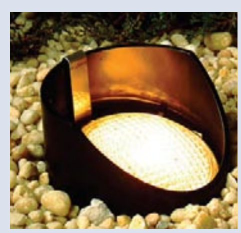
Lighting kits have limitations

Low-voltage lights often are sold in kits that include a transformer, cable, and several fixtures. Kit prices can be as low as $100, but you end up buying a system that can't be expanded or even altered

PATH LIGHTS
Designed to illuminate walkways and patios, these lights come in several varieties. Most have angled louvers or a domed top that throws light onto the path but shields the eyes from glare. $40-$180

ACCENT LIGHTS
These spotlights direct a narrow beam at a feature that deserves nighttime illumination. They're also useful for security lighting. Designed to be mounted on a tree, on a wall, or in the ground, accent lights can swivel and lock. $35-$150.

WALL WASHERS
This type of fixture works like a floodlight, projecting a broad expanse of light in one direction. Although often used to show off the texture, vegetation, or well-crafted detail on a wall, this type of fixture can provide security lighting as well. $50-$100.



WELL LIGHTS
Directing light upward, these fixtures have a can-shaped body designed to be buried fully or partially in the ground. $25-$65

DECK AND PATIO LIGHTS
There's great variety in this category. Many fixtures are designed to be installed on deck railings, mounting on posts or balusters. For patios, flush-mount fixtures are available that install like paver blocks. $30-$50.

Inset photos: Courtesy of eLights.com

easily. The minimal level of the lighting and the short life span of bargain light fixtures can be (excuse the pun) a real turnoff.

I buy my components separately: a high-quality transformer, 10-ga. cable (heavier duty than the 12-ga. cable that comes with many kits), well-made metal (not plastic) light fixtures, and good cable connectors (sidebar facing page). Although a premium low-voltage lighting package costs quite a bit more, you'll be able to power more lights, and you won't be limited by the fixtures that come with the kit. Instead, you can select fixtures from different manufacturers, getting exactly the features and styles you want. The fixtures I used in the project featured here are from Vista (www.vistapro.com).

Overcoming voltage drops

I've found that if the voltage reaching a low-voltage lamp falls below 11v, the output of the lamplight will be reduced, and the light will appear to be dim and yellowish in color. Quality transformers have outputs that are above 12v (usually 13v, 14v, and 15v). These outputs—called taps—allow the circuit to be fed with a voltage above 12v so that even after the voltage is reduced by the resistance in the electrical cable, the farthest fixture still will run above 11v.

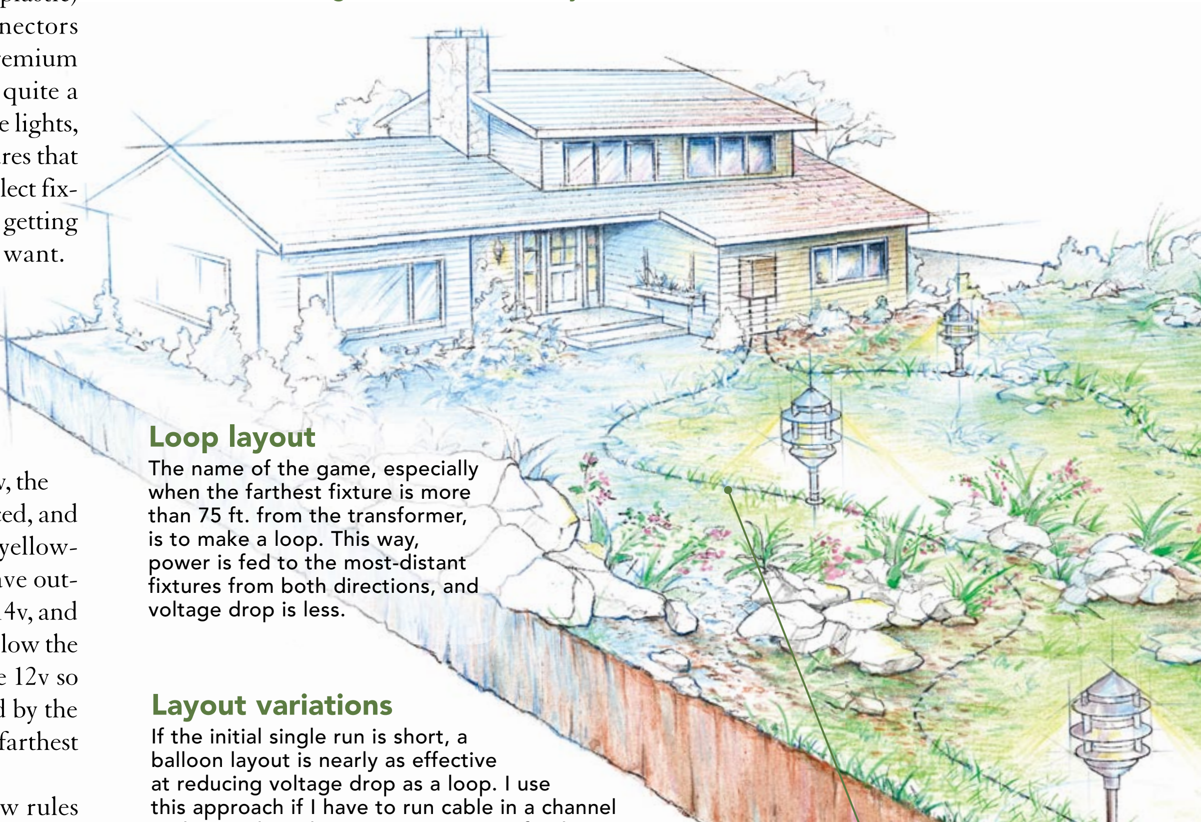
For setups like these, I follow a few rules of thumb: I keep the lamp load to about 70% of the rated transformer capacity, I upgrade to 10-ga. cable instead of the lighter, more-common 12-ga. cable, and I try hard to keep the cable length on individual circuits to 200 ft. or less. If the loop is between 125 ft. and 175 ft. long, I use a 13v tap; if the run has to be longer than 200 ft., a 14v or 15v tap is the best bet. Some transformers also have an 11v tap, perfect for circuits that are loaded lightly or have short cable runs. Running a lamp at a bit less than 12v extends its life considerably and is hardly noticeable in brightness or light color.

Cables typically are covered, not buried

Low-voltage cables can be left aboveground safely, but for appearance's sake, concealing the cables and the splices with some type of mulch or ground cover is a good idea. If the cables are run through an area where they are likely to be damaged by a garden shovel, an edger, or a lawn aerator, they should be buried about 6 in. deep. Otherwise, leave the

CHOOSING THE BEST LAYOUT

To determine the ideal circuit layout, first determine fixture locations. Group fixtures into 150w to 200w circuits that will be controlled together. If the distance from the transformer to the last fixture is 50 ft. or less and the first fixture is within 20 ft., you can use a straight run of cable. Any longer or more complicated than that, and I go with one of the layouts shown below.

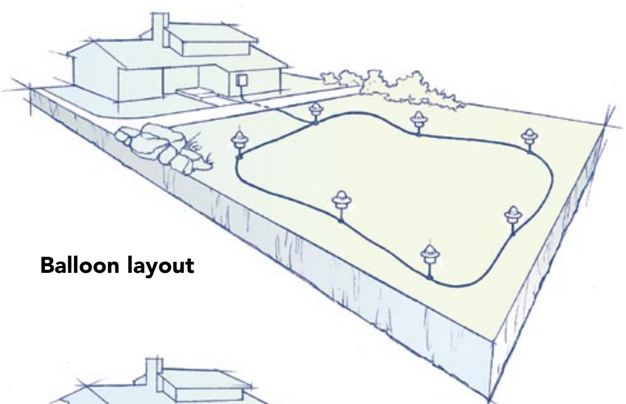


Loop layout

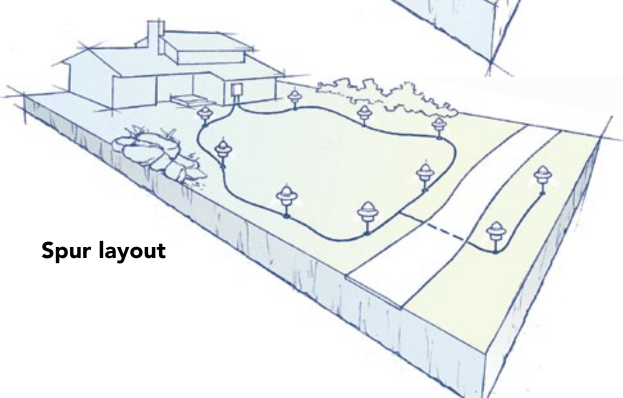
The name of the game, especially when the farthest fixture is more than 75 ft. from the transformer, is to make a loop. This way, power is fed to the most-distant fixtures from both directions, and voltage drop is less.

Layout variations

If the initial single run is short, a balloon layout is nearly as effective at reducing voltage drop as a loop. I use this approach if I have to run cable in a channel under an obstacle. A spur is a way to feed one or two fixtures off a loop, especially if there are obstacles on the far side of a loop layout.



Balloon layout



Spur layout

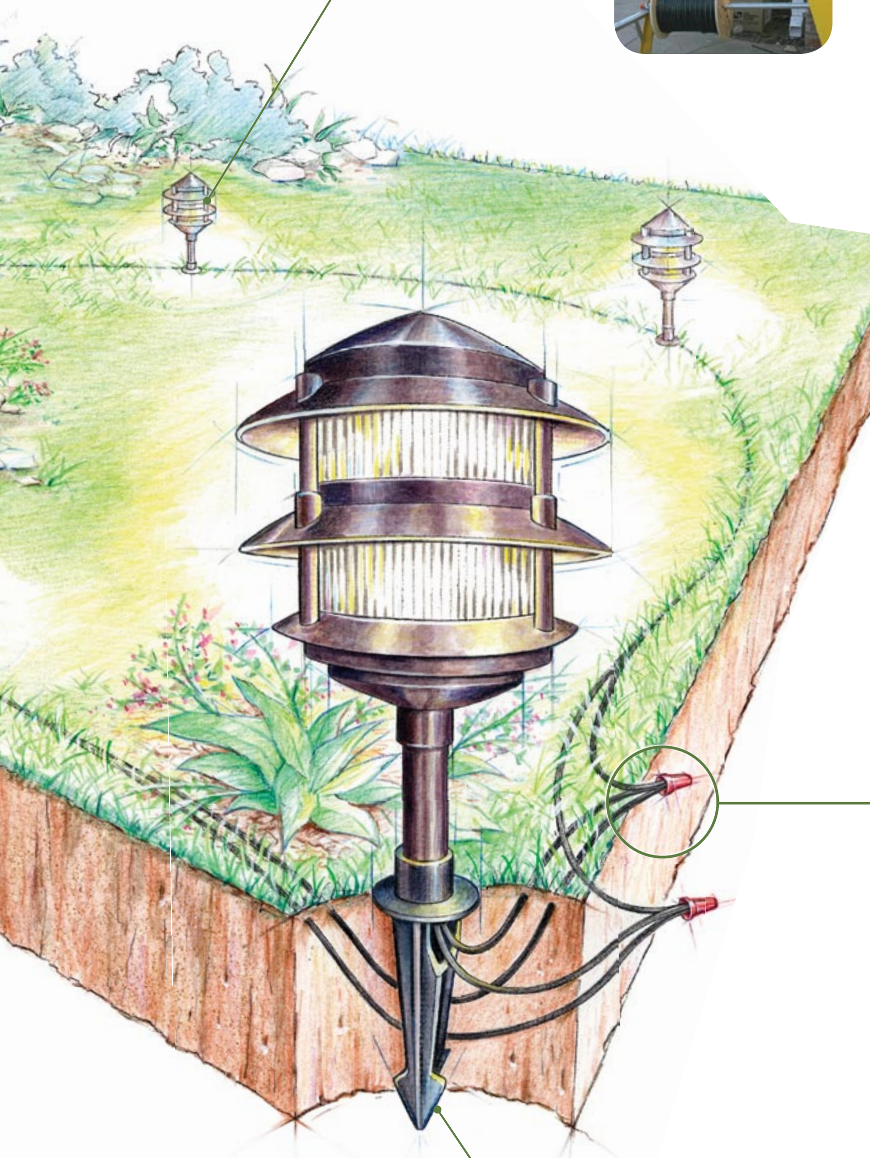
Cover the cable

To run cables across a lawn, use a square shovel to create a narrow trench along the grass; then simply lay the cable in the trench and tamp the grass around it. The grass soon will grow back and hide any signs of digging.

Drawings: Don Mannes. Product photos, bottom right, facing page: Krysta S. Doerfler.

Preview the final effect

To see how plans translate into reality, I place the light fixtures in their proposed positions. This step identifies weak spots in the lighting scheme and gets me familiar with the potential hurdles of each landscape. Once I'm satisfied with the layout, I run cable to each fixture, leaving enough slack to give me wiggle room for wire connections and final positioning. A piece of ½-in. pipe spanning the bottom rungs of a stepladder creates a perfect job-site cable reel.



Anchor the stakes

I use a hammer and a sacrificial scrap of wood to sink the stakes into the soil. The hammer makes quick work of even the toughest soil, while the wood helps protect the threads on the stakes. A 2-lb. rubber mallet also does the job.

Weatherproof the connections

Many manufacturers use connectors with sharp prongs that pierce the insulation of supply cable and tap into the live wire within. These connections are quick and easy, but the prongs aren't strong enough to pierce the thicker insulation of the 10-ga. cable that I prefer. That's why I typically use either a high-quality twist-on connector that I fill with siliconized latex caulk, special twist-on connectors made to be buried directly, or tubes filled with waterproof gel into which I insert splices made with regular wire nuts.

1. First, I split apart the two wires with a utility knife so that I have about 4 in. to 6 in. of length to work with.

2. Then I use the 10-ga. (stranded) hole in my wire strippers to remove about 1¼ in. of insulation.

3. Keep the polarity of the cable consistent: One of the wires will have longitudinal ribs. Keep them together.

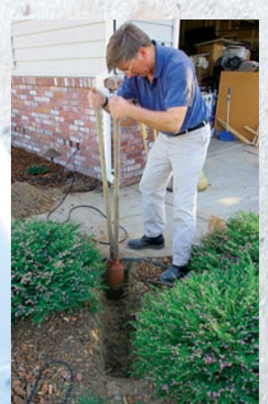
4. Then I twist together the wires with lineman's pliers, trim the end, and spin on a wire connector.

How to overcome obstacles

One common obstacle when running cable is a concrete walkway, driveway, or slab. If there's a control joint or an expansion joint in the right place, I sometimes open the joint with an angle grinder (and a diamond wheel) and tuck the cable in the groove. Then I fill the groove with concrete sealer.

One of the best ways to run cables under a patio, driveway, or in this case, a walkway, is to use a low-tech boring tool called a BorZit (800-803-8738; www.borzit.com). A conventional garden hose connects directly to the body of the BorZit and allows water to be run into the pipe and out the tip of the spinning bit to provide lubrication. Simply add more length to the pipe—using threaded connectors—until you reach the other side of the walk or driveway, then replace the bit with an eyebolt attachment to pull the cable back through the hole as you retract and disassemble the sections of the pipe.

The BorZit can handle moderately rocky soil, and because displaced earth is compacted around the bored hole rather than being washed out, this system doesn't create the same oversize openings and potential surface cracks that are associated with a typical water-jet system. Because the BorZit relies on water and electricity, make sure that the drill is plugged into a GFCI-protected circuit.



Water-powered drilling. *This $200 system requires the use of a heavy-duty ½-in. drill, which spins a special water-lubricated boring bit mounted on the end of one or more standard ¾-in. pipes.*

BUY THE BEST TRANSFORMER YOU CAN AFFORD

In a low-voltage system, a transformer steps down the voltage from 120v to between 12v and 15v. First, pick the fixtures you like, then buy the best transformer you can afford. You can use any 12v transformer with any 12v fixture, but I use only transformers that meet the UL 1838 standard, which incorporates several important safety features.

It's also not a bad idea to choose a transformer with room for expansion. For this project, I installed one unit with two 300w transformers—plenty of room to add more fixtures as the landscape changes and matures. A unit like the one shown here costs about $400 to $500, but it will offer 20 years or more of trouble-free service.

RULES OF THUMB

- Keep the overall lamp load (combined wattage of all lamps) to about 70% of the rated transformer capacity.
- If the circuit or loop is between 125 ft. and 175 ft. long, use a 13v tap; if it's longer than 200 ft., a 14v or 15v tap is the best bet.
- Most low-voltage transformers are intended and listed for outdoor use. If you plan to mount the transformer indoors, make sure you choose a model approved for that application.

cables near the surface, where they will be easier to move. As plants mature or as design tastes change, being able to uncover cable easily and move it are big advantages.

Of course, Murphy's Law says that there will be at least one spot where you want to run cable that is blocked by a walkway, a driveway, or a concrete slab. If there's a control joint or an expansion joint in the right place, I sometimes will open the joint by using an angle grinder equipped with a diamond wheel, then simply tuck the cable in the groove before resealing the joint with concrete sealer.

If there are no expansion joints to work with, often the only way to get past a wide slab or walkway is to go under it. One option is to drive a pipe through the soil, leave it in place, and run the cable through the pipe. It's an effective solution, but it involves lots of hard work. Plus, rocky soil can make this method nearly impossible.

It's easy and tempting to use a garden hose and needle nozzle to blast a hole under a walkway, but you need a way to get rid of the water and mud generated by this method, and it usually leaves a much bigger space than is needed for the cable. Plus, I've never found a really good way to backfill this type of tunneling, and leaving the underside of a wide and heavy surface unsupported can lead to large surface cracks and sinkholes. The best solution I've found is a low-tech, water-lubricated boring tool designed to avoid these common problems (sidebar facing page).

Maintenance ensures a long life

A good lighting system needs a little attention to keep working well. Burned-out lamps or damaged fixtures have to be replaced. In addition, recessed fixtures should be cleared of leaves and dirt at least once a month. As the landscape matures, fixtures might need to be relocated. This maintenance is fast and simple, and it keeps the landscape illuminated as nicely as when the system was new. □

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TROUBLESHOOTING TIPS FROM A PRO ELECTRICIAN

If you finish the installation, flip on the power, and nothing happens, don't lose hope. Although these systems are relatively easy to install, they aren't foolproof. Here's what the instruction manuals might not tell you.

Bottom photo: Clifford A. Popejoy

None of the lamps will light up

Start by checking the 120v supply voltage to the transformer. If that's normal, check the voltage at the tap terminals. If there is no voltage there, check the incoming power; the GFCI or primary protection breaker on the transformer might have tripped and might need to be reset. Consult the transformer manual to locate this breaker.

A single lamp won't light up

If just one lamp isn't lit, check to see if the fixture is getting power. Cut the power, remove the lamp, power up again, and check the fixture's resistance using a multimeter. If the multimeter shows a noninfinite resistance (which indicates a properly closed circuit), the lamp passes the test. If not, install a new lamp. If that still doesn't work, look at the socket for damage or corrosion (typically not a problem in new systems).

One lamp is out, but the supply cable has power

This problem usually indicates a bad splice from the fixture to the supply cable, or a wire that has been severed along the way. Often, signs of recent shovel or spade work are a good guide for finding a cut cable. If there are no obvious indications of damage and it's not a loop-layout circuit, find the last fixture in the circuit where there's power, and look for a break in the cable between there and the dead section of supply cable.

Lights go on and off

If the lights on a circuit go off, and after 20 to 30 minutes come back on for an extended period of time, the problem is an overloaded transformer. The internal secondary overload protector trips, shutting off the lights, then automatically resets itself and turns the lights back on after it cools down. If the circuit is overloaded with too many fixtures or too much wattage, split the circuit and add another transformer to redistribute the load.

Dim or yellowish light

Use a multimeter to check for voltage drop at the most-distant fixtures. To do this, I make a test probe (photo above) by pushing two sewing needles through a wine cork; I attach the alligator-clip leads from the multimeter to the needles. This tool allows me to pierce the insulation of the supply cable accurately. The voltage in the cable should be between 11v and 12v. Less, and the light will appear weak; more, and the lamps will burn out prematurely.