How to Choose and Install Motion Detector Lighting

Automatic night lighting when and where you need it

Motion detector lighting will calm your fears when it automatically lights up a dark garage, a dark sidewalk or even a dark area of your yard. Whether you're coming home at night, have to navigate a dark, icy sidewalk or wonder about strange noises in you back yard, you'll be safer when any nearby motion activates your outdoor lights and they switch on. Motion detector lighting is inexpensive and easy to install.

By the DIY experts of The Family Handyman Magazine:October 2000

TIME

One day

Allow about 2 hours to replace an outdoor light fixture with a motion detector fixture. Allow about a day if you have to run a new cable and install a new electrical box.

COMPLEXITY

Simple

Follow simple electrical wiring techniques to replace an existing fixture. Installing a fixture at a new location is more complex.

COST

$20 - $100

Two bulb detector prices start at about $25 and go up.

Step-by-Step

How motion detectors work

Motion detectors are small electronic eyes that detect infrared waves—heat waves that radiate from moving objects. When the detector senses an object moving across its field of view—especially warmer objects such as people, animals and cars—it electronically turns on the lights. The light stays on anywhere from 1 to 20 minutes, depending on how you preset the timer. Then the detector automatically shuts the light off unless it continues to sense movement. A photocell deactivates the light during daylight hours. Most motion detectors have a semicircular field of view of up to 240

degrees and a distance range, adjustable on most detectors, that extends to 70 ft. or more. The detector will react to the movement of your dog, an approaching person, a passing car or sometimes even wind-blown leaves.

Nuisance “trips,” such as blowing leaves or a passing car, can fool the detector and turn the lights on when you don’t want them. These can be annoying to both you and your neighbors, and in fact, some homeowners won’t install motion detector lights for this reason. However, you can solve most unwanted switching-on by adjusting the distance-range setting and by carefully aiming the sensor to limit its field of view. You can also narrow the field of view even more by applying tape to the sensor, as shown in Photo 7. If nuisance trips concern you, be sure to buy a light that has an adjustable distance/range setting, and an aimable detector unit as shown in Fig. A, Nos. 1 and 3.

Motion detectors allow you to operate the light in the conventional, manual way, usually by flipping the switch off for a second, then back on. This allows you to keep the light on at night when you want to, even when there’s no motion. By double flipping a second time, you return to automatic.

Motion detector and light styles

Figure A: Motion detector and light styles
There are many motion detector and light styles to choose from.

Where to put them

For best effectiveness, position motion detector sensors to cover the walks leading to your front and back doors and the driveway (see lead illustration). That way the lights will come on when you come home at night. You can also use them to light up decks, patios and any potentially hazardous locations such as around stairways and swimming pools.

If improved security is a priority, position the lights to cover all the approaches to your house, including fence gates, the patio door, the darker areas of your yard, and around trees and bushes. Good lighting can’t guarantee security, of course, but it’s one of the best low-cost ways to get unwanted intruders to back away.

Ideally, it’s best to mount motion detector lights 6 to 10 ft. above the ground and position them so that most movement will occur across the sensitivity zone rather than directly toward the detector. Obviously you can’t always do that if you use existing light locations. One solution is to buy a remote motion sensor unit that you can mount some distance away from the light itself (Fig. A, #3). The wires connecting them to the light are low-voltage and not dangerous, so you don’t have to enclose them in metal or plastic conduit.

How to install motion detector lights, step-by-step

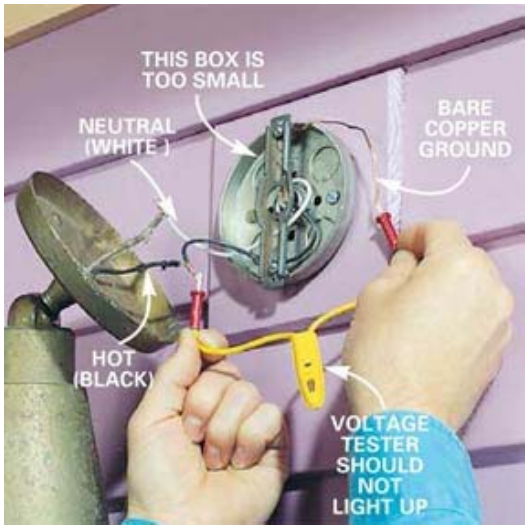

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Photo 1: Shut of the electricity

Turn off the power to the fixture at the main panel, then test the wires to make sure the current is off. Rub one lead of a voltage tester (from hardware stores or home centers) against the ground wire and rub the other lead first against the hot wire (black), then the neutral wire (white). If the tester lights up in either case, the power is still on. Shut off the correct circuit at the main panel.

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Photo 2: Install a larger box

Install a replacement electrical box if your existing box is too small (see “Size Requirements of Electrical Boxes”). Plastic boxes have the size in cubic inches stamped on them.

3 of 7

Photo 3: Wire the new fixture

Mount the light fixture according to the manufacturer's instructions. Run the wires through the rubber gasket. Then connect the neutral wires (white), hot wires (black) and ground wires (green or bare copper) with wire connectors.

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Photo 4: Mount the fixture

Screw the fixture into place. Make sure the rubber gasket seals the edges of the box so moisture can't get in. Apply a bead of clear silicone caulk around the edges if necessary.

5 of 7

Photo 5: Aim the sensor

Aim the motion detector at the field of view you want covered. (Later, you can aim the detector lower to reduce the field of view if nuisance trips are a problem.) Point the light bulbs to the area you want lit. Keep the bulbs as far away from the detector as possible.

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Photo 6: Set the controls

Set the detector's distance range as desired. You can also reduce this later, if necessary, to eliminate nuisance trips. Also set the timer shutoff control. On most units you can choose automatic shutoff after either 1, 5 or 20 minutes.

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Photo 7: Limit the field of view

Cover a portion of the detector lens with plastic tape if it becomes necessary to narrow its side-to-side field of view more than the adjustments will allow.

Motion detector lights are easy to install, but each brand has a few different details, so read the instructions. You'll find the basic information printed on the outside of the box. Read the box before you buy the unit so you know what you're getting. You'll find more detailed instructions inside the box.

Our step-by-step photos and tips from our experts provide a general guide of how to do the job. In most cases, you'll simply replace an existing fixture with the new one, as our photos show. Make sure to turn off the power to the fixture at the main panel before removing it.

However, if you have to run a new electrical line and install a switch, the job can get much more complex. Outdoor electrical lines must be encased in approved conduit and weatherproof electrical boxes. If you're not familiar with conduit or the rules for running new electrical circuits, call in a licensed electrician.

Working with old electrical boxes can be tricky too. Sometimes they don't contain a ground wire (bare wire or one with green insulation) or other grounding means such as

metal conduit. The National Electrical Code requires all electrical boxes and fixtures to be grounded. If you're not sure yours is, check with your electrical inspector to determine if you have to run a new ground wire.

Additional installation tips:

- The cover of an outdoor electrical box must be waterproof. Seat the rubber gasket carefully (Photo 4). And if you are placing it against a rough surface, caulk it as well.
- Moisture can seep into the detector and light sockets and ruin them. To prevent this, either locate the fixture under an eave or other protected area or buy one that has bulb seals (Photo 5) and angle the bulbs downward so water can't run into the socket.
- Heat from the light bulb itself can confuse the detector. Keep the bulb and detector as far apart as possible (Photo 5).
- Adjust the field-of-view angle and set the distance range of your motion detector to avoid nuisance trips from normal passing traffic, animals, pools of water, air conditioners, heating vents and wind-blown trees and shrubs (Photos 5 – 7).

Get an electrical permit from your local department of inspections. Check for special local rules and have your work inspected when finished.

CAUTION:Don't let your ladder or your body touch lethal overhead power lines while you're working.

CAUTION: Aluminum wiring requires special handling. If you have aluminum wiring, call in a licensed pro who's certified to work with it. This wiring is dull gray, not the dull orange that's characteristic of copper.

Size requirements of electrical boxes

You also need to check out the size of your electrical box. A shallow box like the one shown in Photo 1 no longer meets code requirements, and we had to replace it with a larger box, shown in Photos 2 and 3.

The computation table gives the method for calculating minimum box-size requirements. To do the calculation, count the number of wires coming into the box. However, some other things besides wires are counted as "wires" for computation purposes. For example, all the cable clamps used count for one wire, and we recommend always counting the fixture as two wires. Then multiply this total wire number by 2 cu. in. for 14-gauge wire (or 2.25 cu. in. for 12-gauge wire, even if there's just one of the heavier wires in the box).

The computation method given here sometimes overestimates the minimum box size required by code, but it simplifies the calculation.

Tools & Materials List

Required Tools for this Project

Have the necessary tools for this DIY project lined up before you start—you'll save time and frustration.

- 4-in-1 screwdriver
- Voltage tester
- Wire stripper/cutter

Required Materials for this Project

Avoid last-minute shopping trips by having all your materials ready ahead of time. Here's a list.

Motion detector light
Electrical box, remodeling type
Wire connectors
Clear silicone caulk
Electricians tape, plastic