

Problem-Solving

This collection of cleverly designed boxes can get you out

BY GEORGE SOCARIS

When I started in the electrical business 30 years ago, only a few types of electrical boxes were available, most of them the same shape, just different sizes. Installing new electrical fixtures in older homes and accommodating untimely modifications in new construction demanded a lot of head-scratching and plenty of messy, difficult work with a reciprocating saw and other tools. Cramped spaces, absent framing members, varying wall thicknesses, and indecisive homeowners are just a few of the factors that made me wish for innovative solutions.

Legions of frustrated electricians are probably responsible for the boxes shown here. Today, I'm grateful for the time and trouble I can save if I have the right selection of boxes on hand. Among the many different types of boxes that are currently available, the ones featured here are my favorites, mainly because of how frequently they help me to solve problems quickly and cleanly.

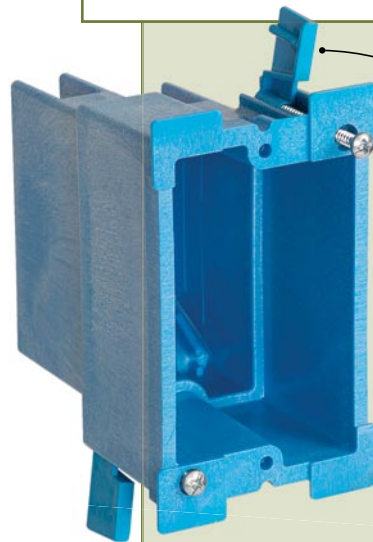
George Socaris is a licensed electrician and professional firefighter in Albany, N.Y. Photos by Krysta S. Doerfler.

PROBLEM: Installing new boxes in old walls

Snaking wires is tough, but retrofitting electrical boxes runs a close second, especially when space is tight and framing isn't in the right location.

SOLUTION: Old-work boxes that mount with tabs, brackets, and toe screws

If you can cut an accurately sized hole, these boxes retrofit easily in drywall, plaster, paneling, and cabinets. The ones shown here are single gang (i.e., designed for one switch or receptacle), but most come in multiple-gang form as well.



The rear tab flips up and pulls tight behind the drywall as the screw is turned.

An old-work box is secured within an opening in the drywall using screws and mounting tabs

Once the opening is cut, insert the box, and turn the mounting screws with a screwdriver or a drill until the tabs tighten to the back of the drywall.

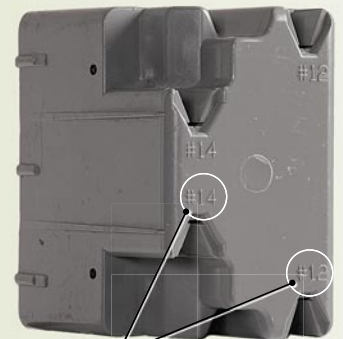
Front tabs at box corners rest on the finished wall surface.



Toe screws are built in for easy installation

Cut a hole in the wall at the edge of a stud, and this box goes in easily. Because the box is easy to move, it's also a great choice in new construction when homeowners are indecisive about fixture locations.

One side of the box is reinforced and has holes for toe screws.



Bring 14-ga. wire into the box on the shallow side and 12 ga. in on the deeper side where there's more room.

Nonmetallic sheathed cable usually goes in a nonmetallic box. The nonmetallic boxes shown throughout this article are for use with nonmetallic cable (shown below), commonly referred to by the brand name Romex. Nonmetallic cable also can be used in a metal box equipped with the proper clamps. Many boxes are available in both metallic and nonmetallic versions.

Electrical Boxes

of trouble quickly during rough-ins or retrofits

A shallow-depth box gains space with a side compartment

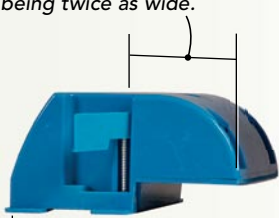
Cut an opening for a single-gang box, and bring wires into the box through the side compartment. Replace the access panel, and tuck the box into the wall opening. Flip-out tabs pull the box tight to the wall.

Corner tabs rest on the finished wall.

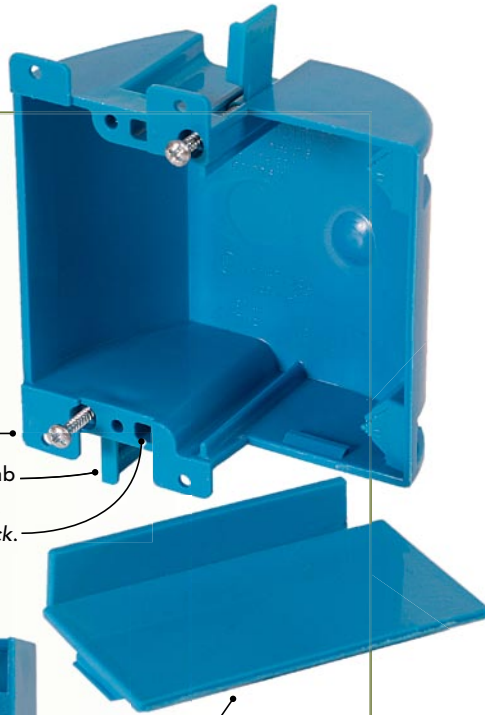
Flip-out tab

Insert a narrow screwdriver to move tabs when they get stuck.

Shallower than a regular box (right), this box achieves nearly the same volume by being twice as wide.



Wall opening



Removable panel provides access to wires during installation.

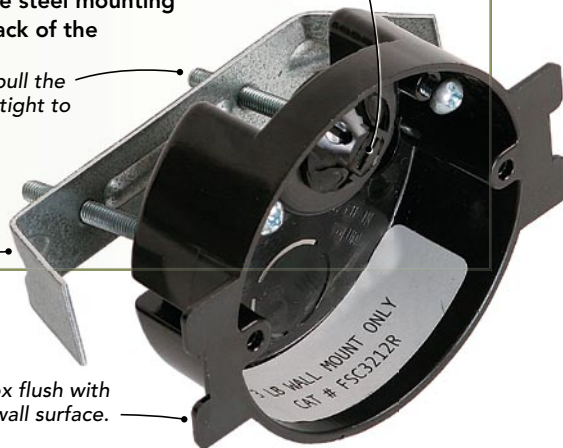
A shallow-depth scone box doesn't mount to framing

This box is ideal when mounting lightweight lights on the wall above a sink where you're likely to encounter a vent pipe. Run wire long in the stud bay, and cut a round hole in the wall. Then pull out the wire, and install it in the box. Insert the box in the opening, and turn the screws until the steel mounting bracket pulls tight to the back of the drywall.

Screws pull the bracket tight to drywall.

A steel mounting bracket grabs the back of the drywall.

Tabs keep box flush with the finished wall surface.



NM-cable connector secures wire inside the box.

Metal-sheathed wire requires a metal box

When working in old houses, I often encounter old metal-sheathed wire called BX (armored) cable. BX cable is used exclusively in metal boxes because its sheathing acts as the ground. A special clamp secures the cable to the box and engages the metallic sheathing, grounding the box and the cable. A new version of armored cable, called MC (metal clad) cable, also must be installed in a metal box. MC cable is secured in a box with a special clamp, but the box is grounded by a separate green grounding wire that attaches to a screw inside the box. MC cable is most common in commercial applications, but it is used often in residential retrofits when adding wire in a box that already contains BX cable. Non-metallic cable can be used in a metal box that contains either BX or MC cable. However, the proper clamps must be used to secure the NM cable in the box, and the uninsulated ground wire must be attached to it with a grounding screw.

The aluminum wire found in older BX cable is wrapped around the metal sheathing. The clamp secures the wire and grounds the metal box.



Like NM cable, newer MC cable includes a separate ground that is secured directly to the metal box with a grounding screw.

PROBLEM: Changing wall thickness creates a code violation

The International Residential Code (IRC) requires that box openings come within ¼ in. of a finished wall surface, depending on the type of finished surface. A tile backsplash, wainscot paneling, or baseboard adds significant depth to wall thickness.

SOLUTION: Adjustable-depth boxes and box extensions bring box openings flush with finished wall surfaces

Using adjustable boxes when framing is exposed is the best approach. But box extensions are the right fix when the boxes already are installed and the drywall is up. These boxes come in multiple-gang versions as well.

A box extension is used when wall thickness changes around an existing box

The extension sits on top of the finished wall surface and slides inside the existing box. The outlet or switch is secured directly to the existing box using long screws.

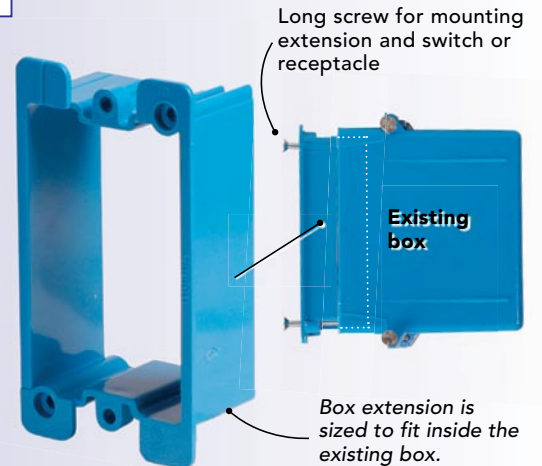
Add nails or screws to rear tabs to keep mounting plate from twisting.

Ears help the mounting plate clip studs or grab onto 2x framing.

An adjustable-depth box needs to be secured to a stud before the drywall is installed

It is perfect for roughing in tiled or mirrored backsplashes, or for running outlets in baseboards.

Turn the screw to move the box in or out.



PROBLEM: Fan location lands right on a ceiling joist

For layout and design reasons, fans and other ceiling-mounted fixtures often end up in the path of a ceiling joist.

SOLUTION: Boxes designed to be secured directly to joists

Modifying the framing or installing shallow-depth boxes used to be the solution, but the boxes shown here offer a less invasive approach.

Saddle design allows wire to enter box from both sides of joist.

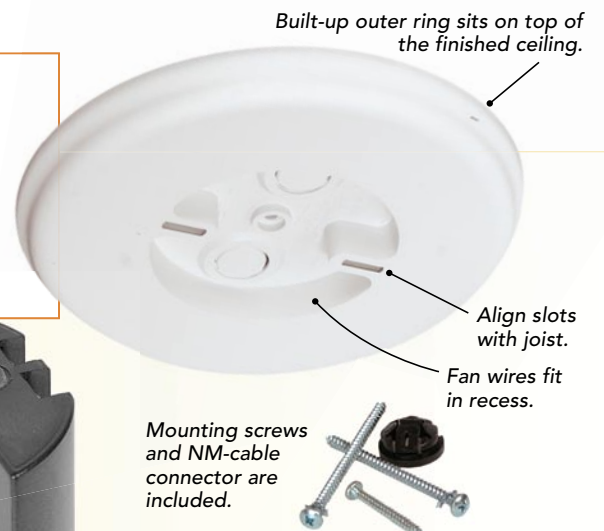
A low-profile fan box with side wire compartments fastens to a ceiling joist

The box slips into an accurately cut opening in the ceiling and installs flush with drywall. The side compartments provide added volume for wires.

Single-leg design

The depth of the round section matches the drywall thickness.

Box and fixture-mounting screws come taped in the box, so they're handy when the fixture is ready to be installed.



A flush-mounting plate fastens directly to a ceiling joist on top of the drywall, eliminating the need for a box

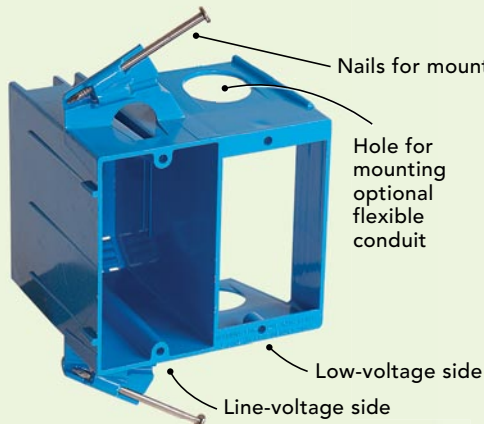
The plate becomes a finished part of a fan or chandelier's canopy. It also can work as an extension over existing ceiling boxes. Run wire through a hole in the finished ceiling, and insert it through a knockout in the plate. Secure the wire to the plate using the NM-cable connector provided.

PROBLEM: Adding telephone, Internet, cable, and speaker wire near outlets and switches

Low-voltage lines usually need to be installed near standard line voltage that feeds switches and receptacles, but the two wiring types must be kept separate.

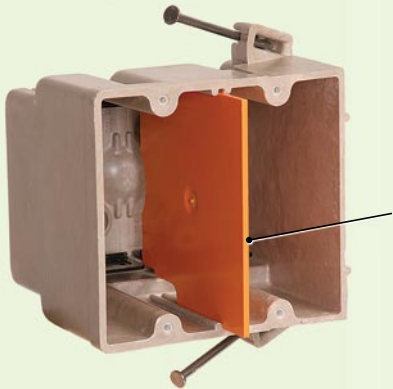
SOLUTION: Boxes and brackets that secure cover plates but keep wires separate

Two types of dual-voltage boxes are useful to have on hand, as well as dedicated low-voltage boxes suitable for new construction and retrofits.



A line-voltage box with a low-voltage side bracket

These boxes are used most commonly for outlet/cable and outlet/Internet combinations. Either combination can be housed under the same plate.

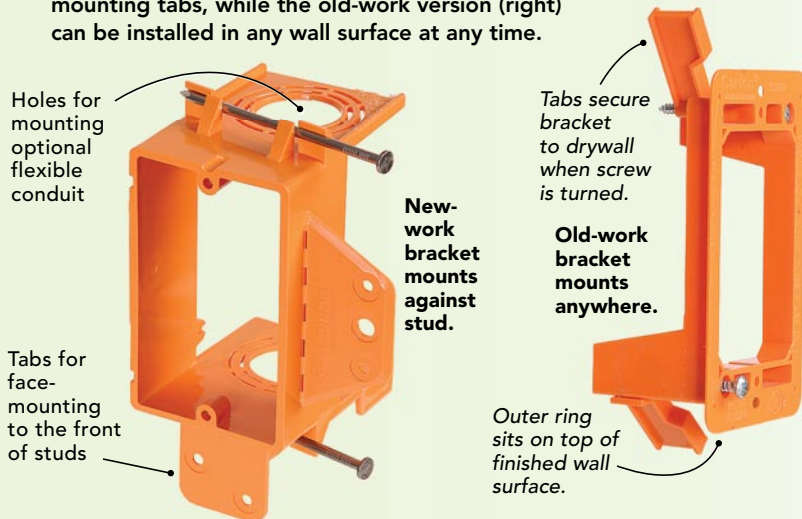


In this box, line- and low-voltage wires can be housed in either side, or the box can be used with all line-voltage wire at a later date.

Removable divider plate keeps line and low voltage separate within the same box.

A low-voltage mounting bracket is the simplest solution for securing low-voltage cover plates to a wall

The new-work version (left) can be mounted to a stud using nails or mounting tabs, while the old-work version (right) can be installed in any wall surface at any time.



Don't overstuff the box

Just because wires fit into a box doesn't mean they're in there safely. Overstuffing a box with too many wires might not seem like a big deal, but it's actually a significant safety concern. Live wires generate heat, and that heat needs airspace to dissipate effectively. When there isn't enough "free air" to allow the wires to cool, they can overheat and cause a fire. To keep this from happening, each box comes with a volume rating stamped inside (inset photo, above). That number refers to the maximum amount of space within the box that wires and devices like outlets or switches can occupy.

Each 12/2 conductor occupies 2.25 cu. in.

Combined grounds occupy 2.25 cu. in.

The receptacle occupies 4.5 cu. in.

There is a formula to calculate how much volume wires and devices occupy, but the equation can become tricky quickly. Refer to section E3805.12 in the IRC for specific instructions, or see *FHB* #144, p. 79. In the example to the left, the wires and outlet add up to 15.75 cu. in., which is less than the 20.3-cu.-in. volume rating for this box.