

A BOOST IN SAFETY AND CONVENIENCE

Think about how you work, then plan to have ample power exactly where you need it. The right array of circuits, switches, and outlets makes the shop more pleasant to work in, and a few key accessories complete the picture.

Heat detector wired to system

Lights should have their own circuit.

Remote starter is connected to dust collector.

Wall switch for the air cleaner

A power strip provides plenty of workbench outlets.

Make sure there are enough wall outlets.

Remote starter for dust collector

Dedicated outlet serves the dust collector and air compressor.

Floor-mounted outlet provides power to the center of the room.

Wiring a Workshop

Plan smart, and you'll know what to tell the electrician

BY CLIFFORD A. POPEJOY

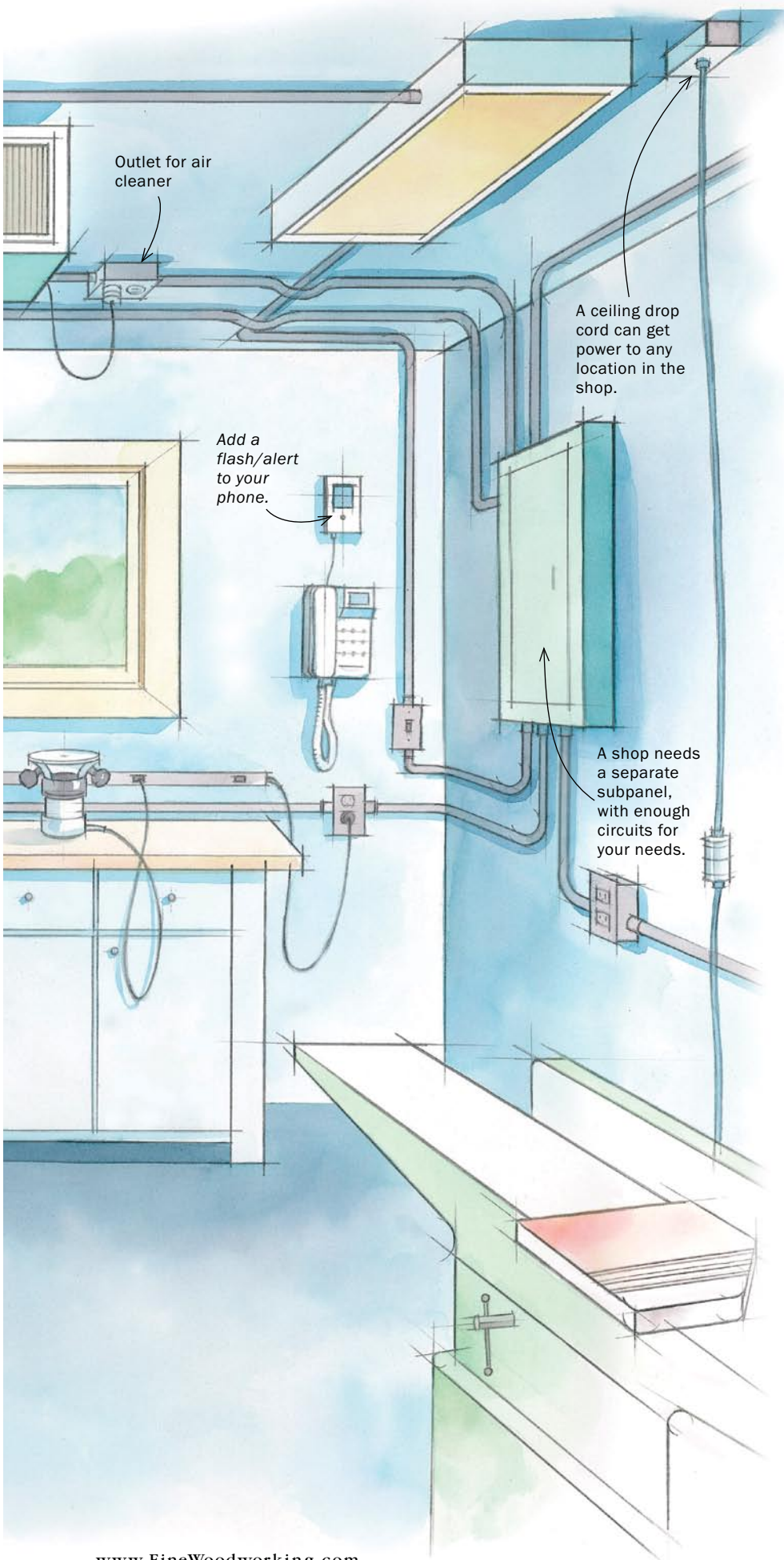
The electrical wiring, outlets, and lighting in your shop should be as specialized as your tools. It's hard to turn out high-quality work—or to work safely—in a poorly illuminated shop. It is equally frustrating and potentially dangerous if your tools keep tripping breakers on underpowered circuits or if your floor is a tangle of extension cords. To upgrade your workspace to meet the special needs of woodworking, you should know how to identify your needs and then communicate them to an electrician with the skills to turn your plan into reality. If you put these ideas to use, your woodworking will be safer and more satisfying.

Shop features dictate the wiring layout

Installing the wiring for a woodshop is done most easily during construction or remodeling with the walls open, but it can be done anytime. If the walls are closed in, either have the wiring run in surface-mounted conduit or hire an “old work” electrician who can run wires in existing walls and make a minimum of holes to be patched later.

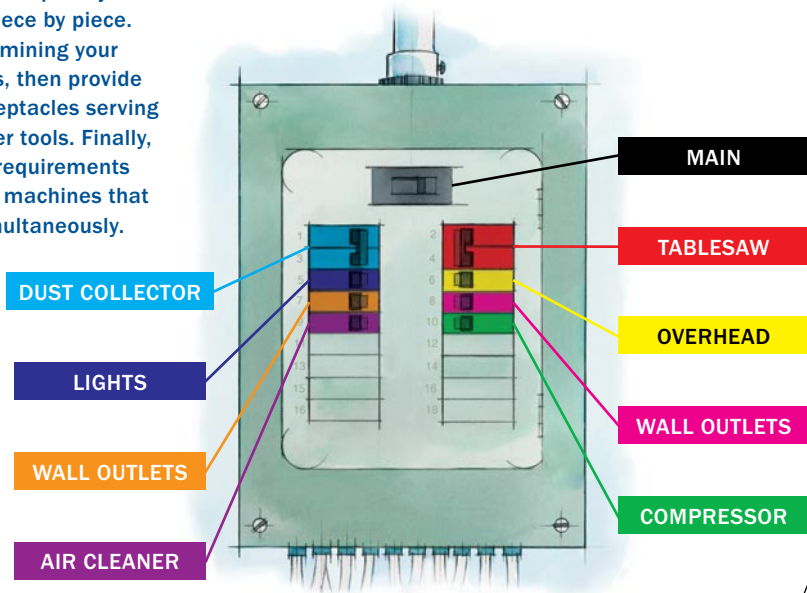
To feed the shop circuits, the best approach is to install an electrical subpanel (breaker box) specifically for the shop. In a well-designed system a breaker will rarely trip, but if it does, it helps to have the panel nearby. There's a wide range of subpanels available, and your choice will depend on how much power and how many circuits you need.

At any given time, most one-person shops will be running one major stationary tool, a dust

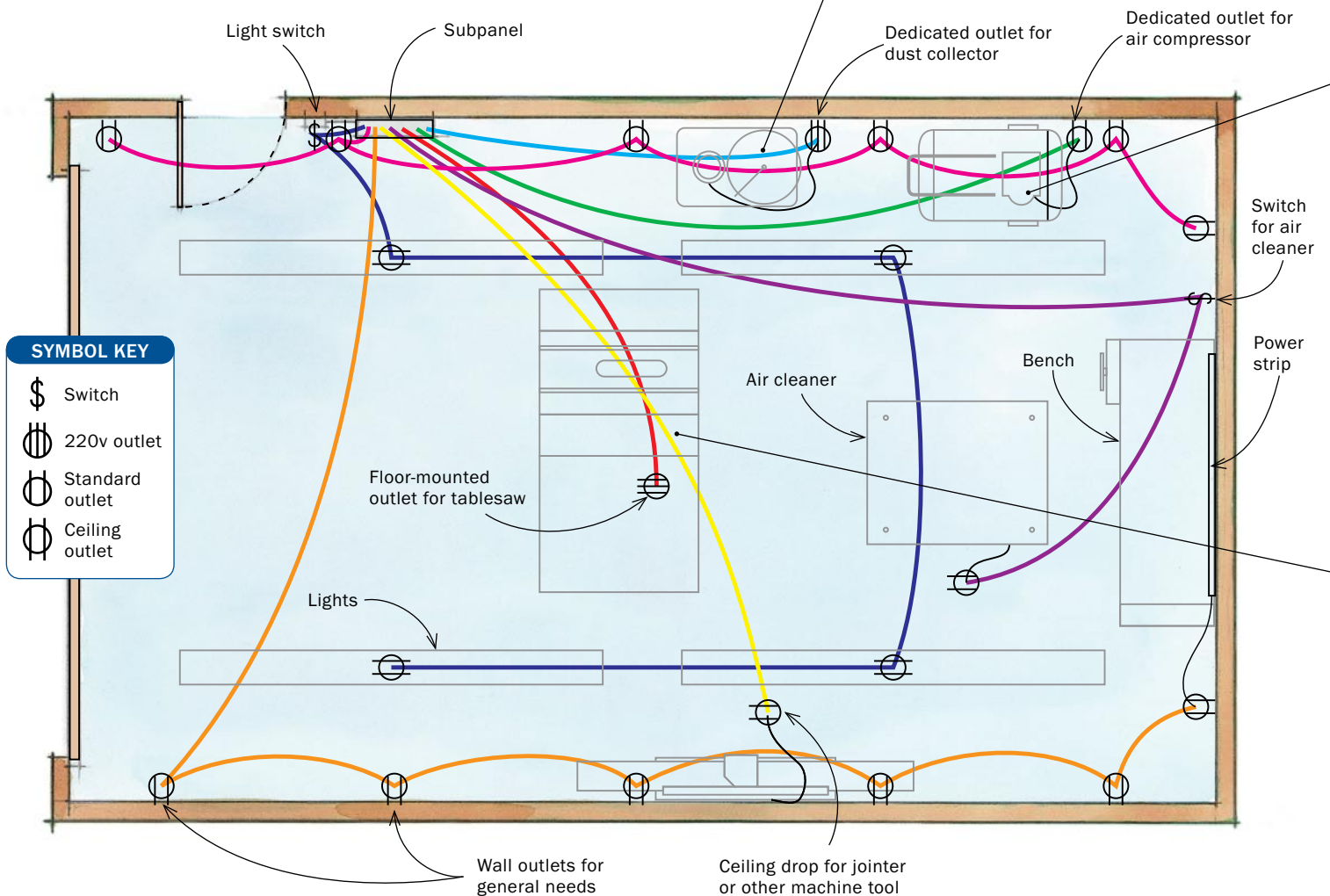


Plan circuit by circuit

Designing the wiring for your shop is pretty simple if you approach it piece by piece. Start by determining your lighting needs, then provide power for receptacles serving portable power tools. Finally, work out the requirements for stationary machines that might run simultaneously.



Dust collector needs dedicated power. Check the voltage that the dust collector motor runs on, and wire a separate circuit for it.



collector, an air filtration system, and lights. In this case, 60 amps at 240/120v likely will provide enough power. If there's heating or air conditioning running as well, a 100-amp subpanel probably will be adequate. I suggest a panel with room for 16 or 20 circuit breakers. These are starting points. Because each shop is different, you should calculate the number of circuits and power needs of your own.



Consider a separate circuit for the compressor. By running your air compressor on its own circuit, you avoid the possibility that it will trip a circuit breaker when another tool is used.

There are two interdependent aspects to wiring a shop. One is circuit design—how the various things that use power (called “loads”) are arranged and grouped, and how they are connected to their electricity source through wiring and circuit breakers. The other is the choice and location of light fixtures, receptacles, and switches.

Let there be light (on its own circuit)

Depending on the size of the shop, you should have one or more 120v, 15-amp circuits dedicated to lighting. That way if you are ripping a board and your table saw trips a breaker, you won't be plunged into darkness and into a dangerous situation.

To compute how many lighting circuits you will need, add up the total wattage of the lights and provide one 15-amp lighting circuit for every 1,500 watts. This is based on loading each circuit to about 80% of its capacity. This cushion, though not required in noncommercial applications, is still a good idea.

For example, to provide lighting for a single-car garage-size shop (240 sq. ft.) with 96-in., high-output (HO) fluorescent lights, you would need four separate 2-lamp fixtures. Each 8-ft. lamp requires 110 watts, so you would need a total of 880 watts to light this shop. Consider installing some task lighting (say a track fixture with three, 65-watt floodlamps or equivalent fluorescent floods) as well. I'd put this lighting on one 15-amp circuit.

Consider setting up the lighting so that the general lighting fixtures are wired to two or more separate switches, with the task lights switched separately from the general lighting. This way, if your machine and bench areas are separate, you can save energy by illuminating only the area in which you're working. (For more information on how to select and install shop lights, see “Lighting for the Workshop,” *FWW* #154, pp. 56-61.)

Outlets: the more the better

It's a fact that a shop can never have too many clamps, and it's equally true that it can't have too many receptacles. Receptacles should go on 20-amp circuits. There's no limit set by the National Electrical Code (NEC) for the number of outlets that can go on a circuit in a residential application. For a shop, it makes sense to identify the loads you expect to operate at the same time and group the receptacles onto circuits so that each circuit can comfortably support the expected demand. A 120v, 20-amp circuit can provide 2,400 watts, although it's a good idea to keep the load to 80% or less, or about 1,900 watts. To figure out how many circuits are needed, look at the power needed as shown on the tool nameplate (some nameplates will specify watts, and some amps). If the tool specs give amps only, convert from amps to watts for a 120v tool by multiplying amps times 120. For instance, if you have a small air compressor that draws 13 amps (1,560 watts), put in a receptacle supplied by its own 20-amp circuit, called a “dedicated” circuit. For outlets that won't be supplying a specific tool, as in an area like an assembly bench where you will be using various small power tools, I suggest three or four outlets on a 20-amp circuit.

The NEC requires ground fault circuit interrupter (GFCI) protection for any 15-amp or 20-amp branch circuits supplying a garage or other work area at grade level. You can meet this requirement by using a GFCI circuit breaker or by having a GFCI receptacle first in line and wired to protect the downstream receptacles.

For general-use outlets, like the ones used for routers, hand sanders, and corded drills, it is a good idea to set up circuits based on the area served. For example, you might set up a separate circuit for each wall. Or you may want a couple of 20-amp circuits to serve your workbench, where



Cabinet saws have special needs. Create a separate 220v circuit, and run it to a floor outlet in the center of the shop.

Get the power where you need it



CEILING

One way to avoid having power cords strewn about your shop floor is to use a ceiling-mounted drop cord. This brings power to the middle of your shop in a convenient and safe way. Just roll out the tool of choice and plug away.

FLOOR



Another way to bring power to the middle of your shop is to use a monument-style receptacle. This type avoids the problems of a flush-mounted receptacle, which include dust clogging and possible shorts from metal objects.



Workbench power. A Plugmold power strip gives you a convenient place to plug in power tools that are used often at your workbench.

you might have three or four outlets on each circuit. A neat trick is to run two circuits along the wall and feed alternating receptacles from the two different circuits. Don't use a shared neutral circuit for this; you have to GFCI-protect the outlets, and keeping the two circuits completely separate makes this easier.

A product called Plugmold (www.wiremold.com) is useful for providing workbench power. It is a steel channel with outlets spaced at intervals. Plugmold stands about 1¼ in. wide and above the surface and is available in various receptacle spacings (12 in. is best for shop use). Plugmold is much sturdier than a typical cord-connected "power strip" and is the right way to pack a lot of outlets along a wall.

It's a good idea to place wall outlets 50 in. above the floor (to the bottom of the box). That way if you lean sheet goods against the wall, they won't cover the outlets. And the outlets will be well above any benchtop or other worksurface. Another nice setup is to set aside a shelf area for cordless-tool chargers, and put a 3-plus-ft. strip of Plugmold with 6-in. receptacle spacing on the wall behind the shelf. Put this on a separate 20-amp circuit, so you can leave it powered up while turning the other receptacle circuits

off at the breakers for safety when you're not in the shop.

Get plenty of juice to stationary tools

The big guns—stationary tablesaw, jointer, planer, dust collector—draw so much power that they each require their own circuit. (Without it, running two simultaneously will trip a breaker.) If the motor can be set up to run on 240v, have an electrician do it. It will probably require taking the motor out of the machine. There's no power efficiency advantage to running a machine at 240v vs. 120v in a single-phase system, but the higher voltage means lower amperage, and as a result, you can use smaller-gauge power-supply wiring. That translates into less expense to run the wire and to hook it up.

To figure out what size circuits you will need, check the amp rating on each tool's data plate or in its product manual. Keep in mind that the circuit breaker at the sub-panel is designed to protect the building's wiring from an overcurrent condition—it does not, however, ensure that the machine's motor won't overload. If the motor does not have an internal circuit breaker for overload protection (the tool manual will indicate this), a fused disconnect may be required. Ask the electrician to install it.

The fuses in the disconnect box will protect the motor windings from overheating.

Some tools are an island—Getting power to a machine in the middle of the floor can be a challenge. You don't want a cord running along the floor that you might trip over. If there's a basement or crawlspace below, I would run cable or conduit below the floor and use a monument-style housing to hold the receptacle at the base of the machine (see bottom left photo, facing page). A flush-mounted floor outlet is a poor choice for a shop. It will fill with debris and could be shorted out by a stray nail or staple.

If you plan to move shop machines around and you want to keep the floor clear, use a hanging (pendant) outlet about 6 ft. to 7 ft. above the floor. To prevent accidental unplugging, a locking cord cap on the receptacle end of the pendant outlet is a good idea (see top left photo, facing page). This will require you to put a compatible locking plug on the machine cord, or make an adapter.

Custom touches add safety, convenience

Even though they are full of flammable materials, most woodshops have no smoke alarms. That is because airborne sawdust can set off the photo-ionization or photo-electric sensors typically used in smoke alarms to detect smoke. The solution is to install a heat-detecting fire alarm that can activate the smoke alarms in the house. Firex (www.icca.invensys.com/firex) has a complete line of smoke alarms that includes compatible heat-detector units.

It's nice to have a phone in the shop, but how do you hear it ring while planing boards and wearing hearing protectors? You can add a flashing visual alert.

Another convenience is to have your dust collector start automatically when you switch on a machine it serves. It's possible to build a current sensor/relay setup (for more information, see *FWW* #143, pp. 66-69), but there are commercially available ones. Ecogate (www.ecogate.com) sells a system that not only turns on the dust collector when it senses that a tool has started, but also opens and closes the adjacent blast gate. Alternatively, you could install a relay and receiver on the dust collector's cord that switches on and off with a remote-control transmitter that can sit in a convenient spot or hang on your key ring (like a car-door remote).

Consider these useful accessories

HEAT DETECTOR



Airborne wood dust can cause false alarms with a standard smoke detector. A heat detector can warn you of a shop fire and can be wired into your home fire-detection system if the shop is in a detached building.

Work with your electrician

Unless you're a qualified electrician or are willing to take the time to become familiar with the techniques of the trade, the many requirements of the NEC, and any local codes pertinent to shop wiring, you should find a licensed electrician or electrical contractor to wire your shop. Look for one who does both residential and commercial work; a strictly residential electrician might not be familiar with some of the products and design elements suggested here.

When working with an electrician, it's more productive to explain the objective or goal than to try to dictate a precise method or approach. Sit down with the electrician before work begins, and lay out your requirements clearly. If your plan and goals are not clear at the outset, be prepared to pay for changes.

Finally, don't expect to find an electrician who will "just do the hookups" after you've pulled the wires, etc. Few licensed electricians will take the risk of putting the finishing touches on work they didn't do themselves. □

Clifford A. Popejoy is a licensed electrical contractor and occasional woodworker in Sacramento, Calif.

TELEPHONE FLASHER

If your shop has a telephone, it will be impossible to hear when you are wearing earplugs and operating loud machinery. This device uses a flashing light to let you know that you have a call.



REMOTE-CONTROL TRANSMITTER SWITCH

A remote-control receiver is connected between the dust collector's power cord and the receptacle. A small transmitter lets you turn the collector on and off from anywhere in the shop. This will save you a few steps and let you devote more attention to your work.

