

# ELECTRICAL INSPECTION

**SECRETS**



**EXPERT ADVICE FOR NEW HOMEOWNERS**

**JOSHUA PAGE**

**Copyright ©2021 Joshua Page.**

**All rights reserved.**

### **DISCLAIMER**

**This e-book is for educational purposes only. Only licensed electricians should perform any kind of electrical work around your home.**

# CONTENTS

<b>Hi!</b>	<b>4</b>
<b>The Electrical Panel</b>	<b>5</b>
<b>The Basement</b>	<b>5</b>
<b>Let's talk circuit breakers</b>	<b>9</b>
<b>Basement Wiring</b>	<b>11</b>
<b>A Brief History of Home Electricity</b>	<b>14</b>
<b>The Main Living Areas</b>	<b>17</b>
<b>Switches</b>	<b>19</b>
<b>The Attic</b>	<b>21</b>
<b>Outdoor Power</b>	<b>22</b>
<b>FREQUENTLY ASKED QUESTIONS</b>	<b>27</b>

# HI!

Congratulations on purchasing your new house: your first house, your 10th house, maybe a second home, a home for your daughter, whatever it may be. CONGRATULATIONS!

Let me introduce myself. My name is Joshua Page and I am a husband, father, master electrician and an entrepreneur. I have been an electrical contractor now for over 10 years in Massachusetts and have done thousands of service calls and projects in homes, commercial buildings, and industrial locations.

I wanted to create a resource guide for homeowners after literally thousands of electrical inspections and estimates for homeowners across Massachusetts. In homes ranging from 500 sq. Ft. to 10,000 sq. Ft., I would repeat the same things to the owners about what I see, what they should look for, and the dangers that lurk in their wiring.

I have found time and time again that the homeowners were not educated enough on their electrical system and things were wrong before they purchased the home or that do it yourselves might try to install or repair things incorrectly.

I want this book to be a learning experience through the eyes of a master electrician with thousands of hours under his belt. In this resource guide you will get real life stories of what I have found, inspectional advice on what to look for and some expert secrets. I hope you're ready to dive in because I sure am. Grab your notebook, pen, tool pouch, and flashlight. We are going on an electrifying adventure...


# The Basement

Let us start in the basement. I know you really don't want to go down there, but I swear, it's not as bad as you think. Yes, it sometimes smells or has plenty of spiders and cobwebs, but the best stuff is down here.

## The Electrical Panel

What we are coming down here for is the *crème del a crème* of your electrical system: your main electrical panel. It's where all your power comes from. Everything that works in the house is because of this 2'x3' piece of metal and plastic tucked in the back of the basement where you like to store everything in front of. (I know you do and don't deny it. We all do!) We want to move all that junk—oops, I meant personal belongings—from in front of the electrical panel to someplace else. It is against electrical code to store them in front of the electrical panel as getting into the panel quickly can mean life or death. Now the next steps should not be performed by anyone other than a LICENSED ELECTRICIAN.

Keep home inspectors out of the electrical panel and really all areas of electrical in your home. They are not trained or qualified to be inspecting electrical systems.



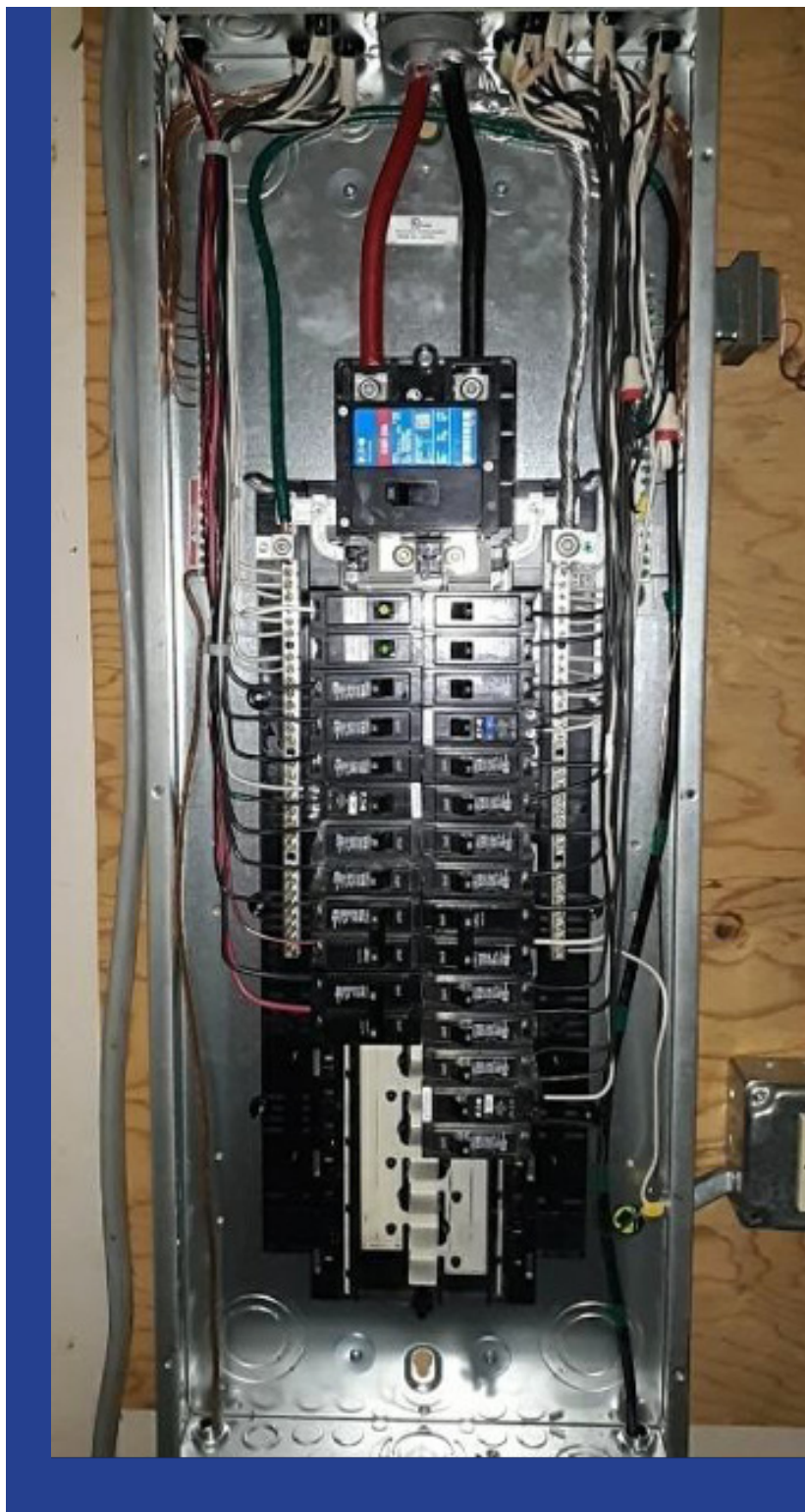
We received a call while I was writing this book from a homeowner who was having a home inspection performed. The home inspector had removed the electrical panel cover to take his pictures and inspect the panel. Then while he was screwing the panel cover back on... BOOM, SPARK, BAM!! The inspector took the cover off, laid it on the ground, and said, "I'm not putting that back on!" We sent an electrician out on an emergency call and found a wire was pinched and shorted out while the home inspector was trying to put the cover back on. We were able to cut that piece out, rewire, and install the panel correctly. The only professionals that should be removing an electrical panel cover is a LICENSED ELECTRICIAN.


To remove the electrical panel cover, we will remove the two bottom screws, then the two top screws and hopefully we still have two screws left in the middle. We will hold onto the electrical panel with one hand while removing one screw and then put our body up against the panel and remove the second screw. Once all screws have been removed, we will take the panel down very carefully.

Now we have exposed live wires that will kill you without one bit of guilt. Unlike a bumblebee that once it stings you it only has a limited time left on earth, this animal sitting quietly tucked into the metal box full of circuit breakers and wires of all shapes and colors will kill you and keep going. Even so, you might get stuck there and the only way to remove you is by a drop kick, a running tackle, or maybe even a 2x4 across your arms. If I did not scare you enough yet just wait. If you don't learn anything else from this book, remember that electricity will kill you if you do not know what you are doing. Do not play with it.



We want to start at the top of the panel and make our way down, looking at all the wires and connections. We are looking for rust, corrosion, water infiltration, burn marks—anything that looks out of place. You can immediately tell how good an electrician is by how they make up the panel. If it is sloppy with wires all over the place and nothing looks good, well, the rest of the wiring throughout the house is probably the same. If the wiring is nice and neat, straight lines, maybe organized with zip ties and all grounds (bare wires) and neutrals (white wires) are dressed nicely down the panel, you've got yourself a winner of an electrician!





Rust and corrosion will happen a few ways. The #1 worst culprit: an unsealed electrical meter or the wire connector at the top of the meter is not sealed up. When this happens, the water will follow down the inside of the SEU (Service Entrance cable Underground) and drip into the panel. Think of the SEU, the grey wire on the exterior of the house, like a straw where if water enters inside of it, it will come out the other end. You can usually see small pools of water on top of the main breaker, corroded terminals on the circuit breakers where the wires enter, or rust on the bottom of the panel. You can also see rust around the edges of the panel or at the bottom of the panel if the basement is very moist and damp. If this is the case, then you should install a dehumidifier, as this will help rid the area of moisture.

I also always look for circuit breakers that are not installed or missing and I make sure there is a black rectangular filler piece on the panel cover that will take the place of the circuit breaker. This keeps you safe until a circuit breaker is needed and installed.

I once went to one of those manufactured homes because the customer was having issues with her lights flickering. When I arrived, I asked to see her electrical panel. After she moved a bureau, a pile of clothes, and a TV, there was this tiny little electrical panel buried in the back corner of her bedroom. When I opened it, I found about four circuit breakers and a bunch of duct tape covering over the other slots where circuit breakers would be.

I removed the duct tape and found insulation literally filling up half of the electrical panel. There was a HUGE mouse nest in there! Then the customer tried to stick her hand in the panel to remove the insulation. “Stop! What are you doing?” I said. “Those are live wires, NEVER stick your hand in there.” We scheduled a service call and found over eight baby mice in that electrical panel and a faulty circuit breaker. If those mice ever decided to chew on the wires, it could have caused a devastating fire.




## Let's talk circuit breakers

A single pole circuit breaker takes up one space. These are used on outlets, switches, and lights. Then we have a two-pole circuit breaker which—you guessed it—takes up two spaces. These are used on dryers, stoves, water heaters, and air conditioning units. We started to phase out fuses around 1965 and solely use circuit breakers.

Newer circuit breakers are GFI-protected circuit breakers which will have a small “test” button on them. These operate the same as the GFI outlet, except as the circuit breaker, they protect the entire circuit and everything attached to it, not just what is plugged into the outlet. You will see the GFI circuit breaker being used with whirlpool tubs, swimming pools, kitchens, garages, and basements.

The other circuit breaker that has been around since the early 2000s is the arc fault circuit breaker. As of this printing in the 2020 National Electrical Code, arc fault circuit breakers are now required pretty much throughout the entire house. When they first came out, they were very sensitive and had a lot of callback issues. Luckily over the past 20 years they have come a long way and they truly do save lives along with the GFI circuit breaker.

The next thing I want to look for is loose connections on the circuit breakers. Very dangerous, as these pose a potential fire hazard! Just by pulling the wires slightly you can see if there is a decent connection on the circuit breaker. We can always tighten these up by using a torque rated screwdriver and tighten them down to manufacturer specifications.



I also want to look for any splices in the electrical panel or anything else that looks like it doesn't belong there. This includes doubled-up circuit breakers, which means more than one wire installed per circuit breaker terminal. Some circuit breakers are listed to be done this way, but most are not. We want to check all connectors coming into the electrical panel and make sure that they are nice and tight and nothing is loose.

Last, we want to look at the panel directory. This is where all the circuit breakers should be labeled correctly. Most likely not, because as electricians, we seem to not know how to spell anything correctly. We surely try, but I have seen a lot of "frig" and "drier" in my time.

The most important step for electricians to do here is really label this correctly and professionally. It takes some time, but it is a HUGE timesaver for the homeowner in the future. There is nothing worse than running up and down stairs ten times until you find the right circuit breaker. Unless of course you want to lose some weight in the process!

Now why haven't I talked about fuses or fuse panels? Well, honestly, I do not like them. Any house built before 1965 had fuses in it, before circuit breaker panels became the norm. There is nothing to inspect on them because they should be replaced with new circuit breakers, as those old fuse panels are most likely 60A or less.

We also want to check the water meter (if you have one). There should be a bare copper or insulated copper wire that goes from the electrical panel to the water meter. It will be bonded or kind of handcuffed on one side of the meter and handcuffed on the other side of the meter. This is so your electrical system always has a path to ground. If the water meter was ever removed for replacement, your path to ground will always be there.

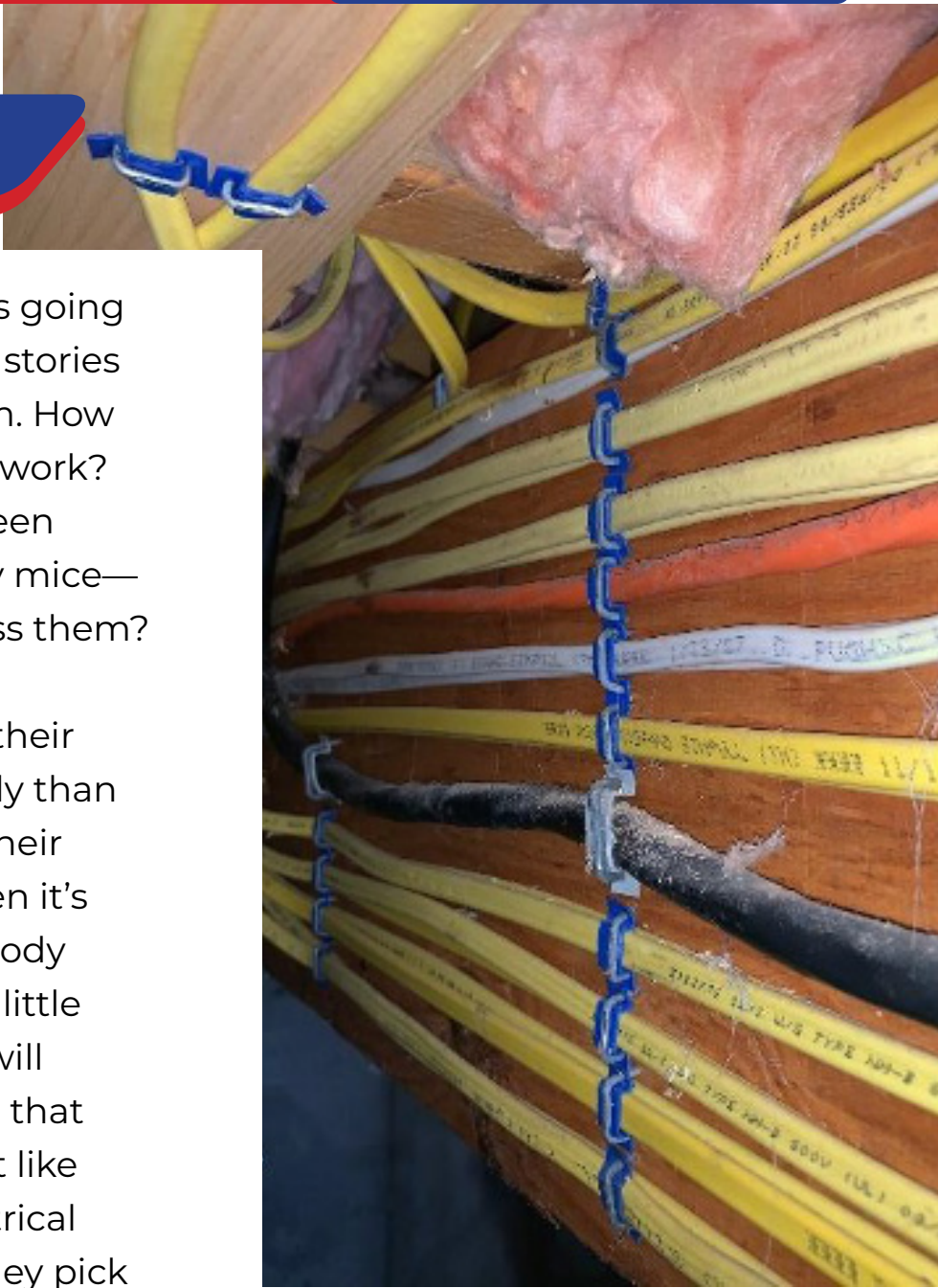
Now that the electrical panel is complete, let's move on...

## Basement Wiring

Look up, look at all those wires going here and going there. Oh, the stories they could tell if you let them. How many things have they made work? How many times have they been turned on and off? How many mice—yes, mice—have crawled across them?

Interesting story about mice: their clavicle is positioned differently than our own. Once they can get their head through an opening, then it's game on and the rest of the body can come on in. They're nasty little creatures that, if not treated, will chew wires for the simple fact that it sharpens their teeth. Almost like a stone sharpens a knife, electrical wiring does the same. Until they pick the live wire and BOOM, that's it. RIP mouse.

Before 2001, a Romex wire sheath was all white. Did not matter what size it was, it was white. After 2001 is when manufacturers started changing the color of the Romex based on the size of the conductors.



- White is for 14-gauge wire. (If it's flat then it's 14/2 Romex. If it's round it has more than two wires so it's 14/3 or 14/4 Romex.)
- Yellow is for 12-gauge wire and same rules apply.
- Orange is for 10-gauge wire and same rules apply.
- Black is for 2 different sizes of wires: #6, which is used for subpanels and large appliances, and #8, which can be used for air conditioning units or large appliances.
- Grey is used for outdoor service entrances and sometimes for electric stoves.

### EXPERT SECRET #1

The outside of this wire will also show you a manufactured date. So, if the date states 3/15/2015 then you know this wire was installed somewhere in 2015. Not many people know about this except inspectors. So shhh, you were just let into a little secret.



You'll want to inspect these wires for any wear and tear, including if the mice have used it as a superhighway. You can tell this by the trail of urine they usually leave behind all over the place. Gross, right?!

Now while we are looking up and seeing all the different wires, let's go back, way back in history. Let me take you back in time to the late 1800s and the turn of the 20th century...

## A Brief History of Home Electricity

Thomas Edison lit up the first streetlights in Menlo Park, New Jersey, on New Year's Eve, 1879. It wasn't until 1892 that he received a patent for his "electric conductor," which was essentially knob and tube wiring. Knob and tube wiring began being used in people's houses starting with the wealthy in the late 1800s, and moving toward the 20th century, more and more houses started to have it. In fact, Henry Heinz—yes, the Heinz ketchup guy—wired his first factory around 1893 with all knob and tube wiring! Heinz was the first factory in the country to have electrified their assembly line! They had over 57 different varieties of products being produced, not just ketchup.


Knob and tube wiring is an open-air conductor which means you cannot insulate around it. (Keep the pink panther out of here!!) The knobs were made from porcelain and were used as support for the conductors. Where the wires would go through wooden beams or a structure, they were run through what is called "tubes," also made from porcelain. When the conductors would enter a switch box or outlet box, they had a special cotton braid wrapped around it called "loom" to protect the wires from entering the box.

Knob and tube began to be phased out around the 1930s, so it was not around long, but it's still in a lot of today's houses. As of this printing some of the most archaic wiring in houses can be more than 100 years old!





BX wiring came out right around 1899 and was first listed in the National Electrical Code in 1903. This type of wiring did not have a ground wire, it only had a hot (black) and a neutral (white) wire. The outside sheath or metal interlocking cover kind of like an armadillo shell was the ground. So, if at any point any connectors became loose, you were looking for trouble as there was no suitable path to ground. There were two types of BX. First was AX and the second was BX. X standing for experimental. BX was the one chosen for production, and like they say, the rest is history.



Romex started coming out around 1926 and was the new rage. It was made with a cotton braid wrapped around each conductor and a tar like substance to protect it from moisture. With knob and tube being phased out, this was going to be the cat's meow. By 1970, all Romex had a PVC outer jacket and until 1960 there was no ground wire in it at all. After 1962 is when the electrical code mandated that we have equipment grounding and provisions to ground it. So, if your house has not been updated and it is older than 1962, most likely it still has ungrounded outlets.

From the mid-1960s to mid-1970s with the price of copper going up, home builders started installing aluminum wire in houses. Roughly 2 million houses are wired with it in the United States. Aluminum wiring was great because the price was low, but the difference between aluminum and copper is that aluminum does not have a memory. When you tighten it down today, in a week you can tighten it down again, and again, and again. It is constantly expanding and contracting, which over time can cause a lot of loose connections and eventually a fire. In the 1970s they did have quite a bit of house fires believed to have been caused by aluminum wiring in houses.

All right, enough of that. I know you're probably bored by now, but the basement is our biggest inspection area and I needed to help build the foundation so we can really get started.

So, we covered the electrical panel and the basement wiring. Let's head upstairs to the first floor.


# The Main Living Areas

When going through the rest of the house, there are a few things that I like to look at. Outlets, receptacles, plugs, whatever you would like to call them. To us, they are receptacles. There are really three types that are very common. #1 would be the older non-grounded or ungrounded type that has two vertical lines. These outlets were used with knob and tube, BX, and ungrounded Romex. Sometimes you can even find them with grounded Romex but for whatever reason they would wrap the ground back around the entire wire and not to the outlet.

Then there are the grounded outlets that are more commonly seen, and they have two vertical lines and a hole at the bottom. These outlets are the most common in every house. Be careful with these outlets because if the house was built before 1960, chances are that those outlets are not properly grounded or they may not have a ground wire at all.

In 2008, tamper-resistant outlets started to become code and they look exactly the same as regular outlets—except when you try to plug something in for the first time, you might as well attach it to the front of a tractor trailer because it needs so much force to push those internal shutters open... No worries though, it's for the safety of children first! We can't have a child sticking anything into them and risk getting electrocuted.

We want to keep our eyes open for any burnt outlets, cracked outlet plates, anything that does n't look normal.



The other receptacle that you would be familiar with is the GFI, ground fault interrupter. This will be found in kitchens, bathrooms, basements, and outdoors. This will “trip” when it senses a ground fault such as a faulty cord being dropped in water or a hair dryer in the sink. It is designed to SAVE YOUR LIFE. So yes, they are kind of important. Always test the GFI outlet by pushing the “test” button and making sure it trips and the “reset” button.

Now in a kitchen or where two bathrooms are stacked one above the other, it’s very common to have a GFI outlet that feeds another receptacle downstream. So, when the GFI trips, the other outlet loses power as well. This is to code and is okay. However, we do want to recognize those outlets so if they do not have power we can remember why.

### **EXPERT SECRET #2**

If you have always had power on a certain receptacle and then suddenly you don’t, check all GFI (Ground Fault Interrupter) outlets to see if they are “tripped.” This is almost always the case and for some reason a GFI outlet in the kitchen will be wired to a receptacle in the garage. Knowing this trick will save you big \$\$\$.

## Switches

Oh switches, there are soooo many styles to choose from, but right now let's inspect and talk about functionality.

- There is the single pole switch, very simple as it's just one switch to one light or many lights in one location. Very important, this switch is only at one location.
- There is the 3-way switch, which will turn on one light or many lights from two different locations.
- There is the 4-way switch which will turn on one light or many lights from many locations.



### EXPERT SECRET #3

The best indicator to see if you have a single pole switch or a 3 way/4-way switch is the ON/OFF wording (only can be used on toggle switches). If your switch says ON at the top and OFF at the bottom, you have a single pole switch. If your switch says NO and FFO, then you have an upside-down single pole switch, ha ha. If you have no wording, then that is a 3 way/4-way switch.





The dimmer switch—yes, we love the dimmer—is a dial rather than a toggle switch. This can make lights dim or bright depending on the ambience you would like. Whether you want your lights dim for a movie night or full blast for a big party at your house, you have full control over any light bulbs that are dimmable. If you do not have a dimmable bulb then you will have a strobe party. (Maybe that's the party you want?)

We always want to test all the switches and their functionality to make sure that everything works. What if there is a switch in a room, with no lights? Then this will most likely be a switched outlet. Which means the top or bottom part of the outlet will always work, and the other part will turn on/off with the switch.

These are used with table lamps or floor lamps. Do not plug your TV into them as you will not be happy when you are watching your favorite episode of “The Bachelor” or the Big Game and then someone shuts the switch off...

#### EXPERT SECRET #4

We get calls all the time from folks trying to figure out where switches go. What do they control? The best thing to do is find a table lamp or a radio and plug it into the top of the receptacle and turn the switches on/off. Then plug it into the bottom of the receptacle and turn the switches on/off. You will almost always find one or two outlets that are wired to a switch that you didn't even know about.



# The Attic

Let's head up into the attic, the only other area in the house besides the basement where you can usually see the wiring.

I like to look for junction boxes, open junction boxes, and wires run over the wooden joists that will cause a safety issue because those wires are susceptible to damage. We want to inspect for mice damage as well.


Okay, attic is done. Let's head outside.

# Outdoor Power



Here we want to check for functioning GFI outlets by pushing the “test” button and making sure they trip. Remember the kitchen and bathroom GFI outlets that I talked about earlier? Well, sometimes the exterior outlets are powered by an interior GFI outlet, so if you see a regular receptacle outside, always check the garage or somewhere in the house for a GFI outlet.

Let’s look at the electrical service. If you have wires going from a pole to your house, this is called an overhead service. Those wires are owned by the utility company, not you. You own everything else that is on your house going down to the meter socket. The only other thing the utility company owns is your meter itself.



We want to look at the condition of the splices up top to make sure there are no exposed wires, the wire is coming down, and make sure that it is intact. Sometimes it will be so old that it will look like snakeskin. This should be changed immediately because you can see the internal conductors and rainwater has a very easy way to enter the electrical panel. If you do not have a grey wire coming down your house, you most likely have a grey pipe or a silver pipe. These are called service masts—no difference in the power to your house, just the protection it provides. Sometimes these are preferred if they have had the service ripped off in the past due to storms. But these can also be ripped down, too. So, look around and try to remove any branches or trees that may come down in a storm and take the service with it.

The top of the meter socket where the grey wire enters is the wet connector. If installed properly, you should see a grey Play-Doh-like compound that is shaped like a volcano. This is done so any water that drips down on the outside can easily be disbursed elsewhere. If it is an older service, this may be cracked or missing and needs to be replaced. If you have a pipe or service mast, then there will be no wet connector.



We also want to look for ground rods, which are copper solid rods that are near your electrical panel and are hammered into the ground and attached to a copper wire that goes back to your electrical meter. These should be there, but most older services do not have them. When you upgrade, if you do, they will need to be installed then.

Let's go over to the garage and look. Any outlets in a garage should be a GFI or protected by a GFI. So, look around and test those outlets to make sure. Some garages will be unfinished so you can see all the wires and some garages are finished so you cannot see any wires. Whatever you can see, look just like in the basement and the attic.

## EXPERT SECRET #5

When you are looking to hire an electrician or any tradesperson (electrician, plumber, roofer, window installer, etc.), make sure you hire someone who is licensed, insured, comes from reputable referrals, and has great reviews online. Do not hire just by price, hire because you feel comfortable, you can trust them, you would not mind giving them the housekeys, and they know what they are doing. If you can do this, then you have picked the right company for your needs. In the trades, you should look for Quality, Service, and Price. Caution: you can only choose two, never all three! So, if you have quality and price, then service usually falls behind. If you have price and service, then quality will fall short. If you have quality and service, then price is usually higher. We at JP Electric and Son always choose to provide quality and service as that is the most important to us.

That about covers your home electrical basics! If you need an electrician, we employ the best electricians out there! They work harder than a pair of woodpecker lips and they are true professionals in the trade. We have seen it all and done it all, from large commercial buildings, house rewires, generators, pool installations, and hotels, to additions and kitchen/bathroom renovations. We can help you as well.



***978-410-5805***



***www.JPElectricandSon.com***



***jp@jpelectricandson.com***



***JPElectricSon***



# FREQUENTLY ASKED QUESTIONS

## ***Is Knob and Tube wiring safe?***

Knob and tube wiring can be 70-100 years old in your home. When it was installed there was normally only 1 outlet in a room and maybe a light in the ceiling. With today's demands on the electrical system the knob and tube wiring are just not sufficient anymore.

## ***Can I do my own electrical work?***

Electricity is very dangerous, and you do not get second chances. You could burn your house down or worse die if you do anything wrong. Always hire a licensed electrician, with proper insurance, great reviews, and knowledge of the electrical systems.

## ***I have so many switches in my house, where do they all go?***

Easiest thing to do is plug in some sort of appliance that lights up or makes noise. Such as a table lamp or a radio and then start turning the switches on. Sometimes one half of the outlet will be controlled by the switch and the other half will always stay on.

I have a Federal Pacific panel and have not had any issues. Why do I need to replace it? It is highly suggested to replace the electrical panel as back in the 1970's they had big problems that actually caused house fires because the circuit breakers wouldn't trip.

## ***Why do electricians charge so much?***

As a Licensed Electrician we spend 600 hours in classroom training learning all about electrical theory and electrical codes. During the same time, we are putting in 8,000 working hours before we can take our electrical exam.

Once we are a Licensed Journeyman Electrician, we must go back to school every 3 years for 21 hours of code update and continuing education. We have insurance, overhead, liability, tools, travel, warranty, among other items that makes us highly qualified and skilled for a trade that is highly needed and sought after throughout any industry.