TECH NOTE

From Zero Surge Inc. September 2025

What is a Dropped Neutral?

You walk into the den to watch TV, and it appears that you do not have power. But you can see that there is power in the house by the fact that the lights are on. But you also notice that the ceiling fan is spinning a lot faster that it normally does. What is wrong?

These are symptoms of a “neutral drop”. What is a “neutral drop”? To answer that, you need to know how power enters a building in North America. We use a split-phase system in North America. Three wires enter the building. Two of them are called the “line” or “hot” wires and one is the “neutral” wire. All three originate from a transformer that is stepping down the voltage from the power company.

The electric panel has two columns. One side is using 120 volts from one of the hot wires and the other side is using the 120 volts from the other hot wire. For devices that require 240 volts (like an electric dryer), both hot wires are used to power the device (each leg’s voltage is added).

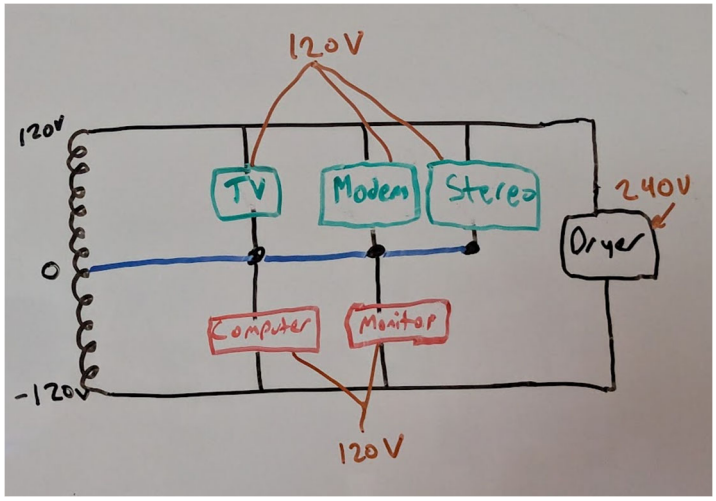
Each hot wire is an opposite phase of 120 volts relative to the center of the transformer coil. If one of these wires is broken, then no power from that hot wire is available to enter the building. This would present as some of your devices working normally and some without any power.

The neutral is tapped onto the middle of the transformer coil which creates a return path for power at the 0-volt point. When this neutral connection is broken, the hot wires can still carry power. This is where problems can arise.

Here is a simple example:

In this circuit, we have power coming from the transformer on the left side. One leg is powering a TV, modem, and stereo. The other leg is powering a computer and monitor. Both legs are powering an electric dryer. The blue line in the middle is the neutral wire. As you can see, all 120-volt devices share the neutral wire. Each device is receiving its proper voltage.

Because the legs are in parallel with each other, the voltage is the same on each leg. The resistance of each leg does not affect the overall voltage to each leg.



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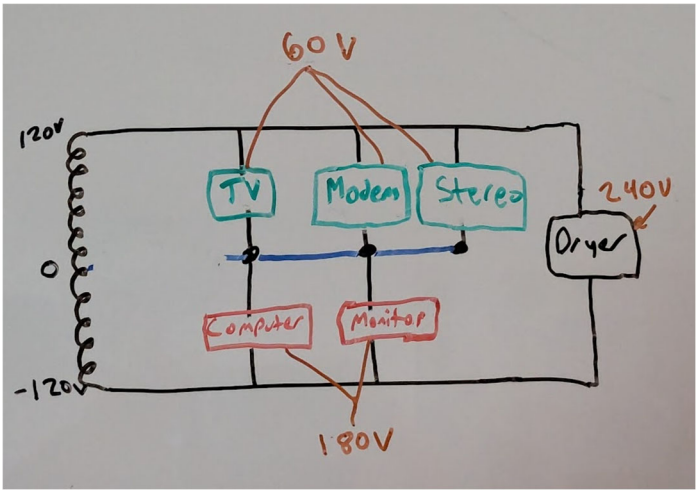
When the neutral wire is missing, an interesting thing happens. The electric dryer is not affected since it does not use the neutral. Therefore, it still receives 240 volts. But each of the 120-volt devices will receive different voltages. This is because all the 120-volt devices are still connected to a neutral inside of the building and each circuit leg becomes one big circuit. This makes the resistance of each device important in determining what voltage each device receives.



Since it is almost impossible to have a perfect balance in resistance among each circuit leg, the voltage changes based on the resistance of each leg. The voltage of each leg balances out based on the resistance with a total voltage of each leg adding up to 240 volts.

In this example, the computer and monitor voltage jump up to 180 volts while the TV, modem, and stereo read 60 volts. Most devices will not operate below 80 volts so it would appear that the TV has no power.

Neutral wires sometimes are failing intermittently. That would cause these voltages to fluctuate randomly until the problem is fixed. This could cause major problems especially in the lower voltage ranges. Devices would be turning on and off randomly.

Note – LED lights do not change their brightness with changes in voltage the way older incandescent lights did. You may not notice any change in the LED lights except they may turn off or flicker on and off.

How can Zero Surge help? While our products can not boost or lower voltage, they will smooth out the wild fluctuations of voltage and current that a neutral drop creates. And Zero Surge devices will not be destroyed by large voltages. Almost every plug-in surge protector on the market will not survive voltages more than 130 volts. They will burn out from the high voltage.

Thanks to our customer Zeke from San Francisco for sharing his experience with a neutral drop. All his Zero Surge units and the protected devices were fine while his major brand surge protector and a work computer were burned up from the high voltage.

There are inexpensive circuit checkers and volt meters available that will confirm your suspicions. If you suspect a neutral has dropped, contact the power company immediately and follow their instructions.

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