SMART PLUG POWER DRAW WHILE OFF

One of the reasons I enjoy making presentations is that audience questions sometimes stump me. If I can find answers, then I can write about them. This is an example.

By John Krout, Potomac Area Technology And Computer Society (www.patacs.org)

Introduction

By mid-January 2025, I had delivered my Intro to Smart Plugs presentation twice, once for my local user group, the Potomac Area Technology And Computer Society in December, and again for APCUG in their first Wednesday Workshop of 2025.

During the Wednesday Workshop, an attendee asked this: how much power do smart plugs draw when in the off state? This means the smart plug is connected to AC power but its remotely controlled AC socket is turned off. The attendee called it **vampire power consumption**, an interesting phrase. I do nfot think of it that way.

On the spot, I figured out one way to find an answer. The Kasa EP25 smart plug can measure power draw of whatever it is powering. That info is shown in a graph produced by the zero-cost Kasa smart plug app.

So, the basic answer I gave during the Wednesday Workshop was this: create a smart plug *stack*, connecting any smart plug to the front of a Kasa EP25. Plug the EP25 into AC power and turn on the EP25. Use the Kasa app to report the power drawn through the EP25 by the smart plug powered by the EP25.

You can see such a stack in **illustration 1**, a Kasa EP10 smart plug atop an EP25 smart plug. The EP25 is in the back.

The smart plug atop the EP25 does not even need to be Kasa brand. Any smart plug brand will do.

Illustration 1

More about the testing process

My answer during the Wednesday Workshop presentation was not quite complete. Here are the ***test process details***.

1) Turn on the EP25 so that it can power the smart plug being measured and connect to WiFi.

2) Turn on the smart plug being tested. This allows that smart plug to re-establish its connection to WiFi. Wait until its LED indicates it is attached to WiFi.

3) Turn off the smart plug being tested.

4) Use the Kasa app to display the power being drawn by the smart plug being tested.

There is a gotcha involved in this process. At low power draws, the **EP25 reports only < 1 watt**. You can see an example in **illustration 2**, captured from the Kasa app on my Samsung Galaxy S20 FE smart phone. I circled the < 1 watt for your convenience. In this case the < 1 watt applies to an EP10 smart plug stacked atop my EP25 smart plug.

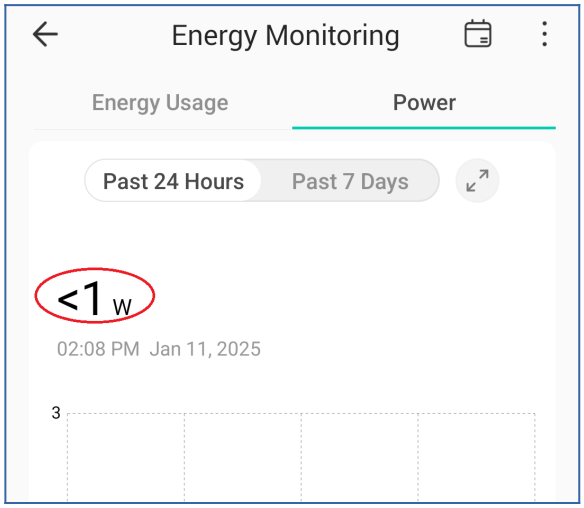

Illustration 2

The EP25 smart plugs through which my clothes washer and dryer draw power report the same < 1 watt value when the appliance is not being used.

Why does a smart plug draw power while turned off?

Each smart plug is called smart because it can be controlled remotely, meaning switch between off and on. While off, it must be able to be turned on remotely. That means it uses WiFi constantly; in case a remote command arrives for it. In turn, that WiFi use means the plug draw some small amount of power while turned off.

This is very much like a TV, disk player or sound bar that can be controlled with a remote control. While turned off, the device uses a tiny amount of power to wait for a command from its remote control to turn it on.

A modern appliance with a clock display consumes some power when not actively used. An example in my home is my microwave oven.

Vampire power devices are already a part of our daily lives, even without smart plugs.

Power measurement using a digital multi-meter

I wanted to measure how much power is drawn by a smart plug while off with greater precision. I asked my son, who repairs computers, electronics and home AC wiring, if he could measure AC current. He found a way to do that for a smart plug.

I am not going to explain how he did that measurement. His method is both ingenious and somewhat dangerous. To mitigate that danger, he wears insulated boots and rubber gloves, and stands on a rubber pad, all to isolate himself from the AC current he measured.

It turned out that the three smart plugs he tested showed that the current draw varies a bit when the tested smart plug is off. This is not terribly surprising, since I do not know all that goes on inside the smart plug, but clearly the smart plug must stay connected to WiFi while in the Off state. Each smart plug drew between 10 and 12 milliamps of current in the off state.

Below, in the calculation of watts consumed, I will show you the eyeball average value of current drawn as displayed on my son's digital multi-meter for each smart plug in the Off state. That value is followed by the word amps.

About calculating Watts when measuring AC current

Electrical power, an instantaneous measure, is expressed as Watts. In high school physics or college electrical engineering courses, the typical expression for calculating watts is voltage times current. Current is measured in a unit called Amperes, or amps for short.

When using AC voltage, which arrives in a sine wave rather than a constant voltage, the voltage is in the calculation of watts is AC peak voltage times 0.707.

US AC is often said to vary between 110 and 120 volts at peak. At my house, it is typically 117 volts at peak. Here I show the calculated power drawn by each smart plug tested using 117 volts AC.

Alatech YP102 smart plug draws 0.010 amps in the Off state. Power drawn is 117 volts * 0.707 * 0.010 amps = **0.83 watts**

Kasa EP10 smart plug draws 0.011 amps in the Off state. Power drawn is 117 volts * 0.707 * 0.011 amps = **0.91 watts**

Kasa EP25 smart plug draws 0.012 amps in the Off state. Power drawn is 117 volts * 0.707 * 0.012 amps = **0.99 watts**

As you can see, when turned off, all three smart plugs draw close to a watt of power. That is a modest power use.

Limits of the tests

Keep in mind that I tested only three smart plugs. There are dozens of companies making smart plugs, some of them using WiFi for communication and some using Z-wave, ZigBee, or another communications method. I suspect the communications method may have some impact on the current drawn by each plug in the Off state.

ABOUT THE AUTHOR: John Krout is a retired software developer. He has been writing about and delivering presentations on interesting uses of personal computers since the early 1980s. In the 21st century, as digital tech became more powerful and widespread, he has also been writing and delivering presentations about interesting uses of smartphones, tablets, digital music, digital photography, Electric Vehicles (EVs) and Pluggable Hybrid Electric Vehicles (PHEVs). He lives in Arlington Virginia.