Zero Beat

September 2022

General Meeting
Wednesday September 14th
At 7:30 pm at the
Hazel Park Library
and on Zoom
With Socializing
At 7:00 pm

Club Officers

President Mike K8WU
qrz@k8wu.me
1st. VP Marvin W5DT
marvstasak@gmail.com
2nd. VP Jim W8DPM
tenaciousjd@gmail.com
Secretary Reuven KB3EHW
rgevaryahu@gmail.com
Treasurer Bob N8REL
rlau6@aol.com
Parliamentarian Bill N8QVS
n8qvs@arrl.net
Director Len AD8FK
len1perkins@yahoo.com

President's QRM

I hope that everyone had a good summer, especially with things being more open than in previous years. Personally, over the summer I did several Parks on the Air activations at state parks with varying levels of success – one of them being Traverse City State Park (K-1547) while on vacation. I also got more satellite contacts after the bug bit at Field Day this year.

Speaking of Field Day: Once again, a huge THANK YOU goes out to everyone who helped make our Field Day event this year as fun, engaging, and exciting as it was. It takes a small village to make it all happen, but seeing everyone come together to ensure that things ran as smoothly as they could reaffirmed my belief in what a radio club should be for its members and its community.

I was also very pleased with the turnout for this year's annual picnic, so thanks to Bill N8QVS and Jim W8DPM for coordinating that and making it happen – and of course, to everyone who brought dishes to pass, and also those who showed up to socialize and eat amongst friends.

Our "back to school" meeting is happening on September 14, 2022 at the Hazel Park Memorial Library. We'll get a status update from Joe WB8ADX on our involvement with the Davis Aerospace Technical High School and their upcoming contact with an astronaut aboard the International Space Station, among other things. This has been a huge undertaking, and I am sure that it will be a defining moment for the school and our club.

Lastly, I would like to remind everyone that as both HPARC members and Amateur Radio operators, we are all mentors. We have new members signing up often these days, and we need to keep them engaged. Just remember back to when you were a new operator; those of you who had mentors surely appreciated getting help and guidance as questions and problems arose. We do a good job of this from what I've seen, so let's keep it going!

I look forward to serving the club in the coming year, and remember, no matter what part(s) of the hobby interest you, above all else: Have fun with Amateur Radio!

Thanks and 73,

Mike Phipps, K8WU
President, Hazel Park Amateur Radio Club

Remembering Larry Koziel K8MU

Our friend, colleague, and longtime club member, Larry Koziel K8MU, passed away after battling a 10-month long illness. Larry brought many things to our club and most recently, he served as a volunteer instructor for the HPARC Extra Class License Course for over five years. He had a knack for expanding our appreciation of a wide array of topics covered on the FCC license exam.

Larry was an accomplished educator and a knowledgeable radio enthusiast who shared his knowledge, experience, and technical expertise by contributing to the course slide presentations. In addition, his in-depth understanding of radio communications helped us visualize many complicated ideas during class discussions, resulting in an unparalleled series of slide show presentations

Larry was also an avid Amateur Radio satellite expert and longtime member of the Radio Amateur Satellite Corporation (AMSAT). As a representative of the ARISS organization, he was the inspiration behind the Davis Aerospace Technical High School to have been selected for a radio contact session between the Davis Aerospace students and the astronauts onboard the International Space Station during the fall 2022 semester.

Exploring Ohm's Law.

Chris Warren July 23, 2022

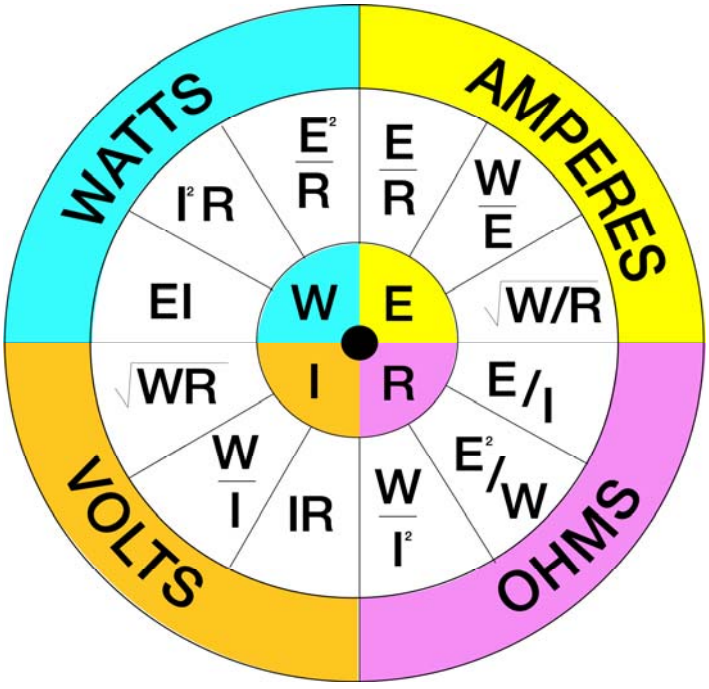
Law school, continued.

A while back we took a dive into Kirchoff's Current Law. It's just one of dozens of scientific principles that explain how and why electronic circuits work. Though one does not need to have deep knowledge of these principles to enjoy amateur radio, having a basic understanding makes one a better amateur. It's the difference between someone who truly knows the how and why of electronics and an "appliance operator" who simply memorized answers to test questions. Ohm's Law is arguably the most fundamental of electrical principles, so we're going to pick it apart and talk about what it really means. Countless textbooks and entire college engineering courses are dedicated exclusively to studying Ohm's Law. We cannot cover everything in one blog article, so you are encouraged to study further on your own.

The man behind the name.

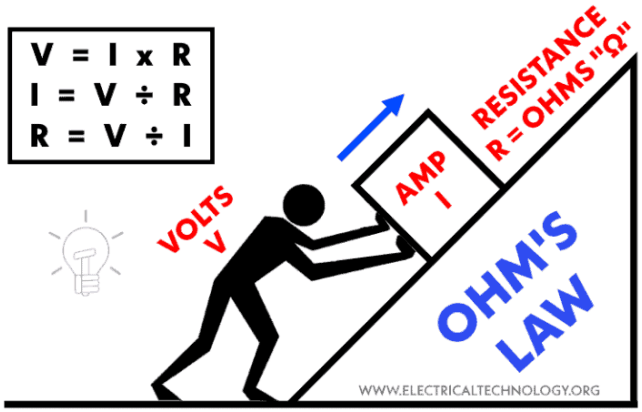
Georg Ohm (1789-1854) was a German mathematician, teacher, and physicist. In 1827 Ohm published *The Galvanic Circuit Investigated Mathematically.* This now-landmark publication described what is universally known today as Ohm's Law. Ironically, Ohm ended up resigning his faculty position at Jesuit College due to the school not taking his work seriously. It was only afterward that his discovery was validated. His research is considered the birth of modern day circuit analysis.

Ohm was not the first to propose a relationship between voltage and current. Scientists before him studied the phenomenon too, but Ohm was the first to prove and document it. Ohm died in 1854 at the age of 65 in Bavaria, now Germany.



What is Ohm's Law?

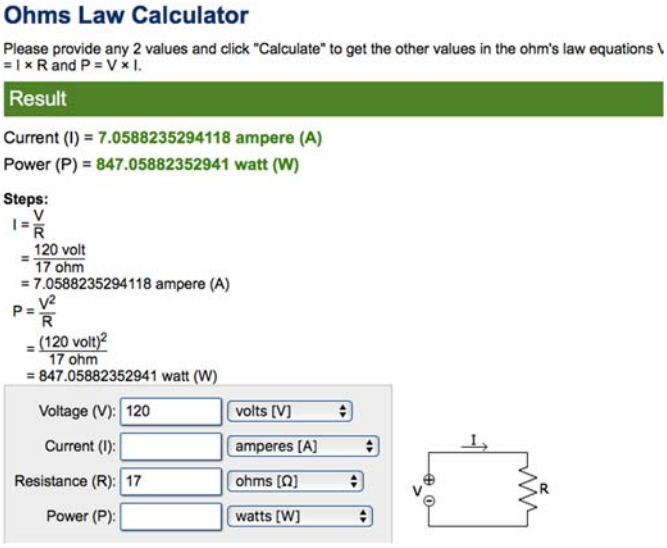
The unit of resistance is named after Ohm, but it may surprise many that Ohm's Law is not directly about resistance. Ohm's Law states that current is directly proportional to voltage. Resistance is of course a controlling component of that dynamic. Ohm's Law only applies if the other physical characteristics of the circuit remain constant. In particular, temperature can effect the electrical properties of conductors1



GRAPHIC COURTESY OF ELECTRICALTECHNOLOGY.ORG

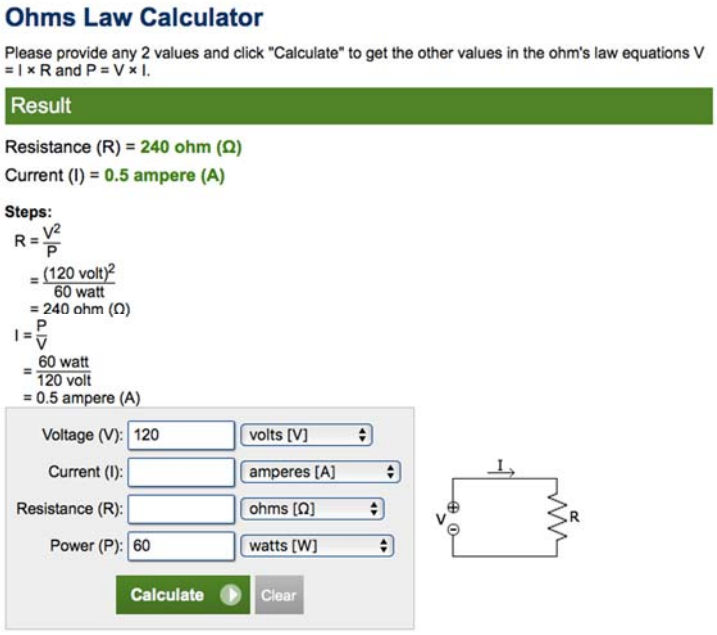
Plugging in the numbers.

Let's take the example of an ordinary incandescent light bulb. The resistance of a light bulb filament is very small. I checked a 60 watt lightbulb and it is only 17 Ohms; that's almost a dead short. If we do the math using the face-value resistance, we get numbers that don't make sense:



As we can see in the screenshot above, a 17 ohm load at 120 volts (standard North American commercial line voltage), is a whopping 847 watts and just over seven amps of current! We all know that in the real world a "60 watt" light bulb does not drink that much juice. What's going on?

What's going on is that 17 ohms is the value of a cold, unpowered filament. When the bulb is turned on, the filament heats up from the current running through it. Heat changes the resistance of the filament. If we punch in the numbers using the known wattage of the light bulb, we get very different results:



In our second calculation, the resistance of the powered up light bulb suddenly increases to 240 ohms. The current is a reasonable 0.5 amps. All the numbers make sense. This illustrates how temperature can effect resistance and vastly change the characteristics of the circuit over what it looks like at face value. Although an incandescent light bulb violates Ohm's Law (because the physical properties of the filament do not remain constant), Ohm's Law is still useful for analyzing the electrical behavior of the bulb circuit.

Since we cannot directly measure resistance in an energized circuit, Ohm's Law is key to calculating the value mathematically.

Temperature matters!

Good engineers will take temperature into account when designing circuits. All resistors have a *temperature coefficient of resistance* (TCR). TCR indicates how far the resistor will "drift" off its established value when exposed to heat. TCR is usually expressed as parts per million per degree centigrade (ppm/c) based on what value the resistor has at a standard of 25 degrees centigrade. So, for every degree above 25c, the resistance will change a known amount. In circuits where a very high level of precision is needed, the TCR helps engineers keep everything within tolerance.

There is such a thing as a "digital resistor" with active circuitry that will automatically compensate for temperature changes. Digital resistors are most commonly found in fiber optic communications gear. Another component, the thermistor, is an older-generation passive resistor that, as the name implies, can change its value with ambient temperature.

If your radio gets wiggy in hot environments one of the contributing causes could be components drifting out of specification from excessive heat.

Reactive loads.

Ohm also applies to AC circuits, but there are some important distinctions.

Purely resistive AC loads, such as an electric heater, have a constant resistance so the current will always be proportional to the voltage as it goes through its 360 degree cycle. In engineering speak, the current and voltage are in phase. In a reactive load, there are other factors that effect the voltage-current-resistance dynamic.

Reactance is a version of resistance that exists in some (but not all) AC circuits. There are two flavors of reactance: inductive and capacitive. Both types can and often do exist in the same circuit. The geeky details of reactance are farther than we need to go this time around. What you need to know for now is that reactance is a form of resistance that can vary according to the power demand of the load, capacitance and inductance in the circuit, and the frequency. Examples of reactive loads are AC electric motors and of course radio circuits.

The mathematical formulas used to calculate inductive and capacitive reactance were not developed by Ohm, but they do have a pedigree back to him.

Applying Ohm's Law to off grid amateur radio.

A knowledgable radio amateur will have a grasp of Ohm's Law without necessarily doing any math.

Problem: You are setting up a solar array that produces 25 amps at 12 volts (300 watts). The wire run will be 50 feet. All you have is 6 gauge wire, which is unsafe for this application. With your knowledge of Ohm's Law and without doing any calculations, what can you do to make the system work? Explain why.

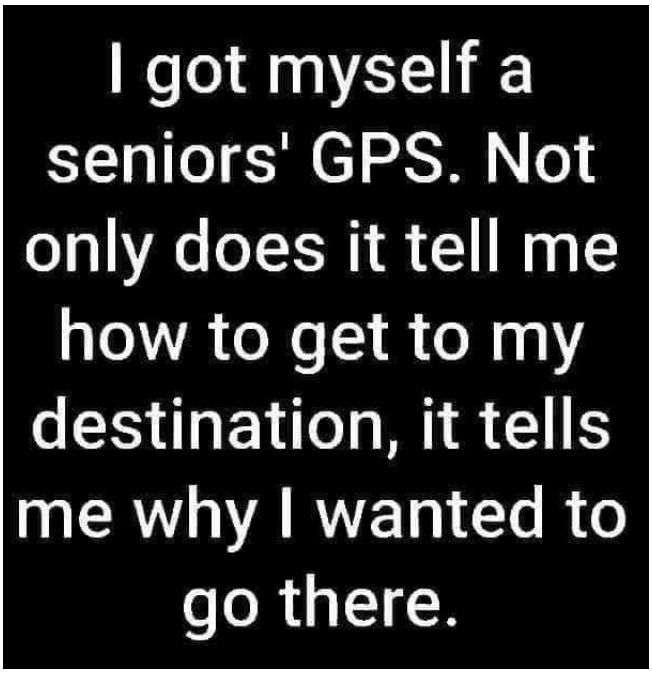
Solution: Wire the solar panels to produce 24 or more volts. The resistance of the wire is constant no matter what the voltage may be. Therefore, when the voltage goes up, the current will go down (Ohm's Law) to a level that is safe to run through 6 gage wire. An MPPT controller will convert the 24 volts to 12 volts for your radio.

If the voltage is doubled then the current is halved but we still get the same 300 watts: This thought process can also be applied to batteries and power supplies. With a little knowledge and experience you can "eyeball" solutions to simple circuit problems without crunching any numbers.

What we learned today.

- Ohm's Law describes the relationship between voltage, current, and resistance.
- The Law only applies when the physical characteristics of the circuit remain constant.
- Temperature can have a significant effect on the electrical characteristics of a circuit.
- Reactance is a form of resistance found only in AC circuits.
- The two forms of reactance are capacitive and inductive.
- Knowledgeable amateurs can apply Ohm's Law to solve simple problems without doing any mathematical calculations.

Countless textbooks and entire college engineering courses are dedicated entirely to studying Ohm's Law. There is no way we can cover everything in one blog article, so you are encouraged to study this further on your own.



Chairmen

Repeater	Joe WB8ADX
W8JXU Trustee	Bill N8QVS
Swap	John KD8NYF
Field Day	John AA8UU
Education	Jerry W9NPI
Sunday Net	Bob N8REL
Zero Beat Editor	Rick KB5OO
Public Information Officer (PIO)	Rick KB5OO
Webmaster	Reuven KB3EHW
Banquet	John W8TOY
Club Picnic	Jim W8DPM

Volunteers

LoTW Manager	Murray KE8UM
Club Cook	Bill N8QVS
Lark in the Park	John AA8UU
Net Control Operators	Len AD8FK John W8TOY Mike K8WU Bob N8REL
HPARC Media Dream Team	Hugh KE8BED Rick KB5OO John AA8UU Mike K8WU John W8TOY

HPARC Nets

HPARC Official Sunday Night 2-meter Phone Net

Every Sunday a 9:00 Pm local time on the DART repeater, 146.64 (PL 1 00), catch up on club news and information, and just to keep in touch. All amateurs are welcome to check in.

ARPSC Thursday Night 2-meter phone net

Every Thursday at 8:00 PM on the W8OAK repeater, 146.90 (PL 100). The Hospital radio check net takes place on the last Thursday each month at 7:30 PM on the W8OAK repeater. http:///www.arpsc.com

Around Town

HPARC Buddy Breakfast every Saturday at 9:00 AM (or so)

Cozy Cabin Diner, 2129 E. 12 Mile Rd, Warren, MI Come in early for the socializing. Park in the restaurant parking lot.

Oakland County ARPSC Siren Testing, 1st Saturday at 1:00 PM.

March through November. Contact Marsha, N8FE, at n8fe@arrl.net, to volunteer and be assigned a siren to test.

Amateur Radio Licensing Testing

Jerry has announced that license testing will be on the first Tuesday of every even month at 7:00 PM at the Oak Park Community Center.

Next Session October 4th