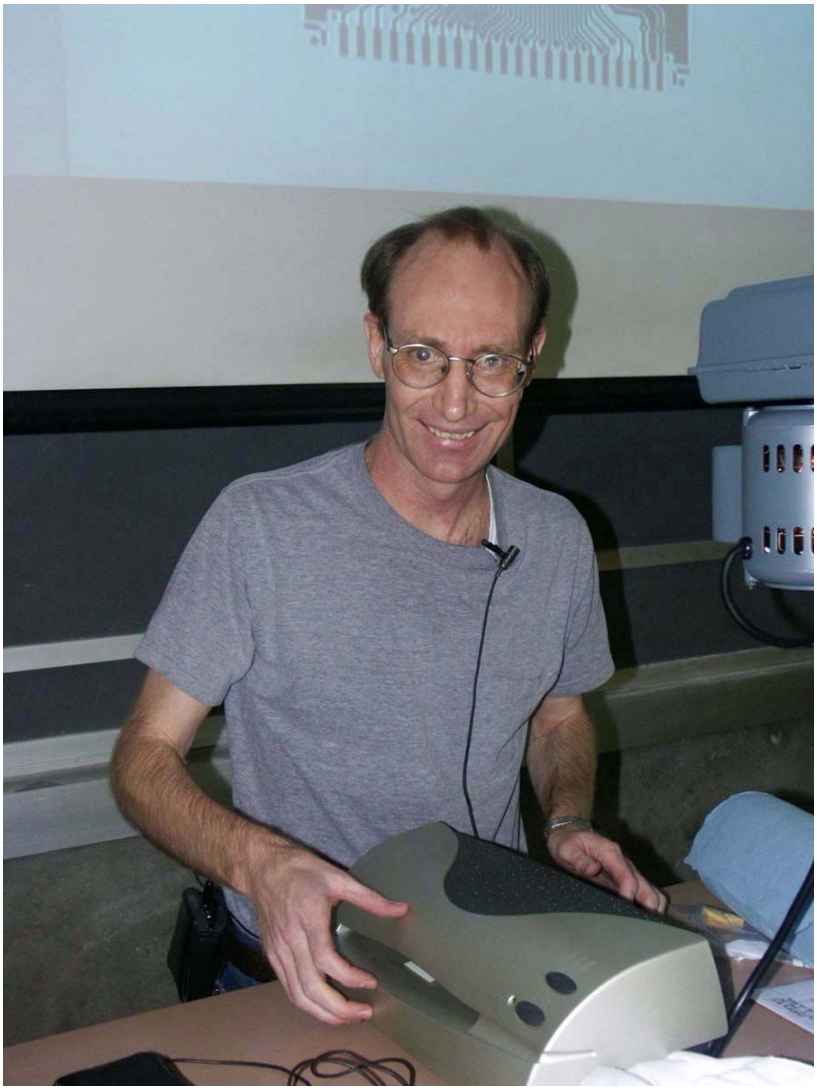

Tony Naef, KE7BBG, shared with us his knowledge of making printed circuit boards.

Volume 48, Issue 3, March 2005

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The Microvolt

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The Microvolt (USPS 075-430) is published monthly except August for $15.00 per year or $1.50 per issue by the Utah Amateur Radio Club, 3666 South State Street, Salt Lake City, UT 84115-4848. Periodicals Postage Paid at Salt Lake City, Utah. POSTMASTER: Send Address changes to *The Microvolt*, c/o Dick Keddington, 1732 Woodside Drive #32, Holladay, UT 84124-1624.

Prologue

The Utah Amateur Radio Club was organized under its present name in 1927, although its beginnings may date back as early as 1909. In 1928, it became affiliated with the American Radio Relay League (club #1602) and is a non-profit organization under the laws of Utah. It holds a club station license with the call W7SP, a memorial call for Leonard (Zim) Zimmerman, an amateur radio pioneer in the Salt Lake City Area.

Meetings: The club meets each month except July and August. The meetings are held on the first Thursday of the month at 7:30 PM in the University of Utah Engineering and Mines Classroom (EMCB) building, Room 101.

Membership: Club membership is open to anyone interested in amateur radio; a current license is not required. Dues are $15 per year, including a *Microvolt* subscription. *The Microvolt* and membership cannot be separated. Those living at the same address as a member who has paid $15 may obtain a membership without a *Microvolt* subscription for $9. Send dues to the Club Secretary: Dick Keddington, KD7TDZ, 1732 Woodside Dr. #32, Holladay, UT 84124-1624. ARRL membership renewals should specify ARRL Club #1602.

Contributions: Monetary contributions are gladly accepted. Send directly to the Club Treasurer: Chuck Johnson, 1612 W. 4915 S. Taylorsville, UT 84123-4244. For in kind contributions, please contact any board member to make appropriate arrangements.

Repeaters: UARC maintains the 146.62- and 146.76- repeaters. The repeaters are administered by the UARC Repeater Committee. Comments and questions may be directed to any Committee member. The Lake Mountain repeater (146.76-) has autopatch facilities on both the Orem exchange (covering Santequin to Lehi) and the Salt Lake City exchange (covering Draper to Layton). The 449.10 repeater has autopatch facilities into Salt Lake City only available to UARC members. Due to the volume of traffic, only mobiles should use this autopatch. Autopatch use is open to all visitors to our area and to all club members. Non-members who wish to use the autopatch are encouraged to help with the cost of maintaining the equipment by joining the club.

Ham Hot-Line: The Utah Amateur Radio Club (UARC) has a Ham Hotline, 583-3002. Information regarding Amateur Radio can be obtained, including club, testing, meeting, and membership information. If no one answers leave your name, telephone number and a short message on the answering machine, and your call will be returned.

Publication: *The Microvolt* is the official publication of the club. Deadline for submissions to the *Microvolt* is the 10th of each month prior to publication. Submissions by email are preferred (uarc@xmission.com), but other means including diskettes and typewritten submissions can be mailed directly to: Telvin Mills, 6864 Beargrass Rd., West Jordan, UT 84084. All submissions are welcome but what is printed and how it is edited are the responsibility of the Editor and the UARC board. Reprints are allowed with proper credits to *The Microvolt*, UARC, and authors. Changes in mailing address should be communicated to the Club Secretary: Dick Keddington, 1732 Woodside Dr. #32, Holladay, UT, 84124-1624.

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For late breaking news listen to the UARC Information Net Sundays at 21:00 on 146.62 or set your browser to:
www.xmission.com/~uarc/announce.html

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The Microvolt

The Official Publication of the Utah Amateur Radio Club, Salt Lake City, Utah
Volume 48, Issue 3, March 2005

QST from the Prez

Glen Worthington, WA7X

Hope we all had a fun time at the VHF Society swap meet and shuffled the "treasures" of radio related equipment among one other. It is great to have so many different clubs in Utah to give our hobby activities that are so fun. I want to thank Fred, the book lady, again for representing UARC at the swap meet!

Each month we get to introduce a number of new hams as well as those moving into our area. Let's be sure and take the time to have an "eyeball" QSO with them at our meetings. And for the newcomers (both the move-ins and newly licensed) please let us know who you are, and if you have any suggestions for our club. Each month one of the big issues the board works on with the Program Chair Persons is to come up with meeting topics, but we welcome all members' suggestions. (In fact last month's meeting was from a new member who approached us with his idea, and what a great meeting that was).

UARC has also been approached about running a future hamfest, which could be in Utah or we could possibly resurrect the WIMU hamfest (which could be held in Jackson Hole or West Yellowstone). What we will need is a strong and committed chairperson and committee. If there are any of you particularly interested in this role please contact one of the UARC board members and we can discuss the details further. Normally it takes more than a year to properly organize what is needed. This does not need (nor is it desired) to be exclusive only to the UARC, so all other amateurs are invited to participate or lead this endeavor.

The board has also identified some priority projects to complete and will announce them shortly.

Hope to see you at the meeting!.

Remember, this is just a hobby, so let's keep having fun! Actually there and enjoying.

73 de WA7X Glen

FYI

KÄRNTEN (one of the states of Austria) has 8 pairs of alternating dits and dahs in Morse code (_._ ._._ ._. _. _ ._.)

A Finnish partitive case "of a shoe" has a total of 17 alternating dits and dahs:
KENKÄÄ (_._ . _. _._ ._._ ._._)

A Finnish tongue twister for "a water devil hissed in the elevator" has 56 dits in a row in Morse code. It has a total of 60 dits and 3 dahs which is the greatest ratio (20:1) known in any mix. VESIHIISI SIHISI HISSISSÄ (…_ . … .. …. .. .. … .. … .. …. .. … .. …. .. … … .. … … ._._)

MOTMOT (a tropical American bird) and TOM-TOM contain only dahs in Morse code (_ _, _ _ _, _ , _ _, _ _ _, _) and (_, _ _ _, _ _, - _, _ _ _, _ _)

SHEESHES (plural of SHEESH) may be the longest word containing only dits in Morse Code
(…, …., ., ., …, …., ., …)

The longest palindrome in Morse Code is
INTRANSIGENCE (.._._._.._ _....._ _.._._._..)

Member of the Month

By Linda Reeder

This month we are featuring Scott Thomson, KD7VFP. Scott became interested in amateur radio while he was attending Murray High School. Scott had a friend whose father was very active in the hobby. They used to spend hours listening to the ham bands on his friend's father's Hallicrafters. Then Scott's friend moved away. They made a pact that both of them would get their amateur licenses, but Scott's friend never did.

Scott received his Novice license in 1978 when he was 17 years old and attending Murray High School. It was during this time that he was building a Heathkit HW101. Scott still uses it today. Scott also has a 101 Tempo boat anchor and an Icom 706. Scott loves to build things. That is his favorite facet of amateur radio.

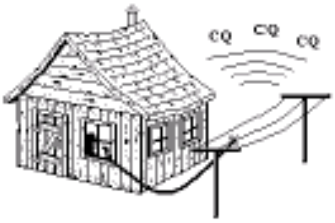
Scott let his license expire in 1995. In 2003 Scott received his Technician license and one year later he received his General license. He hopes to get his Extra class license real soon.

Scott was in the Air Force for 10 years doing weather forecasting. He also worked at Cape Canaveral in Florida working with launching spacecrafts and providing weather reports. While in the Air Force, Scott spent some time in Central America, Germany and Korea. He also worked for an outfit in Nebraska. Scott now works for Qwest trouble shooting high capacity network communications.

Scott has two grown children, one boy and one girl. Scott is a member of UARC. He was elected chairperson for UARC for the year 2005. Scott collects QSL cards and loves Field Day. Scott went to Field Day last year for the first time and had a wonderful time. Another hobby Scott enjoys is photography. Scott, congratulations on your new position with UARC. We know you will do a good job. We wish you the best of luck on upgrading to Extra

.

73, N7HVF Linda Reeder.



March Meeting: VHF DX

Two meters is nice for local communication, but to work someone direct more than 100 miles away, you need to use HF, right? That is probably how many of us view the VHF and UHF bands, but our March meeting will feature a speaker who can dispel that notion. Would it surprise you to learn that there are operators who have worked all states on two meters? (Remember, repeaters and IRLP don't count.)

On Thursday, March 3, the monthly UARC meeting will feature Dave Felgar, NJ7A, a veteran of the VHF and UHF weak signal modes. It's true that you won't find much 20-meter-style F2 propagation on two meters, but there are still some effective ways to get a signal across the country. Meteor scatter, aurora, ducting, and moonbounce are all in the serious VHFer's bag of tricks. Dave will tell us what it's like to operate some of these modes and what is required in the way of equipment and operating skill. And it's all available to anyone with a Technician class license or higher.

Top Signs You Need an Elmer...

- Your friend tells you he has a new two-meter radio and you figure one of the meters must be for SWR and the other for power out.
- You hear a conversation on the low bands about CW and you think they're referring to the cold war.
- You hear someone sign with “this is N8XXX, mobile 4,” and you think it's because he has three other radios.
- You hear that someone won a 40-meter radio at a hamfest and you wonder how they're going to get something that large in their house.
- You build a Morse code key out of Plexiglas and can't figure out why it won't key your radio.
- You think the difference between short wave and long wave is the speed at which you move your wrist back and forth.
- You're thinking about joining your other ham friends in the local ATV group because you own a four wheel drive vehicle that will go just about anywhere.
- You think a collinear antenna can only be used with two amplifiers.
- You think FM is the modulation type that came after EM, DM, CM, BM, and AM.
- You wouldn't mind getting into Packet Radio but no matter how much you practice you can't get the hang of sending those beeps and braps with your keyer.
- You wonder what sound a short wave makes and why anyone would want to listen to one.
- You think the repeater owner would be a lot happier if instead of talking about his cavities he just went to the dentist and got them filled.
- You think a CW ID is the number the Army gave you on your dog tags during the cold war.

Ohm's Law (Part II)

This the second part of a four part series covering Ohm's Law. Thanks to OCARC for permission to reprint this article.

By Bob Eckweiler, AF6C

Thévenin's Theorem:

Last month the three forms of Ohm's Law were introduced. For simple circuits the law is easy to apply, as we saw in the examples and problems. However, as the last problem emphasized, sometimes a circuit can present a problem that is less intuitive to solve. Two theorems may be used to simplify more complex circuits; this month we're going to look at Thévenin's Theorem. The theorem basically states that: *Any two-terminal linear circuits composed of resistors and voltage sources may be replaced by one power source in series with a fixed resistor.* Whoa! What does that really mean?

Let's look at the voltage divider circuit from last month (see Figure 1a). Two output terminals have been added and the meters removed; otherwise it is the same circuit as figure 2 from last month. According to the Thévenin's Theorem this circuit may be replaced with the circuit in figure 1b. The Thévenin's equivalent voltage source is the calculated open circuit voltage across the two terminals. The Thévenin's equivalent resistance may be calculated by assuming all the voltage sources are replaced by short circuits and then calculate the resistance between the two terminals.

First let's calculate the Thévenin's equivalent voltage source. Last month we used Ohm's law to find the current flowing through the resistors and used it again to find the voltage across R_2 to solve the voltage divider. You can also use the Voltage Divider equation (6) to find the Thévenin's equivalent voltage:

$$V_{Th} = \left(\frac{R_2}{R_1 + R_2}\right) \times V \qquad (6)$$

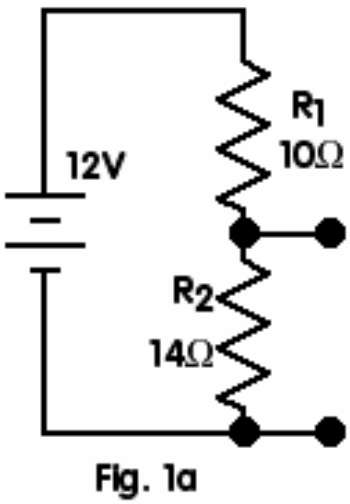


Fig. 1a

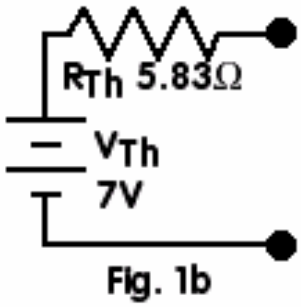


Fig. 1b

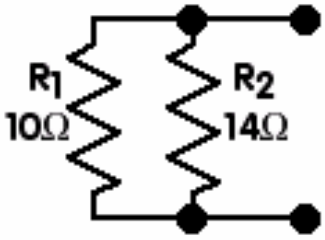


Fig. 1c

The numerator in this equation is always the (series) value of the resistor(s) across the output terminals (in this case R_2) and the denominator is the total series resistance of the circuit (R_1 + R_2 in this case). Solving figure 1a we get:

$$V_{Th} = \left(\frac{14}{10+14}\right) \times 12 = 7 \text{ volts}$$

To calculate the Thévenin's equivalent resistance redraw the circuit with all voltage sources as shorts and calculate the resistance looking into the terminals. Figure 1c shows the circuit as it should be redrawn. The Thévenin's equivalent resistance is just R_1 and R_2 in parallel or 5.83 ohms. Using equation 5 from last month:

$$R_{Total} = \frac{R_1 \times R_2}{R_1 + R_2} \qquad (5)$$

$$R_{Total} = \frac{10 \times 14}{10 + 14} = 5.83\,\Omega$$

Last Month's Problem Three:

Thévenin's Theorem is a very powerful tool for simplifying circuits. Let's look at problem 3 from last month. The circuit is redrawn as figure 2a.

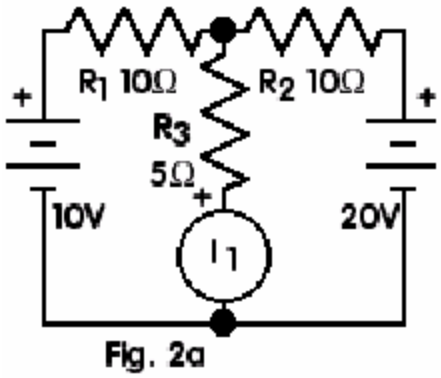


Fig. 2a

You probably had a lot of trouble solving it. Assuming you didn't get any help from Thévenin's and you are a math whiz, you most likely solved it by using simultaneous equations (three equations and three unknowns); it was not an easy task! Since we want to find the current through R_3, let's replace it with two terminals as shown in figure 2b. This is just a series circuit with two batteries and two resistors. Since the voltage at point A is +20V and the voltage at point B is +10V, there is 20V minus 10V across the two series resistors R_1 and R_2. The circuit current through these resistors is:

$$I = \frac{E}{R} = \frac{(E_2 - E_1)}{(R_1 + R_2)}$$

$$I = \frac{(20-10)}{(10+10)} = 0.5 \text{ amps}$$

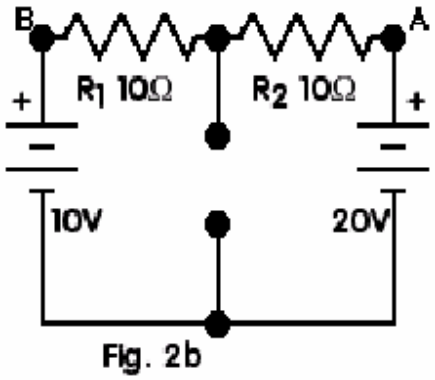


Fig. 2b

And the voltage at the upper terminal is the voltage at point A minus the voltage drop across R_2, which is 5 volts:

$E_{R2} = I \times R = 0.5 \times 10 = 5$ volts

$E_{Th} = 20 - 5 = 15$ volts

The Thévenin's equivalent resistance is easily determined by redrawing the circuit with the two batteries replaced with a short. It is just the two 10-ohm resistors in parallel or 5 ohms. Figure 3a is the Thévenin's equivalent circuit of figure 2b. Now, to solve problem 3, let's just add R_3, the resistor we removed earlier, across the terminals as shown in figure 3b and solve for the current:

$$I = \frac{E}{R} = \frac{E_{Th}}{(R_{Th} + R_3)}$$

$$I = \frac{15}{5+5} = 1.5 \text{ amps}$$

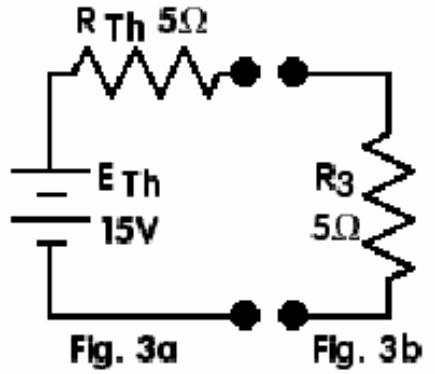


Fig. 3a Fig. 3b

Let's try another one! The Wheatstone bridge circuit, shown in figure 4, is used with strain gages, instrumentation transducers and measurement test equipment.

Basically, when the ratio or R_1 to R_2 is equal to the ratio of R_3 to R_4 the bridge is balanced and no current flows through R_5, which is often a sensitive meter or other detector. The values given in figure 4 are for an unbalanced bridge so current is flowing through R_5. Our assignment is to find out what the value of that current is. Those resistors at 45-degree angles have always looked overwhelming, so our first task will be to redraw the circuit as shown in figure 5a. Note that I've broken the circuit into two voltage dividers with their Thévenin's terminals, and separated out R_5. I've also shown the battery twice so it appears on both sides of the circuit, which changes nothing as shown by the dotted circuit lines. Looking at the left side voltage divider, the Thévenin's equivalent voltage and resistance are calculated using equation (6) and equation (5) respectively as:

$$E_{Th1} = \left(\frac{15}{10+15}\right) \times 20 = 12 \text{ volts}$$

$$R_{Th1} = \frac{(10 \times 15)}{(10+15)} = 6 \text{ ohms}$$

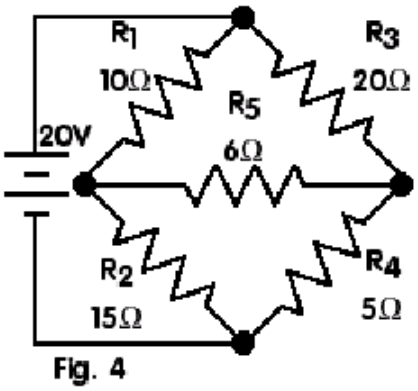


Fig. 4

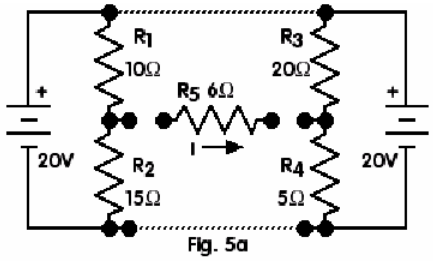


Fig. 5a

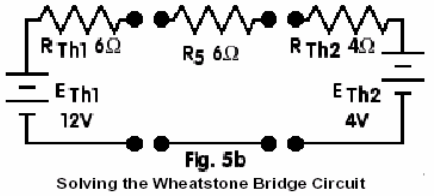


Fig. 5b

Solving the Wheatstone Bridge Circuit

Looking at the right side voltage divider, the Thévenin's equivalent voltage and resistance are:

$$E_{Th2} = \left(\frac{5}{20+5}\right) \times 20 = 4 \text{ volts}$$

$$R_{Th2} = \frac{(20 \times 5)}{(20+5)} = 4 \text{ ohms}$$

The Wheatstone circuit of figure 4 can now be drawn as figure 5b, and the current through R_5 can be easily calculated:

$$I_{R5} = \frac{E}{R} = \frac{E_{Th1} - E_{Th2}}{R_{Th1} + R_{Th2} + R_5}$$

$$I_{R5} = \frac{(12-4)}{(6+4+6)} = 0.5 \text{ am}$$

This is a good example of how Thévenin's Theorem can simplify an otherwise difficult circuit problem. While we haven't probed too deeply, you should now have a good understanding of Ohm's law and how to use it in basic and even somewhat complex circuits. There is another tool, Norton's Theorem that can also be used to simplify circuits. It is beyond the scope of this month's article but it may get discussed in a future issue if anyone shows interest (hint)!

Non-Ideal Meters:

Last month we talked about ideal voltmeters (infinite resistance) and ammeters (zero resistance). Unfortunately these are only available in the labs at *Hogwart's School of Witchcraft and Wizardry*. As a "muggle" you must use non-ideal meters. Let's look at ammeters first:

Analog ammeters have a low series resistance that varies with range. A standard 0-1mA meter typically has a series resistance of 50 to 100 ohms. By Ohm's law this amounts to a voltage

drop of 50 to 100 mV across the meter. In certain applications this can have a noticeable influence on the circuit being measured. The series resistance does provide one benefit; by adding a resistor in parallel with the meter, the meter can be made to operate at a higher full-scale value. This resistor is called a meter shunt. If you want to have a 0-1 mA meter with a series resistance of 50 ohm read 0-5 mA full-scale, a shunt of 12.5 ohms can be place across the meter. This is also a simple Ohm's law problem!

Ammeters are normally manufactured in the range of 20 uA full-scale to 5 amps full-scale; very low current ammeters used in labs are called galvanometers. The full-scale range of high current ammeters is often 5 amps and either an internal or external shunt is used. For very large currents the external shunt can be placed in a convenient place and the wire to the meter need only handle the lower current.

Non-Ideal Voltmeters:

If you place a resistor in series with a 0-1 mA ammeter and select the resistor so that the total resistance of the meter and resistor is series is 10,000 ohms you have a voltmeter that will read 10 volts full-scale. Other resistances may be calculated for other full-scale voltage ranges using Ohm's law. For large resistors the small meter resistance can be ignored. The example above has 0.5% error.

This voltmeter draws one milliamp from the circuit being measured. It can have a major influence on a high impedance circuit. Since the voltmeter described above has a 10-volt full-scale range and a 10,000-ohm impedance, it is said to be a 1,000 "ohm-per-volt" meter. Common values of 1,000, 20,000 and 30,000 "ohms-per-volt" corresponding to meter movements of 1mA, 50uA and 33uA. The higher the value, the less influence on the circuit. To find the resistance of a voltmeter multiply the "ohms per volt" by the full-scale value of the meter. (If it's a multi-range meter, use the full scale value of the range you're on.) For an old workhorse Simpson Model 260 Volt-Ohm Meter (20,000 ohms per volt) the meter resistance is 50,000 ohms on the 2.5 volt scale and 20 Megohms on the 1,000-volt scale. Vacuum tube and FET voltmeters were developed to allow a higher meter impedance at the lower voltage ranges and thus influence the circuit under test. Most Heathkit VTVMs have an impedance of 11 Megs on all ranges!

For next installment we will continue with Ohm's law and discuss power law. Resistive devices dissipate power; this law calculates the power being dissipated in the resistance or load.

Exam Schedule

3/02/05 (Wed.) Farmington
Contact: Rena Skeen, AD7BX
Phone: (801) 773-7048

3/12/05 (Sat.) Logan
Contact: Heidi Black, AC7ZC
Phone: (435) 753-7487

3/16/05 (Wed.) Provo
Contact: Steve Whitehead, NV7V
Phone: (801) 465-3983

3/16/05 (Wed.) St. George
Contact: Ronald C. Sappington, WI7Z
Phone: (435) 673-4552

3/29/05[1] (Tues.) Salt Lake City
Contact: Eugene McWherter, N7OVT
Phone: (801) 541-1871

3/31/05 (Thu.) Roosevelt
Contact: R. Chandler Fisher, W7BYU
Phone: (435) 722-5440

4/02/05[1] (Sat.) Salt Lake City
Contact: Gordon Smith, K7HFV
Phone: (801) 582-2438

4/20/05 (Wed.) Provo
Contact: Steve Whitehead, NV7V
Phone: (801) 465-3983

4/20/05 (Wed.) St. George
Contact: Ronald C. Sappington, WI7Z
Phone: (435) 673-4552

4/26/05[1] (Tues.) Salt Lake City
Contact: Eugene McWherter, N7OVT
Phone: (801) 541-1871

[1] Pre-registration required. Contact the contact person prior to the examination date.

For more detail either call the contact or check out the information on our webpage:

http://www.xmission.com/~uarc/

Brain Teaser

Last Month's Teaser: There are no ***e's*** in the article.

Handy Wiring Tip

If you find yourself pulling wire in tight spaces (e.g. an attic crawl space), you might want to borrow a tool from your golfing buddy. The telescoping ball retrievers used by golfers work very nicely! They expand to 12 or more feet depending on the model…some even have a hook-shaped device that is perfect for snagging the end loop of a pull cord. Because they collapse to a four-foot closed position, they can be easily maneuvered in tight spaces.

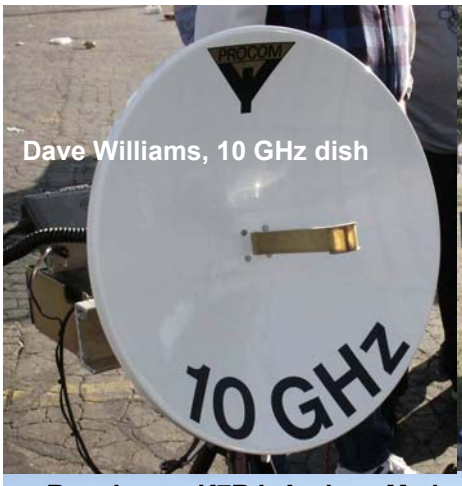
Good luck with your next antenna installation; perhaps this tip will make it a bit easier!

Who's Leading Whom.....

For years, each morning at about 11:30 AM the telephone operator in a small Sierra Nevada town received a call from a man asking the exact time. One day, the operator summoned nerve enough to ask him why the regularity. "I'm foreman of the local sawmill," he explained, "every day I have to blow the whistle at noon, so I call you to get the exact time."

"That's really funny," she replied, "all this time we've been setting our clock by your whistle!"

Microwave Group



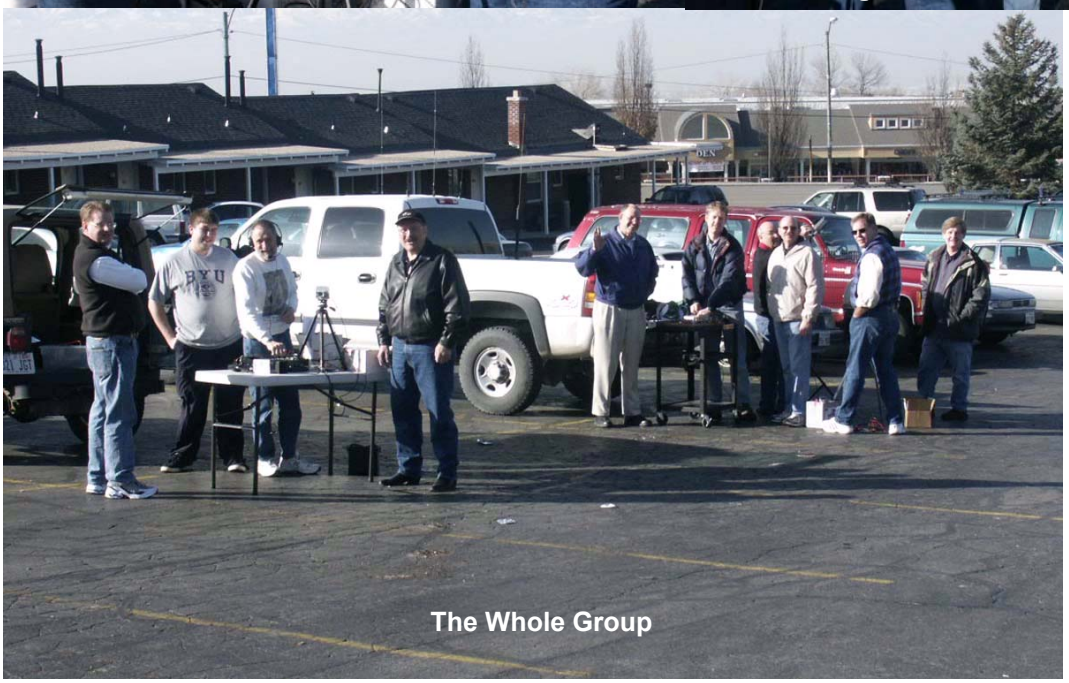
Dave Williams, 10 GHz dish


Dale Heisler,WJ7L

Ron Jones' control box


Ron Jones, K7RJ, Andrew Madsen, AC7CF, Brett Sutherland, N7KG, Dave Earle, KD7LSX


Dave Williams, WA7GIE, John Lloyd, K7JL, Charles Clark, N7MLD, Dave Felgar, N7JA, Brian Mogensen, W7CBM


The Whole Group

Photos by: Ron Speirs, K7RLS

The microwave group had their second get-together February 4th at Marie Callendar's for breakfast.

There was a good turnout of 10 -12 people who are interested in microwave communications.