ORANGE COUNTY AMATEUR RADIO CLUB W6ZE

RF

ARRL

VOL. LII NO. 12 P.O. BOX 3454, TUSTIN, CA 92781-3454 DECEMBER 2015

The 'PREZ SEZ':

The Christmas party is over and we can close the books on a successful year for the club. From my perspective the year seemed to fly by and I know in just over 3 weeks it will be January 2016 and it will start over again with new plans for Field Day, Auction, next year's party along with various speakers and presentations.

Our Vice President, Tom - W6ETC, works hard to find us great speakers throughout the year and if you have any ideas for talks you would like to hear please let him know your ideas. Better yet, if you have a topic that's something of great interest to you

[See **'Prez Sez'**, page 3]

Congratulations to the 2016 Board of Directors:

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Vice President: Tom Cowart	**W6ETC**
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Visit our Webpage: Scan this QR code with your smartphone.

http://www.w6ze.org

NO DECEMBER MTG.

There will not be a December General Meeting due to the **Annual Holiday Party**.

The January Program will be a presentation by Arnie - N6HC on the 2015 DX-pedition to Chesterfield Island.

The Next General Meeting is:

JANUARY15th, 2016 At 7:00 PM

In This Issue: ***Page***

Click on a page number to go to that page. Works in most versions of Adobe's *Acrobat Reader* and Apple's *Preview*. Click on *RF* at the top of any page to return to the index.

Due to travel, the location, date and time of the January Board meeting is yet to be determined. Check later our website often.

THE ORANGE COUNTY AMATEUR RADIO CLUB, INC.
P.O. Box 3454, Tustin, CA 92781

2015 Board of Directors:

President:
Tim Millard, W6TMT
(714) 744-8909
w6tmt@w6ze.org

Vice President:
Tom Cowart, W6ETC
(714) 454-0571
w6etc@w6ze.org

Secretary:
Ken Konechy, W6HHC
(714) 744-0217
w6hhc@w6ze.org

Treasurer:
Greg Bohning, W6ATb
(714) 767-7617
w6atb@w6ze.org

Activities:
Doug Wood, K6PGH
(714) 501-5527
k6pgh@w6ze.org

Membership:
Don Mech, N6XBP
(714) 206-6548
n6xbp@w6ze.org

Publicity:
Robbie Robinson, KB6CJZ
(714) 478-9713
kb6cjz@w6ze.org

Technical:
Bob Eckweiler, AF6C
(714) 639-5074
af6c@w6ze.org

Officers At Large:
Nicholas Haban AF6CF
(714) 693-9778
af6cf@w6ze.org

Paul Gussow, W6GMU
(714) 624-1717
k6yui@w6ze.org

2015 Club Appointments:

W6ZE License Trustee
Bob Eckweiler, AF6C
(714) 639-5074
af6c@w6ze.org

Club Historian:
Bob Evans, WB6IXN
(714) 543-9111
wb6ixn@w6ze.org

Webmaster:
Ken Konechy, W6HHC
(714) 744-0217
w6hhc@w6ze.org

Assistant Webmaster:
Bob Eckweiler, AF6C
(714) 639-5074
af6c@w6ze.org

ARRL Awards Appointees:
Arnie Shatz, N6HC
(714) 573-2965
n6hc@w6ze.org

John Schroeder, N6QQ
(West Orange County)
(562) 404-1112
k6vdp@w6ze.org

***RF* Editor - December 2015:**
Bob Eckweiler, AF6C
(714) 639-5074
af6c@w6ze.org

Contact the Newsletter

Feedback & Corrections:
rf_feedback@w6ze.org

Submit Articles:
editors@w6ze.org

Submit Puzzle Answers:
puzzler@w6ze.org

Monthly Events:

General Meeting:
Third Friday of the Month
At 7:00 PM **except Dec.**
American Red Cross
600 N. Parkcenter Dr.
(near Tustin Ave. & 4th St)
Santa Ana, CA

Club Breakfast (Board Mtg.):
First Saturday of the month at 8:00 AM at the **Marie Callender's**
1821 North Grand Ave.
Santa Ana, CA
(Ball exit west off 57-Fwy)

Club Nets (Listen for W6ZE):
28.375 MHz SSB ± QRM
Wed - 7:30 PM - 8:30 PM
Bob AF6C, Net Control

146.55 MHz Simplex FM
Wed - 8:30 PM - 9:30 PM
Bob, WB6IXN, Net Control

7.086 ± MHz CW **OCWN**
Sun - 9:00 AM - 10:00 AM
John WA6RND, Net Control

VISIT OUR WEB SITE

http://www.w6ze.org

for up-to-the-minute club information, the latest membership rosters, special activities, back issues of ***RF***, links to ham-related sites, vendors and manufacturers, pictures of club events and much much more.

2016 **Club Dues:**

Regular/New Members[1]	$30
Family renewal/Join[2]	$45
New Member (After June)[3]	$15
Replacement Badge[4]	$3

Dues run from January thru December.

[1] New members joining in Jan through Jun; includes badge.

[2] Two or more members of the same family; includes badge.

[3] New members joining from Jul through Dec.; includes badge.

[4] There is an additional charge of $1.50 if you'd like your badge mailed (U.S., APO addresses only).

W6ZE – WINTER FIELD DAY 2016

1700 UTC 30 Jan to 1700 UTC 31 Jan, 2016

After a year of uncertainty over the future of the old SPARs Winter Field Day event and ill health of SPAR's Board of Directors, it would appear that IT's BACK!!! A NEW group has now taken over the reins and is actively promoting this fun event. Do you like the ARRL's Field Day?? If you do, you'll likely LOVE Winter Field Day as a welcome break and fun event in the middle of the cold winter months.
A group of OCARC members will be activating W6ZE from Prado Regional Park the weekend of 30-31 January, 2016. Everyone is welcome and it gives a chance for all those holding a Technician license to operate on the HF bands.

There is a $10.00 per vehicle entrance fee. For more information on the park see:

Prado Regional Park .

The current plans is to set up in the campground around Site 61 - 65. Radio/antenna set up cannot begin before 5:00am PST on Saturday morning.

For more information on OCARC plans contact:

Ron Mudry, (714) 840-3613

For general Winter Field Day information, go to:

http://www.winterfieldday.com

73, de Doug - K6PGH

[The 'PREZ SEZ', from page 1]

consider making a presentation yourself, it doesn't need to be a long presentation, we can easily divide our presenter time between several short topics. Life's too short to have regrets about what you could have done. Give it a try.

Finally, I would like to thank all of you who encouraged me serving as club President. It certainly makes for a pleasant situation when we have so many willing to chip in and help get the job done. Have a Merry Christmas and a Happy New Year!

May all your signals be strong, constant and clear.

de N6TMT - Tim

2015 W6ZE FIELD DAY RESULTS:

Congratulations to the W6ZE Field Day team. Even though 2015 was a training year for us, we still scored quite well in the standings. W6ZE (6A-ORG) finished 47th out of the 2,720 entries submitted overall with 3,391 contacts and 10,150 points. We also placed fourth in the Southwestern ARRL Division, behind our own N6HC and group (2A-LAX), with 12,670 points, N6GA (5AB-LAX) with 11,775 points, and K6LL (2E-AZ). We finished 1st in the Orange Section out of 44 entries.

W6ZE actually made over three times more contacts than N6GA (1,117) who was operating in the battery class, and just under 28% more contacts than K6LL. Besides N6GA operating in the battery class, the difference is that they had more CW contacts than we did. The N6HC group had 3,879 contacts.

The table below shows our finishing position overall (class independent) in the total contest, then in the Southwestern Division (SWD), and finally in the Orange Section. The numbers show our position, the size of the competition and where we scored percentage-wise, in each of the three areas. In the past ten years we have finished in the top-10-overall four times, first in the SWD five times and first in the Orange section seven times.

Congratulations to the Club. Wait until 2016!

de W6ZE

Orange County (California) ARC FD Results - 2002 - 2015

				FINISH: OVERALL			FINISH: SOUTHWEST DIV.			FINISH: ORANGE SECTION		
YEAR	SCORE	# QSOs	CLASS	POS.	OUT OF	%	POS.	OUT OF	%	POS.	OUT OF	%
2015	10,150	3,391	6A	47	2,720	1.7%	4	197	2.0%	1	44	1st
2014	17,970	5,429	7A	6	2,686	0.2%	1	193	1st	1	48	1st
2013	21,258	6,859	12A	2	2,548	0.1%	1	170	1st	1	47	1st
2012	7,684	2,264	5A	118	2,617	4.5%	7	176	4.0%	1	50	1st
2011	6,504	2,110	6A	159	2,632	6.0%	9	179	5.0%	5	49	10.2%
2010	5,936	1,878	4A	175	2,617	6.7%	14	182	7.7%	4	50	8.0%
2009	19,304	5,925	9A	3	2,603	0.1%	1	175	1st	1	45	1st
2008	11,316	3,265	9A	28	2,409	1.2%	1	161	1st	1	44	1st
2007	20,246	6,217	9A	2	2,331	0.1%	1	157	1st	1	42	1st
2006	6,278	1,836	4A	161	2,169	7.4%	7	153	4.6%	2	43	4.7%
2005	6,742	1,938	3A	128	2,199	5.8%	11	172	6.4%	2	32	6.3%
2004	5,666	1,792	4A	207	2,242	9.2%	16	152	10.5%	4	41	9.8%
2003	3,350	946	4A	426	2,079	20.5%	29	150	19.3%	6	32	18.8%
2002	4,928	1,517	4A	303	2,099	14.4%	20	139	14.4%	4	42	9.5%

Data from the ARRL Contest Results Database. de AF6C

OCARC HAM RADIO
ARRL FIELD DAY
10 AM Sat. to 11 AM Sun.
Visitors Welcome

2016 SW Division Convention

Yuma Hamfest

Yuma, Arizona

Feb. 19 & 20, 2016

Yuma County Fairgrounds
2520 East 32nd Street, Yuma, Arizona

www.yumahamfest.org

Check the Website for Additional Information

Gates Open for Camping Thursday, 2 pm Vendor Setup Friday, 7 am - Noon	Event Hours Friday, Noon - 5 pm Saturday, 8 am - 5 pm	Hamfest Dinner & Grand Prize Drawing Saturday Night 6:00 - 8:00 pm

Vendors & Exhibitors
Consignment Sales
License Testing
Hourly Door Prizes
On-site RV Camping
Hamfest Dinner
ARRL Speaker
Transmitter Hunt
$5.00 Admission

Tailgating (Swap Meet)
Full Seminar Schedule
DXCC Card Checking
Incredible Grand Prizes
Emergency Preparedness
Admission Prize
Hospitality Area
Near Space Balloon Launch
Antenna Clinic

Hamfest Talk-In Frequency: 146.840 (–) PL 88.5 Hz

Email Contact: ***info@yumahamfest.org***

We are proud to have the Amateur Radio Council of Arizona (ARCA) as a sponsor of our event.

The Yuma Hamfest is an American Radio Relay League (ARRL) sanctioned event.

Presented by the Yuma Amateur Radio Hamfest Organization

? ? PUZZLER ? ?

Here's a little puzzle to help keep your brain synapses firing!

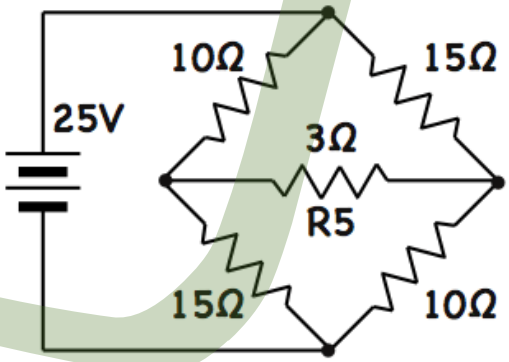
Two electrical engineering freshmen at Parvoo University believed they knew their basic circuit analysis class subject well enough to skip studying for the final exam. Instead, they drove home to a party at their former high school. The party was a wild one, and the next day neither was able to get up in time for the return trip to take their final exam.

In a panic, and knowing the professor would not let them makeup the test if they told the truth, they decided to make up a story that they went home to study and got a flat tire on their way back.

At first, the professor refused to offer a makeup test; but after the two students begged him, saying a failing grade would ruin their future careers, he finally relented at told them to show up the next morning for their makeup test.

The next morning the professor had them leave their cell phones and books in his office, and set them down in separate rooms, each with an identical test.

The first question on the test, which counted for 25 points, showed a simple circuit (Problem 1) and asked: "What is the voltage across R5?" Each of them smiled confidently, and solved the problem.



Problem 1: 25 points

They then turned the page to the next question, which counted for the remaining 75 points....

THIS PUZZLE has two questions:

1. What is the value of the current through R5?

2. What was the second question on the test?

Send your solution to: puzzler@w6ze.org (Answers next month).

? ? PUZZLER ? ?

Heathkit of the Month #68:
by Bob Eckweiler, AF6C

ELECTRONIC TEST EQUIPMENT
Heathkit IM-38
AC Vacuum Tube Voltmeter (VTVM).

Introduction:
Back in March of 2013 **Heathkit of the Month #47** discussed the Heathkit line of AC VTVMs as well as the solid state IM-5238. That article focused mainly on the late 1950s AV-3 model.

I was recently offered an IM-38 by Bill - K6WHP, and jumped at the opportunity. It has many features and improvements over the earlier AV-1, through AV-3 AC VTVMs, and I felt it warranted its own feature article.

The IM-38 AC VTVM:
The IM-38 (Figure 1), sold between 1969 and 1976, was the last Heathkit AC VTVM model before Heath switched to a solid-state design. In between the AV-3 and the IM-38, the IM-21 was offered. The IM-38 originally sold for $39.50 in kit form or $54.95 factory wired (as the IMW-38). In the Christmas 1976 catalog the IM-38 sold for $52.50, and there was no mention of the factory-built model. See Figure 4, an ad from the summer 1969 Heath catalog.

The IM-38 is a significant update from the AV-3. Most of these updates first appeared in the earlier IM-21 model. As a result, the IM-38 shares with the IM-21 an input impedance that is higher than the AV-3 by a factor of ten and also improves the ±1 dB frequency response from 10 cps - 400 kHz to 10 cps - 500 kHz on all ranges (± 2dB 10 Hz to 1MHz). Due to the increased input impedance, the 1,000 : 1 resistive input voltage divider is capacitively compensated to help improve the response at higher AC frequencies. This compensation is internally adjustable via a small trimmer capacitor.

Figure 1:Heathkit IM-38 AV Voltmeter

The ranges remain the same as on the earlier models, going from 10 mV full-scale to 300 volts full-scale in ten 1 : 3 steps. The fully-clockwise eleventh position of the range switch turns the unit off.

The IM-38 differs from the IM-21 in three aspects. First it introduces a new updated style which Chuck Penson - WA7ZZE coined "The New Look" in his book ***Heathkit Test Equipment Products***[1]. This is the light beige front panel with a darker beige cabinet, two-tone brown knobs and dark brown lettering.

The second change is in the power supply; a dual primary transformer is used so the IM-38 may be wired for 120 or 240 VAC use, negating

the need for a separate export model. Surprisingly there is no fuse in the AC line.

Thirdly, the two-wire power cord was replaced with a three-wire cord that connects the chassis to AC power ground. Since the black (low side) of the voltmeter input is also connected to chassis ground, you need to be certain the low side is at ground potential if you are measuring the AC voltage of the power line. Otherwise you will be popping fuses, damaging alligator clips or test probes, possibly damaging the equipment you are measuring, or worse. Still that is likely better than touching a hot chassis, possibly resulting in electrocution.

The IM-38 and IM-21 share a different vacuum tube lineup than the AV-3. Two tubes, with three total sections, replace three tubes with five total sections. Table I shows the lineup. In the IM-21 and IM-38 models Heathkit uses higher gain pentodes to replace pairs of triodes.

The front panel layout of the IM-38 is extremely simple, containing just a 4-1/2" meter, two of the Heathkit five-way binding posts, one red and and one black, and an eleven position rotary switch. A pilot light sits behind the top center of the meter to indicate when the power is on. The rotary switch selects one of the ten meter ranges; the eleventh position (fully clockwise) turns the power off. While most devices have the off position at the fully counter-clockwise position, Heathkit chose the other end, so the meter, when turned on, will first be on the highest (300 Volt) range.

Heathkit AV-3 Tube Lineup		
Tube	**Type**	**Use**
6C4	Triode	Input buffer - follower
12AT7	Dual Triode	Cascode AC amplifier
1/2 12AT7	Triode	Cathode follower
1/2 12AT7	Triode	Meter driver
Heathkit IM-38 Tube Lineup		
Tube	**Type**	**Use**
1/2 6AW8	Triode	Input buffer - follower
1/2 6AW8	Pentode	AC amplifier
6EJ7/ EF184	Pentode	Meter driver

Table I: AV-3 - IM-38 Tube Lineup Comparison

The rear of the IM-38 contains just the calibration potentiometer and the strain-relief grommet for the power cord.

The IM-38 Meter Scale:

The IM-38 meter has three scales. Two are linear RMS voltage scales marked 0 - 3 and 0 - 10 and are arranged at a ratio of 1 : 3.16 (or more precisely 1 : √10). Thus, if the 0 - 3 scale were to be extended to the end of the 0 - 10 scale, it would end at 3.16. If you are interested in the reason for this ratio, see the separate article on dB meter scales in this issue of ***RF***. There is more to selecting meter scales than one thinks!

The third scale is the **DECIBELS** scale which goes from -12 dB to +2 dB. This scale starts at about 2 and ends at about 9.75 on the 0 - 10 scale. It could extend farther down, but the markings would quickly become too close together to read. (0 volts equals negative infinity dB). Thus Heathkit decided to stop there so the scale, across all ranges is: -52 to +52 dB.

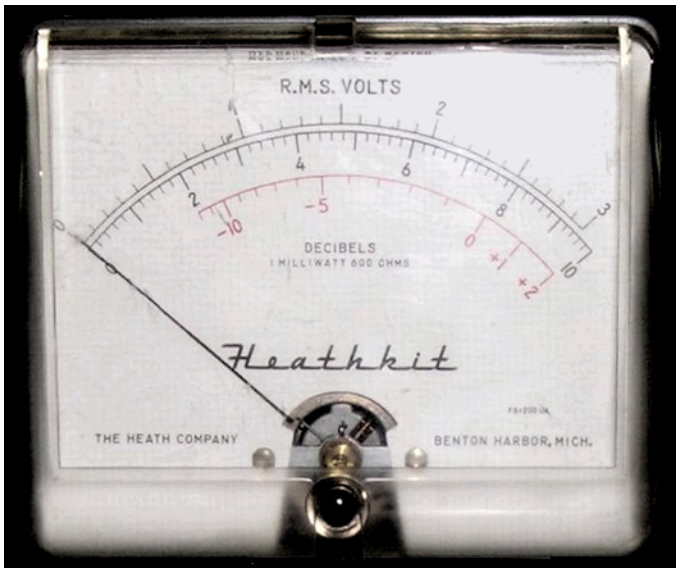


Figure 2: Meter face of a typical AC VTVM showing the three scales.

Since decibels is a ratio, zero dB has to be defined. On the IM-38 the definition is printed right on the meter face as **1 MILLIWATT 600Ω**, (0 dB = 1 mW across 600 ohms) which is a common standard for audio measurements. A simple Ohm's law calculation shows 0 dB to be equal to 0.775 volts (more precisely √0.6 volts). If you look at the meter scale (Figure 2), 0 dB occurs at the 7.75 mark on the 0 - 10 scale.

Other audio dB references exist, one being the standard VU (volume unit) which is defined as 1.228 volts into 600 ohms[2]. Another common standard, that was in use by the telephone industry for many years, is defined as 6 mW across 500 ohms. Luckily, it is easy to convert from one standard to another by simply adding or subtracting a fixed dB value. In the case of the VU, subtract 4.0 dB from the (1 mW/600Ω) reading, and in the case of the telephone standard subtract 7.78 dB from the reading.

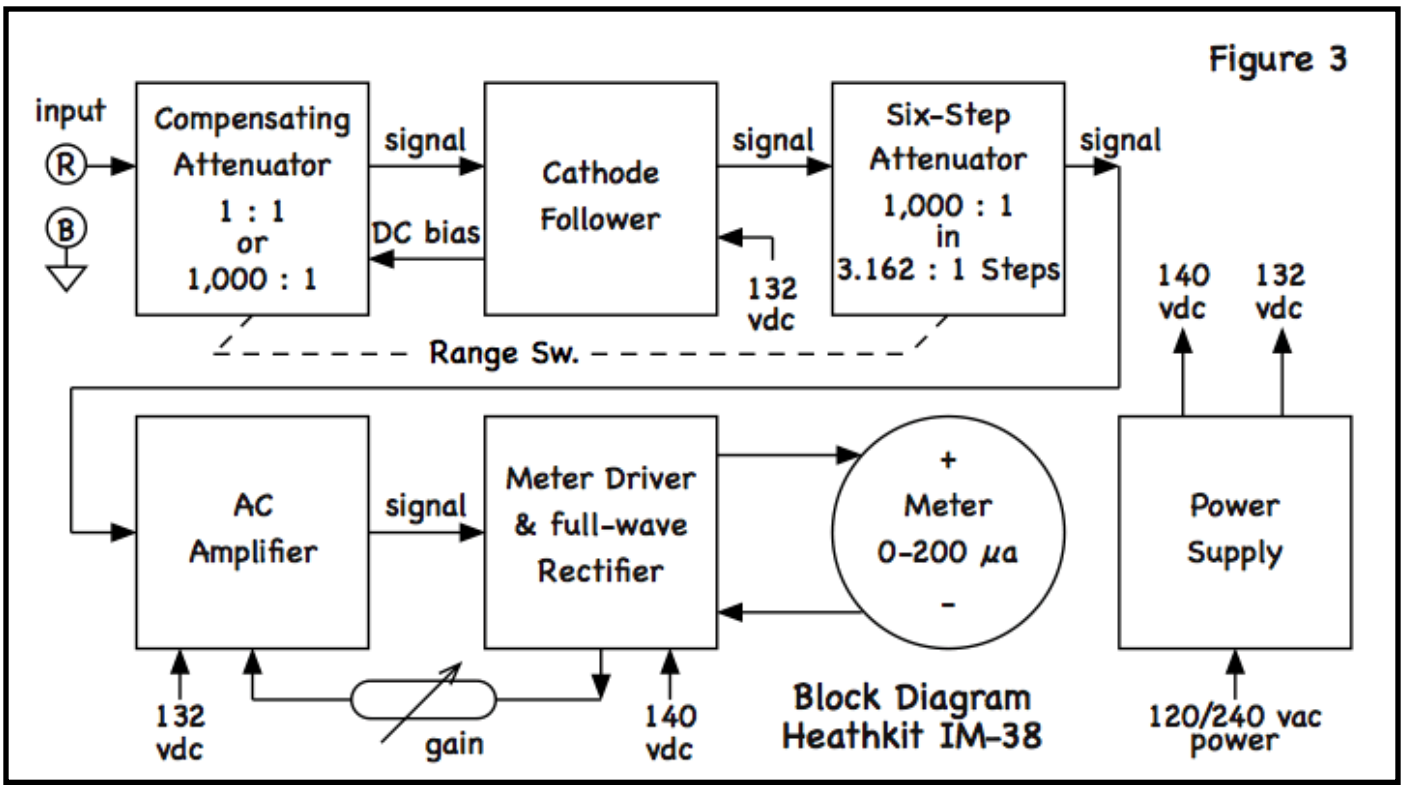
The IM-38 Circuit Description:

A schematic of the IM-38 was not available when I wrote this, however the similar IM-21 is shown as Figure 6.

Figure 3 is a block diagram of the IM-38. The power supply is a simple half-wave rectifier using a silicon diode to produce about 140 VDC. Tapped off this voltage via an RC filter network is a 132 volt supply. The 140 VDC source powers the meter driver amplifier, and the 132 VDC source powers the input cathode follower and the AC amplifier. Filament voltage for the two tubes is supplied by a winding on the power transformer. This voltage is specified as 5.5 VAC, about 13% below the 6.3 VAC standard. This reduces the space charge around the cathode, which matters little since the plate current being drawn is small; perhaps this is done to reduce hum pickup? It does reduce heat and extend the life of the tubes. The filament wiring is balanced twisted pair with a pseudo transformer center-tap, composed of two 47 Ω resistors R28 and R29 to balance the filament voltage around ground, again to reduce hum pickup.

Compensating Attenuator:

The Input binding posts connect to an attenuator. The black post connects directly to chassis ground; the red post is coupled to the attenua-



tor through a capacitor. On the ranges below 10 VAC, the signal is fed directly to to the cathode follower stage; on the ranges of 10 VAC and above the signal is divided by 1,000 before being fed to the cathode follower. The attenuator is composed of resistors R1 and R2 and capacitors C2 and C3. R1 is a 10 MΩ that sets the input resistance; it is large enough, compared to R2 (10 KΩ) that the accuracy is not compromised. Capacitor C2 and C3, along with stray capacitance form a capacitive 1,000 : 1 divider. C2 is adjustable and may be adjusted for the best frequency response. The input impedance is 10 MΩ shunted by 22 pF on the 0.01 through 3 volt ranges, and 10 MΩ shunted by 12 pF on the 10 through 300 volt ranges. This is made up mostly of stray and tube capacitances.

The low side of the attenuator is AC coupled to ground through C4, but is set to about 11 VDC by a voltage divider composed of R3 and R5. This provides DC bias for the cathode follower.

Cathode Follower:

V1A, the triode section of the 6AW8 tube is wired as a simple cathode follower. Plate voltage is held constant by electrolytic C5. R4, in series with the grid is for oscillation suppression. With the 11 volt bias the tube draws around 1.2 ma. The output is taken off the cathode. The stage has a voltage gain of just under one, but there is a large power gain providing isolation from the high impedance of the input. The output is capacitively coupled to the second attenuator.

RANGE	1st. Attenuator	2nd. Attenuator	Total Attenuation	Total dB* Attenuation
0.01 V	x 1	x 1	x 1	-40 dB
0.03 V	x 1	x √10	x 3.162	-30 dB
0.10 V	x 1	x 10	x 10	-20 dB
0.30 V	x 1	x 10√10	x 31.62	-10 dB
1.00 V	x 1	x 100	x 100	0 dB
3.00 V	x 1	x 100√10	x 316.2	+10 dB
10.0 V	x 1,000	x 1	x 1,000	+20 dB
30.0 V	x 1,000	x √10	x 3,162	+30 dB
100 V	x 1,000	x 10	x 10,000	+40 dB
300 V	x 1,000	x 10√10	x 31,620	+50 dB

* Relative to the 1-volt range (0 dB = 0.775 Vrms).
dB meter scale is from -12 dB to +2 dB making the overall range of the instrument -52 dB to +52 dB

Table III: IM-38 Step Attenuator Calculations

Step Attenuator:

The step attenuator provides three decades of attenuation in six 10 dB steps. A resistor chain composed of six 1% resistors, R8 through R13, make up the divider. The AC voltage division at any given position of the switch is the total resistance of the resistors from that switch position to ground divided by the series resistance of six resistors, which is 31.62 KΩ. Table II shows the resulting total attenuation for each of the the six positions. Note that the first four of these attenuations are again used after the 1,000:1 attenuator is introduced for the last four range positions - 10 V, 30 V, 100 V and 300 V. This is shown in Table III.

Att. Pos.	Divider Resistor Values (ohms):		Resistor Sum from Att. Pos. to Gnd.:		Step Attenuator
1	R8 =	21,620	R8 ... R13 =	31,620	x 1
2	R9 =	6,838	R9 ... R13 =	10,000	x 3.162
3	R10 =	2,162	R10 ... R13 =	3,162	x 10
4	R11 =	683.8	R11 ... R13 =	1,000	x 31.62
5	R12 =	216.2	R12 ... R13 =	316.2	x 100
6	R13 =	100	R13 ... R13 =	100	x 316.2
Sum of the 6 Resistors					
R8 ... R13 =		31,620			

Table II: IM-38 Step Attenuator Calculations

AC Amplifier:

After the second attenuator, the input to the AC amplifier will see an AC voltage of 0 - 10 mV on the five ranges with a '1' and 0 - 9.5 mV on the ranges with a '3'. The AC amplifier uses the pentode half of V1, the 6AW8. This stage would have an open-loop gain of about 400 except for the regenerative feedback introduced by the cathode resistance. The gain is further reduced by feedback from the next stage. This feedback is introduced into the cathode via R18, a vari-

able resistor, which sets the overall gain of the two stages and, hence, the calibration of the meter.

Meter Amplifier and Rectifier

The next stage is another pentode amplifier. Due to the low plate resistance presented by the meter circuit it has much lower gain than the previous stage. It also has degenerative feedback in the cathode due to R26, further reducing the overall gain. R26 is bypassed by C14 to give increased gain over about 160 KHz, improving frequency response of the circuit.

Diodes X1 through X4 (germanium type 1N161) form a full-wave rectifier to provide pulsating DC to the meter. C16 smoothes the pulses from the rectification, letting the meter respond to the average DC current.

A portion of the AC signal driving the meter appears across R27. This signal is in phase with the input signal on the preceding stage, but is introduced into the cathode providing feedback. Rough calculations show the overall voltage gain of the two pentode stages to be about 62 dB open-loop. With the approximately 19 dB Heathkit specifies for the feedback, the overall gain is on the order of 43 dB, or about 1.5 volts RMS at the plate of V2.

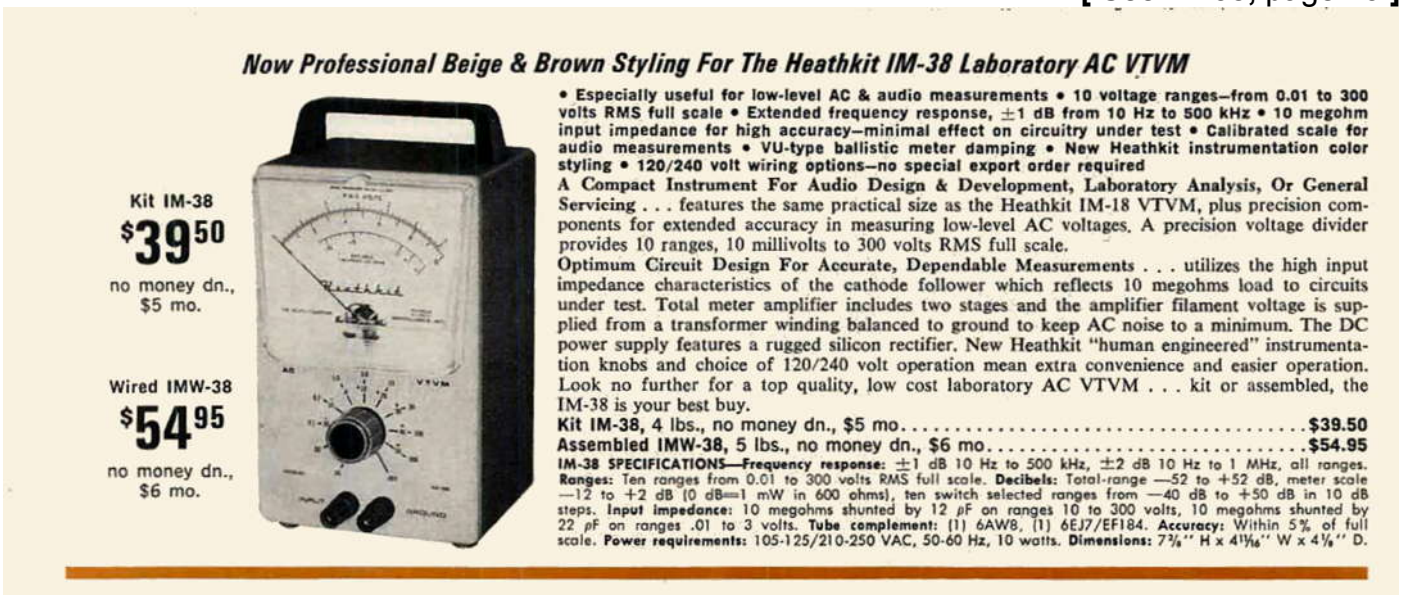
Operation:

Using the IM-38 is quite simple. Prior to turn-on, you should check that the meter needle is resting over zero on the voltage scales. Plastic cased meters sometimes suffer from static buildup on the plastic meter cover, causing the needle to respond to the electrostatic field. If this is the case, the needle will respond to your touching the meter face. Lightly cleaning the meter cover with a mild dishwashing solution will neutralize the static charge. If the meter needle is still not at zero, the mechanical zero should adjusted.

The unit is turned on by moving the function switch from the OFF position to the 300V division. The unit is then allowed to warm up for a few minutes; during this time the meter will move around and finally come to rest at zero.

Once warmed up, connect the test leads from the meter to the AC voltage to be measured. **Heed the fact that the black lead is directly connected to both the chassis and power-line ground.** Set the meter range switch to the position that gives a reasonable deflection of the meter needle. Read the voltage on the proper meter-scale, using the range printed on the front panel switch. To get the reading in decibels, be sure the meter needle is

[See **IM-38**, page 13]



Now Professional Beige & Brown Styling For The Heathkit IM-38 Laboratory AC VTVM

Kit IM-38 **$39.50** no money dn., $5 mo.

Wired IMW-38 **$54.95** no money dn., $6 mo.

• Especially useful for low-level AC & audio measurements • 10 voltage ranges—from 0.01 to 300 volts RMS full scale • Extended frequency response, ±1 dB from 10 Hz to 500 kHz • 10 megohm input impedance for high accuracy—minimal effect on circuitry under test • Calibrated scale for audio measurements • VU-type ballistic meter damping • New Heathkit instrumentation color styling • 120/240 volt wiring options—no special export order required

A Compact Instrument For Audio Design & Development, Laboratory Analysis, Or General Servicing . . . features the same practical size as the Heathkit IM-18 VTVM, plus precision components for extended accuracy in measuring low-level AC voltages. A precision voltage divider provides 10 ranges, 10 millivolts to 300 volts RMS full scale.

Optimum Circuit Design For Accurate, Dependable Measurements . . . utilizes the high input impedance characteristics of the cathode follower which reflects 10 megohms load to circuits under test. Total meter amplifier includes two stages and the amplifier filament voltage is supplied from a transformer winding balanced to ground to keep AC noise to a minimum. The DC power supply features a rugged silicon rectifier. New Heathkit "human engineered" instrumentation knobs and choice of 120/240 volt operation mean extra convenience and easier operation. Look no further for a top quality, low cost laboratory AC VTVM . . . kit or assembled, the IM-38 is your best buy.

Kit IM-38, 4 lbs., no money dn., $5 mo. **$39.50**

Assembled IMW-38, 5 lbs., no money dn., $6 mo. **$54.95**

IM-38 SPECIFICATIONS—Frequency response: ±1 dB 10 Hz to 500 kHz, ±2 dB 10 Hz to 1 MHz, all ranges. **Ranges:** Ten ranges from 0.01 to 300 volts RMS full scale. **Decibels:** Total-range —52 to +52 dB, meter scale —12 to +2 dB (0 dB=1 mW in 600 ohms), ten switch selected ranges from —40 dB to +50 dB in 10 dB steps. **Input impedance:** 10 megohms shunted by 12 pF on ranges 10 to 300 volts, 10 megohms shunted by 22 pF on ranges .01 to 3 volts. **Tube complement:** (1) 6AW8, (1) 6EJ7/EF184. **Accuracy:** Within 5% of full scale. **Power requirements:** 105-125/210-250 VAC, 50-60 Hz, 10 watts. **Dimensions:** 7⅜" H x 4¹⁵⁄₁₆" W x 4⅛" D.

Figure 4: IM-38 Advertisement from the Summer 1969 Heathkit Catalog.

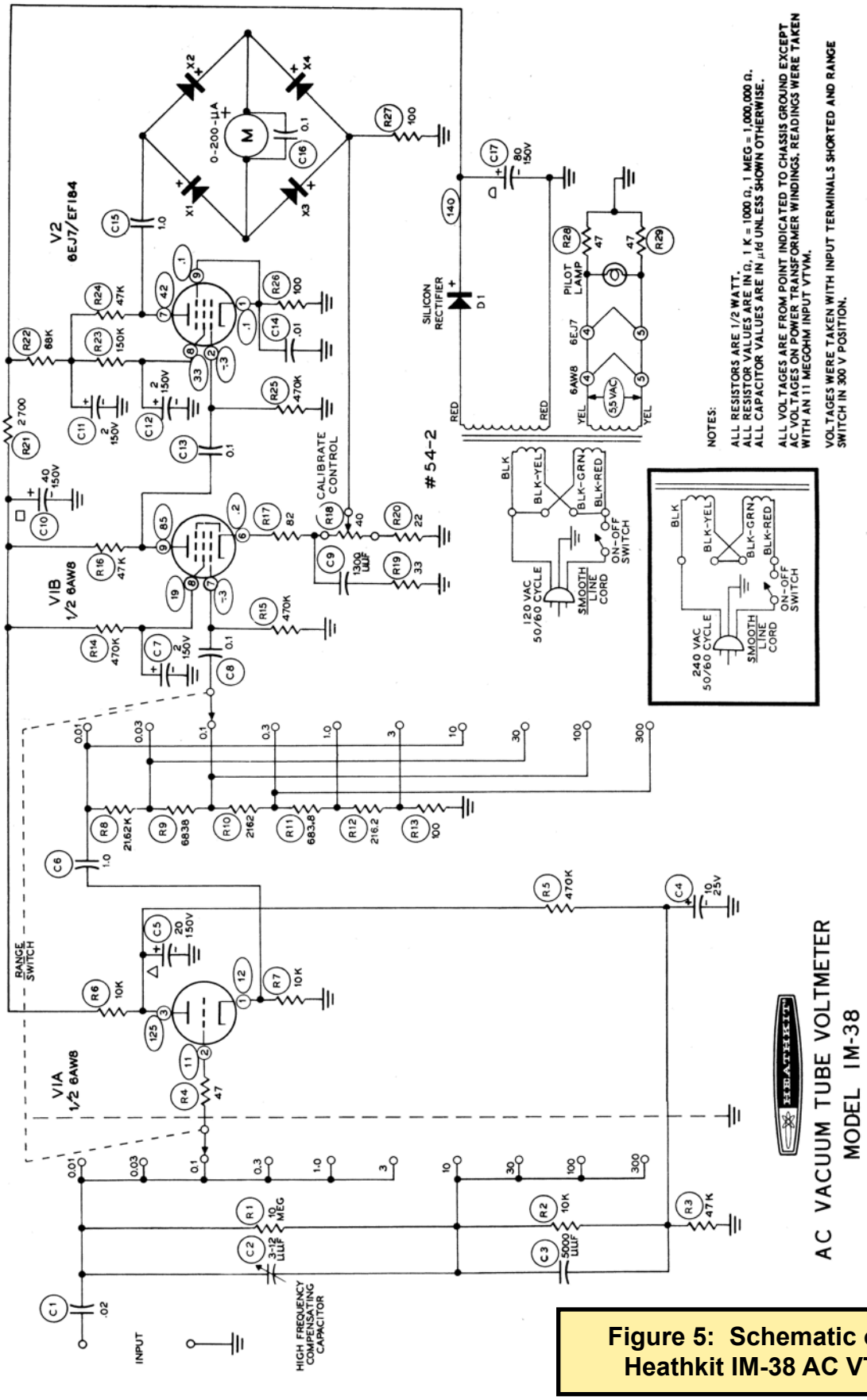


Figure 5: Schematic of the Heathkit IM-38 AC VTVM

[IM-38, from page 11]

on a range that puts it on the red dB scale; then read the dB from the schedule. Finally, add or subtract the dB value given on the current range-switch position.

Comments:
I'd like to apologize for being lax in putting out this column monthly. A family situation has required a lot of my time; I'm also currently involved with two other high-priority projects that are consuming a lot of my spare time.

Several people have written, asking that I cover the Heathkit Single Bander transceivers. Yes, I have managed to acquire enough information to get started on that project but it's still a few months off. It appears Heath did some unusual things when designing these transceivers. They do not follow the scheme used in the SB line produced over the same time period.

I also have a few kits I have yet to do including the first (and only) Heathkit TV I built - the GR-104 circa 1966; also the IM-4180 FM Deviation Meter; the simple SK-107 Stereo Synthesizer; and more.

Notes:

1. *Heathkit Test Equipment Products* by Check Penson - WA7ZZE. Available from Amazon.com $19.95
2. VU meters also have specified weighting and dampening factors for the meter movement.

73, from AF6C

This article is Copyright 2015 R. Eckweiler and The OCARC Inc.

Remember, if you are getting rid of any old Heathkit Manuals or Catalogs, please pass them along to me for my research.
Thanks - AF6C

THE NEW HEATHKIT GR-150-BK

Rumor of a re-birth of Heathkit has been around for the past couple of years. In late 2013 the website Heathkit.com became active with promises of things to come. On December 20th of that year the company held a question and answer session on Reddit. Little real information was distributed, but promises of new kits, as early as mid 2014, were made. At first people were cautiously optimistic that it was happening. Others argued the viability of that happening in the current economic environment. Little change occurred on the website.

Recently the new Heathkit, believed located in the Silicon Valley area, did introduce a new kit, the GR-150 Explorer Jr.™ for $149.95. It is a TRF (Tuned Radio Frequency) AM broadcast radio with dual earbud jacks. The rear has a jack for a powered speaker. Numerous colors are available for the cabinet. The kit is 3-1/4 x 5 x 5 in size, and weighs 1.7 lbs with batteries.

What makes this kit unusual is that there is no soldering required. You use stainless steel hardware to connect components.

Opinions on this first kit are mixed. The ad on the website says "for ages 8 to 88", but it is obviously focused towards the youngsters. You can read more about it on the Heathkit website.

73, from AF6C

The 2015 GOOD of the CLUB AWARD:

Congratulations to Don Mech - N6XBP, our 2015 Membership Chairman. The Board of Directors voted for him to receive the Good of the Club Award. The text in the lower left of the award states:

This award is presented annually to the club member who has made a most significant contribution to the club for the year. In 1997 this annual award was dedicated to the memory of Kei Yamachika, W6NGO, for his year-after-year contributions in support of our club's activities.

Kiyoshi Yamachika - W6NGO was a World War II veteran who fought for the US in the mountains of Italy as part of the famed Japanese-American 442nd Infantry Regiment. During much of the fighting, Kei carried a radio on his back and wore skis over his boots. Before and after the war, he was also a member of the Orange County Amateur Radio Club.

Here's an interesting fact[1]: *The 442nd Regiment was the most decorated unit for its size and length of service in the history of American warfare.*

Kei was an avid CW, as well as phone, operator. When I first met him he had Americanized his nickname to Kay, but too many CW ops thought he was a YL, so he went changed it to Kei. He enjoyed radio and had an impressive station and antenna farm in Orange.

Over the years, Kei helped members construct and raise antennas and towers. He built towers for some members and reconstructed wrecked towers for others. He built towers for our Field Day operations, and overhauled our FD generators; he brought his tractor with auger attachment to dig our FD antenna holes, and hauled most of our equipment to and from the FD site. He was an 'Elmer' of the first degree for our club.

Kei also reigned over what is probably the Eden spot of Orange County. On those hottest of hot days that usually happen in late summer and early fall, and always on the last day of Field Day, the breezeway between his garage and house was the coolest outdoor spot around. At those times a group of club members would migrate there and sip on a cold beverage, talk of ham radio and enjoy the camaraderie.

As the sun set, we'd head into Kei's ham-shack, a room built onto his tractor shed, and work DX. Often the DX was Japan where he could converse in both languages. Members often got to meet these hams in person when they visited the US and Kei's hospitable home.

Each year, with the presenting of the Good of the Club award, many members reflect back on Kei and others who make this THE radio club.

1. Read more about the 442nd at:
http://thejacksonpress.org/?p=38408

The GOOD of the CLUB AWARD - A BIT of HISTORY & RECENT RECIPENTS:

The Good of the Club award has been a long-standing tradition for the OCARC. Years ago it was an engraved plaque that was passed on each year with the newest winner's name added. The plaque became full and, if I recall correctly, either an extended plaque was hung below the original plaque to allow the addition of more names, or a second plaque was started.

Sometime in the eighties, the plaques vanished; Bob Evans - WB6IXN, our club historian, found one of the plaques in his historical files and will bring it to the next club meeting. There, it will be photographed and a picture put into ***RF*** and our archives. This is probably the second plaque, and the earlier one is still missing. Do any of our old timers know where it may be?

For a few years a small individual plaque was handed out to the winner. The logistics and cost of getting the plaque engraved became a problem; the winner was voted on by the Board and it usually was done at the very last minute.

In 1997 the Board decided to hand out a framed certificate instead of a plaque, since, once designed, it could be prepared quickly; the frame could be bought beforehand.

Bob, AF6C designed the certificate, and the Board voted to dedicate it to Kei Yamachika, W6NGO, who had passed away in July of that year, and who was, by far, the person who had received the award the most over the years. Chris Breller accepted the first framed GOC certificate at our Christmas party held at The Country Harvest on N. Tustin St. in Orange (Now a Chuck E. Cheese's).

Over the last 19 years the certificate has gone through some minor changes. Twice the certificate was totally redone due to program and computer upgrades that would no longer handle the earlier format. An effort was made to keep the format as similar as possible.

Art Dillon, KE6WOX was the last member to receive a GOC plaque. It was presented at the to him at the 1996 Christmas dinner by, then President Bob, AF6C. The venue for that dinner was the China Palace in Tustin.

Here is a list of the last 20 year's winners:

Year:	Call:	Name:
2015	N6XBP	Don Mech
2014	W6ETC	Tom Cowart
2013	KC6TOD	Kris Jacob
2012	W6HHC	Ken Konechy
2011	N8AE	Carl Flint
2011	N8UZE	Dee Flint
2010	W6FKX	Doug Britton
2009	KC6TOD	Kris Jacob
2009	K7JA	Chip Margelli
2008	K6YUI	Larry Mallek
2007	KE6WWK	Rich Helmick
2007	KI6APH	Beverly Helmick
2006	N6PEQ	Dan Dankert
2005	N6PEQ	Dan Dankert
2005	K6PEQ	Kristin Dankert
2004	AF6C	Bob Eckweiler
2003	W6HHC	Ken Konechy
2002	W6HHC	Ken Konechy
2001	AF6C	Bob Eckweiler
2000	WA6VPP	Bud Barkhurst
1999	KJ6ZH	Chris Breller
1998	W6HHC	Ken Konechy
1997	KJ6ZH	Chris Breller
New certificate introduced		
1996	KE6WOX	Art Dillon

On four occasions since the certificates started being issued, the award was shared by two people. On three of these times is was for a husband and wife team, and on the fourth it was due to a tie vote and two very deserving members.

BOB'S TECHTALK

#49: AC METER SCALES:
[Tech Talk #121]

While writing a recent ***Heathkit of the Month*** article I spent a little time exploring the meter scale on the Heathkit IM-38 AC Voltmeter. Examining a Hewlett Packard HP-400C I noticed that the meter scale was set up identically, as were the scales on the AV-2 and AV-3 AC VTVMs. These meters all use the same 1 : 3 range step as shown in table I, the Hewlett Packard meter having two additional ranges at the low end.

Each meter also has a decibel scale that starts at -12 dB and extends to +2 dB. This scale starts a bit below 20% of full scale and extends almost to the full-scale point. If the dB scale was continued downward it would quickly become too compressed to read.

A 10-fold increase in voltage is a change of 20 dB and looking at table 1 we see that this is the case with these AC meters: The one-volt range is 0 dB and the ten-volt range adds 20 dB; also the three-volt range adds 10 dB and the 30 volt range adds 30 dB. However, this implies that 10 dB should be an increase of 3 which is not quite accurate. Let's calculate what 10 dB as a voltage ratio really is:

From the ARRL Handbook we know:

$$10 \text{ dB} = 20 \log (V2 / V1)$$

$$0.5 \text{ dB} = \log (V2 / V1)$$

but we want to solve for (V2 / V1) so we need to know the relationship:

$$A = \log (B) \qquad \text{so:} \qquad B = 10^{A}$$

Substituting, we get:

$$(V2 / V1) = 10^{0.5 \text{ dB}}$$

$$= \sqrt{10} \text{ [square root of ten]}$$

$$= 3.162$$

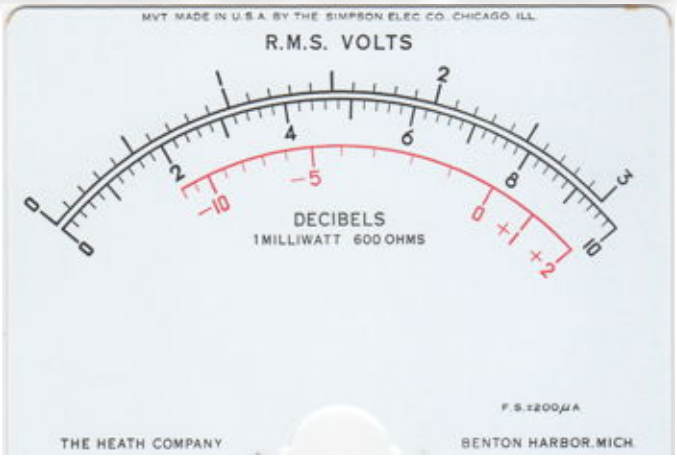


Figure 1: Heathkit AV-3 Meter Scale

Look again at the meter scale of Figure 1. Notice that the two scales do not stop at the same place. If the 0 - 3 scale were extended to 0 - 3.162, it would stop inline with the 10 on the 0 - 10 scale. Dividing 3.162 into 3.0 yields 9.49 which is where 3 aligns to on the 0 - 10 scale. The meter scales are thus in reality 0 - 10 and 0 - √10 [the square root of ten].

Range	Decibels	HP-400C	IM-38*
1.0 mV	– 60 dB	√	–
3.0 mV	– 50 dB	√	–
10 mV	– 40 dB	√	√
30 mV	– 30 dB	√	√
100 mV	– 20 dB	√	√
300 mV	– 10 dB	√	√
1.0 V	0 dB	√	√
3.0 V	+ 10 dB	√	√
10 V	+ 20 dB	√	√
30 V	+ 30 dB	√	√
100 V	+ 40 dB	√	√
300 V	+ 50 dB	√	√
* Also Heathkit AV-2, AV-3 and IM-21			

Since the decibel is a ratio, there has to be a reference that corresponds to zero dB. Probably the most common one used in audio measurements today is the dBm, which is one milliwatt into 600 ohms. The reference is almost always disclosed on the instrument, often right on the meter scale, as in the the case of Figure 1.

Using Ohm's power law, the AC voltage is calculated for the 1 milliwatt 600 ohm standard as:

$$V = \sqrt{(W \times R)}$$
$$= \sqrt{(0.001 \times 600)}$$
$$= \sqrt{(0.6)}$$
$$= 0.775 \text{ volts}$$

Again, looking at Figure 1, notice that the 0 dB mark corresponds with 7.75 on the 0 - 10 scale. Don't let the decimal point confuse you. In table I the 0 dB range uses the 0 - 10 scale for 0 - 1 volt range.

Besides the 1 mW 600Ω standard, many other dB standards exist; hams might be familiar with the ones relating to RF energy or antennas. Two other popular audio standards exist. The first is the volume unit[1] (VU) used in recording levels. It is 1.228 volts 600 ohms (2.512 mW) and is 4 dB higher than the 1 mW 600Ω standard. The second standard was used for many years by the telephone company. It is 6 mW 500Ω (1.732 [√3] volts), and is 7.78 dB greater than the 1 mW 600Ω standard.

Reading a different dB standard on an AC meter is simple. You only need to add or subtract a given dB value corresponding to that standard. For instance, to use the IM-38 to measure an AC voltage in dB at the 6 mW 500Ω standard using the 1 mW 600Ω standard, you first make the measurement in dB and then subtract 7.78 dB to convert. The original Heathkit V-1 VTVM voltmeter, the second kit Heathkit produced, used the 6 mW 500Ω standard. It was not until the V-6 that Heathkit switched to the 1 mW 600Ω standard.

Heathkit's Standard VTVM AC Scales:

After examining the meter scales on AC VTVMs, I assumed that the same held true for the many regular DC-AC-Ohms VTVMs that Heathkit also produced over the years.

The first meter I looked at was an IM-13. Unlike the AC VTVMs the IM-13 AC ranges go from 0 - 1.5 VAC to 0 - 1,500 VAC on 0 - 15 and 0 - 50 scales; see Figure 2. If the scales are designed to be 10 dB steps then the 15 should be aligned just under halfway between 47 and 48 on the 0–50 scale; which it is.

$$Scale_{50} = Scale_{15} * \sqrt{10}$$

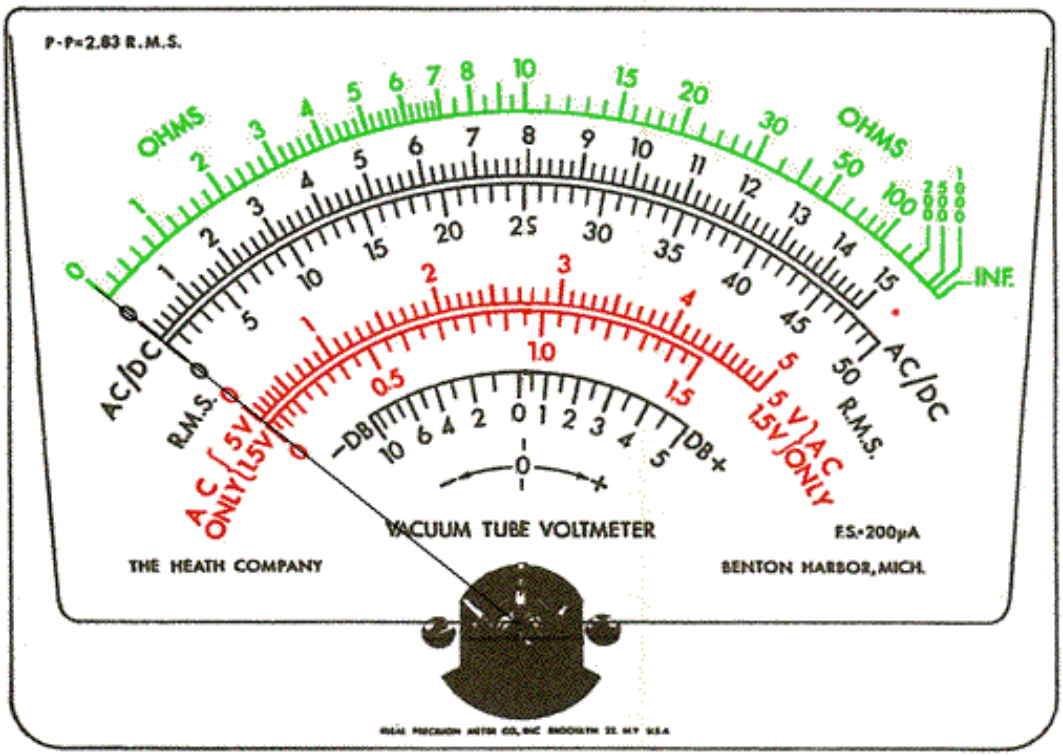


Figure 2: Heathkit IM-13 VTVM Meter Scale

$$Scale_{50} = 15 * 3.162$$
$$= 47.43$$

While typical AC only VTVMs rectify the AC after amplification, eliminating the nonlinearity problems of rectifying low AC voltages, standard voltmeters rectify AC signals before amplification. Thus, separate scales are provided for the 0 - 1.5 VAC and 0 - 5 VAC ranges. Unfortunately this creates errors when using the dB scale. This error is stated in the manual:

Due to the special calibration used on the 1.5 V and 5 V AC scales, slight inaccuracies will be introduced into the db reading when making decibel measurements with the Range switch in the 1.5 V and 5 V positions.

Other Heathkit DC - AC - Ohm VTVMs:
When I examined an IM-11 VTVM, I was surprised to see that the meter scales had a 1 : 3 ratio and the 0 - 5 and 0 - 15 scales ended in alignment; see Figure 3. The dB errors are not discussed in the manual. However the manual discusses how to make comparative dB measurements. There is also no correction for rectification errors on the lower AC ranges. The dB errors are small, getting larger as the reading approaches full-scale. However they are within the range of accuracy specified.

Looking through Chapter 20, the VTVM chapter, of ***Heathkit Test Equipment Products*** by Chuck Penson - WA7ZZE[1] I noticed that the Heathkit VTVMs that are in the "Service Class" with their larger 6" meters, all have the true 10 dB ratio between meter scales. These include the IM-10, IM-13, IM-28, IM-32 and IM-5228. With the exception of the IM-10 and IM-32, these are all "bench" style meters with a large meter to the left and controls to the right. The IM-10 and IM-32 are upright meters with the controls below the meter, but due to the large 6" meter they are wider than the general purpose upright VTVMs.

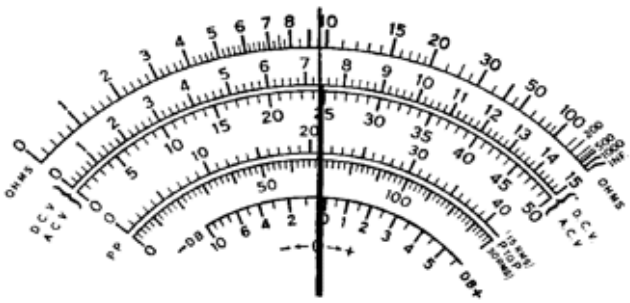


Figure 3: Heathkit IM-11 Meter Scale

All the general upright VTVMs use the lower accuracy 1 : 3 ratio between AC scales. They include the V-6, V-7, V-7A, IM-11, IM-18 and IM-5218. Also included in this group are the V-1 through V-5A, although they vary in ranges and scales from the later meters. All these meters use 4-1/2" or smaller meters.

What About VOMs?
I looked at a Simpson 260 series VOM scale (series 7F). Many VOMs, such as the Simpson, use copper oxide rectifiers to convert AC voltages into DC, causing nonlinearity at the lower AC ranges. This nonlinearity is corrected for voltage by using two separate scales for the AC ranges. This VOM has five AC ranges: 0 - 2.5V, 0 - 10V, 0 - 50V, 0 - 250V and 0 - 500V. The 0-2.5 VAC range has its own scale while the remaining three scales share a scale separate from the DC scale. A table on the meter face gives correction data for the ranges: 10V add 12 dB, 50V add 26 dB, 250V add 40 dB and 500V add 46 dB. The nonlinearity of the meter affects correlation between meter scales and the dB accuracy, while the AC voltage reading remain accurate.

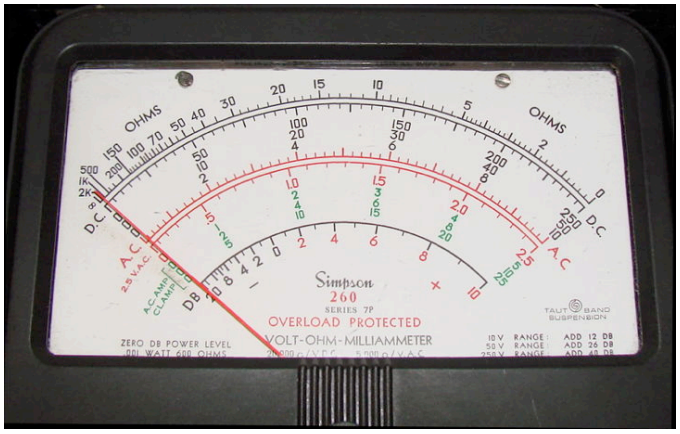


Figure 4: Simpson 260-7F VOM Meter Scale

Summary:
When making dB measurements, you might first want to consider using an AC VTVM. Every one I've covered has a true 10 dB change between scales, and, since the rectification occurs after the amplifiers, it is not prone to errors at lower voltages. When making measurements with standard VTVMs and VOMs, go ahead and read the dB from the scale, but if you desire more accuracy you can also do the calculations using the equation:

$$dB = 20 \log (V2 / V1)$$

where V2 is the voltage reading and V1 is a reference voltage depending on the standard you are using.

Since decibels is a ratio, you may use any value for your standard. Say you're measuring hum from an audio amplifier you just built, and with the amplifier gain control set at a specific setting, you measure 2.0 volts RMS[3] of hum. After making some improvements in the circuit layout you take the measurement again at the same gain setting and measure 0.1 volts RMS of hum. Solving the above equation you get:

$$dB = 20 \log (2.0 / 0.1)$$
$$= 20 \log (20)$$
$$= 20 * 1.30$$
$$= 26 \text{ dB}$$

You've reduced the hum by 26 dB.

If you're using an AC VTVM (look at Figure 1), when you read 2.0 you can read -1.8 on the dB scale. Since you are on the 0–3 volt range you add +10 dB. Then, when you read the 0.1 volts you read -7.8 on the dB scale, and since you are on the 0–0.3 volt range you add -10 dB. Taking the difference gives:

$$dB = -1.8 + 10 - (-7.8 - 10)$$
$$= 8.2 - (-17.8)$$
$$= 26 \text{ dB}$$

Using the scales on the other meters will result is less accurate solutions. I did try this problem using the VTVM and VOM meter scales and came up with different answers; however, they turned out to be surprisingly close as the errors seem to partially cancel when summed up. Usually an error of 1 dB is not considered significant in audio measurements, though in reality it is an error of about 12% in voltage.

Conclusion:
This was not a subject I thought I'd be exploring. However, it turned out to be interesting and provided me with a bit more insight in the measuring of decibels.

As far as ***Bob's Tech Talk*** is concerned, I hope to get back to writing articles on a more frequent schedule sometime in the spring when family matters settle down. I also plan to conclude some of the topics I left hanging in previous articles.

73, from AF6C

NOTES:

[1] Voltage units (VU) also have requirements for the dampening of the meter movement to provide a proper meter response.

[2] ***Heathkit Test Equipment Products*** by Chuck Penson - WA7ZZE is available through Amazon.com for $19.95. It is in its first edition. ISBN 978-0-615-99133-7, April 2014 publication date.

[3] All AC voltages discussed in this article are RMS (Root Mean Square) sine wave voltages. This RMS voltage is 0.707 of the peak voltage.

General Meeting Minutes
November 20, 2015

The OCARC General Meeting was held at the Red Cross Complex on November 20th 2015. The meeting was called to order at 7:02 pm. There were a total of 30 members and visitors attending. Members were reminded of the club Christmas dinner on December 04th at the Marie Callender's restaurant in Anaheim Hills.

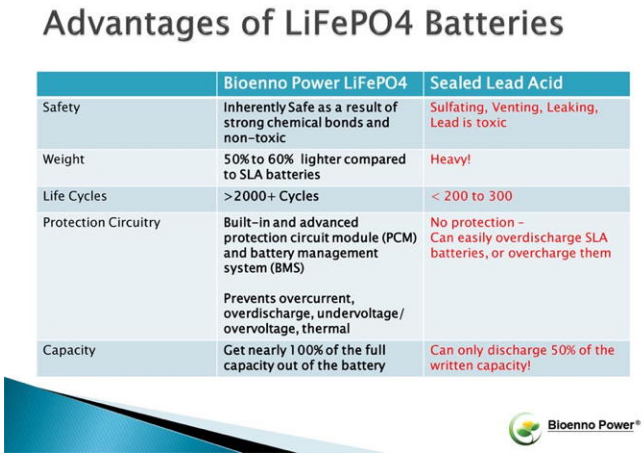
Our main speaker for the evening was Kevin Zanjani - KI6DHQ speaking on:

"Advances in Batteries and Ham Setups for Portable Power and Solar Applications"

Kevin KI6DHQ of Bioenno in Santa Ana presented the list of improvements that are offered by the new Lithium Iron Phosphate batteries (LiFePO4) for use by hams. For "techies", the voltage of each LiFePO4 battery cell is 2.4V.

Kevin KI6DHQ discusses using LiFePO4 as straight batteries for portable ham rigs as well as using solar to charge batteries

Kevin provided the OCARC web site a PDF copy of his battery presentation slide show. The Bioenno presentation on Lithium Iron Phosphate batteries can be found at www.W6ZE.org , then click on the link down the left-side of the home page that is called **Ham Related Sites.**



Kevin presented a list of advantages over lead acid batteries.

Nicholas AF6CF displayed his "battery go-box" during break.

Inside the AF6CF box is a 20AH model BLF-1220W battery and a power-inverter (upper-left module)

Tom W6ETC also displayed his "battery go-box" that uses a model BLF-1220W battery

Inside the W6ETC box is an inverter (silver module) and a battery-charger

After a short break the meeting reconvened to cover club business. A quorum of OCARC Board members was present, all directors and officers present.

The first item of business and most anticipated item of interest was the 2016 Board Officer elections. Club Secretary Ken W6HHC and President Tim N6TMT conducted the elections process. Each of the following officers and directors were duly elected, by a show-of-hands vote to serve during the 2016 term.

Position	Call Sign	Name
President	AF6CF	Nicholas Haban
Vice President	W6ETC	Tom Cowart
Treasurer	W6ATB	Greg Bohning
Secretary	W6HHC	Ken Konechy
Activities	N6TMT	Tim Millard
Membership	N6XBP	Don Mech
Publicity	KG6OXD	Vern DeMars
Technical	WØMEC	Clem Brzoznowski
Director at Large	N2VAJ	Tony Scalpi
Director at Large	AF6C	Bob Eckweiler

El Presidente Tim N6ETC explained that because of the OCARC Christmas Dinner party in December, no general meeting would be held in December. The next OCARC General Meeting will be held on January 15. Arnie N6HC will provide a presentation at that meeting on **"TX3X Chesterfield Isle DX-pedition"**.

Activities Chair, Doug K6PGH, discussed that he is organizing a "Winter Field Day" for the OCARC that will be held at Prado Dam Park on the week end of **January 23 and 24, 2016**. It is planned to be a low-pressure fun-event for club members. Mark that week-end in your calendar! More details will follow in the January RF Newsletter.

Respectfully submitted by:

Ken W6HHC – Secretary

2015 Holiday Party: The Dinner:

The early comers have already filled the best seats. (L to R): Gene - KG6OML, and wife June - AG6UG, Roger - WB6HMW, Dan - KI6X and wife, Paul - W6GMU, and Don - N6XBP and his wife Ruby.
Photo - W6HHC

This photo captures most of the members, spouses, and visitors that came to the Christmas Dinner. Too many here to identify individually.
Photo - W6HHC

(L to R) Paul - WA6LJV, Sheri, in the green sweater, & her husband Tim - N6TMT, in the Santa hat, Greg - W6ATB, in the foreground with his wife Angela, Doug - K6PGH, Jim - KE6FVN and David - KE6OPK,
Photo - W6HHC

Left: Enjoying talk after dinner are (L to R): Lito - KK6OOS, Dan - KI6X, Paul - W6GMU, Don N6XBP and his wife Ruby and Nicholas AF6CF.

Below: Greg - W6ATB and his wife Angela give the camera a post dinner smile. In the background to the left is Doug - K6PGH. Photos - W6ETC

2015 Holiday Party: The Change of the Board:

Above: The Orange Co. ARC Presidential plaque.
Photo - W6ETC

Left:
2015 Vice President Tom Cowart - W6ETC presents the Presidential Plaque to retiring 2015 President Tim Millard - N6TMT.
Photo - W6HHC

Retiring 2015 President Tim Millard shakes hands with Nicholas Haban, - AF6CF, the incoming President for 2016, after passing over to him the gavel.

Watching in the back-ground between them is 2015 Vice President Tom Cowart - W6ETC who will continue in his Vice President position in 2016.

Photo - W6HHC

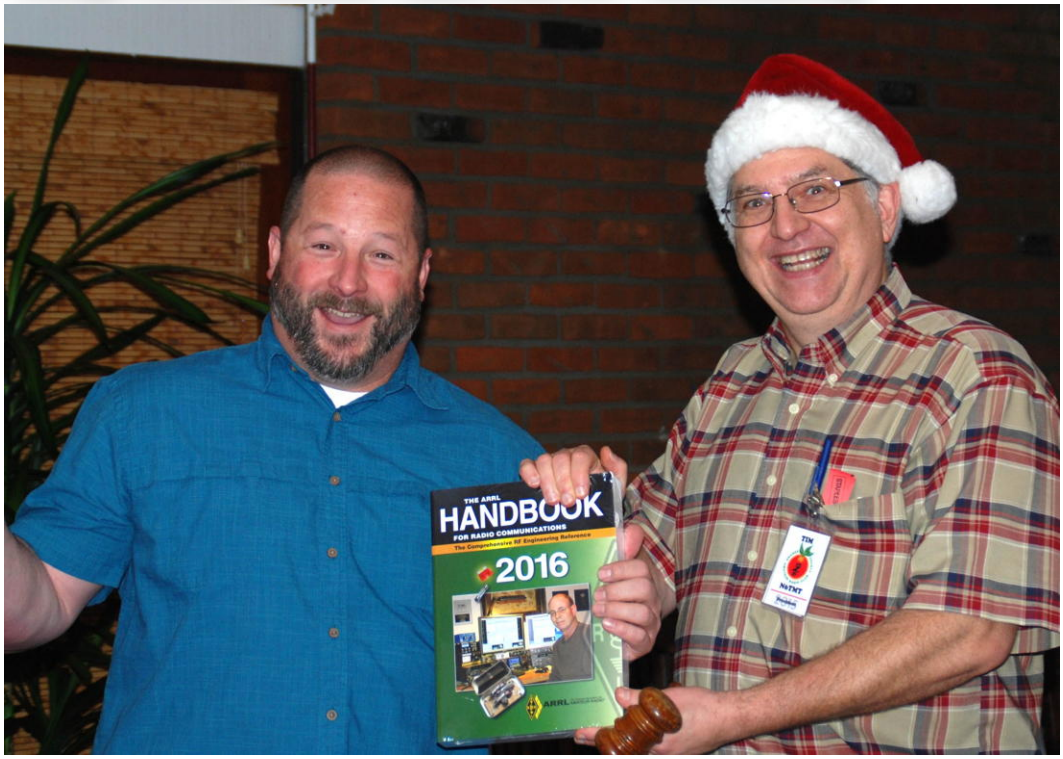
The 2016 Board (L to R):
Greg - W6ATB: Treasurer
Tom - W6ETC: V.Pres.
Tim - N6TMT: Activities
Tony - N2VAJ: Dir. at Large
Nicholas - AF6CF: Pres.
Don - N6XBP: Membership
Ken - W6HHC Secretary

Absent:
Vern - KG6OXD: Publicity
Clem - WØMEC: Technical
Bob - AF6C: : Dir. at Large

2015 Holiday Party: The Prizes:

Nicholas - AF6CF walks away with the grand prize of an ICOM 706 Mark II HF Radio.

Photo - W6HHC



Recent member Steve - KK6REB wins a new 2016 ARRL Handbook. Also known as the Radio Ham's Bible.

Photo - W6HHC

David - KE6OPK is the winner of the $100 HRO Gift Certificate. In all over $500 in prizes were given away at the dinner.

Photo - W6ETC

Christmas Party

2015 Holiday Party: The Good of the Club Presentation:

The OCARC Holiday Party would not be complete without the presentation of the yearly Good of the Club Award. This year the award goes to Don Mech - N6XBP.
Photo - W6HHC

The **ORANGE COUNTY AMATEUR RADIO CLUB, INC.**
P.O. BOX 3454
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