RF

ORANGE COUNTY AMATEUR RADIO CLUB, INC.

VOL. LXIII NO. 01 P.O. BOX 3454, TUSTIN, CA 92781 January 2022

The Prez Sez...

By Nicholas AF6CF

Happy New Year to all!

Once more, the image above represents the old year welcoming the New Year as a newborn full of hope for an end to the pandemic that has been upon us for two years now. We have survived the past year in spite of the media hysteria and conflicting statements about the pandemic so we have many reasons to be happy. One of those is Amateur Radio! Our ranks are still growing and again, with many people being forced to stay home, turning to the hobby is a means to keep in touch with each other. The repeater nets have been alive with activity with new and returning Hams. For the 2022 year, we are still unsure of when or if we can have in-person meetings, so we had to again reschedule the planned February Auction among other activities.

But we are working on scheduling interesting speakers for our Zoom meetings. When we go back to in-person meetings, we plan to have a computer and microphone in the room so people can participate from the comfort of their home, even if they live far away (like our members in Australia). We call those "hybrid meetings" and we'll see how they turn out. Winter and Summer Field Days usually take center stage. This month is the Winter Field Day so we plan to participate as always, and we hope that with the member's support the activity will be as successful as in the previous years. And we still hope that this year is the one that will be remembered as "back to normal".

On a sad note, one of our oldest and most cherished members, Bob Evans WB6IXN has passed away. He was one of our most constant Net Control Operators, and one of our best. He will be missed.
In closing,

I would like to thank last year's Board of Directors for an outstanding job under such difficult circumstances.
Thank you very much &73 from Nicholas, AF6CF

NEXT GENERAL MEETING

January 21st, 2022

Join us via ZOOM at 7:00PM! Current OCARC members will receive an email with instructions. Early check-in available at 6:30 PM(+-)

Speaker:

Wayne Yoshida

KH6WZ

on

"No Tools Troubleshooting"

NEXT BOARD MEETING

Saturday, February 5, 2022

SPECIAL NOTICE:

During the COVID-19 pandemic All OCARC Nets will Remain Active!
See page 2.

In This Issue

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Monthly Events:

Membership Meetings* zoom
Time: 7:00 PM
When: 3rd Friday of each Month
***See ZOOM announcement pg.1**

Board Meetings
February 05 at 8:15 AM
New physical location coming soon
** **Board will handle Club business by ZOOM at this time**

Club Nets (Listen for W6ZE):

10M: 28.375 ± MHz SSB
Wed- 7:30 PM - 8:30 PM
Net Control: Corey, KE6YHX

2M: 146.55 MHz Simplex FM
Wed- 8:30 PM - 9:00 PM
Net Control: Corey, KE6YHX

75M 3.883 MHz LSB
Tue @ 8:00 PM
Net Control: Corey, KE6YHX

CATALINA AMATEUR REPEATER ASSOCIATION (CARA)
147.090 MHz (+0.600 MHz) No PL
Monday - Friday
9:00AM and 9:00PM
Prg. Director. Tom W6ETC
NCO's include Jeff: KK6TRC;
Don W6ZZW, Chris KF6LEX
John AJ6F; Milt N6MG;
David KK6M; John KB6OVO

OCARC 2022 DUES

Membership period is:
1 January to 31 December

Individual New or Renewal:	$30.
Family New or Renewal:	$45.
Teen New or Renewal:	$15.

New Member Dues are *prorated quarterly* and **includes a badge**:
Additional Badges:[1] $ 3.
Use one of our interactive online forms to calculate current prices, join the club and/or order badges:

Online Forms / Dues & Badges

[1] $3. plus mailing costs if applicable
Dues are subject to change without notice

2022 Winter Field Day day/dates are

Saturday, January 29th

and ends on

Sunday, January 30th

Ocean View School District site located at
17200 Pinehurst Lane in Huntington Beach

ORANGE COUNTY AMATEUR RADIO CLUB W6ZE

For more information go to www.W6ZE.org

by W6ETC

"2022 Winter Field Day Planning"

We have had our first planning session for the upcoming OCARC Winter Field Day activity.

We are planning to have five operating positions:

Position 1,
Band/Mode - 20M SSB, Captain – Chip K7JA, Antenna - "20m 3 Elements" (Ron), Tower – 30' (Chip's)
..... Rig-Chip's _____

Position 2,
Band /Mode – 20M CW/80 all/160 all, Captain – Bob AA6PW, Antennas - 20M TH-2 (Chip), 80m Bazooka (Bob), 160 Dipole (Ron), Dino tower, Rigs-Bob's _____

Position 3,
Band/Mode – 40M SSB, Captain – Ron W6WG, Antenna – 3 ele. Wire Yagi, Masts (3) – Ron's,
..... Rig-Ron's IC-746 Pro III (will accept offers for a replacement)

Position 4,
Band/Mode – 40M CW/15 all, Captain - Dan, Antennas – 40M single element (Bob)/ 15M TH-2
..... Dino Tower, Rig-Dan's _____

Position 5,
Band/Mode - VHF/UHF/10M/Sat/PSK-31, Captain – Tim N6GP, Antennas - 10M TH-2/ VHF/UHF / Satellite Antennas (Chip's), Mast - Verticals for most bands – may need to borrow 80M/160M)

Shelter - Tent (1) with 6 tables, 15 chairs will be provided.
Power - Club Propane powered generator
Food - It will be up to each individual to provide his/her own meals and drinks.

If you are interested and need more information contact a Position Captain or Ron W6WG by email, W6WG@W6ZE.ORG

Winter Field Day Covid Do's and Don'ts

1. If occupied, tents shall have one side left open.
2. Tents shall be provided with fan ventilation.
3. Everyone within the tents shall have a tight fitting mask that covers the nose and mouth.
4. Operators shall not share headsets.
5. All those entering a tent shall use hand sanitizer before entering.
6. All those using microphones, keys or keyboards shall use hand sanitizer before their use.
7. Do **not** come to WFD if exposed to Covid-19, Delta or Omicron within the previous five days.
8. Do not come to WFD if you have a fever, unusual coughing or any Covid symptoms.

Radio Activity
January 2022

Upcoming Activities:

JANUARY

- ****North American QSO Party / CW:** 1800 UTC January 15 through 0559 UTC January 16
- ***January VHF Contest:** 1900 UTC Saturday January 15 through 0359 UTC Monday Jan. 17
- ****North American QSO Party / SSB:** 1800 UTC Sat. January 22 through 0559 UTC Sunday January 23
- ***CQ WW 160 Meter / CW:** 2200 UTC Friday January 28 through 2200 UTC Sunday Jan. 30
- **Winter Field Day:** 1900 UTC Saturday Jan. 29th to 1900 UTC Sunday Jan. 30th

FEBRUARY

- **10-10 Winter Contest, SSB:** 0001 UTC Feb.56 through 2359 UTC Sunday Feb. 6
- ***CQ WW WPX / RTTY** 0000 UTC Saturday Feb. 12 through 2359 UTC Sunday Feb. 13
- ***ARRL International DX Contest:** CW: 0000 UTC Sat. Feb. 20 through 2400 UTC Sunday February 21
- ***CQ WW 160 Meter SSB:** 2200 UTC Friday Feb. 25 through 2200 UTC Sunday February 27
- **North American QSO Party / RTTY:** 1800 UTC Feb. 26 through 0559 UTC Sunday February 27

*** Indicates club entries are accepted ** Indicates team entries are accepted**

Note: When submitting logs for ARRL Contests, indicate your club affiliation as "Orange County ARC"

State QSO Parties

- **Vermont QSO Party:** 0000 UTC Saturday February 5 through 2359 UTC Sunday Feb. 6
- **Minnesota QSO Party:** 1400 through 2359 UTC Saturday February 5
- **South Carolina QSO Party:** 1500 UTC Saturday February 26 through 0159 UTC Sunday Feb. 27
- **North Carolina QSO Party:** 1500 UTC Sunday February 27 through 0100 UTC Monday February 28

Repeating Activities:

- **Phone Fry** Every Tuesday night at 0230 UTC to 0300 UTC
- **SKCC** Weekend Sprintathon (Straight Key CW) on the first weekend of the month after the 6TH of the month. 1200 UTC Sat. to 2359 UTC Sunday.
- **SKCC** Sprint (Straight Key CW) 0000 UTC to 0200 UTC on the 4th Tuesday night (USA) of the month.
- **CWops** Every Wednesday 1300 UTC to 1400 UTC 1900 UTC to 2000 UTC and Thursday 0300 UTC to 0400 UTC
- **K1USN Slow Speed Test:** (CW, 20WPM Max.) Every Sunday night at 0000 UTC to 0100 UTC Monday

OCARC Club Nets:

- **75 Meter Net:** Every Tuesday night at 8:00 pm to 8:30 pm Local Time. SSB 3.883 MHz
- **10 Meter Net:** Every Wednesday night at 7:30 pm to 8:30 pm Local Time. SSB 28.375 MHz
- **2 Meter Net:** Every Wednesday night at 8:30 pm to 9:30 pm Local Time. FM Simplex 146.55 MHz

Other Nets:

- **Net-AT-9:** Wellness & Support Monday thru Friday 9:00 am and 9:00 pm Local Time 147.090 MHz (+600 MHz) No PL

Send an email to *Ron W6WG, w6wg@w6ze.org to have your favorite activity or your recent RadioActivity listed in next month's column.*

The terrible Fire Storm in Boulder County, Colorado started on the afternoon of December 30th last year in a parched grass field. As described in the article below from Jim Andrews - KH6HTV, the 110 mph winds quickly allowed the fire to reach nearby homes and communities (to the South and East of the nearby city of Boulder).

FIRE STORM DESTROYS 991 HOMES in BOULDER COUNTY, CO

Reprinted by OCARC with permission by Boulder Amateur Television Club from the ATV Repeaters Repeater Newsletter
www.KH6HTV.com

On Thursday, December 30th, Boulder County was attacked by a severe windstorm with winds exceeding 100mph. A grass fire started near the base of the mountains in Marshall. The winds rapidly created a extraordinary firestorm. It was too big and fierce for firemen to battle. The only battle was evacuation as the towns of Louisville and Superior and northern suburbs of Denver lay in the wind driven path. The only thing that contained the fire was the winds finally stopping during Thursday evening. By that time hundreds of homes had burned down. This was not a typical forest fire, but an urban firestorm.

View of QTH of Jim KH6HTV during the night of Dec 30.
His tower is visible in the center.

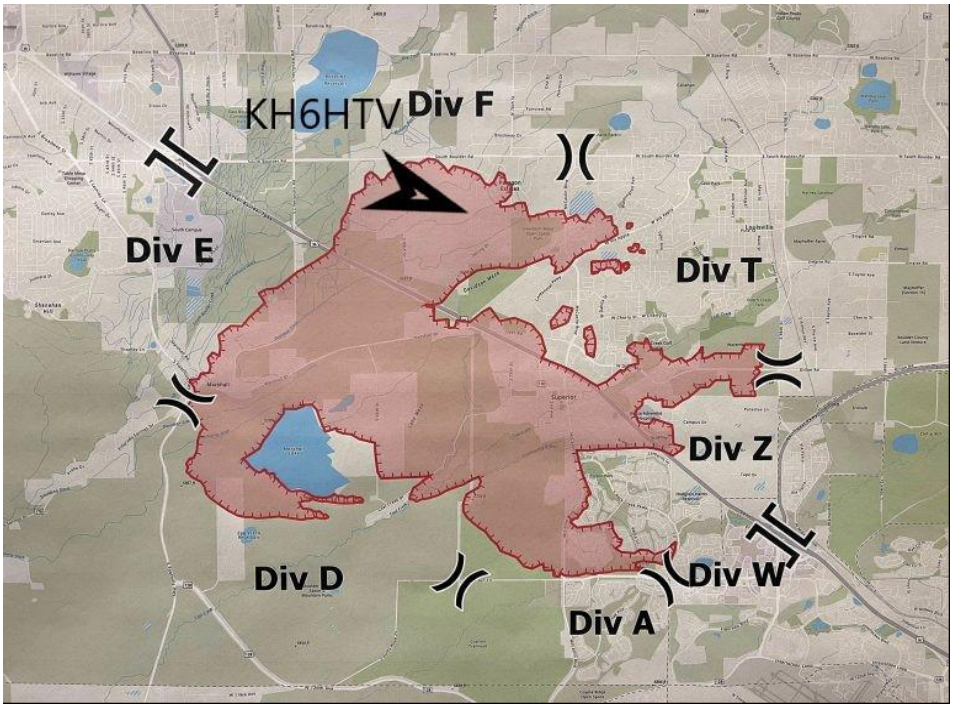
On Saturday, January 1st, Sheriff Joe Pelle announced that a total of 991 homes had been lost. 553 in the town of Louisville and 332 in Superior. Plus 106 more in un-incorporated Boulder County.

View of the remains of KH6HTV home on Friday morning on Dec 31.

Most of those 106 homes were in my own neighborhood. The above photos are of my own home burning down. The Thursday evening photo was taken by my son-in-law, Mike. He really should not have been there as the extremely intense wind driven heat waves could have easily killed him. Early the next morning, I walked into the area to check on our home. The second photo is all I found remaining. Our daughter, Susan, Mike and grand-daughter Alexa lived next to us and their home was also destroyed. All of our close neighbor friends lost their homes also. They included Boulder ATVers, Roger, N0IHX, and Naomi, KD0PDZ.

We had no official warning of the coming firestorm. My only warning was from our daughter who saw it happening. We evacuated saving only ourselves, our bulldog Ruby, 2 laptops and our 2 cars. Lost every thing else.

Surprisingly Sheriff Pelle said there were no deaths. If this had occurred during the middle of the night I am sure there would have been many deaths.



A map showing the fire area, South and East of the City of Boulder, CO
The QTH of KH6HTV is indicated with the large pointer,

So what is the ATV impact? Well for one, KH6HTV Video as a supplier of ATV gear will be out of operation for a very long time to come. I have already had to turn down a couple of orders. I will try to continue, as time permits, this ATV newsletter. But it might come out less often in the future.

Jim, KH6HTV, Boulder, Colorado

BATVC web site: www.KH6HTV.com

Heathkit of the Month #110:
by Bob Eckweiler, AF6C

ELECTRONIC TEST EQUIPMENT
Heathkit "Deluxe Service Bench" VTVMs.
(IM–10, IM–13, IM–28, IM–32 & IM–5228)

Introduction:

During its reign, Heathkit sold three series of vacuum-tube voltmeters (VTVMs); the familiar table-top series, an AC only audio series and a professional series. The V–1, the first of the table-top VTVMs, was the second-ever Heathkit produced. The table-top models were the topic of HotM #19[1]. featuring the V–7A. The AC VTVMs were covered in HotM #47[2].featuring the AV–3. The professional "Deluxe Service Bench" VTVMs will be covered in this article. **Table I** shows the model numbers of the three groups and the range of their production dates.

In 1961, along with a major styling change, the VTVM prefix changed to "IM" (presumably standing for: Instrument, Meter). Various meters, other than VTVMs, share the IM prefix.

The "Deluxe Service Bench" VTVM Series:

With the Radio / Television / HI–FI repair business booming in the early sixties, Heathkit decided to come out with a larger version of their VTVM for professional bench use. They dubbed their product line the "Deluxe Service Bench" (DSB) VTVMs. All together five versions of the DSB line were produced between 1961 and 1989. They are (in order by date) the IM–10, IM–32, IM–13, IM–28 and IM–5228. These VTVMs feature a 6" meter vs. 4½" on most of Heath's other VTVMs. The range resistor values in the DSB meters were changed to provide a constant ratio across the seven ranges. Also, the two lowest AC voltage ranges were given separate meter scales for higher accuracy. (more on these changes later.)

Figure 1: Heathkit IM–10 "Deluxe Service Bench" VTVM. The first of the Service Bench VTVM series, vertically configured with the controls below the large 6" meter. Photo courtesy of Chuck Penson - WA7ZZE.

The DSB series is heavily based on the V–7. circuit. They both use the same range and function rotary switches. Newer part numbers for these switches appeared in 1969. Electrical-

Here is a link to the index of Heathkit of the Month (HotM) articles:

http://www.w6ze.org/Heathkit/Heathkit_Index.html

1. Notes begin on page 24.

HEATH VTVMs

TABLE-TOP VTVMs (14 Models)

V–1	12/47-03/49	V–5A	05/52-08/52
V–2	04/49-11/49	V–6	09/52-08/54
V–2A	11/49-12/49	V–7	09/54-08/55
V–3*	03/49-05/49	V–7A	09/55- 1961
V–4	01/50-08/50	IM–11	1961 - 1969
V–4A	09/50-08/51	IM–18	1969 - 1977
V–5	09/51-04/52	IM–5218	1977 - 1983

AC VTVMs (5 Models)

AV–1	09/51-08/52	IM–21	1961 - 1969
AV–2	09/52-08/56	IM–38	1969 - 1977
AV–3	09/56 - 1961		

PROFESSIONAL (DSB) VTVMs (5 Models)

IM–10	1961 - 1962	IM–28	1969 - 1977
IM–32	1962 - 1963	IM–5228	1977 - 1989
IM–13	1963 - 1969		

Dates prior to 1961 came from Heath ads in Radio (TV) News. Later dates are from catalogs and are approximate. *The V-3 was advertised only, it appears.

TABLE 1

ly the new switches are identical to their predecessors, but mechanically they have a modified flat on the shaft to accommodate push-on knobs for the "new look" and "post new look" styles of the later models. Circuit-wise, other than the DC and AC range resistors, circuit changes were minimal.

The Two New Features of the DSB VTVMs"

On all Heathkit series of VTVMs the meter ranges are set so that every two ranges is a decade increase – such as 1.5 V, 5 V, 15 V, 50 V, etc. However, the table-top VTVMs use multipliers that make the ratios between alternating ranges 3⅓ then 3 (If you multiply them together you get exactly 10, a decade.) While this creates no problem when measuring DC voltages, it creates small errors when using the AC decibel scale, especially between adjacent ranges. A ten-fold change in voltage (a decade) is 20 dB. A 3.162… (the square root of ten) change of voltage is 10 dB. If the changes in voltage are 3 or 3⅓ that results in 9.54 dB or 10.46 dB respectively. About a half dB of error.

The problem may be corrected if the ratio between scales is changed to a constant square root of ten (3.162…) Every second range is still exactly a decade (20 dB). and every adjacent range is exactly 10 dB, but the full scale meter ranges are now approximately 1.58 V, 5 V, 15.8 V, 50 V, etc. This is corrected on the meter scale by simply stopping the "15.8" meter scale short of full-scale at 15, while the "50" scale goes to full-scale (see **Figure 2**.) If you multiply 15 by $\sqrt{10}^{3}$ you get 47.4, and the black 0–15 meter scale ends

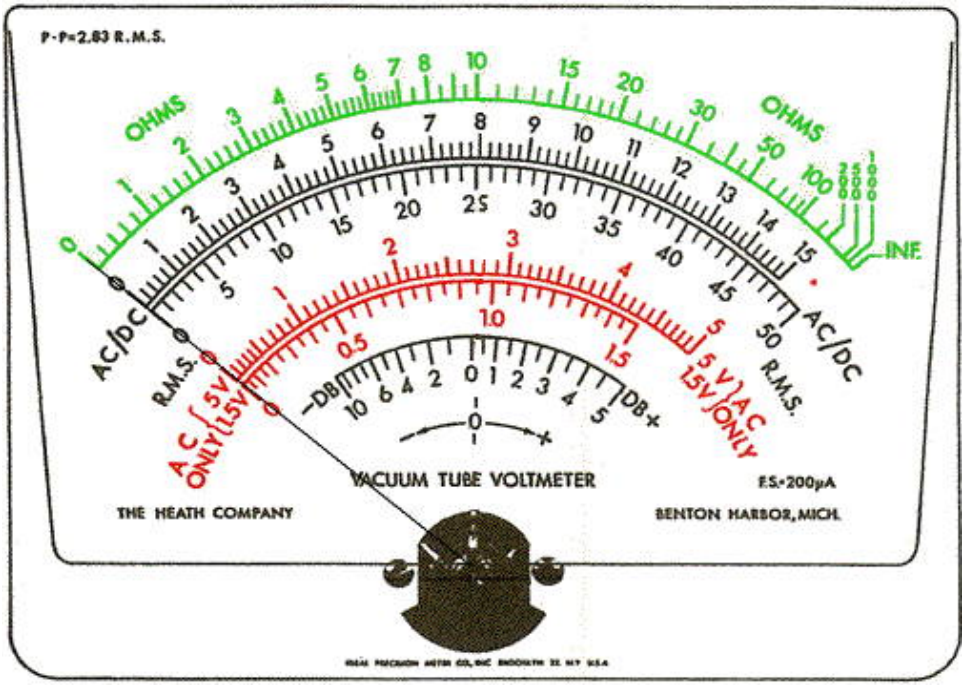


Figure 2: Drawing by author showing the seven meter scales on the Deluxe Service Bench VTVMs. Note the two black scales end so that if the upper scale were expanded it would end at 15.8. Also 15 corresponds with 47.4. See text for explanation.

just above 47.4 on the black 0–50 scale. This makes the black dB (decibel) scale accurate with both black voltage scales. The multiplier resistors on the DSB series of VTVMs have been changed from the values used on the table-top VTVMs to provide a true √10 ratio between ranges.

The second change for the DSB series voltmeters is the addition of two additional meter scales, colored red, for the two lowest AC voltage ranges. Again refer to **Figure 2**. The rectifier used to change AC into DC in the VTVM is not linear at low voltages. This problem is ignored on the table-top VTVMs, and AC voltages will read low on the two low ranges. On the professional DSB meters those ranges are read accurately on their own two corrected red-colored scales.

This might seem a 'Catch 22' situation since voltages read on the red scales cannot be converted to dB directly on the black scale. But it is simple to use the zero control to set the pointer to the corresponding voltage on the black scale and then read the dB on the black dB scale. Just remember to re-zero the meter.

The Heath AC series of VTVM meters all use ranges based on the square root of ten. They also don't suffer from rectifier non-linearity since the rectification is not done until after the last stage of amplification, and any non-linearity is common to all ranges and can be corrected on the meter scale. These series use 0–3.162 and 0–10 scales with the former scale ending at 3.0 (just above 9.49 on the full-scale 0–10 volt scale.)

The IM–10 "Deluxe Service Bench" VTVM:
Heathkit released the first DSB VTVM in the spring of 1961 and gave it the designation IM–10 (**Figure 1**). The VTVM features a 6" meter and was priced at $32.95. The IM-10 is taller then it is wide, measuring 9½"H x 6½"W x 5"D, with the meter at the top filling most of the width, with the controls below. Because of the large width there is plenty of room for the controls and they are well separated. The **ZERO ADJ**ust and **OHMS ADJ**ust controls are horizontal thumbwheels driving miniature potentiometers. Between these controls and slightly below on the panel is a small jeweled pilot light utilizing a #47 incandescent bulb. **Table II** shows the controls of the IM–10 (and IM–32). The AC line cord exit is

IM–10 / IM 32 Front Panel Layout

Across the top:	
Meter	0 – 200 µA, 6" with 7 color scales. (Text shows scale color)
OHMS:	**0 – INF** (10 at center)
AC/DC Volts:	**0 – 15** (**R.M.S.** on AC)
	0 – 50 (**R.M.S.** on AC)
AC Volts	**0 – 5** (**R.M.S.**) range only
	0 – 1.5 (**R.M.S.**) range only
Decibels	**-10 – + 5 dB** (0 dB = 1mW into 600Ω)
Center zero:	**- | +**
Second row (L to R):	
ZERO ADJ.	Potentiometer - 10KΩ Thumbwheel
Pilot Lamp Ass'y	Red jewel - #47 bulb (located between and slightly below the Thumbwheels)
OHMS ADJ.	Potentiometer - 10KΩ Thumbwheel
Third row (L to R):	
Mode Switch:	Five-position rotary switch marked: **OFF, A.C., D.C .–, D.C. +, OHMS**
Range Switch	Seven-position rotary switch marked: **1.5 V. RX 1, 5 V. RX 10, 15 V. RX100 50 V. RX 1000, 150 V. RX 10K, 500 V. RX 100K, 1500 V. RX 1 MEG.**
Fourth row (L to R):	
A.C. OHMS	Banana Jack - Red
D.C.	¼-inch Phone Jack
COMMON	Banana Jack - Red

TABLE II

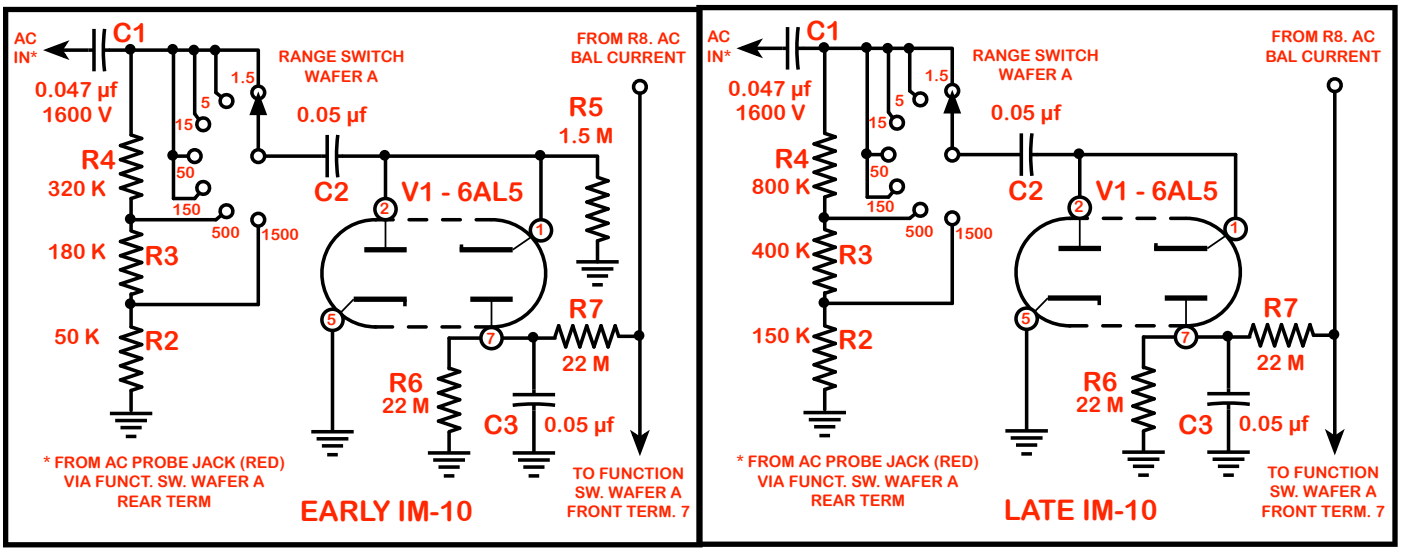


Figure 3: On the left is the early IM-10 AC rectification circuit. On the right is the later circuit which improved the input impedance, by a factor of three, to 1 megohm shunted by 30 µµf. R2, R3 and R4 values were changed and R5 was removed entirely from the circuit. The modification occurred sometime between May and July of 1961. Drawings by the author.

at the rear of the cabinet. There are three internal calibration potentiometers, AC BAL. AC CAL. and DC CAL. The cabinet must be removed for access to these controls.

The IM-10 came with same three test leads as the V-7(A):

- A black lead with a banana plug at one end and an insulated alligator clip at the other, this is the common lead for all measurements and is electrically connected to the chassis.
- A red lead with a banana plug at one end and a red test probe at the other; this is the active test lead for AC voltage and ohms measurements.
- A black shielded lead with a ¼-inch phone plug at one end and a black test probe containing a 1 meg Ω series resistor at the other; this is the active test lead for DC± voltage measurements.

The test leads connect to black and red banana jacks and a ¼-inch phone jack, respectively, on the front panel of the IM-10.

The IM-10 underwent an early production change involving the AC divider resistors around the 6AL5 on the schematic. Initially the IM-10 was specified to have a rather low AC measurement impedance of 320 KΩ shunted by 30 µµf [4]. The modification improved this to 1 MΩ shunted by 30 µµf, bringing it more in line with the V-7 and later table-top VTVMs[5]. The changes are shown in **Figure 3**. Whether Heathkit offered an update kit of parts for early owners is not known.

The early schematic is shown in the Fall/Winter 1961/62 Heathkit catalog. Which, surprisingly, is after the circuit had been changed, as indicated by the updated AC input impedance specification. The April 1962 issue of 73 Magazine reviews the IM-10 and also shows the early schematic[6].

The IM-10 came to market in the spring of 1961 while Heathkit was in the process of changing the style of their test equipment from Classic I to Classic II[7]. Thus the IM-10 ended up with a style unlike either of the two styles. It features wide white arcs, with black

Figure 4: Heathkit IM-32 Deluxe "Service Bench" VTVM The Classic II style update of the IM-10. It was the last of the vertically oriented Bench VTVM. Photo courtesy of Sonny Clutter, www.radiolaguy.com.

lines, marking the positions of the range and function switches, and knobs that appeared only briefly on kits (IO-30 scope and TT-1 tube tester) released in the same period. In 1962 the IM-10 was restyled in the Classic II configuration as the IM-32.

The IM-32 "DSB" VTVM:

IM-32 (**Figure 4**), is electronically almost identical to the later version of the IM-10 and matches the new Classic II style. Physically they are identical in dimensions and control layout. The internal fuse was changed to ⅛ amp slow-blow. The 1½ V C-battery was no longer included in the kit. The price remained at $32.95. The IM-32 was replaced by the IM-13 in late 1963.

The IM-13 "Deluxe Service Bench" VTVM:

After about a year, the IM-32 was replaced with the IM-13 **(Figure 5)** which is still in the Classic II style, but is laid out horizontally instead of vertically, measuring 5" H x $12^{11}/_{16}$" W x 4¾" D, with the same large 6" meter on the left and the controls to the right of the meter. The ZERO ADJust and OHMS ADJust controls are no longer thumbwheels, but potentiometers with a knob-less plastic knurled shaft. The pots feature a built-in ball vernier drive making adjustment easy even with the small diameter control shaft. Another feature added to the IM-13 is front panel access to the three internal calibration controls. These can be accessed, using a small screwdriver, through three holes just to the right of the meter. In the prior models access required removing the cabinet. See **Table III** for front panel layout of the IM-13, IM-28 and IM-5228 models.

Other changes were the replacement of the 9.1Ω resistor in the ohms divider chain from a ½-watt 5% wire-wound resistor (2-48) to a

Figure 5: Heathkit IM-13 Deluxe "Service Bench" VTVM In the Classic II style, and in the new horizontal format. Note calibration access holes to the right of the meter. Photo by author.

IM–13 / IM–28 / IM–5228 Front Panel Layout

Left half of front panel:	
Meter	Same as in Table I
Vertically to right of meter (T to B):	
DC CAL	Access hole to pot behind panel.
A**C CAL**	Access hole to pot behind panel.
A**C BAL**	Access hole to pot behind panel.
Right half of front panel:	
First row (L to R):	
FUNCTION:	Five-position rotary switch marked: **OFF, A.C., D.C .–, D.C. +, OHMS**
RANGE:	Seven-position rotary switch marked: **1.5 V. RX 1, 5 V. RX 10, 15 V. RX100 50 V. RX 1000, 150 V. RX 10K, 500 V. RX 100K, 1500 V. RX 1 MEG.**
Second row (L to R):	
ZERO ADJ. [a]	Potentiometer - 10KΩ Thumbwheel
Pilot Lamp Ass'y	NE-2 neon lamp in amber lens.
OHMS ADJ. [a]	Potentiometer - 10KΩ Thumbwheel
Third row (centered):	
Connector	¼-inch phone jack

[a] On the IM–5228 …**ADJUST** is spelled out.

TABLE III

2-watt precision resistor (3B–4)[8]. An included gimbal mounting bracket allows the meter to be mounted under a bench shelf, on a vertical surface or just sitting on (or bolted to) the bench-top. The VTVM can be easily removed from the mount if needed to be used away from the bench.

Also the internal fuse and holder were removed (the IM–13 and later models were not fused.) The #47 incandescent pilot lamp and jeweled assembly were replaced with a plastic lens assembly containing a neon bulb. And the power rectifier was changed from selenium (#57–22) to a silicon diode (#57–27) without the addition of any dropping resistor[9].

Another significant change was the test lead set. The three test leads were replaced by a single test probe with a ¼-inch phone plug at one end with a shielded wire and a black ground lead exiting the plug body. The black ground lead terminates with an alligator clip. The shielded lead ends in a special test probe with a flip-type switch that selects either **AC – Ohms** in one position or **DC** in the other. In the AC – Ohms position the tip of the test probe is directly connected to the shielded test lead, and in the DC position a 1–Meg Ω resistor is switched in series with the test probe, The front panel contains only a ¼-inch phone jack; no more red and black banana jacks. Also, a new ¼" phone plug with heavier insulation replaces the standard phone plug used on the earlier VTVMs (**Figure 6**).

There was a minor change to the IM–13 specifications due to the new horizontal layout. The input capacitance (at the front panel terminal) increased from 30 to 40 pF in shunt with 1 Meg Ω. However the cable of the shielded test lead adds about 160 pF when used.

Figure 6: Top shows the new phone plug with its thicker insulation to prevent flashover at higher voltages. Below it is the standard phone plug used on the earlier VTVMs.

Figure 7: Heathkit IM-28 Deluxe "Service Bench" VTVM In the "New Look" style. It is the first of the series to use a 120/240 V primary transformer and a three-wire AC plug. Photo by author.

The initial IM-13 price remained at $32.95. At the same time Heath also offered a factory wired version of the VTVM. The wired IMW-13 initially sold for $49.95. These prices increased to $36.50 and $56.95 respectively by 1969 when the IM-13 was replaced by the IM-28.

The IM-28 Deluxe "Service Bench" VTVM

In the summer of 1969 the the IM-13 was rebranded into the IM-28 (**Figure 7**). It initially sold at the same price as the recently discontinued IM-13, $36.50 in kit form and $56.95 factory wired.

The IM-28, supporting the "New Look" style, was the first of the DSB VTVMs to operate on 210 to 250 VAC as well as 105 to 125 VAC and incorporate a three-wire line cord with ground lead. Other than the dual primary power transformer the unit appears electronically identical to the IM-13 with the exception of the neon pilot lamp with was changed to an NE-2E, still with a 150 KΩ series resistor, and operable at 105 to 240 VAC.

The IM-28 continued to be sold until 1977. At that time the IM-28 was selling for $59.95. The assembled model SM21A, (rebranded due to Slumberger buying Heath from Daystrom), sold for $95.00.

The IM-5228 "DSB" VTVM

The IM-5228 VTVM, replaced the IM-28 in 1977 at the same $59.95 price as the unit it replaced. However the factory wired price of the SM-5228 increased to $100.00. The IM-5228 was designed in the "Post New Look" style **(See Figure 8)**. The IM-5228 VTVM sold for thirteen years until 1989 when Heath production was waning. In the Christmas 1987 catalog the IM-5228 sold for $89.95. Circuitry remained the same as the IM-28, but the unit sports a new style meter, though the specifications and meter scales remain the same. The factory wired SM-5228 was discontinued in 1981. In 1981 Heath started selling the PKW-4, a wired replacement test probe for the IM-5228 (and the IM-13 & IM-28), for $10.95. The last time Heathkit is believed to

Figure 8: The last of the "Deluxe Service Bench VTVMs. The IM-5228, sporting the "Post New Look" style and a new style meter continued in production into 1989. Photo courtesy of Chuck Penson WA7ZZE.

advertise a VTVM is in the Christmas 1989 catalog. At that time the IM−5228 was selling for $129.95 in kit form. The PKW-4 wired replacement probe was discontinued in late 1986, last selling for $19.95.

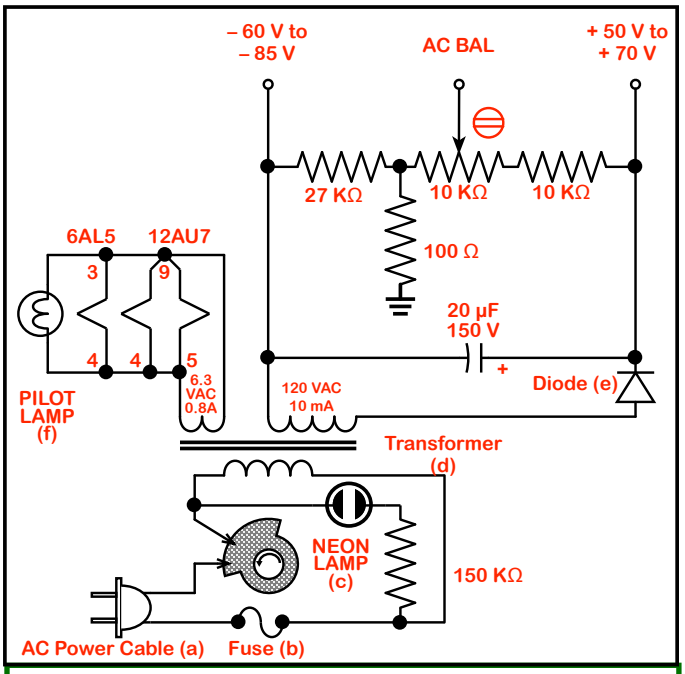
Heathkit "DSB VTVM Circuit Description[10]:

The VTVM circuit used since the V−7 hasn't been discussed before in HotM. The actual circuit since the V−7 has been pretty constant with minor changes. While the circuit descriptions that follow can describe much of the later table-top Heathkit VTVMs, The following descriptions focus on the DSB series of VTVMs. The VTVM circuit can be divided into seven sections: Power supply, meter amplifier, meter calibration circuits, DC range divider, AC range divider, ohmmeter divider and probe.

Power Supply:

Both the table-top and bench series VTVMs share the same basic circuit. They do use different power transformers, though both have the same secondary ratings. The differences are physical because the transformer used with the table-top VTVMs mount on a circuit board, and the transformer used with the DSB VTVMs mount on the chassis.The basic circuit is shown in **Figure 9** is a simple half-wave rectifier with a semiconductor diode and a 20 µF filter capacitor[11]. Surprisingly, the filter capacitor is only rated for 150 VDC which is close to the actual voltage across it [12]. The capacitor working voltage was not increased[13] even when the rectifier was changed from selenium used in the IM−10 and IM−32 (part # 57-22) to a silicon diods used in the later VTVMs (part # 57-27).

The power supply B+ and B– voltage is referenced to ground by resistors so that the power supply provides a positive voltage of + 50 to +70 V (nominally + 65 V) and a negative voltage of 60 to 85 V (nominally −75 V).



Notes:

a. The IM−10, IM−32, & IM−13 use a two wire power cord. The IM−28 & IM−5228 use a three wire power cord.

b. Only the IM−10 & IM−32 contain a fuse; ¼ A and ⅛ A respectively The IM−32 fuse is slow-blow. Fuse is internal.

c. The IM−13, IM−28 & IM−5228 have a neon pilot lamp.

d. Transformers rated rated secondaries of 120 vac @ 10 ma and 6.3 vac at 0.8A. The IM−10, IM−32 & IM−13 use #54-2 Transformer. The IM−18, IM−5218, IM−28 and IM−5228 use dual primary versions with a -24 on the end of their part number. Dual primary wiring is not shown here. See text.

e. The IM−10 & IM−32 use a (57−22) selenium rectifier. The IM−13, IM−28 & IM−5228 use a (57−27) silicon diode rectifier.

f. The IM−10 & IM−32 use a bayonet #47 6.3 V bulb mounted in a jewel lens socket.

Figure 9: The simple Heathkit VTVM power supply.

these values are shown on the Heathkit schematics. Very little current is drawn by the circuit VTVM.

The power supply supports the 12AU7 amplifier tube and supplies a very small current to counter the offset contact potential created by the 6AL5 rectifier tube used for the AC

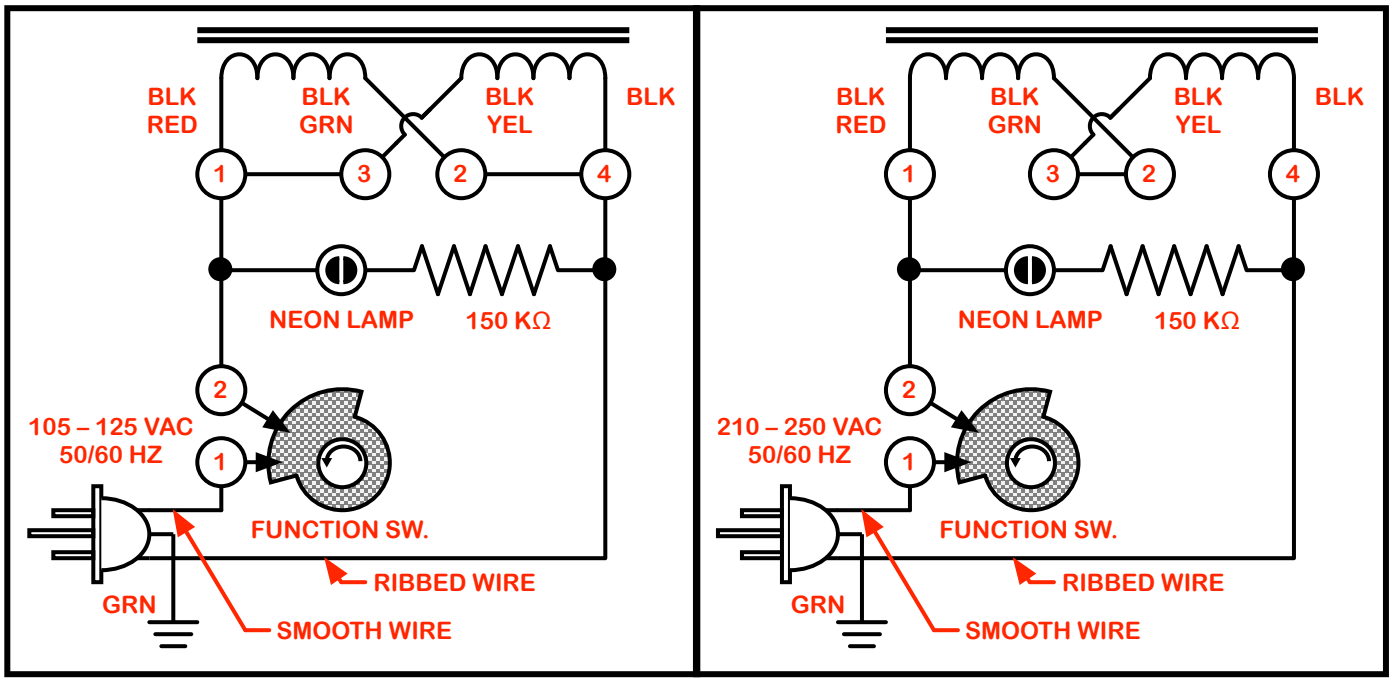


Figure 10: On the left is the primary wiring of the IM–28 and IM–5228 for 120 VAC; On the right is the primary wiring for 240 VAC. A simple wiring change is required to switch.

ranges. It also provides all needed filament voltage and power for VTVMs with an incandescent pilot lamp.

Only the primary wiring for the IM–10, IM–32 and IM–13 are shown in Figure 9 (the IM–13 is not fused.) Dual primary transformers, (#54-2-24) on the IM–28 and IM–5228 provide 105 - 115V or 210 - 240V capability with a wiring change. (See **Figure 10**) The early IM–10 and IM–32 VTVMs use a jeweled red pilot lamp. The IM–13 uses a pre-assembled neon lamp with lens (#412-12) for its pilot light. Later DSB units, the IM–28 and IM–5228, use an NE-2E neon bulb (#412-36) that slips into a plastic lens (#413-11). The neon lamp is across the primary transformer winding in series with a 150 KΩ resistor making it brighter with 230 volt power.

Meter Amplifier:

Figure 11 shows the basic amplifier circuit. The plates of the tube are connected directly to the positive 65 V supply. The cathodes are connected through resistors and a balancing network to the negative 75 V supply. The meter is connected between the cathodes along with the necessary switching and calibration circuits; they will be discussed in the next section. With no input, both grids are at ground potential and plate current will flow in each half of the 12AU7 so that the grid to cathode voltage is about a negative 3 volts. The ZERO ADJUST control changes the cathode resistances. In balance, it is set so the voltage at each of the two cathodes are identical. The balance will happen near 45% of the control rotation since one cathode resistor is 180 KΩ and the other is 150 KΩ. This allows the control more adjustment on the up side, allowing the control to be used to set the meter to half scale so it can be used as a center-scale meter if desired. The amplifier can be thought of as a bridge circuit and the ZERO ADJUST balances the bridge.

When a positive voltage is applied to the grid of the left tube section (Pin 2), that section draws more current and its cathode becomes

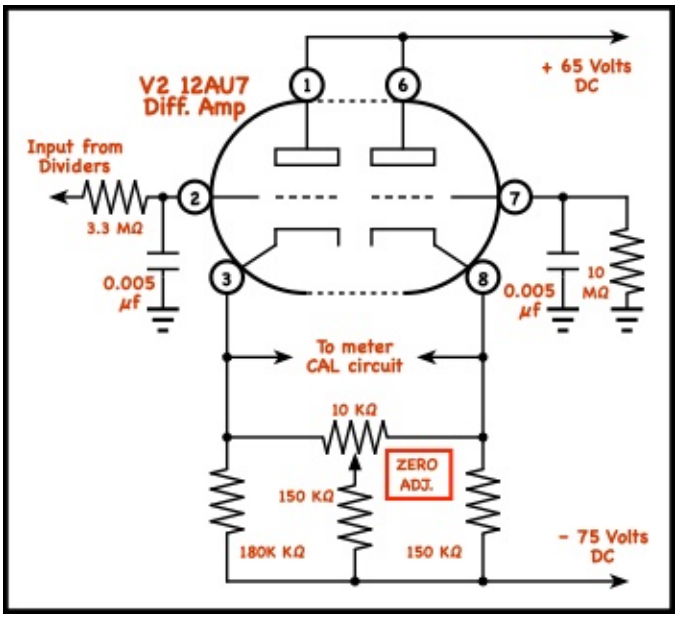


Figure 11: The meter amplifier utilizes a 12AU7 dual triode. About 1.44 volts is applied by the divider chain to give full scale deflection on the meter.

more positive than the other cathode, unbalancing the bridge and sending current through the meter. The circuit is designed so that a voltage of approximately 1.44 volts at pin 2 will result in full scale meter deflection. With the function switch in AC or DC– the signal applied to the grid is negative resulting in the left section drawing less current and the right section drawing more.

Meter Circuits:

Figure 12 shows the meter circuit for each of the four meter functions, AC, DC–, DC+ and OHMS.

Each circuit is the meter in series with a potentiometer. The AC CAL pot sets the AC calibration, the DC– and DC+ positions share the DC CAL pot, and the OHM ADJ. pot mounts on the front panel. It is used to set the meter to full scale with the test leads open. The FUNCTION switch selects the correct potentiometer and, when in the DC+ and OHMS position, reverses the meter leads.

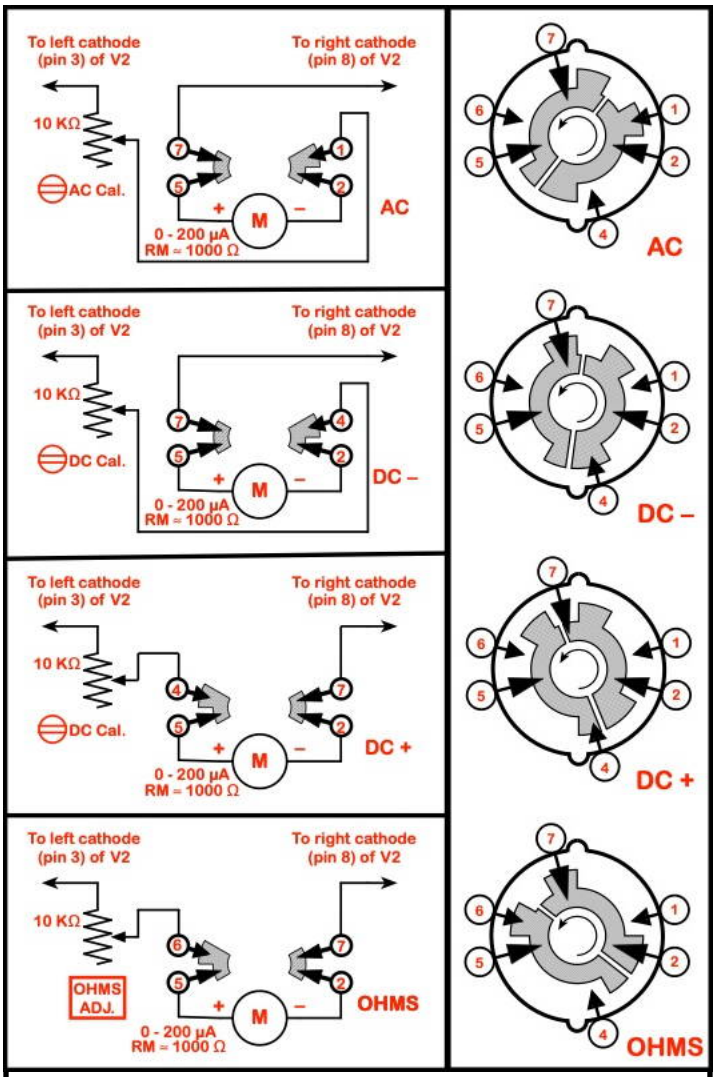


Figure 12: The meter circuit driven off of the two cathodes of the 12AU7 twin triode tube. To the right is the associated switch wafer and its connections for each of the four function positions. Controls marked with a slotted shaft end are internal controls accessible in late units through holes in the front panel. Controls shown with a box are located on the front panel.

DC Range Divider Circuit:

The voltage divider consists of seven resistors mounted on the range switch plus the 1 MΩ resistor in the probe. **Figure 13** is a schematic of the DC divider circuit. Some of it is also used for AC measurements.

The bracketed resistance values near each switch position give the total resistance from that position to ground. A voltage divider consists of two resistances, and the division

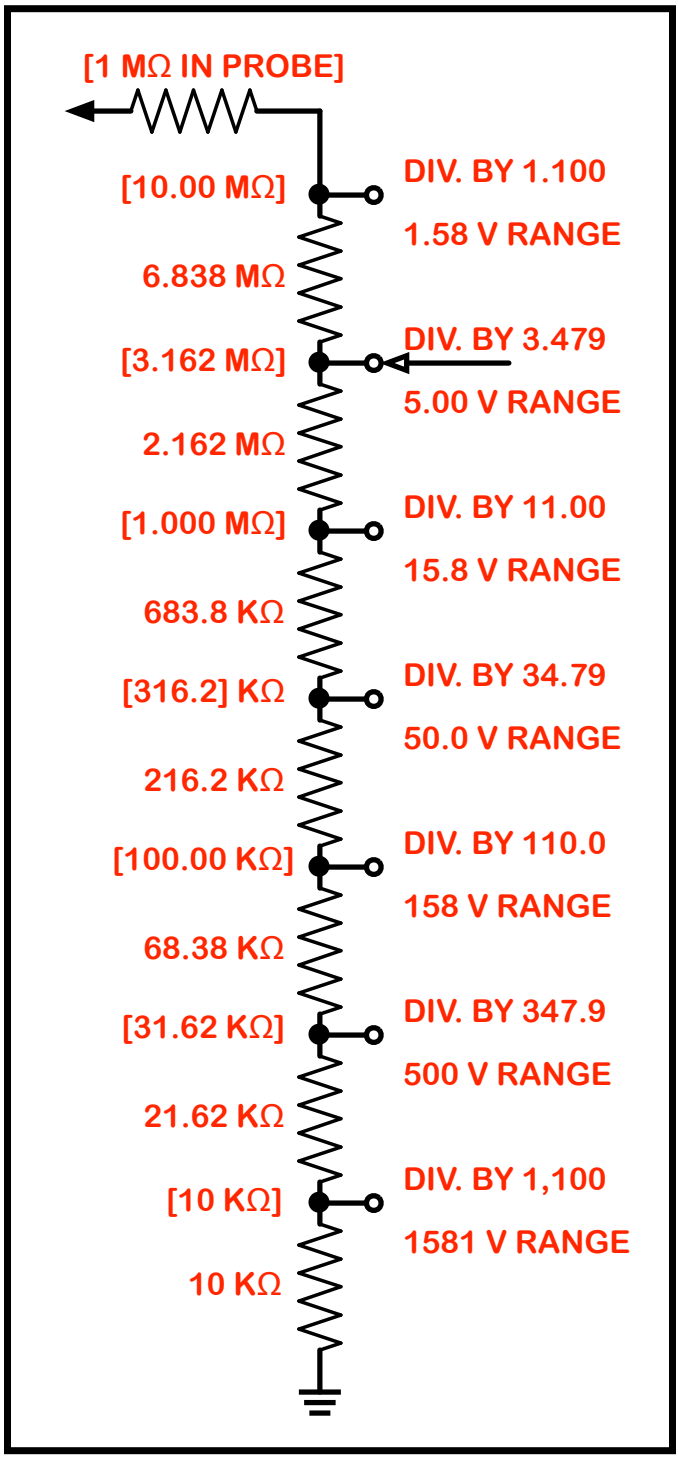


Figure 13: The DSB VTVM DC resistor divider chain with resistor values. The bracketed resistance values are the total resistance from the switch terminal to ground. Eleven million, divided by this resistance value, is the voltage division that occurs for that switch position. If full scale voltage is applied for a given range, the output voltage to the meter amplifier is 1.44 volts. On the 0 –15 black scale full-scale is actually 15.81.

is the total resistance divided by the resistance from the tap to ground. The total resistance is fixed at 11 MΩ (10 MΩ total in the seven dividers plus 1 MΩ in the DC probe trip.) As an example, assume the switch is at the 5 volt full-scale position. This calculates to 11 MΩ divided by 3.162 MΩ or 3.479. When 5.00 volts is applied to the tip of the probe, and the range switch is set to the 5 V range, the output is 5.00 divided by 3.479 or 1.44 volts. If you do these calculations for any of the other range positions you will end up with 1.44 volts. When the VTVM is calibrated, the DC CALIBRATE pot is adjusted so that 1.44 volts at the input to the meter amplifier results in full scale meter movement.

AC Range Divider and Rectifier Circuit:

When measuring AC voltages the input is connected to the AC rectifier circuit (Refer back to the right side of **Figure 3**) For AC ranges from 1.5 V to 150 V, the voltage to be measured is fed through C1, referenced to ground through the three resistor AC voltage divider chain and fed to the 6AL5, which is wired as a half-wave voltage doubler, producing a DC voltage approximately equal to the peak-to-peak voltage of the input AC voltage.

On positive AC peaks C2 is charged up through the left diode of the 6AL5 to the peak voltage (~1.4 times the RMS voltage.) On negative peaks the applied voltage is in series with the voltage across C2 and charges C3, through the right diode of the 6AL5, to twice the peak voltage (~2.8 times the RMS voltage.) Notice that this voltage is negative.

On the 500 and 1,500 AC volt ranges the voltages would exceed the voltage rating of the 6AL5 so they are divided down prior to reaching the tube, to correspond with a 150 volt AC input. The AC divider resistors appear to have been selected empirically for

best accuracy due to the nuances of the voltage doubler circuit.

The resulting voltage is then applied to the DC range divider circuit through a 22 MΩ resistor. This divides the voltage across C3 by 3.2. Since AC voltages in the 500 and 1500 volt ranges are dropped to the 150 volt range, when the range switch is in those positions the output to the meter amplifier is taken from the 150 volt tap of the DC divider chain.

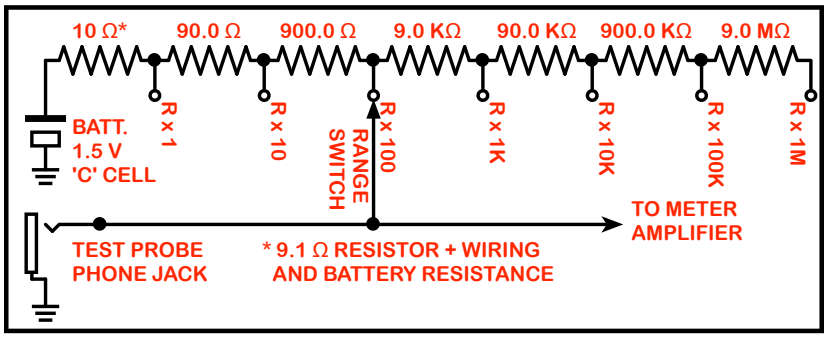


Figure 14: Schematic of the OHMS function with function switch in OHMS and Range switch in R x 100.

Since the V-1, Heathkit (along with many other VTVM manufacturers) has been struggling with offset on the lower AC ranges caused by contact potential in the rectifier tube. In HotM #86 [14] page 10 the solution for the V-6 is discussed. It involves knowing which diode in the twin-diode rectifier tube (6H6) has the higher contact potential, and the unit is then wired accordingly. The rectifier tube for the Heathkit V-6 came pre-aged and marked "reverse diodes" or unmarked. There were separate wiring steps depending on which your tube was.

The half-wave voltage doubler rectifier circuit used, starting with the V-7, solved the problem and allowed the AC BAL. control to balance regardless of which diode has the higher contact potential. The balance current comes from the power supply AC BAL. pot and is fed through four 22 MΩ resistors to the top of the DC range divider chain when the FUNCTION switch is in the AC position.

A separate AC CAL. potentiometer is switched in when measuring AC to allow it to be calibrated separately from the DC calibration.

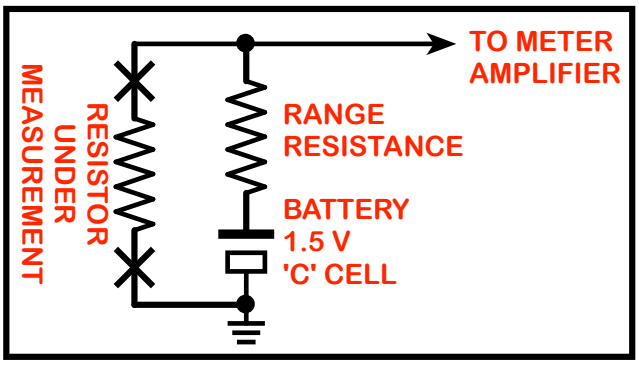


Figure 15: Simplified DSB VTVM OHMS circuit.

Ohms Circuit:

The ohms circuit is shown in **Figure 14** and a simplified version is shown in **Figure 15**. When the FUNCTION switch is in the OHMS position a 1.5 volt 'C' battery is connected to the meter amplifier input through a resistance. This resistance is controlled by the RANGE switch. Resistances of 10 Ω, 100 Ω, 1 KΩ, 10 KΩ , 100 KΩ, 1 MΩ and 10 MΩ correspond to the Rx1, Rx10, Rx100, Rx1K, Rx10K, Rx100K and Rx1M ranges. With the test leads shorted, the ZERO ADJ. pot is set so the meter reads zero ohms. Then, with the test leads open, the OHMS ADJ. pot is set so the meter reads full-scale. When the unknown resistance is connected to the test leads it is in parallel with known resistance and battery. If the range resistance and unknown resistance are the same, the meter will read half-scale. Note that half scale is 10 on the green OHMS meter scale.. The rest of the non-linear scale is calibrated correspondingly. Note that the 10 Ω resistor is in reality 9.1 Ω. The remaining 0.9 ohms is made up by

the internal battery and lead resistances. It is important to keep these resistances low and constant for best accuracy on the Rx1 range. Because the input resistance of the meter amplifier is close to infinity there is no shunt resistance allowing for high range resistances and the ability to measure resistances up to 1,000 megohms.

Table IV shows the percent of full scale on the meter for marked values on the ohms scale.

GREEN OHMS SCALE	
Scale Mark	% of Full Scale
0	0.00%
1	9.09%
2	16.67%
3	23.08%
4	28.57%
5	33.33%
6	37.50%
7	41.18%
8	44.44%
9	47.37%
10	50.00%
15	60.00%
20	66.67%
30	75.00%
50	83.33%
100	90.91%
200	95.24%
500	98.04%
1000	99.01%
INF	100.00%

TABLE IV

VTVM Calibration:

The calibration of the DSB VTVM is straightforward. After aging the tubes the DC zero is checked. Switching between DC– and DC+ should not cause the zero to shift after proper aging.

DC Calibration:

The IM–32, and most (if not all) Heathkit VTVMs before that model, came with a fresh carbon-zinc 'C' 1½ volt battery. Later models, both DSB and table-top VTVMs, required the builder to purchase a "standard" 'C' battery. This battery was used for DC calibration as well as in the ohms circuit. By "standard" battery Heathkit evidently meant a carbon-zinc battery. This type battery, when fresh, measures 1.55 volts. Refer back to **Figure 2** and notice the red dot just to the right of the 0 to 15 black scale. This dot corresponds to 1.55 volts. With the VTVM on the 1.5 volt range measuring DC+, properly zeroed, and the probe set to DC, the battery voltage is measured and the DC CAL. potentiometer is adjusted so the needle is over the red dot. This setting should be approached from the low side. Do not use an alkaline battery for calibration as their voltage, when fresh, is higher and varies between manufacturing processes.

AC Calibration:

Heathkit's AC calibration relies on the accuracy of the AC line voltage. It varies a lot depending on where you are. Find an accurate AC voltmeter that you can borrow and use it to monitor your line voltage while calibrating.

Be very careful when following the Heathkit instructions. VTVMs with 3-wire plugs have their chassis connected to the AC ground. Be sure the common lead of the test probe is connected to the common side of the AC line and the probe is connected to the hot side of the AC line. If they are reversed, you'll blow the fuse in the IM-10 or IM-32, but it will probably blow your house fuse and damage the later IM-28 or IM-5228. On the IM-13, if you touch the chassis of the meter and something close-by that is grounded to earth you will get a good shock, possibly fatal. A good solution is to use an isolation transformer, but be sure you are measuring the voltage after the transformer.

Once you have the voltage you are calibrating to, just measure it with the test probe (set to AC-OHMS) and adjust the AC CAL pot to the measured voltage.

Ohms Calibration:

There is no calibration for the ohms function. It relies on the precision resistors in the ohms resistor chain. They are 1% resistors and not prone to going bad. Use available

known good 1% resistors to verify that your meter is accurate.

An alkaline battery is okay to use in the ohmmeter circuit (it's just not good for calibration,) but choose a brand that is not prone to leaking; that is the most common problem found with VTVMs that use a battery in the ohms circuit. Be sure to remove the battery if you are not planning to use your meter for awhile.

Accessories:
Heathkit made a few accessories for their line of VTVMs These circuits work well with both the DSB and table-top VTVMs.

Probes:

309(A-C)	RF Probe (30 VRF, 500V DC Max)
310	10 KV HV Probe
336	30 KV HV Probe
338(B-C)	Peak-to-Peak Probe (5kc - 5 Mc)
PK-3(A)	RF Probe (90 VRF, 1KV DC Max)
PKW-4	Wired replacement probe for IM-11, IM13 and later VTVMs only.

Tube Replacements:

IMA-18-1	Solid-State replacement set for the 12AU7 and 6AL5 tubes in the later table-top and DSB VTVMs.

Modifications:
There are two modifications for the later Heathkit VTVMs that have been seen on various blogs. One involves using a replacement probe and the other is an internal power supply that provides power to the ohmmeter function, replacing the battery.

Probe Circuit Modification:
Later table-top and DSB VTVMs came with a single probe with a built in 1 MΩ resistor that is switched in series with the probe tip when measuring DC± and switched out when measuring AC or OHMS. If the probe is lost or damaged a replacement probe may be hard to find and building one may be a challenge. Someone, rumored to be a Heath employee, found a way to use a standard test probe connected via coax to the a phone plug, and a way to rewire the existing function switch so that a 1 MΩ resistor will automatically be switched in, internally to the meter, when the function switch is in either DC– or DC+.

From afar this seems a great idea, and one has to wonder why Heathkit didn't think of it. One guess is that the Heathkit employee may have worked in sales and not engineering. The resistor is at the tip of the probe for one purpose only. It isolates the DC point under test from the stray capacitance of the cable and VTVM circuitry. This added capacitance may change the operation of the circuit, especially in higher frequency circuits, giving false readings. I highly recommend one not to do this modification.

Battery Elimination Modification:
Many Heathkit VTVMs have been damaged by leaky batteries. There are a few modifications that involve rectifying some of the filament voltage and using a 1.5 VDC regulator circuit to supply voltage in place of the battery. This idea is appealing, but the circuits, so far seem, to be lacking. They take their power from the filament winding of the transformer, and if the VTVM uses an incandescent pilot lamp the filament winding is already being taxed.

Final Words:
One may wonder what value a DSB VTVM is with all today's fancy digital instruments? They are rugged and do their job well. They are low power devices so you can leave them on for long periods without running up the electric bill. Once warmed up they are stable and the zero holds well.

The 11 MΩ impedance on DC provides isolation and more accurate readings up to the 500 V range. Above 150 V a 10X probe, like the Heathkit 310 HV probe can be used to increase the input impedance to 110 MΩ.

Schematics are available online (See notes.) Table V shows the differences between the the Deluxe Service Bench VTVM models.

This article originally was going to cover the V-7 and later table-top as well as the DSB VTVMs but it just got too long. Thus a full rewrite was started, and the article was not ready for the December issue of RF.

Acknowledgements:

The Heathkit electronics community is a large and enthusiastic group that is willing

Heathkit Deluxe Service Bench VTVM Line						
Item	**Early IM-10**	**Late IM-10**	**IM-32**	**IM-13**	**IM-28**	**IM-5228**
Layout	Vertical		Vertical	Horizontal	Horizontal	Horizontal
Rectifier	Selenium		Selenium	Silicon	Silicon	Silicon
Pilot Lamp	#47 Bulb 6.3V 150 ma Jeweled holder			Neon Ass'y	Neon/w Lens	Neon/w Lens
Power Xfmr	120 V Primary		120 V Primary	120 V Primary	120/240 V Primary	120/240 V Primary
Line Fuse	1/4 Amp Regular		1/8 Amp SB	none	none	none
R2	50 KΩ 1%	150 KΩ 1%	150 KΩ 1%	150 KΩ 1%	150 KΩ 1%	150 KΩ 1%
R3	150 KΩ 1%	400 KΩ 1%	400 KΩ 1%	400 KΩ 1%	400 KΩ 1%	400 KΩ 1%
R4	320 KΩ 1%	800 KΩ 1%	800 KΩ 1%	800 KΩ 1%	800 KΩ 1%	800 KΩ 1%
R5	1.5 MΩ 1%	not used	not used	not used	not used	not used
Phone Jack	DC		DC	AC/DC/Ω /COM	AC/DC/Ω /COM	AC/DC/Ω /COM
Red Jack	AC / Ω		AC / Ω	none	none	none
Black Jack	COM		COM	none	none	none
Zero Adj. & Ohms Adj.	Thumb wheel		Thumb wheel	Multiturn vernier	Multiturn vernier	Multiturn vernier
Feet	Embossed in Cabinet		Rubber	Felt stick-on	Plastic Stick-on	Plastic Stick-on
Price Kit (Mail Order)	$32.95		$32.95	$32.95 - $36.50	$36.50	$49.95 - $129.95
Price Wired (Mail Order)	N/A		N/A	$49.95 - $56.95	$56.95*	$100 -** $120***
* Rebranded Slumberger SM-21A ** Rebranded Sulmberger SM-5228				*** The SM-5228 was discontinued after Zenith bought Heathkit in 1979		

TABLE V: Shows the changes between models of the DSB line

to help others with their projects. This article would not have been possible without the support of this community.

Here is a list of people who helped in the effort by providing information from their manuals, actual manuals, photos, part number information, proof reading, answers to my questions, and over-all moral support. The problem with these lists is I usually leave out a person or two who should be included; not on purpose, just due to my forgetfulness:

C. E. "Sonny" Clutter, (The Radiola Guy)
Steve Gladstein - N8FH
Gary Harmon Jr. - K5JWK
Bob Meister - WA1MIK
Chuck Penson - WA7ZZE (See note 7)
Santos e Silva
Dave Somes - WB6TFC
Gerhard Wagner - DF1DA

73, from AF6C

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

Thanks - AF6C

Notes:

1. https://www.w6ze.org/Heathkit/Heathkit_019_V7a.pdf
2. https://www.w6ze.org/Heathkit/Heathkit_047_AV3.pdf
3. The radical sign before a number signifies the square-root. √10 means "the square-root of ten".
4. As specified in the May 1961 Heathkit catalog. Page 34.
5. The table-top AC voltmeter input impedance, starting with the V–7, is 1 MegΩ shunted by 35 to 40 µµf.
6. ***73 Builds and Tests the Heathkit IM-10 VTVM*** by Donald A. Smith - W3UZN (April 1962 issue).
7. In his book: ***Heathkit Test Equipment Products*** Chuck Penson defines six different styles Heathkit used for their test equipment from 1947 - 1990. They are: Pre-Classic, Late Pre-Classic, Classic I, Classic II, New Look and Post New Look. See the book for details. The book and his others are available at: https://wa7zze.com
8. When Heath computerized its part #s 3B-4 changed to 3-4-2.
9. For those who believe you must add a series resistor when switching from selenium to silicon, Heathkit didn't, the slight increase in voltage only improves efficiency.
10. Full schematics of the DSB VTVMs are available at: https://www.w6ze.org/Heathkit/DSB/DSB.html
11. Table-top VTVMs used a16 µf electrolytic filter capacitor.
12. In at least one Heath VTVM I've measured more than 150 volts across the filter capacitor at a high 125 V line voltage. But see the next note.
13. Though I've worked many Heathkit VTVMs, and I replace the filter capacitor with a higher voltage one as a habit. I have yet to find one of the original capacitors non-functioning, out of tolerance or even with notable leakage. This power supply produces only a small current and is not taxed.
14. https://www.w6ze.org/Heathkit/Heathkit_086_V6RebuildII.pdf

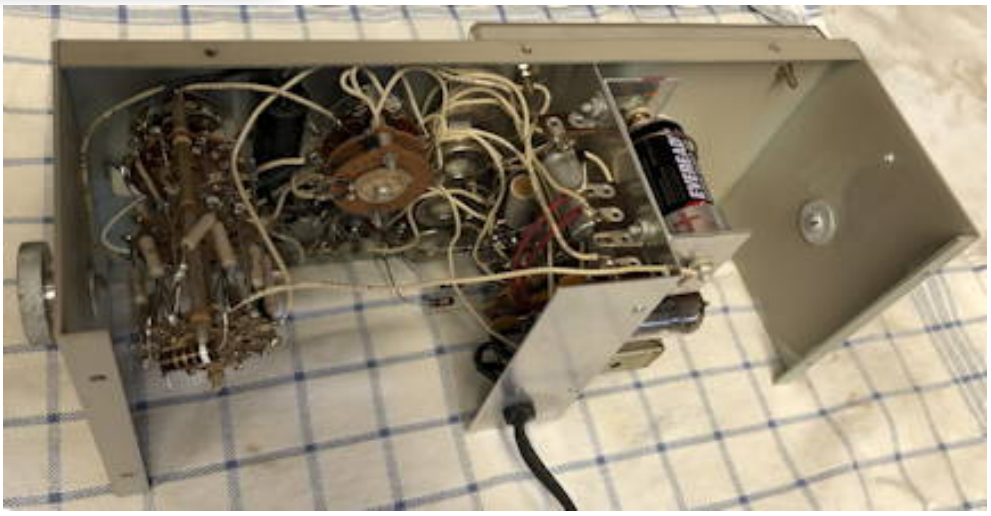


Figure 16: An internal view of the IM-28. On the left is the range switch. To its right is the function switch. Right of that are three potentiometers mounted vertically that can be accessed through holes in the front panel to allow calibration without removing the cover. To their right is the chassis. Partially visible on the top of the vertically mounted chassis are the power transformer, battery and the 12AU7 vacuum tube. Photo by author.

Net@C
AMATEUR RADIO WELLNESS & SUPPORT NET
Catalina
Amateur Repeater Association

OCARC BOARD MEETING MINUTES 2022-01-08

Due to the ongoing pandemic, the first Board Meeting of the year was via Zoom on Saturday, January 8, 2022. The meeting was called to order by our president, Nicholas Haban AF6CF at 8:16 AM PST. All directors were present for a quorum. There were nineteen (19) topics brought to the Board this morning, and three (3) motions made, including adjournment.

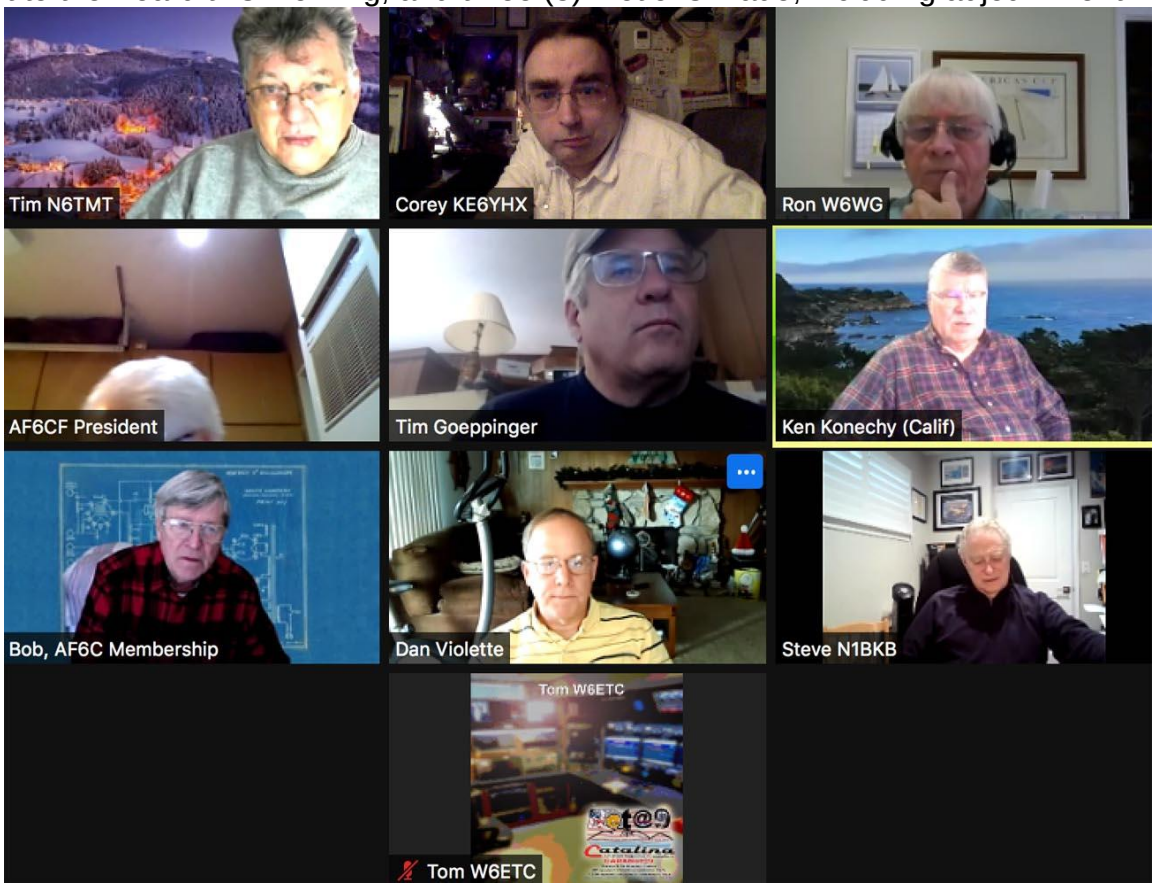


Fig 1 – All ten (10) Board Directors were later present.

•Director Reports

-Secretary: Corey KE6YHX has been in contact with Shakey's in Anaheim, just north of Disneyland on Harbor. We have two options for a gathering. One, a "Party Pack," and the other a "Fundraiser." The "Party Pack" must be reserved in person, and the "Fundraiser" can be requested by webform at https://www.shakeys.com/pizza-parties/request-a-fundraiser/. The maximum room capacity is 120 persons, and we may bring-in equipment to sell. A "Fundraiser" will give us 20% back on the food we buy, and the funds we raise. A "Party Pack" must be paid for in advance with a set menu, and all the attendees must order food. They are only available Mondays through Thursdays for either option. The auction has been postponed to October, so consideration will wait.

-Treasurer: Ken W6HHC reports the Audit Committee will meet next weekend. The books are reasonably balanced. Ken sent a draft copy of the 2021 Audit Report to the Board on Tuesday, January 4, 2022. We had expenses of about $4,861, and inflows of about $7,072, for a net total increase of about $2,211. Our bank account has about $6,923, and our PayPal account has about $194, at the end of December.

-Membership: Bob AF6C reports we have 125 members, including two new people who joined. The December 2021 Combined Roster has been posted to our web site.

-Historian: Corey KE6YHX reports, the club web site at www.w6ze.org for Monday, January 3, 2022, has been backed-up to M-Disc. There are 8,440 files for an uncompressed size of 3.74GB, and a compressed size of 3.37GB (3.62GB decimal).

•New Business

•Newsletter Editors

January: ..... Nicholas AF6CF
February: ..... Greg W6ATB
March: ..... Jim AF6N
April: ..... Bob AF6C
May:..... Tim G. N6GP
June:..... Steve N1BKB
July: ..... --open to volunteers--

•General Meeting Programs

January:Wayne Yoshida KH6WZ presents “No-Tools Troubleshooting”
February: .....--to be determined--

•February Auction

Tim G. N6GP reports Wayne Spring W6IRD’s QTH is available for the club radio auction. There are a couple concerns with that plan, including parking, and the pandemic. It is also considered too-short notice, so the auction is postponed to October. If an earlier date opens, we may decide then.

•New Club Generator

Nicholas AF6CF reports later today that the propane switchover test was successful. The new generator should be ready for Winter Field Day on the last weekend in January.

•Old Generator Disposal

Bob AF6C plans to start work on the old generator soon.

•Future Meeting Plans

The Board decides against having opportunity-drawing prizes for the Zoom meetings. It may resume with in-person meetings.

Due to the conflict with Labor Day Weekend, Corey KE6YHX makes a motion to hold the September Board Meeting on the tenth of that month. Dan KI6X seconds, and the motion is carried at 9:24 AM PST.

Dan KI6X reports the American Red Cross has their facilities closed to outside groups through March of this year.

•PayPal Account Ownership

Tim Goeppinger N6GP contacted past president Willie N8WP for the PayPal Account changeover. Willie has agreed. Tim will now contact PayPal to find out the requirements for doing so.

•Winter Field Day

Ron W6WG tells us we now have a permit from the Ocean View School District, and have about ten (10) people who plan to attend the Winter Field Day site. Dino KX6D will be lending us his 90-foot trailer tower. A pre-planning meeting has already been held with Tim G. N6GP, Chip K7JA, Bob Harrington AA67PW, Dan KI6X, and Ron W6WG. Another planning meeting is needed since the trailer tower will change the antenna and station positions. We need a station captain for 40 meter CW.

The Omicron COVID pandemic is a major consideration. We have a list of dos and don'ts. For all field participants, "fully vaccinated" also means having the vaccine booster. Masks at the voice stations are discussed, and they are highly recommended. The tents will have one side open, and fans should be available. A separate tent for digital is considered.

Food will be an individual consideration, and coffee is planned on being provided.

The Winter Field Day rules state that each club may only hold either a single group effort, or aggregated individual scores, not both. A motion is made by Ken W6HHC to hold a club field group effort at the Huntington Beach site this year, and Tim M. N6TMT seconds. The motion is lost at 9:01 AM PST. The Board decides all single-group plans are tentative until the January General Meeting.

A multi-club operation is considered by the Board to be too difficult under these circumstances.

•Christmas Party

We had a great turnout for the Christmas Party, and there were no illnesses that we are aware of. A last call for opportunity-drawing ticket purchases is recommended, and we needed a designated photographer. The HRO gift certificate recipients are being identified for our records.

•Other Business

•KK6TRC Offer to Rename Echolink Node

The Board decided unanimously at the November Board Meeting to allow Jeff Cowart KK6TRC to rename his Echolink node from KK6TRC-L to OCARC-L. Tom W6ETC sent an official approval email to Jeff, and Corey KE6YHX spoke with Jeff, informing him of our approval and email. Jeff has not come back with an update on his situation. Tom will get in contact with Jeff.

•Social Media Account

Tim M. N6TMT reports, Ken W6HHC set up our YouTube account with Tim M. and Dan KI6X as managers. Ken has some further work to do, after the club financial audit is out of the way.

•Good of the Club

Bob AF6C has decided it is time to get his antenna rotator down off his tower for repairs, so he needs to put together an antenna party.

Tim G. N6GP reports the ARRL VHF Contest is next weekend.

•Adjournment

A motion to adjourn is made, seconded, and carried at 9:43 AM PDT.

--Respectfully submitted by Corey KE6YHX, OCARC Secretary

OCARC PAST PRESIDENTS

A HISTORY of OCARC PRESIDENTS

by **Ken Konechy W6HHC**
with great assistance from our Club Historian Emeritus,
Bob Evans - WB6IXN

2022 AF6CF Nicholas Haban
2021 AF6CF Nicholas Haban
2020 KI6X Dan Violette
2019 KI6X Dan Violette
2018 N6GP Tim Goeppinger
2017 N6GP Tim Goeppinger
2016 AF6CF Nicholas Haban
2015 N6TMT Tim Millard
2014 AF6CF Nicholas Haban
2013 AF6CF Nicholas Haban
2012 W6GMU Paul Gussow
2011 W6GMU Paul Gussow
2010 K6PEQ Kristin Dankert
2009 AF6CF Nicholas Haban
2008 N8WP Willie Peloquin
2007 K6PEQ Kristin Dankert
2006 N8WP Willie Peloquin
2005 W6HHC Ken Konechy
2004 N1AB Steve Brody
2003 KQ6JD Lowell Burnett
2002 KE6WIU Cory Terando
(now AE6GW)
2001 KD6BWH Bob Buss
(later KØBWH)
2000 K6LDC Larry Hoffman
1999 WA6VPP Bud Barkhurst
1998 KD6BWH Bob Buss
(later KØBWH)
1997 WA6VKZ Frank Smith
1996 AF6C Bob Eckweiler
1995 N6XTJ Jim Roberts
1994 KJ6ZH Chris Breller
1993 KC6TAM Jane Breller
1992 WA6VKZ Frank Smith
1991 W6HHC Ken Konechy

YEAR
1990 KJ6ZH Chris Breller
1989 WA6VKZ Frank Smith
1988 W6HHC Ken Konechy
1987 N6JSV Jim Talcott
1986 WA6VKZ Frank Smith
1985 AF6C Bob Eckweiler
1984 KA6IMP Chris Breller
(now KJ6ZH)
1983 W6IBR Al Watts
1982 KA6HNY Robin Hoff
1981 WA6VKZ Frank Smith
1980 WA6FOW Ernie Prichard
1979 WB6IHZ Terry Mathers
1978 WA6LFF Jim Kingsbury
1977 WA6WZO Fried Heyn
1976 WB6PEX Martin Raymond
1975 WA6LHB Art Sheldon
(now K7ZE)
1974 W6HHC Ken Konechy
1973 WB6QNU Bob Eckweiler
(now AF6C)
1972 WA6FIT Ron Cade
(now W6ZQ)
1971 WB6CQR Billy Hall
(now N6EDY)
1970 WB6UDC Jack Hollander
(later N6UC)
1969 WA6ROF Jerry VerDuft
(now ADØA)
1968 W6COJ Dave Hollander
1967 WB6GPK Jim Hill
1966 WA6YWN Jack Shaw
1965 K6KTX Rolland Miller
1964 W6WRJ Ralph Alexander
(later W6RE)
1963 W6DEY Roy Maxson
1962 K6LJA Ted Glick
1961 K6IQ Roy Morriss

YEAR
1960 K6TXS Charles(Ed)Edwards
1959 W6BVI Ken Kesel
1958 W6BVI Ken Kesel
1957 - CLUB DISBANDED -
1956 W6HIL Bob Swenson
1955 W6BVI Ken Kesel
1954 W6UPP Marinus Conway
1953 Probably only informal
meetings, no officers?
1952 W6QZQ Horace Bates
1951 W6LDJ Sam (Mac) McNeal
1950 Probably only informal
meetings, no officers?
1949 W6CGF Chuck Lunder
1948 W6BWO Dale Bose
1947 W6ALO Tommy Gentges
1946 W6DEY Roy Maxson
1945 W6DEY Roy Maxson
1944 - **ALL OFF TO WAR!!**
1943 - **ALL OFF TO WAR!!**
1942 W6IBN Roy Cumpston
1941 W6BAM Shelley Trotter
1940 W6KLU Harold Christensen
1939 Probably only informal
meetings, no officers?
1938 W6NSA Les Gates
1938 W6ADT Noral Evans
1937 W6LYN Noral Evans
(later reissued as W6ADT)
1936 W6LYN Noral Evans
(later reissued as W6ADT)
1935 - CLUB DISBANDED!!
1934 W6IGO Earl Moore
1933 W6IGO Earl Moore
..... :

Note: There is one individual that has been President SIX times.

I hereby challenge any future and/or past president to match or beat this record.

73 DE AF6CF

Robert J. "Bob" Evans, WB6IXN
SK January 2022
•••-•-

Honorary OCARC Member and Historian Emeritus, Bob Evans WB6IXN, passed away peacefully on January 05, 2022. Bob was first licensed in 1959 as K3JFG in Western Pennsylvania. He was an OCARC member since 1964, and established the Office of Club Historian in July 1982. His interests included astronomy, seismology, and computer programming.

He was close to his nieces at a senior's home in Talent, Oregon, and was well looked after, with ham radios at his side. His services will be held next weekend, here in Santa Ana and Orange.

He will be missed.
Corey Miller KE6YHX

January 14, 2022

Dear Family and Friends,

The information for Bob Evans' services are enclosed.

Friday, January 21st: Visitation 4-6
Brown Colonial Mortuary
204 W. 17th St.
Santa Ana, Calif. 92706
Phone 714-542-3949

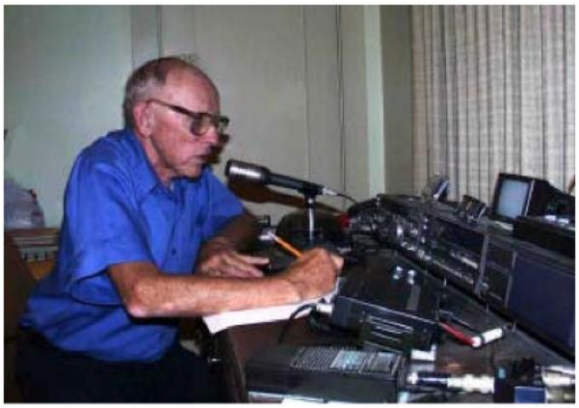
Saturday, January 22nd: Mass 12 noon
St. Anne Church
1344 S. Main St.
Santa Ana, Calif. 92707

Saturday, January 22nd:
Burial after Mass at
Holy Sepulcher Cemetery
7845 Santiago Canyon
Orange, Calif.
714-532-6551

Send flowers to Brown Colonial Mortuary in time for Rosary on Friday.

Sincerely,
Betty Toussaint

If you need to contact Betty, please call Corey Miller at 714-322-0395.



Bob Evans – WB6IXN in his shack (in 2003)
as "OCARC Net Control Operator" in the City of Santa Ana

OCARC Financial Audit Report 2021

12/31/2021 - Revision01

INFLOWS

2021 SK Special Disposal Effort (Net)	$	1,236.00
Badge Income	$	1.64
Christmas - Opportunity Drawing 2021	$	180.00
Christmas Dinner Ticket Sales	$	665.68
Donation -new FD Generator	$	500.00
Dues, Family (PayPal)	$	172.44
Dues, Membership	$	487.50
Dues, Membership (PayPal)	$	1,795.42
Dues, Membership (Paypal) 2022	$	264.12
Sale Of Equipment	$	1,770.07
TOTAL INFLOWS	**$**	**7,072.87**

Assets - Beginning Balance

Wells Fargo		$	3,161.79
Cash Box		$	94.00
PayPal		$	1,593.36
Outstanding checks	(1)	$	(85.76)
Beginning Net Balance:		**$**	**4,763.39**

Assets - Ending Balance

Wells Fargo		$	6,923.11
Cash Box			0.00
PayPal		$	194.47
Outstanding checks	(2)	$	(143.36)
Ending Net Balance:		**$**	**6,974.22**

Total Beginning Balance:	**$**	**4,763.39**
Total Ending Net Balance:	**$**	**6,974.22**
Asset Net Change for the Year 2021	**$**	**2,210.83**
	$	(0.89)

OUTFLOWS

Awards and Plaques	$	19.36
Christmas Dinner - Ladies Gifts	$	54.00
Christmas Dinner 2021 Meal Expenses	$	1,074.00
Field Day - Electrical Boxes	$	225.26
Field Day - Propane	$	45.20
Field Day - Propane Stand-Regulator	$	109.40
Field Day Rental - Tent	$	200.00
Generator - new Firman	$	915.87
LIABILITY INSURANCE 2022	$	300.00
OCARC Historian	$	87.91
Opportunity Drwg - Christmas Radio	$	499.98
PayPal Fee	$	1.75
PO Box Rental	$	118.00
Postage	$	70.00
Storage of Equipment - Ann Millard	$	500.00
Supplies	$	77.54
Web Site Hosting	$	228.00
Web Site SSL Fee	$	69.99
ZOOM subscription	$	264.89
TOTAL OUTFLOWS	**$**	**4,861.15**
QUICKEN NET CHANGE	**$**	**2,211.72**

Audit Acceptance:

Bob Eckweiler

Bob Eckweiler **AF6C**, Direct0r (years 2021 & 2022)

Steve Belasco

Steve Belasco **N1BKB,** Director (years 2021 & 2022)

Ken Konechy

Ken Konechy **W6HHC**, Treasurer (during year 2021)

Date signed: **2022-01-16**

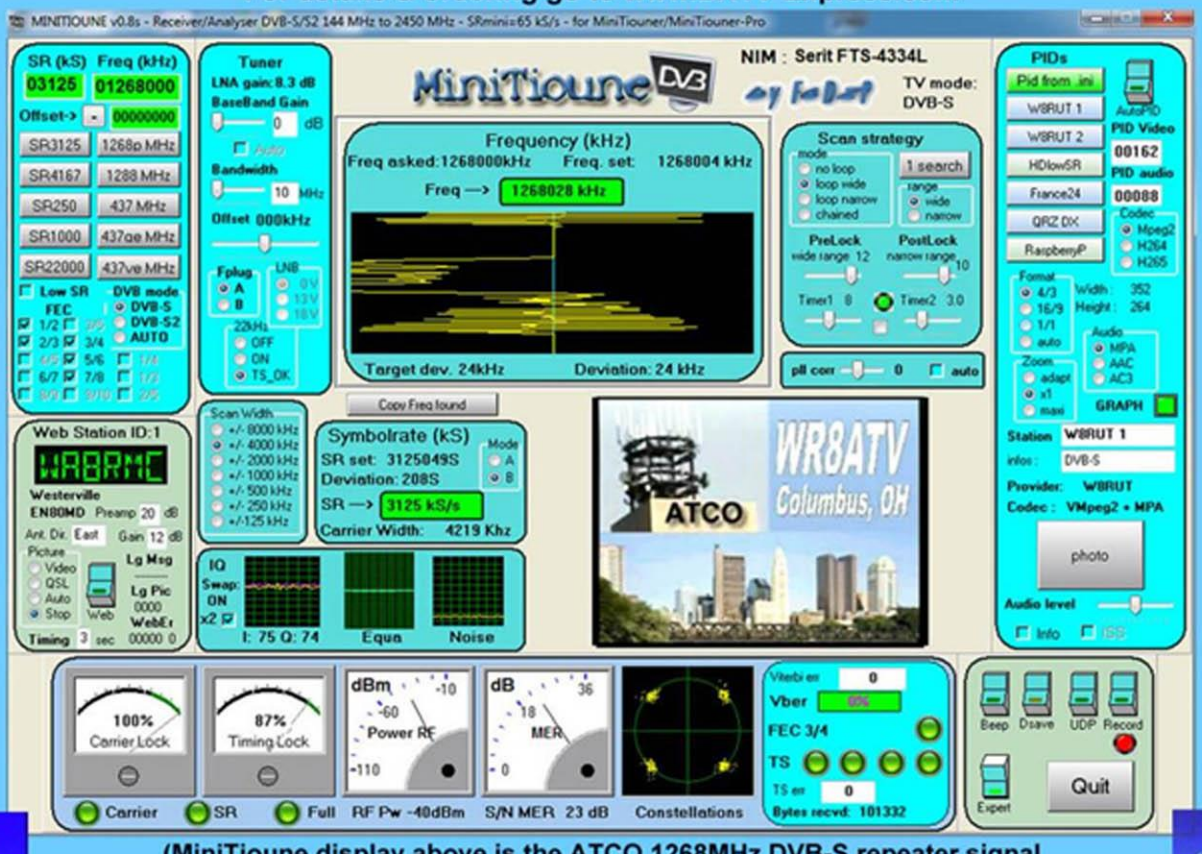
MiniTiouner-Express

Digital Amateur Television DVB-S/S2 Receiver / Analyzer

Available at DATV-Express.com

- Operates with Windows PC using free MiniTioune software from Jean-Pierre F6DZP
- Smaller than a stack of 2 decks of cards (picture above is full size)
- Two independent simultaneous RF inputs with internal preamps
- High sensitivity -100dBm @1288MHz – at 1/2 FEC
- Fully assembled/tested in aluminum enclosure
- Covers 144-2420MHz (ideal for Space Station DATV reception)
- Symbol rates from 75 KSymb/s to >20 MSymbols/sec
- Uses external 8-24VDC supply or +5V from USB-3 port (with small modification)
- Real time signal modulation constellation & dBm signal strength display
- Price: US $75 + shipping – order with PayPal

For details & ordering go to www.DATV-Express.com



(MiniTioune display above is the ATCO 1268MHz DVB-S repeater signal at WA8RMC QTH 15 miles away).