

ORANGE COUNTY AMATEUR RADIO CLUB, INC.

VOL. LIX NO. 06

P.O. BOX 3454, TUSTIN, CA 92781-3454

June 2018

The Prez Sez.....



It is June, and "It's the Most Wonderful Time of the Year", because Field Day is only about 2 weeks away, and there is excitement in the air. Our Field Day is going to be a bit bigger to celebrate the 85th anniversary of our club. In addition to our club, we have the BCD of the ABCD Group (more on the missing A later), Orange County RACES, and some members of WARA all pitching in for this huge effort. There has been a lot of participation in planning meetings, and much logistical planning has been done by our FD Chair Ron W6WG. It is going to kick off with setup Friday June 22 at 9AM at the Walter Knott Education Center in Buena Park. We will need a lot of help Sunday June 24 to tear down. As usual, we will have a

GOTA (Get On The Air) station for new and non-hams to get their first experience making contacts. Contact Tim N6TMT if you are interested. We look forward to the Boy Scouts making some great food for us again this year, and meal tickets will be on sale at our meeting this month. Chip K7JA will give his energetic pep talk about Field Day at our meeting, which is 1 week before the big event. He has promised to bring a video of one of his early Field Days in Washington.

Now, back to the missing A of ABCD, Arnie N6HC – Arnie will be on the Baker Island DXPedition, which will be on the air around June 27 thru July 7. This will be a new DXCC Country for most of us (myself included), and we wish him a successful and safe trip. Keep an eye out for KH1/KH7Z at that time. For more info see www.baker2018.net.

There have been some great Sporadic E openings on 6M so far this season. Let's hope it is good for the June VHF Contest June 9-10.

73.

Tim Goeppinger N6GP President

Next General Meeting

The June 2018 OCARC
General Meeting program will be
presented by:
Chip Margelli, K7JA
His topic will be

"Getting Ready for Field Day" aka: Field Day Pep Talk from the Guru!

The next General Meeting will be on:

Friday, June 15th, 2018 @ 7:00 PM

ENTER from the WEST SIDE entrance of the Red Cross Building, Room 208
Take elevator to the 2nd Floor.
See you there!

In This Issue	Page
The Prez Sez	1
Club Information	2
Radio Activity Opportunities	3
Upcoming Events	4
Save the Date(s)	5
Field Day Info (food, location)	6-8
Save the Date	9
Field Day Info	10-12
Heathkit of the Month #859-14	4, 24+
OCARC Board Mtg Minutes	15-16
Ham Jam	17
Mug Order Form	18
OCARC General Mtg Minutes	19-20
Embroidery Ordering Info	21
OCARC YTD Cash Flow	22
MiniTiouner-Express DATV Rcvi	r 23
Heathkit – continued	24

Orange County Amateur Radio Club

Orange County
Amateur Radio Club
www.W6ZE.org



2018 Board of Directors:

President:

Tim Goeppinger N6GP (714) 730-0395 N6GP@w6ze.org

Vice President:

Dan Violette KI6X@w6ze.org

Secretary:

Jim Schultz AF6N (714) 544-5435 AF6N@w6ze.org

Treasurer:

Ken Konechy, W6HHC (714) 348-1636 W6HHC@w6ze.org

Membership:

Bob Eckweiler AF6C (714) 639-5074 **AF6C@w6ze.org**

Activities:

Ron Mudry W6WG (714) 840-3613 W6WG@w6ze.org

Publicity:

Tim Millard, N6TMT (714) 744-8909 n6tmt@w6ze.org

Technical:

Kenan Reilly KR6J (714) 277-8798 KR6J@w6ze.org

Directors-At-Large:

Clem Brzoznowski, WØMEC (714) 927-4065 W0MEC@w6ze.org

Corey Miller KE6YHX (714) 639-5475 KE6YHX@w6ze.org

2018 Club Appointments:

W6ZE Club License Trustee:

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

Club Historian(s)

Corey Miller KE6YHX (714) 639-5475 KE6YHX@w6ze.org

Bob Evans, WB6IXN (Emeritus) (714) 543-9111 WB6IXN@w6ze.org

RF Editor – Rotating June:

Dan Violette, KI6X (714) 637-4632 KI6X@w6ze.org

Webmaster:

Ken Konechy W6HHC (714) 348-1636 W6HHC@w6ze.org

Assistant Webmaster:

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

Tim Millard, N6TMT (714) 744-8909 N6TMT@w6ze.org

ARRL Awards Appointees:

Arnie Shatz, N6HC (714) 573-2965 n6hc@aol.com

John Schroeder, N6QQ (West Orange Co.) (562) 404-1112 n6qq@msn.com

Contact the Newsletter:

Feedback & Corrections: rf feedback@w6ze.org

www.W6ZE.org

Submit articles:

editors@w6ze.org

Monthly Events:

General Meeting:

Third Friday of the month at 7:00 PM held at: American Red Cross 600 Parkcenter Drive Santa Ana, CA (Near Tustin Ave. & 4th St.)

Club Breakfast (Board Mtg):

Normally First Saturday of month at 8am Marie Callender's Restaurant 1821 North Grand Ave Santa Ana, CA (Between 17th & Santa Clara)

Club Nets (Listen for W6ZE):

28.375 ± MHz SSB Wed- 7:30 PM - 8:30 PM Bob AF6C, Net Control Alt: Corey, KE6YHX, Net Control

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

 $7.086 \pm MHz$ CW **OCWN** Sun- 9:00 AM - 10 AM Ann K6OIO, Net Control



Club Dues for 2018:

Regular Members renewals*- - - \$30 Family renewal/Join**- - - - - - \$45 New Member Join May-Jun*** \$22.50 Replacement Badge**** - - - - - \$ 3

- * Member renewals Jan-Dec.
- ** Two members or more, w/badge.
- *** New members Apr-Jun, w/badge.
- **** There is a \$1.50 charge if you'd like to have your badge mailed to you.

Radio~Activity Opportunities

Dates and Activities well worth considering...

JUNE

- *ARRL June VHF QSO Party: 1800 UTC Saturday June 9 through 0259 UTC Monday June
- Kids Day: Saturday in June 16, 1800 UTC through 2359 UTC
- OCARC Field Day: 1800 UTC Saturday 23 through 1800 UTC Sunday 24.

JULY

- RAC Canada Day Contest: 0000 UTC through 1359 UTC Sunday July 1.
- **IARU HF World Championships:** 1200 UTC Saturday July 14 through 1159 UTC Sunday July 15.
- *CQ WW VHF: 1800 UTC Saturday July 21 through 1159 UTC Sunday July 22.
- **North American QSO Party / RTTY: 1800 UTC Saturday July 21 through 0559 UTC Sunday July 22
 - * 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:

None

Continuing Activity:

ARRL International Grid Chase
 January 1, 2018 through December 2018

Repeating Activities:

- Phone Fry Every Tuesday night at 0230Z to 0300Z
- SKCC Weekend Sprintathon (Straight Key CW) on the first weekend of the month after the 6TH of the month. 1200 Sat. to 2359Z Sunday.
- **SKCC** Sprint (Straight Key CW) 0000Z to 0200Z on the 4th Tuesday night (USA) of the month.

To have your favorite activity included in next months *Radio~Activity* column send an email to *Ron W6WG*, w6wg@w6ze.org





July 20th, 2018

Panel "ARES and RACES – A Discussion"

In the planning stage for Carl Gardenias (WU6D – Section Manager, ARES) and Ken Bourne (W6HK – OC RACES Chief) to support a half hour presentation from each on their organizations. Would include purpose, membership, when activated, etc. This will be followed up with a panel of the presenters available for some questions.



August 17th, 2018

"Not Your Grandpa's Ham Radio"

We've all participated in demonstrating ham radio to non-hams in events like Field Day or perhaps emergency communications drills. In every case, demonstration stations feature station equipment and antenna setups and operators in front of the radios. Often, the rigs and operators face away from the passers-by, and all they see are people's backs and wires and the rear panels of radios.

For the most current Upcoming event information go to the **OCARC EVENTS website:**

http://www.w6ze.org/Events.htm



September – 85th Anniversary and Reunion



Opportunity Drawing Request:

If you have something you would like to part with, donate it before the meeting for the Opportunity Drawing. See Ron W6WG



OCARC -An ARRL AFFILIATED CLUB



Save the Date - Sept. 21, 2018

Early in 1933 the Moore brothers, Earl W6IGO and Harry W6FUU, opened a radio store in Santa Ana and supported the formation of a radio club that came to be named the Orange County Amateur Radio Club. Shortly thereafter, on March 15, 1934, that club, OCARC, was granted affiliation with the American Radio Relay League.

Today, in 2018, we're celebrating our 85th year of service to the ham community and plan to gather at the September General Meeting for an 85th Anniversary Celebration including all current and former OCARC members.

Please keep the date of Friday, September 21, 2018 open and plan to meet with your old friends at our 85th Anniversary Reunion Meeting.

Meeting time – 7 pm
Meeting location – Santa Ana Red Cross Office Building, Room 208
600 Park Center Drive
Santa Ana, CA 92705
Directions including a map are available at www.w6ze.org/meetings.

Save the Date #2 – December 7, 2018

Tentative December Club Dinner (Christmas) Party date @ Mimi's Tustin

Field Day Meal Plan 2018 from the Boy Scouts (Troop 440)

Contact Tim: n6tmt@w6ze.org with your pre-order (money given at the next meeting or at FD)

Price of single meal: \$8 Price for 4 meals: \$30

Price for all 5 meals: \$35 (best deal for OCARC members & best for troop fund raiser event)

Friday 6/22/18: Dinner

Foil-wrap dinner:

Cabbage leaves, ground beef, carrots, celery, potatoes, onions, bell peppers, broccoli, + spices.

Cookie

Diet drinks/ Bottle water/ Coffee

Saturday 6/23/18 Breakfast:

Scrambled eggs Slice of HAM Pancakes (2) + butter and syrup OJ/ Milk / Bottle water/ Coffee

Saturday 6/23/18: Lunch

Chicken Street Tacos (3) (w/ diced onions and cilantro) + lemon wedge Salsa (Asian chop)
Cookie

Diets drinks/ Bottle water/ Coffee

Saturday 6/23/18: Dinner:

BBQ chicken (drum sticks) (2 pieces) Salad Corn Bread (Dutch oven) Diets drinks/ Bottle water/ Coffee

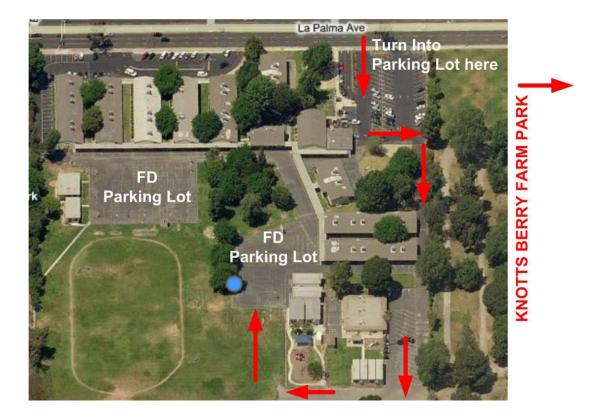
Sunday 6/24/18: Breakfast

Breakfast Burrito (flour tortilla, scrambled eggs, hash browns, 2 bacon slices) + pace picante salsa OJ/ Milk /Bottle water/ Coffee

FIELD DAY SCHEDULE

- Thursday June 21 4-6 PM HELP needed at storage unit to move supplies.
 Address: Placentia Self Storage, 585 Porter Ave, Placentia, CA
- Friday June 22 9AM until evening. Walter Knott School for FD set-up. * Need helpers
- Saturday June 23 sunrise 11 AM. Walter Knott School, finish set-up. * Need helpers
- FD 11 AM Saturday 11 AM Sunday.
- Sunday June 24 11 AM until about 2 PM. Walter Knott School, tear down. * Need helpers

FIELD DAY LOCATION



Driving Instructions:

Directions to the Walter Knott Education Center ("School") in Buena Park:

- Head for Knott's Berry Farm
- Take the Beach Blvd (south) exit from the 91 or 5 FWY
- Turn right (west) on La Palma Ave, along the north edge of Knott's Berry Farm
- Continue driving on La Palma, past the Park to 7300 La Palma Ave.
- The school will be on your left on the south side of La Palma. Use the first entrance on the East side of the school buildings.

Notes:

- Vehicles are NOT permitted on school grass/grounds except where noted.
- Alcohol or Tobacco products are not allowed on the school premises.
- If you bring a dog it must be on a leash. Dog owners are responsible to dispose of their animal's waste materials.

June 23rd - 24th

Mark you Calendar NOW to JOIN with us!

Field Day University Class #2 is 6PM June 15th

Our first Field Day University Class meets one hour before our general meeting at the Red Cross. This course is targeted at the beginning level operator, who will be using the microphone (phone) on Field Day.

We hope to train some new operators for either the GOTA station or the other Phone stations. This class was a secret weapon that helped propel us high ranking scores in previous years. Topics for this class include:

Introduction to Field Day – What is it?

How to call "CQ Field Day"

Search and Pounce- Knowing if and when to use it.

Use of Phonetics on the air

US and Canadian Callsigns – How to enter them correctly

This is the second class of a 2 part series taught by Tim Goeppinger N6GP. The class in June will be hands-on training of the N3FJP software. As the mattress salesman says "It's FREEEE"



Heathkit of the Month #85: by Bob Eckweiler, AF6C

RF Newsletter



ELECTRONIC TEST EQUIPMENT

Heathkit 'O' Series Oscilloscopes Part I O-1 through O-4

Introduction:

The first electronic kit to carry the Heathkit brand was introduced in an ad in the July 1947 issue of *Radio News*. This ad for an "Oscilloscope Kit" for \$39.50 was just nine lines at the bottom of a full column ad (1/3 page) featuring 94 other electronic items. The "Oscilloscope Kit" was later designated the O-1¹ (See figure 1). A reproduction of the nine-line ad is shown in figure 2. The next two ads appear in the September and November 1947 issues with photos; the first, under the heading HEATHKIT 5" OSCILLOSCOPE (Figure 3) and the second alongside the parts that make up the scope (Figure 4).

A total of twelve versions of the 'O' series of scopes were released on an average yearly cycle until 1960. Heathkit kept the price constant until late 1951, but with the O-7 the kit's cost began to climb to the point, where in 1954, Heathkit began releasing four less expensive scopes, the 3" **OL-1** (HotM #41) and three less-expensive 5" scopes, the **OM-1**, **OM-2** and **OM-3**. These won't be covered as part of the 'O' series; nor will two other scopes, the **OP-1** "Professional" and the **OR-1**

¹ Notes appear at the end of the article.

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

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

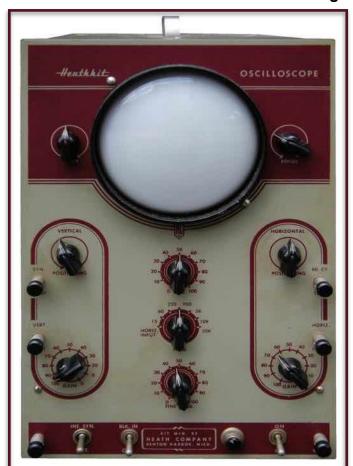


Figure 1: The First Heathkit: The O-1 Oscilloscope. (Handle appears to be from a later model scope)

"Research" scopes that feature DC coupling. The OP-1 sold for more than two-and-a-half times the cost of the **O-12**, and the OR-1 sold for just under twice the cost of the **O-12**.

The O-1 through O-4 Oscilloscope CRT:

The Cathode Ray Tube (CRT) commonly used in the O-1 through O-4 is the 5BP1². The initial number for this CRT designation (and many others) is the screen diameter, (nominally 5") a one or more character identification (B here) and a P followed by a number is the phosphor used in the screen. P1 is probably the most common for oscilloscopes; when hit by electrons it produces a medium persistence green fluorescence.

Rumor has it that Heath Company purchased a boxcar full of 5BP1 CRTs as war

OSCILLOSCOPE KIT

Fig. 2: Text of the first (9-line) O-1 Ad. Radio News July 1947

surplus. And this got them started in manufacturing their first kit oscilloscope. Starting in June 1948 Heath warned about a possible CRT shortage in their flyer and in the subsequent Radio News ad; it stated "Order one now while surplus tubes make this extremely low price possible". However, Heath evidently found more sources because the \$39.50 price remained the same through the O-4 and beyond. Some of those surplus tubes evidently turned out to have the P4 phosphor,

Complete kit to build a beautiful 5' scope, cabinet, chassis and panel punched, formed and lettered. Every part supplied, including tubes with 5BP1, cased power transformer, oil condenser. Frequency compensated amplifier, 15 to 30 M cy. sweep, all controls, blueprint and instructions. This kit makes an excellent training course.

Complete\$39.50

Figure 3: First image of the Heathkit 5" Scope (O-1) from the Heath ad in the September 1947 issue of *Radio News*. Also this ad is the first use of the name *Heathkit*!

so for awhile Heath specified the CRT as either the 5BP1 or 5BP4 for the O-3 and O-4. P4 is a medium persistence white phosphor also used in early black and white TVs.

The early Heath surplus ads were selling a lot of metal oil-filled condensers ³, and bathtub condensers, as were many surplus houses. These normally expensive and high quality parts could be had for a song after the war. Their long life (at the price of size and weight) can be attested to today, as many of these

are functioning as well today as in the forties. Heath used these condensers in their early model scopes, but started phasing them out starting with the O-4.

All of the scopes include a **60 CY. TEST** binding post. This is a connection to the 6.3 V rms. filament line through a current limiting $10 \mathrm{K}\Omega$ resistor. It can be used to check scope calibration and operation.

The Heathkit Model O-1

Announced in July of 1947, and replaced with the O-2 in an ad in the February 1948 issue of *RadioNews*, the O-1 is a behemoth of a scope weighing about 55 lb.⁴; it is likely the heaviest scope Heathkit ever made. The



Figure 4: November 1947 issue of **Radio News**. shows the Heath 5" O'scope (O-1) along side a layout of the parts used.

large weight is due to the steel cabinet and chassis, and a large sealed war surplus power transformer that was only used in the O-1. It was replaced with smaller, lighter ones in the later o'scopes. The cabinet measures 15" H x 10" W x 17" D. The depth of this scope and, most others, is determined by the length of the CRT. Heathkit did make a few larger scopes; most notably the IO-14 with dimensions of 15" H x 10.5" W x 22" D. But the IO-14 weights 15 lb. less and has 20 more tubes than the O-1. Little documentation exists on the O-1: these early Heathkits didn't come with the famous manuals accompanying later kits. Instead they came with five individual sheets: schematic, parts, instruction, construction and an isometric drawing 5. Only the schematic sheet is available to this author. It wasn't until the O-3 that Heathkit started a part number system, which was replaced not too many years later with the one that has been in use since. The O-1 parts carry R1, R2 ... Rn and C1, C2 ... Cn type designations, etc. Part values are not on the schematic but instead on a separate parts sheet. Some schematics available for the O-1 and O-2 scopes contain penciled in values for some of the components. These marks were probably done by the builder. Many of these are reasonable in value, but others seem questionable.

ABBREVIATIONS Used in Tables I-2 to I-4:

BLK. HORIZ. Horizontal Blanking CY. Cycle Internal / Intensity INT. DWN. Down INTEN. Intensity x 1,000 EXT. External K FREQ. Frequency M x 1,000 (really!) **Synchronization** GEN. Generator SYN. **VERT.** Vertical GND. Ground HOR. Horizontal

TABLE I-1

Heathkit O-1 Specifications:

Very few specifications were given for the O-1 other than the sweep frequency range spanning 15 cps to 30K cps. Other specs can be

Heathkit O-1 Front Panel Layout

The left third (top-to-near bottom):

INTEN. Potentiometer

scale is circular CW arrow.

VERTICAL POSITIONING Potentiometer scale is circular CW arrow.

SYN. INPUT

VERT. INPUT

(Vertical) GAIN

100, 90, 80, 70, ..., 10, 0 (arbitrary scale)

The center third (top-to-near bottom):

CRT Screen five-inch diameter

SYN. Potentiometer

0, 10, 20, 30, ..., 90, 100 (arbitrary scale)

(Sweep) **FREQ.** Rotary switch 7-pos.

HORIZ. INPUT, **15** - 60, **60** - 220, **220** - 900 **900** - 3K, **3K** - 10K, **10K** - **30K** (cps - coarse)

(Sweep) **FINE FREQ.** Potentiometer **0**, **10**, **20**, **30**, ..., **90**, **100** (arbitrary scale)

The right third (top-to-near bottom):

FOCUS Potentiometer

scale is circular CW arrow

HORIZONTAL POSITIONING Potentiometer

scale is circular CW arrow.

60 CY. TEST (6.3 volts) Binding post HORIZ. INPUT Binding post (Horizontal) GAIN Potentiometer 100, 90, 80, 70, ..., 10, 0 (arbitrary scale)

The full bottom row L to R):

GND Binding post

INT. SYN. / EXT.

BLK. IN / OUT

Pilot lamp

Power ON / OFF

Toggle switch, SPDT

Toggle switch, SPDT

Jeweled red Indicator

Toggle switch, SPST

GND Binding post

Note: Bold capital text represents actual front panel printing See Table I-1 for abbreviations used here.

Table I-2



Figure 5: O-1 vertical gain control showing reversed scale. Horizontal control is identical.

gleaned from the front panel controls but one mostly has to assume they are close to the O-2 model which came out at the end of 1947. Table III, near the end of this article shows the published specifications of the O-1 through O-4 oscilloscopes.

The O-1 Front Panel:

The O-1 front panel came painted in the colors Heathkit would use until sometime in 1954, a cream-beige color and maroon red. There's plenty of room on the large front panel for the O-1 controls. Table I-2 shows the layout and nomenclature (in bold) of the controls and connections. At the top of the front panel is the word "Heathkit" in a script logo form 6, followed by the word "Oscilloscope" in a san-serif font. The six binding posts on the front panel are of the style that allows you to push in on the insulated black cap and then insert a wire or pin-plug into the hole. Releasing the black cap causes spring pressure to hold the wire or pin in place. These were probably obtained as war surplus. Similar style posts can be found on war surplus equipment, often as antenna connectors.

GAIN controls. They appear to work backwards from normal as shown by 100 at the full counterclockwise position and 0 at the full clockwise position; see **figure 5**. Subsequent scopes were numbered clockwise.

Also of interest is the coarse sweep FREQ. switch. It is a six position rotary switch on the original schematic, but a seven position switch on the o'scope photos available.

Heathkit O-1 Circuit Description:

A readable but poor copy of a Heathkit O-1 oscilloscope schematic was obtained ⁷. It has been redrawn using a vector graphic program and appears at the end of this writeup. Component values hand-written on the original are included but should not be trusted.

The Heathkit O-1 uses five tubes plus the CRT. They are shown in Table II. Four of the tubes are standard vacuum tubes of the period, one is the CRT and the last is a thyratron gas tube. These same tubes, or equivalent substitutes, are also used in the O-2, O-3 and O-4.

The O-1 circuit can be divided into five areas: The B+ power supply; the HV power supply; the vertical amplifier, the horizontal amplifier and the sweep generator:

The B+ Power Supply:

The heart of the two power supplies is the transformer. This massive potted unit has 18 ceramic solder terminals and six secondary windings including four filament windings: one 5V winding for each 5Y3 rectifier; one 6.3V isolated winding for the CRT; and one 6.3V winding for the remaining tubes. There is also a center tapped winding for the B+ on the order of 600 to 700 VAC and a 575 volt winding between one side of the B+ winding and the HV filament winding for the high voltage 8.

The B+ winding is rectified in a full-wave configuration by one of the 5Y3 tubes and the output is filtered by a dual 5 µf surplus oil-filled condenser (C11 and C12) and an 6 henry choke CH1). B+ output is guessed to be around 300 to 350 volts DC. Current requirements are low for the B+ circuits, less than 50 ma.

The High Voltage Power Supply:

the 5BP1 CRT requires negative high voltage on the order to 1 to 2 KV. The O-1 HV power supply produces about -1,000 volts. One half of the 350 volt B+ winding is connected in series with a low current 575 volt winding. At the top of this winding is a well insulated 5V 2 ampere winding. The five volt winding supplies filament power to another 5Y3 rectifier tube. The two plates of this 5Y3 are wired together to make the tube a single diode rectifier. Output from the plates is filtered with an HV oil condenser. The two series winding produce about 925 volts rms. which should result in a DC voltage somewhere around -1000 volts to -1200 VDC. For this article an assumption of -1000 VDC will be made. The war surplus oil-filled filter condenser used is believed to be rated at 1000 V.

The choice of a 5Y3 rectifier is interesting. It has a peak inverse voltage rating of 1400 volts, yet with the plate held at -1000 VDC due to the charge on the filter condenser and the filament (cathode) at +1300 volts during the nonconducting peak part of the AC cycle, the PIV rating is over voltage by close to 900 volts! I have to assume Heath did a lot of experimenting before deciding on using this tube. HV rectifiers were expensive and this must have been a cost related decision. The 5Y3 continued to be used through the O-9 o'scope. With the O-10, the HV rectifier tube was changed to the 1V2 which has a PIV rating of over 6 KV. The 5Y3 tube must have worked well to have been used for so long, evidently without major problems.

A separate 6.3 volt filament winding for the CRT is necessary as the filament and cathode within the tube are in close proximity and could easily arc. To prevent this, the manufacturers internally connected one side of the filament and the CRT cathode together. Thus the filament is at a negative potential of around 1000 VDC and there is a separate (well insulated) filament winding for the CRT.

Output from the HV supply goes thru a chain of resistors, totaling about 1.2 megohms, to ground, the first resistor is the intensity control; the wiper goes to the CRT control grid and the low end of the pot goes to the CRT cathode. Thus, the grid is more negative than the cathode and the difference decreases as the pot is increase, lowering the bias on the grid and increasing the electrons striking the phosphorus screen. Next in the chain is a fixed resistor followed by the FOCUS pot; the wiper of this pot goes to the focus anode of the CRT, and the pot controls the focus voltage that causes the beam to converge at the screen. The low end of the FOCUS pot goes to ground through two more resistors. The junction of these resistors is around 120 volts negative and provides a negative voltage to one end of the positioning potentiometers.

The Vertical Amplifier:

The vertical amplifier consists of a single 6SJ7 pentode. A cathode resistor provides bias and negative feedback to improve linearity. Input

O-1 - O-4 Tube Lineup						
#:	Tube #			Use		
1	5Y3		Dual Diode	B+ Rectifier		
2	5Y3		Dual Diode	HV Rectifier		
3	6SJ7		Pentode	Vertical Amplifier		
4	6SJ7		Pentode	Horizontal Amplifier		
5	844	6Q5	Thyratron	Sweep Generator		
6	5BP1	5BP4	CRT	Display		
Table II						

to the vertical amplifier is through a binding post; a corresponding ground post sits below it. The input is capacitively coupled to the grid of the 6SJ7 through the vertical gain potentiometer. Frequency compensation is by a peaking coil in series with the plate load resistor.

Screen voltage is obtained from a dropping resistor and a filter condenser to hold the screen voltage reasonably steady. The output of the RC network also supplies the horizontal amplifier's 6SJ7 tube. Screen voltage works out to be about 120 VDC with the values given.

The 5BP1 CRT has a nominal vertical plate sensitivity of 42 volts-per-inch of deflection. Thus, to get a vertical signal that fills the 5" vertical screen the voltage on the vertical deflection plates must be 210 volts peak-to-peak. This corresponds with an rms. AC voltage of just over 74 V rms. Assuming the plate load resistor is $100 \text{K}\Omega$ this works out to a current change of 2.1 ma. With a B+ voltage of 350 VDC the tube saturation current is 3.5 ma (ignoring cathode bias resistance). If the tube is biased at the center of the load line, the plate must swing from about 70 to 280 volts for five inches of deflection. Rough calculations give a gain of around 20 resulting in a maximum input sensitivity of 0.75 Vrms for a deflection of one-inch. This is close to the 0.65 V value given for the O-3 with its refined amplifier circuit.

The output of the vertical amplifier is coupled by a condenser to one of the vertical deflection plates so a negative changing plate voltage will result in upward deflection. The other vertical deflection plate is tied to ground. The **VERTICAL POSITION** potentiometer superimposes a DC bias between ± 120 VDC on the vertical amplifier signal to set the trace vertical position. A separate output from the vertical amplifier is coupled through an isolation condenser to the INT./EXT. SYNc switch.

The Horizontal Amplifier:

The horizontal amplifier is identical to the vertical amplifier with two exceptions. There is no peaking coil to extend the frequency response and the trace positioning is done with the **HORIZONTAL POSITION** control. The horizontal deflection plates have lower volts-per-inch deflection and are slightly more sensitive.

The Sweep Circuit:

The heart of the O-1 sweep circuit is an 884 gas-filled thyratron triode. This tube normally does not conduct until the voltage between the plate and cathode reaches a "firing voltage". This voltage varies from around 25 to 300 volts depending on the negative bias on the grid; the more negative the grid, the higher the firing voltage. In the O-1 the grid bias is set to around 4.5 volts by R24 and R25. One of five timing condensers is selected by the **FREQ**uency switch and it appears between the cathode and plate of the thyratron. The timing condenser begins to charge from the B + supply through R27 and the **FINE FREQ**uency pot (R28).

In free running mode (no sync signal) the condenser continues to charge until it reaches about 35 volts at which time the thyratron fires and the timing condenser discharges rapidly. A small resistance (R23), in series with the plate, limits the discharge current to a safe value. Once the timing condenser is discharged the tube stops conducting and the condenser begins charging again. The voltage across the timing condenser is thus a sawtooth wave. Since the sawtooth voltage is only over about one tenth of the B+ voltage, the ramp up is quite linear, and since the discharge is rapid, the slope of the back edge of the sawtooth is almost vertical. This sawtooth sweep voltage is coupled to the horizontal amplifier to make the beam move across the

Continued on Page 24

OCARC BOARD MEETING MINUTES June 2, 2018

The June OCARC Board meeting was held at the Marie Callender's Restaurant at 1821 N. Grand Ave in Santa Ana on June 2, 2018. Meeting called to order at 8:05 am with a quorum.

Roll Call:

President: Tim N6GP, Present Vice President: Dan KI6X, Present Secretary: Jim AF6N, Present Membership: Bob AF6C, Present Technical: Kenan KR6J, Present Treasurer: Ken W6HHC, Present Activities: Ron W6WG, Present Publicity: Tim, N6TMT, Present **Directors at Large:**Corey KE6YHX, Present
Clem W0MEC, Present

DIRECTOR REPORTS:

Vice President No current report.

Secretary: Jim AF6N reported that the PO Box rental has been paid and accepted.

A notice for Statement of Information was received and has been filled out ready for \$20.00 payment. Ken W6HHC recommended that an attachment be made recognizing KI6X as Vice President of the corporation.

"Save the Date" Anniversary mailers have been sent out.

Membership: Bob AF6C reported current roster at 81 members. He suggested that a photo be made of the current board for the club archive.

Technical: No current report.

Treasurer: Ken W6HHC passed out the current Cash Flow Summary and reported little change in the account.

Tim, N6GP suggested that a Field Day budget be developed at this time. All agreed and Ron, W6WG will do so.

Activities: Ron W6WG asked that a request for prize donations such as used books be included in the RF Newsletter.

Publicity: Tim N6TMT reported restocking the club pamphlets at HRO.

Directors at Large: Corey KE6YHX reported positive results from 80 meter NVIS trials between his QTH and other club members. He suggested that an 80m NVIS net be considered.

OLD BUSINESS:

NEWSLETTER EDITORS: Upcoming editors will be:

June: Dan KI6X, July: Kristen K6PEQ. Tim N6TMT volunteered for August.

PROGRAMS: Dan KI6X reported as follows:

June – Chip K7JA will offer his annual Field Day Prep and Pep Talk

July – A combination of half hour talks is planned including representatives from both ARES and RACES.

August – Wayne KH6WZ, a frequent CQ writer, is expected to present on the topic of encouraging youth interest in ham radio.

September – OCARC Anniversary Meeting

October – Annual Club Auction

November – Possible EMI and/or SteppIR presentation by John Stanford, KF6I.

December – Christmas Dinner

HISTORIAN:

Corey KE6YHX presented a detailed discovery linking the current W6ZE call to the earlier K6DKF call (license picture enclosed, can you find it? – ed.). Corey's discovery was formally adopted for the OCARC Archives. Santa Ana Library progress reports are suspended pending resumption of RF scanning.

85th ANNIVERSARY: Tim N6GP reported that Peter NI6E will not be available to show his news van conversion at the September Anniversary Meeting.

Jim AF6N reported that mug sales have been slow (5 sales to date). Several board members with intent to order asked for and were given order forms. An email blast for mug orders was sent out to members during May.

Lifetime Achievement Award: Corey, KE6YHX explained that he has completed extensive research on one candidate for Lifetime Achievement and is well into research on a second candidate. The results and names of candidates will be withheld for the selection committee.

Emergency Communications: Bob AF6C reported meeting with Jeff KK6YUP and that Jeff has several ideas for an update of the Emergency Communications Page.

Christmas Dinner:

The date of the Christmas dinner was discussed and December 7 was agreed upon. Tim N6TMT will approach Mimi's Café for a reservation on that date.

NEW BUSINESS:

Field Day Report: Ron W6WG reported 31 people have indicated that they would like to operate field day. Of those 10 preferred CW, 5 preferred digital, and some of the remaining 16 indicated slow CW. Ron indicated some concern about providing enough operating time for the number of possible operators.

Ron suggested an email blast detailing how the food service payment is expected to be paid and what the menu will be. Jim AF6N will be responsible for the email blast.

Ron has contacted Michael Slygh NM6X, who has agreed to come and photograph Field Day for us.

Ron asked for suggestions for a drone or time lapse record of our Field Day preparation.

Steve KK6REB and Joel KM6OML will provide transportation of equipment to the site. They will be at the Placentia Storage site for pickup at 4pm on Thursday June 21 and will need help with loading.

Ron reported that Arnie N6HC will be leaving some coax and equipment with Wayne W6IRD that can be used if needed.

Doug K6JEY will provide a Boy Scout interactive program for the Youth Participation activity.

Bob AF6C will talk with Gene KM6OML regarding use of his ramps to load the generator.

Ron W6WG will prepare a food time schedule to be entered in the RF Newsletter.

Tim N6GP expressed concern about available help during set up and tear down. Approximately 12 people are needed just for raising and lowering the 50ft towers. Dan KI6X will note the need for help in the June RF.

Ken W6HHC presented a map for the RF intended to help new members find and enter the Field Day site.

Bob AF6N will gas up and test the generator the week of June 4.

Setup will begin Friday 9am

GOOD OF THE CLUB:

Tim, N6TMT demonstrated and explained the operation of his new Android APRS/cell phone equipment. Corey KE6YHX offered use of his truck mounted APRS to assist Tim in a General Meeting Show and Tell demonstration.

Nicholas AF6CF reported on his trip to the Dayton Hamvention and will present about 10 minutes of similar reporting prior to Chip K7JA presenting at the next General Meeting.

Nicholas is presenting at WARA Monday and, while there, will invite their members to visit our Field Day. WARA is not participating as a club this year.

Tim N6GP announced an FT8 Field Day test on 14090 Khz at 11am Saturday June 2.

The meeting adjourned at 9:50 am.

Submitted by *Jim Schultz, AF6N OCARC Secretary*



Our 7th Annual HRO Ham Jam is coming up!

Saturday, July 7, 2018 is the date, store hours are 10AM-5:30PM, and once again we will be hosting our local clubs and communications specialists in the store parking lot for another educational and fun event.

Come see local communications vehicles, learn about Hospital Disaster Services, and see how many of the local clubs make various activities available to local hams. We look forward to hearing from any local group who would like to reserve space for this event. However, space is limited and will be available on a first-come, first-served basis. Unfortunately, we cannot accept any last minute requests out of respect for our neighboring businesses and the limited parking space here in our strip mall.

The hotdog lunch this year will be hosted by Big Brothers Big Sisters of Orange County courtesy of NCG Co, and Mr. Gordon West and many manufacturer representatives (including Yaesu, Kenwood, Icom, Comet/Daiwa, ABR Industries, and Bioenno among others) will be available for questions. Seminars will be scheduled on various subjects, including D-Star, C4FM System Fusion/Wires, and the hot new ZUMspot.

License testing will also be available most of the day; if interested in testing, please call Janet at the store at 714-533-7373 with name and contact information so that we may plan for appropriate seating.

Two prize drawings will be held during the day at 12 noon and 3PM. Winners will need to be present to win goodies from many of our suppliers who have donated some really great stuff!

Come join us for a fun-filled Saturday of ham radio; make it your goal to leave having learned at least one new thing and/or shared your own knowledge with at least one new ham.

Janet Margelli, KL7MF

Manager

Ham Radio Outlet

933 N Euclid St, Anaheim, CA 92801

(714)533-7373 Tel - (800)854-6046 Tel - (714)533-9485 Fax

anaheim@hamradio.com <mailto:anaheim@hamradio.com>
www.hamradio.com <http://www.hamradio.com/>

Orange County Amateur Radio Club 85th Anniversary Coffee Mug



Celebrate 85 Years of OCARC with your Morning Cup O' Joe

Order Form	-
Call Sign	Quantity
Name Desired	
Call Sign	Quantity
Name Desired	
	Price Each \$14.00
Please make & mail check to: OCARC	Total
PO Box 3454	
Tustin, CA 92781	
or	
Bring check to next meeting	

OCARC GENERAL MEETING MINUTES May 18, 2018

The OCARC General meeting was held at the Santa Ana Red Cross Complex on May, 18, 2018.

Club Officers:

There was a quorum with all officers present.

Attendance:

Present were 25 members, 6 guests, and our guest speaker Marty Woll, N6VI.

The meeting was called to order at 7:02 pm and was followed by the Pledge of Allegiance to the Flag and introductions of the members and guests.

February Program:

Dan, KI6X welcomed Marty Woll, N6VI our presenter for the evening.

Marty's background is extensive. It includes 26 years as a CPA and accounting firm partner, Chief Financial Officer of a publically held corporation, and many speaking engagements and services to the general business world. He also found time to be very active in Southern California community development and affairs.

Marty's amateur radio background is equally impressive. He has participated in several DXpeditions and has been involved in many local radio clubs and services. He has a long history of ARRL responsibilities including recently retiring as Vice Director of the ARRL Southwestern Division.

Marty's topic for the evening was "Troubleshooting for the Non-techie Ham." The topic is intended to help non-technical hams be comfortable with tackling problems encountered in everyday operation through a systematic troubleshooting approach. Marty's approach to basic troubleshooting includes: operation of radio equipment, power supplies, locating antennas, operating protocol, choice of bands and modes, and particularly, resolving apparent equipment failures. The system involves 5 key areas, those being: a logical approach including step by step elimination, basic knowledge, simple tools and equipment, and patient determination. He recommends following a troubleshooting path beginning with the flow of power and then following the flow of the signal. Often the problem is a simple one easily overlooked such as a poor cable connection or a power supply turned off, overloaded, or incorrectly wired. He continued, again, concentrating on receiving problems such as

the receiver turned on with no audio output and transmitting problems such as distorted audio. In each case he suggested very practical corrections for the problems, often made by simple adjustments available on the equipment itself. He also emphasized that substitution of equipment or parts can be a most useful method of troubleshooting.

Wayne, N6NB brought a problematic M² Yagi and Marty demonstrated troubleshooting and identifying an intermittent gamma match connection.

We appreciate Marty's long drive in from Chatsworth, and we thank him for his presentation, both entertaining and useful.

Intermission was taken from 8:07 to 8:32 pm.

Business Meeting:

Field Day Reports:

Ron, W6WG reported that the plans for Field Day are on track and that the next planning meeting will be held Wednesday May 23, 6pm at Tim, N6GP's house. Ron will be sending an announcement to all band captains and asking each captain to be prepared to identify any needs or concerns regarding his station at the meeting.

Jessie, KB6MQY reported that the Boy Scouts will again provide on-site meals. The prices will be the same as last year, \$30.00 for 5 meals. Tim, N6GP suggested that, considering the additional operators this year, we should plan for about 20% more meals this year.

Tim explained Field Day for the benefit of the new members present. He also reported our exceptional past results.

Vijay, KM6IZO will bring the networking router to the planning meeting. All band captains should bring their laptops as well. Vijay reports that he will also bring samples of his recent batch of homebrew.

Ask the Elmer: Clem, W0MEC reported that he has added an amplifier to his 2m rig and that Tim, N6TMT has raised his antenna. They hope to have improved reception between them during the next 2m net.

Continued next page



Show and Tell: Tim, N6TMT reported on a new Android App for his cell phone. The App allows him to connect with an HT or Bluetooth for APRS use.

He also reported on successfully installing FT8 on his new IC 7300.

Tim, N6GP showed a new \$15.00 dongle for FT8 time synching while commenting on the lowering cost of such electronic equipment.

Good of the Club: Tim, N6GP announced the introduction of a new Kenwood HF transceiver to be priced between the existing 590 and 890 rigs.

Ron, W6WG and Tim, N6GP reported on news from the Dayton Hamvention. Nicholas, AF6CF has called in saying that it is very crowded and he will give a report of the Hamvention at our next General Meeting.

Bob, AF6C reported on a new electric rate being introduced that will raise the 5 to 8pm summer rate to \$0.49 per kwh.

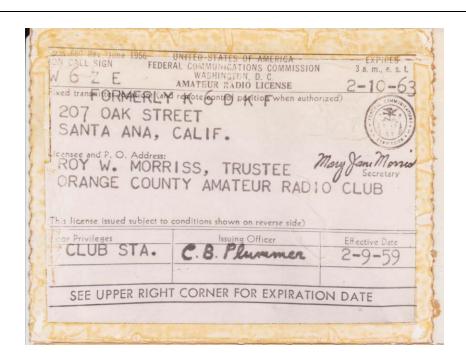
Tim, N6GP reported seeing a photo of Don, K0VNJ on the County of Orange Emergency Facebook page. The article reported Don's service to the police department during the recent county Radio Rodeo drill.

Dan, KI6X announced that the June presentation will be Chip, K6JA delivering his annual Field Day Prep and Pep Talk.

Closing:

The meeting was adjourned at 8:59pm.

Submitted by *Jim Schultz, AF6N OCARC Secretary*



Above is the first "Orange County Amateur Radio Club" license with callsign W6ZE at Trustee's address (2/9/1959). Previously the club call was K6DKF, "Orange County Radio Club", at the OC Communication Center or "Dog Patch" address since the meeting place was next to the County Animal Shelter. Earl Griffin, originally W6LRP, later received the call letters W6ZE and became a SK in 1950's.

2018 is OCARC's 85th Anniversary

Customized Embroidering of the OCAR C Logo,

Your Name and Callsign can placed on shirts, jackets, hats, bags, and just about anything you want.



You can either purchase the item from I.Initial or bring in whatever you have and have it embroidered for \$10.00.

They have the OCAR C logo artwork on file. Delivery takes one to two weeks.

Location: 399 El Camino Real, Tustin, CA 92780

Phone # (714) 573-2552 Online at "iinitial.com"

OCARC Cash Flow - Year To Date

1/1/2018 through 6/1/2018

Category	1/1/2018- 6/1/2018	
INFLOWS		
Badge Income	2.00	
Coffee Mug Sales	70.00	
Donation	10.00	
Dues, Family (PayPal)	172.89	
Dues, Membership	787.50	
Dues, Membership (PayPal)	634.26	
Opportunity Drawing -Monthly	193.00	
Opportunity Drawing IN - Christmas	100.00	
Refreshments Income	43.83	
TOTAL INFLOWS	2,013.48	
OUTFLOWS		
CU service Fee	20.00	
Opportunity Drawing - Monthly	114.57	
PO Box Rental	70.00	
Postage	11.00	
Publicity - OCARC Biz Cards	18.29	
Refreshments Expense	31.22	
Storage Locker	410.00	
Supplies	24.33	
Web Site Hosting	101.94	
TOTAL OUTFLOWS	801.35	
OVERALL TOTAL	1,212.13	



MiniTiouner-Express

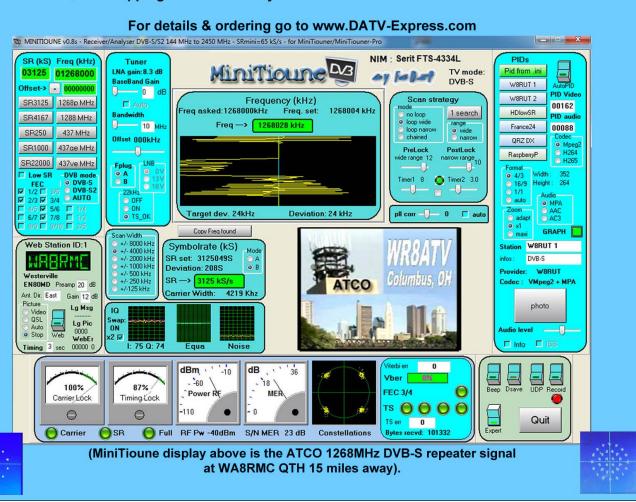
Digital Amateur Television DVB-S/S2 Receiver / Analyzer





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



Continued From Page 14

screen from left to right at a constant speed and then quickly back to the left.

When a sync signal is applied, either from an external source or the output of the vertical amplifier, the sweep will continue to work as before except that a positive going voltage, AC coupled to the grid of the thyratron through the **SYN**c pot will cause the thyratron to fire causing the trace to move rapidly to the left and start a new sweep. By adjusting the SYNc pot and the FINE FREQuency controls a cyclic event can be made to appear stationary on the face of the CRT. Once the thyratron has fired, sync signals will have no effect until the discharge of the timing condenser has finished and it is again charging.

To switch from horizontal sweep to an external horizontal input the FREQuency switch is moved to the **HORIZ. INPUT** position. This grounds the plate of the thyratron, stopping the sawtooth oscillations. Strangely, the horizontal input binding posts are connected to the sweep oscillator at all times. Thus any signal, or capacitance attached to the horizontal input terminals when in sweep mode can interfere with the timing. An isolation resistor (R3 - value unknown) provides some isolation to limit this problem. In subsequent scopes in the 'O' line the horizontal input is switched out entirely when not in use.

Blanking:

A switch on the front panel of the O-1 couples the top of the sweep condenser to the to grid 1 of the CRT through condenser. This has little effect when the timing condenser is charging, but the rapid discharge causes a negative pulse. This blanks (or dims) the CRT trace as it flies back from right to left due also to the discharge. This blanking may be turned off by the BLK switch on the front panel. Evidently

it either didn't perform well or was not needed as blanking disappeared from the O - series scopes until the $\mathrm{O}\text{-}10$.

The Heathkit O-2 Oscilloscope:

One only needs to see the O-2 oscilloscope next to the O-1 to know that there were major physical changes made. The O-2, which first appeared in the December - January (1947 / 1948) Heath flyer (See **figure 6**), and the in the Heath ad in the February 1948 issue of *Radio News*, is quite a bit smaller and less than half the weight of the O-1. Only the depth dimension remained the same at 17"-governed by the length of the CRT. Heathkit referred to this scope as the "New 1948 Heathkit 5 Inch Oscilloscope Kit". A slogan that never changed when the O-3 scope was released in mid 1948.

The front panel controls changed from the O-1. (See Table I-3 and Figure 7) The three controls down the center of the O-1 are now located in a triangular pattern in the center. Gone is the HORIZ. INPUT position on the sweep frequency switch, replaced by the SWEEP GEN. / HOR. INPUT toggle switch located among binding posts, a pilot light and other toggle switches in a double row across the bottom. The new style binding posts are screw type instead of push type. Also gone is the blanking switch of the O-1. The VERT. IN-PUT and HOR. INPUT binding posts, along with their associated GNDs, have been moved to the bottom two rows. The INT. SYN / EXT. SYN, SWEEP GEN. / HOR. INPUT and ON / **OFF** toggle switches are mounted horizontally instead of vertically.

Heathkit O-2 Circuit Changes:

The O-2 continues to use the parts identification scheme of the O-1. The power supplies utilize a lighter transformer; plate and HV winding voltages may have changed some, and a change to a single 2 µf filter condenser



Figure 6: O-2 Ad from the Dec/Jan 1948/49 Heath Flyer introducing the New O-2 Scope.

for the HV results in a published 1,100 V CRT acceleration voltage. The ad also states: "Power supply delivers 1100 volts negative, 350 volts positive, making 1450 volts available for the CR tube." That voltage may be "available" but it is not used, the CRT acceleration anode remains connected to ground and not to the 350 volt B+.

The vertical and horizontal amplifiers have a few changes. Besides the loss of the peaking coil in the vertical amplifier, both now have 2 K Ω cathode resistors resulting in better operating gain (The O-1 is believed to use 820 Ω). The cathode resistors are bypassed by a 0.0068 μ f condenser to boost higher frequency gain with a 3 db gain point at 12 kc. Vertical sensitivity is specified at 0.65 volts/inch and frequency response at 50 cps to 50 kc \pm 20% (+1.6 db to \pm 1.9 db).

The third area of change is to the sweep generator. Instead of six sweep ranges there are

now five, though they still cover the 15 cps to 30 kc sweep range, perhaps with less overlap. The other sweep generator change is that the horizontal input is totally switched out of the circuit when using sweep.

Heathkit O-2 Front Panel Layout

The top row (L to R):

INTEN. Potentiometer

scale is circular CW arrow.

CRT Screen five-inch diameter

FOCUS Potentiometer

scale is circular CW arrow

The second row (L to R):

VERTICAL POSITION Potentiometer **DWN.** scale is circular CW arrow **UP**

(Sweep) **FREQ. SELECTOR** Rotary switch 6-pos. **15** - 60, **60** - 220, **220** - 900, **900** - 3K,

3K - 10K, 10K - 30K (cps)

HORIZONTAL POSITION Potentiometer LEFT scale is circular CW arrow RIGHT

The third row (L to R):

(Vertical) GAIN Potentiometer
SYNCRONIZING Potentiometer
FREQ. VERNIER Potentiometer
(Horizontal) GAIN Potentiometer

(These four controls each have the same scale): 0, 10, 20, 30, ..., 90, 100 (arbitrary scale)

The fourth row L to R):

VERT. INPUT Binding post

INT SYN / EXT SYN Toggle switch, SPDT Pilot lamp Jeweled red Indicator

SWEEP GEN./HOR. INPUT Toggle switch, SPDT

HOR. INPUT Binding post

The fifth row L to R):

GND. Binding post SYN. INPUT Binding post

Power **ON / OFF** Toggle switch, SPST

60 CY. TEST (6.3 volts) Binding post Binding post

Notes: Bold caps text represents actual front panel markings. See Table I-1 for abbreviations used here.

Table I-3



Figure 7: The Heathkit O-2 Oscilloscope. Photo courtesy of Chuck Penson - WA7ZZE

The Heathkit O-3 Oscilloscope:

Heathkit released the O-3 oscilloscope and about the only clue it happened was that the top handle changed from a pull-drawer type to polished metal. This appears have been a good change. Note that the handle on the O-1 in figure 1 has been changed to the later style. Lifting 55 lb. with the original handle must have been painful. Careful observers will also note that the O-3 vertical and horizontal gain pots now have a switch at the fully counter-clockwise position. Fully CCW is marked as **PLATES** and the former 0 (zero) mark immediately clockwise says AMP (See figure 8). This added text can be seen on most ads that show the Heathkit front panel, which helps in detecting the O-3 model in an ad. Internally more changes happened.

Heathkit O-3 Circuit Changes:

Again the power transformer has been changed. Voltages appear the same, but the new transformer has wire leads instead of terminals used in the O-1 and O-2 trans-

formers. The O-3 schematic ⁹ shows the color coding of these leads.

The most significant change is the ability to directly couple the vertical and horizontal inputs to the scope deflection plates. This allows the display of much higher frequencies, like transmitter RF, allowing the monitoring of modulation, etc. The change is the addition of a SPDT switch to the associated (V or H) gain control activated at the fully CCW (PLATES position). When activated the switch disconnects the amplifier and directly connects the input through the existing coupling condenser to the deflection plate. The centering controls, which are after the coupling condenser still allow control of the trace position.

Heathkit O-3 / O-4 Front Panel Layout

The top row: (Same as top row of O-2)

<u>The second row</u> (Same as 2nd row of 0-2) except: (Sweep) FREQ. SELECTOR Rotary switch 5-pos.

15 - 80, **80** - 180, **180** - 900, **800** - 6000, **6000** - **30M** (cps)

The third row (L to R):

(Vertical) GAIN Pot w/CCW switch

PLATES - (Vert. input switched directly to CRT)

AMP., 10, 20, ..., 90, 100 (arbitrary scale)

SYNCRONIZING Potentiometer

FREQ. VERNIER Potentiometer

(These two controls each have the same scale):

0, **10**, **20**, **30**, ..., **90**, **100** (arbitrary scale)

(Horizontal) **GAIN** Pot w/sw ccw position

PLATES - (Horiz. input switched directly to CRT)

AMP., 10, 20, ..., 90, 100 (arbitrary scale)

The fourth row (Same as 0-2 4th row of 0-2):

The fifth row (Same as 5th row of O-2):

Notes: Bold caps text represents actual front panel markings. See Table I-1 for abbreviations used here.

Table I-4

Another significant change is the addition of an intensity modulation input on the rear panel of the scope. This input is in the form of a red phone tipjack just above the power cord exit. It allows modulating the intensity of the trace, and is directly coupled through a 0.01 µf condenser to grid one of the CRT.

The vertical and horizontal amplifiers had a slight change in the cathode resistor bypass condenser from 6800 $\mu\mu f$ to 5000 $\mu\mu f$. This moves the 3 db gain point up to 19 kc.

During the production of the O-3 the three toggle switches (part # O46 for SPST & O53 for SPDT) on the front panel were replaced with less expensive

slide switches (part # O94 for SPST & O95 for SPDT). This mandated a change in the front panel fabrication. The date on the parts sheet that has this change is 09/20/1948.

The O-3 also sports a new parts numbering system to be discussed in a later paragraph.

The Heathkit O-4 Oscilloscope:

The change from the O-3 to the O-4 oscilloscope occurred without fanfare. It appears the new scope was introduced in the April 1949 Heathkit flyer (See **Figure 9**). There was no change to the scope's outward appearance other than the front panel showing O-4 instead of O-3, and one could have missed it entirely except for two things. First, in the same flyer, right below the scope ad, was an ad for a "Heathkit Scope R.C. Tube Shield" (This must have been a typo and should have read "...C.R. Tube Shield" See **figure 10**). This ad states the shield, which sold for \$2.50 "Fits all O-2, O-3, and

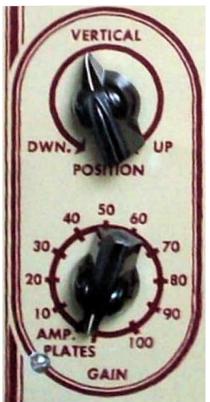


Figure 8: O-3 Plates Switch

O-4 models". Thus it must be assumed the O-4 is being shown in the current ad. The second reason is that, for the first time, Heathkit mentions their current parts suppliers, including Mallory, Centralab, KenRad and Chicago Transformer Company, all big-time electronic component manufacturers. Much of the surplus must have dried up, but Heathkit was able to maintain quality and the \$39.50 price. Surplus 5BP1 CRTs still were abundant.

The O-4 is electrically identical to the O-3 with the exception of numerous component changes. Up to this point Heathkit advertised the use of "long-life oilfilled condensers". These were

war surplus, and Heathkit was selling them as surplus by the truckload for the previous two years. However the dual 5 uf oil filled condenser (O73) in the B+ power supply and the two 8 µf tubular condensers (O50) in the B+ and amplifier screen circuits were replaced by a single triple section 20 uf can condenser (O96). The vertical and horizontal amplifier coupling condensers were changed from 0.5uf bathtub condensers (O61) to 0.25 uf tubular paper condensers (O97). Also, the two 0.25 µf oil bathtub condensers (O62) were replaced with 0.1µf tubular paper condensers (049); these condensers directly couple the inputs to the CRT deflection plates when their gain control is in the PLATE position. Finally, the intensity modulation input load resistor (O16) was increased to a higher wattage resistor (O18).

The O-4 is the last of the five-tube plus CRT scope line. In September 1949 the O-5 was released sporting seven tubes plus the CRT.



Figure 9: Ad for the new Heathkit 5" O-4 Oscilloscope from the April 1949 Heath Flyer

It is the first Heathkit scope to feature push-pull vertical and horizontal amplifiers. The O-5 through O-8 will be discussed in a future *Heathkit of the Month* article.

Early Heathkit Part Numbers:

As mentioned earlier, the O-1 and O-2 had no part numbering system other than a schematic identification (R1 for instance). R1 could be one value for the O-1 and a completely different value for the O-2.

The O-3 sported a new parts identification system. Parts are identified by one or two letters followed by a two or three digit number. The use of an additional suffix (such as L or R for left or right parts) is found on some part numbers. The leading letter(s) signifies the first kit the part was used in: A for audio amplifier, O for oscilloscope, V for



Figure 10: CRT Shield Offered in April 1949 Flyer

VTVM, etc. The number is sequential and starts at ten. This system was used through the O-6 and across the kit line. The system Heath would use for the rest of their existence was implemented in late 1951. It appears in the O-7 scope and the V-6 VTVM manuals.

A Gain Changer:

Heathkit often included letters and mods in their flyers. One of particular interest shows how to increase the gain of the vertical amplifier (at the cost of bandwidth). It is reprinted in **figure 11**.

Summary:

These initial kits played an important role in the growth of Heathkit as a company. Their consistent updating of products as well as dedication to keeping the kits at an affordable price helped this company to reach number one in the electronic kit business.

Finding information on these kits was not easy. I'm still hoping to acquire a parts list and perhaps construction notes for the O-1 and O-2. This article will be on the club's Heathkit website and updated when and if further information comes to the author.

Acknowledgements:

I have some people to thank for helping me with information for this article:

First is Chuck Penson - WA7ZZE, who provided many of the pictures, schematics and parts lists for the O-series scopes. Chuck is the author of three books on Heathkits including one that is due out this summer.

Second is Erich Brueschke - KC9ACE whose article *The First Heathkit, the O-1 Oscilloscope, and the series from O-1 through O-12* provided photos and insight into the O-1 and O-2 oscilloscopes. My attempts to contact Erich have been futile so far. See note 5 for the source of his article.

INCREASING GAIN OF SCOPE AMPLIFIER

Several suggestions have been received from customers for increasing gain of Heathkit scopes as shown below. Both substitute a 6AC7 tube for the 6SJ7 in the amplifiers. The first increases the gain for audio purposes to .06 volt RMS per inch. The second is better for overall band width response and has a sensitivity of .25 volt RMS per inch. All parts not identified same as original.

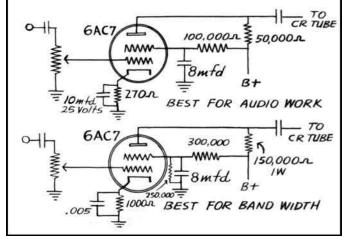


Figure 11: Gain modification suggestions from the June 1949 Heathkit Flyer.

Third is Keith Greenhalgh who has put some excellent photos of Heathkits on *Flickr*. My attempts to contact him have also so far failed, but I do have a new email to try. However, his high resolution photos did let me look into the insides of the O-3 and O-4 scopes, and I was able to answer some of the questions I had concerning changes, updated parts and features. The photos he presents are of kits that he has restored impressively.

Coming Up:

Part II of the O series scope article, which is a few months off yet, will discuss the O-5 through O-8 oscilloscopes.

Next month I plan to discuss the V-6 VTVM I've been restoring. Power has been applied and it seems to be working nicely. The new tubes are burning in and the final calibration is all that is needed to complete the meter

Specification	0-1	0-2	O-3	0-4
Announced Date: Discontinued Date:	Announced July 1947 December 1947	January 1948 June 1948	July 1948 April 1949	April 1949 September 1949
Input Impedance	Not given	1 megohm and 50 μμf	1 megohm and 50 μμf	1 megohm and 50 µµf
Sensitivity (volts per inch)	Not given	0.65 volts/inch	0.65 volts/inch	0.65 volts/inch
Freq. Response V Amp.	Not given	50 cps to 50 kc ±20%	50 cps to 50 kc ±20%	50 cps to 50 kc ±20%
Freq. Response H Amp.	Not given	Assumed slightly less than vertical amplifier	Assumed slightly less than vertical amplifier	Assumed slightly less than vertical amplifier
Horizontal Sweep Range Range Switch Positions	15 cps to 30 kc 6 plus HORIZ. INPUT	15 cps to 30 kc 5	15 cps to 30 kc 5	15 cps to 30 kc 5
60-cycle Test Voltage Post	Yes	Yes	Yes	Yes
Electrostatic CRT Shield	No	Upgrade kit available in Spring of 1949	Upgrade kit available in Spring of 1949	Upgrade kit available in Spring of 1949
Direct Input to CRT Deflection Plates	No	No	Yes	Yes
Intensity (Z) Modulation Input	No	No	Yes	Yes
Size H" x W" x D"	15 x 10 x 17	13 x 8-1/2 x 17	13 x 8-1/2 x 17	13 x 8-1/2 x 17
Net. Weight (lb.)	55	26	26	Not given
Shipping Weight	Not given (freight)	35	35	24
Price US\$	\$39.50	\$39.50	\$39.50	\$39.50

Table III Heathkit O-1 through O-4 Specifications

Notes:

- The O-1 designation was never published and only surmised when the next scope officially received the O-2 designation on its front panel and schematic drawing.
- The 5BP1 CRT and others are discussed in detail in Bob's TechTalk article #51 published in the May 2018 RF Newsletter.
- **3.** In keeping with the era of these kits *condenser* is being used in place of *capacito*r.
- **4.** Weight and dimension information are from *Heathkit Test Equipment Products* by Chuck Penson (WA7ZZE) as well as by emails with him.
- Document information is from "The First Heathkit, the O-1 Oscilloscope" by Erich Brueschke, AWA Review Volume 26, 2013.
- 6. As shown in the Header to this article.
- **7.** Obtained from Chuck Penson (WA7ZZE) and from Erich Brueschke's AWA article (see note 5).
- **8.** Actual transformer voltages for the O-1 have not been published. These voltage are from a later

other than painting the cabinet and removing scratches from the meter face.

73, from AF6C

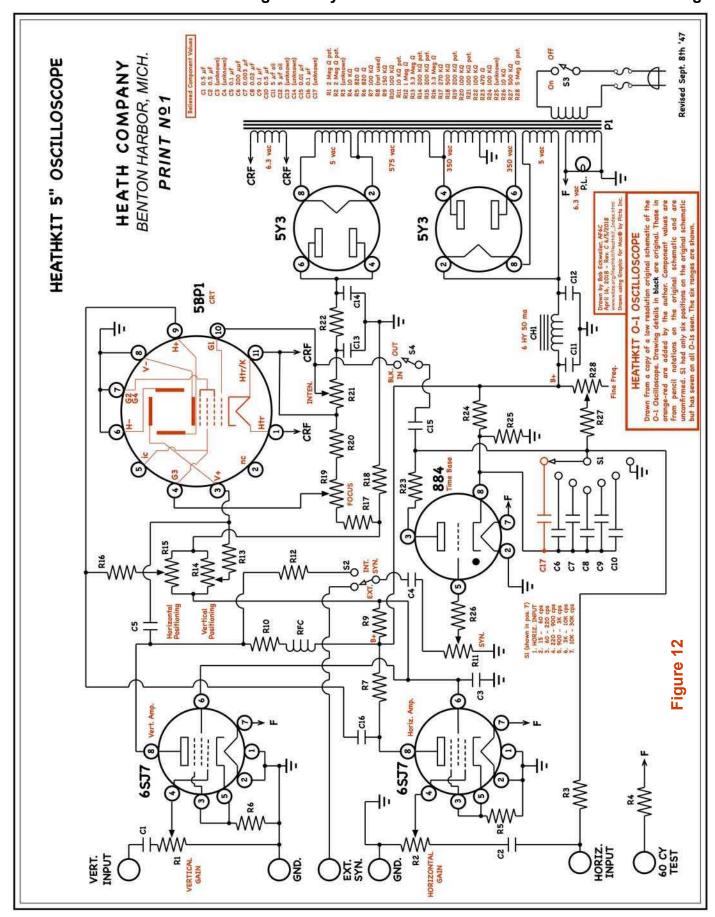


This article is Copyright 2018 R. Eckweiler, AF6C and The OCARC Inc.

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

Thanks - AF6C

- transformer. However the voltages are believed to be reasonably close.
- **9.** Schematics of the O-1 through O-4 will be posted at http://www.w6ze.org/Heathkit/Sch/o_scopes.html when and if they become available for posting.



June 2018 - RF Newsletter - Page 31