RF

ORANGE COUNTY AMATEUR RADIO CLUB, INC.

VOL. LXVI NO. 8 PO Box 3454, Tustin, CA 92781 August 2025

The Prez Sez...
By Dan KI6X

As many say each year about this time, "Where did the year go?" The fall season is approaching and our club has a large list of things to complete in this season. We are full bore on planning the December Holiday Party. It will be at Mimi's, Friday Dec 5, at 5:30. Good food, good friendship, good prizes, good presentations. More information to follow. We also are planning for our October (17th) club auction meeting. We need an Auctioneer, Accountants, Helpers, and sellers and buyers. And, if that is not enough, officer elections are around the corner (Nov) and candidates need to be identified. As with most any club, volunteers are what keep it going. Please continue to monitor the information sent out for opportunities to help your club. We need officers, newsletter editors, newsletter articles, meeting speakers, web content creators, Field Day captains, etc.

I have enjoyed seeing the great turnout at the club monthly meetings. I think we have had more at the meetings and glad to see most stay around for the business meeting. I hope I keep that portion moving enough that you don't have an incentive to leave during the break. We need club member participation in the business of the club too. We also leave time to answer general radio related questions and the more people in attendance the better chance of a knowledgeable person helping with an answer.

As a Board, we have had discussions on how to "advertise" the club to newly licensed hams. If you have ideas, send a note to one of us on the Board (emails on page 2). Our website shows high in Google searches which helps a lot. We have talked about getting the list of new licensees from the FCC, but mailing costs can get steep. Many members do talk up the club to their friends and it is much appreciated. As I hope I have gotten across to the membership this year as President that the Board may keep the club moving, but the general membership is needed for ideas and assistance.

Dan Violette, KI6X
President

NEXT GENERAL MEETING

-Marty Woll N6VI- presents

DXpedition to The Gambia

August 15th, 2025, at 7pm
at the
American Red Cross
Orange County Chapter
Santa Ana, Room 208

NEXT BOARD MEETING
Saturday, September 6th, 2025

In This Issue

2025 Board of Directors

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af6cf@w6ze.org

Directors-at-Large
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2025 Club Appointments

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n6tmt@w6ze.org

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(before regular meetings)
Ken Simpson, W6KOS
(714) 651-6535
w6kos@w6ze.org

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

Monthly Events

Membership Meetings*
Time: 7:00 PM
When: 3rd Friday of each Month
Red Cross Orange County, Room 208
600 N Parkcenter Dr, Santa Ana
(Replaced by the Christmas Party in December.)

Board Meetings
First Saturday of each Month
Board will handle Club business now IN-PERSON.

Club Nets (Listen for W6ZE)

10M ~ 28.375 MHz SSB
Wed- 7:30 PM - 8:30 PM
Net Control: Corey, KE6YHX
Alternate Net Control: AJ, W6OTO

2M ~ 146.55 MHz Simplex FM
Wed- 8:30 PM - 9:00 PM
Net Control: Corey, KE6YHX
Alternate Net Control: AJ, W6OTO
Echolink Node: KK6TRC-L

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

Other Nets

Catalina Amateur Repeater Association (CARA)
147.090 MHz (+0.600 MHz) No PL
Monday - Friday
9:00AM & 9:00PM
Prg. Director. Tom W6ETC
COME JOIN US

OCARC 2025 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, renew, or order badges:

https://www.w6ze.org/FormsShortcut.html

[1] $3 or less + mailing. See form.

Guest Speaker
Marty N6VI
August 2025

Our August speaker is Marty N6VI. He has been in Amateur Radio for over fifty-seven years. First licensed as a Novice in 1967 as WN6VZI, he progressed through Technician (WB6VZI), General, Advanced, and finally Amateur Extra Class. His primary radio affiliation back then was the West Valley ARC, where he learned about contesting and made lifelong friends. His upstart group of school kids won their category nationwide for five Field Days. He later served as a member and chair of the ARRL's Contest Advisory Committee. He is a life member of the League, a former president of the Southern California DX Club and the L. A. Area Council of Radio Clubs, and a founding member of the Southern California Contest Club. Marty was interviewed in QSO Today Amateur Radio Podcast Episode 354.

Marty's presentation will be "Preparing for the Worst – Overcoming Operating Challenges in The Gambia".

For those who cannot attend in person, the presentation will be provided via Zoom®.

Huntington Beach News
Serving the community since 1904

Community News

OC Amateur Radio Club hold Field Day in HB

by: Jerry Person Published: June 30, 2025

L-R: Willy Bustamante with Club President Dan Violette

HUNTINGTON BEACH...This last Saturday and Sunday, June 28 & 29 at the old Spring View School location, members of the Orange County Amateur Radio Club participated in a national amateur radio exercise called ARRL Field Day hosted by the American Radio Relay League (ARRL). The American Radio Relay League is the national association for amateur radio in the United States with ham radio operators that range in age from youngsters to seniors.

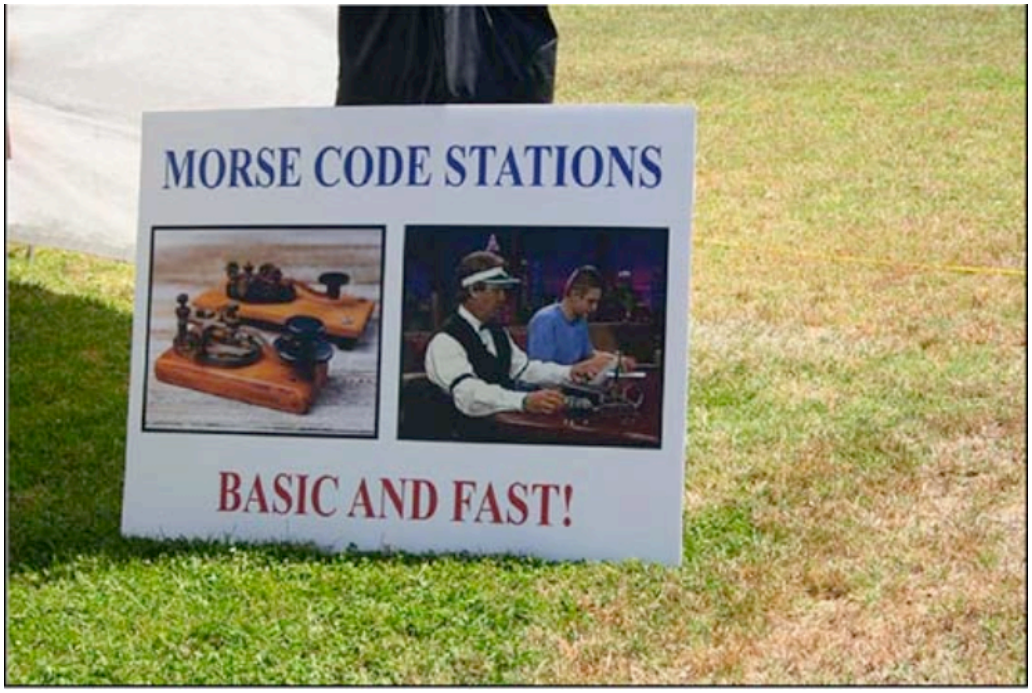
One of two giant antennas

This is the second year at this new location on Trudy Lane and the fifth year in Huntington Beach that the club has set up the tall antennas, tents and equipment that will enable club members to contact other ham operators in other states and countries.

Walking past the Voice Station tent one could hear the words “Calling CQ, Calling CQ” coming from the inside. For over a hundred years these words were sent out over the air by amateur radio "Ham" operators asking to talk to anyone who heard these words or their Morse code dots and dashes.

From the first messages sent out in the early 1900s, ham radio equipment has kept pace with the times going from the very first ham transmitters that were little more than a spark fired between two contacts with a antenna connected to it. These spark gap transmitters connected to a telegraph key sent Morse code messages to nearby receivers. On hand were the past club President Nicholas Haban (AF6CF) and present President Dan Violette and when asked how they like the new site, Haban replied "It's good, not as good as the other site.", "It's great fun and this site has a fence enclosure," said Violette.
Ham operators participated in what they call "Field Day" when hams operators go out into parks, fields, mountains and seashores with portable equipment to see how far their call sign will reach other ham operators.

This is a 24 Hour event where radio operators and clubs throughout the United States deploy in remote locations as a practice for Emergency Communications. Most are done on propane generators or alternative power such as solar or wind. The objective is to make as many contacts with other licensed ham operators in the 24 hours period in a variety of different radio telecommunication modes such as voice, morse code, packet radio, high frequency, low frequency, satellites and even moon bounce.
Last year Station 1 had 900 contacts, Station 2 had 700 contacts and the Morse Code Station was able to contact 1500 stations around the world.



In the other tent the people walking past could hear the clicking sound from the Morse Key as they contact others using Morse Code.
Today with cell phones one might think that Amateur Radio Operators and their equipment are no longer needed, but they are very wrong.
These exercises helps prepare ham operators for a possible major emergency when normal communication, radio, telephone, internet, cell phones, or power stations were damaged and out of commission. A ham can set up mobile communication to the outside world in minutes, relaying messages to other hams thousands of mile away to let someone know that a relative or friend is ok. If an emergency disaster happens anywhere in the world, ham radio transmitter/receiver with their portable backup generator may be the only means of communicating with the outside world. There are still places in this world with no signal for a phone.
The Orange County Amateur Radio Club meets in Orange and has approximately 108 members. The first Field Day took place in 1933 and just in time for the major earthquake to hit Los Angeles and Orange counties.
For those who may be interested in Amateur "Ham" Radio in Orange County, they should check out the club's website at www.w6ze.org or email a question to them at ochamclub@w6ze.org

Huntington Beach News 18582 Beach Blvd. #236 Huntington Beach, CA 92648

Email: hbnews@hbnews.us

Visit more of our week's

Community News webpages

FIELD DAY — RADIO CONNECTS FD25 — JUNE 28–29

ARRL Home | Field Day Home | Field Day Rules and Resources | Field Day Locator | Entry Form | Entries Received | Results | Soapbox

2025 Field Day Entry - Confirmation

Entry Update. You've successfully updated your Field Day entry, as well as uploaded all required documentation. Your confirmation number is **28iour23**. A summary of your updated submission is provided below for your review, as well as e-mailed to you. If you have any questions about your entry, please contact the Contest section at contests@arrl.org.

If you need to further update your entry, enter soapbox comments or upload photos of your Field Day activities, please use the appropriate link below (also included in the e-mail sent to you).

	Link
Update entry/upload documents	https://field-day.arrl.org/fdentry.php?call=w6ze&id=28iour23
Soapbox comments/photos	https://contests.arrl.org/contestsoapbox.php?call=w6ze&id=28iour23

Summary

Entry received at: 2025-07-17 04:55:19 UTC

Submitted by: **Tim Goeppinger, N6GP** E-mail: timgep@yahoo.com

Call Used: **W6ZE** GOTA Station Call: **W6NGO** ARRL/RAC Section: **ORG** Class: **5A**

Participants: **30** Club/Group Name: **Orange County (CA) ARC**

Power Source(s): **Generator, Solar**

Power Multiplier: **2X**

Preliminary Total Score: 12,119

Bonus Points:

Bonus	Points	Status
100% emergency power	500	
Media publicity	100	File [hb news.jpg] previously uploaded
Public location	100	
Public information table	100	
W1AW Field Day message	100	File [field day bulletin 2025.txt] previously uploaded
Natural power QSOs completed	100	File [solar QSOs 2025.txt] previously uploaded
Educational activity	100	
Safety officer	100	File [safety checklist.jpg] previously uploaded
Social media	100	
GOTA Station	145	
GOTA Coach	100	
Entry submitted via web	50	
Total bonus points	**1,595**	

Score Summary - File [W6ZE.dup] previously uploaded

	CW	Digital	Phone	Total	
Total QSOs	1569	365	1394		
Total Points	3138	730	1394	**5262**	**Claimed Score =** (QSO points x power mult) = **10,524**

Band/Mode QSO Breakdown:

	CW		Digital		Phone	
Band	QSOs	Pwr(W)	QSOs	Pwr(W)	QSOs	Pwr(W)
160m						
80m						
40m	314	100	75	100	387	100

20m	755	100	161	100	597	100
15m	500	100	73	100	301	100
10m			50	100		
6m			6	100		
2m					66	50
222						
432					14	50
Other Satellite						
GOTA					29	100
Total 1569			**365**		**1394**	

GOTA Station: GOTA Coach - 100 Bonus Points

Name	Call	QSOs	Bonus Points
Nathanial L	KO6HKD	2	10
Jon H	KO6JOB	5	25
George T	N6WTZ	3	15
Sherri M	KO6JKJ	16	80
John G	N6GTQ	3	15

Send comments or questions about this page to ARRL Contest Manager.
Version: 1.18.3, Revised: July 6, 2025

Amateur Radio License Testing Available!

W6ZE offers license exam sessions before our general meeting at the same location at 5:30 PM new licensees and upgrades. The cost is $15.

Requests for testing should be sent to
Ken Simpson, w6kos@w6ze.org
or by calling 714-651-6535.

RadioActivity
August 2025

Upcoming Activities:

August

- **North American QSO Party, SSB:** 1800 UTC Saturday August 16 through 0559 UTC Sunday August 17.
- **Run for the Bacon QRP Contest:** 2300 UTC Sunday August 17 to 0100 UTC Monday August 18.
- **U.S. Islands QSO Party:** 1200 UTC Saturday August 30 through 0300 UTC Sunday August 31.
- **World Wide Digi DX Contest:** 1200 UTC Saturday August 30 through 1200 UTC Sunday August 31.

September

- **WAE DX Contest, SSB:** 0000 UTC Saturday Sept. 13 through 2359 UTC Monday Sept.14.
- **ARRL September VHF Contest:** 1800 UTC Saturday August 13 through 0300 UTC Monday September 15.
- **North American Sprint, CW:** 0000 UTC to 0400 UTC Sunday September 14.

***** 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 CA”

October

- **California QSO Party**
  1600 UTC Oct. 4 through 2200 UTC Sunday Oct. 5.
  Note: When submitting logs for CQP indicate your club affiliation as “Orange County ARC”

State QSO Parties:

- **Maryland-DC QSO Party:** 1400 UTC Saturday August 9 through 0400 UTC Sunday August 10.
- **Hawaii QSO Party:** 0400 UTC Saturday August 23 through 0400 UTC Monday August 25.
- **Ohio QSO Party:** 1600 UTC Saturday August 23 through 0400 UTC Sunday August 24.
- **Kansas QSO Party:** 1400 UTC Saturday August 23 through 0200 UTC Sunday August 24 and 1400 UTC through 2000 UTC August 24.
- **Colorado QSO Party:** 1300 UTC Saturday August 30 through 0400 UTC Sunday August 31.
- **Tennessee QSO Party:** 1700 UTC Sunday Sept. 7 through 0300 UTC Monday Sept. 8.

Repeating Activities:

- **Phone Fray** 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.
- **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 Friday 2000 UTC to 2100 UTC
  Every Sunday night at 0000 UTC to 0100 UTC Monday.

- **ICWC Medium Speed Test:** (CW, 25WPM Max. Every Monday 1300 UTC to 1400 UTC 1900 UTC to 2000 UTC and Tuesday 0300 UTC to 0400 UTC.

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

Other Links:

- ARRL Contest Calendar
- VOACAP Online for Ham Radio

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

New OCARC Members
2025

JANUARY
AK6AT Michael Porteous
W6VLN Daphne Tsao

FUBRUARY
NC6M Anatoly Ananovsky
N6MG Milton Garb
K6MKL Michael Berchtold
W6NVI Carolyn Berchtold
KN6WPB Thom Belford

MARCH
KN6NXJ Harry Long

APRIL
KO6ION Phil Sallaway

MAY
N6GTQ John Gabler
KO6JES Arshia Attar

JUNE
KO6JOB Jon Hoover
KG6LHK Robert Stone

JULY
K06FKD Robert Wellington
N6YZ Adam Ehrheart

OCARC Membership Director
Ron W6WG, membership@w6ze.org

How To Get Precise Time Outside Your Shack

By Dave N3BKV

Often when I decide to do Parks on the Air (POTA), I just grab my gear and go forgetting to sync my laptop's time. When I get to the park, sometimes my system clock is 5-30 seconds off which means I'm not able to do FT8.

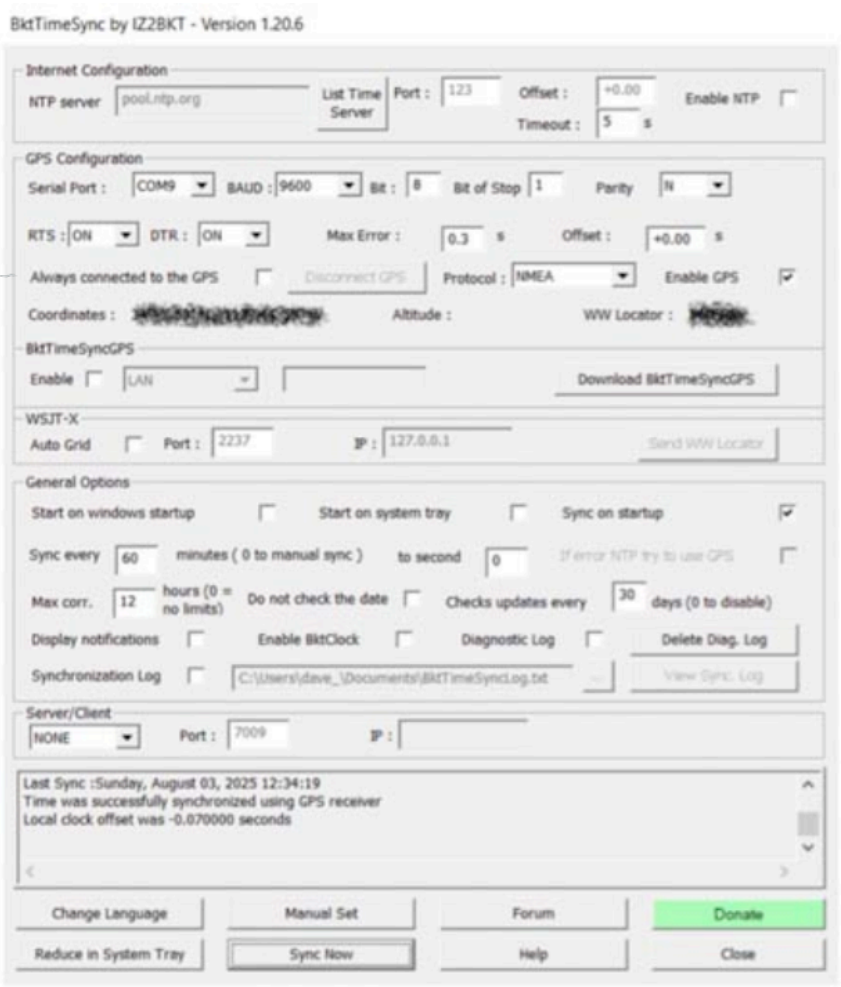
I have found some inexpensive solutions to help fix this issue. First, you'll need a GPS dongle to capture accurate time signals. These dongles are great and can get time almost anywhere, if they have a good view of the sky.

Here is the one I like since I can move it around if I need to and can keep it away from my radio to reduce RFI. It is called the "VFAN USB GPS Receiver Antenna Gmouse for Laptop PC Car Marine Navigation Magnetic Base" and available on Amazon for $20.

If you want something less expensive ($12) and smaller, I've heard good things about this unit (although I have never used it) – "HiLetgo VK172 G-Mouse USB GPS/GLONASS USB GPS Receiver for Windows 10/8/7/VISTA/XP".

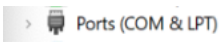
Next, you'll need software to allow your computer to interface with the dongle and update its clock. Here are a couple of options that I've tested. The first one is free and it is called BktTimeSync (https://www.maniaradio.it/en/bkttimesync.html).

Since there are a lot of ads on the download page, here is the direct download link – (https://www.maniaradio.it/OldVersion/elenco.php?nomefile=BktTimeSync%2FBktTimeSync_1.20.6.exe).



After downloading you'll need to find the COM port of your GPS dongle. In your Windows search box (bottom left of your screen), type "Device Manager" and press "Enter".

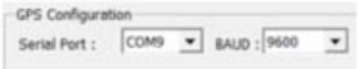
Now click on the ">" next to Ports (COM & LPT)



Look for something like USB Serial Device and note the COM number (in this case 9).

If you have a lot of devices and are not sure which one it might be, you can unplug the GPS dongle and see what disappears to find the COM port number for it.

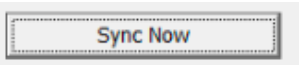
Now go into BktTimeSync and adjust the COM port to the correct number and set the speed to 9600 baud.



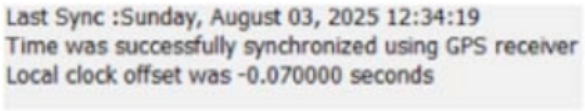
You should then see your GPS coordinates show up if you have the right COM port.

Next, make sure you click GPS enable and turn off NTP.

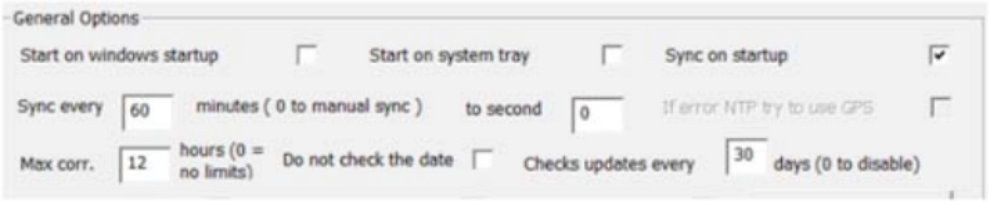
Now click “Sync Now”.



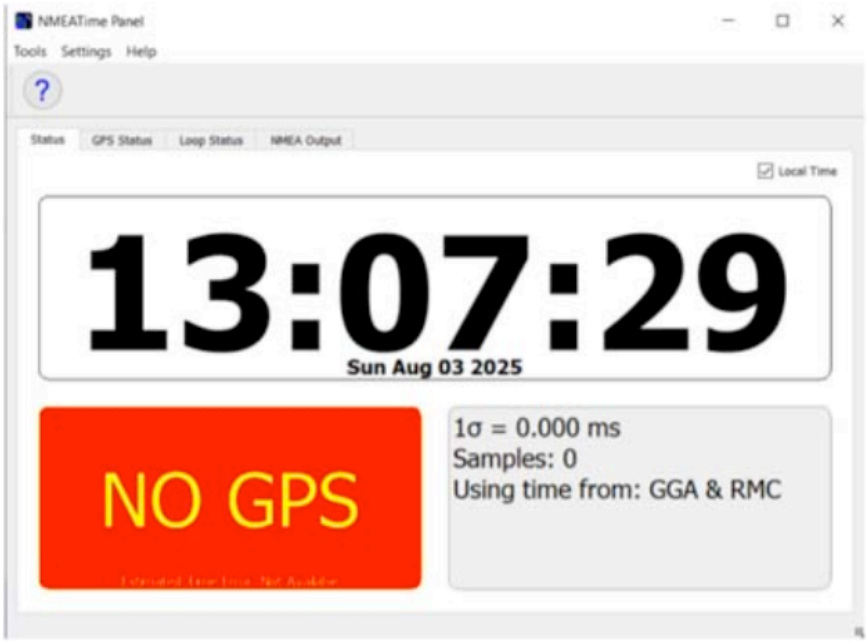
and you should see a successful GPS sync notification.



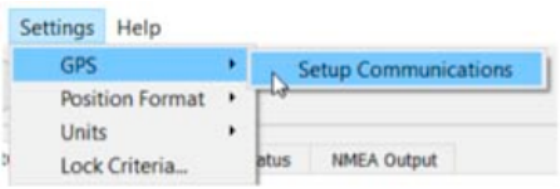
Next, you’ll want to set your syncing options moving forward if they are different than the default.



For software option 2, I really like NMEATime2 since it is much simpler to use and has some cool data screens - https://www.visualgps.net/#nmeatime2-content. It is about $21 (and free for the first 30 days to try) .

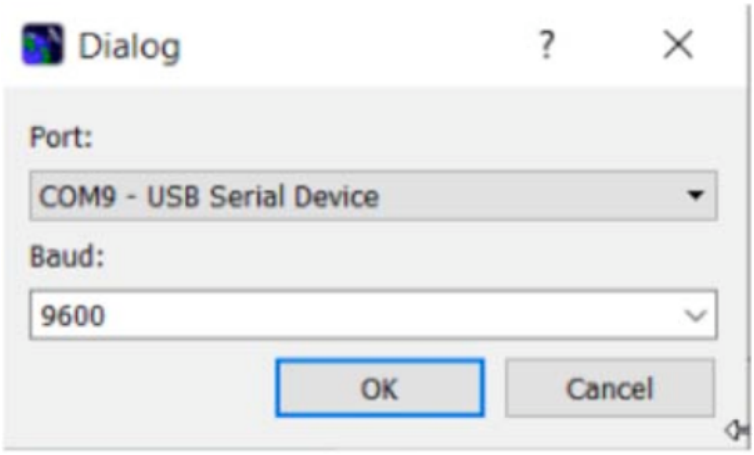


To get set up with it, you’ll need to set the COM port of your dongle.

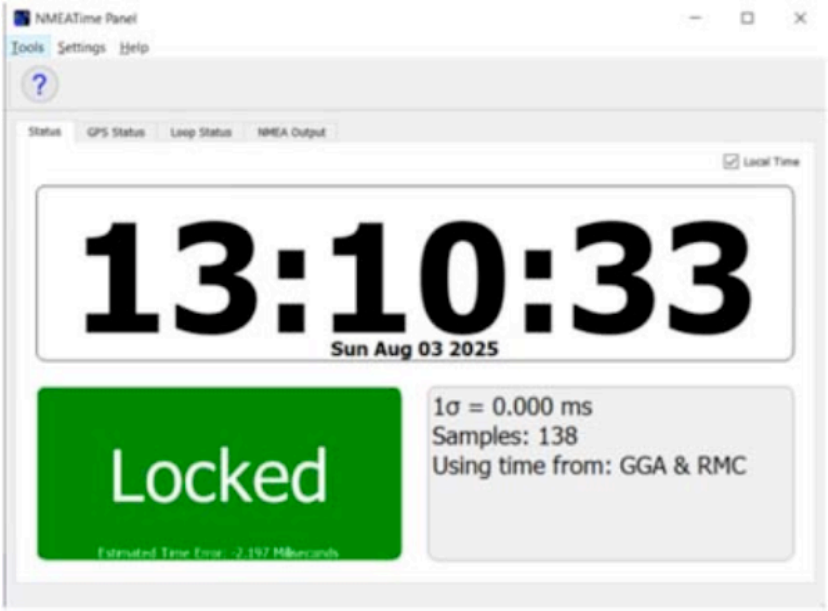


What is nice here is you do not need to use the Device Manager since the program shows you the descriptions of each COM port in setup dialog box.

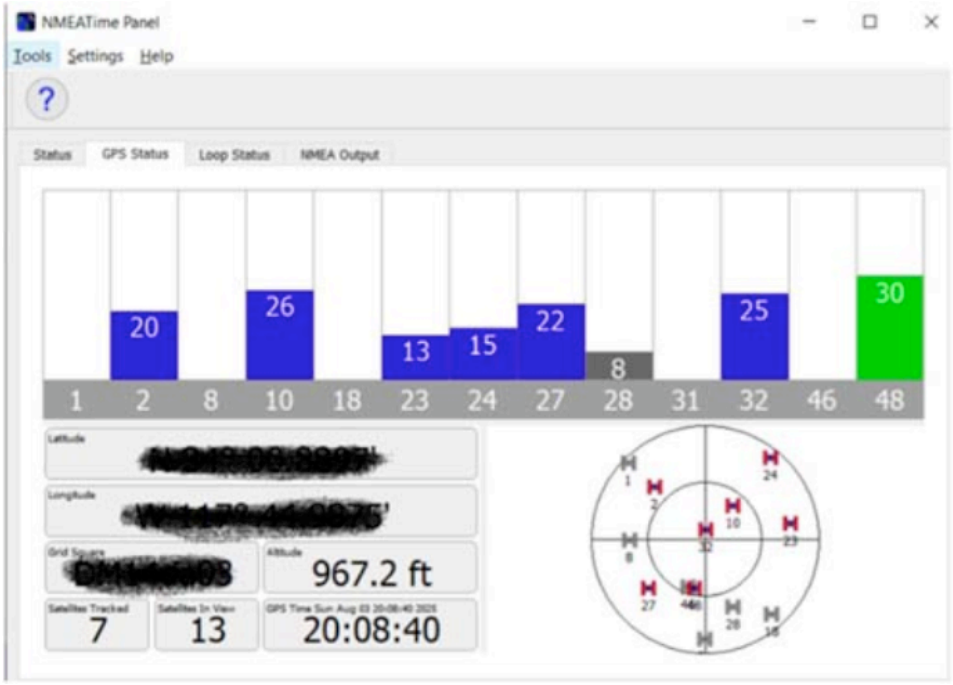
Pick the correct port and set it to 9600 baud.



You should see a “Locked” indication and the program will now automatically sync and update your computer’s clock for you on an ongoing basis.



You can now click the “GPS Status” tab to see what satellites it is using.



As well as see some info on the accuracy of your computer’s clock on the “Loop Status” tab.

That’s all there is to it for you to have accurate time out in the field. Have fun at your next POTA knowing that your time is exact!

Product links:

https://www.amazon.com/Receiver-Antenna-Gmouse-Laptop-Navigation/dp/B073P3Y48Q

https://www.amazon.com/HiLetgo-G-Mouse-GLONASS-Receiver-Windows/dp/B01MTU9KTF

Cash Flow
July 31, 2025

Cash Flow - Year to Date

Category	1/1/2025-7/31/2025
INFLOWS	
Badge	6.00
Donation	62.00
Dues 2025	607.50
Dues, PayPal 2025	1,634.25
Interest Inc	228.25
Opp Drwg Income	200.00
Refreshments Income	146.00
TOTAL INFLOWS	**2,884.00**
OUTFLOWS	
Activites Supplies	87.22
Badge Expense	158.17
Field Day - Equip	26.92
Field Day - Flowers	36.50
Field Day - Oil	7.51
Field Day - Propane	55.14
Field Day Rental - Tent	325.00
PayPal Fees	84.19
Printing Brochures	265.80
Prize Expense	104.80
Refreshments Expense	321.27
Software License	59.88
Speakers Meal Reimburse	29.29
Storage	325.00
Website	178.85
TOTAL OUTFLOWS	**2,065.54**
OVERALL TOTAL	***818.46***

? PUZZLER ? ANSWER

The Puzzler:

Last week I was working on my house and had to make a trip to the hardware store to get some things that were needed to finish the job. I explained what I needed to the guy behind the counter, and asked him how much for one.

He said, "$2.99."

I replied, "Great, how much for ten?"

"Ten will cost you $5.98," he answered.

I said, "OK, I'll take six hundred and sixty-seven."

"That'll be $8.97," he replied as he took the $10 bill I handed him and gave me back thirty-three cents in change - California state tax, remember!

What was I buying for my house?

The Puzzler Answer:

I was buying a set of house numbers for my home. Each individually cost $2.99, so I could buy the three digit house number 667 for $5.98.

The Winners:

None who responded had the right answer, even after the 'big beautiful' clue: "I'll take six hundred and sixty-seven."

I was in the hardware store the other day. Talk of inflation, the price of house numbers were closer to $20 - $35 each! I thought I had upped the cost used in the original puzzler from 99¢ to $2.98 to be more realistic!!!

? PUZZLER ? ANSWER

A Dedication

Starting on the next page is the latest Heathkit of the Month article, #129. It covers a kit I had not planned to write on until Janet - KL7MF passed two Heathkit boxes on to me last year at a club meeting. She found them while cleaning out the estate of Chip - K7JA. In the first box was a Heathkit ET-3100 *Electronic Design Experimenter/Trainer*. In the second box was one of the original training courses Heath designed to use with this trainer, *AC Electronics*. There was also another surprise in the first box, a group of loose components that turned out to be for the *DC Electronics* course, but not the looseleaf binder for the course. That, it turns out, is available on the web in PDF format, as are many of the other courses designed for this trainer. All those loose components are listed in the parts list for that course.

That was all I needed to decide this was a kit worth writing about, so I began looking into the kit and its history. To my surprise there is even a group on **Groups-IO** that has been formed for support of this trainer, and the other trainers Heath began designing and selling after ET-3100 and associated courses proved profitable.

So I'd like to dedicate this Heath of the Month #129 article to Chip and Janet. As a radio club, we are so lucky to have had Chip a member. Both Chip and Janet have added so much to the club and to our, enjoyment of (and performance at) Field Day.

Thank you Janet! ***BOB AF6C***

Heathkit of the Month #129:
by Bob Eckweiler, AF6C

HEATH EDUCATIONAL PRODUCTS

Heathkit ET-3100/A/B
Electronic Design Experimenter/Trainer
(and Associated Heath Offered Courses)

Introduction:
If you read HotM #124[1], you know that in the mid-1960s Heath was offering scientific level lab equipment for colleges, universities, and industry, supporting the Berkeley Physics Lab and the Malmstadt-Enke Instrumentation Lab as part of their expansion into the educational field. Earlier that decade they also released some basic courses: Three "*How to use and Understand your...*" courses, for the VTVM, Oscilloscope and Signal Generator, as well as various other courses focused on the Heathkit consumer, more than the university student.

In their 1975 Christmas catalog[2], Heathkit dedicated four pages to introduce the ET-3100 Electronic Design Experimenter/Trainer (**Figure 1**). In the same ad Heath announced three courses utilizing the ET-3100 trainer: the EE-3101 DC Electronics course, the EE-3102 AC Electronics course and the EE-3103 Semiconductor Devices course. Stand-alone, the ET-3100 trainer originally sold for $59.95 and each course was an additional $39.95. However, if you bought one of the courses with the trainer, you saved $9.95 ($89.95). The trainer, along with all three courses, was offered for $154.95, a savings of $24.95. Later, Heath added three more courses that utilized the ET-3100 trainer. More detail on these courses appears later.

Figure 1: Original ET-3100 Electronic Design Experimenter (Trainer) showing the two power supply controls, the 15/30 VAC line frequency terminals, the generator controls, the two undedicated potentiometer controls and the breadboard area.

In the same four-page ad the ET-3200 Digital Design Experimenter/Trainer was also introduced, initially along with one course. Perhaps this will be a topic for a future article?

In the package I received from Janet - KL7MF was a box containing an early ET-3100B trainer (unbuilt), and a box containing the EE-3102 AC course. Also in the opened ET-3100 box were some components that didn't belong to the kit. It didn't take long to discover those were the parts that came with the EE-3101 DC course. I was able to download the manual so now I had the workings of the DC-course too.

ET-3100 Series Breadboard Trainers:
Through its life, three versions of the ET-3100 were produced. The original unit was introduced in late 1975. It was replaced with a slightly modified ET-3100A in mid-to-late 1981. A year later, a more heavily modified ET-3100B was released, which sold for six-and-a-

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 33

half years. The 'B' model was replaced in the spring 1988 with the short-lived ET-3600. The ET-3600 will not be covered in this article. Schematics for the ET-3100 versions are online[3].

ET-3100:

The ET-3100 consists of a breadboarding area; two adjustable DC power supplies covering 1.2 to 15 VDC – one positive and one negative; a 15V/30V AC **LINE FREQ**uency source; a signal generator covering 200 Hz to 20,000 Hz in two one-decade ranges and two undedicated potentiometers (1 KΩ and 100 KΩ) that may be used in breadboarded circuits. The ET-3100 has a two-wire power cord, a neon-bulb pilot lamp and a power transformer (54-892) with a dual primary and a single 30 VCT 200 mA secondary. Its fuse mounts internally in clips in a box molded into the cabinet with a screw-on access cover. It can be wired for 120 or 240 VAC power.

Figure 2: The ET-3100 Ad from the Winter 1976 catalog. Note the ***'1.2 to 16 volts, current rating 120 mA'*** specifications. See text for details.

ET-3100A:

The ET-3100A is a slightly modified version of the ET-3100. The most significant change is a modified primary circuit. The two-wire power cord has been replaced with a three wire cord. A fuse holder has been added, accessible on the left side of the cabinet, making the fuse replaceable without opening the cabinet. Insulation has been added around the power switch and its terminals, The neon pilot lamp has been replaced with a low-voltage LED. All these moves are for electrical safety. It is difficult to be exposed to line voltage with the cabinet open as long as the cover remains on the molded box that holds the primary wiring. Jeff Tranter, in a video on YouTube[4] discussing the ET-3100A, believes this was to meet Canadian CSA standards. It probably helped meet any new US standards too.

The new LED pilot lamp is driven off the zener regulated +15 volt DC supply. **R101** was changed from 27 KΩ, when it was used to limit the current for the NE-2H neon bulb, to 1 KΩ to current limit the 15 volts to the LED. **R104**, the limiting resistor for the zener diode, was reduced from 220 Ω ½ watt to 150 Ω 1 watt to compensate for the current drawn by the LED. Its companion resistor on the negative supply remained 220 Ω but was also increased to 1 watt. The specifications from the manuals for the ET-3100 and ET3100A are identical and are listed in **Table I**.

There seems to have been a battle between the people who wrote the manuals and the people who wrote the catalog ads as to the specs of the two DC voltage supplies. The manuals state the voltages to be from 1.2 to 15 volts at 100 mA, and the catalog ads state it to be between 1.2 and 16 volts at 120 mA. (**See Figure 2 and 3**). To end the conflict, Heath came out with a 'B' model that included significant changes.

ET-3100 and ET-3100A Specifications

POWER SUPPLIES:

Positive Supply Output:	1.2 to 15 DC. continuously variable.
Load Regulation:	Better than 1% no load to full load.
Current Output:	100 mA with short circuit protection.
Negative Supply Output:	1.2 to 15 DC. continuously variable.
Load Regulation:	Better than 1% no load to full load.
Current Output:	100 mA with short circuit protection.

SIGNAL GENERATOR:

Range Selector Sw.:	LO, 200 Hz to 2,000 Hz HI, 2,000 Hz to 20,000 Hz continuously variable.
Sine Wave Output:	1 volt rms from 600 ohms at less than 4% distortion.
Square wave Output:	15 volts peak-to-peak (+15 volts maximum, 0.1 volt minimum) with rise time less than 1 µ second and nominal duty cycle of 30%.

60 Hz SINE WAVE OUTPUT:

Volts:	15 and 30 volts rms.
Current	200 mA maximum (total current from all supplies must not exceed 200 mA.

GENERAL:

Power requirements:	105-130 volts or 210-260 volts RMS 50-60 Hz, 7 watts maximum.
Dimensions:	12-⅛ wide x 11-¾ deep x 3-½ high.
Net Weight:	4 lbs.
Shipping Weight:	6 lbs.

TABLE I

ET-3100B:

The ET-3100B has heavier power supplies than its siblings. To accomplish this it has a new power transformer (#54-1005) with dual secondary windings. One winding has the same specifications as the single winding of the earlier transformer (30 VCT @ 200 mA). The new secondary is spec'd at 20 VCT at 600 mA[5]. This is incorrect and should be 40 VCT (20 V - 0 - 20 V) at 300 mA. While the power supply current is now increased from 100 mA to 250 mA, the circuit remains identical, except heavier duty pass transistors are used and they are mounted on metal heatsinks., The resistors determining the current limiting (**R105** & **R115**) have been decreased from 4.7 Ω to 1.8 Ω. Due to the higher current output, the regulation specification has changed from "better than 1%" to "better than 2%".

The 30 VCT winding is now exclusively used for the 60 Hz sine wave output, and maximum current available is 200 mA regardless of what

ET-3100B Specifications

POWER SUPPLIES:

Positive Supply Output:	1.2 to 15 DC. continuously variable.
Load Regulation:	Better than 2% no load to full load.
Current Output:	250 mA with short circuit protection.
Negative Supply Output:	1.2 to 15 DC. continuously variable.
Load Regulation:	Better than 2% no load to full load.
Current Output:	250 mA with short circuit protection.

SIGNAL GENERATOR:

Range Selector Sw.:	LO, 200 Hz to 2,000 Hz HI, 2,000 Hz to 20,000 Hz continuously variable.
Sine Wave Output:	1 volt rms from 600 ohms at less than 4% distortion.
Square wave Output:	15 volts peak-to-peak (+15 volts maximum, 0.1 volt minimum) with rise time less than 1 µ second and nominal duty cycle of 30%.

60 Hz SINE WAVE OUTPUT:

Volts:	15 and 30 volts rms.
Current	200 mA maximum ~~(total current from all supplies must not exceed 200 mA).~~

GENERAL:

Power requirements:	105-130 volts or 210-260 volts RMS 50-60 Hz, 25 watts maximum.
Dimensions:	12-⅛ wide x 11-¾ deep x 3-½ high.
Net Weight:	4.2 lbs.
Shipping Weight:	6 lbs.

Differences from TABLE I are shown in RED

TABLE II

Experimenter/Trainer augments electronics courses

$79.95

- **Get hands-on experience building circuits, doing course experiments**
- **Use the ET-3100A later for breadboarding and experimenting**

Seven of our popular electronics courses use this versatile Trainer. **The ET-3100A** Experimenter/Trainer is designed for use with the DC, AC, Semiconductor, Electronic circuits, Electronic Communications, Electronics for Hobbyists and Test Instruments Self-Instruction Courses. You'll get maximum benefit out of each of these Courses by doing the hands-on experiments on this Trainer.

The Experimenter/Trainer features solderless breadboarding sockets for ease of component substitution, a 2-range variable sine and square wave (200 – 20,000 Hz) signal source, dual-variable power supplies for positive and negative voltages (1.2 to 16 volts, 120 mA), 1 k and 100 k linear potentiometers. A center tapped transformer provides 30 volts rms, 60 Hz for line experiments.

The Heathkit/Zenith ET-3100A Experimenter/Trainer can be wired for either 120 or 240 VAC, 50/60 Hz operation. The instrument measures a compact 3½"H x 12⅛"W x 11¾"D (8.9 x 30.8 x 29.8 cm).

The ET-3100A has been designed to give you exactly the kind of invaluable, practical experience you need. It works side-by-side with text materials to drive home important points made in the Heathkit/Zenith Educational Courses which are designed for use with this trainer.

And your Heathkit/Zenith Experimenter/Trainer will continue to give you value, even after you've completed your basic electronics courses. It's ideal for putting your newly acquired knowledge to use in breadboarding your own circuits and experiments with circuit design.

Save money by getting your Experimenter/Trainer with a course – or, for even bigger savings, as part of the basic electronics system.

Heathkit/Zenith ET-3100A Experimenter/Trainer.
Kit ET-3100A, Shpg. wt. 6 lbs. **79.95**
Kit ET-3100AS, ET-3100 with Spanish manual, Shpg. wt. 6 lbs. **80.00**
ETW-3100A, Factory Assembled Trainer, Shpg. wt. 6 lbs. **139.95**

Figure 3: The ET-3100A Ad from the December 1981 catalog. Note the ***'1.2 to 16 volts, current rating 120 mA'*** specifications. See text for details. Note also a Spanish language Manual was available.

the DC power supplies are drawing. Note that the center tap is at ground potential.

The signal generator circuit has been changed substantially, though the specifications remain the same. The ET-3100B uses two LM-301 op amps (442-39) and two NPN MPSA20 transistors (417-801), while the older models used one 741 op-amp (442-22) and four transistors; three MPSA20 and one PNP 2N4121 (417-235).

The LED pilot light circuit was changed. It is now driven off the positive 26 VDC unregulated line instead of the 15 zener supply, and its current limiting resistor (R101) has been increased to 1800 Ω. The series resistor for the +15 zener regulated supply was changed back to 220 Ω.

EE–3100 Courses Using the ET-3100/A/B Experimenter/Trainer:

When the ET-3100 was first introduced in the Christmas 1975 catalog (**Figure 4**) three courses, each a single module, were listed that use the ET-3100. Each course came with a looseleaf binder, the needed components for the experiments and flexible colored vinyl audio records. Later, three more courses were added, including one that had four separate stand-alone modules (EE-3105 Electronic Test Equipment Course).

EE–3101 DC Electronics Course:
8 Unit-Subjects: 1. Electron Theory; 2. Voltage; 3. Resistance; 4. Ohm's Law; 5. Magnetism; 6. Electrical Measurements; 7. Network Theorems; 8. Inductance & Capacitance. Included 56 components and parts.

EE–3102 AC Electronics Course:
6 Unit-Subjects: 1. AC Fundamentals; 2. AC Measurements; 3. AC in Capacitive Circuits; 4. AC in Inductive Circuits; 5. Transformers; 6. Tuned Circuits. Included 16 components and parts.

EE–3103 Semiconductor Devices Course:
10 Unit-Subjects: 1. Semiconductor Fundamentals; 2. Semiconductor Diodes; 3. Zener Diodes; 4. Special Diodes; 5. Bipolar Transistor Operation; 6. Bipolar Transistor Characteristics; 7. Field Effect Transistors; 8. Thyristors; 9. Integrated Circuits; 10. Optoelectronic Devices. Includes 31 components and parts.

EE–3104 Electronic Circuit & Applications Course:
In the Christmas 1976 catalog Heath an-

Figure 4: Page one of the four page introduction of the ET–3100 and the first three courses announced with it. DC Electronics, AC Electronics and Semiconductor Devices. (Christmas 1975 Catalog)

nounced a fourth course to be added soon (**Figure 5)**. The course was first listed in the Spring 1977 catalog **(See Figure 6)**. It initially sold for $49.95.

7 Unit-Subjects: 1. Basic Amplifiers; 2. Typical Amplifiers; 3. Operational Amplifiers; 4. Power Supplies; 5. Oscillators; 6. Pulse Circuits; 7. Modulation. Included over 110 components and parts.

EE–3105 Electronic Test Equipment Course:
In the Winter 1979 catalog (1978 - 1979) a fifth course was introduced, the Electronic Test Equipment course. This course included 4 modules with a total of 6 unit subjects. Each module came with its own binder. Only the first two modules were introduced in the Winter 1979 catalog; the remaining two courses were introduced in the Spring/Summer 1979 catalog. Heath advised: ***"NOTE: Each module requires the test instruments discussed in that module for effective learning."***

EE-3105-1 (Module 1): 2 Unit-Subjects: 1. Analog Meters; 2. Digital Meters; includes 27 components and parts.

EE-3105-2 (Module 2): 1 Unit Subject: 3. Oscilloscopes; includes 5 components and parts.

EE-3105-3 (Module 3): 2 Unit Subjects: 4. Frequency Measurement; 5. Frequency Generation; includes 18 components and parts.

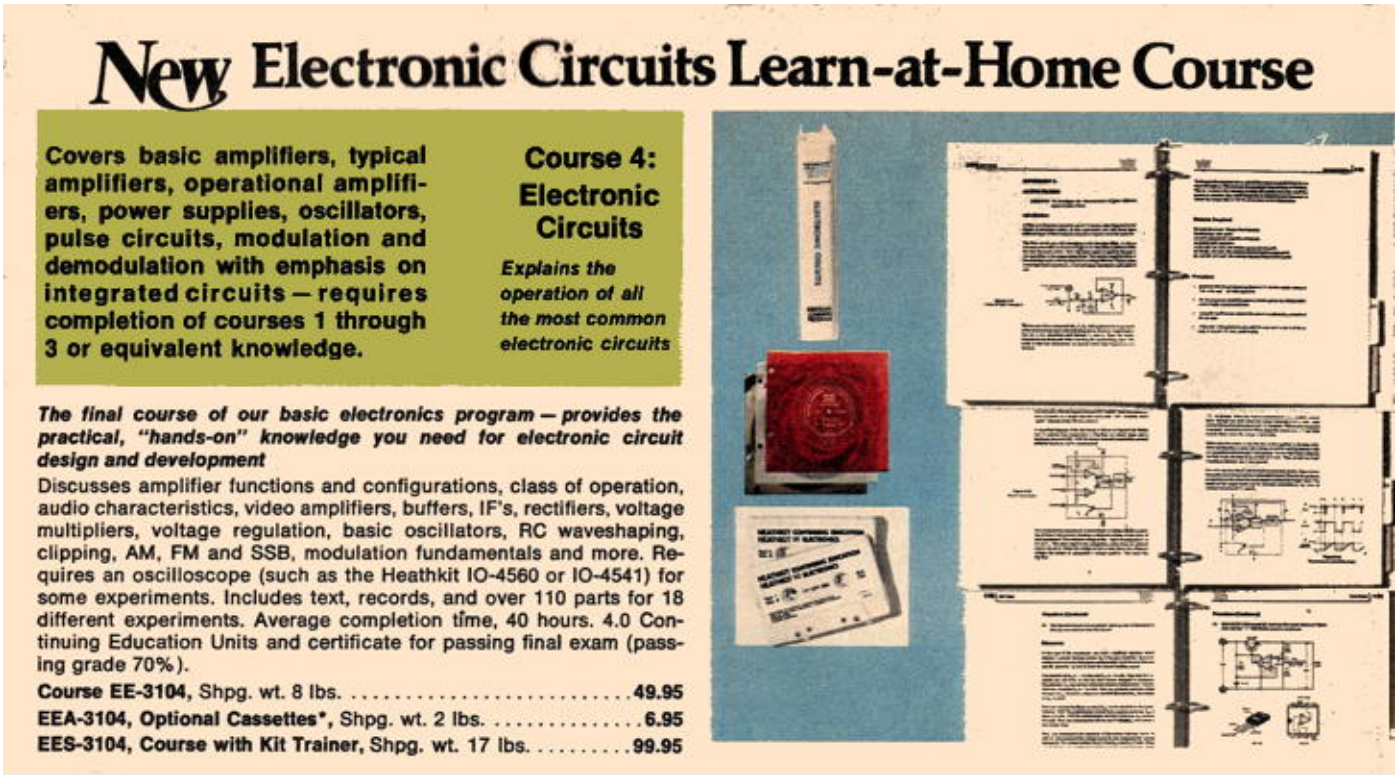
EE-3105-4 (Module 4): 1 Unit Subject: 6. Special Measuring Instruments; includes 48 components and parts.

When the first two modules were offered, they were sold separately. Module 1 sold for $19.95, and Module 2

COMING SOON:

Part 4: Electronic Circuits and Applications Covers power supplies, amplifiers, oscillators, regulators, op amps, AM/FM, pulse circuits. Emphasizes integrated circuit applications.

Figure 5: In the Christmas 1976 Catalog Heath announced the fourth course for the ET-3100.



New Electronic Circuits Learn-at-Home Course

Covers basic amplifiers, typical amplifiers, operational amplifiers, power supplies, oscillators, pulse circuits, modulation and demodulation with emphasis on integrated circuits – requires completion of courses 1 through 3 or equivalent knowledge.

Course 4: Electronic Circuits

Explains the operation of all the most common electronic circuits

The final course of our basic electronics program – provides the practical, "hands-on" knowledge you need for electronic circuit design and development

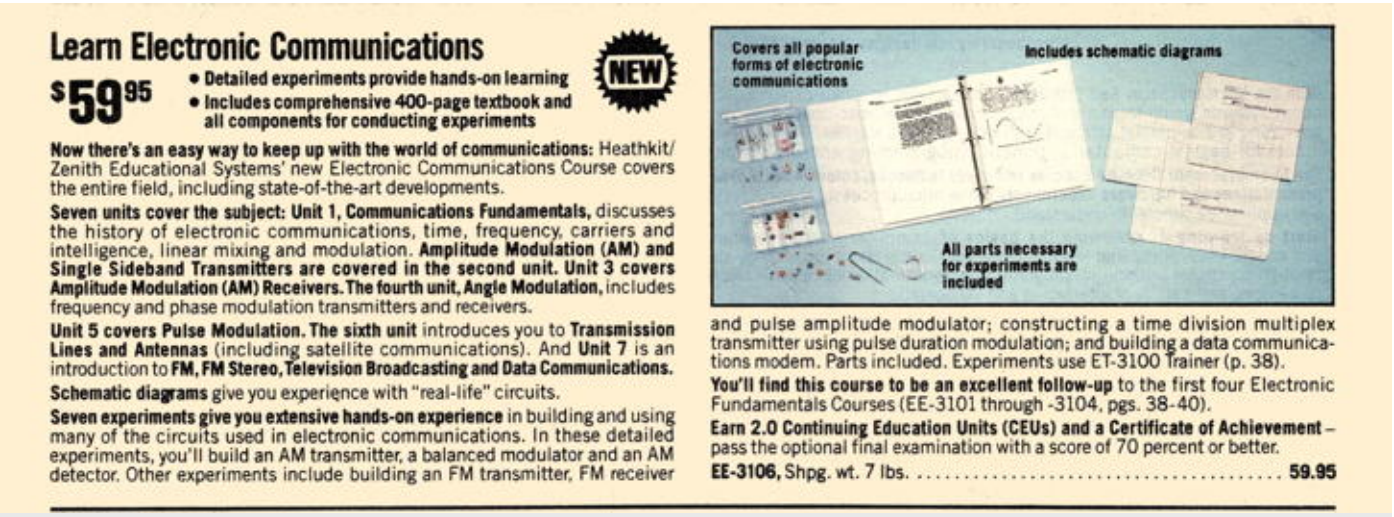
Discusses amplifier functions and configurations, class of operation, audio characteristics, video amplifiers, buffers, IF's, rectifiers, voltage multipliers, voltage regulation, basic oscillators, RC waveshaping, clipping, AM, FM and SSB, modulation fundamentals and more. Requires an oscilloscope (such as the Heathkit IO-4560 or IO-4541) for some experiments. Includes text, records, and over 110 parts for 18 different experiments. Average completion time, 40 hours. 4.0 Continuing Education Units and certificate for passing final exam (passing grade 70%).

Course EE-3104, Shpg. wt. 8 lbs. **49.95**
EEA-3104, Optional Cassettes*, Shpg. wt. 2 lbs. **6.95**
EES-3104, Course with Kit Trainer, Shpg. wt. 17 lbs. **99.95**

Figure 6: The fourth course (EE-3104) was introduced in the Spring 1977 catalog. Also this is the first catalog available that shows the new optional cassettes.

sold for $14.95. In the spring, when the remaining two Modules were introduced, all four could be ordered separately. Modules 3 and 4 sold for $19.95 each, or you could buy all four for $64.95, saving $9.85. By the Fall 1979 catalog, the four modules were shown only as a set at $59.95, though you could likely still buy them individually.

<u>EE–3106 Electronic Communications Course</u>: A sixth course, covering Electronic Communications, was introduced in the 1981 Spring-Summer catalog. While the first five courses required, as a prerequisite, the preceding courses, the prerequisite for this course only required courses 1 through 4; the 5th course was optional.



Learn Electronic Communications

$59.95

NEW

- **Detailed experiments provide hands-on learning**
- **Includes comprehensive 400-page textbook and all components for conducting experiments**

Now there's an easy way to keep up with the world of communications: Heathkit/Zenith Educational Systems' new Electronic Communications Course covers the entire field, including state-of-the-art developments.

Seven units cover the subject: Unit 1, Communications Fundamentals, discusses the history of electronic communications, time, frequency, carriers and intelligence, linear mixing and modulation. **Amplitude Modulation (AM) and Single Sideband Transmitters are covered in the second unit. Unit 3 covers Amplitude Modulation (AM) Receivers. The fourth unit, Angle Modulation,** includes frequency and phase modulation transmitters and receivers.

Unit 5 covers Pulse Modulation. The sixth unit introduces you to **Transmission Lines and Antennas** (including satellite communications). And **Unit 7** is an introduction to **FM, FM Stereo, Television Broadcasting and Data Communications.**

Schematic diagrams give you experience with "real-life" circuits.

Seven experiments give you extensive hands-on experience in building and using many of the circuits used in electronic communications. In these detailed experiments, you'll build an AM transmitter, a balanced modulator and an AM detector. Other experiments include building an FM transmitter, FM receiver and pulse amplitude modulator; constructing a time division multiplex transmitter using pulse duration modulation; and building a data communications modem. Parts included. Experiments use ET-3100 Trainer (p. 38).

You'll find this course to be an excellent follow-up to the first four Electronic Fundamentals Courses (EE-3101 through -3104, pgs. 38-40).

Earn 2.0 Continuing Education Units (CEUs) and a Certificate of Achievement – pass the optional final examination with a score of 70 percent or better.

EE-3106, Shpg. wt. 7 lbs. **59.95**

Figure 7: The last of the Courses that used the ET-3100 was introduced in the 1981 Sprint-Summer catalog. Unlike its predecessors it doesn't appear to have audio records included.

Figure 8: Gerhard - DF1DA Sent a photo of his bookshelf with his course manuals used with the ET-3100. With the magic of the computer, a few missing manuals were added to complete his shelf.

7 Unit-Subjects: 1. Communications Fundamentals; 2. Amplitude Modulation (AM) and Single Sideband Transmitters; 3. Amplitude Modulation Receivers; 4. Angle Modulation; 5. Pulse Modulation; 6. Transmission Lines and Antennas; 7. FM, FM Stereo, Television Broadcasting and Data Communications. A component and parts count is not available in the Heath advertising. This last course sold for $59.95.

The full set of course manuals are shown in order in **Figure 8**.

Course Cassette Tapes:
While most of the courses came with assorted color vinyl records, playable on a 33-⅓ RPM phonograph, cassette tapes were the new media, and you could order a set of cassette tapes for each of the courses. They contained the same audio material as on the included records, and Heath emphasized that in their advertising. Still, a lot of people didn't mind paying for the convenience of the tapes.

CEU Credits & Certificates of Achievements:
After completing a course you could opt to take a final exam. You would be awarded Continued Education Unit credits (CEUs) if you pass the test with a score of 70% or above, as well as a Certificate of Achievement. A total of 18½ CEUs can be earned for courses one through six: 2, 1.5, 3, 4, 6, 2 CEUs respectively.

A Closer Look at the ET-3100B:
Here is a closer look at the last of the ET-3100 series trainers. While the trainers were updated twice, any of them could be used for their designed courses. With a minor exception, all controls and indicators remained the same. That exception is the changes in the pilot lamp in each version, as previously discussed. The controls and indicator, which all mount on the sloping front panel, are shown in **Table III**.

The heart of the ET-3100 trainers is the breadboarding socket that includes 480 'holes', that are arranged as 96 groups of five. Each vertical group of five is connected together. Forty-eight

ET-3100/A/B Sloping Front Panel Controls, Indicators, Connectors

Top Row (left side - L to R)

Pilot Light:	Neon, NE2	(ET-3100)
	LED, Red	(ET-3100A/B)
POWER	Switch, Rocker, SPST	

Center Row (Left Box)

POWER SUPPLY
(Upper)

+ **VOLTAGE**	Potentiometer 3KΩ **1 - 5 - 10 - 15**
– VOLTAGE	Potentiometer 3KΩ **1 - 5 - 10 - 15**

(Lower)

POS	Wire Connector (4-term.)
GND	Wire Connector (4-term.)
NEG	Wire Connector (4-term.)

Center Row (Center Box)
LINE FREQuency

1 (upper)	Wire Connector (4-term.)
2 (middle)	Wire Connector (4-term.)
3 (lower)	Wire Connector (4-term.)

1 – 2: **15 VAC**; **2 – 3**: **15 VAC**; **1 – 3**: **30 VAC**

Center Row (Right Box)
GENERATOR
(upper)

FREQuency	Potentiometer, Dual 100 KΩ/100 KΩ (ET-3100/A) 200 KΩ/5 KΩ (ET-3100B) **200 Hz 1 kHz 2 kHz** **2 kHz 10 kHz 20 kHz**

(center)

RANGE	Switch, slide, DPDT **LOW – HIGH**

(lower)

SINE	Wire Connector (4-term.)
GND	Wire Connector (4-term.)
SQUARE	Wire Connector (4-term.)

Bottom Row (L to R)

1K Ω	Potentiometer 1K Ω
1 (CCW)	Wire Connector (4-term.)
2 (Wiper)	Wire Connector (4-term.)
3 (CW)	Wire Connector (4-term.)
Breadboard	2 x 48 x 5 Wire Connections
100K Ω	Potentiometer 100K Ω
1 (CCW)	Wire Connector (4-term.)
2 (Wiper)	Wire Connector (4-term.)
3 (CW)	Wire Connector (4-term.)

TABLE III

of the groups are in the top half of the breadboarding socket, and 48 are in the bottom half. Spacing of the 'holes' is 0.10". The spacing between the top 48 groups and bottom 48 groups is 0.3", which is standard between pin rows for many DIP integrated circuit packages. The 'holes' are designed to accept up to #20 solid wire (0.032" diameter).

The ET-3100 trainers each also have 15 wire connectors. These connectors have 4 'holes' similar to the ones in the breadboarding connector. The 4 are connected together and each is used as an output connection for the power sources and generator. They are also used for the two potentiometers available for breadboarding. these connectors are listed as Wire Connector (4-term.) in TABLE III.

Assembling the ET-3100B Trainer:
Circuit Board:
A major amount of the components mount on the main circuit board, which is also the sloping front panel of the unit. Most of the circuit components mount near the top of the board and they are covered by the upper part of the cabinet top. Assembly begins with installing small parts onto the board. Then larger parts are installed such as the two switches, five potentiometers, 15 wire connectors, and the large breadboarding socket. This is covered over 12-¼ pages, including 1-½ pages that are a refresher section on soldering to a circuit board. The circuit board is then checked and set aside.

Cabinet Assembly:
The AC wiring is done next. The 3-wire power cord is prepared, fed through a hole in the bottom of the two-part cabinet, and fastened to a relief plate using a power cord strain relief. This kit has no chassis as such. The only real chassis parts are the circuit board common and the shell of the power transformer. They are connected together and tied to the AC ground lead. All the primary wiring, with the exception of the leads to the power transformer and the power switch **SW-101** are in a small box molded inside the cabinet bottom. Inside the box

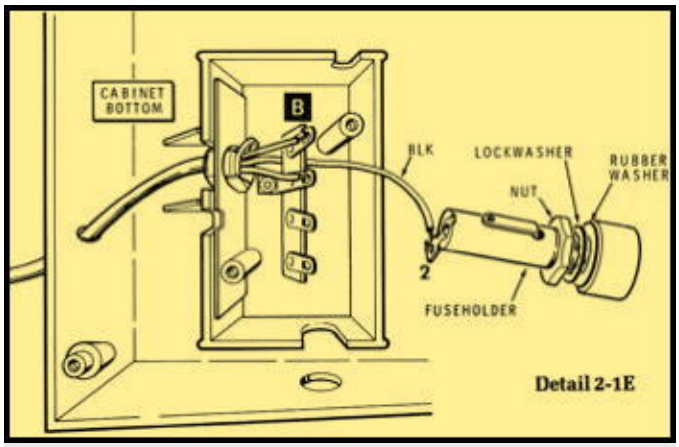


FIGURE 9: Molded box that holds the primary AC winding. Three notches are along the top edge of the box. The upper one handles the four transformer primary leads and a ground lead to the transformer case and PC board common; the left one is for the two wires going to the power switch; and the bottom one holds the fuse-holder. Note the cabinet hole for fuse access.

(Figure 9) is a four-lug terminal strip (B), the fuse holder and a relief plate that holds the power cord strain relief. The AC leads to the transformer are not exposed; the switch leads, however are, so they are protected with shrink tubing to prevent accidental contact. The power transformer is installed and its primary is wired to the 4-lug terminal strip. Different terminals are used depending upon whether the unit is wired for 120 or 240 volts (See **Figure 10**).

Final Wiring:

The transformer secondary (6-leads) are connected to the circuit board. One of the twisted leads from the power switch **SW1** are connected to lug 3 of the 4-lug terminal strip; the other connects to lug 1 of the fuse holder. Green ground leads are run from a solder lug under a mounting screw of the transformer to lug 2 of the 4-lug terminal strip, and to the circuit board common foil. With the primary wiring complete, an insulated cover is screwed over the box opening isolating the primary wiring. The knobs are installed by carefully pressing bushings into the knob after aligning the fully CCW control with the proper knob marking. The knobs are needed to perform the test and adjustments.

Test and Adjustments:

First the Generator section is tested using a

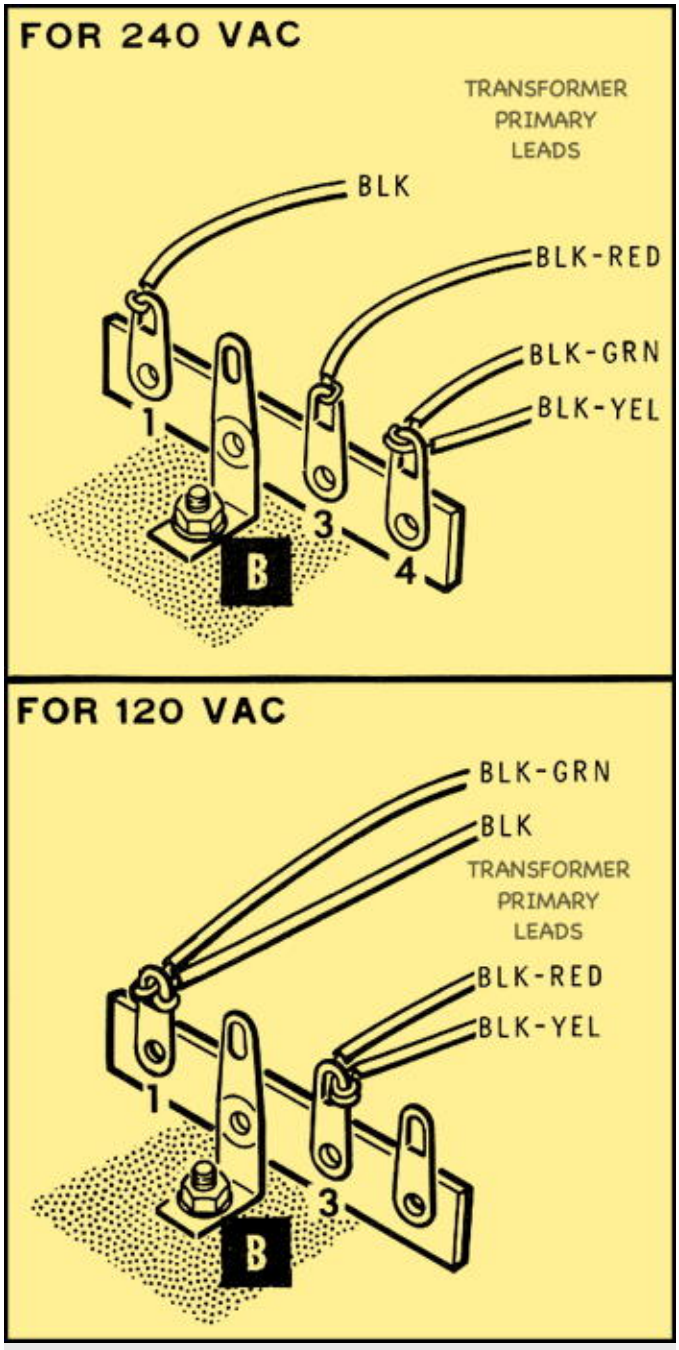


FIGURE 10: Wiring for the 4-lug terminal strip for 120 and 240 VAC power. Terminals: 1 is AC common, 2 is chassis ground (see text), 3 is AC hot after fuse and power switch, 4 is used only as a series tie-point for 240 VAC wiring.

counter or an oscilloscope, if available. Next each of the two 1.2 – 15 volt power supplies are tested using a VOM or VTVM. Finally the 15 and 30 volts **LINE FREQ** outputs are checked with an AC voltmeter. Pieces of hookup wire are used to connect the wire connector blocks to the scope and meter.

Final Assembly:
The final assembly involves mounting the nameplate label to the upper section of the top chassis, mounting the circuit board, dressing and clamping some wires and joining the top and bottom cabinet halves. The Caution label, Blue and White series label and the FCC compliance label are attached to the bottom of the cabinet, and the feet are installed. Completing the assembly.

Using the ET-3100 Trainer:
Use of the ET-3100 trainer is covered in depth in the EE-310x course material. Many of the courses can be found online. Links to the DC and AC Electronics Courses are given in the notes. They will provide good usage details.

ET3100B Circuit Description
The trainer may be broken into four sections, the Negative DC power supply, the Positive DC power supply, the Line Freq. AC power supply and the 20 Hz to 20 kHz generator.

The Negative DC Power Supply:
The negative DC power supply is complementary to the positive DC supply. PNP transistors are used instead of NPN transistors. Diodes and polarized capacitors are reversed from the positive supply. It outputs regulated -15 VDC to the Generator and regulated -1.2 to -15 VDC for breadboard use. Refer to the positive power supply for circuit discussion.

The Positive DC Power Supply Circuit:
A schematic of the power supply is shown in **Figure 12**. Transformer **T101**, **D102, D104** & **C101** provide about 26 VDC. **R101** and **V101**, an LED, function as a pilot lamp circuit, indicating the power is on.

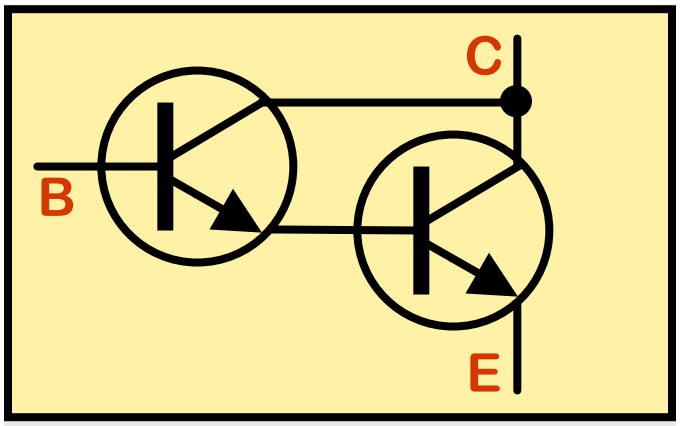


FIGURE 11: Two transistors wired as a Darlington pair. The gain is approximately the same as the two gains multiplied together. However the V_{BE} is twice single transistor.

R102, ZD101, **C102** and **C103** make up a zener regulator that drops the 26 volts to a regulated 15 VDC which powers the generator circuit and also provides a stable 15 V reference voltage to **R104**, the + VOLTAGE control. The 26 VDC is also fed to **Q101** and **Q102.** These transistors are wired as a Darlington pair. (**Figure 11**) Consider them a single transistor with very high gain **(Q101/Q102)**. They are biased on by **R103** causing voltage to appear at the output. The emitter of **Q103**, the control transistor, is at the voltage selected by **R104**, and the collector is at the output voltage. As the output voltage reaches about 1.2 volts more than the voltage selected by **R104**, **Q103** begins to conduct and draws current away from the base of **Q101/Q102** controlling the output voltage. Should more current be drawn from the supply, the output voltage will tend to drop causing **Q103** draw less current and raise the drive to **Q101/Q102** keeping the voltage steady.

Q104 and **R105** make up the current limiting circuit. **Q104** is off during normal power supply operation. However, should too much current be drawn through **R105**, the voltage drop across **R105** will turn on **Q104** which will draw current away from the base of **Q101/Q102** limiting the current to a safe level.

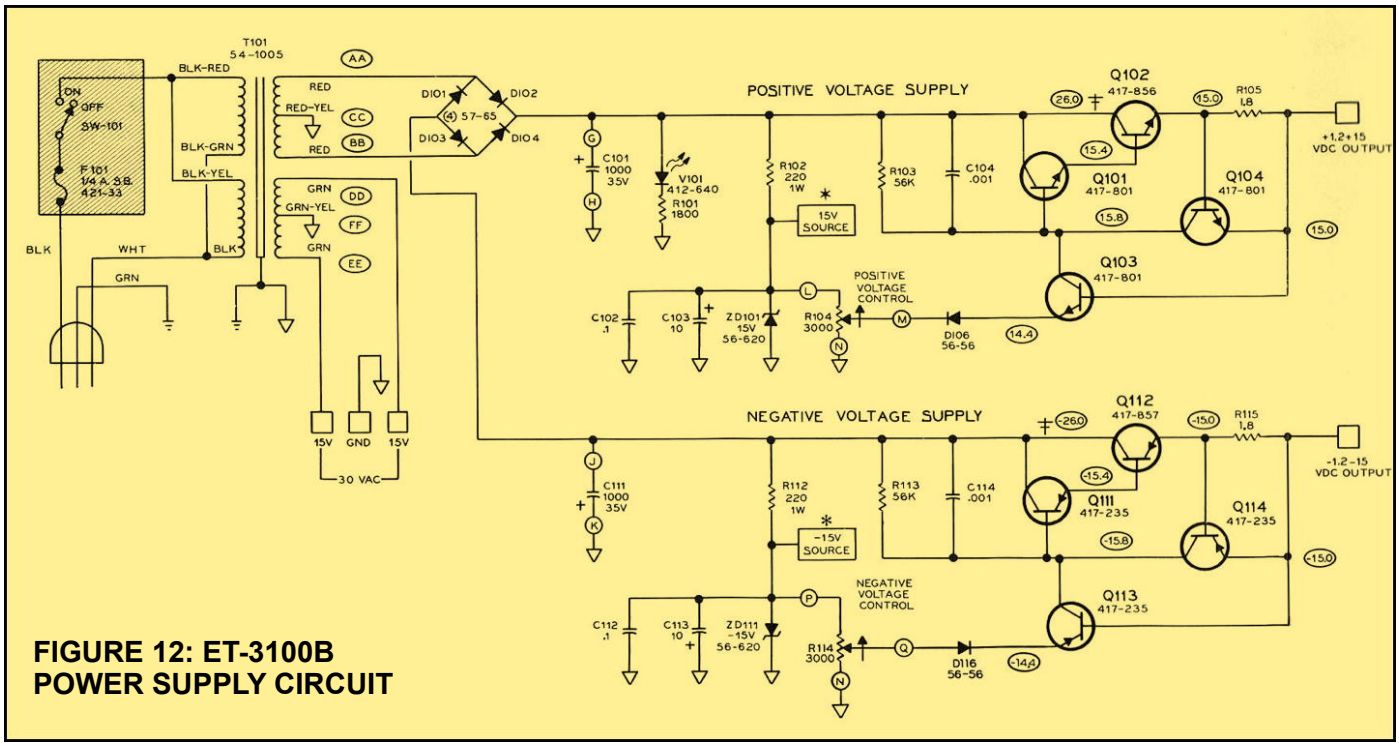


FIGURE 12: ET-3100B POWER SUPPLY CIRCUIT

The 60 Hz Sine Wave Output Circuit:

The 60 Hz sine wave output are just connections to a separate 30 VCT secondary winding on the power transformer, with the center-tap grounded. These go to the three **LINE FREQ** wire connectors, #**1**, #**2** and #**3**. #**1** and #**3** are 15 VAC to #**2** which is ground. #**1** to #**3** is 30 VAC. It's shown on **Figure 12**.

The 20 Hz to 20 kHz Generator Circuit:

The circuit of the generator in the ET-3100B **(Figure 13)** changed significantly from the two earlier models. It uses two LM301 op-amps instead of a single 741 op-amp. The LM301 has 8 pins. Pin-2 is the inverting input; Pin-3 is the non-inverting input, held at ground potential in this circuit; Pin-6 is the output; Pin-4 and Pin-7 are the -15 and +15 VDC Vcc pins respectively, and pins 1, 5 and 8 are null and compensation terminals. **U1** is wired as an inverting amplifier that gets its signal from the output of **U2**. **R1** and **R2** set the gain of **U1,** and **C2** attenuates high frequencies to prevent unwanted parasitics. The output of **U1** is fed through a frequency determining network to the input of **U2** which is also an inverting amplifier. Capacitors **C3** and

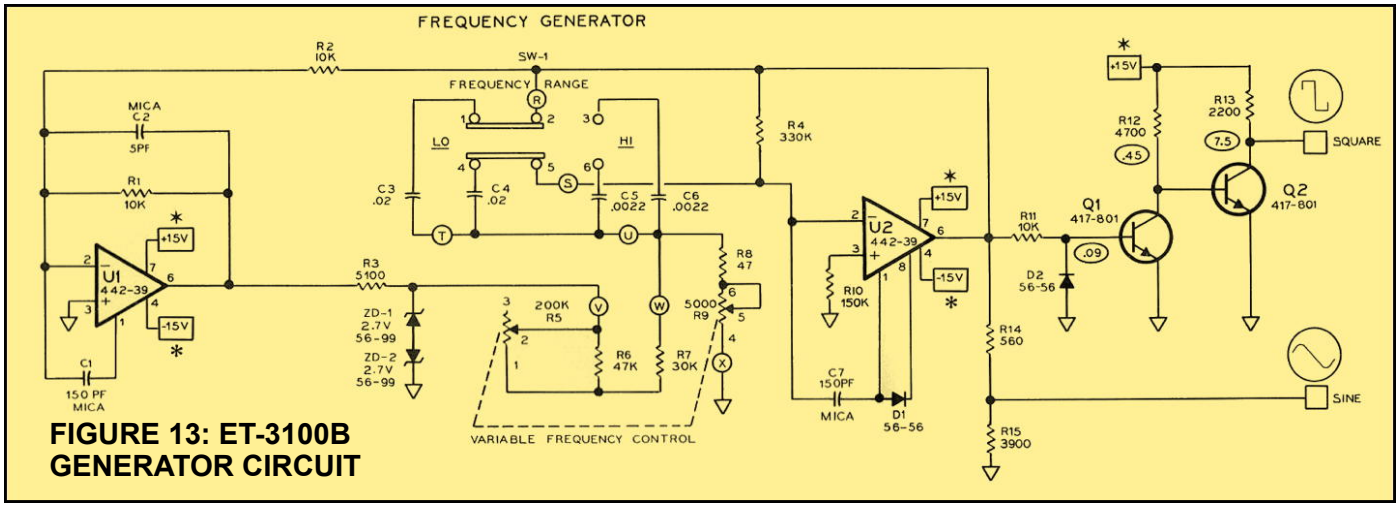


FIGURE 13: ET-3100B GENERATOR CIRCUIT

C4 are used for the low range and **C5** and **C6** are used for the high range. **R8** and **FREQ** potentiometer **R9** set the frequency. Since there is positive gain and there is 180° phase shift between the input and output of **U2** the circuit will oscillate at the frequency determined by the network. The zener diodes **ZD1** and **ZD2** limit the level of output from **U1** into the network. **FREQ** control **R9** is in tandem with **R5**. As **R9** and **R5** turn in unison CW, increasing the frequency, the resistance of **R9** decreases, raising the frequency. And **R5** also decreases in resistance, raising the drive into the network to compensate for the frequency increase.

The output of **U2** is a clean sine wave and is fed via a divider consisting of **R14** and **R15** that provides a nominal 600Ω impedance output to the **SINE** wire connector.

The output of **U2** is also fed through **R11** to **Q1**. Diode **D2** prevents the base of **Q1** from going negative. **Q1** and **Q2** are high gain amplifiers and at the output of **Q2** the sine wave has been transformed into a square wave, which is output to the **SQUARE** wire connector.

On **U1** and **U2** Pin 5 is not used. It allows the addition of a null trim pot if nulling is critical. Pins 1 and 8 are for internal amplifier compensation. Heath used 150 pf for **C1** and **C7**. They also used diode **D1** to increase the bandwidth of **U2**. Details on compensation are given on the LM301 data sheet[6].

ET-3100 Conclusion:

My first impression, viewing the ET-3100, was very positive. One weakness, I thought, was that the breadboard could have been larger. All the

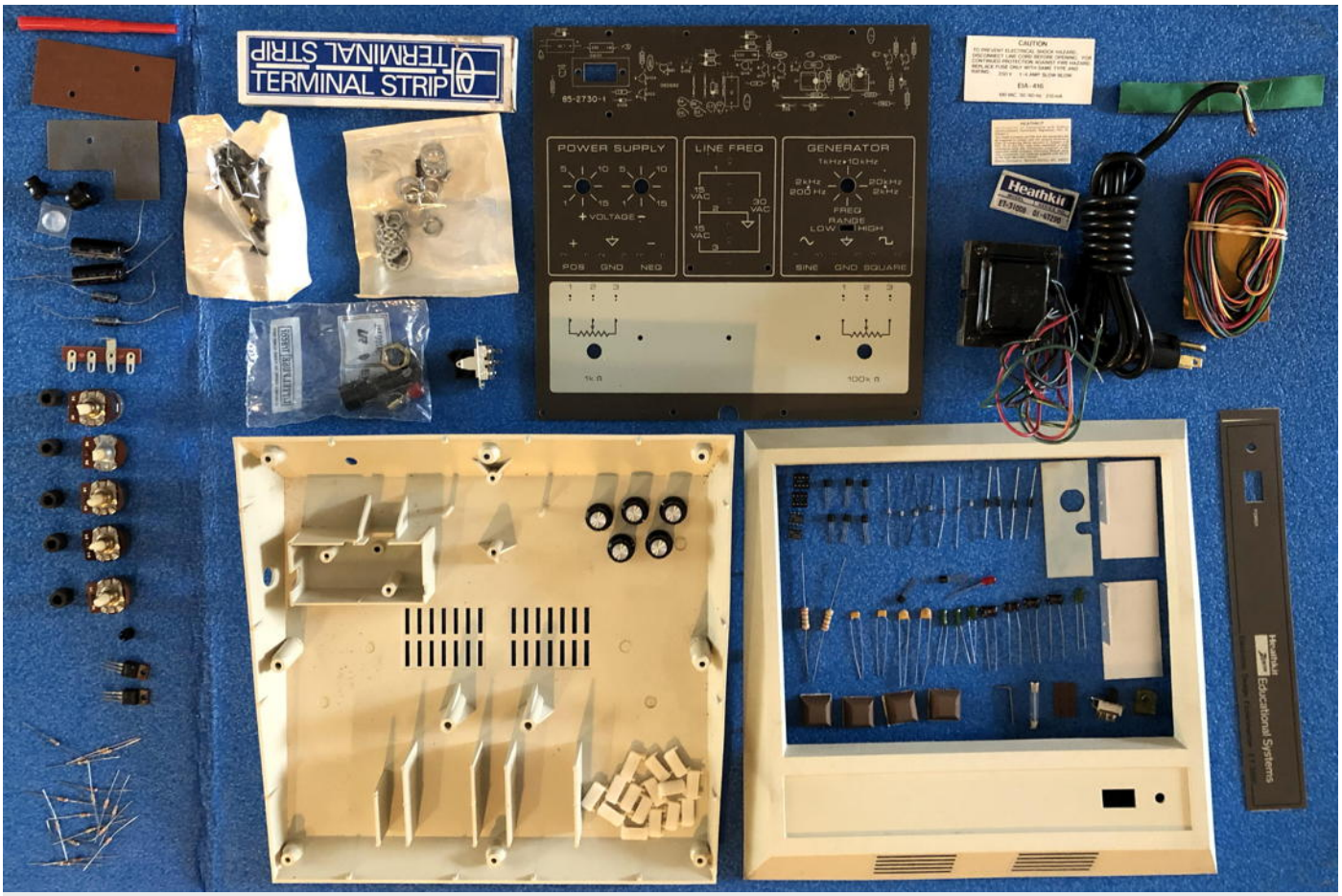


Figure 14: The components that make up the ET-3100B are laid out for display.

experiments easily fit on it. Yet, I wondered about using it later on, on other projects? Of course it could be used with an easily available separate breadboard.

Browsing through the first three course manuals, it was obvious that a lot of thought and study went into their preparation. When first looking at the extra parts in the ET-3100 box. (that I later figured out were the parts for the DC Electronics course) The parts included two envelopes of resistors. In one, that was marked "RESISTORS FOR EXPERIMENT 5", I found a standard carbon ½ watt 20% resistor, with the most unusual markings: brown black violet, 100 Meg Ω (Heath part #1-139). The highest value standard carbon ½ watt resistor I'd ever seen before was 22 Meg Ω. Looking, a little further, I found one an order of magnitude higher in value, a 1,000 Meg Ω (1 giga Ω) carbon ½ watt 20% resistor marked brown black gray (Heath part #1-141)[7]. I was curious what they would be used for in the course? Experiment #5 involves removing a resistor from the envelope noting the size and reading the color code to determine the values of that resistor (wattage, ohms, and tolerance).

If you'd like to see the course manuals for the DC and AC Electronics they are available online[8]

Heath continued to develop new courses, some with specific trainers, and some that didn't require a trainer. Even after Heath stopped selling kits, their Educational Division continued for a few more years.

Comments:

As usual, I had a lot of help preparing this article. Steve Gladstein - N8FH provided hard-to-find information on the 'A' version, including the schematic and parts list. Gerhard Wagner - DF1DA provided a lot of insight as well as the photo of the course manuals. Chuck Penson - WA7ZZE, author of those excellent Heathkit books, filled in a lot of details including sending copies of pages from his vast Heathkit catalog collection. A lot of support also came from Santos e Silva of Portugal; he is very knowledgeable about Heathkits. One could say this is an international effort!

Be sure to checkout the Heathkit Specification section I've added to the website. It currently has 164 data spec. sheets in 14 categories. There are still more to add, mostly audio/HiFi but scanning schematics that are 34" x 22" is a challenge!:

https://www.w6ze.org/Heathkit/HeathSpecSheetsIndex.html

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. See HotM #124: https://www.w6ze.org/Heathkit/Heathkit_124_EUW18.pdf
2. The catalog is available here (See pages 62 - 65) https://www.worldradiohistory.com/Archive-Catalogs/Heathkit-Catalogs/Heathkit-Christmas-1975.pdf
3. https://www.w6ze.org/Heathkit/ET3100/index.html
4. The Tranter video is available here: https://www.youtube.com/watch?v=X9haztHTCsg
5. These are the values given in a Heath Parts Master File. The plus to minus value of 52 volts would not be possible. No doubler circuit is used.
6. The data sheet for the LM-301 can be found here: https://www.ti.com/lit/ds/symlink/lm101a-n.pdf
7. In later releases of the DC Course the 1,000 MegΩ resistor was replaced with a 10 MegΩ resistor, Heath part #6-106.
8. The first four course manuals are available online at: https://archive.org. Search for 'Heathkit EE-310n' where n is 1, 2, 3, 4 for the four courses. (Select 'meta' for search type when asked.)

General Meeting Minutes
July 18, 2025

The meeting began with the Pledge of Allegiance.

Everyone in attendance took a moment to introduce themselves.

Vice-President Tim N6GP introduced our speaker Kristopher Cutting, W6KJC who spoke about his roles as a Safety and Emergency Management Specialist, starting out at Orange Coast College and obtaining many skills. During the last 10 years or so, Kris has built up an impressive resume' of education and expertise, particularly in the area of Emergency Management. He attained a BS degree in Homeland Security and Emergency Management from Grand Canyon Univ. in 2020. He has continued with many Sociology, OSHA, Environmental & Health, Climate Adaptation, and Emergency Management certifications. He spoke about his job functions at a multi-campus organization. He also spoke about CERT (Community Emergency Response Team) explaining how it can work with the local authorities. He volunteers for the OC Fire Watch through the OC parks. He worked with the recent fires in Malibu by helping a team to go and help out.

After a short break the meeting continued with club business.

Business Meeting

A quorum of club members was present.

Tim N6GP Vice-President reports that Marty Woll N6VI, our guest speaker will be on Zoom, "Preparing for the Worst-Overcoming Operating Challenges in the Gambia". Marty was part of the 2003 C5Z DX-Pedition team working the 2003 CW Worldwide DX Contest in West Africa.

Tim, N6TMT, Treasurer reports we continue to be in good shape at this time, even with the Summer Field Day expenses.

Corey, KE6YHX, Activities reports he is working on sending out the information and scheduling for our Dec 5th Christmas Party which be discussed at our next Board meeting.

Ron, W6WG, Membership reports we now have a total of 111 members, with 3 Honorary members. We had a good meeting tonight with 30 members present.

Ask the Elmer

"Ask the Elmer" was presented with several members asking for advice. One asked about setting up an older ICOM radio, and members with knowledge discussed what they could. Another member had a question about GMRS radios to purchase. Our Publicity Board member, AJ, was mentioned as a source of info.

Show And Tell

Nicholas AF6CF presented a show and tell as he purchased wiring from Harbor Freight that did not live up to the specifications! He passed around the burnt/fried/melted wire to demonstrate.

Charlie, KM6KCK presented a book from HB Banning library about the 40's that had a picture of an early Field Day.

General Meeting Minutes continued,

Good of the Club

Ken W6KOS continues to offer VE testing prior to our monthly club meeting at 5:30 pm, also assisting with testing were Charley, KM6KCK, Chuck AK6JT, Fred W0PE and Arnie N6HC. Tonight, our member Sheri Millard N6ASM passed her General!

8:50 pm Motion to adjourn made, seconded and passed.

As some of our members were leaving Dan KI6X pointed out the Starlink rocket had just taken off and we were treated with a dazzling view!

Submitted by Joyce KN6UKJ.

Board of Directors Meeting Minutes
August 2, 2025

OCARC Board Meeting Minutes for August 2, 2025
The OCARC board meeting was held at the Streamliner Lounge,
186 Atchison St. Orange and was called to order by President
Dan KI6X at 8:15 am.
A quorum of Board members were present.

Directors Report

Treasurer Tim N6TMT reports our cash flow from Jan to July 2025 as follows, Inflows: $2,884.00 Outflows: $2,065.54 Overall total: $818.46
The Club's CD account was renewed July 2025, interest received was
$228.25, deposited $1,093.36 from our checking account to bring total
CD deposit to $8,000 for the next 11-month term.

Membership Ron W6WG reports that we now have 112 members with 3
Honorary members. Ron continues to send out "welcome" emails to our new members.

Activities Corey KE6YHX reports he has a proposed a tentative schedule for our Holiday Party:
Final Head Count due Nov 28 2025
Holiday Party: Friday, Dec 5, 2025 starts 5:30pm,
Dinner Orders 6:00-6:20
Each attendee will receive a free raffle ticket with ability to purchase $1 per ticket or 6 tickets for $5.
Presentation 6:30-7:30 pm.
Dinner served about 7:00 pm

Board of Directors Meeting Minutes continued,

Entertainment and New Board 8-8:30pm.
Raffle 8:30-8:45pm
Clear-Out by closing 9:00 pm.

Corey also reports we will have an opportunity drawing at the next club meeting with new prizes.

Club Monthly Planner Review
Planning began for our October auction.

Old Business
Newsletter Editors: August Ron W6WG, September: TBD, October Corey KE6YHX
Speakers/Entertainment: August: Marty N6VI via Zoom; September: Nicholas AF6CF; October: Auction

New Business
Discussed Christmas party planning, Director-at-Large Janet KL7MF, has volunteered to possibly provide entertainment for the party. The board unanimously approved $1000 for Janet to purchase prizes for the party. Reviewed need for auction personnel in October, at this time Tim N6GP will do the accounting, with Corey KE6YHX and Tim N6TMT willing to help out. Nicholas AF6CF has agreed to be the auctioneer. Discussed needing brochures to advertise our upcoming auction.

Tim, N6TMT, brought up our club providing a donation at the end of the year
to the Red Cross which provides space for our club activities.

Started forming an Election Committee. Nicholas, AF6C, may lead it.

Good of the Club
Arnie N6HC spoke with Allen Kesinger the Senior Librarian for Adult Services at the new Irvine Public Library as he is interested in a presentation about amateur radio, Arnie has agreed to do this presentation which will be scheduled in January 2026, he will pass out brochures as well.

Discussed using QRZ to link to our newsletter. Also discussed sending our newsletter to affiliate members.

VE sessions for amateur radio licensing continue to be held prior to our monthly club meetings at 5:30pm under the guidance of Ken W6KOS. Ron W6WG, Janet KL7MF and Joe KM6SVV are able to assist if needed.

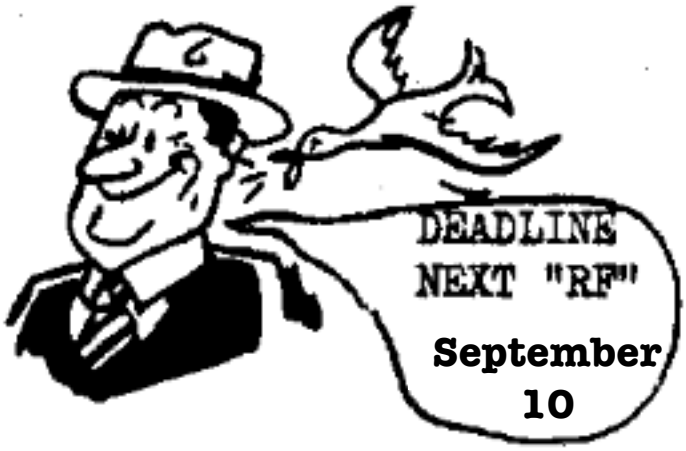
Adjournment
An adjournment was voted on and agreed at 9:30am.

Submitted by Joyce KN6UKJ.

-- FOR SALE --

See the updates in the For Sale section of the website: OCARC For Sale Page
- also in the left menu on the home page of www.w6ze.org -

-- FOR SALE --



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