QRPp

The Journal of the California QRP Club
Fall 2017

Table of Contents

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From the Editor,

We are starting on another adventure with a brand new QRP Club, the California QRP Club. I must admit that I miss the old Norcal days with Jim Cates, WA6GER, (SK) who was the co-founder of the club with me. Norcal never was the same after his death, and I want to see if I can recapture the magic and fun I had with a new club. I have thought about doing this for a long time, probably 10 years or so, but I never found anyone that reminded me of Jim. I started having QRP monthly meetings a year and a half ago, and Steve Smith, WB6TNL, also known as "Snort Resin", immediately contacted me and started driving to the meetings from Oxnard, which is near Los Angeles. Now there is a dedicated QRPer. Steve and I talk daily on the phone, just like Jim and I used to. And we are in complete agreement as to our philosophy as to what a QRP club should be about. In short, I have found Jim again.

In September, Steve discovered that NorCal QRP Club had let Jim's call lapse as their club call over 3 years ago. The FCC will hold a call for 2 years after it lapses, but returns it to the pool of available calls if it is not renewed in that time period. What that means is that WA6GER has been available for anyone to claim for over a year. Steve asked me if I was interested in forming a club in order to get the call as a club call. I immediately said yes, and then thought, yes it is time to do it again. I asked Steve if he would be my partner in caretaking of a qrp club. I said that it would be run the same way as Jim and I did with one exception, we would never have a club treasury. I did not want any tax problems that come with a club treasury, and told Steve that he and I would pay for any incidental expenses that we have concerning the club. He agreed. So, we formed the California QRP Club. There are no officers, dues, or business meetings. There is no club treasury. We will never take any money on behalf of the club. We meet on the first Sunday of the month from 1 to 3 PM at Denny's at 1140 Hillsdale Ave. in San Jose. Everyone is welcome. And everyone is welcome to become a member. We have a Yahoo group, CalQRP@yahoogroups.com. We invite you to join the group, and you will become an automatic member of the club. We have membership numbers, and you may get your membership number by joining the Yahoo group, then send an email to Steve at:

Sigcom@juno.com

with Membership Number in the subject line. Do not send requests for a number to the Yahoo group as it will be ignored.

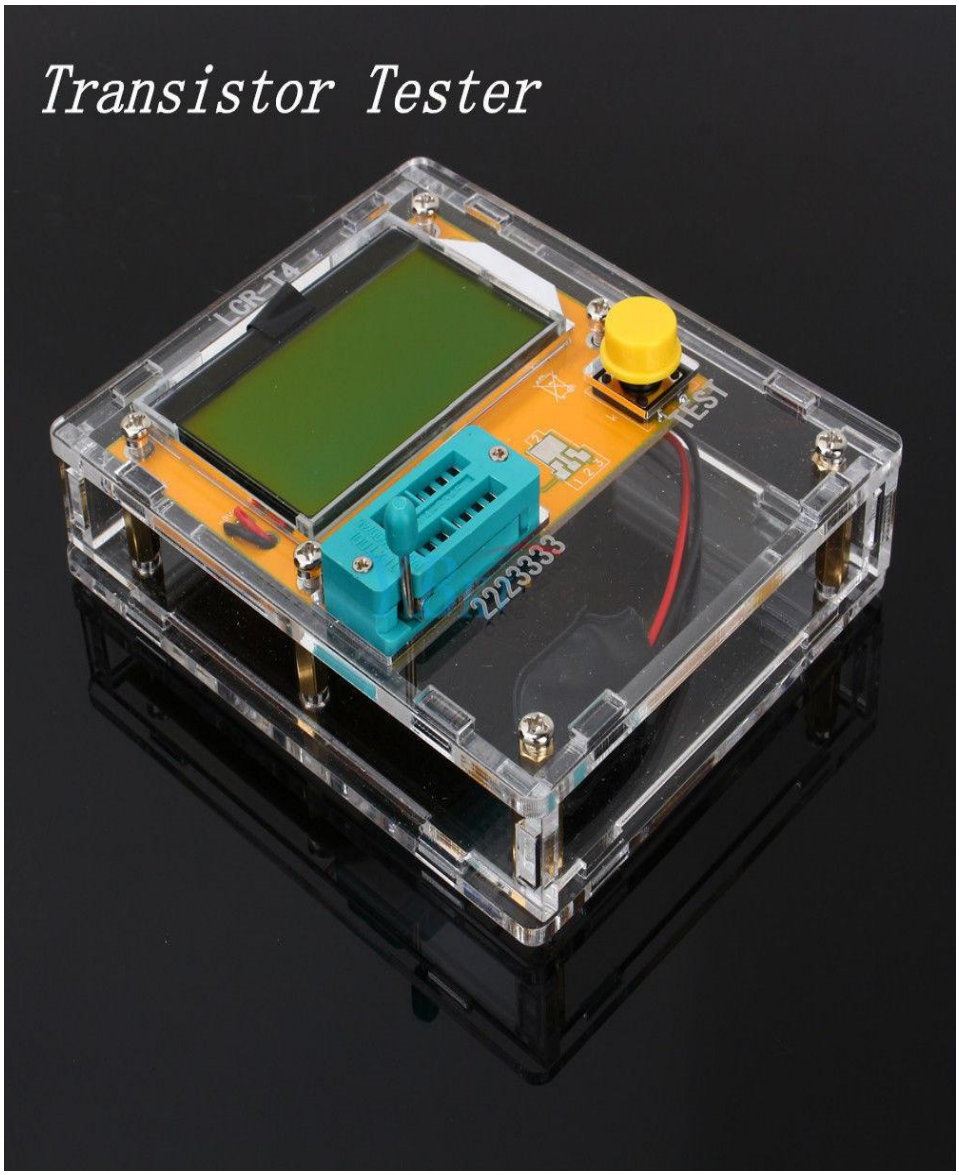
We are going to have club projects, and the first one will be a group build of the Norcal 40A. You can find all the details in the Club Project article in this issue.

I am excited and hope you are too. QRPp will be published quarterly again, but since we don't have a treasury, we won't be printing paper copies. It will be an internet journal, free to anyone to download on the CalQRP yahoo group. Thanks for your time and thanks for your interest. Doug, KI6DS

A Comparison of 2 L/C Meters

Doug Hendricks, KI6DS

One of the most valuable tools that a home brewer can have is an Inductance/Capacitance Meter. I first bought mine at Dayton many years ago. Chuck Adams, K7QO, told me about the AADE IIB, and highly recommended it. He even designed an adapter to make it easier to use. I bought the meter and paid about $80 for it at the time. I have used it for years. It is great to check the markings on capacitors, and make sure that you have the right part. I also use it for measuring inductance of toroids.



Last year I purchased the Lcr-T4 Meter from Ebay. It is a cheap meter that sells for $9.70 plus $1.85 shipping. You can find it on ebay by searching for item number 222235430386. Here are the specs.

Resistor: 0.1ω-50Mω
Capacitor: 25pF-100000uF
Inductance: 0.01mH - 20H
Working power: DV-9V
Standby current: 0.02uA
Operating current: 25mA
Size:105 x 87 x 28.6 mm / 4.1"x3.4"x1.1"
Case: Clear acrylic

Not bad for $12 or so. One of the features that I like is the automatic shutoff. But if you take a close look at the specs, you see that it does not measure below 25pF, which is a handicap as there are times when I want to measure below that value. Plus the inductance is measured in hundredths of mH, not microhenries, which is what we need. .01 mH is 10 uH, and the resolution doesn't tell you enough information. What it does do well is provide you with lead identification on transistors, and it identifies the type, NPN, PNP, Fet. That feature has saved me a couple of times as I was confused as to which lead was which, and the meter told me. I like the acrylic case too.

Here is the AADE IIB. Sadly, this is no longer in production. The inventor, Neil Hecht, passed away, and production has ceased. Here are the specifications:

SPECIFICATIONS

Range:

- .001 uHy (1 nHy) to 100 mHy (most units measure to 150 mHy)
- .010 pf to 1 uF (most units measure to 1.5 uF)
- AUTOMATIC RANGING

Accuracy:

- 1% of reading typical
    - Typical means the average error of 83 different components compared to an
        - HP4275A digital L/C meter (test frequency 1MHz) for components ranging from .1uHy to 1mHy and 2.7pf to .068uF,
        - B&K 878 digital LCR meter (test frequency 1KHz) for components ranging from 1mHy to 100mHy and .1uF to 1.6uF.
- (L/C Meter II is characterized for hobby or non-critical commercial use)
- SELF CALIBRATING

Display:

- 16 character LCD display module
- Four digit resolution
- Direct display in engineering units (ie: Lx= 1.234 uHy / Cx= 123.4 pF)

Operating modes:

When the Lx and Cx switches are off the ZERO switch acts as a MODE SELECT.

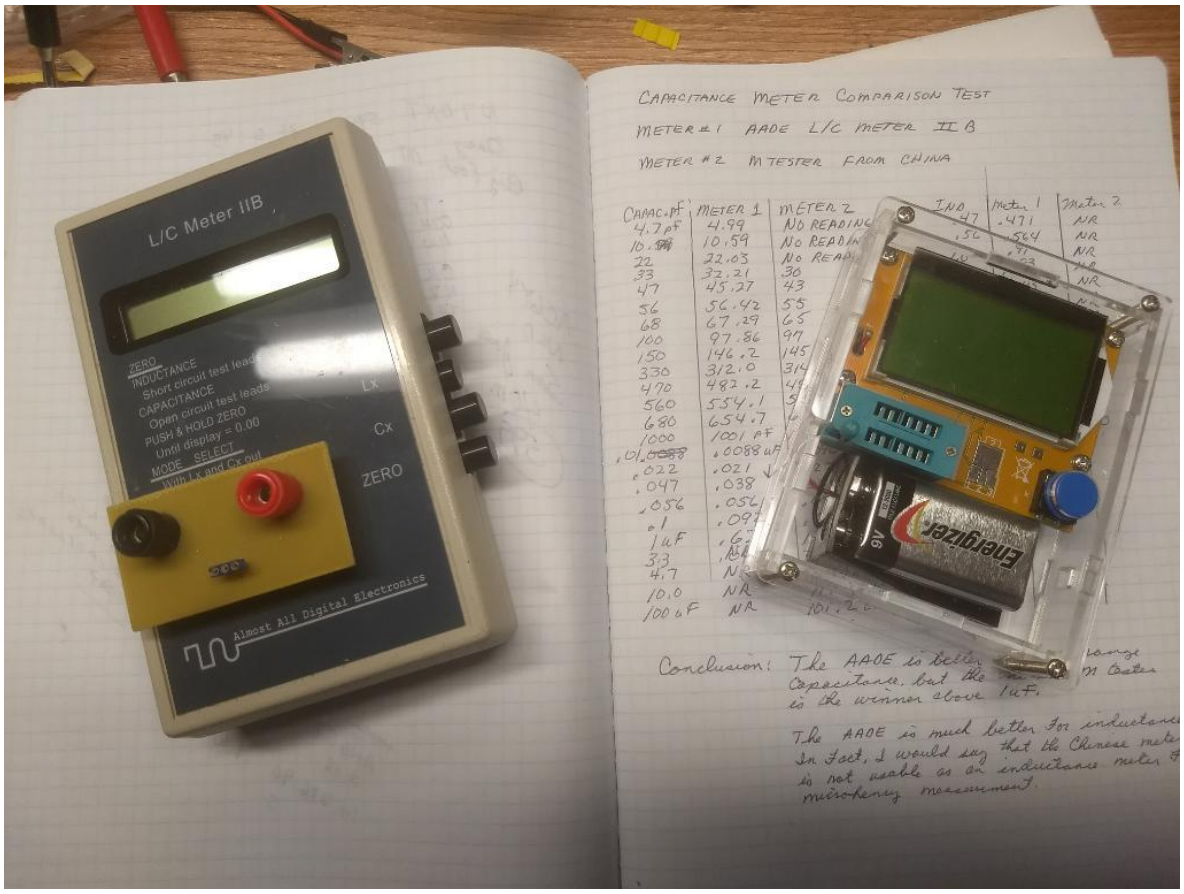
- The following modes are sequentially selected
    - **READY MEASUREn MODE** - measure Lx or Cx and display in nano units when applicable
    - **READY MEASUREu MODE** - measure Lx or Cx and display in micro units (ie: .01000 uF instead of 10.00 nF)
    - **READY MATCHn MODE** -

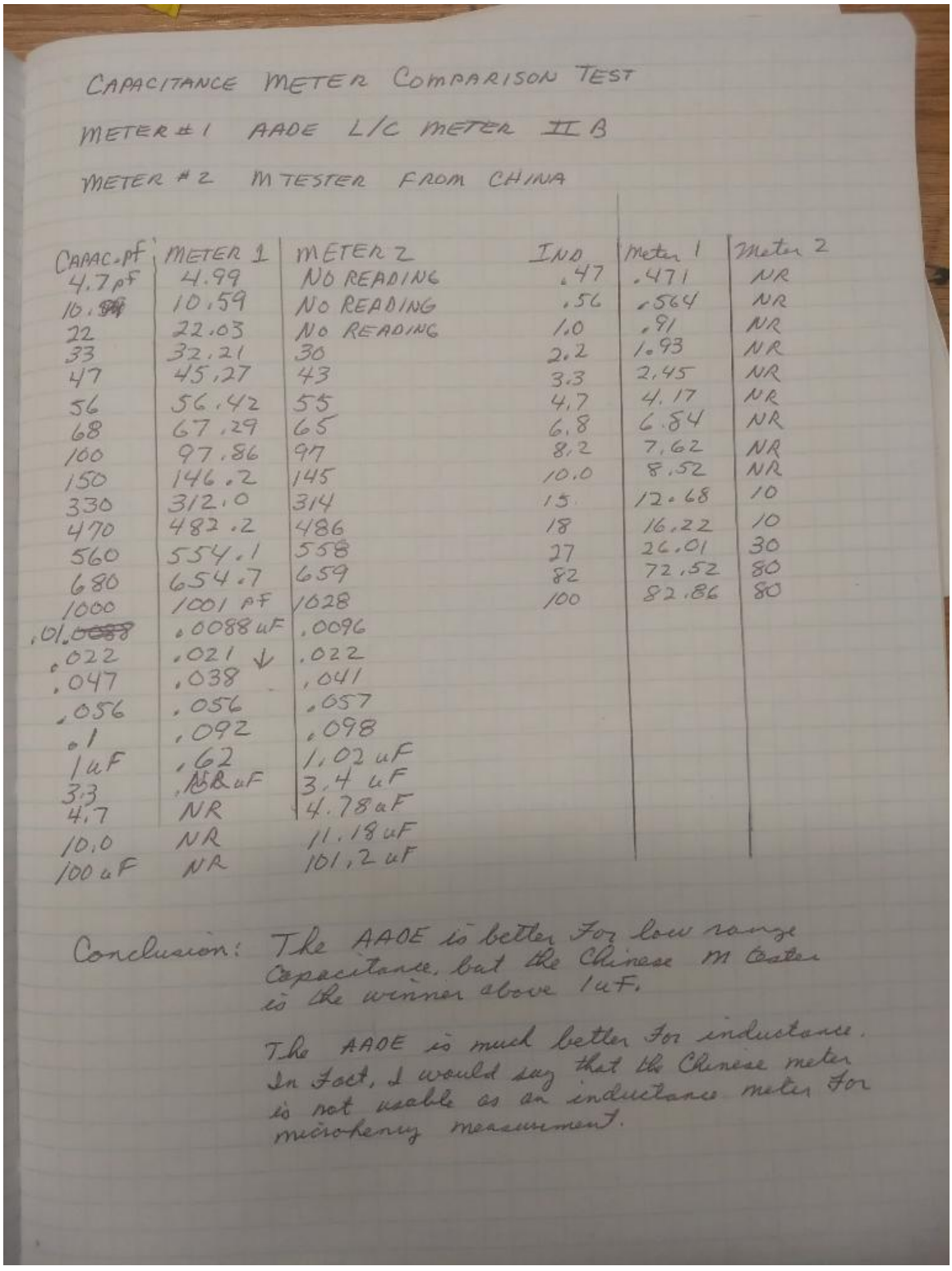
        - first measures your reference component Lz or Cz and displays its value in nano mode
        - measures subsequent components, Lx or Cx, and displays the difference (Lz-Lx) or (Cz-Cx) in nano mode
    - **READY MATCHu MODE** -
        - first measures your reference component Lz or Cz and displays its value in micro mode
        - measures subsequent components, Lx or Cx, and displays the difference (Lz-Lx) or (Cz-Cx) in micro mode
    - **READY MATCH% MODE**
        - first measures your reference component Lz or Cz and displays its value in nano units
        - measures subsequent components, Lx or Cx, and displays the percentage difference
            - (Lx-Lz)/Lz*100 or
            - (Cx-Cz)/Cz*100 as percent.
                - range is -100% to +9999%
                - maximum resolution is 00.01%
- L/C Meter IIB zeros out stray inductance and capacitance by storing their values in RAM and subtracting them from the measured values. It can zero out any value in its range allowing longer test leads and slightly improved accuracy over L/C Meter II.

L/C Meter IIB works by measuring the shift in frequency caused by inserting an unknown into it's oscillator tank circuit. A PIC16C61 micro-controller measures the frequency before and after. It then computes the value of the unknown using a floating point math package and displays the result on a 16 character intelligent LCD display.

L/C Meter IIB will NOT measure inductors designed for 60 or 120 Hz applications such as power transformers, filter chokes or motors. The minimum test frequency is about 20KHz and these devices have enormous core losses at that frequency. The LC Meter IIB is powered by a 9V battery, not included..

I decided to do a comparison of the two meters and did so in my lab. I have a pretty good selection of parts, and decided to measure all the capacitors and inductors that I have. Here are the results:


L/C Meter IIB
ZERO
INDUCTANCE
Short circuit test leads
CAPACITANCE
Open circuit test leads
PUSH & HOLD ZERO
Until display = 0.00
MODE SELECT
With Lx and Cx out
Lx
Cx
ZERO
Almost All Digital Electronics
CAPACITANCE METER COMPARISON TEST
METER #1 AADE L/C METER II B
METER #2 M TESTER FROM CHINA
CAPAC. pF
METER 1
METER 2
4.7 pF 4.99 NO READING
10.1 10.59 NO READING
22 22.03 NO READ
33 32.21 30
47 45.27 43
56 56.42 55
68 67.29 65
100 97.86 97
150 146.2 145
330 312.0 314
470 482.2 47
560 554.1 5
680 654.7 6
1000 1001 nF
.0068 .0088 uF
.022 .021
.047 .038
.056 .056
.1 .097
1 uF .6
3.3 N
4.7 N
10.0 NR
100 uF NR
IND.
47
56
Meter 1
Meter 2
.471 NR
.564 NR
NR
NR
NR
101.2
Energizer
9V
Conclusion: The AADE is better
Capacitance, but the M Tester
is the winner above 1uF.
The AADE is much better for inductance
In fact, I would say that the Chinese meter
is not usable as an inductance meter
microhenry measurement.



CAPACITANCE METER COMPARISON TEST

METER #1 AADE L/C METER II B

METER #2 M TESTER FROM CHINA

CAPAC. pF	METER 1	METER 2
4.7 pF	4.99	NO READING
10. ~~pF~~	10.59	NO READING
22	22.03	NO READING
33	32.21	30
47	45.27	43
56	56.42	55
68	67.29	65
100	97.86	97
150	146.2	145
330	312.0	314
470	482.2	486
560	554.1	558
680	654.7	659
1000	1001 pF	1028
.01 ~~.0088~~	.0088 uF	.0096
.022	.021 ↓	.022
.047	.038	.041
.056	.056	.057
.1	.092	.098
1 uF	.62	1.02 uF
3.3	~~.88~~ uF	3.4 uF
4.7	NR	4.78 uF
10.0	NR	11.18 uF
100 uF	NR	101.2 uF

IND	Meter 1	Meter 2
.47	.471	NR
.56	.564	NR
1.0	.91	NR
2.2	1.93	NR
3.3	2.45	NR
4.7	4.17	NR
6.8	6.84	NR
8.2	7.62	NR
10.0	8.52	NR
15	12.68	10
18	16.22	10
27	26.01	30
82	72.52	80
100	82.86	80

Conclusion: The AADE is better for low range capacitance, but the Chinese M tester is the winner above 1uF.

The AADE is much better for inductance. In fact, I would say that the Chinese meter is not usable as an inductance meter for microhenry measurement.

As you can see from my notes, I basically verified the specifications on both meters. I think that both meters have their place in the lab. I use them both. But the problem is that the AADE IIB is not available except on the used market. I talked with Steve Smith about this, and he told me that he has an

LC200A, which is basically the same meter as the AADE IIB. And it is available from $30 to $40 on Ebay depending on where you buy it. I couldn't resist, so one is on order and I will do another article in the next issue. To be continued. Doug, KI6DS.

CalQRP Club Project Number 1 – The NorCal 40A

by Doug Hendricks, KI6DS

Club projects are a popular item in qrp clubs. In fact, the Norcal 40 probably had as much to do with making them popular as any club project before or since. So, what better first project for the club than the Norcal 40A. Wayne Burdick, N6KR, designed the first Norcal 40 to kickstart Norcal. Boy did it ever. After the club sold 500 of them, we gave the design back to Wayne, along with the rights to use the name Norcal 40 for whatever purpose he deemed necessary.

We are going to do club projects a little bit different than most clubs. We will not sell kits or boards. In fact, the club will never take money for any purpose. We do not want the problems associated with a club treasury, so we won't have one. Simple, like the rest of the club. Here is how it will work. There will be an announcement of a club project. The announcement will include a construction article telling you how to build the project and align it. There will be a schematic, and a bill of materials, commonly called a bom. Gerber files will be provided so that you may get a board made. You do not have permission to take any club project and make it a commercial product. Just because you see it in print does not mean that you may use the information to make a commercial product. Think of it as being like 1975. In 1975, you would read an article in one of the ham magazines of the time. It would describe a project, and give you a schematic, parts list, and if there was a circuit board, you would get a pcb pattern that you could make your own board from. We will use the same process. That way, no one has to use their time ordering parts, stuffing and mailing kits, and doing all of the other things needed to produce a kit. If you want it bad enough, you will do the work yourself to obtain the parts.

When I order parts, I always order extra for my junk box. I think I have all the parts that I need to build my Norcal 40A in my parts stash. I will go through the parts list and tell you where you can get the parts. I suggest you order extras. The bom for the Norcal 40A contains part numbers for Digikey and Mouser, plus other sources. They are out of date and are not usable. To participate in the build here is what you will need to do.

1. Join qrp-tech. The address is qrp-tech@yahoogroups.com. The list is owned and maintained by Chuck Adams, K7QO. When you join, please read the rules. Chuck enforces them, and the list is very well run. No politics on this list. Remember, you are a guest. Here you will find lots of discussion about building the Norcal 40A

2. Go to the files section of CalQRP, download and print out the parts list, schematic, and Chucks building guide.
3. Get the parts.
4. Get the board. To do this you will have to download the Norcal 40A gerber files from the files section of CalQRP. Then you will need to send them to a board house. You may not profit from the sale of boards. Chuck does not want anyone to violate this rule. If you order multiple boards, you may only sell the extras for your cost. He also does not want anyone to become a "board distributor". By the way, no one has the right to make a commercial product from this project. The rights to this project, the Norcal 40A, belong to the designer Wayne Burdick, N6KR.
5. Once you have the board and the parts, start building. If you have questions, get on the CalQRP list or the QRP-Tech list and ask for help.

As we all know, Wayne helped Bob Dyer start Wilderness Radio, and the Norcal 40 became the Norcal 40A, and Bob sold thousands of them. Dr. David Rutledge of Cal Poly even wrote a textbook using the construction of a Norcal 40A to teach electronics. The Norcal 40A has been retired for several years and is no longer available. Chuck Adams, K7QO, wanted to do a special construction project for his yahoo group, QRP-Tech, which is at

qrp-tech@yahoogroups.com

If you are not a member, I strongly suggest that you join. Chuck realized that 2018 is the 25th anniversary of the Norcal 40. He has organized an operatiing activity for all versions of the rig. Both original club kits and the Wilderness Radio version. It is called the Norcal 40 Anniversary Party, or NAP for short. It starts on January 1, 2018 and runs through December 31, 2018. The objective is to operate and collect as many NAP numbers as you can during the year. NAP numbers are available from Chuck on qrp-tech.

Rahul Srivastava, VU3WJM, volunteered to lay out the board and make the gerber files available. That will happen as soon as there is a final board. That is a major contribution, and Rahul deserves our gratitude. There has been a long thread about the NAP project and I encourage everyone to read back through it all. Chuck has done a step by step building procedure and here it is:

NorCal40A Simplified Assembly Document

by Chuck Adams, K7QO

Thanks to Wayne Burdick, N6KR, for the use of the NorCal40A as a teaching exercise on qrp-tech in anticipation of the 25th anniversary of the transceiver. Thousands are assembled and ready to operate. The anniversary party is to get them all back on the air and making noise in the ionosphere and

music in the ears of operators worldwide.

The series of assembly steps shown here are a minimal assembly manual for all who wish to build the NorCal40A from the qrp-tech PCB. Experienced builders should not have problems. Others are asked to get local help, if possible, in order to avoid pitfalls and possible failure of the project. Don't be afraid to seek help. There is no kit of parts for this project. Consider it a scavenger hunt.

======Phase 1======================

Assembly steps.
- o Standoffs. Used to guarantee no shorts on power up.
- o J1 -- power connection
- o D7 -- 1N5817 Schottky diode
- o S1 -- power switch
- o C43 -- 47nF cap
- o C42 -- 10uF electrolytic cap
- o U5 -- 78L08 voltage regulator
- o C54 -- 47nF cap
- o C8 -- 47nF cap
- o C41 -- 100uF electrolytic cap

Testing.
- o Power up.
- o Measure current, if possible. Should be about 2mA or so.
- o U1--8 voltage measured 7.9V for my regulator.
- o U2--8 voltage measured 7.9V for my regulator.
- o U3--6 voltage measured 7.9V for my regulator.

======Phase 2 -- AF AMP======================

Assembly steps.
- o J4 -- Audio jack.
- o C26 -- 10uF electrolytic cap
- o R8 -- 500 ohm trimmer
- o R22 -- 1.8K (Leave off for beta boards. Causes oscillation.)
- o C27 -- 100uF electrolytic cap
- o C55 -- 100nF cap
- o U3 -- socket
- o C23 -- 2.2uF electrolytic cap
- o C22 -- 10nF cap
- o R7 -- 47K resistor
- o U3 -- LM386N into socket

Testing.
- o R8 -- maximum CCW rotation to minimize volume
- o PC Speakers at reduced volume
- o P/S on.
- o Turn volume up to see if you hear a hiss.

======Phase 3 -- AGC and Mute Circuits======================

Assembly steps.
- o C30 -- 2.2uF electrolytic cap
- o D6 -- 1N5817 or 1N1711 Schottky diode
- o D5 -- 1N5817 or 1N1711 Schottky diode
- o R5a-c -- Four matched 2.2M 1/4W resistors
- o D1 -- 1N4148 silicon diode
- o D2 -- 1N4148 silicon diode
- o D3 -- 1N4148 silicon diode
- o D4 -- 1N4148 silicon diode
- o C28 -- 100nF disc or mono cap
- o C20 -- 100nF disc or mono cap
- o C21 -- 100nF disc or mono cap
- o C19 -- 10nF disc or mono cap
- o Q2 -- J309 JFET or equivalent
- o Q3 -- J309 JFET or equivalent
- o C29 -- 10uF electrolytic cap
- o R3 -- 150K resistor
- o R4 -- 8.2M resistor
- o R6 -- 10K variable resistor

Testing.
- o Set R6 to mid position.
- o Power up transceiver. Touch test probe at pads U-4 and U-5 of U2. A noise should be heard in speaker or headphones.
- o Then the hiss will disappear and then come back after a few seconds or so.

======Phase 4 -- Product Detector and BFO================

Assembly steps.
- o X5 -- 4.915MHz crystal
- o C17 -- 50pF variable cap
- o U2 -- insert and solder socket into place

o C15 -- 2.2uF electrolytic cap
o C14 -- 47pF disc or mono cap
o C18 -- 270pF disc or mono cap
o U2 -- NE602A IC into socket inproper orientation

Testing.
o Power up. Touch test probe to pin U2-1 of the NE602 and you should hear an
increase in noise in the speaker or headphones.

o If you have an AFA or frequency counter, see if you can
measure a frequency reading on pin 7 of U2.

o If you have a crystal oscillator, take one of the other
IF crystals and power up the oscillator with one of
the crystals in it. With the oscillator near the NC40A,
you should hear a tone in the speaker or headphones.

o Adjustment of C17 should vary the tone heard with
external signal source.

o Measure about 1.4V or so at U6-5 and U6-2.

======Phase 5 -- IF Crystal Filter======================

Assembly steps.
o L4 -- 18uH molded inductor
o C13 -- 270pF disc or mono cap
o C12 -- 270pF disc or mono cap
o C11 -- 270pF disc or mono cap
o C10 -- 270pF disc or mono cap
o C9 -- 270pF disc or mono cap
o X1 -- 4.915MHz crystal
o X2 -- 4.915MHz crystal
o X3 -- 4.915MHz crystal
o X4 -- 4.915MHz crystal

Testing.
o Power up transceiver as before.
o Touch test probe to either pad of C9 or pad 3 of T3 and
you should hear an increase in noise in
the speaker or headphones. Note that the frequency range of the
noise is reduced from previous tests because of the band pass
frequency range of the IF filter. The noise level will be

reduced in amplitude also.

======Phase 6 -- Receive Mixer==========

Assembly steps.
 o T3 -- FT37--61 toroid with 23T of #28 (primary); 6T of #26 (secondary).
 o C6 -- 47pF disc or mono cap
 o C5 -- 10nF disc or mono cap
 o U1 -- insert and solder 8-pin socket
 o U1 -- NE602A IC into socket with correct orientation
 o C4 -- 5pF disc or mono cap

No test at this time without VFO operating.

======Phase 7 -- Receiver Band Pass Filter (BPF)==========

Assembly steps.
 o T2 -- FT37-61 20T #26 (secondary); 1T #26 (primary)
 o C2 -- 50pF variable capacitor
 o R2 -- front panel 1K RF gain control
 o L1 -- 15uH molded inductor
 o C1 -- 50pF trimmer cap
Part of muting circuit.
 o Q1 -- 2N4124 NPN transistor
 o C3 -- 47nF disc or mono cap
 o R1 -- 1.8K 1/4W resistor

No testing done at this time.

======Phase 8 -- VFO Section and RIT==========

Assembly steps.
 o C7 -- 10nF disc or mono cap
 o C32 -- 150pF disc or mono cap
 o R23 -- 1.8K resistor
 o RFC2 -- 1mH molded inductor
 o Q8 -- J309 or equivalent JFET
 o C52 -- 1200 poly cap
 o C53 -- 1200 poly cap
 o D9 -- 1N4148 silicon diode
 o R21 -- 47K resistor
 o C51 -- 390pF poly cap

o L9 -- 21uH toroid inductor, 60T of #28 on T68-7 toroid
o C50 -- 2-25pF air trimmer cap or omit and later friction
fit C0G or NP0 cap with value between 2-25pF to
bring VFO lower range to desired value
o C49 -- 47pF NPO or C0G cap
o D8 -- MVAM108 varactor diode or equivalent
this will determine tuning range
o R19 -- 47K resistor
o R20 -- 4.7K resistor
o R15 -- 510 ohm resistor
o U6 -- socket
o U6 -- LM393 IC
o R17 -- 10K front panel tuning pot
o R16 -- 1K front panel RIT pot
o S2 -- front panel on/off RIT switch

Testing.
o If you have a frequency counter, power on and measure
frequency at U1-6, the VFO input into the receiver mixer.
With RIT off, adjust VFO tune pot to lowest frequency
of the VFO. Make adjustments to get this plus the IF
frequency to the lowest range of operation on 40m you
want. Usually this will be 7.025MHz.

======Phase 9 -- Key Switch====================

Assembly steps.
o Q4 -- 2N3906 PNP transistor
o R24 -- 150K resistor
o R9 -- 47K resistor
o D11 -- 1N4148 silicon diode
o C57 -- 47nF disc or mono cap
o C36 -- 47nF disc or mono cap
o R25 -- 100 ohm resistor
o C48 -- 10nF disc or mono cap

Testing.
o Power up transceiver.
o See if receiver can hear any 40m signals with short wire
CAREFULLY touching pad common C44, L7 or C45. At least
atmospheric noise levels. Adjust C1 for maximum noise.
o Short keyline at J3 to ground.
o Receiver should mute.
o 8V level voltage should at U4-8 when keyline shorted to ground.
After short or key closure is removed, receiver should become

active again. Delay may occur due to muting time constant.

======Phase 10 -- Transmit Mixer, Bandpass Filter, and Buffer==========

Assembly steps.
- o C31 -- 5pF disc or mono cap
- o C38 -- 100pF disc or mono cap
- o C34 -- 50pF variable trimmer cap
- o C35 -- 270pF disc or mono cap
- o C37 -- 5pF disc or mono cap
- o C33 -- 47nF disc or mono cap
- o R10 -- 510 ohm resistor
- o L6 -- T37-2 red toroid with 28T of #28 AWG magnet wire
- o L5 -- 18uH molded inductor
- o X6 -- 4.915MHz crystal
- o Q5 -- J309 or equivalent JFET transistor
- o R11 -- 510 ohm resistor

Testing.
- o power up transceiver
- o key the transmitter
- o should hear a weak tone in the receiver
- o adjust C34 to see if tone changes and set to desired tone for monitoring while operating CW

==========Phase 11 -- Transit Driver circuit==========

Assembly steps.
- o Q6 -- 2N2222A plastic transistor with ferrite bead on base
- o R12 -- 20 ohm resistor
- o R13 -- 500 ohm variable resistor (set full CCW)
- o C56 -- 10uF electrolytic cap
- o D10 -- 1N5817 Schottky diode
- o C48 -- 10nF disc or mono cap (if not already installed)
- o T1 -- FT37-43 toroid 14T \#26; 4T \#26
- o R14 -- 100 ohms reverse of silkscreen on beta board

Testing.
- o power up transceiver
- o key transmitter
- o tone heard in receiver should increase as R13 is turned clock wise.

==========

WARNING. From this point forward. The transceiver should NEVER be keyed without a 50 ohm dummy load on the ant output connector or a tuned antenna for 40 meters. The PA will be damaged due to high SWR and resulting voltages on the collector of the PA if this is not done.

==========

==========Phase 12 -- Transmitter PA and LPF==========

Assembly steps.

- o R18 -- 1K resistor
- o RFC1 -- 18uH molded inductor
- o C44 -- 47nF disc or molded inductor
- o C45 -- 330pF disc or mono cap
- o C46 -- 820pF disc or mono cap
- o C47 -- 330pF disc or mono cap
- o D12 -- 1N4755A 43V 1W zener diode
- o Q7 -- 2SC799 or equivalent, or D882 in inline pads

==========

This completes assembly of the components on the PCB. Work now must be done to put transceiver in an enclosure of your choice with all controls, switches, power connector and antenna connector (BNC). Then transceiver must be tested with dummy load and power measured and adjusted. Several dummy loads with diode detection can be used to do this.

See qrp-tech at yahoo groups for information and help, if needed.

Everything has been done in creation of these steps above. Double check all your work and follow the schematics as you build and look for deviations. Discussions will be in progress on substitute parts in future discussions on qrp-tech.

73 and good luck,

chuck adams, k7qo

The Norcal 40 Parts List

The original Norcal 40A parts list from 1999 is available in the files section. It contains parts numbers, but most of them are no longer valid. After all, the list is 18 years old!! I will take it section by section and tell you where you can obtain the parts. It is important that you buy the right type of parts. Not all capacitors are created equal. It does make a difference. To be safe, you should use NPO or c0g capacitors for any cap listed in picofarads, designated by pF. Also, pay attention to the lead spacing of the parts that you order. I like to order .1 inch radial leads, or sometimes they use 2.5 mm. The reason I prefer this size is that you can bend the leads if the board has wider spacing, but it looks kind of hokey if the board has .1 inch spacing for a cap, and you have to bend .2 inch leads to fit. It will still work, but I like my projects to look nice. You can find the npo and c0g caps at Kits and Parts.com or Digikey. Mouser has some of them too. If you are local to San Jose, HSC, Anchor and Excess Solutions all have a nice selection. The electrolytics can be ordered from Mouser or Digikey. Diz at Kits and Parts has the polystyrenes.

Now we come to the variable caps. C50 is an air variable that is used to adjust the frequency coverage. Chuck and others suggest using an old Dave Benson trick. Dave used to ship 3 or 4 npo caps and you would pick the one that gave you the coverage that you wanted. You test it by friction fitting the cap, making a measurement and then soldering in the cap after you determined the one that you want. I suggest that you do the same. The air variable is available from RF Parts, but it is expensive, $3.50. But the problem is that the minimum order is $20 plus shipping. Much easier to use the method that Chuck suggests. I would order a 10pF, 12pF, 15pF, 18pF, 22 pF and a 27pF, and pick the one that works the best. You will squeeze the turns of the toroid to set the frequency. The rest of the variable caps are available from Diz, just order the trimmer caps that are 8-50pF trimcaps. The rest of the caps are just common 20% caps, but be sure to use mylar where specified. You can use either disc or mono caps for the .047uF, .01uF and the .1uF bypass caps. That takes care of the caps.

The diodes are available from Kits and Parts. You can use the MVAM109 or use a 1N4007 in its place.

Next we have the inductors. I would order the molded inductors from Tayda Electronics on the web. The toroids and magnet wire are available at Kits and Parts, and as you are already ordering from Diz, go ahead and add the them to your order.

The connectors and can be ordered from Tayda. The resistors from Mouser or Digikey. You will need to match 4 2.2M resistors for the resistor network called for at R5. The trimpots are available from Tayda, as are the pots. I would order the 10 Turn pot from ebay. I have ordered several and they work fine.

The transistors are all available from Kits and Parts. Use a J310 for the J309. Use a BD139-16 for the final. The IC's are available here too, except for the LM393, which you can order from Mouser. The voltage regulator is available

from Tayda. See qrp-tech for information on the crystals. The rest of the hardware can be sourced locally.

First California QRP Club Meeting

By Doug Hendricks, KI6DS

November 5, 2017 was the date of the inaugural meeting of the newly formed California QRP Club, which is called CalQRP. The meetings are held at Denny's at 1140 Hillsdale in San Jose. We meet from 1 – 3 on the first Sunday of the month. Everyone is welcome.

I decided to get there a little early, as I needed to verify with the manager that it was ok for us to meet there. He was very gracious and happy to have us there. I finished talking to the manager, and turned around. There stood Steve Smith, WB6TNL, who is the co-caretaker of CalQRP with me. Steve was supposed to come to Pacificon, but had his trip canceled due to medical problems. I was thrilled to see him. We had a great turnout with the following there. Bob Mix, Ori Mizrahi-Shalom, Barbara Mizrahi-Shalom, John Sutter, Lynn Johnson, Vic Black, Vladimir Rytikof, Ned Tully, Mike Flueguemann, Steve Smith, and Doug Hendricks.

Bob Mix brought his new SDR receiver that covers 1kHz to 2 Ghz. It was amazing to see and listen to. Vic Black brought his Sota setup, which is a KX2 and an Alex Magnetic Loop antenna. Vic has worked his way up to number 40 in California as a Sota chaser. Quite an accomplishment as there are several hundred participating. Mike brought his Spanish qrp radio and his mfj set up along with his buddypole. I had my KX2 and my UnUnTenna from QRPGuys. It was pretty neat to see the 31 foot Sota Beams pole up in the air with the UnUnTenna. We worked a station in British Columbia with the KX2. Got a 5 and 9 plus a comment that it was a loud signal for qrp. Vladimir brought his KX2 and his MFJ 20 meter whip, but quickly abandoned it for the other antennas that were setup.

John Sutter brought his power meter that may turn in to a club kit later on. He wants to chance the microprocessor to an arduino chip so that it will be easier to reproduce.

We had some nice give-a-ways. Ori brought a whole box of books, including many back issues of QRPp. They didn't last long. Vladimir brought an adjustable power supply from China, and a 2 MHz. function generator. Both in working order. Steve Smith brought Altoids tins donated by a member in Reno. I did not catch his name, but thanks for the donation.

We had a great time and it sure was a lot of fun. Everyone commented on how easy it was to get there with no traffic compared to the usual Tuesday night fight on the freeway.

And we announced that the first CalQRP kit would be the Norcal 40A from QRP–Tech. Thanks to Chuck Adams for doing all of the work he has done and for giving us permission to be a part of it. John Sutter is way ahead of us as he is building a beta board and has it about ½ done. Looks great so far.

John Sutter shows the group his latest project, a digital power meter. We compared it to the power meter in the KX2 and it tracked very well.

The Power Meter

Here you can see the 3 antennas at the meeting. The Buddy Pole is in the foreground, next is the UnUnTenna and in the back is the Alex Loop.

Mike Flueguemann with his Buddy Pole.

Vic Black and his Alex Loop

Goodies brought to the meeting. Look real close and you can see the Norcal 40A beta board brought by John Sutter.

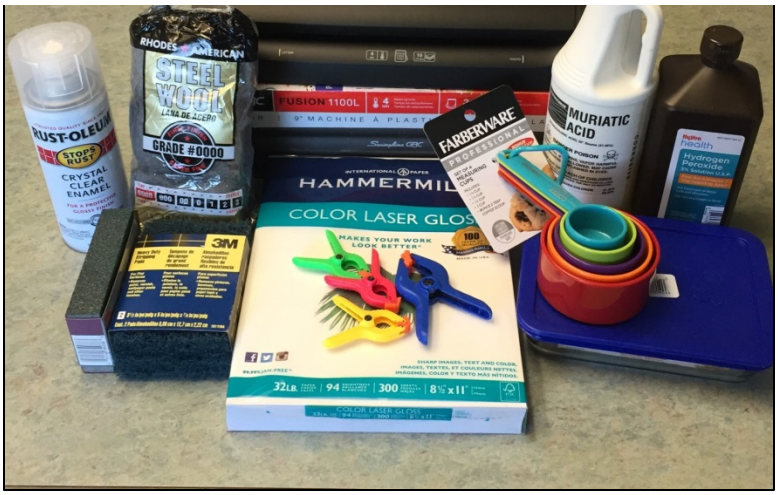
"Herb'sNotes"
So you want to make your own circuit boards?

By Darrel Swenson, KØAWB

Chuck Adams, K7QO, has developed a simple process for making repeatable individual circuit boards over the past few years. Chuck uses the process to make his MUPPET boards, but the process will work for making any simple single or double sided circuit board.

The purpose of this article is not to improve or refine Chuck's process. The purpose of this article is to combine all the pieces of documentation (You-Tube, e-mails, QRP-Tech, and Chuck's Lab Book) into a single simple "how to process".

Think of this article as the CliffsNotes® of circuit board construction (with apologies to Cliff Hillegass.)



You will need the following items:

☐ A circuit board layout. You will want a PDF of the layout, 1:1 (actual size), Mirrored or Reflected. I.E. printed as though you were looking through the board, the text will be reversed.

☐ A Samsung Laser Printer, M2020W and ML-2545 are examples. Almost any < $150 Samsung printer will work. Many times Samsung printers are on sale for $50-70.
[Any laser printer will work but the toner in Samsung printers melts at a lower temperature making them better for this process. I have also used several Brother printers with good results.]

☐ Hammermill Color Laser Gloss Paper. This is available in most Office Supply Stores.

☐ PCB material. 0.060", single sided. FR-4 material. Available at the *abcfab Store* on EBay. Google for other sources.

☐ 3M Heavy Duty Stripping Pads. Available near the paint department.

☐ GBC BadgeMates laminator, Swingline GBC laminator, or similar laminator. These are available in most Office Supply Stores or online.
[An ordinary clothes iron will also work, but it takes a lot of pressure.]

☐ Small plastic clamp for holding hot PCB material. A clothespin will also work.

☐ Pyrex or similar 3 cup/750 ml flat glass dish.

☐ Plastic 1/4 cup (and 1/8 cup) measuring cups for measuring the etching fluids.
[See note at end for correct measuring cups to go with Muriatic Acid.]

☐ Plastic spoon

The clamp, dish, measuring cups, and spoon are available in most "big box" discount stores.

☐ Hydrogen Peroxide (2%) Available in almost any drug store or drug counter.

☐ Muriatic Acid (14.5% HCl) available at Swimming Pool Supply stores.
Muriatic Acid (31.45% HCl) is a 2nd choice; it is available at Pool or Hardware stores. [See notes in text and at end.]

☐ #0000 Steel Wool (gives a smooth finish.) Available near the paint department.

☐ Clear enamel spray paint. Available in the paint department.

Step by Step Process

1. Print your PCB layout on the Hammermill paper using the Samsung Printer.
   If you are using a layout from a construction article make sure it is 1:1 and "reversed or mirrored". If not, scan the layout into a .PDF document so you can manipulate the image. If you are making your own layout from ExpressPCB or a similar program; print your layout to a .PDF document and then "flip, reverse, or mirror" the image. (How you "flip, reverse, or mirror" will depend on the programs and operating system you are using. Google is your friend.)
   The object is to get the image on top of the paper so it looks like you are looking through the PC board to the layout. Then when you transfer the image to the PCB it will be right side up.
   While just about any laser printer will work for this, the toner in the Samsung printers melts at a lower temperature making them ideal for this process. I have also used several Brother printers with good results.

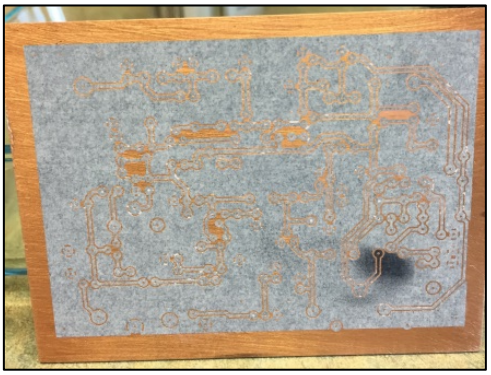
   [While you are cleaning your PCB material in the next step, turn on your laminator and let it warm up.]

2. Chuck recommends 0.060", single sided, FR-4 PCB material. The abcfab Store on E-bay is one source. (There are many sources… Google…)
   Prepare your PCB material by cleaning it to remove any glue, oils, finger prints, etc. Then lightly sand the surface of the PCB material with the 3M Heavy Duty Stripping Pad. You do not necessarily want a perfectly smooth surface at this step. The toner will stick better to the lightly roughed up surface.

3. Run the PCB material through the laminator 5 to 6 times to heat it up before attaching the paper. (IF you have an infrared thermometer the board should be >100°F or > 40°C by this point.)
   CAUTION – The PCB material will be **VERY HOT** by this time, use a clothespin, plastic clamp, or similar instrument to handle the **HOT PCB**. Be careful not to burn yourself or anything else.

4. Cut your paper layout so it is approximately the same size as your PCB board. Lay the paper layout on the PCB, lining it up carefully. [Remember the PCB is **HOT**.] Run the paper/PCB pack through the laminator another 5 to 6 times. (Again if you have an infrared thermometer the board/paper pack should be 190-200°F or 90°C by this point.)

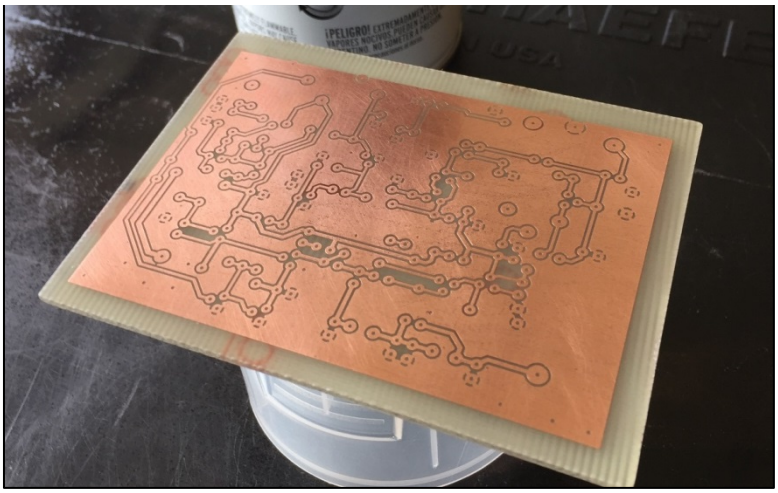
5. Allow the PCB/Paper pack to cool slightly (1-2 minutes) then put it in a tray of warm water and let the paper soak off for 5 minutes. You may have to peel gently to get all the paper off. The toner should be pretty well attached to the PCB at this point so you can rub, just don't scrape hard enough to remove the toner.
   [If something does not work right, you can remove the toner with acetone and start over.]



6. Mix 2 - 1/4 cup measures (1/2 cup) of Hydrogen Peroxide (2%) with 1/4 cup of 14.5% Muriatic Acid in the Pyrex dish.
   NOTE: if you could not find 14.5% Muriatic Acid and are using 31.45% Muriatic Acid, mix 2 - 1/4 cup measures (1/2 cup) of Hydrogen Peroxide with 1/8 cup of 31.45% Muriatic Acid. [See additional notes at the end of this article.]
   DO NOT use metal trays or instruments. **ALWAYS** add the Acid last.

7. Slowly place the PCB board into the Pyrex dish with the Peroxide/Acid solution. Use a plastic spoon to gently move fresh solution over the board. The process should take 5 minutes or so, depending on the size of the board and the freshness of the solution. When the copper is removed from the exposed areas, remove the board and rinse with water.

8. Use the #0000 Steel Wool to remove the toner and polish the copper traces on the board. Then spray a very thin coat of clear enamel spray on the board and let it dry.



That's it. You have a Printed Circuit Board.

NOTES

HOLES if needed can be drilled with a small drill press (cheap) and small bits (0.030, 0.035, 0.040, etc.) Use a drill press; you will break lots of bits with a handheld drill.

IF you live in an area without year around swimming pools, you may have trouble finding the 14.5% Muriatic Acid. Apparently it is not used as much in areas where pools are not in use all year long. I checked 6 Pool Supply Stores and 3 Big Box Hardware stores. They either didn't have Muriatic Acid or only had 2 gallon packages of 31.45% Muriatic Acid.

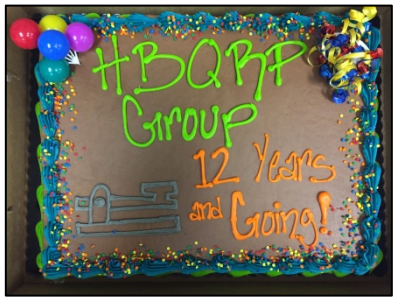
The Ace Hardware Stores near me all have quart plastic bottles of 31.45% Muriatic Acid for less than $5.00. Look in the paint cleaner area. This size was much closer to the amount I needed.

I checked with Chuck and he said the 31.45% Muriatic Acid would work just as well mixed 1 part acid and 4 parts Peroxide. I used 2 - 1/4 cup measures (1/2 cup) of Hydrogen Peroxide with 1/8 cup 31.45% Muriatic Acid and it worked fine.

You can use a 1/4 cup measure for the Hydrogen Peroxide, but it is much easier to measure the 31.45% Muriatic Acid with a 1/8 cup measure. If you have trouble finding 1/8 cup measuring cups, plastic coffee measures are usually 1/8 cup.

FINALLY these directions were written in 2016. They were accurate at the time of publication. If you are reading this in 2026, you may have to find substitutes for the Laser Printers, Laminators, Paper, and maybe some of the other items.

HBQRP Group celebrates 15th Anniversary



The Eastern Nebraska HBQRP Group celebrated their 12th anniversary with 19 people attending for cake and ice cream at the regular meeting November 12th, 2016. The group meets the 2nd Saturday of the month at Breadeaux Pizza, 1425 Silver St., Ashland, NE 68003. Ashland is about half-way between Lincoln and Omaha Nebraska, just north of exit 420 or exit 426 on I-80.