

NorCal40A Simplified Assembly Document]
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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.

See <<http://www.k7qo.com/>> for lots of information.

=====Phase 1 -- Power and 8V Regulator=====

Assembly steps.

- o Standoffs. Used to guarantee no shorts on power up.
- o J2 -- power connection
- o D7 -- 1N5817 Schottky diode
- o S1 -- power switch
- o C43 -- 47nF cap, disc or mono
- o C42 -- 10uF electrolytic cap
- o U5 -- 78L08 voltage regulator
- o C54 -- 47nF cap, disc or mono
- o C8 -- 47nF cap, disc or mono
- 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 Rz -- 10 ohms (mod to NC40A, Zobel filter)
- o Cz -- 100nF (mod to NC40A, Zobel filter)
- o R8 -- 500 ohm trimmer
- o R22 -- 1.8K 1/4W resistor
- o C27 -- 100uF electrolytic cap
- o C55 -- 10nF cap, disc or mono
- o U3 -- socket
- o C23 -- 2.2uF electrolytic cap
- o C22 -- 10nF cap, disc or mono
- o R7 -- 47K 1/4W 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.
- o Insulated wire with 1mm exposed, probe R7, either end.
Should hear increase in noise level in speakers.

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

Assembly steps.

- o C29 -- 10uF electrolytic cap
- 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 R3 -- 150K resistor
- o R4 -- 8.2M resistor (this may be changed later for sidetone level)

- o R6 -- 10K variable resistor, small trimmer

Testing.

- o Set R6 to mid position.

- o Power up transceiver. Touch test probe at pads U-4 and U-5 of U2. An increase in background noise should be heard in speaker or headphones.

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

Assembly steps.

- o C17 -- 50pF or 60pF variable cap

- o X5 -- 4.915MHz crystal

- 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 right pad of L4 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. There is an empty pad to the right of C17 for this purpose.

- 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 with a DMM.

=====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.
- o Can use remaining crystal with crystal oscillator/tester to generate a signal.

=====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 C32 -- 150pF disc or mono cap
- o C7 -- 10nF 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 voltage 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
- o U4 -- socket
- o U4 -- NE602 IC into socket
- o C39 -- 50pF variable capacitor

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 -- Transmit 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, trimmer (set full CCW)
- o C56 -- 10uF electrolytic cap
- o D10 -- 1N5817 Schottky diode
- 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.

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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.

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

Assembly steps.

- o R18 -- 1K resistor
- o RFC1 -- 18uH molded inductor
- o C44 -- 47nF disc or mono cap
- 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
- o L7 -- T37-2 18T #26
- o L8 -- T37-2 18T #26

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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,

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