



SDR Cube Transceiver

Online

Assembly

Guide

Detailed construction notes for building and testing each of the SDR Cube kit modules

[Home](#) [Bill of Materials](#) [I/O Board](#) [Controls Board](#) [DSP Board](#) [Softrock SR-Base](#) [Softrock TX/PA](#)
[RXAMP](#) [X-LPF](#) [Internal Cable Set](#) [External Cable Set](#) [Main Enclosure](#) [Accessory Enclosure](#)
[Digital Subassembly Test](#) [Final Assembly](#) [RF Functional Test](#)

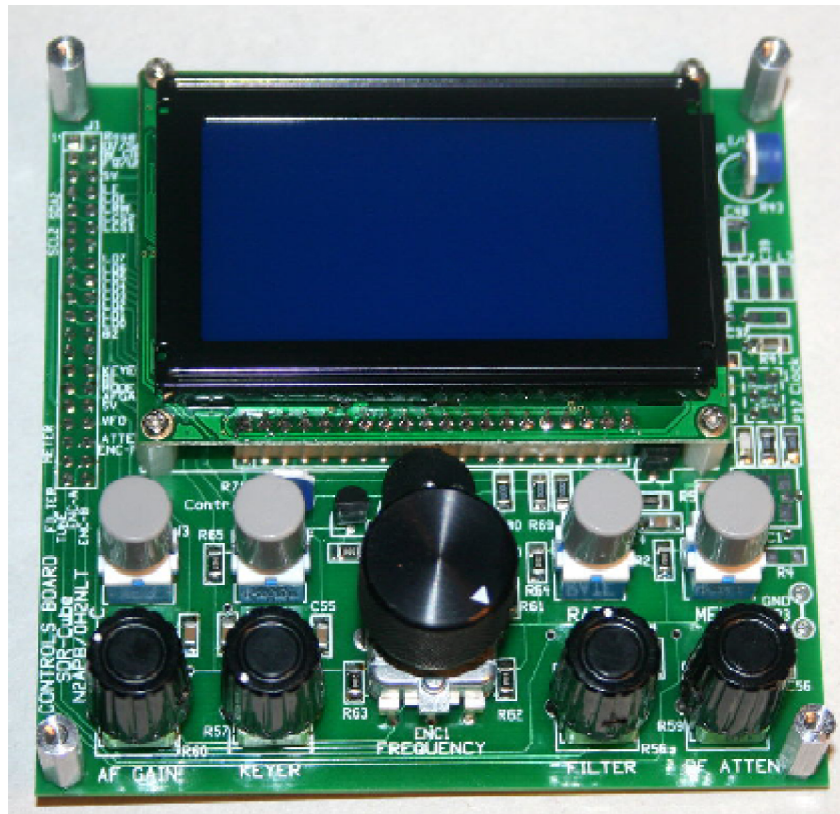
Building the Controls Board

... (Section version 1.0a)

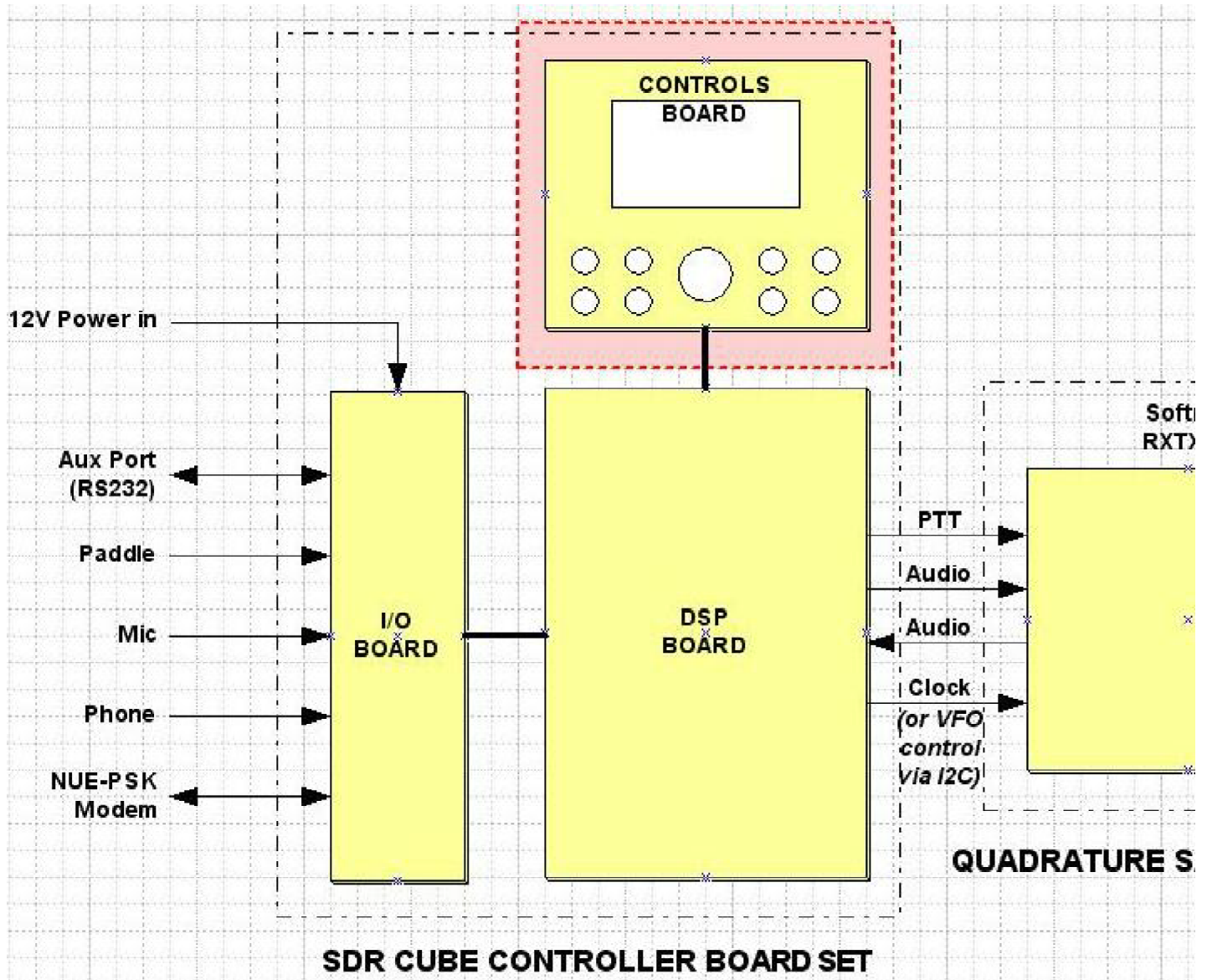
What Is It?

The Controls Board serves as the main user interface, providing the controls and display for the operator to control the radio in every way. It sits directly behind the front panel of the enclosure and connects to the DSP board by direct plug-in on its edge-mounted 2x20 position socket.

Assembling the SDR Cube Transceiver



Controls Board

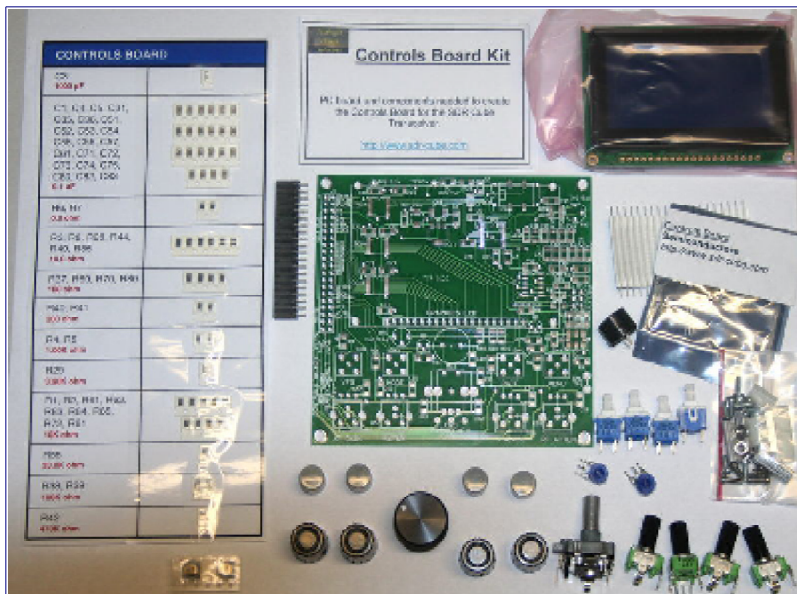


CONSTRUCTION STEPS

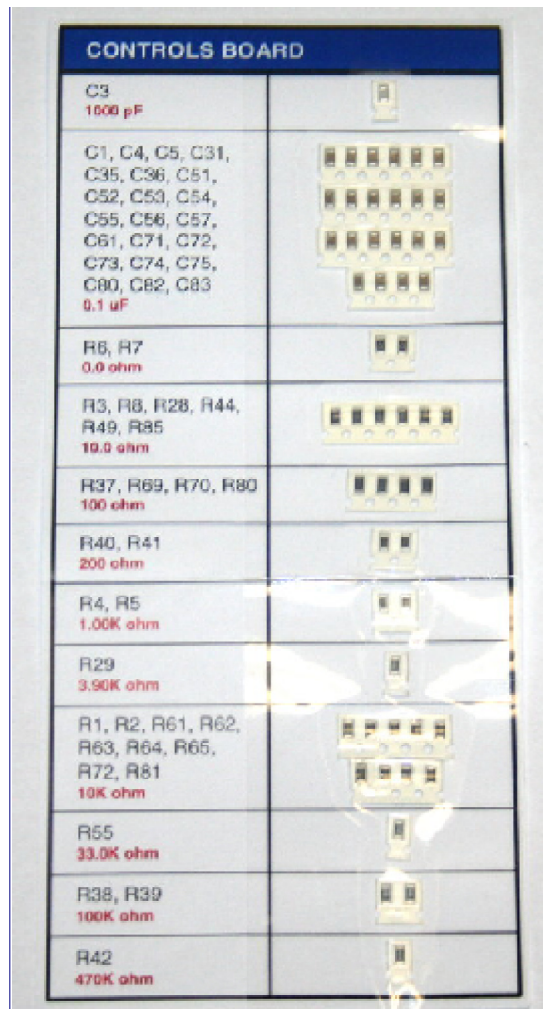
☐ **STEP 1:** Inventory the supplied parts

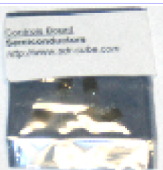
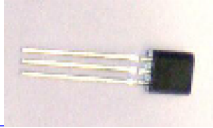
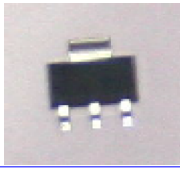
Check to make sure you received the Controls Board Kit bag and all the components that are pictured below. (Click on any photo to see a larger image.)

Assembling the SDR Cube Transceiver



Assembling the SDR Cube Transceiver



Designator	QTY	Description	
Anti-Static Bag			
	1	Anti-Static Bag	
Q2, Q3	2	MOSFET N-CH 60V 350MA TO-92	
IC11	1	IC, LDO REG FXD 3.3V 800MA SOT223	
IC13, IC14	2	IC, Octal Level Shifting Buffer, TXB0108 (TSSOP-20)	

Assembling the SDR Cube Transceiver

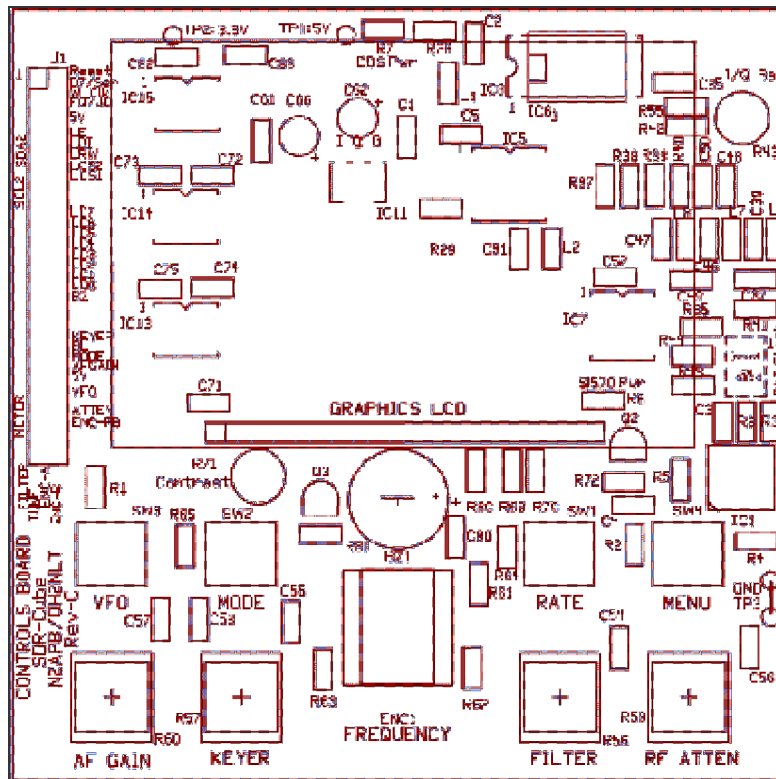
Loose			
BZ1	1	Piezo buzzer	
C62, C66	2	CAP 10UF 35V ELECT FC SMD	
ENC1	1	Encoder, Rotary, 11MM VERT 20PPR (ACZ11BR4E-15FD1-20C)	
J1	1	Receptacle, 40P 2ROW STRT SOCKET (2x20, 0.1") (rear mounted)	
LCD	1	LCD, CFAG12864, 128x64, graphics	
R43, R71	2	Trim Pot, 10K	
R56, R57, R59, R60	4	Resistor, POT 100K OHM	
SW1, SW2, SW3, SW4	4	Pushbutton, DPST, momentary "PVA1 OA H1"	
W1	1	Flex Cable, 20-wire, 1", 0.1" (FSN-21A-20)	
PCB-Controls	1	PCB, Controls	

Assembling the SDR Cube Transceiver

	4	Cap, Pushbutton, Gray, 8.8x10.5mm Rnd	
	4	Knob (pots), BLACK .50 D X .61 H, 6.35mm shaft	
	1	KNOB BLK GLOSS.75"DIA .250"SHAFT KNOB BLK/MATTE.75"DIA .250"SHAFT	
HARDWARE BAG			
	8	Machine screw, pan slotted, #2- 56x1/4"	
	4	Spacer, nylon, hex tapped, #2, 3/8" (LCD)	
	4	Spacer, AL, hex tapped, #2, 9/16" (0.562"), (PCB)	
	4	hex nut, #2 (spacer), "2057", .060" thick	
	8	machine screw, #2-56, 1/4", phillips, fillister head	

PARTS LAYOUT diagrams for the Controls Board ...

Assembling the SDR Cube Transceiver



(click graphic for larger view)

STEP 2: Install the Octal Level Shifting Buffers (IC13 and IC14), as found in the Semiconductor Bag

The lead pitch on these IC legs is small, and you will likely need to use the "flood and solder" technique. (Refer to this topic on the Home page for reference on how to attach SMT ICs.)

☐ IC13

☐ IC14

STEP 3: Install the 3.3V regulator (IC11), as found in the Semiconductor Bag

This is an easy SMT IC to attach. Just align the legs of the IC over the pads, tack solder one leg to hold it in place, then solder the other two legs and the larger metal tab to the larger pad.

☐ IC11

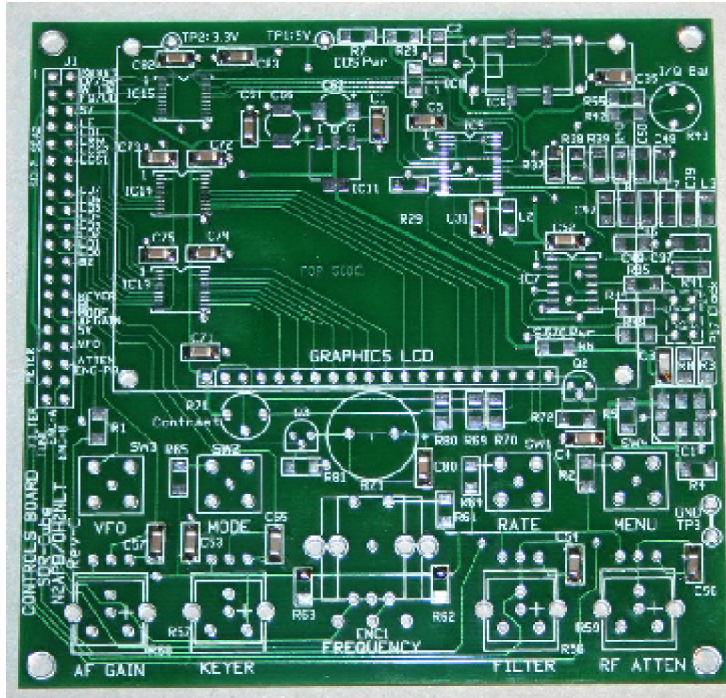
STEP 4: Install the surface mount capacitors and resistors from the SMT Card.

Using the order of the parts as listed on the SMT card as a guide, and the Parts Layout diagrams above (and on the board's silkscreen) as a guide, first attach the capacitors to their respective pads ...

☐ C3

☐ C1, C4, C5, C31, C35, **C36, C51**, C52, C53, C54, C55, C56, C57, C61, C71, C72, C73, C74, C75, C80, C82, C83 ... **NOTE:** C36 and C51 are no longer used on the board and the parts should not be installed. **HOWEVER** ... use one of these unused caps as shown at the C58 step later down this page.

Assembling the SDR Cube Transceiver



Next, attach the resistors to the board, in the order they are listed on the SMT parts card ...

☐ R6 ... **NOTE:** Only install R6 if you will be using an onboard Si570 clock generator (IC1).
Otherwise, do not populate the R6 position!

☐ R7

☐ R3, R8, R28, R44, R49, R85

☐ R37, R69, R70, R80

☐ R40, R41

☐ R4, R5 ... **NOTE:** Only install R4 & R5 if you will be using an onboard Si570 clock generator (IC1).
Otherwise, do not populate the R4 and R5 positions!

☐ R29

☐ R1, R2, R61, R62, R63, R64, R65, R72, R81

☐ R55

☐ R38, R39

☐ R42

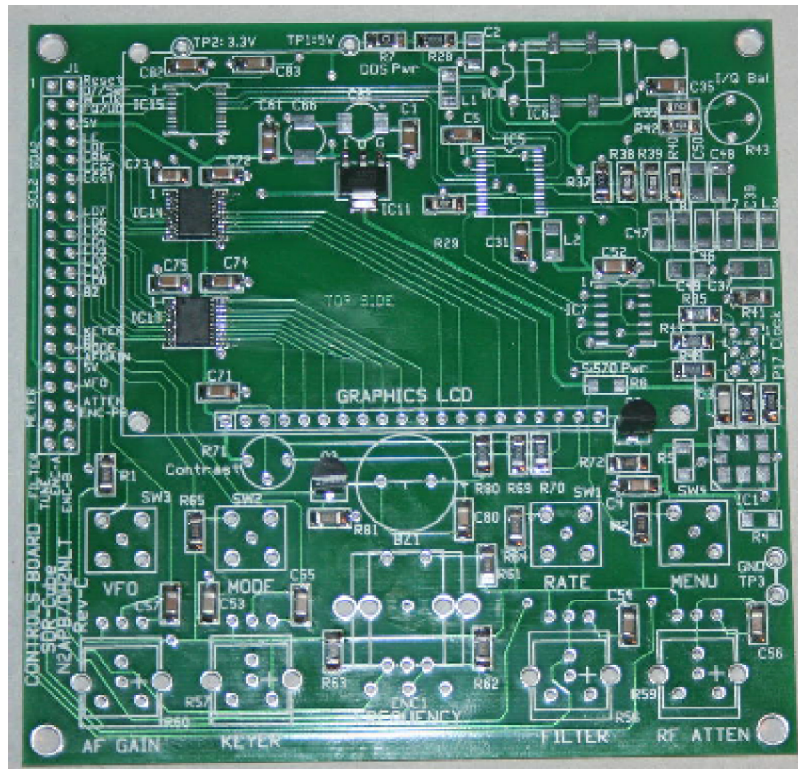
STEP 5: Install the 2N7000 FETs (Q2 and Q3), as found in the Semiconductor Bag

Assembling the SDR Cube Transceiver

The devices are quite static sensitive so practice good ESD handling. Be sure to orient these TO92-packaged devices according to the half-moon symbol on the board, with the flat of the FET on the same side as the flat of the symbol. Push the device down as far as possible and then solder.

☐ Q2

☐ Q3



STEP 6: Install the little blue trim pots (R43 and R71)

These 3-terminal devices will stand up on end when properly attached. Some people prefer to attached R71 on the bottom side of the board to enable easier adjustment of the LCD contrast; however others prefer all components on the top side, and the LCD contrast adjustment is a one-time thing that can be accomplished with a pointed object (e.g., point of an Exacto blade) ... you'll see the (easy) challenge during the Smoke Tests.

☐ R43

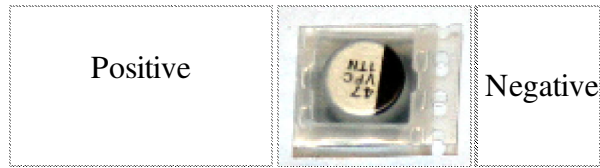
☐ R71

STEP 7: Install the 10 uF electrolytic capacitors (C62, C66)

The electrolytic caps looks like little silver "tin cans" with leads on the bottom that will attach to the pads at their location. It is important to note that these electrolytic capacitors are polarized and must be installed with the proper orientation or things could get messy when powered up. The negative side is indicated with a black half-moon mark, and the positive side is the unmarked side, as shown below for a 47 uF capacitor

Assembling the SDR Cube Transceiver

(the marking is the same for the 10 uF caps used on the Controls board) ...



☐ C62, C66

STEP 8: Install the Piezo Buzzer (BZ1)

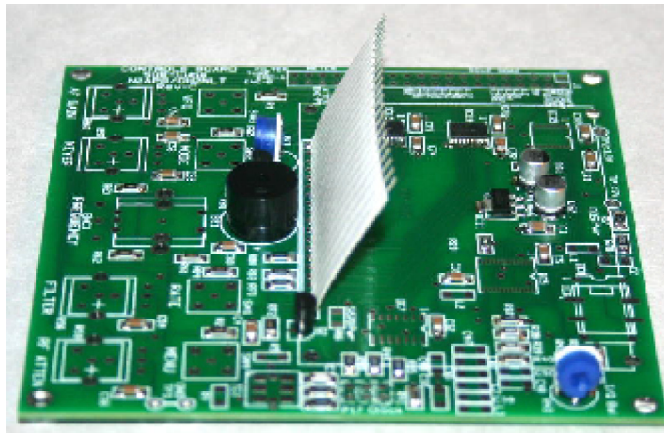
The piezo buzzer device must be installed noting the proper polarity. The positive (+) terminal is indicated on the bottom of the device, and it must be inserted with that pin toward the + marking on the silkscreen designator. Hold the device flush against the pc board when soldering.

☐ BZ1

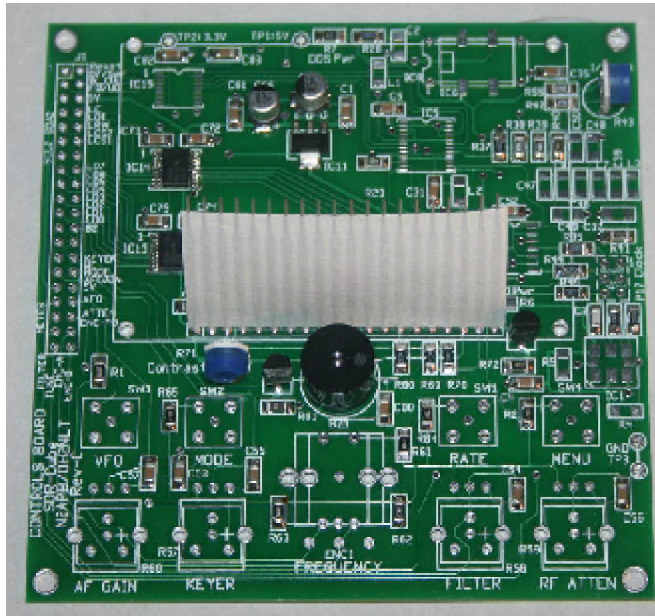
STEP 9: Install the 20-wire flex cable (W1)

The flex wire should be inserted to the top of the board and soldered on the bottom. If you angle (tip) the cable toward the top of the board (i.e., away from the pushbuttons below it), the task of attaching the LCD and folding the wire cable will be simpler in a few steps.

☐ W1



Assembling the SDR Cube Transceiver

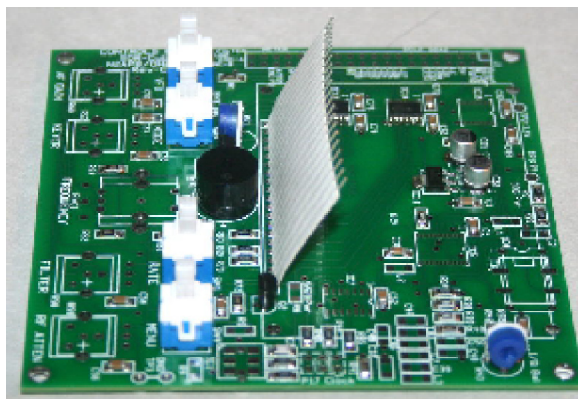


STEP 10: Install the four pushbuttons (SW1-thru-SW4)

The blue and white pushbuttons must be oriented properly for them to operate correctly in the circuit.

IMPORTANT: The pushbuttons must be inserted with the [white tabs along their sides oriented toward the left-and-right sides of the board](#) ... **not** oriented toward the board's top and bottom. Push the buttons all the way down and flush with the board surface. Before you solder them in place, ensure that they are perpendicular to the plane of the board ... if they are tilted even a little bit, the pushbutton caps may experience some interference from the holes in the front panel when the board is assembled into the enclosure.

[] SW1, SW2, SW3, SW4

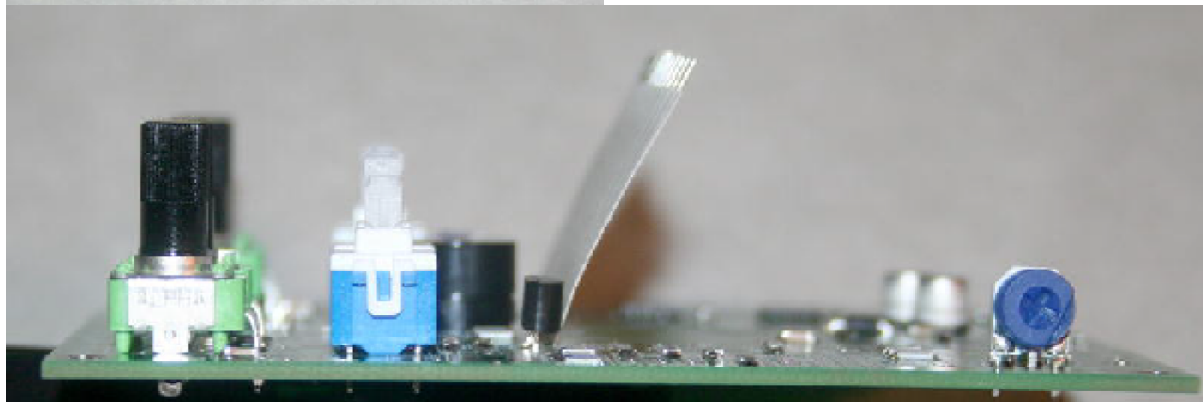
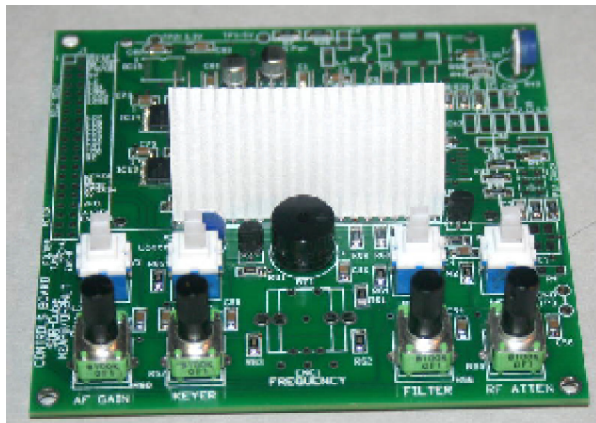


STEP 11: Install the four mini-potentiometers (R56, R57, R59, R60)

Push the potentiometers all the way down and flush with the board surface. Before you solder them in place, ensure that they are perpendicular to the plane of the board ... if they are tilted even a little bit, the pot knobs may experience some interference from the holes in the front panel when the board is assembled into the enclosure.

Assembling the SDR Cube Transceiver

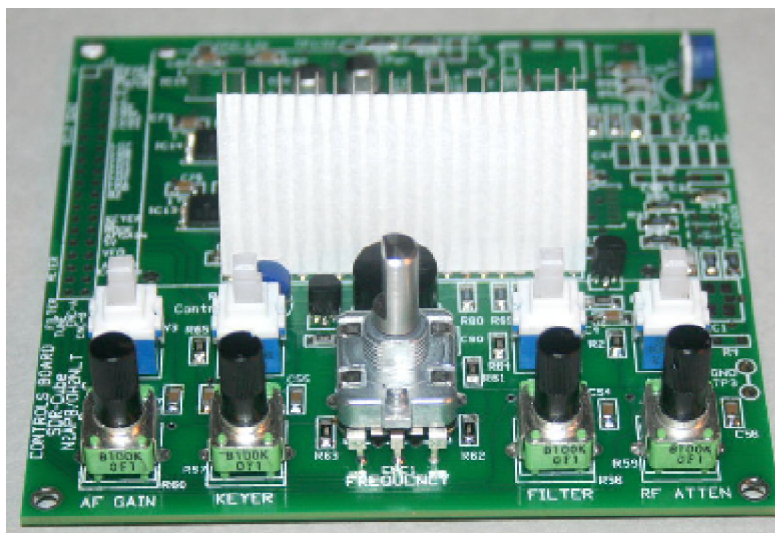
[] R56, R57, R59, R60

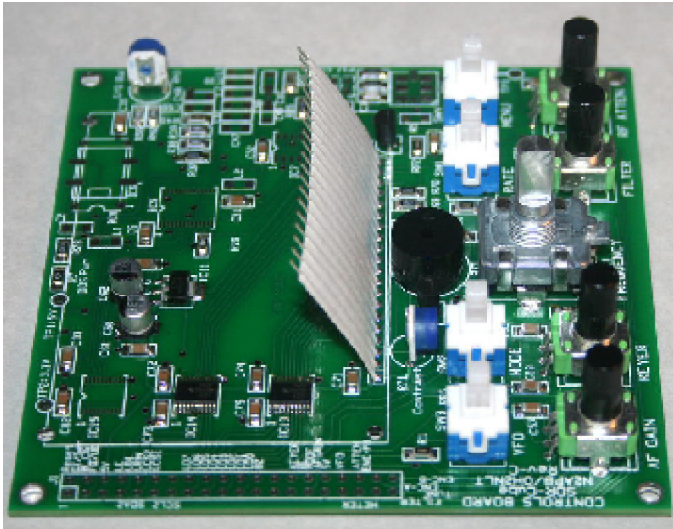


STEP 12: Install the rotary encoder (ENC1)

Push the encoder all the way down and flush with the board surface. Before you solder it in place, ensure that it is perpendicular to the plane of the board ... if it is not installed straight, the Frequency dial knob may rub against the front panel.

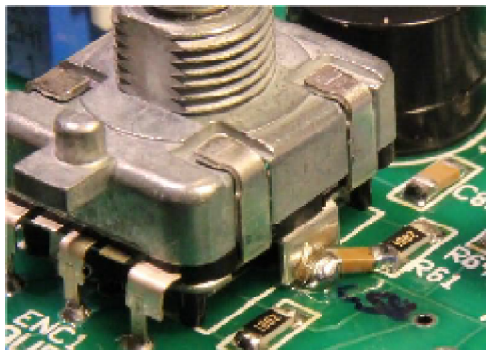
[] ENC1





STEP 13: Install C58 next to the Encoder

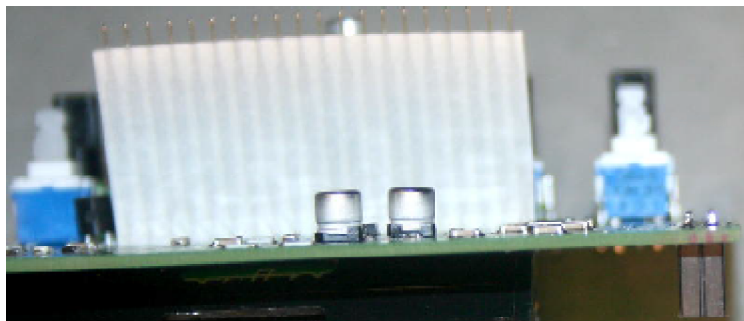
"What C58?" you say! Well, we have C58 as a 0.1uF SMT capacitor on the schematic, but we forgot to provide for it on the pc board. So we'll use one of the extra 0.1uF caps from step 2 at the top of this page. As shown in the photo below, mount the capacitor from the pad for R61 over to the mounting pad for the Encoder.



STEP 14: Install the 2x20 receptacle (J1) on the bottom of the board

Insert the 2x20 position receptacle from the bottom side of the board, hold in place flush to the board, and tack solder a pin on each end of the connector. **IMPORTANT:** Double check to ensure that the connector is mounted flush and perpendicular to the plane of the board, then solder the remaining connections.

[] J1



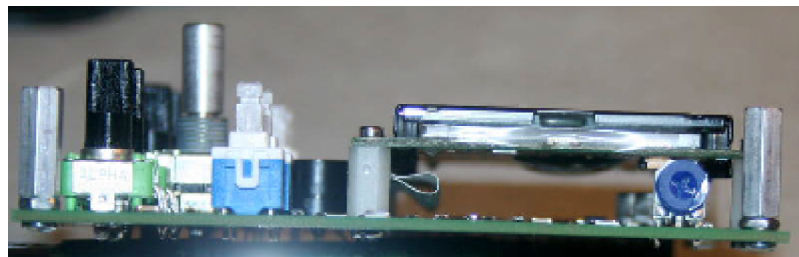
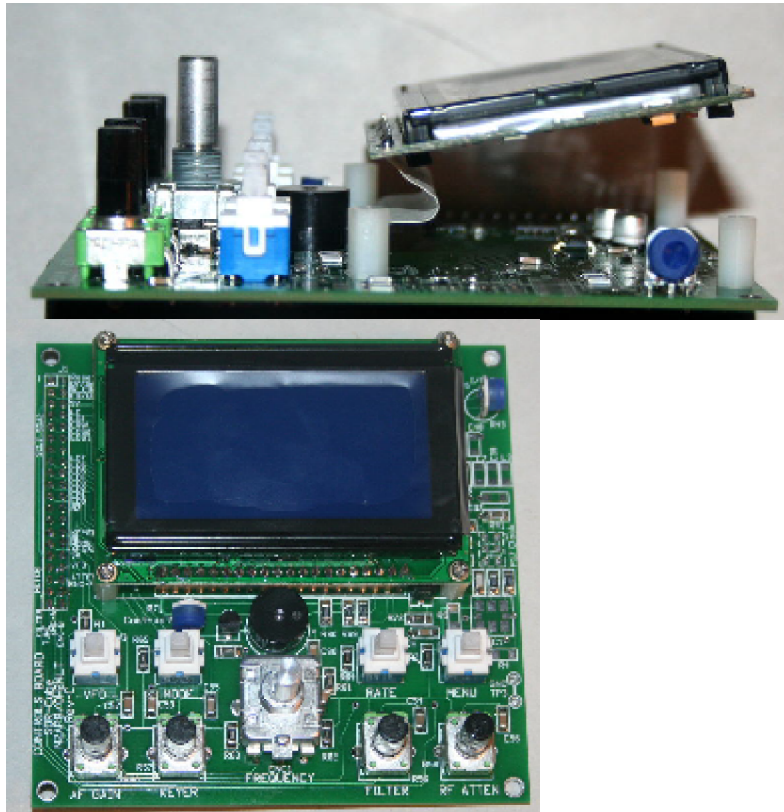
Using the nylon threaded standoffs and the #2-56 [slotted pan head screws](#), attach the standoff to the top side of the pc board.

STEP 16a: Insert the free end of the 20-wire flex cable into the 20-position LCD pads from the bottom of the board and solder on the top. **IMPORTANT:** Be certain that the cable is

STEP 16b: Fold the 20-wire flex cable inward, in a single-fold accordion-style manner, such that the LCD is able to sit flat on the four nylon standoffs. Ensure that the portion of the flex cable folded inward is not rubbing against the top of the pc board or against the underside of the LCD. (This will ensure that no protruding lead on either pc board will rub against the flex cable.)

[] LCD, nylon standoffs, 4 slotted pan head screws and 4 phillips head filister screws

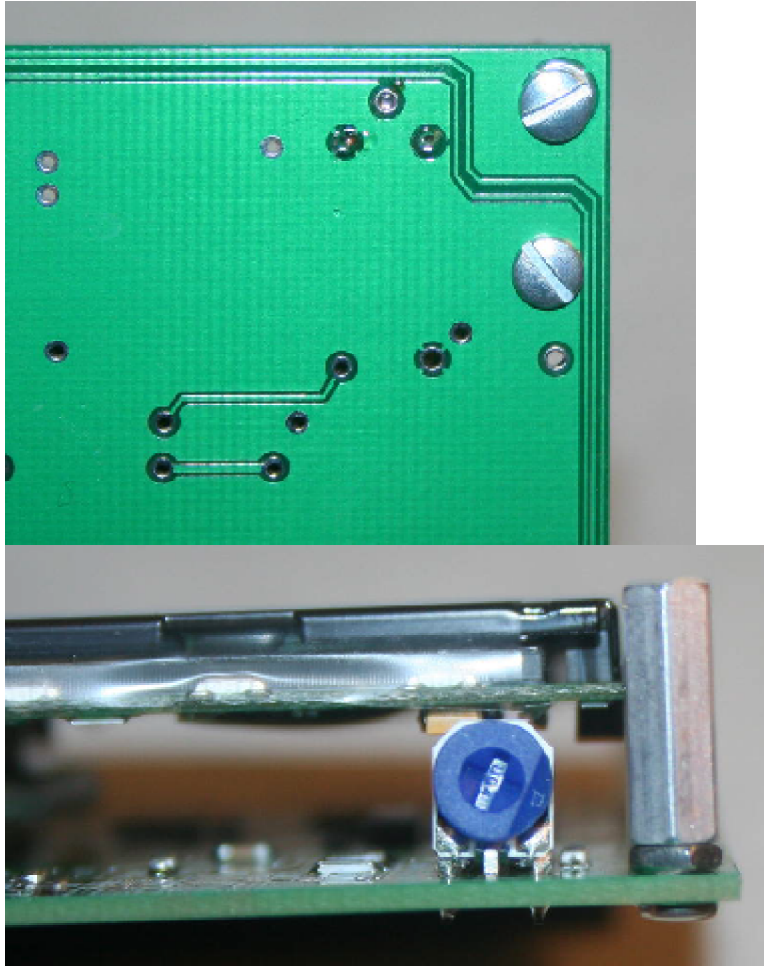
Assembling the SDR Cube Transceiver



STEP 17: Install the Controls pc board mounting hardware

Insert a #2-56 slotted pan head screw into the mounting hole one corner of the Controls board, from the bottom side of the board, and screw on a #2 nut to hold it in place. Finger-tight is good enough at this point. Onto that same screw that is protruding upward from the top of the board, screw on an stainless steel threaded standoff. Again finger-tight is good enough. Do this same screw/nut/standoff assembly for the remaining three corner mounting holes of the Controls board

[] Stainless standoffs, nuts and slotted pan head screws



STEP 18: Install the gray caps (4) on the pushbuttons

Press a gray button cap onto each of the four pushbuttons, pressing them firmly downward until they snap into place. Each pushbutton and cap assembly should operate freely and should be at the same height above the board.

[] Pushbutton caps (4)

STEP 19: Install the black knobs (4) on the mini-potentiometers

Turn each potentiometer shaft to the midpoint position and install a black knob on each, oriented with the white "pointer dot" at that same midpoint position (pointing up toward the LCD). Using an appropriate screwdriver, tighten the set screw on each knob and ensure that the shaft turns freely throughout its range. Also ensure as much as possible that the knob does not wobble when turned. (This will likely not be a problem, but "shimming steps" can be taken to minimize this common-yet-annoying condition.)

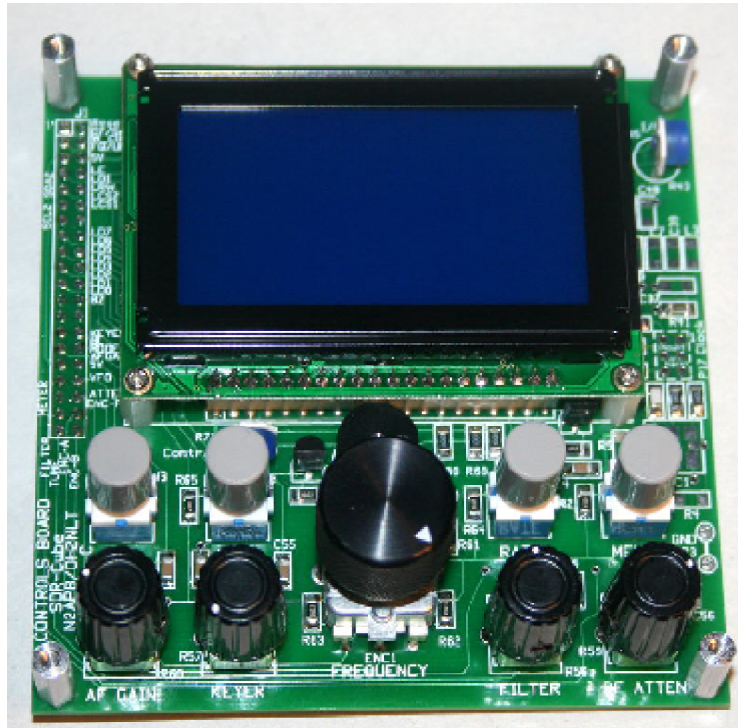
[] Potentiometer knobs (4)

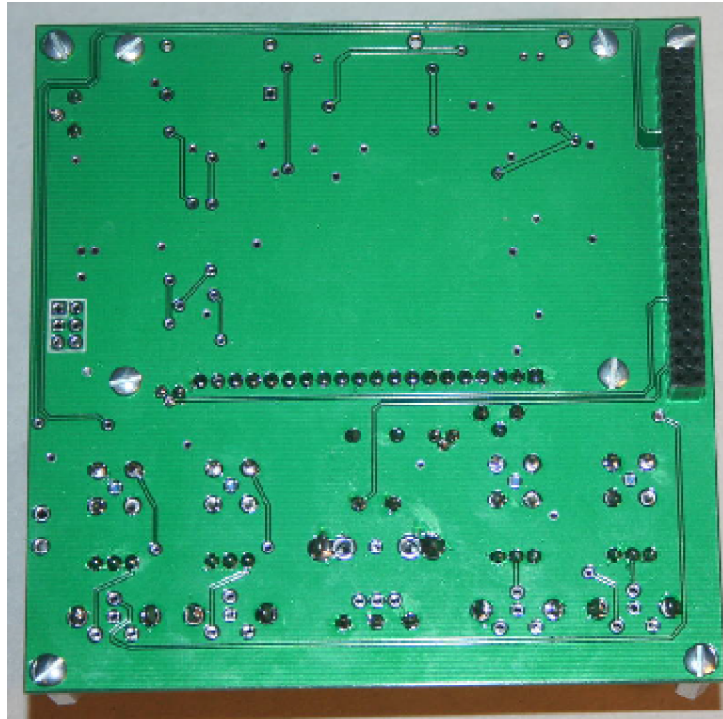
STEP 20: Install the black anodize aluminum Frequency knob onto the encoder shaft

Install the nice black anodized aluminum knob onto the encoder shaft, ensuring that you have it raised about 1/8"-1/4" above the lowest point that it can be installed. Holding it at this position, use an appropriate screwdriver to tighten the set screw on the knob. Ensure that the shaft turns freely throughout its range, and that you can feel the mechanical detent of the built-in pushbutton when you press on the knob. Also ensure as much as possible that the knob does not wobble when turned. (This will likely not be a problem, but "shimming steps" can be taken to minimize this common-yet-annoying condition.)

NOTE: You will need to remove and re-install this knob when inserting the Controls board into the enclosure.

[] Encoder knob





The Controls Board is complete! Set it aside and next move on to building the DSP Board.

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