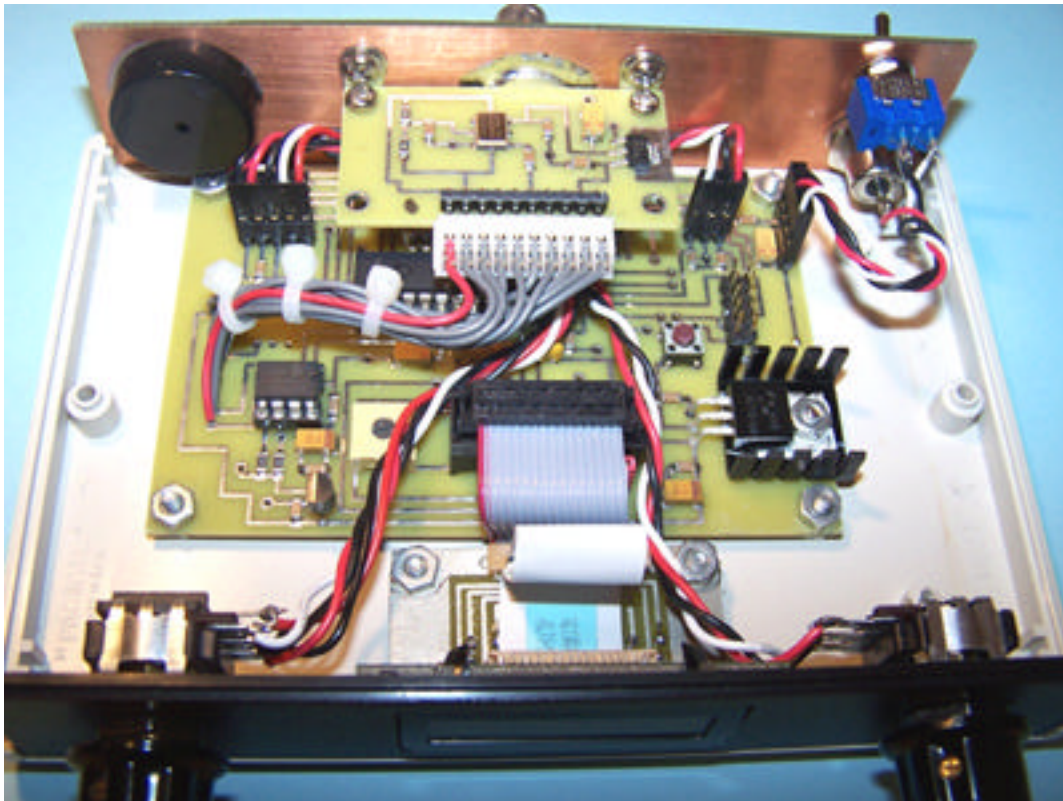


WA6UFQ's Universal Controller and Si570 Card Construction Guidelines



Controller installed in 'mini' enclosure (1.5" high). It was necessary to mount the Si570 card on the rear panel, powering it by a wire harness to the PC board. The 2X16 LCD display is 1.7" X .8"

If you are new to surface mount construction techniques, don't worry; it's not as difficult as you imagine it to be.

There are a few items that make working with SDM less difficult:

- Use .015 dia. solder for the SMD parts, and .032 dia. for all other components. I'll try to remember to include some .015 solder with each board I ship.
- A small tipped soldering iron
- A stainless, anti-magnetic tweezers
- Magnifying light, or magnifying glasses (Harbor Freight Tools)
- Lots of light on the construction area
- A clean work bench
- Non-carpeted work area

None of these are absolutely essential, but each of them improves your ability to work with SMD components.

In addition to the above items, I use a '3rd Hand' tool that I have constructed to hold SMD components in place while soldering. It can be seen at http://home.austin.rr.com/wa6ufq/3rd_hand_smt_tool.html

It eliminates the thrill of chasing the board around your workbench when soldering, and does a great job of holding the SMD device in place as well.

Let's discuss the various options available when building this partial kit.

- Headers – I chose to use headers on the controller board to connect to the power connection (J11), shaft encoders (J4 and J8), Piezo sounder (J10), DDS and Si570 output (J5 and J7). I used miniature connectors from discarded computers to connect to these headers. However any or all of these headers could be eliminated in favor of wire jumpers to the shaft encoders, piezo sounder, etc.
- I also used a header at J9; along with a .1" shunt to enable the LCD display backlight. This could be replaced by a short jumper wire for an 'always on' backlight, or wire leads to a panel mounted on/off switch.
- If you decide to use the headers, purchase the 40-pin header in the parts list, and cut them to size with a razor blade knife. Smooth the cut edges with a file.

- Purchase 10-pin connectors for the board connectors for the DDS boards (8 pins), and Si570 board (10 pins). Then cut one of the connectors down to an 8-pin connector using a razor blade knife.
- If the intention is to use the controller exclusively to control a DDS board, or exclusively to control a Si570 board, then components associated with the other option could be eliminated.
- The reset switch (SW1) could be eliminated, or brought out to a rear panel mounted momentary ON switch. The reset switch was handy when developing the software, but not really necessary now.
- The programming port (J2) could be eliminated, or installed at a later date for possible field updates.
- Do not skimp on the heat sink (HS1). The 5V regulator gets hot without it.
- Do not eliminate the 51 ohm resistors (R20 and R21) on the output ports. They are essential for proper operation.
- The PIC processor could be soldered to the board, but I don't recommend it. There could be future updates.
- The LCD board connector (J6) and its associated ribbon cable connector could be eliminated by hard wiring the display to the board (I like connectors).
- There are various sources of 2X16 LCD displays on the surplus market, with or without backlights. BGMicro is a good source for the LCD displays (LCD1031) - \$5.95. They also sell a piezo sounder (AUD1082) for 99 cents. Electronic Goldmine has a nice 2X16 LCD display for \$2.95, but it is not backlit.
- If you find that one or both of your shaft encoders tune backwards, reverse the A and B leads.
- I have installed the controller board in PacTec LH64-130 and LH64-200 enclosures. The LH64-130 was 'tight', requiring special mounting of the Si570 card to the back panel of the controller (see the picture at the top of page one).

Controller Board Construction

The first eight steps install SMD components. Installing these components first, before any thru hole components are installed helps keep the printed circuit board flat on your workbench while soldering the SMD components.

1. Install C2 C3 C4 C5 C6 C9 C10 C11 C13 C14 C16 C17 C18 - .1mf SMD capacitors
2. Install R1 – 10k SMD resistor

3. Install R2 R3 R4 R5 R6 - 4.7k SMD resistors
4. Install R13 R14 - 2.2k SMD resistors
5. Install R15 R16 R17 - 1.2k SMD resistors
6. Install R20 R21 – 51 ohm SMD resistors
7. Install C7 C8 – 22pf SMD capacitors
8. Install C1 C12 C15 C19 – 10mf 16v tantalum SMD capacitors. Be sure to observe polarity; the line or bar is the positive end.
9. Install R7-R12 – 10K resistor array. The dot on the array indicates the common lead. This lead goes to the square pad.
10. Install R19 – 10 ohm .5 watt thru hole resistor
11. Install R18 – 10K contrast control
12. Install X1 – 10 mHz crystal. Be sure that the crystal can clear the traces on the PC board.
13. Install SK1 – 8-pin DIP socket. The notch in the socket and chip face toward the right side of the board.
14. Install SK2 – 28-pin DIP socket. The notch in the socket and chip face toward the right side of the board.
15. Optional – Install SW1 – reset switch. It is a pair of SPST switches in a single tactile switch package. Notice the two trace jumpers on the PC board at this location. The SPST switches go opposite of these jumpers. Do not install the switch so that the SPST switches parallel the trace jumpers.
16. Optional – Install J6 – LCD display connector. You may choose to hard wire to the board with wire jumpers.
17. Install J3 – Si570 10-pin board connector.
18. Install J1 – DDS 8-pin board connector. The connector must be modified to an 8-pin connector by cutting the plastic connector with a razor blade knife between pins 8 and 9.
19. Optional - Install J7 – Si570 output connector. Install with flat side towards the top of the board. The three-pin connector was chosen over a two-pin connector in order to provide more space between the center conductor and the shield of the mating connector. This connector is optional; you may decide to solder the output cable directly to the PC board.
20. Optional – Install J5 – DDS output connector. Install with flat side towards the top of the board. This connector is optional; you may decide to solder the output cable directly to the PC board.
21. Optional – Install J2 – Programming connector. Notice that this is a 10-pin DIP connector. The smallest ribbon connector I could find was a 10 conductor connector. So this connector mates with that ribbon connector. You may decide to not install this connector until a later date should it be necessary to do a field update.

22. Optional - Install J9 – Backlight switch header. This could be replaced with a wire jumper for an 'always on' backlight, or wires to a panel mounted backlight on/off switch. I installed the header, and put a .1" shunt connector on the header.
23. Optional – Install J10 - Piezo sounder header. This could be eliminated by soldering the piezo sounder wires directly to the board.
24. Optional – J11 - Board power header. This could be eliminated by hard wiring a panel mounted on/off switch to terminals #1 and #2, and wiring a back panel power jack to terminals #3 and #4; pin #3 is the positive lead.
25. Install U4 – 5v regulator and HS1 – Heat sink. Use some thermal compound between the regulator chip and the heat sink, and secure to the PC board with a 4-40 bolt and nut.
26. Install U3 – 3.3v regulator. Observe correct orientation of the device. The flat side goes towards the left edge of the board.
27. Install Q1-Q4 – 2N7000 FET's. Observe correct orientation of the device. The flat side goes towards the bottom edge of the board.
28. Optional – Install J4 – Fine shaft encoder header. This could be eliminated by hard wiring to the Fine shaft encoder.
29. Optional – Install J8 – Select shaft encoder header. This could be eliminated by hard wiring to the Select shaft encoder.

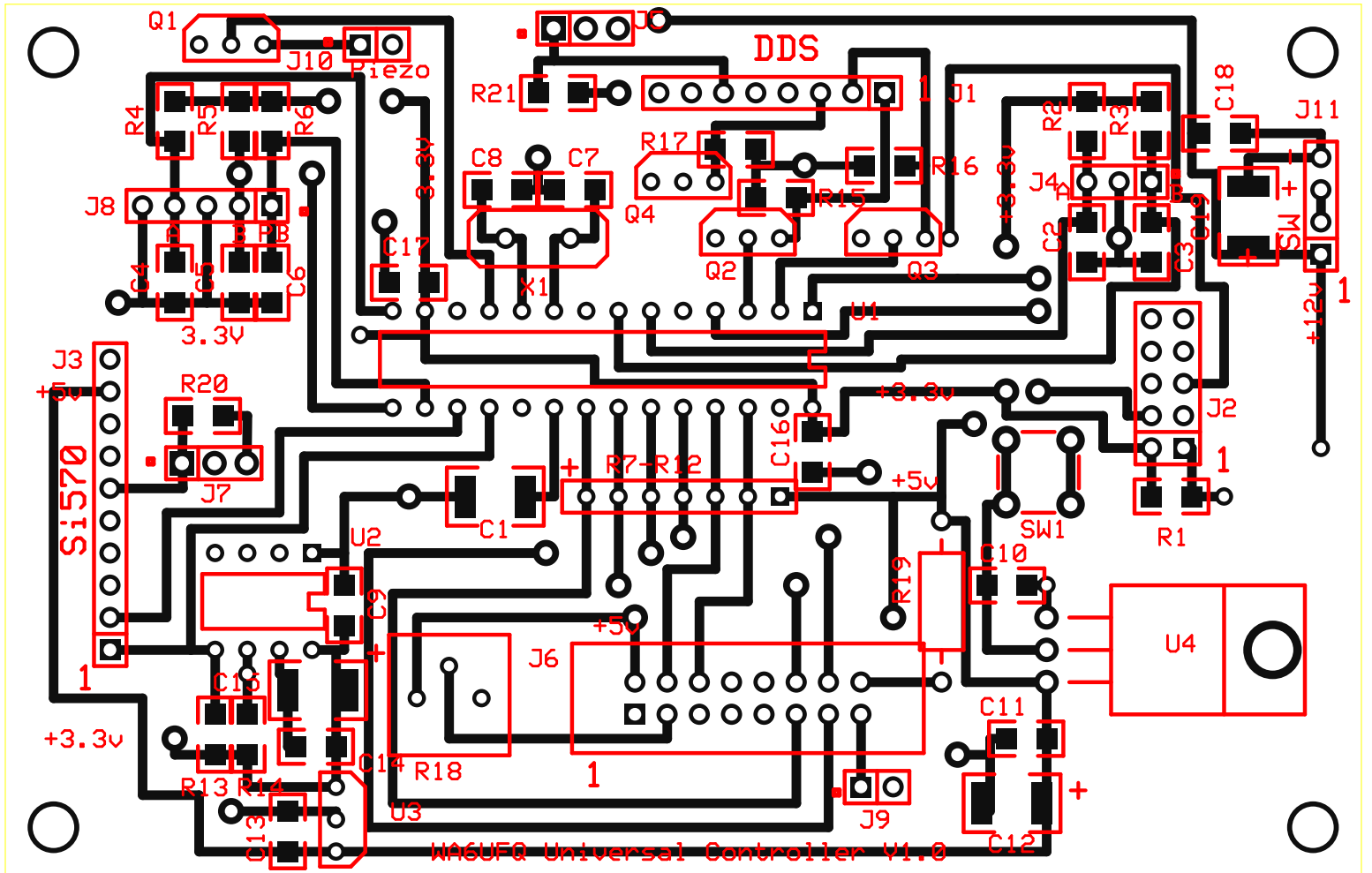
Finishing Up

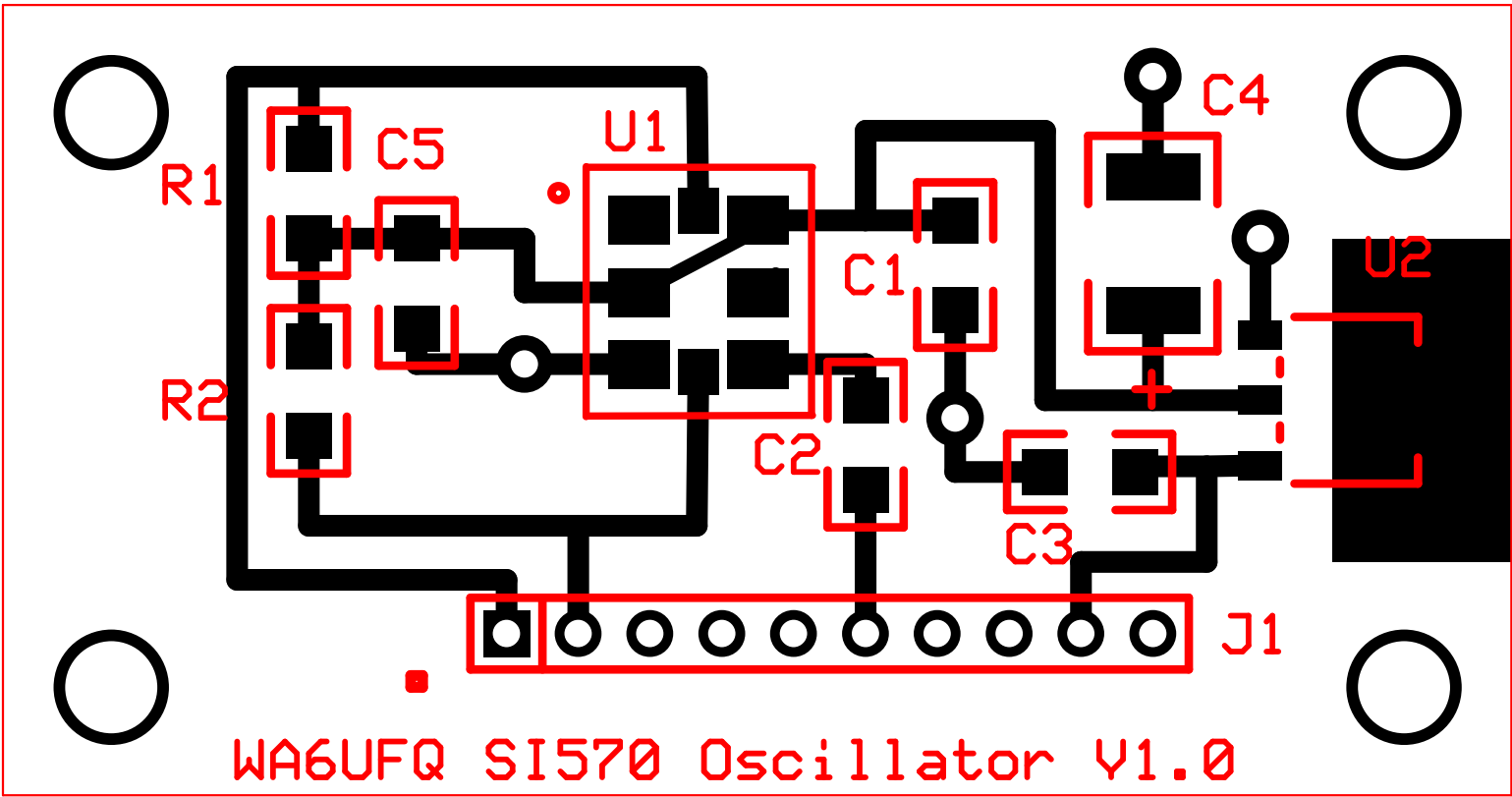
30. If you installed J6 in step #17, then install a ribbon cable connector onto a short length of 16 conductor ribbon cable that is long enough to reach where you intend to place your LCD display. I use a vise to compress the connector once I have the cable lined up properly. Pin #1 is on the left side of the board. The connector usually has an arrow indicating pin #1. Orientate the cable accordingly if it has a red stripe that indicates pin #1.
31. Fan out the ribbon cable slightly, strip and tin about 3/16" of insulation from each wire and solder each wire to the appropriate pad on the LCD display.
32. If you have chosen to use headers at J4 and J8, fabricate a three conductor and a five conductor cable that are long enough to reach where you intend to place the shaft encoders. I have been using discarded computer cables that have these connectors installed. Solder these cables to the shaft encoders. If you find that your encoders are incrementing instead of decrementing, just reverse the plugs, or swap the A and B wires on the encoders if you have hard wired them to the board.

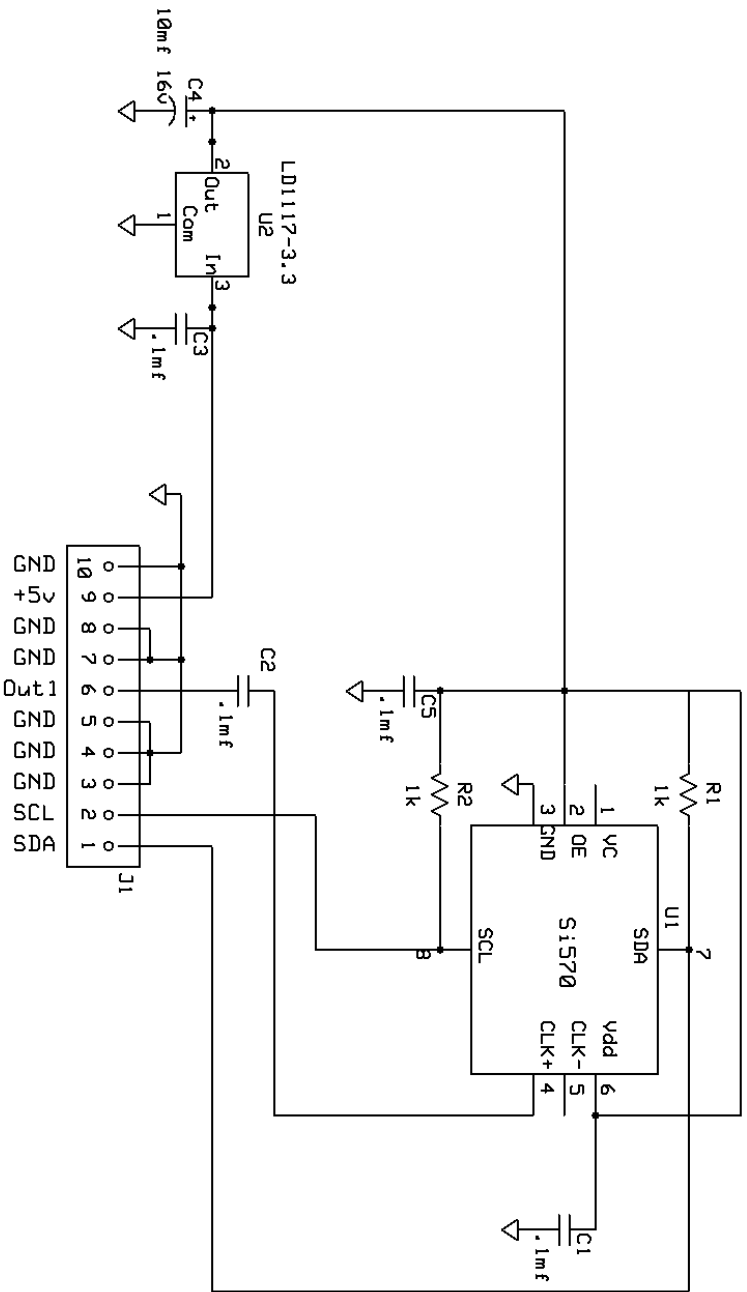
33. If you have chosen to use a header at J10, the piezo sounder header, fabricate a two-conductor cable with connector that is long enough to reach where you intend to place the piezo sounder. Otherwise, solder the piezo sounder wire leads directly to the J10 pads on the board. The piezo device is polarity sensitive. Solder the plus (+) wire to the square pad at J10; the minus wire gets soldered to the round pad to the left.
34. If you are using a LCD display with backlight, and chose to install the backlight switch header J9, either install a .1" shunt for an 'always on' backlight, or fabricate a two conductor cable with connector that is long enough to reach where you intend to place a panel mounted backlight on/off switch. If you chose to not use the header, either solder a jumper wire across J9 (always on), or wires long enough to reach a panel mounted backlight on/off switch.
35. Install U1 – PIC24HJ processor. The notch on the chip should face the right side of the board.
36. Install U2 – EEPROM. The notch on the chip should face the right side of the board.
37. Fabricate cables for the DDS output and the Si570 output, using the 3 pin connector housings P5 and P7, and the associated crimp terminals. I recommend using sub miniature coax. The three terminal connectors were chosen to ease the task of fabricating the plugs by providing additional separation between the two conductors.
38. Be sure to fuse the power lead at about ½ to 1 amp.
39. The LCD contrast control initial setting should be close to fully CCW.

Si570 Oscillator Daughter card construction

1. Install R1 R2 – 1K SMD resistors
2. Install C2 C3 C5 - .1mf SMD capacitors
3. Install C4 – 10 mf 16v tantalum SMD capacitor
4. Install U1 – Si570 oscillator chip
5. Install U2 – 3.3v regulator chip. If you substitute a different regulator, be sure that the pin-out is identical. The center pin is the output pin. The tab is also output.
6. Install J1 – 10-pin right angle header. The plastic material goes on the topside of the board. The pins are soldered on the backside of the board.







S1570 Oscillator

WAGUFQ

Bob Hilliard

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Page 1