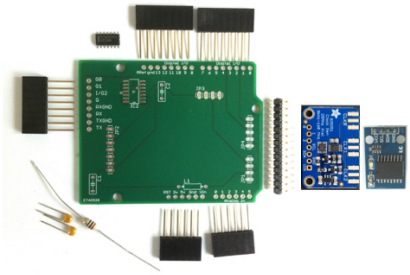
Concept Session 5 - VFO Kit Build
Course Notes

These are the course notes for building the VFO_RTC_IQ shield.



Let's build the VFO_RTC_IQ

Digital VFO, Real Time Clock
with Quadrature IQ outputs

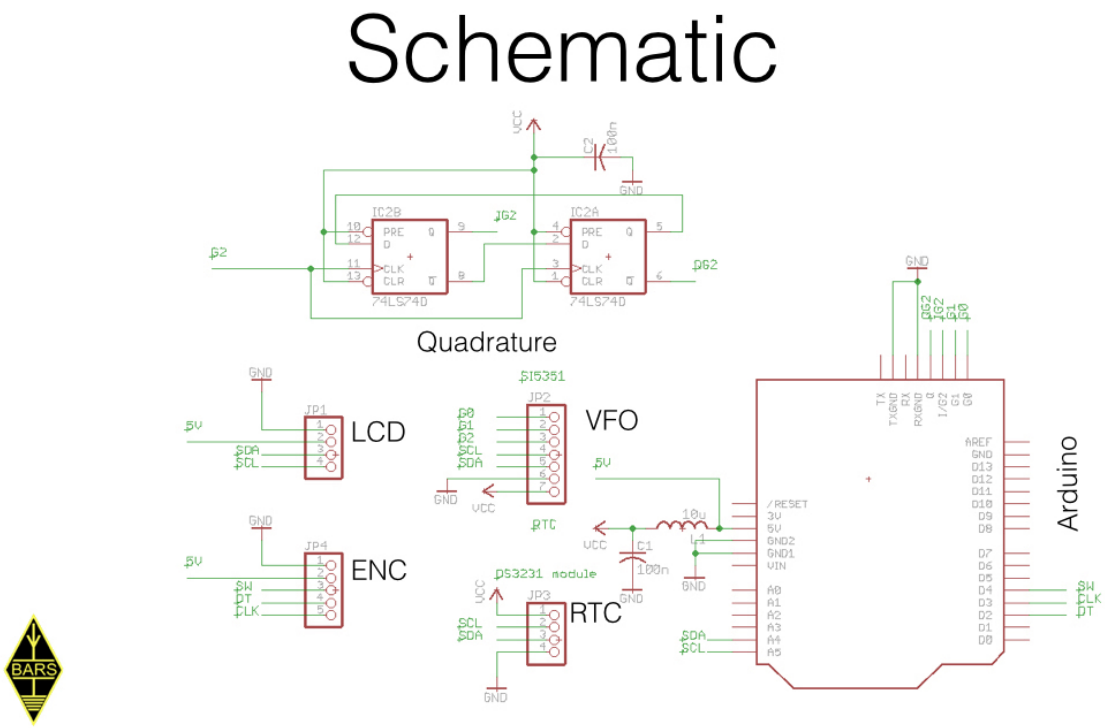
For this part of the course you will need some tools, take care to get the right ones, especially the soldering iron which should have sufficient power (not less than 40W) and temperature control. Also needed is some thin solder (0.3mm suggested). To handle the mounting of the surface mounted device a pair of tweezers is recommended.

Tools needed

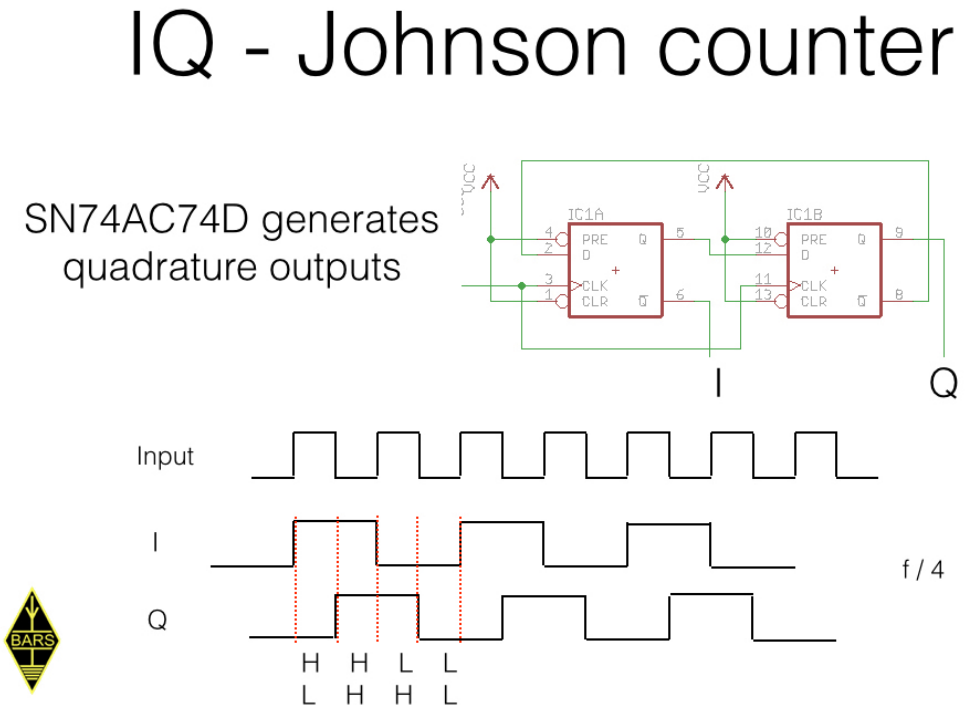
- Check you have a suitable soldering iron. Wire cutters. A small set of tweezers, a magnifier would be useful
- Hobby components has a very good soldering iron (40W temp controlled). Amazon has Solder Flux Pen + 0.3mm Solder and magnifiers.

CMOS device WARNING. The SN74AC74 is a CMOS device and care should be taken to ground the soldering iron and if possible work on a conductive mat when building this shield.

The schematic

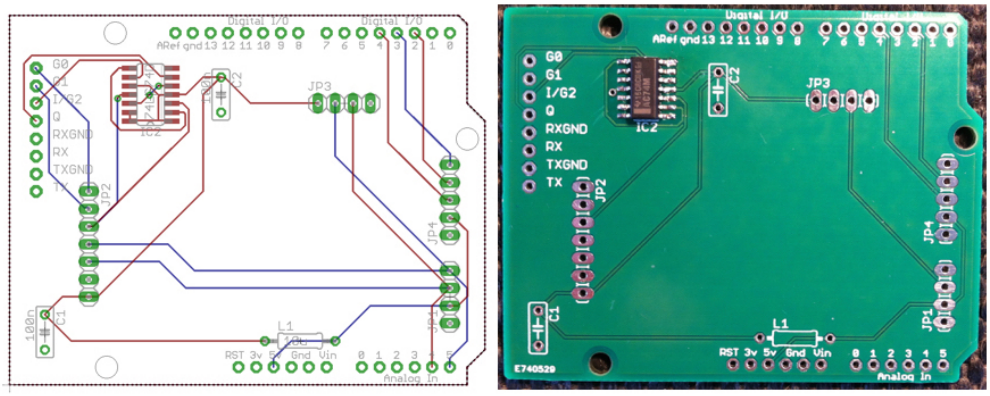


The schematic is quite simple, as is the shield, as it just carried two modules, the Si5351 DDS and the DS3231 RTC. Plus a single logic device the SN74AC74 which generates the quadrature IQ outputs:



Building the shield

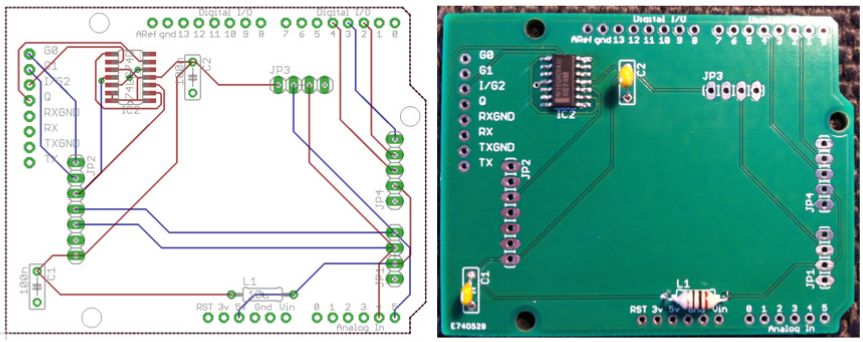
SMD mounted



The first steps is to mount the SMD part SN74AC74. The part's ID (a line or a dot) is at the bottom. Melt a small amount of solder (very small!) onto the bottom right pad, then position the part and melt to solder to fix it in place. Check its position then solder the other pins.

Other components

Take care to correctly identify each component

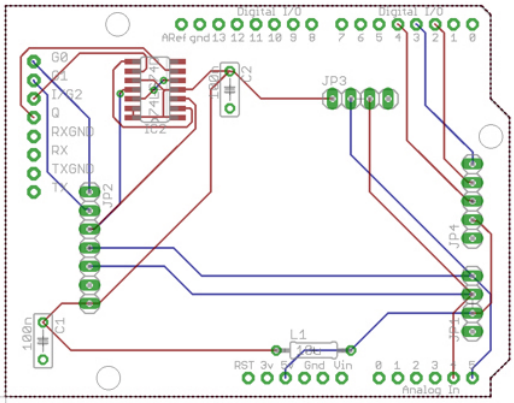


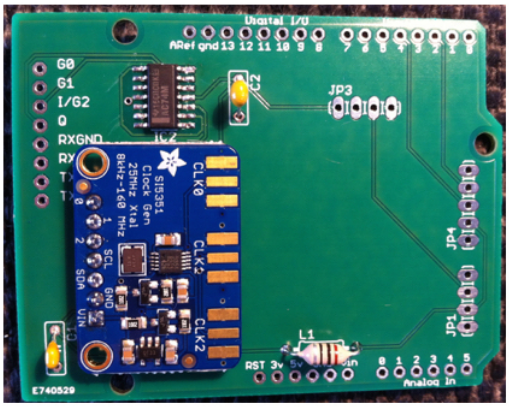
C1 100nF 104
C2 100nF 104
L1 10uH

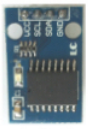
Next mount the two 100nF capacitors and the 10uH inductor.

Modules

IMPORTANT!!! Put in the CR1220 battery
before you mount the RTC module, +ve side UP





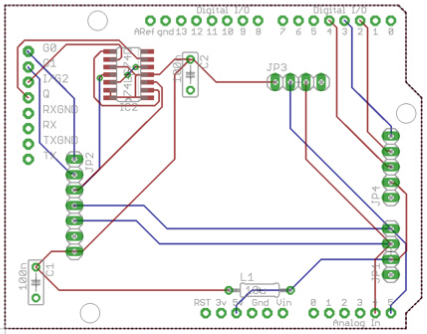


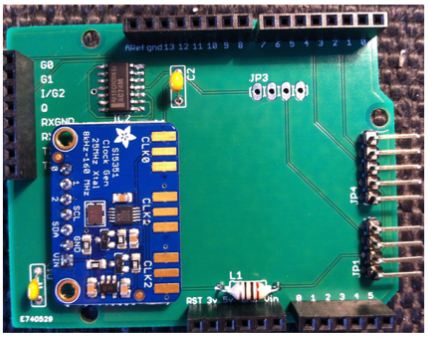
Note: RTC not available when
this photo taken

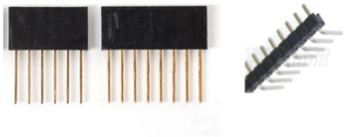
Now it is time to mount the two modules. The Si5351 is shown mounted. After mounting the modules trim off the wires underneath.

Headers

Plug another Arduino board on top
to make sure they are vertical







Next mount the 6 pin and 8 pin headers. To hold them in place while you solder them and to get them vertical, you could plug another Arduino shield in on top and make sure each header is flush with the board. An alternative is to place the shield upside down on a flat surface and hold it steady with the headers in place until you have soldered one pin on each.

Then cut the right angle headers to size (4 and 5 pin) and solder in place.

Wire up & test

File > Sketchbook > My_VFO_40M

16 x 2 LCD not available
so I used 20 x 4

That's it. Wire up connections to your Rotary Encoder and LCD display (a 20 x 4 is shown here, but the software is written for a 16 x 2, both will work).

Load the program My_VFO_40M and test your 40m VFO. Press the encoder shaft button to change the tuning steps 100Hz, 1kHz, 10kHz.

Check the VFO is outputting RF by listening on a nearby receiver. A short aerial can be connected to output G0 to radiate the RF.

Incidentally... the Si5351 can work up to 160MHz, but your sketch will not do this, it will stop at around 40MHz. Why? Because the variable used for the "freq" is only 32 bits and this is not enough to store a frequency above 40MHz!. Change the "uint32_t" variables to "uint64_t" - a 64 bit variable - and it will work at VHF frequencies. Try it on 2m / 144MHz.