A simple Frequency Reader for conversion VFOs

The project in few words

If you are interested in improving the mechanical frequency reading of your home made transceiver, or if you want to equip your old RIG with a digital reader, this may be the project for you. It is simple enough to assure a good and sure result also to beginners, and it doesn't require any microprocessor programming, in fact the only components employed are simple and conventional CMOS ICs.

How it is made

The device is composed by four boards 95 x 65 mm. The first three boards are double sided PCB, the components are placed on one side without drillings, while the other side is used as a ground layer. Theese three boards are stacked to reduce the overall dimension. The ground connections are obtained by drilling the board and soldering a wire on both sides.

A strip connector on the upper board allows to insert the fourth "display board". This one makes use of an universal "multi holes" board, and the connections are made using a normal insulated wire.

An RCA socket and a power supply connector are housed on a side of the little cabinet.

How it works

The circuit on the first PCB performs the following functions :

- *Tame Base* : makes use of a 4060 CMOS oscillator/divider and a 3.276.800 Hz crystal. The two capacitors on pins 10 and 11 allow some control on the crystal frequency. A 4013 CMOS divider lowers the output frequency to 50 Hz.
- *Prescaler* : a 74LS90 decade counter allows to rise the upper frequency limit above 40 MHz. Any high frequency transistor may be employed as T1, T2. The dc voltage measured at pin 14 of the 74LS90 should be about 2 V. I recommend to use a shielded cable, like the RG174, to connect the input and the output of the prescaler. The VFO signal level should be at least 100 mV pp.

On the second board we find :

- *Trigger Generator* : a 4017 CMOS IC produces the PRESET and LATCH pulses, so controlling the opening of the counter gate. A 4011 CMOS works as a gate and inverter for the LATCH pulse. The diagram of the triggering signals points out the overall working.
- *Power supply* : is obtained with a 7809 IC regulator equipped with a little heat sink. The two inductors are made by 20 turns of enameled 0.50 mm wire on a ferrite balun. The external source must deliver 12/14 V max at 300 mA.

The third board contains :

- *The programmable counter* : makes use of four 4029 CMOS IC, and counts forwards starting from the value programmed on pins 3-4-12-13 (that is the same as adding the preset value to the input frequency). The gate opening time is 100 mS, therefore the maximum frequency reading is 999,9 KHz, above this frequency the most significant digits will be lost. Let's see how it works :

  Assuming a RIG IF frequency of 8973 KHz, the VFO will range from 22973 to 23473 KHz to cover the 20 meters band. Let’s suppose to obtain theese frequencies with a conversion circuit making use of a 18.000 KHz crystal and a 4973 - 5473 KHz free oscillator. The counter reads theese frequencies, loses the most significant digit and adds the preset value, in this case 027.0, the reading on the display will be :

  4973.0 + 027.0 = 5000.0 → 000.0 (lower limit)
  5473.0 + 027.0 = 5500.0 → 500.0 (upper limit)

The programming is obtained by connecting the +Vcc to the programming pins. For example the 027.0 preset value can be obtained by :

no programming on the first CMOS (0)
programming pin 12 on the second CMOS (2)
programming pins 4, 12, 13 on the third CMOS (7)
no programming on the fourth CMOS

If we would subtract the IF value instead of adding it, that is the case of a VFO ranging from 5027 to 5527 to cover the 20 meters band, we should simply program the value 973.0 to get the same result.

The programming connections between the 4029 pins and the 20 leads connector in the proposed PCB are made using common insulated wire.

On the fourth board we find :

- *The displays and 7 segment decoders* : it makes use of four 4511 CMOS decoders and FND500 displays. The assembly is made on a common multi holes board. In the published image you may see a 3 digit counter version with a 1KHz limited resolution

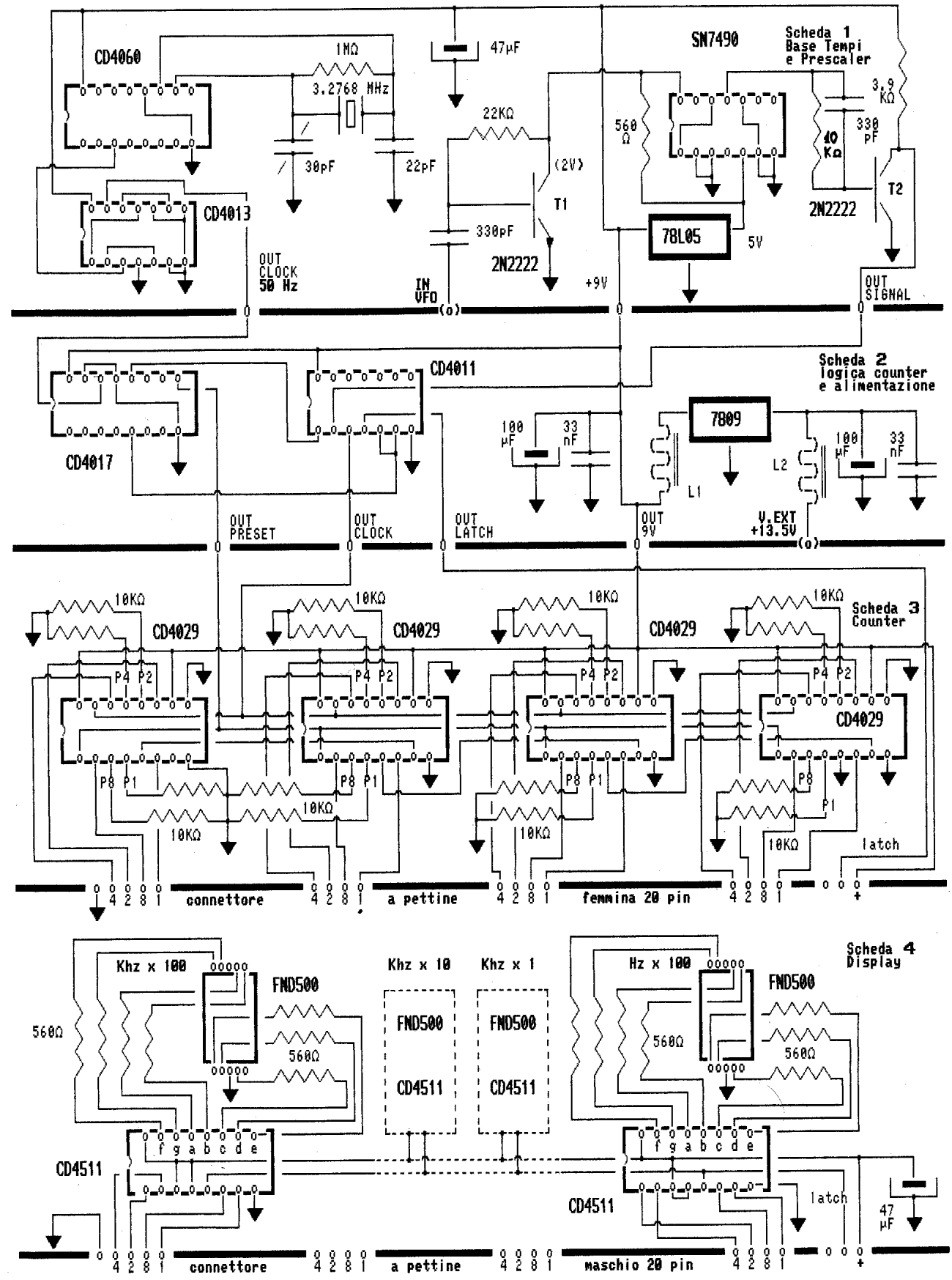
Final notes

Making a correct assembly the circuit should work immediately and, in absence of an input signal, the display will show the preset value. Having a frequency meter you could make an accurate frequency tuning by adjusting the 30 pF trimmer, otherwise you may simply insert two 22 pF capacitors.

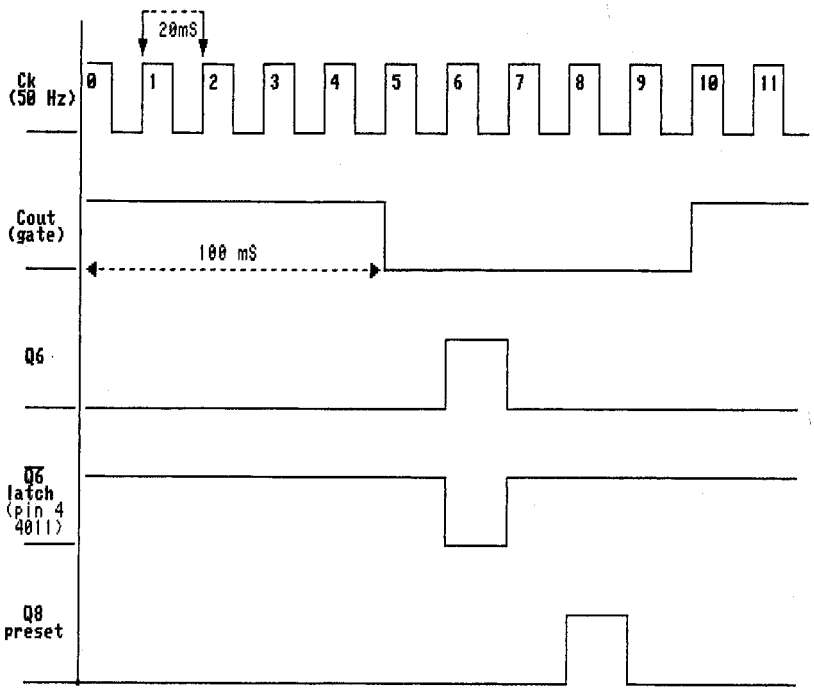
If you have an RF generator and an oscilloscope, you could also test separately all the boards, referring to the signal shapes shown in the diagram.

For any doubt or problem you may contact me at my E-mail box

The Electrical Schematics



The triggering signals diagram



The PCB boards Layout