Fox Delta

Amateur Radio Projects & Kits

FD- FC 2A

Technical Details & Assembly Note: 40/400MHZ LCD PIC16F84 Frequency Counter

Introduction:

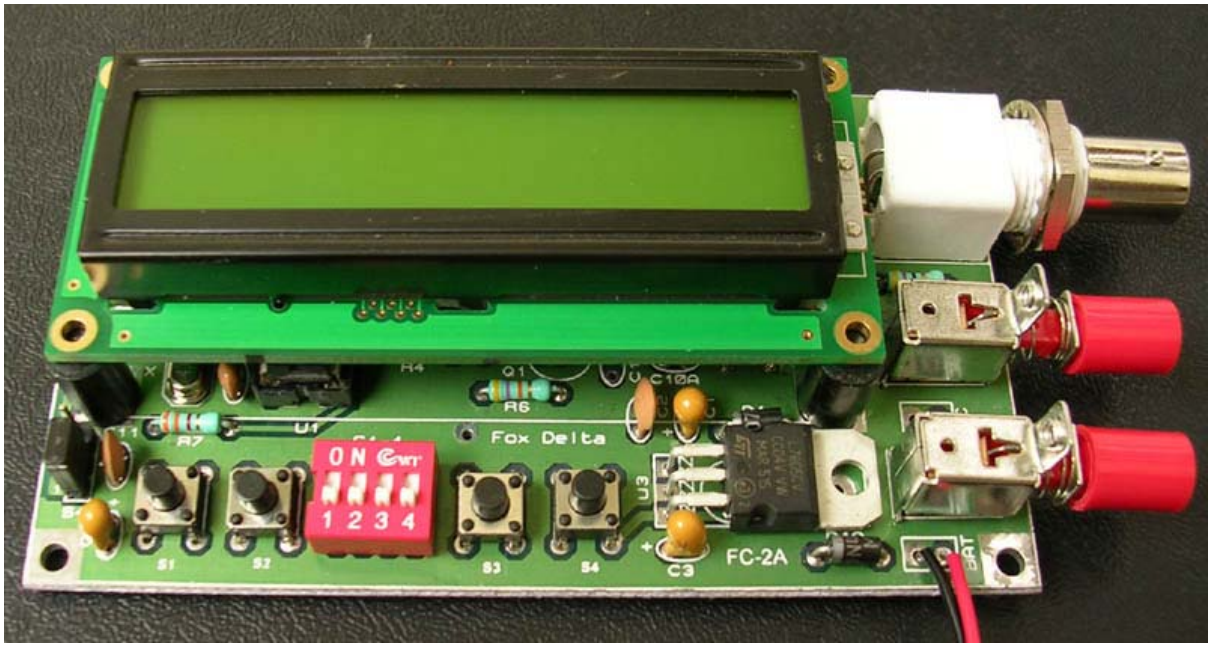
Frequency counter is a very important test instrument for Radio Amateurs, especially those who wish to develop or test circuits. There are lots of frequency counters in the market but building one was never so easy & exciting with Microprocessors doing lots of work for us.

FC2 40/400 kits received unexpected response from radio amateurs and I finished my first lot of PCBs quickly.

Keeping in view few problems that were faced by me in preparing FC2 kits and feedback received from kit builders, I decided to implement following changing on my new design for FC2A:

1. **Using J309 (TO92) in place of MMBF310 (SMD)**
2. **Instead of a DC connector have included an on/off switch**
3. **Now B/L of LCD may be switched off to save battery power to use this counter as a portable unit**
4. **Have option to use either 7805 or 78L05 (for battery operation).**
5. **Slide DIP switches added in place of headers.**
6. **Now only MC12080 is the SMT part & it will be pre-soldered on all 400mhz kits.**
7. **PCB size and everything else remains same.**

Picture of the Completed FC-2A:



This Frequency counter Project is based on PIC16F84A Micro controller chip manufactured by Microchip. Although rated at 1.1GHZ due to Pre-Scale IC capability, it can measure up to 400MHZ in this project.

Correct frequency display function in firmware is limited to divide by 10 of the pre-scale decimal control, making it a 400MHZ Frequency Counter. (If you are lucky, it may go to as high as 500MHZ maximum, a 50MHZ maximum measuring capacity of PIC16F84A) Also if you are smart, you may update the firmware & change pre-scale chip to higher division ratio to get full 1.1GHZ capability!!.

Project is built on a Double Sided PTH PCB a little bigger than the size of the 1X16 LCD display, 10cm x 6cm. Unlike 3.5GHZ frequency counter project detailed on this site, for this project, I made every effort to minimize component count & prevent all kind of switching, to make this counter small & multi-purpose.

A BNC RF input socket is provided. Please note that, pre-scalar remains in circuit all the time. If you want a 35Mhz counter, a suitable link is to be installed on Pre-Scalar pads to “bypass” it.

A Lo Z Switch, SW1 with 50 ohms resistor is provided for those who wish to measure Lo-Z signals with direct connection to BNC socket.

The input circuit is quite sensitive using Q1, FET J309. Followed by a differential driver Q2, J309 to the input of pre-scale chip MC12080. Pre-scale chip requires appropriate settings on H1-3 slide switch to divide the signal by 10.

Programming Buttons S1-S4 and Header S4:

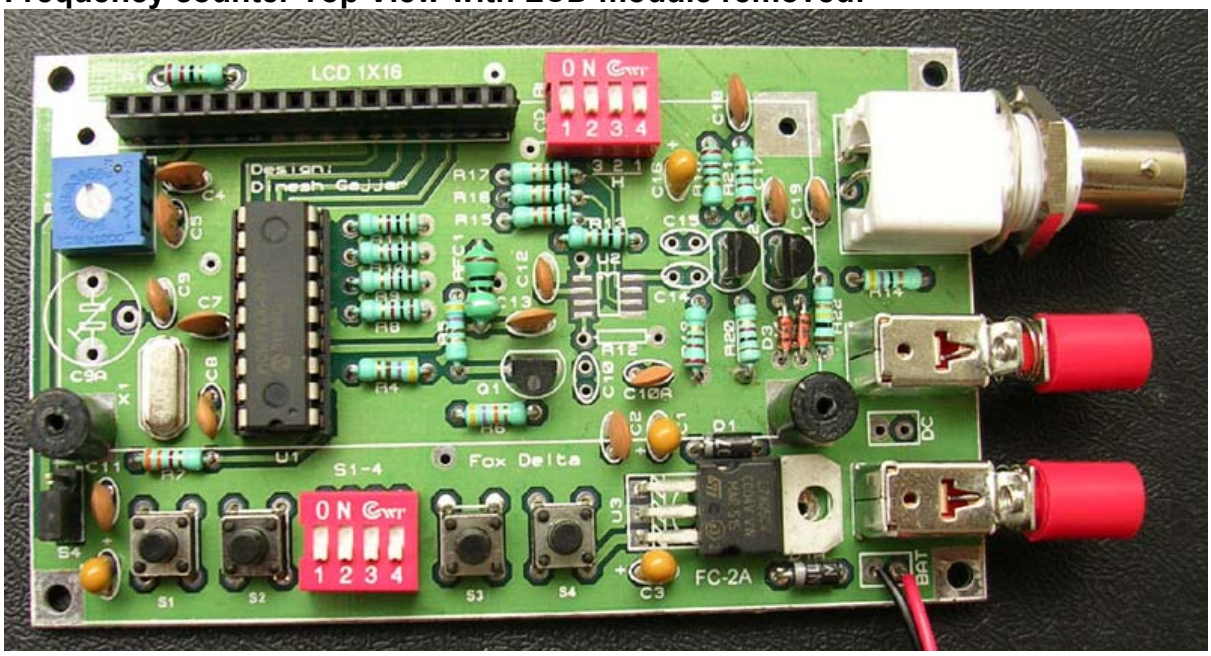
Offset Freq 1, Offset Freq 2, Direct or Pre-scale and for entering EE-Prom data entry, etc. **Please refer to "Configuring Fox Delta FC2 Frequency Counter Document for more details.**

In this version: FC2A: 4 slide switches are provided in place of headers which are in parallel to S1-S4 Push Buttons.

Counter is designed on a 6 X 10cm PTH Double Sided PCB on which LCD fits on the component side of the PCB. However, Contrast pot P1 and crystal trimmer C9A may be installed on the other side of the PCB for easy adjustment.

All kits 400MHZ kits (FC2A-400) are supplied with SMT IC (MC12080) pre-soldered on the PCB.

Frequency counter Top View with LCD module removed:



In above picture, board is populated with 40mhz components (some 400mhz parts are present only for demo purpose).

Note the position of C10A. For 40MHZ, this 1000pf capacitor (C10) is installed at C10A, bypassing the MC12080.

A 7805 is visible above but it may be replaced by 78L05 if you wish to use this counter as a portable unit.

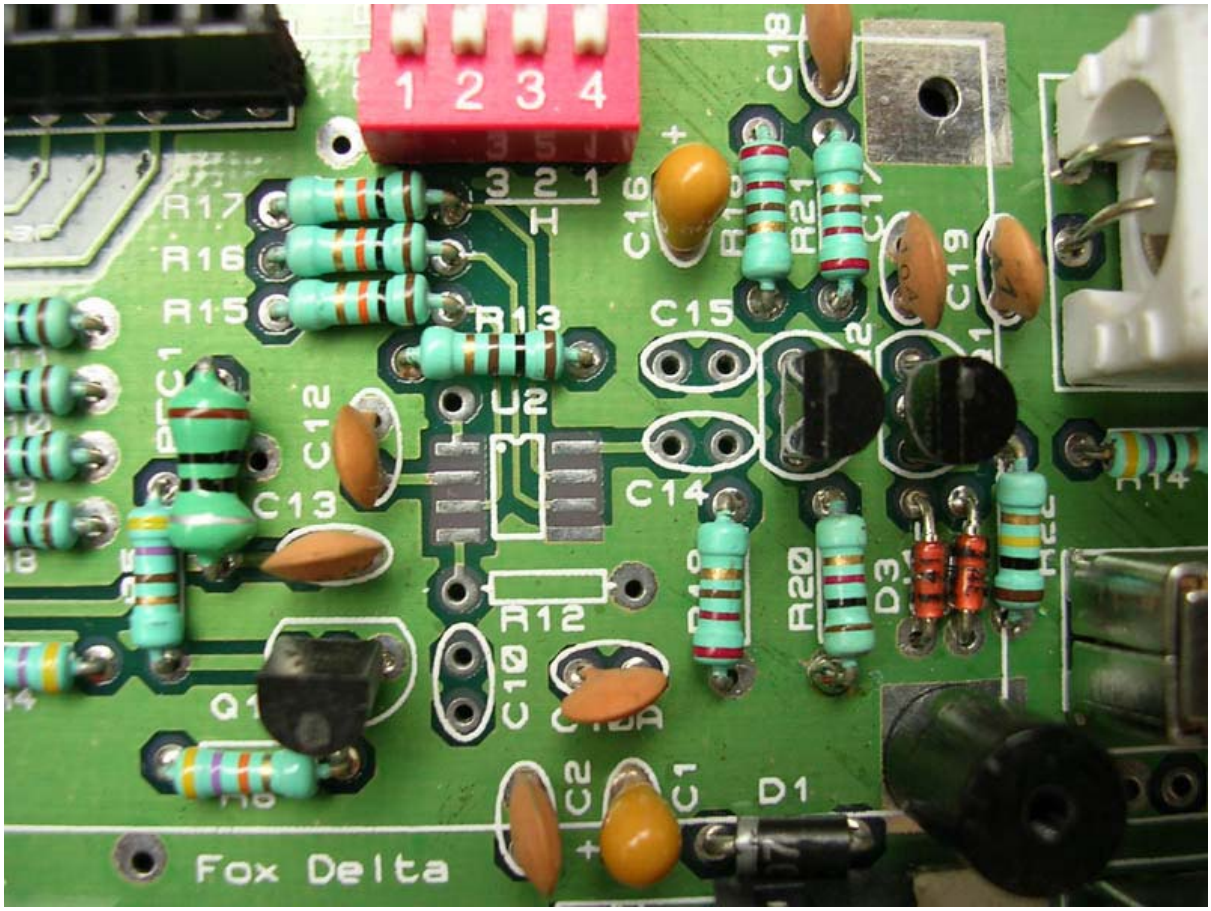
Two power input options are available, DC and Battery:

Battery (9V) may be placed inside the case and DC connector may be installed on the case for external supply of 9-12V DC

Red Switches:

The red switch on right-center is High/Low Z input selector. It terminates the input with a 47 ohms resistor. Second red push switch is used as power on switch.

View of the board around MC12080 SMT and related components:



If you wish to update 40mhz counter (as visible in above picture) to 400mhz counter, you only require an MC12080 and few parts.

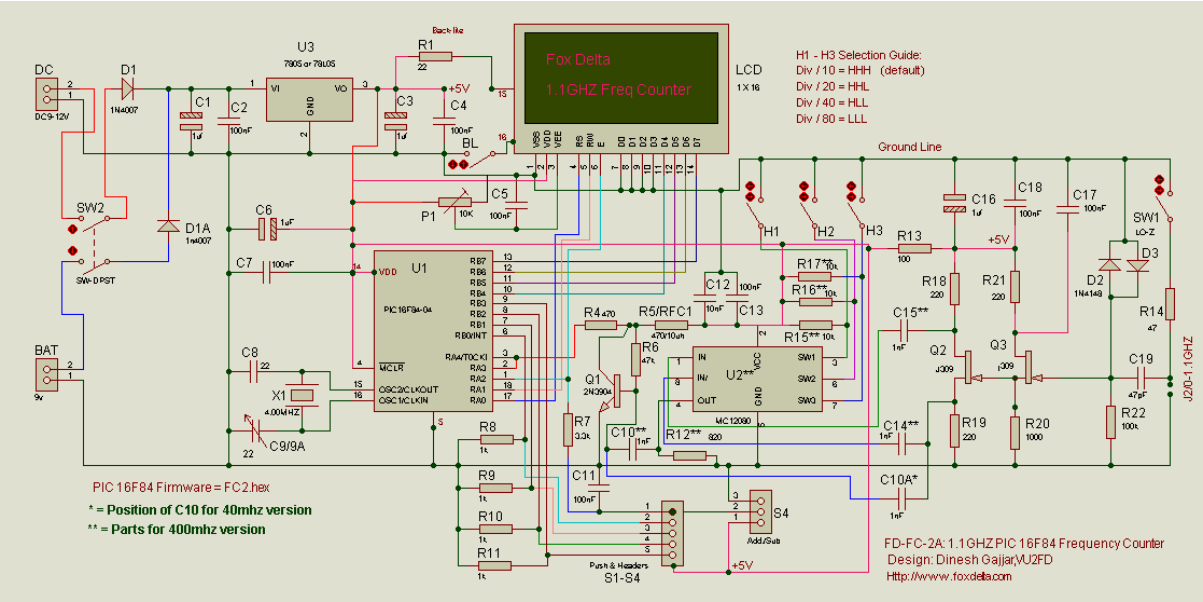
You will have to remove 1000pf capacitor from C10A and installed new one at C10.

Other parts required for upgrade are:

R12, C14, C15, C10, MC12080.

A 400mhz upgrade kit will be available.

Schematic of the 1.1GHZ PIC 16F84 Frequency Counter: FC2A



Front panel push switches (low profile) were used considering that functions such as Freq offset etc are only required once.

Once counter is configured for required offset etc, Slide switches may be selected to get required function for prolonged period of counter, which are provided in parallel to the push switches.

This counter was specially designed for those who own standard radios, antique radios & home made radios where IF offset is required to display correct frequency of reception.

Skill Level:

Like all other kits listed on this website, this kit is for radio amateurs and especially for those who fully understand the supplied schematic, silk snap and have ability to do good soldering. To the best of my knowledge, no special skills are required related to micro controller, as PIC16F84A will be supplied pre-programmed with the kit.

I hope this project & PCBs would be useful to many radio amateurs looking for economical frequency counter to measure frequencies up to 400Mhz.

Although counter is capable of measuring up to 1.1GHZ, I haven't tested it myself at frequencies beyond 400mhz and have no idea as to its performance beyond 400mhz.

Thanks & Regards
Dinesh Gajjar
19th June 2007

For more details on this project please visit http://www.foxdelta.com