



Fox Delta

Amateur Radio Projects & Kits

FC3-0812

FC3 Project Info: PIC18F4550 50/500MHZ Frequency Counter & RF Meter

This project is developed for Amateur Radio Community by:

[Antonio Alfinito / I2TZK](#)

[Dinesh Gajjar / VU2FD](#)

[Frank Dzuirda / K7SFN](#)

FC3-0812 50/500MHZ Frequency Counter and RF Meter:



HF 1S Gate and DBm Mode



FC3: Interesting features of this project:

1. Its USB and DC12V Powered
2. Measures RF Level using Analog Device Log amplifier AD8307
3. Count frequency to 50MHZ and 100 to 500MHZ
4. 2 x 16 LCD Display with BL
5. Signal Level measurement in dbm, vpp and rms
6. 50 ohms input impedance
7. Frequency "off-sets" may be set by PC program.
8. Free PIC Firmware & PC WIN Software by [Tony/I2TZK](#)
9. Auto Detect: DC12V (Stand-alone) or USB (with PC Link)

FC3 is designed on a Double Sided PTH Board and works on USB or external DC12V power.

FC3 is designed and developed for Radio Amateurs looking for economical frequency counter for their hobby work and wish to measure RF signal Level at the same time. [Analog Device](#)'s AD8307 is used to measure RF level accurately in DBm, Vpp or RMS.

Counter works with PC or as a Stand-alone. PC Connection is auto detected and so is stand-alone mode.

Front panel push buttons are provided for RF Meter Mode and HF/VHF Frequency measurement modes.

A PC program is specially designed for FC3 by [Tony/I2TZK](#) is provided for configuration of IF Off-sets and AD8307 related parameter configuration thru USB interface.

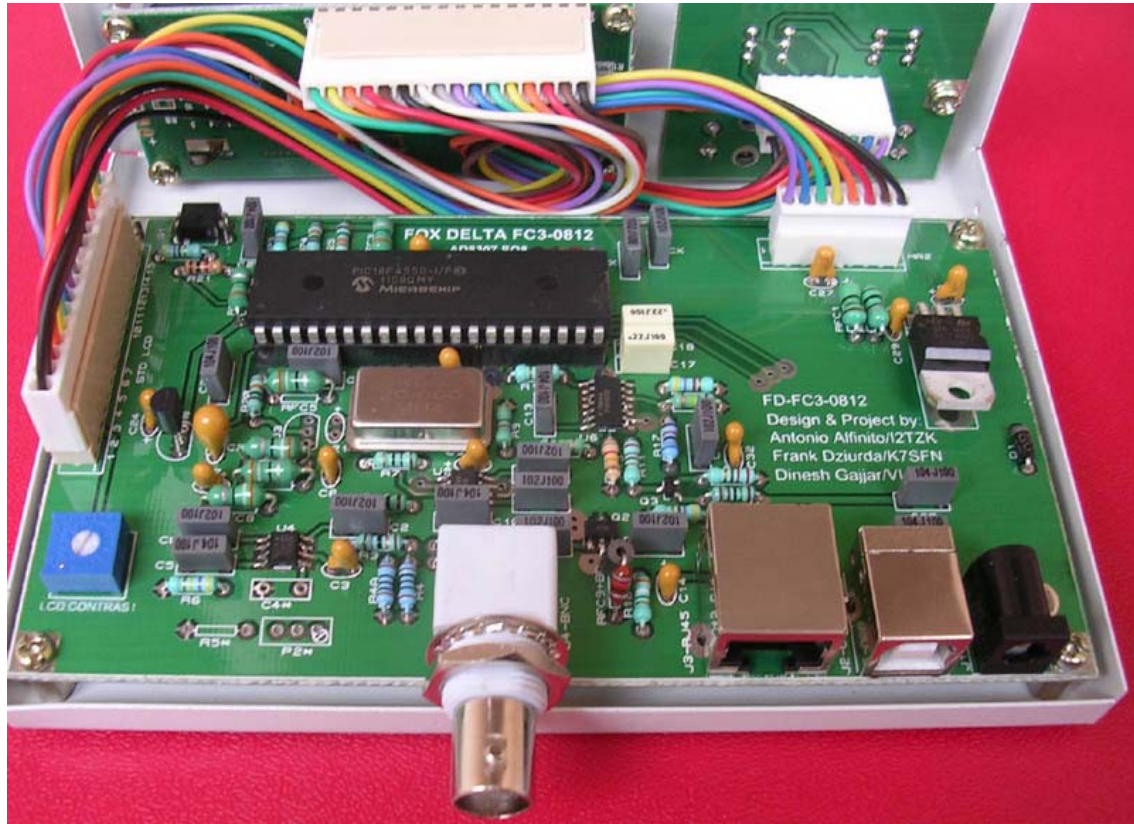
FC3 Complete KIT includes AD8307, ADA4789, 74VHC00 and MC12080 in SMT package. Complete kit is supplied with pre-soldered SMT parts on PCB for those who do not like to solder SMT devices.

Assembled FC3 may also be available but buyer will have to calibrate RF Measurement section of meter using PC software provided.

AD8307 Trim:

For advance experimenters, AD8307 may be "Trim" to suit special needs. Components marked with * are not supplied with kits and not needed for general use of this Counter + Meter. (R5, C4 and P2)

Another View of Completed FC3:

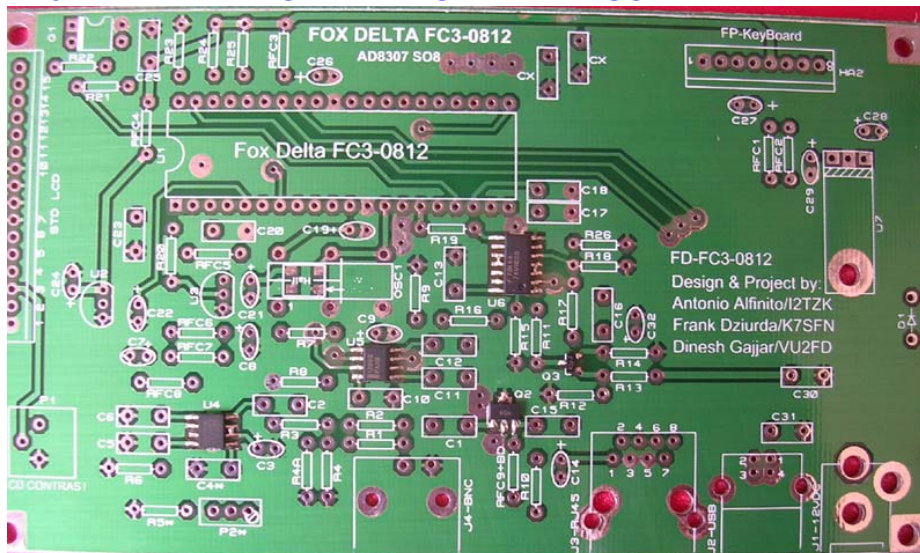


TCXO:

For those looking for accurate time base, an option to use Fox924 type SMT 20MHZ TCXO is available.

You may buy TCXO from [Fox Delta School](#) or from Mouser or Farnell at about \$5 - 8. You will also require 3.3V regulator (U3: MCP1702-3.3) and a Tantalum Capacitor. (1uF C21)

FC3 KIT PCB: ALL SMT PARTS ARE PRE-SOLDERED



Basic Operation of FC3:

FC3 has single input for measurement of Frequency and RF Signal Level. Both are at 50 Ohms.

Front Panel Push buttons are:

1. AD8307 related parameter: DBm, VPP and RMS
2. Frequency Division Parameter: Direct, Divide by 10 or 80

Direct Mode to 50MHZ:

In direct mode, FC3 counts to approximately 50MHZ as the signal is directly feed to PIC for counting. In this mode, we have two Gate Times: 1S and 10S



VHF/UHF Mode:

100 to 500MHZ mode is activated by front panel push button. This mode brings in MC12080 pre-scaler in to circuit and we have two possibilities: Divide by 10 and Divide by 80.



Divide by 80 is a projected scheme of this counter that we call it as a 500MHZ counter. However, MC12080 can count reliably to 1.1GHZ. Since I do not have source of 1GHZ to test, test above 500MHZ was not possible. Division: 80 may be used for measurement of Frequency to 1GHZ, if PCB and other hardware support it.

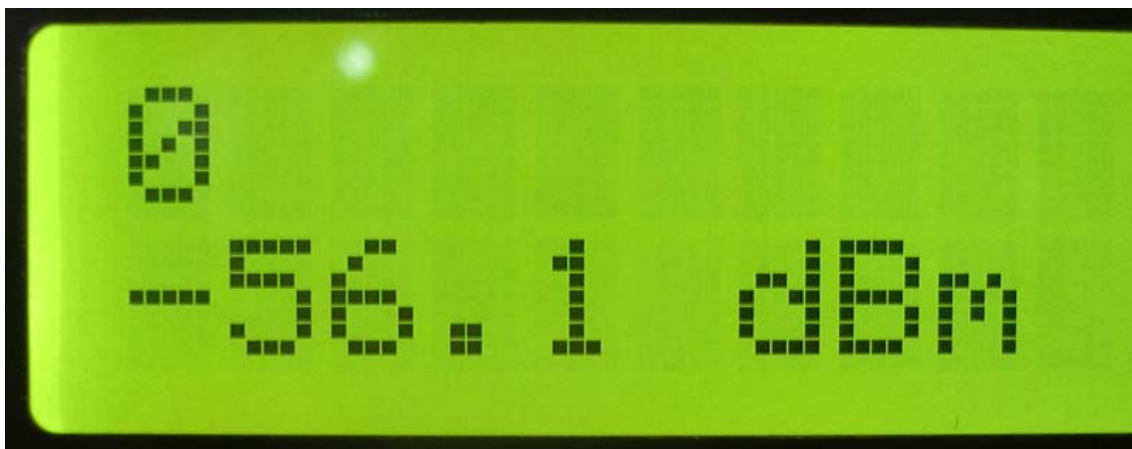


Actual Measurement of VHF Signal:

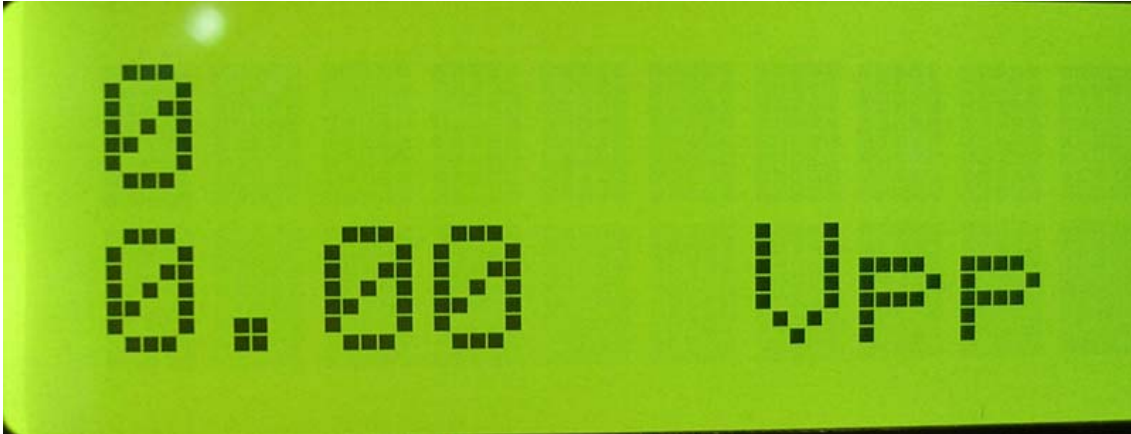


RF Level Measurement Mode:

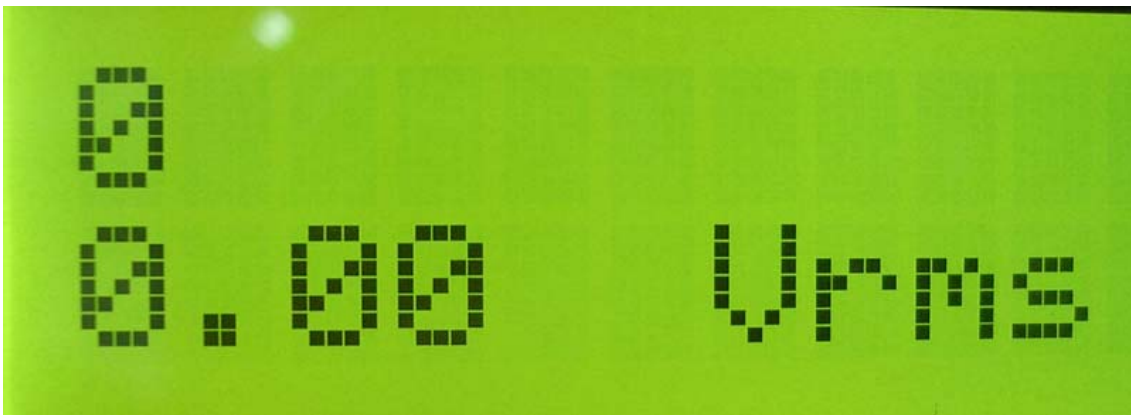
Measure signal in DBm:



Measurement in VPP:



Measurement in RMS:



Calibration of AD8307 parameters:

FC3 is using Analog Device's AD8307 Log Amplifier chip in SO8 package.

No adjustments are required in hardware.

However, Tony/I2TZK who has written code for PIC18F4550 has provided a PC software to accurately calibrate measurement values of AD8307 for various Amateur Radio Bands. (1 to 50MHZ)

Please refer to calibration document for more details. (Not yet ready)

Remember that AD8307 is connected all the time without any change in any component values for the measurement of RF Level from DC to 500MHZ.

(irrespective of either FC3 is in direct or Pre-Scaler mode)

AD8307 may not work well above 500MHZ and for that reason, FC3 is stated as a 500MHZ counter, although it should go well above it to as much as 1GHZ.

FC3-0812 Parts List:

Quantity	Part ID	Details
1	U1	PIC18F4550 DIP40
1	PCB	FD-FC3-0812
1	IC Socket	40 PIN DIP
X	U3*	MCP1702-3.3 (for TCXO – Option)
1	U4	AD8307 SO8
1	U2	MCP1525 2.5V Reference
1	U7	7805
1	U5	MC12080 SO8
1	U6	74VHC00 SO14
1	Q1	IRFD110
6	Q2	ADA-4789
1	Q3	BFR93A
1	OSC	Oscillator 20MHZ Full size (DIP14)
1	P1	10K Preset
1	D1	1N4007 Diode
1	RFC9	82uH
6	RFC3, 4, 5, 6, 7, 8	33-39uH
2	RFC1, 2	10uH
1set	LCD Header	16PIN SIL 0.1INCH (male+ribbon)
1set	KB Header	10PIN SIL 0.1INCH (male+ribbon)
2	KB Buttons	12mm push buttons
2	Push Switches	Front Panel ON/OFF and USB/DC select
1	KB PCB	FC3-0812-1
1	J3	RJ45 R/A PCB Connector
1	J4	BNC R/A Connector
1	LCD	2x16 LCD with BL
1	J2	USB Connector
1	J1	DC Connector
1	Case	Free powder coated metal case.
1	Set	LCD and KB mounting hardware

Resistors: All 1/4W

Quantity	Part ID	Details
3	R1, 2, 3	18 ohms 1%
2	R4, 4A	100 ohms 1%
1	R5	22K (Not part of this kit)
1	R6,	470K
1	R7	10
1	R8	100K
1	R9	820
1	R10	39
2	R11, 14	220
2	R12, 22	470
1	R13	1.5K
1	R15	820K
2	R16, 18	750K
1	R17	680K
1	R19	150
3	R20, 24, 25,	10K
1	R21	1K
2	R23, 26	4.7K

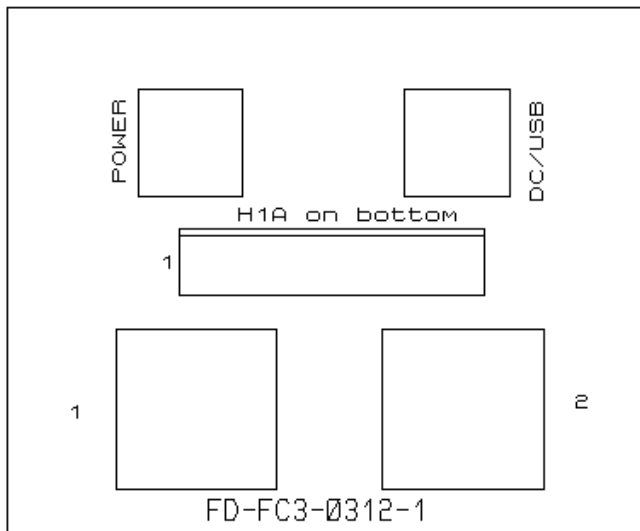
Capacitors:

Quantity	Part ID	Details
10	C1, 2, 6, 11, 12, 15, 16, 20, CX, CX	0.001uF Ploy
7	C5, 23, 25, 13, 10, 31, 30 (C4)	0.1uF Ploy
12	C3, 7, 8, 24, 26, 19, 9, 14, 32, 27, 28, 29	1uF Tantalum
1	C22	10uF Tantalum
2	C17, 18	0.22uf Poly

Note:

1. R5, P2 and C4 are not part of this kit. (For expert trim only) May be offered as an option at nominal cost of free of charge.
2. CX are key bounce caps. Install if needed.
3. U3 and TCXO not part of this kit but may be available as an option.
4. U4, U5, U6, Q3 and Q2 may be available as Pre-Soldered on PCB

FC3-0812-1 Key Board:



Keyboard PCB has two 12mm push buttons and two push ON/OFF switches.

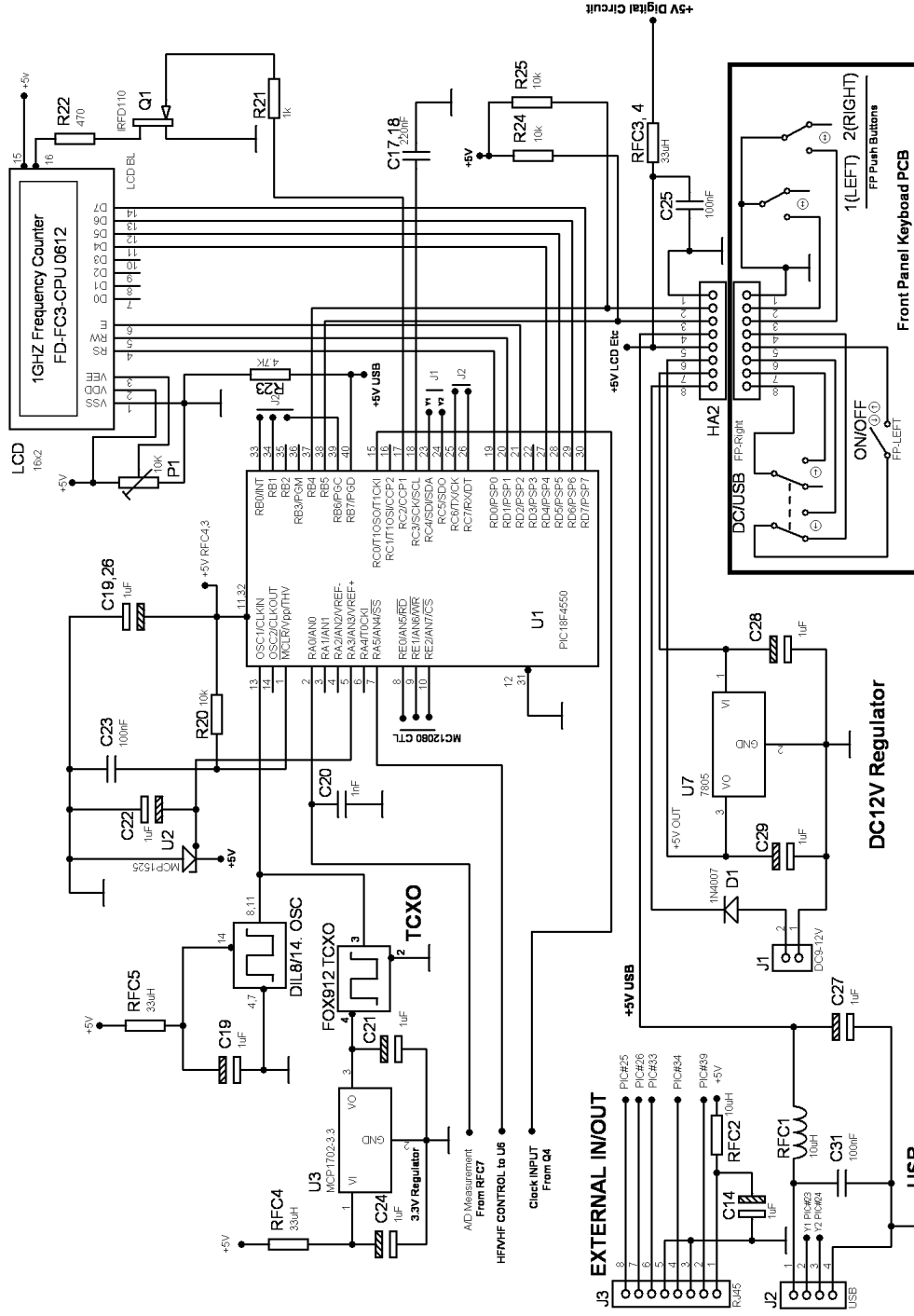
ON/OFF Switches:

1. Power: Power to FC3
2. DC/USB: Select source of power: DC12V or USB

Push Buttons:

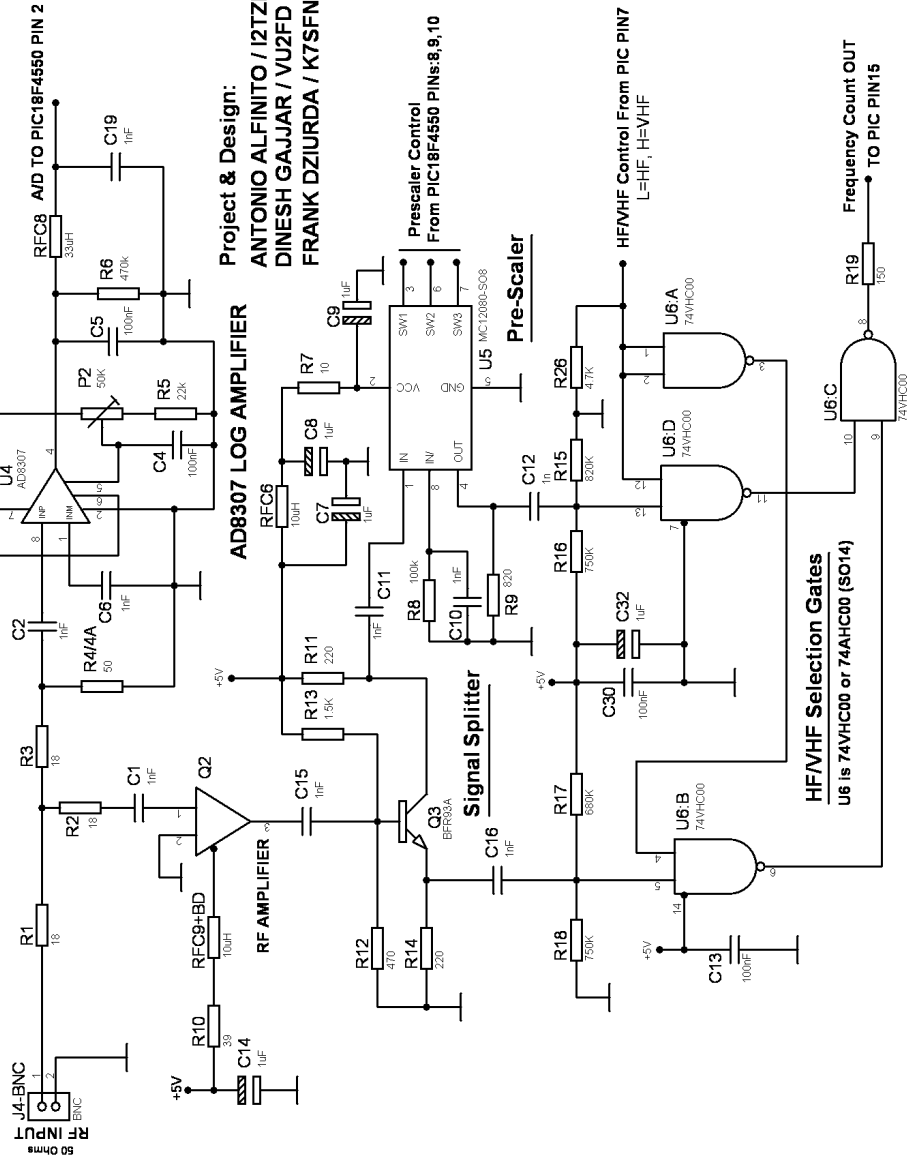
1. RF Measurement modes: DBm, Vpp, RMS
2. Frequency Counter Modes: Direct or Div by 10 or 80

FC3-0812 CPU Schematic:



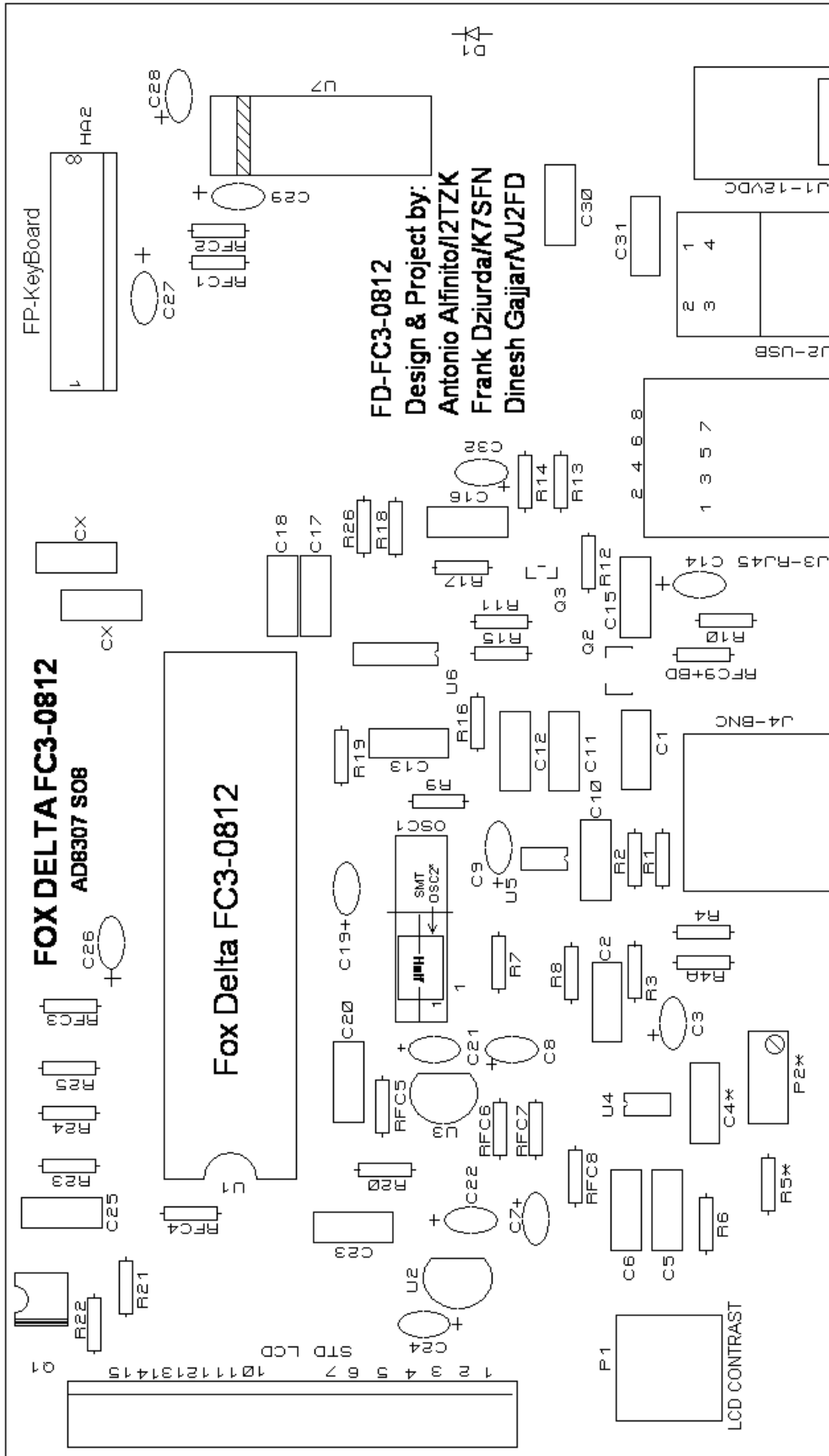
Project & Design by: Antonio Alfinito / I2TZK, Dinesh Gajjar / VU2FD, Frank Dziurda / K7SFN
 Fox Delta FC3-CPU-0812 PART-1 <http://www.foxdelta.com>

FC3 500MHZ (1.1GHZ) LCD Frequency Counter & RF Meter

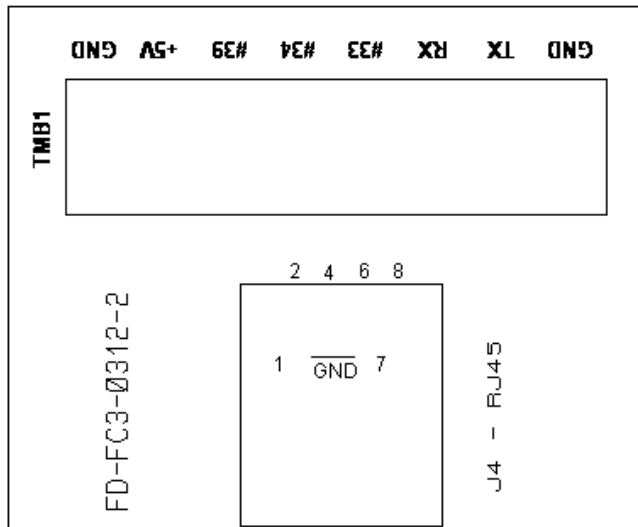


Project & Design:
 ANTONIO ALFINTO / I2TZK
 DINESH GAJJAR / VU2FD
 FRANK DZIURDA / K7SFN

FC3-0812 PCB TOP SILK:



FC3-0812-2 Extension Board Silk: (OPTION)



An extension board is available for experimenter and may be offered free of charge. It includes: 1xRJ45 Connector, 1xPCB, 8PIN SIL Terminal Block and 1Mtr Long Cat5 cable. User need to be aware that all connections from this board are directly connected to CPU and it may damage CPU if CPU maximum parameters are exceeded. Please refer to PIC18F4550 datasheet for maximum ratings of CPU.

Final Note:

FC3 will be available in kits and assembled. Efforts are made to ease construction for kit builders. For that reason, as many kit builders will not be happy with SMT parts, all kits will be supplied with SMT parts pre-soldered.

I hope this project will help many radio amateurs measure frequency and signal level for their hobby development work.

73s

Dinesh Gajjar
240812

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