G0CWA ANALOG AF/MF SIGNAL GENERATOR

APRIL 2013

INTRODUCTION

Hi here is my design for a simple easily customizable signal generator generating variable levels of sin, triangular and square wave signals for setting up of filters etc with the added bonus of a 5v TTL compatible clock signal all from 3Hz up to around 200KHz. The whole unit is powered by either two PP3 9 volt batteries or, preferably, because of the relatively high current consumption a cheap (12V 200mA or higher) unregulated power supply. The cheap 12V wall wart types give around 15V+ peak.

Any supply greater than 14V to up to around 20V will do as the onboard regulators will take care of it.

I apologise for using an out of date chip for the design the ICL8038 although now out of production is still easily available on e-Bay or via a lot of component suppliers as it was a very popular chip. Take care though as you should expect to pay no more than £4.00 probably a lot less I got some from Hong Kong for £1.00 each, some people are asking for up

to £50.00, yes £50.00. At present there is no SMT equivalent available. I chose this route rather than a DDS approach because it is far easier to reproduce as a “one off” home brew project.

Although for best performance ideally a split rail power supply should be used, a cheap split rail supply was not easily available so I designed the circuit by several simple “fiddles” to run on a single rail with an onboard synthetic Ground.

BROAD SPECIFICATION

Power supply either 2x 9volt batteries internal or an external DC of 14-20V

Frequency coverage 2Hz to around 200KHz in 6 switched ranges

Range no.	1	2	3	4	5	6
Frequency Hz	2 - 50	26 - 470	260 - 5K	2.3K - 43K	5.2K - 100K	12K - 210K
Sin	ok	ok	slight xover distortion	slight compression	slight compression	slight compression
Triangle	ok	ok	ok	slight "rounding"	slight "rounding"	slight "rounding"
Square	ok	ok	ok	slight "rounding"	rising distortion	rising distortion
TTl	ok	ok	ok	slight "rounding"	rising distortion	rising distortion

Sin, Triangular and Square wave outputs of up to around 3V PTP

5V TTL compatible clock signal

Optional Un-calibrated output level meter (guide to levels only)

Optional Digital frequency read out

Output monitor socket


MONITOR
EXT 14V

MODULES

The generator is built in a modular format as are most of my projects, the minimum required is the PSU and main board calibrated dials will serve the same purpose and reduce cost.

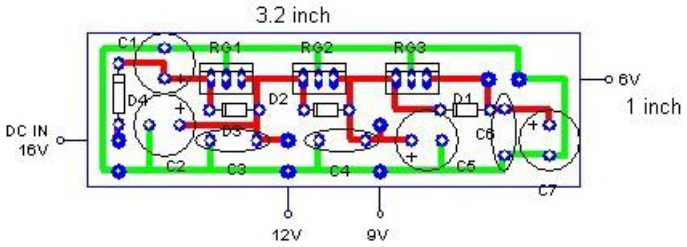
The frequency meter module was bought off e-Bay from “jpl995” and was listed as

FREQUENCY COUNTER 1HZ-80MHZ WITH 1HZ RESOLUTION

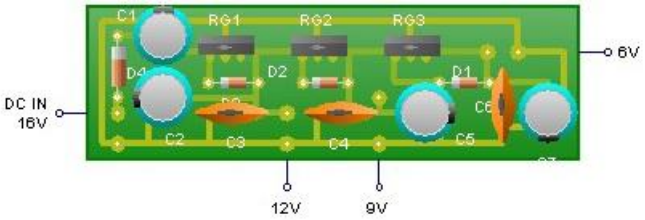
I found Jim was very reliable and helpfull. Others supply similar modules but I have not dealt with them.

PSU

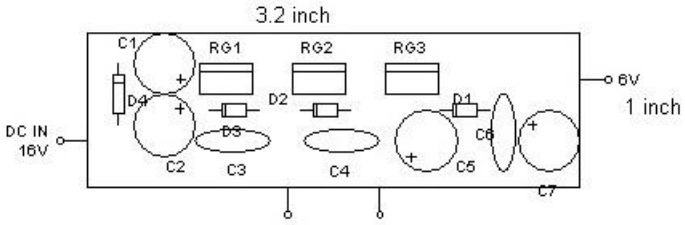
There is nothing special here just a regulator chain made up of a 7812, 7809 and 7805 the whole unit being bolted to a die-cast box which provides sufficient heat-sinking and shielding. No insulating washers were needed as the “mounts” are connected internally to the OV rail



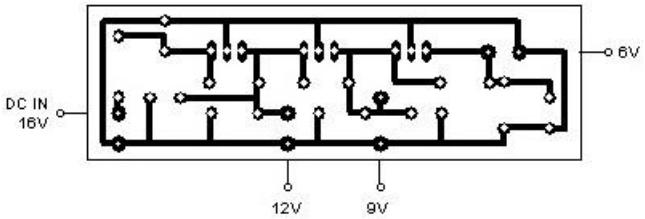
PSU COMPONENT PLACEMENT



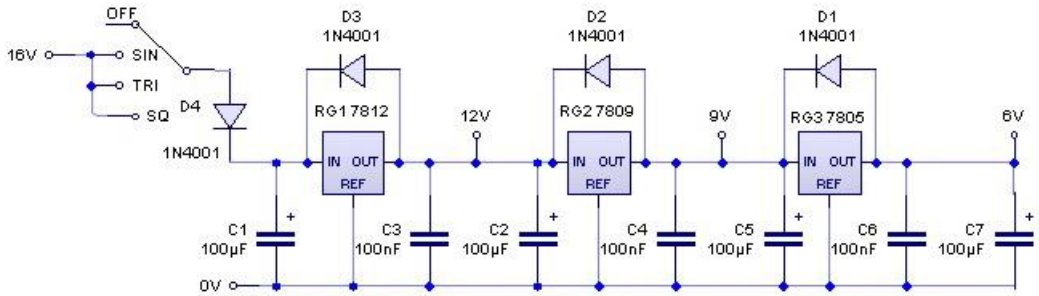
PSU REAL WORLD



PSU SILK SCREEN



PSU TRACK (X-RAY VIEW)



PSU CIRCUIT

MAIN BOARD

Firstly an apology this board although basically the same as my prototype does have slight differences the major ones being on the right hand side of the board. My prototype had two extra op-amp buffers, one for the square wave signal and one for the output, I found neither were needed and removed them from the final layout, just taking the inputs to the simulated ground (5V rail).

The operation of the ICL8038 chip is covered on the data sheet and is not discussed here.

I have included a minimum of pre-sets to set up the board all are needed, it is not me being too lazy with the calculator to work out single resistor values.

Their uses are

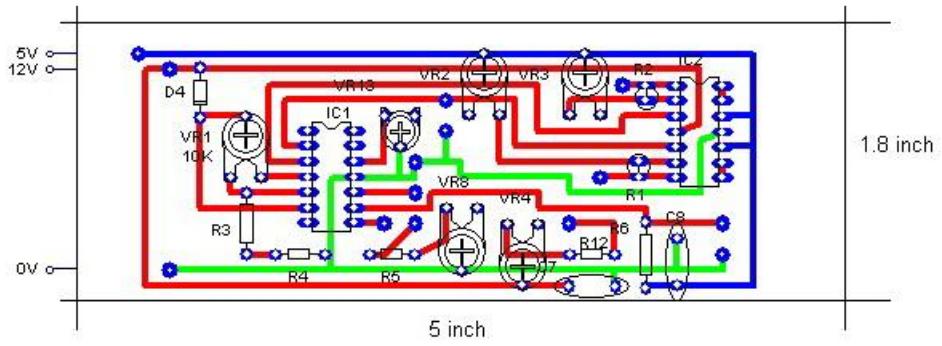
VR1 to balance the mark space ratio of the outputs

VR2 and 3 to vary the gain of the sin and triangle waveform buffers to prevent clipping of the wave forms

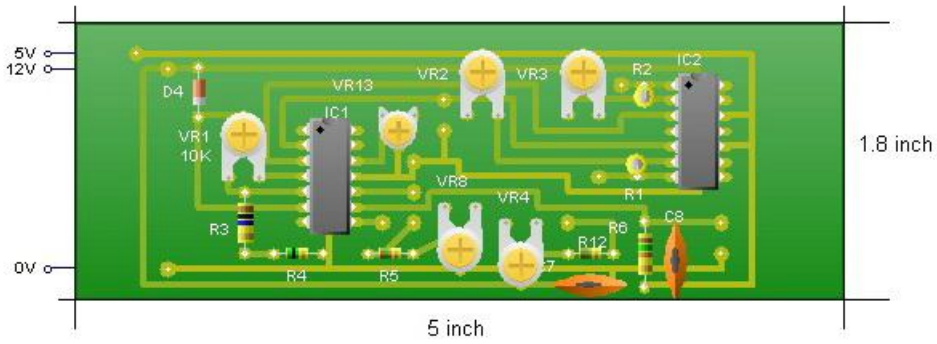
VR13 is to optimise the sine wave shape, use a scope or the best spectrum analyser you have available, one supplied by nature, your ears, for the cleanest signal.

The final two VR4 and VR8 control the frequency span control voltage and will be roughly 2/3 of the pos supply i.e. 8V to near full rail.

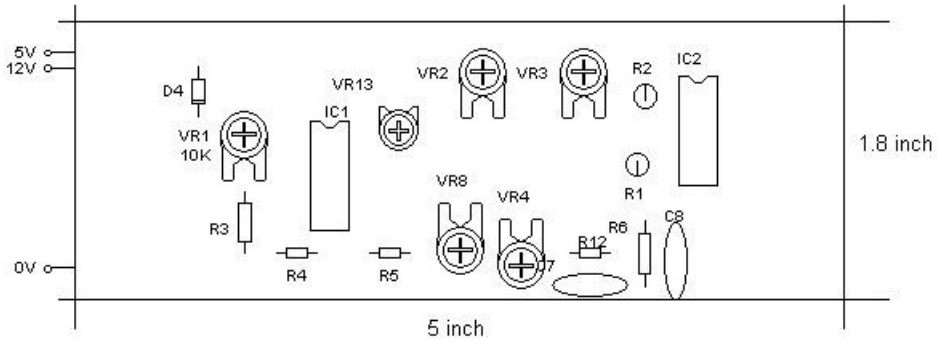
Please note if the control high voltage is too high all sorts of distortions creep in, my prototype covered around 8-11.6 volts but this is an SOT value and depends on the individual chip, I tried 3 different ones all needed the pots set differently for best performance.



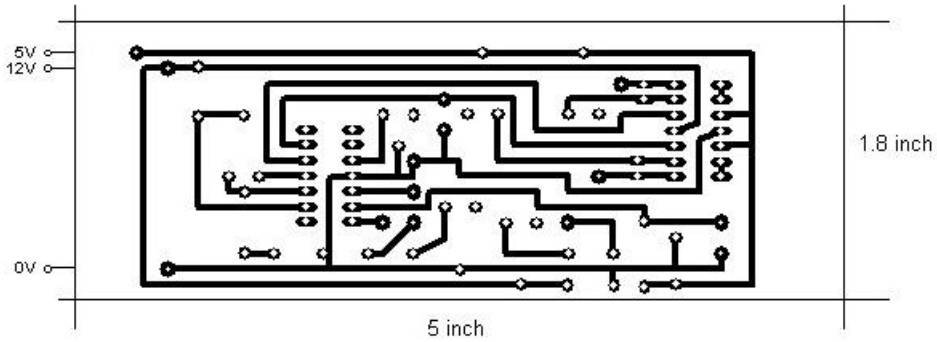
MAIN BOARD COMPONENT PLACEMENT



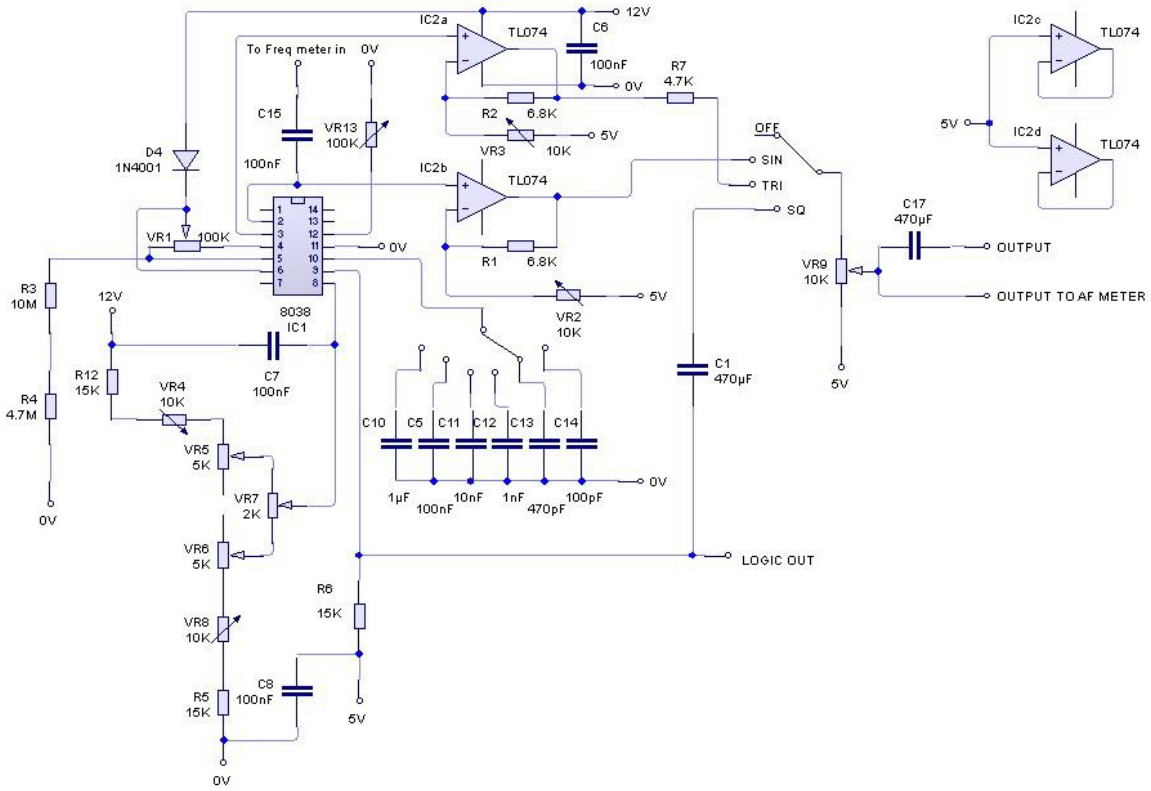
MAIN BOARD REAL WORLD



MAIN BOARD SILK SCREEN



MAIN BOARD TRACK (X-RAY VIEW)



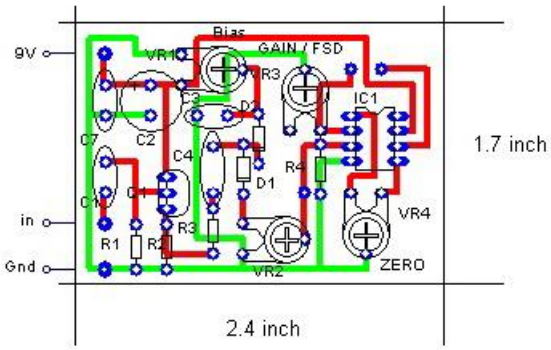
MAIN BOARD CIRCUIT

OUTPUT METER

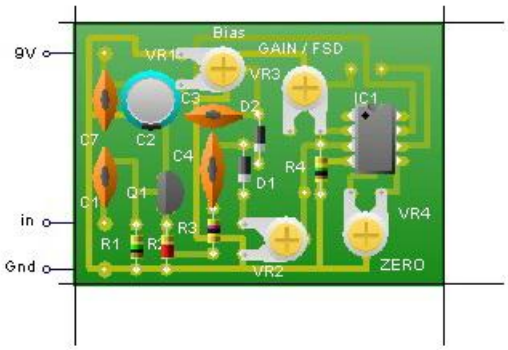
The output meter is included for giving a visual display of the output amplitude of the signals and although it works on all modes is accurate on sin waves only, even then it is not particularly accurate and is intended as an indicator only. Accurate levels would have to be measured on a scope, but, it is still a useful addition enabling quick return to values.

The meter is basically a copy of my RF mV meter but “tuned” to operate at lower frequencies, below around 25 Hz although not giving a constant level can still be used the peak values being shown by the peak deflections of the meter. Any meter movement can be used the gain and range pre-sets VR3 and VR2 should give sufficient adjustment. It is also possible to correct for any slight DC offsets using VR4. R5 is an optional component and is included for meter matching to the circuit if the meter is too sensitive, it is an SOT value.

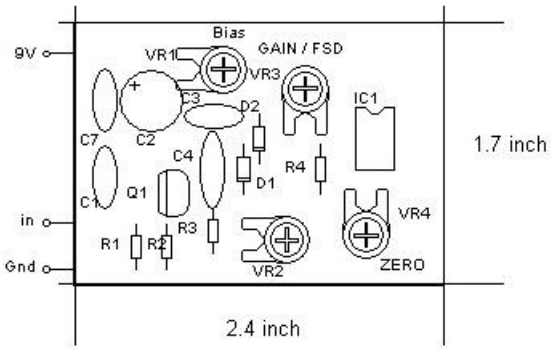
The final pot VR1 is used to adjust the biasing of the diode D1 to just conduct with no input signal adjust it till a very low dc voltage can be measured at the junction of D1, C6 and VR2, the lower the better.



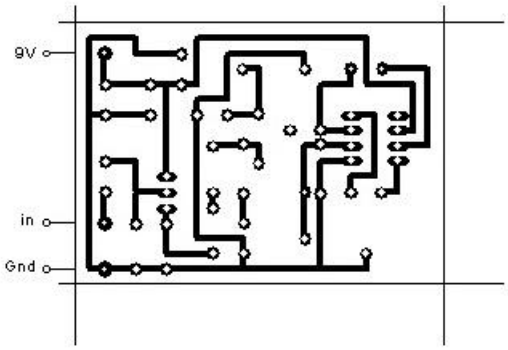
OUTPUT METER COMPONENT PLACEMENT



OUTPUT METER REAL WORLD



OUTPUT METER SILK SCREEN



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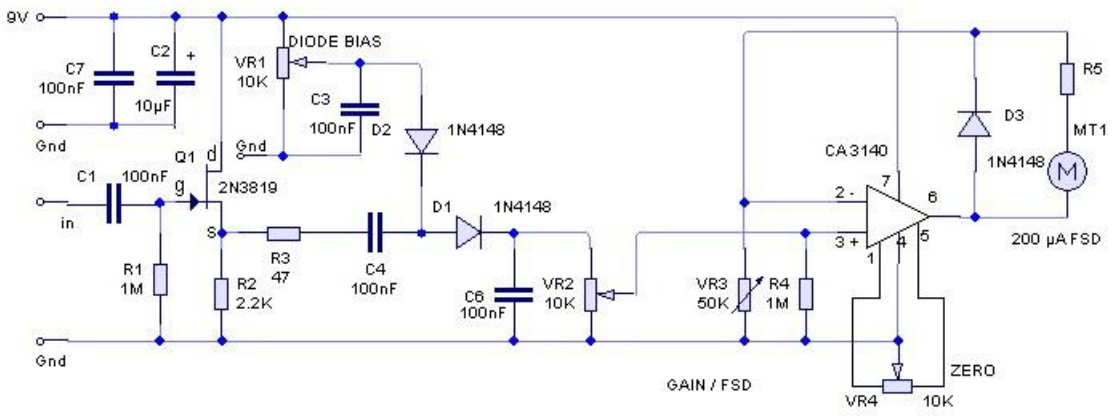

OUTPUT METER CIRCUIT

Parts sources

The frequency meter off e-Bay from “jpl995” and was listed as **“**FREQUENCY COUNTER 1HZ-80MHZ WITH 1HZ RESOLUTION”

The **ICL8038** although now out of production is still easily available on e-Bay or via a lot of component suppliers, but watch the price, don’t pay more than around £4.00 maximum.

All the rest of the parts are standard ones and should be easily available

This again was built to replace my original unit liberated by my friend who at the moment is building up his test equipment.

Hope you find this of use and happy oscillating 73 for now de Nick G0CWA.

Any comments will be gratefully received and as usual I can be contacted by e-mail at n.strong@hotmail.co.uk or via the Radio Board and QRZ forums as G0CWA.

I cannot guarantee to see your questions if posted elsewhere

REMEMBER TO CHECK THE PCB TRACK LAYOUTS AND MIRROR THEM IF NEEDED. I HAVE PRESENTED THEM AS “X-RAY” VIEWS OF THE FINAL BOARD !!!!

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