# nonlinearcircuits

Choral Generator build & BOM
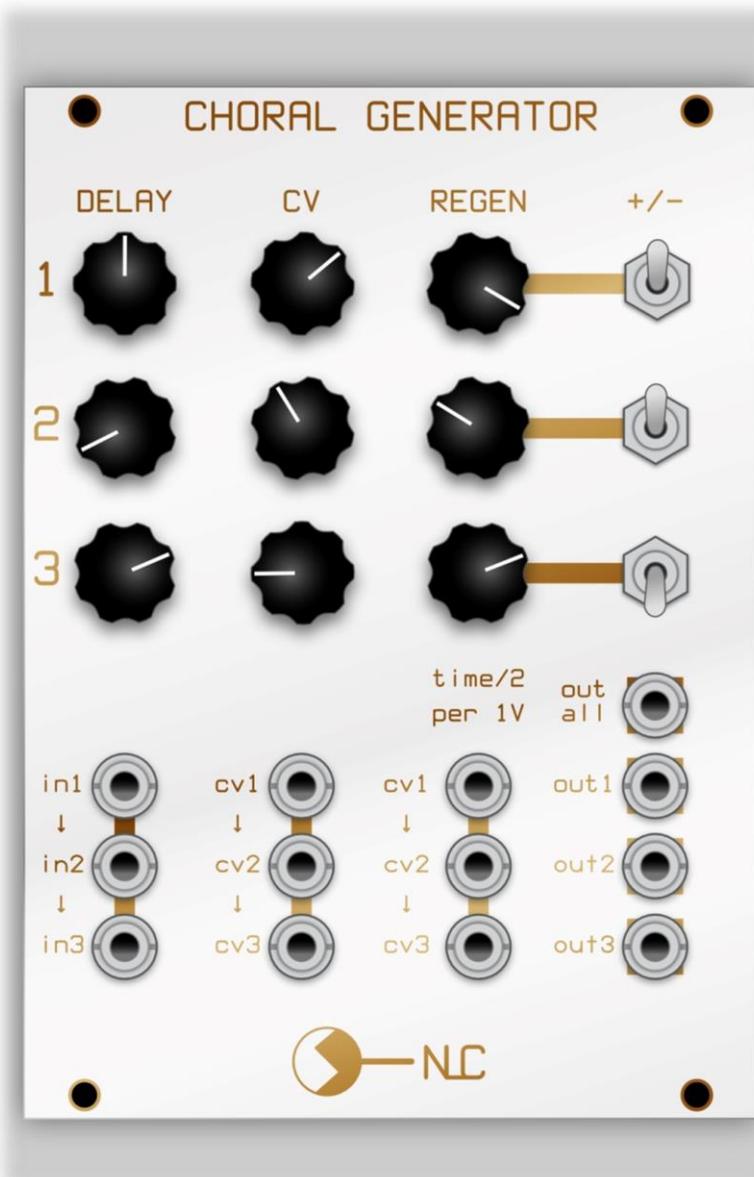
This is a BBD based triple chorus generator. It is inspired by the Choral generator in the ARP Omni, although the circuit is based on one from Electronotes.

The circuit is DC coupled so it can be used to process CVs as well as audio.

As is, a signal patched into **in 1** will be fed thru all 3 BBDs and arrive at **out all**, so the 3 BBDs operate in parallel as is done on the ARP Omni. The best effect is to modulate them with a 3 phase signal (I guess I better make one) or signals from a quadrature oscillator such as the NLC Feague.

If patched **out 1** > **in 2**, **out 2** > **in 3**, then **out 3** to the Mixer/VCA, you will have the three circuits in series.

Alternatively, the three circuits can be used individually; patching to the inputs will break the internal routing.

BOM — The Tayda & Mouser part numbers are given as examples

VALUE	QUANTITY	DETAILS
47pF	3	0805 Tayda: A-3517 but better to get C0G/NP0 from Mouser:80-C0805C470J5G
1nF	3	0805 Tayda: A-944
100nF or 104	8	0805 Tayda: A-3511
10uF	8	0805 25V or higher voltage rating Mouser:963-TMK212BBJ106MG-T
220R	6	0805 (R=Ω)
1k	7	0805
1k8	6	0805
3k3	3	0805
10k	9	0805
12k	3	0805
15k	12	0805 see notes (install on 33k*)
18k	3	0805
22k	6	0805
30k	3	0805
33k	3	0805 see notes (do not install on 33k*)
47k	7	0805
82k	3	0805 **marked on PCB as 150k***
100k	36	0805
150k	3	0805
300k	3	0805
1M	3	0805
TL072 or TL082	8	Soic Tayda: A-1139
LM13700M	3	Soic Mouser: 926-LM13700MX/NOPB
CD40106	3	Soic Mouser: 595-CD40106BM96 or similar
V3207 / MN3207	3	DIP See notes
78L05 (8 pin soic IC)	1	Tayda: A-629 soic
BC857	6	Tayda: A-1345
BC847	3	Tayda: A-1339
MMBFJ309 FET	3	SOT23-3 Mouser:863-MMBFJ309LT1G similar ones should work (J112, J108 maybe?)
LL4148	9	Tayda: A-1213
Eurorack 10 pin power connector	1	Tayda: A-198 cut to size
S1JL, Schottky, power rectifier or 10R, optional - for reverse voltage protection...or not	2	SMD SEE NOTES #1. **dot on PCB indicates CATHODE (stripe on component).** My current fave is BAT54GWX, Mouser:841-BAT54GWX
3.5MM SOCKET Kobiconn style	13	Tayda: A-865 or Thonkiconn Jacks (PJ301M-12) from Thonk, Synthcube or Modular Addict
10 Pin 2.54mm Single Row Pin Header Strip	4	Tayda: A-197 (cut to size)
10 Pin 2.54mm Single Row Female Pin Header	4	Tayda: A-1306
100k pot	9	Tayda: A-1848 or similar
10k trimpot	3	Tayda: A-586
100k trimpot	6	Tayda: A-587
On-off-on toggle SPDT	4	Tayda: A-3670 or A-3187 see notes

Additional notes:

1. , Schottky (best option) **or** standard power rectifier diode 50-600v 1A or more, **or** use a resettable fuse **or** just a 10R. Examples: BAT54GWX, PMEG2005EGWX, AEC-Q101, 20V, SOD-123, PMEG2005EH DIODE, SCHOTTKY, 0.5A, 20V, 1N400x or S1JL or similar.

2. The chips, resistors, caps are cheapest from Tayda. Schottky diodes, CMOS & 1uF, 10uF 25V 0805 caps from Mouser/E14/Farnell/etc.

3. Join the Nonlinearcircuits Builders Guild on FB: https://www.facebook.com/groups/174583056349286/ and ask questions there if you have any. If you prefer not to FB then email is fine.

4. For V3207, check Cabintech on ebay – https://www.ebay.com/usr/cabin-globa Or https://www.banzaimusic.com/Coolaudio-V3207.html

5. The toggle switches can be ON-ON or ON-OFF-ON. These select positive or negative feedback, or off if using the ON-OFF-ON type. The REGEN pot can simply be set to 0 if you don't want feedback and have used ON-ON switches.

6. Replace the 150k* on the PCB with 82k, this is noted in the BOM.

7. Replace the three 33k* with 15k. This mod was suggested by Paul A. to reduce distortion but you can still get a 10Vp-p output.

8. You can install V3208 for longer delay times (less of a chorus, no mods needed) or V3205. If installing V3205, you will need an adapter PCB. I have these available (free with main PCB), just ask when ordering or if you are reading this now with the PCBs already on hand I can send some in a letter.

Setup:

Each of the three channels has three trimpots:

Balance – this used to minimise clock noise
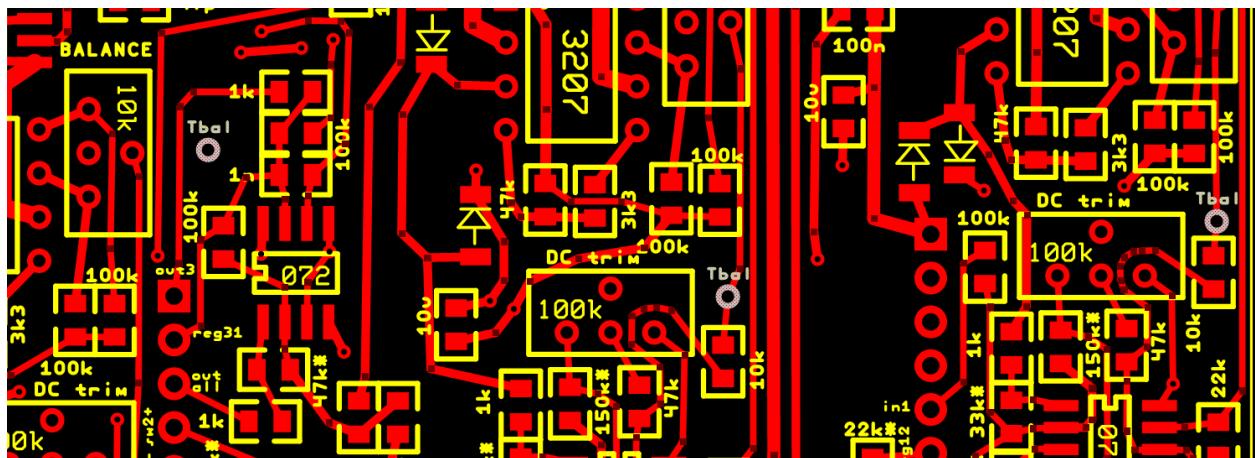
DC Trim – to remove offest from your signal

Gain – to set the output signal to the same size as the input signal

It is best to use an oscilloscope to set up, if you do not have one a multimeter and your lovely ears will have to do. Do the setup one channel at a time and ignore the OUT ALL jack for now.

1. With nothing patched in, measure the voltage on the channel output and adjust DC Trim so it is about 0V
2. Patch in a 10Vp-p signal (I use a sine wave from a LFO)
3. Crank up the DELAY pot to maximum, turn REGEN to 0.
4. Adjust GAIN trimpot until the output is approx 10Vp-p.

5. Remove the input signal and turn REGEN to maximum with toggle switch turned downwards.
6. Listen to or check the output, it should self-oscillate.
7. Adjust the DELAY pot to change the oscillating frequency (Yes you also have a triple VCO)
8. Wind back the REGEN pot, the oscillating should stop at about 7 or 8 on the dial (if there was a dial and 10 was max). The GAIN trimpot determines whether the circuit will self-oscillate and where it will start, adjust it to suit.
9. If you have an oscilloscope, probe the TBAL (balance test) points on the PCB. Patch in a signal, something simple like a sinewave. If you zoom in with the oscilloscope, you can see a bit of fuzz on the signal. Adjust the BALANCE trimpot so this fuzz is minimal. As you turn the screw, you can see the fuzz get smaller, then increase again, so wind it back to the smallest point. It will never get to zero, there is a low pass filter to clean out the rest of the clock noise (mostly).

10. If you don't have an oscilloscope, patch in a clean sinewave and adjust BALANCE trimpot while listening to the output. Wherever it seems the least noisy will have to do.

Circuit Description:

Each section has an OTA (LM13700) based VCO that runs between approx 400Hz and 250kHZ. The VCOs have a rough 1V/oct scaling which also controls the low pass filters on the outputs. The VCO square output is buffered and boosted by the 40106 inverters to give signals suitable for clocking the BBD ICs. The 40106 and V3207 all run on 5V provided by the regulator

The signal inputs reduce the incoming signal to approx 3Vp-p and offset it to approx 2.5V. If you need or want to change this. The 33k* resistors set the gain and the 150k* (modded to 180k) set the offset. There are two diodes to clip the signal if it is too hot for the BBD chip to handle.

After the BBD does its thing, the output circuit removes the DC offset, boosts the signal gain and the feeds it thru a low pass VCF to help reduce clock noise. Feel free to try different capcitors on the VCF. The PCB has 1nF caps as is, I tried a few higher and lower values but didn't notice any great improvement or detriment so stuck with 1nF.

nonlinearcircuits

choral generator

andrew

Rev 1.0

6/20/2020

Page # or name

VCO

VCF

MIX

IN

cv

2:1 per 1V

DC trim

trim balance

test point
Tbal

trim Gain

REGEN

SW

choral out

out

Circuit above x3

from stages 1,2 3

change to 100k
150k** on pcb

11 = +V
6 = -V

3,14
4,13
1,16
5,12

LM7805 soic
In   Out
Com

40106
1   U   2
3   U   4
5   U   6
9   U   8
11   U   10
13   U   12

14
7

3207
1   8
2   7
3   6
4   5

+12v
-12v
+5v
-5v

100k
150k
33k
1k8
1k8
1M
10k
30k
47p
15k
15k
15k
100k
100k
100k
100k
300k
100k
12k
10k
40106
47k
3k3
33k**
1k
10k**
100k
100k
10k
100k
47k
100k
10k
10k
100k
22k
100k
100k
220R
220R
1n
22k**
100k
100k
100k
1k
100k
100k
47k**
1k
100k
100k
100k
10u
10u
2367
10u
100n

Q
Q
Q
Q
D
D
D
D