

GliGli's Overcycler

Affordable polyphonic hybrid single cycle / analog synthesizer.

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Introduction

This project started about 10 years ago, when I wanted to make use of spare SSM2044 voltage controlled low pass filters I had laying around.

It went through 3 major revisions until it became the full-fledged retail synthesizer it is now.

There is 2 versions of this synthesizer, “Fully built” and “DIY”. This manual is about operating the synthesizer for both. Build instructions for the “DIY” version will be available in another document.

Overview

1 Features

- 6 voice polyphony using hybrid synthesis (Digital “single cycle” oscillators / per-voice analog voltage-controlled filter and voltage-controlled amplifier).
- 2 synchronizable oscillators per voice, duty cycle modulation on any waveform, dual waveform mix modulation, “grith” modulation (from a subtle veil to “ring modulation”-like sounds), 64KHz sample rate for a clean sound by default.
- 3 complete envelopes with linear/exponential choice and looping (oscillators / filter / amplifier).
- 2 complete low frequency oscillators with 6 modulation destinations.
- 1 noise generator.
- Voice panning on the stereo output.
- Sequencer / Arpeggiator.
- Patches and single cycles (AKWF, ProphetVS,...) stored on an internal flash chip, accessible through USB mass storage.
- USB powered with USB MIDI and regular MIDI, Ccs for coarse values, NRPN, channel after-touch,...

2 Front panel



- ① Back-lit character LCD screen, 4 rows of 40 characters.
- ② 10 potentiometers, in 2 rows of 5.
- ③ Keypad, 4 rows of 4 keys.

3 Rear panel



① Main output 6,35mm jacks.

- Connect a single jack to get TRS (tip-ring-sleeve) stereo (eg. headphones).
- Connect 2 jacks to get TS (tip-sleeve) left and right stereo (eg. connect to 2 mono channels on a mixer).

Note: As synthesizer voices are hard-panned on the stereo output, it is recommended to connect to a mixer through 2 mono channels, that way mixer channel panning can be used to moderate the stereo effect (by setting channel panning symmetrically from the center).

② Main volume knob, from low volume (left) to high volume (right).

③ DIN MIDI input.

④ Pedal (aka. foot switch) 6,35mm TS input jack, “press to connect” configuration.

- Acts as a sustain input when not arpeggiating or in unison mode.
- Holds the arpeggiator pattern when arpeggiating (has priority over sustain).
- Sets a chord pattern when in unison mode (has priority over sustain and arpeggiator hold).

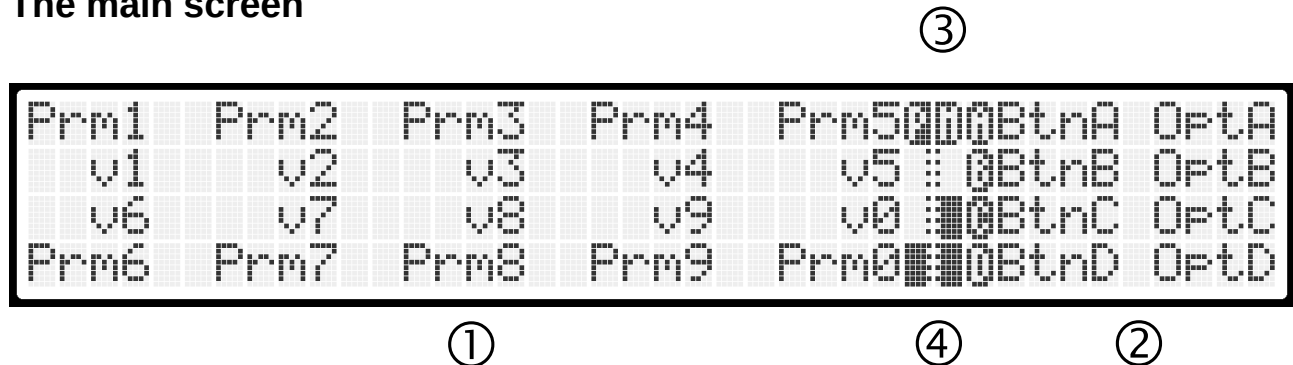
⑤ USB-B input, power input for the synthesizer. It can also be used for USB MIDI and for internal disk access through USB mass storage.

⑥ Synthesizer on / off switch, pressed is on.

4 Basic ergonomics

Basically, ergonomics are centered around the use of the screen, mainly to show potentiometers and buttons values for the current page of parameters.

The main screen



① 2 rows of 5 parameters, one for each potentiometer from the front panel. Each parameter has a short name on 4 characters and a value. Turning a potentiometer will allow changing the corresponding parameter value through the “Potentiometer edit screen”.

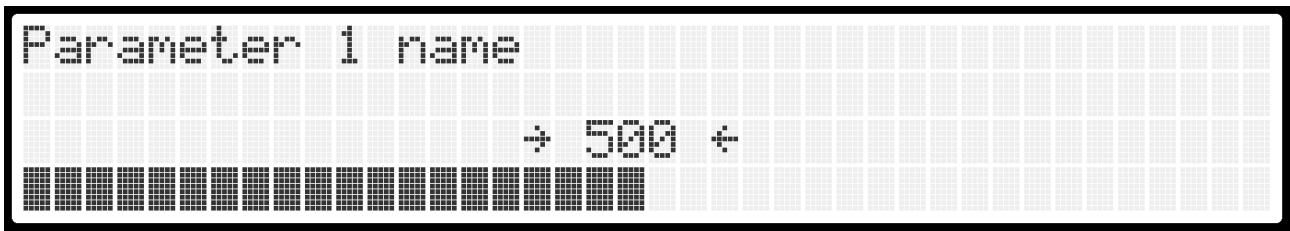
② 4 rows of parameters, corresponding to the rightmost A / B / C / D buttons of the keypad. Pressing one of those keypad keys will allow changing the corresponding parameter to a new value through the “Button edit screen”.

③ “Preset modified” indicator. Changing any parameter from the current preset will show this indicator as a remainder that changes many need to be saved to persist.

④ .”Voice activity” indicators. One for each of the 6 voices, giving an overview of the amplifier envelope state for each voice. The layout is as follows:

Voice 1	Voice 2
Voice 3	Voice 4
Voice 5	Voice 6

The potentiometer edit screen



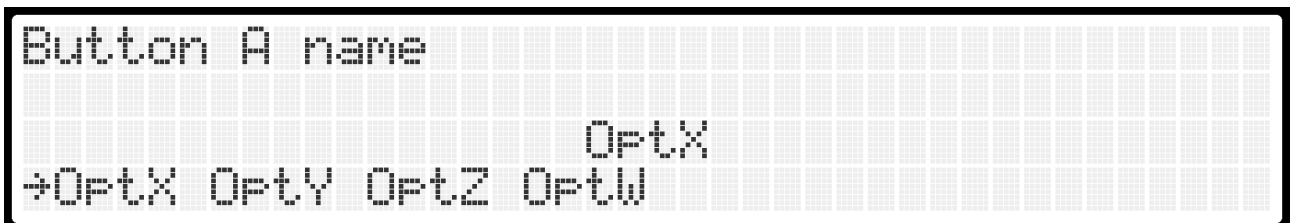
When a potentiometer is turned, this screen shows detailed information about the parameter being edited:

- The parameter long name at the top.
- The current parameter value in the middle.
- A bar-graph showing the approximate value at a glance.

When the current potentiometer position is out of range, and the value hasn't been reacquired (that is, the potentiometer is still locked to its previous value), the screen will show one of two arrows around the numerical value to hint which way it should be turned.

Note: when more than one potentiometer is turned at the same time, this screen will not show. Instead, the main screen will directly reflect the changes.

The button edit screen



When a button (A / B / C / D) is pressed, this screen shows detailed information about the parameter being edited:

- The parameter long name at the top.
- The current parameter value in the middle.
- A list of all the possible values for the parameter, with an arrow indicating which is currently chosen.

Note: some buttons are used for actions, in that case the action is performed as soon as the button is pressed and this screen only shows the action long name.

The pages

1 Oscillators

ABnk	AWav	AFrq	NVol	AVol	:	AXoC	0001
0	1	C 0	0	500	:	BXoC	0001
0	1	C 0	0	0	:	FrqM	Oct
BBnk	BWav	BFrq	Detn	BVol	:	Sync	Off

- ABnk / BBnk: Oscillator A / B Single-cycle bank.
- AWav / BWav: Oscillator A / B Single-cycle waveform. Note: Waveforms are displayed on the screen while they are chosen.
- AFrq / BFrq: Oscillator A / B base frequency. Note: The FrqM parameter can be used to change the granularity.
- Detn: Oscillator A / B relative detune. Note: This parameter will slightly change both oscillators pitch, to ensure the overall tuning stays the same.
- NVol / AVol / BVol: Oscillator A / B and noise generator volume. Note: When the sum of these 3 volumes exceeds 1000, a strong but pleasing overdrive will be heard.
- AXoC / BXoC: Copy A / B bank/wave to A / B Crossover. Note: The "Crossover" WaveMod has to be chosen for these parameters to have an effect.
- FrqM: Granularity for AFrq and BFrq, either in octaves, in semitones, or freeform.
- Sync: Oscillator A to B Synchronization. Note: Try the "Frequency" WaveMod on oscillator B to get typical sounds.

2 WaveMod

AWmo	BWmo			AWEA	BWEA	::	0AWmT	None
0	0			0	0	::	0BWmT	None
0	0	0		0	0	::	0WEnT	FExp
WAtk	WDec	WSus	WRel	WVel		::	0WEnL	Norm

- AWmo / BWmo: Base amount of WaveMod for oscillator A / B.
- AWEA / BWEA: WaveMod Envelope Amount for oscillator A / B.
- WAtk / WDec / WSus / WRel / WVel: Attack time / decay time / sustain level / release time / velocity amount for the WaveMod ADSR envelope.
- AWmT / BWmT: WaveMod Type for oscillator A / B, available options:
 - None: No wavemod.
 - Grit: Simulates low resolution relative to time. A positive amount gives a subtle veil, while a negative amount is wilder and can sound like ring-mod.
 - Width: Applies duty cycle modulation akin to “Pulse Width Modulation” but for any waveform.
 - Frequency: Frequency modulation. Note: especially useful for drum sounds or typical Sync sounds.
 - Crossover: Allows mixing 2 single cycles, controls the mix of both.
- WEnT: WaveMod Envelope Type, available options:
 - Fast-exponential.
 - Slow-exponential.
 - Fast-linear.
 - Slow-linear.
- WEnL: WaveMod Envelope Loop. Note: When looped, a cycle of attack / decay happens in what is left of the sustain level. Eg. at full sustain, no looping can be heard.

3 Filter

FCut	FRes		FKbd	FEnv	::		
999	0		0	0	::		
0	0	0	0	0	::	0FEnT	FExp
FAtk	FDec	FSus	FRel	FVel	::	0FEnL	Norm

- **FCut**: Filter Cutoff frequency. Note: The filter is tuned in C, so setting it to eg. 500 will allow to play the filter like an oscillator as long as the Resonance parameter is high enough.
- **FRes**: Filter Resonance. Note: Self-oscillation can be heard in the last third of amount.
- **FKbd**: Filter Keyboard tracking. From 0 to 100%, relative to C4 on the keyboard.
- **FEnv**: Filter Envelope amount.
- **FAtk / FDec / FSus / FRel / FVel**: Attack time / decay time / sustain level / release time / velocity amount for the filter ADSR envelope.
- **FEnT**: Filter Envelope Type, available options:
 - Fast-exponential.
 - Slow-exponential.
 - Fast-linear.
 - Slow-linear.
- **FEnL**: Filter Envelope Loop. Note: When looped, a cycle of attack / decay happens in what is left of the sustain level. Eg. at full sustain, no looping can be heard.

4 Amplifier

Glid		MDet	MTun	VCnt	::	0	Unis	Off
0		8	0	6	::	0	Prio	Last
0	0	999	0	0	::	0	AEnT	FExp
AAtk	ADec	ASus	ARel	AVel	::	0	AEnL	Norm

- Glid: Glide amount. This acts as a slew limiter on the oscillators pitch.
- MDet: Master unison Detune. This spreads voice tuning. Note: A small amount can simulate the non-exactness of an analog oscillator.
- MTun: Master Tune. Note: default tuning is A=440Hz.
- VCnt: Voice count.
- Unis: Unison mode (all voices playing for a single key press). Note: If a chord is pressed while activating this option, this works as "chord mode". The pedal input can be used to latch a new chord.
- Prio: Assigner Priority mode, available options:
 - Last: the last played note (relative to time) has priority.
 - Low: the lowest played note (relative to pitch) has priority.
 - High: the highest played note (relative to pitch) has priority.
- AAtk / ADec / ASus / ARel / AVel: Attack time / decay time / sustain level / release time / velocity amount for the amplifier ADSR envelope.
- AEnT: Amplifier Envelope Type, available options:
 - Fast-exponential.
 - Slow-exponential.
 - Fast-linear.
 - Slow-linear.
- AEnL: Amplifier Envelope Loop. Note: When looped, a cycle of attack / decay happens in what is left of the sustain level. Eg. at full sustain, no looping can be heard.

5 LFO 1

1SPd	1Amt	1Wav			MD1y	::	01SPd	x1
300	0	Tri			0	::	01T9t	Both
100	0	0	0	0	0	::		
1Pit	1Wmo	1Fil	1Res	1AmP	::			

6 LFO 2

2SPd	2Amt	2Wav			MD1y	::	02SPd	x1
300	0	Tri			0	::	02T9t	Both
0	0	0	0	0	0	::		
2Pit	2Wmo	2Fil	2Res	2AmP	::			

7 Arpeggiator

Clk						::	0AMod	Off
300						::	0AH1d	Off
					C 5	::		
					Trsf	::		

8 Sequencer

Clk						::	0AP1y	Stop
300						::	0BP1y	Stop
0					C 5	::		
SBnk					Trsf	::	0SRec	Off

9 Miscellaneous

MRng	BRng	PRng	MidC	Sync	::	QLBas			
Low	3rd	Low	Omni	Int	::	QParc			
LF01	Pit	Fil	7	None	::	QHelp			
MTgt	BTgt	PTgt	Ctst	UsbM	::	QTune			

10 Presets

*:Set	preset	number	digits		::	QLoad		0
					::	QSave		0
		Othr	Othr		::	QPrev		
		Type	Styl		::	QNext		

Maintenance

- 1 Adding single-cycle waveforms**
- 2 Data backup**
- 3 Upgrading the firmware**

MIDI implementation

1 Chart

Function		Transmitted	Recognized	Remarks
Basic Channel	Default Changed	✕ ✕	1 – 16 ✓	See Miscellaneous
Mode	Default Messages Altered	✕ ✕ ✕	1 ✕ ✓	See Amplifier
Note Number	True Voice	✕ ✕	0-127 0-120	
Velocity	Note On Note Off	✕ ✕	✓ ✕	See Amplifier, Filter, WaveMod
After Touch	Key Channel	✕ ✕	✕ ✓	See Miscellaneous
Pitch Bend		✕	✓	See Miscellaneous
Control Change		✕	✓	See Detailed continuous controllers
Program Change	True #	✕ ✕	✓ 0-99	See Presets
System Exclusive		✕	✕	
System Common	Song position Song select Tune request	✕ ✕ ✕	✕ ✕ ✕	
System Real Time	Clock Start Continue Stop	✕ ✕ ✕ ✕	✓ ✓ ✓ ✓	See Arpeggiator, Sequencer, Miscellaneous
Aux Messages	All Sound Off Reset Controllers Local On/Off All Notes Off Omni Mode Off Omni Mode On Mono Mode On Poly Mode On Active Sensing System Reset	✕ ✕ ✕ ✕ ✕ ✕ ✕ ✕ ✕ ✕	✓ ✕ ✕ ✓ ✕ ✕ ✕ ✕ ✕ ✕	

2 Detailed continuous controllers

Number	Type	Parameter
0	Standard	Preset bank coarse
1	Standard	Modulation wheel
2		
3		
4		
5		
6	Standard	NRPN Data Coarse
7		
8		
9		
10		
11		
12	Continuous Coarse	cpAFreq
13	Continuous Coarse	cpAVol
14	Continuous Coarse	cpABaseWMod
15	Continuous Coarse	cpBFreq
16	Continuous Coarse	cpBVol
17	Continuous Coarse	cpBBaseWMod
18	Continuous Coarse	cpDetune
19	Continuous Coarse	cpCutoff
20	Continuous Coarse	cpResonance
21	Continuous Coarse	cpFilEnvAmt
22	Continuous Coarse	cpFilKbdAmt
23	Continuous Coarse	cpWModAEnv
24	Continuous Coarse	cpFilAtt
25	Continuous Coarse	cpFilDec
26	Continuous Coarse	cpFilSus
27	Continuous Coarse	cpFilRel
28	Continuous Coarse	cpAmpAtt
29	Continuous Coarse	cpAmpDec
30	Continuous Coarse	cpAmpSus
31	Continuous Coarse	cpAmpRel
32	Standard	Preset bank fine
33		
34		
35		
36		
37		
38	Standard	NRPN Data Fine
39		
40		
41	Stepped	spLFO2Speed
42		

43		
44	Continuous Coarse	cpLFOFreq
45	Continuous Coarse	cpLFOAmt
46	Continuous Coarse	cpLFOPitchAmt
47	Continuous Coarse	cpLFOWModAmt
48	Continuous Coarse	cpLFOFilAmt
49	Continuous Coarse	cpLFOAmpAmt
50	Continuous Coarse	cpLFO2Freq
51	Continuous Coarse	cpLFO2Amt
52	Continuous Coarse	cpModDelay
53	Continuous Coarse	cpGlide
54	Continuous Coarse	cpAmpVelocity
55	Continuous Coarse	cpFilVelocity
56	Continuous Coarse	cpMasterTune
57	Continuous Coarse	cpUnisonDetune
58	Continuous Coarse	cpNoiseVol
59	Continuous Coarse	cpLFO2PitchAmt
60	Continuous Coarse	cpLFO2WModAmt
61	Continuous Coarse	cpLFO2FilAmt
62	Continuous Coarse	cpLFO2AmpAmt
63	Continuous Coarse	cpLFOResAmt
64	Standard	Hold Pedal
65		
66		
67		
68		
69		
70	Continuous Coarse	cpLFO2ResAmt
71	Continuous Coarse	cpWModAtt
72	Continuous Coarse	cpWModDec
73	Continuous Coarse	cpWModSus
74	Continuous Coarse	cpWModRel
75	Continuous Coarse	cpWModBEnv
76	Continuous Coarse	cpWModVelocity
77		
78		
79		
80	Stepped	spLFOSpeed
81	Stepped	spABank
82	Stepped	spAWave
83	Stepped	spAWModType
84	Stepped	spBBank
85	Stepped	spBWave
86	Stepped	spBWModType
87	Stepped	spLFOShape
88	Stepped	spLFOTargets
89	Stepped	spFilEnvSlow
90	Stepped	spAmpEnvSlow

91	Stepped	spBenderRange
92	Stepped	spBenderTarget
93	Stepped	spModwheelRange
94	Stepped	spModwheelTarget
95	Stepped	spUnison
96	Standard	spAssignerPriority
97	Standard	spChromaticPitch
98	Standard	spOscSync
99	Standard	NRPN Number Coarse
100		
101		
102	Stepped	spAXOvrBank
103	Stepped	spAXOvrWave
104	Stepped	spFilEnvLin
105	Stepped	spLFO2Shape
106	Stepped	spLFO2Targets
107	Stepped	spVoiceCount
108	Stepped	spPresetType
109	Stepped	spPresetStyle
110	Stepped	spAmpEnvLin
111	Stepped	spFilEnvLoop
112	Stepped	spAmpEnvLoop
113	Stepped	spWModEnvSlow
114	Stepped	spWModEnvLin
115	Stepped	spWModEnvLoop
116	Stepped	spPressureRange
117	Stepped	spPressureTarget
118	Stepped	spBXOvrBank
119	Stepped	spBXOvrWave
120	Standard	All sounds off
121		
122		
123	Standard	All notes off
124		
125		
126		
127		

3 Continuous NRPN parameters list

Coarse number	Fine number	Parameter	Zero centered?
0	0	cpAFreq	-
0	1	cpAVol	-
0	2	cpABaseWMod	Yes
0	3	cpBFreq	-
0	4	cpBVol	-
0	5	cpBBaseWMod	Yes
0	6	cpDetune	Yes
0	7	cpCutoff	-
0	8	cpResonance	-
0	9	cpFilEnvAmt	Yes
0	10	cpFilKbdAmt	-
0	11	cpWModAEnv	Yes
0	12	cpFilAtt	-
0	13	cpFilDec	-
0	14	cpFilSus	-
0	15	cpFilRel	-
0	16	cpAmpAtt	-
0	17	cpAmpDec	-
0	18	cpAmpSus	-
0	19	cpAmpRel	-
0	20	cpLFOFreq	-
0	21	cpLFOAmt	-
0	22	cpLFOPitchAmt	-
0	23	cpLFOWModAmt	-
0	24	cpLFOFilAmt	-
0	25	cpLFOAmpAmt	-
0	26	cpLFO2Freq	-
0	27	cpLFO2Amt	-
0	28	cpModDelay	-
0	29	cpGlide	-
0	30	cpAmpVelocity	-
0	31	cpFilVelocity	-
0	32	cpMasterTune	Yes
0	33	cpUnisonDetune	-
0	34		-
0	35		-
0	36		-
0	37	cpNoiseVol	-
0	38	cpLFO2PitchAmt	-
0	39	cpLFO2WModAmt	-
0	40	cpLFO2FilAmt	-
0	41	cpLFO2AmpAmt	-

0	42	cpLFOResAmt	-
0	43	cpLFO2ResAmt	-
0	44	cpWModAtt	-
0	45	cpWModDec	-
0	46	cpWModSus	-
0	47	cpWModRel	-
0	48	cpWModBEnv	Yes
0	49	cpWModVelocity	-

4 Stepped NRPN parameters list

Coarse number	Fine number	Parameter	Number of steps
1	0		-
1	1		-
1	2	spABaseWMod	5
1	3		-
1	4		-
1	5		--
1	6	spBBaseWMod	5
1	7		-
1	8	spLFOShape	7
1	9	spLFOSpeed	4
1	10	spLFOTargets	4
1	11	spFilEnvSlow	2
1	12	spAmpEnvSlow	2
1	13	spBenderRange	3
1	14	spBenderTarget	5
1	15	spModwheelRange	4
1	16	spModwheelTarget	2
1	17	spUnison	2
1	18	spAssignerPriority	3
1	19	spChromaticPitch	3
1	20	spSync	2
1	21		-
1	22		-
1	23	spFilEnvLin	2
1	24	spLFO2Shape	7
1	25	spLFO2Speed	4
1	26	spLFO2Targets	4
1	27	spVoiceCount	6
1	28	spPresetType	8
1	29	spPresetStyle	8
1	30	spAmpEnvLin	2
1	31	spFilEnvLoop	2
1	32	spAmpEnvLoop	2
1	33	spWModEnvSlow	2
1	34	spWModEnvLin	2
1	35	spWModEnvLoop	2
1	36	spPressureRange	4
1	37	spPressureTarget	7
1	38		-
1	39		-