Erica Synths Polivoks VCO Assembly Guide

A note from Synthrotek:

When Erica Synths made their DIY line open source, they made a few changes to the circuits, mostly to use more common components. The VCO was the most significantly changed circuit in the lineup. This assembly guide shows pictures for the original circuit, so it looks different, but the build order is the same and the guide is still. The calibration instructions are also the same as in the original circuit.

The only place there is a significant difference is in the placement of the rotary switch. We have a note with a picture explaining how to orient the switch properly.

Also, because of some minor changes between revisions, please use our visual BOM rather than Erica Synths' BOM or schematic.

Thank you!

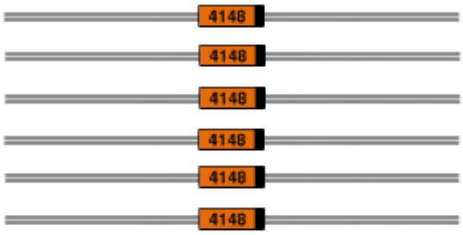
Erica Synths Polivoks VCO Bill of Materials

Assembly guide can be found here: github.com/erica-synths/diy-eurorack

LOGIC BOARD

DIODES

1N4148: VD7, VD8, VD11, VD13-VD15



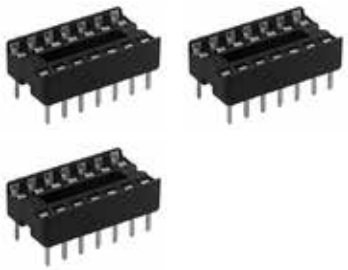
Total: 6

INTEGRATED CIRCUITS & SOCKETS

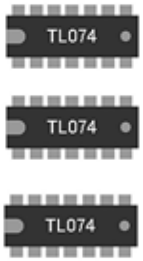
8 Pin Dip Socket: DA4

TL072

14 Pin Dip Socket: DA1-DA3



TL074



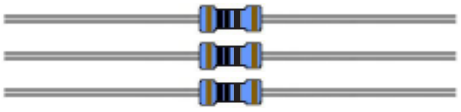
14 Pin Dip Socket: DA5

KR198NT1A

Total: 10

RESISTORS (1/4 Watt, 1%)- All Stand-Up

100Ω: R35, R39, R44

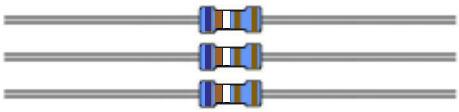


RESISTORS (1/4 Watt, 1%)- All Stand-Up

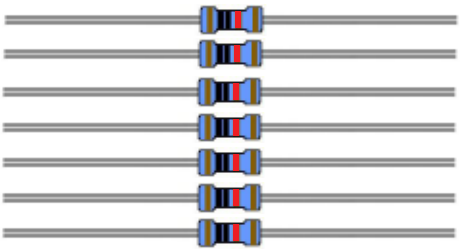
910Ω: R37

1k: R36

6.19k: R42, R74, R75



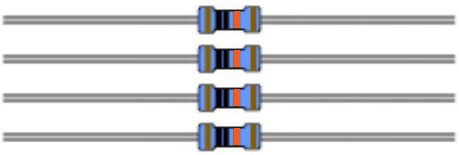
10k: R1-R5, R32, R58



33k: R31, R94

39k: R66

100k: R27-R30



120k: R92

470k: R93

Total: 24

Erica Synths Polivoks VCO Bill of Materials

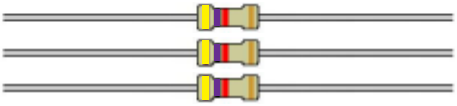
LOGIC BOARD

RESISTORS (1/4 Watt, 5%)- All Stand-Up

270Ω: R23

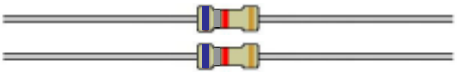
470Ω: R43

4.7k: R72, R81, R84



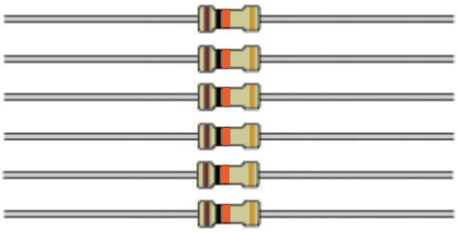
5.6k: R69

6.8k: R47, R51



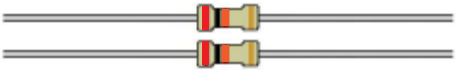
8.2k: R38

10k: R18, R34, R40, R54, R55, R83

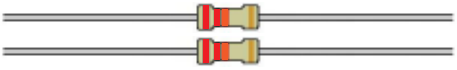


18k: R77

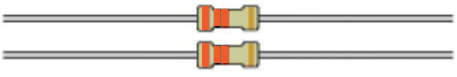
20k: R19, R68



22k: R56, R73



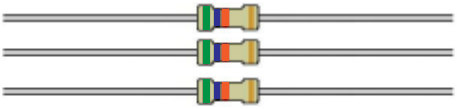
33k: R64, R67



RESISTORS (1/4 Watt, 5%)- All Stand-Up

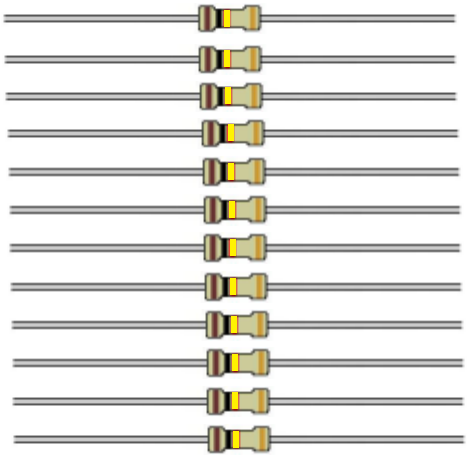
47k: R59

56k: R12, R25, R57



75k: R53

100k: R20, R22, R41, R46, R60, R61 R63, R65, R70, R76, R82, R85



200k: R95

360k: R26

10M: R87

Total: 42

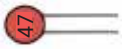
Erica Synths Polivoks VCO Bill of Materials

LOGIC BOARD

CAPACITORS

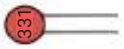
5.6nF Film: C23

47pF Ceramic: C21



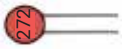
100pF Ceramic: C17

330pF Ceramic: C19



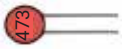
2.2nF Ceramic: C18

2.7nF Ceramic: C15

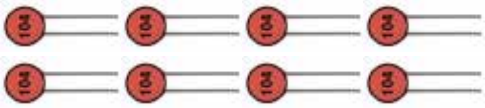


10nF Ceramic: C32, C35

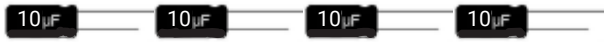
47nF Ceramic: C16



0.1µF Ceramic: C7-C14



10µF Non- Polarized Electrolytic: C2, C26-C28



22µF Electrolytic: C20

47µF Electrolytic: C29

Total: 23

TRANSISTORS

2N3904: VT1, VT3, VT4, VT6

2N3906: VT2, VT5

Total: 6

POTENTIOMETERS

1k Single Turn Trim Pot: R45, R50

100k Single Turn Trim Pot: R21

10k Multi Turn Trim Pot: R7

Total: 4

CONNECTORS

1x8 Long Pin Header: XP2-XP5

Total: 4

SWITCHES

CK1049 Rotary Switch : SW1

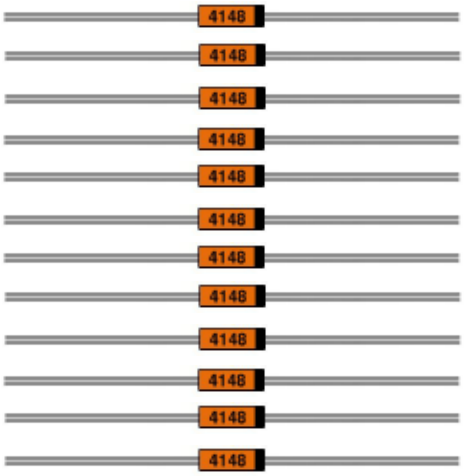
Total: 1 *See end of Visual BOM for orientation

Erica Synths Polivoks VCO Bill of Materials

CONTROL BOARD

DIODES

1N4148: VD3-VD6, VD9, VD10, VD16-VD21

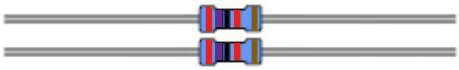


1N4001 or 1N4002: VD1, VD2

Total: 14

RESISTORS (1/4 Watt, 1%)

27k: R13, R15

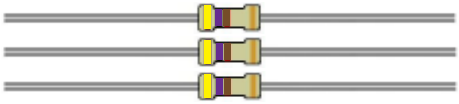


150k: R6

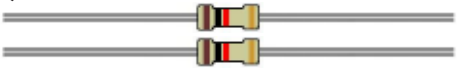
Total: 3

RESISTORS (1/4 Watt, 5%)

470Ω: R78-R80



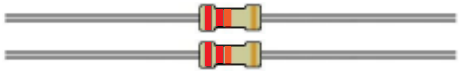
1k: R88, R91



RESISTORS (1/4 Watt, 5%)

10k: R11, R16, R49, R71, R89

22k: R86, R90



100k: R9, R10, R48, R96-R98

Total: 18

INDUCTORS

Ferrite Bead: L1, L2

Total: 2

FUSES

400mA Resettable Fuse: VR1, VR2

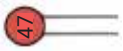
Total: 2

Erica Synths Polivoks VCO Bill of Materials

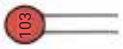
CONTROL BOARD

CAPACITORS

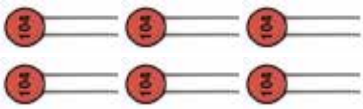
47pF Ceramic: C1



10nF Ceramic: C30



0.1µF Ceramic: C5, C6, C22, C25, C31, C34



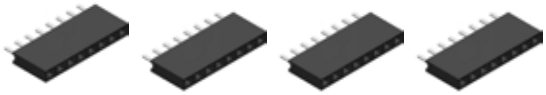
10µF Electrolytic: C33, C36

47µF Electrolytic: C3, C4

Total: 12

CONNECTORS

1x8 Pin Socket: XS8-XS11



10 Pin Header: XP1

Total: 5

VOLTAGE REGULATORS

LM337L: DA6

LM317L: DA7

Total: 2

JACKS

3.5mm Mono Jacks: XS1-XS7

Total: 7

POTENTIOMETERS

1k Multi Turn Trim Pot: R33

B10k Vertical Mount: R14, R62

B100k Vertical Mount: R8

Total: 4

OTHER

HARDWARE

2.5mm Screws

3mm Screws

Total: 8

Erica Synths Polivoks VCO Bill of Materials

OTHER

KNOBS

19mm Small Black Knob

28mm Large Black Knob

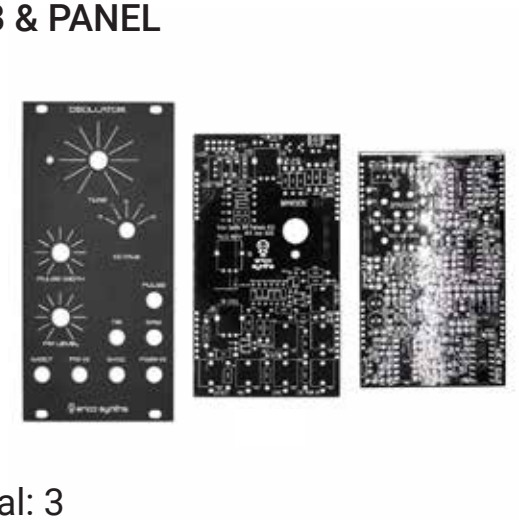
Total: 4

POWER CABLES

10 to16 Pin Power Cable

Total: 1

PCB & PANEL



Total: 3

GUIDE TO ASSEMBLY OF ERICA SYNTHS POLIVOKS-INSPIRED VCO

If you are reading this, most probably, you are about to build Erica Synths DIY Polivoks-inspired Oscillator. This VCO is 35mm deep, skiff friendly, has solid mechanical construction and doesn't require wiring. The core of the VCO is borrowed from famous Russian synth Polivoks VCO and in exponential converter we use the original matched transistor IC that was used in Polivoks. But we significantly updated schematics:
1) we introduced +-10V regulators for greater stability of operation,
2) we adjusted signal amplitudes to match requirements of contemporary modular synths and made all output signals available simultaneously,
3) we redesigned CV inputs to accept positive CV signals,
4) we introduced PWM circuit with manual and voltage controlled pulse width,
5) we introduced synchronization input, so you can sync the VCO to other VCOs.

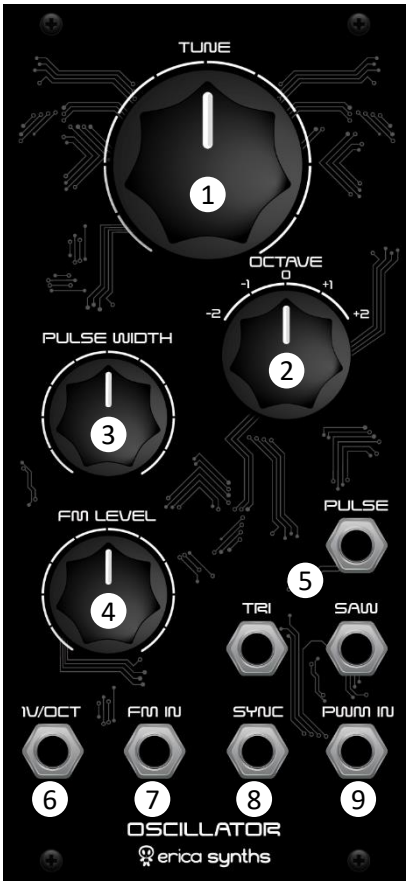
The Oscillator kit comes in three versions:
1) Set of 2 PCBs + matched transistor IC + mechanical parts (PCB connectors and spacer) + 5 position rotary switch,
2) Set of 2 PCBs + matched transistor IC + mechanical parts (PCB connectors and spacer) + 5 position rotary switch + panel,
3) Full kit.

FEATURES:

- Triangle, saw and pulse wave outputs
- Manually adjustable and CV controlled pulse width
- Great tracking across 8 octaves
- Exponential FM input with attenuator
- Synchronization input
- Octave switch – 5 octaves
- Skiff-friendly design

SPECIFICATIONS:

• Audio output amplitude	10Vptp
• Octave range	C0 – C8
• Panel width	12HP
• Module depth	35mm
• Power consumption	34mA@+12V, 36mA@-12V



1. The TUNE knob allows you to set the tune of the VCO across two octaves
2. Use Octave switch to set octave the VCO tune octaves up or down instantly
3. Adjust pulse width manually!
4. This is FM CV attenuator
5. These are VCO outputs. All three waves are available simultaneously
6. Patch 1V/oct CV source here. The VCO tracks well across 8 octaves
7. Patch FM CV source here for vibrato effects!
8. This is VCO Sync input. Patch another VCO output here to reset VCO circle. This gives you new, interesting waveforms
9. Patch PWM CV source here! 10Vptp CV signal affects pulse width form 1% to 99%

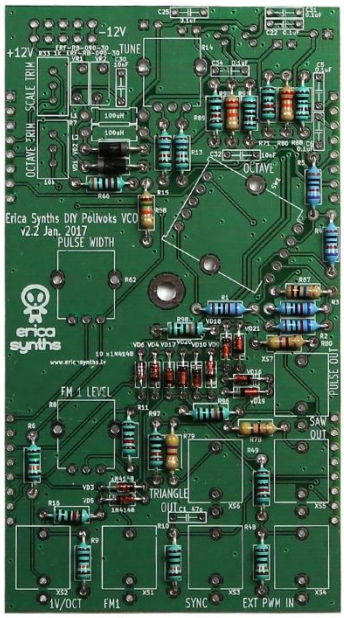
GUIDE TO ASSEMBLY OF ERICA SYNTHS POLIVOKS-INSPIRED VCO

ASSEMBLY

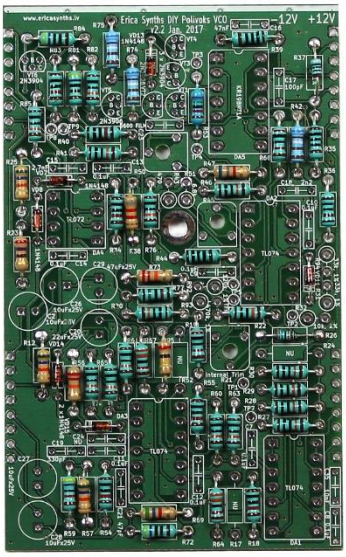
Take precautions with regard to electrostatic discharge (ESD) safety. Handling components should be done in electrostatically safe environment. Use personal and workplace grounding. Any discharge (even a minor one) from body to a component may permanently damage it.
Our PCBs have silkscreened both component values and designators nevertheless we highly recommend you to print out files with component placement before you start assembly of the module. And, please, at least take a look on this manual!
Some components are marked as NU (not used) – leave those unpopulated! Some components are market as OPTION (those are for optional modifications) – leave those unpopulated for now.

1 Solder horizontally placed resistors and diodes on both PCBs (Controls board and Main board)! Pay attention on orientation of diodes!

Controls board



Main board



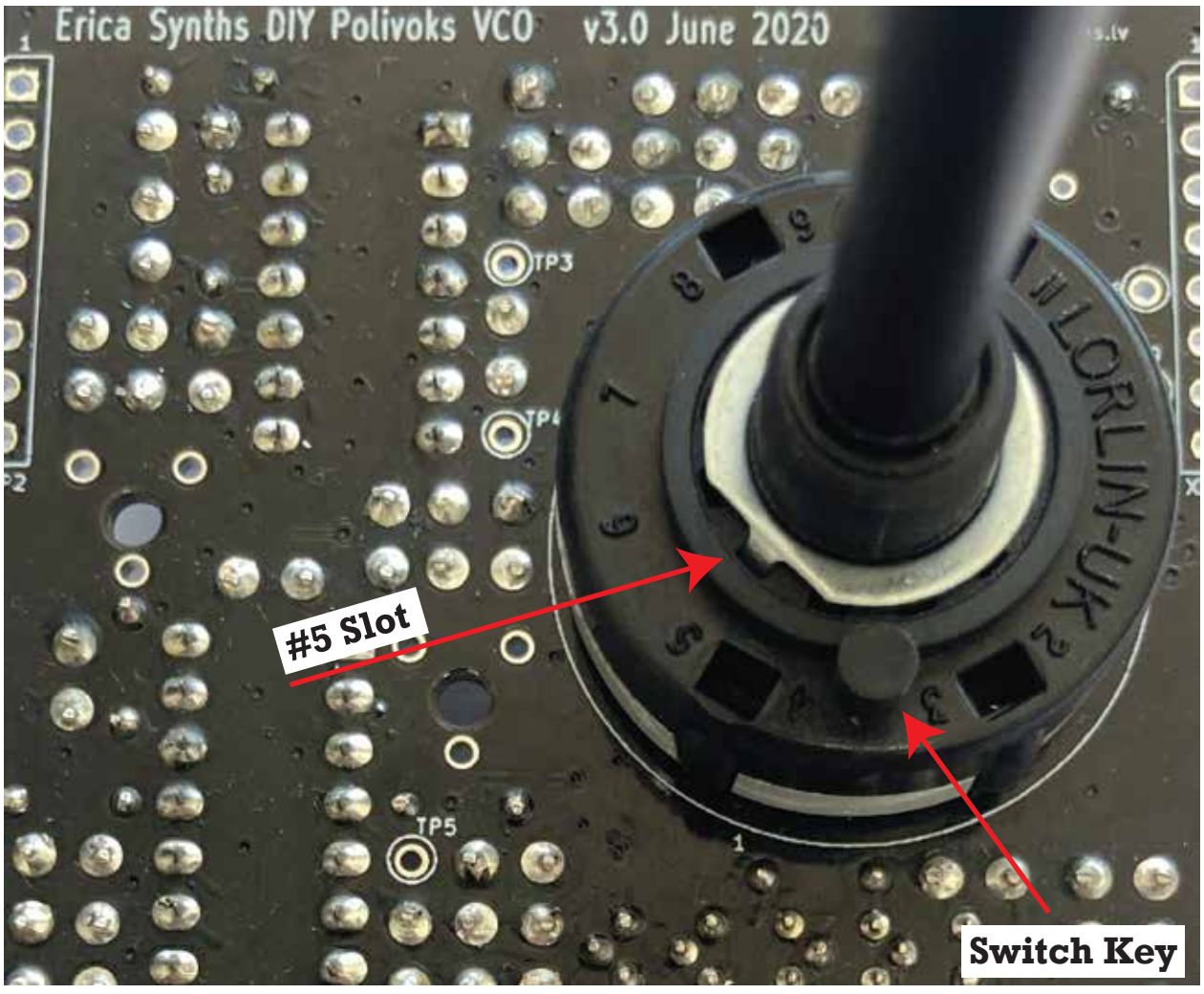
2 Solder IC sockets and vertically placed resitors on the Main board, ferrite beads on the Control board and capacitors of both boards!

Addendum to Erica Synths Assembly Instructions

1. Remove the nut, lock washer, and keyed washer.
2. Turn switch fully counter clockwise.
3. Place keyed washer on the switch where the key is in slot 5.

Switch is ready to be mounted

Do NOT use the lock washer



GUIDE TO ASSEMBLY OF ERICA SYNTHS POLIVOKS-INSPIRED VCO

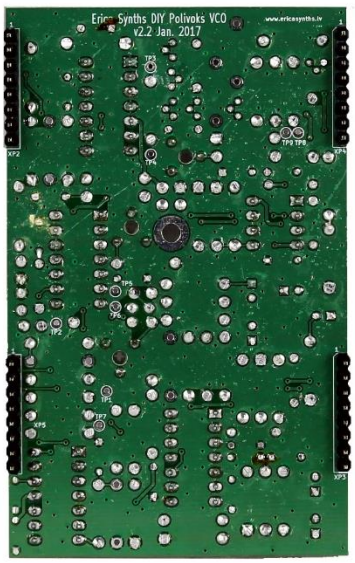
3

Solder electrolytic capacitors, transistors and trimpots on the Main board! Mind polarity of electrolytic capacitors and orientation of transistors! Don't mix up NPN and PNP transistors!

Negative lug of electrolytic capacitor is marked with a stripe!

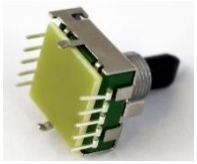
4

Turn the Main board around and solder 1x8 male connectors!



5

Place 16x16mm textolite piece under the switch (it will ensure that the switch is the same height as potentiometers) and solder the switch, potentiometers, two multiturn trimpots and jacks! Cut off orientation stopper on the switch.



6

Turn the connectors PCB around and solder voltage regulators, resettable fuses and electrolytic capacitors! Also solder 1x8 female connectors and PSU connector! Bend resettable fuses down.

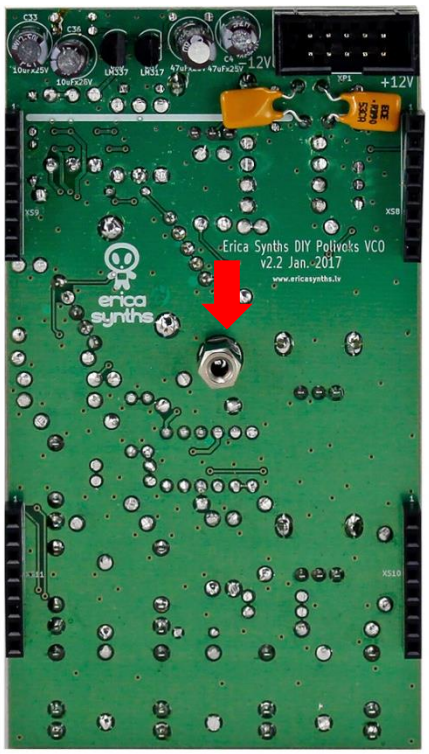
GUIDE TO ASSEMBLY OF ERICA SYNTHS POLIVOKS-INSPIRED VCO

7

Now it's time to make some measurements! Connect a PSU to controls PCB and measure, if you get +-12V and +-10V on the connector to the main PCB (refer to schematics)! If you are not getting these voltages, check, if you have soldered 10V regulators correctly!

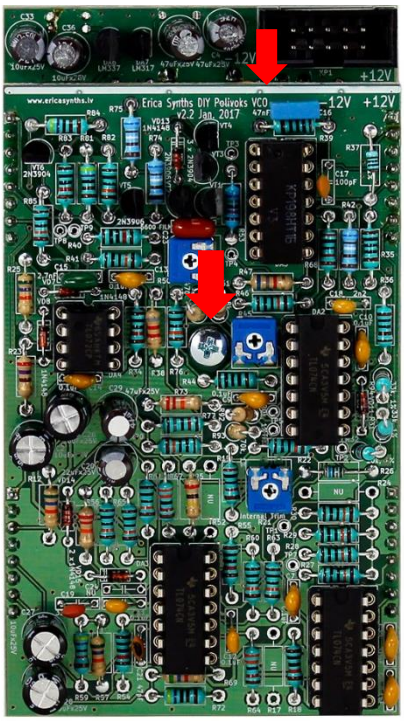
8

Use M3x6 screw to install 11mm header on the controls PCB!



9

Connect both PCBs together! And fix the bottom one with the M3x6 screw! For all our modules with 2 PCBs white stripes on both PCBs have to match.



10

Install the front panel and potentiometer knobs!

GUIDE TO ASSEMBLY OF ERICA SYNTHS POLIVOKS-INSPIRED VCO

CALIBRATION

1) Connect the VCO to the PSU. Let it "heat up" for ~15mins.
2) Set octave switch to 0 and Tune pot somewhere around 12:00
3) Set Octave switch to +2! Connect multimeter to the TP1 and adjust OCTAVE trimpot (bottom one on the front panel) until you get +5V on TP1! Switch across all octaves and adjust OCTAVE trimpot, until you have exactly 1V intervals between octaves. Don't worry, if you can't adjust it exactly. We'll come back to octave interval adjustment later.
4) Connect a tuner to the saw output of the VCO
5) Connect ka keyboard/midi-CV interface that generates 1V/oct CV to the input
6) Play C4 on the keyboard and use TUNE potentiometer on the front panel to adjust tuning so that tuner shows C4
7) Play C5 on the keyboard and see the tuner reading
8) If the tuner shows something higher that C5 use SCALE tripmot to INCREASE the frequency of the VCO slightly. If the tuner shows something lower than C5, use SCALE trimpot to DECREASE frequency slightly
9) Play C4 again and use TUNE potentiometer to adjust tuning so tuner shows C4 again.
10) Play C5 and see, what you get. The tuning should be more precize. If it's not exactly C5, go back to step 6
11) Once you are happy with C5, check what you get on C6, C7 and C3. You may need to adjust it little bit more as described on step 6.
12) Now set the frequency to C4 and rotate the OCTAVE switch around several octaves, and check tuner readings! If switching octaves up, frequency gradually increases octave by octave, turn OCTAVE trimpot (top right one) slightly clockwise, set frequency to C4, and check readings again. If the frequency decreases, turn the trimpot counter clockwise. With slight adjustments you should be able to get precise readings C4, C5, C6, C7 and C3, C2 when rotating the octave switch.

If you succeeded with calibration – congratulations – you have completed the most difficult module of Erica Synths DIY line! Enjoy!

Additional Trimmer Information

Some of the trimmers are not explained in the Erica Synths calibration instructions (found in the Erica Synths Github at the end of the assembly guide). They are all optional:

R21: Internal Tune Trimmer
Matches the tuning of two Erica Synths VCOs so that they play the same note when the Tune knob is in the same orientation on both VCOs. First, follow the tuning instruction for both VCOs. Then set the Tune knob to 12:00 on both VCOs and adjust R21 on one VCO so that both modules play the same note.

R45: Temperature Compensation
The exponential converter of the VCO is built around the KR198NT1A chip, which is a matched transistor array. The original Polivoks oscillator didn’t have a temperature compensation circuit and a tempco resistor, so instead one of the transistors inside the chip was used to heat the chip from the inside. This was an attempt to maintain a constant temperature in order to avoid frequency drift, but in reality, it didn't work as well as expected. We recommend not adjusting this trimmer.

R50: High Frequency Scale Adjustment
After following the calibration instructions, you may notice some tuning deviations in higher frequencies; adjust R50 to compensate for this.