Suiseki Phase Shifter for Eurorack

Thank you for purchasing the Suiseki circuit board and panel set. This document includes the parts list, schematic, a reference layout image, construction notes and operation notes.

Construction Notes:

The attached bill of materials (BOM) lists all parts needed for the board. The BOM uses mostly Digikey product numbers for reference, but parts can of course be ordered from any supplier such as Mouser or your favorite octopart.com search result using the vendor numbers. Some folks like to use all 1% metal film resistors, but it is not necessary. The only critical capacitors are C8 to C14 and C23 to C25, these need to be polyester film types. Note: there are seven 0.1uF bypass capacitors of the usual X7R ceramic type.

The board is made with a standard hot air solder layer, but soldering with leaded solder is fine. Similarly, you can use "no-clean" or organic solder, just be sure to rinse the board in the case of organic solder.

The recommended soldering order is install all axial resistors first. Certain resistors are vertical-mount: just bend one lead in a "U" such that it points down next to the other lead, then install. Next, install the three ICs, then transistors and capacitors. These parts can all be soldered with organic flux-core solder and rinsed in warm water. Be sure to allow sufficient time for the board to air dry.

Note: leave out capacitor C25 for now. It will be installed after the power header JP1 is installed. C25 is a tight fit and it is easier to deal with after JP1 (and R11) are mounted.

Note: four 15K resistors are omitted: R21, R28, R38, R39. These are bias resistors for the linearizing diodes of the OTA cells. On this version they are not necessary and are not used.

The parts that must be soldered with rosin-core or "no-clean" low residue solder are the pots, jacks and headers. Pay attention to the panel pots and jacks so they line up flush with the panel board. It is helpful to check the fit for each panel part. Flat washers between the circuit board and the panel should not be needed, just be sure to use a washer under each pot and jack nut in final assembly.

The trimpot R27 can be mounted on the top or bottom. It is used to tune the default position of the phase shift response when no LFO or CV signal is present.

JP1 is a user's choice of 2x5 or 2x8 shrouded header. For 2x5, the header installs in the lower 5 rows of holes, leaving the top 3 rows open. The 2x8 header of course occupies all holes. In both cases the header installs on the component side of the board with the notch to the *right* (toward edge of board). Once JP1 is installed, go ahead and install capacitor C25.

LED: the LED is installed last, after the panel is installed. Using pliers make a right-angle *downward* bend in the leads approx 4mm from the base of the LED with the shorter lead above the longer lead (as seen before bending). Drop the LED leads into their PCB holes and gently nudge the LED into the panel hole. Turn board over and solder one LED lead. Adjust the alignment if needed, then solder the remaining lead. The LED will glow green for positive LFO half-cycles and red for negative LFO half-cycles when installed correctly.

Suiseki Parts List for version 1

Qty	Value	Package	RefDes	Description	Vendor No.	Digikey Part No.
	Capacitors (C3, C6, C17 and C22 designators are not used)					
4	6800pF	radial 5mm	C13, C14, C23, C24	6800pF 50V film 5%	B32529C1682J289	495-4894-1-ND
2	100nF	radial 5mm	C8, C10	0.1 uF 63V film 5%	R82DC3100AA50J	399-5863-ND
7	100nF	radial 5mm	C1, C2, C7, C15, C16, C20, C21	0.1 uF 50V X7R ceramic	C322C104K5R5TA	399-4329-ND
4	470nF	radial 5mm	C9, C11, C12, C25	0.47 uF 63V film 5%	R82DC3470Z360J	399-9690-ND
2	22uF	radial 2.5mm	C4, C5	22 uF, 50V alum 2.5mm	EEU-FC1H220H	P19653CT-ND
2	100uF	radial 2.5mm	C18, C19	100 uF, 35V alum, 2.5mm	ECA-1VM101	P5165-ND
	Resistors and potentiometers (may use all 1% if desired)					
2	100R	axial	R25, R29	100 Ohm 1/4W 5% carbon	CFR-25JB-52-100R	100QBK-ND
7	1K	axial	R9, R12, R23, R34, R49, R55, R61	1K 1/4W 5% carbon film	CFR-25JB-52-1K	1.0KQBK-ND
1	1K5	axial	R11	1.5K 1/4W 5% carbon film	CFR-25JB-52-1K5	1.5KQBK-ND
3	4K7	axial	R6, R19, R30	4.7K 1/4W 5% carbon film	CFR-25JB-52-4K7	4.7KQBK-ND
1	6K8	axial	R2	6.8K 1/4W 5% carbon film	CFR-25JB-52-6K8	6.8KQBK-ND
1	7K5	axial	R17	7.5K 1/4W 5% carbon film	CFR-25JB-52-7K5	7.5KQBK-ND
11	10K	axial	R5, R35, R36, R43, R45, R46, R51, R52, R57, R58, R63	10K 1/4W 5% carbon film	CFR-25JB-52-10K	10KQBK-ND
5*	15K	axial	R18, R21, R28, R38, R39	15K 1/4W 5% carbon film	CFR-25JB-52-15K	15KQBK-ND
* - R21, R28, R38, R39 are optional, see notes						
1	22K	axial	R4	22K 1/4W 5% carbon film	CFR-25JB-52-22K	22KQBK-ND
8	27K	axial	R7, R33, R47, R48, R53, R54, R59, R60	27K 1/4W 5% carbon film	CFR-25JB-52-27K	27KQBK-ND
2	30K	axial	R24, R31	30K 1/4W 5% carbon film	CFR-25JB-52-30K	30KQBK-ND
1	47K	axial	R10	47K 1/4W 5% carbon film	CFR-25JB-52-47K	47KQBK-ND
2	56K	axial	R1, R26	56K 1/4W 5% carbon film	CFR-25JB-52-56K	56KQBK-ND
1	82K	axial	R15	82K 1/4W 5% carbon film	CFR-25JB-52-82K	82KQBK-ND
10	100K	axial	R3, R8, R14, R16, R32, R37, R41, R50, R56, R62	100K 1/4W 5% carbon film	CFR-25JB-52-100K	100KQBK-ND
1	220K	axial	R40	220K 1/4W 5% carbon film	CFR-25JB-52-220K	220KQBK-ND
1	330K	axial	R22	330K 1/4W 5% carbon film	CFR-25JB-52-330K	330KQBK-ND
2	470K	axial	R13, R20	470K 1/4W 5% carbon film	CFR-25JB-52-470K	470KQBK-ND
	Potentiometers are Alpha 9mm right-angle PC mount types from Thonk, Small Bear, Erthenvar, etc.					
1	B10K	9mm R/A	VR2	10K linear 9mm R/A PC mnt	Erthenvar 9mm B10K	
3	B100K	9mm R/A	VR1, VR3, VR4	100K linear 9mm R/A PC mnt	Erthenvar 9mm B100K	
1	10K	3362 trimmer	R27	10K linear trimpot 3362 series	3362P-1-103LF	3362P-103LF-ND
	Semiconductors					
1	TL074P	quad opamp	IC3	Quad JFET op-amp, PDIP14	TL074CN	296-1777-5-ND
2	LM13700	dual OTA	IC5, IC6	Dual OTA, PDIP16	LM13700N	LM13700N-ND
2	2N3906	PNP TO-92	Q1, Q2	PNP transistor TO-92	2N3906BU	2N3906FS-ND
10	2N3904	NPN TO-92	T1, T2, T3, T4, T5, T6, T7, T8, T9, T10	NPN transistor TO-92	2N3904BU	2N3904FS-ND
1	Bicolor LED 3mm		I1	3mm red/green 2-lead	LTL-14CHJ	160-1058-ND
	Headers and connectors, jacks from Erthenvar, Thonk and other CUI vendors					
3	3.5mm R/A PC jack		J1, J2, J3	CUI-3536 jack	Erthenvar 3536	
1	2x5 shrouded header		JP1	On Shore Technology 2x5	302-S101	ED1543-ND
1*	2x8 shrouded header		JP1	On Shore Technology 2x8	302-S161	ED10523-ND
* - Only need one header for JP1, user choice of 2x5 or 2x8 for euro power						
1	1x2 friction header		JP2	TE Connectivity 1x2	640456-2	A1921-ND
	Misc.					
1	Panel PCB (included)					
4	knobs for 6mm shaft, recommend Erthenvar “mini fluted knob”					

Operation Notes:

Header JP2 is provided if the user wishes to connect the onboard LFO to an external jack for general use. The local LFO is switched through the CV jack: plugging a CV in disconnects the LFO. The “lvl” knob attenuates the local LFO or external CV, whichever is active.

The “lfo” control adjusts sweep rate, while “frq” and “res” set the initial frequency of the phase shift offset and resonant feedback.

Modding note: to get a Univibe-type sound, the phase shift capacitors can be changed out for the following values: C13 is 1nF, C14 is 10nF, C23 is 470pF and C24 is 4.7nF.

Calibration Notes:

Adjust R27 with “frq” fully CCW and “lvl” fully CCW to desired default setting.

Suiseki specifications:

DC power requirements: +/- 12VDC@50mA or +/-15VDC@40mA nominal
Frequency range: 0.1Hz to 20KHz

Input levels:
IN: 5Vp-p nominal
CV: -10V to +10V nominal.

Output levels:

OUT: 5Vp-p nominal

CV response: approx. 1V/octave

Dimensions: Panel width: 4HP (20.3mm or 0.800” with a 5 mil “slop gap”)
Panel height: 128.5mm (5.06”)
Module depth, mounted : 51mm (2”)
Module PCB internal height: 104.2mm (4.1”)

Old Crow's Synth Shop at www.cs80.com
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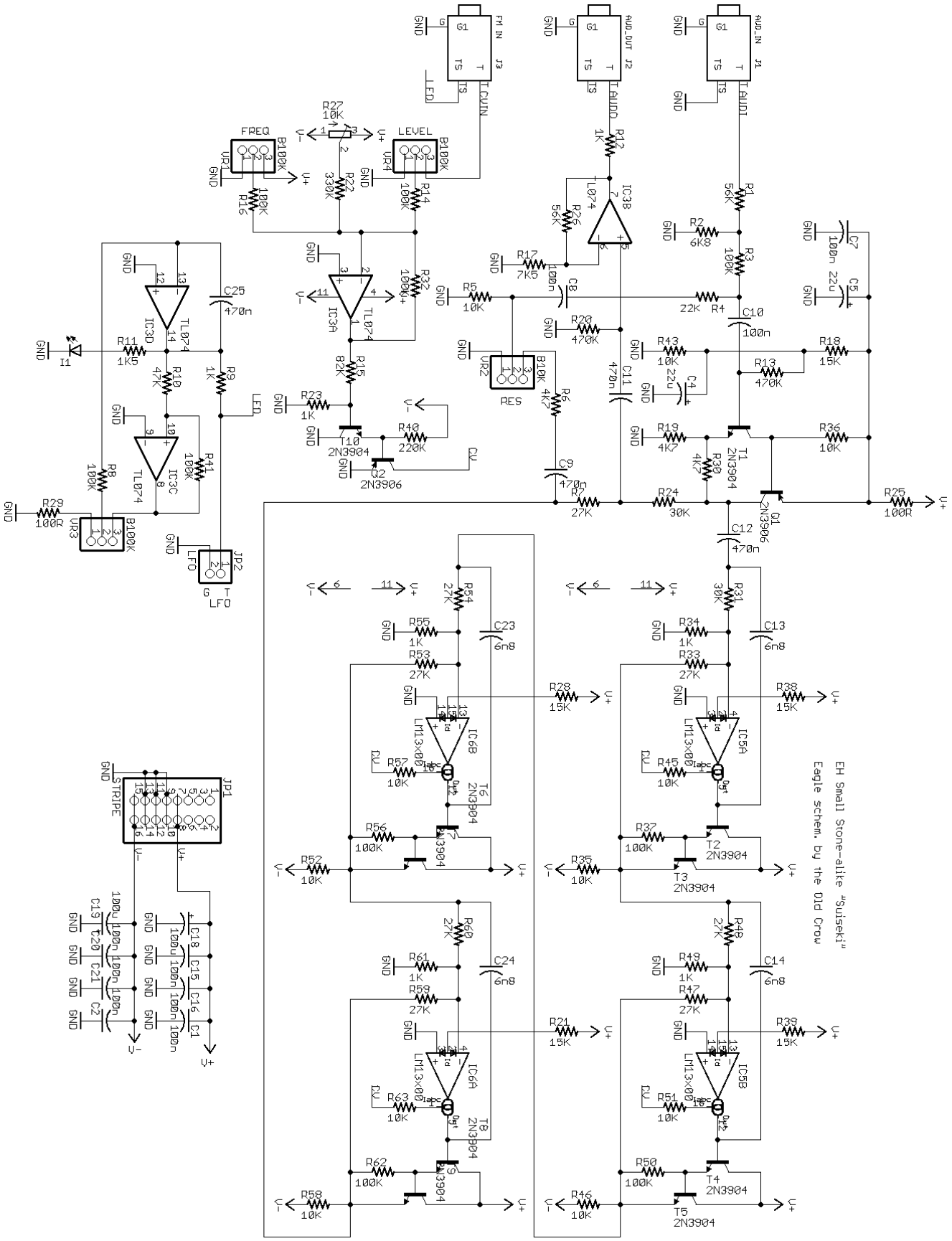

Fig.1 Schematic

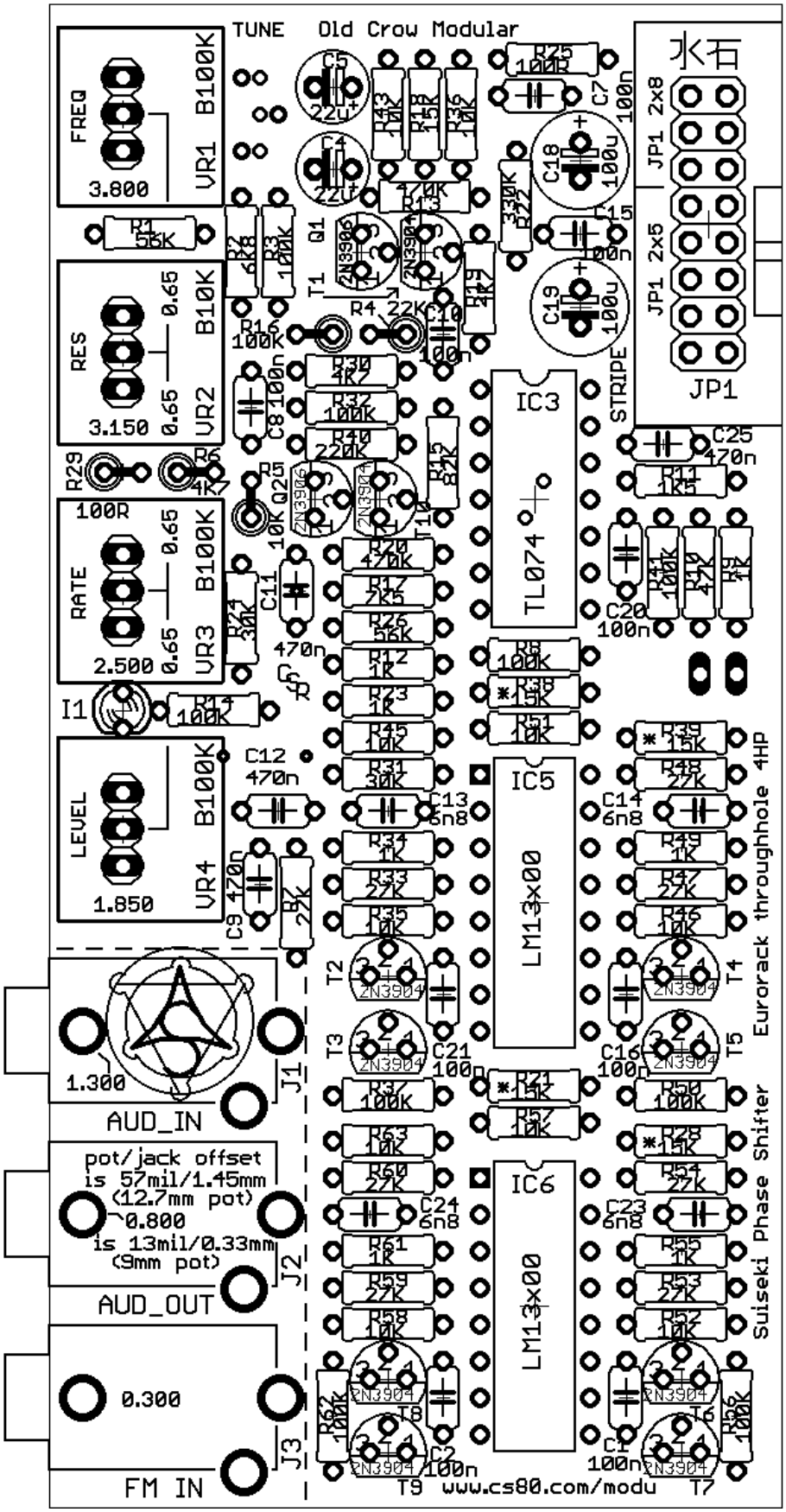

Fig.2 Board Reference