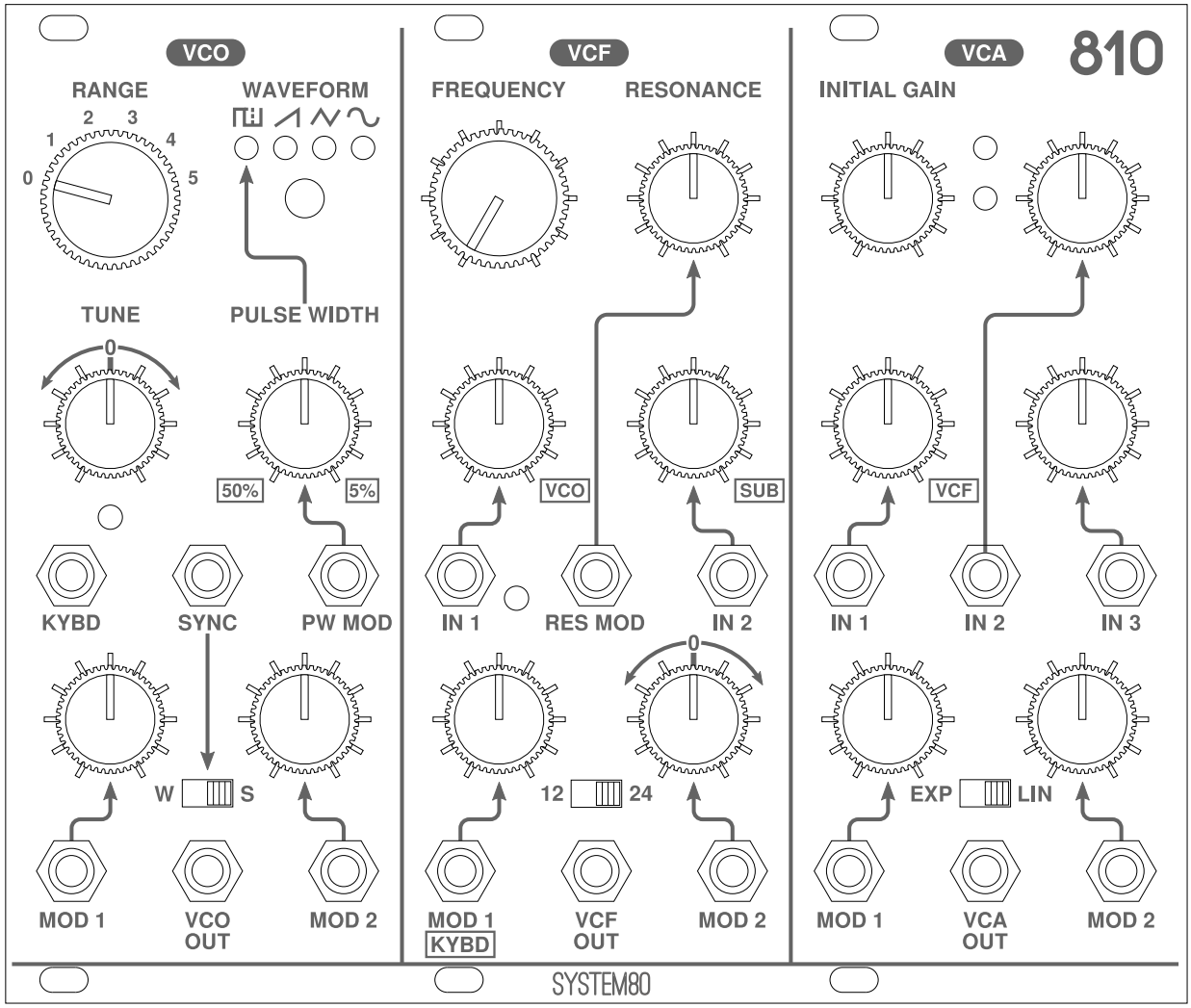
810

User Guide



810 Eurorack Synthesizer Voice Module

Overview

The System80 810 is a Eurorack format synthesizer voice module. It combines a Voltage Controlled Oscillator (VCO), a Voltage Controlled Filter (VCF) and a Voltage Controlled Amplifier (VCA) with convenient normalized connections between sections. Adding modulation from a modulation source such as an LFO or Envelope Generator module allows the creation of a standard subtractive analog synthesizer voice.

The 810's circuits are inspired by the golden age of 'Japanese Analog', including circuits from the System 700, System 100M and Jupiter-8. The VCO is a traditional temperature compensated saw core design with wave shaping circuitry that generates a triangle wave with a small reset glitch. The triangle wave is 'clipped' by a diode circuit to generate an approximate sine wave.

The VCF is a classic cascaded Operational Transconductance Amplifier (OTA) circuit that works and sounds very much like vintage filters based on the IR3109 quad OTA chip. The VCF has both 24 dB and 12 dB slopes and will self-oscillate and track about 3 octaves at maximum resonance.

The VCA is another traditional OTA design similar to vintage VCAs using the BA662 or CA3080 OTAs. The VCA can be set to have a linear or exponential reponse to control voltage.

Installation and Power

The 810 is a 30 HP Eurorack module. It must be installed in a Eurorack case and supplied with Eurorack standard power. Use the supplied screws and washers to install the 810 in your Eurorack case.

It is strongly recommended that a professional, high quality Eurorack power supply be used with the 810. Do-It-Yourself (DIY) power supplies and unfiltered 'off-the-shelf' switching power modules may result in unwanted noise and performance issues. Ensure that your power supply has sufficient overhead to handle the current drawn by all the Eurorack modules connected to it.

The 810 uses a standard 10 pin non-shrouded/non-keyed power connector. A standard 10 pin Eurorack power cable is supplied. The red stripe on the power cable indicates the position of the –12 V conductor. When connecting the power cable ensure that the red stripe side of the cable is aligned with the thick line next to the power header on the back of the 810's circuit board. Connnect the 10 pin connector to the 810's power header and connect the 16 pin connector to your system's power bus board.

VCO Control Descriptions

Ⓐ Octave Range Switch

Changes the frequency range in 1 octave steps from +0 octaves to +5 octaves.

Ⓑ Waveform Selector

Selects the waveform output.

Ⓒ Tune Control

Fine tune adjustment from –12 to +12 semitones.

Ⓓ Pulse Width Control

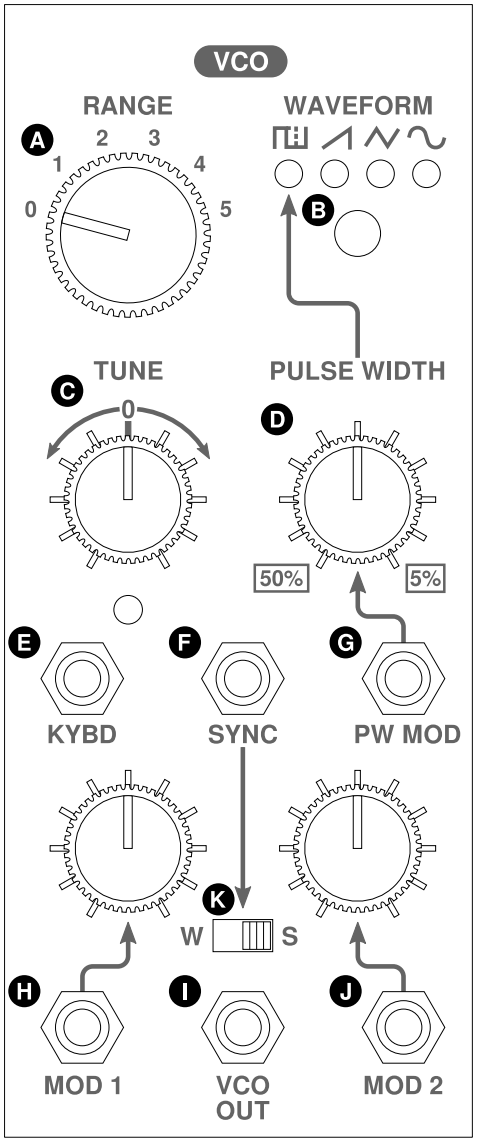
With no signal present at the PW MOD input, Ⓖ, the knob adjusts the pluse waveform's width from 50% (square wave) up to 5%. At higher frequencies the minimum pulse width will go to 0% (no output).

Ⓔ Keyboard Control Input

Input for 1V/octave pitch control signal.

Ⓕ Sync Input

Input for master synchronization signal.



Ⓖ Pulse Width Mod Input

Modulation input for pulse width control. When a signal is present the Pulse Width Control knob, Ⓓ, sets the depth of the pulse width modulation signal.

Ⓗ Frequency Mod Input 1

Input for exponential pitch control signal with logarithmic adjustable depth control.

Ⓘ VCO Output

Ⓙ Frequency Mod Input 2

Input for exponential pitch control signal with linear adjustable depth control.

Ⓚ Sync Type Switch

Sets the synchronization type to Weak (W) or Strong (S). Weak synchronization will force the VCO to lock to interger or fractional multiples of the master frequency, with the reset occuring near the waveform's maximum value. Strong synchronization forces the VCO to reset with every cycle of the master, regardless of where it is in its waveform cycle.

VCF Control Descriptions

Ⓐ Frequency Control

Changes the Cutoff Frequency of the filter.

Ⓑ Resonance Control

With no signal present at the Resonance Modulation input, Ⓕ, the knob adjusts the amount of feedback applied to the input of the filter. Self-oscillation will occur at or near the maximum setting.

Ⓒ Filter Input 1 Level

Adjusts the level of the audio applied to the IN 1 jack. Normalized to VCO Output.

Ⓓ Filter Input 2 Level

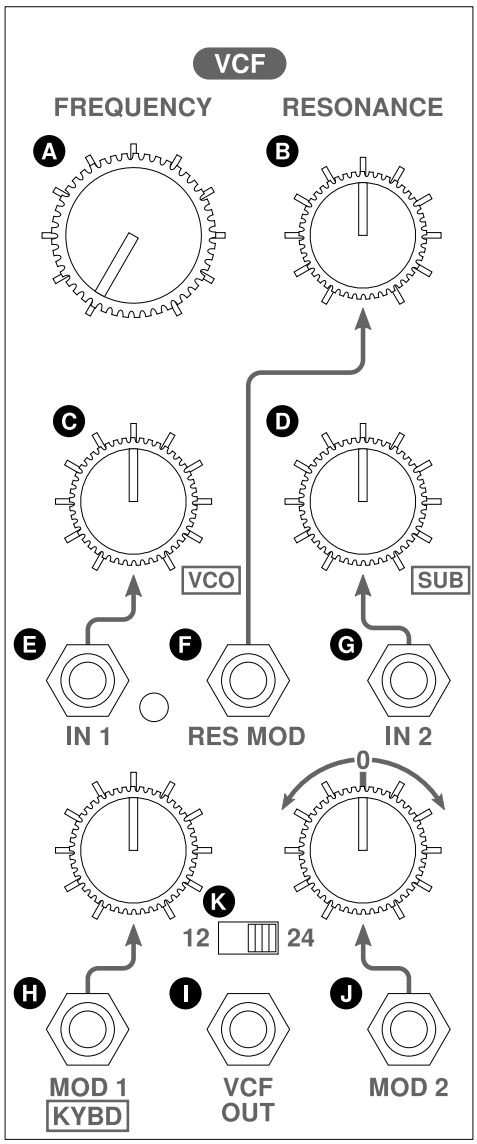
Adjusts the level of the audio applied to the IN 2 jack. Normalized to VCO Sub Oscillator Output.

Ⓔ Filter Input 1

Audio input to filter. Attenuated by Ⓒ.

Ⓕ Resonance Modulation

Input for resonance modulation signal. When a signal is present, the Resonance Control knob, Ⓑ, adjusts the modulation depth of the input signal.



Ⓖ Filter Input 2

Audio input to filter. Attenuated by Ⓓ.

Ⓗ Frequency Mod Input 1

Input for positive Frequency Modulation signal with attenuation. Normalized to VCO KYBD input. Set attenator knob fully clockwise for 1 V/octave tracking during self-oscillation.

Ⓘ VCF Output

Ⓙ Frequency Mod Input 2

Input for bipolar Frequency Modulation signal with attenuation. Maximum attenuation at centre position.

Ⓚ Filter Mode Switch

Sets the slope of the cutoff response between 12 dB and 24 dB per octave.

VCA Control Descriptions

Ⓐ Initial Gain Control

Sets the initial gain of the VCA.

Ⓑ In 2 Level Control

Adjusts the level of audio applied to the IN 2 jack, Ⓕ.

Ⓒ In 1 Level Control

Adjusts the level of the audio applied to the IN 1 jack, Ⓔ. Normalized to VCF Output.

Ⓓ In 3 Level Control

Adjusts the level of the audio applied to the IN 3 jack, Ⓖ.

Ⓔ VCA Input 1

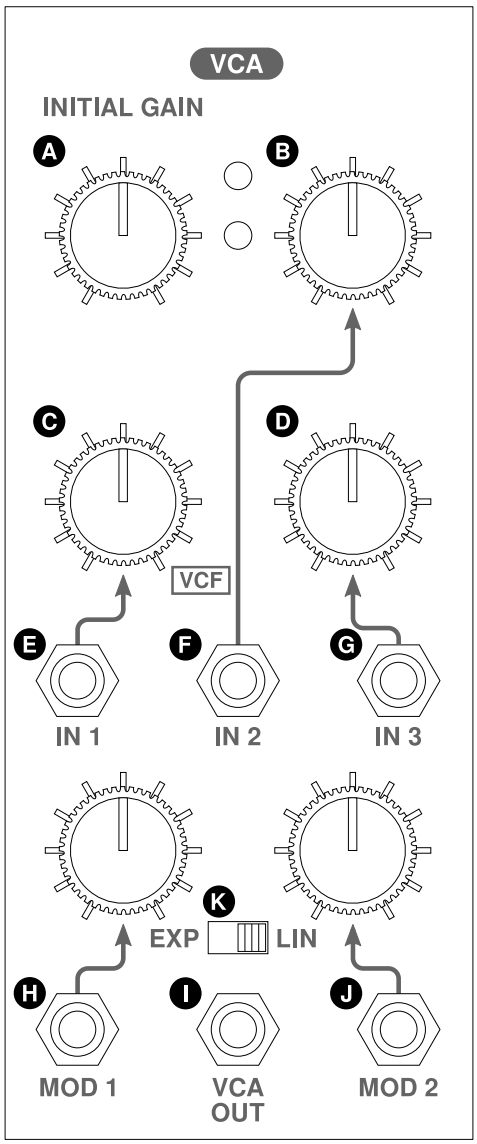
Audio input to VCA. Attenuated by Ⓒ.

Ⓕ VCA Input 2

Audio input to VCA. Attenuated by Ⓑ.

Ⓖ VCA Input 3

Audio input to VCA. Attenuated by Ⓓ.



Ⓗ Amplitude Mod 1 Input

Input for amplitude modulation signal with attenuation.

Ⓘ VCA Output

Output level indicated by green LED. Red LED lights when output signal exceeds +7.5 V.

Ⓙ Amplitude Mod Input 2

Input for amplitude modulation signal with attenuation.

Ⓚ VCA Response Switch

Sets the modulation response between exponential (EXP) and linear (LIN). The EXP response is calibrated to turn the VCA on very rapidly when the amplitdue CV input reaches about 5 V. Use the Inital Gain Control to add an offfset to the amplitude CV if required.

Calibration

General

The 810's VCO is calibrated to track at 1 V/octave over a range of approximatley 7-8 octaves within a tolerance of ±5 cents. When troubleshooting pitch and tracking issues ensure that you are using an accurate 1 V/octave CV source that is not subject to loading by being fanned out through multiples.

When self-oscillating the VCF is calibrated to track at 1 V/octave over a range of about 3 octaves starting at around middle C (C4, 261.6 Hz).

The pitch of both the VCO and the self-oscillating VCF will drift over time as the 810 warms up. About 20 minutes after warm up the VCO pitch should remain stable to within a few cents of the initial frequency.

From time to time the VCO and VCF may need to be calibrated. More detailed instructions for calibration are available on the 810's Github page:

http://github.com/minisystem/810

VCO

Allow the VCO to warm up for at least 10 minutes before begining calibration. Connect the output of the VCO to the input of a digital tuning device (Mordax DATA, DAW VST/AU tuner plugin, chromatic guitar tuner, etc.). Set the RANGE switch to position 2 and use the TUNE control to set the pitch to C1 (32.7 Hz). Set the RANGE switch to position 5. The pitch should read C5 (523.3 Hz) ±5 cents. If the pitch is outside this range, use an electronics trimming tool or a small flat bladed screwdriver to turn the SCALE trimmer located below the TUNE knob on the front panel. Start with just half a turn or so, until the pitch changes by a few cents. Note the direction you turned the trimmer and the reading on your tuner. Set the RANGE switch back to position 2 and read the pitch, switch back to position 5 and adjust the trimmer, repeating this procedure until the pitch at positon 2 and position 5 are 4 octaves apart within 5 cents or less.

VCF

Connect an accurate 1 V/octave CV source to the VCO KYBD input and turn the VCF MOD 1 attenuator fully clockwise. Connect the output of the VCF to the input of your digital tuning device. Turn both the IN 1 and IN 2 knobs fully counter clockwise and turn the Resonance knob fully clockwise. With 0 V applied to the CV input, adjust the Frequency knob so that the pitch is middle C (C4, 261.6 Hz). Increase the CV to 3.00 V and read the pitch (it may take a moment to settle). It should be 3 octaves higher within 10 cents. Use the VCF SCALE trimmer next to the VCF IN 1 jack on the front panel to adjust the scaling. Switch the CV back to 0 V, read the pitch, switch back to 3 V and adjust the SCALE trimmer. Repeat these steps until the pitch at 0 V and the pitch at 3 V are 3 octaves part within 10 cents.

NOTE: filter tracking at 1 V/octave does not have the same range or stability as VCO 1 V/octave tracking.

Specifications

General

Power consumption: 50 mA +12V, 40 mA –12 V

Width: 30 HP

Depth: 30 MM (incl. power connector)

VCO

Initial Frequency: C0 (16.35 Hz)

PWM CV response: 0 V (50%) to +10 V (min.)

Output amplitude (approx.)

0 V to +7.5 V

0 V to +6.5 V

–4 V to +4 V

–5 V to +5 V

VCF

Frequency CV response: 0 V to +10 V

Frequency CV range: –10 V to +10 V

Resonance CV response: 0 V to +10 V

VCA

Amplitude CV response: 0 V to +10 V

Maximum attenuation: –85 dB (typical)

Output signal indication: Green: >0 V, Red: >+7.5 V

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