

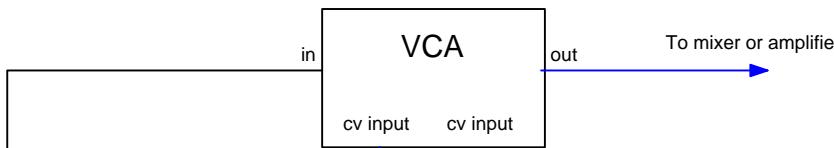
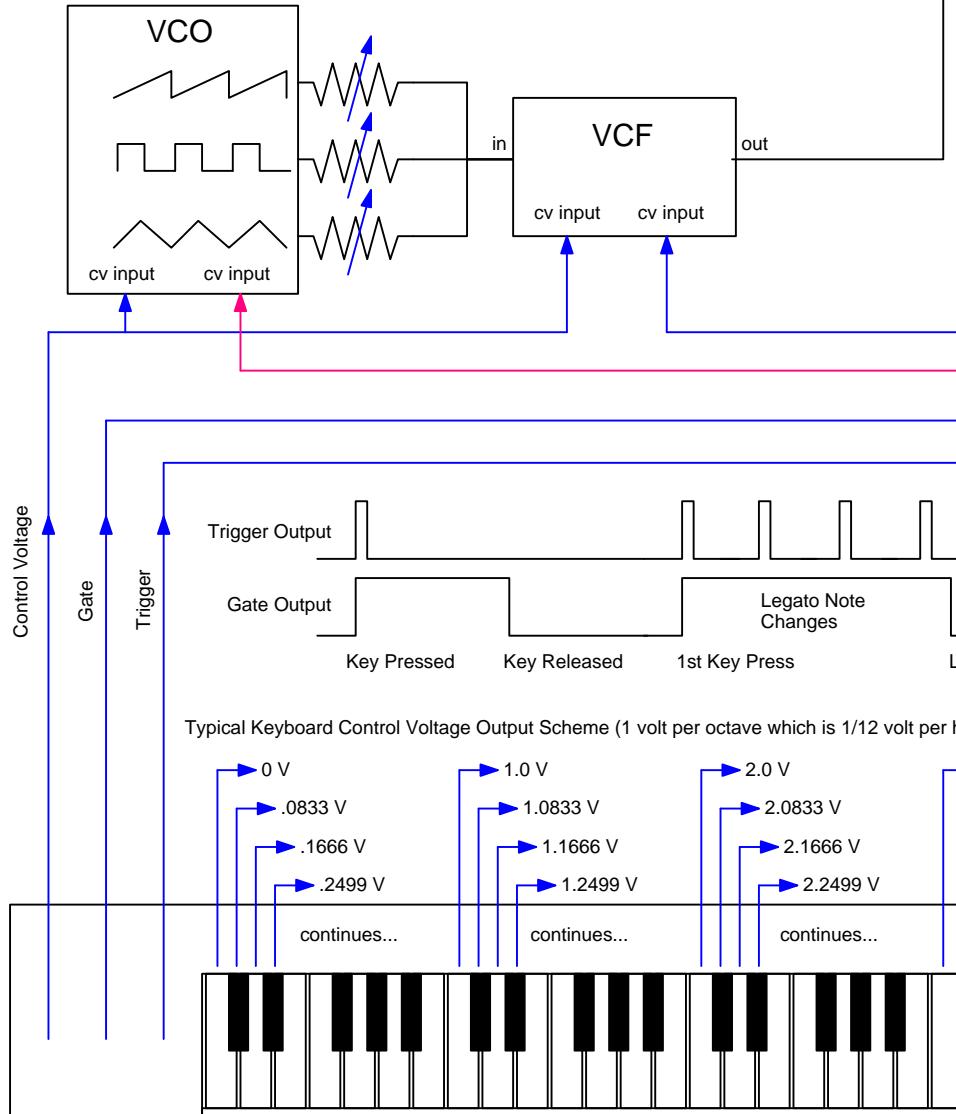
Most voltage controlled oscillators (VCO) generate several waveforms to provide a variety of timbres. They also typically operate in the audio range. The frequency responds exponentially to the control voltage. They are typically scaled to change one octave for every volt of control voltage. This is referred to as 1V/Octave scaling.

Voltage controlled filters (VCF) are used to filter out parts of the signals applied to their inputs. The cut-off frequency responds exponentially to the control voltage. They are typically scaled to change one octave for every volt of control voltage. This is referred to as 1V/Octave scaling. Low Pass, Band Pass and High Pass are typical filter types. The Q or resonance of the filter can be adjusted to emphasize the cut off frequency resulting in interesting timbres

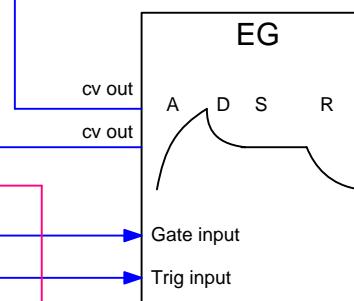
# Analog Synth 101

by Ray Wilson

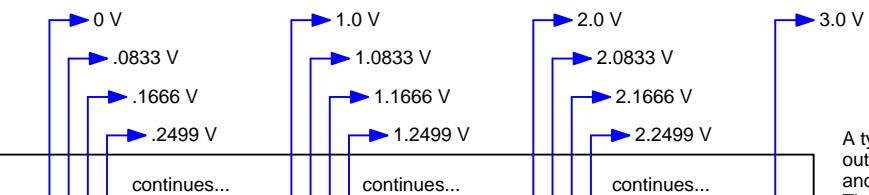
Voltage controlled amplifiers (VCA) are used to apply amplitude modulation to the signal. The higher the input voltage the more signal passes through the amplifier. Control voltage sources can be envelope generators, LFOs or VCOs.



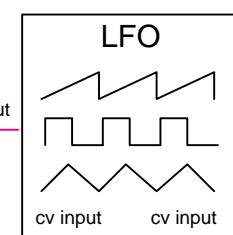
Envelope generators (EG) generate voltage envelopes that resemble the envelopes of various sounds. Some sounds have slow attacks (cello for example). Others have fast attacks (bells for example). This ADSR envelope generator is controlled by the keyboards gate and trigger signals. Its output is used to control any VC controllable module (VCF and VCA being typical candidates). The attack time, decay time, sustain level and release time are all independently adjustable. Typical A, D and R times range from 1mS to 20 (or more) seconds. Most synths have one EG for the VCA and one for the VCF.



Typical Keyboard Control Voltage Output Scheme (1 volt per octave which is 1/12 volt per half step)



A typical analog keyboard controller outputs control voltage and gate and trigger control signals. The control voltage is used to control VCOs, LFOs, and VCFs. Gate and trigger outputs are used to turn on envelope generators such as Attack Release or Attack Decay Sustain Release modules.



Low Frequency Oscillators (LFO) are used to modulate VCO frequency, VCF cutoff frequency, or VCA output level. They typically provide several waveforms for modulation variety. LFO frequency range can be very low 1 cycle per minute to 1Khz (or higher).