

Wiard GR-341 Classic VCO

Rev: 031001

Classic VCO	One circuit - VCO1	
	Generator	Processor
Audio	5 waveforms at audio rate	VCA does amplitude control, FM and Synch inputs
Control Voltage	In low range acts as LFO, AR envelope	DC-coupled VCA mix/attenuate CVs, AR Env acts as env follower

Pulse Width Modulation Control

PULSE [knob] - Pulse Width Modulation. Setting Changes the width of the positive edge of *PULSE [out]*. Range is 10-90% - control at 1200 hours provides a square wave. The pulse width signal is derived from the sawtooth signal (fixed edge PWM). Ensures timing accuracy when used as a sequencer clock source. PWM-ing the clock signal feed to an ADSR envelope generator (such as the Envelator) produces dramatic, musically-useful changes in modulation. Special circuitry assures that no combination of pulse width settings and PWM makes the pulse signal disappear entirely.

PWM [knob] - Pulse Width Modulation Attenuator. Controls signal attenuation at *PWM [in]*. Allows the pulse width to be controlled by an external LFO or envelope for complex pulse waveform output.

Envelope Control

ATTACK, RELEASE [knob] Attack/Release Controls. Adjusts the built-in AR envelope/slew rate limiter, and determine the ramp-up/-down speed of the envelope when the gate signal at *GATE [in]* is processed. **NOTE:** Pulse signal at *GATE [in]* must be at least as long as the attack time. The input has a half wave rectifier followed by a dual direction lag processor. With *ATTACK* set to 700 hours, and *RELEASE* set to 1200 hours, the unit will act as an envelope follower, generating a DC voltage at *AR ENV [out]* proportional to the positive peaks of an audio signal input at *GATE [in]*.

Oscillator Range

LOW/HIGH [switch] - Oscillator Range Setting. Changes the range of the *COARSE* knob. When *HIGH*, *COARSE* has a full 10-octave tuning range. When *LOW*, *COARSE* has a 0-20 Hz range.

Oscillator and Wave Control Inputs

1V/OCT [in] Standard in for oscillator pitch control, using a standard 1 V/Oct (exponential) range. Responds to a 10v (10 octave) range.

FC [in] Direct frequency modulation of the oscillator. There is no control of this input. This input is "close" to a 1v/Oct modulation, but is not calibrated for this purpose.

FC1 [in] Similar to *FC[in]* In but is attenuated by the FC1 front panel control.

SYNCH [in] The signal used for oscillator sync where the type of sync is controlled by *SYNCH*.

LIN [in] In conjunction with *LIN*, provides standard linear frequency modulation (FM) of the oscillator. This input is AC coupled allowing FM modulation to be introduced while minimizing unwanted pitch shift.

PWM [in] The input to the PWM front panel attenuator for external voltage control of pulse width.

LED Cycle Display

The left three LEDs, **SN** (Sine Wave), **SW** (Square Wave), and **PU** (Sawtooth) show the current "speed" of the oscillator. When running at audio rate, LEDs will simply twinkle as the oscillator runs. When running at a low rate (as an LFO), LEDs will show the difference in cycle for each waveform type. For each waveform, green represents positive excursion, while red represents negative excursion. The fourth LED, **G** (Gate Input - yellow) shows the state of the envelope output by changing it's brightness. It follows the gate input.

LED VU Meter Display

-10...+20 (VCA Output) Shows the VCA output volume.

Oscillator Tuning

COARSE [knob] Sets the base-line tuning of the oscillator. When in "high rate" mode, tuning can be set within the 10-octave range of the oscillator. Control set at 1200 hours provides Middle C (256Hz) - approx. When in "low rate" mode, oscillator rate can be set between 0.1 and 20 Hz. See *LOW/HIGH* switch.

FINE [knob] Provides finer control over the tuning; allows approx. one octave of adjustment over its range.

Oscillator and Wave Control Attenuators

FC1 [knob] - Frequency Control Attenuator. Sets the amplitude of the signal found at *FC1 [in]* that controls the oscillator frequency.

SYNCH [knob] - Oscillator Sync Attenuator. Allows control of the sync function via a signal found at *SYNCH [in]*. At the control's low-end (700 hours) sync is off. Moving the control clockwise introduces oscillator "soft-sync". At the control's high end (500 hours) the oscillator is "hard-sync-ed".

LIN [knob] - Linear FM Attenuator. Attenuates the signal found at *LIN [in]*, allowing control of standard FM functionality.

VOL [knob] - Volume. Determines the minimum output level of the built-in VCA. When set to 700 hours, audio output is off - to be opened using an envelope or LFO with *VCA ENV [in]*. When at 500 hours, the output level is "full-on", which is useful for tuning the oscillator.

Wave Outputs

SINE [out] +/-4v sine wave output.

TRI [out] +/-4v triangle wave output.

SAW [out] +/-4v sawtooth wave output.

PULSE [out] +/-4v pulse wave output, pulse width determined by *PWM* and *PULSE* knobs, and *PWM [in]*. Output normalized to *VCA1 [in]*.

RAND [out] - Random Voltage Output Outputs a 64-level random voltage between 0-8v. At *HIGH [switch]* it produces various colors of noise. At *LOW [switch]* it can be used as a sample-and-hold fed from a noise source. A new random voltage is generated on the rising edge of the *PMW [out]*. When *PMW [out]* is used for clocking a sequence, the random voltage is updated in time with the sequence.

Envelope and VCA Section

GATE[in] The input signal processed by the AR envelope/slew rate limiter.

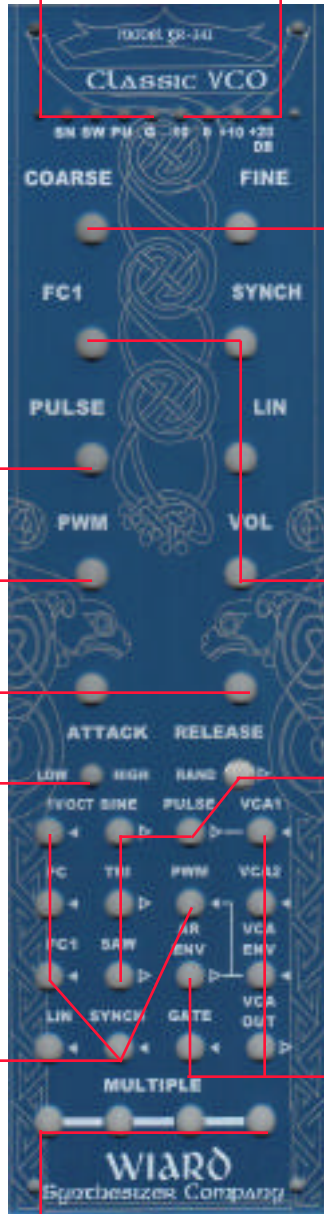
AR ENV [out] The output signal of the built-in envelope/slew rate limiter. Output normalized to *PWM [in]* and *VCA ENV [in]*.

VCA1 [in] First mixer input to the internal VCA. Normalized to *PULSE[out]*.

VCA2 [in] Second mixer input to the internal VCA.

VCA ENV [in] The output level control for the VCA. Input normalized to the *AR ENV[out]*.

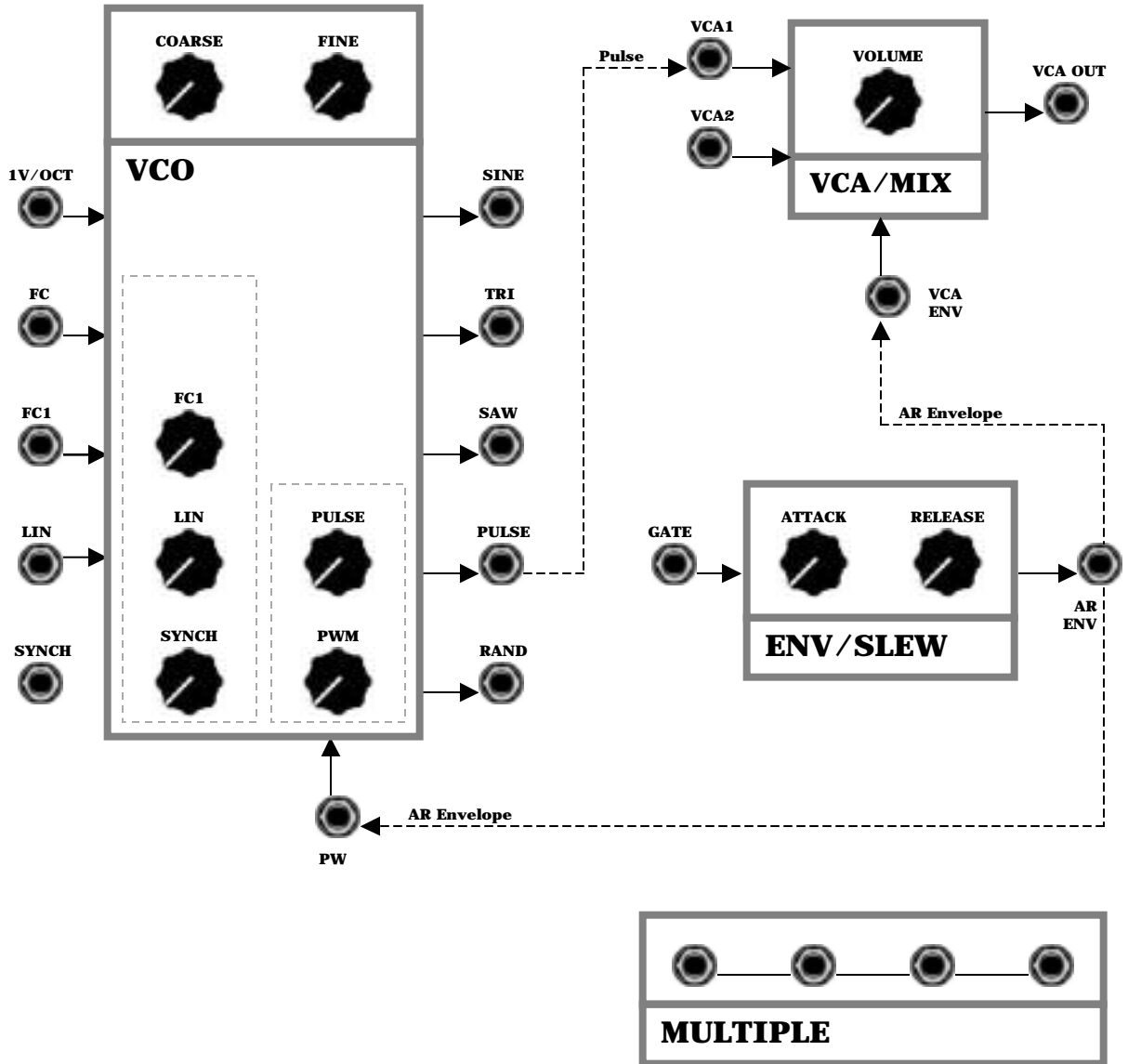
VCA OUT [out] The VCA output signal. This is normally the synthesizer output, where the output contains the pulse waveform, amplitude modulated by the envelope.



MULTIPLE [in/out]

Any signal can be multiplied (that is, duplicated) by placing a signal into any of these jacks, and using the remaining three jacks as duplicate outputs.

Classic VCO First Order Units



Classic VCO Module Description

The Classic VCO is the most full featured analog oscillator module ever made. It produces the standard classic analog waveshapes -- sine, triangle, sawtooth and pulse with pulse width modulation. In addition to the standard tuning, FM and pulse-width controls, the Classic VCO provides a built-in envelope and VCA to create a complete synth-in-a-module.

It also has a unique random voltage output which provides 64 random voltage levels. In the audio range, this sounds like "noise" of various colors depending on the tuning of the oscillator. In the "low" range, it can be used in the same way as a noise generator feeding a sample and hold.

The Classic VCO has three exponential control inputs, one with attenuator. It also has an AC coupled linear input with attenuator and a proportional synchronization control with attenuator. In addition, this module contains a simple attack-release envelope generator (which can also be used as an envelope follower or lag

processor) and a voltage controlled amplifier (VCA) with two mixing inputs. The VCA is intended to be used with the "Velocity" output of a MIDI to CV converter but can be used as a general purpose VCA. The modulated pulse output is normalized to one VCA input while the output of the envelope generator is normalized to the VCA control input.

Red and Green Bicolor LEDs monitor three of the waveform outputs and the voltage output of the envelope generator is displayed by the brightness of a fourth LED. The output level of the VCA is displayed on a four LED VU meter.

The Classic VCO module contains:

- A five-waveform pure analog oscillator
- An Attack-Release Envelope Generator. The envelope is set by an internal jumper for either exponential or linear envelopes.
- A Voltage Controlled Amplifier (VCA)
- A jack multiple

Classic VCO Example Patches

Assumptions

- o Notation used: MPN (see *Modular Patch Notation (MPN) Explained* for a discussion on MPN)
- o Only one module and circuit (the same): VCO.
- o Assume **Top** VCO for all patches

Hello World

Controls

[(COARSE, FINE, PULSE)= 12,
(FC1, SYNCH, LIN, PWM, VOL, ATTACK,
RELEASE)= 7,
LOW/HIGH SWITCH=HIGH]

Connect

[KBD.CV -> 1V/OCT,
KBD.GATE -> GATE,
VCA OUT -> +MON]

Comment

Classic PWM square wave patch. Vary PWM, ATTACK and RELEASE controls to experiment with the sound.

Self-Articulating Clock

Controls

[(COARSE, FINE, PULSE, PWM)= 12,
(FC1, SYNCH, LIN, VOL, ATTACK, RELEASE)= 7,
LOW/HIGH SWITCH=LOW]

Connect

[RAND -> PWM,
PULSE -> +ENVELOPE]

Comment

The pulse width self-modulates between staccato and legato. Vary PULSE control to move the clock between these two extremes. Also try varying PWM and COARSE control for different effects. PULSE out has the clock out signal that can go to triggering an envelope and sequencer.

Enhancing the Fundamental

Controls

[(COARSE, FINE, PULSE, PWM)= 12,
(FC1, PWM, ATTACK, RELEASE)= 7,
VOL= 5,
LOW/HIGH SWITCH= HIGH]

Connect

[SINE -> VCA2,
VCA OUT -> +MON]

Comment

Adds a sine wave to the square wave, boosting the fundamental by 6db.

Joystick-Controlled Modulation Source

Controls

[(COARSE, FINE, FC1)= 12,
VOL= 7,
LOW/HIGH SWITCH=LOW]

Connect

[SINE -> VCA1,

JOYSTICK.X -> VCA ENV,
JOYSTICK.Y -> FC1,
VCA OUT -> +MON]

Comment

Use the X axis of the joystick to control the modulation depth, and the Y axis for the modulation frequency. Also try varying the originating wave, using TRI and SAW instead.

Dynamic Depth Linear FM

Controls

[(COARSE, FINE)= 12,
LIN= 5,
LOW/HIGH SWITCH=HIGH]

Connect

[+MODULATION SINE -> VCA1,
+ENVELOPE -> VCA ENV,
VCA OUT -> LIN,
SINE -> +MON]

Comment

The modulation oscillator input into VCA1 is usually a sine wave. The FM envelope is usually an AR envelope. +ENVELOPE is used as the FM envelope.

Second Control Voltage Attenuator

Controls

[VOL= 12]

Connect

[KBD.CV -> 1V/OCT,
+ENVELOPE -> FC1,
VCA OUT -> FC,
+LFO -> VCA1,

Comment

Uses VCA as a second attenuator for FC input. VCO then has 1V/Oct and two inputs with attenuators. Example: Modulating VCO with Keyboard CV, envelope and LFO simultaneously.

Chiff Attack

Controls

[(COARSE, FINE, FC1, LIN)= 12,
LOW/HIGH SWITCH= HIGH]

Connect

RAND -> VCA1,
+AR ENV -> VCA ENV,
VCA OUT -> LIN,
KBD.CV -> 1V/OCT]

Comment

This patch can use a linear (LIN) or exponential CV input (FC1). A short AR envelope mixes noise into the attack. Try varying LIN or FC1 for different results.

Slave Soft VCO Oscillator Synch

Patch +HARD SYNC

Controls

[(COARSE, FINE, FC1)= 12,
SYNCH= 11,
LOW/HIGH SWITCH= HIGH]

Connect

[+ENV -> FC1,
+OSCILLATOR -> SYNCH,
VCA OUT -> LIN,
SINE -> +MON]

Comment

The master oscillator is usually a square wave. Try varying COARSE and FC1 for different effects, and substituting the output SINE wave for a TRI, SAW or PULSE.

Slave Hard VCO Oscillator Synch

Initial +HARD SYNC

Controls

[SYNCH= 5]

Comment

By varying SYNCH from 11am to 5pm, the synch of the oscillators is changed.