ALLSCILLATOR

Manual V1.1

APOLLO VIEW

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SPECIAL THANKS

Thomaas Banks Thomaas Banks
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Limited Warranty

Apollo View Modular Ltd warrants this product to be free from defects in materials or construction for a period of one year from the date of purchase (proof of purchase/invoice required).

This warranty does not cover any damage caused by misuse of the product, or any unauthorised modification of the product.

Apollo View Modular Ltd reserves the right to determine what qualifies as misuse at their discretion. Examples of misuse include, but are not limited to:

1. Exposure to extreme heat or moisture
2. Malfunction resulting from wrong power supply voltages, backwards or reversed eurorack bus board cable
3. Issues related to third party products
4. Any condition resulting from incorrect or inadequate maintenance or care.
5. Damage resulting from misuse, abuse, negligence, accidents or shipping damage.
6. Dissatisfaction due to buyer's remorse
7. Normal wear and tear
8. Damage to the product caused by excessive physical force or abuse of the product, removing knobs, changing faceplates

This warranty does not cover any other causes determined by Apollo View Modular Ltd to be the fault of the user, and standard service rates will apply.

Apollo View Modular Ltd agrees, at its option during the warranty period, to repair any defect in material or quality or to furnish a repaired or refurbished product of equal value in exchange without charge (except for a fee for shipping, handling, packing, return postage, and insurance which will be incurred by the customer). Such repair or replacement is subject to verification of the defect or malfunction and proof of purchase as confirmed by showing the model number on the original dated sales receipt.

Apollo View Modular Ltd implies and accepts no responsibility for harm to person or apparatus caused through the operation of this product.
Please contact info@apolloviewmodular.com with any questions, requests for a return to the manufacturer, or any needs & comments.

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Introduction

ORIGIN

The Curtis Electromusic Specialties CEM3340 is a classic integrated circuit VCO – “oscillator on a chip” designed by Doug Curtis and released in 1980. The CEM3340 is found in many of the famous synths of the analogue era; the Sequential Prophet-10, Prophet 600, Pro-One, Prophet 5 and T8, the Oberheim OB-Xa, OB-Sx and OB-8, the Roland SH-101, MC-20, Jupiter 6 and early model MKS-80, the Voyetra 8, even the MemoryMoog and more. Instruments with CEM ICs are said to have that Curtis sound, described as "fantastically saturated, brash and powerful"[1]. Many believe this chip to be the greatest sounding analogue oscillator of all time.

If you are curious, Tom Wiltshire (Electric Druid) has an excellent article on CEM3340 VCO designs where he explores the implementation of this chip in the Roland MKS-80, Roland SH-101, Sequential Prophet 5 Rev.3 and the MemoryMoog.

We wish to pay our respects to Doug Curtis for all of his achievements and technical contributions to music. Without his contributions to integrated circuit design, many of the famous synths we know and love might have sounded different.

The original CEM3340 went out of production decades ago and more recent years, it was cloned and updated by Alfa Rpar and Cool Audio separately. CEM themselves reissued the CEM3340 rev G in 2016. We had wished to use the CEM3340 rev G for Allscillator. Unfortunately, it is only available in a PDIP-16 (300mil) package. To meet our design constraints of keeping Allscilator to 10HP, we chose to use the AS3340 from Alfa Rpar which is available in a smaller SOIC-16 (150 mil) package. We wish to highlight the technical support from Alfa Rpar has been excellent throughout our development process.

3340 VCOs are precision voltage controlled oscillators, featuring both exponential and linear control scales and four buffered output waveforms: triangle, sawtooth, square, and pulse with voltage controllable pulse width. Through waveshaping, we have expanded these basic waveshapes to include additional output waveforms of square-sine, Sharktooth, pulse-width modulation saw, and sub-octave output that can be switched between -1 octave, -2 octave and -2* octave (-2* is achieved by summing waveshaped -1 and -2 octave signals). Unusually, also included on the 3340 is a provision for hard and soft synchronisation of the frequency. Many classic synthesisers' designs overlooked this feature and opted to include alternative circuits to implement a classic synth effect. We have stuck to the original CEM3340 datasheets concept for the frequency sync inputs as, according to the datasheet, this method will ‘provide a wider variety of synchronised sounds than available through conventionally synchronised oscillators”[2].

[1] Description of Sequential Circuits Prophet-600 sounds

[2] CEM3340 datasheet

WHAT IS IT?

An all analogue triangle core VCO / LFO / Ultra-LFO based on 3340 VCO IC, which utilises the full potential of the 3340's capabilities and adds additional wave-shaped outputs.
'ALL' the oscillator waveforms in 10 HP - No ordinary 3340 VCO!

Allscillator is extremely stable across all temperatures and has a wide-ranging (0.0011Hz – 20kHz) frequency. 1V/oct control extends over +10 octaves.

Eight simultaneously available waveforms:

- Square Sine
- Sine
- Tri
- Pulse (PWM)
- Sharktooth
- Saw
- PWM Saw
- Sub (-1 Octave, -2 Octave and -2* Octave Pulse)

Sub octave is square/pulse selectable via a switch: -1 Octave, -2 Octave and -2* Octave Pulse (25% high, 75% low duty cycle)

1V/oct control extends over +10 octaves. Further frequency modulation is possible through independent Exponential Frequency Modulation and Linear Frequency Modulation. Each FM input has an attenuator for controlling the range of the modulation.

Three types of independent oscillator sync are available for locking the pitch to another master oscillator and creating new harmonically rich waveform shapes at the outputs.

- Positive edge Hard Sync
- Negative edge Hard Sync
- Soft sync (from a negative edge)

The oscillator range can be switched between Audio frequency, LFO frequency and Ultra LFO.

- Audio - 23Hz to +20kHz
- LFO - 0.67Hz (1.5 seconds) - 45Hz
- Ultra LFO - 15mins to 12 seconds

SPECIFICATION

- 10HP
- 40mm depth
- Reverse polarity protected
- +12V 135mA
- -12V 120mA

Installation Allscillator

POWER

Allscillator is supplied with a 10-pin power cable. The shrouded socket is between the two PCBs. Connect the power cable to the shrouded socket using gentle pressure, ensuring correct alignment of the ‘key and lock’. The red stripe should be at the top of the module.

The module has reverse protection diodes, which will simply divert the reverse current to ground in case of incorrect installation.

JUMPERS

Allscillator comes with 2 jumpers installed. Both are found on the right side of the module on the back of the front PCB in the space between the two PCBs.

Fine Frequency Jumper - The top jumper is situated directly behind the Tri output socket. The purpose of this jumper is to connect the Fine frequency control. With this jumper removed, the Fine Knob would no longer affect the frequency of the Allscillator. When calibrating the 1V per octave tracking, it is helpful not to have the Fine Knob connected.

LED Jumper - The second jumper is situated directly behind the Saw output socket. The purpose of this jumper is to select the behaviour of the LEDs. It is possible to select the following behaviour with the position as indicated on the PCB silkscreen:

1. LEDs constantly OFF
2. LEDs flash with the -2 octave of the frequency of Allscillator
3. LEDs constantly ON

The jumper connection should be between the two pins that are perpendicular to the PCB.

NOTE: It is possible to access these jumpers without removing the back PCB. But if you want to make it easier you can remove the back panel by unscrewing the 2 x M2 screws that connect the back PCB to the standoffs.

Allscillator Front Panel

CV INPUTS

The CV Inputs are the seven Jacks on the left side of the module.

1V/Oct - 1 volt per octave frequency modulation input. Used to exponentially control the frequency/pitch of Allscillator, typically with a keyboard or sequencer, with the standard 1V/Oct response. The base frequency of the Allscillator is set by the Coarse and Fine frequency knobs to the right of the 1V/Oct input. In Audio mode (See "Switches" later in this manual), this Coarse knob has a 5V and, therefore 5 Octave control range, and the Fine knob has a +-5 semitone control range, 0 semitones is the centre (12 o'clock) position.

Exp FM - This is a second exponential frequency modulation input. Adjacent to the input is the Exp FM knob which is used to control the set modulation depth. With the knob at full (all the way clockwise), the Exp FM has a 1V/Oct response.

Lin FM - Linear Frequency Modulation input. Linear FM is a lot subtler than its Exponential counterpart. Subtle amounts of Linear FM can be used for vibrato, for example. Adjacent to the input is the Lin FM knob which is used to control the set modulation depth.

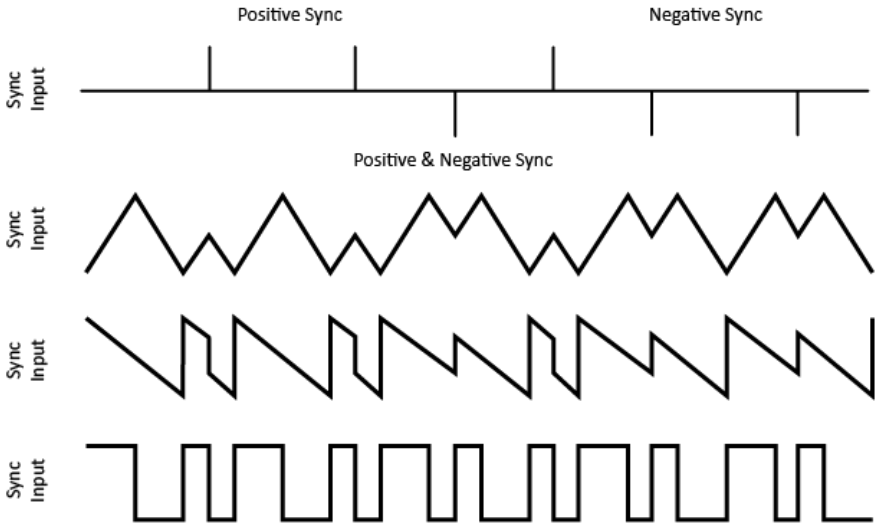
> **NOTE:** All of the above Frequency Modulation inputs can accept negative control voltages. This will lower the previously stated frequency ranges. For example, in Audio mode, a large enough negative offset voltage applied to Exp FM would make Allscillator behave like an LFO. Unlike maybe other implementations of the 3340, it is possible to use both Exp FM and Linear FM together. This is useful for adding vibrato to Exp FM patch or to synthesise an acoustic-sounding kick drum. (Credit to DivKid for the acoustic kick drum patch, this patch can be found alongside other great patch tips on YouTube).

PWM - Pulse Width Modulation input. This controls the pulse width of the Pulse and PWM Saw outputs. Adjacent to the PWM input is the PWM offset knob. The PWM CV input is mixed with the PWM offset knob, and the sum of these two signals determines the PWM of the Pulse and PWM Saw waveforms. For the summed voltage, the PWM pulse is 0% duty cycle at 0V and 100% duty cycle at 5V. Both of these states are just a constant Low or constant High signal, respectively, and do not produce any sound. With no PWM CV input present, the PWM offset knob ranges from 0.1V to 3.75V and controls the width of the Pulse output from 2% duty cycle through to 75%. The PWM also affects the width of the two notched parts of the PWM Saw output (see "Outputs" section later in this manual). For best results, the summed input to the PWM (CV input + offset knob) should be between 0.5V-4.5V.

> **NOTE:** Depending on the source of your modulation, it might be necessary to attenuate and offset the PWM modulation signal. For example, if using a second Allscillator's Tri output in LFO mode, this signal is bipolar 10Vpp. This would require attenuating by more than half and offsetting by approximately +5V. Bare in mind that offsetting is possible by the use of the PWM offset knob, and its range is 0.1V to 3.75V

PosSync - A positive sync pulse to this input will cause the triangle wave to reverse direction only in the rising portion of the waveform.

NegSync- A negative sync pulse to this input will cause the triangle wave to reverse direction only in the falling portion of the waveform.



SoftSync - Negative pulses applied to the SoftSync input cause the upper peak to reverse direction prematurely, causing the oscillation period to be an integral multiple of the input sync pulse period. Avoid applying positive-edged pulse signals to the SoftSync input, as these manifest as transient spikes in the output waveforms.

Notes on Sync: Sync can create new timbres and harmonics by forming different waveshapes at the Outputs. If using another oscillator (Master) to sync Allscillator (Slave), Allscillator's pitch will match the pitch of the Master oscillator, which is useful when creating synth voices by mixing the outputs of the Master and Slave. When sending a 1V/oct sequence to this synth voice, mult this to both Master and Slave to maintain the relationship of the new waveform created by sync. Alternatively, just 1V/oct sequence the Master, which will cause the synced Allscillator waveform output shape to change.

Simultaneous Sync: Using a +-5V sync signal from another oscillator, and multing this to both PosSync and NegSync inputs, it is possible to sync both in the rising and falling parts of the triangle waveform. This gives a very pleasing and smooth-sounding sync tone.

Effect of Sync on different Waveform Outputs: The Sync input affects the Triangle core of the VCO. The other waveshapes are all derived from this Triangle waveshape. The effect of Sync on the other outputs varies on how this waveform is derived; therefore, each Output can create its own very interesting timbre when using Sync.

SWITCHES

LFO/Audio - This is a 3-way switch to select between Ultra LFO, LFO and Audio rate frequencies.

The oscillator range can be switched between Audio frequency, LFO frequency and Ultra LFO.

- Audio - 23Hz to +20kHz
- LFO - 0.67Hz (1.5 seconds) - 45Hz
- Ultra LFO - 15mins to 12 seconds

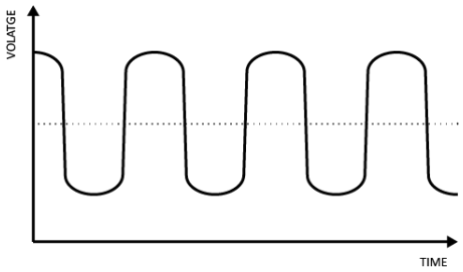
The LFOs can be pushed up into the Audio range by using 1V/oct and FM inputs.

-1 -2 -2* - This is a 3-way switch to select between the Sub output waveform from between square wave -1 octave below the core frequency, square wave -2 octaves, and a pulse wave 25% duty cycle at -2 octaves. There will be more description of these waveforms below.

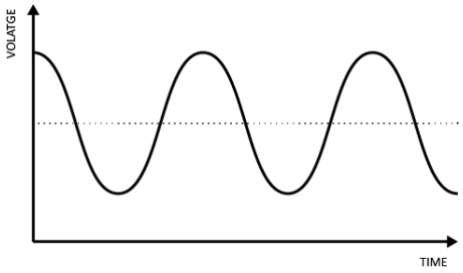
WAVEFORM OUTPUTS

All waveforms are 10Vpp. The core of the 3340 is a Triangle wave; from this, the Saw and PWM Pulse are derived on the 3340 IC. Allscillator then uses waveshaping, blending and other techniques to generate the other waveforms.

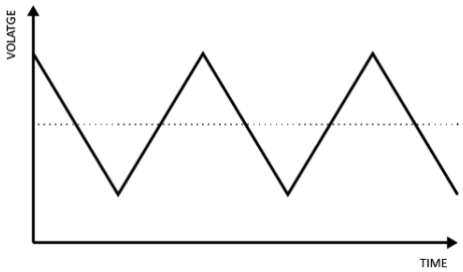
Square Sine
This is derived by clipping the sine wave and mixing the clipped version along with the original sine. This creates some extra upper harmonics. This is the perfect waveform for creating phat basslines.



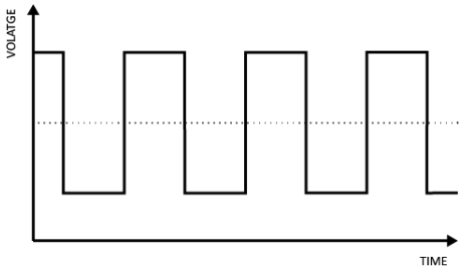
Sine
Most analogue VCOs derive their sine from waveshaping (saturating) the Tri wave, but normally little peaks from the Tri remain. Allscillator's waveshaping removes these little Tri peaks which supresses overtones for an almost pure Sine. The Sine is just the fundament frequency of the oscillator



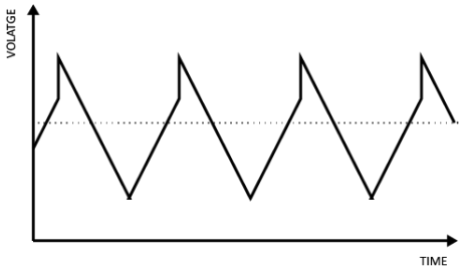
Tri
This is the output from the VCOs core. A triangle wave is comprised of just odd multiples of the fundamental harmonic. But these upper harmonics roll-off (reduce in amplitude higher up the frequency spectrum) quite quickly.



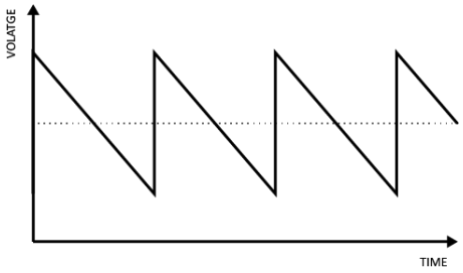
Pulse (PWM)
The Pulse's width can be modulated by the PWM offset and PWM CV in. With no PWM CV input present, the Offset can control the Pulse width from 2% to 75% duty cycle. A square wave (50% duty cycle) consists of just odd harmonics. Modulating the PWM adds animation by varying harmonics introducing even harmonics.



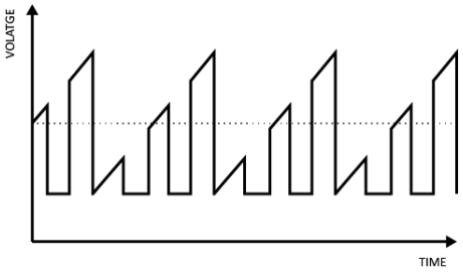
Sharktooth
This waveshape is created by blending the Saw & Tri waveshapes. This waveform is found on classic Moog Model D.



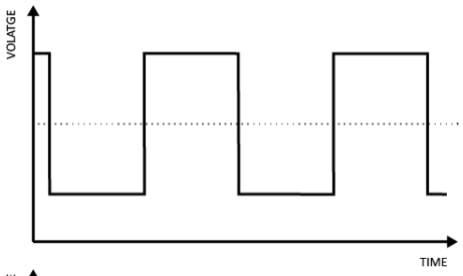
Saw
A very harmonically rich waveform due to the straight edge in the wave. It contains both odd and even harmonics. This results in a harsh, buzzy tone.

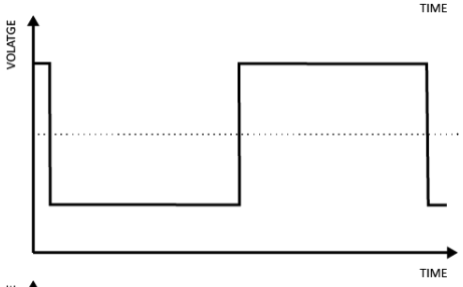


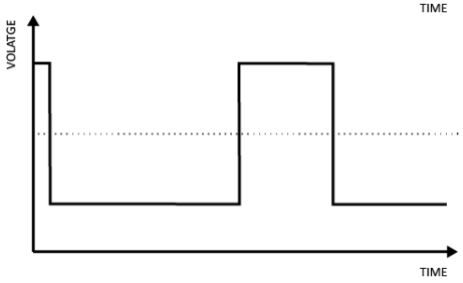
PWM Saw
This is a similar sound to the Saw, but as it is possible to PWM the notches out of the Saw, it is possible to add animation to this sound.



Sub
The Sub output is selectable by the 3-way Switch -1 -2 -2*. With the switch to the left most position the Sub output is a square wave with frequency -1 octave below the core. The middle position is -2 octave square wave. The right most switch position is again a -2 octave frequency, but the waveshape is a 25% duty cycle pulse. Harmonically speaking the -2* is quite similar to mixing the -1 and -2 together.







Calibration

Each Allscillator has been individually calibrated and tested; do not adjust the trimmers if not needed. However, if you find your Allscillator is no longer tracking well (within 5 cents tolerance is expected behaviour). Be aware, Allscillators need to warm up before achieving their optimum performance; this is usually around 20 minutes.

NORMAL 1V/Oct CALIBRATION

This process requires a voltage source and a tuner. The voltage source should be capable of accurately supplying 0V, 1V, 2V, 3V, 4V, and 5V. A typical keyboard with 1V/Oct CV output is fine, or any sequencer where you can accurately be aware of the output voltage.

1. Remove the Fine Jumper, which is found on the front PCB behind the Tri output and keep it somewhere safe so as not to lose it, as you will want to replace it later. Removing the Jumper prevents the Fine frequency knob from skewing the calibration
2. Set the Coarse knob fully counterclockwise, making sure it doesn't get knocked when completing the following steps
3. Connect the tuner to the Sine output
4. Plug your voltage source into 1V/Oct and supply 5V
5. Check the reading on the tuner
6. Adjust the **C6 trimmer until the tuner reads C6
7. Supply 0V to the 1V/Oct
8. Check the reading on the tuner
9. Adjust *C1 until the tuner reads C1
10. Supply 4V to the 1V/Oct
11. Check the tuner
12. Adjust **C6 until the tuner reads C5
13. Supply 1V to the 1V/Oct
14. Check the tuner
15. Adjust C1 until the tuner reads C2
16. This should complete the calibration steps
17. Play a sequence into the 1V/Oct to check the tracking
18. Repeat the above steps if necessary
19. Replace the Fine Jumper

DEEP 1V/Oct CALIBRATION

This is documented in the DIY Build Doc. If you still have issues with the tracking (or anything else), don't hesitate to get in touch with info@apolloviewmodular.com for support.

SINE CALIBRATION

The other trimmers on the module are for calibrating the Sine output. Should your Sine output become misshapen or offset, again contact us on the email above for support.

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