# User Manual

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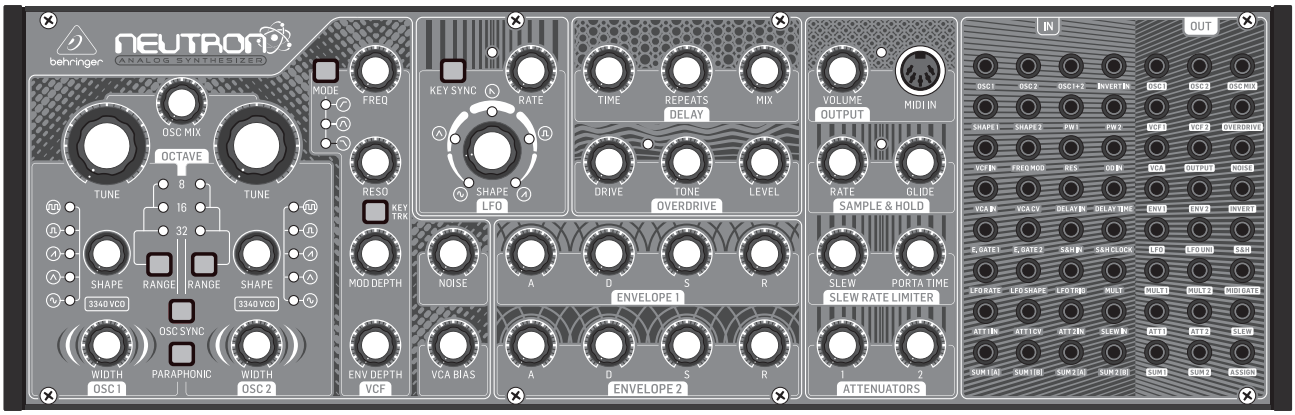


# NEUTRON

Paraphonic Analog and Semi-Modular Synthesizer with Dual 3340 VCOs,
Multi-Mode VCF, 2 ADSRs, BBD Delay and Overdrive Circuit in a Eurorack Format

behringer

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# Table of Contents



## Thank you

Thank you very much for expressing your confidence in BEHRINGER by purchasing the Neutron analog synthesizer - with 2 x 3340 VCOs, analog bucket brigade delay (BBD), soft-clipping overdrive circuit, 5 shape morphing LFO, 12 dB multi-mode 2 pole filter, paraphonic mode, semi-modular and Eurorack format

## EN Important Safety Instructions

**CAUTION**
RISK OF ELECTRIC SHOCK!
DO NOT OPEN!
**ATTENTION**
RISQUE D'ÉLECTROCUTION !
NE PAS OUVRIR !

Terminals marked with this symbol carry electrical current of sufficient magnitude to constitute risk of electric shock. Use only high-quality professional speaker cables with ¼" TS or twist-locking plugs pre-installed. All other installation or modification should be performed only by qualified personnel.

This symbol, wherever it appears, alerts you to the presence of uninsulated dangerous voltage inside the enclosure - voltage that may be sufficient to constitute a risk of shock.

This symbol, wherever it appears, alerts you to important operating and maintenance instructions in the accompanying literature. Please read the manual.

**Caution**
To reduce the risk of electric shock, do not remove the top cover (or the rear section). No user serviceable parts inside. Refer servicing to qualified personnel.

**Caution**
To reduce the risk of fire or electric shock, do not expose this appliance to rain and moisture. The apparatus shall not be exposed to dripping or splashing liquids and no objects filled with liquids, such as vases, shall be placed on the apparatus.

**Caution**
These service instructions are for use by qualified service personnel only. To reduce the risk of electric shock do not perform any servicing other than that contained in the operation instructions. Repairs have to be performed by qualified service personnel.

**1.** Read these instructions.

**2.** Keep these instructions.

**3.** Heed all warnings.

**4.** Follow all instructions.

**5.** Do not use this apparatus near water.

**6.** Clean only with dry cloth.

**7.** Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.

**8.** Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.

**9.** Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding-type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.

**10.** Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.

**11.** Use only attachments/accessories specified by the manufacturer.

**12.** Use only with the cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.

**13.** Unplug this apparatus during lightning storms or when unused for long periods of time.

**14.** Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

**15.** The apparatus shall be connected to a MAINS socket outlet with a protective earthing connection.

**16.** Where the MAINS plug or an appliance coupler is used as the disconnect device, the disconnect device shall remain readily operable.

**17.** Correct disposal of this product: This symbol indicates that this product must not be disposed of with household waste, according to the WEEE Directive (2012/19/EU) and your national law. This product should be taken to a collection center licensed for the recycling of waste electrical and electronic equipment (EEE). The mishandling of this type of waste could have a possible negative impact on the environment and human health due to potentially hazardous substances that are generally associated with EEE. At the same time, your cooperation in the correct disposal of this product will contribute to the efficient use of natural resources. For more information about where you can take your waste equipment for recycling, please contact your local city office, or your household waste collection service.

**18.** Do not install in a confined space, such as a book case or similar unit.

**19.** Do not place naked flame sources, such as lighted candles, on the apparatus.

**20.** Please keep the environmental aspects of battery disposal in mind. Batteries must be disposed-of at a battery collection point.

**21.** Use this apparatus in tropical and/or moderate climates.

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## LIMITED WARRANTY

For the applicable warranty terms and conditions and additional information regarding MUSIC Tribe's Limited Warranty, please see complete details online at musictri.be/warranty.

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## About the Neutron

- Paraphonic, dual analog VCO design which allows for ingenious music creation.
- Semi-modular design requires no patching for immediate performance.
- Dual 3340 VCOs authentically recreate the classic sound creation.
- 32 in/24 out jack patch bay for sound patching experimentation.
- 5 variable oscillator shapes with pulse width modulation for high quality sounds.
- Blend or switch the OSC & LFO shape. A unique sound creation tool.
- Paraphonic mode allows both oscillators to be independently controlled.
- Audio-rate LFO with 5 waveform shapes, key sync, delay and MIDI sync.
- 2 assignable ADSR generators for modulation of VCF, VCA etc.
- 8192 stage Delay based on legendary BBD (Bucket Brigade Delay) technology.
- Overdrive circuit adds grit and edge to your sound.
- Complete Eurorack solution – main module can be transferred to a standard Eurorack case.
- 36 knobs and 7 buttons give you direct and real-time access to all important parameters.
- Powerful 12 dB multi-mode 2 pole filter with three types, Low-pass, Band-pass and High-pass.
- Assignable Sample and Hold with Glide for added creativity.
- Slew Rate Limiter for amazing glissando sound effects.
- White noise generator dramatically expands soundscape creation.
- Pure analog signal path based on legendary VCO designs.
- External audio input for processing external sound sources.
- Servo balanced mono output for the highest signal integrity.
- 10-Year Warranty Program*.
- Designed and engineered in the U.K.

*Warranty details can be found at www.musictri.be

# 1. Introduction

An ultra-affordable leap into the warm world of analog synthesis, the BEHRINGER Neutron gives you the power to create virtually any monophonic sound imaginable with incredible power and ease.

The pure analog signal path is based on the legendary V3340 VCO chip with 5 variable oscillator shapes. Blend or switch the 2 oscillators and 5 LFO shapes for unique sound creation. For protection and convenience, the Neutron can even be mounted in a standard Eurorack, making it ideal for the studio and/or the road. Owning a Neutron gives you all the power of a monster modular synthesis system in a flexible package with the ability to create bewildering, complex sounds.

## 1.1 Before you get started

The Neutron was carefully packed in the factory to guarantee safe transport. Nevertheless, we recommend that you carefully examine the packaging and its contents for any signs of physical damage, which may have occurred during transit. If the unit is damaged, please do NOT return it to us, but notify your dealer and the shipping company immediately, otherwise claims for damage or replacement may not be granted.

### 1.1.1 Initial operation

Be sure that there is enough space around the unit for cooling purposes and, to avoid over-heating, please do not place the Neutron on high temperature devices such as radiators or power amps.

WARNING: The Neutron is supplied with a DC power adapter. It meets the required safety standards. Do not use any other power adapter.

WARNING: Please make sure that all units have a proper ground connection. For your own safety, never remove or disable the ground conductor from any units or AC power cords in your system.

## 1.2 The product manual

This product manual is designed to give you both an overview of the Neutron, as well as detailed information on each of the controls and parameters. The manual is based on the initial software release, V1.2.2. Further features may be added later so please regularly check for software updates. You will find an overview of the physical control elements in the next chapter.

## 1.3 Preparation

CAUTION: Remember to turn your monitors/loudspeakers on last when powering up your system. Turn your monitors/loudspeakers off first when powering down your system.

# 2. Features

### A Past Classic Reincarnated

Great care has been taken in designing the Neutron to achieve new possibilities in sound creation by reviving a legacy VCO chip from classic synths of yesteryear. By creating a fresh modern take on a semi-modular synth, the Neutron gives you the power to harness the prodigious sound of the V3340 chip. Colossal bass tones through to screaming lead sounds can be achieved to take your sound conception to the next level.

### Paraphonic Performance

Paraphonic mode allows the two oscillators to be independently pitched when more than one MIDI note is played. This gives tremendous tonal qualities by hearing two pitches which can evolve and interplay with each other.

### Innovative Multi Mode Filter

The very heart of the sound of the Neutron is its highly-flexible 12 dB 2-pole filter, which lets you freely experiment with the cutoff frequency and resonance to create out-of-this-world soundscapes. Neutron's Filter Mode button toggles between LFP, BPF and HPF. You can also adjust the attack, decay, release and sustain controls to affect the cutoff frequency with time. A second filter output allows further audio contortion with its own dedicated output from the patch bay.

### Distorted Reality

The VCA passes through the powerful soft clipping overdrive circuit which can add punch and bite to your creations. This section also features a diverse tone control to further expand your creative palette.

### Oscillator and LFO morphing

The exquisite ability to blend or morph the oscillator and LFO shape lets new adventures in tone creation begin. By modulating these waveforms, psychedelic sounds can be cooked up comparable to other synthesizers.

### Poly Chain Ready

While it is largely a monophonic instrument (one note at a time) the Poly Chain function lets you combine multiple Neutron synthesizers for polyphonic sounds.

### Bucket Brigade Delay

The Neutron has an impressive analog bucket brigade delay section. Gone is the cold digital delay chip found in most modern synthesizers and replaced by a warm analog design. Effects from long dub delays to extreme chorusing can be created.

### Semi-Modular Design

Designed around an elegantly clean, calculated work stream. The Neutron benefits greatly from its semi-modular design, which requires no patching for quick operation. Just connect your keyboard or computer via MIDI or USB and start exploring the versatile world of analog music synthesis.

### Eurorack Ready

Designed to handle the rigors of life on the road or in the studio, your Neutron can easily be transferred into a standard Eurorack case for the perfect integration into your existing system.

### Controls and Connectivity

The Neutron has 36 knobs and 7 buttons, all laid out in a highly-intuitive format that puts the fun back into your music creation. Input and output connections include: Audio input, MIDI I/O and thru over USB/MIDI DIN plus a full 32 input, 24 output patch bay for countless experiments into the world of modular synthesis.

### You Are Covered

We always strive to provide the best possible customer experience. Our products are made in our own MUSIC Tribe factory using state-of-the-art automation, enhanced production workflows and quality assurance labs with the most sophisticated test equipment available in the world. As a result, we have one of the lowest product failure rates in the industry, and we confidently back it up with a generous Warranty program.

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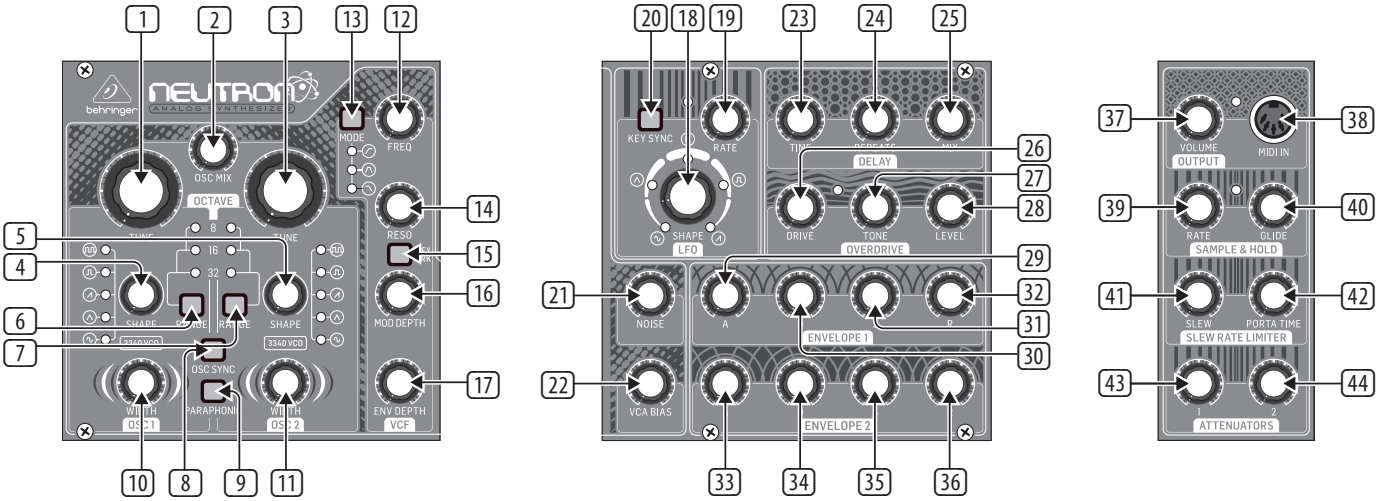
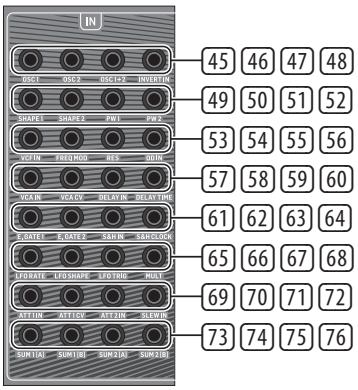
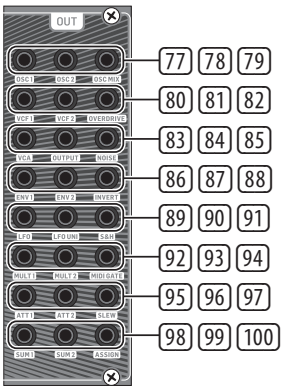
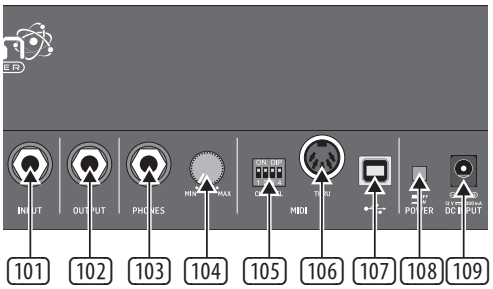
# 3. Controls

## 3.1 Top Controls

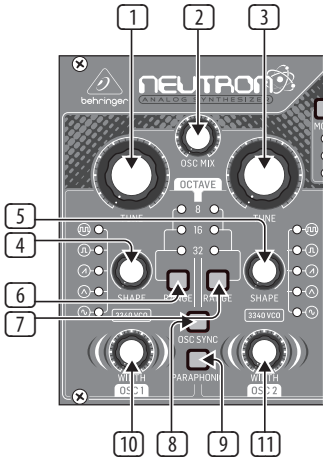


### 3.1.1 Oscillator Section VCO (Voltage Controlled Oscillator)




1 and 3 **OSC TUNE** - Adjusts the frequency of the oscillators.

2 **OSC MIX** - Adjusts the blend between oscillator 1 and 2.

4 and 5 **OSC SHAPE** - Adjusts the shape of the oscillator. Can be configured to switch between fixed waveforms or to blend continuously between adjacent waveforms.

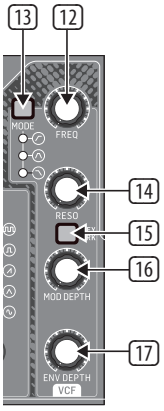
6 and 7 **OSC RANGE** - Adjusts the pipe length of oscillators between 32/16/8. +/-10 octave mode enabled when all 3 LEDs are on.

8 **OSC SYNC** - OSC 1 will restart the period of OSC 2, so that they will have the same base frequency.

9 **PARAPHONIC** - Allows the two oscillators to be independently pitched when more than one MIDI note is played. If only one note is received, both oscillators will play the same pitch.

10 and 11 **PULSE WIDTH (PW)** - Sets the pulse width of oscillator pulse/tone mod waveforms.

### 3.1.2 VCF Section (Voltage Controlled Filter)




12 **FREQ** - Adjusts the cutoff frequency of the VCF.

13 **MODE** - Selects the filter type. Choose between High Pass Filter (HPF), Band Pass Filter (BPF) and Low Pass Filter (LPF).

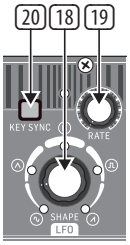
14 **RESO** - Adjusts the resonance of the filter.

15 **KEY TRK** - Applies keyboard tracking to the VCF.

16 **MOD DEPTH** - Sets the depth of filter modulation from the FREQ MOD input.

17 **ENV DEPTH** - Sets the depth of filter modulation from ENVELOPE 2.

### 3.1.3 LFO Section (Low Frequency Oscillator)

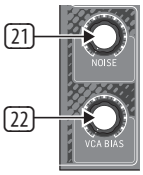



18 **SHAPE** - Adjusts the shape of the LFO with the ability to blend between waveforms.

19 **RATE** - Adjusts the speed of the selected LFO waveform.

20 **KEY SYNC** - Re-trigger the LFO phase with each new key press.

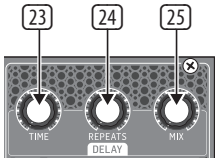
### 3.1.4 Noise & VCA Bias




21 **NOISE LEVEL** - Adjusts the amount of white noise injected into the filter.

22 **VCA BIAS** - Opens or closes the VCA.

### 3.1.5 Delay Section

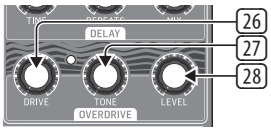



23 **TIME** - Controls the rate of the delay. When the time control is fully to the right, the longest delay time is set.

24 **REPEATS** - Controls the number of repeats or echoes.

25 **MIX** - Adjusts the wet/dry mix. When the mix control is turned fully to the left, no effect will be heard. Turning the mix control fully to the right will give you the delayed wet signal only. With the repeat control fully to the right, repeats will be infinite and keep building.

### 3.1.6 Overdrive Section




26 **DRIVE** - Sets the amount of overdrive. The drive control can be used to add subtle overdrive through to wild all-out distortion. Turn to the left for gentle warming or turn to the right for more aggression and bite.

27 **TONE** - Changes the timbre of the overdriven sound. Turning the tone to the left boosts the lows to create rich warm sounds. Turning to the right gradually thins out the low end and starts to boost the highs to create sharp cutting sounds.

28 **LEVEL** - Controls the volume of the overdrive output. When fully off you may hear no audio at the output.

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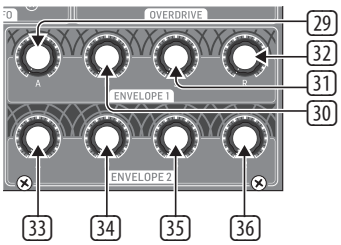
### 3.1.7 Envelope Section

#### Envelope 1

Envelope 1 is routed to the VCA CV by default.




29 **A [Attack]** - Controls the attack time of the envelope.

30 **D [Decay]** - Controls the decay time of the envelope.

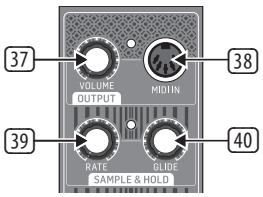
31 **S [Sustain]** - Controls the sustain level of the envelope.

32 **R [Release]** - Controls the release time of the envelope.

#### Envelope 2

Envelope 2 is routed to the VCF filter cutoff via ENV DEPTH control by default. See 17. ADSR knobs 33-36 function the same as 29-32.

### 3.1.8 Output Section




37 **VOLUME** - Controls the output level of the synthesizer. The headphone output is independent of the volume control and has its own control on the back of the synthesizer.

38 **MIDI IN** - Accepts incoming MIDI data from the selected MIDI channel.

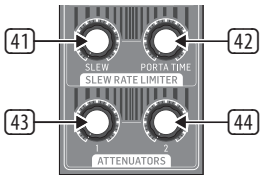
### 3.1.9 Sample & Hold

Generates a random pattern based on the sample and hold clock.

39 **RATE** - Controls the rate of the sample and hold clock.

40 **GLIDE** - Sets the rate of change between sample values.

## 3.2 Slew Rate Limiter & Attenuator Section




41 **SLEW** - The Slew Limiter is used to limit the rate of change in a signal. This function is sometimes referred to as 'Glide', 'Glissando', 'Lag Processing', or 'Portamento'. The amount of limitation is set by this control.

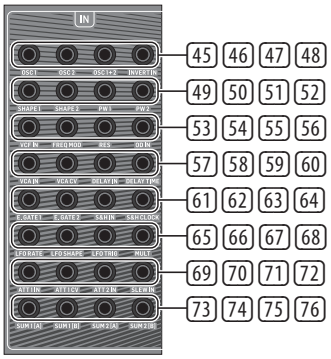
42 **PORTA TIME** - Controls the rate of change between MIDI notes. The effect is off when turned fully left and increases when turned to the right.

43 **ATTENUATOR 1** - Used to reduce the amplitude of the input signal. ATT1 can be controlled by a control voltage. See 58.

44 **ATTENUATOR 2** - Passive attenuator, reduces the amplitude of a signal. Normalized patching routes the LFO to the oscillator Pulse Width inputs to provide a Pulse Width Modulation (PWM).

### 3.2.1 Patch Bay

#### Input Patch Bay Section




45 **OSC 1** – OSC 1 pitch CV.

46 **OSC 2** – OSC 2 pitch CV.

47 **OSC1+2** – OSC 1 and 2 pitch CV.

48 **INVERT IN** – The input signal is inverted at INVERT OUT. See 88.

49 **SHAPE 1** – OSC 1 Shape CV.

50 **SHAPE 2** – OSC 2 Shape CV.

51 **PW1** – OSC 1 PW CV.

52 **PW2** – OSC 2 PW CV.

53 **VCF** – VCF signal input.

54 **FREQ MOD** – VCF cutoff frequency CV.

55 **RES** – VCF resonance CV.

56 **OD IN** – Overdrive signal input.

57 **VCA IN** – VCA signal input.

58 **VCA CV** – VCA CV.

59 **DELAY IN** – Delay signal input.

60 **DELAY TIME** – Delay time CV.

61 **E. GATE1** – Envelope 1 gate.

62 **E. GATE2** – Envelope 2 gate.

63 **S&H IN** – Sample and Hold signal input.

64 **S&H CLOCK** – Sample and Hold clock input.

65 **LFO RATE** – LFO Rate CV.

66 **LFO SHAPE** – LFO Shape CV.

67 **LFO TRIG** – LFO Trigger input.

68 **MULT** – MULT signal input. See 92/93.

69 **ATT1 IN** – Attenuator 1 signal input.

70 **ATT1 CV** – Attenuator 1 CV.

71 **ATT2 IN** – Attenuator 2 signal input.

72 **SLEW IN** – Slew signal input.

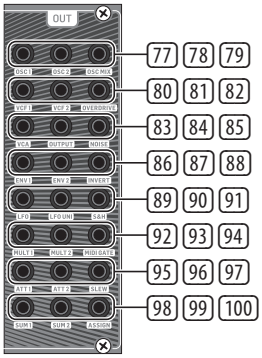
73 **SUM1(A)** – SUM 1 first signal input. See 98.

74 **SUM1(B)** – SUM1 second signal input. See 98.

75 **SUM2(A)** – SUM 2 first signal input. See 99.

76 **SUM2(B)** – SUM 2 second signal input. See 99.

### Output Patch Bay Section




77 **OSC 1** – Output of Oscillator 1.

78 **OSC 2** – Output of Oscillator 2.

79 **OSC Mix** – Output of OSC 1/2 mix.

80 **VCF 1** – Main output of the filter.

81 **VCF 2** – Alternate output of the filter.

82 **OVERDRIVE** – Overdrive output signal.

83 **VCA** – Voltage Controlled Amplifier output signal.

84 **OUTPUT** – Main output signal, post delay.

85 **NOISE** – Output of the white noise generator.

86 **ENV1** – Envelope 1 output.

87 **ENV2** – Envelope 2 output.

88 **INVERT** – Inverted version of signal applied to INVERT IN. See 48.

89 **LFO** – Output of the Bipolar LFO (-5 V to +5 V).

90 **LFO UNI** – Output of the Unipolar LFO (0V to +5 V).

91 **S&H** – Sample and Hold output signal.

92 **MULT 1** – Duplicate of signal applied to MULT IN. See 68.

93 **MULT 2** – Duplicate of signal applied to MULT IN. See 68.

94 **MIDI GATE** – MIDI gate output.

95 **ATT1** – Output of Attenuator 1.

96 **ATT2** – Output of Attenuator 2.

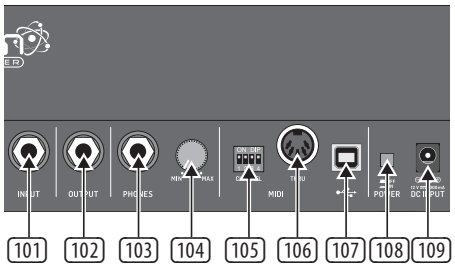
97 S**LEW** – Output of Slew.

98 **SUM1** – Summation of SUM 1(A+B).

99 **SUM2** – Summation of SUM 2(A+B).

100 **ASSIGN** – Assignable output. See User Configurable Options & Features.

### 3.2.2 Rear Panel




101 **INPUT** – Mono unbalanced audio input using a ¼" (6.35 mm) jack cable for processing external sound sources.

102 **OUTPUT** – Connect to a mixer or audio interface using a ¼" (6.35 mm) mono jack cable. Remember to turn your monitors/loudspeakers on last when turning on your system and turn your monitors/loudspeakers off first when turning your system off.

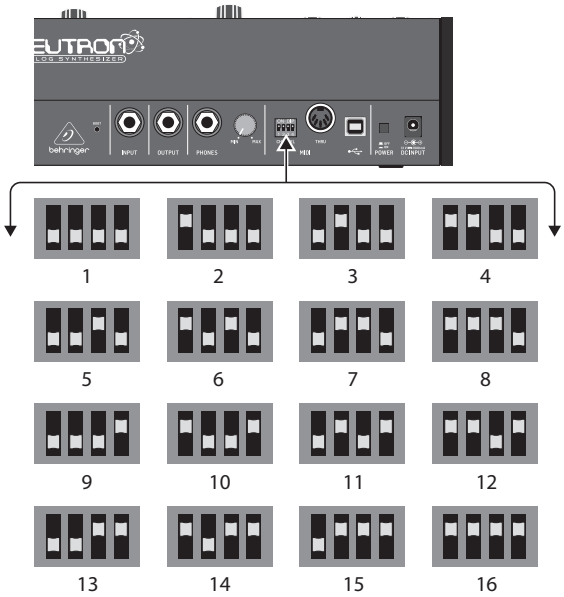
103 **PHONES** – ¼" (6.35 mm) jack connection to plug headphones in.

104 **PHONES LEVEL** – Ensure the volume control is at minimum when putting on headphones or when turning the synthesizer on or off.

105 **MIDI CHANNEL SELECTION.**

Move the four dip switches to select the incoming MIDI channel for the synthesizer.

MIDI CHANNEL DIP SWITCH SETTINGS




106 **MIDI THRU** – The 5-pin MIDI DIN connector is used to pass through MIDI data received at the MIDI INPUT.

107 **USB PORT** – Connects to a computer via standard USB cable. The Neutron will display in your DAW as a class-compliant USB MIDI device, capable of sending and receiving MIDI information.

108 **POWER SWITCH** – Turns the synthesizer on and off. Make all audio connections before powering on.

109 **POWER INPUT** – Connect the supplied power supply only.

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# 4. Overview

This overview will help you set up the Neutron analog synthesizer and briefly introduce its capabilities.

## 4.1 Connection

The Neutron has a ¼" (6.35 mm) mono jack output on the rear of the unit which is also duplicated on the patch bay via a 3.5 mm output. Audio input is via a ¼" (6.35 mm) mono jack on the rear panel. Please consult the connection set-up guide for examples (8.1).

Caution: Do not overload the 3.5 mm inputs. They can only accept the correct level of voltages as shown in the specification tables later in this manual. The 3.5 mm outputs should only be connected to inputs capable of receiving the output voltages. Failure to follow these instructions may damage the Neutron or external units.

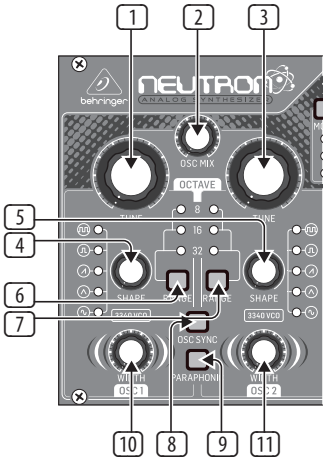
## 4.2 Software Setup

The Neutron is a USB Class Compliant MIDI device, and so no driver installation is required. The Neutron does not require any additional drivers to work with Windows and MacOS.

## 4.3 Hardware Setup

Make all the connections in your system. Use the rear panel MIDI switches to set the Neutron to a unique MIDI channel in your system. Connect an external keyboard with MIDI output directly to the Neutron MIDI IN 5-pin DIN type input or via MIDI over USB. Apply power to the Neutron using the supplied power adapter only. Ensure your sound system is turned down. Turn on the Neutron rear panel power switch.

## 4.4 Oscillator Section




Each oscillator has a tune control which gives approximately +/-1 octave range in 8/16/32 modes or a range from 0.7 Hz to over 50 kHz when all range LEDs are illuminated which is around +/-10 octaves.

The OSC MIX control is used to blend between the two oscillators to create rich harmonic sounds.

You can adjust the SHAPE control for each oscillator to select different waveforms, if in blend mode, the waveforms will morph into one another in a smooth transition.

The five oscillator shapes are:


Tone Mod


Square/Pulse


Sawtooth


Triangle

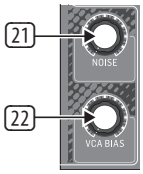

Sine

The P. WIDTH affects the first two wave shapes, TONE MOD and SQUARE WAVE. When OSC SYNC is engaged, oscillator 1 tracks the MIDI note and provides a reference to reset the period of oscillator 2.

When the PARAPHONIC switch is engaged, it allows the two oscillators to be independently pitched when more than one MIDI note is played simultaneously. If only one note is played, both oscillators will be driven at the same pitch.

The NOISE control injects white noise into the filter, which can be used to add another texture to the sound. Noise can be used to create percussive sounds when used with short VCA envelope settings.

VCA Bias is used to control the VCA. It allows the user to 'open' the VCA without triggering the envelope (e.g. with a MIDI note), allowing audio to sound continuously.



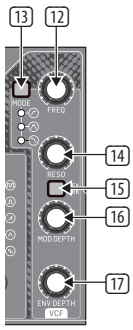

## 4.5 Filter Section

The Neutron has a powerful 12 dB filter with three modes available:


High Pass Filter (HPF)


Band Pass Filter (BPF)


Low Pass Filter (LPF)




The mode button steps through each filter mode.

The FREQ control sets the filter cutoff frequency. The RESO control adjusts the resonance of the filter. When the resonance control is set to at, or close to, maximum the VCF will become self-resonant and produce a sine wave tuned to the cutoff frequency of the filter. This tone can be used in sound creation and played in tune with the oscillators by activating KEY TRACK and tuning the VCF using the FREQ control.

By default, the LFO is patched through the FILTER DEPTH control. This enables modulation of the filter frequency using the LFO. The VCF has a second output which is accessible from the patch bay (VCF 2). VCF 2 mode is determined by the select VCF mode. The relationship is:

Mode = ◜, VCF2 = ∧

Mode = ∧, VCF2 = ◝

Mode = ◝, VCF2 = ◜

This allows for additional filter modes. For example, a notch filter can be created when the filter mode is set to by summing VCF 1 and VCF 2, then patching the summed output into OD IN.

KEY TRACK applies keyboard tracking to the VCF.

This sets the filter cutoff frequency based on the latest MIDI note received. The base cutoff frequency is set using the FREQ control with MIDI notes increasing the cutoff frequency relative to the note being played. Additionally, this allows the filter to be played like an oscillator when the resonance control is turned up.

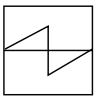
## 4.6 LFO Section

The Neutron LFO has a frequency range of 0.01 Hz to 10 kHz. This allows low frequency modulation up to audio rate modulation using the LFO.

The Shape control sets the type of LFO waveform. When selecting the LFO waveform, the control can be set to select between fixed types or to blend between wave shapes. The five LFO shapes are:


Sine

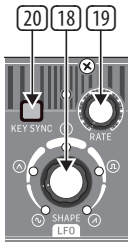

Triangle


Sawtooth


Square

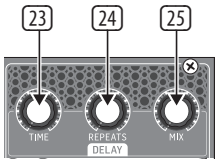

Reverse Sawtooth

With KEY SYNC engaged, the LFO is re-triggered when a MIDI note is received.




## 4.7 Delay Section

The Neutron has an impressive analog bucket brigade delay section. Delay times of 24 ms to 640 ms can be set. Effects from long dub delays to extreme chorusing can be created. Set the MIX control at 12 o'clock. Then try turning the RATE control fully left with the REPEAT control to the right a little for a long dub style sound. Chorus effects can be created by modulating short delay times with an LFO applied to the DELAY TIME input via one of the ATTENUATORS.




## 4.8 Overdrive Section

The overdrive section can be used to add subtle warmth through to extreme distortion by using an analog soft clipping circuit. Turning the DRIVE control to the right increases the amount of distortion, adding rich harmonics. The TONE control shapes the sound of the overdrive. To the left, high-end filtering is applied to take away the harsh edge. When the TONE control is turned to the right the low end is filtered out to give a brighter sound. As DRIVE level is increased, the LEVEL control can be utilized to turn down the volume of the synthesizer, without affecting the drive or tone of the sound.

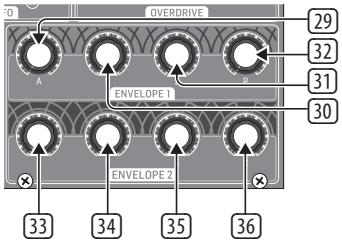
NOTE: If the level control is all the way down it is possible that no sound will be heard.


## 4.9 Envelope Section

The Neutron contains two ADSR (Attack, Decay, Sustain, Release) envelopes. Both envelopes are triggered when a MIDI note is received unless the E.GATE 1/2 inputs are used.

ENVELOPE 1 is routed to the VCA CV by default. This allows the signal to pass through the unit when a MIDI note is being played and closes the VCA when no note is being played.

ENVELOPE 2 is routed to the VCF, via the ENV DEPTH control, by default. This can be used to create filter sweeps when a MIDI note is being played. Try different combinations of slow and fast settings to create different sounds and textures.

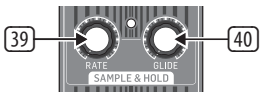


EN

## 4.10 Sample And Hold

The sample and hold function generates a random, stepped waveform by taking a sample of the input signal. The sample rate is governed by the RATE control or the SH CLOCK input. This generates a distinctive, bubbling random waveform that can be used to modulate other synth parameters. Its random nature makes it well suited to sci-fi effects. Try patching S&H to OSC 1&2 to modulate the oscillator's pitch. The distinctive gurgling effect can be heard throughout sci-fi movies.

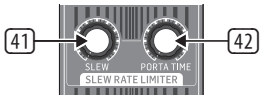
The GLIDE control limits the rate of change between samples, allowing smooth transitions between sample values.




## 4.11 Slew Rate Limiter

PORTA TIME is the amount of time taken to transition between two MIDI notes. This feature can be used to add a pleasing musical slide into your sounds.

The SLEW Limiter is used to limit the rate of change of a signal. For example, Slew can be used to add Portamento to pitch CVs generated from an external sequencer.




## 4.12 Attenuators

ATTENUATOR 1 is an additional VCA which can be used to reduce the amplitude of the input signal based on the Att1 CV control or the attenuator 1 front panel control (43).

The output of attenuator 2 is routed to the attenuator 1 input by default.

ATTENUATOR 2 - Reduces the amplitude of a signal based on the attenuator 2 control (44). The BIPOLAR LFO output is routed to the attenuator 2 input by default.

Note: The attenuator 2 output is also routed to P.WIDTH 1 and P.WIDTH 2 controls by default.


## 4.13 Pitch Bend Messages

The Neutron responds to pitch bend messages via USB MIDI or the MIDI IN and is fixed to +/-2 semitones in software version 1.2.2.

# 5. User Configurable Options & Features

| Advanced Features | Access | Action | Result | Exit |
|---|---|---|---|---|
| Change Assignable Output (ASSIGN) | Hold OSC SYNC | Use RANGE buttons to change Output function | LFO shape displays selected option. | Hold OSC SYNC |
| Envelope Retriggering | Hold OSC SYNC | the KEY TRK button toggles the retriggering mode | When the KEY TRK LED is on - retriggering is enabled | Hold OSC SYNC |
| OSC 1 Shape (Blend or Switched) | Hold OSC1 RANGE | PARAPHONIC will either throb or flash. Push to toggle mode | OSC 1 Shape mode will toggle. Blend or switch | Hold OSC 1 RANGE |
| OSC 2 Shape (Blend or Switched) | Hold OSC2 RANGE | PARAPHONIC will either throb or flash. Push to toggle mode | OSC 2 Shape mode will toggle. Blend or switch | Hold OSC 2 RANGE |
| LFO (Blend or Switched) | Hold LFO KEY SYNC | PARAPHONIC will either throb or flash. Push to toggle mode | LFO Shape mode will toggle. Blend or switch | Hold LFO KEY SYNC |
| OSC 1 Tuning | Hold RANGE 1 | LFO shape LEDs shows tuning with respect to the last played MIDI note | Top center LFO Shape LED indicates that the oscillator is in tune | Hold RANGE 1 |
| OSC 2 Tuning | Hold RANGE 2 | LFO shape LEDs shows tuning with respect to the last played MIDI note | Top center LFO Shape LED indicates that the oscillator is in tune | Hold RANGE 2 |
| Poly Chain mode | Hold PARAPHONIC | The LED will pulse slowly in mono mode - quickly in duo mode | Poly-Chain mode toggled on/off | Hold PARAPHONIC |

## 5.1 Assignable Output

It is possible to select the source of the ASSIGN output jack.

To change the source press & hold the OSC SYNC button until both the RANGE buttons are flashing. The currently selected assignable output is indicated by the flashing LFO shape LED - the available options are (clockwise from the sine shape):

OSC 1 CV

OSC 2 CV

"Note On" velocity

Modwheel

Aftertouch

Use the two range buttons to change the selected output. When you're done, press and hold the OSC SYNC button until the RANGE buttons stop flashing. The currently selected assignable output value will be stored and will persist across power cycles.

## 5.2 Envelope Retriggering

Enter the Assignable Output mode (see above). The KEY TRK button toggles the retriggering mode. When the KEY TRK LED is on, retriggering is enabled and vice versa.

## 5.3 OSC & LFO Shape Mix Blended or Switched

It is possible to either blend or switch the OSC and LFO shape. This feature is an incredibly powerful, unique sound creation tool. For OSC1, press and hold the OSC1 RANGE button (this will enter the tuning feature). The PARAPHONIC button will flash if shape mixing is disabled, or it will throb if shape mixing is enabled. Press the PARAPHONIC button to toggle the shape mix state. Press and hold the OSC1 RANGE to leave this mode. Similarly, for OSC2 shape mixing press and hold OSC2 RANGE; for LFO shape mixing press and hold LFO KEY SYNC.

## 5.4 Tuning

The Neutron will self-calibrate at start up. An additional "tune" feature is designed to allow the user to manually tune the oscillators to the last played MIDI note.

To tune OSC1 or OSC2 to the nearest 'C' note, press and hold the appropriate RANGE button until the octave LED starts to flash. Play a MIDI note. The LFO shape LEDs will display the tuning; turn the TUNE control until only the descending saw LED is lit. That oscillator will now be playing a 'C'. This enables the accurate tuning of intervals. For example, play an 'F' note, then tune as above. That oscillator is now playing a fifth above the root note. To exit tuning mode, press and hold the RANGE button until the octave LED stops flashing. This is available in +/-10 octave mode (note that the long period of very low notes means that it appears to be unresponsive).

## 5.5 Tune Pot Bypass

Press and hold OSC (1 or 2) RANGE and PARAPHONIC buttons until the selected OSC octave LED starts to flash. This indicates that the tune pot for that OSC is now inactive and all notes played are in tune. Press and hold OSC RANGE and PARAPHONIC buttons again to leave this mode. The LED will return to solid to indicate that the tune pots are in circuit.

## 5.6 Software Version

Press and hold OSC SYNC and PARAPHONIC until all 3 OSC1 octave LEDs light up. The LEDs will then flash out the software version, just count the flashes. The version is of the form <Major>. <Minor>. <Build number>. Major is flashed on the 8' LED, minor on the 16' LED & build number on the 32' LED. All 3 OSC1 octave LEDs will light up again to indicate the end of the output.

## 5.7 LFO MIDI Clock Sync

The LFO will sync to the beat when receiving MIDI clock (it does nothing with MIDI time code).

The LFO rate position determines the clock multiplier-divider. The LFO control is divided into 21 positions using the white lines and the gaps in between.

The LFO divider values are: 4/1, 3/1, 2/1, 3/2, 1/1, 1/2, 3/8, 1/3, 1/4, 1/5, 3/16, 1/6, 1/7, 1/8, 3/32, 1/12, 1/16, 1/24, 1/32, 1/48, 1/64.

## 5.8 MIDI Note Range

The supported MIDI note range is 24 (C1) to 96 (C7) inclusive. Notes outside of this range will still trigger the Neutron. MIDI notes 0-23 will trigger note 24 (C1) note. MIDI notes 97-127 will trigger note 96 (C7).

## 5.9 Poly-Chaining

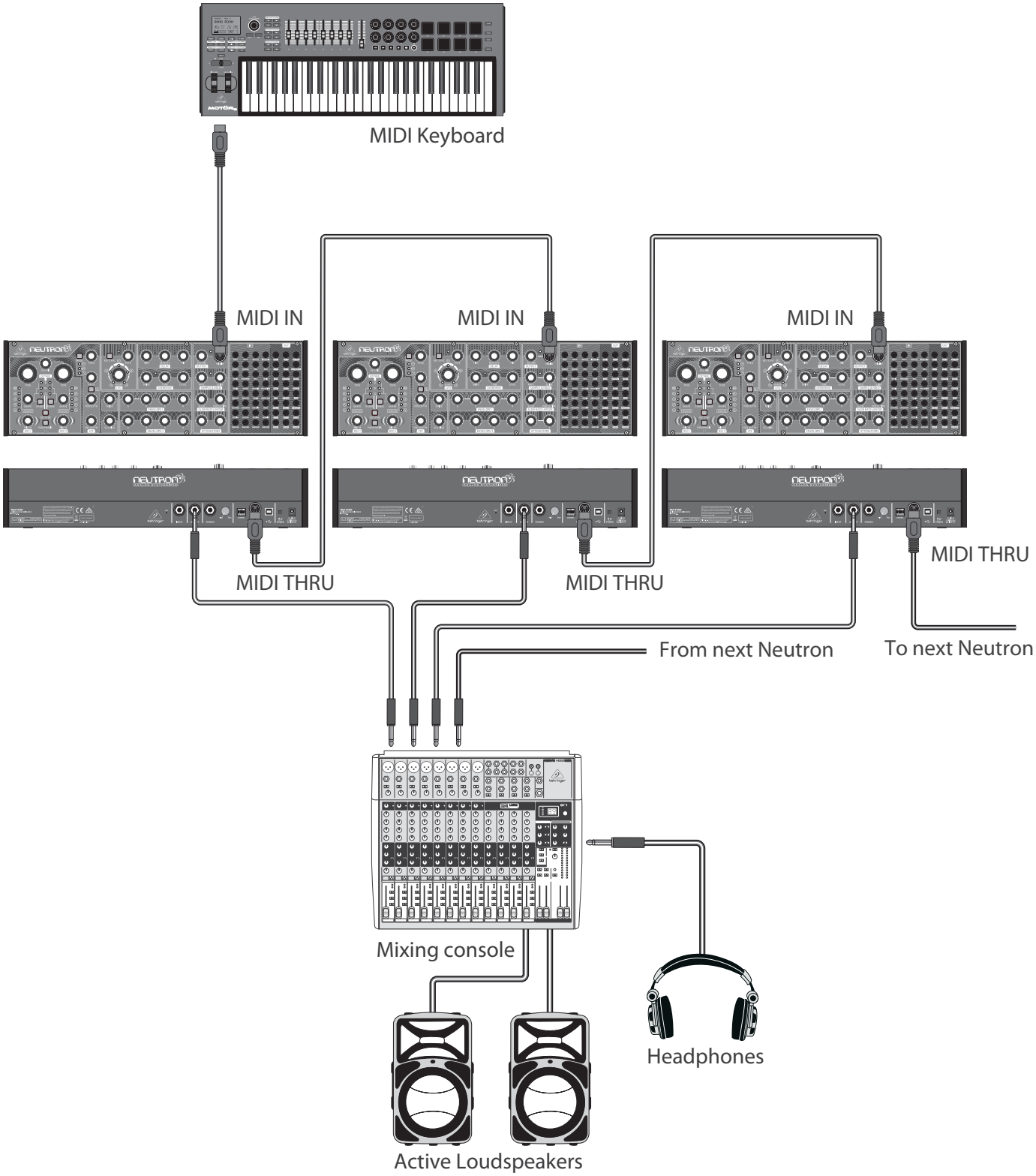
If you have multiple Neutron units, you can connect them in a 'Poly Chain' to produce polyphonic sounds. The Neutron works by sending unhandled notes to the next in the chain. When the chain runs out, the notes are dropped (i.e. not played). The first Neutron plays the first played note, the second plays the second, the third plays the third etc.

Note that a Neutron in Paraphonic mode will handle 2 notes. Each Neutron must have the same MIDI channel number set using the rear panel switches. The Poly Chain connections are shown in the diagram. Set the Poly Chain ON for all Neutrons. The last Neutron in the chain can either be set to Poly Chain on or off depending on how you would like the MIDI information to be handled. If Poly Chain is on, the last Neutron will act as if it is sending the next played note over the maximum number of notes played to the next device in the chain, and the note will not be heard or dropped. If Poly chain is off for the last Neutron, the next played note over the maximum number of notes will steal the last played note from the last Neutron.

To toggle Poly Chain mode, press and hold the PARAPHONIC button for 2 seconds. The LED will repeatedly flash (once when in mono mode - twice when in duo mode). A short press on the PARAPHONIC button will still toggle the PARA/DUO mode. Hold PARAPHONIC to exit. If you are only using one Neutron, then make sure the Poly Chain is OFF.

EN

**Poly chain system**



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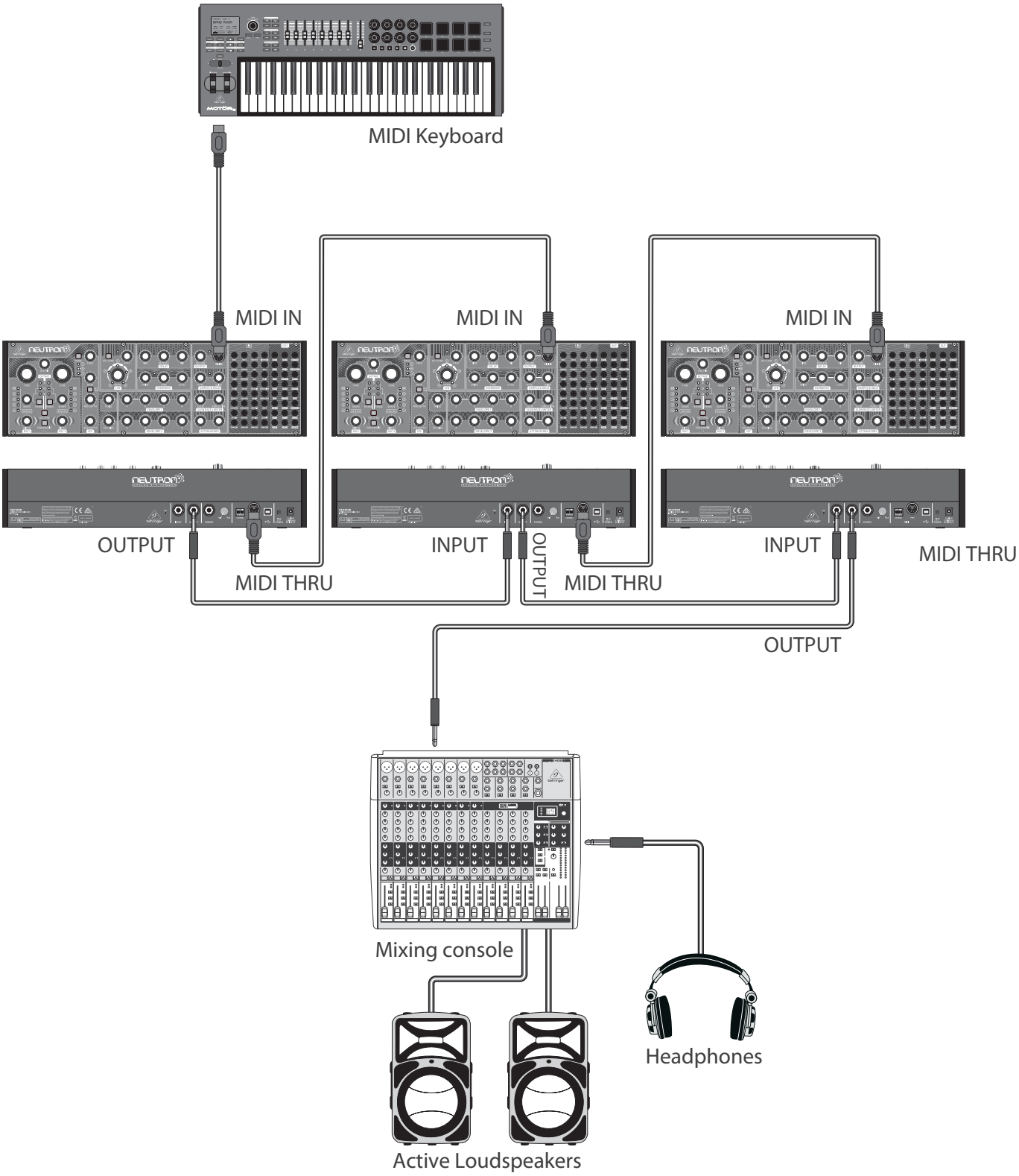
## Poly chain system using Neutron's audio input



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# 6. Eurorack Installation

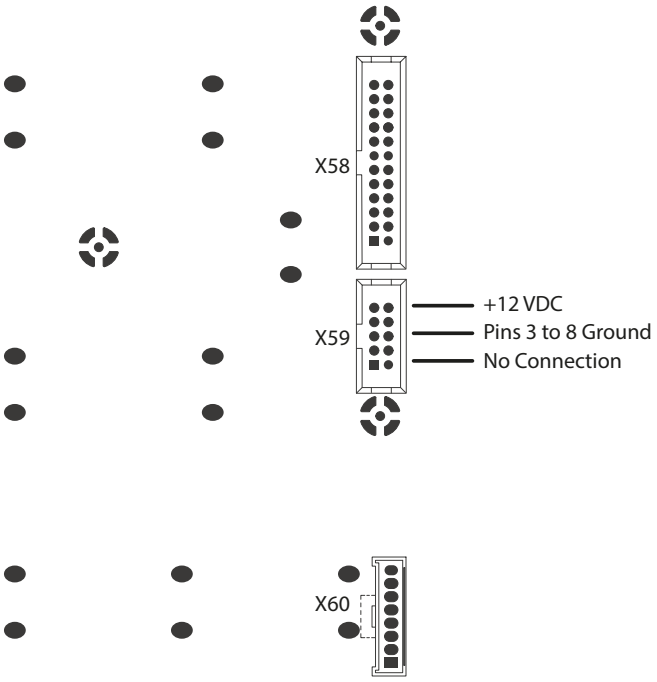
The Neutron synthesizer can be taken out of its factory chassis and fitted into a standard Eurorack case (not supplied).

We recommend that this procedure is undertaken only by an experienced service technician, to prevent personal injury, or damage to the unit. The Eurorack case will need its own suitable power supply unit to power the Neutron synthesizer.

A 10-pin connector on the rear of the main PCB of the Neutron allows the +12 VDC power supply connection to be made. A 10-pin to 16-pin adapter ribbon cable is supplied to connect to your power supply.

Before proceeding, make sure that your power supply is capable of supplying +12 VDC, 1 Amp.

Make sure that the connections using the supplied adapter cable will supply the ground and power to the correct pins.




## 6.1 Procedure

Follow all steps in the order in which they are presented.

1. Disconnect the power cord and all other connections to the Neutron.

2. Undo the 8 screws on the top panel as shown. There is no need to undo any other screws.

3. Carefully lift the top panel assembly and turn it over so the PCB is facing

upwards. Be careful not to pull on the cable from the lower side of the main PCB.

4.Disconnect the 24-pin cable from the side of the main PCB of the Neutron, X58 and remove the assembly from the chassis.

5. Store the chassis assembly and the power supply adaptor in a dry safe place.

6. Securely connect the 10-pin end P1 of the supplied adapter cable to connector X59 on the Main PCB of the Neutron.

7. Make sure your power supply is turned off and disconnected from the AC mains.

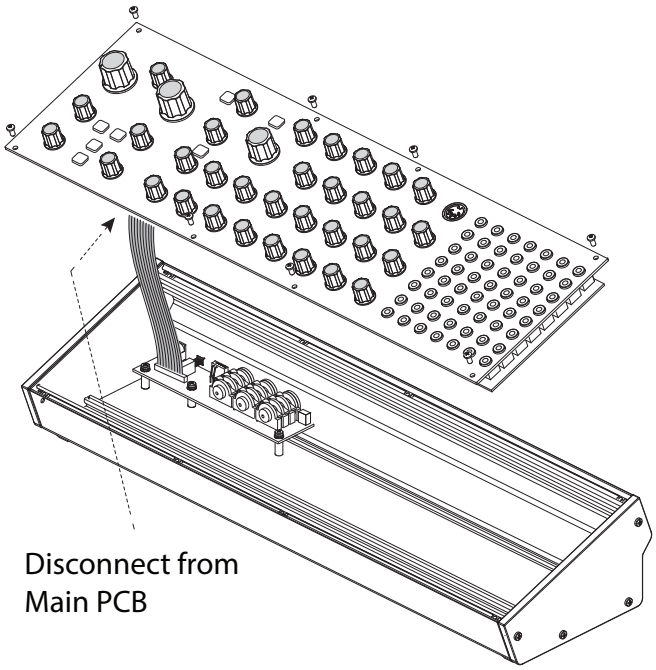
8. Make sure that your power supply will supply a 12 V voltage to the pins of the connector, as shown in the diagram.

9. Securely connect the 10-pin end P2 of the supplied adapter cable to your power supply, and double check all connections are correct.

10. Securely install the Neutron Synthesizer into your Eurorack, using 8 screws in the front panel.

11. Perform a full system test and safety test before using the Neutron.

12. The 3.5 mm OUTPUT connector on the top panel is used instead of the rear output which is no longer present.



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# 7. Software Update & Calibration

## 7.1 Software Update

The Neutron DFU (Device Firmware Upgrade) updater can be downloaded by going to www.musictri.be

Please follow the steps documented in the release notes accompanying the update.

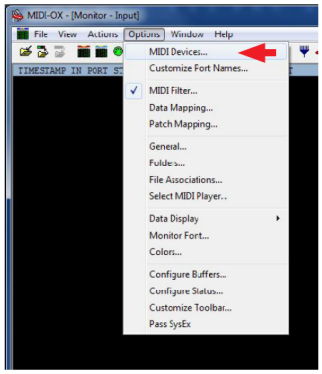
## 7.2 Assign Out Calibration

This calibration has been carried out by the factory at the manufacturing stage but instructions are described here if needed.

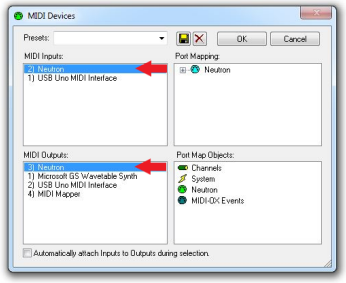
For this, you'll need a 3.5 mm mono patch cable, a digital voltmeter, and MIDI-OX installed on your PC.

1. Insert the patch cable into the ASSIGN output on the Neutron front panel.

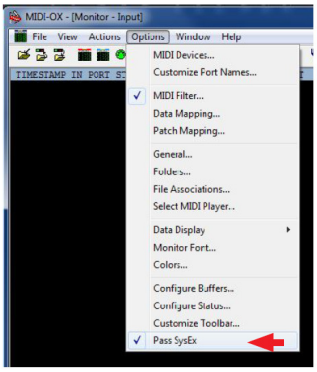
2. Run MIDI-OX on your computer. Go to OPTIONS →MIDI DEVICES.



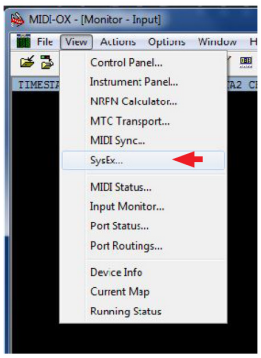

3. Select Neutron as the MIDI IN and MIDI OUT



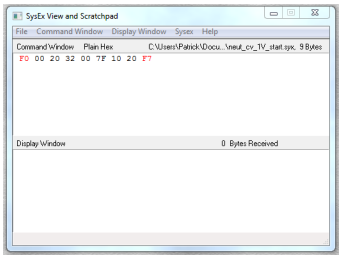

4. Make sure "Pass SysEx" at the bottom of the Options drop-down menu is ticked.



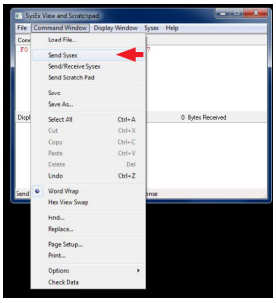

5. In the VIEW menu, select SysEx...



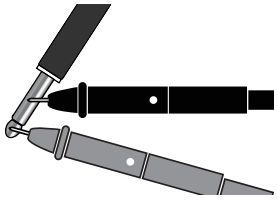

6. In the Command Window, enter the SysEx command to be sent to the Neutron. For ASSIGN out calibration at 1 V, the command is: F0 00 20 32 00 7F 10 20 F7




7. In the Command Window drop-down menu, select Send SysEx. The Sysex command will be sent to the Neutron. Both 8' octave range LEDs will be flashing to indicate the Neutron is in ASSIGN out 1 V calibration mode.




8. Measure the voltage on the patch cable attached to the ASSIGN out and adjust until it reads 1 V +/- 0.001 V.



9. To increase the voltage send the Sysex command F0 00 20 32 00 7F 10 23 F7.

To decrease the voltage, send the Sysex command F0 00 20 32 00 7F 10 22 F7.

Repeat until the voltage reads 1 V +/- 0.001 V. Then move on to step 10.

10. Send the Sysex command for ASSIGN out calibration to the Neutron at 4 V. The command is F0 00 20 32 00 7F 10 21 F7.

Both 32' octave range LEDs will be flashing to indicate the Neutron is in ASSIGN out 4 V calibration mode.

11. Repeat step 9 until the voltage reads 4 V +/- 0.001 V. Then move onto step 12.

12. Save the calibration data and exit calibration mode by sending the Sysex command F0 00 20 32 00 7F 10 24 F7.

The Neutron will return to its normal operating mode.

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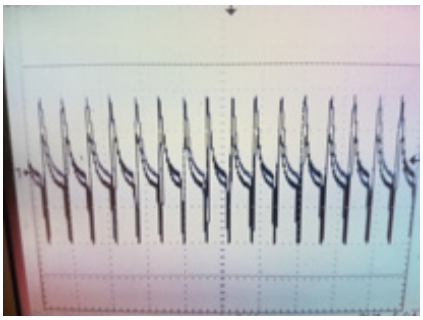
## 7.3 Bucket Brigade Delay Calibration

### Delay Repeat Output Calibration

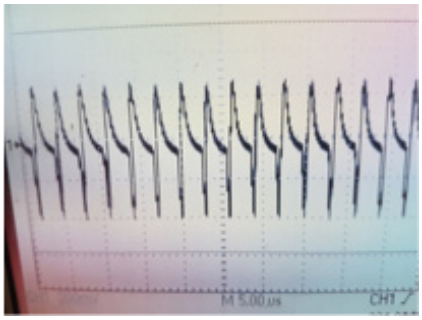
First, you will need an oscilloscope set to 200 mV/division. Turn the number of repeats down low, which will stop the BBD from self-oscillating, making it easier to take readings. Make sure your scope is set to AC coupling. Please note that both trimmers need to be calibrated.

Ground a scope to the Neutron chassis and touch the housing of the delay repeat trim pot as shown below:

An uncalibrated unit may look like this image, with the 2 BBD signals out of phase with each other:



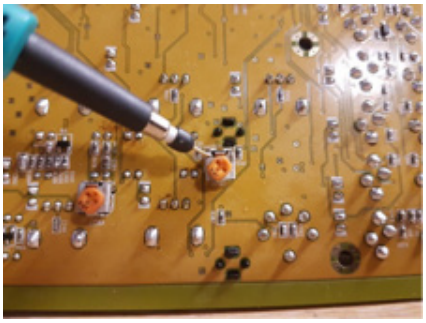
Adjust the BBD trim (clockwise in most cases) until the clocks are in phase, as below:



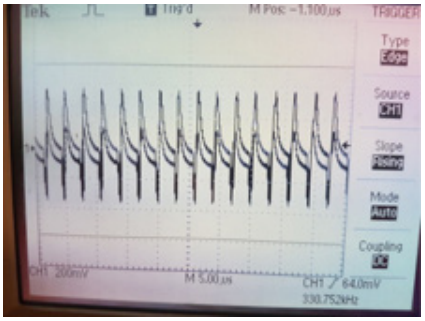
The end result should be a BBD that will self-oscillate when the Repeats knob is at its maximum position. Rolling the control back a little should remove the self-oscillation.

### BBD Clocks Calibration

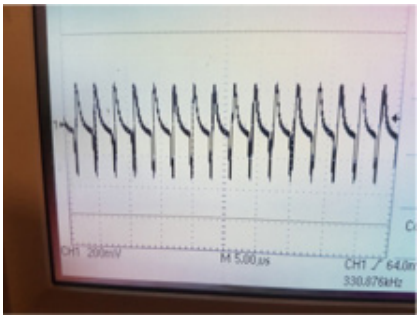
Using the same method outlined above, ground a scope to the unit and connect the probe to the housing of the BBD Clocks Trim pot:



An uncalibrated unit may look like this image, with the 2 BBD clock signals out of phase with each other:




Turn the BBD Clocks until the clocks are in phase with one-another, this ensures the least amount of clock bleed into the signal:



A quick audition will show the ability of the BBD to self-oscillate and determine if the clock noise is as low as can be for the unit.

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# 8. Patch Bay

In a patchable semi-modular synthesizer such as the Neutron, inputs and outputs are independent from one another. It is up to the user to patch the modules together as they wish. This is different from a normalized synthesizer where the functions are hard-wired together and the user just changes parameters. Patchable modular synthesizers are more complex to operate but give infinite options. Below is a table of default or normalized routings. Please refer to the numbering diagram earlier in this document. There follows a block diagram of the normalized signal flow to show how audio travels through the Neutron.

| DEFAULT ROUTINGS | | |
|---|---|---|
| OUTPUT FROM | GOES TO | THEN INTO |
| | | |
| OSC MIX + EXT INPUT + NOISE | VCF>OD>VCA>DELAY | LINE OUT + Headphones |
| ENV 1 | VCA CV | |
| LFO (BIPOLAR) | ATT 2 | ATT 1 |
| ATTENUATOR 2 | PULSE WIDTH 1&2 | |
| NOISE | SAMPLE AND HOLD | |
| LFO (BIPOLAR) | FILTER DEPTH | VCF FREQUENCY CV |
| ENV 2 | ENV DEPTH | VCF FREQUENCY CV |
| ASSIGN | ATT1 CV | |
| LFO (BIPOLAR) | MULT INPUT | |
| ENV 2 | INVERT | |
| E. GATE1 | E. GATE2 | UNLESS OVERRIDDEN USING E. GATE 2 INPUT |

## 8.1 Tips and Tricks of the Patch Bay

1. Patch Sample and Hold out into FREQ MOD in. Turn MOD DEPTH to 12 o'clock. Then Turn the S&H rate to 3 o'clock and the GLIDE to 12 0'clock. This will give you a random filter position which glides between filter cutoff points.

2. Patch LFO to PW1 and MULT 1 into INVERT IN, then INVERT OUT to PW2 for opposite direction pulse width modulation. This is a is a variation that sounds slightly different to turning ATTENUATOR 2 (see normalized routings for details).

3. With OSC 1&2 in blend mode, patch LFO to SHAPE 1. Patch MULT 1 into INVERT IN then INVERT OUT into Shape 2 for opposite direction oscillator shape shifting, a very powerful sound creation tool.

4. Set both OSC to Tone Mod Shape and ENV 2 to PW1&2 via the Mult with slow ADSR settings. This gives a rich Pulse Width Modulation (PWM) effect.

5. Patch LFO into ATT 1 IN, then patch ATT1 OUT to DELAY TIME IN. Set a short delay with the delay mix around 50% and adjust the LFO speed and shape to create a chorus effect.

6. Patch VCF 1&2 into Sum 1 A&B. Patch the output of SUM 1 into OD In. Set the filter shape to LPF to create a notch filter.

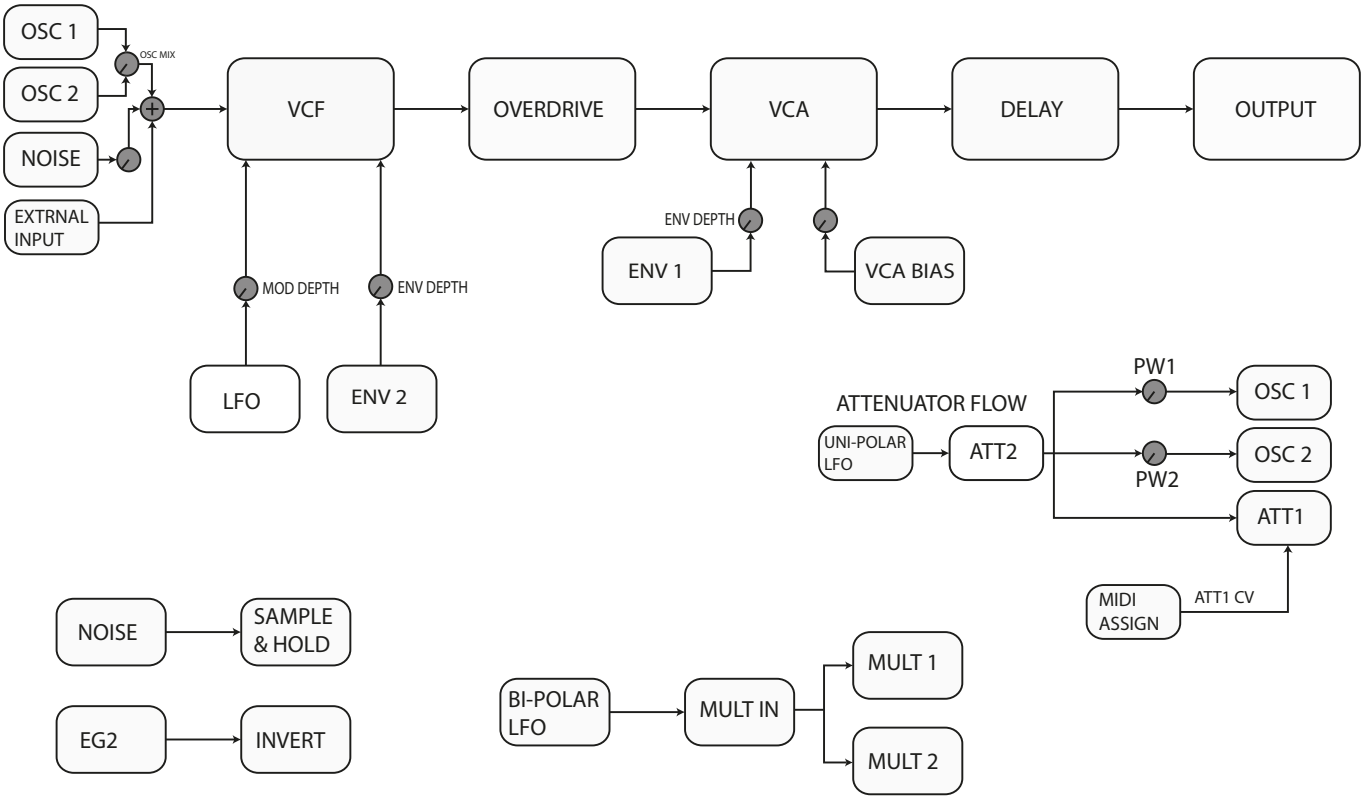
7. Patch a square wave shape LFO out to the delay time in. Then try ENV2 out patched to LFO Rate. This sounds like and 80's computer game.

8. Patch OSC 1 into OSC 2 with OSC SYNC active for frequency modulation synthesis.

9. Patch LFO into ATT 1 IN, Then ATT 1 into OSC2 with OSC SYNC active. This gives another style of FM synthesis to experiment with while using both oscillators. Try changing the position of ATT 1 to hear subtle changes.

10. Patch ASSIGN to ATT1 CV, set ASSIGN to MOD WHEEL, patch ATT1 OUT into OSC 1&2 pitch CV, this way the mod wheel sets the depth of vibrato, with LFO rate/ shape setting the characteristics and ATT2 setting the maximum depth.

## Neutron normalised routing.



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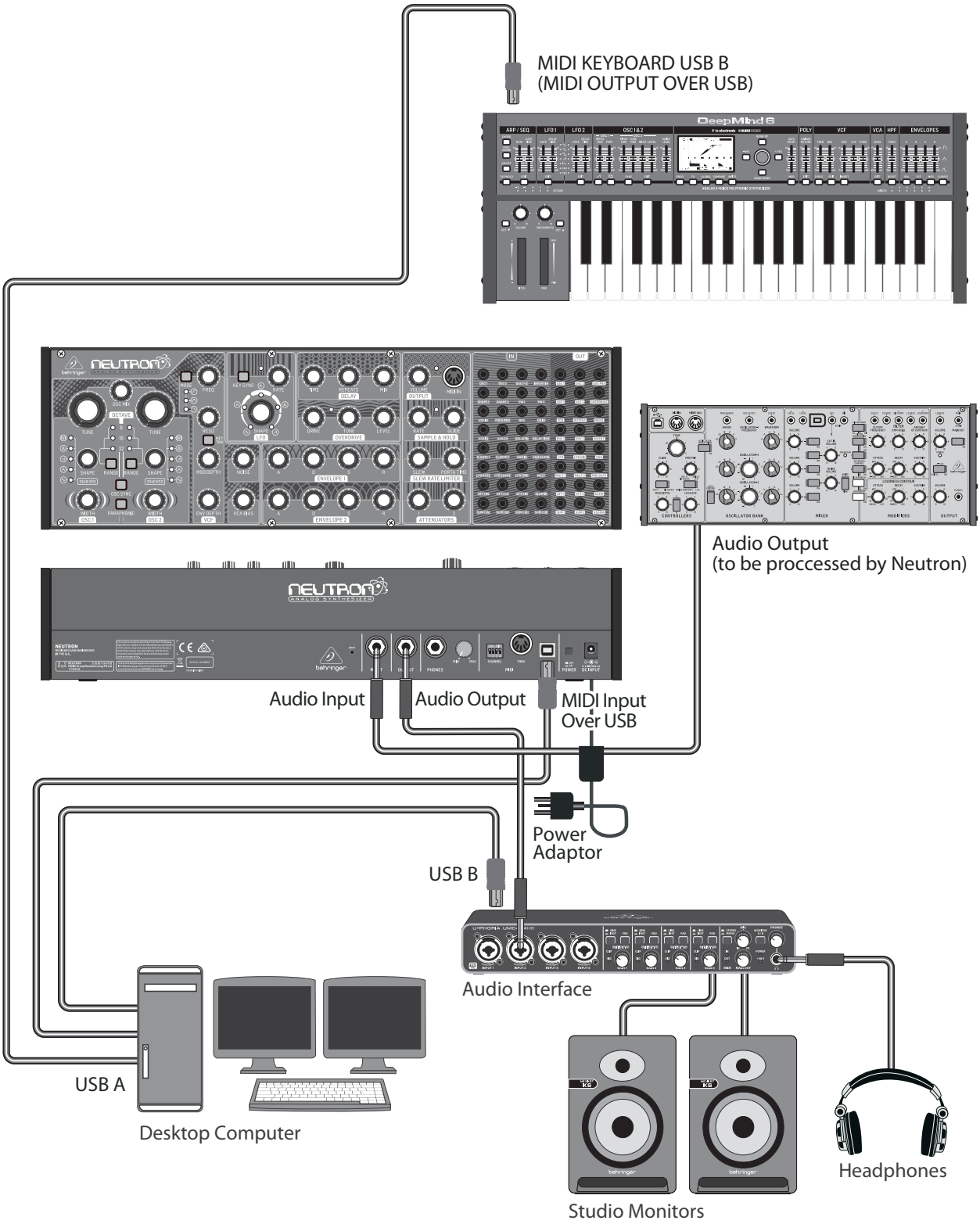
# 9. Neutron Set-up Examples

**Studio System**



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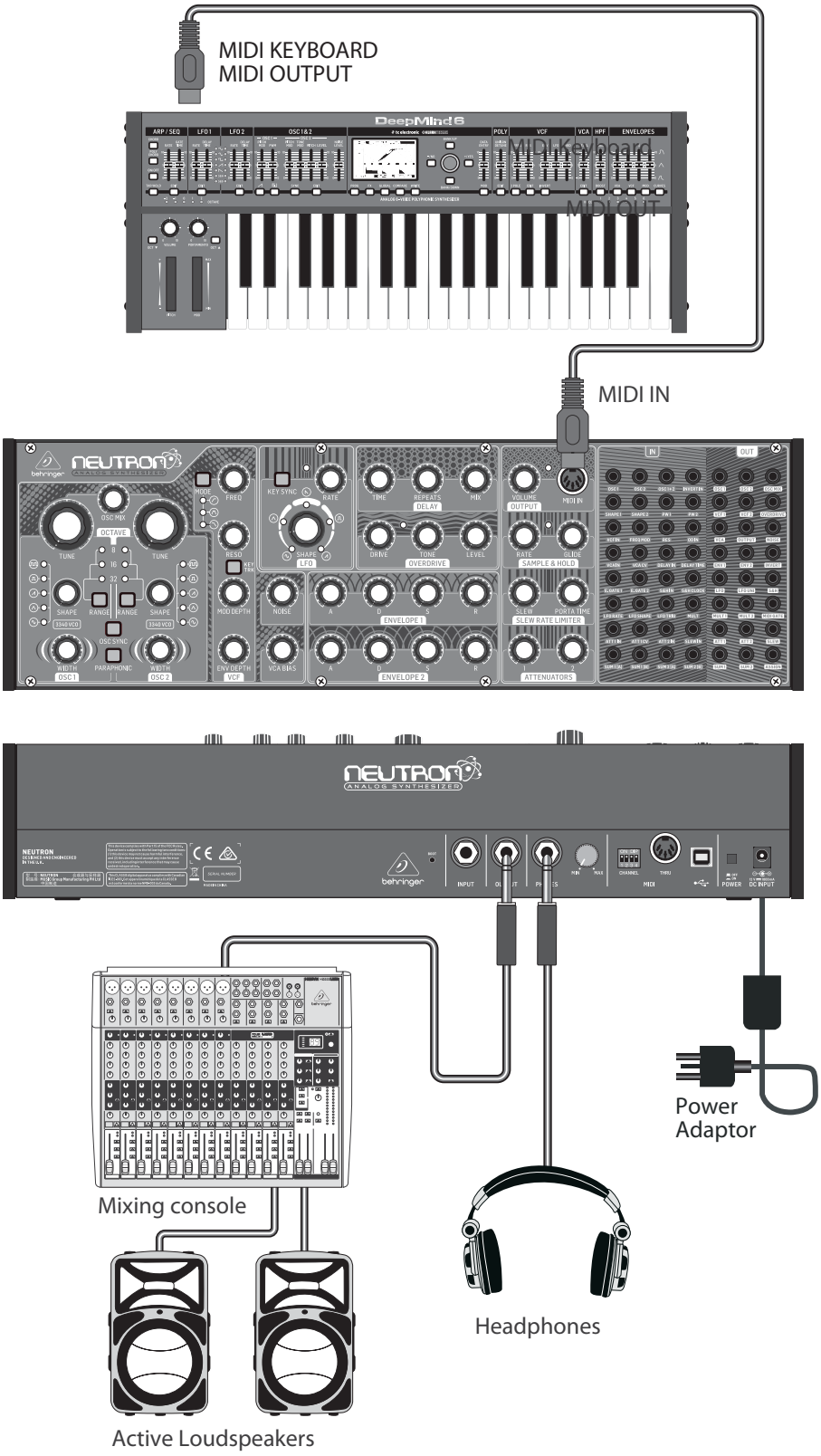
## Live Set-up



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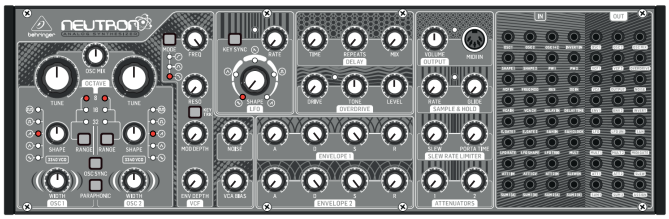
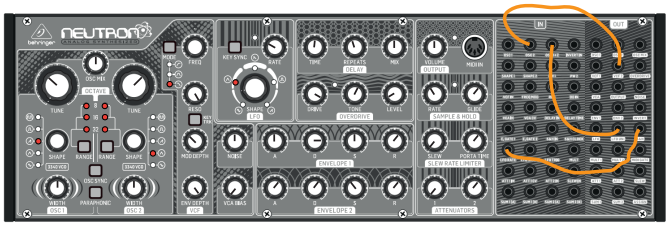
# 10. Preset Patches

The following examples give you a glimpse into the wonderful world of modular synthesis. Try these patches to show the versatile power of the Neutron.

Default Patch - This is a great starting point for sound creation. No patching required. A standard sawtooth sound will be audible using these settings.

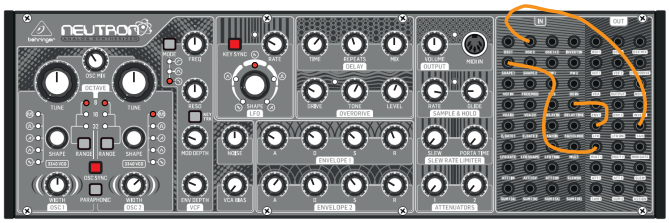


Out Of This World – A Sci-fi style sound showing off the S&H function of the Neutron. Here, the VCF self-resonates and drops into wonderfully deep sub tones. Play with the VCF FREQ control to sweep through various textures. Patch VCF 2 into OSC 2, LFO UNI into OSC 1&2 and S&H into LFO RATE.



Edge Synth – A slow evolving sound using frequency modulation and wave shape blending to create either a screaming when the filter is set to HPF or a dark bubbling bass with the filter set to LPF.

Patch S&H OUT to OSC 2 IN, LFO to DELAY TIME and MULT 1 (LFO BY DEFAULT) to SHAPE 1.



Quantum Loop - A Sub Sawtooth sound with VCF squelch. A sample & hold noise loop is added to give some movement to the sound. Try different amounts of resonance to hear the variations.

Patch OSC MIX to S&H IN then S&H OUT to FREQ MOD.

# 11. Troubleshooting

Before turning on the Neutron power, please check that:

Your speakers or headphones are correctly connected.

The external devices are powered-off.

Turn the VOLUME knob on the Neutron to the off position.

Turn on the POWER switch located on the rear panel.

The Neutron will run its startup routine.

Once the Neutron has stopped the LED calibration sequence, you can then turn on power to the connected devices and raise the volume to an appropriate level.

Before turning off the Neutron, please check that:

The output level is down on all connected audio devices.

The power is then turned off for all connected audio devices.

## 11.1 There is no sound coming from the synthesizer.

Check if the audio connections are correct.

Check if the volume control is turned up.

Check if the overdrive volume is up as this can cut audio if fully turned to the left.

If using headphones, check that the volume on the rear of the Neutron is turned up.

Check the position of the FREQ cutoff point. Depending on the filter type selected, it determines where the FREQ control will let audio pass through the filter stage.

Check that any patch cables that are in use are not cutting the sound. For example, if a 3.5 mm cable is patched into VCA IN and the other end of the cable is not plugged in, no sound will be audible.

## 11.2 There is no MIDI data coming from an external source.

Check if the MIDI connections are made to the USB or the MIDI IN on the front panel.

Check if the Neutron MIDI channel is set to the same one as the transmitting device using the DIP switches on the rear.

Check that you are using either USB or MIDI. The Neutron may not respond if two sets of MIDI data are being transmitted to it via USB and the MIDI IN port at the same time.

## 11.3 The synthesizer is behaving erratically.

Check that any connected devices/applications are not creating a MIDI loop which is feeding back MIDI data.

## 11.4 The synthesizer sounds out of tune.

The Neutron calibrates its tuning on start up. If it sounds out of tune, please look at section 5.4 to tune the oscillators to your choice of MIDI note.

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## 11.5 Buzzing or humming sounds can be heard from the audio outputs.

USB and or audio connections made between different devices using different power supplies, sources or sockets can sometimes create ground loops. You can attempt to resolve these grounding issues between computers and the Neutron by following good grounding practice and ensuring all devices use the same ground point. Unplugging one cable at time can make the background noises better or worse, depending on how this affects the remaining ground loops.

By removing every audio cable and working through your studio item by item, you can potentially eradicate ground-loop problems. Other possible solutions include the use of a DI box to connect the Neutron to your audio mixer or sound card where the transformer will isolate the audio connections.

## 11.6 There is no sound when using the external audio input.

The Neutron needs the VCA envelope to be triggered and open. This can be achieved via MIDI or an external E.GATE 1 input, adjust the ADSR settings in order to hear the input signal.

Another way to use the external audio input is turning up the VCA BIAS in order to hear audio.

# 12. Specifications

| | |
|---|---|
| **Synthesizer Architecture** | |
| Number of oscillators | 2 x V3340 |
| Type | Analog |
| Oscillators | 2 (0.7 Hz to 55 kHz across 4 ranges) |
| LFO | 1 (0.01 Hz to 10 kHz) |
| VCF | 1 (switchable low pass, band pass or high pass (12 dB/octave slope), dual output |
| Envelopes | 2 analog envelope generators |
| **Connectivity** | |
| External input | ¼" TS, unbalanced, 100 kΩ impedance |
| Output | ¼" TRS, balanced, max. 12dBu |
| Headphones | ¼" TRS, balanced |
| Headphones output impedance | 8 Ω |
| MIDI In/Out (soft Thru) | 5-pin DIN/ 16 channels |
| USB (MIDI) | USB 2.0, type B |
| **USB** | |
| Type | Class compliant USB 2.0, type B |
| Supported operating systems | Windows 7 or higher/ Mac OS X 10.6.8 or higher |
| **Oscillator Section** | |
| Controls | Tune (OSC 1&2): +1/-1 octave (8', 16' or 32') or +10/-10 (full range) |
| | OSC mix: (linear blend control between OSC 1&2) |
| | Shape (OSC 1&2): Tone Mod, Square, Sawtooth, Triangular or Sine |
| | Pulse width: 0 to 100% (OSC 1&2) |
| Switches | Range (OSC 1&2): 8', 16' or 32' or full range (all 3 LEDs) |
| | OSC sync: on/off |
| | Paraphonic: on/off |
| LED | Octave (OSC 1&2) 8', 16' or 32' or +/-10 (all 3 LEDs) |
| | Shape (OSC 1&2): Tone Mod, Square, Sawtooth, Triangular or Sine |
| **Envelope 1** | |
| Controls | Attack: 300 µs to 5 s (linear attack) |
| | Decay: 2.4 ms to 10 s (exponential decay) |
| | Sustain: 0 V to 9 V |
| | Release: 1.5 ms to 6 s (exponential release) |
| **Envelope 2** | |
| Controls | Attack: 300 µs to 5 s (linear attack) |
| | Decay: 2.4 ms to 10 s (exponential decay) |
| | Sustain: 0 V to 9 V |
| | Release: 1.5 ms to 6 s (exponential release) |
| **Output Section** | |
| Controls | Volume: 0 to 100% |
| LED | MIDI: Gate signal |
| **Sample & Hold Section** | |
| Controls | Rate: 0.26 Hz to 28 Hz (can be clocked from extrenal source) |
| | Glide: 500 µs to 1 s |
| LED | Rate: 0.26 Hz to 28 Hz (can be clocked from extrenal source) |
| **Slew Rate Limiter Section** | |
| Controls | Slew rate: 1 ms to 3 s |
| | Portamento time: 0 to 10 s |
| **Attenuator Section** | |
| Controls | Attenuator 1: +4 dB to -∞ |
| | Attenuator 2: 0 dB to -∞ |
| **Filter Section** | |
| Controls | Cutoff frequency: 10 Hz to 15 kHz |
| | Resonance: 0 to 10 (capable of self oscillation) |
| | Modualtion depth: 0 to 100% |
| | Envelope depth: 0 to 100% |
| | Noise: 0 to 100% |
| | VCA bias: 0 to 100% |
| Switches | Filter mode, high pass, band pass and low pass |
| | Filter key track: on/off |
| LED | Filter mode, high pass, band pass and low pass |
| **LFO Section** | |
| Controls | Shape: Sine, Triangle, Sawtooth, Square and Ramp |
| | Rate: 0 to 10 (0.01Hz to 10kHz) |
| Switches | Key sync: on/off |
| LED | Rate/Level indicator |
| | Shape: Sine, Triangle, Sawtooth, Square and Ramp. |
| **Delay Section** | |
| Controls | Time: 25 ms to 640 ms |
| | Repeats: 0 to 100% |
| | Mix: 0 to 100% |
| **Overdrive Section** | |
| Controls | Drive: 0 to 11 |
| | Tone: 0 to 10 |
| | Level: 0 dB to -∞ |
| LED | Drive amount indicator |

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| Inputs (TS 3.5 mm) | |
|---|---|
| OSC 1 | Control voltage: 1 V per octave |
| OSC 2 | Control voltage: 1 V per octave |
| OSC 1&2 | Control voltage: 1 V per octave |
| INVERT IN | inverts voltage |
| SHAPE 1 | Control voltage: -5 V to +5 V |
| SHAPE 2 | Control voltage: -5 V to +5 V |
| PULSE WIDTH 1 | Control voltage: -5 V to +5 V |
| PULSE WIDTH 2 | Control voltage: -5 V to +5 V |
| VCF IN | Signal input |
| FREQ MOD | Control voltage: -5 V to +5 V |
| RESONANCE | Control voltage: -5 V to +5 V |
| OVERDRIVE IN | Signal input |
| VCA IN | Signal input |
| VCA CV | Control voltage: -9 V to +9 V |
| DELAY IN | Signal input |
| DELAY TIME | Control voltage: -5 V to +5 V |
| E GATE 1 | Control voltage: -5 V to +5 V (envelope triggers @ 1.5 V) |
| E GATE 2 | Control voltage: -5 V to +5 V (envelope triggers @ 1.5 V) |
| SAMPLE & HOLD IN | Signal input |
| SAMPLE & HOLD CLOCK | Control voltage: -5 V to +5 V (S&H triggers @ 3 V) |
| LFO RATE | Control voltage: -5 V to +5 V |
| LFO SHAPE | Control voltage: -5 V to +5 V |
| LFO TRIG | Control voltage: -5 V to +5 V (S&H triggers @ 1.6 V) |
| MULT (Multiple) | Input Signal is duplicated on Mult 1 and Mult 2 outputs |
| ATT 1 IN | Signal input |
| ATT 1 CV | Control voltage: -5 V to +5 V |
| ATT 2 IN | Signal input |
| SLEW IN | Signal or CV input |
| SUM1(A) | Signal input or CV input |
| SUM1(B) | Signal input or CV input |
| SUM2(A) | Signal input or CV input |
| SUM2(B) | Signal input or CV input |

| Outputs (TS 3.5 mm) | |
|---|---|
| OSC 1 | Max. +14 dBu |
| OSC 2 | Max. +14 dBu |
| OSC Mix | Max. +14 dBu |
| VCF 1 | Max. +12 dBu |
| VCF 2 | Max. +12 dBu |
| OVERDRIVE | Max. +18 dBu |
| VCA | Max. +18 dBu |
| OUTPUT | Max. +15 dBu |
| NOISE | Max. +18 dBu |
| ENV 1 | Control voltage: 0 V to +9 V |
| ENV 2 | Control voltage: 0 V to +9 V |
| INVERT | inverts signals up to +/-9.5 V |
| LFO | Control voltage: -5 V to +5 V |
| LFO UNI | Control voltage: 0 V to +5 V |
| SAMPLE & HOLD | Tracks input voltage upto a maxiumum of 9.5 V |
| MULT 1 | Tracks input voltage upto a maxiumum of 9.5 V |
| MULT 2 | Tracks input voltage upto a maxiumum of 9.5 V |
| MIDI GATE | Control voltage: 0 V to +3.3 V |
| ATT 1 | Control voltage -9.5 V to +9.5 V (dependant on input signal) |
| ATT 2 | Max output voltage dependant on input signal |
| SLEW | Control Voltage -9.5 V to +9.5 V (dependant on input signal) |
| SUM 1 | Control Voltage -9.5 V to +9.5 V (dependant on input signals) |
| SUM 2 | Control Voltage -9.5 V to +9.5 V (dependant on input signals) |
| ASSIGN | Control voltage: 0 V to +5 V |
| **Power Requirements** | |
| External power adaptor | 12 V DC, 1000 mA (12 W) |
| Power consumption | 7.5-9 W typical |
| **Enviormental** | |
| Operating temperature range | 5 °C to 40 °C (41 °F to 104 °F) |
| **Physical** | |
| Dimensions (H x W x D) | 94 x 424 x 136 mm (3.7 x 16.7 x 5.4") |
| Weight | 2.0 kg (4.4 lbs) |
| Shipping weight | 3.0 kg (6.6 lbs) |
| Eurorack HP | 80 HP |

# 13. Glossary

## NEUTRON GLOSSARY

This glossary provides an explanation of useful symbols, terms and abbreviations.

32'/16'/8': Used to describe the range of an oscillator, this term originates from pipe organs. The length of the pipe is inversely proportional to the pitch it produces, for example, an 8' pipe is one octave higher than an 16' pipe.

AC: Alternating Current

ADSR: Attack, Decay, Sustain and Release, an envelope with four stages.

Aftertouch: Aftertouch is MIDI data sent when pressure is applied to a keyboard after the key has been struck, and while it is being held down or sustained.

Amplifier: A circuit which increased the level of a signal.

Amplitude Modulation (AM): Modulation of the amplitude (or level) of a sound by another signal source. AM is used to produce tremolo using a low frequency modulation source.

Analog: Something which is proportional or similar to something else. In the case of the synthesizer, audio electronic circuits are another form of air pressure waves. Analog signals contain distortions from the components, topology, circuits and designs which are often perceived as warmer and more natural than their digitally generated counterparts.

Arpeggiator: An "Arpeggio" is a number of notes played sequentially instead of simultaneously. Some external keyboards have an Arpeggiator that responds to a number of keys being held by playing a sequence of notes.

Attack Time: The first stage of an ADSR envelope, used to control the initial part of a sound. Specified as the duration of time for an envelope to reach the maximum level after it has been triggered on by a key press or gate signal.

Attenuate: To reduce the level of a signal.

Balanced Audio: A type of audio connection that uses the three wires in a cable as part of a phase-cancelling arrangement to boost the signal and reduce noise.

Band: A range of frequencies.

Band Pass Filter (BPF): A filter that passes frequencies within a certain range and rejects (attenuates) frequencies outside that range.

Bandwidth: The difference between the upper and lower frequencies of a filter.

Bass: Lower frequencies in a signal ranging from 60 Hz to 250 Hz (Approximately B1 to B3).

Beat Frequency: When two waveforms of different frequencies are mixed together, the resulting waveform will have points of constructive and destructive interference. The beat frequency is equal to the difference in frequencies and is heard as a "beating" or amplitude modulation.

Beats Per Minute (BPM): Used to describe the tempo of a composition by specifying the number of beats which should occur in every minute.

Bipolar: Having or relating to two poles or extremities both positive and negative.

Cent: Unit of measurement for pitch tuning. There are one hundred cents in a semitone.

Chorus: An effect which uses multiple copies of a signal played together and slightly out of time, to create a shimmering effect. Sometimes referred to as “Ensemble”.

Continuous Controller: A type of MIDI message assigned to a specific parameter. When the parameter is adjusted, continuous controller messages are sent. If the assigned continuous controller is received then the parameter will be adjusted.

Control Voltage (CV): A voltage signal used to control any parameter. Was common on synthesizers before MIDI and is now found mostly on modular synthesizers.

Cross-Modulation (X-Mod): Two oscillators modulating each other at the same time. The outputs are a mix of the sum and difference of the oscillators. The term is also used to describe the ability for parameters of a synthesizer to be able to modulate other parameters.

Cut-Off Frequency: The frequency which a filter is set to. Beyond this frequency (in a low-pass filter, the most common), the sound is cut off (attenuated) at a rate set by the slope of the filter response curve.

Cycle: In a sound wave, the cycle refers to a single repetition of a wave-shape. For example, in a square waveform, it is the time from a positive edge to the next positive edge.

dB: Symbol for “decibel”. A unit of measurement of the loudness of sound. See dBu.

dBu: A unit of measurement of sound used in professional audio. Derived from the decibel, where the “u” stands for unloaded, this unit is an RMS measurement of voltage based on 0.775 VRMS, which is the voltage at which you get 1 mV of power in a 600 Ohm resistor. This used to be the standard impedance in most professional audio circuits.

DC Offset: An imbalance that sometimes occurs in A/D converters. It is a constant voltage that is present, which can eat up headroom and cause clicks and pops during editing.

Decay Time: The second stage of an ADSR envelope. Specified as the duration of time for an envelope to reach the sustain level after the maximum level has been reached during the attack stage.

Default: An initial value for parameter, i.e., the value before any changes have been made.

Delay: An effect by which a reproduction of a signal is played back later then its original. Primarily used for echo, but also is the basis for phasing, flanging, chorus and basic reverb type effects.

Detuning: The action of adjusting the pitch of an oscillator from a reference point or another oscillator. When oscillators are detuned slightly they will make the output sound "fatter" or "wider". When oscillators are detuned heavily to note intervals it can create harmonies.

Digital Audio Workstation (DAW): A computer-based recording system. More commonly used to describe the software package used to record, process and mix.

Digitally Controlled Oscillator: An analog oscillator circuit controlled and monitored by a digital processor. The advantages over a VCO is increased stability which results in far less tuning drift.

Dip Switch:  A manual electric switch that is packaged with others in a group.

Distortion: An effect based on pushing the boundaries of what a specific technology or implementation can achieve. At the point where technology begins to overload, overdrive, clip, saturate or generally misbehave is where distortion starts to appear. Examples include tape, valve, transistors, and also digital algorithms and processes.

Drive: provide a gain boost to produce soft clipping.

Dynamic: The range of levels in an audio signal, from the softest to the loudest.

Effect: One of a number of audio processes that can be applied to a signal to modify it, such as reverb, flanging, phasing, delay etc.

Envelope Generator (EG): An envelope signal which can be adjusted to a specific shape in order to control the way a sound behaves over time.

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Equalization (EQ): Processor used to adjust the volumes of various frequency ranges for creative or corrective purposes.

Exponential: A mathematical function of growth or decay where the independent variable is the exponent. This results in a "hockey stick" shaped curve.

Feedback: A loop created between an audio input and an audio output of an audio circuit, system or processing block.

Filter: A device that attenuates certain frequencies while letting other frequencies through. Using a filter to reduce harmonics, changes the timbre or color of the sound.

Flanger: An effect which alters a sound signal by introducing a cyclically varying phase shift into one of two identical copies of the signal and recombining them.

Frequency Modulation (FM): Using one frequency to modulate another frequency's pitch. When the modulation source is in the audio range, it can be perceived as a change in the timbre or color of the sound. FM can be used to create a wide range of rich and complex sounds and is often described as having a clear and distinctive timbre.

Frequency: The number of times that a sound waves cycle repeats within one second.

Fundamental Frequency: The lowest frequency of a periodic waveform.

Gain: The amount of signal level increase provided by an amplifier stage.

Gate (Synthesizer): A signal used to trigger an event, such as a note or an envelope.

Gate (Dynamics): A device used to cut off the level of a signal when it falls below a specified threshold. Can be used to cut background noise, control reverb tails, or creatively to produce chopping type effects.

Glide: See Portamento.

Global: The settings and parameters which govern the general operation of the synthesizer and are not directly associated with the voice engines.

Harmonics: A series of integer-related sine waves at varying levels creating different timbres. Waveforms (other than a pure sinusoidal) generate various harmonics which help define the character of the sound.

Hertz (Hz): A unit of frequency equal to one cycle of a wave per second.

High Pass Filter (HPF): A filter that attenuates lower frequencies from a signal, leaving the higher frequencies unaffected.

Hum: Undesirable low-frequency tone (typically 50 or 60 Hz) present in a signal due to grounding problems or proximity to a power source or power cables.

Impedance (Z): Opposition to the flow of alternating current in a circuit, measured in Ohms.

Insert: A point in a processing chain where a device can be inserted.

Invert: To change it to its opposite, i.e. a positive value becomes negative etc.

Keyboard: A range of keys, arranged in order of ascending pitch, which enables the synthesizer to be played by hand.

Keyboard Tracking: Allows the control signal from played keys to adjust another parameter. Commonly used to open a filter as higher notes are played which then enhances harmonics.

Kilohertz (kHz): A unit of frequency equal to one thousand cycles of a wave per second.

Latency: A delay introduced by processing. Measured by the time it takes to produce a signal after a request has been made. In a synthesizer, it is the time taken to produce a note after a key has been played. In an audio interface, it is used to measure the time it takes for an input signal to reach the processor, or for a signal from the processor to reach the output.

Level: Used to describe the magnitude of a sound, often relative to an arbitrary reference.

Limiter: A device used to limit the level to a range of values irrespective of the input level.

Linear: Used in audio to describe a straight-line response of circuit or process which results in a change which is directly proportional to an independent variable.

Line Level: A nominal operating level used by audio equipment. Professional line level is normally +4 dBu and consumer line level is -10 dBu.

Looping: Automatically restarting a function at the end of a period of time or defined cycle, to create a continuous loop.

Low Frequency Oscillator (LFO): An oscillator that commonly runs at a very low speed and is used to modulate another parameter.

Low Pass Filter (LPF): A filter that attenuates higher frequencies from a signal, leaving the lower frequencies unaffected.

Mark to Space Ratio: The ratio between the positive and negative parts of a rectangular waveform, or pulse wave.

Meter: Visual device to indicate the level of a signal.

MIDI (Musical Instrument Digital Interface): A technical standard that describes a protocol, digital interface and connectors and allows a wide variety of electronic musical instruments, computers and other related hardware/software devices to connect and communicate.

MIDI Clock: A clock signal which is broadcast over MIDI to ensure that devices are synchronized. Also known as MIDI Beat Clock or MIDI Timing Clock.

MIDI Message: Data or information transmitted from one MIDI device to another. Each MIDI message contains at least two numbers: one that identifies the type of message being sent, and another which represents a value for the selected type of message.

MIDI Gate: The MIDI Gate typically controls the note on-off.

Midrange: Frequencies in a signal ranging from 250 Hz to 5 kHz (Approximately B3 to D#8).

Mix: The balance of level between one signal and another.

Mixer: A device that blends input signals into composite signals for output.

Mode: The selection of filter settings in use.

Modular Synthesis: A synthesis system comprised of a number of modules which can be connected in many different ways. Modules can perform a single function such as an oscillator or filter or perform multiple functions.

Modulation: The process of controlling one or more properties (destinations) of a signal using another signal (source).

Modulation Wheel (Mod Wheel): A wheel located to the left of a keyboard that allows you to change specified parameters in real-time.

Monitors: Studio quality loudspeakers, providing an accurate representation of the audio signals.

Mono: A single signal.

Monophonic: Only one note can be played at any given time, as there is only a single voice.

Mult: A way of splitting a signal

Mute: Function that allows a signal to be silenced.

N/A: Abbreviation for "not applicable" or "not available".

Noise: A circuit that produces white noise.

Note-Priority: Determines which note is played when more notes are held simultaneously than the number of available voices (often: low/high/last).

Octave or Oct: Unit of measurement for pitch. Every time the frequency of a waveform doubles, the pitch increases by one octave.

Ohm (Ω): Unit of electrical resistance.

Oscillator: An electronic device which generates a periodic signal used to form the basis of a synthesizer program.

Output: The signal sent out by a device or process. Also used to describe the physical socket where a signal leaves a device.

Overdrive: To push to excess or drive too hard.

Overtone: Any frequency that is present in a waveform that is higher than the fundamental frequency of that waveform.

Pad: A program that is usually characterized by slow attack and release times.

Panning / Pan: The positioning of a signal within a stereo image.

Parameter: A setting whose value can be changed.

Parametric EQ: A type of EQ that allows all of the parameters of equalization to be changed, including center frequency, boost/cut in gain and bandwidth.

Paraphonic: Is the use of two oscillators independently pitched when more than one MIDI note is played.

Patch: The cables used on modular synthesizers (or synthesizers with modular compatibility) to connect devices together. Patch cables can carry audio, gate or control voltage signals.

Period: The time that it takes a wave to complete a full cycle. Period is calculated by dividing 1 by the frequency

Phase: A measurement (in degrees) of the time difference between two waveforms, or between a single waveform and a reference point.

Phaser: An effect which uses a series of notched all-pass filters (also called stages) to create a comb-filter response which does not always have harmonic relationships between the notches. The result is a sweeping effect similar to a flanger but smoother and often more natural sounding.

Pitch: A quality of sound that makes it possible to judge if a sound is higher or

lower than another.

Pitch Bend / Pitch Bend Wheel: Controlling the pitch of a note after it has been played.

Pitch Shift: Alteration of pitch or frequency, but without adjusting tempo.

Pole: A section of a filter stage. The more poles a filter has, the steeper its attenuation slope will be, and the more accurate the filter will be.

Polyphonic: Capable of playing more than one note at once.

Polyphony: The number of notes a polyphonic synthesizer can play simultaneously.

Portamento: An adjustable performance effect that glides or bends the pitch from one note to the next.

Poly-Chaining: A way to connect multiple monophonic synths to play together to create a polyphonic sound.

Post: The point for accessing audio just after it leaves a specific component or stage. For example, Post-Fader audio is affected by the fader.

Pre: The point for accessing audio just before it reaches a specific component or stage. For example, Pre-Fader audio is not affected by the fader.

Program: A complete set of parameters and settings which the synthesizer uses to create a specific sound.

Power Supply Unit (PSU): The component in a system which is responsible for supplying and managing power.

Psychoacoustics: The study of the perception of sound, that is, how we listen, our psychological responses, and the physiological effects on the human nervous system.

Pulse Wave: Similar to a square wave, but without symmetry. Also known as a

"Rectangle Wave."

Pulse Width Modulation (PWM): Modulation of the pulse width (the duty cycle of a pulse wave measured as a percentage). A pulse width of 50% has equal positive and negative sections and is considered a square wave.

Q Factor: A bandwidth (or selectivity), of a particular band in an equalizer. The higher the Q Factor, the wider the bandwidth.

Range: Adjusts the pipe length of oscillators.

Rate: The speed at which a particular device is operating.

Release Time: The fourth and final stage of an ADSR envelope. Specified as the duration of time for an envelope to reach zero after the played key is released.

Resonance (Reso): The emphasis/boost of frequencies around the cut-off point just before attenuation starts to occur. As resonance increases, it will reach a point where the filter will start to self-oscillate, producing a signal even when there is no input.

Reverb: An effect where the ambience of a physical space is simulated.

s: Symbol for "second," a unit of time.

Sample & Hold (S&H): A circuit or function in synthesizers that enables the instantaneous value (voltage) of a waveform to be captured and continues to output that value until the next sample is taken.

Sawtooth: A waveform that combines an instantaneous rise or fall, followed by a gradual linear incline or decline. The name comes from the waveform's similarity to the teeth of a saw.

Semitone: A chromatic half-step. There are twelve semitones in an octave.

Sequencer: A programmable device or module used to arrange/sequence timed events into musical patterns and songs.

Self-oscillation: Occurs when the resonance of a filter is increased to the point where it will begin to generate a sine wave independently of any input. Signal flow: The path of a signal from one module (or component of a system) to another.

Sinusoidal / Sine Wave: Mathematical description of a smooth waveform that contains only the fundamental frequency and has no additional harmonics. The shape resembles the letter "S" rotated 90 degrees.

Shape: In reference to the waveform shape of the LFO.

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Slew Rate: The rate of change of a voltage or control signal. Spectrum: First used to describe the full range of colors in visible light, the term is also used to describe the full range of frequencies in the audio spectrum.

Soft Clipping: is a technique for adding warm harmonic distortion to your audio, giving the sound a much more analog feel than digital distortion.

Square Wave: A symmetrical waveform that combines an instantaneous rise or fall, followed by a positive or negative steady state. The name comes from the waveform's similarity to a square.

Step: A step is one stage in a sequence and can be a control signal, single note, chord or rest.

Sub-Bass: Frequencies in a signal ranging from 10 Hz to 60 Hz (lower than C0 to approximately B1).

Subtractive Synthesis: A technique of creating sounds by filtering waveforms which are rich in harmonics.

Sum: A way to combine signals

Sustain Level: The third stage of an ADSR envelope. Specified as "the level an envelope will return to, after the decay stage". The envelope will remain at the sustain level until the played key is held.

Synchronization (Sync): Coordination of timing between devices.

Sync (Tempo): A function where a cyclical event such as an LFO is synchronized to a tempo value.

Sync (Oscillator): A function where one oscillator is synchronized to another. The waveform of the slave oscillator is reset whenever the waveform of the master oscillator restarts.

Sync (Arp/Seq): A function where an arpeggiator or sequencer is synchronized to a tempo value.

Sync (Key): A function where an event is synchronized to the pressing of a key.

Tempo: The speed at which a composition should be played, usually expressed in beats per minute (BPM).

Threshold: In dynamic effects, this is the level that must be passed before the processing is engaged.

Timbre: The tone, character, or aesthetic qualities of a sound.

Tone Control: Processor used to adjust the volumes of various frequency ranges for creative or corrective purposes.

Transposition / Transpose: A function that allows you to shift the entire keyboard up and down in pitch.

Treble: Frequencies in a signal ranging from 5 kHz to 20 kHz (approximately D#8 to above C10).

Tremolo: A periodic change in amplitude.

Triggering: Activation of a function, such as the start of a note, envelope, or LFO.

Tune / Tuning: The process of adjusting the root pitch of the instrument to a specific reference frequency.

Unbalanced Audio: A type of audio connection that uses two wires in a cable and does not offer the noise rejection qualities of a balanced system.

Unipolar: Having a single positive pole or kind of polarity.

Unison: Two or more voices that are playing together at roughly the same pitch.

Universal Serial Bus (USB): A "plug and play" interface that provides a fast connection between a computer and peripherals.

VCA Bias: Controls the minimum amplification present.

Volt (V): A unit of electrical potential differential or electromotive force. A difference in charge between two points in a circuit. This difference, when combined with the rate of the charge (current) allows for the control of many analog circuits that “synthesize” sound.

Voltage Controlled Amplifier (VCA): An amplifier whose resultant magnitude is controlled by a voltage.

Voltage Controlled Filter (VCF): A filter whose cut-off frequency can be controlled by a voltage.

Voltage Controlled Oscillator (VCO): An oscillator whose cut-off frequency can be controlled by a voltage. Typically creates the possibility of tuning drift when used in a synthesizer.

Vibrato: A periodic change in pitch.

Voice: A physical embodiment of a complete set of OSC, Envelopes, LFOs and VCF which can play a single note.

Waveform: A repeating signal typically created by an oscillator. A waveform can also be random in the case of noise.

Wavelength: The shortest distance between two successive points on a wave that are in phase. When used in audio or acoustics, the physical wavelength is calculated by dividing the velocity of sound in air (approximately 340 m/s) by the waveform frequency.

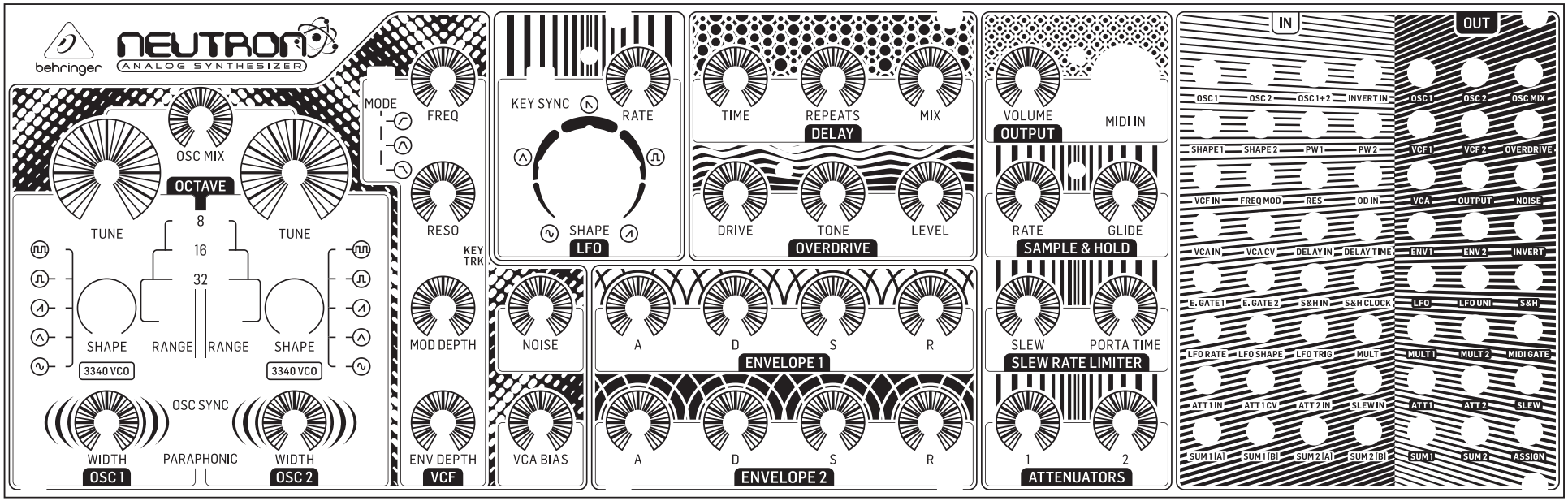
White Noise: A sound that contains every frequency within the range of human hearing (generally from 20 Hz to 20 kHz) in equal amounts.

Width: Sets the pulse width of oscillator square / tone mod waveforms.

# Neutron Patch Sheet

## Patch Number

| DATE: | AUTHOR: | TITLE: |
|---|---|---|
| NOTES: | | |

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# FEDERAL COMMUNICATIONS COMMISSION COMPLIANCE INFORMATION

BEHRINGER

NEUTRON

| | |
|---|---|
| Responsible Party Name: | **MUSIC Tribe Commercial NV Inc.** |
| Address: | **5270 Procyon Street<br>Las Vegas, NV 89118<br>USA** |
| Phone Number: | **+1 702 800 8290** |

**NEUTRON**

complies with the FCC rules as mentioned in the following paragraph:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

**Important information:**

Changes or modifications to the equipment not expressly approved by MUSIC Tribe can void the user's authority to use the equipment.

We Hear You

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