

Axon User's Guide

Audio Damage, Inc.
Release 3.0

The screenshot displays the Axon3 software interface, which is divided into several functional sections:

- Top Left:** Includes a tempo control set to 110, a transport section with play/pause buttons, and a pitch quantizer set to D with a transpose of 2.
- Top Center:** A routing diagram showing a central node connected to five peripheral nodes.
- Top Right:** A 'NEURON 1' section with controls for threshold (-4), MIDI note in (-60), MIDI note out (-72), and various trigger parameters like likelihood, velocity, and ratchet.
- Bottom Left:** A 'SYNTHESIZER' section with multiple oscillators and envelopes, including parameters for tune, wave, amount, decay, and shape.
- Bottom Center:** A central waveform display with 'FM' and 'TIMBRE' controls, and a 'MIX' section with a volume knob.
- Bottom Right:** A 'MIXER & FX' section with controls for pitch, mix, attack, decay, shape, filter, and output level/pan.

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System Requirements

The following table summarizes the operating system requirements and provided formats for Axon. Axon is a 64-bit plugin.

Operating System	Minimum Version	Formats
macOS	10.13	AAX, AudioUnit, CLAP, VST3; Intel and Apple Silicon
Windows	10.0	AAX, CLAP, VST3
Ubuntu	18.0	CLAP, LV2, VST3
iOS (separate purchase)	iOS 11	AUv3, IAA, Standalone

Demonstration Version

We encourage you to download and try the demonstration version of Axon before purchasing it. The demo version of Axon is the same as the regular version, but has the following limitations:

- Presets cannot be saved, nor can parameter values or other settings. This includes the information usually stored by your host DAW. If you save a DAW session with an instance of the demo version of Axon, Axon will revert to its default state when you reload the session.
- Axon will cease to emit audio altogether 20 minutes after you add it to your DAW session. You can remove it and add it again, but it will revert to its default state.

Introduction

Now in its third major incarnation, Axon 3's Neuron Sequencer remains unique in the world of rhythm-oriented plugins. Bearing a resemblance to a simple artificial neural network, the sequencer eschews the traditions of x0x- or MPD-style pattern programming, instead generating patterns and melodies through the interaction of interconnected nodes we call *neurons*. Each neuron receives pulses from other neurons, counts these pulses, and transmits a pulse of its own when the count reaches a programmable threshold. Simultaneously with sending the pulse, the neuron triggers its individual synthesizer voice and/or transmits a MIDI note event. Axon's sequencer has become a respected secret weapon for generating fresh, complex patterns.

While the results of Axon's neuron sequencer are at times unpredictable, they are not random. However, recognizing that a bit of complete unpredictability can be a good thing in music, with version 3 we've added features for randomizing almost everything: velocities, repeated hits, trigger probabilities, synthesizer settings, pitches, even the connections of the neuron network itself.

Axon's seven identical synthesizer voices operate independently but share a common set of controls. A hybrid of FM and subtractive synthesis techniques, the voice structure is simple to understand and use but provides a vast range of timbres suitable for drum synthesis, tuned percussion, and odd bleeps and zaps. Two two-dimensional XY pads provide immediate real-time tweaking of waveshaping and FM parameters. A complex noise source generates both white noise and the distinctive quasi-metallic ring of the cymbal circuits of analog drum machines from last century, both shaped by a multi-mode resonant filter. In a manner similar to the interaction of the neurons, Axon's synthesizer voices can modulate each other, via frequency modulation, ring modulation, or both, generating timbral changes related to the sequencer pattern. Finally, a complete mixer, delay effect, and compressor provide mix-ready stereo output. Alternatively, route individual voices to three auxiliary busses for individual processing in your DAW.

If You Don't Like to Read Manuals

We understand. You just got a shiny new plugin and you'd really rather play with it than read some dull exposition. Go ahead, then—install it, load it up, flip through the presets, move some of the controls around. Axon comes with a healthy assortment of built-in presets that will provide instant gratification and keep you amused for quite some time.

However, eventually you may find that it's not entirely clear exactly what's going on. Circles blink, sounds happen, beats emerge, but how? When you're ready to learn about how Axon does what it does, come back to this manual and read on.

New in Version 3.0

With version 3.0, we rewrote most of Axon from scratch in order to deliver a number of new features and improvements:

- An overhauled synthesizer engine with inspiration drawn from our percussion-oriented hardware modules of yesteryear
- A refreshed, resizable user interface with two panels to accommodate all of the new goodies
- Several dozen scales and modes for matching Axon's melodic activities to your composition—or inspiring new compositions
- An Offset parameter for the sequencer makes it easier to create traditional drum patterns as well as exotic new ones
- New reset options for the sequencer to keep it in sync with your song's structure
- Numerous randomization features for generating new sounds and patterns, and dynamic variations
- Ratchets for sub-step repetitions or delay-like echoes
- A compressor on the output buss
- Improved MIDI handling, both on the way in and the way out
- A reworked mixer and output structure, with non-exclusive Solo behavior
- A new preset manager for browsing and organizing presets

Because of the comprehensive nature of these changes, Axon 3 is not compatible with Axon 2. Axon 3 will not load presets from Axon 2 or vice versa. As far as your DAW is concerned, they are separate plugins. You can leave Axon 2 installed on your system; it won't conflict in any way with the new version.

Installation

Axon uses our custom plugin manager application for installation. Launch it as usual on your operating system of choice and you'll be presented with a window like this:



Near the top of the window, beneath the large words AXON 3, you'll see the version number of the software carried by the installer. This is distinct from the version of the plugin manager itself, which is shown in the upper right and usually not of much interest.

Under the heading FORMATS are large buttons corresponding to the plugin formats which can be installed: AAX, CLAP, LV2 and/or VST3, depending on the operating system. If the plugin is already present on your system in one or more formats (i.e. if you're upgrading from a previous version), the corresponding button is drawn in blue. When possible, the version number of the existing plugin is also shown.

Click a button to select the format for installation. A yellow outline appears around the button to indicate that its format will be installed. In the above screenshot, VST3 and CLAP are installed, AAX is not installed, and VST3 is selected for installation. The older instance of the VST3 plugin will be overwritten by the version contained in the plugin manager. Clicking a button a second time removes the yellow outline and the corresponding format will not be installed. Clicking the SELECT ALL button selects all available formats for installation.

No changes to your system's storage device take place until you click the INSTALL button near the lower-right corner of the window. Click that button and you'll receive visual confirmation that the formats you've selected have been installed. (Yes, it happens quickly.) If you hold down the Shift key on your keyboard, the INSTALL button's label switches to UNINSTALL, and clicking it will remove the selected formats from your system. Once you're installed and/or removed the formats you need, simply close the application in the usual manner for your operating system. You're done. There is no license code or other authorization necessary; we'd rather assume we can trust you than burden you with an onerous DRM system.

You'll find some handy buttons under the EXTRAS heading, all of which are pretty self-explanatory:

EULA – presents the End-User License Agreement for our products. By clicking the INSTALL button you're implicitly agreeing to these terms, but we expect that you'll find them reasonable should you take the time to read them.

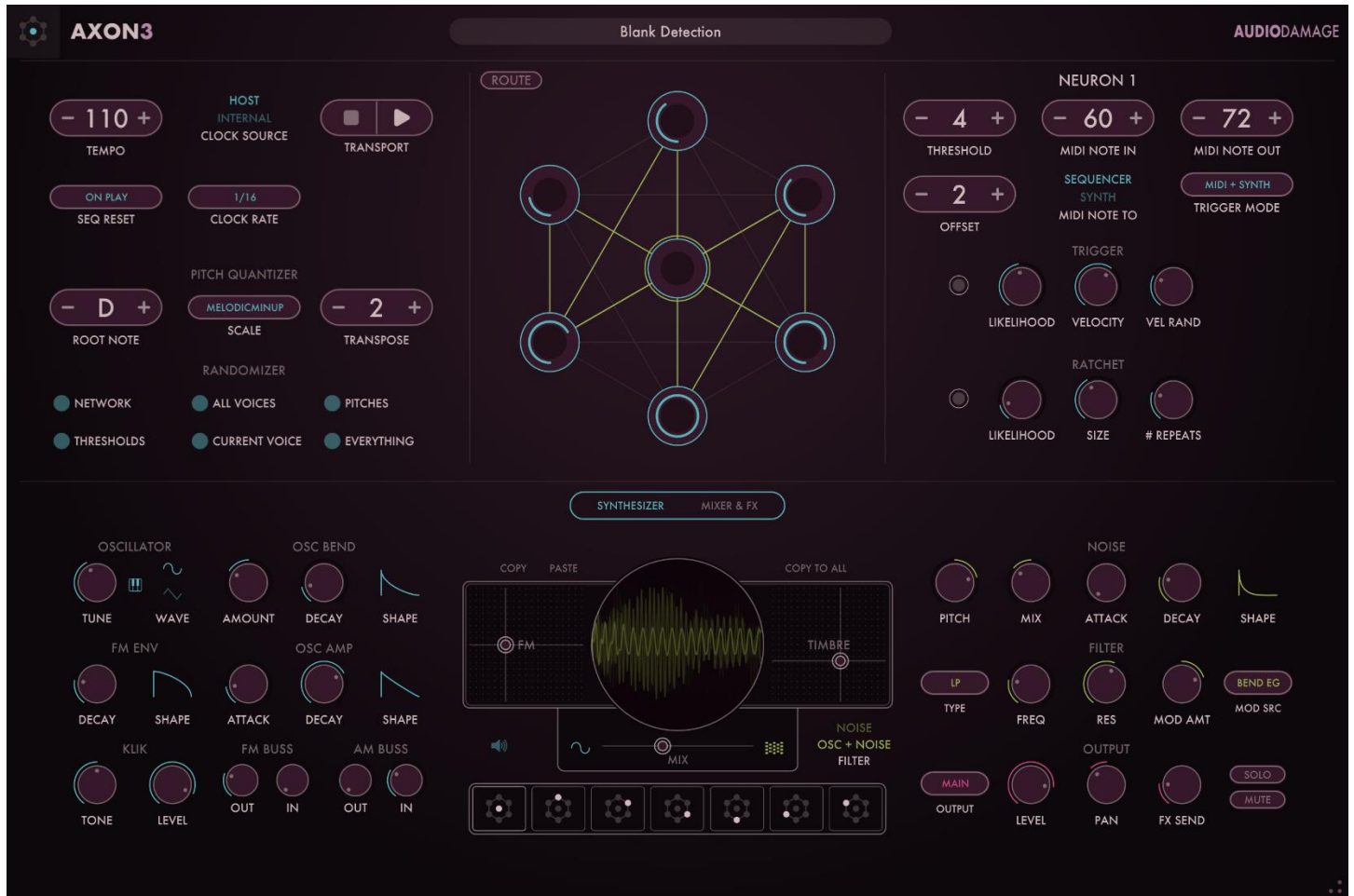
MANUAL – opens the current version of this user manual, in PDF form, in your web browser.

WEBSITE – opens the product's web page in your browser.

SUPPORT – displays information for contacting us, either via our Discord presence or through email.

Operation

The following screen shot shows Axon's window:



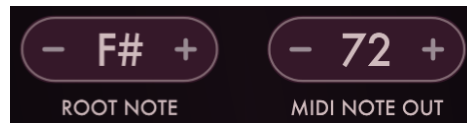
The lower half of the window has two views named Synthesizer and Mixer & FX. Click the words near the center of the window to switch between the views. The Synthesizer view appears in the above screenshot; the Mixer & FX view looks like this:



As you've no doubt figured out by now, the Synthesizer view houses the controls for Axon's percussion synthesizers and the Mixer & FX view has the controls for mixing the signals from those synthesizers and applying delay and compression effects. The controls in both views are described in the following paragraphs.

Obloid Controls

Besides the knobs, Axon's user interface has several controls which we affectionately refer to as *obloids*. They look like this:



This kind of control handles several parameters in Axon. There are several different ways you can change parameter values with an obloid:

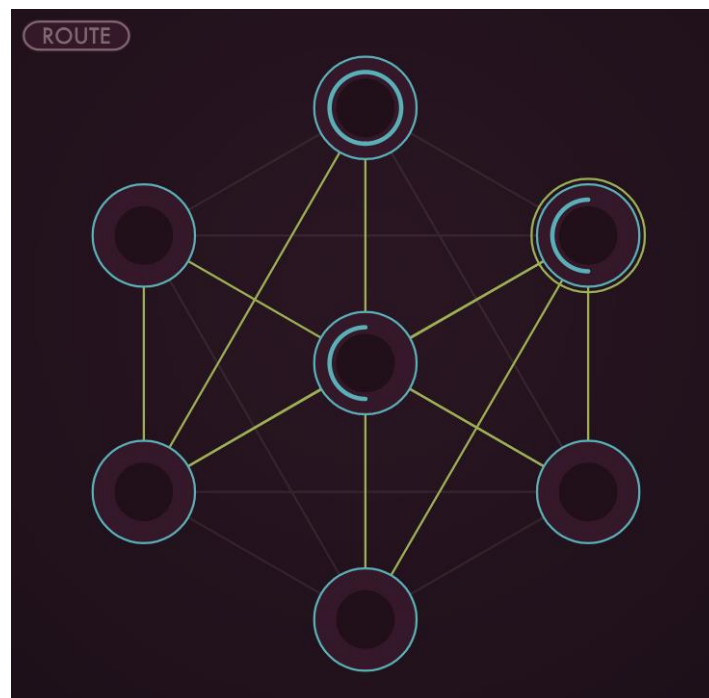
- Click and drag vertically with your mouse or trackpad (or with your finger if you're using an iOS device) to increase and decrease the value.
- Click or tap the minus symbol on the left to decrease the value; click/tap the plus symbol on the right to increase it.
- Double-click or double-tap the numeric value to type in a new value directly. Press the Enter or Return key on your keyboard to finish changing the value or press Escape to cancel your changes.

There are also oval popup controls which bear a superficial resemblance to obloids. You can tell them apart by the absence of plus/minus symbols on the popup menus.



Neuron Sequencer

Axon employs a unique design for its internal sequencer. It is made up of a group of seven interconnected objects we call *neurons*, so we call it the *neuron sequencer*. The neurons are displayed in a pane at the upper center of Axon's window, depicted as a group of seven circles.



The neurons are numbered from one to seven. The neuron at the center is neuron 1. Neuron 2 is directly above neuron 1, and the remaining neurons are numbered in a clockwise fashion. You can select any neuron by clicking it, or by clicking one of the graphical buttons at the bottom of the window. Neuron 3 is selected in the previous illustration.

Any neuron can be connected to other neurons. Connected neurons send signals, called *pulses*, to each other at metrical intervals. A neuron that sends pulses to other neurons is called a *transmitter*. A neuron that receives pulses from other neurons is called a *listener*. A neuron can be both a transmitter and a listener. Connections are shown as lines between the circles.

Neuron 1 is special: it receives pulses at a fixed rate determined by your host program's tempo, or Axon's internal timing source. We'll describe Axon's timing features in greater detail in a following section titled [Transport Controls](#); for now, just remember that neuron 1 always receives a steady stream of pulses regardless of any connections in the neuron sequencer. Neuron 1 is the origin of pulses within the neuron sequencer. If neuron 1 isn't connected to any other neurons, then no other neurons will receive (or send) pulses.

Each neuron has a *threshold* value. The neurons each have a counter to keep track of how many pulses they receive. When the number of received pulses exceeds the threshold value, the neuron fires and five things happen simultaneously:

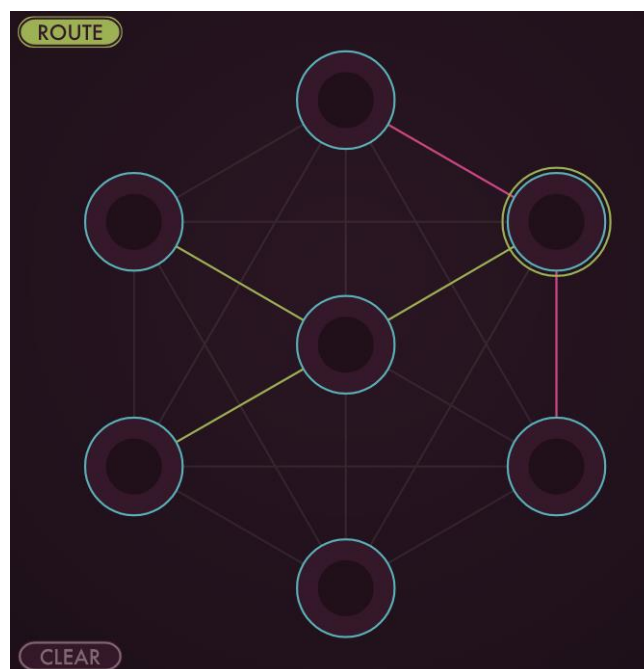
1. The neuron sends a pulse to any other neurons that are connected to it.
2. The neuron triggers its corresponding synthesizer voice, generating a sound.
3. A MIDI note message is transmitted by the plug-in to anything that might be connected to it, such as a software or hardware synthesizer.
4. The neuron, and its symbol at the bottom of the window, flashes briefly.
5. The neuron resets its pulse counter to zero.

A neuron's threshold has a value from zero to sixteen. If its threshold is zero, the neuron will fire every time it receives a pulse. If the threshold is one, it will fire every other time it receives a pulse; if the threshold is two, it will fire after it receives three pulses, and so on. The neuron's counter is displayed with a blue arc within the neuron, which fills as the counter increases with each incoming pulse.

Routing Mode

Axon's window has a special mode for making connections between neurons called *routing mode*. The button labeled **ROUTE** at the upper-right corner of the Neurons area let you switch between routing mode and play mode.

When routing mode is active, the connections between the currently selected neuron and other neurons are shown by red lines. Other connections are shown with green lines. In the following screenshot, Neuron 3 is the currently selected neuron. Neurons 2 and 4 are listening to neuron 3, and neuron 3 is listening to neuron 1. Neurons 6 and 7 could be listening to neuron 1, or vice-versa; you'd have to select neuron 1 to find out.



To make a connection from one neuron to another, first select a neuron by clicking its box in the row of neuron symbols at the bottom of the window. Then click on another neuron within the routing diagram to make it listen to the first neuron. A red line will be drawn between the neurons to indicate the connection.

To remove a connection, click the receiving neuron again; the red line disappears. You can remove all of the connections for all of the neurons by clicking the **CLEAR** button at the lower-left corner. (Use with caution!)

You can connect any neuron to any number of other neurons. The only restriction is that you cannot connect neurons such that the connections create a loop. Axon checks for loops as you make connections and will prevent you from forming loops.

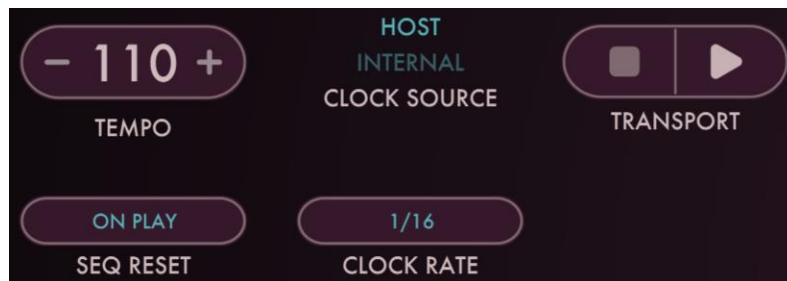
Creating patterns with Axon consists of finding combinations of connections and threshold values that produce interesting results. Keep in mind that while the results can be unpredictable, they are not random.

Transport Controls

The controls near the upper-left corner of Axon's window adjust Axon's timing and tempo parameters.

Tempo

The obloid labeled **TEMPO** sets Axon's current operating tempo. If Axon is using its internal timing source, change this control to make Axon play faster/slower. If Axon is following your host program's timing source, the **TEMPO** control is disconnected.



Clock Source

The text button to the left of the **TEMPO** control switches Axon between using your host program's timing information and its internal timing source to set its tempo. If the word **HOST** is illuminated, Axon follows your host's tempo and is synchronized to its transport. If the word **INTERNAL** is illuminated, Axon uses its own timing source to control its tempo, set with the **TEMPO** control. Click on either word to toggle back and forth between the two settings.

N.B.: The Tempo and Source settings are not stored in Axon's individual presets but are stored within your DAW's session files. Hence they do not change when you change presets.

Clock Rate

The **CLOCK RATE** control sets the metrical unit of the pulses that trigger Axon's central neuron 1. Setting the **CLOCK RATE** control to 1/8 will trigger neuron 1 every eighth note, setting it to 1/16 will trigger neuron 1 every sixteenth note, and setting it to 1/32 will trigger neuron 1 every thirty-second note.

Reset Options

The popup menu labeled **SEQ RESET** chooses one of several options for resetting the neuron sequencer, that is, setting all the neuron counters to the initial values set with the **OFFSET** control. There are several choices:

NEVER – the sequencer neurons cycle indefinitely, counting up to their independent threshold values and starting over. They may or may not ever simultaneously return to their initial values.

ON PLAY – the sequencer resets every time it starts playing, either by clicking the Transport button or under control of your DAW.

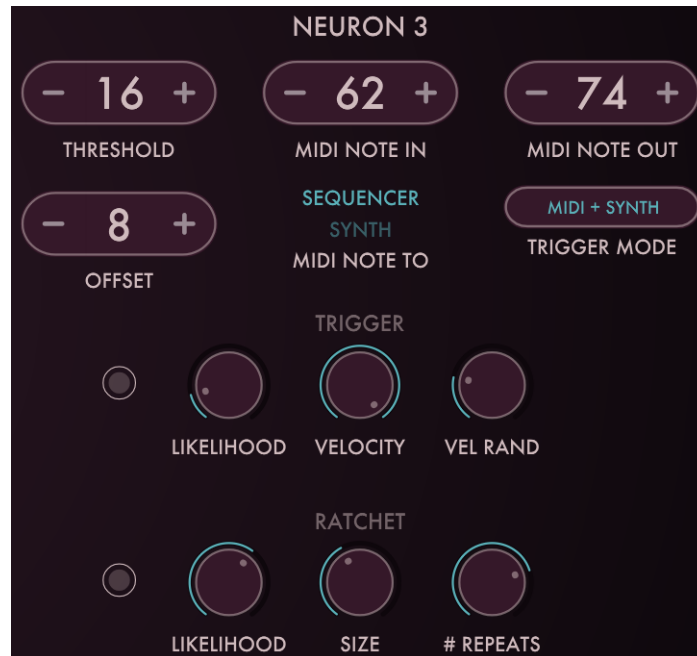
1 MEAS, 2 MEAS, etc. – the sequencer resets every time your host DAW's transport reaches the corresponding number of measures, i.e. every measure, every two measures, and so forth.

Transport

The triangular button to the right of the tempo control starts and stops Axon's internal timing source. Click it to start Axon playing, click it again to stop. If Axon's **SOURCE** control is set to Host the button has no effect and Axon plays and stops in sync with your host program's transport.

Neuron Controls

The neurons share a set of controls at the upper right of Axon's window. The controls apply to the currently selected neuron. The currently selected neuron is indicated at the top. Click a neuron within the network diagram, or one of the neuron symbols in the row at the bottom center of the window, to select a neuron.



Threshold

The **THRESHOLD** knob sets the threshold value of the neuron, as [described previously](#). The threshold value ranges from zero to sixteen. The neuron, upon receiving a pulse, emits a pulse of its own after receiving a number of pulses equal to the threshold.

After a neuron emits a pulse, its internal counter resets to zero. The **OFFSET** knob changes the initial value for that counter when Axon's sequencer is reset, such as when the host DAW starts playing. This changes the phase of the pulses relative to the start of the measures.

Example: Simple Basic Beat

We'll state up front that if you're looking to program simple, standard beats, Axon is probably not the best tool. However, we'll describe how to build a simple beat with the neuron sequencer because it's easy to describe the result and it illustrates the use of the Threshold and Offset parameters.

Suppose we want a kick drum on every quarter note, a snare or clap sound on every other quarter note, and a sixteenth-note hi hat. Since the smallest note value we need is a sixteenth, we'll set the **CLOCK RATE** control to 1/16. If we set neuron 1's Threshold and Offset controls to zero, neuron 1 will trigger on every sixteenth note. Assuming that neuron 1's synthesizer voice is generating a hi hat sound, we're done with our hi hat part.

We'll use neuron 2 for the kick. We connect neuron 1 to neuron 2 so that neuron 2 receives pulses from neuron 1. We want the kick on quarter notes, which means once for every four sixteenth-note pulses that 2 receives from 1. Setting neuron 2's Threshold to three does the trick; it will receive three pulses without doing anything and then trigger its synthesizer on the fourth. This means, though, that it will first trigger partway into each measure, and that's probably not what the kids like to dance to. Hence the Offset control: setting the Offset to 3 initializes the neuron's counter with three rather than zero. When the neuron receives the first pulse when the transport starts, its counter will advance to four, which exceeds its Threshold setting of three, and the neuron will fire its synth voice right on the beat as we desire. Program an appropriately thumpy sound on the second synth voice and we have our kick.

Using neuron 3 for the snare, we could use a similar approach as with the kick by connecting it also to neuron 1 and setting its Threshold to seven and its Offset to three. This would trigger the neuron every eight sixteenth notes—that is, every other quarter note—starting with the second quarter note. However, a more Axon-ish method is to connect neuron 3 to neuron 2. Neuron 3 will then receive quarter-note pulses every time neuron 2 fires. Then, setting neuron 3's Threshold to one and its Offset to zero will make it trigger on every other quarter, starting with the second. Give the third voice an appropriate backbeat sound and our basic beat is complete.

You can find this example among the factory presets, named Simple Beat Example. Compared to the other presets it's pretty boring, but it's a useful illustration and possibly a good starting point for more exotic rhythms. You might also find it handy when exploring the trigger-randomization and ratchet controls we'll describe in following sections.

MIDI Note In/Out

The obloids labeled **MIDI NOTE IN** and **MIDI NOTE OUT** choose which incoming MIDI note number will trigger the neuron, and which note number it will transmit when triggered. By default the note values start at 60 (middle C) for neuron 1 and go up sequentially to 66 for neuron 7, but you can set them to whatever suits your controller and/or target device.

The text switch labeled **MIDI NOTE TO** chooses one of two options for how incoming notes are handled. If it is set to **SEQUENCER**, MIDI notes trigger the neuron's pulse counter in the same manner as pulses from other neurons. If it is set to **SYNTH**, MIDI notes trigger the neuron's synthesizer voice directly. The **SEQUENCER** option is useful for driving Axon's sequencer in unusual ways; for instance, you can trigger it with irregularly spaced notes in a DAW track to impart a feel or groove which Axon otherwise lacks. Use the **SYNTH** option if you want to use Axon as a tone generator, bypassing its internal sequencer altogether.

The **TRIGGER MODE** popup menu determines what happens when the neuron's counter reaches the threshold value after receiving one or more pulses. If set to **SYNTH ONLY**, the neuron triggers its synthesizer. Conversely, if set to **MIDI ONLY**, the plugin transmits a MIDI note message. If you choose the **MIDI + SYNTH** option, both happen.

Trigger Controls

The knobs under the heading **TRIGGER** impart some variation to how the neuron responds to pulses and what it does when its internal pulse counter reaches its threshold. The **LIKELIHOOD** knob sets the probability that the neuron will trigger its synthesizer voice and/or send out a MIDI note message when triggered by its counter. Putting it another way, the **LIKELIHOOD** knob introduces some unpredictable variation in Axon by randomly omitting some notes.

If the knob is set to 100% the neuron will trigger every time its counter reaches its threshold. On the other hand, if it is set to zero, the neuron will never trigger. As you might expect, if it is set to 50% it will trigger about half of the time.

The **VELOCITY** knob sets the MIDI velocity value for MIDI note messages transmitted by the neuron. It also has some influence on the loudness of the sound generated by the neuron's synthesizer. The **VEL RAND** knob imparts random variation of the velocity; turning the knob up will increase how much the velocity varies from the setting of the **VELOCITY** knob.

The dot to left of the **LIKELIHOOD** knob blinks blue when the neuron is triggered.

Ratchet Controls

The Ratchet controls cause the neuron's synthesizer voice to play twice or more for each trigger, adding rhythmic accents or extra hits. In a manner similar to the **TRIGGER LIKELIHOOD** knob, the ratchet **LIKELIHOOD** knob sets the probability that the synthesizer will play more than once, and/or more than one MIDI note message will be sent, when the neuron triggers. At a setting of 0% there will be no extra hits, at 100% there will be extras on every trigger, and at 50% there will be extras about half the time.

The **SIZE** knob sets the interval or spacing of the repeated hits. Sizes are expressed as fractions or multiples of Axon's clock rate and range from 1/8 to 4. For example, if Axon's clock rate setting is 1/16 and the Size setting is 1/2, the voice will repeat hits at 1/32-note intervals.

The **# REPEATS** knob sets how many times the voice will repeat, from zero to eight. Zero means no extra hits, one means two hits per trigger (i.e. one extra), and so on. Notice that a combination of a high **SIZE** value and a larger number of repeats means that Axon will cheerfully play on for awhile after you stop the transport.

The dot to the left of the Likelihood knob blinks red on every repeated hit.

Voice Controls

The controls in the lower area of Axon's window control Axon's seven percussion synthesizers, which we call "voices" for short. Each voice is a small, monophonic synthesizer with two sound-generating sections: a pair of oscillators followed by a wave shaper, and a metallic noise source. The two signals from these sections are mixed together before passing through a filter; alternatively, you can route just the noise source through the filter. The seven voices share one set of controls. The current voice is selected and indicated in the same way as the current neuron: with the row of graphical buttons at the bottom center of the window and a green circle around one of the neurons in the network graph. Click on either the buttons or the network graph to select a voice.

The two oscillators are arranged such that one modulates (changes) the frequency of the other; hence the term *frequency modulation*, abbreviated FM. In the usual parlance, the two oscillators are referred to as the *modulator* and the *carrier*. The carrier generates the sound that you actually hear, and the modulator changes the timbre of the carrier by rapidly changing the carrier's frequency.



Each voice has several envelope generators for altering the oscillator frequency, the FM amount, and the loudness of the oscillator and the noise source. The first two have instant attack times and adjustable decay times; those that control loudness also have an adjustable attack time. Each envelope generator has a knob that sets how long the envelope lasts and has a range of 10msec to 2 seconds. Each also has a graphical Shape control that warps the shape of the envelope between a straight line and a concave or convex curve. Click and drag up and down on the drawing and you'll see how this control influences the shape of the envelope.

We'll explain all of the controls, starting with the oscillator controls on the left.

Oscillator

The **TUNE** knob sets the pitch that the voice plays. If the little keyboard button to the right of the knob is turned off (dimmed), the Tune knob's value is displayed in Hertz and can be set to any arbitrary value. Click on the keyboard button to quantize the Tune knob's setting to the nearest semitone. The knob's value will then be displayed as notes. Notes are indicated with the usual names of "A" through "G" followed by a single digit indicating the octave. C4 is middle C. Sharps are indicated by a # symbol following the note name¹.

The **WAVE** switch chooses one of two wave shapes for the oscillator: a simple sine wave and a brighter triangle wave. Click the wave drawings to choose between the two shapes. You may note that the triangle wave isn't very pointy-looking in the oscilloscope display. The triangle wave has limited bandwidth to reduce aliasing and hence is rounder than a simple triangular shape.

¹ The omission of flat symbols from this control is accidental.

OSC BEND

The Oscillator Bend envelope generator changes the pitch of the oscillator. The **AMOUNT** knob controls how much the pitch changes and is bidirectional. At its default, center setting the oscillator's pitch remains constant for the duration of the sound. Turning the knob clockwise makes the oscillator frequency start higher and bend downwards to its nominal pitch; turning it anti-clockwise makes the frequency start lower and bend upwards. An **OSC BEND** setting with a short decay can add a "blip" to the sound, making its beginning more noticeable. A longer decay phase can be particularly useful when using the voice to modulate other voices through the FM and Ring Mod busses (see below).

FM ENV

The Frequency Modulation envelope generator controls the loudness of the hidden modulator oscillator which modulates the frequency of the carrier oscillator. Its controls are simply a Decay knob and a Shape control, as described previously. Note that the FM amount is set with the **FM XY** control described below.

OSC AMP

The Oscillator Amplitude envelope generator, labeled **OSC AMP**, controls the overall loudness of the oscillator signal. In addition to the usual Decay and Shape controls, it has an **ATTACK** knob for softening the rise in loudness at the beginning of the note, with a range of zero to 25 msec.

KLIK

The Klik controls add a short click to the beginning of the note to produce a more distinct attack. The **TONE** knob adjusts the timbre of the click, and the **LEVEL** knob adjusts its loudness².

FM XY

The dotted region to the left of the oscilloscope labeled **FM** is a two-dimensional "XY" control that alters the frequency modulation parameters of the synthesizer voice.

Clicking and dragging in the **FM XY** control affects the oscillators in two ways. The horizontal position of the circle sets the ratio of the frequencies of the two oscillators, and the vertical position of the circle determines how much the modulator modulates the carrier. In general terms, moving the circle left and right changes the character or timbre of the sound, and moving it up and down changes its brightness.

If the circle is at the bottom edge of the grid, the modulating oscillator is effectively disconnected, and you'll hear only a simple, static wave from the oscillator. As you move the circle upwards the amount of modulation increases, and the sound becomes brighter. Try moving the circle up just slightly from its lowest position and then moving it left and right to hear how changing the position of the circle affects the sound.



Timbre XY

The dotted region labeled **TIMBRE** is another two-dimensional control which affects the oscillator's tone. The **TIMBRE** control adjusts a pair of mathematical functions which change the shape of the sound wave that is generated by the oscillator. In other words, the sound changes in two different ways as you move the circle horizontally and vertically.

² Why the funny spelling? It's a nod to a pioneering electronic music band from Germany whom you've probably heard of.

If the circle is at the lower-left corner of the grid, the **TIMBRE** control has no effect on the sound. As you move the circle either to the right or upwards, you'll hear the sound change. Moving the circle to the right shapes the oscillator wave to produce tones reminiscent of a resonant filter. Moving the circle vertically applies digital distortion based on bit-reduction or bit-crushing.

Modulation Busses

The voice controls described so far affect Axon's voices individually. Changing the pitch control of voice 2, for example, has no effect on voice 3 or any of the other voices. The knobs labeled **FM BUSS** and **AM BUSS** allow Axon's voices to affect *each other*, altering each other's timbres in rhythmic and sometimes unpredictable ways.

Axon contains a pair of internal busses similar to the effects-send busses in a mixing console. Each voice can send a variable amount of its output to each of these busses. The two busses independently add together (or sum) the signals from each voice. Each voice can also receive a variable amount of the summed signals from the busses.

The voices send their signals to both busses in the same manner: two knobs control how much of the voice's output is added to the buss. The voices receive signals from the busses in two different ways. The FM buss, short for Frequency Modulation, changes the timbre of a voice by modulating the frequency of the carrier oscillator in the same manner as the modulator oscillator. The AM buss, short for Amplitude Modulation, essentially turns the oscillator on and off at a rate equal to the frequency of the signal on the bus. This creates an effect similar to the ring modulators found on analog synthesizers.

It is perhaps self-evident that the effect of both busses is easier to hear than it is to describe. The most important point to remember as you experiment is that the voices are modulating each other. There are no internal oscillators that generate the signals for FM and Ring busses. If no active voices have their **FM BUSS OUT** or **AM BUSS OUT** knobs positioned above their minimum values, there will be no signals sent to the busses and you won't hear any effect as you move the **FM BUSS IN** and **AM BUSS IN** knobs.

FM Buss In/Out

The **FM BUSS OUT** knob sets how much of the voice's output is added to the FM bus. Turning the knob up increases the amount that the voice's signal contributes to the FM bus.

The **FM IN** knob sets how much the FM buss signal modulates the voice's carrier oscillator—that is, how much it changes the oscillator's timbre by frequency modulation. If the knob is turned down to 0% the FM buss has no effect on the voice.

AM Buss In/Out

The **AM SEND** knob sets how much of the voice's output is added to the AM bus. Turning the knob up increases the amount that the voice's signal contributes to the AM bus.

The **AM RECEIVE** knob controls how much you'll hear the Ring bus change the timbre of the voice. It essentially acts as a level control. If the **AM RECEIVE** knob is at zero, you'll hear the voice unaltered by the AM bus. As you turn the knob up, you'll hear an increasing amount of the voice's output modulated by the AM bus signal.

Noise

Axon's voice has a quasi-pitched, metallic-sounding signal source modeled on the core circuit of the cymbal sounds in Roland's TR-606 and -808 drum machines, blended with a white-noise generator. Under the Noise heading, the **PITCH** knob controls the frequency of the oscillators in the metallic signal, varying them by up to an octave either sharp or flat.



The **MIX** knob blends the metallic signal with the white-noise source. With a setting of 0%, you hear only the metallic sound; with a setting of 100%, you hear just the noise. In-between settings give you a blend of both.

The mixed noise signals are shaped by an amplitude envelope generator, identical to the oscillator's envelope generator. As described above, it has an **Attack** knob for softening the rise in loudness at the beginning of the note the usual **DECAY** and **SHAPE** controls.

There is also a slider labeled **MIX** beneath the oscilloscope display. This slider changes the blend between the oscillator's signal and the noise signal. Move the slider all the way to the left and you'll hear only the oscillator; move it to the right and you'll hear only the noise. Put it at the center and you'll hear both. A small amount of noise is useful for adding a little bit of grit to the sound; a large amount of noise is useful for synthesizing snares, cymbals, and other percussion instruments.

Filter

A multi-mode filter follows the mixed noise source. The **FREQ** or frequency knob changes where, in the range of audible sound frequencies, the filter takes effect. Changing the frequency setting makes the sound brighter or darker, or fuller or thinner, depending on the filter's type or shape.

The resonance control, labeled **RES**, when turned up causes the filter to emphasize frequencies near its frequency setting. In plainer terms, if you turn up the resonance knob, the filter sounds more "synthy". (Try it—you'll hear what we mean.)

The **TYPE** popup menu chooses one of three filter-frequency modes: low pass, band pass, and high pass, abbreviated **LP**, **BP**, and **HP**. The low pass mode attenuates high frequencies, allowing low frequencies to pass through. The high pass mode does the opposite. The band pass mode attenuates low and high frequencies, passing frequencies in the middle of the frequency range.

The filter's frequency can change as the note plays; that is, it can be modulated. The **MOD SRC** popup menu chooses one of three sources for the modulating signal: the noise generator's amplitude envelope generator, the oscillator's pitch-bend envelope generator, or the oscillator's audio signal. The **MOD AMT** knob sets how much the modulation source changes the filter's frequency. This knob is bidirectional; at its center position, the modulation source does not affect the filter. Turn the knob clockwise and the modulation source will increase the filter's frequency; turn it anti-clockwise and the modulation will decrease the filter's frequency.

The text switch on the left labeled **FILTER** chooses whether only the noise sources, or the noise sources and the oscillator, pass through the filter. Click the text to toggle back and forth between the two options.

Output Controls

At the lower right of Axon's window are controls for the current voice's output level and stereo position. These controls duplicate those found on the Mixer & FX panel and are present on the Synthesizer panel for convenience while altering a voice's timbre.



The **LEVEL** knob sets the loudness of the voice's signal. Much of the time you'll probably leave it turned all the way up, but you can turn it down a bit to balance the voice against the others. It's also ripe for automation within your host DAW, enabling you to bring individual parts in and out of your mix.

For further control over your mix, you can route Axon's voices to separate outputs. Axon has four separate stereo output busses, designated **MAIN** and **AUX 1-3**. By default the voices all emit on the main buss; you can direct a voice's output to the other busses with the **OUTPUT** popup menu. If necessary, consult your host DAW's documentation for how to use plugins with multiple outputs. This varies quite a bit between DAWs; in some cases you have to explicitly enable the additional outputs for a plugin.

The **PAN** knob varies the left-to-right position, or panning, of the voice. Turn it to the left or right from center and the voice's sound will appear to move in the corresponding direction between your speakers or headphones.

The **FX SEND** knob directs some or all of the voice's sound to the delay effect show on the Mixer & FX panel. If you leave all of the **FX SEND** knobs at their zero position, you won't hear the delay at all because it's not receiving any sound at its input. Turning up the knob sends the voice's sound to the delay.

Turning on the **SOLO** switch silences the other voices, letting you focus your attention on the current voice. Conversely, turning on the **MUTE** switch silences the current voice.

Copy/Paste Voice

The **COPY** and **PASTE** text buttons let you copy all of the settings from one voice and apply them to another voice. Click the **COPY** button and all of the values of the current voice's controls are stored within Axon. Switch to a different voice, click the **PASTE** button, and those stored values will be applied to the voice. This lets you easily set up two or more of Axon's voices to create the same, or similar, sounds. If you want all of the voices to make the same sound, click the **COPY TO ALL** text button and the settings of the current voice will be applied to all other voices.

The voice copy/paste mechanism does not affect the voice's mixer settings, nor does it work between separate instances of Axon. If you need to move voice settings between two instances, use the Copy and Paste commands present in the preset manager, [described later on](#).

Pitch Quantizer

If you use Axon for generating melodic material, you'll find the controls under the **PITCH QUANTIZER** header useful. The pitch quantizer makes the notes played by Axon's voices conform to a chosen scale and key.

The **ROOT NOTE** obloid sets the tonic, that is, the central or most important note of the scale. Usually you'll set this parameter to the note corresponding to tonal center of the music you're working on, since this will probably produce the most useful results if you transpose the pattern.



The **SCALE** popup menu chooses the set of semitones, out of the twelve which make up an octave, which define the intervals present in the key. We use the term "scale" to include both that general notion as well as the more specific term *mode*; looking at the menu, you'll find entries which are usually referred to as modes. If you want to see the exact patterns of notes within each scale, refer to this article at Wikipedia:

https://en.wikipedia.org/wiki/List_of_musical_scales_and_modes. All of Axon's scales were created from the descriptions in that article. In practice, though, just flip through the different scales until you find something which pleases your ear.

The **TRANPOSE** obloid adds or subtracts semitones to/from the pitch of the voices. It has a range of +/-24, or four octaves. The **TRANPOSE** control won't move notes that Axon plays outside of the key you choose with the **ROOT NOTE** and **SCALE** controls. For instance, the Whole Tone scale is made up entirely of whole steps, i.e., intervals of two semitones. Changing the **TRANPOSE** control by one may not change the notes that Axon plays at all if the voice pitches are already set to notes within this scale. The scale quantizer works by rounding, though, so it's possible that a voice's pitch will move to a different whole tone when the transpose control changes by a semitone.

You may be wondering about the relationship between the **TRANPOSE** and the **ROOT NOTE** controls. One way to think about it is this: the root note, together with the scale, determines the series of intervals as you play upwards from the tonic note. A Major scale, to pick an easy example, has a series of two whole steps, a half step, three more whole steps, and one half step. The key of C Major starts with C and uses that series, playing the notes C, D, E, F, G, A, B. If you set the Root Note to C and the Scale to C Major, Axon will always play those notes, regardless of the **TRANPOSE** setting. If you change the root note to D, the same series of intervals will be used and your pattern will play the notes D, E, F#, G, A, B, C#, regardless of how it is transposed. The root note, together with the scale, determines a set of which notes will be played. The Transpose control moves your notes up or down within that set.

It's important to note that the pitch quantizer is non-destructive in the sense that it doesn't change the setting of each voice's **OSCILLATOR TUNE** control directly. You can freely change the **ROOT NOTE**, **SCALE**, and **TRANSPOSE** controls without losing your starting point. Changing the scale and transpose back to their default settings of Chromatic and zero effectively turns off the **SCALE** control since the Chromatic scale contains all notes in the octave.

The Pitch Quantizer controls also affect the MIDI notes which Axon transmits. We describe MIDI transmission later under [Sending MIDI Notes](#).

Randomizer

The round buttons beneath the heading Randomizer, when clicked, set different groups of parameters to random settings. The names of the buttons are largely self-explanatory, but there are a couple of subtleties worth mentioning:

NETWORK – deletes all the connections between neurons and then makes about a third of all possible connections between neurons, chosen at random.

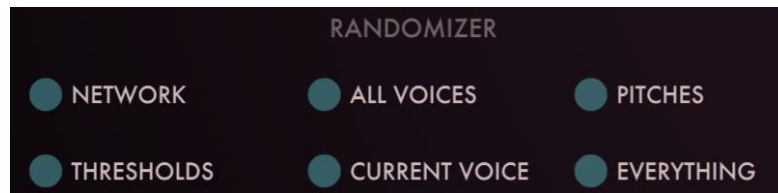
THRESHOLDS – sets the Threshold parameter of each voice to a random value.

ALL VOICES – sets the sound-generation parameters of all the voices to random values. Does not affect the sequencer, MIDI, or mixer parameters.

CURRENT VOICE – same as **ALL VOICES** but affects only the currently selected voice.

PITCHES – sets the **OSCILLATOR TUNE** parameter of all voices to a random value, constrained to within an octave above or below the current tune value.

EVERYTHING – same as clicking all the other randomizer buttons. Does not affect the sequencer, MIDI, or mixer parameters.



Aside from the **PITCHES** randomizer, there are no particular constraints placed on the randomizations, and there's no guarantee that the results will be either useful or interesting.

Beware! In some cases, you (or rather your host program) won't be able to undo the effect of clicking the randomization buttons. It's prudent to make sure that you've saved Axon's state in a preset if you want to get back to where you started before randomizing.

Mixer Controls

The **MIXER** controls (screenshot on the next page) fill the lower-left corner of Axon's window when the **MIXER & FX** panel is active. Each of Axon's seven synthesizer voices has its own set of mixer controls. Looking from top to bottom, the controls consist of:

Pan Knob

This knob moves the voice's sound between the left and right channels of Axon's output and thus sets its position in the stereo field. The pan knob works on both the main output buss and the three auxiliary busses.

FX Send Knob

This knob sends some or all of the voice's sound to Axon's delay. If all the **FX SEND** knobs are turned fully anti-clockwise you won't hear delay effects since the delay won't receive any signal.



Output Buss Menu

Beneath the FX SEND knob is a popup menu for choosing which output buss carries the voice's signal. There are four busses designated MAIN and AUX 1-3 (short for Auxiliary). By default all voices go through the main buss. If you need to process one or more of the voices individually, set its popup menu to one of the auxiliary busses. The main buss should be readily visible in your DAW when you insert Axon; the auxiliary busses may not be revealed unless you ask for them explicitly. If you can't find them readily, consult your DAW's documentation, looking for information about plugins with multiple outputs. Sometimes the necessary operation is a bit obscure; for instance, in Bitwig Studio, you select the command "Reveal Hidden Chains" from the plugin's Device Panel context menu.

Mute and Solo buttons

The mute and solo buttons, labeled M and S, selectively silence Axon's voices. Clicking a voice's mute button silences the voice. Clicking a voice's solo button silences all of the other voices. Soling is not exclusive; if you solo a second voice, you'll hear both the first and the second, and you'll continue to hear only the second if you then disengage the first voice's solo button. The mute button has priority over the solo button.

Level Knob

The knobs at the bottom set the output level or loudness of the individual voices. They have a maximum gain of unity or 0dB; in other words, they can reduce a voice's overall level but not increase it.

Activity Indicators

The symbols below the Level knobs represent the neuron network, with a white dot indicating the neuron's voice is affected by the mixer controls above. The symbols flash blue when their corresponding neuron triggers.

Output Knobs

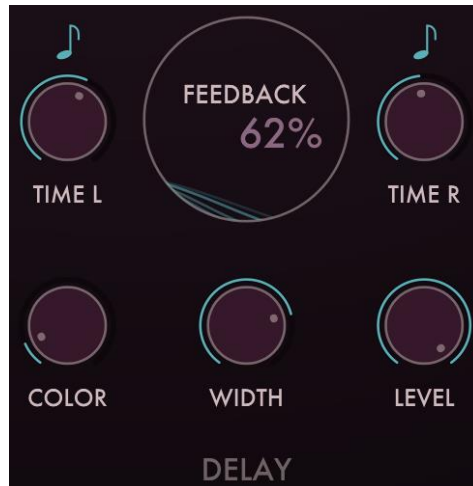
The four knobs at the far right of the MIXER & FX panel adjust the loudness of each of the four output busses. Turning these knobs adjusts the level of the signals of all of the voices assigned to the corresponding buss. The knobs have a maximum gain of +6dB so you can use them to boost the level of quiet voices.

Effects

Axon has two built-in effects processors, both essential for contemporary drum and percussion tracks: a delay and a compressor.

Delay

The controls for the delays and filter reside in the lower center of Axon's window. Axon has two delays, one for each channel of the stereo output, each with a filter for adjusting the tone of the delay signals.



The **TIME L** and **TIME R** controls change the amount that signals are delayed in relation to the original (dry) signal. Each delay has a range of zero to two seconds.

The delay controls operate either in units of time or in metrical units, that is, fractions of a beat. Click on the little note symbols above the **TIME** knobs to switch the respective delays between the two modes.

If the note symbol is illuminated, Axon uses the current tempo reported by your host to calculate its delay time. In this mode the delay time control sets the delay length in metrical units. The range of values is $1/32^{\text{nd}}$ to $2/1$ (two measures), with dotted and triplet times available. Triplet values are denoted with a "T" after the beat fraction, and dotted values are denoted with a "D". For example, "1/8 D" indicates a delay time with a dotted eighth note feel. Axon will track tempo changes, saving you from having to adjust its delay time by hand when you change the tempo of your song.

Dragging up and down on the **FEEDBACK** control located between the two **TIME** knobs varies the feedback level of the delays. As you drag the dot upwards more of the delayed signal will be fed back into the delays, creating more repeats.

Axon has low-pass and high-pass filters which come after the delays. These filters can be adjusted to alter the timbre of the delayed signal. The filters are controlled in tandem with the **COLOR** and **WIDTH** knobs. Since the filter controls change the low- and high-pass filters simultaneously the filters act like a band-pass filter with a variable width. The **COLOR** knob changes the corner frequencies of both filters. Turning it anti-clockwise moves the filter frequencies downwards, making the delayed signal darker; turning it clockwise moves the frequencies upwards, making the delayed sound brighter.

The **WIDTH** knob to the right sets the separation of the low- and high-pass filters. Turning the **WIDTH** knob up moves the filters farther apart. If you make the filter separation small enough you may not hear any of the delayed signal at all.

The **LEVEL** knob sets the level of the delayed/filtered signal as it is mixed into Axon's output. Turning it up increases the level of the signal. If you turn it all the way up the delayed signal will be about as loud as the original signals (although the filters may attenuate the signal, depending on their settings).

Note that the delayed/filtered signal is sent only to Axon's stereo output channels, and not to the auxiliary output busses.

Compressor

Since drum sounds love compressors, we've added a compressor to Axon's stereo output bus. This compressor's heart comes straight out of our wildly popular Rough Rider compressor plugin.



The **SENSITIVITY** control sets the level at which the compressor starts to engage or reduce the gain of the signal. Any signal level that exceeds the threshold will be compressed according to the ratio setting. The value displayed is in decibels relative to a full-scale signal, so *lower* values mean that the compressor is more likely to affect the signal. Drag vertically on the Sensitivity control to change the value.

The **RATIO** knob determines how much gain reduction is applied to the signal once it crosses the threshold set by the **SENSITIVITY** control. The value expresses the ratio between the signals before and after gain reduction. For example, a 4:1 ratio means that if the input signal is 4 dB over the threshold, the output signal will be 1 dB over the threshold. The ratio knob has a range of 1:1 (no compression) to 1000:1 (very dramatic compression).

The **ATTACK** knob dictates how quickly the compressor starts to work after the signal has surpassed the threshold. A fast attack time means the compressor reacts quickly, flattening out sharp transients. A slower attack time preserves the sharp initial transient of the sound while leveling the following body of the sound. The Attack knob has a range of zero to 100 msec.

The **RELEASE** control sets how quickly the compressor stops compressing after the signal falls below the threshold. Adjusting the release knob can provide smooth compression without abrupt changes or stranger gain-changing and pumping effects. Let your ear be your guide. The Release knob has a range of 10 msec to one second.

The **MAKEUP** knob allows you to boost the output to compensate for the gain reduction caused by the compression. It has a range of zero to 30 decibels.

Finally, clicking the switch at the lower center of the compressor's panel turns the compressor on and off entirely.

The compressor, like the delay, affects only Axon's stereo output channels, and not to the auxiliary output busses. The compressor is placed after the delay in the signal path.

MIDI In and Out

Axon both sends and responds to MIDI note on/off messages. You can use Axon as a software percussion synthesizer without using its Neuron Sequencer, and you can use its Neuron Sequencer to control other synthesizers.

Receiving MIDI Notes

The MIDI NOTE IN obloid near the top-right corner of Axon's window determines which MIDI note number the neuron will recognize. MIDI note number 60 corresponds to middle C or C4 on a keyboard.

The MIDI NOTE TO control beneath that obloid has two settings: **SEQUENCER** and **SYNTH**. If it's set to Sequencer, incoming notes will send trigger pulses to the neuron's pulse counter. If it's set to Synth, notes trigger the neuron's synthesizer voice directly. Use the **SEQUENCER** setting to drive Axon's sequencer independently of your DAW's transport timing information or Axon's internal clock to create unusual timings or a less rigid feel. Use the **SYNTH** setting if you want to use Axon's voices independently of its sequencer, i.e., as a seven-voice percussion synthesizer. Click on the control to toggle it between the two settings.

Sending MIDI Notes

The VST3 version of Axon transmits a MIDI note message every time a voice is triggered. Use the MIDI NOTE OUT obloid to set MIDI note's pitch for each voice. The **VELOCITY** knob below the **TRIGGER** heading sets the velocity value of the transmitted note. The [Pitch Quantizer](#) controls affect the transmitted note.

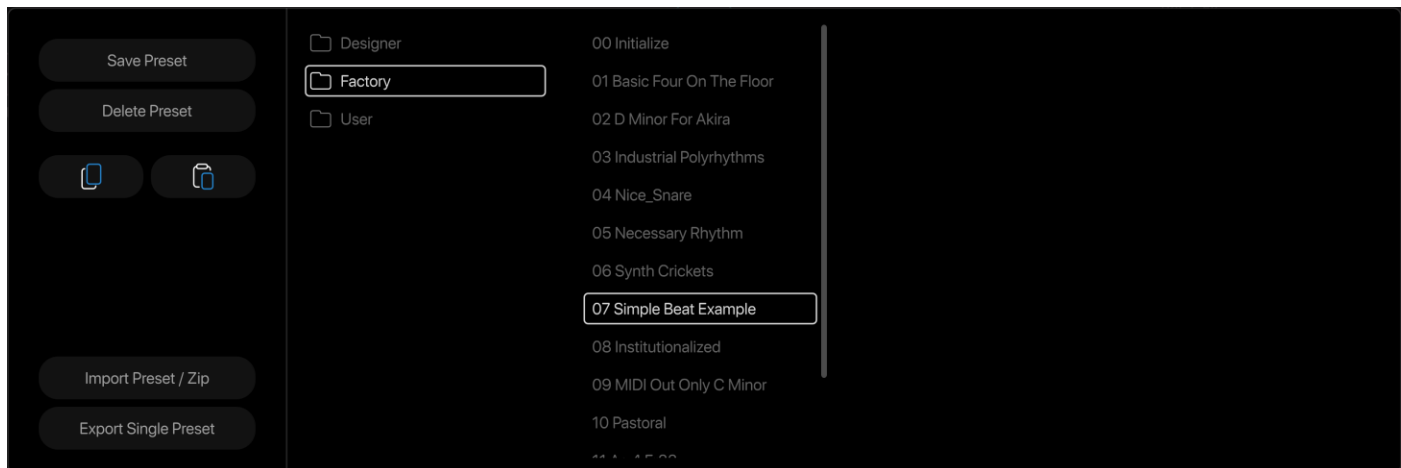
The **TRIGGER MODE** popup menu has three choices which let you choose whether the neuron triggers its internal synthesizer, sends MIDI notes, or both.

Automation

Almost all of Axon's parameters can be automated using your host's automation features. Consult your host's documentation for information on how to use these features.

Presets

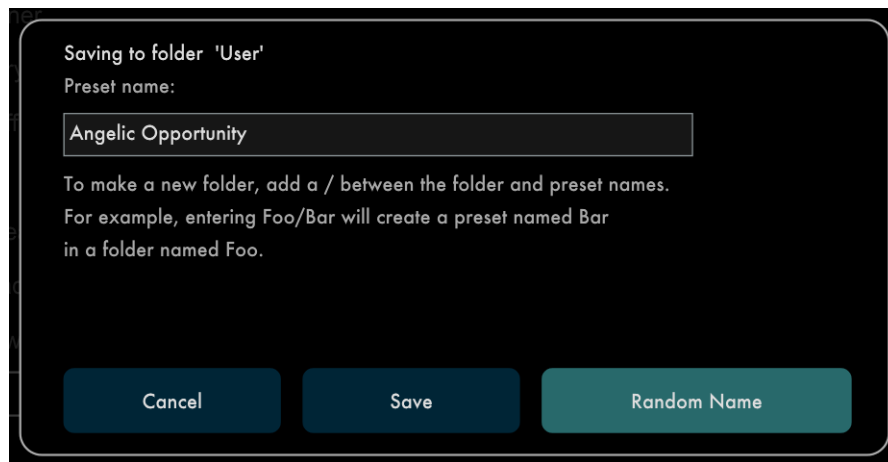
Axon includes a number of presets to serve as a demonstration of its capabilities and inspirations for your own creations. To access the presets, click the name of the current preset at the top of the window to open the preset browser. Click the name again to dismiss the preset browser.



The browser displays presets and folders in scrollable lists, arranged in columns. The leftmost list shows the presets and folders within Axon's preset collection. Clicking any of these folders reveals its contents in the next list. These folders can contain sub-folders of their own. Clicking on a preset name loads the settings into Axon. Double-clicking a preset name loads the preset and dismisses the preset browser.

The folders and presets in the browser correspond to folders and files within Axon's own folder on your storage device (i.e. your computer's hard drive or SSD). This folder is located at `C:\ProgramData\Audio Damage\Axon3\` on Windows, and `~/Music/Audio Damage/Axon3/` on macOS. You can store your presets anywhere you like but, to avoid possible collisions during future updates, do not store your presets within the Factory or Designer folders.

Loading a preset irretrievably erases Axon's current settings, so if you have created a sound that you want to use again, save it as a new preset before loading another preset. To save your own presets, click the **SAVE PRESET** button at the left edge of the window. This invokes a dialog box with a couple of helpful features. As the text therein describes, you can create a folder within the destination folder (whose name is given at the top of the dialog box) by adding the folder's name to the beginning of the preset's name, separated by a slash mark. The browser displays four columns so you can nest up to three levels of folders within the Presets folder; that is, two levels of folders within the User folder.



Clicking the **RANDOM NAME** button replaces the preset's name with a pair of words chosen at random from two lists. While the resulting names won't have any connection with what the plugin is doing, you may find this feature useful for coming up with alternatives to routine names like "My Preset 12".

You can delete presets from the lists by clicking their name and then clicking the **DELETE PRESET** button. Axon will give you a chance to confirm this action or cancel it. If you confirm, the preset/folder will be removed from your storage system and is gone for good.

Importing and Exporting Presets

Preset files are plain-text XML files so that you can exchange them online in forums, copy them between a Windows computer and a Macintosh, email them to your friends, etc.

The two buttons with icons representing copying and pasting (copy on the left, paste on the right) copy Axon's current settings to the system clipboard and paste settings from the clipboard. You can use the copy and paste commands to transfer settings between two instances of Axon or paste the settings into an email message or text editor. When copied to the clipboard, presets are presented in the same XML text as used in preset files.

The **IMPORT PRESET / ZIP** button provides a way to add presets to Axon without manually moving them into the appropriate folders in your file system. Clicking this button produces a file-browser window wherein you can select either a single preset file or a .zip file containing one or more presets. After you select the file, Axon copies the preset(s) into whichever folder you have selected in Axon's preset list, unzipping the file first if necessary.

Depending on whether you've selected a preset or folder, the **EXPORT SINGLE PRESET** or **EXPORT FOLDER AS ZIP** button performs the complementary functions of the **IMPORT** button. First select either a preset or a folder in Axon's list, then click the export button. A file-save window appears; choose a location in your file system, give the file a name, and click Save. If you have chosen a folder in Axon's preset list, the plugin places it and all of the presets it contains in a .zip file.

Default Preset

If you save a preset with the special name "Default" in the User folder, new instances of Axon will load it automatically when you add it to your DAW session. You can use a default preset file to give you the same starting point with Axon whenever you use it. Axon's installer creates a default preset file for you but feel free to replace it with your own.

And Finally...

Thanks again for purchasing Axon. We make every effort to ensure your satisfaction with our products, and want you to be happy with your purchase. Please write to support@audiodamage.com if you have any questions or comments.

Document Revisions

- 23 February 2024: Initial release
- 4 March 2024: Corrected routing example text and illustration which was embarrassingly wrong.