Axon User's Guide
Audio Damage, Inc.
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Introduction

Axon introduces an Audio Damage original: the Neuron Sequencer. A radical departure from traditional x0x- or MPD-style sequencers, the Neuron Sequencer generates rhythms and melodies with a network of interconnected nodes called neurons. Each neuron has a flexible but simple to use FM-based synthesizer capable of generating electronic percussion sounds and metallic tones. Axon includes an internal mixer for setting the relative levels and stereo positions of these seven synthesizers. The mixer also feeds a stereo delay and a pair of filters, both drawn from Audio Damage's highly regarded effects plug-ins. Axon's neurons also transmit MIDI note messages so you can use Axon to drive your favorite hardware or software synthesizers, sample players, etc. Axon can receive MIDI note messages and be used as a software synthesizer without using its internal sequencer.

If You Don't Like To Read Manuals

We understand. You just got a shiny new plug-in and you'd really rather play with it than read some dull exposition about it. 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 and lines 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 2.0

Version 2.0 improves Axon in many ways:

- The percussion synthesizers sport new Noise and Distortion controls, providing a much wider tonal palette.
- The maximum counter threshold for each neuron has been increased from six to sixteen, expanding the number and variety of possible patterns. As a result, Axon has 100% fewer hexagons and its Neuron Sequencer controls have been reworked slightly.
- MIDI operation has been streamlined by assigning notes to Axon's neurons in the convention of most drum machines and software drum synths.
- The user interface is resizable and appropriate to contemporary display technologies.
- Axon is now compatible with VST 3 and AAX hosts.
- Presets use a cross-platform XML-based file format.
- Axon is built with up-to-date code libraries for better host compatibility and future-proofing.

Axon version 2 has a different name and internal identifier than version 1. This means that you can install version 2 alongside whatever version you are currently using, and continue to use the older version in your existing projects. Version 2 cannot be directly substituted in existing projects and cannot read preset files created by version 1.

Also, direct MIDI control assignment has been removed. Host DAWs have progressed considerably since Axon's last major revision and it's now appropriate to leave MIDI mapping up to them.

System Requirements

Axon is provided as 32- and 64-bit VST2 and VST3, and 64-bit AAX plug-ins for Windows. On OSX, Axon is provided as Universal Binary Audio Unit, VST2, VST3 and AAX plug-ins.

Axon is a plug-in, not a standalone application. To use it, you'll need a host application such as Ableton Live, Steinberg Cubase, Apple Logic, Avid ProTools, etc[1]. Obviously you'll also need a computer capable of running one of these applications. We assume that you are familiar with using plug-ins with your particular host. If you have general questions about using plug-ins with your host, please refer to its documentation.

We support the use of Axon under Microsoft Windows 8 or newer, and Apple OS X version 10.8 or newer.

Installation

To install Axon, double-click the Axon Installer icon, and follow the instructions. You can choose which plug-in formats to install and, for some formats, the plug-in destination folder.

To un-install from OS X, simply delete the plug-in from your VST folder, which is usually located at `/Library/Audio/Plug-Ins/VST/Audio Damage`, and your Audio Units folder, which is located at `/Library/Audio/Plug-Ins/Components/`. To un-install from Windows, delete the file named `Axon 2.dll` from your VST folder(s). The presets are stored in separate files which you can also delete, although they occupy very little space. On OS X, they're in `/Library/Application Support/Audio Damage` . On Windows, they're in the hidden folder `C:/Program Data/Audio Damage/` .

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[1] Product names are copyrighted by their respective owners.

Operation

The following screen shot shows Axon's user interface. The controls are described in the following paragraphs.
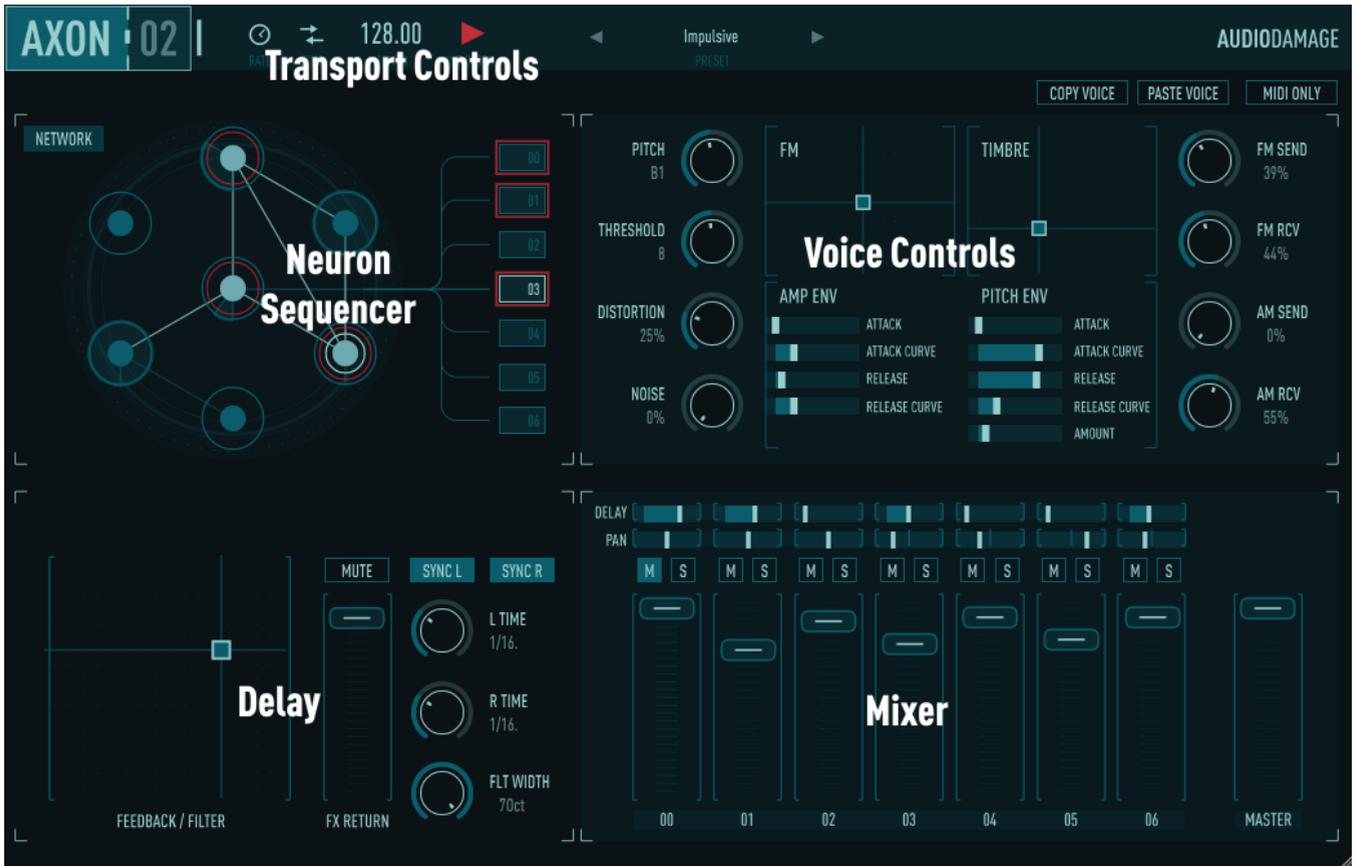
1. Neuron Sequencer

Axon employs a unique new 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 left of Axon's window, depicted as solid circles with outlines.

The neurons are numbered from zero to six. The neuron at the center is Neuron 0. Neuron 1 is directly above Neuron 0, and the remaining neurons are numbered in a clockwise fashion. The column of numbered boxes to the right lets you select any one of the neurons by simply clicking the appropriate box. An extra circle appears in the selected neuron. Neuron 3 is selected in the accompanying 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

Neuron 0 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 0 always receives a steady stream of pulses regardless of any connections in the neuron sequencer. Neuron 0 is the origin of pulses within the neuron sequencer. If Neuron 0 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 connections, if any, flash 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.

Use the knob labeled **THRESHOLD** near the top center of Axon's window to change the threshold of the selected neuron. The threshold's value is displayed next to the knob. The neuron's counter is displayed with a shaded arc within the neuron, which fills as the counter increases with each incoming pulse. The counter of the neuron shown to the right has reached about 2/3rds of the neuron's threshold.

Network Mode

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

When network mode is active, the connections between the currently selected neuron and other neurons are shown by red lines. Other connections are shown with blue lines.

In the adjacent screenshot, Neuron 2 is the currently selected neuron. Neurons 1 and 3 are listening to neuron 2, and neuron 2 is listening to neuron 0. Neurons 5 and 6 are also listening to neuron 0, and neuron 3 is listening to both neurons 2 and 5.

To make a connection from one neuron to another, first select a neuron by clicking it or its box in the column on the right (as usual). Then click on another neuron 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 ALL** button at the lower-left corner. (Use with caution!)
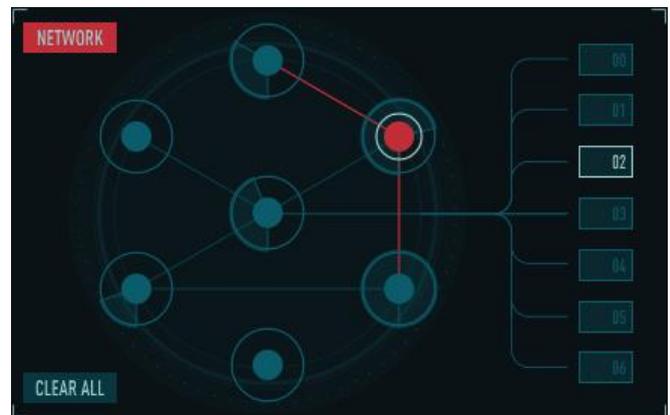
You can connect any neuron to any number of other neurons. The only restriction is that you cannot connect neurons such that the connections create a loop. Axon checks for loops as you make connections and will prevent you from forming loops.

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.

2. Voice Controls

The controls in the upper-right area of Axon's window control Axon's seven percussion synthesizers, which we call "voices" for short. Each voice is a simple but flexible synthesizer based on a pair of oscillators followed by a wave shaper. The seven voices share the controls; the current voice is selected and indicated in the same way as the current neuron: with the stack of rectangles and a light circle in one of the neurons.

Pitch

The **PITCH** knob sets the note that the voice plays. 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 name[2]. Click and drag up/down to change the pitch of the voice.

Threshold

The **THRESHOLD** knob controls the threshold value of the voice's neuron. The threshold value ranges from zero to sixteen.

Distortion

The **DISTORTION** knob makes the voice louder and brighter by imparting a variable amount of overdrive-like distortion.

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[2] The omission of flat symbols from this control is accidental.

Noise

The **NOISE** knob blends the voice's oscillators with a white noise source. With a setting of 0%, you hear only the oscillators; with a setting of 100%, you hear just the noise. In-between settings give you a blend of 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.

Amplitude Envelope Generator

The amplitude envelope generator, labeled **AMP ENV**, controls the overall "shape" of the sound—that is, its loudness over the duration of the note. Since Axon's voices are intended for creating percussive sounds, the **AMP ENV** is fairly simple. It has a brief attack phase in which it jumps from silence to a peak, followed by a release phase in which it fades back to silence. You can control the duration of both phases as well as their curvature.

Drag the **ATTACK** and **RELEASE** sliders to the right to increase the attack and release times respectively. The **ATTACK CURVE** and **RELEASE CURVE** sliders vary the shape of the envelope from concave on the left to convex on the right, and linear in the center.

Pitch Envelope Generator

The pitch envelope generator, labeled **PITCH EG**, is similar to the **AMP EG** but affects the frequency or pitch of the sound. It has the same characteristics and controls as the amplifier envelope generator—an attack phase followed by a release phase—but you can also vary its impact on the sound with the **AMOUNT** slider.

The position of the **AMOUNT** slider determines how much the sound changes in frequency. If the slider is at its leftmost position, the sound will have the same pitch for its entire duration. As you move the slider to the right you'll hear the sound's pitch bend. A **PITCH EG** setting with an instantaneous attack and 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 XY

The grid labeled **FM** is a two-dimensional "XY" control that alters the frequency modulation parameters of the synthesizer voice. Axon's voice consists of two audio-frequency oscillators, one modulating (changing) the frequency of the other. 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 its frequency.

Moving the small square 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 square is at the bottom edge of the grid, the modulating oscillator is effectively disconnected and you'll hear only a simple sine wave (i.e., a pure tone, and a fairly dull-sounding one at that). As you move the circle upwards the amount of modulation increase and the sound becomes brighter. Try moving the square up just slightly from its lowest position and then moving it left and right to hear how changing the position of the square affects the sound.

Timbre XY

The grid labeled **TIMBRE** is another two-dimensional control which affects the voice'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 timbre changes in two different ways as you move the square horizontally and vertically.

If the square is at the lower-left corner of the grid, the **TIMBRE** control has no effect on the sound. As you move the square either to the right or upwards, you'll hear the sound change in character. Moving the square vertically usually has a greater effect than moving it horizontally. While the **FM** and **TIMBRE** controls adjust independent parts of Axon's synthesizers, you'll find that both of them can alter the sound dramatically and the influence of one is in some sense dependent on the position of the other.

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 at the right of the voice panel 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 its carrier oscillator in the same manner as the modulator oscillator. The Ring buss, short for Ring modulation, essentially turns the output of the voice 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 of the 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 Send and Ring Send 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 Receive and Ring Receive knobs.

FM SEND
18%

FM RCV
26%

AM SEND
66%

AM RCV
0%

FM Send/Receive

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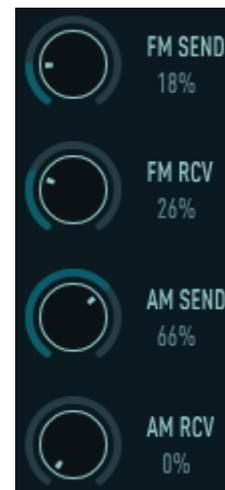
Ring Send/Receive

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

The **RING 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 **RING RECEIVE** knob is at zero, you'll hear the voice unaltered by the Ring bus. As you turn the knob up, you'll hear an increasing amount of the voice's output modulated by the Ring bus signal.

MIDI Only

If the **MIDI ONLY** switch in the upper-right corner is turned on (by clicking it—click it again to turn it off again), the voice does not generate any sound by itself. Instead, only MIDI note on/off messages are transmitted by Axon. Since the voice isn't generating any sound, it doesn't contribute to the FM and Ring busses either. Turning on the **MIDI ONLY** switch can save a little of your computer's available CPU resources if you're using Axon exclusively to control another synthesizer via MIDI.

Copy/Paste Voice

The **COPY VOICE** and **PASTE VOICE** 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.

The 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 on the preset menu (which we'll describe in more detail later).

3. Transport Controls

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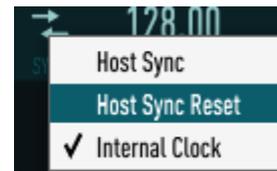
Tempo

The numbers labeled **TEMPO** display Axon's current operating tempo. If Axon is using its internal timing source, click and drag up/down on these numbers to make Axon play faster/slower. If Axon is following your host program's timing source, the **TEMPO** control is disconnected.

Source

The button to the left of the **TEMPO** label invokes a pop-up menu which switches Axon between using your host program's timing information and its internal timing source to set its tempo. There are three modes with the following functions:

- Host Sync: Axon follows your host's tempo and is synchronized to its transport.

- Host Sync Reset: Axon follows your host's tempo, and Axon resets the pulse counters of all seven neurons to zero when you stop your host program's transport. While the **RST** mode provides more predictable synchronization between Axon and other tracks in your composition, you may find that the timing offsets or phases between Axon's voices are subtly changed when you stop and restart the song.

- Internal Clock: Axon uses its own timing source to control its tempo, set with the **TEMPO** control.

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

Rate

The **RATE** control sets the metrical unit of the pulses that trigger Axon's central Neuron 0. Setting the **RATE** control to 1/8 will trigger Neuron 0 every eighth note, setting it to 1/16 will trigger Neuron 0 every sixteenth note, and setting it to 1/32 will trigger Neuron 0 every thirty-second note.
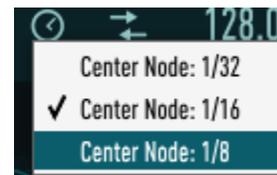
Transport

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 Sync or Host Sync Reset, the button has no effect and Axon plays and stops in sync with your host program's transport.

4. Mixer Controls

The **MIXER** controls fill the lower-right corner of Axon's window.

Each of Axon's seven synthesizer voices has its own set of mixer controls. Looking from top to bottom, the controls consist of:

Delay slider

This slider sends some or all of the voice's sound to Axon's delay and filter effects. Click and drag the slider to the right to increase the amount of signal sent to the effects section. If all the **DELAY** sliders are off (i.e. at their leftmost position) you won't hear anything from the effects since they won't receive any signal.

Pan slider

This slider moves the voice's sound between the left and right sides of Axon's output and thus sets its position in the stereo field. Click and drag the slider left and right from its center position to move the voice correspondingly. The pan slider does not affect the individual output busses for Axon's voices.

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. Any number of voices can be muted at the same time, but only one voice can be soloed. If, for example, Voice 2's Solo button is illuminated and you click Voice 4's Solo button, Voice 4 will become the only audible voice. Theses buttons do not affect the individual output busses for Axon's voices.

Level Slider

The vertical level sliders set the output level or loudness of the individual voices. Clicking and dragging a voice's slider upwards makes the voice louder. If you drag the slider all the way to the bottom you won't hear anything from that voice. The level slider does not affect the individual output busses for Axon's voices.

Note that a pair of white lines is drawn around the level slider of the voice corresponding to the currently selected neuron.

Master Slider

At the far right of Axon's mixer panel is a slider which sets the overall output level. You may find that Axon's output is too loud (i.e., causes clipping in your audio interface) when several voices play simultaneously. Click and drag the master slider downwards to reduce Axon's output.

Delay and Filter Controls

The controls for the delays and filter reside in the lower-right corner of Axon's window. Axon has two delays, one for each channel of the stereo output, and a multi-mode filter.

The **L TIME** and **R TIME** controls change the amount that signals are delayed in relation to the original (dry) signal. Each delay has a range of 0 to 1999 milliseconds, or approximately two seconds.

The delay controls operate either in units of time or in metrical units, that is, fractions of a beat. Click on the **SYNC L** and **SYNC R** buttons to switch the respective delays between the two modes.

If the **SYNC** mode is active, 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 1/32nd to 1/1 (a whole measure), with dotted and triplet times available. Triplet values are denoted with a "T" after the beat fraction, and dotted values are denoted with a period. For example, "1/8 ." 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.

The two-dimensional **FEEDBACK/FILTER** panel controls both the feedback level for the delays and the frequencies of the filters. 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 **FEEDBACK/FILTER** control. Since the filter controls change the low- and high-pass filters simultaneously the filters act like a band-pass filter with a variable width. Dragging the small square in the control changes the corner frequencies of both filters.

Dragging it to the left moves the filter frequencies downwards, making the delayed signal darker; dragging it to the right moves the frequencies upwards, making the delayed sound brighter.
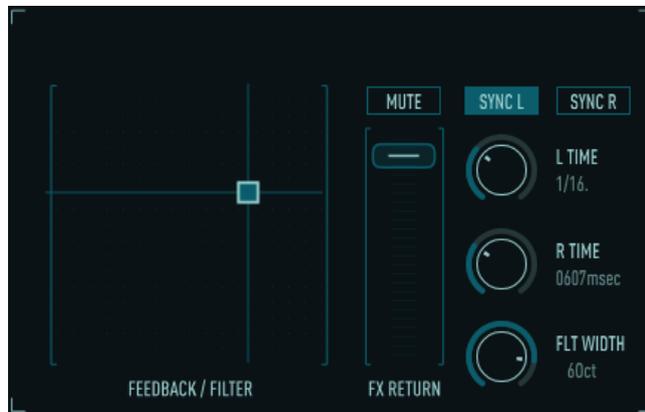
The **FLT WIDTH** knob to the right sets the separation of the low- and high-pass filters. Turning the **WIDTH** knob up moves the filters farther apart. If you make the filter separation small enough you may not hear any of the delayed signal at all.

Dragging the square up and down 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.

The **FX RETURN** slider sets the level of the delayed/filtered signal as it is mixed into Axon's output. Dragging the slider upwards increases the level of the signal. If you move it to its top position the delayed signal will be about as loud as the original signals (although the filters may attenuate the signal, depending on their settings). Click the **MUTE** button to silence the delayed signal altogether.

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

MIDI Notes

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

Axon's seven voices are permanently assigned to the notes C1 through F#1. Here's a chart showing the voices and their assigned notes and MIDI note numbers:

Voice	Note Name	MIDI Note Number
0	C1	60
1	C#1	61
2	D1	62
3	D#1	63
4	E1	64
5	F1	65
6	F#1	66

Sending MIDI Notes

The VST versions of Axon transmit a MIDI note message every time a voice is triggered. The MIDI note's pitch is as shown in the table above. Its velocity is proportional to the position of the voice's level slider in the mixer (i.e. the higher the slider, the higher the velocity value). As described previously, if you turn on a voice's **MIDI ONLY** switch, the internal synthesizer for that voice will be turned off.

Automation

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 built-in presets to serve as a demonstration of its capabilities and inspirations for your own creations. You can flip through the presets by clicking the arrows on either side of the preset name near the top center of Axon's window.

You can also click the name itself to invoke a popup menu with several handy features. The menu lists all the factory-installed presets. There is a Save As command for saving your settings in individual files. If you place these files in Replicant's own folder (located at `C:\ProgramData\Audio Damage\Axon2\Presets\User` on Windows, `/Library/Application Support/Audio Damage/Axon2/Presets/User` on OS X), your presets will appear on this menu.

There are also commands for copying the current settings to the system clipboard, and pasting settings from the clipboard. The settings are presented in a plain-text XML format so that you can exchange them online in forums, copy them between a Windows computer and a Macintosh, etc.

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 info@audiodamage.com if you have any questions or comments.