Noise Engineering
Ataraxic Iteritas Magnus

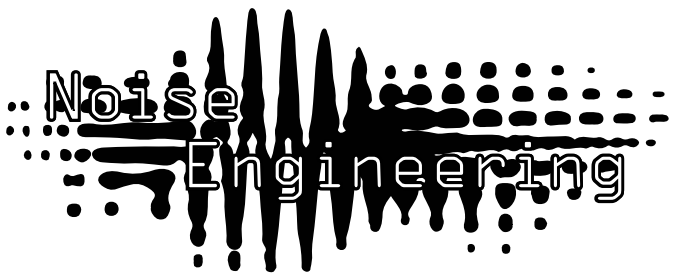
Digital voice inspired by the last millenium

"Yep." - Patrick Leonard

Ataraxic Iteritas Magnus is an extension of our first Eurorack module, the Ataraxic Translatron. AIM starts with one of three bit tables shaped via variable interpolation that is then scrolled through, amplitude modulated, folded, and distorted by the CV-controllable front panel controls. Subby basses, metallic drones, unrelentingly digital timbres and more are all to be had from the AIM. Ataraxic Iteritas Magnus is the 5U version of the Ataraxic Iteritas. Guaranteed to make the fax machine jealous on an even bigger scale.

Patch Tutorial

First Patch:
Patch Out to your mixer. Play with the knobs. Magic.
Second Patch:
Apply CV to any/all of the inputs to make AIM come to life. Looping envelopes, CV sequences, and gate/trigger sequences all work to modulate AIM. Patch a 1v/8va sequence into the Pitch input to bring out the melodic side of AIM.
Third Patch:
AIM isn't just noisy! Try turning all the tonal parameters down and Comb to 12 o'clock. Slowly dial up some of the wave morphing and shaping parametrs to bring out some gentler sounds.
Other Patching Tips:
AIM pairs very well with filters and lowpass gates. Try patching the AIM out to your favorite filter and see how you can shape the sound.
AIM also creates fantastic rhythms and textures in the subsonic range. Flip the Range switch to Bass and turn the pitch down until you can hear the individual pulses of the oscillator. Processing this type of sound with reverb and delay creates unique soundscapes and atmospheres.



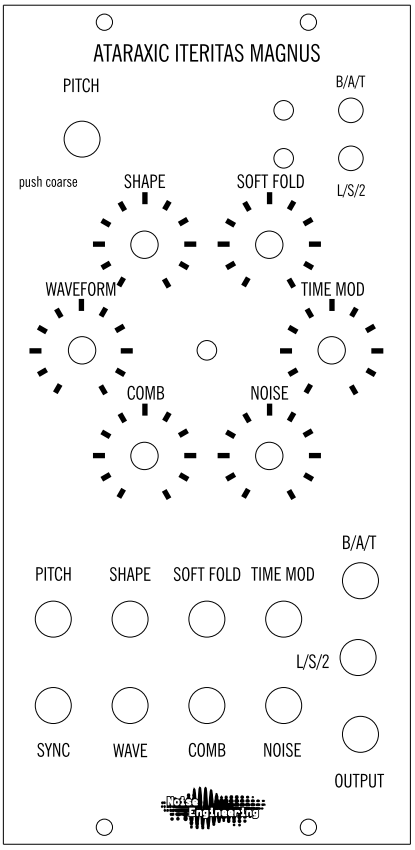
Interface

Pitch: An encoder knob. Adjusts the pitch of the fundamental oscillator. Default is fine mode: steps are sub-perception so AI is difficult to bump out of tune. Push and turn for coarse adjustment: each step is a semitone. CV input is a 1v/8va standard input.

Noise: Displaces samples in time, and amplitude modulates the signal by white noise. Useful for adding an aggressive, broken edge to the output.

Comb: Changes the emphasis of the harmonic structure of the output. At 12:00 the filter is off. To the left, it brings out more high harmonics, and to the right, it brings out more low harmonics.

Shape: Adjusts the interpolation between waveforms. Sonically, this ends up being almost identical to morphing from triangle to saw to square.



Soft Fold: Soft Fold uses the following polynomial:

$$\frac{x}{48}\left(-x^4 + 8x^3 - 9x^2 - 50x + 100\right)$$

This is applied to a unipolar signal with gain controlling the fold amount. This gives an asymmetric soft fold. Soft fold is useful for adding interest to simple sounding waveforms, and works well in conjunction with the Noise knob.

Waveform: Blends between waveforms in the bit table selected by the Mode switch.

Time Mod: Similar in sound to PWM or hard sync. Modulating this parameter creates phaser-type sounds.

Mode: Selects between three different sets of waveforms, arranged in bit tables. The waveforms generated are all unique and unapologetically digital in nature. They are then modified by the Shape and Waveform parameters. For more details on the different modes, see the Design Notes section below.

Range: B/A/T The range switch sets the lowest note. Each position is two octaves above its left neighbor (Bass, Alto, and Treble).

Sync: Resets the state of the oscillators on a rising edge. Used for sync modulation.

Out: A low-impedance audio source. The output varies based on parameters as AI compensates for loudness.

CV Inputs: All parameters are CV-able. Knobs act as offsets unless stated otherwise. AI expects an incoming voltage of 0-5v for non-pitch parameters and 0-8v for pitch.

Genesis and Design Notes

AIM started simply enough. Let's take our first product, Ataraxic Translatron and re-implement it on the Iteritas hardware platform, blowing it out with more features and controls. This simple-sounding task ended up being one of the most technically challenging things we have done. The hardest constraint was simply sample rate. The high-order LFSR waveforms require an extremely high sample rate to sound the way we want them to. All attempts to downsample lost their edginess. As with all of the Iteritas oscillators, the sample rate varies by pitch, but for AIM it's between 100--200khz.

Having such a high sample rate means we have about 1/4 of the per-sample processing power as on BIA so every feature was a struggle to fit into the performance envelope. Every tone control needed to be as simple as possible which led to a lot of the basic choices. Soft fold is a simple quintic polynomial that will gently fold a waveform. Noise is just simple modulation by noise in both amplitude and time domains. Time mod is a variant of the saw mod on the Manis Iteritas except it operates on the passage of time in the waveform interpolation rather than the amplitude of the waveform. The comb filter was chosen because the near-finished product was begging for a filter but we were almost out of computational power. Comb filters are simple and elegant, and when we tried it, we were so excited that we looked no further. One of the things done for performance was to encode the waveforms AIM uses into a table. This ended up being significantly faster than computing it on the fly and made it easy to change the waveforms to produce different modes. The LFSR tables are based on the same waveforms as in the AT (in some cases octave-shifted differently). SQR is a square wave that is amplitude modulated by the harmonic series so turning the waveform knob will blend between harmonics. SQR2 is the same except the modulating pitch goes up an octave every waveform.

After we ported our first two oscillators to large-format modules (Basimilus and Manis), it seemed like a reasonable idea to do a couple more. AIM, along with Cursus Iteritas, was the obvious candidate. It's a good complement to the others: it can be harsh and quite sound-designy, but if you want to tame the beast, you can coax some really beautiful sounds out of it too.

Variable Sample Rate

Ataraxic Iteritas Magnus uses a sample rate that is a multiple of the fundamental (lowest) frequency produced. is moves alias power that is a multiple of the fundamental to be mapped to a multiple of this tone, therefore making the aliasing align with the harmonics of the tone. This works well for settings with a strong harmonic structure (spread fully CW or fully CCW) and adds unique aliasing character for other tones.

Calibration of Tuning

Ataraxic Iteritas comes pre-calibrated but over time it may drift and need a touch up. Pitch calibration is controlled by a linear resistor-divider network. To calibrate the tuning, attach a volt meter (preferably 4+ digit) to the test points TPCV and TPGND on the rear panel and adjust the trim pot. The voltage measured should be 5/16 (.3125) times the input voltage applied to the CV input. A reasonable way to tune the scale is to use an adjustable voltage source to generate 4 volts then adjust the tuning trim until the test points read 1.2500V. AIM can also be tuned using a reference supply capable of generating a 1-volt difference and using a stroboscope such as the Peterson 490 to tune to an octave interval. This method is preferred to the meter-only method.

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