Pentagon I Performance Oriented Synthesizer
User Manual

Thank you for using rgcAudio Pentagon I!

Pentagon I is an extremely powerful instrument, packed with an extensive feature set. Most of its functions are very intuitive and easy to use, but to get the best results and to unveil some *hidden* features we strongly suggest you take at least a brief look at this manual.

Basics

Pentagon I includes 300 factory presets for *instant* music production, but its greatest potential lies in its programming flexibility. Here is a brief list of things that will make your track / preset construction experience more comfortable:

Sound Bank Selection
Pentagon I has 6 banks, with 128 presets each. All banks are saved together in all hosts, so all presets are ready whenever you open the instrument. Banks can also be selected with the main screen bank selector letters (a ~ f).
Bank selection from front panel sends Bank Change events to the host[1].

Preset Selection
Right Click anywhere on the screen, and a complete list of all presets available for the selected bank will appear for instant recall.
In low-resolution screen modes with big fonts, sometimes there is not enough space on the screen to show all presets In this instance, use Ctrl-Right Click to show a scrollable preset list (Ctrl-Right click will toggle between full and scrollable modes).
Preset selection will send Program Change MIDI events to the host[1].

[1] Few hosts (Cubase 5 the most common) are capable of processing MIDI events transmitted from plugins.

Sound Preview
On the main screen click and drag horizontally on the bottom wood ribbon to preview your sound while editing. It acts like a keyboard, but without the valuable screen space and with full note (0 ~ 127) range, plus a "glissando" action, useful for adjusting release times to save CPU.
Preview Ribbon sends MIDI note on/off to the host[1].

Circular-Linear Knob movements
Alt-Clicking a knob can be used to turn the knob handling from Circular to Linear mode or vice versa. In some hosts (e.g. Steinberg's Cubase 5) this option can be fixed to any mode.
For hosts that don't have this capability, just click on the Pentagon I logo to toggle between Circular and Linear modes.

Default Values
Ctrl-Left Click on a knob to select the default parameter value (ie 2 for PitchBend Range).

Double Function Knobs
Knobs marked with a small triangle below the label have a dual function.
This double function feature allows the less commonly used functions to still have their own knob for programming and automation purposes, while keeping the screen usage within comfortable limits.
While playing back a sequence, or while using an external MIDI controller, automation will move the knobs according to shown label.

Oscillators Section

An Oscillator is the Sound Generation unit in Pentagon I. There are four oscillators, grouped in two pairs.
Every oscillator has 13 different waveforms to select from, including most classic and vintage waveforms like Saw, Square, Sine, White Noise, plus 4 user-loadable waveforms.

Oscillator Basics

Shape, **Fine**, **Coarse** and **Pitch Eg** controls have a double function. Clicking on the label below the knob, they become **Mode**, **Phase**, **Octave** and **LFO Eg**, respectively.

For all oscillators, the following parameters can be adjusted:

01. Oscillator On/Off

Clicking on the indicator light the oscillator is turned On/Off.
Even one-oscillator programs sounds very fat in Pentagon I, due it's sophisticated waveform generation engine. However most complex sounds are generated using two or more oscillators.

TIP: Turning **off** unused oscillators decreases CPU utilization, so it's much better to disable the oscillator than setting the **Level** parameter to zero.

02. Oscillator Level

This control adjusts the volume level of the oscillator.

TIP: Like in Hardware Synthesizers when using the same waveform in two oscillators with a small value difference in the FINE parameter (small detuning), high transient peaks could appear. You can avoid these by adjusting the level of one oscillator slightly lower (say, 70% of the other).

03. Shape

This knob allows selecting the waveform that the oscillator will output. The waveforms are arranged from high to low harmonic content, to allow quick real-time waveform swapping with a MIDI controller.
The waveforms available for all oscillators, from min to max are:

Perfect Saw
Vintage Saw
Perfect Square
Vintage Square
Pulse 50%
Pulse 25%
Pulse 12%
Pulse 6%
Harmonics 5/2
Harmonics 3
Harmonics 4
Harmonics 5
Pure Sine
User Wave 1
User Wave 2
User Wave 3
User Wave 4
White Noise

When using User Wave 1-4, wavetables loaded as wavetable 1-4 will be used.

Perfect Saw and Perfect Square are mathematically generated waveforms, very bright, while Vintage Saw and Vintage Square are modeled from old vintage generators using very special vintage filters, with a warm and dull sound.
Pulse 50%, 25%, 12% and 6% are classic pulse waveforms found in most common synthesizers.

Harmonics 5/2, 3, 4, and 5 are mathematically generated waveforms containing only N-th harmonics. For example, Harmonics 3 is a wave that have only fundamental + 3rd harmonic + 6th harmonic + 9th harmonic... etc.
All waveforms are fully band limited, alias free, so don't be afraid to play chords using the highest notes on the keyboard.

One of the most impressive capabilities in Pentagon I is its ability to load external waveforms for use with its four oscillators. There are two modes for external waveforms:

Full wavetable	This kind of wavetable is a special file describing the full range of tables the oscillator will use for every MIDI note. Several full wavetable files are available at rgcAudio web site. Full wavetable files must be loaded as USER 1 and USER 2.
Single-Cycle Wavetable	This is a single-cycle that will be used for the oscillator as source. It can be created in any standard wave editor. See Appendix 1 ‘Creating Single-Cycle wavetables’. Single-Cycle wavetable files must be loaded as USER3 and USER4.

To load a wavetable, click on the corresponding wavetable indicators on top:

The loaded waveforms will be available as USER1, USER2, USER3 and USER4 in the waveform selection knob.

04. Mode

This selects the working mode for the oscillators. There are 4 modes available:

Key Sync	The phase of the oscillator restarts on NOTE ON event.
Free Running	The phase of the oscillator does not restart on NOTE ON event.
Key Sync Inverted	The same as Key Sync, but with inverted phase.
Free Running Inverted	The same as Free Running, but with inverted phase.
Fixed Pitch	Oscillator frequency does not change no matter which note number the instrument receives.

TIP: Pulse Width fine adjustment for a square waveform can be performed setting OSC1 to Sync and OSC2 to Sync Inverted, and selecting the same SHAPE, FINE, COARSE and OCTAVE settings on both while using the PHASE knob to control the width.

05. Fine

Allows fine-tuning the oscillator ± 2%.
Fine control is very useful to '*detune*' two oscillators to create a wider/fatter sound.

06. Phase

When Sync or Sync Inverted mode is selected, **Phase** control sets the initial phase of the waveform when a NOTE ON event is received.

TIP: Highly percussive sounds can be obtained setting the phase control to the half and using a Volume Attack value of 0.

07. Coarse

Selects the whole note interval for the oscillator, ± 24 semitones.

08. Octave

Selects the octave range for the oscillator, from 0 to 6 octaves.
Combining the use of the **Octave** the **Coarse** parameters, the whole keyboard range can be covered with any individual oscillator. It's even possible to stack two oscillators with a nine-octave range difference!

Combining this flexibility with the Fixed Pitch mode, it is possible to have chords with any octave range being played in any point of the keyboard.

09. Eg Sens (Envelope Generator Sensitivity)

This control adjusts the amount of variation the Envelope Generator applies to the oscillator.

10. LFO Sens. (LFO Sensitivity)

This control adjusts the amount of variation the pitch LFO applies to every individual oscillator.

11. F1 F2

This is the filter routing control. It adjusts the amount of the oscillator output that will be routed to Filter 1 and Filter 2.
Setting it at the middle (default position) will send equal amounts of oscillator signal to both filters.

12. Oscillator Group Mode

The four oscillators in Pentagon I are arranged in two groups: Oscillators 1 and 2 form Group 1, and Oscillators 3 and 4 form Group 2.

Oscillator Group Mode can be changed by clicking on the label between the On/Off light indicators for the selected group.

Oscillator Group Mode selects between the four modes Pentagon I features for inter-modulating the oscillators. There are two labels for Oscillator Group Mode changing, allowing changing the mode for Group 1 (Osc1 -> Osc2) and Group 2 (Osc3 -> Osc4).

Add	The output of every oscillator in the group is fully individual. This is the default mode, allowing stacking four individual oscillators. Osc 1 and Osc 2 on, Coarse set to a perfect fifth (C-G), Vintage Square waveform, Add mode.
Ring	The output of Osc 1/3 modulates Osc 2/4 in amplitude. Osc 1/3 outputs are unaffected in this mode. Osc 1 and Osc 2 on, Coarse set to a perfect fifth (C-G), Vintage Square waveform, Ring mode.
Sync	The phase of Osc 2/4 restarts when Osc 1/3 restarts. This is commonly known as Hard Sync oscillator. Osc 1/3 outputs are unaffected in this mode. Osc 1 and Osc 2 on, Coarse set to a perfect fifth (C-G), Vintage Square waveform, Sync mode.
FM	The output of Osc 1/3 modulates the frequency of Osc 2/4. Osc 1/3 outputs are unaffected in this mode. Osc 1 and Osc 2 on, Coarse set to a perfect fifth (C-G), Vintage Square waveform, FM mode.

Any combination of the two oscillator groups is possible, like having HardSync'ed Osc1 and Osc2 while having Osc3 FM modulating Osc4, etc.

TIP: Best Sync mode effects are commonly obtained by setting the EG/LFO sensitivity of Osc 1 (3) to zero, while setting it to maximum in Osc 2 (4). Check program 1 Sync Jungle as example.

Pitch LFO

The Pitch LFO is a dedicated Low Frequency Oscillator used to modulate the pitch of the four oscillators.
In regular synthesizers, it's used to create the typical *vibrato* effect, but with the big palette of waveshapes in Pentagon I it's also able to make very complex textures.
Pentagon I LFO can also load externally created waveforms, which can be used as shapes. See Appendix 2 "External LFO Waveforms" for details on creating your own waveforms.

> Pitch LFO **Shape**, **Speed**, **Depth** and **Aftertouch** controls have a double function. Clicking on the label below the knob, they become **Offset**, **Delay**, **Fade** and **Breath**, respectively.

The following parameters can be adjusted in the Pitch LFO:

13. Pitch LFO On/Off

Turns Pitch LFO On/Off.

14. Shape

The waveforms available for the Pitch LFO, from min to max are:

Sine
Square
Pulse 50%
Pulse 25%
Pulse 12%
Saw Up
Saw Down
Triangle
Step 1
Step 2
Step 3
Step 4
Random

When loading an external waveform, Step 4 waveform will be replaced.

15. Offset

This control adjusts the direction of the pitch variation that the LFO will produce in the oscillators, as follows:

Value = 0.5 (knob center): Variation is centered on normal pitch.
Value < 0.5: Pitch variation will be higher to negative values (lower pitch).
Value > 0.5: Pitch variation will be higher to positive values (higher pitch).

Using Offset with positive values is a good method to imitate Guitar and other string instrument's vibrato.

16. Speed.

Adjust the LFO frequency; from 0.01 Hz to 20 Hz. Knob center is 2 Hz.

The Pitch LFO can be synchronized to Host Tempo in most hosts. To sync the LFO to tempo, click on the Pitch LFO label. A menu will appear, where you can select the desired beat division value: 16, 8, 4, 2, 1, ½, ½ t, ¼, ¼ t, 1/8, 1/8t, 1/16, 1/16t. All divisions marked *t* are *triplet*.

Alternatively, it is possible to shift-Left/Right click on the Pitch LFO label to select next/previous division value.

17. Delay.
Sets the time elapsed from when the NOTE ON message is received to when the LFO starts affecting the pitch.

18. Depth.
Adjusts the amount of fixed modulation that will be applied to the oscillators. The x1/x5 control scales this control, allowing higher ranges of modulation to be applied. The amount of the modulation applied to every individual oscillator can also be controlled with control 10. LFO sens (see Oscillator Basics).

19. Fade.
Sets the time used to fade the LFO action from zero (when NOTE ON message is received) to the current Depth setting, from 0 to 10 seconds. Knob center is 0.5 seconds.

20. Aftertouch
The amount of modulation to be applied to the oscillators when MIDI Aftertouch messages are received. Note that this setting is independent of the fixed Depth setting, so when both controls are activated both effects will be added.

21. Breath
The amount of modulation to be applied to the oscillators when MIDI Breath messages are received. Note that this setting is independent of the fixed Depth / Aftertouch setting, so when those controls are activated both effects will be added.

22. Modulation
The amount of modulation to be applied to the oscillators when MIDI Modulation Wheel messages are received. Note that this setting is independent of the fixed Depth / Aftertouch / Breath setting, so when those controls are activated both effects will be added.

Polyphony Limiter
Pentagon I features an advanced Intelligent Voice Allocation engine, which allows playing with minimum voice-stealing artifacts even with low polyphony settings.

23. Polyphony
Maximum polyphony can be set to 1, 2, 3, 4, 5, 6, 8, 16, 32 or 64 voices. Sustain switch usage is allowed in all polyphony settings.
When maximum polyphony is set to 1, Full Legato mode is activated. In this mode, the release of a midi key will retrigger the last pressed and still active note.

Normal/High Quality Operation

Pentagon I has one of the most advanced sound generation engines available in a virtual instrument.
It is also possible to fully disengage its filters and use the oscillators in raw mode. In this mode, the full harmonic content of all waveforms is used, allowing the maximum high-end.
While using the filters, High Quality operation isn't necessary. Without filters, however, some waveforms with high transients may need a higher order interpolation algorithm to keep the transient response in its maximum quality.

High Quality operation mode will switch to this higher order interpolation, while taking a little more CPU usage.

Portamento

Portamento or Glide is a very typical effect in Vintage Synthesizers. It makes the transition between played notes with a smooth frequency sweep instead of immediate switching.
Pentagon I has a very advanced Portamento operation, allowing Monophonic and Polyphonic Portamento.
There are four Portamento operation modes in Pentagon I:

Normal, fixed time	The glide effect between two notes will be applied always, and it will take the same time no matter the interval between notes.
Normal, variable time	The glide effect between two notes will be applied always, but it will take longer if the interval between notes played is longer.
Fingered, fixed time	The glide effect between two notes will be applied only to legato notes (when the new note is played before last note ends), and it will take the same time no matter the interval between notes.
Fingered, variable time	The glide effect between two notes will be applied always, and it will take longer if the interval between notes played is longer.

The following parameters can be set for Portamento effect:

24. Portamento On/Off

Turns the Portamento effect On/Off.

25. Portamento Mode

Selects the mode used for Portamento as described above.

26. Portamento Time

Adjusts the time used for the frequency transition.

Pitch Envelope Generator

The Pitch Envelope Generator is a dedicated envelope generator applied to the pitch control of all oscillators. The operation of the Pitch Envelope Generator is fully band limited, so don't be afraid of set it to extreme values.

Following parameters can be set for the Pitch Envelope Generator:

27. Start Level

The frequency start point for the envelope:
Value = 0.5 (Knob center): Normal Pitch is selected.
Value < 0.5: Initial value is lower (Lower Pitch).
Value > 0.5: Initial value is higher (Higher Pitch).

28. Attack Time

The time the generator takes to go from Start Level to Attack Level, from 0 to 10 seconds.

29. Attack Level

This is the level the generator will reach after Attack stage. Values are similar as Start Level.

30. Decay Time

This sets the time it takes for the pitch to go from Attack Level to normal pitch, from 0 to 10 seconds.

31. Release Time

The time it takes for the pitch after key releasing to go from normal pitch to Release Level pitch.

32. Release Level

The level the pitch will reach after Release Time once the key has been released.

33. Envelope

This setting controls how much the Envelope Generator controls all oscillators. The x1/x5 switch multiplies this range allowing full keyboard sweeps.
Ranges are as follows:

x1: ± 1 octave
x5: ± 3 octaves

The amount of modulation the Envelope Generator applies to every individual oscillator can be set with parameter 9. Eg sens (Envelope Generator Sensitivity).

34. Velocity

This controls how much the Pitch Envelope Generator will control all oscillators according with the Note On Velocity of incoming MIDI events. The effect of this control is added by control 33. Envelope.

Bend Mode, Bend Range

> **Bend Range** control has a double function. Clicking on the label below the knob, it becomes **Bend Mode.**

Pentagon I has 5 Pitch Bend modes, expanding the typical Pitch Bend applications and allowing for a very expanded control palette:

Normal	Standard Pitch Bend operation, with range according to Bend Range setting.
Asymmetric	Pitch Bend range will be –12 when bending down, and Bend Range setting when bending high. This mode is best suited to create Guitar Lever *whammy bar* emulations.
High-note only	Bending will be applied to highest note only when playing chords.
Low-note only	Bending will be applied to lowest note only when playing chords.
Hold-notes only	Bending will be applied to the notes that are still pressed in the keyboard, and not to the ones being held by sustain switch or in release state.

The following parameters can be set for Pitch Bend effect:

35. Bend Range
Selects the range for bend operation, from 0 to 12 semitones.

36. Bend Mode
Chooses the Bend Mode as described above.

Random Pitch, Main Tune/Transpose

> **Tune** control has a double function. Clicking on the label below the knob, it becomes **Transpose**.

37. Random
The Random control adds a random tuning factor to all oscillators individually, recreating the tune drift of early analog synthesizers.

38. Tune
Sets the main tune for this preset.

39. Transpose
Sets the main transposition for this preset, within a ±12 semitone range.

Pulse Width Modulation

Using Square or Vintage Square waveforms, it is possible to modulate the pulse width of the waveform with the Filter 1 Envelope Generator, or with a dedicated LFO.

40. Pulse Width Modulation On/Off

Turns Pulse Width Modulation (PWM) On/Off.

41. Speed

This sets the speed of the dedicated LFO for Pulse Width Modulation. When speed is set to zero, the Filter 1 Envelope generator will modulate the pulse width instead.

42. Osc1
43. Osc2
44. Osc3
45. Osc4

Sets the amount of Pulse Width Modulation for every individual oscillator.

46. Sync

Sets the phase synchronization of the Pulse Width Modulation applied to all oscillators. When Sync is set to zero, all oscillators will have the same width at every time. When Sync is set to max, there will be a full phase spread between the oscillators width.

Filters Section

There are two Multimode Resonant Filters in Pentagon I. Both filters can be connected in Serial and Parallel configuration, and each one has its own Envelope Generator.

Filter Basics

The two filters in Pentagon I can be Low Pass, High Pass, Band Pass and Notch (Band Rejection), all of them being 12dB/Octave filters.

It is also possible to use the two 12dB/Octave filters in Serial configuration in order to get 24dB/Octave filter with separation. Combining the different filter modes in Serial and Parallel configurations is one of the strongest point in Pentagon I sound richness.

The LINK control allows to set the same parameter value for both filters at same time, saving valuable programming time.

For each filter, the following parameters can be adjusted.

47. Filter Configuration

There are four possible configurations:

Off	Filters are off, the output of all oscillators is routed directly to the Amplifier Envelope Generators 1 and 2, according to the corresponding mix (see Oscillators Section parameter 11. F1 F2)
Single	Only Filter 1 is On. Filter 1 output is routed to Amplifier EG 1 and then to individual output 3, and to Effects section. Filter 2, Filter EG 2 and Amplifier EG2 have no effect in this mode. Main F1-F2 control should be fully set to F1 in this mode.
Parallel	Filter 1 is routed to Amplifier EG1 and then to individual output 3 and Effects Section. Filter 2 is routed to Amplifier EG2 and then to individual output 4 and Effects Section. Master balance between both filters is controlled with Main F1-F2 control.
Serial	Filter 1 is routed to Amplifier EG1, then to Filter 2, then to Amplifier EG2, then to individual output 4 and Effects section.

	Amplifier EG1 has no effect in this mode. Main F1-F2 control should be set to F2 in this mode.

48. Filter Type 1
49. Filter Type 2
Each filter can be set to the following modes:

Low Pass	Only frequencies below Cutoff setting will pass, others will be eliminated. This is the most common used filter type.
High Pass	Only frequencies above Cutoff setting will pass.
Band Pass	Only frequencies in the neighborhood of Cutoff setting will pass.
Notch	All frequencies except the ones in the neighborhood of Cutoff setting will pass.

Select desired Filter Type by clicking the Type label.

50. Frequency Cutoff 1
51. Frequency Cutoff 2
This is the most important setting for the filters. It allows you to select the point where the filter starts working.
The Cutoff can be set for the while audio spectrum, from 16 Hz to 20480 Hz.

52. Resonance 1
53. Resonance 2
This controls the boosting that frequencies in the vicinity of the Cutoff frequency will receive.
Be careful when setting this parameter, abrupt volume changes or frequency boosting could occur, damaging your speakers or affecting your ears.

Filter Envelope Generators

Every filter in Pentagon I has its own Envelope Generator, with Attack, Decay, Sustain and Release settings plus Envelope Amount, Velocity Amount and Keyboard Tracking controls.

54. Attack Time 1
55. Attack Time 2
Sets the time for the filter cutoff to go from Cutoff setting to the value regulated by the filter Envelope setting.

56. Decay Time 1
57. Decay Time 2
Sets the time for the filter cutoff to go from the value regulated by the filter Envelope setting to the filter Sustain Level.

58. Sustain Level 1
59. Sustain Level 2
Sets the value that will reach the Filter Cutoff after the Decay stage.

60. Release Level 1
61. Release Level 2
Sets the time for the filter cutoff to go from Sustain Level to Cutoff setting.

62. Envelope 1
63. Envelope 2
This control is extremely important, as it determines how the Filter Envelope Generator affects the Filter Cutoff frequency.

The Envelope Control has positive and negative values, being the Center Knob equal to no effect.

When the Envelope control is greater than 0.5, the Envelope Generator affects the Filter Cutoff positively. This is the most used setting when using Low Pass Filters. When it is lower than 0.5 the Filter EG will affect the Cutoff negatively. It is common to see this setting as 'Invert Envelope'.

64. Velocity 1
65. Velocity 2
Sets the amount of modulation that the Filter Envelope Generator will apply according to the incoming Note On Velocity. It has positive and negative settings, same as the Envelope control.

66. Keyboard Tracking 1
67. Keyboard Tracking 2
Sets the frequency variation with MIDI note number, from 0 to 100 cents (one semitone). This can be also positive or negative, being the Center Knob the zero variation position.

Filters MIDI controls

Apart from its exclusive MIDI Learning mode, Pentagon I has direct controls for Aftertouch, Breath and Modulation Wheel to the Filter Cutoff Frequency.

68. Aftertouch 1
69. Aftertouch 2
This controls how much MIDI Aftertouch messages affects the Filter Cutoff.

70. Breath 1
71. Breath 2
Sets how much MIDI Breath Controller messages affects the Filter Cutoff.

72. Modulation Wheel 1
73. Modulation Wheel 2
Sets how much MIDI Modulation Wheel messages affects the Filter Cutoff.

Filter LFO

Pentagon I does have a dedicated LFO for filter cutoff control, featuring multiple waveforms and real-time MIDI control. Very rich, animated textures and sweeps can be obtained using this LFO.

Pentagon I LFO's are able to load externally created waveforms to be used as shapes. See Appendix 2 "External LFO Waveforms" for details on creating your own waveforms.

> Filter LFO **Shape**, **Speed**, **Depth** and **Aftertouch** controls have a double function. Clicking on the label below the knob, they become **Offset**, **Delay**, **Fade** and **Breath**, respectively.

Following parameters can be adjusted in the Filter LFO:

74. Shape

The waveforms available for the Filter LFO, from min to max are:

Sine
Square
Pulse 50%
Pulse 25%
Pulse 12%
Saw Up
Saw Down
Triangle
Step 1
Step 2
Step 3
Step 4 / User
Random
OSC4

The externally created waveforms will replace Step 4 waveform when loading. When Shape is set to OSC4 and Oscillator 4 is on, then the sound generation of Oscillator 4 will be used to control filters cutoff.

75. Offset.

This control adjust the direction of the cutoff variation the LFO will produce, as follows:

Value = 0.5 (knob center): Variation is centered on cutoff setting.
Value < 0.5: Cutoff variation will be higher to negative values (darker).
Value > 0.5: Cutoff variation will be higher to positive values (brighter).

76. Speed.

Adjust the LFO frequency; from 0.01 Hz to 20 Hz. Knob center is 2 Hz.

The Filter LFO can be synchronized to Host Tempo in most hosts. To sync the LFO to tempo, click on the Filter LFO label. A menu will appear, where will be possible to select the desired beat division value: 16, 8, 4, 2, 1, ½, ½ t, ¼, ¼ t, 1/8, 1/8t, 1/16, 1/16t. All divisions marked *t* are *triplet*.

Alternatively, it is possible to shift-Left/Right click on the Filter LFO label to select next/previous division value.

77. Delay.
Sets the time elapsed since the NOTE ON message is received to the LFO starts affecting the filter.

78. Depth.
Adjusts the amount of fixed modulation that will be applied to both filters.

79. Fade.
Sets the time used to fade the LFO action from zero (when NOTE ON message is received) to the current Depth setting, from 0 to 10 seconds. Knob center is 0.5 seconds.

80. Aftertouch
The amount of modulation that will be applied to the filters when MIDI Aftertouch messages are received. Note that this setting is independent of the fixed Depth setting, so when both controls are activated their effects will be added.

81. Breath
The amount of modulation that will be applied to the filters when MIDI Breath messages are received. Note that this setting is independent of the fixed Depth / Aftertouch setting, so when these controls are activated their effects will be added.

82. Modulation
The amount of modulation that will be applied to the filters when MIDI Modulation Wheel messages are received. Note that this setting is independent of the fixed Depth / Aftertouch / Breath setting, so when those controls are activated their effects will be added.

Drive Stage
Filter 1 has a special Polyphonic Drive Stage, which allows for Overdrive/Distortion effects. It is possible to process the output of the Drive Stage with Filter 2 when the configuration is Serial.

Drive Stage features following parameters:

83. Drive On/Off
Turns On/Off the Drive Stage.

84. Drive
Drive Stage consists of a pre-amplifier used to boost incoming signal, followed by a non-linear clipping device where the distortion effect is achieved.

This control sets the amount of pre-amplification the Drive stage will introduce before the signal reaches non-linear stage.

85. Tone

This control filters the high frequency contents of the Drive Stage output, to get a warmer tone.
Setting this control to zero, no filtering is applied. Raising the control value will make the tone duller.

Simulator

The Simulator is one of the most powerful features in Pentagon I. It offers 19 different frequency response characteristics, ranging from Amp/Cabinet simulations to esoteric artificial equalizations to sample rate limiting responses.

86. Simulator

Allows you to choose the desired simulation between:

Off	No simulation
1x 8 inch Speaker Cabinet	Guitar Cabinet with one 8” speaker.
1x 15 inch Speaker Cabinet	Guitar Cabinet with one 15” speaker.
2x 15 inch Speaker Cabinet	Guitar Cabinet with two 15” speakers, improved low frequency range.
Radio 1	Home radio simulation.
Radio 2 (no low)	Very small radio simulation.
Generic Amp	Guitar Valve amplifier simulation.
Combo 1	Guitar Combo Amp.
Combo 2	Guitar Combo Amp.
Valleys 1	Artificial environment.
Valleys 2	Artificial environment.
Valleys 3	Artificial environment.
Mid / Hi	Extended Mid/High frequency range.
Eq Curve 1	Equalization Curve.
Eq Curve 2	Equalization Curve.
Eq Curve 3	Equalization Curve.
Fs = 32k	Samplerate limited to 32k
Fs = 22k	Samplerate limited to 22k
Fs = 11k	Samplerate limited to 11k
Fs = 6k	Samplerate limited to 6k

Amplifier Section

The amplifier section in Pentagon I consist of two Amplifier Envelope Generators, connected to the outputs of Filters 1 and 2, featuring Attack, Hold, Decay, Sustain and Release plus Velocity Sensitivity, Keyboard Tracking and Aftertouch/Breath.

A dedicated LFO with Tempo Host syncing capabilities for the amplifier stage allows amplitude modulation/tremolo/sound slicing effects.

Amplifier Envelope Generators

There are two Amplifier Envelope Generators, featuring Linear/Exponential segment variation.

87. Attack Time 1
88. Attack Time 2
Sets the Attack Time, from 0 to 10 seconds. Knob center is 0.5 seconds.

89. Hold Time 1
90. Hold Time 2
Sets the Hold time, which is the time that the volume will stay at maximum amplitude before starting Decay stage. This is very useful to emulate compressed sounds.

91. Decay Time 1
92. Decay Time 2
Sets the time it takes for the volume to go from maximum level to Sustain Level.

93. Sustain Level 1
94. Sustain Level 2
Sets the level where the volume will stay after Decay stage, until the note is released.

95. Release Time 1
96. Release Time 2
Adjust the time it takes for the volume to go off after the note is released.

97. Velocity 1
98. Velocity 2
Sets the Velocity Sensitivity of the amplifier, from 0 (no sensitivity) to full sensitivity.

99. Keyboard Scaling 1
100. Keyboard Scaling 2
Sets the volume variation with MIDI note number. Higher settings means higher volume in higher notes.

101. Aftertouch 1
102. Aftertouch 2
Sets the volume reinforcement that will be applied when receiving MIDI Aftertouch messages.

103. Breath 1
104. Breath 2
Sets the volume reinforcement that will be applied when receiving MIDI Breath Controller messages.

Amplifier LFO

Pentagon I does have a dedicated LFO for volume control, featuring multiple waveforms and real-time MIDI control. Tremolo, panning and slicing effects can be obtained with this LFO.

Pentagon I LFO's are able to load externally created waveforms to be used as shapes. See Appendix 2 "External LFO Waveforms" for details on creating your own waveforms.

> Amplifier LFO **Shape** and **Aftertouch** controls have a double function. Clicking on the label below the knob, they become **Offset** and **Breath**, respectively.

Following parameters can be adjusted in the Amplifier LFO:

105. Shape
The waveforms available for the Amplifier LFO, from min to max are:

Sine
Square
Pulse 50%
Pulse 25%
Pulse 12%
Saw Up
Saw Down
Triangle
Step 1
Step 2
Step 3
Step 4 / User

The externally created waveforms will replace Step 4 waveform when loading.

106. Offset.
This control adjust the direction of the volume variation the LFO will produce, as follows:

Value = 0.5 (knob center): Variation is centered on volume setting.
Value < 0.5: Volume variation will be higher to negative values (softer).
Value > 0.5: Volume variation will be higher to positive values (louder).

107. Speed.
Adjusts the LFO frequency; from 0.01 Hz to 20 Hz. Knob center is 2 Hz.

The Amplifier LFO can be synchronized to Host Tempo in most hosts. To sync the LFO to tempo, click on the Amplifier LFO label. A menu will appear, where will be possible to select desired beat division value: 16, 8, 4, 2, 1, ½, ½ t, ¼, ¼ t, 1/8, 1/8t, 1/16, 1/16t. All divisions marked *t* are *triplet*.

Alternatively, it is possible to shift-Left/Right click on the Amplifier LFO label to select next/previous division value.

108. Depth.
Adjusts the amount of fixed modulation that will be applied to the volume.

109. Aftertouch
The amount of modulation that will be applied to the volume when MIDI Aftertouch messages are received. Note that this setting is independent of the fixed Depth setting, so when both controls are activated their effects will be added.

110. Breath
The amount of modulation that will be applied to the volume when MIDI Breath messages are received. Note that this setting is independent of the fixed Depth / Aftertouch setting, so when those controls are activated their effects will be added.

111. Modulation
The amount of modulation that will be applied to the volume when MIDI Modulation Wheel messages are received. Note that this setting is independent of the fixed Depth / Aftertouch / Breath setting, so when those controls are activated their effects will be added.

112. Pan
When Amplifier LFO Depth parameter is set to any value, the Pan parameter controls the amount of LFO applied to L-R panning.

Effects Section

Pentagon I features the following built-in effects:

One Modulation effect, which can be selected between:

Chorus
Stereo Chorus
4-Voice Chorus
Phaser
Stereo Phaser
4-Voice Phaser

One Delay effect, which can be:

Stereo Delay
Ping Delay (MIDI CC#95)

Plus a quasi-parametric two-band equalizer.

Stereo Modulation Effect

The following parameters are adjustable for the modulation effect:

113. Modulation Effect On/Off

Turns On/Off the modulation effect.

114. Effect Mode

Click on the 'Chorus' label, a menu will appear where you can select one of the following effects:

Chorus	Standard Chorus effect.
Stereo Chorus	Quadrature Chorus, L&R channels with opposite phase.
4-Voice Chorus	Four voice chorus, very rich and warm.
Phaser	Standard Phaser effect.
Stereo Phaser	A Stereo Phaser, filter-delay based. Multiple effects can be obtained from this configuration.
4-Voice Phaser	A very rich 4-Voice Phaser effect.

115. Level

Allows mixing the dry signal with the signal processed by the modulation effect. This is the Wet/Dry control for the modulation effect.

116. Depth
Regulates the amount of modulation applied to incoming signal.

117. Speed
Sets the speed of the modulation.

118. Delay
Adjusts the delay time of the delay line. Small values are best for Flanger-like effects, greater values for Chorus-like effects.

119. Feedback
Sets the feedback amount for the modulation line.

Stereo Delay

Pentagon I features a Stereo/Ping delay. Following parameters can be adjusted:

120. Delay On/Off
Turns On/Off the delay effect.

121. Level
Allows mixing the dry signal with the delayed signal. This is the Wet/Dry control for the delay effect.

122. Time L
123. Time R
Sets the delay time for Left and Right channels.

124. Feedback
Sets the feedback amount for the delay line.

125. Cutoff
Sets the cutoff frequency for the delay effect.

Value = 0.5 (Knob center): No filtering.
Value < 0.5: High Pass filter (delay effect becomes brighter every pass).
Value > 0.5: Low Pass filter (delay effect becomes duller every pass).

MIDI Continuous Controller #95 is hardwired to Stereo/Ping delay mode:

CC#95 < 64: Stereo Delay
CC#95 > 64: Ping Delay

Quasi-Parametric Two-Band Equalizer

The two-band quasi-parametric equalizer allows cutting/boosting desired frequency ranges. As the signal never leaves digital domain, no noise (hiss or hum) is added even with extreme reinforcement settings.

126. Eq On/Off

Turns the Eq On/Off.

127. Lo

Sets the cut/boost amount for low frequencies. Knob center = no cut/boost, range is ± 12dB.

128. Lo Freq

Sets the frequency center point where the reinforcement will start, from 30 Hz to 230 Hz.

129. Hi

Sets the cut/boost amount for high frequencies. Knob center = no cut/boost, range is ± 12dB.

130. Hi Freq

Sets the frequency center point where the reinforcement will start, from 3000 Hz to 9000 Hz.

Program Management

There is a 768-program capacity in Pentagon I, grouped in 6 banks (a ~ f) of 128 programs each. Bank and Program MIDI messages are recognized, and selected bank/preset will be updated when receiving that messages.

There are three program management functions in Pentagon I: Copy/Paste and Init. Program Copy/Paste functions allow arranging presets by copying them from one slot to another. Copy and Paste commands are in the front panel next to Bank selector.

Program Init function will reset the currently selected preset to the initial status. To avoid accidentally initializing a preset, this function is somewhat “hidden”. To call the Program Init function, Alt-Left Click the Pentagon I logo.

MIDI Operation

Pentagon I has one of the best MIDI implementations in a Virtual Instrument of its class. Every simple knob or light indicator in the Front Panel (including dual function knobs) can be assigned to any MIDI continuous controller, in direct or reverse mode and with adjustable minimum and maximum values.

To assign a MIDI controller to a control, Shift-Left Click on the control. A menu will appear with following options:

MIDI Learn	Select this option to assign a MIDI continuous controller to a control. After selecting MIDI Learn, the desired control message should be sent to Pentagon I. It will immediately start controlling the knob/light. *Learned* control will be shown in the menu on next Shift-Click.
MIDI Forget	De-assign all controllers to selected knob/light.
Set Min	Sets the minimum value this control will reach. Pentagon I will scale incoming control messages from Min to Max value. Selected value will be shown in next Shift-Click on the control as a 0~1 value. Set Min option will not appear for light indicators.
Set Max	Sets the minimum value this control will reach. Pentagon I will scale incoming control messages from Min to Max value. Selected value will be shown in next Shift-Click on the control as a 0~1 value. Set Max option will not appear for light indicators.
Reverse	Reverses the operation of this control.

It is possible to assign the same MIDI continuous controller to several knobs in the front panel (in fact, it would be possible to assign one controller to all knobs if desired). To get this, just Shift-Left Click on several controls and select MIDI Learn, and then send a MIDI CC to Pentagon I. All selected controls will be assigned to it.

Also, is possible to assign more than one MIDI CC to a simple Pentagon I control by repeatedly selecting MIDI Learn and sending different MIDI CCs to it.
NOTE: Pentagon I will show only the first learned controller for every control when Shift-Clicking the control again.

MIDI Controls #123 (All note off), #32 (Bank Change), and #95 (hardwired to Stereo/Ping delay) are not *learnable*, so they can't be assigned.

MIDI Controls #1 (Modulation Wheel), #2 (Breath Control) and #64 (Sustain Switch) will be learned, but they will keep their assigned function.

Notice that in the case of Modulation Wheel and Breath Controller assignments in the front panel (Pitch LFO, Filter LFO, Amp LFO, Filter, Amp), these are remembered for every program, while MIDI Learned controls are global (all programs).

While assigning a knob to a controller, be careful of starting your sequencer after selecting MIDI Learn. According to the sequencer settings, it could send several MIDI #CCs when starting to reset their status, and one of them could be *learned* instead of desired one.

Appendix I: Creating Single-Cycle Waveforms

Pentagon I can load two types of USER wavetables: FULL and SINGLE CYCLE wavetables.

FULL wavetables are special files, which include one wavetable per MIDI note. There are several of this wavetables available at rgcAudio web site.

SINGLE CYCLE wavetables are just one-cycle wavetables that will be mapped across the whole keyboard.

To keep the full audio path in full 32-bit floating-point format (which is the native VST format), wavetable files should be saved as .PCM mono, 44100Hz 32-bit IEEE floating-point format. Most modern editors, including SoundForge and CoolEdit support this format.

A brief wavetable sample using CoolEdit can be created as follows:

1. Start CoolEdit.
2. Select Generate…Tones menu. The New Waveform dialog box will appear.
3. Choose SampleRate = 44100, Channels = Mono and Resolution = 32-bit (float).
4. Choose any waveform from Flavor dropdown (i.e. Sin^2).
5. Enter 0.2 seconds in Duration textbox. This will create an 8820 samples file.
6. Enter 5 in Base Frequency textbox. This will create a single-cycle wave of 8820 samples.
7. Select File…Save As… menu.
8. Enter the filename, and choose PCM RAW data (*.pcm) from the Save as type dropdown.
9. Click on the Options button, and choose 32-bit IEEE float (0.24), offset input data by 0, and uncheck the Create DAT header file on save.

That's it. Single-Cycle wavetable is now ready to load in Pentagon I USER3 and USER4 slots.

Appendix II: Creating LFO Waveforms

Pentagon I is capable of loading USER-LFO waveforms. Clicking the small 'L' in the right corner of the instrument performs this unique capability.

The file for LFO shapes is quite similar to the SINGLE-CYCLE user waveforms, except than the length of the file must be fixed to 4410 samples.

A brief wavetable sample using CoolEdit can be created as follows:

1. Start CoolEdit.
2. Select Generate…Tones menu. The New Waveform dialog box will appear.
3. Choose SampleRate = 44100, Channels = Mono and Resolution = 32-bit (float).
4. Choose any waveform from Flavor dropdown (i.e. Sin^2).
5. Enter 0.1 seconds in Duration textbox. This will create a 4410 samples file.
6. Enter 10 in Base Frequency textbox. This will create a single-cycle wave of 4410 samples.
7. Select File…Save As… menu.
8. Enter the filename, and choose PCM RAW data (*.pcm) from the Save as type dropdown.
9. Click on the Options button, and choose 32-bit IEEE float (0.24), offset input data by 0, and uncheck the Create DAT header file on save.

That's it. LFO wavetable is now ready to load in Pentagon I.