Nebulæ

Sample Player/Granular Oscillator

QU-BIT ELECTRONIX

Description

Nebulæ is a voltage controlled sample player and granular oscillator in the Eurorack modular synthesizer format. Expanding upon techniques pioneered by 1980's era samplers and Curtis Roads in his book *Microsounds*, Nebulæ uses recorded audio for generating granular clouds, microtonal drones, loops and otherworldy sounds from any source material. It is also capable of acting as a classic keyboard style MIDI sampler/drum sequencer while in one-shot mode.

The module uses a Raspberry Pi as a CPU and the audio programming language Csound for digital signal processing.

For more information on the Raspberry Pi:
http://www.raspberrypi.org/

For more information on Csound:
http://www.csounds.com/

Table of Contents

Installation

To install, locate 20HP of space in your Eurorack case and confirm the positive 12 volts and negative 12 volts sides of the power distribution lines. Plug the connector into the power distribution board of your case keeping in mind that the red band corresponds to negative 12 volts and the white to positive 12 volts. In *most* systems the negative 12 volt supply line is at the bottom.

Specifications

Format: 20 HP Eurorack module

Dimensions: 40mm deep (skiff friendly)

Max current: 320mA

Looping Mode

Looping Mode Functions

1. MIDI Input - MIDI input jack for 5 pin MIDI cable. Note-on events set pitch to note on value. Specified CCs correspond to every parameter excluding drive and amp. See MIDI implementation chart on page 17 for CC numbers associated with looping mode parameters.

2. Speed CV - Bipolar control voltage input for speed of playback. Range is +/- 2.5V.

3. Speed Negative LED - LED indicating the current value of speed when speed is negative.

4. Speed Positive LED - LED indicating the current value of speed when speed is positive.

5. Speed - Control for speed of playback. If speed is positive the file will play forwards. If speed is negative the file will play backwards. The current range setting sets the maximum and minimum values for speed. [See edit mode functions on page 10 for detailed explantion of how to change the range.] In 1/V octave range, the maximum value for speed is twice as fast as the original and the minimum value is twice as fast, playing in reverse. In normal range, the maximum value for speed is the original speed of the file and the minimum value is the original speed of the file playing backwards. In extended range, the maximum value is seven times as fast and the minimum is seven times as fast, playing in reverse. The default range is 1/V octave.

6. Preset Recall Trigger - Toggle for recalling the current preset. The color of the System LED indicates which preset is being recalled.
Preset 1 - Yellow
Preset 2 - Green
Preset 3 - Blue

7. Preset Recall CV Input - CV input for Preset recall. When input is above 2.5V, the preset is recalled. When lower than 2.5V, the preset is not recalled.

8. Freeze LED - LED indicating the current state of freeze. If lit up, freeze is activated. If not lit up, freeze is not activated.

9. Freeze - Trigger to "freeze" the current audio stream.

10. Freeze Gate Input - Gate input for freeze. Threshold voltage is 2.5V.

11. Next File - Selects new audio file according to the current audio file selection mode. [See the edit mode section for information on how to change the current audio file selection mode.] If the current selection mode is sequential, *next file* will choose the next file in alphabetical order. If the current selection mode is backwards, it will move through the files in reverse alphabetical order. If the current selection is random, it will choose a random file. The default is sequential.

12. Next File Gate Input - Gate input for next file. Threshold voltage is 2.5V.

13. 1 Volt Per Octave CV Input - Unipolar 1 volt per octave input for pitch of playback. 5 octave range from 0V - 5V. When the range setting is in normal or extended this input becomes a linear input (will not track 1/V octave).

14. Glide - Sets transition time between successive pitch values. Minimum value is 0 seconds. Maximum value is .175 seconds.

15. Pitch - Controls pitch of playback. The current range setting sets the maximum and minimum values for pitch. [See the edit mode section for detailed explanation of how to change the range.] In 1/V octave range, the maximum value for pitch is two octaves higher than the original pitch of the file and the minimum value is three octaves lower than the original. In normal range, the maximum value for pitch is the original pitch of the file and the minumum value is three octaves lower than the original. In extended range, the maximum value is thirty octaves higher than the original and the minimum is three octaves lower than the original. The default range is 1/V octave.

16. Grain Mix - Sets wet/dry mix between granular audio stream and regular audio stream.

17. Grain Mix CV - Bipolar control voltage input for grain mix. Range is +/- 2.5V.

18. Grain Size - Sets the size of each grain in the granular audio stream. Minimum value is .01ms. Maximum value is 78ms. Each grain is enveloped with a Gaussian curve.

19. Grain Size CV - Unipolar control voltage input for grain size. Range is 0V - 5V.

20. Grain Rate - Sets the rate of grain distribution per second in the granular audio stream. Minimum value is 1 grain per second. Maximum value is 23 grains per second.

21. Grain Rate CV - Unipolar control voltage input for grain rate. Range is 0 - 5V.

22. Loop Start - Sets start position of file.

23. Loop Start CV - Unipolar control voltage input for loop start. Range is 0 - 5V.

24. Loop Size - Sets size of loop.

25. Loop Size CV - Unipolar control voltage input for size of loop. Range is 0 - 5V.

26. Edit/Load New Files/One-Shot Mode - Pressing once will enter edit mode where system settings can be changed that aren't readily accessible via the front panel such as range, audio file selection, random grain displacement and current preset. Holding down the *edit* button and pressing *next* will load new audio files from the flash drive that is currently in the USB port. Holding the *edit* button down and pressing *recall* will enter One-Shot mode.

27. USB File Load - USB port for loading audio files and .csd files into the module. Nebulæ will load every .wav, .flac, .aif, and .ogg file in the root directory of the flash drive into RAM in alphabetical order. Maximum 9.5 minutes of audio can be loaded at a time. If a .csd file is in the root directory of the flash drive, Csound will begin playing that file and will not load audio files into RAM. **NOTE: To improve boot time it is highly recommended to convert the sound files to mono.**

28. Drive - Control of analog distortion applied to output signal.

29. System LED - RGB LED for indication of system state and functions.
During boot: **Pulsing Red** indicates the Raspberry Pi is booting up.
        Pulsing White indicates that the module is ready to load files
        Pulsing White/Red Flashes indicates that the module has begun to copy soundfiles from a USB drive into RAM
        Off indicates that the module is playing the audio files

After boot: **Fast Pulsing Yellow** indicates preset 1 is being recalled.
        Fast Pulsing Red indicates preset 2 is being recalled.
        Fast Pulsing Green indicates preset 3 is being recalled.
        White Pulse indicates a new file was selected
        White Pulsing indicates the edit button is being held down.

30. Attenuator - Analog attenuator of output signal.

31. Output - Audio output jack

Edit Mode

Edit Mode Functions

1. Audio File Selection LEDs - Indicates the current behavior of the *next audio file* parameter in looping mode. When the LEDs are moving left to right, it indicates that Nebulæ will choose audio files alphabetically. If the LEDs are moving right to left, it indicates that Nebulæ will choose audio files in reverse alphabetical order. If the LEDs are flickering in a random pattern, Nebulæ will choose audio files at random.

2. Save Preset - This button will save the current knob / CV states to the currently selected preset.

3. Audio File Selection Mode - Sets the audio file selection mode for the *next audio file* parameter in looping mode.

4. Range - Cycles through settings for range of speed and pitch in looping mode. Current range setting is indicated by the Nebula indicator LED.

5. Scatter Grain Toggle - To change the scatter grain parameter press the audio file selection (freeze) and range (next) buttons simultaneously. Toggles between a random "scattering" of grain rate and a consistent grain rate (equal distance between consecutive grains). Upon boot, this parameter defaults to a consistent grain rate (no scattering). This parameter cannot be saved in a preset.

6. Exit - Pressing this button once will exit edit mode and return to looping mode.

7. Preset Select - Sets the current preset to be saved / recalled. Far left is preset 1, center is preset 2, far right is preset 3.

8. System LED - Indicates the currently selected preset and range:

Presets:
> **Preset 1** - Yellow
> **Preset 2** - Green
> **Preset 3** - Blue

Range:
> **1/V Per Octave -** Violet
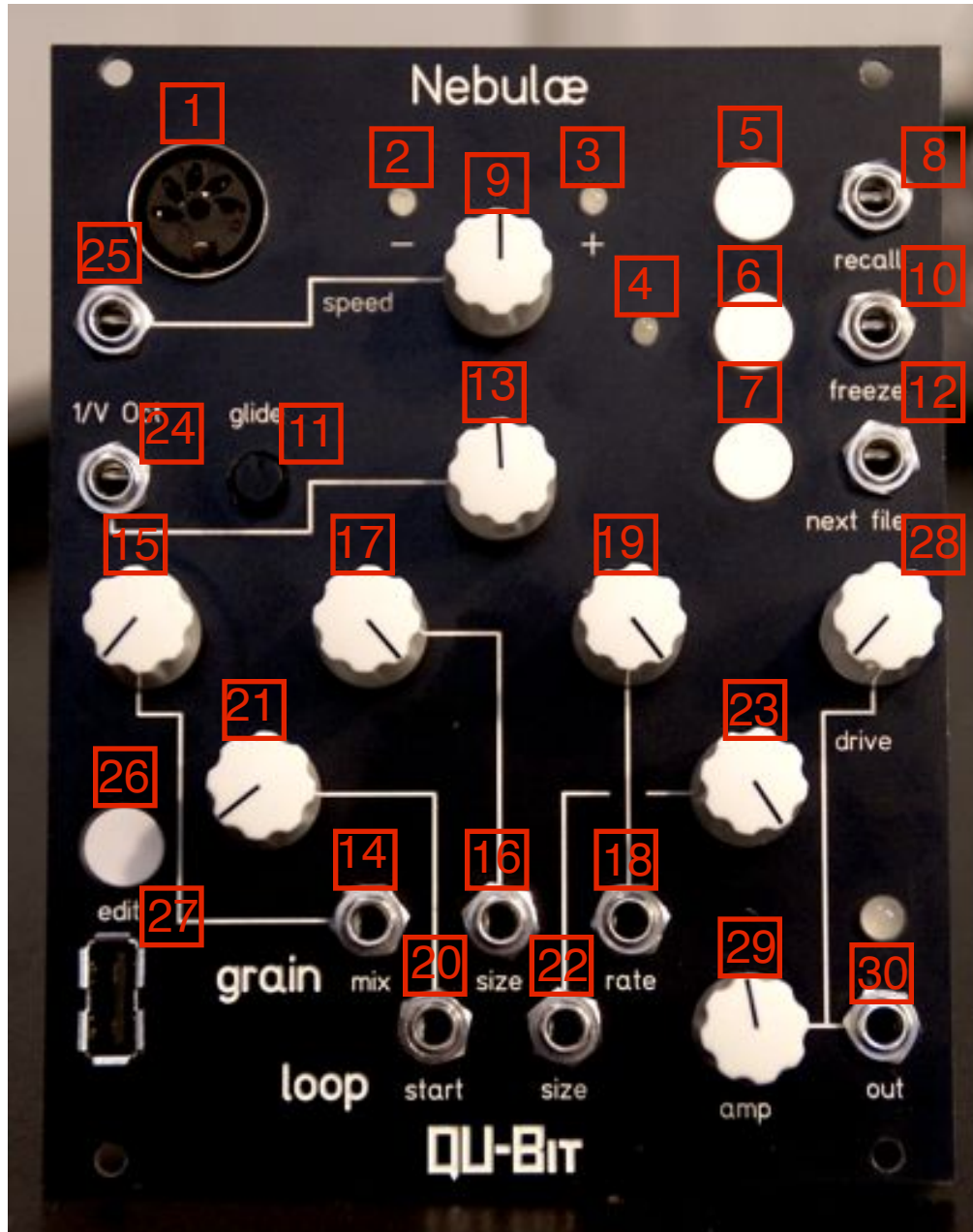> **Normal -** Orange
> **Extended(alias) -** Red

Scattered Grains:
    Steady - Pink steady
    Scattered - Pink flashing

One Shot Mode

One-Shot Mode Functions

1. MIDI In - MIDI input. See MIDI implementation chart on page 17 for CCs and note numbers for controlling one shot mode.

2. Bank 1 LED - Indicates that buttons will trigger the first three samples in memory

3. Bank 2 LED - Indicates that the buttons will trigger samples 4-6 in memory

4. Bank 3 LED - Indicates that the buttons will trigger samples 7-8 in memory

5. Trigger for first file of current bank - Triggers the first file in the present bank as indicated by the bank LEDs.

6. Trigger for second file of current bank - Triggers the second file in the present bank as indicated by the bank LEDs.

7. Trigger for third file of current bank / Kill all - Triggers the third file in the present bank as indicated by the bank LEDs. If the current bank is 3, this button becomes a trigger to stop all currently playing files.

8. File 1 Gate Input - Gate input for file 1. Threshold voltage is 2.5V.

9. File 1 Varispeed - Varispeed control of file 1. Minimum is 4 octaves beneath original pitch. Maximum is 1 octave above original pitch.

10. File 2 Gate Input - Gate input for file 2. Threshold voltage is 2.5V.

11. File 2 Varispeed - Varispeed control of file 2. Minimum is four octaves beneath original pitch. Maximum is one octave above original pitch.

12. File 3 Gate Input - Gate input for file 3. Threshold voltage is 2.5V.

13. File 3 Varispeed - Varispeed control of file 3. Minimum is four octaves beneath original pitch. Maximum is one octave above original pitch.

14. File 4 Gate Input - Gate input for file 4. Threshold voltage is 2.5V.

15. File 4 varispeed - Varispeed control of file 4. Minimum is 4 octaves beneath original pitch. Maximum is 1 octave above original pitch.

16. File 5 Gate Input - Gate input for file 5. Threshold voltage is 2.5V.

17. File 5 varispeed - Varispeed control of file 4. Minimum is 4 octaves beneath original pitch. Maximum is 1 octave above original pitch.

18. File 6 Gate Input - Gate input for file 6. Threshold voltage is 2.5V.

19. File 6 varispeed - Varispeed control of file 6. Minimum is 4 octaves beneath original pitch. Maximum is 1 octave above original pitch.

20. File 7 Gate Input - Gate input for file 7. Threshold voltage is 2.5V.

21. File 7 Varispeed - Varispeed control of file 7. Minimum is 4 octaves beneath original pitch. Maximum is 1 octave above original pitch.

22. File 8 Gate Input - Gate input for file 8 . Threshold voltage is 2.5V.

23. File 8 Varispeed - Varispeed control of file 8. Minimum is 4 octaves beneath original pitch. Maximum is 1 octave above original pitch.

24. Global varispeed CV input - CV input for varispeed of all audio files. This value is added to the current varispeed knob state of each file. Range is 0 - 5V.

25. Kill All Gate Input - Silences all currently playing files when a gate signal is detected. Threshold voltage is 2.5V.

26. Sample Bank Select / Edit - Allows for the loading of new audio files and returning to looping mode. Holding down the edit button and pressing next will load new audio files. Holding down the edit button and pressing recall will cause the module to return to looping mode.

27. USB file load - USB port for loading audio files and .csd files into the module. Nebulæ will load every .wav, .flac, .aif, and .ogg file in the root directory of the flash drive into RAM in alphabetical order. Maximum 9.5 minutes of audio can be loaded at a time. If a .csd file is on the flash drive, Csound will begin playing that file and will not load audio files into RAM.
NOTE: To improve boot time it is highly recommended to convert the sound files to mono.

28. Drive - Control of analog distortion applied to output signal.

29. Attenuator - Analog attenuator of output signal.

30. Output - Output jack

Looping Mode MIDI Implementation

CC Number	Channel	Parameter	Range
5	Omni	Portamento Time	0 - 127
12	Omni	Speed (MSB)	0 - 127
13	Omni	Pitch (MSB)	0 - 127
14	Omni	Loop Start (MSB)	0 - 127
15	Omni	Loop Size (MSB)	0 - 127
16	Omni	Mix	0 - 127
17	Omni	Grain Size	0 - 127
18	Omni	Grain Rate	0 - 127
20	Omni	Freeze	0/127 (change state)
21	Omni	Next File	0/127 (change state)
22	Omni	Save Preset 1	0/127 (change state)
23	Omni	Save Preset 2	0/127 (change state)
24	Omni	Save Preset 3	0/127 (change state)
25	Omni	Recall Preset 1	0/127 (change state)
26	Omni	Recall Preset 2	0/127 (change state)
27	Omni	Recall Preset 3	0/127 (change state)
44	Omni	Speed (LSB)	0 - 127
45	Omni	Pitch (LSB)	0 - 127
46	Omni	Loop Start (LSB)	0 - 127
47	Omni	Loop Size (LSB)	0 - 127

Note-on events between MIDI note numbers 32-100 will set the pitch parameter to the pitch value specified in the note-on message relative to the pitch of the sample.

One-Shot Mode MIDI Implementation

CC Number	Channel	Parameter	Range
13	Omni	Global Varispeed (MSB)	0 - 127
45	Omni	Global Varispeed (LSB)	0 - 127

Note	Note Number	Channel	Parameter
C4	60	Omni	Trigger File 1
D4	62	Omni	Trigger File 2
E4	64	Omni	Trigger File 3
F4	65	Omni	Trigger File 4
G4	67	Omni	Trigger File 5
A4	69	Omni	Trigger File 6
B4	71	Omni	Trigger File 7
C5	72	Omni	Trigger File 8
D5	74	Omni	Stop all files
C6	84	Omni	Stop File 1
D6	86	Omni	Stop File 2
E6	88	Omni	Stop File 3
F6	89	Omni	Stop File 4
G6	91	Omni	Stop File 5
A6	93	Omni	Stop File 6
B6	95	Omni	Stop File 7
C7	96	Omni	Stop File 8

Qu-Bit Electronix is Andrew Ikenberry && Jason Lim
https://www.qubitelectronix.com

For samples to play on your Nebulae, go to:
http://www.qubitelectronix.com/#!nebulae-sample-library/c1mhj

This module is open source! Get the code and schematics at:
http://www.qubitelectronix.com/#!nebul-source/c1ha7

Or clone from git with:
git clone https://github.com/aikenberry/qubitnebulae.git

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