# µClouds SE

## Eurorack Module

TD–UCSE–C

Designed by Daniel & Michael Gilbert of *Tall Dog Electronics* in Western Massachusetts
**tall-dog.com** | **uclouds-se.com**

Based on the *Clouds* module designed by Émilie Gillet of *Mutable Instruments*
**mutable-instruments.net**

Partially manufactured by *Worthington Assembly* via *CircuitHub* in South Deerfield, MA
**worthingtonassembly.com**
**circuithub.com**

Partially manufactured by *PCBWay* in Hangzhou, China
**pcbway.com**

Assembled at *Rust Temple* in Easthampton, MA
**rusttemple.today**

Source materials are available on *GitHub*
**github.com/loglow/uClouds_SE**

# Contents

# About

*Clouds* is a granular audio processor that creates textures and soundscapes by combining multiple overlapping, delayed, transposed and enveloped segments of sound taken from a recording buffer.

This redesigned *µClouds SE* (Special Edition) is a new revision of *Clouds* that miniaturizes the module from 18HP to 8HP and redesigns its front panel layout.

*µClouds SE* remains fully compatible with future upstream *Clouds* firmware upgrades and any other alternate firmwares that are compliant with the standard *Clouds* design.

# Included Parts

*µClouds SE* includes a standard 16-pin to 10-pin Eurorack power cable and two sets of mounting screws for racks/enclosures with either M2.5 or M3 threads.

The **TD-UCSE-C/B** variant has a matte black front panel with gold markings made from FR-4 (glass-reinforced epoxy laminate) material. The included mounting screws are black.

The **TD-UCSE-C/S** variant has a satin silver front panel with black markings made from anodized aluminum material via the Metalphoto process. The included mounting screws are silver.

# History

The original *Clouds* (**mutable-instruments.net/ modules/clouds**) was designed by Émilie Gillet of *Mutable Instruments* (**mutable-instruments.net/ about**) under a CC BY-SA 3.0 (**creativecommons.org/ licenses/by-sa/3.0**) license. *Clouds* is available as a 18HP Eurorack module.

*Clouds* differs from other granular Eurorack modules in that it focuses on the real-time processing of audio sources from your modular system itself, rather than the playback of pre-recorded samples from a storage device. It rewards the freezing, fragmentation and dissolution of the unexpected instant, rather than the careful planning of what might very well not come.

Source: **github.com/pichenettes/eurorack**

# Warranty

This product is covered under warranty for one year following the date of purchase as indicated on the original sales receipt. This warranty covers any defect in the manufacturing of this product. This warranty does not cover any damage or malfunction caused by incorrect use—such as, but not limited to, power cables connected backwards, excessive voltage levels, exposure to extreme temperature or moisture levels, physical damage due to impact, or any aftermarket physical or electrical modifications or repairs.

This warranty covers either repair or replacement, at our sole discretion. This repair or replacement is subject to verification of the defect or malfunction and proof of purchase as confirmed by showing the model number on an original dated sales receipt. Shipping and handling fees are to be paid for by the customer.

Please contact **support@tall-dog.com** for a return authorization prior to shipping anything to us. Please understand that we will not be able to service units under warranty that have been modified or previously repaired by the customer or a third party.

# Granular Synthesis

*Clouds* continuously records the incoming audio into a short amount of sample memory. While recording time can reach up to 8 seconds by reducing the audio quality setting, don't think of this as *tape*—think of it as a space, a room. Using this recorded audio data, the module synthesizes a sonic texture by playing back short (overlapping) segments of audio (also known as *grains*) extracted from it.

*Clouds* allows you to control:

- From which part of the buffer the grains are taken.
- How long the grains are.
- At which speed/pitch the grains are replayed.
- How much overlap there is between the grains (density).
- Whether the distribution of grains in time is constant or random.
- Which envelope curve is applied to the grains, thus giving the impression of a *rough* or *smooth* texture. In addition, to create textures with a *blurry* feel, a diffuser (a network of all-pass filters, like reverb without tail) can be applied.

# Granular Synthesis *Cont'd*

The module plays grains continuously, at a rate determined by the **DENS** (density) and **SIZE** settings. A trigger input (**TRIG**) is also present to explicitly instruct the module to start the playback of a new grain. The maximum number of concurrent grains is quite large— between 40 and 60. This specificity brings Clouds closer to the roots of granular synthesis, and allows the synthesis of varied textures even from basic waveforms. There are many more dimensions to granular synthesis than keeping a playback pointer moving through a SD-card sample!

It is possible, at any time, to **FREEZE** the audio buffer from which the grains are taken. In this case, the incoming audio is no longer recorded. In a sense, *Clouds* is the exact opposite of a sampler: by default, the module always samples the audio it receives, except when it is in the frozen state.

# Front Panel

**IN L** and **IN R** — Stereo audio input jacks. When no patch cable is inserted in the right channel input, this input will receive the signal from the left channel.

**IN GAIN** — Audio input gain adjustment knob, with a range from -18 dB to +6 dB.

**TRIGGER** — Generates a single grain. By moving the **DENS** knob to 12 o'clock, and sending a trigger to this input jack, *Clouds* can be controlled like a micro-sample player. An LFO or clock divider (or even a pressure plate) can thus be used to sow grains at the rate of your choice.

**FREEZE** — This button stops the recording of incoming audio. Granularization is now performed on the last few seconds of audio kept in memory in the module. When the **FREEZE** input jack's gate signal is high, the recording of incoming audio stops, just as latching the **FREEZE** button would do.

# Front Panel *Cont'd*

All CV inputs are calibrated for a range of ±5V. Voltages outside of this range are tolerated, but will be clamped to ±5V.

**POS** — Grain position adjustment knob and CV input. Selects from which part of the recording buffer the audio grains are played. Turn the knob clockwise to travel back in time.

**DENS** — Grain density adjustment knob and CV input. At 12 o'clock, no grains are generated. Turn clockwise and grains will be sown randomly, counter-clockwise and they will be played at a constant rate. The further you turn, the higher the overlap between grains.

**SIZE** — Grain size adjustment knob and CV input.

**TEXT** — Grain texture adjustment knob and CV input. Morphs through various shapes of grain envelopes: square (boxcar), triangle, and then Hann window. Past 2 o'clock, activates a diffuser which smears transients.

**PITCH** — Grain pitch (transposition) adjustment knob and CV input with V/octave response. At 12 o'clock, the buffer is played at its original frequency.

**BLEND** — The CV input can control one of the following functions depending on the active blending parameter: dry/wet balance, grain stereo spread, feedback amount and reverb amount. The multi-function **BLEND** knob is described in the **Blend Parameters** section on page 11.

# Front Panel *Cont'd*

**MODE** — This button selects which of the blending parameters is controlled by the **BLEND** knob and CV input, or selects one of the four audio quality settings.

**MEMORY** — This button is described in the **Saving & Loading Buffers** section on page 14.

Indicator LEDs — These work as an input VU meter. When **FREEZE** is active, they monitor the output level. Soft-clipping occurs when the last LED is on. They can also indicate the quality setting (red), the function assigned to the **BLEND** knob (green), or the values of the four blending parameters (multicolor).

**L** and **R** — Stereo audio output jacks.

# Blend Parameters

The **BLEND** knob can control one of four settings:

- Dry/wet balance
- Stereo spread (amount of random panning/balance applied to the grains)
- Feedback amount
- Reverberation amount

To select which parameter is controlled by the **BLEND** knob and its associated CV input, press the **MODE** button. The current parameter is temporarily indicated by a green LED.

When turning the **BLEND** knob, the color of the four status LEDs temporarily shows the value of the four blending parameters (from off, when the parameter is set to its minimum value, to green, amber, and then red for its maximum value).

At times, the position of the knob may not match the value of a parameter. This is a drawback inherent to multi-function knobs. When this happens, turning the **BLEND** knob clockwise (or counterclockwise) will cause a small increase (or decrease) in the value of the parameter, and turning it further will cause a larger change, until the value progressively catches up with the knob's position.

# Blend Parameters *Cont'd*

There are a few things worth knowing about these settings:

- All settings are automatically saved, and will be restored the next time the module is powered on.

- Strange things happen when **FREEZE** is enabled. Because feedback/layering can no longer occur in the recording buffer (which is frozen) the output signal is routed through delays and all-pass filters, letting the feedback build-up in this extra recording space. This gives the sound a reverb-like nature.

# Audio Quality

Hold the **MODE** button for one second, then press it repeatedly to choose a recording quality. The current quality setting is indicated by a red LED:

|   | Rate | Resolution | Channels | Buffer |
|---|------|-----------|----------|--------|
| **1** | 32 kHz | 16-bit | Stereo | 1 sec |
| **2** | 32 kHz | 16-bit | Mono | 2 sec |
| **3** | 16 kHz | 8-bit μ-law | Stereo | 4 sec |
| **4** | 16 kHz | 8-bit μ-law | Mono | 5 sec |

Note that *Clouds* uses a lovely flavor of 8-bit called *μ-law companding* which sounds like a cassette or a Fairlight, but with less hiss and more distortion.

# Saving & Loading Buffers

Up to 4 frozen audio buffers can be saved and reloaded. Along with the audio data itself, the quality settings and the processing mode are saved with it.

To save the recording buffer in permanent memory:

1. Hold the **MEMORY** button for one second.
2. Press the **MODE** button repeatedly to select one of the 4 memory slots. The selected slot is indicated by a blinking red LED.
3. Press the **MEMORY** button to confirm.

To load a recording buffer from permanent memory:

1. Press the **MEMORY** button.
2. Press the **MODE** button repeatedly to select one of the 4 memory slots. The selected slot is indicated by a blinking green LED.
3. Press the **MEMORY** button to confirm.

If you press the **MEMORY** button by mistake, don't press any button for a few seconds and the module will return to its normal state.

# Tips & Tricks

- If you need a noise source to randomize grain position or pitch, you can reuse one of the audio outputs. It's not white noise, but it's random enough.

- Scratch and caress a sound by using a contact microphone or a touch strip to trigger grains, then modify the playback position via **POS**.

- Very dense clouds sound the best when at least one parameter (**PITCH** or **POS**) receives random modulations. Otherwise, the many identical *echoes* created by the repeating grains will sound like a very resonant feedback comb filter.

- Raw material like sawtooth or sine waves sound very good, especially with heavy random modulation. A fun exercise is to recreate the classic THX sound with a random source and a VCA.

- Send a very fast sequence of 3 or 4 notes to the **PITCH** input, so that each randomly sown grain picks one of the notes. The result is a chord!

- Experiment with capturing many small fragments of sound by sending short pulses to **FREEZE** while a complex patch is being played through the audio input!

# Calibration

The module is factory-calibrated using precision voltage sources. Follow this procedure only if you want to compensate for inaccuracies in your CV sources, or if your module has lost its calibration settings following a fault or the installation of alternative firmware.

To calibrate the unit:

1. Disconnect all CV inputs.

2. Connect the note CV output of a well-calibrated keyboard interface or MIDI-CV converter to the **PITCH** input jack.

3. Press and hold the **MEMORY** button, and while holding it, press the **MODE** button. The first two LEDs will blink orange. Release the buttons.

4. Play a C2 note, or send a 1V signal from your CV source.

5. Press the **MEMORY** button. All four LEDs will blink orange.

6. Play a C4 note, or send a 3V signal from your CV source.

7. Press the **MEMORY** button.

Calibration is complete.

# Alternate Modes

Early in its development, *Clouds* tried to be many different things. This experimental code is still available in the module. Press the **MODE** button for 5 seconds until one of the LEDs glows orange, then repeatedly press the button to select one of the following functions:

1. Granular processor *(default mode)*
2. Pitch shifter/time-stretcher
3. Looping delay
4. Spectral processor

These features are experimental, undocumented, and the knobs might be reassigned to functions very different from what is printed on the panel!

# Firmware Warnings *18*

Before starting the audio firmware update procedure, please double-check the following:

- Make sure that no additional sound (such as email notification sounds, background music, etc.) from your computer will be played during the procedure.

- Make sure that your speakers/monitors are muted or not connected to your audio interface—the noises emitted during the procedure are aggressive and can harm your hearing.

- On non-studio audio equipment (for example the line output from a desktop computer), you might have to turn up the volume to the maximum.

# Firmware Update

Unplug all inputs/outputs from the module. Connect the output of your audio interface or sound card to the **IN L** input jack. Power on your modular system while holding the **FREEZE** button, then release. The **FREEZE** LED should blink.

When you are all set, play the firmware update file into the module. While the module receives data, the bar graph will show the signal level. Signal reception is optimal when two or three LEDs are lit. You can use the **IN GAIN** knob to boost or reduce the gain. When the end of the audio file is reached, the module will automatically restart. If it doesn't restart, please retry the procedure.

If the signal level is too weak, the LEDs will blink red. Press the **FREEZE** button and retry with a higher gain. If this doesn't help, try the procedure from a different computer or audio interface, and make sure that no other equipment (such as an equalizer or FX processor) is inserted in the signal chain.

# Serial Programming

The module can also be programmed using a serial data connection. This is most easily accomplished by using a USB-to-serial chip such as the popular *FT232R* which can be found in many standalone breakout boards and cables, including the *FTDI TTL-232R-3V3* as well as various equivalents from *Adafruit*, *SparkFun*, and others. Data signals should be at 3.3V levels.

The serial connection should be hooked up to the white shrouded 6-pin header labeled **FTDI** (H6) on the module's PCB. This is a *JST-XH* header that works very well with the 0.1″ pitch female connectors that are frequently found on these cables. Only pins **1 (GND)**, **4 (RX)**, and **5 (TX)** are used, and the location of pin 1 is closest to the top of the board. Power must be supplied separately via a Eurorack power cable connected to the **POWER** (H7) header.

To prepare the processor for serial programming:

1. Power-on the module.
2. Press and hold both the **BOOT** (S1) and **RESET** (S2) buttons at the same time.
3. Release the **RESET** button.
4. Wait a moment, then release the **BOOT** button.

The processor is now ready to be programmed.

# JTAG Programming

The module can also be programmed using a JTAG programmer connected to the black shrouded header labeled **JTAG** (H5) on the module's PCB. Power must be supplied separately via a Eurorack power cable connected to the **POWER** (H7) header.

An example of this kind of programmer is the *Olimex ARM-USB-OCD*. Their *ARM-JTAG-20-10* adapter is also necessary in order to accommodate the module's miniature 0.05" pitch 10-pin header.

No additional steps are necessary to prepare the module for programming via this method.

If you are interested in serial or JTAG programming, please explore the *Vagrant environment for Mutable Instruments modules hacking* which can be found at **github.com/pichenettes/mutable-dev-environment**

Other programming resources can be found at **forum. mutable-instruments.net/t/4336** (*Mac Tutorial: How to compile and upload the firmware of MIs eurorack modules*) and at **medium.com/music-thing-modular-notes/a08173cec317** (*How to get started writing your own firmware for Mutable Instruments Clouds*).

# Documentation

Much of the information in this manual was created by Émilie Gillet of *Mutable Instruments* and released under the *CC BY-SA 3.0* license.

Modifications and additions to this material were created by *Tall Dog* and released under the compatible *CC BY-SA 4.0* license.

For an overview of the implications and terms of these licenses, please read the following page.

# Support

For all support inquiries, please send an email to
**support@tall-dog.com**

# Who We Are

***Tall Dog Electronics*** is located in the Pioneer Valley
region of Western Massachusetts. *Tall Dog* has primarily
focused on producing a variety of breakout boards for
the *Teensy* microprocessor development platform and
conducts the majority of its business via the *Tindie*
marketplace. *Tall Dog* released their first Eurorack
module, *µBraids SE*, in late 2017.

***Michael Gilbert*** is a composer, recording artist, and
teacher of electronic music, for over 40 years. His
music is a creative mix of electronic, jazz, world, and
contemporary classical idioms, and is available on 9
albums of original work as *Michael William Gilbert*. The
music has featured Adam Holzman, Mark Walker, Peter
Kaukonen, David Moss, and Tony Vacca. He has also
designed and built electronic music equipment, using
it in his own studio and making it available to other
musicians.

***Daniel Gilbert*** is a designer and engineer with a
background in film, photography, and animation. After
graduating from *Hampshire College* he spent the next
several years working in the Los Angeles film industry.
He now resides in Easthampton, Massachusetts, where
he designs, builds, and distributes *Tall Dog* products.

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