

μo_C SE

Eurorack Module

TD-OCSE-B

Designed by Daniel & Michael Gilbert of *Tall Dog Electronics* in Western Massachusetts

tall-dog.com | uoc-se.com

Based on the *Ornament & Crime* module designed by Patrick Dowling, mxmxmx, and Tim Churches

ornament-and-cri.me

Main board manufactured by *Worthington Assembly* via *CircuitHub* in South Deerfield, MA

worthingtonassembly.com
circuithub.com

Display manufactured by *PCBWay* in Hangzhou, China

pcbway.com

Assembled at *Rust Temple* in Easthampton, MA

rusttemple.today



Licensed under *Creative Commons*

Attribution-NonCommercial-ShareAlike 4.0 International

creativecommons.org/licenses/by-nc-sa/4.0

Source materials are available on *GitHub*

github.com/loglow/uo_C_SE

Contents	2
About	3
Included Parts	3
History	4
Warranty	5
Overview	6
Manual Scope	6
List of Apps	7
Startup	8
App Selection	9
Save Settings	10
Reset Settings	10
General Operation	11
Scales & Tunings	13
Inputs & Outputs	14
Firmware Update	16
Documentation	17
Hardware License	17
CC BY-NC-SA 4.0	18
Support	19
Who We Are	19

Ornament & Crime (aka *o_C*) is a multi-purpose module in which a generic set of inputs and outputs are provided. A textual OLED display is used to permit the re-mapping of these inputs and outputs via a number of different *apps* which can be selected on-the-fly.

This redesigned *μo_C SE* (Special Edition) is a new revision of *o_C* that miniaturizes the module from 14HP to 8HP and redesigns its front panel layout.

μo_C SE remains fully compatible with future upstream *o_C* firmware upgrades and any other alternate firmwares that are compliant with the standard *Ornament & Crime* design.

Included Parts

μo_C 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-OCSE-B/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-OCSE-B/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.

The original o_C schematic was designed by Patrick Dowling (aka pld), Max Stadler (aka mxmxmx), and Tim Churches (aka bennelong.bicyclist) and released under a *CC BY-NC-SA 4.0* (creativecommons.org/licenses/by-nc-sa/4.0) license.

o_C is described as “a post-capitalist product of the sharing economy,” and as such, it is neither manufactured nor sold by a single entity. It is available in its original incarnation as a 14HP Eurorack module from various sources and individuals.

It should be noted that the original o_C boards and panels were released under a more permissive *CC BY-SA* license. However, because $\mu o_C SE$ is derived from the original o_C schematic, it retains the non-commercial licensing terms of its upstream counterpart.

Sources:

- ornament-and-cri.me/buy-it
- ornament-and-cri.me/licensing
- ornament-and-cri.me/schematic

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.

The original μ_C module was designed to perform a single function: a digital, quantising version of the classic analogue shift register (ASR).

There is still a quantising ASR (analogue shift register) function in the current *Ornament & Crime* firmware, now named *CopierMaschine*, but several other *apps* have been added, including quantisers, sequencers, LFOs, random/chaotic CV generators, and so on.

These apps are selectable on-the-fly, without having to reboot the module or toggle the power.

Manual Scope

This manual goes on to cover the basic operation of the μ_C SE module, but it does not go into detail about each one of the individual apps, or how to use them.

Fortunately, there's excellent, in-depth documentation for each and every app available at the official *Ornament & Crime* website, which is located here: **ornament-and-cri.me/user-manual-v1_3**

Note: The μ_C SE front panel layout is somewhat different from the one pictured in the document referenced above. For more information, please see the diagrams in the **Inputs & Outputs** section on pages 14 and 15 of this manual.

- **CopierMachine** — quantising digital emulation of a four stage analogue shift register (ASR)
- **Harrington 1200** — neo-Riemannian Tonnetz transformations of triadic chords
- **Automatonnetz** — Tonnetz transforms combined with a “vector” sequencer
- **Quantermain** — quad pitch quantiser for external voltages
- **Meta-Q** — dual-channel quantiser with scale and note mask sequencing
- **Quadraturia** — wavetable quadrature LFO (low-frequency oscillator)
- **Low-rents** — dual Lorenz and Rössler (strange attractor) modulation generator
- **Piqued** — quad voltage-controlled envelope generator
- **Sequins** — dual-channel 4-track step sequencer
- **Dialectic Ping Pong** — quad bouncing ball envelope generator
- **Viznutcracker, sweet!** — quad “byte beat” equation generator
- **Acid Curds** — chord quantiser and chord progression sequencer
- **References** — specific reference voltage output and other utility functions

Immediately after power-on, the startup phase is indicated by a line at the bottom of the display which progressively shrinks right-to-left over several seconds.

By default, following the startup phase, the module boots into the last app from which settings were saved, unless one of the two encoders is being held down when the startup phase ends:

- **Left encoder (P1)** — enter calibration mode
- **Right encoder (P2)** — enter the app selection menu

Your μO_C SE module has already been calibrated at the factory using precision voltage sources and meters, so no further calibration steps should be necessary before you begin to use it.

Calibration mode is explained in detail at:
ornament-and-cri.me/calibration

The app selection menu can be reached either when the module is first powered on (by holding **P2** during startup) or during normal use by depressing the right encoder (**P2**) for two seconds or longer (this is considered a *long press*) and then releasing it.

The controls within the app selection menu are:

- Rotate the right encoder (**P2**) to highlight an app.
- Press the right encoder (**P2**) to use the selected app.
- Press the **UP** button (the upper button between the two encoders) to toggle *encoder acceleration* on and off. There will be no visual indication of this change.

Encoder acceleration increases the amount by which values are incremented or decremented on each encoder rotational click when you are rapidly spinning the encoder to edit values within an app.

This speeds up sweeping across the full range of values, while still retaining full precision when moving the encoder slowly.

Save Settings

10

You must manually save the state of the module if you want your settings to be preserved between reboots.

Your settings will not be automatically saved!

To save the current state, enter the app selection menu (long press **P2** and release) and then long press **P2** again (for a second time). This will save the module's state and also make the currently highlighted app the default app to load the next time the module is turned on. You'll see a brief confirmation animation as soon as the save occurs.

The current settings for **all apps** are saved each time you save the settings by doing this, not just the settings for the currently selected app.

The operation of the module is **briefly paused** while the settings are being saved. You may need to take this pause into account if you're in a live performance setting. Operation only pauses during a save, but not when switching from one app to another.

Reset Settings

To reset the app settings to their default state, push the **UP** and **DOWN** buttons simultaneously during the startup phase. This won't reset calibration data.

Each app has two display pages: a *settings mode* and a *screensaver mode*. Apps will drop into screensaver mode after a set period of inactivity (meaning no user interaction). This timeout period can be changed via the calibration menu, but the default timeout is 10 seconds. You can also *long press* the **UP** button (hold for at least 2 seconds) to manually invoke the screensaver mode.

The module functions the same regardless of whether settings are displayed or the screensaver is displayed. When the screensaver is displayed, clicking or rotating either of the two encoders (**P1** or **P2**) or pressing the **UP** or **DOWN** buttons will immediately bring up the settings display.

In settings mode, for most apps, the right encoder (**P2**) is used to scroll up and down the list of available settings. Press on the right encoder (**P2**) to toggle *edit mode*, indicated by one or two small up/down triangles next to the setting. Rotate the right encoder (**P2**) while in edit mode to increase or decrease the relevant setting. Press again on the right encoder (**P2**) to leave edit mode.

In multi-channel apps, the left encoder (**P1**) selects which of the four channel's settings are currently displayed (**A**, **B**, **C** or **D**). All channels remain active in the background at all times, even while editing values for a different channel. Also, the channel can be changed while editing a value, making it easy to edit the same setting on each of the four channels.

In non-multi-channel apps, the left encoder (**P1**) is used to set a root note or a transposition, or to set frequency or rate, or to select a scale. Its exact behavior is noted in the documentation for each individual app.

The two buttons below the display and between the encoders (the **UP** and **DOWN** buttons) either transpose notes up or down an octave, or increase or decrease frequency or speed in steps of 32. There are a few exceptions to this in certain apps, which are noted in the respective app-specific documentation.

The *Ornament & Crime* module comes with over 100 predefined scales, plus four user-defined scales which can be edited directly through the user interface via the *scale editor*.

For details about using the scale editor, please see the app-specific documentation for the *Quantermain* app: **ornament-and-cri.me/user-manual-v1_3/#active-note-scale-mask-and-scale-editing**

For more information about custom scales, see: **ornament-and-cri.me/custom-scales**

For a list of all the predefined scales, see: **ornament-and-cri.me/predefined_scales**

Many of the predefined scales are microtonal, which means that they have more than 12 notes per octave, or they are subsets of tunings with more than 12 notes per octave.

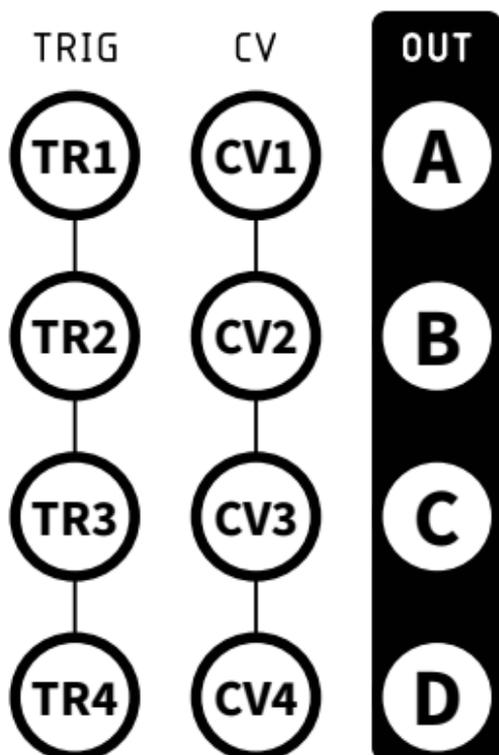
Scales with up to 16 notes per octave are supported. However, those 16 notes are arbitrary and themselves can be subsets of scales with many more than 16 notes per octave.

Inputs & Outputs

There are four trigger (**TRIG**) inputs, four control voltage (**CV**) inputs, and four output (**OUT**) channels. Within the app documentation, these inputs and outputs are referred to as:

- Trigger inputs — **TR1**, **TR2**, **TR3**, and **TR4**
- Control voltage Inputs — **CV1**, **CV2**, **CV3**, and **CV4**
- Output channels — **A**, **B**, **C**, and **D**

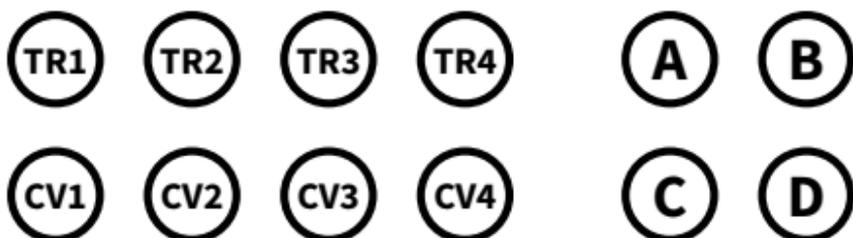
The arrangement of these jacks on the $\mu o_C SE$ module is as follows:



The original 14HP version of the *Ornament & Crime* module has a slightly different panel layout, and as such, the online documentation diagrams the inputs and outputs according to their original layout.

While reading the online app-specific documentation, please make a note of the differences in jack layout between the original 14HP module and the μO_C SE module.

The original jack layout, as it appears in the online app-specific documentation, is as follows:



Note: Updating the firmware (on an already calibrated module) doesn't require re-calibration. The calibration values are **not** overwritten when you install new versions of the firmware.

1. Download, install, and run the *Teensy Loader* application from: **pjrc.com/teensy/loader.html**
2. Download the *detectMK20.hex* file from: **goo.gl/sqWZht**
3. Download or compile a HEX file of the version of the firmware that you want to install. Official firmware releases are available at: **github.com/mxmxmx/O_C/releases**
4. Connect a Micro USB cable from the *Teensy 3.2* (on the back of the μo_C SE module) to your computer. The *Teensy* should not be removed from its socket on the module.
5. Provide standard Eurorack power to the μo_C SE module.
6. In the *Teensy Loader* application, select **Operation > Automatic Mode** and verify that a check appears next to it.
7. Select **File > Open HEX File** and choose the downloaded *detectMK20.hex* file.
8. Press the tactile button on the *Teensy* board once. A progress bar will appear briefly while the board is programmed. Verify that the orange LED on the *Teensy* blinks on and off.
9. Select **File > Open HEX File** and choose the firmware file.
10. Press the tactile button on the *Teensy* board once. A progress bar will appear briefly while the board is programmed. The module should now boot with the newly installed firmware.
11. Disconnect the cables. The firmware update is complete.

Much of the information in this manual was created by *mxmxmx*, *Patrick Dowling*, and *Tim Churches* and is **not** licensed under any open-source or *Creative Commons* license, and therefore third parties are **not** permitted to copy or re-publish the material. It is used here because permission was granted by the original authors.

Modifications and additions to this material were created by *Tall Dog* and, for the sake of simplicity, have also **not** been released under any particular license.

As such, please do not copy or redistribute the material in this manual without explicit written permission from the original copyright holders.

Hardware License

The design and hardware of the $\mu\text{o_C SE}$ module itself is released under the *CC BY-NC-SA 4.0* license in accordance with the upstream source material. Permission for commercial use of this material by *Tall Dog Electronics* has been explicitly granted by the copyright holders. Under the terms of this license, third parties are **not** permitted to use this material **commercially** without prior written permission. However, this material may be used, modified, or shared freely for non-commercial purposes.

For an overview of the implications and terms of this license, please read the following page.

This is a human-readable summary of (and not a substitute for) the license, which can be found at creativecommons.org/licenses/by-nc-sa/4.0/legalcode

You are free to:

- **Share** — copy and redistribute the material in any medium or format.
- **Adapt** — remix, transform, and build upon the material.

Under the following terms:

- **Attribution** — You must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.
- **NonCommercial** — You may not use the material for commercial purposes.
- **ShareAlike** — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original.
- **No additional restrictions** — You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits.

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.



μo_C SE User Manual
Revised 2019-05-17

Documentation © mxmxmx, Patrick Dowling and Tim Churches