Quad satellite system

Manual v0.1.0 **(DRAFT)**

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Safety warning

Before installing this module, ensure your Eurorack case is powered OFF.
Connect the power ribbon with correct orientation to avoid damage to the module or power supply. Use only standard Eurorack ±12V power and avoid exposure to moisture, excessive heat, or direct sunlight. Make sure all signals stay within typical Eurorack voltage ranges (usually ±5V to ±10V), and do not connect incompatible sources. Allow for ventilation, use proper mounting screws, and keep the module away from children and pets. Do not attempt repairs or modifications unless you are qualified—unauthorized changes may cause malfunction or void warranty and cause permanent damage to the module and/or your power supply.

Installation

1. Power OFF your system.
2. Connect the power supply ribbon cable in the correct orientation
3. Use the provided screws (or any compatible M3 screws) to mount it on your system.

Specs

height 3U | width 18hp | depth 25mm
power consumption NA on +/-12V rails
48khz 16bit

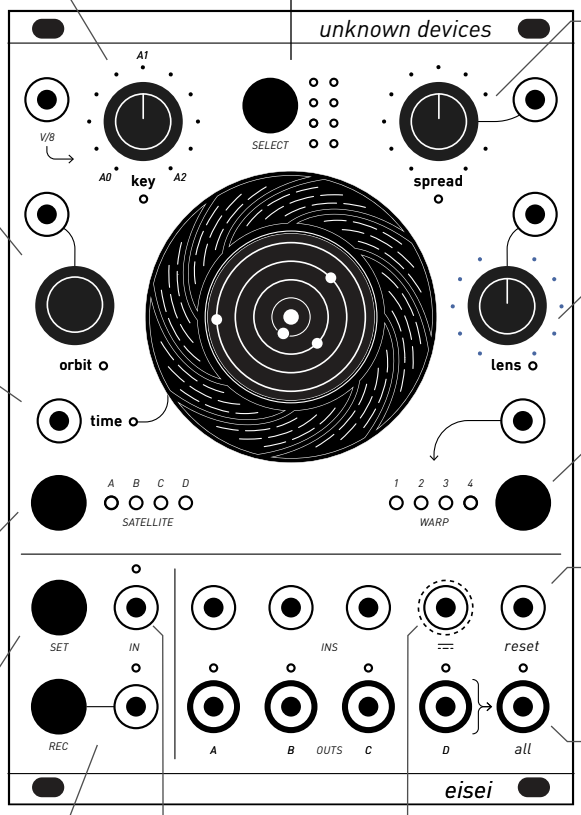
Features

Unique UI
Spectral sampling™
8x spectral tables
4x 20 bands filterbanks
4x internal oscs
4x Warp modifiers
based on esp32 + daisy 2
127x127px monochrome OLED display
48khz 16bit audio

Connectivity

6x CV inputs
3x trig/gate inputs
3x audio inputs
1x REC input
4x audio outputs
1x audio sum out
i2c port
expansion port

Panel Overview



Key
Musically control the tonic of the satellites (1V/oct input)

Spectral table Selector
Eisei can store and recall 8 spectral tables

Spread
Set the frequency intervals of the Satellites, from unison to octave unison - and anything in between.

Lens
Filterbank shaper.
At Noon all bands are wide open, the spectral table is unaltered. CCW for lopass-like response, CW for spectrum tilt towards the hi end.

Orbit
Set the speed of the satellites

Time
offset satellites position

Warp Mode
This section provides four methods to further manipulate the signal: Shift, Tanh, Shape and Blur

Satellite Selector
Edit ORBIT and TIME for each satellite individually

Reset
Set the satellites to their “0” position keeping the Time offset

Set
Edit Orbit start & end points (hold to enter SAVE page)

All out
analog sum of outs A-D

Record
Hold REC or send a gate to record a new spectral table

INs & OUTS
each satellite has its own in & out

REC AUDIO Input
Send audio to be analyzed translated into a Spectral table

Input D
activates satellite D’s scanner mode

Parameters ranges (CV & pots)

Key
CV ±5V (1V/oct scaled)
pot A0 - A2 (27.5-110hz)

Orbit
CV ±5V
endless encoder ± 64hz

Time
CV ±5V
touch wheel 360°

Record
Gate/Trig +5V (rising)

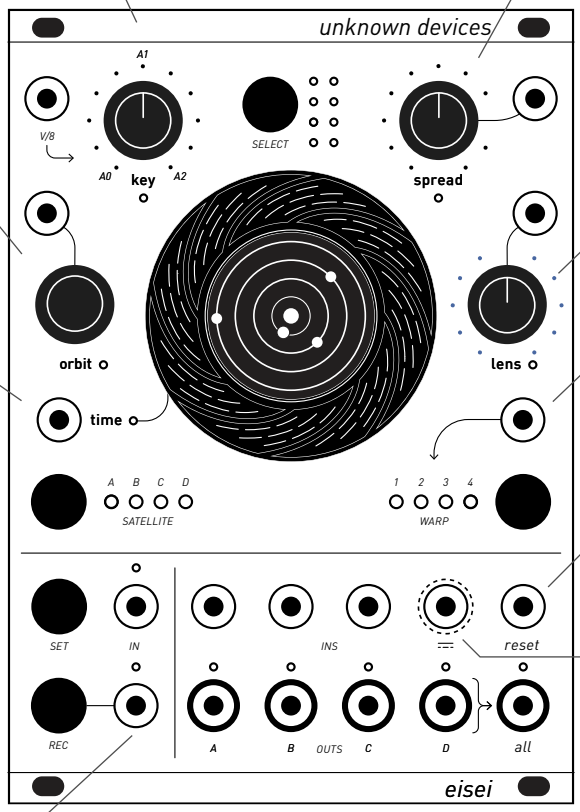
Spread
CV ±5V
pot unison to octave unison

Lens
CV ±5V
pot low pass to high tilt

Warp
CV ±5V

Reset
Gate/Trig +5V (rising)

Sat D Scanner
CV ±5V



Satellites

In this environment a satellite is a combination of 3 elements:

1. playhead that reads a spectral table
2. filterbank to which the spectral table is applied
3. sound source, either using the internal pulse wave oscillator (one for each satellite) or external signal using the dedicated input - exception made for input D, more on that later.

The result is a sort morphing vocoder.
Eisei features 4 satellites A, B, C, and D.

Time

Think of *time* as a control over day and night, the ability to explore *time* means controlling celestial masses back and forth at your will.

This parameter acts as an offset on the position of the satellite on the orbit path. Can be edited manually using the touch wheel or using the dedicated CV input.

- Global operation
Touch the Time Wheel or send a CV into the time CV IN to move all the satellites along their orbit path. Positive voltage will offset the satellites clockwise, negative voltage will offset them counterclockwise. Mapping voltage as follows:
0/5V = 0°/360°
-5/0V = -360°/0°

- Individual operation (touch wheel only)
Use the *SATELLITE* selector button to select the satellite you want to move along the orbit path, the corresponding LED will be lit to confirm selection and the satellite on the screen will be highlighted. Now touch the time wheel will move the selected satellite.
After 5 seconds of inactivity the selection will be disabled and will be back to default (all 4 satellites selected).

Sending a trig or a gate to the reset input resets the position of the satellites maintaining time offset.

Shortcut
Push & Hold the orbit encoder for 2 seconds to restore default time position.

Orbit

Each satellites runs on its own orbit at its own pace. Sweeping through their orbits the satellites read the Spectral table which contains all the spectrum info captured when holding REC. So, to do an analogy, think of the satellites as playheads (each with independent speed control) and Orbit as a vinyl record. We can run through the Orbit with 4 playheads with different speed and direction settings and highlight a slice of interest to loop in (more on this later).

- Global operation (SPEED)
Use the orbit encoder to set the orbit speed value, ranging from 0.000 hz to 64 hz in both clockwise (+) and counterclockwise (-) directions.
Control Voltage sent into the orbit cv input multiplies the main frequency in the range 0.1/10x in both directions mapping voltage as follows:
0/5V = 1/10x
-5/0V = 0.1/1x

- Individual operation (MULT)
Use the *SATELLITE* selector button to select the satellite you want to edit, the corresponding LED will be lit to confirm selection and the satellite on the screen will be highlighted. Now twist the orbit encoder to engage the MULT page, here you can set a multiplier of the main orbit speed with stepped values ranging from x0 to x10 in both clockwise and counter clockwise directions.
After 5 seconds of inactivity the selection will be disabled and will be back to default (all 4 satellites selected).

To stop the satellites you can either reach orbit speed 0 by twisting the encoder with precision or simply by pushing down the encoder (don’t hold), presse the encoder once again to restart the satelites rotation.

Shortcut
Press SET and Push & Hold the orbit encoder for 2 seconds to restore default orbit MULT values (x1).

Spectral tables

Eisei can record Spectral tables, a particular type of sample that stores 20 sequences of values corresponding to the 20 bands of the filterbanks. It's like 20 streams of automations extracted from the analyzed audio.

Recording
Select a slot using the SELECT button, the corresponding LED will be lit.
Plug some audio signal into the rec audio in.
Press & Hold the REC button or send a gate to the corresponding gate input to start recording, the corresponding LED will light up red.
Recording will start as soon as the button is pressed or a high gate is received and will stop as soon as the button is released or the gate is low. Right after that the new spectral table will be available in the slot to be explored.

ATTENTION:
The newly recorded spectral table will temporarly overwrite whatever is on the slot but won't be permanently stored until it is saved. This is to avoid unwanted overwriting and preserve your data.
To SAVE the spectral table hold SET and confirm the procedure (more in the next paragraph).

Shortcut
Push SET & SELECT to empty the current slot.

Saving

Spectral tables are volatile until they are saved.

Hold SET to enter saving mode.
You will be prompted to confirm the procedure.
Use the touchwheen to make a circle clockwise to confirm, counterclockwise to cancel.

Eisei will display SUCCESS once the procedure is complete.
If an ERROR screen appears please check the SD on the back.

Loading tables

Push SELECT button until the desired slot is highlighed.
Hold SELECT to enter the spectral table list.
While in this page use the *orbit* encoder to scroll through the list and the *time* wheel to scroll through the highlighed table.
Push the encoder to load the selected table into the current slot.

Key

The key pot acts just like a tuning key to set the tonic of Eisei, it affects both the internal oscillators and the filterbanks.
The available tuning range for the pot is two octaves, spanning from A0 to A2 (27.5hz - 110hz). This limitation is intentional to best fit the filterbanks response.
The key CV input is 1V/octave scaled and only affects the oscillators.
Using the CV IN allows to significantly widen the frequency range of the oscillators from sub audio oscillations to pearcing high frequencies.
Sending a negative voltage can bring to sub audio oscillation, basically turning the oscillators into gates (this will ping the filterbanks!).

Spread

Satellites are deeply entangled one to each other and move like a hive mind thanks to the Spread parameter. This parameter coordinates the span between the satellites frequencies. Fully CCW they are be unison, fully CW unravel octave unison, anything in between will unfold happy accidents.

Satellite A is not affected by spread, and sort of acts as reference point to define the tonic, satellites B to D will build on that base frequency each adding spread value multiplied by its own id so for example:
if key is set to 100hz and spread is fully CW then A will be on 100hz, B on 200hz, C on 300hz, D on 400hz.

Sending negative voltage might bring to uncharted harmonic territories.

Lens

Lens is all about framing, Classic spectral processor’s per band control is re-imagined as a centralized shaper that affects all the filterbanks.
At Noon it’s panfocus, all bands are wide open, the spectral table is unaltered. Sliding counterclockwise smooths out harsh spikes rewarding us with a lowpass like response, while taking the opposite path tilts the spectrum towards the hi end, enphasizing chirp and hisses, without completely cutting the lows.

Warp

This section provides four methods to further manipulate the signal.

1. SHIFT
shifted clone of the bands configuration

2. TANH
from gentle distortion to brick clipping

3. SHAPE
internal oscillators pulse width

4. BLUR
bands decay, from snappy and grainy transients to smooth and ethereal

Press the Warp button to enter the dedicated page, the corresponding LED will light up blue, and touch the wheel to set the value of the selected warp.
Hold the Warp button to set the selected Warp as target of the warp CV input, the corresponding LED will change to warm yellow to confirm and will remain lit.
Any combination of Warps can be targeted.

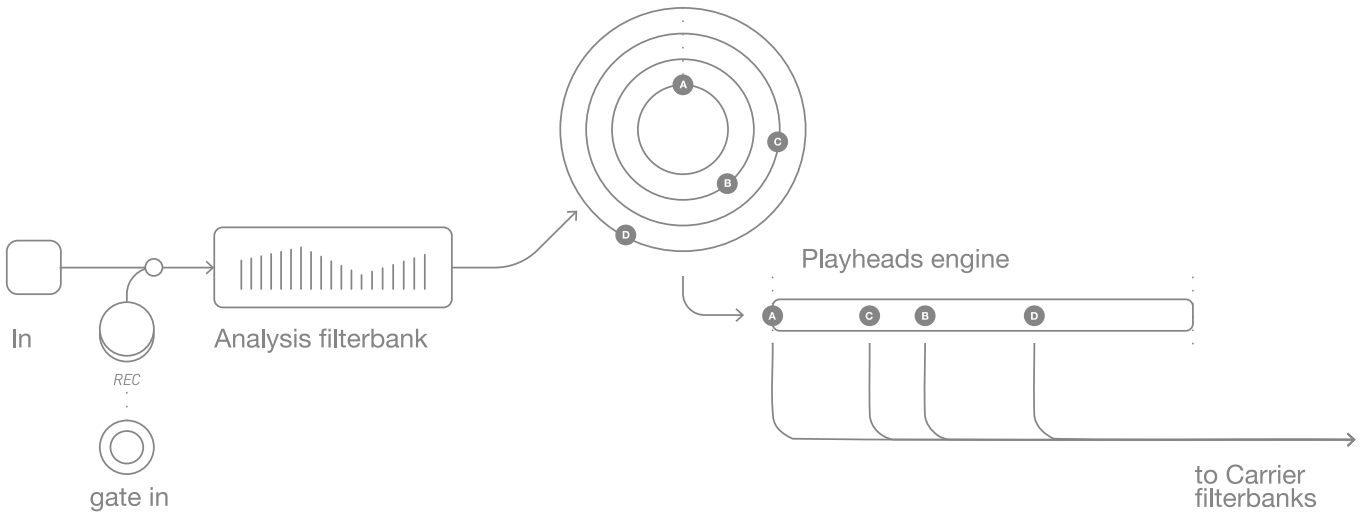
Warp Animation
abstract representation of selected warp. Affected by CV

Slider
visualizes the offset value. Unaffected by CV

Structure (1)

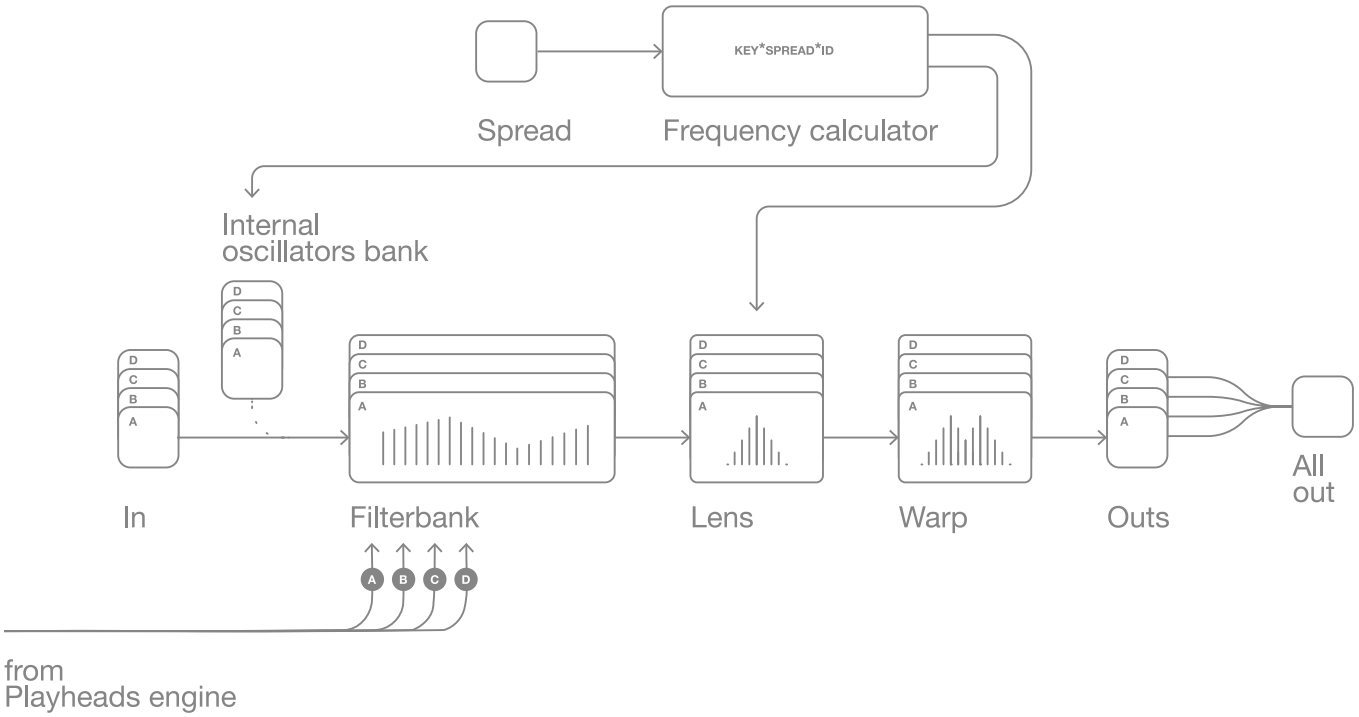
Eisei can be divided in two main blocks:

1. Analysis
This block analyzes any incoming signal and converts it into automations, sort of translating the signal from time domain to frequency domain.
This operation involves an “analysis” filterbank identical to the processing ones but its only purpose is to split the signal into bands and for each band an envelope follower moves according to the amplitude of the band.
The spectral table is the recording of these envelope followers movements.



Structure (2)

2. Processing
In this block each satellite audio signal (either internal oscillators or external signal) passes through its filterbank, shaped by the spectral table and lens.
The signal is then processed through the Warp modifiers and finally comes out of the corresponding output.



Audio in & outs

Audio inputs

Each satellite input can receive audio except for the satellite D input. Input D can still process the internal oscillator and any audio signal coming from the normalized connections with the other satellites (see scanner mode paragraph below).

NORMALIZATION
Normalization flows left to right, A to D, so a signal plugged into input A will be copied to the following input until it reaches input D or it encounters a plugged cable.
Configuration example:
Stereo to quad - plug the L channel of a stereo signal into input A and the R channel into the input C. the L channel will be processed by both A and B satellites and the R channel will be processed by both C and D satellites.
It is also possible to mix internal oscillators with external audio, for example leaving input A empty but filling the other inputs.
Yes, inputs can be pinged.

SCANNER MODE
Insert a cable in the input D to enable *scanner* mode. This is satellite D's special ability to crossfade between its own internal oscillator and other satellites audio signals.
When in scanner mode, sat D phase is inverted causing subtraction of sat D signal from the "all" output.

Audio outputs

Each satellites has its dedicated audio output. The *all* out is an analog sum of every satellites output. The all out signal sums each satellite out divided by 4 in amplitude and applies a soft tanh distortion to avoid clipping.

Firmware update procedure

1. Download the firmware from unwn.dev
2. Copy the firmware file in the root of Eisei's micro SD.
3. Insert the micro SD back into Eisei and power on the system.
4. Eisei will boot and automatically start the update procedure.
5. Once it's done turn off the system, wait a few seconds and restart the system.
6. You successfully updated Eisei!

Troubleshooting

Eisei doesn't boot.
Probably related to an incomplete firmware update procedure, reflash the firmware.

Unresponsive touch wheel / encoder and no audio.
Probably related to an incomplete firmware update procedure, reflash the firmware.

The recorded Datum disappear after power cycle.
To permanently store a datum it needs to be saved, hold SET and confirm the procedure. Check "saving" paragraph.