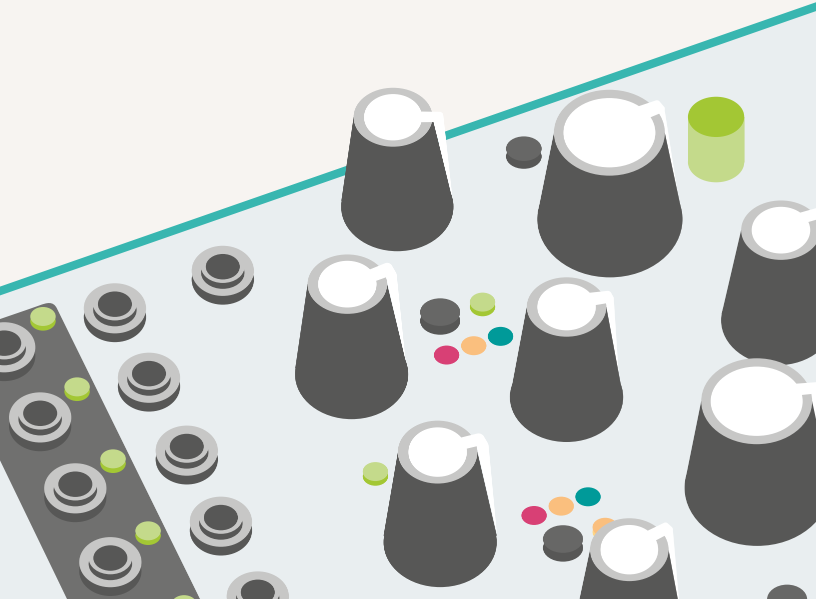
Mutable Instruments

Marbles

Random sampler



About Marbles

Marbles is all about randomness – generation of random events, or randomization of external CV/Gate signals. The module is organized as three sections: the **t** section generates and processes clocks and triggers, the **X** section generates and processes voltages, and the **DEJA VU** section imposes structure, in the form of repetition, upon all the events generated by the two other sections.

Installation

Marbles requires a **-12V/+12V** power supply (2x5 pin connector). The red stripe of the ribbon cable (-12V side) must be oriented on the same side as the "Red stripe" marking on the module and on your power distribution board.

The module draws **80mA** from the **+12V rail**, and **20m**A from the **-12V** rail.

Online manual and help

The full manual can be found online at
mutable-instruments.net/modules/marbles/manual

For help and discussions, head to
mutable-instruments.net/forum

Please refer to the online manual for detailed information regarding compliance with EMC directives

Marbles' recipe for random music

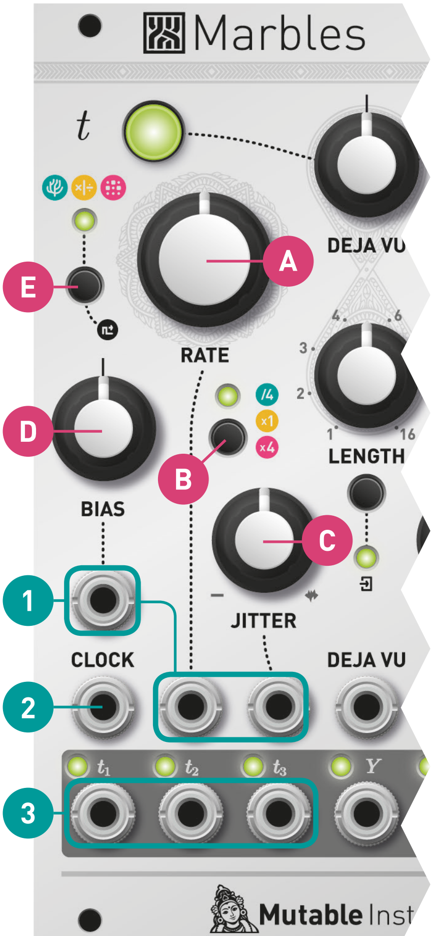
1. Start with a **clock** – generated internally or divided/multiplied from an external clock signal.
2. If required, add some **jitter** to it, from slight humanization to complete chaos.
3. Split this randomized clock into two streams of random triggers to generate two **contrasting rhythmic patterns** complementing the main clock.
4. Generate three **random voltages** in sync with the rhythmic patterns obtained at the previous step.
5. Transform the random voltages to **spread them further apart, or concentrate them** around a specific voltage.
6. Add a pinch of **lag-processing** to obtain smooth random modulations... or **quantization** to get random tunes.

Steps **1 to 3** are handled by the left half of the module, the random rhythms being generated on the outputs labelled **t**. In your Eurorack system such duties might have been performed by modules like Grids and Branches.

Steps **4 to 6** are handled by the right half of the module, the random voltages being generated on the outputs labelled **X**. A large number of modules would be necessary to patch this functionality: a triple noise source and sample&hold, waveshapers, quantizers, and lag processors.

And now let's take it further: what if everything the module did could be controlled by a slowly evolving or lockable loop, like with Music Thing's Turing Machine? That's what the **DEJA VU** section is for.

Time to dive into the details!



Marbles
t
DEJA VU
A
E
RATE
4
6
3
2
1
16
LENGTH
D
/4
x1
x4
B
BIAS
C
JITTER
1
CLOCK
DEJA VU
2
t_1
t_2
t_3
Y
3
Mutable Inst

t Generator

The **t generator** produces random gates by generating a jittery master clock (which is output on $\mathbf{t}_2$) and deriving from it two streams of random gates which are output on $\mathbf{t}_1$ and $\mathbf{t}_3$.

A. Clock rate. 120 BPM at 12 o'clock.

B. Clock range. Divides or multiplies the clock rate by 4.

C. Amount of randomness in the clock timing - perfectly stable, then simulating an instrumentalist lagging and catching up, then... complete chaos.

D. Controls whether gates are **more likely to occur on $\mathbf{t}_1$ or $\mathbf{t}_3$**. Several methods are available for splitting the master clock into $\mathbf{t}_1$ and $\mathbf{t}_3$, selected by the button **[E]**.

A coin is tossed at every pulse of $\mathbf{t}_2$, to decide whether the pulse is passed to $\mathbf{t}_1$ or $\mathbf{t}_3$. **BIAS** controls the fairness of the coin toss.

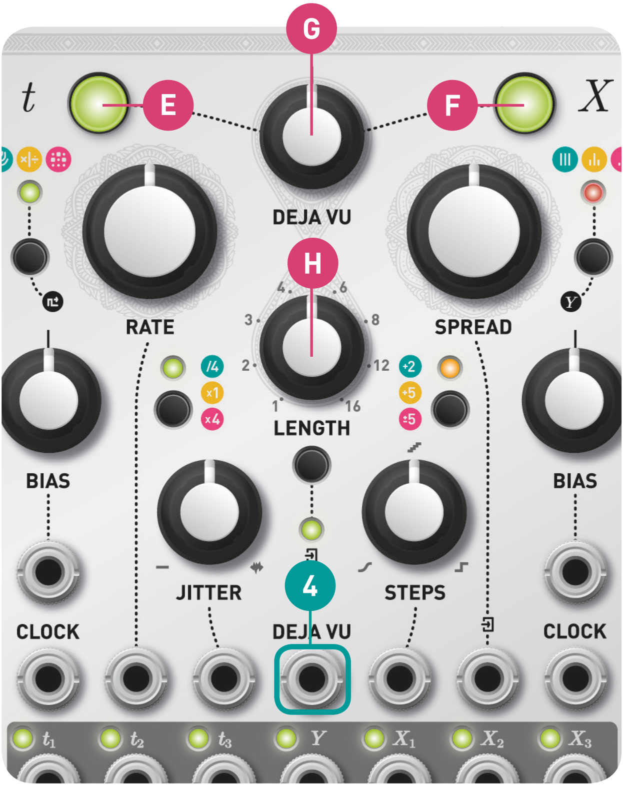
×|÷ $\mathbf{t}_1$ and $\mathbf{t}_3$ are generated by respectively multiplying and dividing $\mathbf{t}_2$ by a random ratio. Turn the **BIAS** knob fully clockwise or counter-clockwise to reach more extreme ratios.

the triggers alternate between $\mathbf{t}_1$ and $\mathbf{t}_3$, following the same kind of regularity as kick/snare drum patterns.

1. BIAS, **RATE** (with V/O scaling) and **JITTER** CV inputs.

2. External clock input. The clock signal patched in this input replaces the internal clock. In this case, the **RATE** knob and CV input are re-purposed as a division/multiplication control, and the jitter setting is applied to the external clock.

3. Gate outputs. Hold the button **[E]** and turn **BIAS** to adjust the gate length from 1% to 99%, or **JITTER** to adjust the gate length randomization (from deterministic to completely random).



G
E
F
H
4
t
X
DEJA VU
RATE
SPREAD
3
2
1
4
6
8
12
16
/4
x1
x4
+2
+5
±5
LENGTH
BIAS
BIAS
JITTER
STEPS
CLOCK
DEJA VU
CLOCK
t1
t2
t3
Y
X1
X2
X3

DEJA VU section

Whenever the module needs to make a random choice (for instance, to decide on the amount of jitter to apply on the next tick of its clock, or to generate a random voltage for one of its outputs), it queries the **DEJA VU** section. The **DEJA VU** section either recyles a previously generated random choice, or samples fresh random data from a hardware random source.

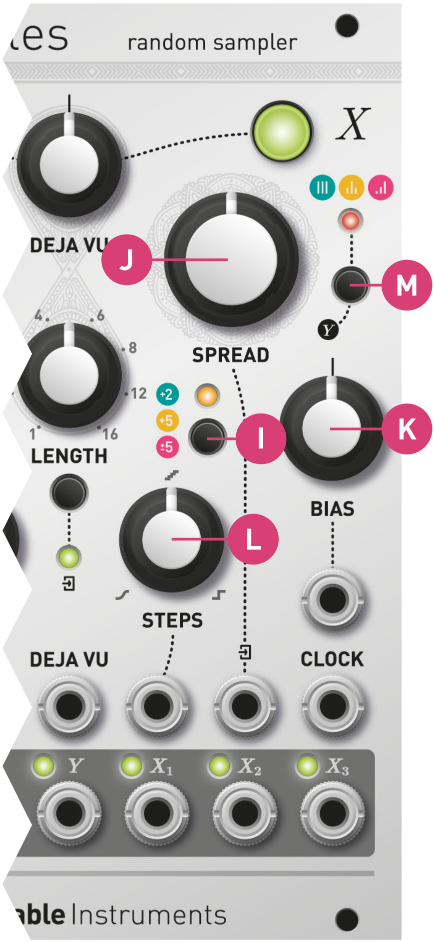
E. F. These buttons control whether the **DEJA VU** settings apply to the **t or X section** (or neither, or both). For example, the module can generate a non-repeating sequence of voltages locked to a looping rhythm (t enabled, X disabled); or cycle through the same sequence of voltages on an ever-changing rhythm (t disabled, X enabled).

G. **Probability of re-cycling random decisions/voltages** from the past.

- From 7 o'clock to 12 o'clock, this probability goes from 0 (completely random) to 1 (locked loop).
- At 12 o'clock, the module is thus stuck in a loop, because it never generates fresh random data. In this case, the illuminated pushbuttons [E] and [F] blink.
- From 12 o'clock to 5 o'clock, the probability of randomly jumping within the loop goes from 0 to 1.
- At 5 o'clock, the module thus plays random permutations of the same set of decisions/voltages.

H. **Loop length**.

4. **DEJA VU CV input**.


random sampler
X
DEJA VU
J
M
Y
SPREAD
4
6
8
12
1
16
+2
+5
±5
I
K
LENGTH
BIAS
L
STEPS
DEJA VU
CLOCK
Y
X_1
X_2
X_3
Instruments

X Generator

The X generator generates **three independent random voltages** output on $\mathbf{X_1}$, $\mathbf{X_2}$ and $\mathbf{X_3}$. They are clocked by the three outputs from the t section, or by a common external clock.

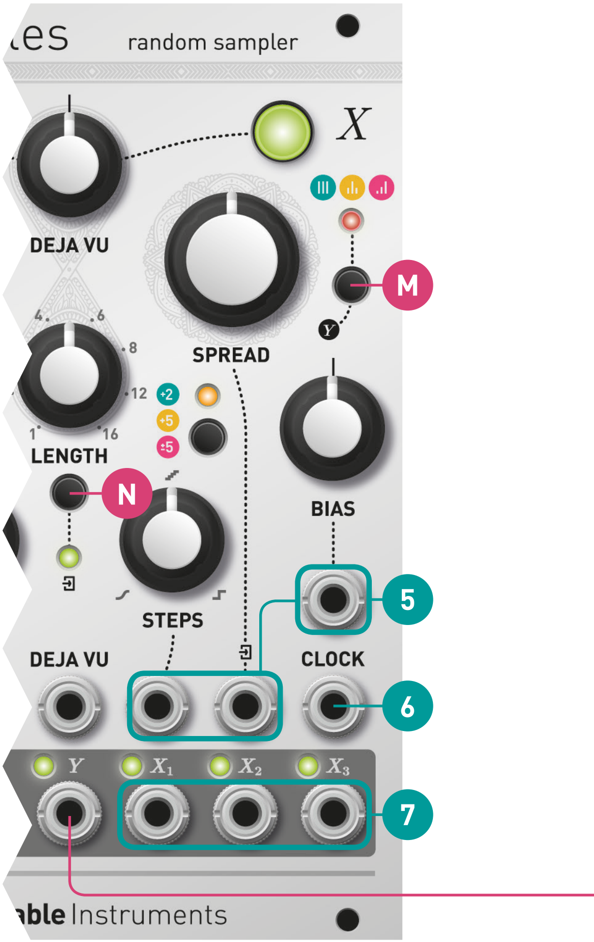
I. Output voltage range. 0 to +2V, 0 to +5V or -5 to +5V.

J. Probability distribution width and shape. Turning counter-clockwise from 12 o'clock, the voltages are increasingly concentrated near the center of the range. Fully counter-clockwise, a constant voltage is output. At 12 o'clock, they follow a bell curve - more likely to occur near the center but able to reach the extremes. At 2 o'clock, they occupy the entire voltage range with equal probability. Past this point, extreme values become more likely. Fully clockwise, only the minimum and maximum voltages are possible, turning $\mathbf{X_1}$, $\mathbf{X_2}$ and $\mathbf{X_3}$ into random gates.

K. Distribution bias. Skews the distribution towards low or high voltages. Think of this as the probabilistic equivalent of an offset: it does not shift the voltage down or up, but biases the decision towards the bottom or top of the voltage range.

L. Horizontal and vertical "steppiness" of the generated voltages. At 12 o'clock, generates the typical S&H steps. Turn CCW to generate smoother edges, then random linear segments, then smooth random curves. Turn CW to quantize the generated voltages to a scale, then to progressively strip the scale of its notes until only the root note remains.

M. Controls how the outputs $\mathbf{X_1}$, $\mathbf{X_2}$ and $\mathbf{X_3}$ react to the settings dialed on the knobs **[J]**, **[K]** and **[L]** – allowing you to obtain different flavors of random voltages from the 3 outputs (>continues on next page).


random sampler
X
DEJA VU
SPREAD
M
4
6
8
12
1
16
LENGTH
+2
+5
±5
BIAS
N
STEPS
5
DEJA VU
CLOCK
6
Y
X_1
X_2
X_3
7
Instruments

All channels follow the settings on the control panel.

X_2 follows the control panel, while X_1 and X_3 take opposite values. For example, if **STEPS** is turned fully CW, X_1 and X_3 will be smooth while X_2 is quantized to the root note and its octaves.

X_1 follows the control panel, X_3 reacts in the opposite direction, and X_2 always stays in the middle (steppy, unbiased, bell-curve).

N. External processing mode (>see the next section).

5. STEPS, **SPREAD** and **BIAS** CV inputs.

6. External clock input. When patched, all three outputs follow the same external clock, as opposed to being clocked by the three outputs from the **t** section.

7. CV outputs.

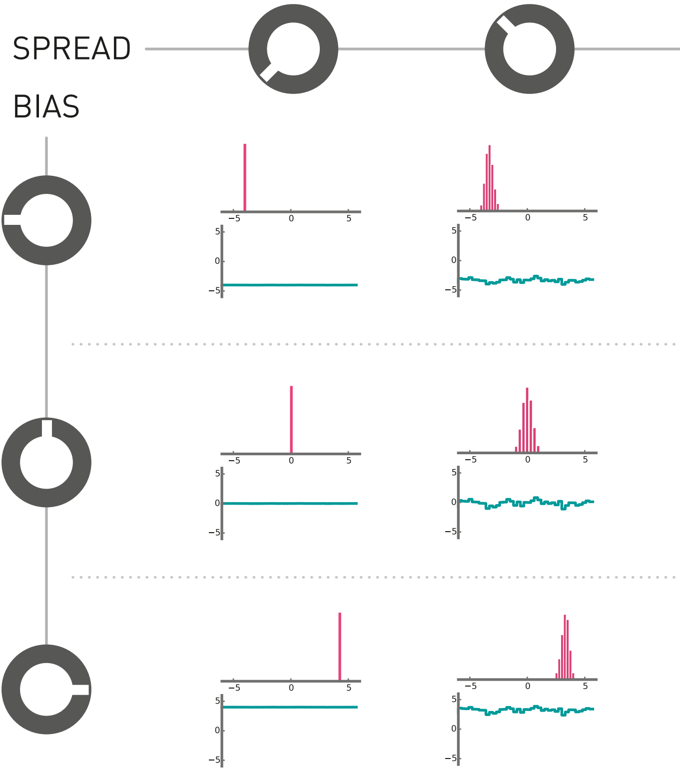
Sampling external CVs with the X generator

Press the button **[N]** to enable the external processing mode. In this mode, the module samples the voltage present on the **SPREAD CV** input **(5)** whenever a random value is needed for one of the X outputs. This allows the artist to sample, loop, quantize, shuffle, or transpose external CVs.

Y Generator

The Y generator, by default, is a **smooth, full-range (-5V to +5V), random source** that is clocked at 1/16 the rate of X_2. These settings can be modified by holding the button **[M]** and adjusting **RATE** (division factor relative to X_2, from 1/64 to 1), **SPREAD**, **BIAS** and **STEPS** while the button is held. The **Y** output is never affected by the **DEJA VU** section.

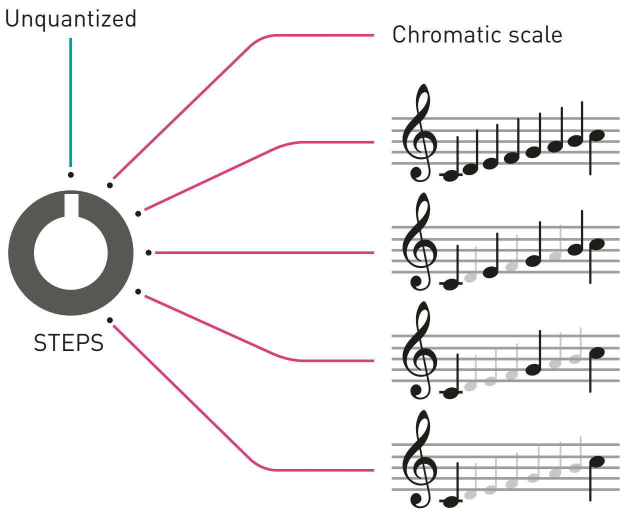
Shaping voltage distributions with SPREAD and BIAS



The pink histogram represents the distribution of possible output voltages: the tallest bar corresponds to the most likely outcome. The teal oscillogram is an example of output voltage sequence.

STEPS Quantizer

The **STEPS** knob progressively eliminates notes from a chromatic scale: first to reveal an interesting scale, then to mask all notes except the most salient ones in this scale. The example below is for a C-major scale (first factory preset).



Selecting a scale

Hold the voltage range button **[I]** for 2 seconds and repeatedly press it to select a scale. The color of the blinking LED and the rate of blinking indicates the active scale. Six memory slots are available for recording scales. They are pre-programmed with scales rooted in C.

Preset scales

Slow blink	Fast blink
● Major	● Gamelan (Pelog)
● Minor	● Raag Bhairav
● Pentatonic	● Raag Shree

Programming a scale

1. Connect the CV and Gate outputs of a keyboard or MIDI interface to the **SPREAD** (5) and **CLOCK** (6) inputs respectively.
2. Hold the external processing mode button [N] for 2 seconds. The LED above the scale selection button [I] blinks and indicates the active scale.
3. Play a little jam in the scale you want to program. Fifty notes, or more, is the recommended length.
4. Press the button [N] when done.

The module analyzes your jam to measure how frequently each note occurs. The least frequently played notes will be the first to be eliminated when **STEPS** is turned clockwise from 12 o'clock. The most frequently played note will be the last one to remain when **STEPS** is at 5 o'clock.

Note: it is also possible, at step 3, to play the scale in ascending order, instead of a long melody. In this case, the module will not know the relative importance of each note of the scale, and the gradual scale "carving" will not be performed: turning the **STEPS** button from 12 o'clock to 5'clock will not modify the scale.

Tips and tricks

- If **DEJA VU** is past 12 o'clock and the loop length is set to 1, the outputs remain frozen in the same state.
- If **DEJA VU** is around 11 o'clock, the loop will slowly mutate.
- The **DEJA VU** knob has a "virtual notch" at 12 o'clock - even if it is not exactly at 12 o'clock, you will still get a perfectly non-random loop.
- Once a sequence is looping, it is still possible to alter it with **SPREAD/BIAS** to map it to a different range of voltages.
- Once a sequence is looping, a rapid double press on the **DEJA VU** buttons reseeds it.
- When the X section is not externally clocked, $\mathbf{X_1}$, $\mathbf{X_2}$ and $\mathbf{X_3}$ are rhythmically independent from each other, each output changing its voltage at its own pace. Setting the loop **LENGTH** to 3 (for example), will cause each output to go through a 3-note sequence independently from the other, creating polyrythmic effects.
- Self-patching is a rewarding technique with **Marbles**! In particular, the **Y** output provides a useful slow modulation source for randomizing the other parameters of the module.