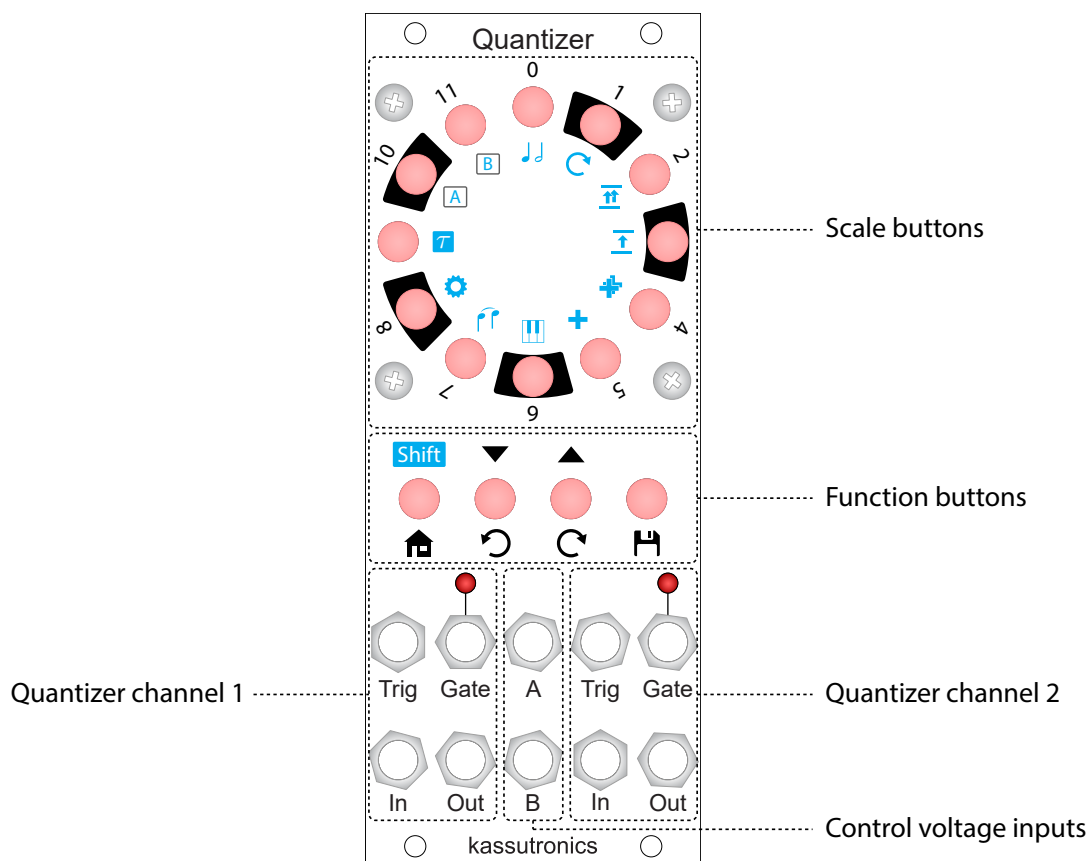


## Introduction: what is a quantizer?

A typical modular VCO accepts control voltage in the V/Oct scale, meaning that steps of  $\pm 1V$  will change the frequency up or down one octave. To play consecutive semitones on a VCO, you must feed it a voltage increasing in steps of  $\frac{1}{12} V$ , or 83 mV, since there are 12 semitones in an octave.

In it's basic form, the quantizer is a module which takes in any voltage and rounds it to the nearest  $\frac{1}{12} V$ , allowing your VCO to always play in tune. To make the quantized notes even more musical, the Quantizer allows you to define which semitones are allowed with the scale buttons. More advanced features such as transpositions, chords and CV control will be discussed later in this manual.

## Module overview



The interface of the quantizer is built around a ring of 12 buttons that define the quantization scale, and four function buttons. The **Shift** button gives access to extra button functions labeled in blue. For example, pressing **Shift** + button 6 opens the keyboard mode . Pressing will return from any menu to the normal display.

# Getting started

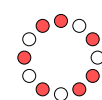
## Basic connections

To start, connect some voltage source to the **In** jack of channel 1. This could be an LFO, sequencer, ribbon controller, or any other CV source. Connect the **Out** jack to the V/Oct input of a VCO. Now, the VCO will play in tune to the active scale, which by default is a major scale.

Each time the input voltage changes enough for the Quantizer to change the note, the **Gate** output will go high and the corresponding LED will flash. The Gate output is typically used to trigger an envelope.

The **Trig** input can optionally be fed with any gate or trigger signal. Once a cable is connected to this input, the quantizer will only output a new note when there is a rising edge on the Trig input. Among other things, this is useful for connecting the trigger or gate output of a CV keyboard or ribbon controller. When the cable is removed from the Trig jack, the quantizer will automatically go back to the normal freerunning mode after about one second.

## Setting the quantization scale





Use the scale buttons to define the musical scale – the quantizer will only allow notes which enabled (button LED on) to be played. The 12 scale buttons correspond to the 12 semitones in an octave. They are arranged in a circle to emphasize the circular nature of musical pitch: going up 12 semitones gives you the same note, but one octave higher.



Usually, the top button (labeled 0) is seen as the root note of the scale. The scale buttons are also surrounded by white and black regions, which correspond to the white and black keys of the piano keyboard assuming button 0 is a C. So, enabling only the white buttons (which is the default setting) gives you a major scale.

## Rotation: everything is circular





While the white and black keys are useful if you are used to a piano keyboard, I think the circle gives a more natural insight into many aspects of musical theory. Once you have set up a scale you like with the scale buttons, try using the rotate buttons  and  to rotate the scale in steps of one semitone.

The effect of rotating a scale can be seen in two ways. In one view, the rotated scale is the same scale with a different root note. For example, rotating a C major scale clockwise 3 semitones gives an Eb major scale. Alternatively, a rotated scale can be viewed as a different scale but with the same root note. Using the same example, C major rotated clockwise 3 semitones is a C minor scale. Which of these views is relevant depends on the musical context where it is used.

In addition to using the rotate buttons, you can also use the rotate menu to rotate to a specific note. Press  +  to enter the menu, and press one of the 12 scale buttons to rotate the root note to that location.

## Keyboard mode




There is one special mode where the quantizer stops its normal quantizing business: keyboard mode. It is activated by pressing  + . In keyboard mode, the 12 scale buttons act like a CV keyboard, and the last pressed note is output on both channels.

The octave can be changed with the ▲ and ▼ buttons. This mode is particularly useful when tuning your oscillators.


## Gate length



Press **Shift** +  to enter the gate length menu. The gate length can now be set with the buttons 0 through 11, where 0 corresponds to a very short gate of 1 ms, and 11 corresponds to a gate length of 2 seconds.

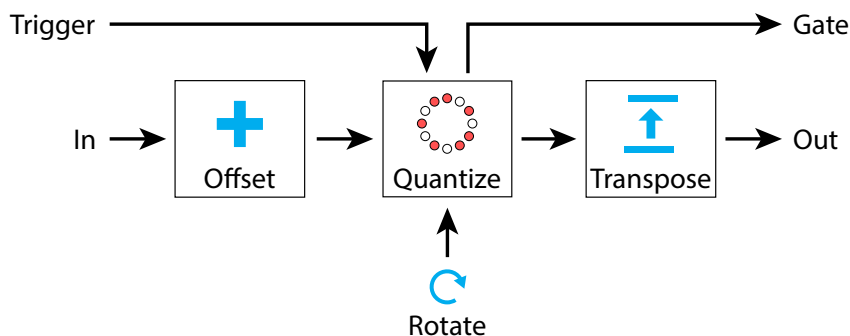
## Legato mode



By default the quantizer is in staccato mode, where it ensures the gate always briefly turns off between two notes. To turn on legato mode, press **Shift** + . Now, the gate will not retrigger if it was still on from the previous note. Typically this is only noticeable with longer gate lengths.

## Transposition and offsets




By default, the quantizer simply rounds the incoming voltage to the nearest enabled note, so with a 0V input you will get a 0V output. The transpose and offset features are two different ways to alter this behavior. The following block diagram shows the operation of the quantizer algorithm.



### Offset



The offset adds any number (positive or negative) of semitones and octaves to the input signal before it is quantized. This makes the pitches go up or down while still quantizing them to the original scale.


Press **Shift** +  to go to the **Offset both** menu. Using the buttons 0 to 11 adds an offset of 0 to 11 semitones, and the buttons  and  add or subtract a whole octave. This is applied to both channels at once.


Similarly, press **Shift** +  to go to the **Offset channel 2** menu. Any offset programmed here is only applied to channel 2.

### Transpose



The transpose function adds any number of semitones and octaves to the *output* signal after it is quantized. This not only makes the pitches go up or down, but also changes the musical scale of the output.








Press **Shift** +  to go to the **Transpose both** menu. The transposition set here is applied to both channels at once.

Similarly, press **Shift** +  to go to the **Transpose channel 2** menu. Any transposition programmed here is only applied to channel 2.

## CV (almost) everything!

The Quantizer module has two control voltage (CV) inputs, labeled A and B, that can be assigned to almost all parameters of the Quantizer. This allows dynamically changing the scales in different ways to create chord or scale progressions in the music, as well as changing the gate length.

To assign one of the CV inputs, enter the CV menu by pressing either **Shift** + **A** or **Shift** + **B**. Then, press the button corresponding to the function you want to put under CV control. The following buttons can be chosen:

-  Gate length (not yet implemented)
-  Rotate scale
-  Transpose both channels
-  Transpose one channel (CV A transposes channel 1, CV B transposes channel 2)
-  Offset both channels
-  Offset one channel (CV A offsets channel 1, CV B offsets channel 2)
-  Load scale

## CV input specifications

For most functions, the CV inputs are 1V/Oct inputs, internally quantized to the nearest semitone. For the **Rotate**, **Transpose** and **Offset** functions this means you can connect any V/Oct CV source to program these functions. For example, connecting a CV keyboard to the Rotate function allows you to play a chord sequence – the root note will be set to the key pressed on the keyboard.

For the **Load** function, the input also follows the V/Oct standard, but now each note on the CV keyboard corresponds to a different slot in memory. More technically, the input works in steps of 83 mV. For example, a CV of 0.0 V loads slot 0, 0.083 V loads slot 1, 0.166 V load slot 2, and so on. When you reach 1 V it wraps around to slot 0 again.

For the **Gate length** function a CV of 5V corresponds to the full scale of gatelengths accessible through the gatelength menu. The CV value is added to the menu setting, and where positive CV voltages lengthen the gate, and negative CV voltages shorten the gate. **Tip:** The CV control of gate length is continuous, and allows much finer changes in length than the 12 possibilities in the gate length menu.

## Load/Save

### Autosave

The Quantizer automatically remembers all settings and the currently active scale, and restores to the same state where you left off on powerup.<sup>1</sup>

### Load/Save scales



There are 12 slots for saved scales, represented by the 12 scale buttons.

To save the current scale, press **Shift** + **F**. The **F** button will flash, and the scale buttons light up to show the memory contents: empty slots are off, and used slots are lit. Press the scale button corresponding to the slot you want to save in. Alternatively, press the **ESC** key to cancel.

To load a saved scale from memory, press **F**. Again, the scale buttons light up to show which slots have any data in them. Press the button from which you want to load the scale, or press **ESC** to cancel.


---

<sup>1</sup>To avoid excessive wear of the EEPROM memory, data is saved 10 seconds after the last time any relevant button was pressed.

## Advanced settings

### Quantization mode



This setting affects the detail in how an incoming note is handled when it does not fit in the selected scale. Enter the settings menu by pressing **Shift** + , and choose one of the following modes with the corresponding scale button:

- 0 **Nearest note.** This is the default mode. The incoming voltage will always be quantized to the nearest note that is enabled. This mode is best suited with random / unquantized voltage sources.
- 1 **Skip.** In this mode the quantizer will ignore the note if it is not enabled in the scale, even when receiving a trigger input. The gate output will also not be fired. This mode can be useful when the incoming voltage source is already quantized to 1V/Oct. For example when playing a CV keyboard, pressing keys not in the current scale will be ignored.
- 2 **Equally distributed.** In this mode the enabled notes in the scale are distributed equally over the octave. For example, if 4 notes are enabled, each note will get an equal 0.25 V range of input voltages. This mode is can be useful when using a continuous voltage source such as a ribbon controller, or when quantizing a random voltage source. In the latter case this mode makes sure each note will appear equally likely.

### Trigger delay



Normally, the Quantizer responds nearly immediately when a trigger is detected on the Trig input. However, sometimes the voltage source connected to the In input needs a bit of extra time to stabilize. The trigger delay function can be used to add a variable delay up to 11 ms between receiving the trigger and sampling the input voltage.

Press **Shift** +  to enter the trigger delay menu. Press the scale buttons 0 through 11 to vary the trigger delay between 0 and 11 ms, respectively, where 0 means no delay.

The trigger delay is particularly useful with some sequencers and CV keyboards that send a trigger/gate signal before the V/Oct output is updated. For example the Arturia Keystep and Beatstep range typically needs around 5 ms trigger delay to function properly.

Trigger delay has no effect in free running mode.

### Further information

Check for updated documentation and other information on my blog at [kassu2000.blogspot.com](http://kassu2000.blogspot.com). I am always happy to answer questions and receive feedback at [kassutronics@gmail.com](mailto:kassutronics@gmail.com).