Quantizer user manual

Kassutronics

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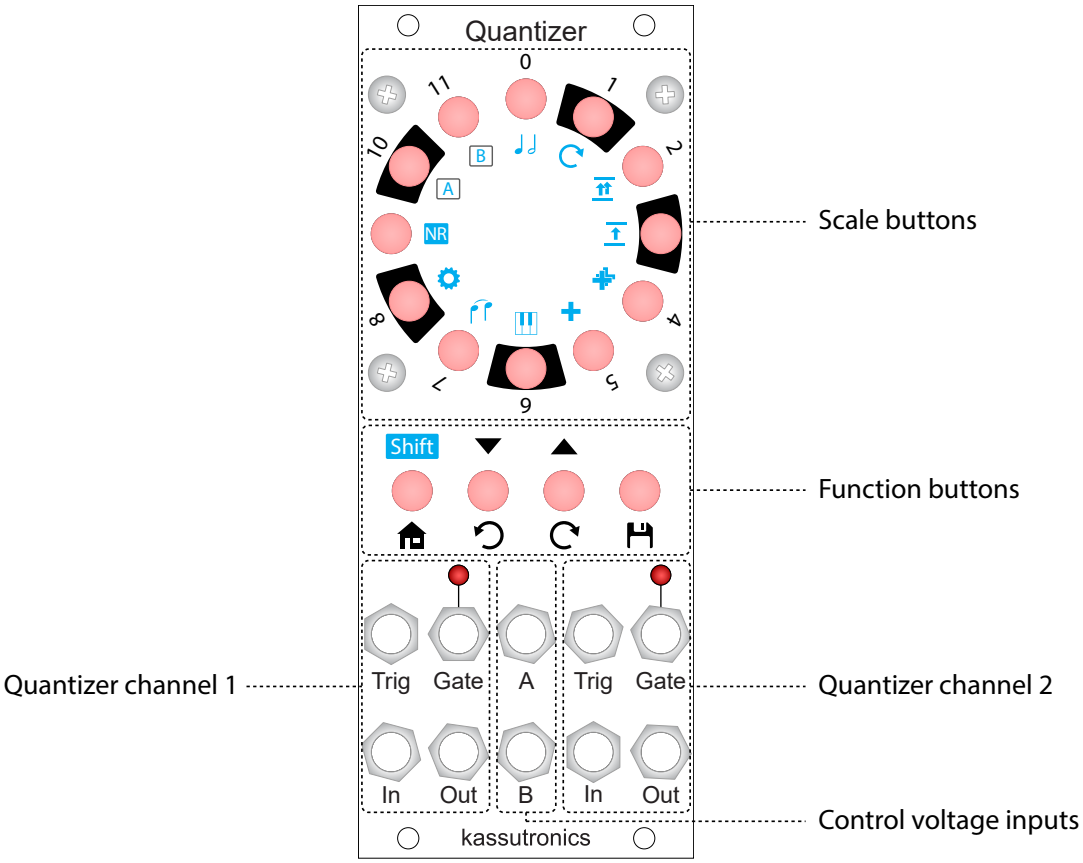
Introduction: what is a quantizer?

A typical modular VCO accepts control voltage in the V/Oct scale, meaning that steps of ± 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 E♭ 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 Shift + ↻ 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 it's normal quantizing business: keyboard mode. It is activated by pressing Shift + 🎹. 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

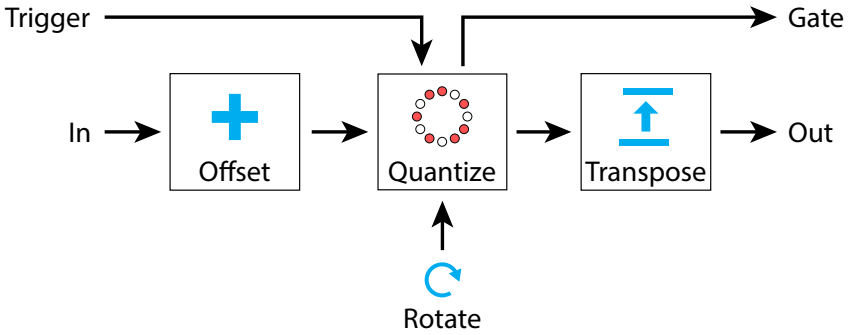
Press Shift + ♩♩ to enter the gate length menu. The gate length can now be set with the buttons 0 through 11, where 0 corresponds to a very short gate of XX ms, and 1 corresponds to a gate length of XX seconds.

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 (postive 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 (not yet implemented)

For most functions, the CV inputs are **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 is also quantized to semitones and thus works in steps of 83 mV. For example in Load mode, 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. In other words, you can once again connect a CV keyboard and each note in an octave will load a different scale from memory.

The **Gate length** function is not yet implemented and I have yet to decide how it will work exactly.

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.[1]

Load/Save scales

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

To save the current scale, press Shift + 💾. The 💾 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 🏠 key to cancel.

To load a saved scale from memory, press 💾. 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 🏠 to cancel.

[1] 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 allways 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.

Noise reject mode

Noise reject mode adds extra digital filtering to the input signals. It can be enabled independently for input 1 and 2, as well as for CV A and B. Press Shift + NR to enable or disable the noise reject menu. Scale buttons 1 and 2 can now be pressed to toggle noise reject on channel 1 and 2, respectively. Similarly, buttons A and B toggle noise reject on the CV A and CV B inputs, respectively.

The noise reject algorithm requires the incoming voltage to be stable for 1 ms before accepting the new voltage. In triggered mode, it also adds a delay of 1 ms after receiving the trigger, to allow the incoming voltage to stabilize.

Noise reject mode is suitable when the incoming voltage is particularly noisy, or when it is updating relatively slowly. The latter is known to be a problem with some sequencers and keyboards such as the Arturia BeatStep and KeyStep products.

The noise reject mode is designed to work in cases where the input voltage is a stepped voltage, such as the output of a sequencer, keyboard or sample and hold module. For continuously varying signals such as an LFO the noise reject mode is best turned off.

Further information

Check for updated documentation and other information on my blog at kassu2000.blogspot.com. I am always happy to answer questions and receive feedback at kassutronics@gmail.com.