



# Batumi

QUADRUPLE LOW  
FREQUENCY OSCILLATOR  
MODEL OF 1974

## SALUT

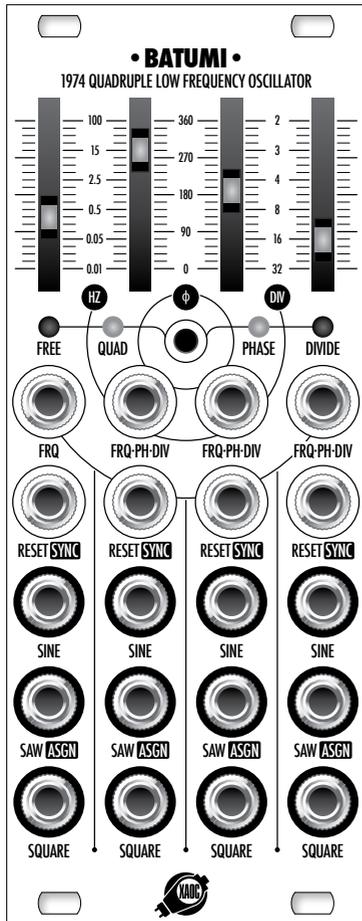
*Thank you for purchasing this Xaoc Devices product. Batumi is a fully voltage controlled quadruple digital LFO module with a slew of interesting and user-customizable*

*features. Each oscillator can be used independently or in one of 3 synchronized modes as described in paragraphs 1 to 4. The total frequency range spans from 28 hours in voltage controlled DIVIDE mode,*

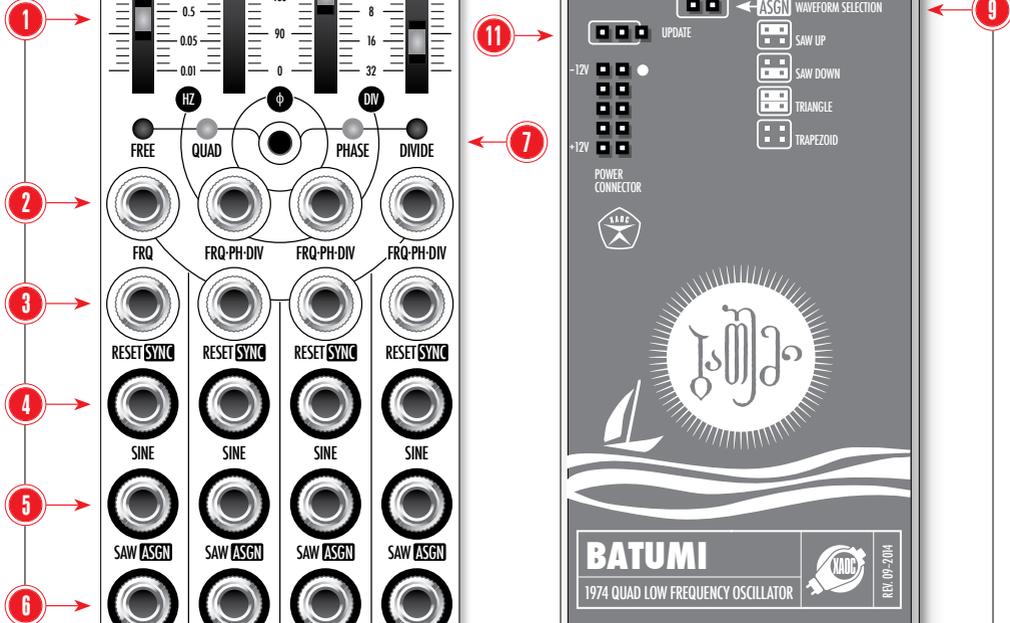
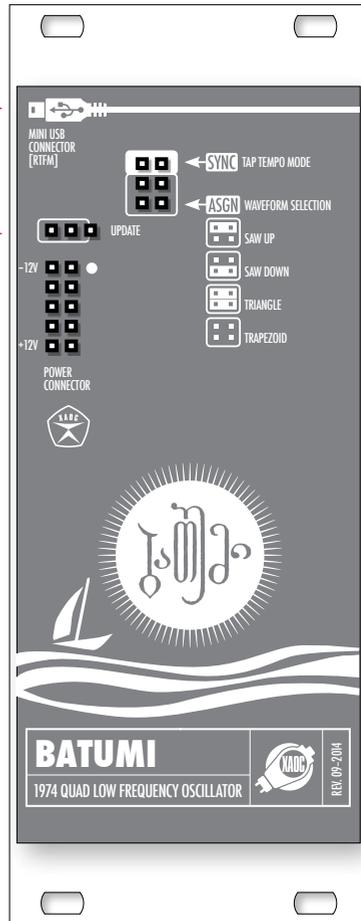
*up to 500 Hz. Truly compact (only 10 hp), economically attractive yet uncompromised, Batumi is a perfect solution for portable modular setups, but can empower any system significantly.*

# THE MODULE EXPLAINED

## PANEL CONTROLS *(see text)*



## JUMPERS *(see text)*



## GETTING STARTED

Ensure that you have 10 hp free space in your eurorack cabinet and turn the power off. Now, plug the provided ribbon cable into the bus board, paying close attention to its pinout and orientation. The red stripe (and a white dot) indi-

cate the negative 12 V rail, and is supposed to point the same on the busboard as well as the unit. The module has been secured against reversed power connection but it is always a good habit to pay attention to this. Now, mount the screws provided and switch your system back on.

## MODULE OVERVIEW

Each LFO section is identical and consists of the same elements.

The slider potentiometer 1 allows you to manually adjust one of the four main parameters, dependent on the global mode chosen. For the first—master LFO—it is always the

frequency rate (from 0.01 Hz to 100 Hz). In **FREE** mode, all the sliders define the frequency rate. In **QUAD** and **PHASE** mode, sliders 2–4 define the phase shift. In **DIVIDE** mode, sliders 2–4 define the multiplication of the master period.

To manually set the frequency rate more precisely, use the **ZOOM** mode, described in paragraph 6.

The **FREQ/PH/DIV** socket ② allows the corresponding slider parameter to be voltage controlled (1V/oct.). Expected voltage amplitude is 10 V and the extended frequency range 53 minutes to 500 Hz may be obtained. **SIDE NOTE:** Going above 100 Hz you can expect the waveforms to be less precise and the output amplitude lowered.

The **RESET/SYNC** socket ③ is an user-defined trigger input that can serve as either cycle reset or external tempo sync. Details to be found in paragraph 5.

The **SINE** socket ④ outputs a sine waveform (–5 to +5 V). In quad and phase modes, the sines are shifted in relation to each other.

The **SAW/ASGN** socket ⑤ outputs either a default upwards saw waveform (–5 to +5 V) or one of the user-selectable shapes, described in paragraph 7.

The **SQUARE** socket ⑥ outputs a square waveform (–5 to +5 V).

The **LFO sync mode toggle section** ⑩ allows you to set the four oscillators to run free or synced to the master, as follows:

## 1. FREE LFO MODE

To enter this mode, click the central button until the red, **FREE** LED lights up.

Now, any of the four LFOs works independently.

## 2. QUADRATURE LFO MODE

Click the central button until the yellow, **QUAD** LED lights up.

The first LFO is a master controlling the frequency for all the remaining LFOs, then each subsequent LFO generates a wave that is 90° shifted in relation to the preceding one (90°, 180°, 270°).

In this mode, sliders and control inputs for LFOs 2–4 are not active.

## 3. PHASE LFO MODE

Click the central button until the yellow, **PHASE** LED lights up.

Similar to quadrature mode, but allows the phase shift to be set arbitrarily.

Sliders 2–4 and **FREQ** inputs are active. **RESET/SYNC** 2–4 inputs are not active in this mode.

**A TIP:** In **PHASE** mode, patch one of the LFOs to control the phase shift of another. Stacking 2 or more LFOs results in very complex, interesting waveforms.

## 4. DIVIDE LFO MODE

Click the central button until the blue, **DIVIDE** LED lights up.

LFOs 2–4 are synced to the first (master) one and their frequency rates are subdivided. Sliders 2–4 define the multiplication ratio. Resulting cycle rates can be 2, 3, 4, 8, 16 or 32 times slower than the primary, master LFO's cycle.

**RESET/SYNC** 2–4 inputs are not active in this mode.

## 5. RESET & SYNC MODE

The **RESET/SYNC** input can serve two different purposes.

In **RESET** mode, an incoming trigger impulse resets the LFO cycle to zero state (hard sync).

In **SYNC** mode (default setting) the LFO frequency rate can be slaved to an external clock source or tapped via manual gate.

These modes are selectable by the jumper ① on the back (no jumper for **RESET**, jumper present for **SYNC**).

## 6. ZOOM MODE

Hold the central button for a second until the current mode LED starts to blink. Now you can adjust the frequency rates much more precisely, around the central value—as the slider travel is upscaled. Hold the button again to leave the **ZOOM** mode.

## 7. ASSIGNABLE WAVEFORMS

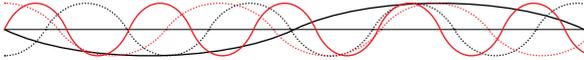
The **SAW/ASGN** output can be altered to provide other waveform types as well. In the default firmware, there are four waveform types to choose from: saw upwards, saw downwards, triangle and trapezoid. To assign the desired waveform, use the jumpers cluster ④ on the back, according to the legend printed nearby.

## FIRMWARE UPDATES VIA USB

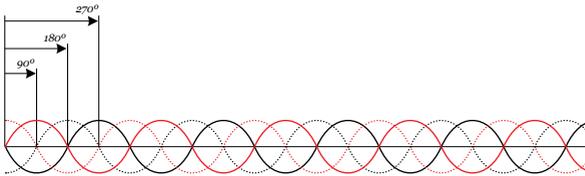
This does not end here. There are some alternate firmware revisions planned, allowing i.e. different waveforms to be assigned. The popular Mini USB standard port ⑩ allows an easy and straightforward update procedure. Detailed instructions will be bundled with the firmware package available online. **CAUTION!** Orient the **UPDATE** jumper ① in the 'on' state (jumping the left 2 pins) only while updating the firmware! Otherwise orient to the 'off' state (the right two pins).

## QUADRUPLE LFO MODES

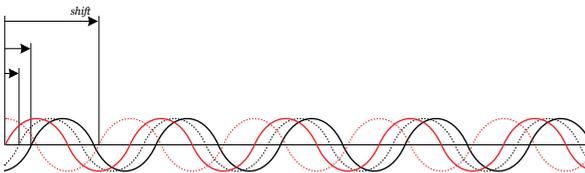
### 1. FREE • four free running LFOs



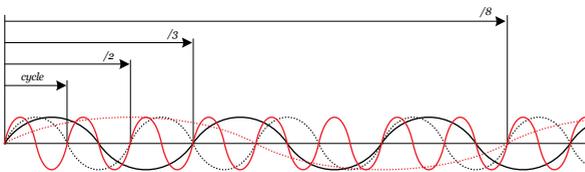
### 2. QUAD • fixed quadrature phase shift



### 3. PHASE • variable phase shift



### 4. DIVIDE • divisions of the main LFO frequency rate



## MODULE FEATURES

- 4 voltage controlled LFOs
- free, quadrature, phase and divide modes
- assignable waveform outputs
- assignable reset/tap tempo inputs
- zoom mode for precise frequency setting
- USB connector for alternate firmware
- reversed power protection

## TECHNICAL DETAILS

- eurorack synth standard compliant
- 10 hp wide
- 45 mm deep (skiff friendly)
- +12/-12V powered
- current draw: 80 mA



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BY THE PEOPLE'S  
COUNCIL FOR MUTUAL  
ECONOMIC AID

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# APPENDIX

SINCE THE ORIGINAL BATUMI USER MANUAL IS STILL VALID AND RELEVANT FOR THE MOST PART, WE DECIDED TO JUST LIST THE MOST SIGNIFICANT FUNCTIONALITY CHANGES IN THE FOLLOWING LEAFLET. YOU CAN ALWAYS DOWNLOAD AND PRINT THE LATEST MANUAL VERSION FROM OUR WEBSITE.

## BATUMI REV.10.2015

The hardware has been redesigned for some technological reasons but functionally, it remains exactly the same as. The only thing you should be aware of

is the reversed power connector. No matter the Batumi version you own, it remains compatible with the Poti expander module and any upcoming firmware updates. Obviously, the module you have just

purchased comes armed with the current, completely new firmware release, written from scratch by M. Puech, to achieve way better specs, higher performance and some important extra features.

## NEW FACTORY FIRMWARE

Most of the functionality described in the original manual remains unaltered. Here's a list of changes [current file: `batumi-v1.0.bin`] with respect to the previous version:

1. In **QUAD** mode, sliders 2, 3, and 4 control the respective channel's amplitude. CV inputs are added to this level.

2. In **QUAD**, **PHASE** and **DIVIDE** modes, the second **RESET** input now holds (pauses) all the LFOs, the third **RESET** input reverses the direction of the waveform, the fourth **RESET** input selects next waveform. Switching mode will reset the waveform to the jumper position.

3. When exiting **ZOOM** mode, LEDs will flash if the value of a parameter does not correspond to the

position of its slider when going out of **ZOOM** mode.

4. In **DIVIDE** mode, the fine setting will add or subtract 0-3 to the division set outside of **ZOOM** mode. It can be used to access divisions not accessible previously.

5. When in **SYNC** mode, phase will be aligned to the external clock.

6. A short press on the mode button now exits **ZOOM** mode.

## ALTERNATE FIRMWARE

For the adventurous geeky soul, there's also an expert, Xaoc authored firmware, developed by M. Puech [current file: `batumi-alt-v1.0.bin`]. It has all the features of the new factory firmware above, plus the following:

### I. RANDOM WAVE BANK

There are now two banks of assignable waveforms (on the `SAW/ASGN` output): the original one – saw, ramp, triangle and trapezoid – and a new bank of more unpredictable waveforms. To switch bank, press the button for two seconds, until the short LED animation.

The lower jumper, or the lower switch if you have the Poti expander, selects the kind of unpredictivity of the waveforms. The first kind is classic random

voltage sampling: it follows a uniform distribution, successive values are picked uniformly on the whole scale, and they are uncorrelated to the previous ones. The second kind is the approximation of a simple chaotic system known as Verhulst's logistic map. Listening to it carefully, you will hear patterns emerge: sometimes it will fall into a repetitive sequence for a while, then break out of it, vary around a random center, then jump unexpectedly...

The upper jumper or switch turns interpolation on or off: with interpolation off, the voltages will be stepped like a sample and hold; with interpolation on, transition between values will be smoothed.

Resetting a channel will immediately produce a new random value, therefore possibly producing a discontinuity in the otherwise smooth waveform.

In **FREE** and **QUAD** mode, the random values of the four channels will be completely unrelated. But in **PHASE** mode, only one stream of random value will be produced; the other 3 channels will follow the same stream, only delayed by the phase shift. Similarly, in **DIVIDE** mode, the random values of the slave channels (2-4) will be sampled from the master channel (1).

### 2. NEW QUAD MODE

The **QUAD** mode changes function completely. The old quadrature mode can be accessed in **PHASE** mode by setting the sliders 2, 3 and 4 to their highest position. The phase will then "snap" to quadrature mode. In the new **QUAD** mode, the channels are summed in various proportions to obtain original waveforms. The first channel's slider (and CV input) sets the mas-

ter frequency; the three remaining ones are locked to divisions of this frequency (by default, /2, /3 and /4). Each output is the mix of its own channel's waveform, plus all the channels on its right.

For instance, the third SINE output is the sum of the sinusoids of channels 3 and 4; the first SAW output is the sum of the saws of all channels. Sliders 2, 3 and 4 (and their CV input) set the amplitudes of their respective channel. SQUARE outputs a 1-bit version of the SINE output: if sine is positive, it will be +5V, if sine is negative, it will be -5V. Note that the division can be changed with the advanced ZOOM interface (see below).

The SINE outputs can be used in your patches to break the monotony of modulating with sines. SQUARE output odd rhythms when it triggers an envelope; they will change dramatically when the levels are changed, but will always repeat every 24 steps (depending

on the divisions).

You can also use triangle, saw and ramps from the assignable ASGN outputs, but there is one exception in this mode: trapezoid has been replaced by a square. Contrarily to the SQUARE output, which will always be binary, these squares are summed together, therefore producing repetitive sampled voltages. This square waveform is perfect to generate surprising sequences: feed the first assignable output to the FM input of your oscillator and change the levels.

**A FINAL TIP:** try to abuse the first Sine output as a VCO, putting an offset in the first CV input.

### 3. ADVANCED ZOOM INTERFACE

The ZOOM mode changes drastically: instead of a fine control, it now allows to set four different parameters for each channel, including the fine control. The ZOOM mode acts only on the last channel modified; to select another

channel, move its slider a little bit. When long-pressing on the mode button, the LED corresponding to the focused channel will blink.

Each slider now sets a different parameter:

- Slider 1 fine-tunes the value of the main parameter (frequency, level, phase or division).
- Slider 2 sets the output levels of the SINE and SAW outputs
- Slider 3 sets the CV attenuation
- Slider 4 sets the phase

There are two exceptions to this assignment, to avoid redundancy:

- In QUAD mode, the level is already set by the main parameter, so slider 2 sets the division value (from 1 to 8).
- In PHASE mode, the phase is already set by the main parameter, so slider 4 allows to divide the frequency (from 1 to 8).

## XAOC FIRMWARE UPDATE TOOL

This utility will copy the new firmware to the module's flash memory via the mini USB port

on the back. There are two executables: one for Windows and one for OSX. These files are available for download from the "Support" section on the Xaoc

devices website. Please download the and unzip the firmware files, the app, and carefully follow these steps listed in the appropriate "readme" files.

## EXPANDER MODULES

A simple but very useful breakout expander module is available as well, called Poti. It provides an immediate access to the Batumi functions originally selected by the cluster of jumpers on the back of the module.

Also, the upcoming Samara module will complement the Batumi to a great extent. While being an independent module, it's the Swiss army

knife for processing voltages. It offers 4 channels of attenuation, inversion, offsetting, mixing and voltage analysis. Use it together with Batumi for precise modulation control. Check out our website [xaocdevices.com](http://xaocdevices.com) for details.

## BLACK GOLD

Being asked for that numerous times, we now offer the alternate black faceplates for the most popular Xaoc modules. These are

of the same supreme quality as the regular ones, just in black. Sold separately, contact us for details.

## OPEN SOURCE CONTEST

We have opened the source code for the Batumi firmware to encourage the talented programmers to make their own custom firmwares. The more creative and deviating from the original functionality the better. The best efforts will be gratified with free modules.