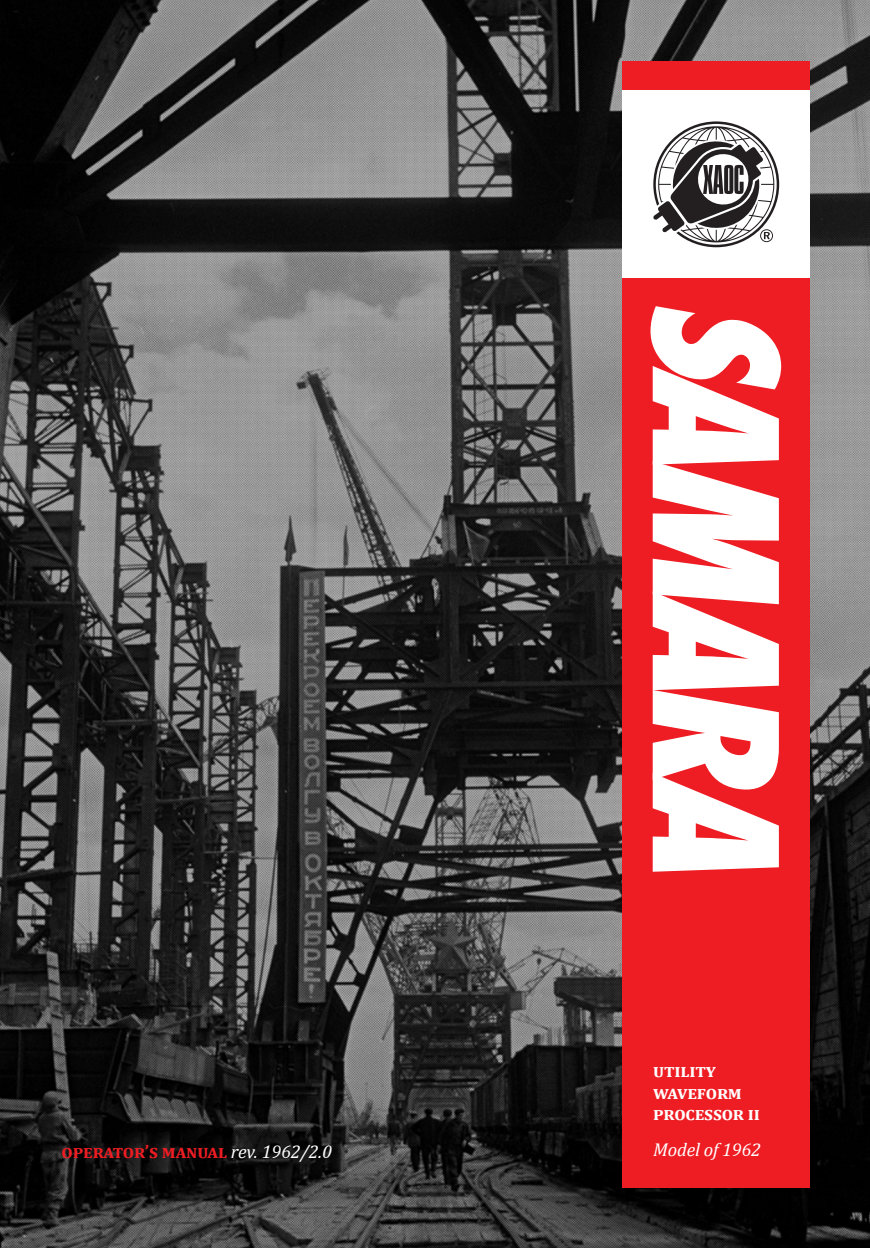

ХАОС
SAMARA
UTILITY
WAVEFORM
PROCESSOR II
Model of 1962
OPERATOR'S MANUAL rev. 1962/2.0

SALUT

Thank you for purchasing this Xaoc Devices product. Samara II is both a flexible mixer and a multifunction utility that may be used for processing audio signals, control voltages, and modulation waveforms.

It is a second, significantly extended version of Samara, originally introduced in 2016. It offers four channels of signal attenuation, conversion between unipolar and bipolar voltages (offsetting by either positive or negative value), mixing in various configurations, as well as a variety of useful signal transformations: clamping, minimum/maximum, sample & hold, and wave scanning.

INSTALLATION

The module requires 10hp worth of free space in the Eurorack cabinet. The ribbon-type power cable must be plugged into the bus board, paying close attention to polarity orientation. The red stripe indicates the negative 12V rail and should point in the same direction on both the bus board and the unit. The module itself is secured against reversed power connection, however reversing the 16-pin header **MAY CAUSE SERIOUS DAMAGE** *to other components of your system because it will short-circuit the +12V and +5V power rails.*

The module should be fastened by mounting the supplied screws before powering up. To better understand the device, we strongly advise the user to read through the entire manual before using the module.

MODULE OVERVIEW

Samara features four channels—each with two inputs and an attenuator, plus two additional switchable (+5V/-5V) offset generators, four voltage level and polarity indicators, two adders with switchable scale, and a four-input/two output signal processor that performs a variety of transformations on the four attenuated difference signals, according to one of its five switchable modes.

ATTENUATION, INVERTING & OFFSET

Looking at the front panel layout (fig. 1), there are four channels. Each channel features a regular **IN** *input* ❶ *as well as an inverting* **INV IN** *input* ❷ *(note there are additional labels at some* **IN** *inputs related to the signal processing part of the module). Signals from these two inputs are subtracted, and this difference signal is processed by an active linear attenuator. Each unused input is normalized to 0V, hence this arrangement allows for normal attenuation, or inversion followed by attenuation or computing an attenuated difference between two voltages or signals.*

Additionally, two sources of a switchable +5V or –5V offset are available in channels **1** *and* **3***, activated by pressing the corresponding illuminated* **OFFSET** *button* ❸*. A short press turns the offset on and off, while long press flips the*

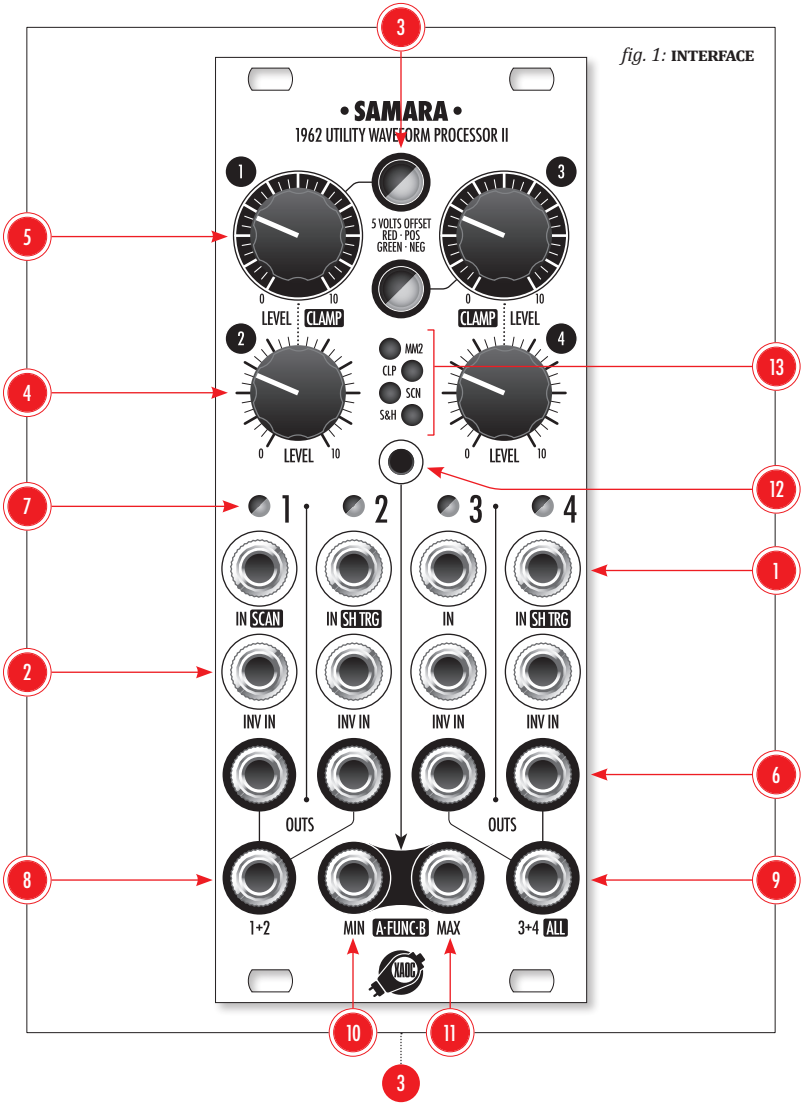


fig. 1: **INTERFACE**

polarity, which is indicated by the button lit red (for +5V) or green (for –5V). This offset is added to the inputs before attenuation. Thus, if nothing is patched to the inputs of channels **1** *and/or* **3***, they can be used as a source of variable constant voltage, from 0 to +5V, or from 0 to –5V. On the other hand, combining the offset with a signal fed to the corresponding inputs facilitates conversion from bipolar to unipolar voltages (by using +5V offset), or converting from unipolar to bipolar (by using –5V offset). The resulting signal or voltage, after being manually attenuated by the* **LEVEL** *knob* ❺*, is available at the corresponding* **OUT** *socket* ❻*.*

A bi-color LED ❼ *indicates the value and polarity of the individual* **OUT** *voltage via brightness and color, wherein red indicates positive and green indicates negative. For audio signals, fast blinking of red and green yields a yellow-orange mixture with intensity indicating signal level.*

MIXING

A cascaded arrangement of summers allows for a multitude of mixing configurations. First of all, note that patching a cable into an individual output excludes the corresponding channel from further mixing (however, it does not exclude it from taking part in additional processing for **FUNC** *outputs). To mix four signals, feed them into inputs and adjust the* **LEVEL** *knobs* ❹*. The resulting signal is available at the* **ALL** *socket* ❾ *(make sure that nothing is plugged into* **1+2** *output socket* ❽*). Additionally, you can also use the inverting inputs* ❷ *to mix up to eight signals.*

To use Samara as two independent 2:1 mixers, use both **1+2** ❽ *and* **3+4** ❾ *outputs. Patching a cable to* **1+2** *output breaks the internal connection, so that these two channels are no longer mixed with channels* **3** *and* **4** *at the* **ALL** *output. Again, using the inverting inputs allows for two four-component mixes.*

Since mixing multiple hot signals with little attenuation usually yields distortion (especially at the **ALL** *output* ❽*), Samara offers a soft-clipping solution. It can be engaged by putting a jumper on the two–pin header labeled* **SOFT CLIP** *at the back of the unit.*

Additionally, optional –6dB (2:1) attenuation is available independently for **1+2** *and* **3+4** *summers by moving two jumpers marked* **ATTEN** *from the upper to lower position. Switching just one jumper does not affect the amplitude on the second summer. Note that the mix at* **ALL** *will then have unequal proportions. The jumpers do not affect the operation of the additional processing at the multi-functional* **FUNC** *outputs* ❿⓫*.*

WAVEFORM PROCESSING FUNCTIONS

In addition to linear mixing, Samara features a multi–function signal processing unit that operates on the four **OUT** *signals from channels* **1**–**4***. The results of processing are deliv-*

ered to **FUNC** *outputs* ⑩ ⑪. *These functions are implemented in a precise analog circuit under digital control. A small DSP chip monitors the signals and operates a number of analog CMOS switches that route them (or chop them into pieces) to the output buffers.*

There are five modes selectable by the small pushbutton ⑫. *Pressing it selects the desired mode in a cycle, indicated by a corresponding LED* ⑬.

MIN/MAX OF FOUR

None of the LEDs are lit. This is the default mode and is the same as the original Samara. In this mode, the minimum voltage of all four inputs is determined and delivered to the **MIN** *jack* ⑩, *and the maximum of all four inputs is delivered to the* **MAX** *output* ⑪. *Note that all inputs always take part in the equation (fig. 2). If there is nothing plugged in, the corresponding value is zero, which in certain situations may be selected as the minimum or the maximum value.*

MIN/MAX OF TWO

Indicated by the LED labeled **MM2**. *In this mode, only channels* **1** *and* **2** *take part in the calculation of minimum and maximum. This mode is more useful if you only need to operate on two signals. Also, it spares half of your Samara for other uses.*

CLAMP

Indicated by the LED labeled **CLP**. *This mode limits the range of two independent signals or voltages by two voltage controlled clamps (fig. 3). Channels* **1** *and* **3** *define interchangeably the minimum and maximum voltage the signals are clamped within. These two limits can be set manually (by engaging positive or negative offsets and adjusting attenuators) or dynamically, by applying control voltages to the inputs of channel* **1** *and* **3**. *Signal fed to in-*

fig. 2: **MIN/MAX OF FOUR** *mode*

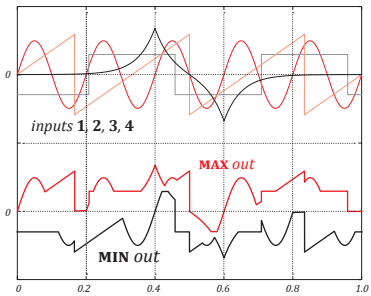
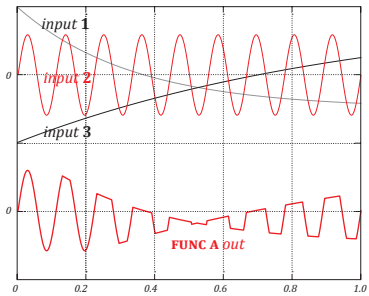


fig. 3: **CLAMP** *mode*



put **2** *is then clamped by these two limits and the resulting signal is available at the* **FUNC A** ⑩ *output. Similarly, signal from channel* **4** *is clamped by the same two limits and appears at* **FUNC B** *output* ⑪.

SCAN

Indicated by the LED labeled **SCN**. *Three input signals from channels* **2**, **3** *and* **4** *are scanned (or selected) by the voltage in channel* **1** *(fig. 4). This scanning voltage may be set manually (by engaging offset in channel* **1** *and adjusting the attenuator), or it may be an external signal plugged into the inputs of channel* **1**, *labeled* **SCAN**. *Two orders of scanning are implemented.*

The **FUNC A** *output offers the result of scanning in a pendulum-like order, while* **FUNC B** *output delivers signals being selected in a circular arrangement, see the table (fig. 5).*

channel **1** *voltage*	**FUNC A** *output*	**FUNC B** *output*
above 3V	*input* **4**	*input* **2**
1V to 3V	*input* **3**	*input* **4**
-1 to +1V	*input* **2**	*input* **3**
-3V to -1V	*input* **3**	*input* **2**
below -3V	*input* **4**	*input* **4**

fig. 5: **SCAN** *outputs arrangement*

SAMPLE AND HOLD

Indicated by the LED labeled **S&H**. *This mode offers two independent channels of full sample and hold operation. In this mode, channels* **2** *and* **4** *are the control channels (as indicated by the* **SH TRG** *panel labels), while signals or voltages in channels* **1** *and* **3** *are being sampled, and the result of this sampling (a stepped voltage) is available at the* **FUNC A** *and* **FUNC B** *outputs, respectively (fig. 6).*

fig. 4: **SCAN** *mode*

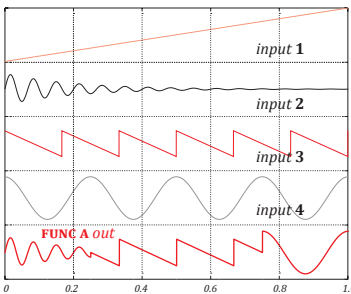
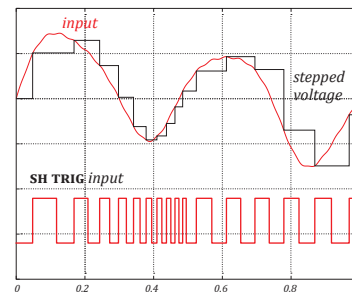


fig. 6: **SAMPLE & HOLD** *mode*



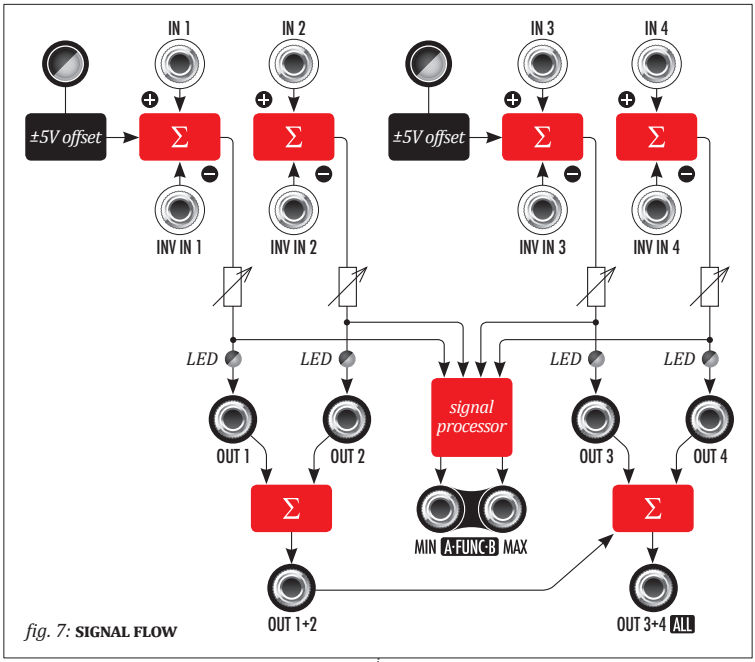


fig. 7: **SIGNAL FLOW**

The motivation of this setup is that besides typical processing of external signals, it allows sampling of manually controlled voltages when offsets (either positive or negative) in channel **1** *and* **3** *are engaged.*

Note that this is an analog sample and hold implementation where output voltages are not processed by any digital converter. Even though special low-leakage foil capacitors are used to hold the sampled value, there will be a noticeable droop after a longer period of time.

Actually, you do not have to use a trigger-like signal for the control inputs. Any analog signal will fire a new sample at the instant it crosses the 1V threshold. Note, however, that slowly changing signals may produce a series of multiple samples due to the presence of noise and multiple crossing of the threshold. In order to prevent this, there is a small hysteresis near the threshold. •

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MADE IN THE EUROPEAN UNION

MAIN FEATURES

Four attenuation channels

Two offset channels

Four inverters

One four–channel mixer

Two double–channel mixers

Mixing of up to eight signals when using inverted inputs

Two modes of min/max calculation

Clamp, scan, sample and hold waveform processing modes

TECHNICAL DETAILS

Eurorack synth compatible

10hp, skiff friendly

Current draw: +50mA/-20mA

Reverse power protection