



# ADDAC402 HEURISTIC RHYTHM GENERATOR USER'S GUIDE

Revision.01 July.2017

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## INTRODUCTION

The ADDAC402 4-Voice Heuristic Rhythm Generator is as the name suggests a Eurorack format module designed to generate four independent channels of gates or triggers at intervals determined according to a selection of rules or 'heuristics'.

The rhythmic patterns generated by the 402 are determined by the incoming clock, the selected algorithm ('mode') and the settings of individual parameters. The multi-function display provides information about the algorithms and graphics showing the current parameter settings and the resulting patterns.

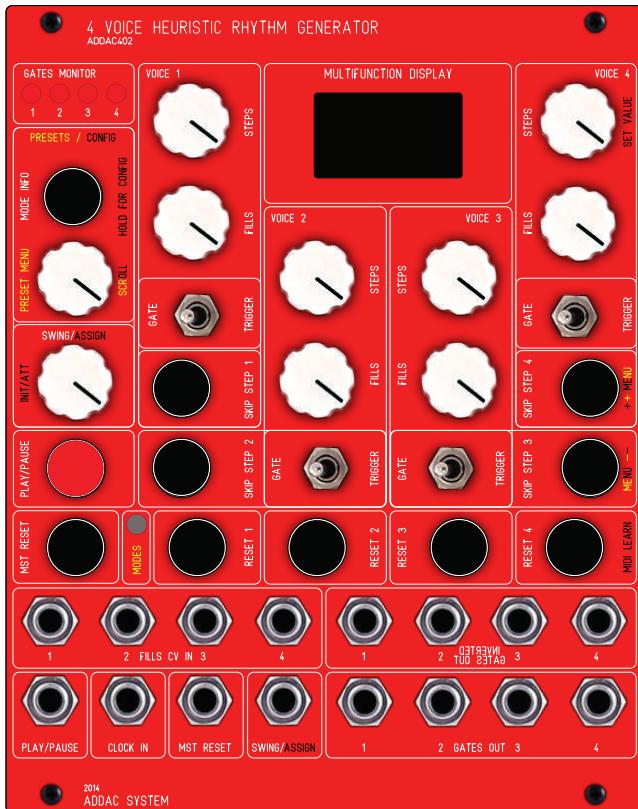
This guide does not cover the separately-available MIDI expansion module, as this is covered in another .pdf file available from the module webpage.

<http://addacsystem.com/>

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## OVERVIEW



### FRONTPANEL:

4 Indicator Leds

4 Toggle Switches with Positions

1 Illuminated Push Button

1 Miniature Push Button

10 Push Buttons

10 Knobs

16 Jacks I/O

Oled Screen

### FEATURES:

6 Rhythm generation algorithms

Gate Sequencer Mode with presets

Swing function for all algorithms.

All voices can have different step sizes

MIDI Bridge Mode (available with ADDAC402B Expansion)

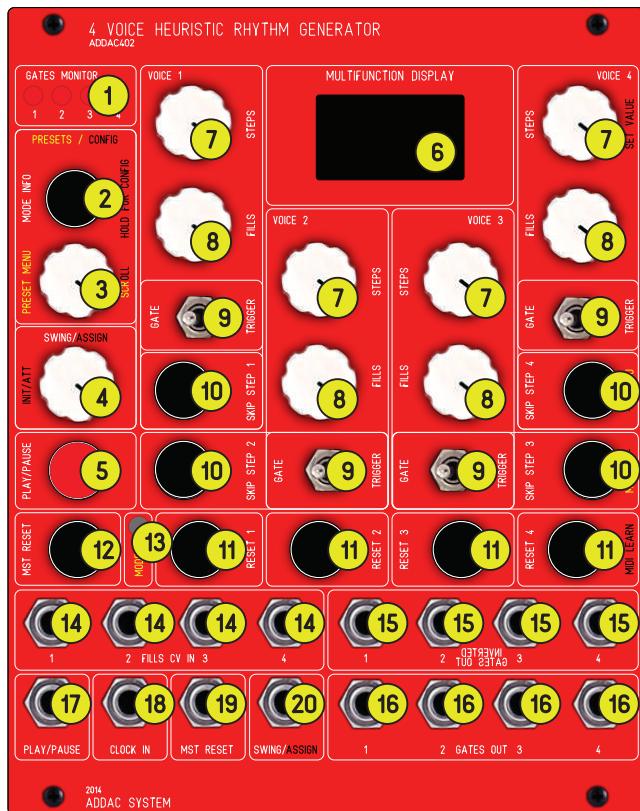
Note the 'U' shaped layout of the four channels - this is generally reflected in the layout of channel parameters in the display.

### POWERING UP

After power has been provided the Module will display a brief animation on the leds and load the last selected Preset. It will also load all Configuration Settings.

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## FRONT PANEL

- 1 Voices State Indicator Leds
- 2 Mode Info, Input Button & Configuration Menu
- 3 Preset selector & Menu Scroll knob
- 4 Swing / Assign Control & Attenuator Knob
- 5 Play/Pause Push Button
- 6 Oled Display
- 7 Steps / Parameter A Control Knobs
- 8 Fills/ Parameter B Control & Attenuator Knobs
- 9 Gate / Trigger Switches
- 10 Skip Step Push Buttons
- 11 Resets Push Buttons
- 12 Master Reset Push Button
- 13 Mode Selector Miniature Push Button
- 14 Fills/ Parameter B CV Inputs
- 15 Inverted Gate Outputs
- 16 Gate Outputs
- 17 Play/Pause Trigger Input
- 18 Clock Trigger Input
- 19 Master Reset Trigger Input
- 20 Swing / Assign CV Input

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## Description

### 1. Indicator Leds

These four Leds will show the state of the four main outputs, when On Gate out will be up.

### 2. Mode Info, Input Button & Configuration Menu

This push button has three different functions:

1. Pressing it will show information regarding the currently selected mode.
2. On Configuration and Preset menus it will serve as an Enter button.
3. Holding it for 3 seconds enters the Configuration Menu.

### 3. Preset Selector & Menu Scroll Knob

This knob has 2 different functions:

1. Moving it on certain Modes will show the Preset Selection Menu.
2. While in the Configuration Menu it works as a Scroll.

### 4. Swing / Assign Control & Attenuator Knob

This knob works as a control knob without any input connected to Swing/Assign CV Input (20). If an input is connected then it works as an attenuator.

This knob function depends on the setting defined in the Menu. Default function is Swing.

### 5. Play / Pause Push Button

This push button starts/stop the sequencer.

### 6. Oled Display

### 7. Steps / Parameter A Control Knobs

These knobs are used to control Parameter A of all Modes.

### 8. Fills / Parameter B Control Knobs

These knobs are used to control Parameter B of all Modes.

These also work as attenuators when a CV Input is plugged in (14).

### 9. Gate / Trigger Switches

Defines if the Gate Output works in a trigger or gate mode.

Trigger Size can be defined in the Configuration Menu.

### 10. Skip Step Push Buttons

These push buttons skip a step in the current sequence.

### 11. Resets Push Buttons

These push buttons Resets the current sequence to step 1.

### 12. Master Reset Push Button

This push button resets all voices sequences to step 1.

### 13. Mode Selector Miniature Push Button

Pressing this push button advances to the next mode.

### 15. Inverted Gate Outputs

These Outputs are analog inversions of the normal outputs.

### 16. Gate Outputs

The main gate outputs.

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## Rhythm Generation Modes

There are 7 different modes, each with its own set of rules and controls.  
Use the Mode Select button cycle through each one in the following order:

1. Euclidean
2. Gate sequencer
3. Game of Life
4. Golomb Rulers
5. Probabilistic Footwork
6. Pong
7. MIDI Bridge

If ADDAAC402B MIDI expansion module is not attached, the MIDI Bridge mode will briefly flash on screen and then advance to the next mode (Euclidean).

### Mode Brief Description

Pressing the Menu Button shows and advances between 3 pages with a brief mode and controls description.

### Knob Pick-up Between Modes

Once you change a mode the knobs may not react immediately when you turn them.  
You will have to turn each one until it crosses the current value before it will have any effect.  
This allows to change between Modes without drastic changes as it will load the values that were previously set instead of loading all current knob positions.

### Preset Manager

Up to 16 different Preset patterns can be saved and loaded in the Euclidean and Gate Sequencer modes.  
Turn the Preset Knob (13) to activate Preset mode and select a Preset number.  
Use the up/down buttons (Skip Step 4 and 3) to scroll between Load, Save and Exit.  
Press the Preset button to execute.

For feedback, comments or problems please contact us at:  
[addac@addacsystem.com](mailto:addac@addacsystem.com)

**Special thanks to:**

Bill Buttler (aka 'Jumbuktu')

For taking the time to create the Unofficial User Guide which was used as the starting point for this document.

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## Euclidean Generator Mode

Based on the paper 'The Euclidean Algorithm Generates Traditional Musical Rhythms' by Godfried Toussaint. The Euclidean Algorithm computes the Greatest Common Divisor of two given integers, in this case STEPS and FILLS. All controls work as printed in the panel. For Presets, rotate Scroll Knob to enter menu.

### Notes:

The number of Fills for each pattern can be controlled using the channel CV inputs.

The 'Skip' buttons rotate the pattern forward in time by one step every time they are pressed.

Some CV control over 'Steps' (pattern length) and 'Skip' (pattern rotate) can be obtained using the Swing/Assign CV input - see Assign Chapter for details.



## EUCLIDEAN CONTROLS

- 1 Preset selector
- 2 Swing / Assign Control & Attenuator Knob
- 3 Play/Pause Push Button
- 4 Steps Controls
- 5 Fills Controls & Attenuator Knobs
- 6 Gate / Trigger Selector
- 7 Skip Step Push Buttons
- 8 Master and Individual Resets Push Buttons

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## Gate Sequencer Mode

A standard Gate sequencer up to 32 steps with independent bar size per voice.

STEPS set the number of bars.

FILLS moves edit cursor.

SKIPS activate / clear steps.

RESETS work normally.

For Presets, rotate Scroll Knob to enter menu. 16 Presets are available in this mode.

Notes:

Moving the cursor to the right cell can be finicky, since the reaction time is a bit slow.

The white-filled cells generate triggers or gates - the black-filled ones are background (no trigger generated).



## Sequencer CONTROLS

- 1 Preset selector
- 2 Swing / Assign Control & Attenuator Knob
- 3 Play/Pause Push Button
- Individual Voice Bar Size
- Move Voice's Cursors
- Gate / Trigger Selector
- Activate / Clear Selected Step
- Master and Individual Resets Push Buttons

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## Game of Life Mode

The Game of Life is a cellular automaton devised by the British mathematician John Conway in 1970. STEPS are inactive.

FILLS set the number of bars.

SKIPS work normally.

MST RESET calculates next Game of Life pattern.

Individual RESETS generate a new initial pattern.

Notes:

The patterns generated by this mode are static - there is nothing you can do to modulate the current pattern. However, hitting Master Reset generates a new pattern that is related to the current one, so it is possible to make the pattern 'evolve'.



## G.O.L. CONTROLS

- 1 Swing / Assign Control & Attenuator Knob
- 2 Play/Pause Push Button
- Yellow Individual Voice Bar Size
- Orange Gate / Trigger Selector
- Purple Skip 1 Step Forward
- Blue Generates New Game of Life pattern
- Green Calculates Next Game of Life pattern

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## Golomb Rulers Mode

A set of marks along a pattern such that no two pair of marks are the same distance apart.

STEPS are inactive in this mode.

FILLS choose the ruler/pattern.

All other controls as printed in the panel.



## GOLOMB CONTROLS

- 1 Swing / Assign Control & Attenuator Knob
- 2 Play/Pause Push Button
- Choose the ruler/pattern.
- Gate / Trigger Selector
- Skip 1 Step Forward
- Master and Individual Resets Push Buttons

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## Probabilistic Mode

Probability is an estimation of likelihood of occurrence of an event, given a value between 0 and 100% chance it will happen.

STEPS are inactive in this mode.

FILLS set the probability percentage.

All other controls are as printed in the panel.

Notes:

Not sure exactly what the relationship between the channel probabilities is, but setting one too high 'eats up' the probability available to later channels.



## PROBABILISTIC CONTROLS

- 1 Swing / Assign Control & Attenuator Knob
- 2 Play/Pause Push Button
- Set probability percentage
- Gate / Trigger Selector
- Skip 1 Step Forward
- Master and Individual Resets Push Buttons

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## Footwork Mode

This mode behaviour is based on a code bug that proved to be extremely rhythmical.

Gate/Trigger, SKIPS and RESETS are inactive in this mode.

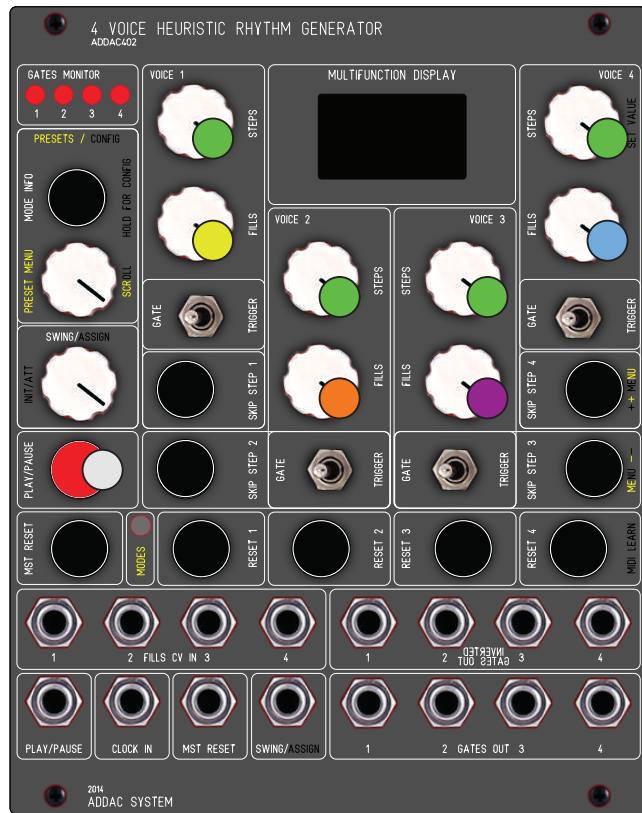
STEPS determines each channel trigger length.

FILLS functions are described in the main screen.

Notes:

If you have the 'Steps' knobs too high, you won't get anything happening at all. Best to start with them close to fully CCW.

Events, Factor and Offset controls can be unintuitive because controls only affect the algorithm over time.



## FOOTWORK CONTROLS

- Play/Pause Push Button
- Individual Gates Length
- Overall Speed
- Events
- Factor
- Offset

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# Pong Mode

This simulation of a Pong game generates rhythm patterns based on whenever the ball hits any of the 4 walls.

Left wall = Gate 1

Top wall = Gate 2

Right wall = Gate 3

Bottom wall = Gate 4



# PONG CONTROLS

- 1 Swing / Assign Control & Attenuator Knob
  - 2 Play/Pause Push Button
  - Left & Right Pad Control
  - Ball Speed - Clock Multiplication
  - Pad Size
  - Gate / Trigger Selector
  - Resets Game score

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## Modes Quick Reference Guide

MODE	STEPS	FILLS	SKIP	INDIVIDUAL RESETS	MASTER RESET	GATE / TRIGGER
EUCLIDEAN	Pattern Length	Number of Fills	Rotate Forwards	Reset Channel	Reset All Channels	Active
GATE SEQUENCER	Pattern Length	Move Cursor	Activate Step	Reset Channel	Reset All Channels	Active
GAME OF LIFE	/	Pattern Length	Rotate Forwards	New Pattern	Advance Pattern	Active
GOLOMB RULERS	/	Ruler Length	Rotate Forwards	Reset Channel	Reset All Channels	Active
PROBABILISTIC	/	Channel Probability	/	/	/	Active
FOOTWORK	Trigger Length	Various	???	/	/	???
PONG	/	Various	/	/	Reset Game	Active
MIDI BRIDGE	/	/	/	/	/	/

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## Configuration Menu

A long press on the Menu button (12) opens the Configuration menu.

Turning the Menu Knob scrolls through the sub-menu items:

CONFIG + ASSIGNS  
MIDI GENERAL CONFIG  
MIDI IN CONFIG  
MIDI OUT CONFIG

A short press on the Menu button (12) opens the selected sub-menu.

Without the ADDAC402B Expansion connected MIDI sub-menus are not accessible.

### Configuration sub-menu: CONFIG + ASSIGNS

This menu allows to configurate the Gate and Trigger time and enables you to assign one or more functions to the Swing/Assign knob.

Each option is selected using the Up/Down buttons (Skip Step 3 and 4), changes are immediate.

Menu Items:

TRIGGER TIME: can be set to 2, 4, 6, 16, 32 ... milliseconds  
GATE TIME: can be set to 1/4, 2/4, 2/3, 3/4, 4/4 or Legato (fractions of a clock step)  
ASSIGN PRESETS  
ASSIGN SWING  
ASSIGN MIDI VELOCITY: available only with ADDAC402B Expansion attached.  
ASSIGN STEPS 1  
ASSIGN STEPS2  
ASSIGN STEPS 3  
ASSIGN STEPS 4  
ASSIGN G/T 1  
ASSIGN G/T 2  
ASSIGN G/T 3  
ASSIGN G/T 4  
ASSIGN SKIP 1  
ASSIGN SKIP 2  
ASSIGN SKIP 3  
ASSIGN SKIP 4  
ASSIGN RESET 1  
ASSIGN RESET 2  
ASSIGN RESET 3  
ASSIGN RESET 4

Long press on the menu button (12) **SAVES** settings and returns to the Main Configuration menu.

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## Swing / Assign

'SWING' is the default function assigned to the knob but this function can be changed using the Configuration Menu. There you can assign this knob and cv input to other functions like: PRESETS, MIDI VEL. (velocity), STEPS, Gate/Trigger, Skips and Resets. MIDI Velocity is only relevant if you have a MIDI expander attached.

Multiple assigns can be active at the same time.

Gate/Triggers, Skips and Resets have binary values (i.e. 'on' or 'off'). If one or more of these is assigned to the knob, the knob acts as a switch, with positions CCW from 12 o'clock being 'off' and CW from 12 o'clock 'on'.

### Note:

Assigning binary functions to the knob is not particularly useful if you are just using the knob to manually control them. For example, switching 'Reset' on will just make the relevant channel keep resetting with every clock. However, these assignments become useful when you feed a CV or gate into the Swing/Assign CV input. This makes it possible to do things like rotating a selected channel or channels forward using SKIP every time a positive gate is detected at the CV input.

### Swing behaviour.

The default function of the Swing/Assign knob is to introduce 'swing' into the pattern.

However, 'swing' may not behave as you expect.

At the fully CCW 'off' position the pattern will have no swing - steps will be evenly spaced in time.

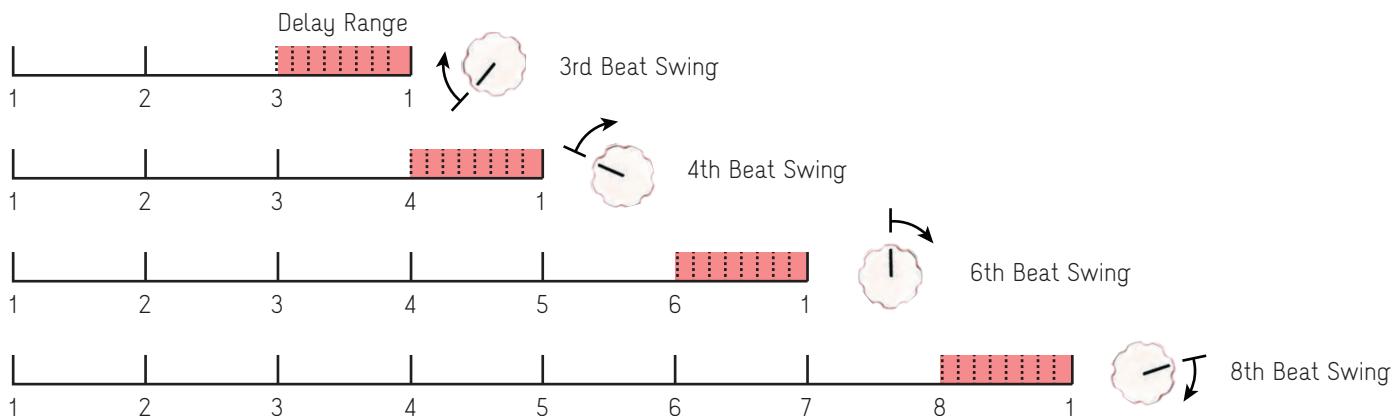
As you rotate the knob CW, swing will be progressively introduced, delaying every X clock pulse slightly later in time.

The first 1/4 of the knob range delays the incoming clock every 3 clocks.

The second 1/4 of the knob range delays the incoming clock every 4 clocks.

The third 1/4 of the knob range delays the incoming clock every 6 clocks.

The fourth 1/4 of the knob range delays the incoming clock every 8 clocks.



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## Inverted Outputs

The inverted gate outputs are literally an inverted version of their associated gate outputs: For example, in the above example, the Gate Output would produce a trigger or gate starting on clock pulses 1, 4, 7, 10 and 13. The corresponding Inverted Output would produce a trigger or gate on clock pulses 2, 5, 8, 11 and 14. If you are using the gates to trigger an envelope or drum hit, the inverted output will produce the same pattern as the main output, but delayed by one clock pulse.