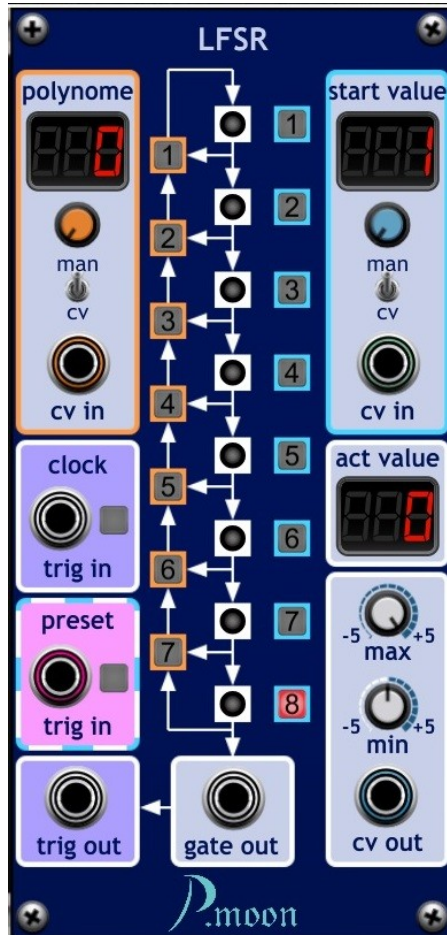


LFSR

Version f, 2022-03-28



LFSR = Linear Feedbacked Shift Register

This module is based on a LFSR design of Italian mathematic **Leonardo Fibonacci**. It can provide a pseudo random CV. Depending on preset values created signal repeats after 8, 16, 32 or 64 or more clock pulses.

Because the shift register consists of a limited number of stages, there will be no *random* CV at the output. With other words, based on start values the pseudo random CV will be the same at each restart. That makes it possible to create defined series of tones every times the preset is used.

Function principle

Main part is an eight stage shift **register**. At least one stage output is fed back to first stage input. When no feedback knots are defined, stage eight output is used for feedback.

Before first use, register must preset with a **start value**, that consists of at least one bit. Such minimal values can be 1, 2, 4, 8, 16, 32, 64, 128. Without defined feedback knots each preset value bits will rotate through register. So register will get initial state after eight clock pulses.

Stage one to seven outputs lead to feedback knots. If such a knot is activated, it acts as boolean **XOR** element. At an active knot a **TRUE** feedback value will only attempt, when just and only one of it's two inputs gets a **TRUE** signal.

Mathematics describe realized feedback with a formula, called **polynome**. The polynome of a LFSR with feedback from stages no. 1, 4, 5, 6, 8 is:

$$p_f(x) = x^8 + x^6 + x^5 + x^4 + 1$$

That's why number on **P.moon LFSR** left side is called **polynome**.

Polynome as well as start value can be set up with three methods:

- Click on a polynome knot or start value bit.
- Adjusting polynome or start value knobs.
- CV inputs.

Controls and connectors



Counter displays actual polynome value.

With this knob you can set polynome value from 0 to 127.

When the switch is on **CV**, polynome is set by CV only.

A -5 to +5 volt CV can be input here to set polynome. Negative values will be change to positive ones.



You can activate and deactivate single feedback knots by clicking on these toggle buttons. Relating polynome value will be displayed at the counter field.



Counter displays actual start value.

With this knob you can set start value from 1 to 255.

When the switch is on **CV**, start value is set by CV only.

A -5 to +5 volt CV can be input here to set start value.

Negative values will be change to positive ones.



You can activate and deactivate single value bits by clicking on these toggle buttons. Relating start value will be displayed at the counter field.

At least one of the eight buttons must be active. You cannot toggle last active button off.



A trig pulse or a click onto the button will load start value into register.



LEDs signalize a register stage, that is actually ON.



This counter displays register content as decimal number.



With **max** knob you can define highest cv out voltage at register value "**255**".

With **min** knob you set the lowest signal voltage at register value "**0**".

After each shift step this jack sends normalized CV from -5 to +5 volts, that represents actual register value.



This gate out jack provides +5 volt, as long as register stage no. 8 is ON.



Each time, stage eight gets an ON value from stage seven, this jack sends a trig pulse of one sample length.

Getting started

Set polynome to "0" and start testing various start values, that contain 3 to 5 "ON"-Bits. So LFSR will only rotate register content and act like an eight step sequencer. **trig out** pulses can be used for a rhythm device. **cv out** jack could serve as pitch source. It should better be used together with a scale module in order to get harmonic tones. At certain start values you will get useful rhythm patterns.

Useful patterns you can get with 82, 86, 91, 95, 115, 125, 189, 202 and others. 85, 102, 119, 136, 153, 170, 187, 204, 221, 234, 238, 255 deliver trivial patterns.

With activated polynome knots #1 or #7 cycle length will extend to 32 or 64 steps. Most varying variants you can achieve, when knots #3, #4 or/and #5 are active. Then out put CV seems to be rather randomly.

Simplest useful example setup:

polynome: 1

start value: 1

This sequence cycle is already 64 steps long.

Example presets

[PM LFSR - Example 1a \(1 1\).voltagepreset](#)

[PM LFSR - Example 1b \(8 1\).voltagepreset](#)

[PM LFSR - Example 1c \(16 1\).voltagepreset](#)

[PM LFSR - Example 1d \(12 85\).voltagepreset](#)

[PM LFSR - Example 2.voltagepreset](#)

[PM LFSR - Example 3.voltagepreset](#)

P.moon DOC files:

<https://p-moon-modules.de/modules.htm>