DSF/Disyn Oscillator User Manual

Guide to operating the Disyn algorithm oscillator firmware for kxmx_bluemchen.

Overview

This firmware replaces the original DSF algorithm set with the Disyn algorithm collection from the disyn-esp32 project. It provides 19 synthesis algorithms plus a calibration slot, consistent parameter mapping, two CV inputs tied to pitch and the primary algorithm parameter, and a simplified menu system for secondary parameters and output routing.

Key Specifications

- **Audio Rate**: 48 kHz
- **Frequency Range**: 55 Hz - 7040 Hz (7 octaves)
- **Algorithms**: 19 Disyn oscillator algorithms + calibration slot
- **CV Inputs**: 2x 0-5V (12-bit ADC)
- **Audio Inputs**: Not used in this firmware
- **Audio Outputs**: 2x Eurorack level
- **MIDI**: DIN-5 input, channel 1
- **Power**: Eurorack +12V/-12V

Front Panel Layout

```
┌─────────────────────────────┐
│      kxmx_bluemchen         │
│                             │
│   ┌───────────┐             │
│   │ OLED Display │          │
│   └───────────┘             │
│                             │
│   ○ POT 1 (Frequency)       │
│                             │
│   ○ POT 2 (Param 1)         │
│                             │
│   ┌───┐    Encoder          │
│   │ ↻ │   (Menu)            │
│   └───┘                     │
│                             │
│  CV 1  CV 2   IN 1   IN 2   │
│   ○     ○      ○      ○     │
│                             │
│  OUT 1  OUT 2   MIDI IN     │
│   ○      ○        DIN       │
└─────────────────────────────┘
```

Basic Operation

1. **Turn Knob 1** to set base frequency.
2. **Patch CV 1** for V/Oct pitch modulation (0-5V = 5 octaves).
3. **Turn Knob 2** to set Param 1 (main algorithm parameter).
4. **Patch CV 2** to modulate Param 1.
5. **Rotate the encoder** to pick an algorithm (default page).
6. **Short press the encoder** to cycle through pages for Param 2, Param 3, and Output mode.

Control Summary

Control	Function	Range	Notes
Knob 1	Base frequency	55 Hz - 7040 Hz	Exponential response
Knob 2	Param 1	0.0 - 1.0	Algorithm dependent
CV 1	V/Oct pitch	5 octaves	Multiplies base frequency
CV 2	Param 1 modulation	0.0 - 1.0	Adds to Knob 2

Control	Function	Range	Notes
Encoder rotate	Page value	Depends on page	See menu below
Encoder short press	Page select	ALG → P2 → P3 → OUT	Cycles pages
Encoder long press	Output overlay	On/Off	Shows output mode line

Menu System

The encoder controls a simple five-page menu. The current page is shown on the top line as **ALG**, **P2**, **P3**, **OUT**, or **IN**.

- **ALG**: Select algorithm (encoder rotates through the 19 algorithms + calibration).
- **P2**: Adjust Param 2 (secondary algorithm parameter).
- **P3**: Adjust Param 3 (tertiary algorithm parameter).
- **OUT**: Select output mode.
- **IN**: Select how the two audio inputs are used (see below).

Knob 1, Knob 2, and both CV inputs are always active regardless of page (except in Calibration, where the knobs are repurposed).

Output Modes

- **Mono (M)**: Primary output on both channels.
- **Stereo (S)**: Primary on OUT 1, secondary on OUT 2.
- **Detune (D)**: Second oscillator detuned slightly on OUT 2.

Audio Input Modes

The audio inputs are always active in **Trajectory** (polygon driver). For other algorithms you can pick one of three modes in the **IN** menu page.

- **Reactor**: IN1 and IN2 modulate Param 2 and Param 3 at audio rate for chaotic timbre movement.
- **CrossMod**: IN1 FM-modulates pitch, IN2 crossfades between primary/secondary outputs.
- **Exciter**: IN1 and IN2 are mixed into the outputs to "re-excite" the algorithm.

Calibration Slot

The last algorithm slot is **Calib**. It behaves like an algorithm entry but is used to set pitch scale and offset. Values are saved to flash automatically after you stop moving the knobs for about a second.

- **Knob 1**: Pitch scale (0.8 - 1.2)
- **Knob 2**: Pitch offset (-1 to +1 octave)
- **CV 1**: Still active to verify V/Oct tracking

While in Calib, a sine tone is output to both channels so you can tune by ear or with a tuner.

Algorithm List

Each algorithm exposes three parameters. Param 1 is on Knob 2 + CV 2. Param 2 and Param 3 are on the encoder pages.

Primitive algorithms

- **Dir Pulse**: Dirichlet pulse train with shaping.
  - P1 Harm (1-64), P2 Tilt (-3 to 15 dB), P3 Shape (0-1)
- **DSF S**: Single DSF component with sine blend.
  - P1 Decay (0-0.98), P2 Ratio (0.5-4), P3 Mix (0-1)
- **DSF D**: Dual DSF with positive/negative balance.
  - P1 Decay (0-0.96), P2 Ratio (0.5-4.5), P3 Balance (-1 to 1)
- **Tanh Sq**: Driven square wave.
  - P1 Drive (0.05-5), P2 Trim (0.2-1.2), P3 Bias (-0.4 to 0.4)
- **Tanh Saw**: Square-to-saw waveshaping.
  - P1 Drive (0.05-4.5), P2 Blend (0-1), P3 Edge (0.5-2.0)
- **PAF**: Phase-aligned formant texture.
  - P1 Form (0.5-6), P2 Bandwidth (50-3000 Hz), P3 Depth (0.2-1.0)
- **Mod FM**: Exponential FM-like modulation.
  - P1 Index (0.01-8), P2 Ratio (0.25-6), P3 Feedback (0-0.8)

Combination algorithms

- **C1 Hyb**: ModFM plus fixed formants.
  - P1 Index, P2 Unused, P3 Formant spacing (0.8-1.2)
- **C2 Cas**: DSF → asym FM → tanh.
  - P1 DSF decay, P2 Asymmetry (0.5-2), P3 Drive (0-5)
- **C3 Par**: Parallel ModFM bank + formants.
  - P1 Index, P2 Unused, P3 Mix (0-1)
- **C4 Fdb**: ModFM with feedback and drive.
  - P1 Index, P2 Feedback (0-0.95), P3 Drive (1-5)
- **C5 Mor**: DSF ↔ ModFM ↔ PAF morph.
  - P1 Morph, P2 Character, P3 Curve (0.5-2)
- **C6 Inh**: Inharmonic DSF into PAF.
  - P1 DSF decay, P2 PAF shift (5-50), P3 Mix (0-1)

- **C7 Flt**: Filter-like DSF/ModFM blend.
    - P1 Cutoff (0-1), P2 Resonance (0-1), P3 Mix (0-1)

Novel algorithms

- **N1 Mul**: Tanh → exp → ring modulation.
    - P1 Tanh drive (0.1-10), P2 Exp depth (0.1-1.5), P3 Ring ratio (0.5-5)
- **N2 Asy**: Frequency-dependent asym FM.
    - P1 Low R (0.5-1), P2 High R (1-2), P3 Index (0.2-1)
- **N3 XMod**: Cross-mod DSF/FM blend.
    - P1 Mod 1 (0-1), P2 Mod 2 (0-1), P3 Mix (0-1)
- **N4 Tay**: Taylor series approximation.
    - P1 Terms 1 (1-10), P2 Terms 2 (1-10), P3 Blend (0-1)
- **Traj**: Polygonal trajectory oscillator.
    - P1 Sides (3-12), P2 Angle (0-360), P3 Jitter (0-10 deg)

MIDI Control

- **Channel 1 Note On**: Sets the base pitch and scales output level by velocity.
- **Channel 1 Note Off**: Releases velocity gain back to full.

MIDI pitch replaces Knob 1 base frequency while active, and CV 1 still applies as pitch modulation.

Display Guide

- **Top line**: Algorithm name with `>` when the encoder is on ALG page. Page label (ALG/P2/P3/OUT) and output mode letter (M/S/D) are on the right.
- **Line 2**: Frequency in Hz.
- **Line 3**: Param 1 label and value (or Scale in Calib).
- **Line 4**: Param 2, Param 3, or Output depending on the current page (or Offset in Calib).

Tips

- Use **P3 Mix/Balance** controls to create stereo interest in Stereo mode.
- Detune mode is subtle; increase pitch and drive parameters for obvious beating.
- For percussive sounds, try **Mod FM**, **C4 Fdb**, or **N1 Mul** with fast parameter modulation.