



*BleLabLink - Hands-on BLE electronics labs*

# Illustrated User Manual

PIC32-BZ6 Curiosity board • Android app 1.5.0, build 100 • demonstration runtime 52

Practical guidance for connecting, operating, and learning from supported BLE electronics labs.

Educational reference only. Confirm the board, module, socket, jumpers and firmware profile before powering hardware. PIC32 BZ6 Curiosity Board product photo © Microchip Technology Inc.; Click board product photos © MikroElektronika d.o.o. All brand names and trademarks belong to their respective owners; no vendor endorsement is implied.

# Contents

Connect and choose an application . . . . . 3

In-app manual and help . . . . . 5

Board LED and switches . . . . . 5

4x4 RGB matrix . . . . . 6

OLED display . . . . . 7

Matrix animation gallery . . . . . 8

OLED animation gallery . . . . . 9

GPIO and buses . . . . . 9

Live monitor and saving logs . . . . . 10

BLE terminal and teaching . . . . . 10

Presets and sequences . . . . . 12

Firmware and first installation . . . . . 12

Technical notes: controls and confirmation . . . . . 13

Motion, GPS and power LED labs . . . . . 13

UART/I<sup>2</sup>C capture and serial forwarding . . . . . 15

Privacy policy . . . . . 15

Safety & disclaimer . . . . . 16

OLED mode: Temperature / time . . . . . 37

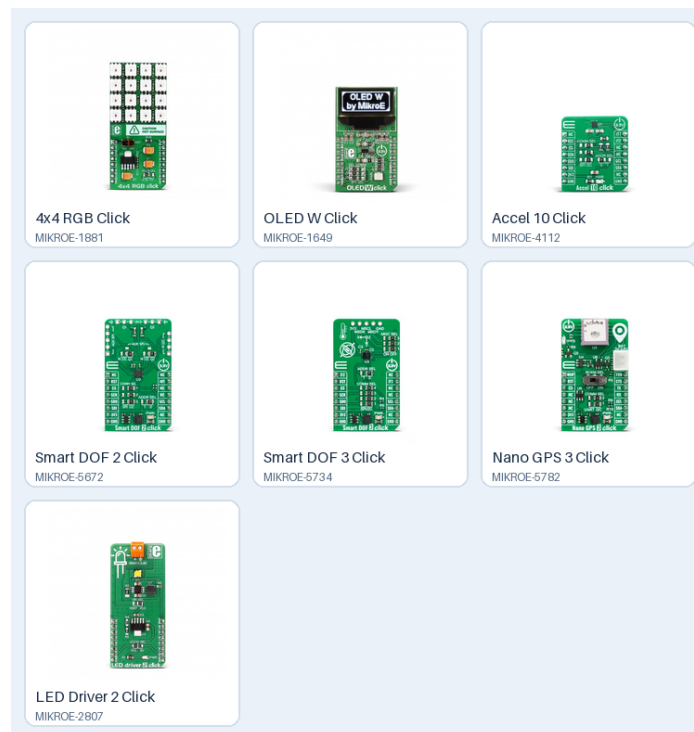
OLED mode: Automatic display cycle . . . . . 37

App 1.5.0, build 100. PIC32WM-BZ6 Curiosity board with manually selected, supported Click combinations. Display labs use matrix/socket 1 + OLED/socket 2; sensor and GPS + OLED layouts use OLED/socket 1 + sensor or GPS/socket 2. Check each module's layout and restrictions before activation. Runtime 52 adds UART/I<sup>2</sup>C capture and monitor-only GPS serial forwarding. First-install and connected-board release validation must be completed before public distribution.

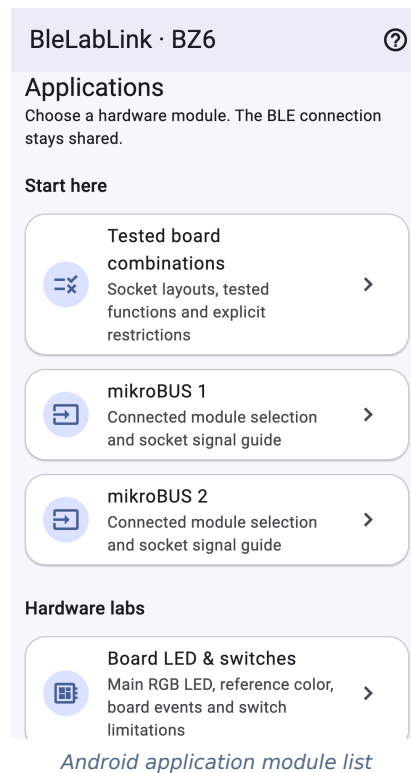
## Connect and choose an application



*PIC32 BZ6 Curiosity Board EV31U42A - official Microchip product photograph*



*Supported MikroE Click boards - official product photos: 4x4 RGB, OLED W, Accel 10, Smart DOF 2 and 3, Nano GPS 3, and LED Driver 2*



The board photo is supplied by Microchip; the Click board photos are supplied by MikroElektronika (MikroE). All brand names and trademarks belong to their respective owners; no vendor endorsement is implied. Third-party components on the boards belong to their respective manufacturers. These are product photographs, not socket-layout or wiring diagrams. The screen capture is from the Android app; menu availability depends on the connected board, firmware and selected profile.

## Check compatibility before connecting Click boards

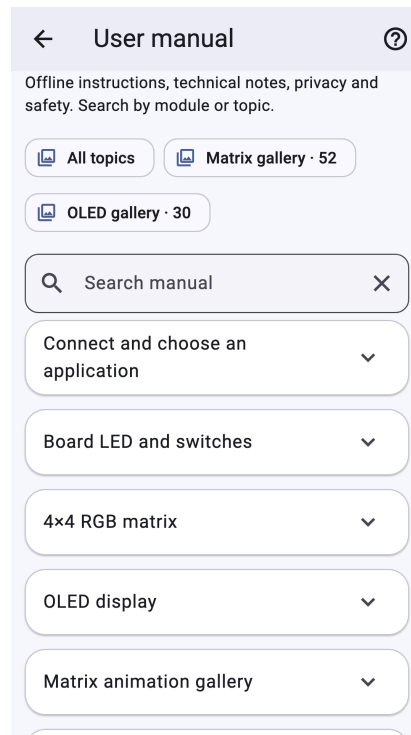
Not all Click boards can run together, even with socket extensions. Shuttle Click 2880 and mikroBUS Shuttle 2882 pass through shared host signals; they do not create independent GPIOs. Check pin ownership, bus/address and chip-select conflicts, logic voltage, total power/current and available firmware drivers. Devices can share buses when their interfaces are compatible. A board fitting a socket does not mean its combination is supported. Find this notice in the app under **Firmware & Learning** ▢ **Click board compatibility**.

The current example is OLED reset and main RGB green sharing PC10 on socket 2; the 4×4 matrix has a separate transport. The app does not automatically identify all attached Click boards.

Power the board using its debug USB connection. Enable Bluetooth on the phone, grant the app's requested nearby-device permissions, scan and connect to the board. Open Applications and choose a module. All modules share one BLE session. Leaving a screen does not disconnect the board.

## In-app manual and help

Open the Manual module from Applications for the quick-start guidance, lab descriptions, safety notes and searchable animation chapters. This downloadable guide expands those topics with board diagrams, app screenshots and effect illustrations. Screen names and available controls can vary with firmware/profile.



*Android in-app manual*

## Board LED and switches

Choose a color and adjust brightness. The requested default is blue at 5% on startup, unless a different startup setting was explicitly saved to board flash. Changing a live color alone does not save a startup override.

**Current wiring limitation:** OLED reset uses RC10, also the board green LED output. The OLED driver holds that GPIO high. The green LED can therefore stay bright independently of RGB brightness. Independent green control requires rerouting OLED reset and updating its driver; reducing the slider cannot resolve the electrical sharing. Do not press SW801 while it is used for OLED chip-select.

SW800 normally toggles RGB. With saved-plan control explicitly enabled, a short press starts, pauses or resumes the saved plan, and a two-second hold stops it. SW802/MCLR is the physical MCU reset. Reset board state in the app is not an MCU reboot.

## 4×4 RGB matrix

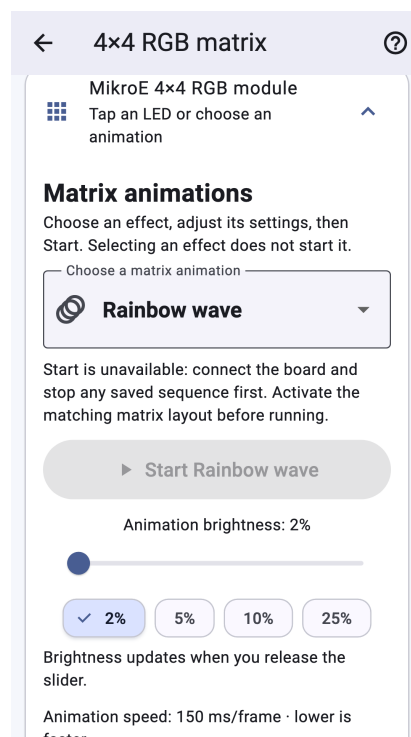


4x4 RGB Click - MikroE MIKROE-1881 official product photograph

Select an animation in the large animation selector, then press Start followed by the selected effect name. There is one primary Start action. Adjust animation/master brightness conservatively. Manual pixel editing returns the matrix to manual mode.

Tap a pixel: its ring, checkmark and Selected LED label confirm app selection, not a board acknowledgement. Choose a color reference or custom RGB mix. The individual slider scales that pixel relative to master brightness. White is available; outlined color references remain visible on a light background. Master reset sets all 16 pixels to blue at 25%; it is not a board reboot. Rotate 180° reverses both axes to match the viewing orientation.

Example: select pixel 6, choose white and reduce its individual brightness. Then choose a rainbow animation and start it. Switching back to individual pixel editing ends animation mode. The manual grid is not live animation telemetry.



Android 4×4 matrix controls

This screen capture illustrates the selector and brightness controls. Start may remain disabled until a board is connected and the matching matrix profile is active.

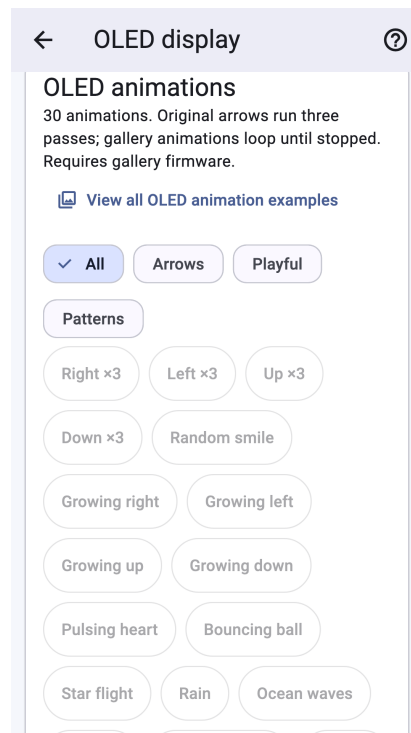
## OLED display



*OLED W Click - MikroE MIKROE-1649 official product photograph*

Choose animations, temperature/time dashboard, custom text or stopwatch. The monochrome OLED W display does not support different character colors. Phone time synchronization sets the board's displayed time; do not assume it survives loss of power. Temperature uses the reported sensor reading. Rotate 180° reverses both axes.

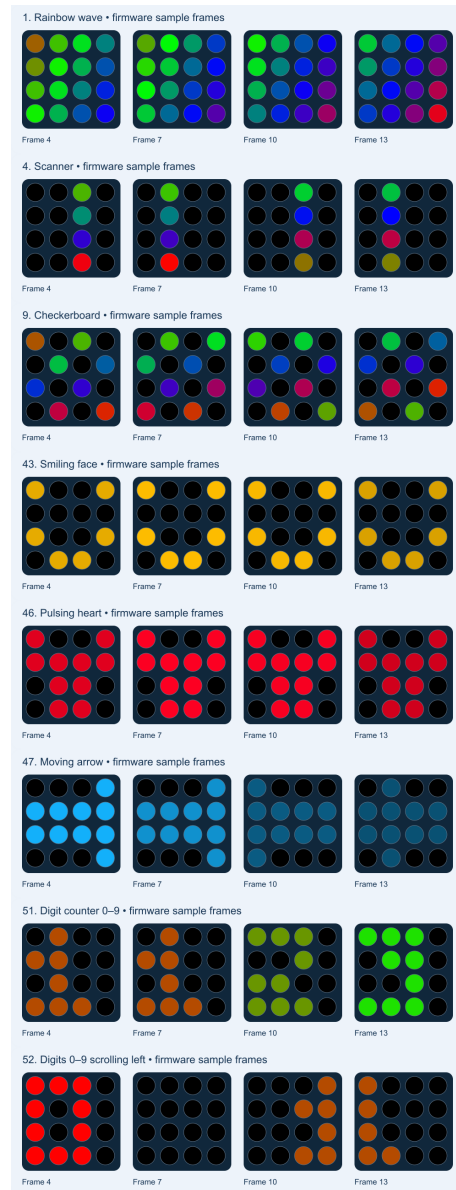
Use the text editor to select size, scroll direction, speed and duration. The stopwatch controls are Start, Stop, Split and Zero. A split display is not proof the underlying elapsed clock stopped.



*Android OLED module controls*

## Matrix animation gallery

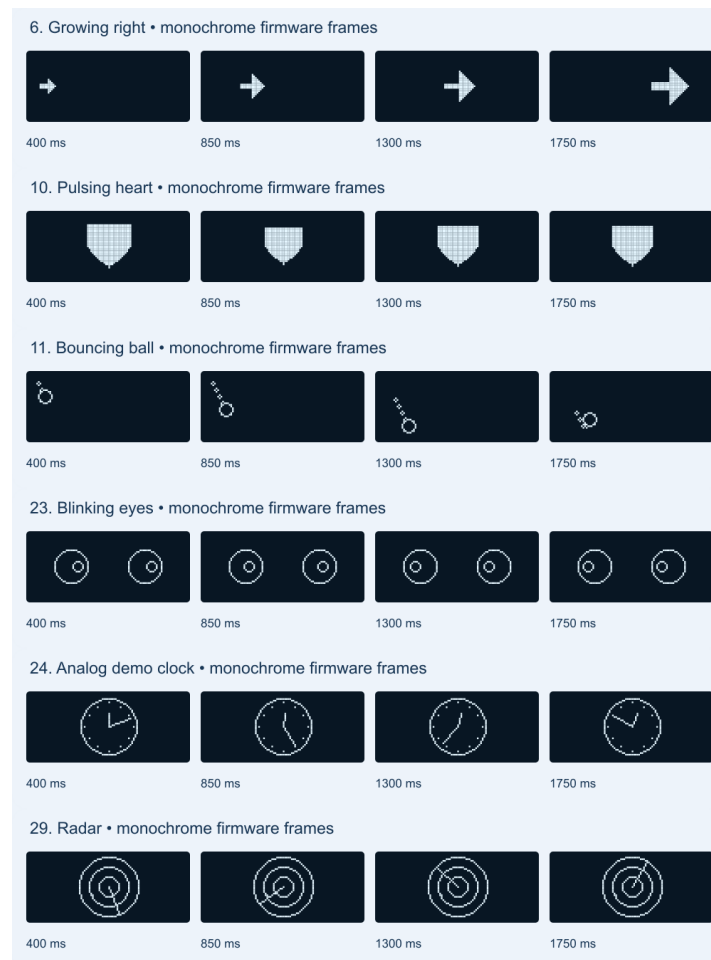
The following strips sample the actual firmware renderer in chronological frame order. They are illustrations, not measured LED brightness or physical photographs. Orientation settings can mirror the result. All 52 matrix effects have individual searchable chapters below, in the app and web manual. Use the Matrix gallery button or search an effect name. The overview below shows representative examples; a still cannot demonstrate a complete animation cycle.



*Matrix rainbow, scanner, checkerboard, smile, heart, arrow and digit sample frames*

## OLED animation gallery

Monochrome sample frames are rendered by the actual OLED gallery routines. These show growing arrows, pulsing heart, bouncing ball, blinking eyes, demo clock and radar. Illustrations preserve the 96×39 logical pixel area. This is not a color display; labels and board illustrations may use color. All 30 OLED animations have searchable chapters below. Temperature/time and the automatic display cycle are documented separately as modes, not animations.



*OLED firmware sample frames - arrows, heart, ball, eyes, clock and radar*

## GPIO and buses

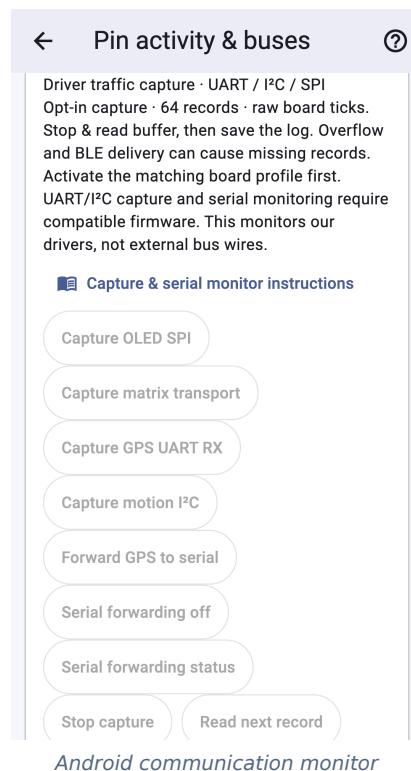
Direct GPIO controls have been removed. Connect external lab circuits through mikroBUS using compatible firmware drivers. The mikroBUS 1 and mikroBUS 2 sections describe socket signals and allow manual, session-only module selection. Selection is not automatic detection, saved board configuration or electrical conflict resolution. Existing matrix controls are available for socket 1 and OLED W Click controls for socket 2; other selections require driver development. Power down before changing modules. Pin activity & buses is read-only: current Runtime 14 reports legacy configuration only. Runtime 16 adds slow digital samples for explicitly configured socket 1 PWM/PD1 and INT/PE4 lab signals. Choose Other Click / external lab circuit in mikroBUS 1 for the protected lab. The controls require a fresh Runtime 16 capability report; INT is input-only. See [digital lab guide](#) for wiring and limitations.

Runtime 17 adds bounded OLED SPI TX-byte capture and matrix encoded-transport previews. Runtime 52 adds GPS UART RX and motion I<sup>2</sup>C driver TX/RX capture. See [driver traffic capture](#) for limits and operation. Communication monitor is not an external-bus analyzer. Save log file is visible above the Communication monitor panel. It exports a diagnostic snapshot with connection/status age and reported counters when available, or explicitly records that no bus statistics were reported. It also exports received Runtime 17 driver records, including truncation and overflow.

## Live monitor and saving logs

The heartbeat shows recently received BLE data, not continuous temperature sampling. Select Temperature to view its separate retained history and the age of the last received value. Factory temperature notifications occur when the reading changes by more than 1°C, so unchanged temperature need not add entries. Disconnected readings are historical.

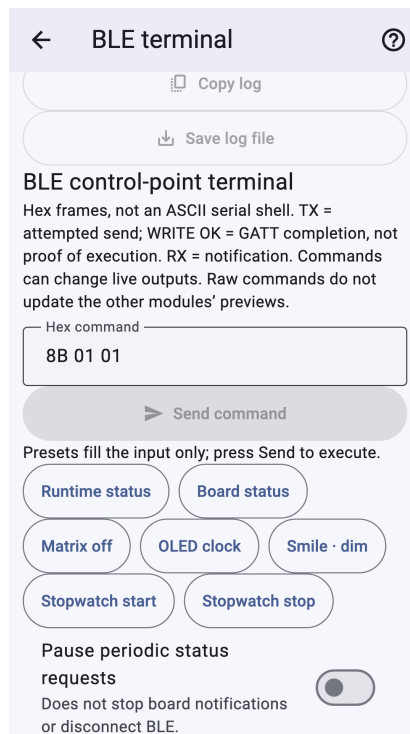
Search and filters apply to the visible log. Freeze view freezes presentation while capture continues. Copy visible log copies oldest-first. Save log file opens Android's document picker: choose a phone folder and confirm Save. Exports contain a snapshot of retained entries, not unlimited background logs. Clearing logs discards their in-app history, not previously saved files.



*Android communication monitor*

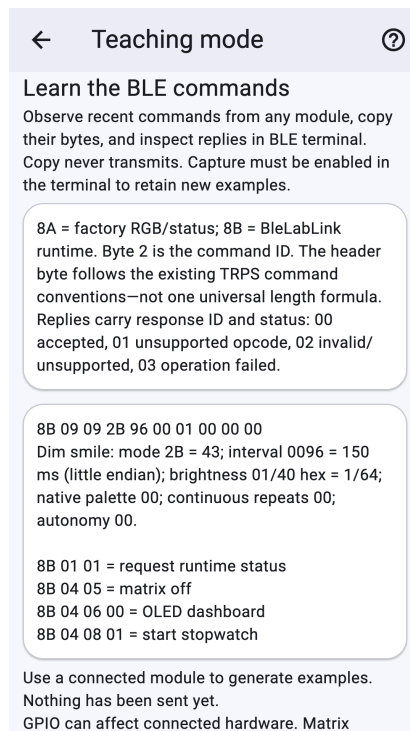
## BLE terminal and teaching

The terminal accepts hexadecimal BLE control frames, not an ASCII UART shell. Presets fill the input; Send executes. TX records an attempt; WRITE OK records GATT completion; RX records a notification. None alone proves physical output. Decoded rejection messages help diagnose unsupported or invalid commands. Copy log and Save log file export captured traffic oldest-first.



Android BLE terminal

Teaching mode explains the command behind an action and lets learners copy it. Raw terminal commands can change outputs without updating another module's requested-state preview. Avoid experimenting with unfamiliar GPIO commands on connected motors or other loads.

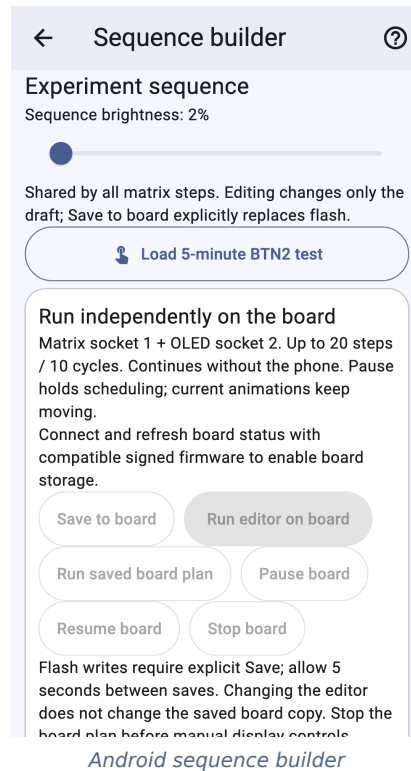


Android teaching mode

## Presets and sequences

Experiment presets save supported requested settings on the phone. Restore requires a connection and does not prove the resulting physical state. Phone sequences run while the app remains foreground and connected. Use Start, Pause, Resume and Stop. Board-owned display plans can be explicitly uploaded and saved to flash with compatible firmware; the app waits for save/read-back confirmation. They do not automatically start on boot.

Example: show a smile for five seconds, show temperature, then run rainbow. Use low matrix brightness and confirm each module independently before combining steps. Board storage currently covers supported display plans and startup RGB / SW800 preferences, not arbitrary applications or all GPIO/sensor configurations.



## Firmware and first installation

Firmware & Learning describes this project's runtime and guided experiments; it is not a catalog of unmodified Microchip factory HEX files. First installation uses a PC or Mac with MPLAB tools and the board's onboard PKoB4 through **USB DEBUG J100 only**. No external programmer/debug probe is permitted for BleLabLink labs; TARGET USB J103 is not the programming port. If an application/boot image is damaged, stop and follow Microchip's recovery procedure for the affected component under instructor supervision. PKoB4 tool recovery is different from restoring the target application; never guess erase ranges or rewrite security fuses. A release download must identify board model, runtime version, SHA-256, signing compatibility and recovery steps. Never substitute an unsigned HEX for a required signed production image.

An OTA package is distinct from a programmer HEX. OTA requires compatible firmware/bootloader, image layout and signing already installed. Do not advertise factory-board OTA as a universal first-install path. Bundling a verified signed HEX and an in-app Save firmware file action must not be advertised until the actual release package and signing have been verified.

## Technical notes: controls and confirmation

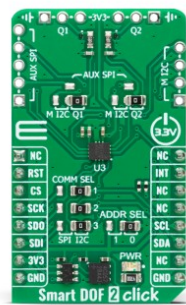
Selected means a local choice, not an output change. Start/Send requests an action. Board-confirmed means a fresh firmware report, not independent physical sensing. Reports expire after seven seconds; stale values are historical. BLE commands have no per-command transaction IDs. A write completion or accepted handler response alone cannot prove the electrical output behaved correctly. Disabled actions require connection, compatible firmware/profile, or stopping an active saved plan. Selecting an effect does not run it.

Matrix animation/master brightness is shared. Releasing its slider updates the board and restarts an active effect; firmware quantizes brightness into 64 steps. Individual pixel edits leave animation mode. The manual grid is not a live animation preview. H flips left/right, V flips up/down; both give 180° rotation.

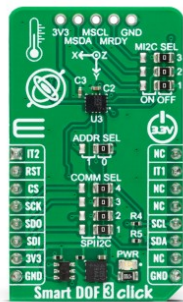
## Motion, GPS and power LED labs



*Accel 10 Click - MikroE MIKROE-4112 official product photograph*



*Smart DOF 2 Click - MikroE MIKROE-5672 official product photograph*



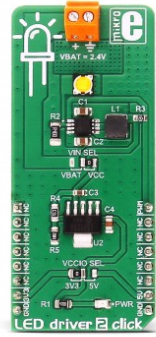
*Smart DOF 3 Click - MikroE MIKROE-5734 official product photograph*

Accel 10, Smart DOF 2 and Smart DOF 3 each have their own module. Select the installed device and address, acknowledge its layout, then activate. Calibration sets a relative reference: small residual noise is normal, and gravity remains part of accelerometer measurements. Angles are lab estimates, not navigation or safety instrumentation. Select OLED measurements or animations explicitly.



*Nano GPS 3 Click - MikroE MIKROE-5782 official product photograph*

Nano GPS 3 uses socket 2; OLED, if used, is on socket 1. Match the communication jumpers to the UART profile. Enable GPS, inspect RX and fix status, and allow clear-sky acquisition. Indoors/window reception may be intermittent. Start journey records valid fixes; Stop ends recording; Clear/new journey removes the in-app track. Coordinates and speed may be stale or noisy. Do not use this lab for navigation, driving decisions or emergency location.



*LED Driver 2 Click - MikroE MIKROE-2807 official product photograph*

LED Driver 2 requires its supported layout and acknowledgement. Begin with low brightness, use Off when finished and avoid looking into an intense LED. Select continuous or 2/5/10 cycles for supported effects. Observe electrical ratings and cooling; the app cannot make an unsafe circuit safe.

## UART/I<sup>2</sup>C capture and serial forwarding

Activate the matching GPS or motion profile. In Pin activity & buses select Capture GPS UART RX or Capture motion I<sup>2</sup>C. Capture briefly, choose Stop & read buffer, then Save log file. The first 64 records are retained; further records are dropped and counted. New captures replace the board buffer. UART byte batches and I<sup>2</sup>C data are split across records. I<sup>2</sup>C records include address, register, direction and driver errors; they do not capture every electrical START/STOP/ACK or timing event. BLE delivery can lose records too.

Forward GPS to serial enables a read-only PC/Mac monitor through the existing SERCOM0 USB-to-UART adapter console at 115200 baud, 8N1, no flow control. This is not a new native TGT-USB CDC device. Serial forwarding is off at boot and after changing profiles. Its bounded 512-byte queue counts overflow and does not wait for a host. Diagnostics can interleave with GPS bytes. The adapter cannot confirm delivery when the PC is absent. PC input is not forwarded to the GPS or interpreted as commands. Bidirectional operation is not enabled.

## Privacy policy

BleLabLink by Rintronic - updated October 8, 2026.

This version works locally with a board over Bluetooth. The current app code contains no account service, advertising SDK, analytics uploader or developer cloud sync. Rintronic does not receive your lab telemetry through this app. Operating-system/store diagnostics and device backups are governed separately by Apple/Google and your device settings; this policy does not describe a website's cookies or server logs.

The app processes BLE device names/identifiers, commands, responses, sensor readings and board status to connect, display results and debug labs. GPS coordinates, speed and routes come from the connected GPS Click board, not a phone location-tracking service implemented by this app. Bluetooth/Nearby Devices permissions enable scanning and communication. Location permission may be declared/requested for platform compatibility; the current app does not read the phone's position. You can revoke permissions in device Settings; revoking Bluetooth permission prevents board communication.

Presets and sequence libraries are saved in local app preferences. Retained terminal/monitor logs and journeys are session data unless you export them. Board flash plans/settings are stored on the board separately. App preferences are not a secure encrypted vault. Phone backups may retain app data according to platform settings. No developer account or server-side deletion is involved.

Copy, Save and Share actions intentionally transfer selected content to the clipboard, a file location or another app chosen by you. Logs and CSV/GPX files can contain precise coordinates, device identifiers and timestamps. Review them before sharing; other apps and cloud-backed folders have their own privacy policies. Serial forwarding also exposes GPS bytes to the connected computer and anyone with access to its terminal/logs.

Use module Clear/Delete actions to remove session logs, journeys and saved presets/libraries. Clear app storage on Android, or delete the app on iOS, to remove local app data (not offload). Delete exported files and backups separately. App removal does not erase board flash; use explicit board storage controls. For privacy questions contact the developer through the support contact in the app's store listing. Public policy URL and contact details must be verified before publishing this release.

## Safety & disclaimer

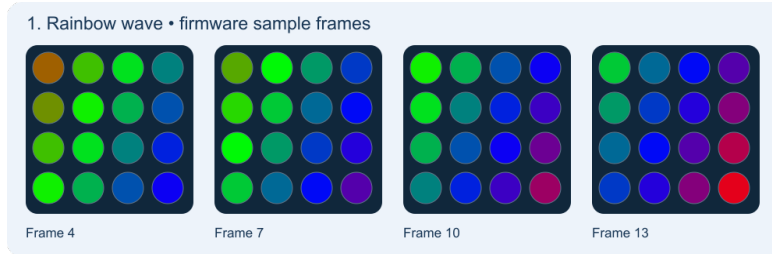
BleLabLink is an educational electronics lab, not certified industrial, medical, automotive, navigation, emergency or safety-control equipment. Measurements, timing and animations may be inaccurate or interrupted. Do not depend on BLE, a phone or these examples for a safety interlock.

Power off before swapping boards or changing jumpers. Check board supply, logic voltage, current limits, common ground and wiring against the relevant hardware documentation. Never connect mains voltage or directly drive motors or high-current loads from MCU pins. Use suitable drivers and protection. Start bright LEDs at low intensity and follow the LED board's thermal limits.

Only the named, supported layouts have reviewed drivers. Manual selection is not physical Click identification. Users must install the correct board in the correct socket with the correct jumpers; socket extensions do not remove pin conflicts. A displayed confirmation describes firmware state, not proof of electrical safety. Keep shared-pin restrictions visible when activating a layout.

Firmware programming can erase settings or require recovery. Verify board model, image version, signing and checksum; retain a known-good recovery image and use USB DEBUG and onboard PKoB4 only, not an external programmer. Follow Microchip's component-specific recovery procedure if the boot image is damaged. Factory-board OTA must not be assumed. Experiments should be supervised where appropriate. These notes do not remove applicable consumer rights or replace hardware documentation or professional advice. Microchip and MikroE names identify compatible hardware; no endorsement or affiliation is implied.

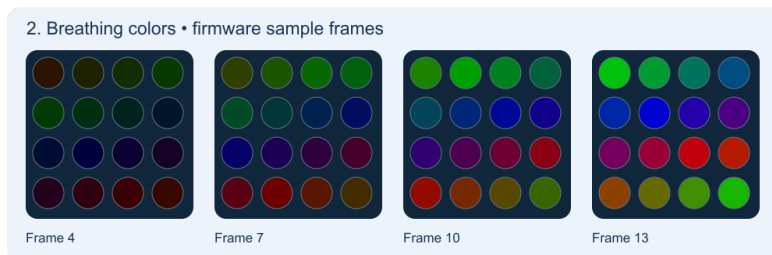
## Matrix animation 1: Rainbow wave



*Rainbow wave: four firmware-rendered example frames*

Select **Rainbow wave** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

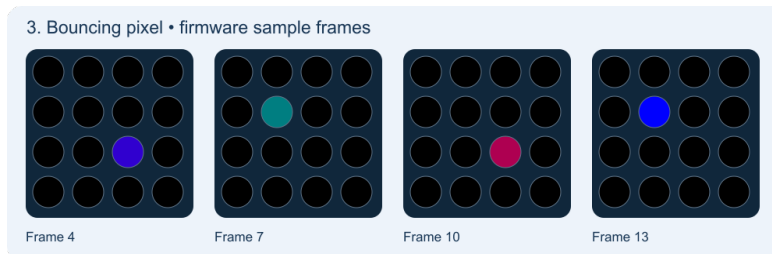
## Matrix animation 2: Breathing colors



*Breathing colors: four firmware-rendered example frames*

Select **Breathing colors** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

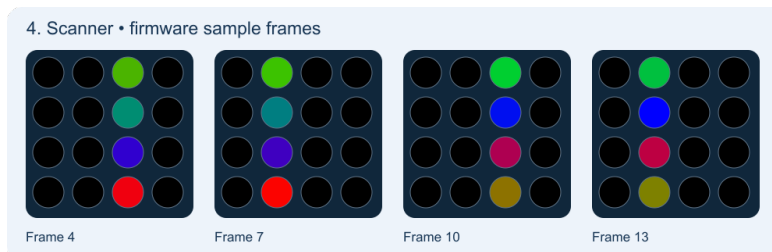
## Matrix animation 3: Bouncing pixel



*Bouncing pixel: four firmware-rendered example frames*

Select **Bouncing pixel** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

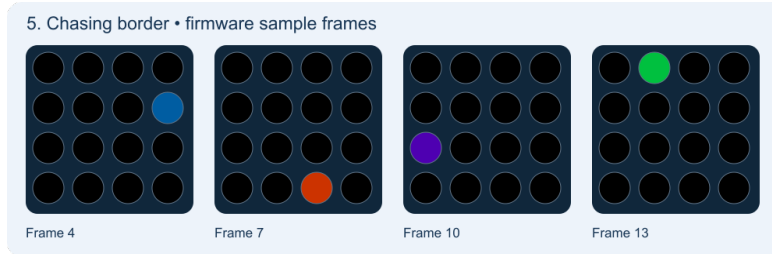
## Matrix animation 4: Scanner



*Scanner: four firmware-rendered example frames*

Select **Scanner** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

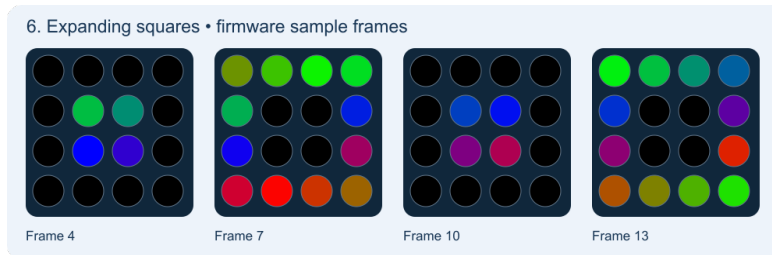
## Matrix animation 5: Chasing border



*Chasing border: four firmware-rendered example frames*

Select **Chasing border** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

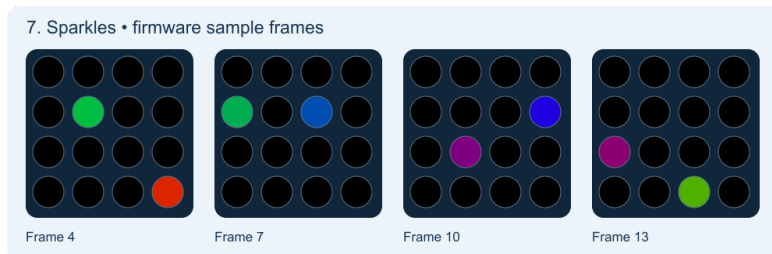
## Matrix animation 6: Expanding squares



*Expanding squares: four firmware-rendered example frames*

Select **Expanding squares** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

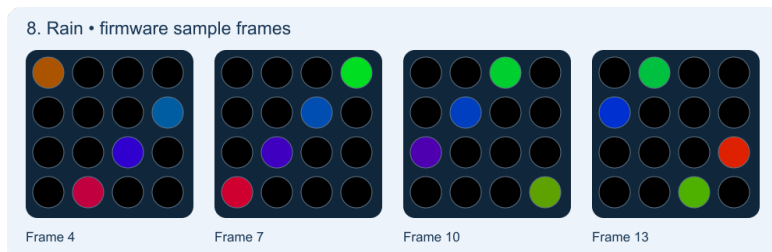
## Matrix animation 7: Sparkles



*Sparkles: four firmware-rendered example frames*

Select **Sparkles** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

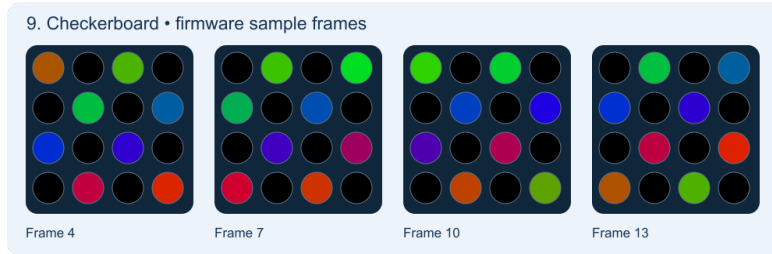
## Matrix animation 8: Rain



*Rain: four firmware-rendered example frames*

Select **Rain** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

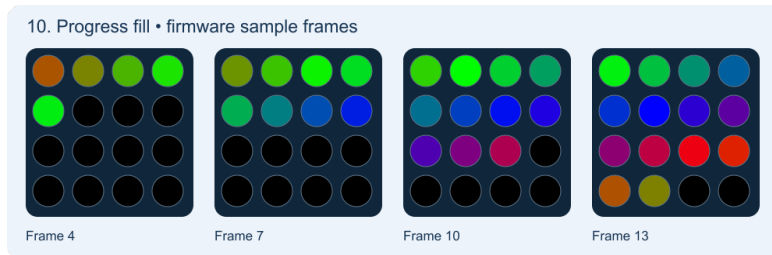
## Matrix animation 9: Checkerboard



*Checkerboard: four firmware-rendered example frames*

Select **Checkerboard** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

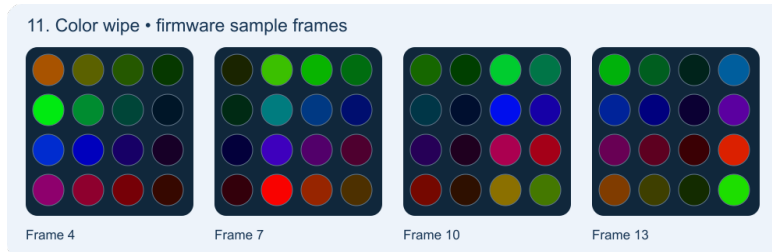
## Matrix animation 10: Progress fill



*Progress fill: four firmware-rendered example frames*

Select **Progress fill** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

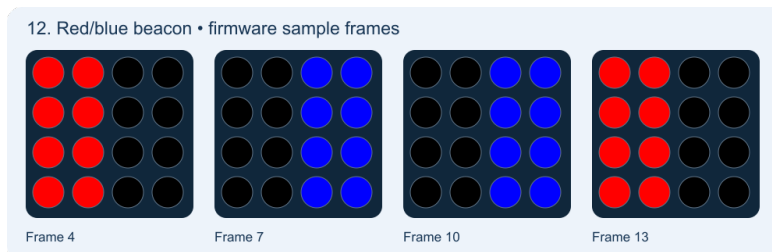
## Matrix animation 11: Color wipe



*Color wipe: four firmware-rendered example frames*

Select **Color wipe** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

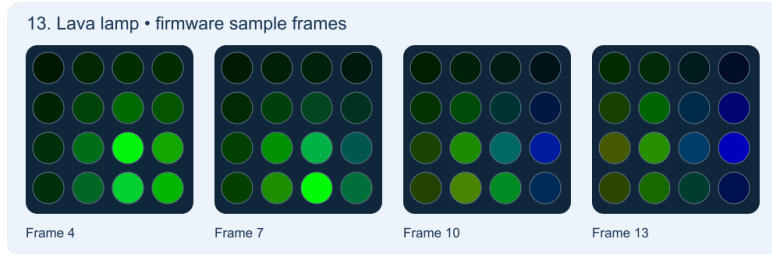
## Matrix animation 12: Red/blue beacon



*Red/blue beacon: four firmware-rendered example frames*

Select **Red/blue beacon** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

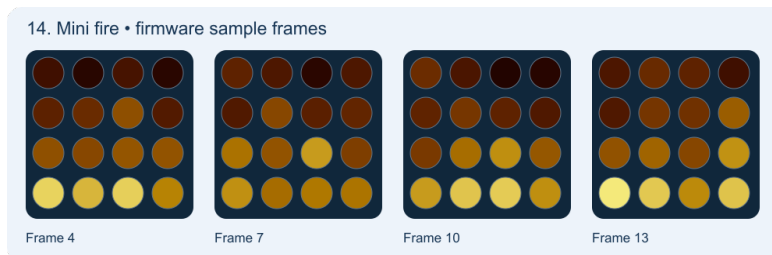
## Matrix animation 13: Lava lamp



*Lava lamp: four firmware-rendered example frames*

Select **Lava lamp** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

## Matrix animation 14: Mini fire



*Mini fire: four firmware-rendered example frames*

Select **Mini fire** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

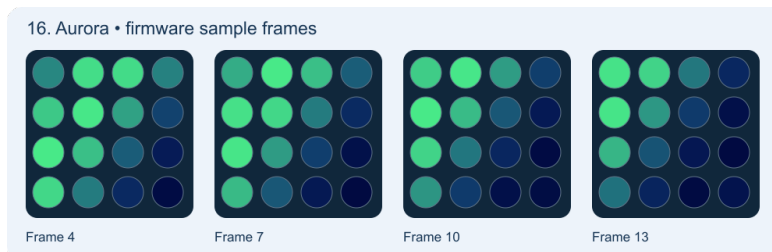
## Matrix animation 15: Comet trail



*Comet trail: four firmware-rendered example frames*

Select **Comet trail** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

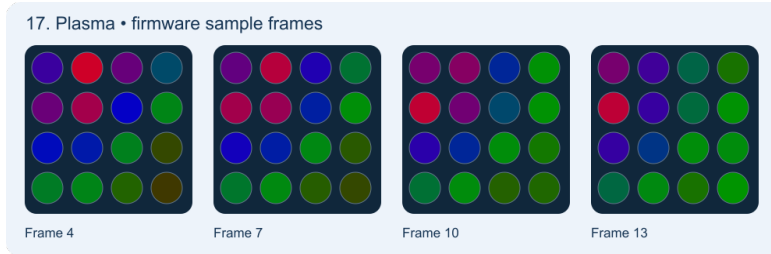
## Matrix animation 16: Aurora



*Aurora: four firmware-rendered example frames*

Select **Aurora** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

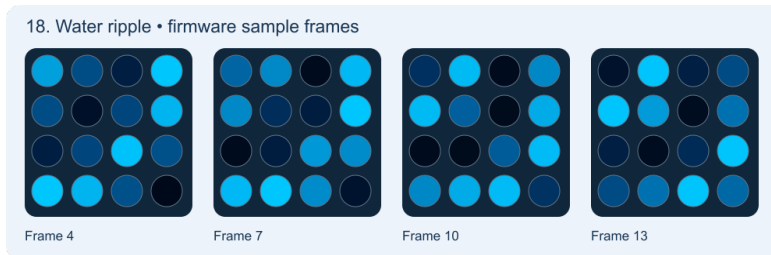
## Matrix animation 17: Plasma



*Plasma: four firmware-rendered example frames*

Select **Plasma** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

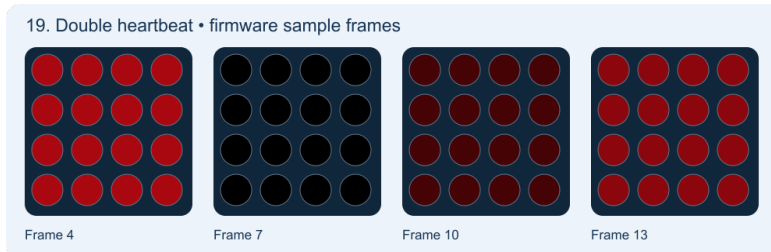
## Matrix animation 18: Water ripple



*Water ripple: four firmware-rendered example frames*

Select **Water ripple** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

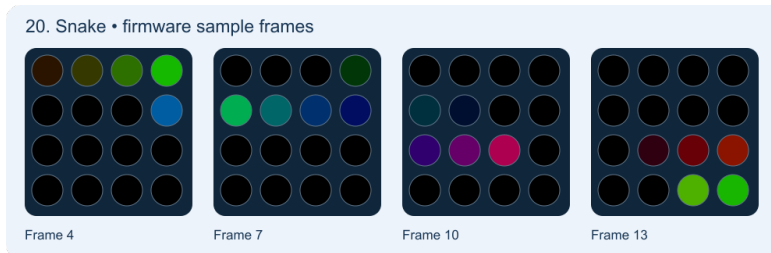
## Matrix animation 19: Double heartbeat



*Double heartbeat: four firmware-rendered example frames*

Select **Double heartbeat** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

## Matrix animation 20: Snake



*Snake: four firmware-rendered example frames*

Select **Snake** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

## Matrix animation 21: Crossfade tiles



*Crossfade tiles: four firmware-rendered example frames*

Select **Crossfade tiles** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

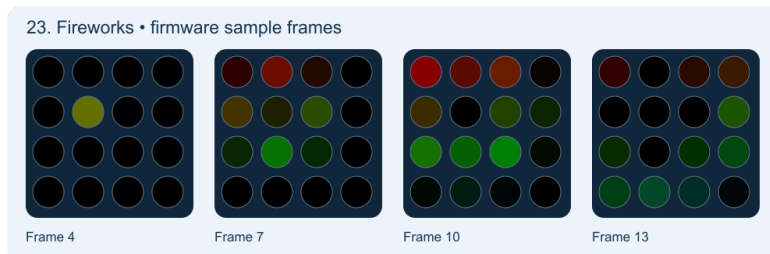
## Matrix animation 22: Rotating pinwheel



*Rotating pinwheel: four firmware-rendered example frames*

Select **Rotating pinwheel** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

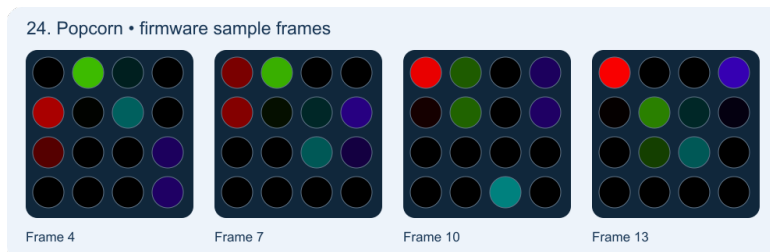
## Matrix animation 23: Fireworks



*Fireworks: four firmware-rendered example frames*

Select **Fireworks** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

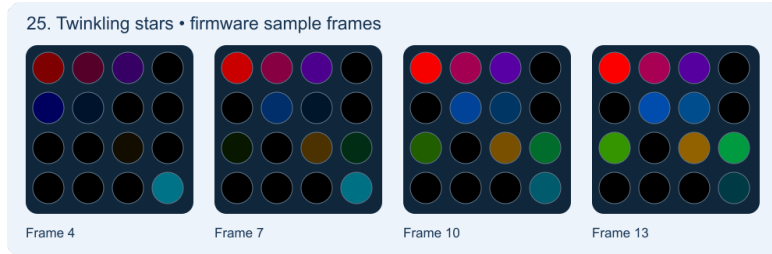
## Matrix animation 24: Popcorn



*Popcorn: four firmware-rendered example frames*

Select **Popcorn** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

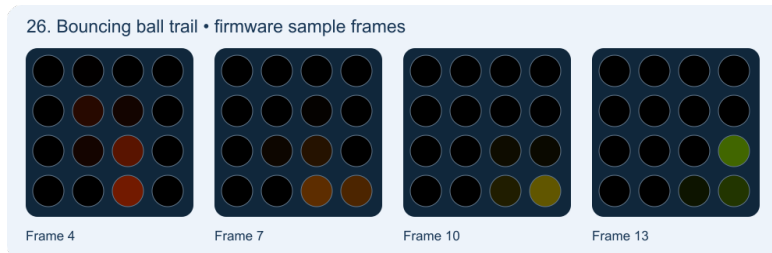
## Matrix animation 25: Twinkling stars



*Twinkling stars: four firmware-rendered example frames*

Select **Twinkling stars** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

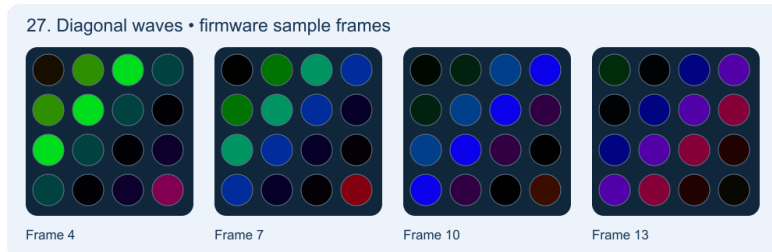
## Matrix animation 26: Bouncing ball trail



*Bouncing ball trail: four firmware-rendered example frames*

Select **Bouncing ball trail** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

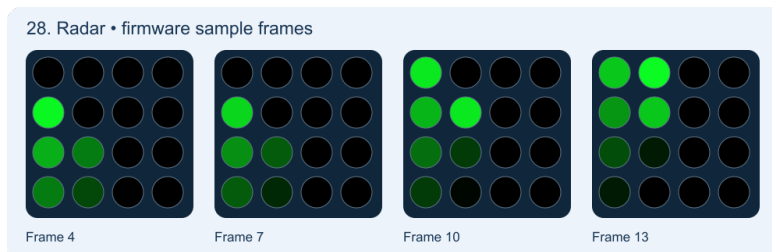
## Matrix animation 27: Diagonal waves



*Diagonal waves: four firmware-rendered example frames*

Select **Diagonal waves** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

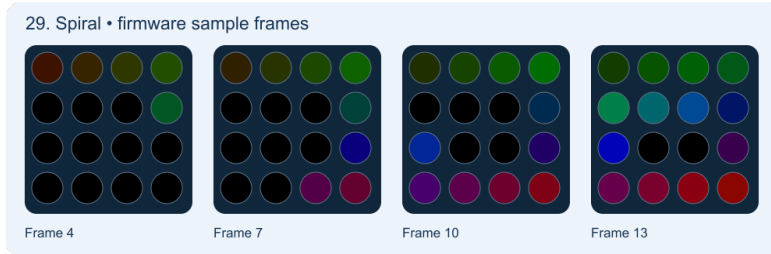
## Matrix animation 28: Radar



*Radar: four firmware-rendered example frames*

Select **Radar** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

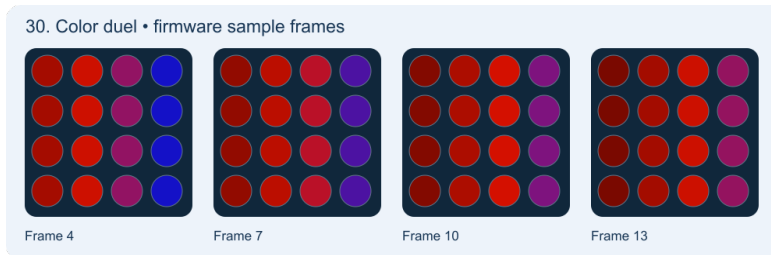
## Matrix animation 29: Spiral



*Spiral: four firmware-rendered example frames*

Select **Spiral** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

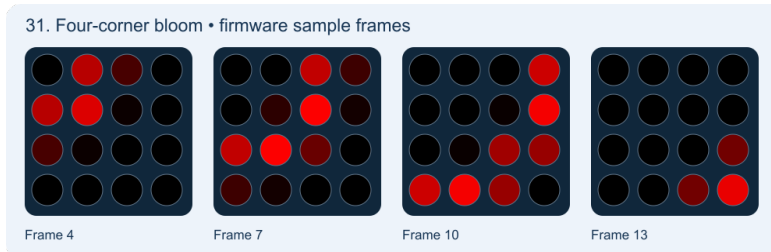
## Matrix animation 30: Color duel



*Color duel: four firmware-rendered example frames*

Select **Color duel** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

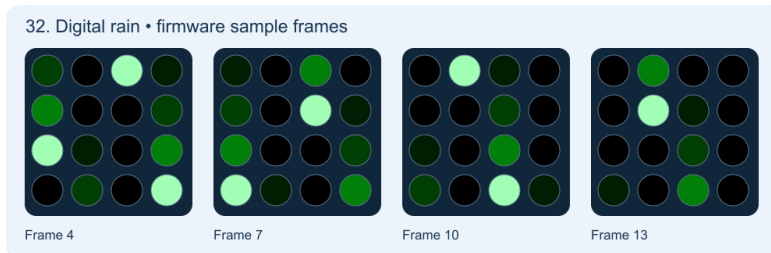
## Matrix animation 31: Four-corner bloom



*Four-corner bloom: four firmware-rendered example frames*

Select **Four-corner bloom** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

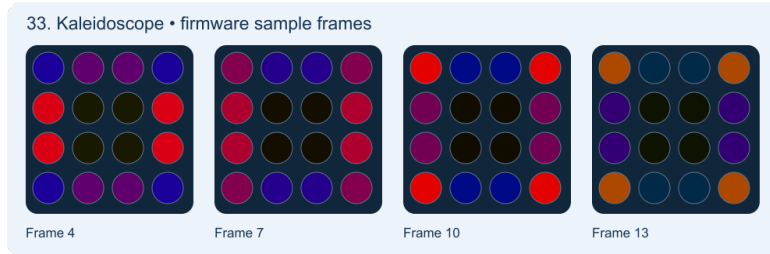
## Matrix animation 32: Digital rain



*Digital rain: four firmware-rendered example frames*

Select **Digital rain** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

## Matrix animation 33: Kaleidoscope



*Kaleidoscope: four firmware-rendered example frames*

Select **Kaleidoscope** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

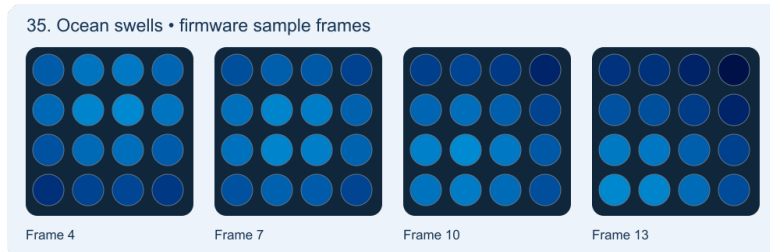
## Matrix animation 34: Breathing petals



*Breathing petals: four firmware-rendered example frames*

Select **Breathing petals** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

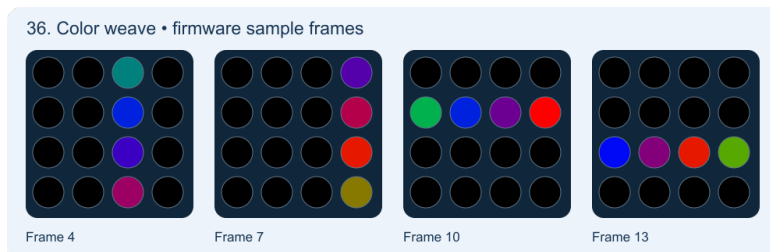
## Matrix animation 35: Ocean swells



*Ocean swells: four firmware-rendered example frames*

Select **Ocean swells** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

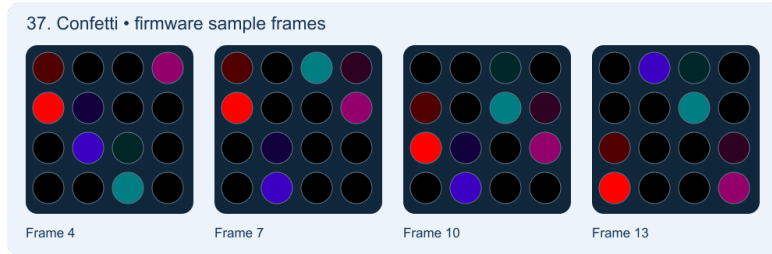
## Matrix animation 36: Color weave



*Color weave: four firmware-rendered example frames*

Select **Color weave** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

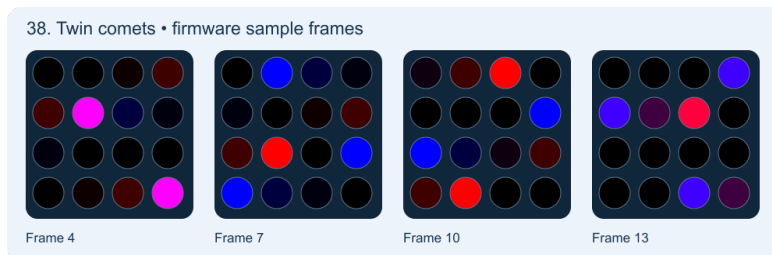
## Matrix animation 37: Confetti



*Confetti: four firmware-rendered example frames*

Select **Confetti** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

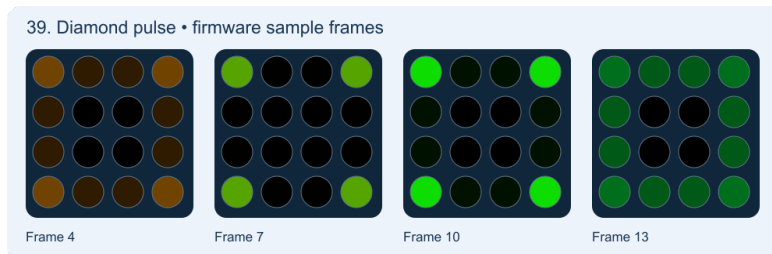
## Matrix animation 38: Twin comets



*Twin comets: four firmware-rendered example frames*

Select **Twin comets** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

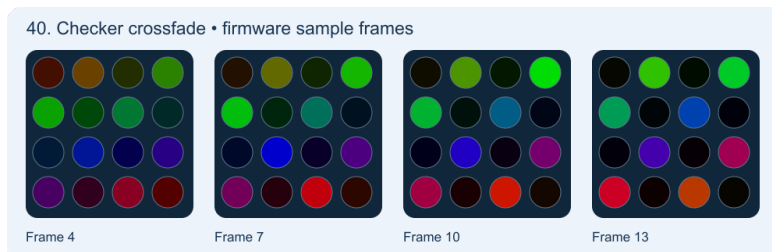
## Matrix animation 39: Diamond pulse



*Diamond pulse: four firmware-rendered example frames*

Select **Diamond pulse** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

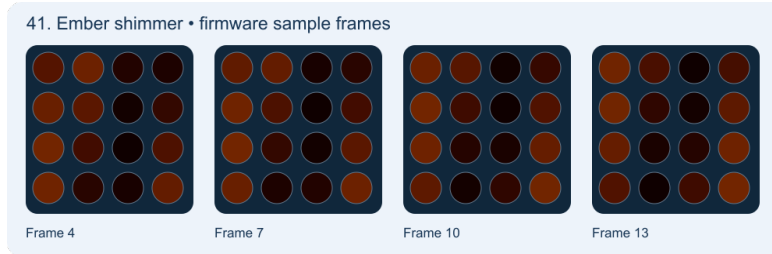
## Matrix animation 40: Checker crossfade



*Checker crossfade: four firmware-rendered example frames*

Select **Checker crossfade** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

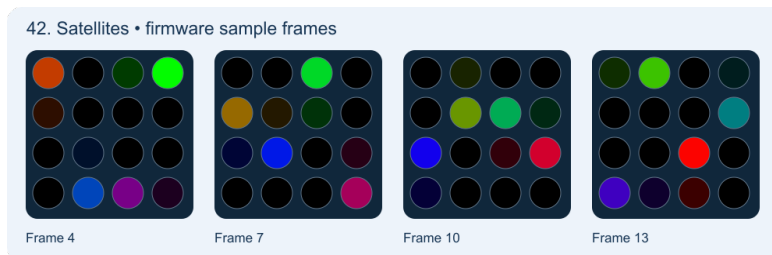
## Matrix animation 41: Ember shimmer



*Ember shimmer: four firmware-rendered example frames*

Select **Ember shimmer** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

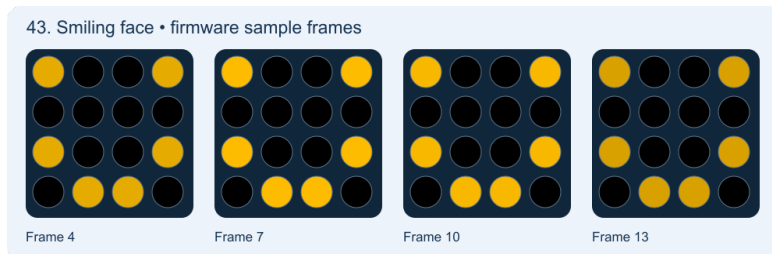
## Matrix animation 42: Satellites



*Satellites: four firmware-rendered example frames*

Select **Satellites** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

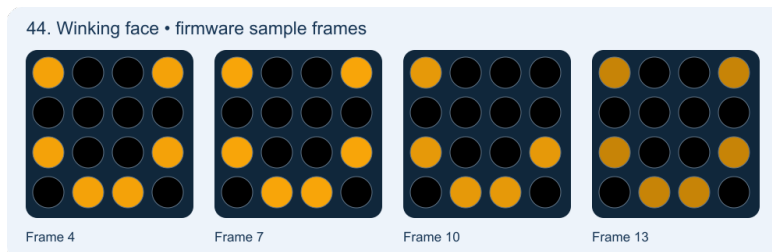
## Matrix animation 43: Smiling face



*Smiling face: four firmware-rendered example frames*

Select **Smiling face** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

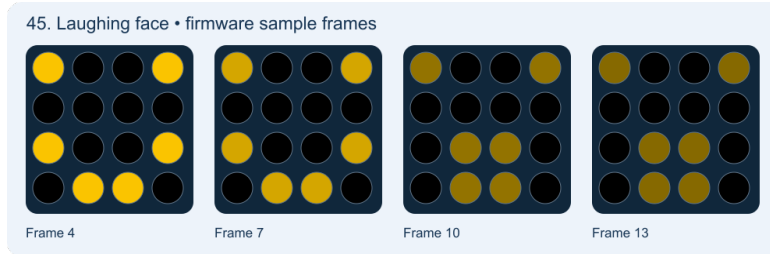
## Matrix animation 44: Winking face



*Winking face: four firmware-rendered example frames*

Select **Winking face** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

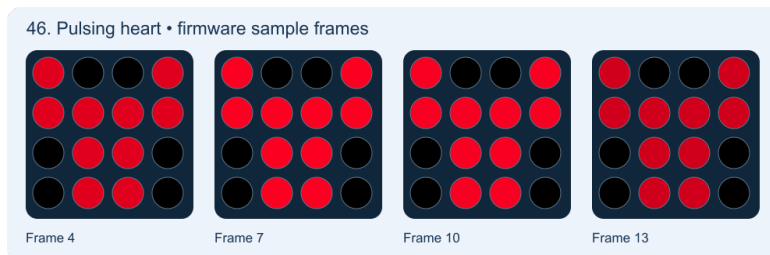
## Matrix animation 45: Laughing face



*Laughing face: four firmware-rendered example frames*

Select **Laughing face** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

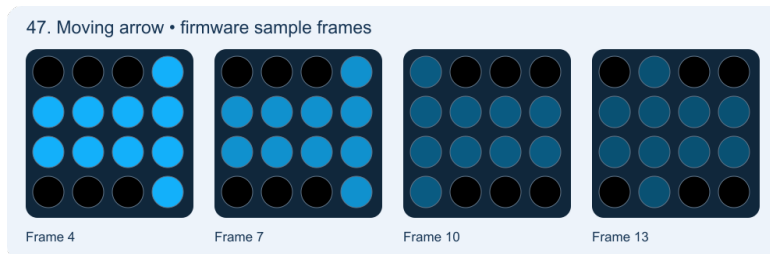
## Matrix animation 46: Pulsing heart



*Pulsing heart: four firmware-rendered example frames*

Select **Pulsing heart** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

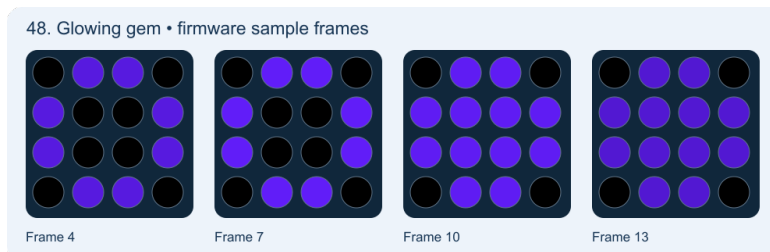
## Matrix animation 47: Moving arrow



*Moving arrow: four firmware-rendered example frames*

Select **Moving arrow** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

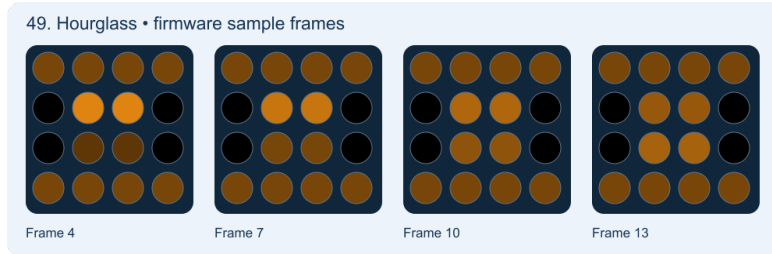
## Matrix animation 48: Glowing gem



*Glowing gem: four firmware-rendered example frames*

Select **Glowing gem** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

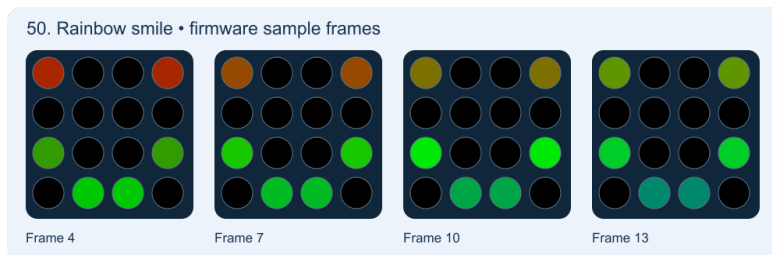
## Matrix animation 49: Hourglass



*Hourglass: four firmware-rendered example frames*

Select **Hourglass** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

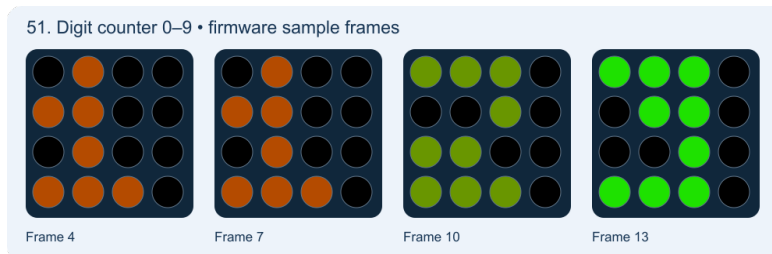
## Matrix animation 50: Rainbow smile



*Rainbow smile: four firmware-rendered example frames*

Select **Rainbow smile** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

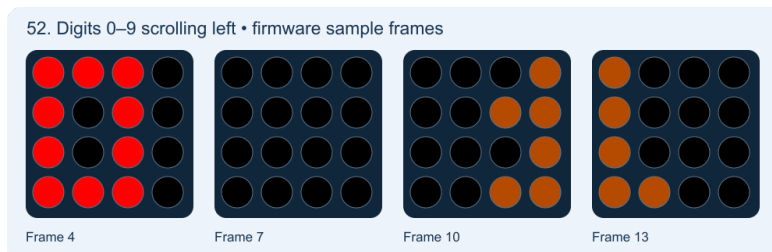
## Matrix animation 51: Digit counter 0-9



*Digit counter 0-9: four firmware-rendered example frames*

Select **Digit counter 0-9** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

## Matrix animation 52: Digits 0-9 scrolling left



*Digits 0-9 scrolling left: four firmware-rendered example frames*

Select **Digits 0-9 scrolling left** in 4×4 RGB matrix, set brightness and speed, then Start. These are static sample frames, not a live preview or measured LED brightness. Colors and orientation depend on your settings.

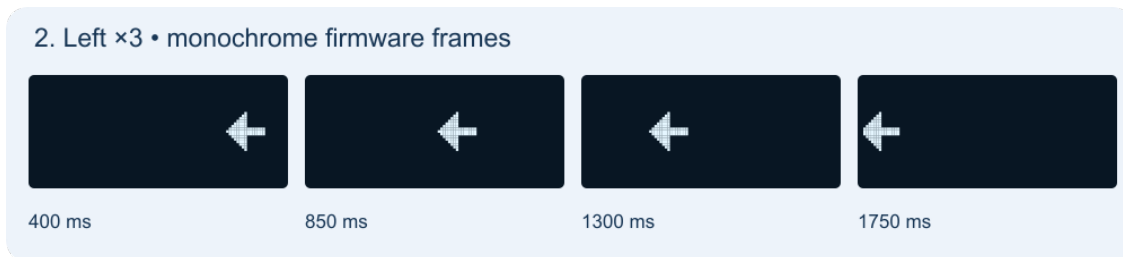
## OLED animation 1: Right ×3



*Right ×3: four monochrome example frames*

Select **Right ×3** in OLED display. The arrow crosses the display three times. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 2: Left ×3



*Left ×3: four monochrome example frames*

Select **Left ×3** in OLED display. The arrow crosses the display three times. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 3: Up ×3



*Up ×3: four monochrome example frames*

Select **Up ×3** in OLED display. The arrow crosses the display three times. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 4: Down ×3



*Down ×3: four monochrome example frames*

Select **Down ×3** in OLED display. The arrow crosses the display three times. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 5: Random smile

### 5. Random smile • monochrome firmware frames



*Random smile: four monochrome example frames*

Select **Random smile** in OLED display. The smile uses random positions; these show illustrative positions with the actual firmware icon. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 6: Growing right

### 6. Growing right • monochrome firmware frames



*Growing right: four monochrome example frames*

Select **Growing right** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 7: Growing left

### 7. Growing left • monochrome firmware frames



*Growing left: four monochrome example frames*

Select **Growing left** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 8: Growing up

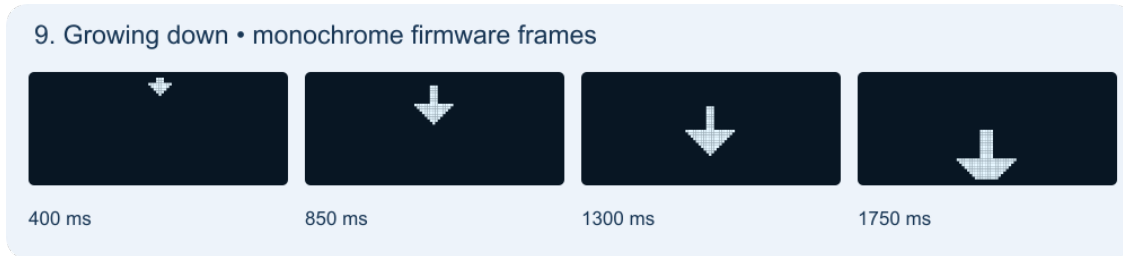
### 8. Growing up • monochrome firmware frames



*Growing up: four monochrome example frames*

Select **Growing up** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

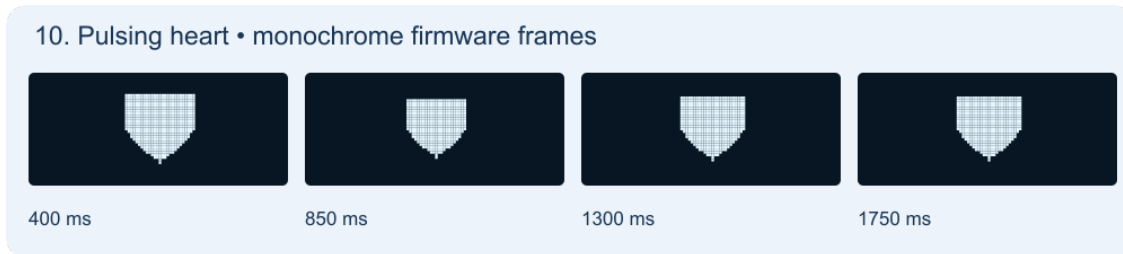
## OLED animation 9: Growing down



*Growing down: four monochrome example frames*

Select **Growing down** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

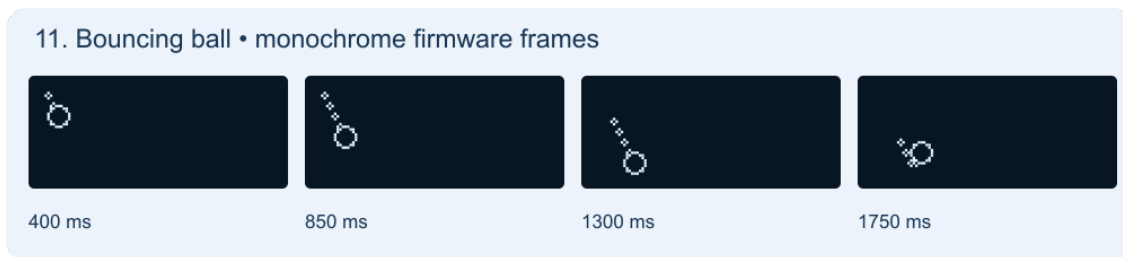
## OLED animation 10: Pulsing heart



*Pulsing heart: four monochrome example frames*

Select **Pulsing heart** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 11: Bouncing ball



*Bouncing ball: four monochrome example frames*

Select **Bouncing ball** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 12: Star flight



*Star flight: four monochrome example frames*

Select **Star flight** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

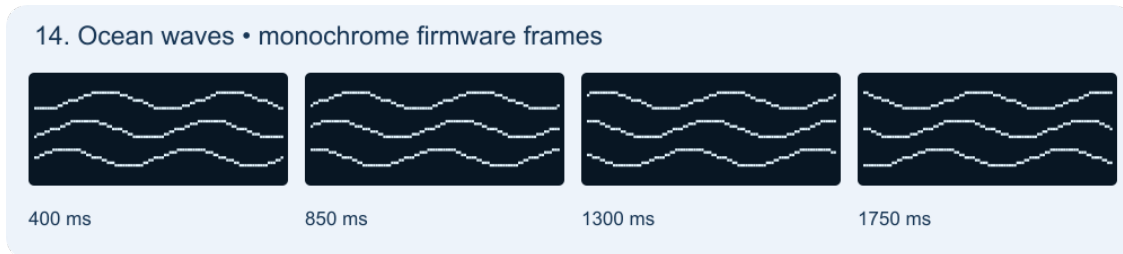
## OLED animation 13: Rain



*Rain: four monochrome example frames*

Select **Rain** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 14: Ocean waves



*Ocean waves: four monochrome example frames*

Select **Ocean waves** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

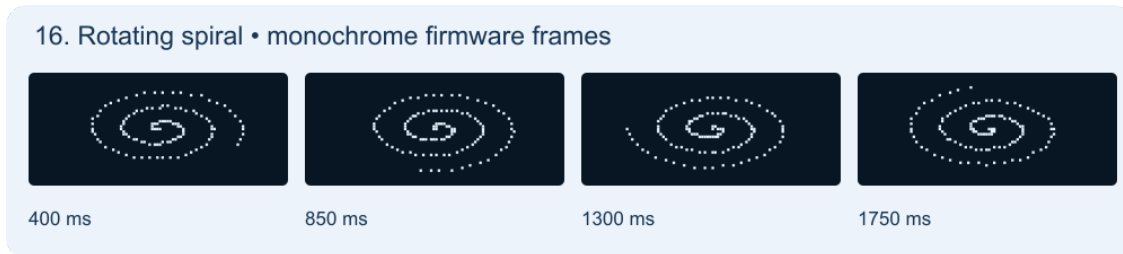
## OLED animation 15: Scanner



*Scanner: four monochrome example frames*

Select **Scanner** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 16: Rotating spiral



*Rotating spiral: four monochrome example frames*

Select **Rotating spiral** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 17: Ripples

17. Ripples • monochrome firmware frames

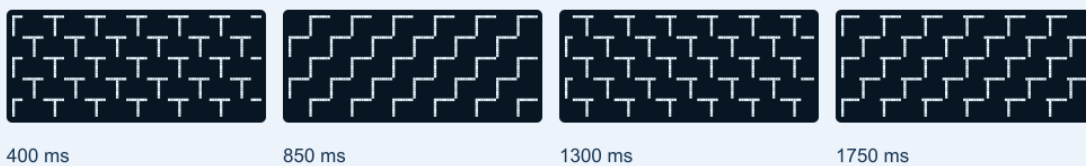


*Ripples: four monochrome example frames*

Select **Ripples** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 18: Checkerboard

18. Checkerboard • monochrome firmware frames



*Checkerboard: four monochrome example frames*

Select **Checkerboard** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 19: Fireworks

19. Fireworks • monochrome firmware frames



*Fireworks: four monochrome example frames*

Select **Fireworks** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 20: Solar orbit

20. Solar orbit • monochrome firmware frames



*Solar orbit: four monochrome example frames*

Select **Solar orbit** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 21: Hourglass

### 21. Hourglass • monochrome firmware frames



*Hourglass: four monochrome example frames*

Select **Hourglass** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 22: Music equalizer

### 22. Music equalizer • monochrome firmware frames



*Music equalizer: four monochrome example frames*

Select **Music equalizer** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 23: Blinking eyes

### 23. Blinking eyes • monochrome firmware frames



*Blinking eyes: four monochrome example frames*

Select **Blinking eyes** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 24: Analog demo clock

### 24. Analog demo clock • monochrome firmware frames



*Analog demo clock: four monochrome example frames*

Select **Analog demo clock** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 25: Marching chevrons

### 25. Marching chevrons • monochrome firmware frames



*Marching chevrons: four monochrome example frames*

Select **Marching chevrons** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 26: Rocket

### 26. Rocket • monochrome firmware frames

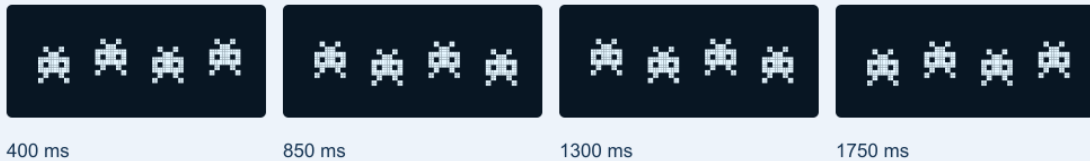


*Rocket: four monochrome example frames*

Select **Rocket** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 27: Pixel creatures

### 27. Pixel creatures • monochrome firmware frames



*Pixel creatures: four monochrome example frames*

Select **Pixel creatures** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 28: Twinkling stars

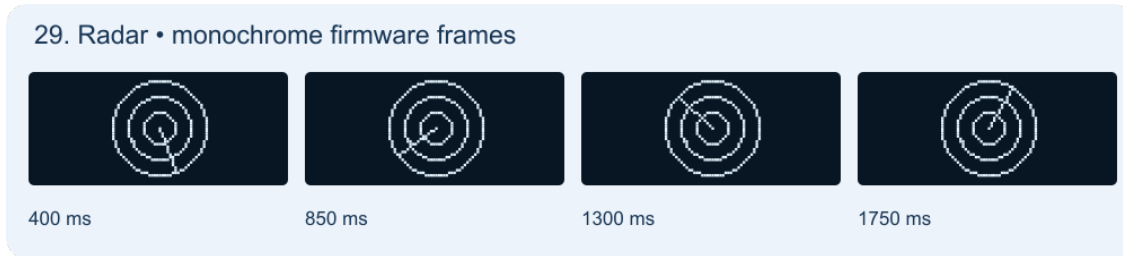
### 28. Twinkling stars • monochrome firmware frames



*Twinkling stars: four monochrome example frames*

Select **Twinkling stars** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

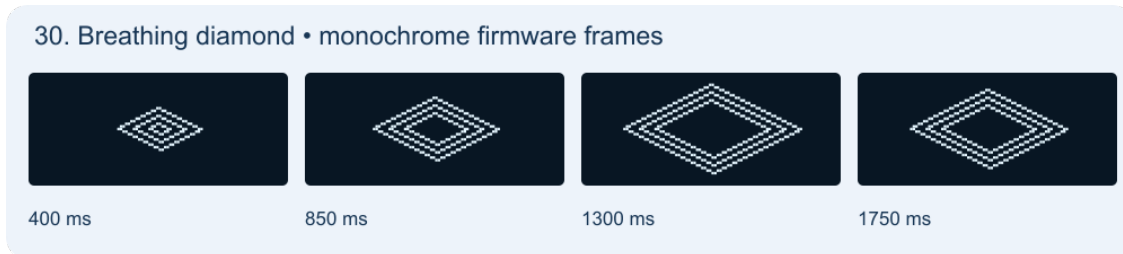
## OLED animation 29: Radar



*Radar: four monochrome example frames*

Select **Radar** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED animation 30: Breathing diamond



*Breathing diamond: four monochrome example frames*

Select **Breathing diamond** in OLED display. These are static firmware-rendered samples, not the full animation cycle.

## OLED mode: Temperature / time

This is a data page, not an animation. It displays temperature and synchronized phone time; values depend on the connected board. No invented readings are used in the gallery.

## OLED mode: Automatic display cycle

This mode combines the startup text, temperature/time pages, synchronization message and blinking eyes. It is a sequence, not an additional standalone drawing. Use the OLED mode selector to activate it.