safety compliance

Document Version: 1.0
Project: Sampler / Sequencer / Synthesizer
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Electrical Safety

Device operates at low voltages (≤5V DC).
Supply voltages:
- Raspberry Pi Pico: 1.8–5.5V (VSYS), 3.3V logic
- DFPlayer Mini: 3.2–5V supply, 3.3–5V logic

Always use a regulated, fused 5V supply.
Protect against reverse polarity and short circuits.

Thermal Safety

No significant heat generation expected.
Ambient operating temperature: **0–50°C recommended**.
Provide basic airflow to avoid heat buildup.

Mechanical Safety

Enclosure must have smooth edges, secure mounting.
Use PCB standoffs; avoid stressing connectors.
External ports (TRS, power) must be strain-relieved.

EMI & ESD

Ground metal parts to reduce ESD risk.
Keep digital signal lines away from audio paths.
Use shielded cables where possible.

MIDI & SYNC Output

MIDI OUT conforms to MIDI 1.0 electrical spec (31250 baud, 5V).
TRS Type B wiring:
- Tip → UART TX via 220Ω
- Ring → GND
- Sleeve → GND

SYNC OUT: 0–5V square wave, 16 pulses per quarter note.

Software Safety

Debounce all mechanical inputs.
Ensure all GPIOs are set to known states at power-on.
Provide “STOP” mode to silence audio and reset safely.

Compliance Guidance

This project is DIY and not certified; however, design aligns with:
- CE / FCC Part 15 Class B (EMC)
- RoHS (lead-free solder, compliant components)
- WEEE (recyclable materials recommended)

Component Notes

Component	Notes
Raspberry Pi Pico	CE, FCC, RoHS certified development board.
DFPlayer Mini (DFR0229)	Ensure clean 3.2–5V rail for noise-free audio.
TM1637 Display	3.3–5V tolerant.
KY-040 Encoder	Mechanical bounce — debounce required.
Custom Analog Circuits	Keep within safe voltage/current limits.

Recommended Protections

Series resistors (220–1kΩ) on all GPIO outputs.
100nF ceramic decoupling caps on supply rails.
Fuse on main power input (500mA–1A fast-blow recommended).

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