ESP32 Optical Tachometer – Version 1.0

1. General Description

Digital optical tachometer based on ESP32 for RPM measurement using a slotted disk sensor.

The system uses the ESP32 hardware PCNT unit to ensure accuracy and stability beyond 50,000 RPM.

The design is optimized for electrically noisy environments.

2. Main Specifications

- MCU: ESP32
- Measurement method: hardware PCNT
- Sensor: optical photointerrupter
- Disk: 32 slots
- Maximum tested RPM: >50,000
- Display: SSD1306 OLED (I2C)
- Power supply: 5 V (NO USB)
- CPU frequency: 160 MHz
- Flash frequency: 80 MHz
- PSRAM: disabled

3. Measurement Architecture

Sensor signal is acquired on GPIO18 and handled by the PCNT hardware counter.

RPM is calculated using stable time windows and EMA filtering.

The STABLE state is shown only at steady speed.

4. Sensor Wiring

Sensor OUT → GPIO18

Sensor GND → ESP32 GND

Sensor VCC → ESP32 3.3 V

Shielded cable with shield connected to GND on ESP32 side only.

5. EMI Mitigation

330 Ω series resistor on signal line

4.7 kΩ I2C pull-up resistors

100 nF capacitor across motor terminals

Short wiring and clean ground routing

6. Factory Calibration

The trimmer is intended exclusively for factory calibration.

Calibration is performed at 70–80% of the operating range.

The trimmer must not be adjusted during normal operation.

7. Accuracy

Typical error after calibration: ±1–2%

Maximum acceptable error: ±3%