Injector Tester with ESP32

1. Introduction

The **ESP32 Fuel Injector Tester** is a device designed to test and control fuel injectors using PWM (Pulse Width Modulation) signals. It simulates different operating conditions (RPM, PWM, time) and includes a built-in web server for remote control via a smartphone or computer.

Key Features:
✅ 6 operating modes (A, B, C, D, E, F)
✅ Rotary encoder + selection button control
✅ 16x2 LCD display for parameter visualization
✅ WiFi server for browser-based control
✅ Individual or simultaneous injector activation
✅ Real-time progress bar

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2. Components and Connections

Buttons and Controls:

Component	Function
Rotary encoder	Navigates menu options / Adjusts submenu values
Center button	Selects an option / Confirms changes
Button 1 (↵)	Returns to previous menu / Exits current mode
Button 2	(Reserved for future functions)

Injector Outputs:

Pin	Injector	Color (Recommended)
16	Injector 1	Yellow
17	Injector 2	Green
18	Injector 3	Blue
19	Injector 4	Red

◆ **Tip:** Verify injector polarity before connecting.

3. Operating Modes

📌 Main Menu

When powered on, the device displays the menu with the following options:

- Rotate the encoder to select a mode.
- Press the center button to confirm.

🔧 Mode A: Simultaneous Activation

Description:

- All injectors activate simultaneously with the same RPM, PWM, and time settings.

Configuration:

1. **RPM:** Engine speed (900–5000 RPM).
2. **PWM:** Duty cycle (1–99%).
3. **Time:** Test duration (minutes:seconds).

Usage:

- Rotate the encoder to adjust values.
- Press the center button to edit a parameter.
- Select "Start" to begin the test.

🔄 Mode B: Sequential Activation

Description:

- Injectors activate one by one in sequence (1→2→3→4).

Configuration:
Same as Mode A, but with individual timing per injector.

Usage:

- The system guides the user step-by-step.
- Each injector activates according to the programmed time.

📈 Mode C: Progressive RPM

Description:

- Automatically increases RPM from 900 to 5000 in steps.
- Ideal for testing injector behavior across different RPM ranges.

Usage:

- Only adjust the initial PWM (default: 50%).
- Press "Start" to begin the sequence.

⚡ Mode D: Progressive PWM

Description:

- Automatically increases PWM from 1% to 99%.
- Useful for calibrating injector response to varying pulse widths.

Usage:

- Set the base RPM (default: 2500).
- Start the test with the center button.

🎮 Mode E: Manual Control

Description:

- Allows real-time adjustment of RPM and PWM without a timer.
- Injectors are activated/deactivated manually.

Usage:

1. Adjust RPM and PWM with the encoder.
2. Press "Start" to activate injectors.
3. Press "Stop" to deactivate them.

🌐 Mode F: Web Control (WiFi)

Description:

- Turns the ESP32 into an Access Point (AP) for remote control.

Steps:

1. Connect to the WiFi network:
   - **SSID:** `ESP32-Inyectores`
   - **Password:** `12345678`
2. Open a browser and navigate to: `192.168.4.1`
3. Web interface:
   - Control RPM, PWM, and individual injectors.
   - Enable/disable the system.

📱 **Compatible with smartphones, tablets, and PCs.**

4. LCD Indicators

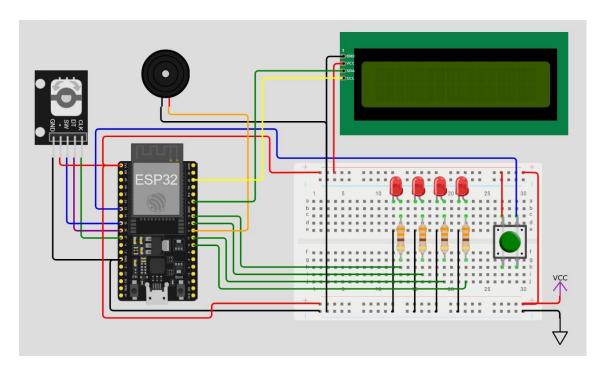| Symbol	Meaning
	Selected option
*	Edit mode active
T:00:00	Countdown timer
Inj:X	Active injector (1–4)

5. Safety Recommendations

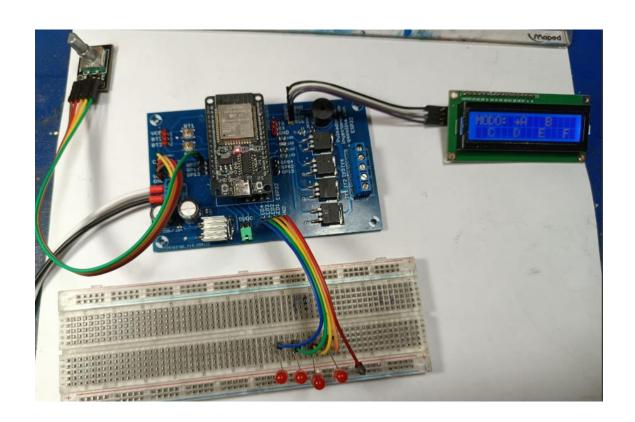⚠ **Do not exceed the voltage/amperage limits of the injectors.**
⚠ **Verify connections before powering the system.**
⚠ **Use a stable power supply (recommended: 12V).**
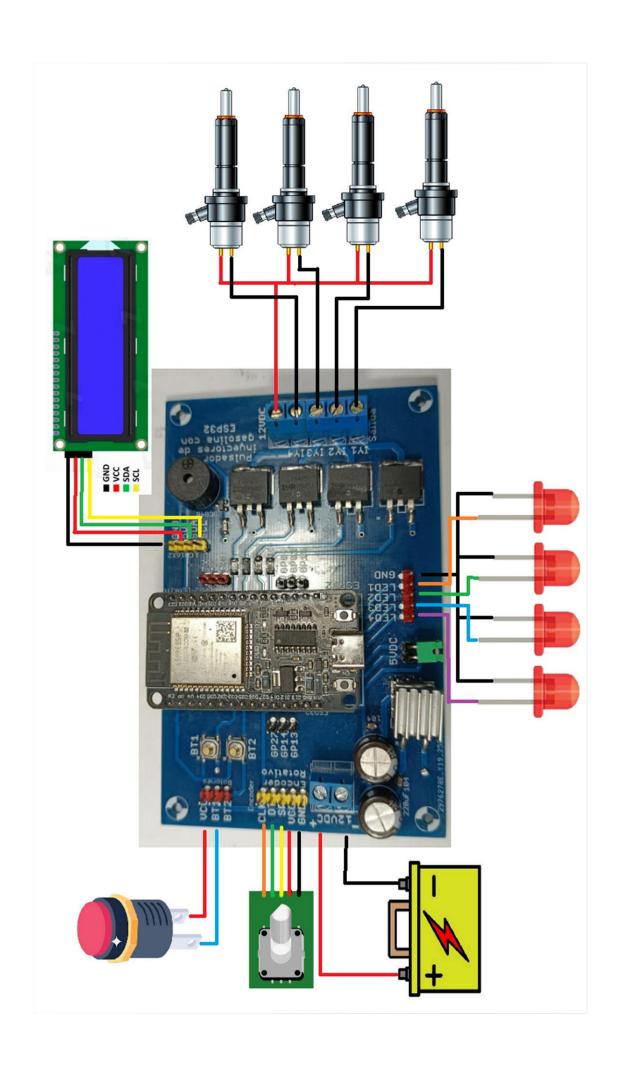⚠ **Disconnect the tester after use.**

6. 📥 Download Code and Schematics

🔗 **Project GitHub** (Coming Soon)

7. Connection method

ESP32
Pulsador inyectores de gasolina con

GND
VCC
SDA
SCL

12VDC
Salida
JY1 JY2 JY3 JY4

GND
LED1
LED2
LED3
LED4

5VDC

BT1
BT2
GP27
GP14
GP13

Botones
Encoder Rotativo
CLK
DT
SW
VCC
GND

VCC
BT1
BT2

12VDC

8. Electronics schematic