

# Enhanced ESP-01 WiFi relay module

ESP-01/S 3.3V,5V,12V+ WiFi GPIO serial opto-isolator/MOSFET/SSR/relay module  
Makes the ESP-01 more useful than a 555.  
Optimised for convenience & functionality over profit.

## Compared with some 555 module boards:

- + WiFi GUI allows selection of Astable / Monostable .. and ..  
Time period specified by 555 equivalent RC or desired times.  
Config by WiFi, serial, GPIO, button & saved to internal flash.
- + Can be deeply embedded but still adjustable / re-configurable.
- + Dual 555 (556 mode)
  - astable + astable
    - lo freq, hi freq
  - astable + monostable (like mark:space ratio)
    - freq, duration
  - monostable + astable
    - duration, freq
  - monostable + astable \* with sweep
    - duration, start freq, end freq
- + re-trigger behaviour:
  - holds on ..or.. ignored while busy
- + auto-trigger in boot
- + active high or low
- + log of trigger activity since boot
  - to web page status
  - to syslog
  - to internal flash
  - to serial (prevents LED)
- + get date from browser
- + complex pulse sequences specified in a text string.
- + Bitstream 1-bit DAC sample player (DC OC/PP & bypass the RC)
- + Arbitrary sequences: [H110L130H170L190H230]1 ..or.. [[H270L290]3[H310L370]6]0
- + FM controlled by web browser or serial
- + PPM controlled by web browser or serial
- + PWM controlled by web browser or serial:
  - high frequency (DC OC/PP & bypass the RC) - Synthesises analogue
  - medium frequency 20mS resolution - for AC by ZVS-SSR
  - low frequency - PID output
- + Option to daisy-chain up to 3 boards as slave to first (shared ESP-01, !RESET & power. Limited/No serial)

by user supplied program.

- + LED\_BUILTIN can show when it is busy running a triggered sequence (ignoring re-trigger) (only if logging not in use)
- + Higher DC sink/source output current than 555 (when using appropriate output device).
- no analogue frequency/time modulation.

## **Compared with other ESP-01 relay boards:**

- + Does not glitch the output during boot/reset/wake.
- + Control from WiFi, serial, GPIO, button - all at the same time.
- + Breadboard friendly.
- + In-situ programming with on-board buttons (requires separate USB to TTL serial UART).
- + Inputs are 3-15Vdc tolerant.
- + On-board trigger button.
- + PCB designed for easy customisation with through-holes & surface-mount pads.
- + Mounting holes. Two for stability, spaced for 35mm DIN rail.
- + Output by GPIO & mechanical relay, SSR, MOSFET or push-pull DC opto-isolator.
- + Power from 3.3V or 3.6-14.5Vdc (when on-board regulator is fitted).
- + 3.3v output (when on-board regulator is fitted).
- + Use multi-function firmware with calibrated optimisation.
- + Use your own program without special coding.
- + No embedded micro-controller.
- + Can be deeply embedded with OTA updates.
- + Can use deep sleep. Requires ESP-01 not S version.
- + Compatible with other APP & LUA software.
- + Directly connect multiple 1-Wire bus sensors such as DS18B20 for PID/thermostat etc.
- Cannot switch faster than 20mS.
- Slightly bigger.
- Only recommends 3A switched output on-board because 10A is not realistic. Off-board is unlimited.

## **Compared with other ESP-01 firmware:**

- + Self-locking, Inching & many other modes without re-programming.
- + Control from WiFi, serial, GPIO, button - all at the same time.
- + Does not depend on control from WiFi, serial, GPIO, button.
- + Activity log to browser, serial, SPIFFS, syslog
- + No inaccessible micro-controller.

## **Compared with other ESP-01 WiFi GUI:**

- + Self-locking, Inching & many other modes without re-programming.
- + No App required - just any browser.
- + Accepts GET URL for bookmarking favourite pulse configurations.
- + Allows GET control of many WiFi55 devices from a single controller.
- + Compatible with any ESP-01 App.
- + Optional authentication.
- + OTA update.
- + Save & load defaults, calibration, log.
- + Activity log from device.
- + HTML & CSS on SPIFFS for easy white-label customisation.

## **Interfaces easily with:**

Arduino, Raspberry Pi, Automotive  
Voice/Fax/Modem for DTMF touch-tone control.

Board has:

Pin-Through-Hole-Technology but you can also use SMT.  
SIL pin headers (pref. 90-degree) enable breadboard use.  
Optional adjacent SIL header for GND to accompany signals for easy connection  
InCircuitProgramming by exposing TX,RX,GND with Schottky to tolerate 5v on RX (or omit & solder short)  
Logging by exposing TX,GND  
Serial control from upstream device by exposing RX,GND & having ESPuC set OUTPUT/vars in response to serial commands.  
External connection for !RESET & !TRIGGER switches. E.g. foot-switch for spot welder.  
!OUTPUT as open collector (not like 555).  
Diode for deep-sleep wake.

Optional 10-12kΩ pull-up res for RST, ENA & GPIO0 on ESP-01 (the ESP-01S has them)  
Optional back EMF protection diode, (all to either 3.3V or 5V)

Optional physical relay, SSR, MOSFET push-pull-pair for 200mA OUTPUT like 555.

Option to bypass RC but keeping the inversion (omit C & solder short for R)

Option to bypass RC and omitting the inversion (omit Q1 & solder short)

Optional 10-12kΩ pull-up on !RESET (or omit)

Optional 10-12kΩ pull-up on !TRIGGER (or omit)

Optional Schottky on !RESET to accept 5-12V input logic (or solder short & omit)

Optional Schottky on !TRIGGER to accept 5-12V input logic (or solder short & omit)

Optional 470Ω on GPIO0 to protect if set as output (or solder short)

Optional 3.3V regulator from whatever the 555 normally takes (4.5 to 15 (18 abs max)) E.g. 5,6,9,12

Optional LED & res - for either 'Active' or 'Throb' in case of S or not-S version of ESP-01

What would a 555 do?

Power from 5 to 15Vdc

!TRIGGER = active low

!RESET = active low

OUTPUT = active high (needs push-pull opto isolator with  $\geq 200\text{mA}$  source/sink)

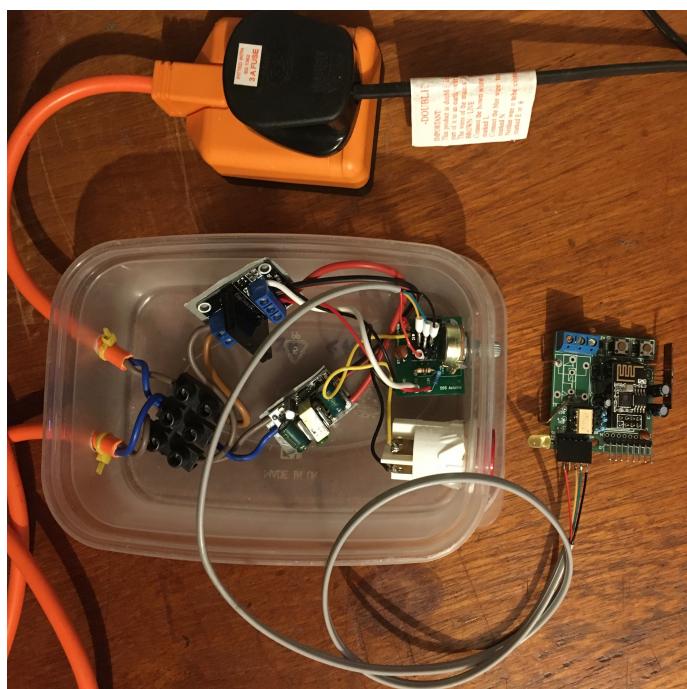
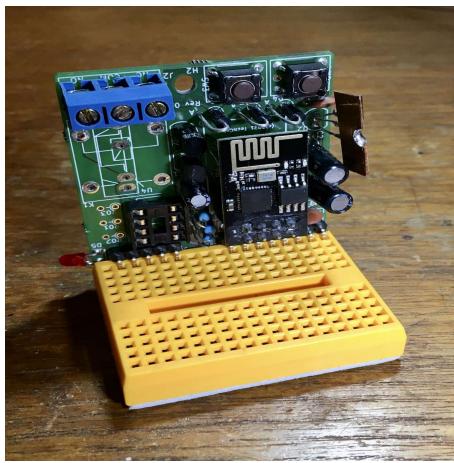


Figure 1: WiFive55 with DC-push-pull opto-isolator wired as in-circuit emulator for a 555 astable board



*Figure 2: Added features make it a bit larger allowing easy DIY modification*



*Figure 3: No separate ESP-01 breadboard adaptor required*



*Figure 5: No separate ESP-01 programming adaptor required, just a cheap USB-TTL-serial adaptor (5V pictured)*

5-pin header exposes 555-like function pins



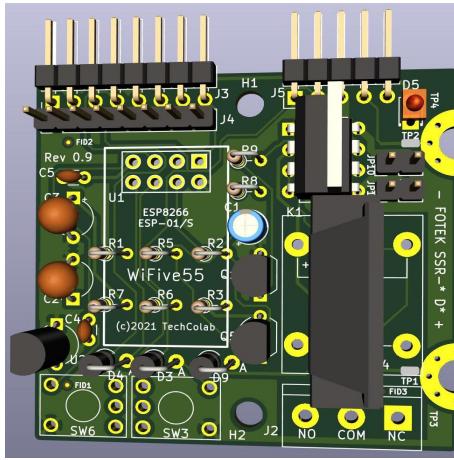
*Figure 6: Shows space for optional mechanical relay, PCB-SSR, DC opto-isolator*

Prototype pictured. Final version also allows TO220 MOSFET and separate DC push-pull output



*Figure 8: Serial logging and control with cheap USB-TTL-serial adaptor (3.3V pictured)*

8-pin header exposes all ESP-01 pins



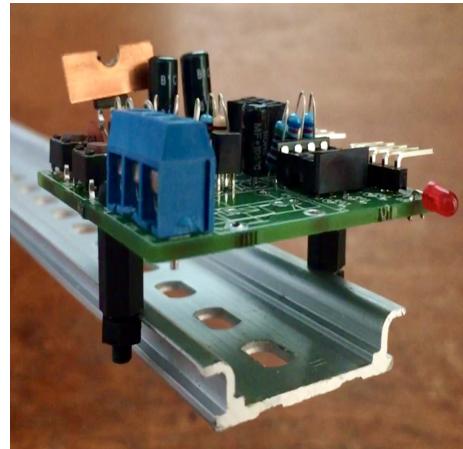
*Figure 9: Through-Hole-Technology allows easy build & customisation*

Rendering of final version PCB



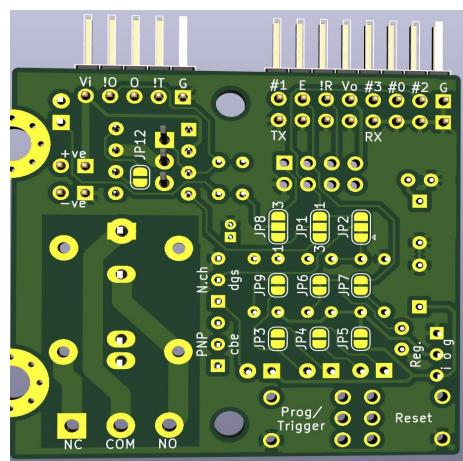
*Figure 4: Direct connection & mount onto common high power SSR*

Prototype pictured. Final version uses 4mm round castellated edge connections



*Figure 7: Can mount to standard 35mm DIN rail with stand-offs*

Prototype pictured shows temporary regulator with copper heat-sink towards rear left



*Figure 10: Solder jumper configuration & well labelled*