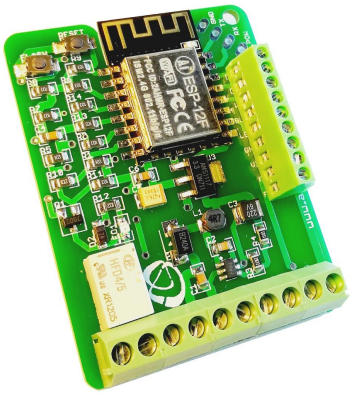
ESP-RFID Relay Board v2.0

ESP-RFID Relay Board is tiny ESP12 module (ESP8266) board, designed with wiegand RFID readers in mind.

- Small size factor, sometimes possible to glue it into existing readers.
- **Single power source to power 12V/2A powers ESP12 module, RFID Wiegand Reader and magnetic lock for opening doors.**
- Exposed programming pins for ESP8266
- Regarding hardware design, you get multiple possible setup options:
  - Forward Bell ringing on reader to MCU or pass it out of board
  - Track Door Status
  - Control reader's status LED
  - Control reader's status BUZZER sound *
  - Power reader, lock and the board through single 12V, 2A PSU
  - Optionally power magnetic lock through external AC/DC PSU
  - Possible to use any kind and any type of wiegand readers
  - **Enables you to make IOT Access System with very litle wiring**
- Fit in universal enclosures with DIN mount
- Opensource Hardware
- Optionally comes with **Opensource "esp-rfid" firmware** which makes it "single door control" ready device with possibility to add rfid access cards or tokens and handle access systems.



** This is atypical technical documentation, with a purpose to explain every single part on the board and it's properties. It's based mostly on tests and other technical docs for parts that had been used on the board.*

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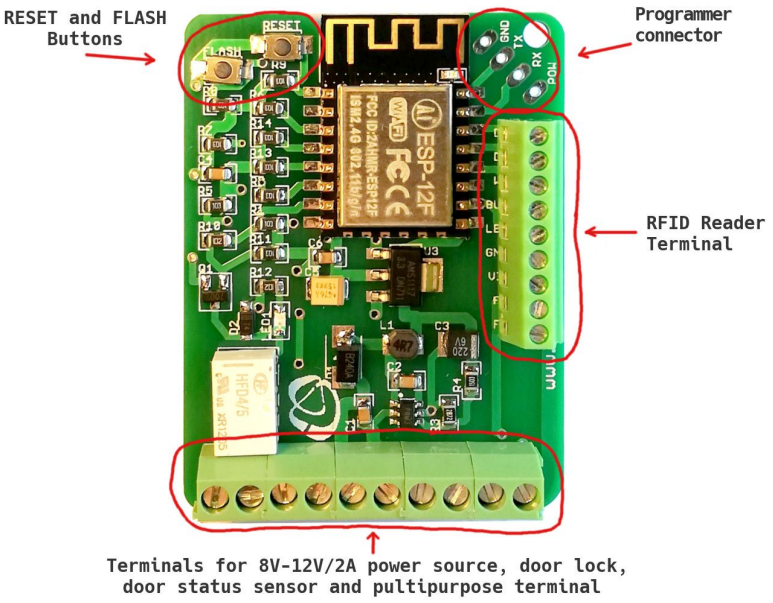
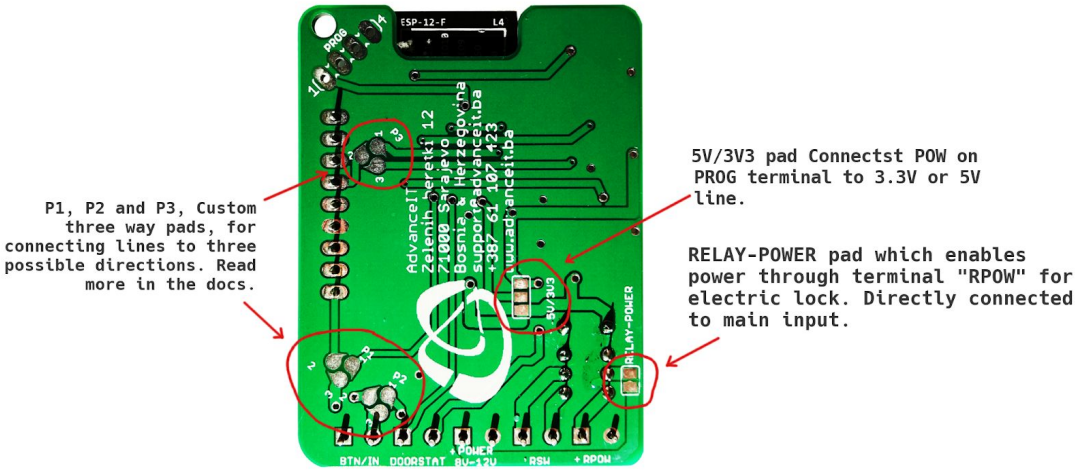
HARDWARE EXPLAINED

Main parts of ESP-RFID Relay Board explained on following sketch:

Top view:



Bottom View:



RESET and FLASH Buttons

Same as for any other ESP8266 programmer where you need to put EPS8266 into a specific mode. If you want to upload your program, you would use this buttons to put ESP8266 into FLASH mode. Check programming procedure down.

RFID Reader Terminal

The reason for 9 pins is to cover the most complex wiegand reader i could fins on the market. Mostly they only have 5 or 6 wires but sometimes, they also have 9 wire versions.

*This particular model of **Wiegand RFID Reader** has 9 wires and 9 pin connector on **ESP-RFID Relay Board** can handle all those lines.*

PIN NAME	CONNECTION	DESCRIPTION
DO	GPIO4	Wiegand data line D0 (*)
D1	GPIO5	Wiegand data line D1. (*)
WG	GPIO0	Some readers have WG line which if HIGH/LOW can change Wiegand stream bits. **Usually not very important!**
BUZ	GPIO12	Almost always Wiegand RFID Readers have Buzzer line which can control piezo buzzer. Due to some inconsistency among readers, i was able to make it work only when i connect this line through 10K resistor and than control it with changing HIGH/LOW on that particular pin, depending what i want. **IMPORTANT: P3 Pad** on the back of board, can make that line to be connected directly to GPIO or through 10k resistor. Check **P3 Pad** explanation.
LED	GPIO15	Most Wiegand readers have RED/GREEN status LEDs. Some color is default and if the line is changed HIGH/LOW than the other color appears.
GND	GND	Planned for Wiegand RFID Reader GND.
VIN	VIN	Connected directly to board's POWER terminal's positive pole. **(*)**
F2	To BTN/IN terminal left pole or to **GPIO14 (**)**	Rarely Wiegand RFID Readers incorporate one button which is often doorbell switch, but the version that i took as an example for this board has those wires. It's simply the switch between F1/F2.
F1	To BTN/IN terminal right pole or to **GPIO14 (**)**	

(*) *Usually Wiegand RFID Readers can work with 8V to 12V as the ESP-RFID relay Board. So, single power supply directly powers both devices.*

(**) *F1/F2 can be transferred to BTN/IN terminal or to GPIO14, depending on P1/P2 configuration. Check P1/P2 Pads configuration properties below.*

Screw Terminals On the bottom of ESP-RFID Relay Board

TERMINAL NAME	DESCRIPTION
RPOW	In case RELAY-POWER pad is connected, when relay connects the circuit, this terminal provides input voltage directly on it's poles. So the door magnet lock can be powered directly through this terminal.
RSW	Since i used small signal relay, it had two sides so another side is also connecting at the same time when relay makes connection but it only cus circuit. So practical use for this terminal can be to power magnetic lock with external source and even AC so that you get buzzing sound when the lock opens and avoid jamming of the lock. (*)
POWER 8V-12V	This is the main power source and in some settings only power source that you need. Please provide **minimum 2A** if you also power magnetic lock and Wiegand RFID Reader from same source, through **ESP-RFID Relay Board**
DOORSTAT	This terminal was planned to accept door status magnet switch. It can be also repurposed since it's just a "button" connected to **GPIO16**.
BTN/IN	Depending on P1 and P2 Pads connection, it can have different purposes.Check P2/P3 pads description below.

Configuration pads P1, P2, P3, RELAY-POWER, 5V/3V3

PAD NAME	DESCRIPTION
P1	**Options:** ■ Connected poles 3 and 2 redirects **F1** on **RFID Reader Terminal** to **BTN/IN** right pole. ■ Connected poles 3 and 1 and you will get **GPIO14** to be connected on left **BTN/IN** terminal, grounded with 10k resistor. ■ Connected poles 2 and 1 and you will power pin **F1** on **RFID Reader terminal** with **GPIO14** **(*)**
P2	**Options:** ■ Connected poles 3 and 2 redirects **F2** on **RFID Reader Terminal** to **BTN/IN** left pole. ■ Connected poles 3 and 1 and you will get **3V3** on left pin of **BTN/IN** terminal. ■ Connected poles 2 and 1 and you will power pin **F2** on **RFID Reader terminal** with **3V3** **(*)**
P3	**Options:** ■ Connected poles 1 and 2 redirects **BUZ** pin on **RFID Reader Terminal** and **GPIO12.** ■ Connected poles 2 and 3 redirects **BUZ** pin on **RFID Reader terminal** and **GPIO12** through 10K resistor.
RELAY-POWER	This pad is usually connected if you want to power **RPOW Terminal** from main power source as **ESP-RFID Relay Board**
5V/3V3	Only purpose of this pad is to connect **5V** or **3V3** line to **PROG**'s **POW** pin.

Pads and what was the idea.

The main idea was to be able to adjust this little board to your scenario and also not to occupy few GPIO where there is possibility to use those in some other way.

For example, i thought that somebody would like to have remote doorbell but somebody would simple hook it directly. Yet, it might happen that you don't need doorbell at all but you might find use for GPIO14. So, i made custom PCB Three Way Pad.

Find out about it here:
https://hackaday.io/project/54277-3-way-pcb-pad
https://github.com/nardev/eagle3wayPCBpads

So, it's similar to other pads which you just solder but this pad has unique shape so it can be soldered not in 2 but in 3 different ways. Just solder it in a way you want. **(*)** *Check the table with description above.*

P1 and P2 pads must be set in pair. Essentially you can get one of three different options.
I : You can redirect **F1** and **F2** on **RFID Reader Terminal** to **BTN/IN** terminal.
II: You can redirect input on **F1** and **F2** on **RFID Reader Terminal** to ESP8266's **GPIO14**.
III: You can redirect **BTN/IN** terminal to ESP8266's **GPIO14** as button input.

P3 has bit strange purpose. I noticed that most popular wiegand readers have BUZZER line which i couldn't control directly by simply HIGH/LOW on digital pins of ESP8266 and i also couldn't find any docs what signal is required, but i found a way for most of readers, it's simply to put 10K resistor on the line. But, since it varies i also left an option to hook it directly to **GPIO12**

RELAY-POWER is just connecting positive line to **RPOW** terminal. Usually, if you power the lock from the **ESP-RFID Relay Board**, that pad will be connected and you will use **RPOW** terminal to hook the lock.

5V/3V3 pad can be handy if you are powering **ESP12F** module through programmer itself while programming.

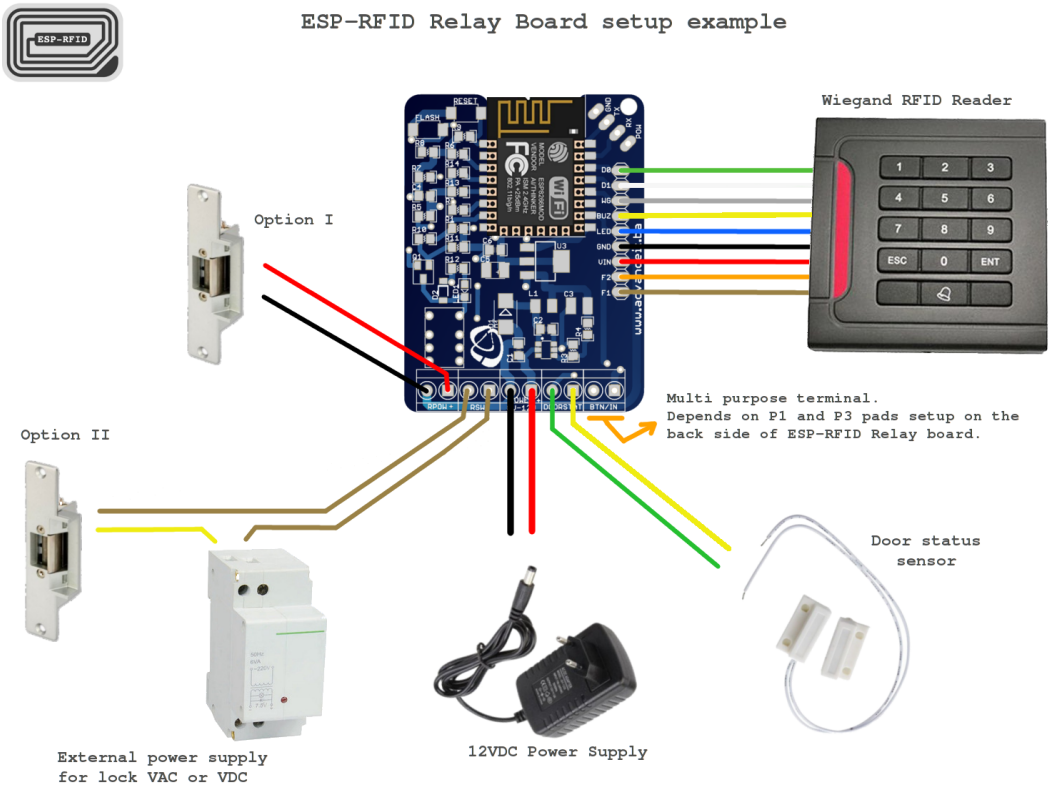
Relay

The relay used on this board is HFD4/5, DPST signal relay and it's controlled through **GPIO13** on ESP8266.

BOARD USAGE OPTIONS

"While designing, the idea was to minimize wiring but to provide few more options which could be useful for some installations."

What is where on the board:



I. Most Common Case

- Single power source 12VDC/2A
- RFID reader powered directly from the ESP-RFID Board v2.0
- Door lock powered directly from the ESP-RFID Board v2.0

[IMAGE/DESCRIPTION COMING SOON]

II. With additional AC Power for Door Lock

- Main power source 12VDC/2A
- RFID reader powered directly from the ESP-RFID Board v2.0
- Door lock powered directly from the ESP-RFID Board v2.0

[IMAGE/DESCRIPTION COMING SOON]

III. Optional Features

Door status sensor
[IMAGE/DESCRIPTION COMING SOON]

Ring button forward to ESP
Ring button forward to ESP8266

Ring screw terminal as input for sensor or a button
In case it's not used to forward RING button or Ring is not forwarded to ESP8266, by soldering P1 and P2 …… You can use "BTN/IN" terminal as input to ESP8266.

BUZZER Control
Due to strange behaviour of buzzer, there is there is PAD which can connect the BUZ pin directly to GPIO or through 10K resistor.

[IMAGE/DESCRIPTION COMING SOON]

POWER SPECIFICATIONS

Power Specifications

There is three levels of voltage on the board. Main input, 5V and 3.3V. Check the description:

Segment	Type of Device	Current/Voltage	Purpose on the board
Required general Input	General purpose 12VDC source	2A/12V	Main input. Powers everything hooked to a board: - Wiegand RFID reader (~0.5A peak) - ESP-RFID Board (up to 1A max) - Buck Converter - Linear 3V3 Voltage Regulator - Door magnet lock (usually up to 0.5A)
Buck converter	ACT4088	Lower 12V to 5V / up to ~1A	Power up: - Linear 3V3 Voltage Regulator - Provide 5v for Relay * Possible to pass it to programmer terminal
Linear voltage regulator	LM1117	Lower 5V to 3.3V / up to ~0.5A	Powering ESP12 module and it's IO's. (*) Possible to pass it to programmer terminal
External Power for Relay	AC/DC	18V/2A	Optional, only if powering door lock or ring.

(*) Please check "5V/3V3" pad purpose.

PROGRAMMING

Programming procedures and options.

ESP-RFID v2 is essentially dev board extension for **ESP12** modules. As that, it has **RESET** and **FLASH** buttons and the rest of circuit required to put ESP8266 in programming mode.

In order to program the board, you would need "**USB-TTL**" or similar compatible programmer. (I personally like this 1$ one here)

Programming Procedure

Considering that you already installed required drivers for your OS and that you have programming software already set, follow procedure:

1. Connect your **USB-TTL** programmer to **PROG** terminal.
   (Don't forget to cross lines, RX to TX and vice versa)
2. Press **FLASH** and **RESET** buttons together.
3. Release **RESET** Button and keep **FLASH** Button pressed for 1-2 sec and than release it too.
4. Now, your **ESP8266** should be in **FLASH** mode and you can upload you program.

(*) I noticed that it it doesn't make any problems if you keep **FLASH** Button pressed and sometimes **ESP8266** won't start with **FLASH** mode in any other way.

KNOWN ISSUES

- Silkscreen mistake WG/LED pins should be switched. (To test with base firmware and setting pins to down/up and to check if that is the case only with **ESP-RFID** firmware)
- Sometimes, connected ringing button through board, VAC source and to bell, causes buck converter to jamm. It could be due to poor wire quality or something else. But usually if it doesn't occur immediately on first try, it never appears later.

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