Description:

The ESP-R8-POE-3 is an 8-channel relay board suitable for automation (such as pool and grill controllers, robotics, and home automation), alarm, and hobby/DIY applications. 8 onboard relays allow you to switch 8 AC or DC circuits at up to 10 amps/250 volts AC or 10 amps/30 volts DC. The board also contains 8 dry-contact ESD protected inputs, a real time clock, and expansion header which exposes the I^2C bus and several GPIO pins as well as providing both 12 volt and 3.3 volt DC power. The entire board is controlled by an ESP32-WROOM-32U module.

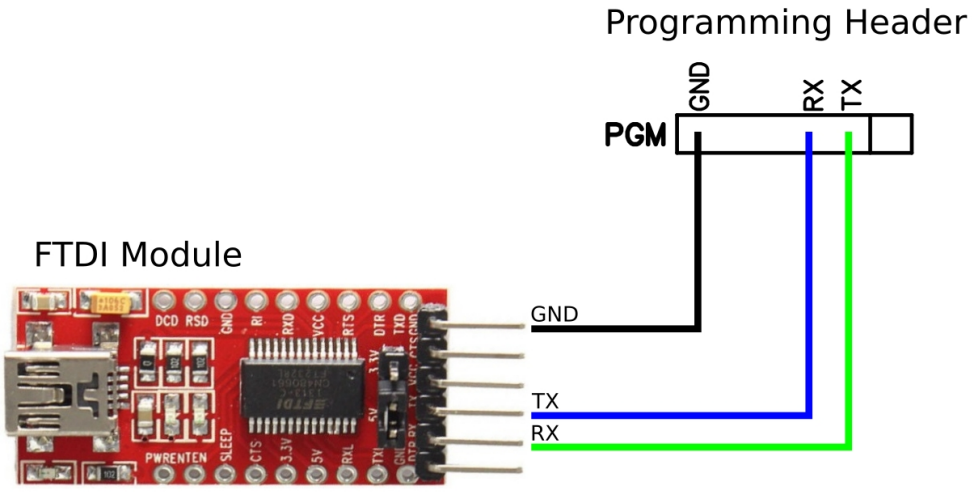
The board allows for dual power supplies (PoE and 12 volt DC input), as well as dual networking options (Ethernet and WiFi). There is also an onboard re-settable fuse rated for 2 amps to protect against faults on the board and is shared with the expansion header. When drawing power from the expansion header, please limit your circuit's current draw to 1 amp to allow for an overhead for the rest of the board.

There is an LED connected to GPIO 14 of the ESP32 to serve as a system status LED or other user-defined function.

Programming:

In order to flash new firmware, you will need a USB FTDI module. These modules can be obtained from many hobbyist electronics dealers. An example is this one from Adafruit: https://www.adafruit.com/product/284.

Wire the module to the "PGM" header as follows:



The board will not auto-reset by itself like some other ESP boards when uploading firmware. You must manually put it into bootloader mode first by holding down both "EN" and "BOOT" buttons, releasing the "EN" button, and then releasing the "BOOT" button. It will then be in a state ready to receive firmware. After upload, press "EN" once to reset the ESP32.

Onboard I^2C devices:

The I^2C bus is wired to ESP32 pin 8 (GPIO 32) for SDA and pin 9 (GPIO 33) for SCL signals.

U3

IC: XL8574T, PCF8574A equivalent
Device Type: GPIO Expander
Address: 0x23
Purpose: Controls the 8 relay channels. An output's high signal will turn that output's relay on, and a low signal will turn it off. The relay output terminals are labeled NO (Normally Open), C (Common), and NC (Normally Closed).

U5

IC: XL8574T, PCF8574A equivalent
Device Type: GPIO Expander
Address: 0x25
Purpose: Monitors the 8 dry-contact input channels. These inputs are normally pulled up to 3.3 volts, and a short across an input and a "C" terminal will register a digital low signal on that input.

U7

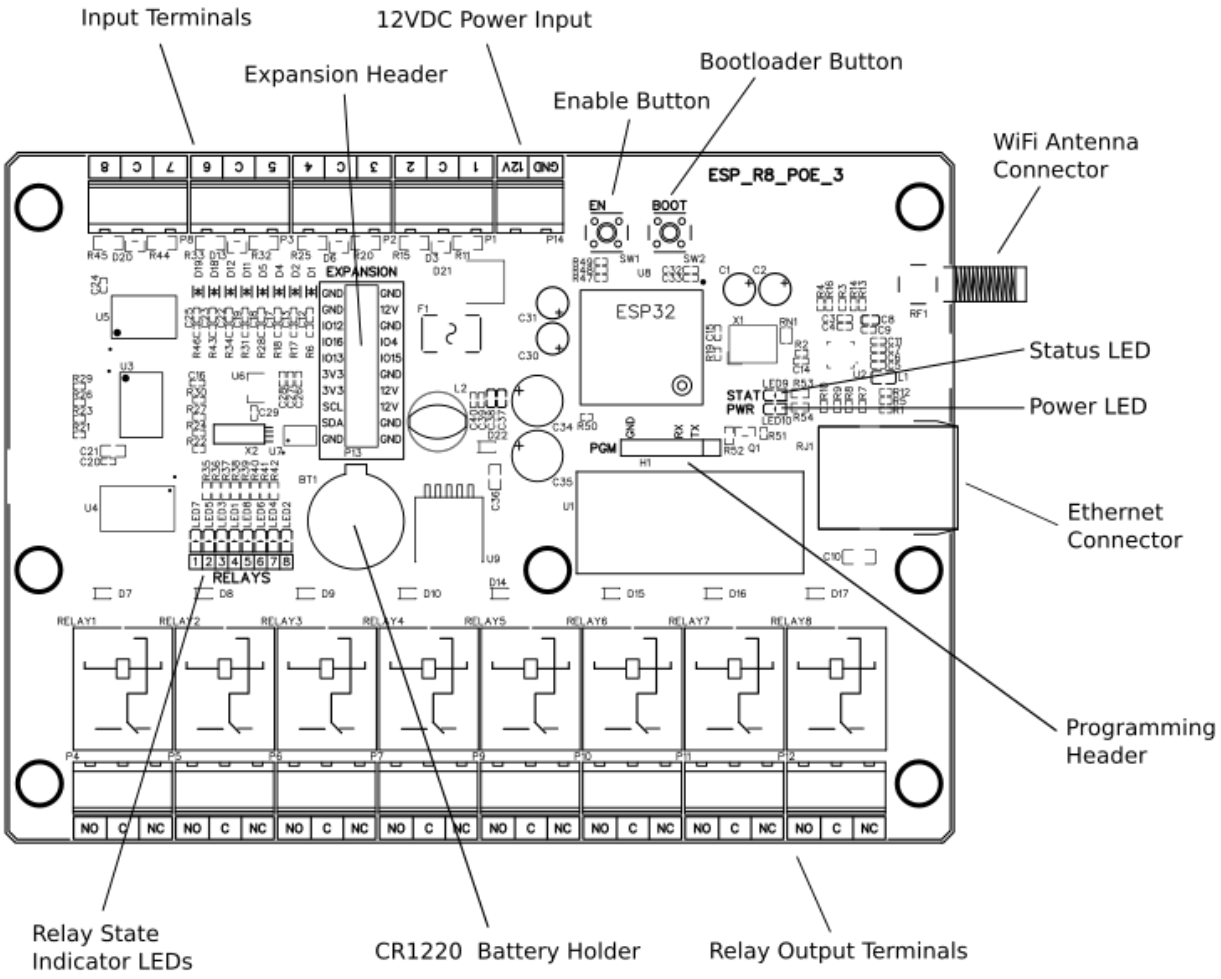
IC: DS1307
Device Type: Real Time Clock
Address: 0x68
Purpose: Keeps track of the time and date. CR1220 Coin cell battery must be installed for this device to function.

Ethernet:

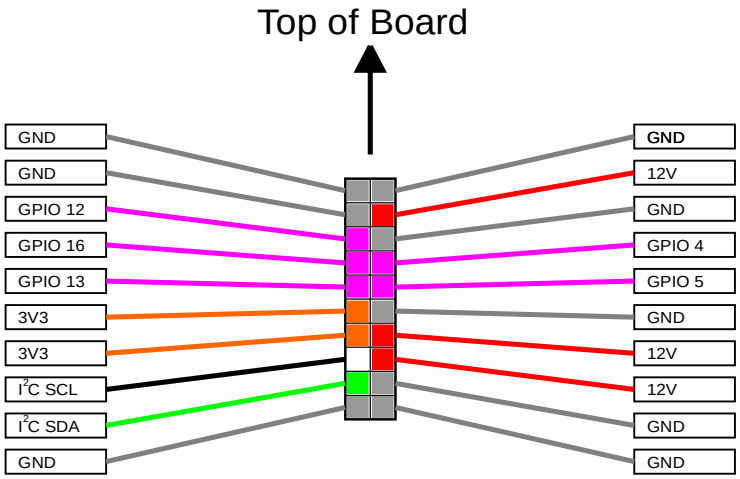
This board contains a LAN8720 Ethernet PHY allowing for 10/100 hardwired networking. The PHY uses RMII mode for communication with the ESP32 with a dedicated external 50Mhz crystal. The PHY is available on address 1 and is wired to the ESP32 as follows:

ESP32	LAN8720
Pin 11 (GPIO 26)	Pin 7 (RXD1/MODE1)
Pin 10 (GPIO 25)	Pin 8 (RXD0/MODE0)
Pin 12 (GPIO 27)	Pin 11 (CRS_DV/MODE2)
Pin 30 (GPIO 18)	Pin 12 (MDIO)
Pin 37 (GPIO 23)	Pin 13 (MDC)\
Pin 25 (GPIO 0)	Pin 14 (nINT/REFCLKO)
Pin 33 (GPIO 21)	Pin 16 (TXEN\
Pin 31 (GPIO 19)	Pin 17 (TXD0)
Pin 36 (GPIO 22)	Pin 18 (TXD1)
Pin 28 (GPIO 17)	50Mhz Crystal Enable Pin (PHY_POWER) This pin must be pulled high for the crystal to oscillate. There is a pulldown resistor on this line to give it a default low state which disables the PHY.

Board Diagram:



Expansion Header:



License and Disclaimers:

I make no guarantees or offer any warranties of any kind on this hardware. It is a hobbyist/DIY product, and as such, you are responsible for correct and safe wiring connections to this hardware. I have made every effort to design the relay output section of the board to be rated for the voltage and current I have stated that it can handle using isolation cutouts and thick traces, but ultimately the responsibility for success or failure rests on you. If you are inexperienced in dealing with 120/240 volt circuits, I highly suggest you consult a licensed electrician.

If you wish to ground the board, the annular rings of the upper 5 screw holes are connected to the PCB ground plane. You may connect them to earth ground through either a metal standoff attached to a suitable metal cabinet that's grounded, or by attaching a screw and a bolt to one of the screw holes and attaching a ground wire with with a ring terminal.

The full schematics, BOM, board layout, and this document may be found at https://github.com/DanielLCopeland/ESP_R8_PoE_3.