trigBoardDocs Documentation

Release 0

Kevin Darrah

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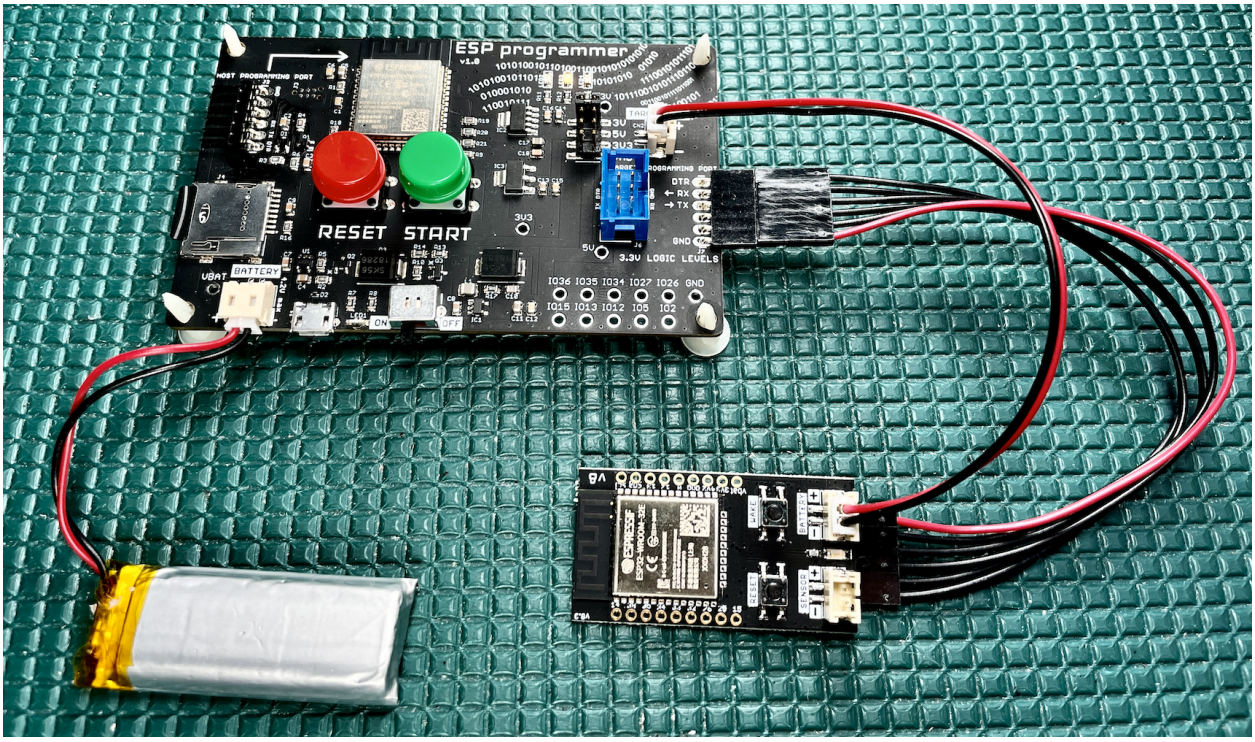
ESPPROGRAMMER DOCS


ESP programmer
RESET
START
BATTERY
3.3V LOGIC LEVELS

CHAPTER

ONE

WHAT IS IT?

- Standalone ESP32 board to easily upload bin files to a target ESP32. Great for factory programming or just updating firmware in existing systems without a need for OTA or connecting to a computer. No messing around with IDE's or Command line!
- Uploads bin files from included 8GB micro SD card. These are the same exact bin files that are uploaded when you click "upload" from the Arduino IDE.
- Powered by micro USB power or 4.2V lithium battery (built in charger), which makes the board versatile for updating boards in the field.
- Target board is programmed from standard UART connection and also toggles DTR/RTS line, to activate auto-reset circuit for ESP32 to enter download mode.
- Simple two button interface for mass programming START and RESET
- On board jumper selects power output from JST PH 2.0mm connector. 3.0V is a controlled power source, which is useful for integrating a power cycle from the programmer as well as for calibration. Other selections that are always on, 5V, 3.3V, and the raw Battery voltage.
- 1x6 female connector for "FTDI" style cables, and 2x3 IDC male header, which is nice for Tag Connect Cables
- EXPANSION! All spare IO broken out to pads, which could be used to control an automated fixture - relays, sensors, etc… or even if the auto-reset circuit requires RTS and CTS signal.
- It's based on an ESP32! This means you have the ability to activate an AP for your target ESP32 to connect to and communicate with. The trigBoard tester firmware did just this and sent over messages containing critical board information that was part of the automated test sequence. You also have bluetooth available as well.
- The board provides a 6 pin UART interface that can be used to provide information back up to a PC. Test logs, MAC address, etc… Even had one customer consider using this with a thermal printer.

Where to buy?

For higher quantities or OEM opportunities, please contact KD Circuits directly

1.1 Usage

The board ships with everything ready to go - preloaded with firmware to start flashing right away. Even the microSD card is preloaded with bin files for trigBoard release (11/29/21)

1.1.1 Board Power

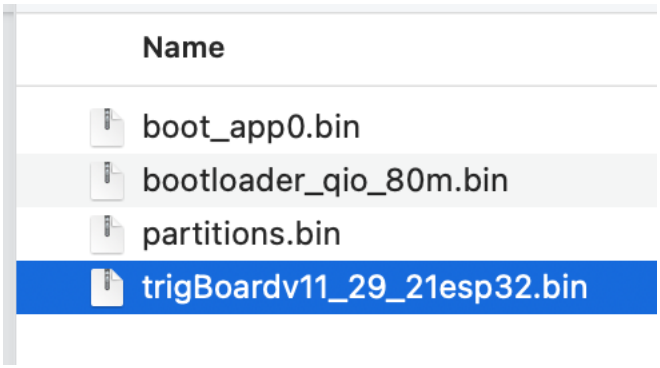
Can just connect a micro USB cable to the board or a 4.2V lithium battery (CHECK POLARITY), any of the adafruit batteries will work. Note that the board can also charge the battery - the charge LED indicates status red-charging, green-complete

Target Power The board has a PH-2 JST connector that can be used to power the target ESP32. There are 4 power sources for this connector selected by jumper:

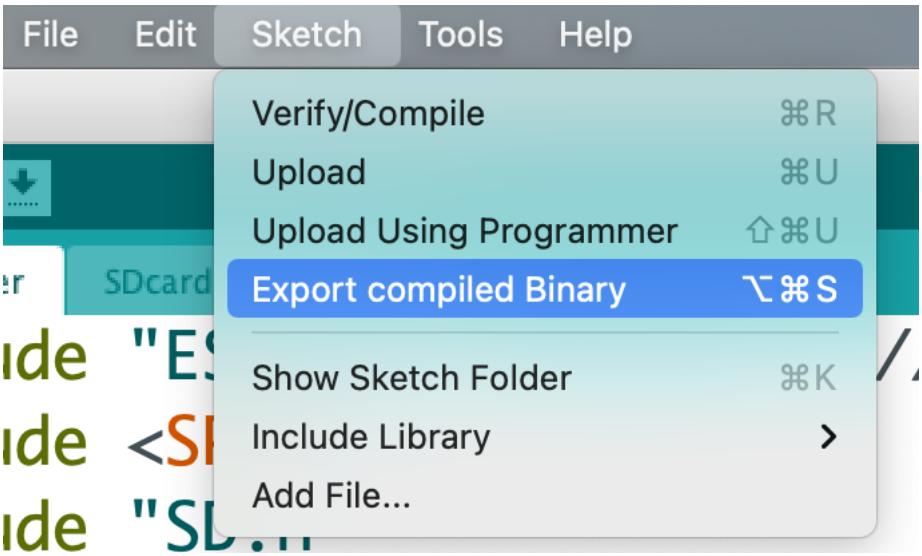
- 3.0V is a switched power source that the board can turn on/off on-demand. Very useful for power cycling the target and since it's 3.0V, can be used for calibration. **RECCOMENDED**
- 5V always on from USB, or boosted if running on battery
- 3.3V always on
- VBAT is the raw battery voltage

1.1.2 Files

When you upload from the Arduino IDE, it flashes x4 bin files. One of these is the actual firmware, while the other 3 are mostly going to be the same for most applications. You can use the stock files that are on the microSD card, and only replace this file:



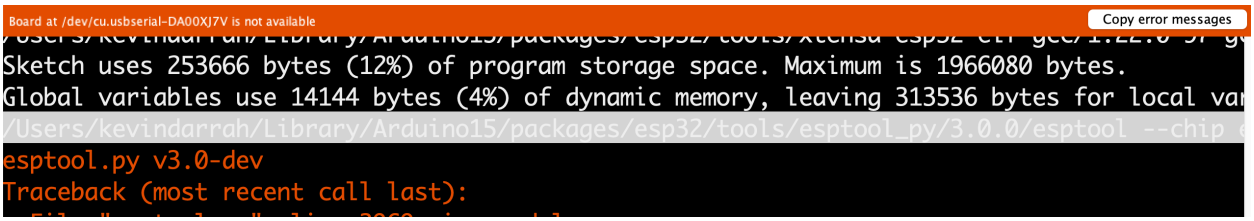
You can generate this file yourself by "Export Compile Binary" from the Arduino IDE:



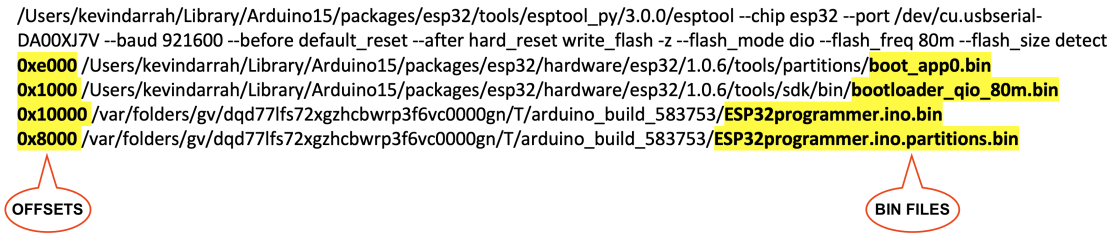
The ESPprogrammer will automatically find all of these files by their names, so don't worry about renaming.
This is how it finds these files:

```
const char bootKey[] = "boot_app";
const char bootloaderKey[] = "bootloader";
const char partitionsKey[] = "partitions";
const char firmwareKey[] = ".ino.bin";//when you flash over USB, it looks like this
const char firmwareSecondKey[] = "esp32.bin";//when you export compiled binary, this is␣
↪the file it generates
```

Those other three bin files can also be updated, since these are generated when their are updates to the ESP32 core or if any of the board settings are changed. From the IDE, make sure Verbose output is enabled, then when you try to upload via USB (even if a board isn't connected), you want to copy this last command out:



Paste that into text editor and you'll see the paths to all 4 bin files:



You can navigate to these folders and **COPY** them to the microSD card.

Also, note the offsets above. These can change depending on your partition scheme, so double check your settings and note that you may have to also change the ESP programmer code. ***THE PARTITON SCHEME USED HERE IS "Minimal SPIFFS(1.9MB APP with OTA/190KB SPIFFS)"***

```
14    if (ESPFlashBin(bootName, 0xe000)) { //bootapp
15      ESPFlasherInit(true, &Serial);
16      if (ESPFlasherConnect()) {
17        if (ESPFlashBin(bootloaderName, 0x1000)) { //bootloader
18          ESPFlasherInit(true, &Serial);
19          if (ESPFlasherConnect()) {
20            if (ESPFlashBin(firmwareName, 0x10000)) { //firmware
21              ESPFlasherInit(true, &Serial);
22              if (ESPFlasherConnect()) {
23                if (ESPFlashBin(partitionsName, 0x8000)) { //partitions
24                  if (flashSPIFFS) {//only if SPIFFS bin is present!
```

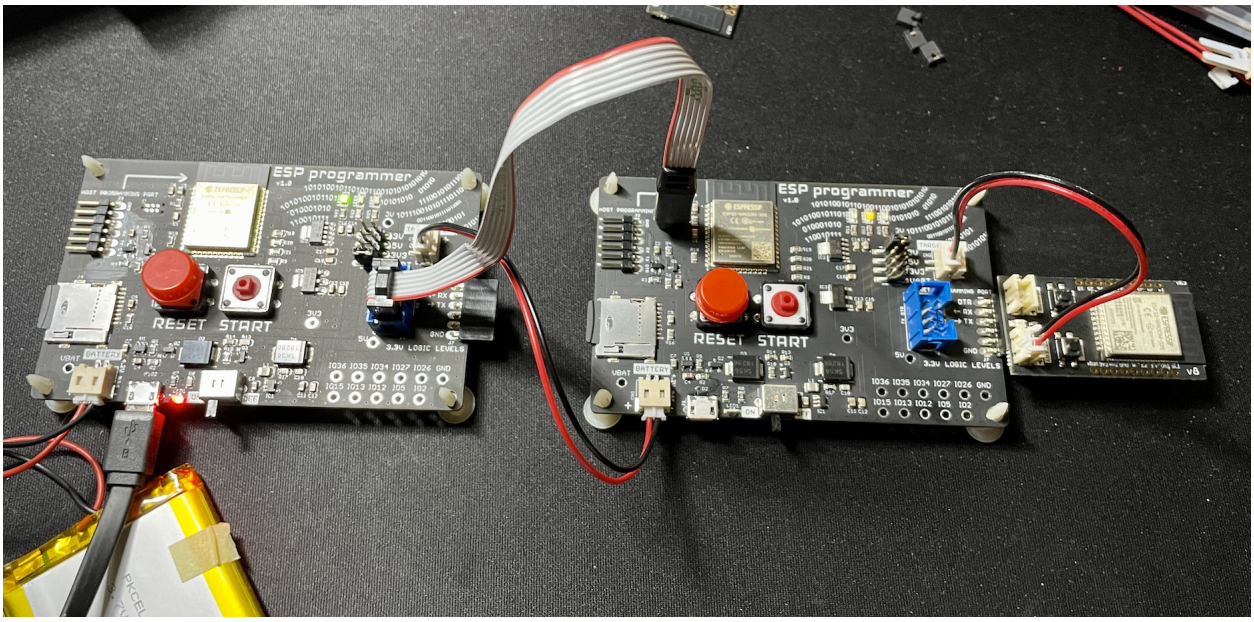
1.1.3 Connections

All signals are 3.3V! regardless of target power setting

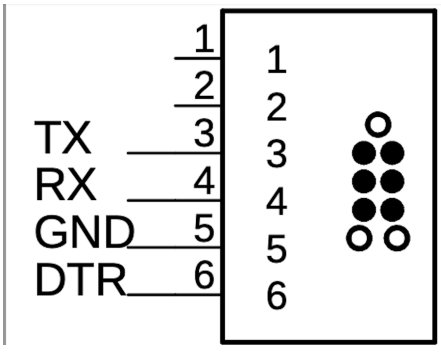
The female 1x6 connector follows a standard FTDI pinout, where the DTR pin is controlled by the board to trigger the auto-reset circuit, but if your target board doesn't have an auto-reset circuit, then you'll have to toggle reset/gpio0 on the target to place in download mode.

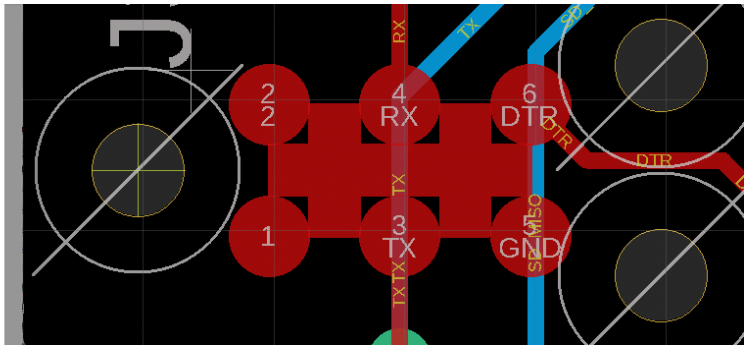
The 2x6 was intended to be used with Tag Connect Cables

You'll notice that even the programmer board uses this style interface, so technically programmer board can upload to another programmer board!!



For reference, the supporting pinout on the target board:





1.1.4 Flashing

- Files loaded on microSD card?
- Target Power set?
- Target board connected?
- Programmer board has power?
- Slide the switch to ON, wait for GREEN LED?
- PRESS Green Button, and should see the YELLOW LED start flashing, when you see the GREEN LED flash, then you know everything is working. Eventually, you'll see the only the GREEN LED flash, and you're done!

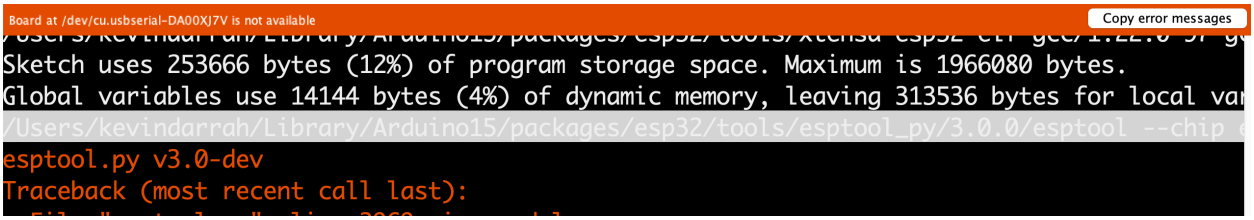
NOTE: If you see the RED LED turn on, this means something went wrong and will have press the RESET button to start over. You can connect to the HOST Programming port with a USB-Serial converter to debug what went wrong.

1.1.5 Clone Board/Copy SPIFFS

A lot of ESP32 projects will use SPIFFS to store various settings/parameters. All customizable features in the trigBoard are stored in SPIFFS, so if you had one "golden" board that you had setup (WiFi/Push Notification Settings/etc), then you can also create a separate bin file that contains this information as well. Otherwise, when you flash only the 4 files as described above, the SPIFFS remains as-is. So if you're flashing a fresh device, the SPIFFS will be blank.... or maybe you want to erase the SPIFFS as well? This is possible with this same technique.

STEP 1 - READ FROM GOLDEN BOARD You will need to use the command line/terminal with a USB-Serial converter connected to the "Golden" ESP32. Will be using MacOS for this walkthrough, though should be similar on Windows.

Fastest way to get going with this is to use the Arduino IDE as if you're programming an ESP32. Connect the USB-Serial converter, choose the com port, and **without** the ESP32 connected, try uploading a blank sketch. **It will obviously fail** but this is what we want. Now you can copy out the command used to flash the board:



We're not going to flash, but instead, we're going to read the flash. This sets up the command for us, so you'll start with something like this from the Arduino IDE:

```
/Users/kevindarrah/Library/Arduino15/packages/esp32/tools/esptool_py/3.0.0/esptool --
↪chip esp32 --port /dev/cu.usbserial-DA00XJ7V --baud 921600 --before default_reset --
↪after hard_reset write_flash -z --flash_mode dio --flash_freq 80m --flash_size detect␣
↪0xe000 /Users/kevindarrah/Library/Arduino15/packages/esp32/hardware/esp32/1.0.6/tools/
↪partitions/boot_app0.bin 0x1000 /Users/kevindarrah/Library/Arduino15/packages/esp32/
↪hardware/esp32/1.0.6/tools/sdk/bin/bootloader_qio_80m.bin 0x10000 /var/folders/gv/
↪dqd77lfs72xgzhcbwrp3f6vc0000gn/T/arduino_build_3054/sketch_feb27a.ino.bin 0x8000 /var/
↪folders/gv/dqd77lfs72xgzhcbwrp3f6vc0000gn/T/arduino_build_3054/sketch_feb27a.ino.
↪partitions.bin
```

Let's change that to this:

```
/Users/kevindarrah/Library/Arduino15/packages/esp32/tools/esptool_py/3.0.0/esptool --
↪chip esp32 --port /dev/cu.usbserial-DA00XJ7V --baud 230400 read_flash 0x3D0000 0x30000␣
↪spiffs.bin
```

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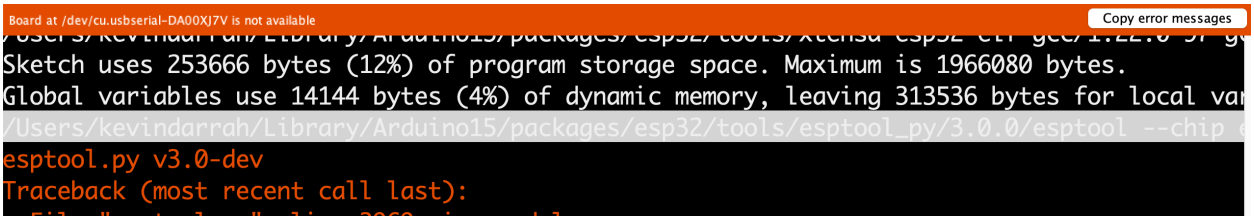
Couple things I changed there:

- Slowed the baud rate slightly for reading - this has just been more reliable for me
- The command is now read_flash
- The 0x3D0000 in there is the offset for the SPIFFS **Based on your partition scheme** In my case, again I used "Minimal SPIFFS… " But if you change this, you can look it up here
- The second number there 0x30000 is the size, which is also defined by the partition table.

For example, when you pull up the ***min_spiffs.csv*** from that link, you can see the two numbers you'll need for this scheme:



- That "spiffs.bin" is file name for the bin file you will create. I didn't give this a path, so it just ends up here on my machine: /Users/kevindarrah/spiffs.bin

What if you want to erase the SPIFFS? Well, just run this command before you read the flash:

```
/Users/kevindarrah/Library/Arduino15/packages/esp32/tools/esptool_py/3.0.0/esptool --
↪chip esp32 --port /dev/cu.usbserial-DA00XJ7V erase_flash
```

Now you have an easy way for the programmer board to erase the SPIFFS as well if you want as well.

STEP 2 SETUP PROGRAMMER BOARD

The latest ESPprogrammer code supports SPIFFS programming as well, so if it finds a file on the sd card "spiffs.bin", then it will use that to flash the SPIFFS with this file. Otherwise, will only flash the 4 required files.

```
4 const char firmwareSecondKey[] = "esp3
5 const char SPIFFSKey[] = "spiffs.bin";
6 boolean flashSPIFFS = false;//that way
```

NOTE,just like the other 4 files, the offset in the code must match the partition scheme used, so you may have to change this code for your programmer:

flashing

```
ESPFlasherInit(true, &Serial);
if (ESPFlasherConnect()) {
  if (ESPFlashBin(spiffsName, 0x3D0000)) { //S
    Serial.println("!!!EVERYTHING IS FLASHED A
    return true;
  } else
    return false;
} else
```

So if you're also using the minimal SPIFFS scheme, then just copy the spiffs.bin file to the sd card and you're good to go.

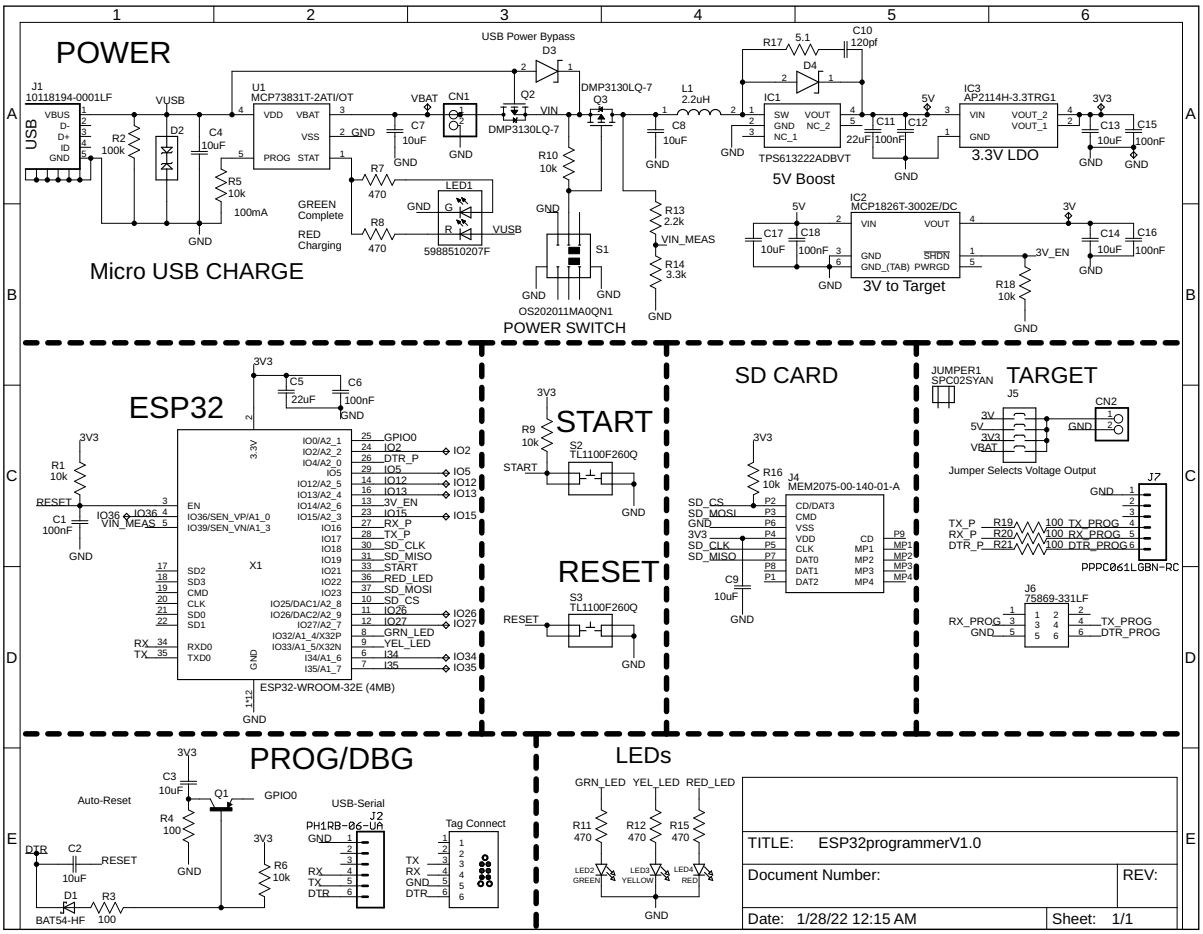
STEP 3 Calibration

The trigBoard also stores a factory calibration constant for the battery voltage measurement, so if you copy the SPIFFS from one trigBoard to another, you will also be copying the **WRONG** constant. No big deal though, you'll just need to recalibrate the new board. Luckily, the programmer board provides an accurate 3V source, so if you have the jumper set to 3V and you're power the board from this source, then just launch the configurator, scroll all the way down and make sure the calibration constant is set to 0. Then you can scroll back up and see the difference away from 3.0V the board is. Like if you see 3.5V, scroll back down and set the calibration to -0.5. Simple as that!

1.2 Source

ESP Programmer Firmware Github

`PDF SCHEMATIC DOWNLOAD`


POWER
Micro USB CHARGE
USB Power Bypass
POWER SWITCH
3.3V LDO
5V Boost
3V to Target
ESP32
ESP32-WROOM-32E (4MB)
START
RESET
SD CARD
TARGET
Jumper Selects Voltage Output
PROG/DBG
Auto-Reset
LEDs
GRN_LED YEL_LED RED_LED
TITLE: ESP32programmerV1.0
Document Number:
REV:
Date: 1/28/22 12:15 AM
Sheet: 1/1