

# General Guide

Synerduino STM

**VERSIONS: F405, F411, H743**

For more Information:  
[www.synerflight.com](http://www.synerflight.com)





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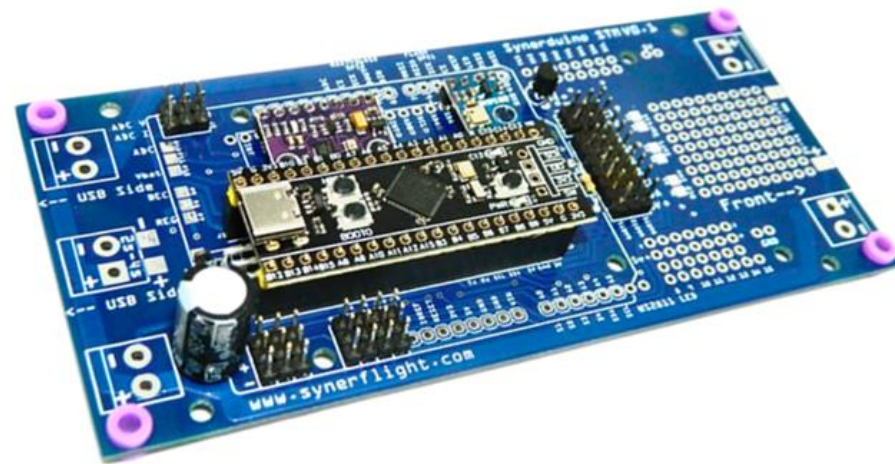
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# STM VERSIONS THROUGHOUT THE YEARS

F411



**SYNERDUINO  
STM F411**

1

F405



**SYNERDUINO  
STM F405**

2

H743



**SYNERDUINO  
STM H743**

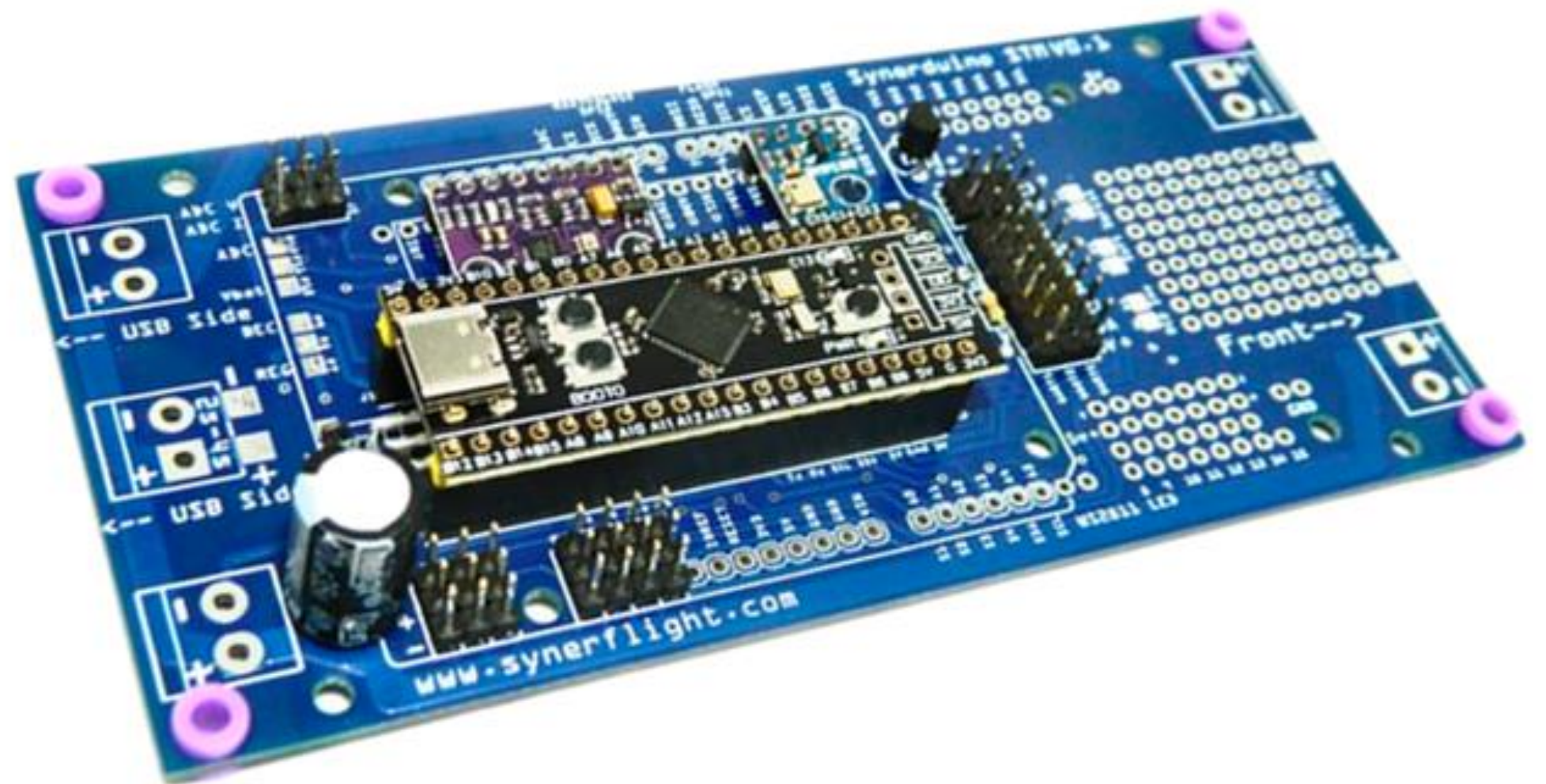
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# INTRODUCTION

The Synerduino STM is a 32-bit version of the Synerduino shield family, designed to enhance the performance of your drone applications, making it an ideal tool for research developers in robotics and drone technology.

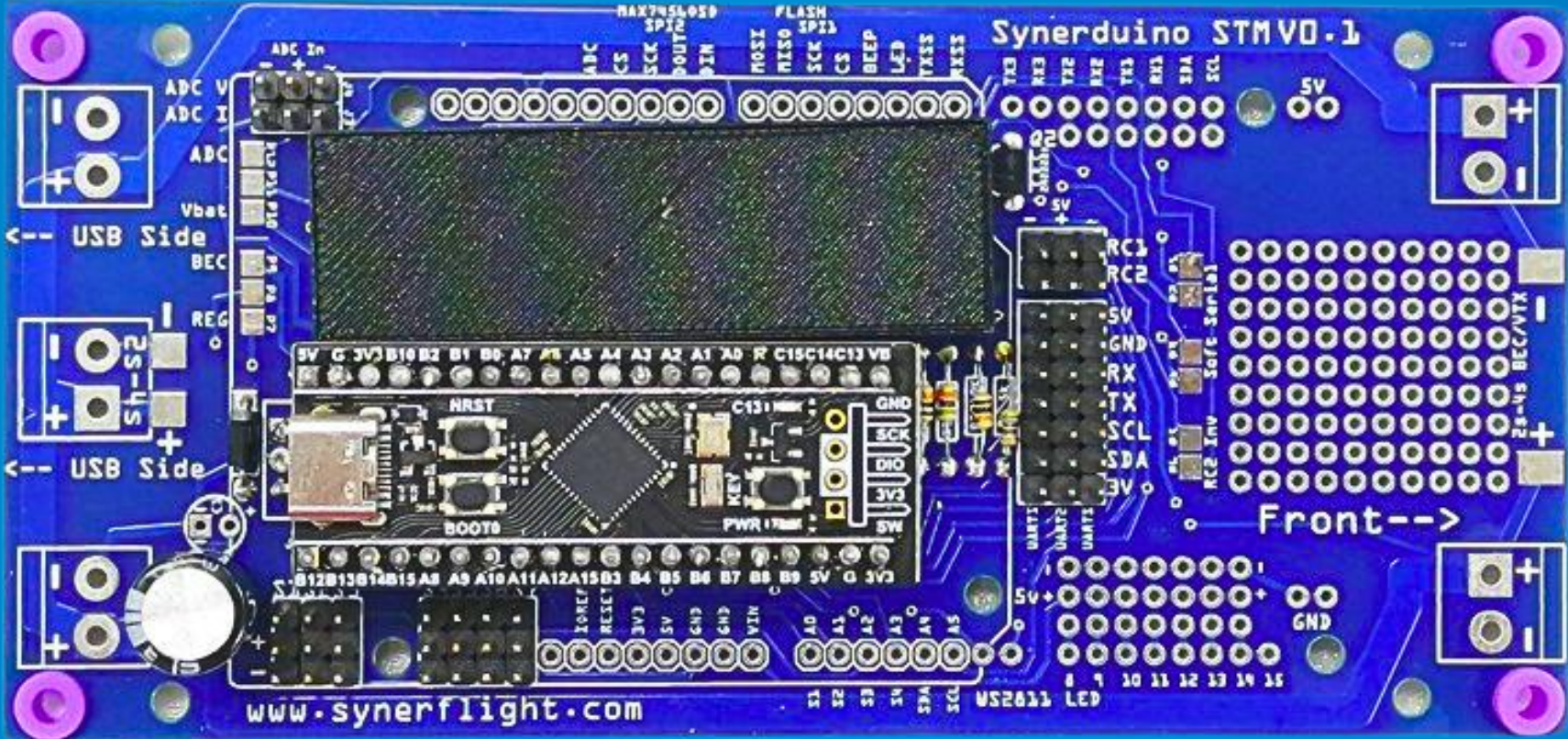
More details will be shared as they become available. The Synerduino STM shield is built on an STM32-based platform, offering advanced functionality for your drone projects while maintaining the classic Arduino form factor, ensuring compatibility with existing Arduino prototyping boards.





# SYNERDUINO STM F411

## ABOUT THE BOARD



### Power

- WS2811 LED Power 5V 1.5A
- Serial Power Rail 5V 1.5A
- PWM Power Rail Regulated – 5V 1.5A
- Drone Power Input Voltage – 12.6V (3S) or 16.8V (4S)
- Power Distribution Lines – 12.6V-25.2V 80A

### Properties

- Dimensions: 128 x 62 x 28 mm LWH / (V1.1)135mm x 62mm x 28mm
- Weight: 46.1g
- Arduino Prototyping Shield Footprint
- 4 Solder Pad set s for 4 ESCs and Motors
- DIY section for component addons
- 7 3-Pin PWM Headers S1-S7
- 2 3-Pin RC Headers w/ Sbus inverter
- 3 7-Pin Serial Headers
- 2 3pin ADC in (Voltage and Current)
- 2 RC Serial input Pin
- WS2811 LED output

### Compatibility

- GYRO/ACC: BMI160 (Align CW 0)
- MAG: HMC5883/QMC5883 (Align CW 180)
- BARO: BMP180/280



# SYNERDUINO STM F405

## ABOUT THE BOARD



### Power

- WS2811 LED Power 5V 3A
- Serial Power Rail – 3.3V 3A
- PWM Power Rail Regulated – 5V 3A
- Drone Power Input Voltage – 12.6V (3S) or 25.2V (6S)
- Power Distribution Lines – 12.6V-25.2V 80A

### Properties

- Dimensions: 128 x 62 x 28 mm LWH / (V1.1)135mm x 62mm x 28mm
- Weight: 46.1g
- Arduino Prototyping Shield Footprint
- 4 Solder Pad set s for 4 ESCs and Motors
- DIY section for component addons
- 10 3-Pin PWM Headers S1-S10
- 2 3-Pin RC Headers w/ Sbus inverter
- 4 4-Pin Serial Headers
- 4 3pin ADC in (Voltage and Current)
- 2 RC Serial input Pin
- 1 WS2811 LED output
- 2 PIN IO (User Action)

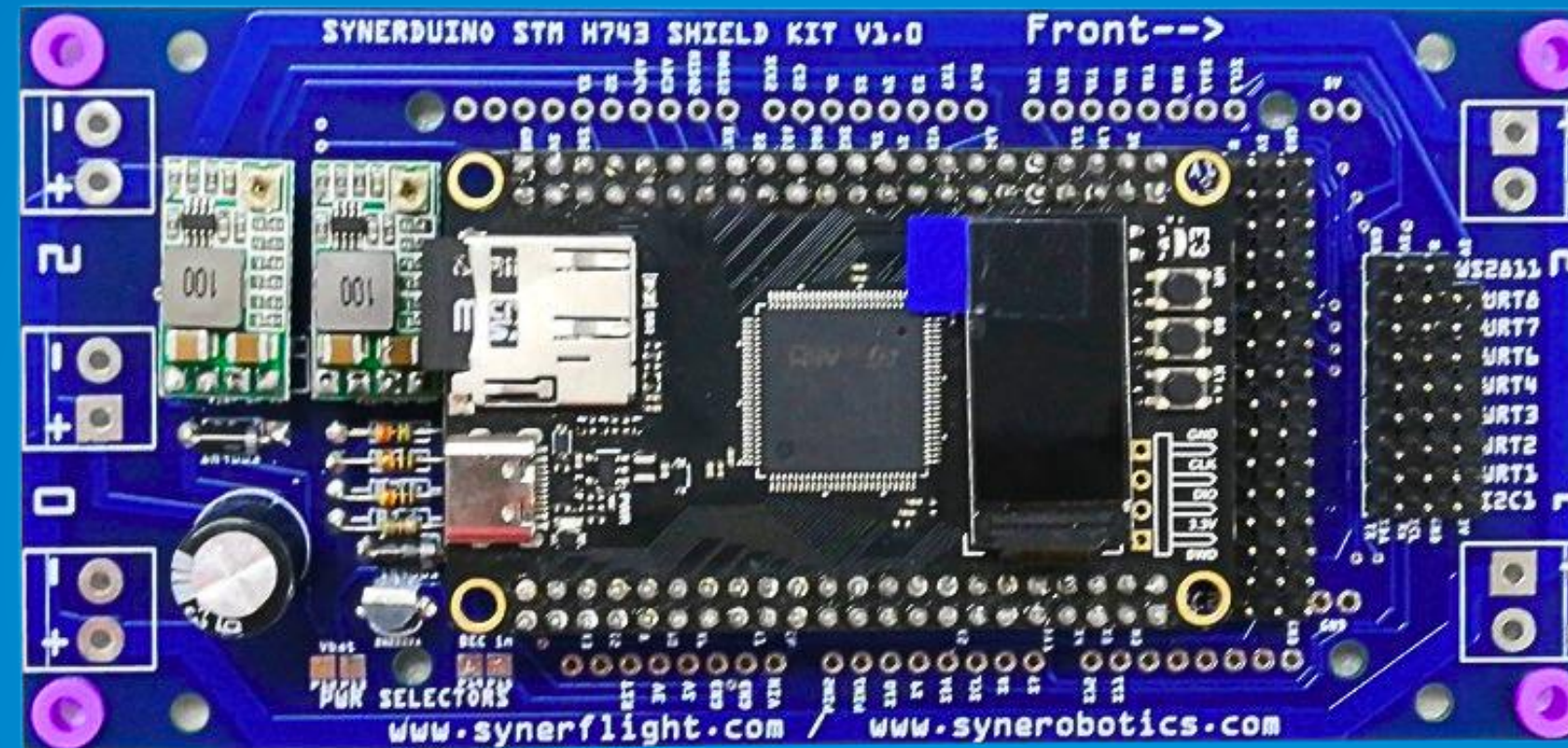
### Compatibility

- GYRO/ACC: BMI160 (Align CW 0)
- MAG: HMC5883/QMC5883 (Align CW 180)
- BARO: BMP180/280



# SYNERDUINO STM H743

## ABOUT THE BOARD



### Power

- WS2811 LED Power 5V 3A
- Serial Power Rail – 3.3V 3A
- PWM Power Rail Regulated – 5V 3A
- Drone Power Input Voltage – 12.6V (3S) or 25.2V (6S)
- Power Distribution Lines – 12.6V-25.2V 80A
- Note: 8S – 12S Use External UBEC 5V to the main power input and external ESC Power distribution

### Properties

- Dimensions: 128 x 62 x 28 mm LWH / (V1.1)135mm x 62mm x 28mm
- Weight: 46.1g
- Arduino Prototyping Shield Footprint
- 4 Solder Pad sets for 4 ESCs and Motors
- DIY section for component add-ons
- 10 3-Pin PWM Headers S1-S10
- 2 Aux PWM Headers S11-S12
- 2 3-Pin RC Headers w/ Sbus inverter
- 7 4-Pin Serial Headers
- 4 3pin ADC in (Voltage and Current)
- 2 RC Serial input Pin
- 1 WS2811 LED output
- 2 Pin IO (User Action)

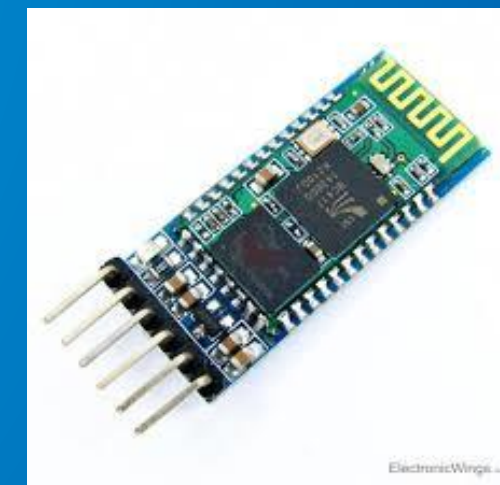
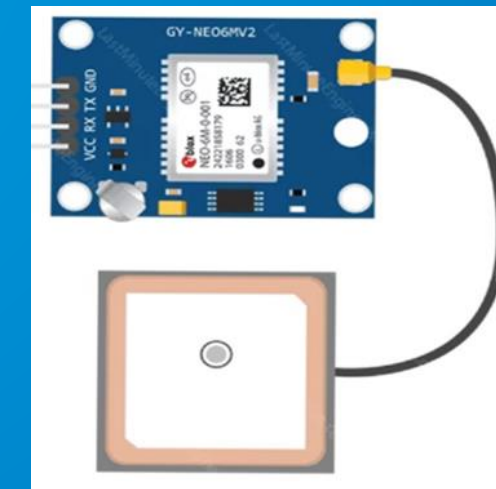
### Compatibility

- GYRO/ACC: BMI160 (Align CW 0)
- MAG: HMC5883/QMC5883 (Align CW 180)
- BARO: BMP180/280



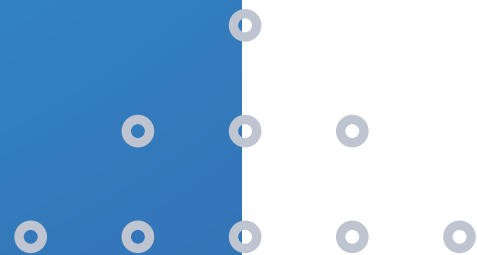
# SYNERDUINO KIT COMPONENTS

## *Drone Kit + Synerduino Board*





# ASSEMBLY





# TOOLS AND MATERIALS



## PLIERS

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## TAPES

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## SOLDERING SET

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## HEX DRIVER SET

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## CUTTER

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## ZIP TIES

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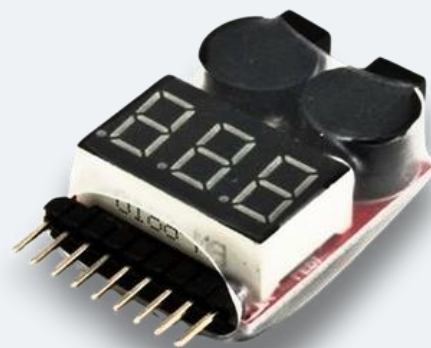


# TOOLS AND MATERIALS



## LI-PO BATTERY

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## BATTERY ALARM CHECKER

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## LI-PO BATTERY CHARGER

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## PVC GLUE

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## THREAD LOCKER PURPLE

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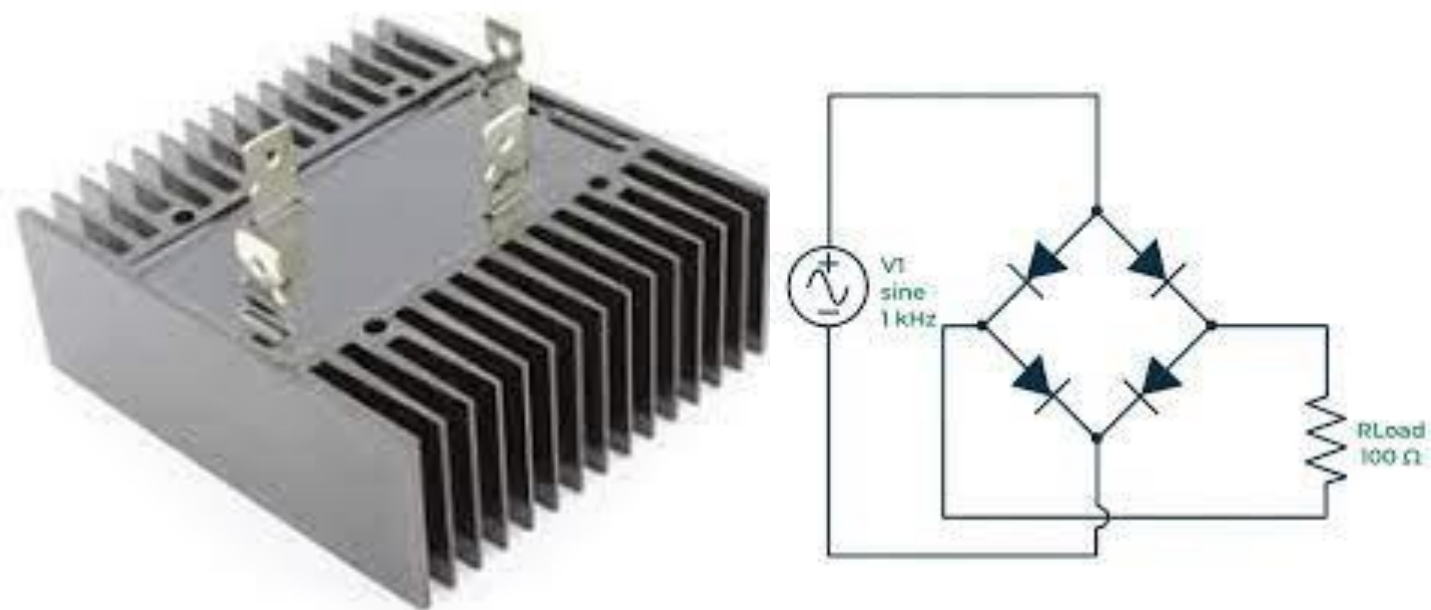


# HIGH POWER HARDWARE

For those running additional sensors , servos and other **5V** or **6V** components Please use an standalone BEC to power extra hardware



Rectifiers are useful as reverse polarity protection at source. Can be place before the ESC,Servo,Synerduino board rating must be higher than the combine current off all the electronics and motor current draw



For ESCs that have **6V – 8V** BEC , to prevent damage to Synerduino PWM Power Rail its recommended that the PWM Power wire is disconnected

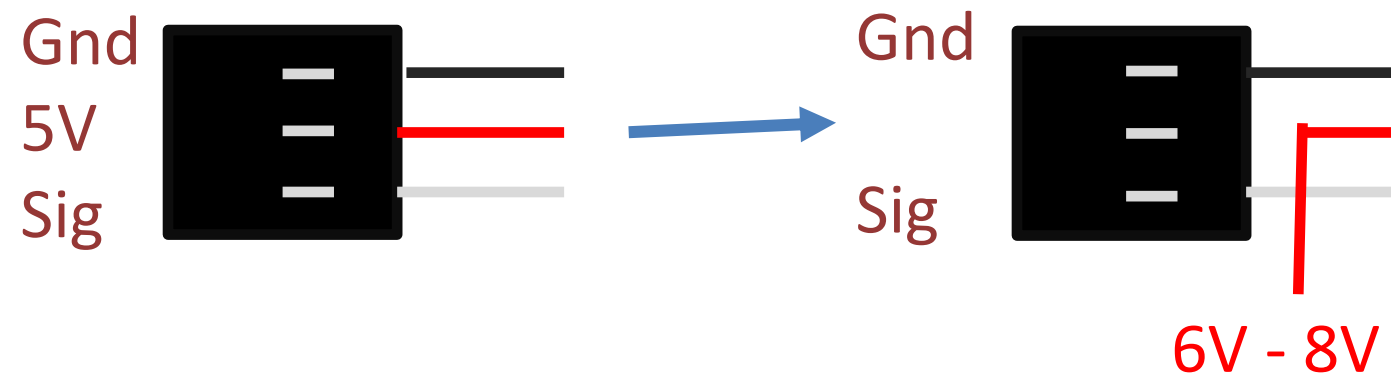


High power servos that required **6V-12V**

Its required you use an External BEC or Power supply to power Large servos



Disconnect the **Red** PWM servo wire to

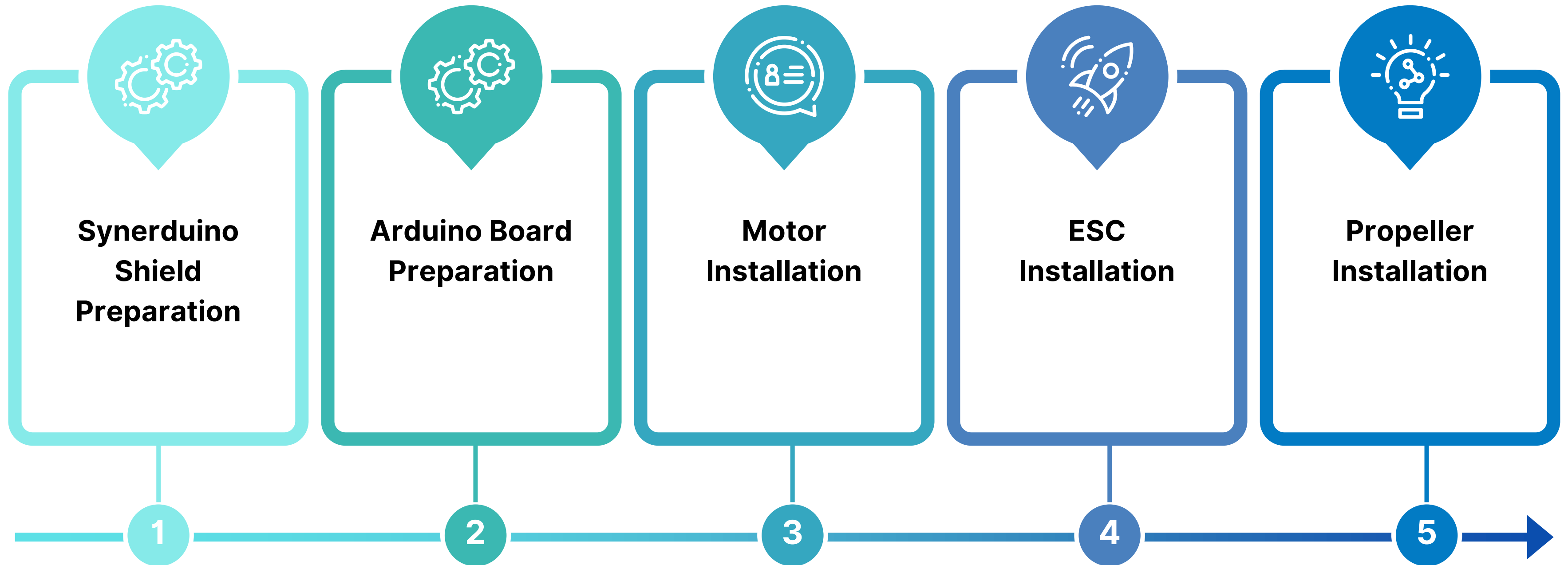


this can be redirected to the power input rail or high power servo input



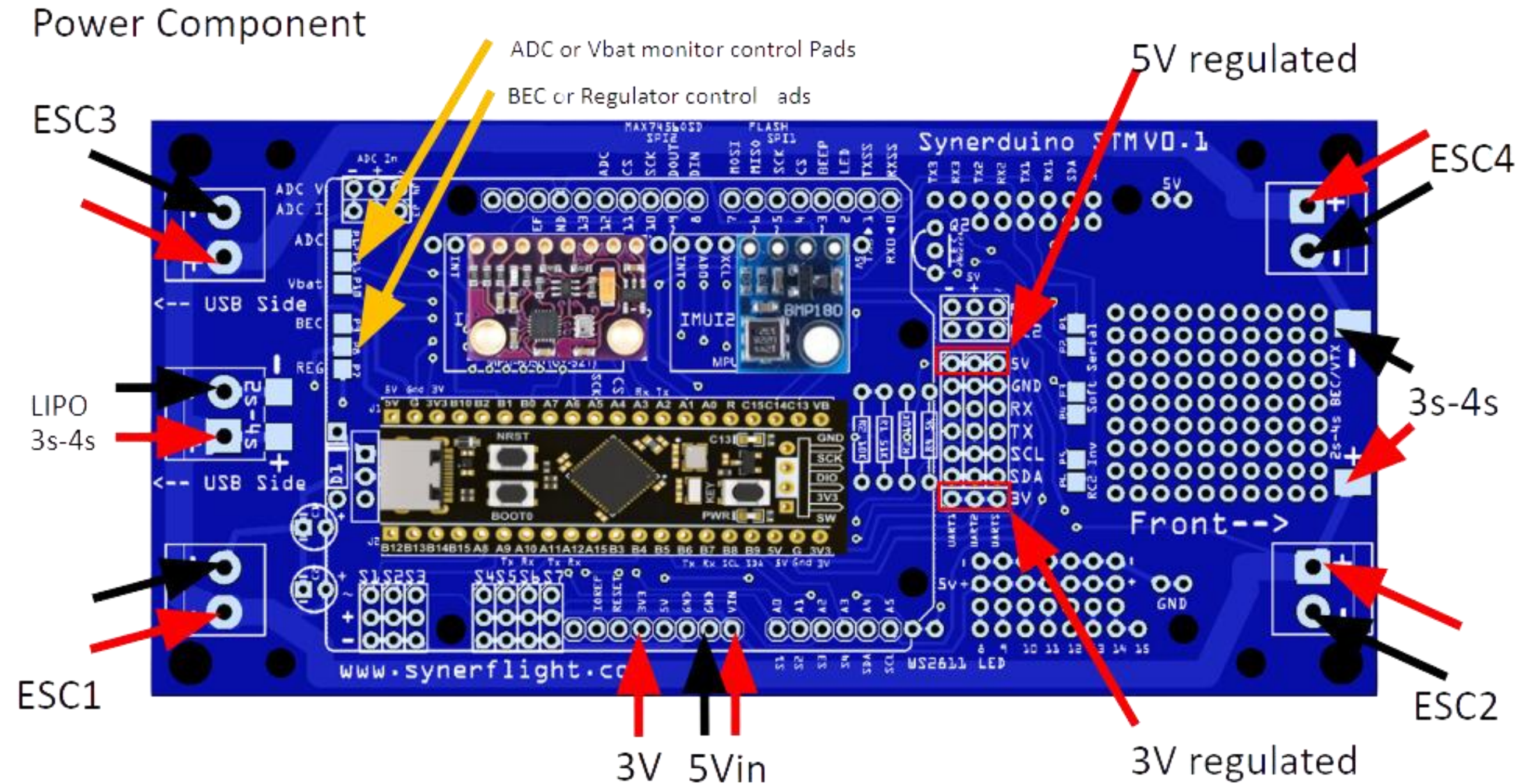
# ASSEMBLING PROCESS

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Integer semper libero ex, ac egestas erat accumsan vitae. Fusce facilisis risus at justo venenatis, ut suscipit lectus auctor.



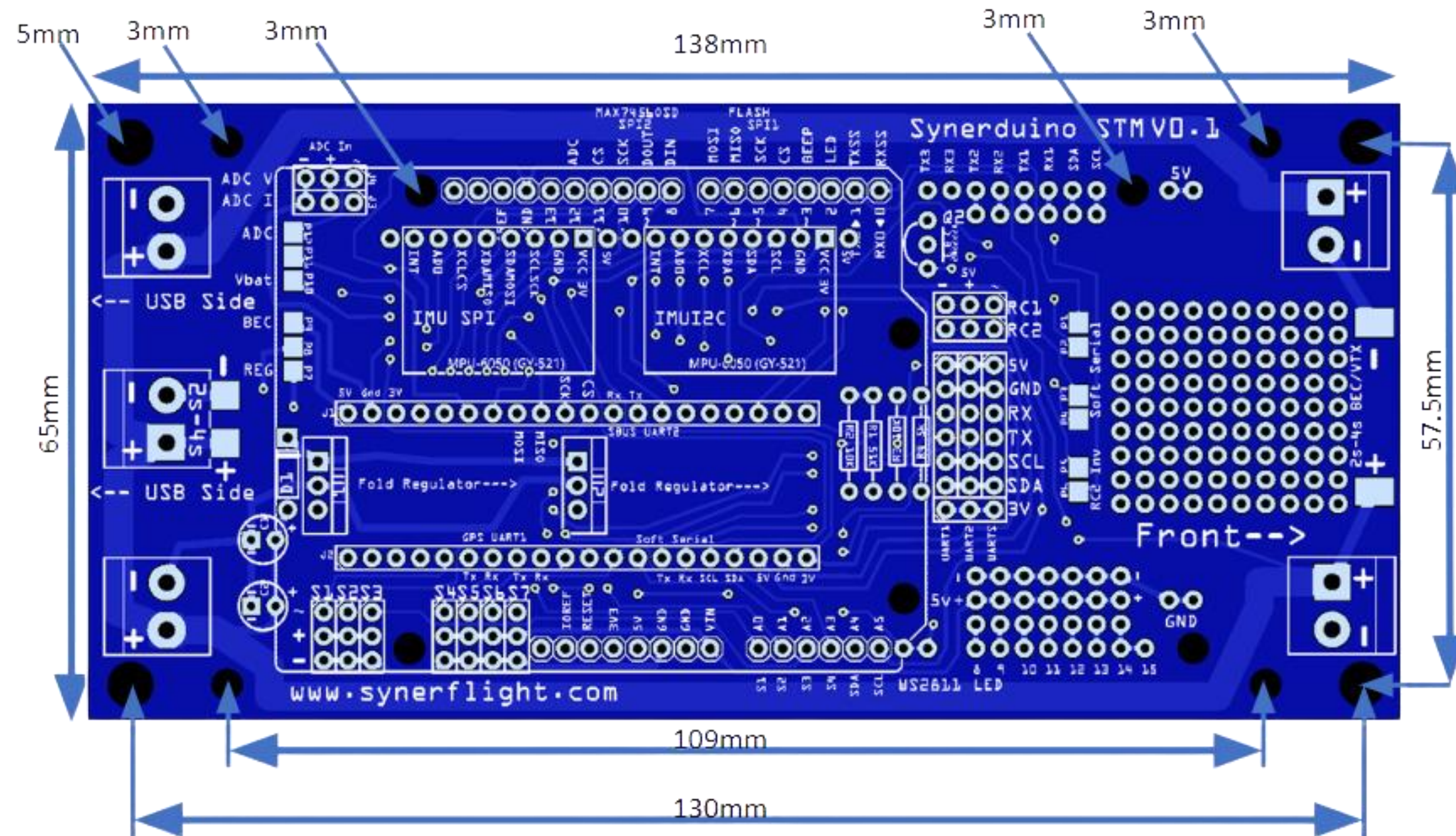


# SYNERDUINO STM F411 SHIELD





# SYNERDUINO STM F411 SHIELD

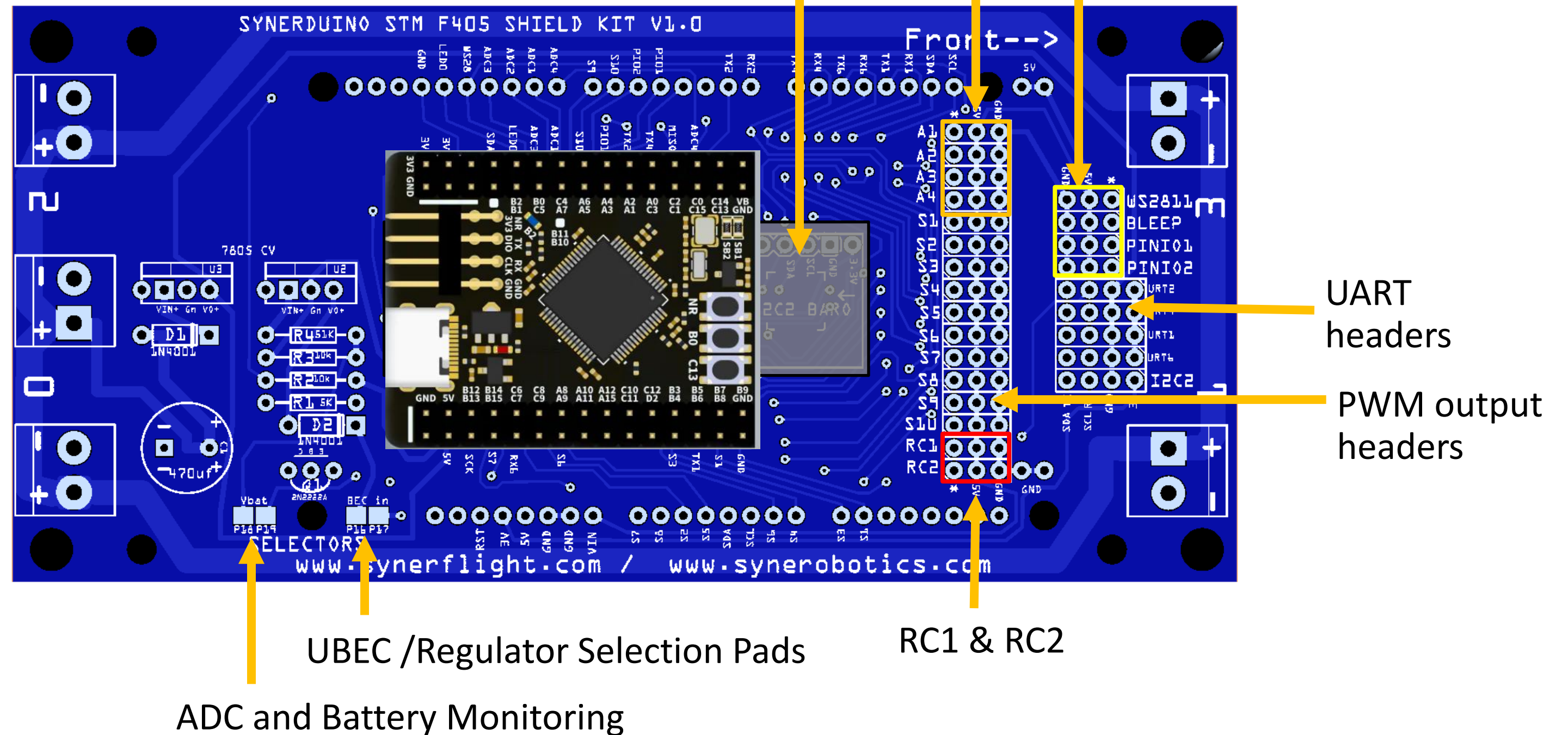




# SYNERDUINO STM F405 SHIELD

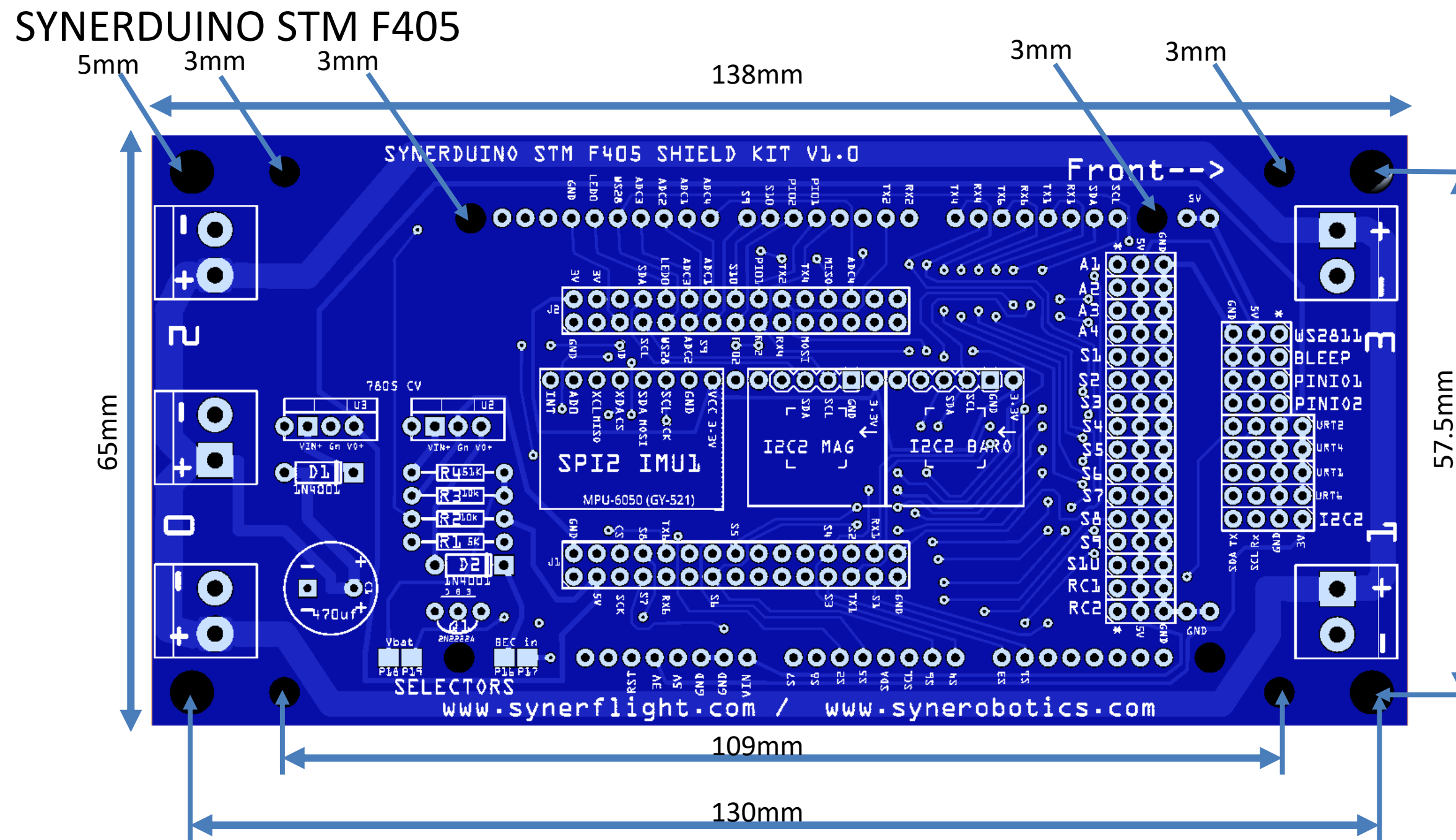
Sensors must be covered with the provided housing glued into place using PVA white glue

ADC input headers  
WS2811 & I/O





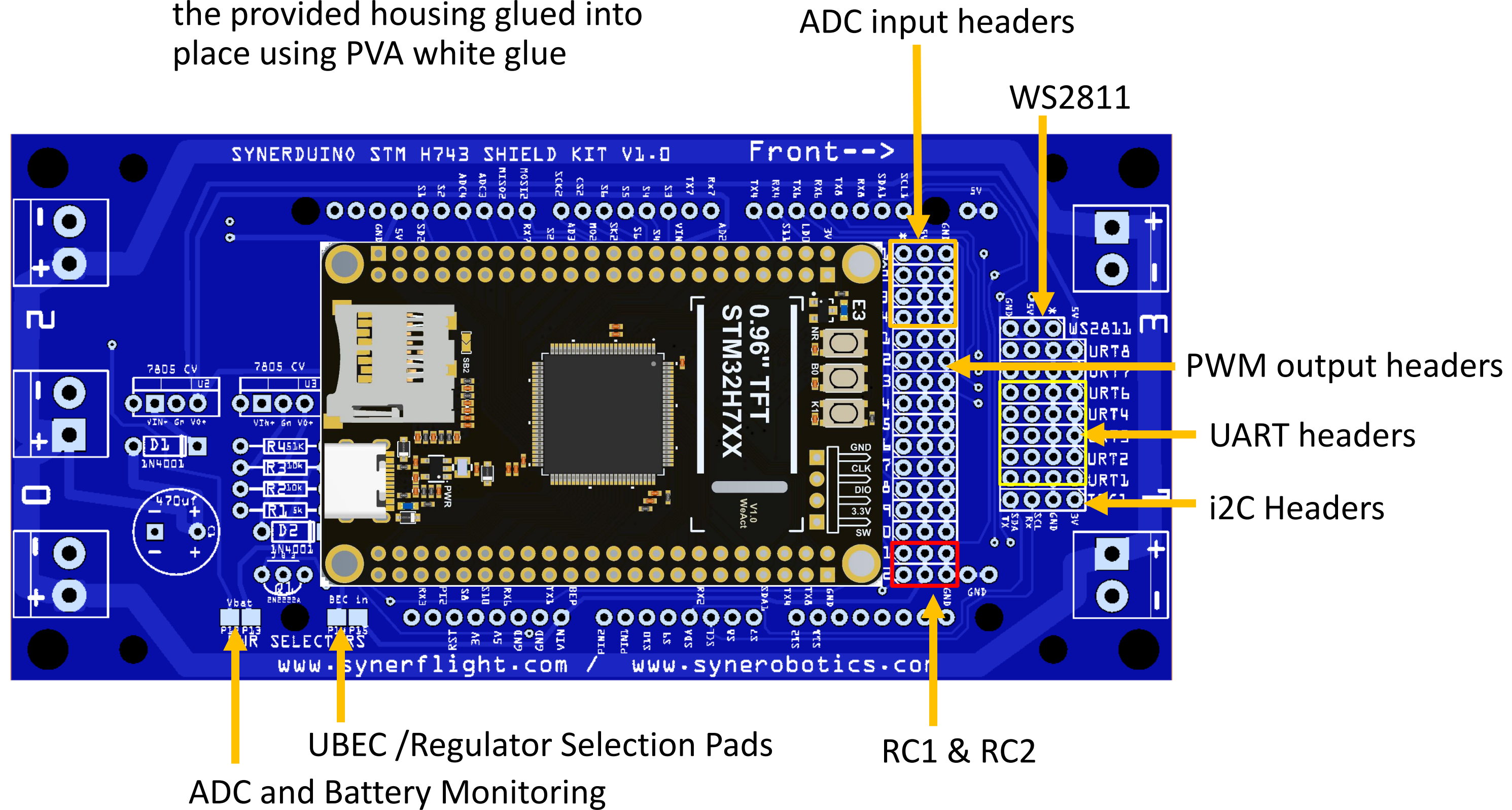
# SYNERDUINO STM F405 SHIELD





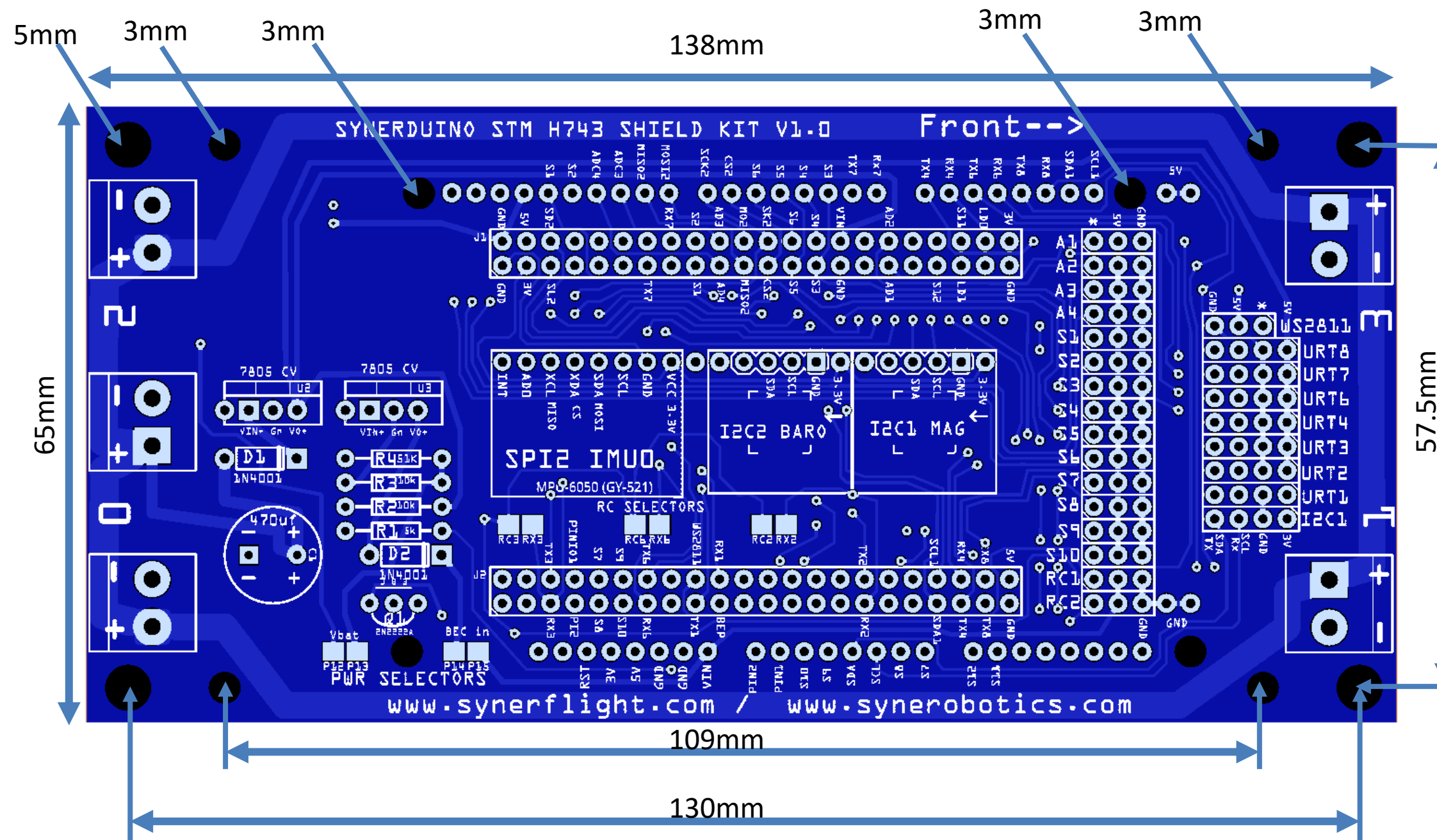
# SYNERDUINO STM H743 SHIELD

Sensors must be covered with the provided housing glued into place using PVA white glue





# SYNERDUINO STM H743 SHIELD





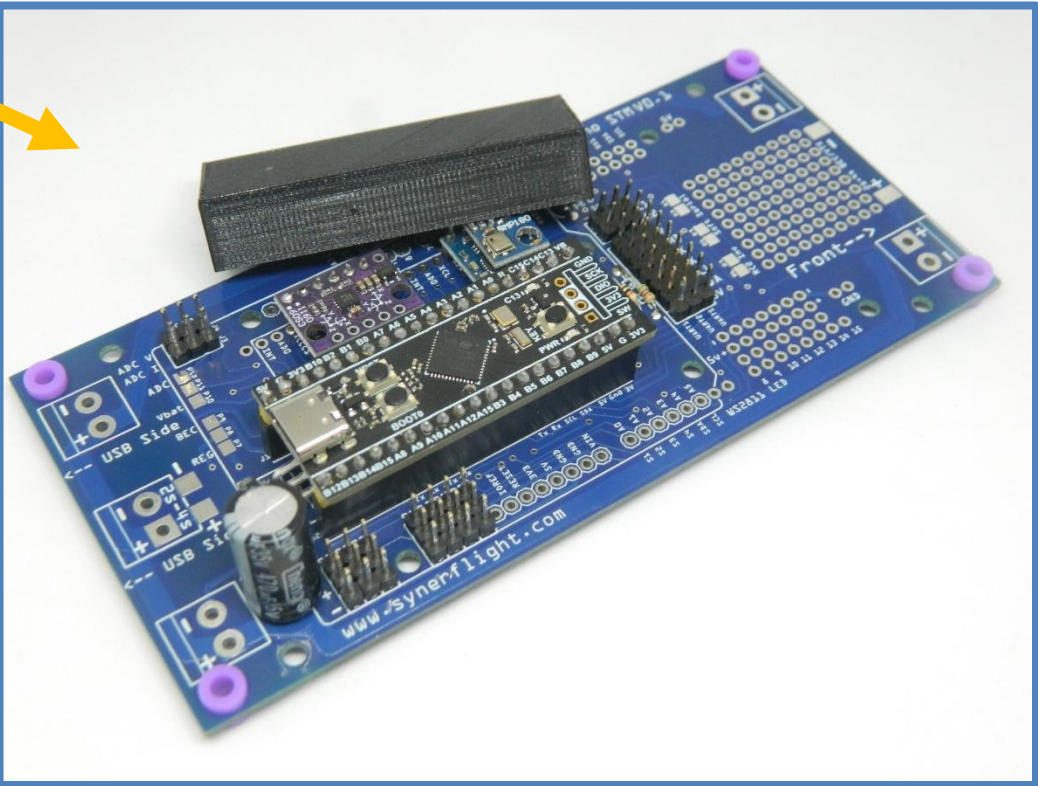
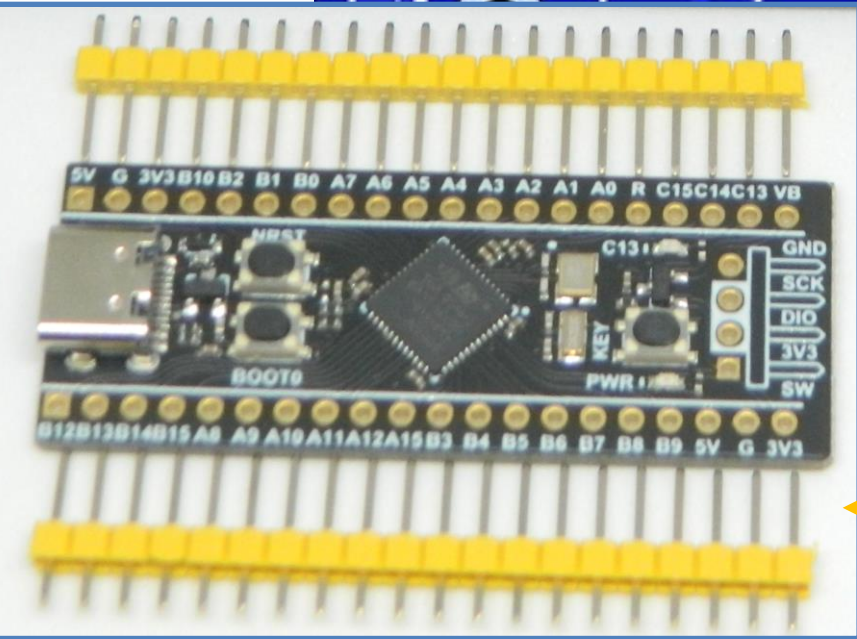
# Board Preparations

ADC and Battery Monitoring

Sensors must be covered with the provided housing glued into place using PVA white glue

UBEC  
/Regulator  
Selection  
Pads

USB  
facing  
this side



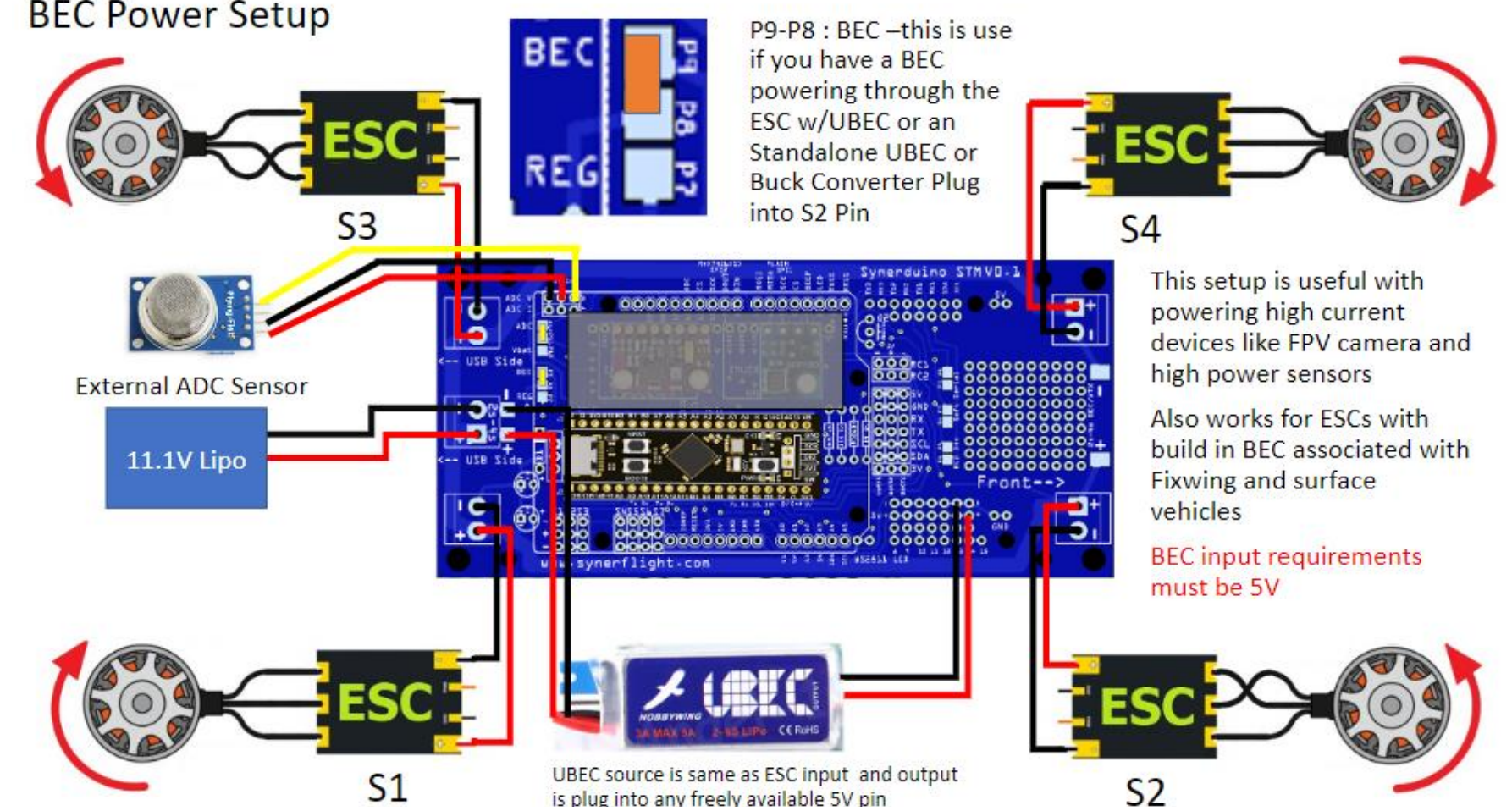
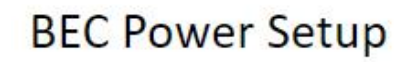
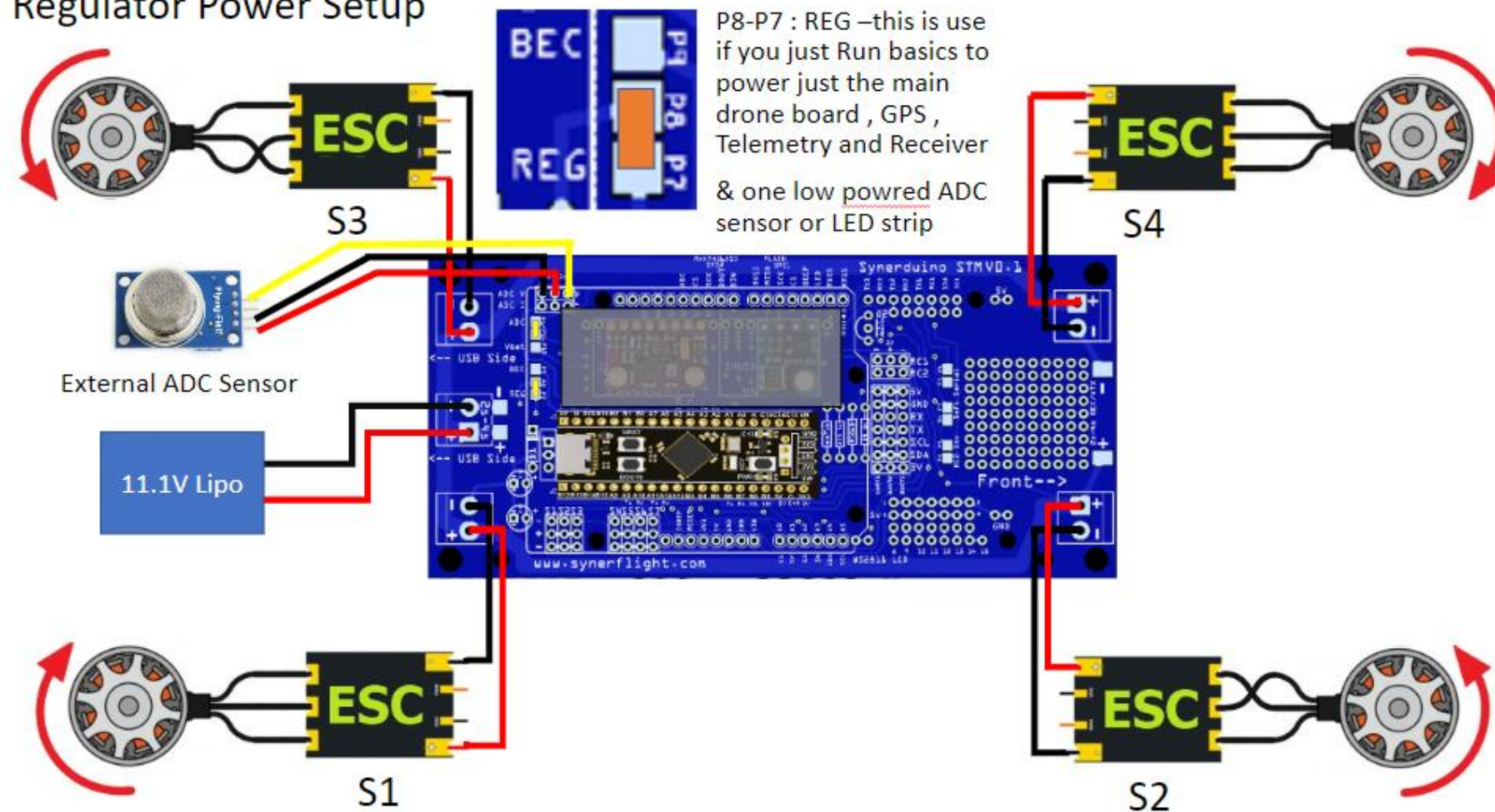
Pins have to be solder  
on before installation

8-9 WS2811 LED out

RC2 inverted Sbus signal  
For those using PWMto  
SBUS converter



# F411 POWER LAYOUT





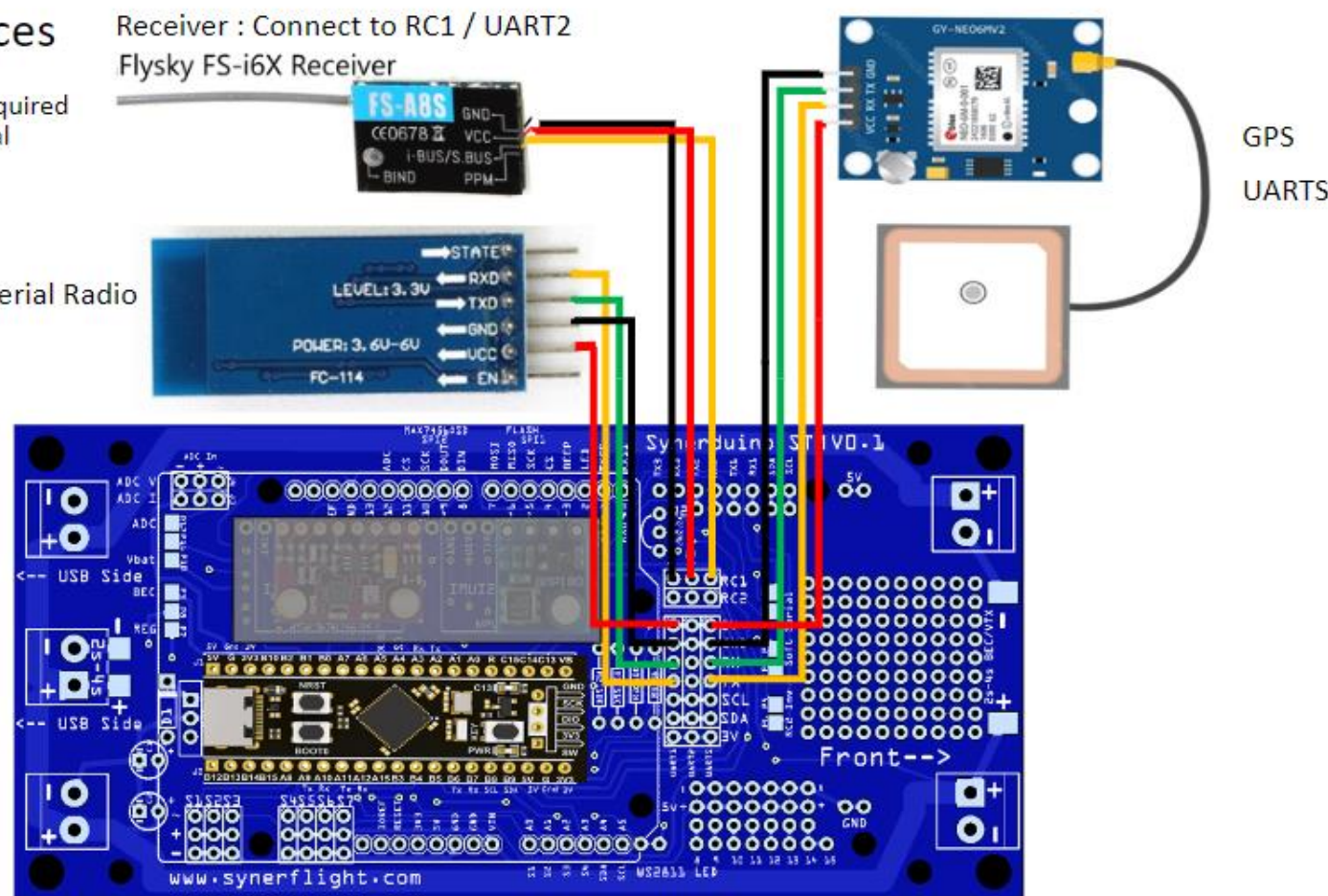
# F411 RC RECEIVER & UARTS

## UART Serial Devices

AS if INAV5 and INAV6 its Required Receiver supports SBUS Serial

Receiver : Connect to RC1 / UART2  
Flysky FS-i6X Receiver

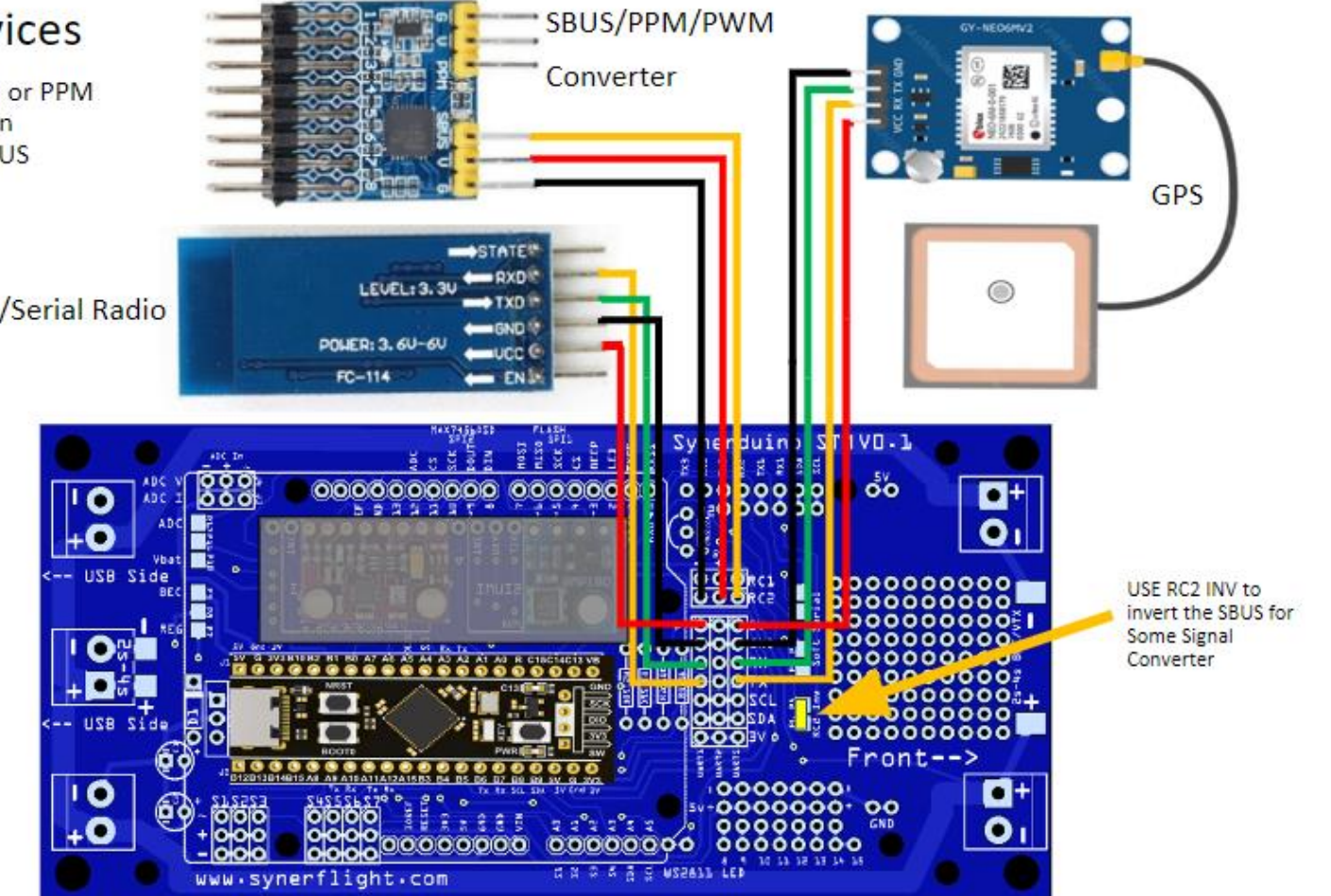
Bluetooth/Serial Radio  
UART1



## UART Serial Devices

For those who Uses PWM or PPM Receiver Require to add an Additional PWM/PPM/SBUS Converter to RC2/UART2

Bluetooth/Serial Radio

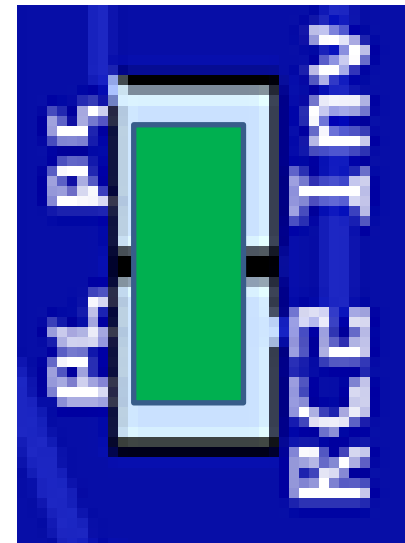




# RECEIVER TYPES

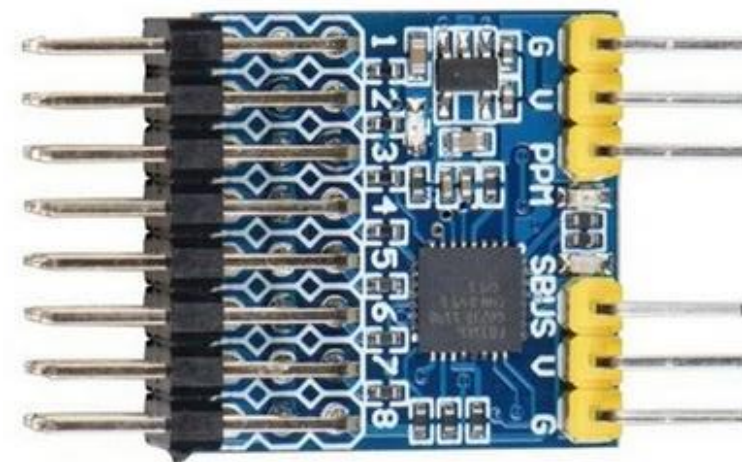


PPM AND PWM RECEIVER



The Invert Pads are only Present in the F411 boards .

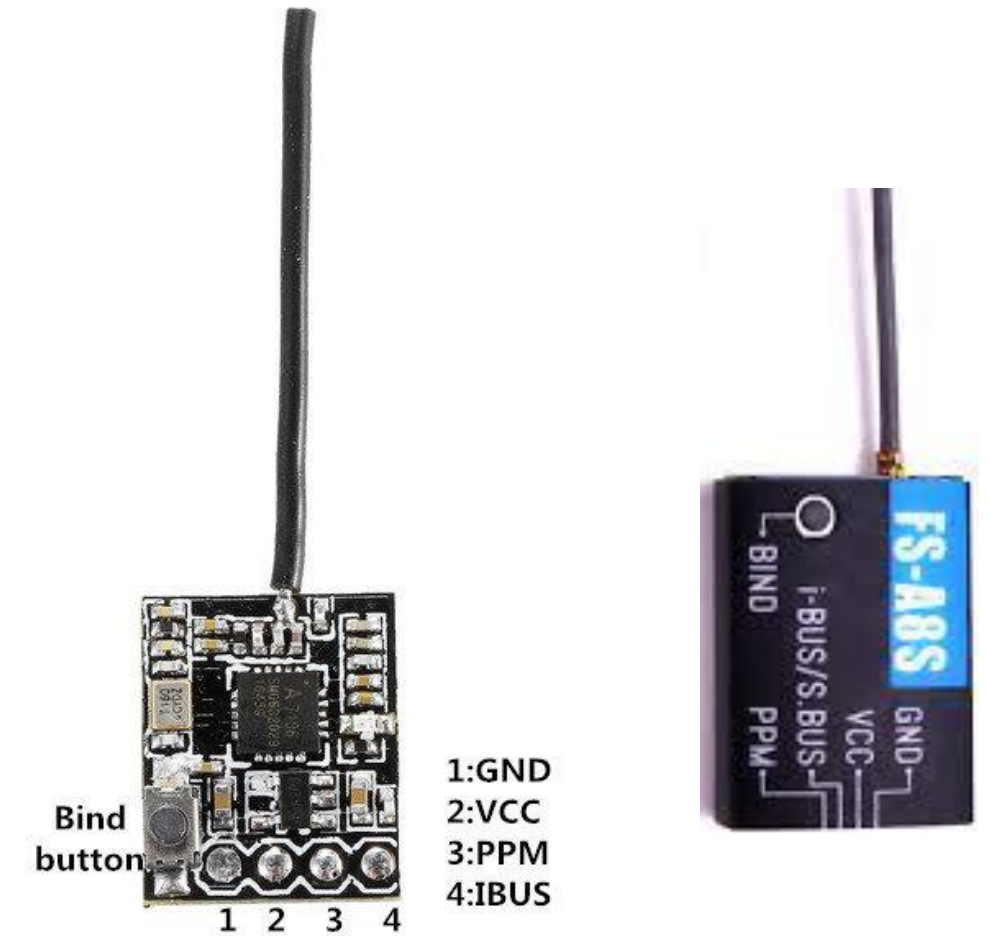
F405 and H743 boards does a way with this



## PWM/PPM/SBUS CONVERTER

For those who Uses PWM or PPM Receiver Require to add an Additional PWM/PPM/SBUS Converter and connect it to RC2 to SBus

## SERIAL RECEIVER





# F405 RC RECEIVER & UARTS

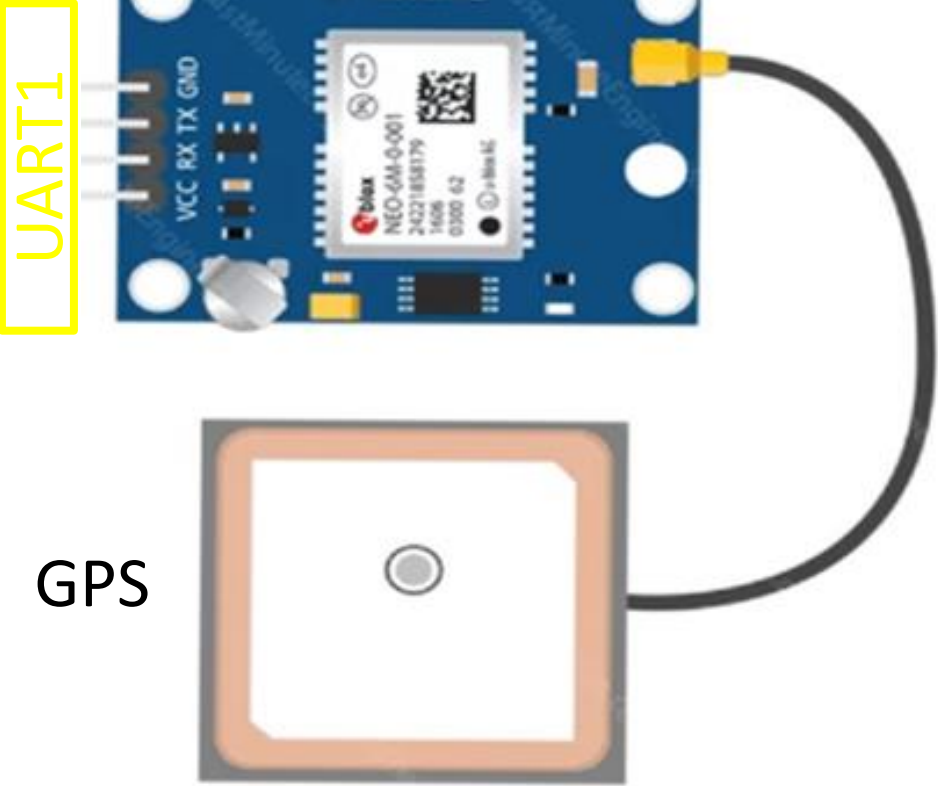
Flysky FS-i6X Receiver



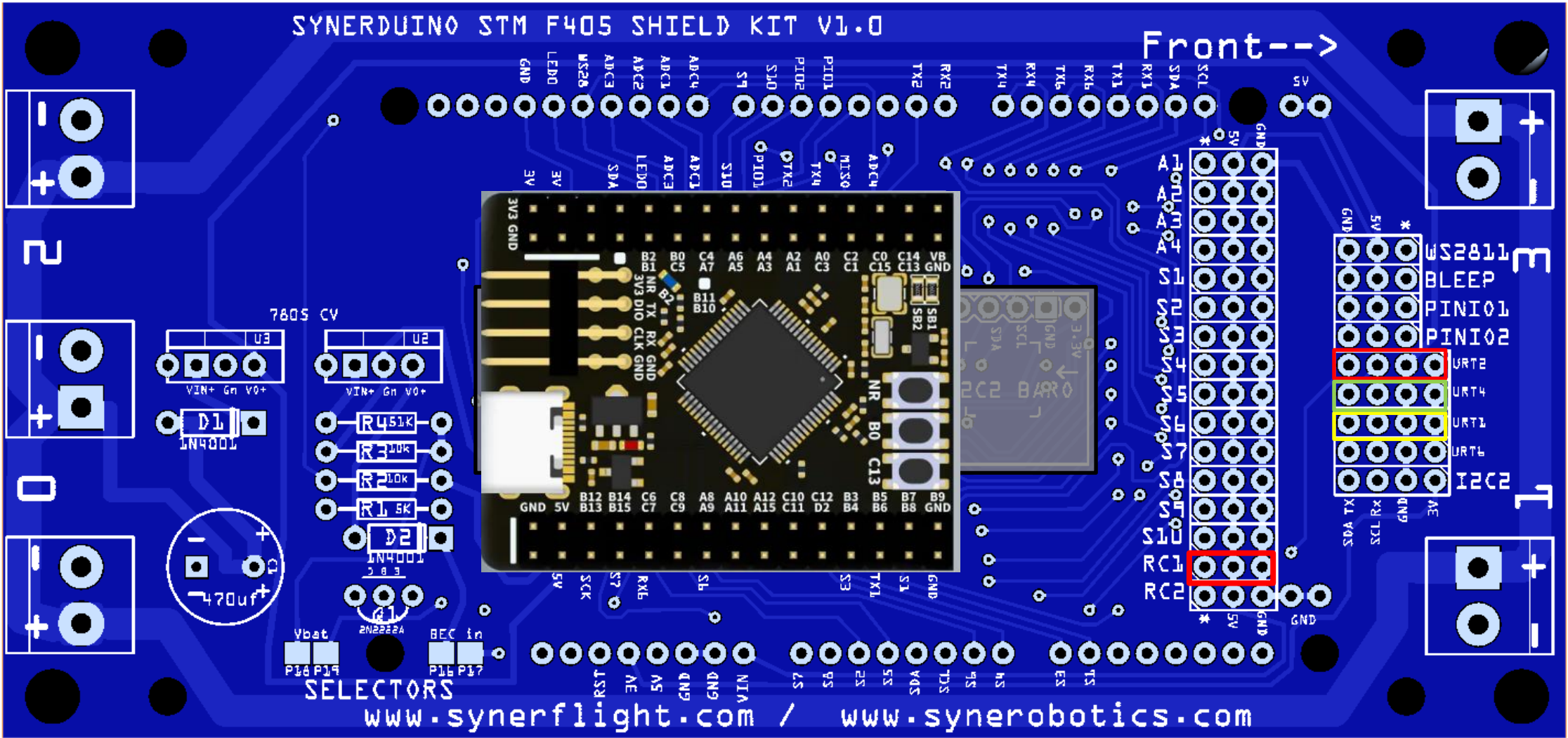
Receiver : Connect to RC1 / UART2



Bluetooth/Serial Radio

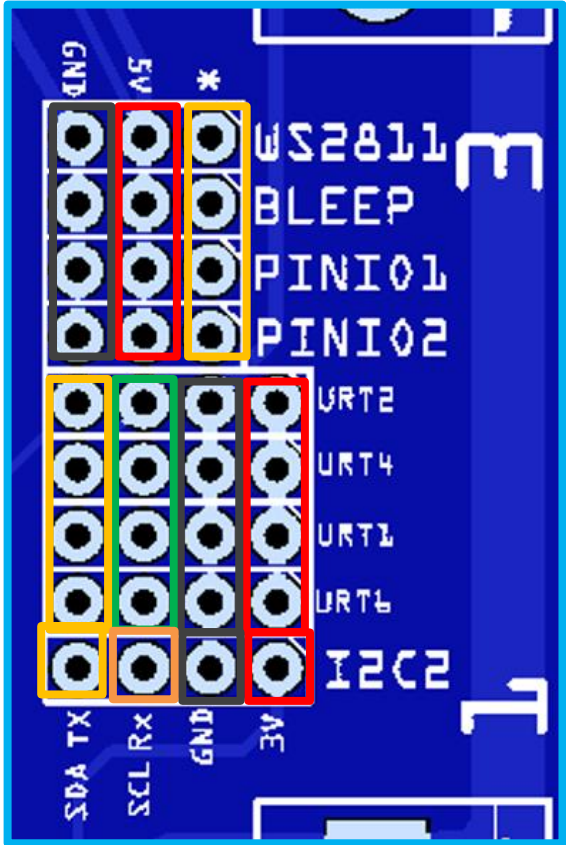


GPS



STMF405

V+ Gn Dat



TX RX Gn V+

Check connection Polarity



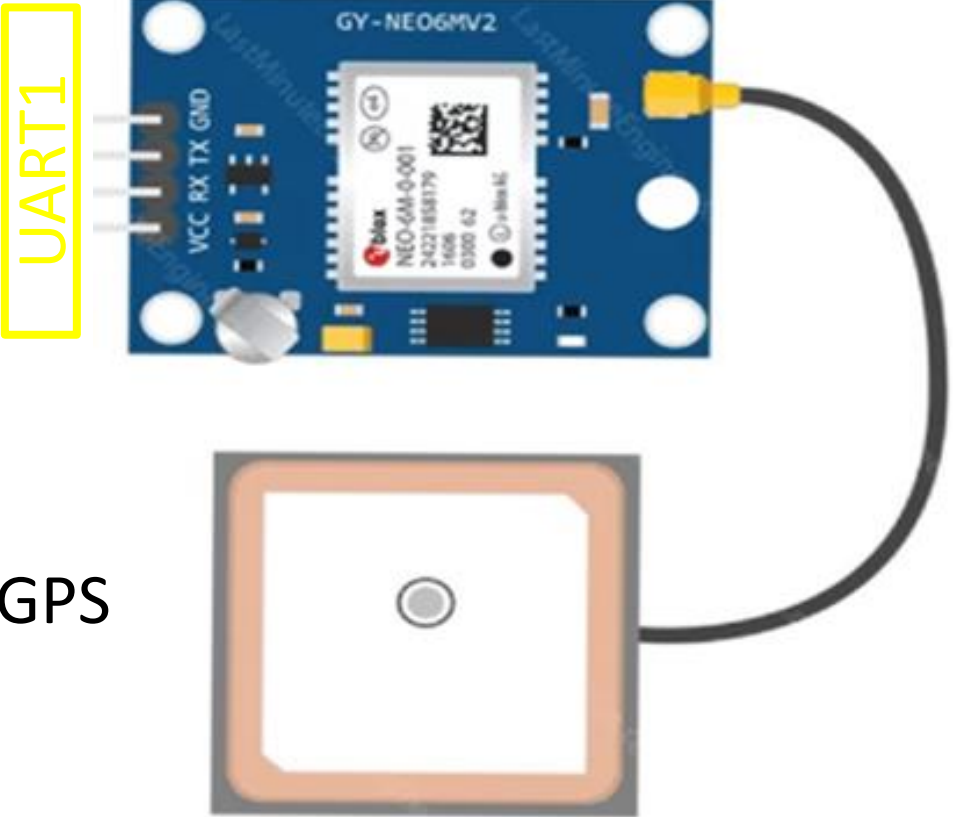
# H743 RC RECEIVER & UARTS



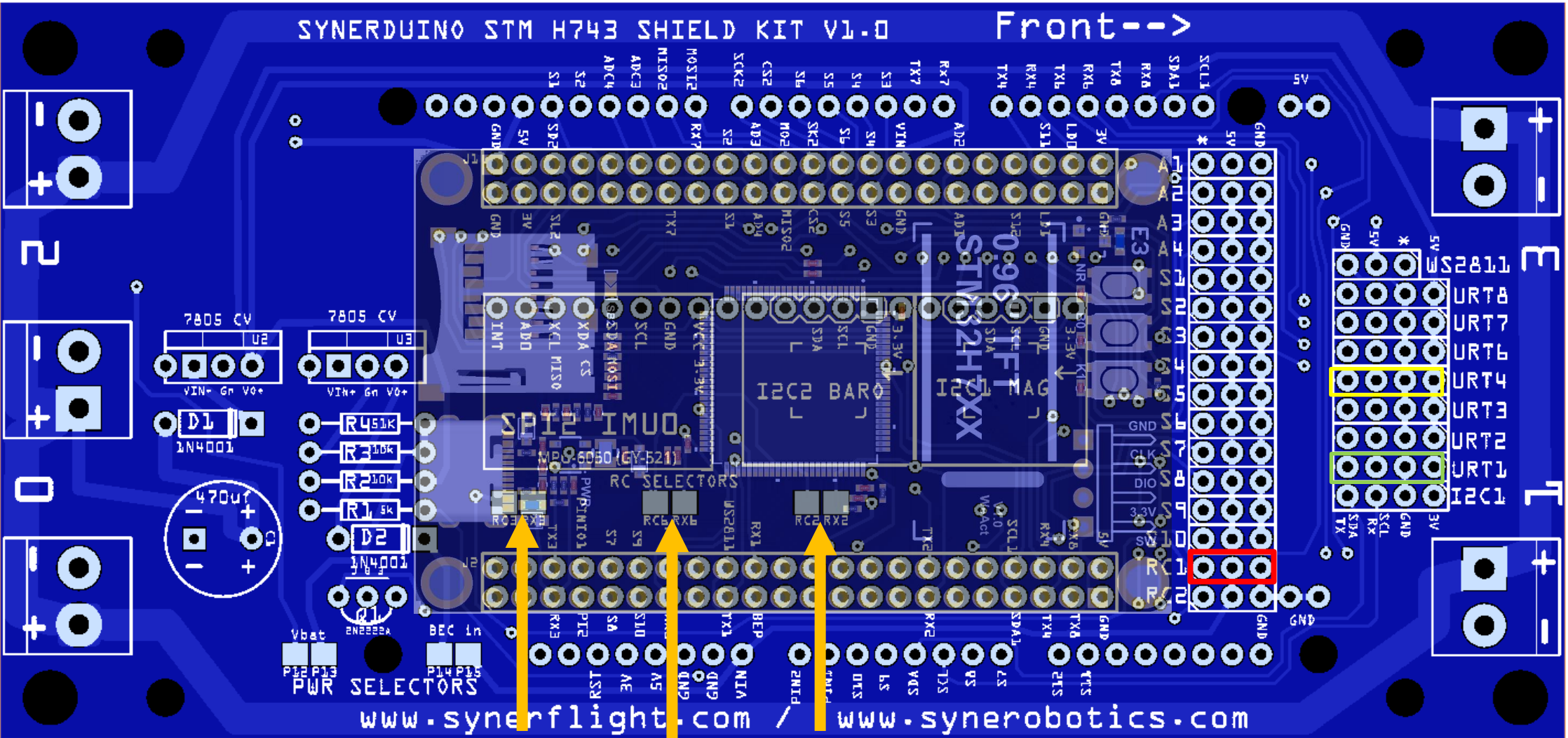
Receiver : Connect to RC1 / UART2



Bluetooth/Serial Radio

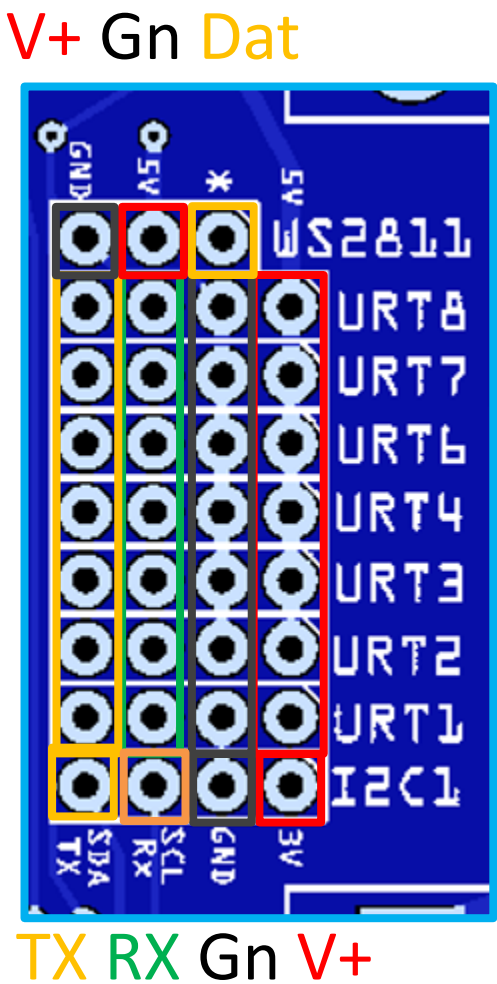


GPS



STMH743

RC UART selector you have 3 option where your RC receiver can be connected



Check connection Polarity



# F411 SELECTOR SELECTOR PADS

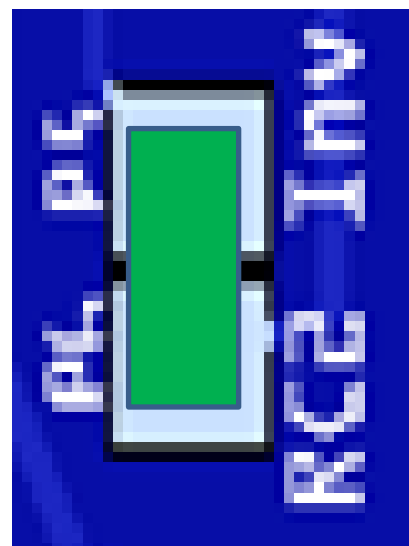
To Select two adjacent pads must be shorted with a solder blob



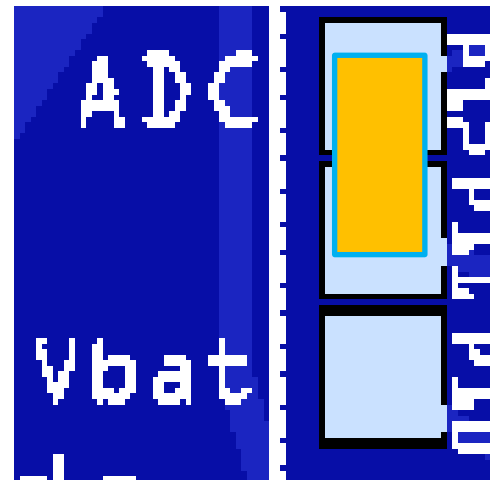
P9-P8 : BEC –this is use if you have a BEC powering through the ESC w/UBEC or an Standalone UBEC or Buck Converter Plug into S2 Pin **BEC input is 5V**



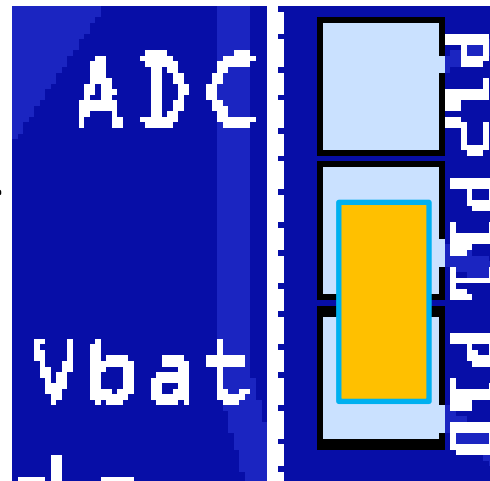
P8-P7 : REG –this is use if you just Run basics to power just the main drone board , GPS , Telemetry and Receiver



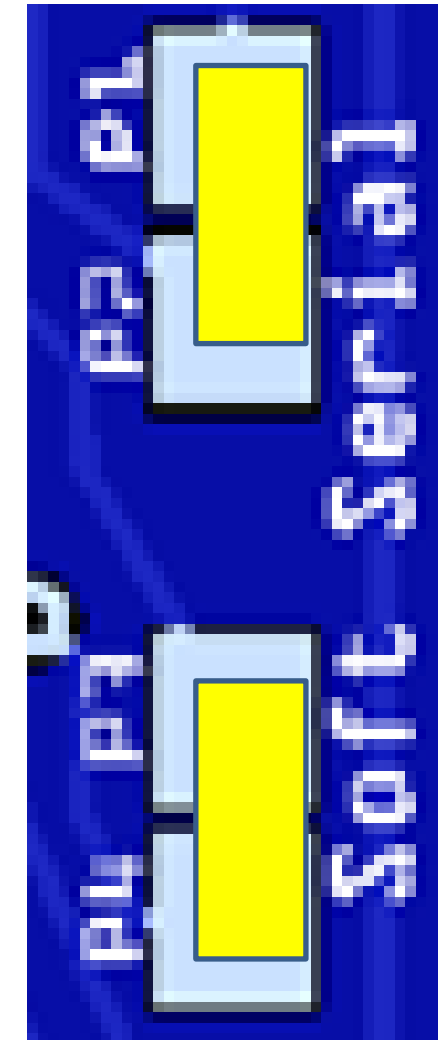
P5-P6 RC2 Inv : inverts the Sbus signals which activates the RC2 Sbus pin input to the UART2



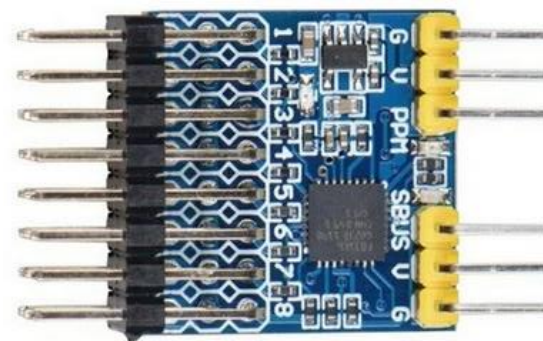
P12-P11 ADC Sensor Input



P11-P10 ADC Voltage Monitoring input



P1-P2 P3-P4 Softserial activates the TXSS and RXSS connection to the expansion pins for Prototyping board serial Connection



Primary use for PWM to SBUS Converters

**Synerduino**

**Note: the power rails would support upto 4s safely**

**For 6s setup this would require an external UBEC to supply 5V**



# F405 & H743 SELECTOR PADS



P16-P17 : BEC –this is use if you have a BEC powering through the ESC w/UBEC or an Standalone UBEC or Buck Converter Plug into S2 Pin **BEC input is 5V**



Default ADC1 input  
P18-P19 ADC  
activate Battery  
monitoring

Synerduino

**Note: the power rails would support upto 6s safely**

**For 6s- 14s setup this would require an external UBEC to supply 5V**

**For ESCs with UBEC ensure it outputs 5V**

Default Onboard  
Regulator



(H743 Boards ) Selectable UART for RC2 RX  
RC2-RX2 is Default

To Select two adjacent pads must be shorted with a solder blob



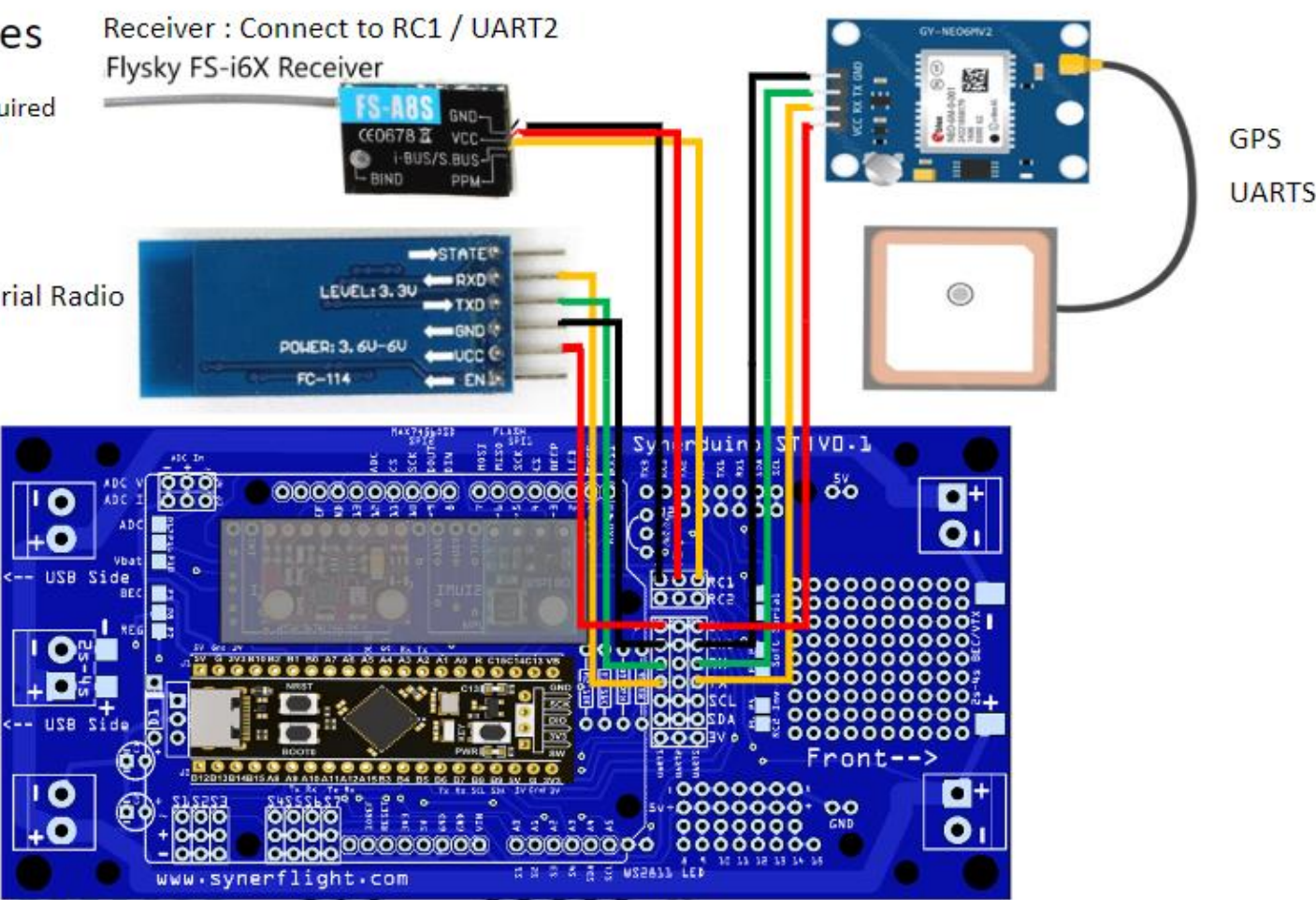
# UART CONNECTIONS

## UART Serial Devices

AS if INAV5 and INAV6 its Required Receiver supports SBUS Serial

Receiver : Connect to RC1 / UART2  
Flysky FS-i6X Receiver

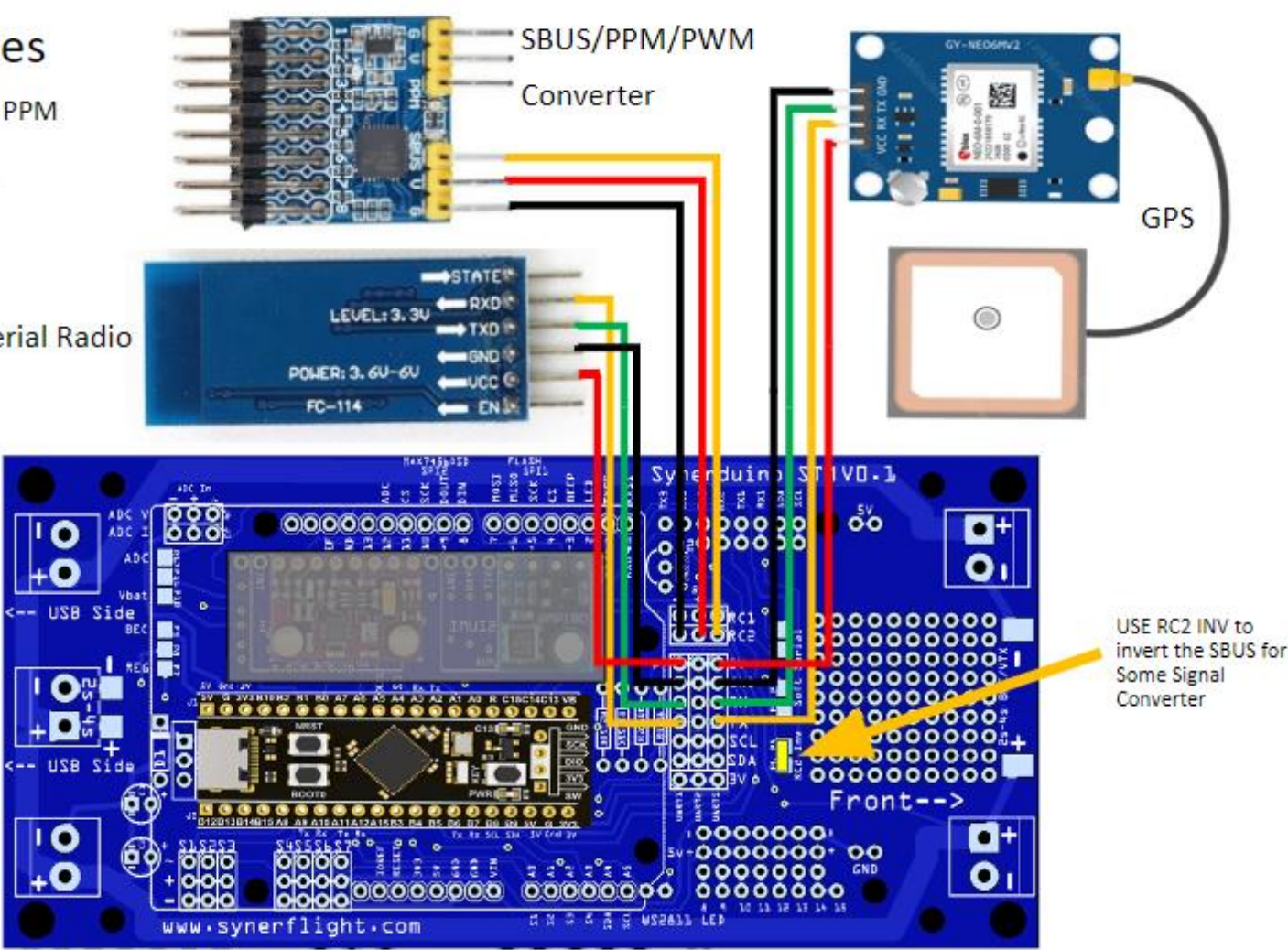
Bluetooth/Serial Radio  
UART1



## UART Serial Devices

For those who Uses PWM or PPM Receiver Require to add an Additional PWM/PPM/SBUS Converter to RC2/UART2

Bluetooth/Serial Radio





# F411 SPI CONNECTIONS

## SPI2 Devices

These are optional addons

All Addon SPI devices can Access SPI2 Pins

CS - CS

DIN - MOSI

DOOUT - MISO

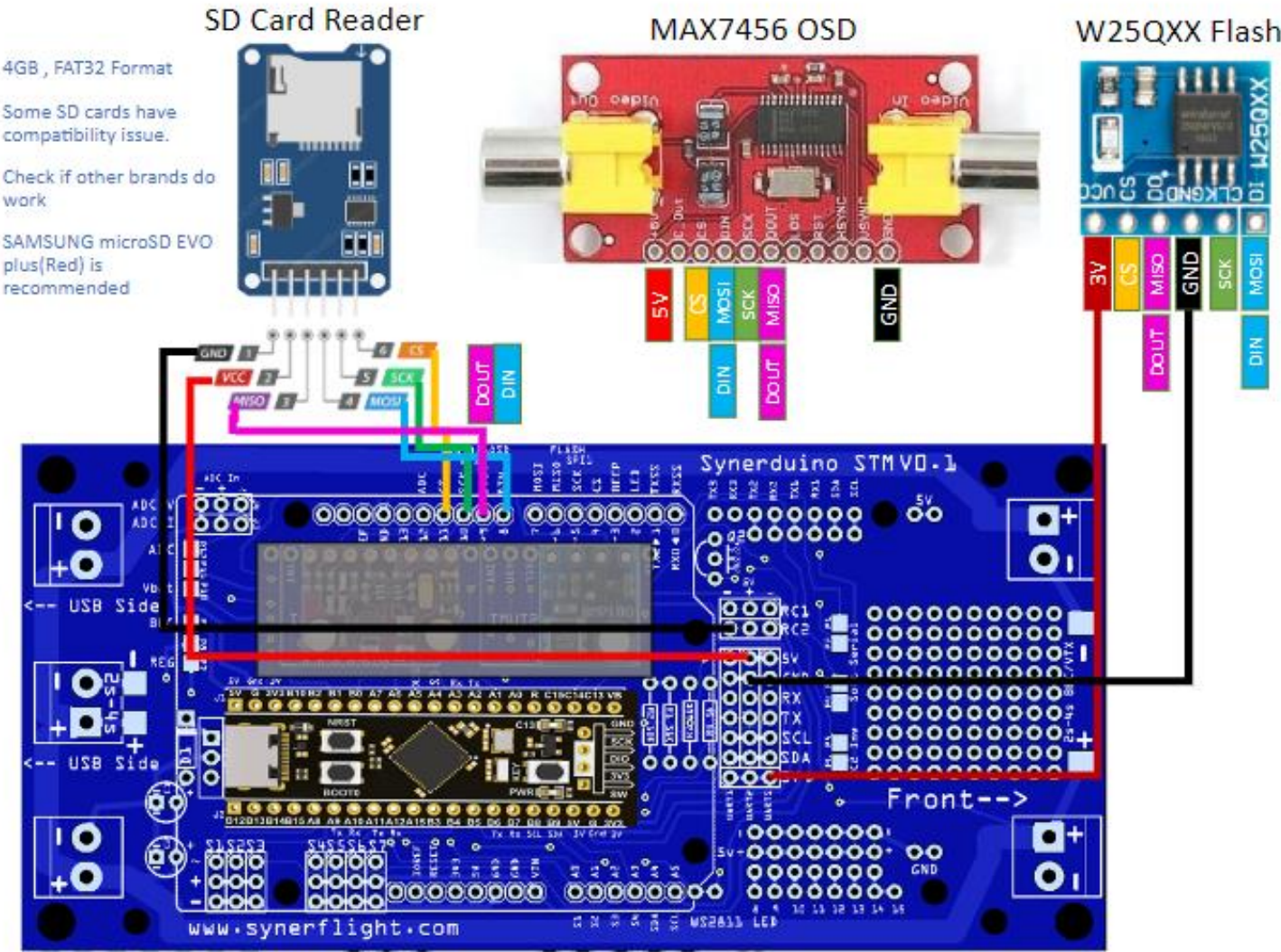
SCK - SCK

Power can be tap into any freely available 3V or 5V pin

SD Card is Active Default for Synerduino STM firmwares:

Synerduino STM.HEX

Synerduino STM VS.HEX



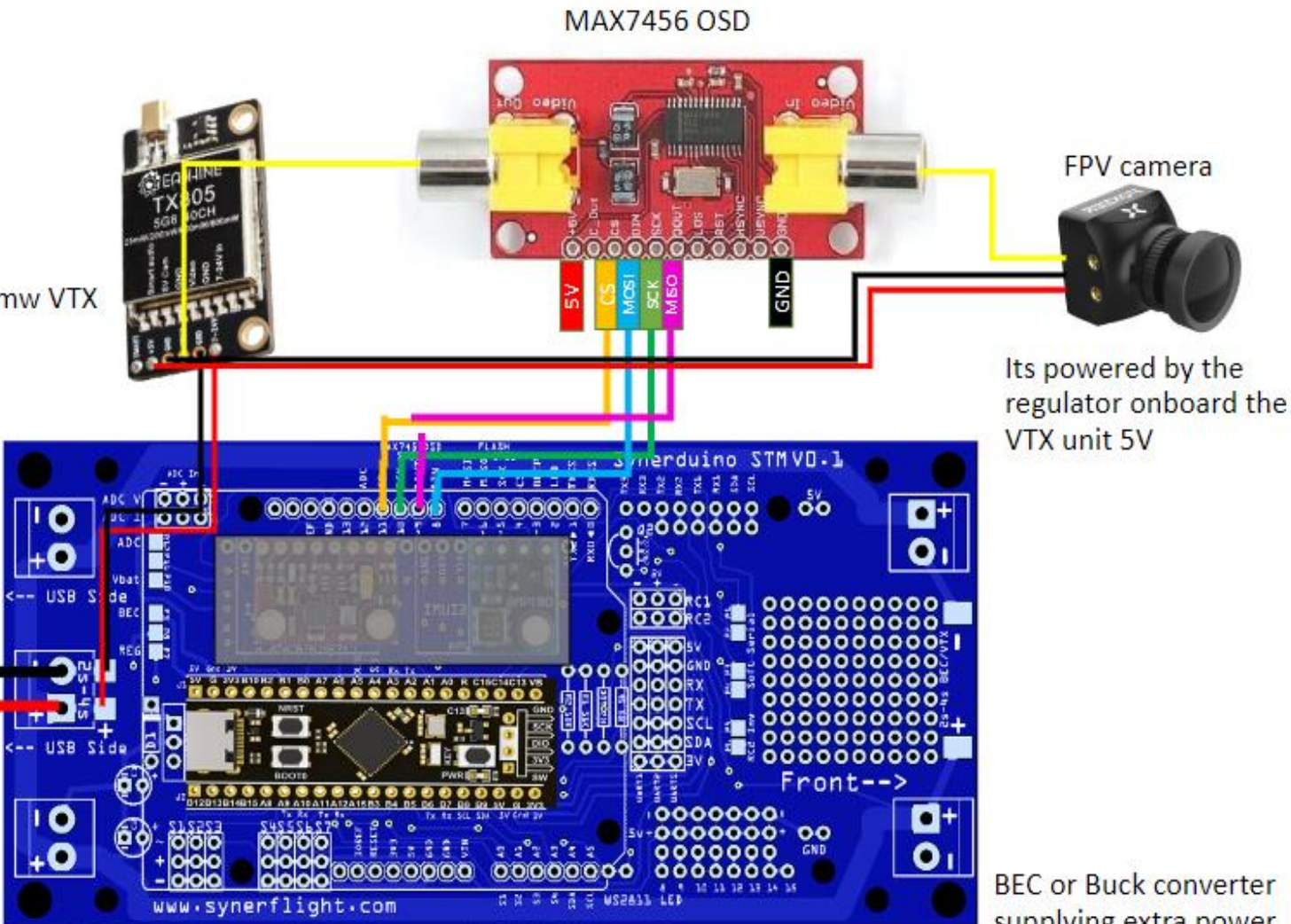
## FPV with SPI OSD

The Telemetry can also use the SPI OSD module

Split VTX camera Setup

600mw to 800mw VTX

Battery 3s or 4s

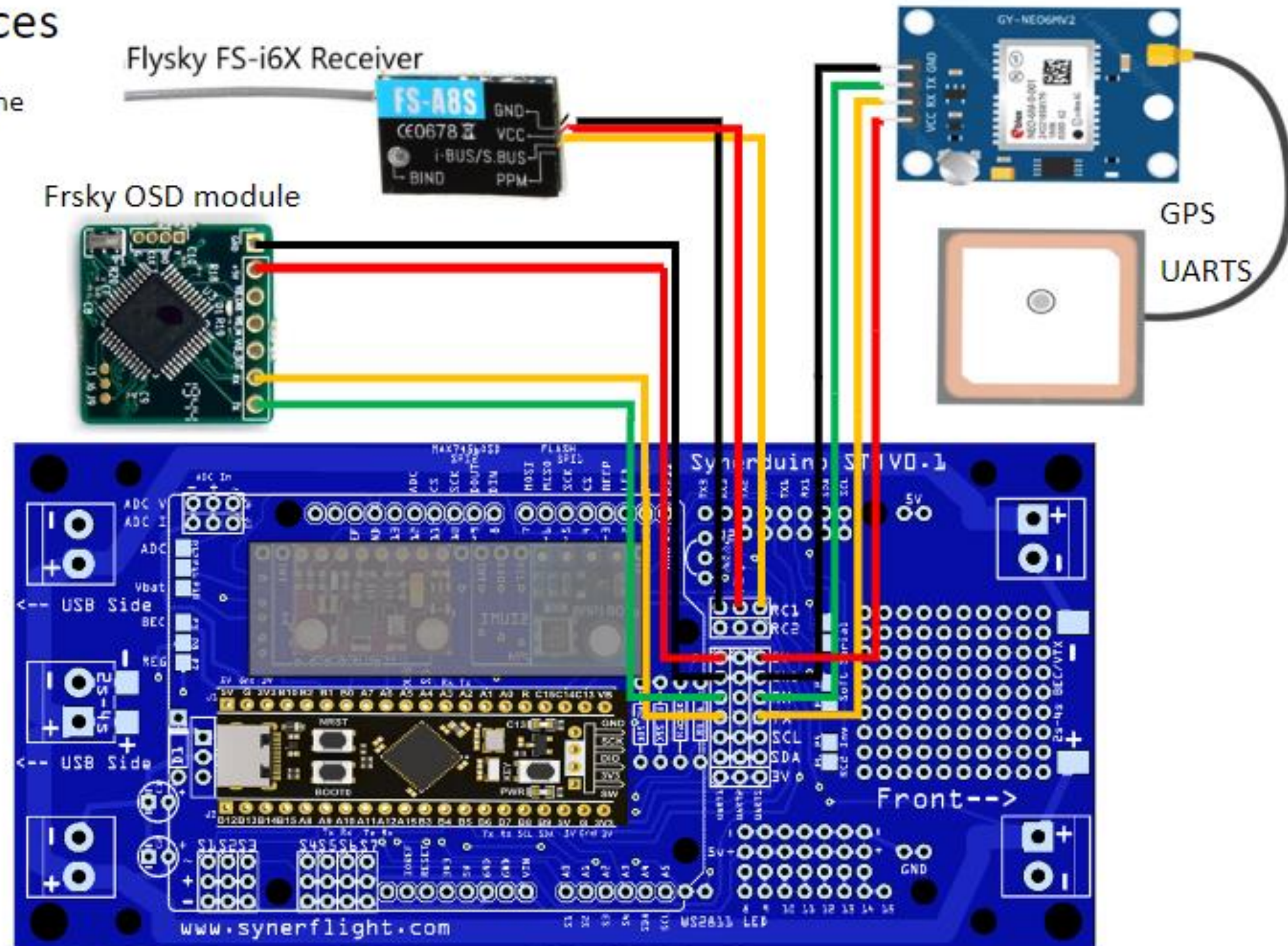




# F411 UART CONNECTIONS

## UART Serial Devices

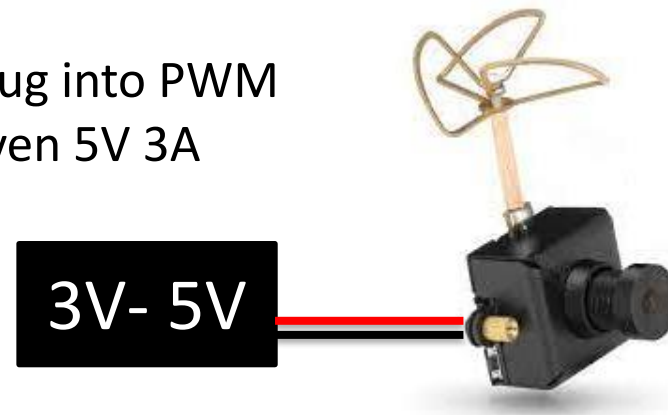
The Telemetry can also use the Serial OSD module





# FPV SETUP

Can be plug into PWM  
power given 5V 3A  
Power



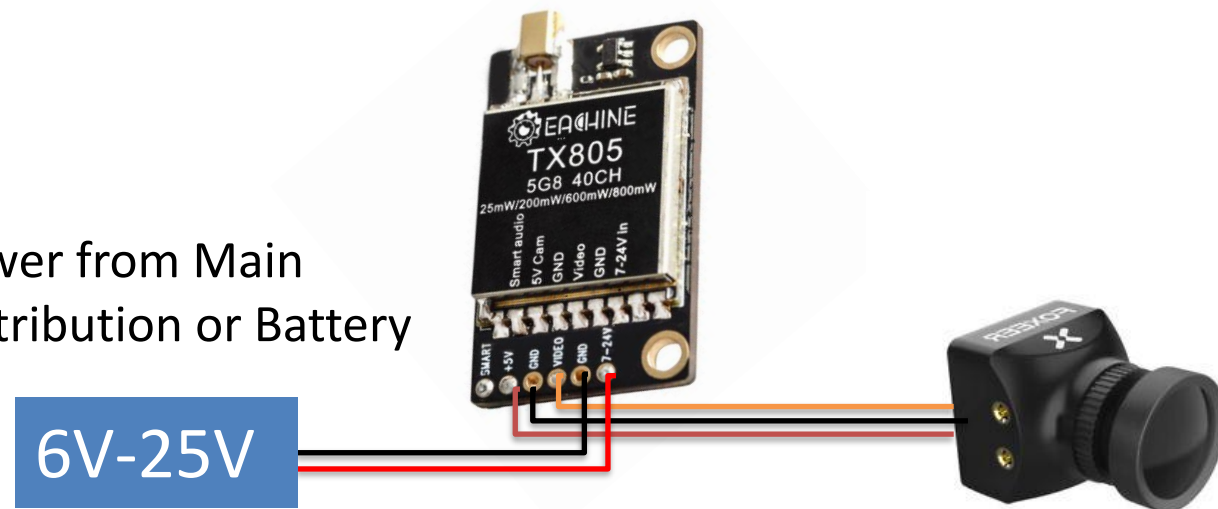
STAND ALONE FPV CAMERA

Power from Main  
Distribution or Battery



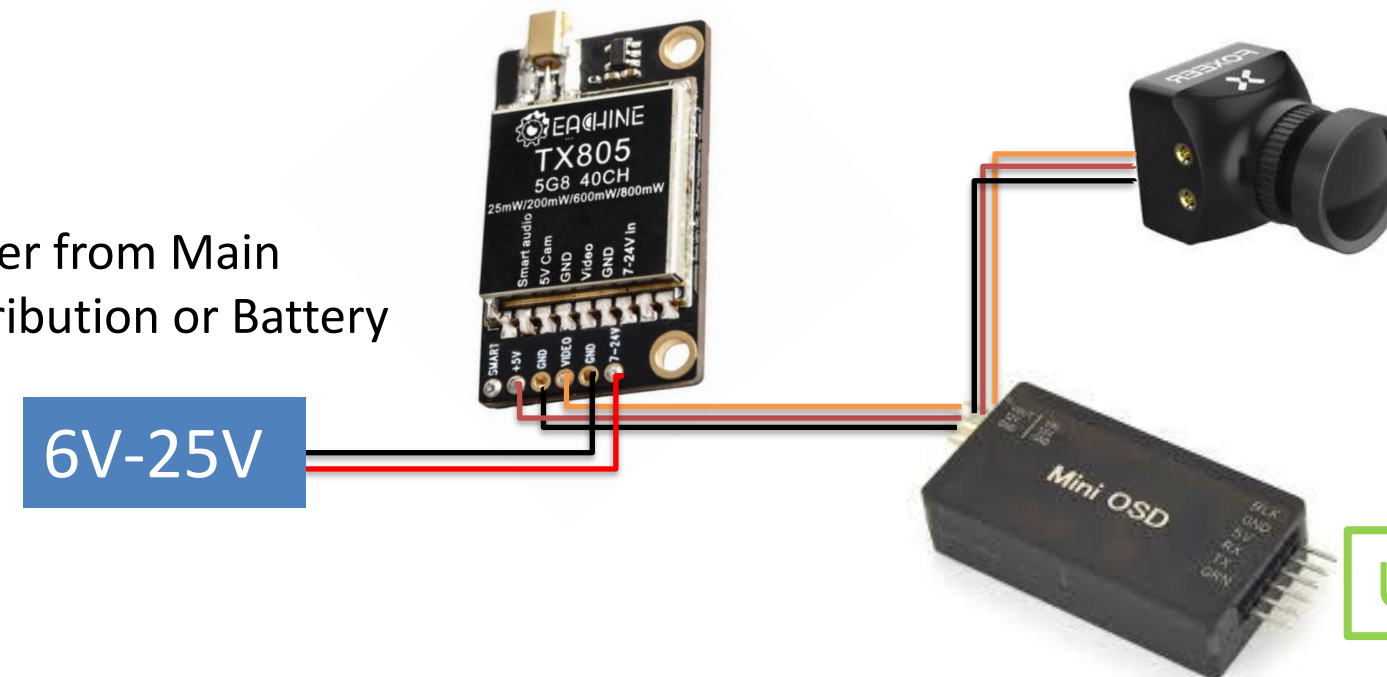
UBEC POWERSOURCE FPV CAMERA

Power from Main  
Distribution or Battery



VTX with UBEC FPV CAMERA

Power from Main  
Distribution or Battery



VTX with UBEC and OSD FPV CAMERA

Ports needed to be configure  
as MSP or Mavlink depending  
on OSD used



UART MSP

UART MAVLINK



# F411 FPV UART SETUP

## FPV with SERIAL OSD

The Telemetry can also use the Serial OSD module



Power Pads is selected to BEC to use external BEC

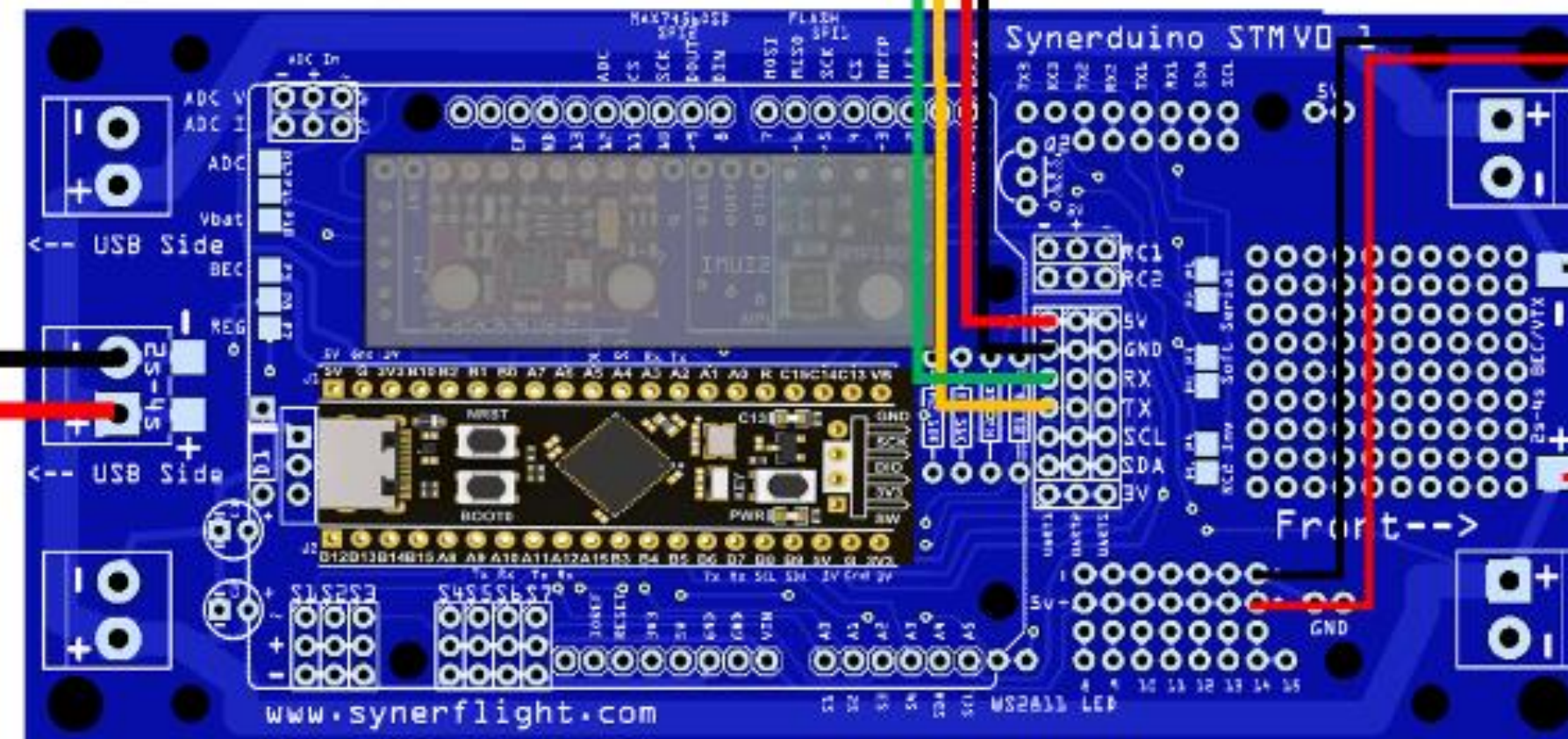
Battery 3s or 4s

UART 1 needs to be configure in Ports to OSD flysky serial

Frsky OSD module



FPV camera 25mw Standalone



BEC or Buck converter supplying extra power

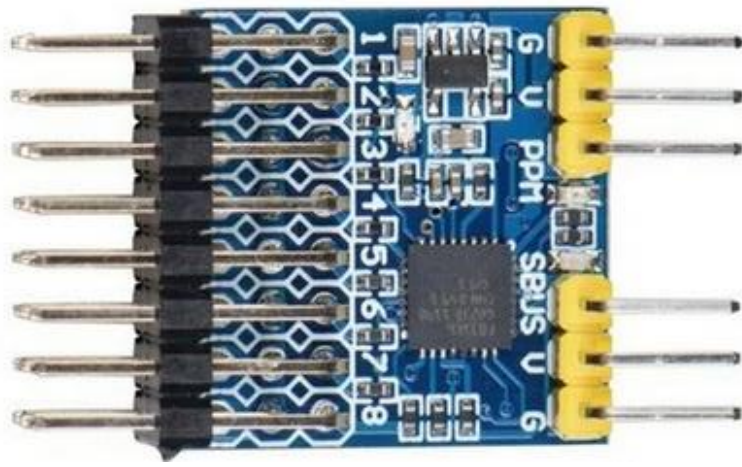


# F405 FPV UART SETUP



# Mavlink OSD module

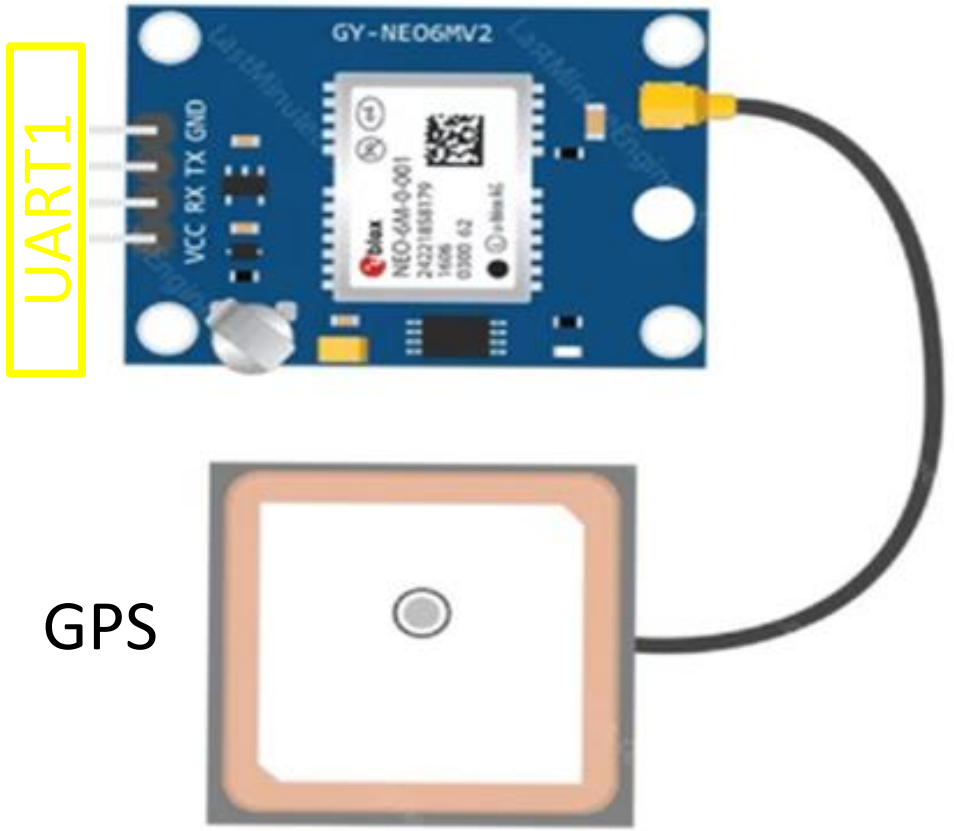
# Frsky OSD module



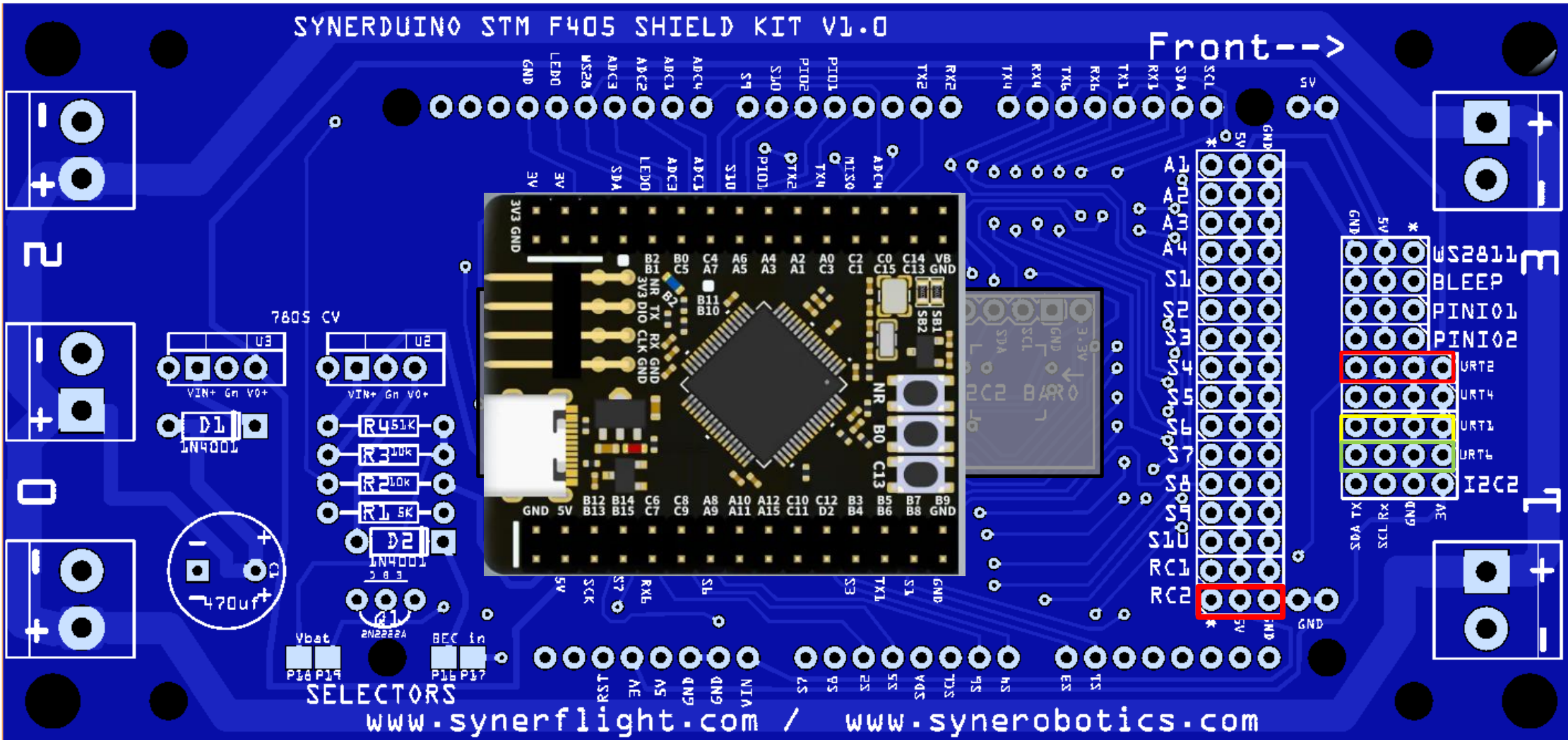
RC2



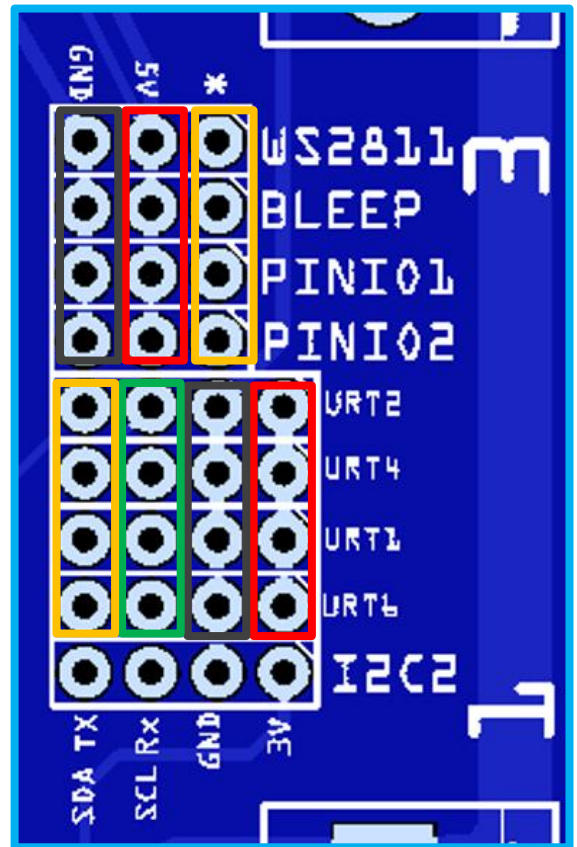
UART6



# GPS



V+ Gn Dat



TX RX Gn V+

## Check connection Polarity

# STMF405

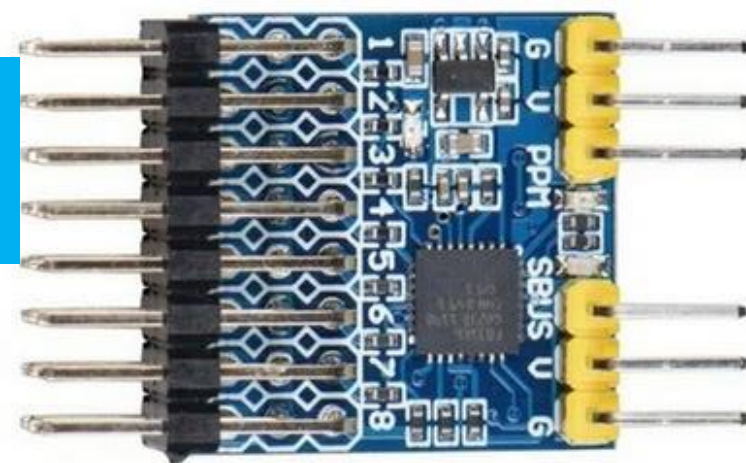


# H743 FPV UART SETUP

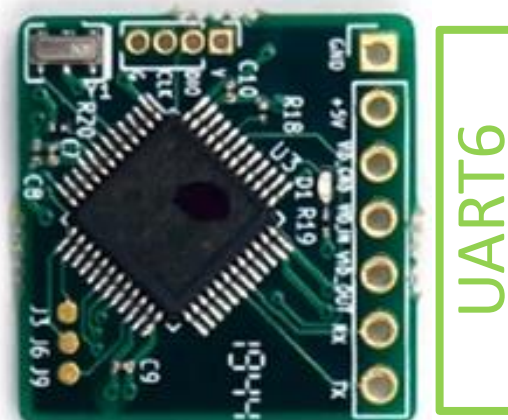


Mavlink OSD module

Frsky OSD module



RC2

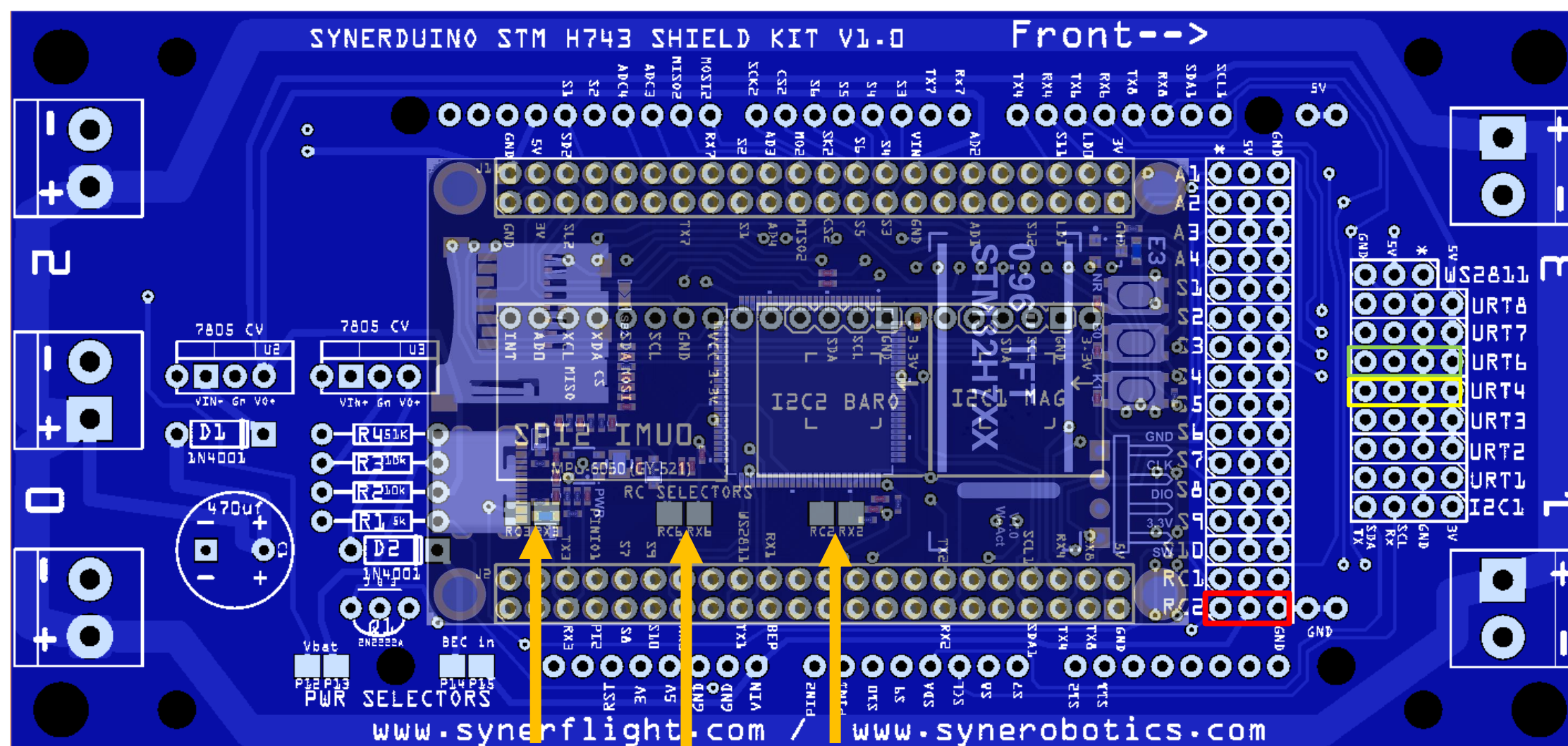
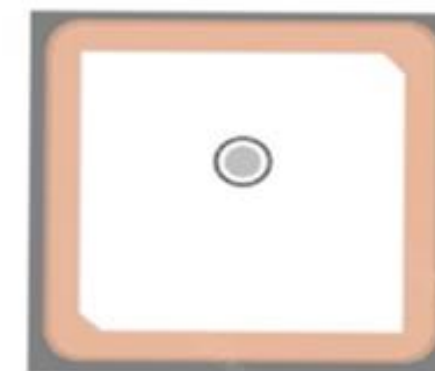


UART6

UART1

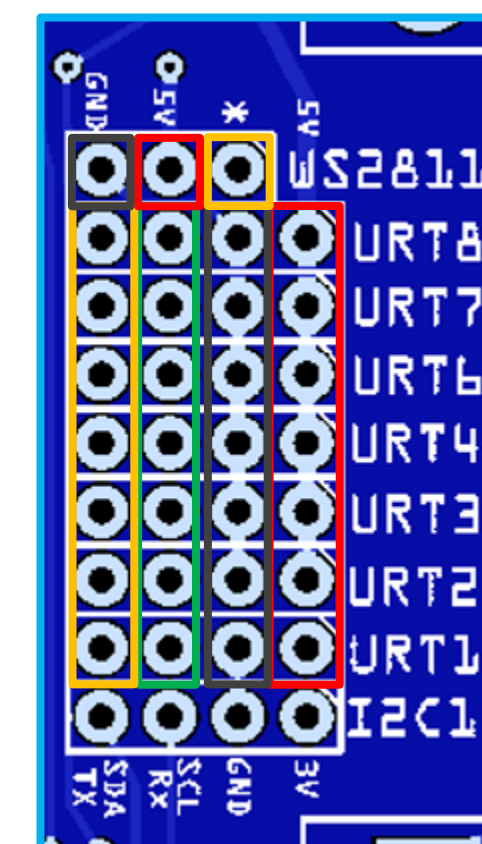


GPS



STMH743

V+ Gn Dat



TX RX Gn V+

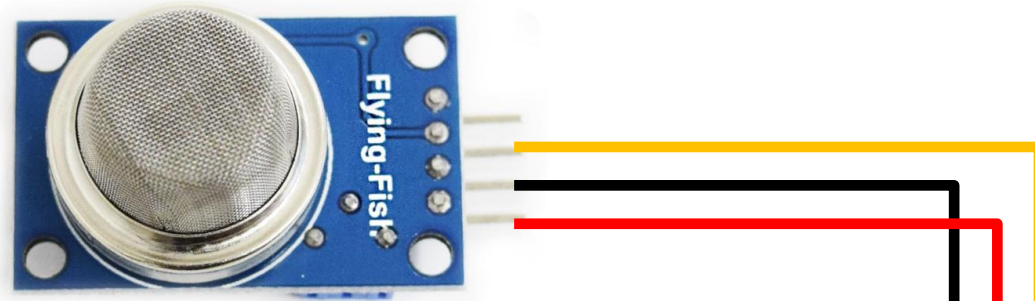
Check connection Polarity

RC UART selector you have 3 option where your RC receiver can be connected

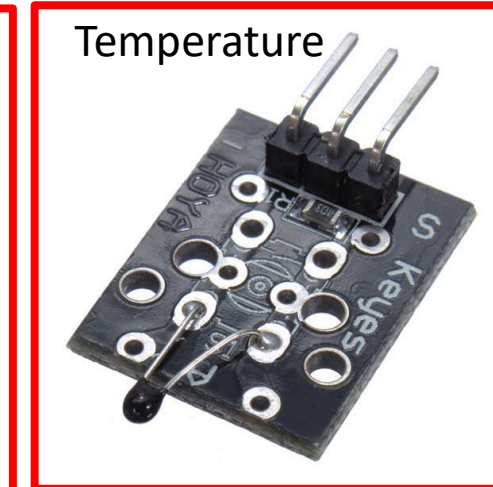


# F411 ADC SENSOR

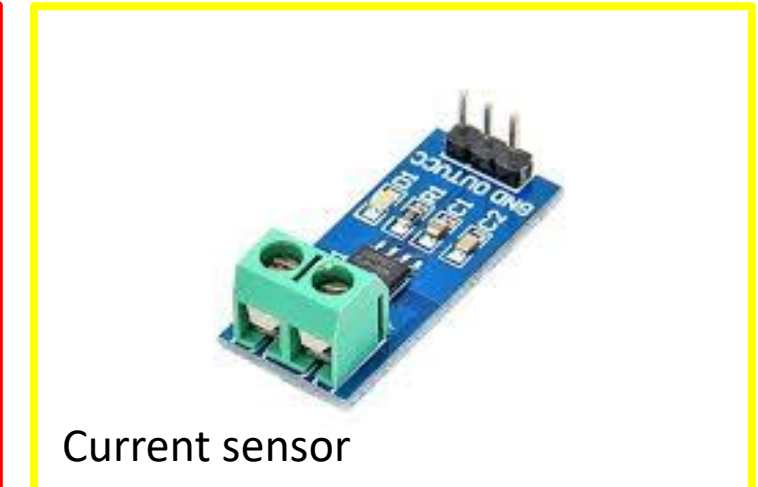
ADC External Sensor



MQ Gas sensor



Temperature

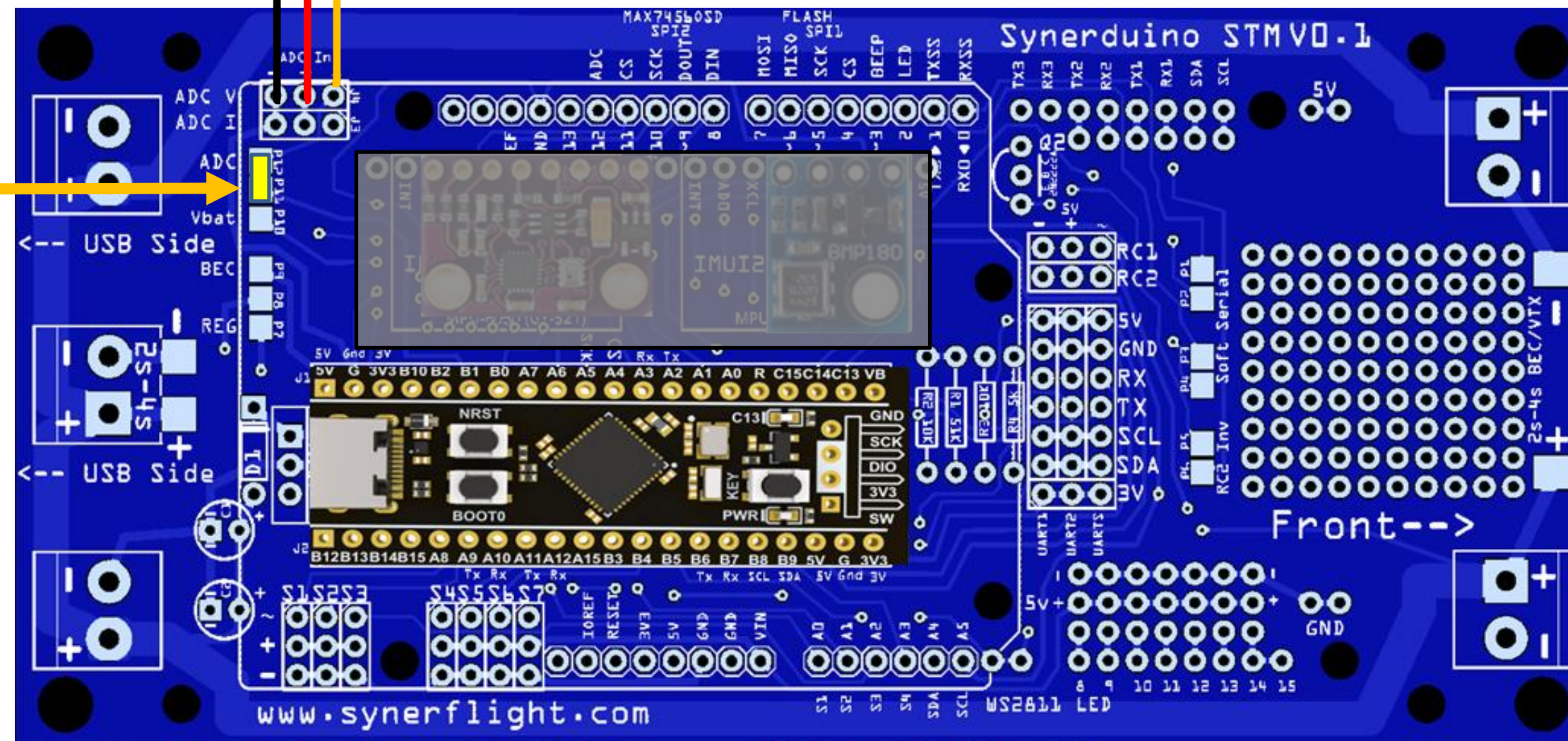


Current sensor

Here you can switch to  
ADC sensor input or  
VBAT for Battery  
monitoring

ADC V – Voltage 0-5V

ADC I – Current 0-5V





# F405 ADC SENSOR

Here you can switch to ADC sensor input or VBAT for Battery monitoring

A1 ADC V – Voltage 0-5V

A2 ADC I – Current 0-5V

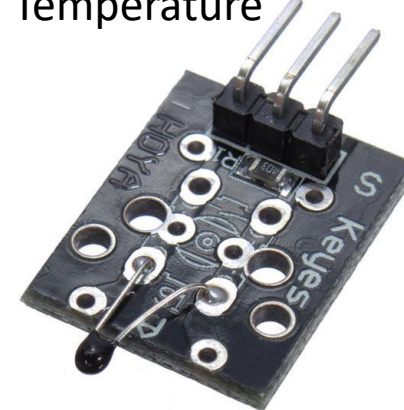
A3 ADC T – RSSI 0-5V

A4 ADC A – AIRSPEED 0-5V

PH sensor



Temperature



MQ Gas sensor



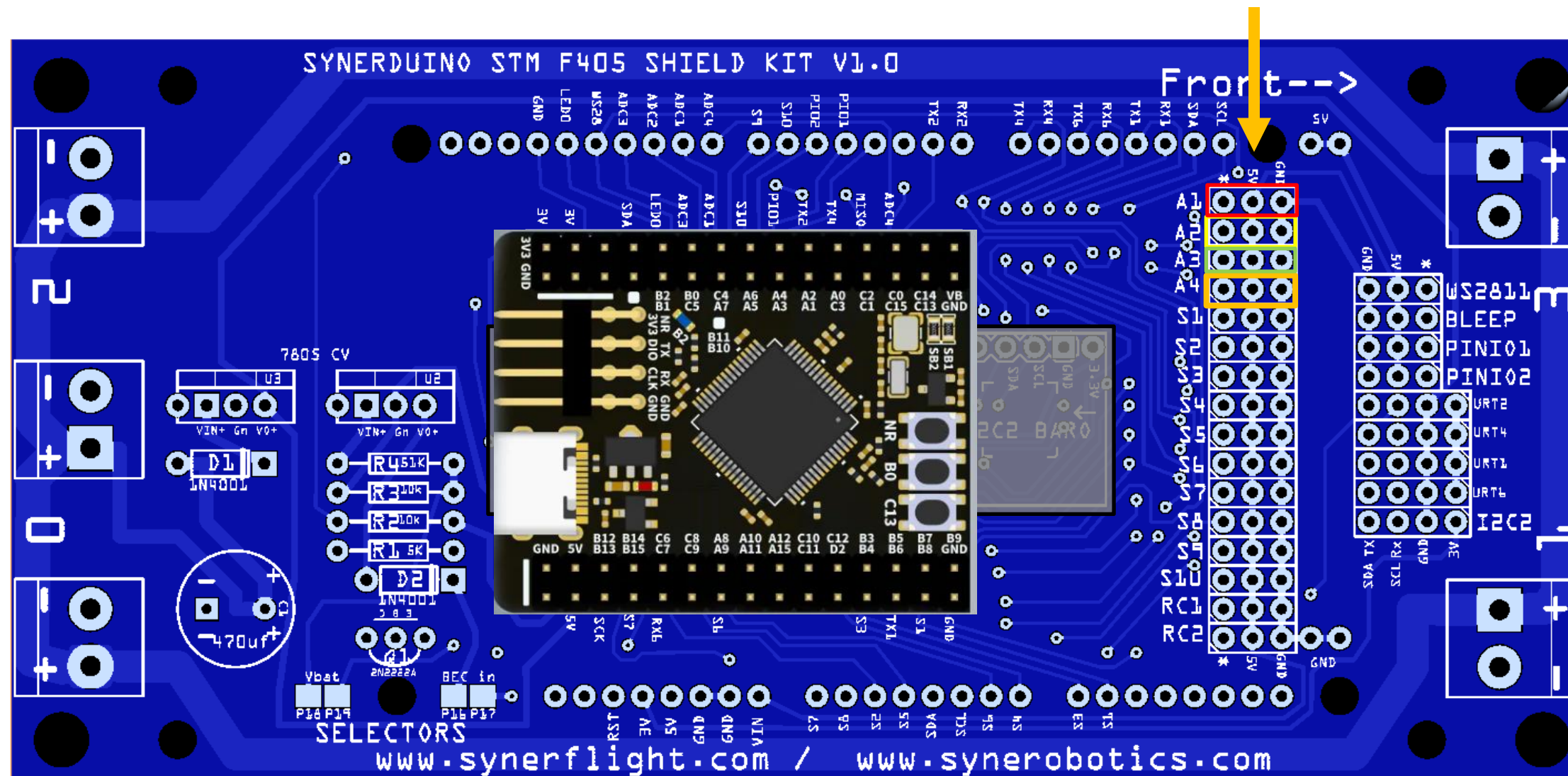
ASPD 7002 Analog Airspeed



PWM to Analog RSSI



Current sensor



STMF405



# H743 ADC SENSOR

Here you can switch to ADC sensor input or VBAT for Battery monitoring

A1 ADC V – Voltage 0-5V

A2 ADC I – Current 0-5V

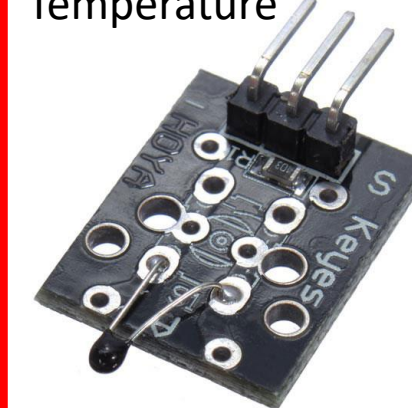
A3 ADC T – RSSI 0-5V

A4 ADC A – AIRSPEED 0-5V

PH sensor



Temperature



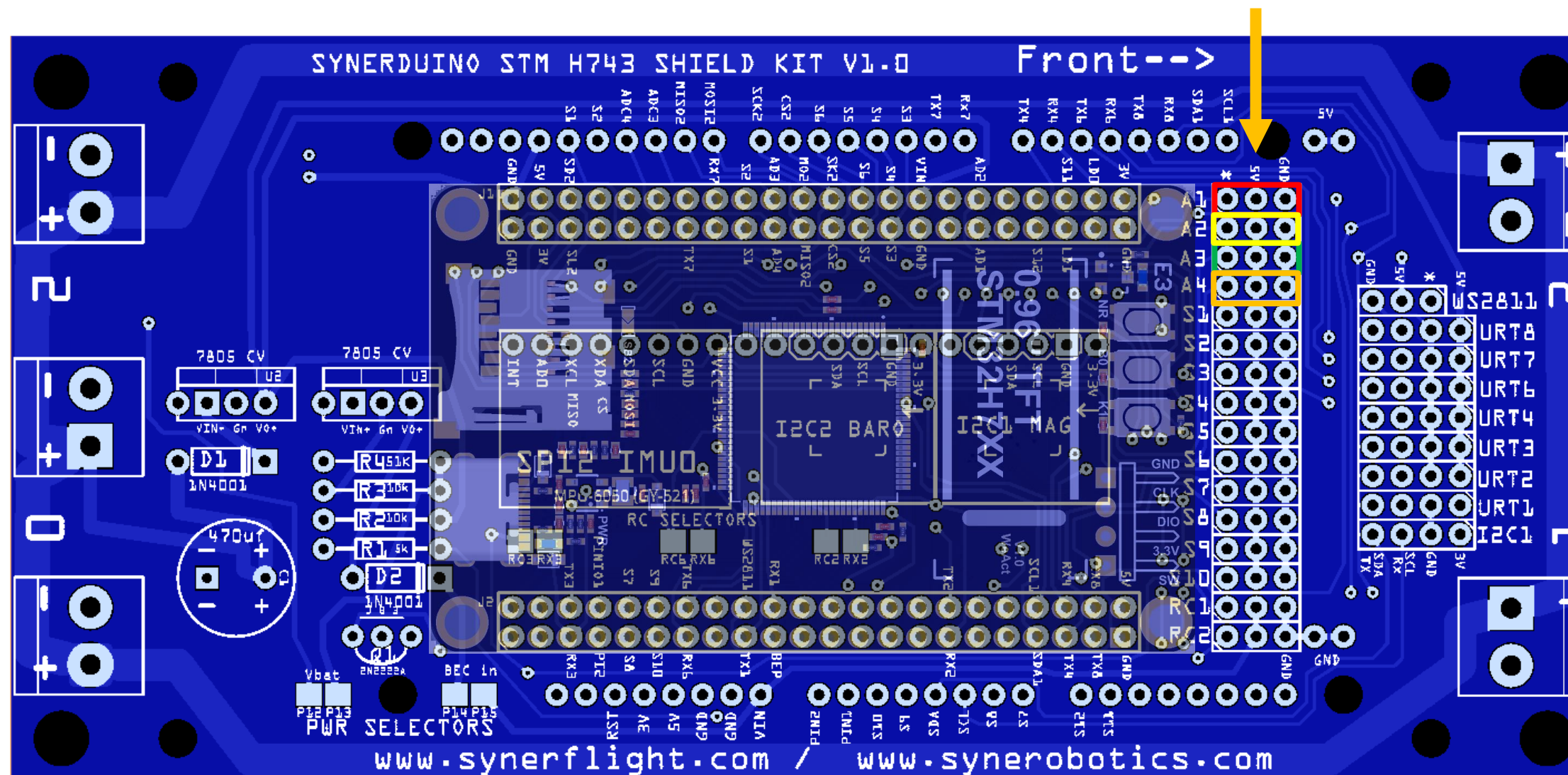
MQ Gas sensor



PWM to Analog RSSI



Current sensor

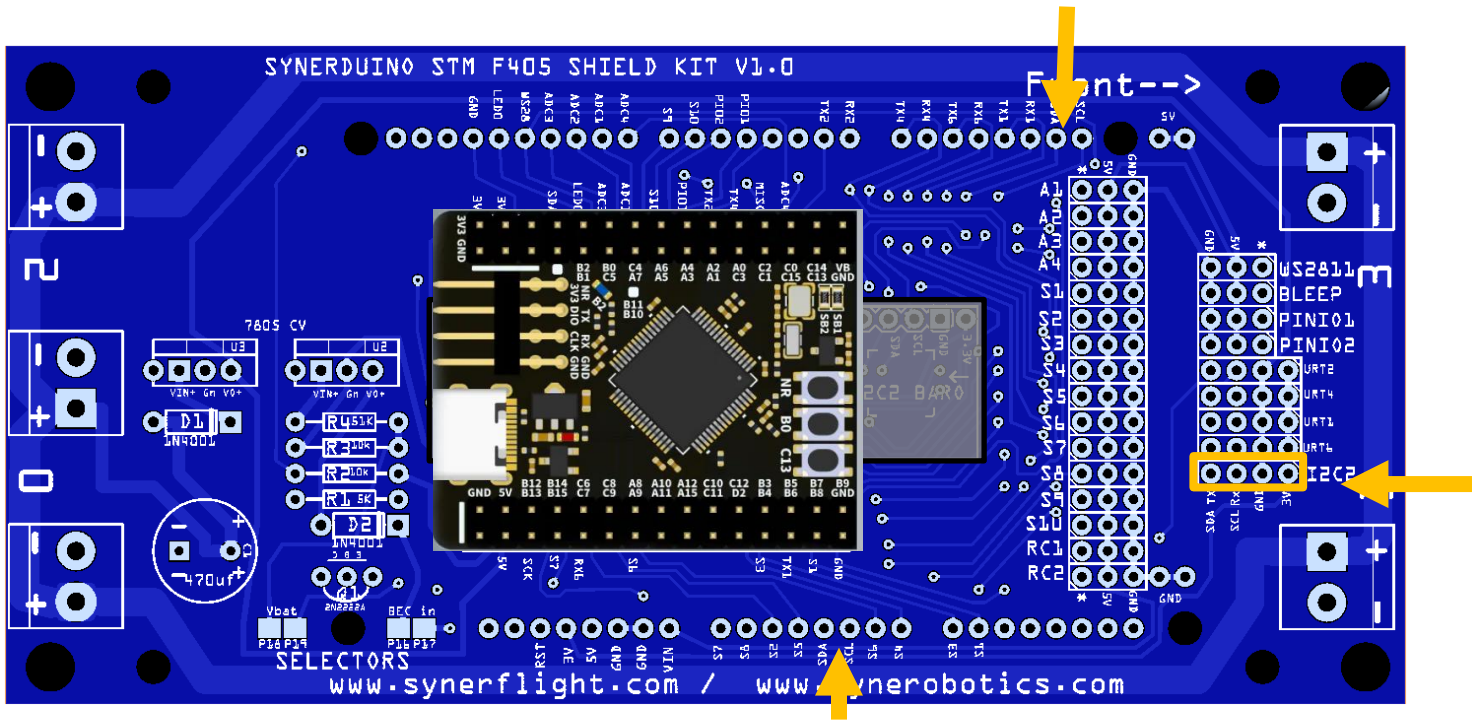
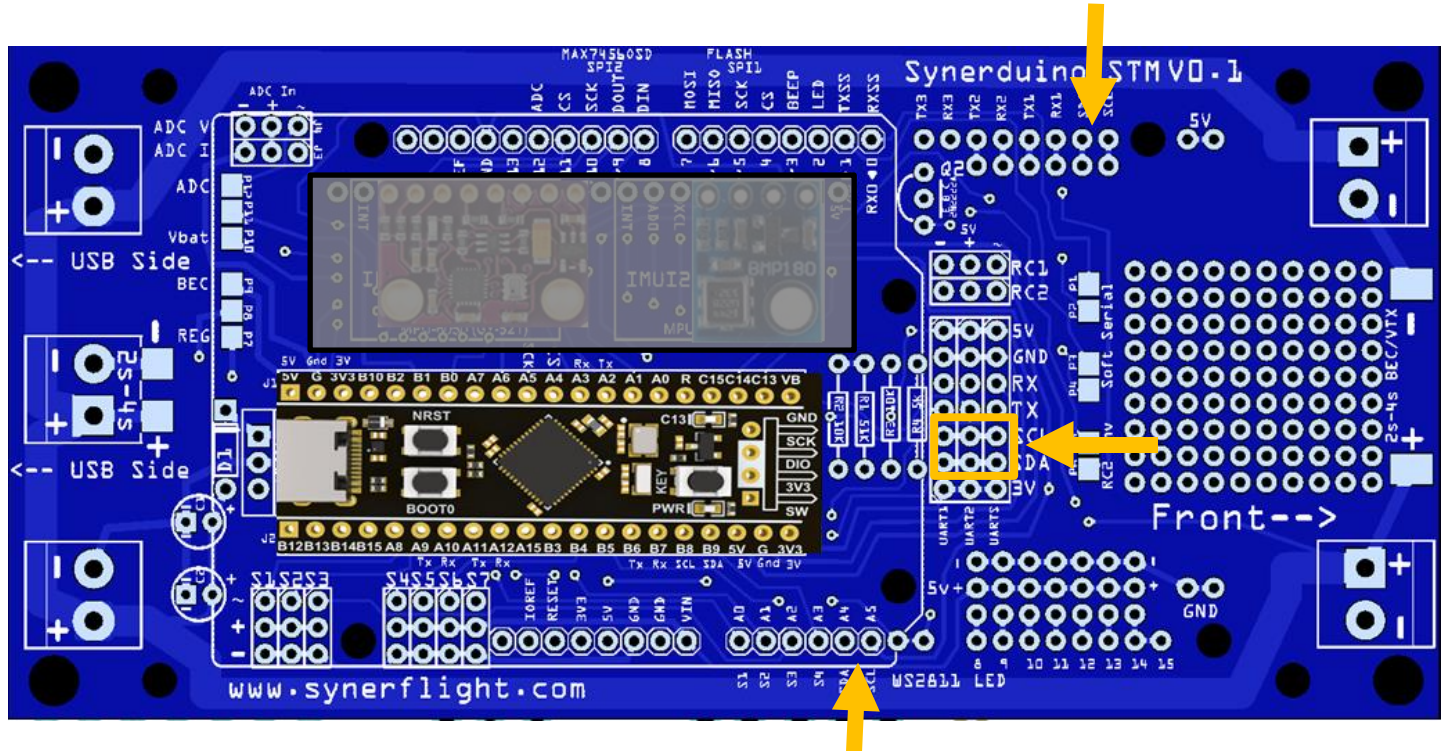


STMH743



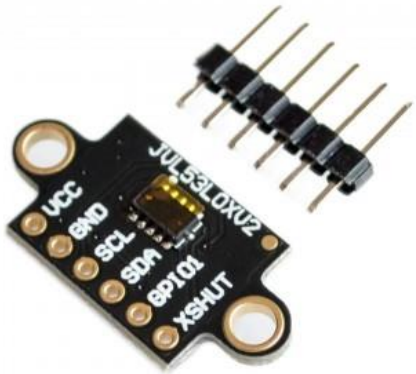
# I2C SENSORS

I2C digital sensors expansion allows you to add a host of external sensors to the current board via i2C pin (SLC SDA)



## Range Finder

- VL53L0X
- VL53L1X
- TOF10120



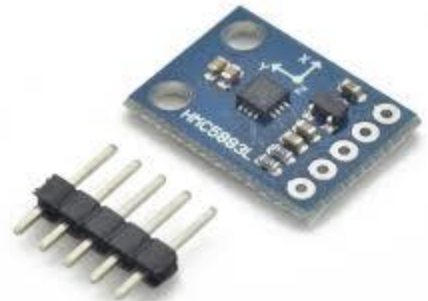
## Airspeed sensor

- MS4525
- ASPD-DLVR L10D



## Magnetometer

- HMC5883
- QMC5883
- IST8310
- MAG3110
- LIS3MDL
- MPU9250





# F411 LED WS2811

## LED Devices

### These are optional addons

Serves as Status indicator or put up a heck of a light show

WS2811 or WS2812

DATA

5V

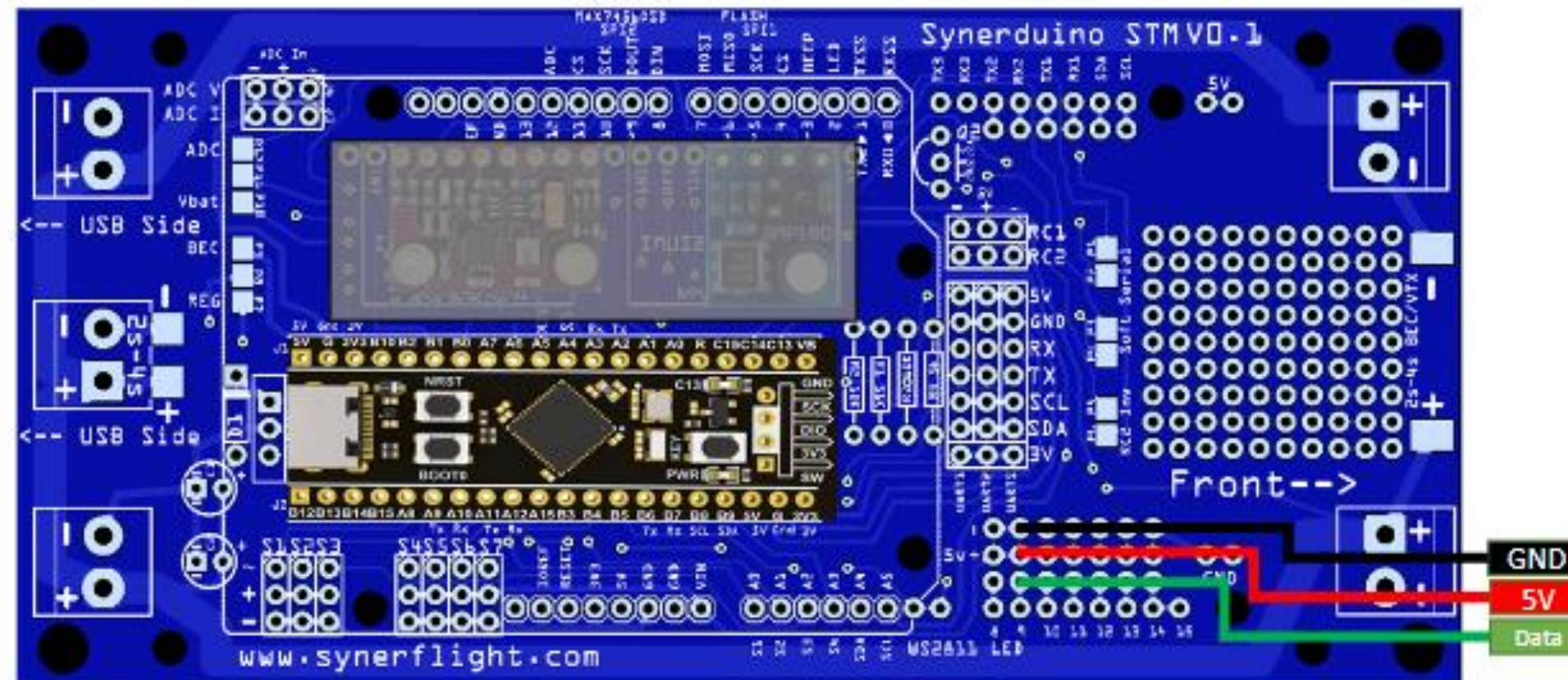
GND

WS2811 LED allows you to add upto 32 LED strip or 5x5 Led Matrix

Accessible on Pin 8 & 9

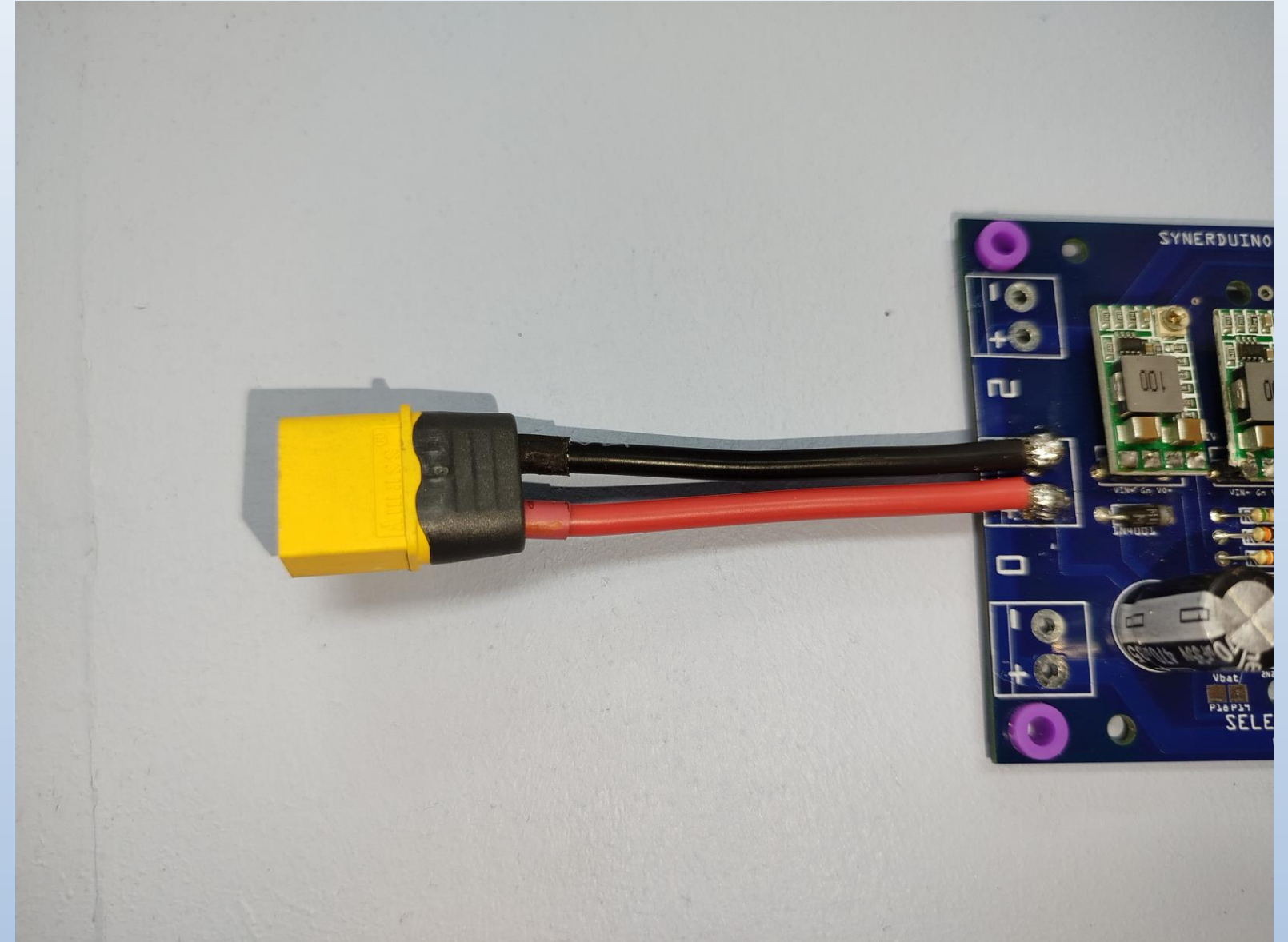
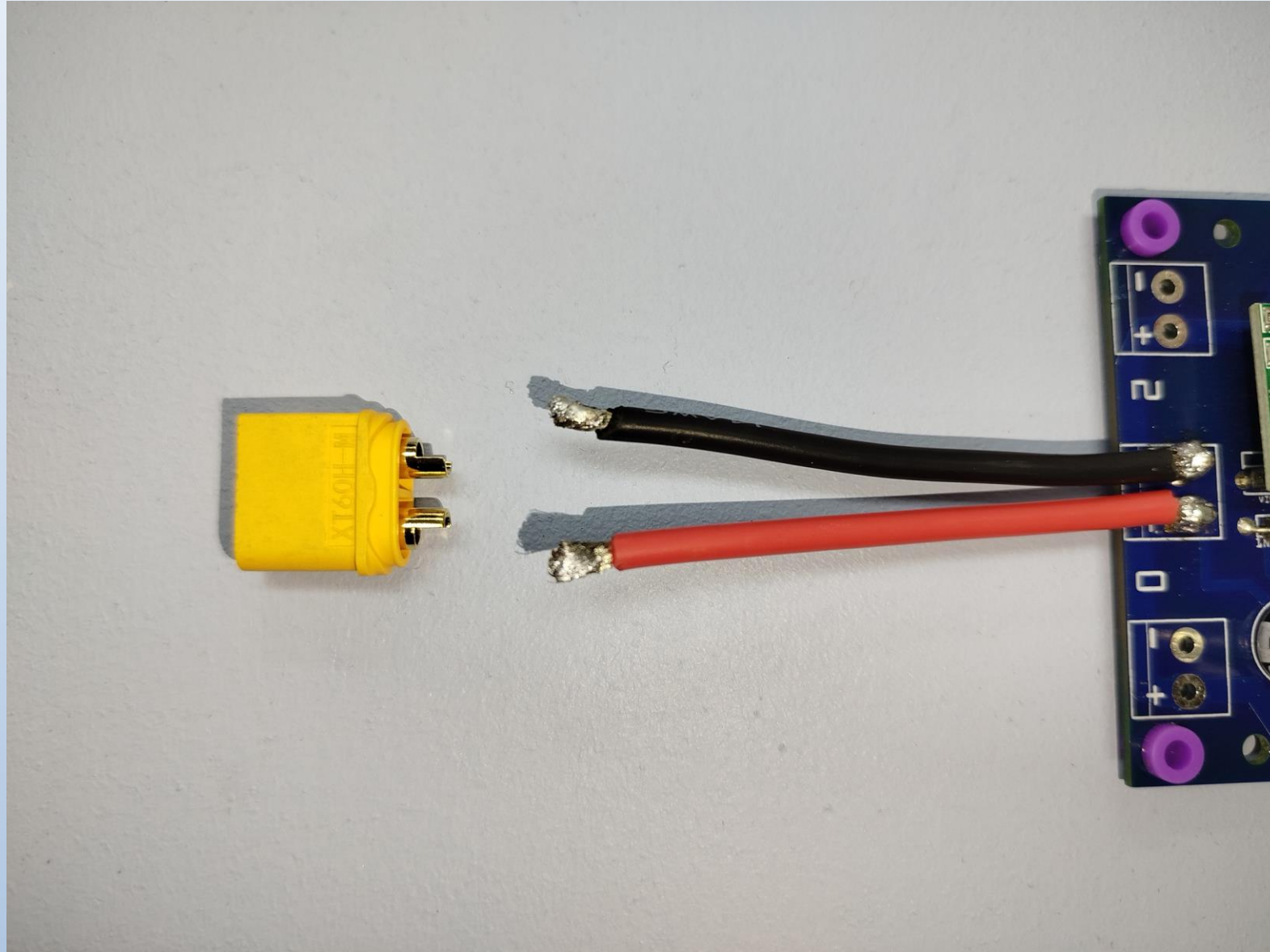
This also requires 3 Timers

When activated only 5 PWM pins can be use for Motor/Servo



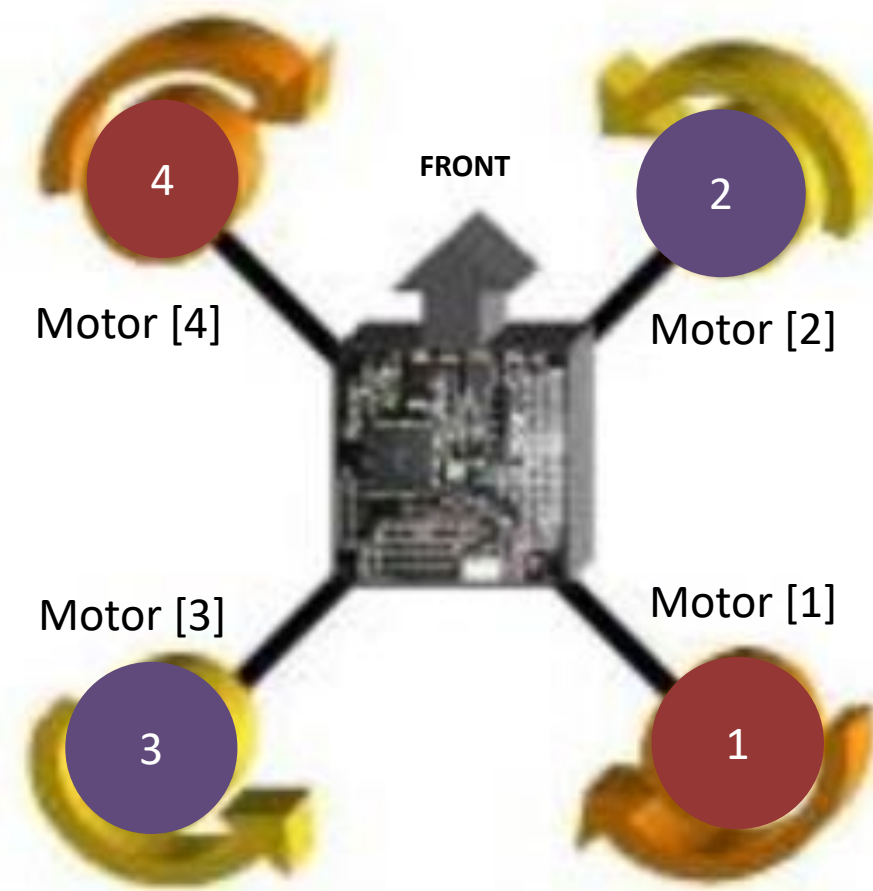


# POWER



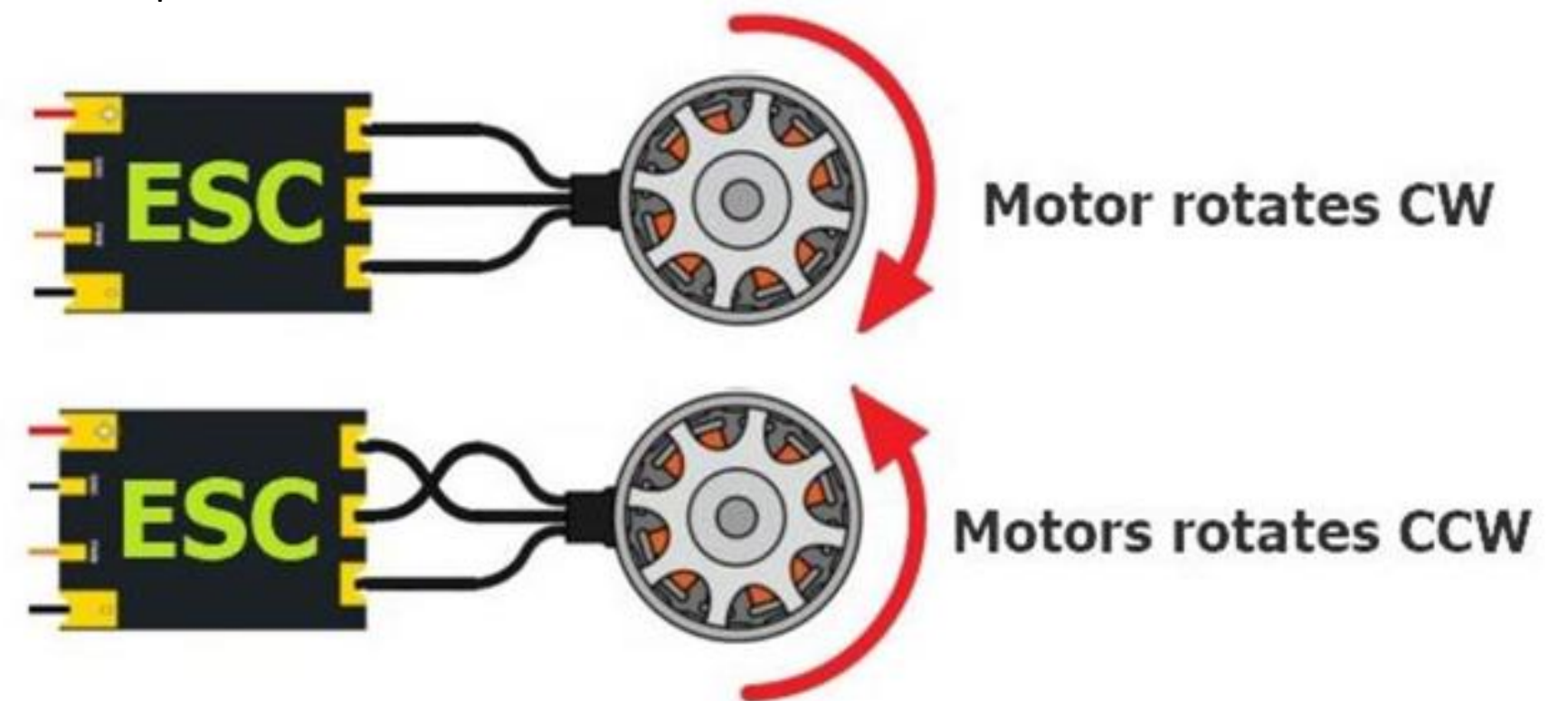


# MOTOR, ESC, & PROPELLER INSTALLATION



Note : you can pre solder the motor to the board and check for rotation before installing the propeller to ensure all motor rotations are correct

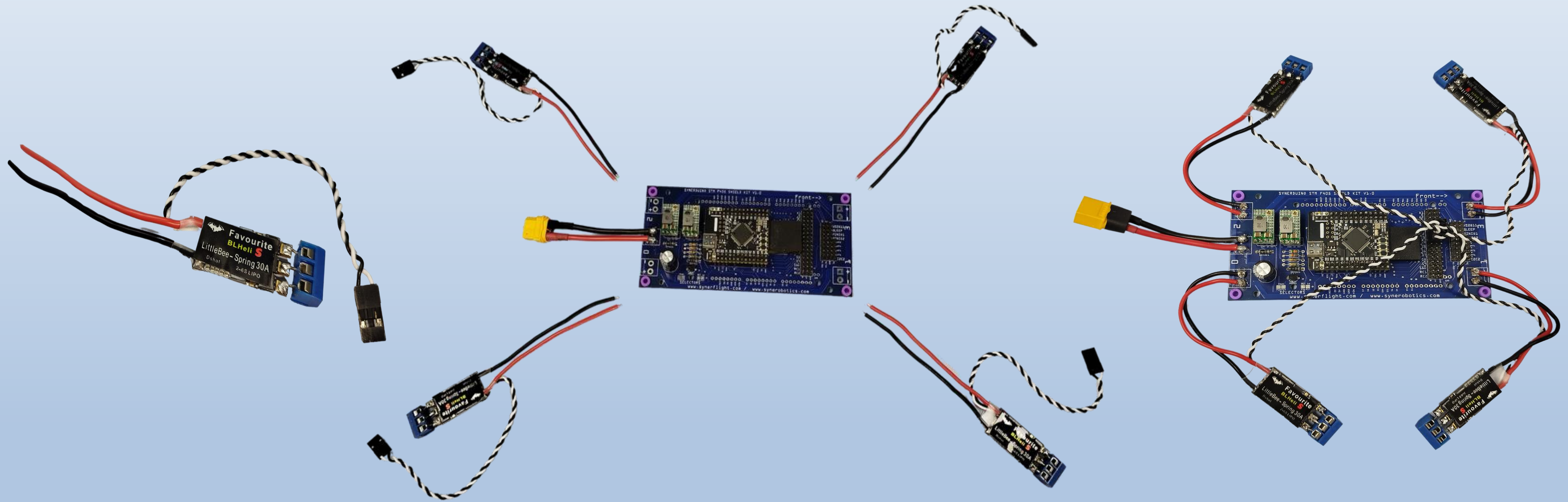
Electronic Speed Controller



Note : on some brands of motor they may come in two different prop nuts color (Known as self tightening nuts)

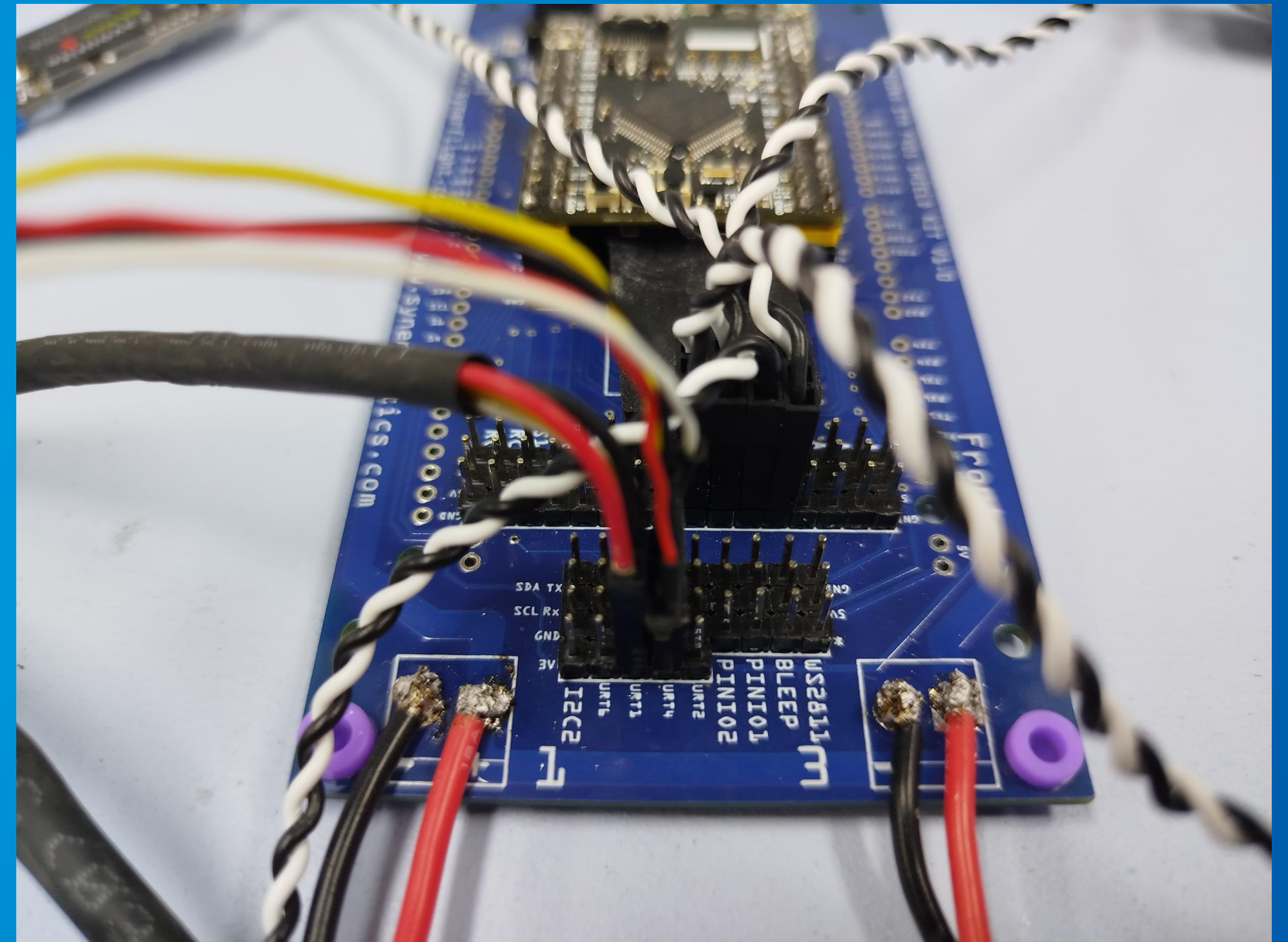
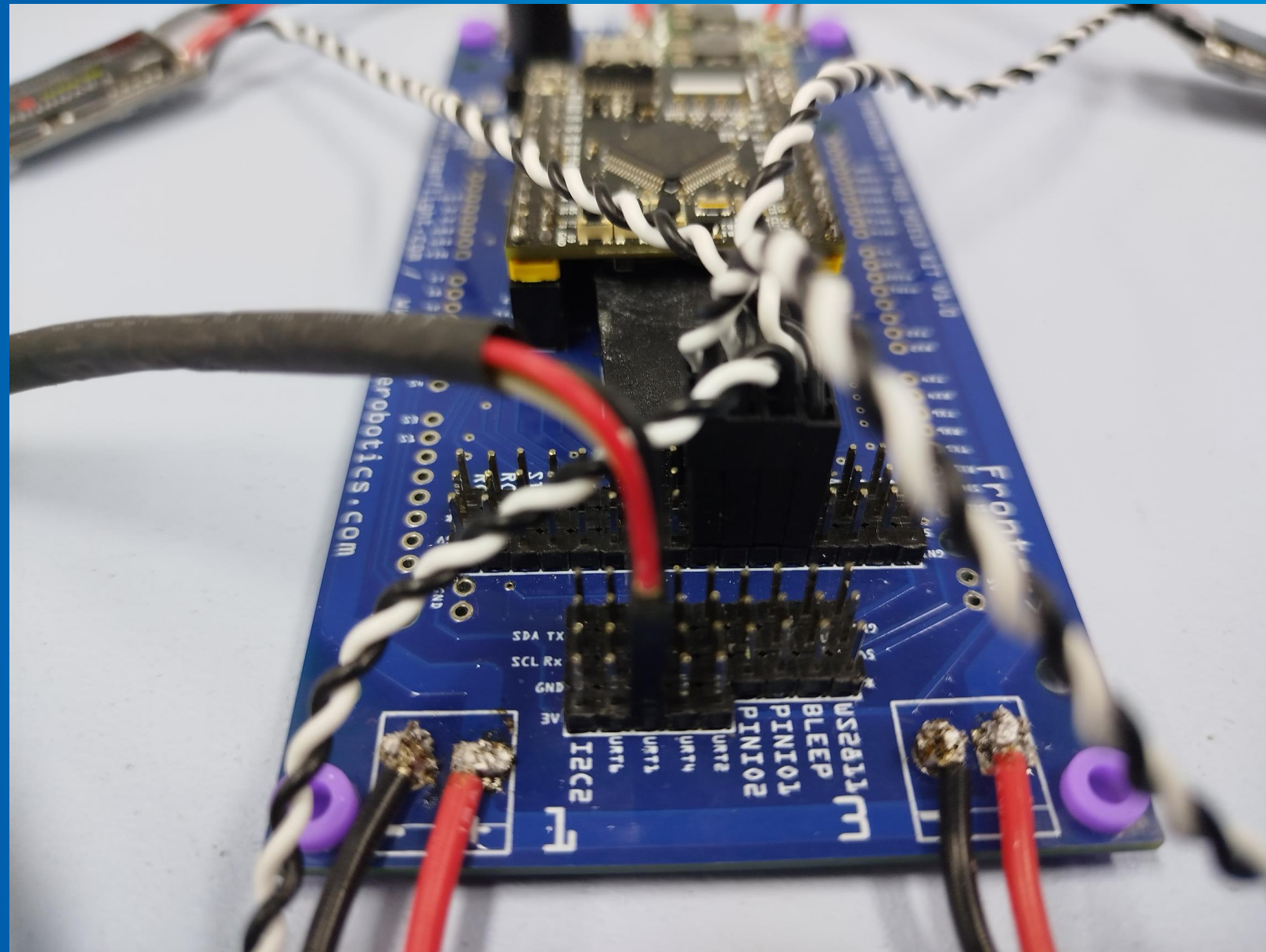


# ESC INSTALLATION



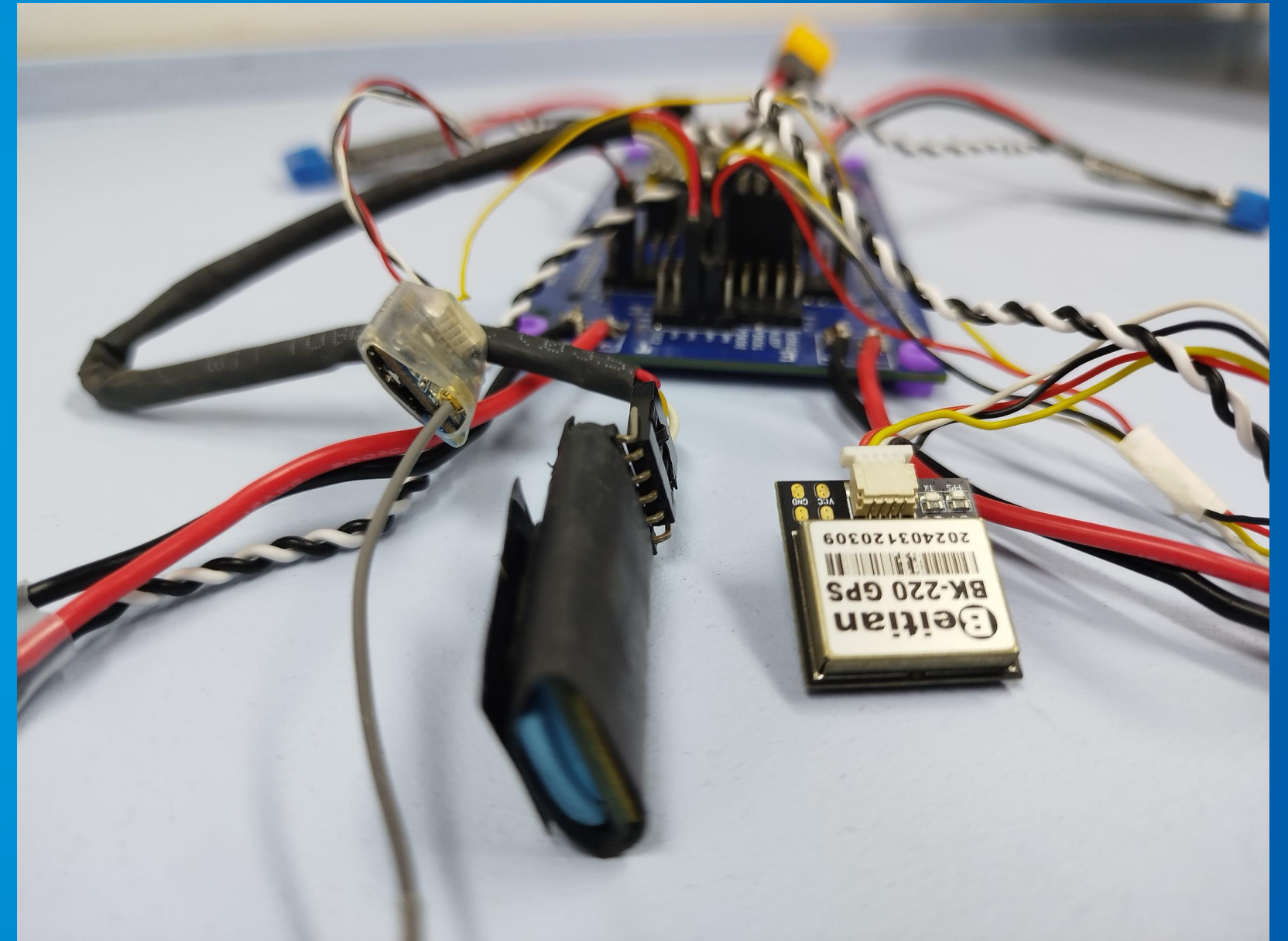
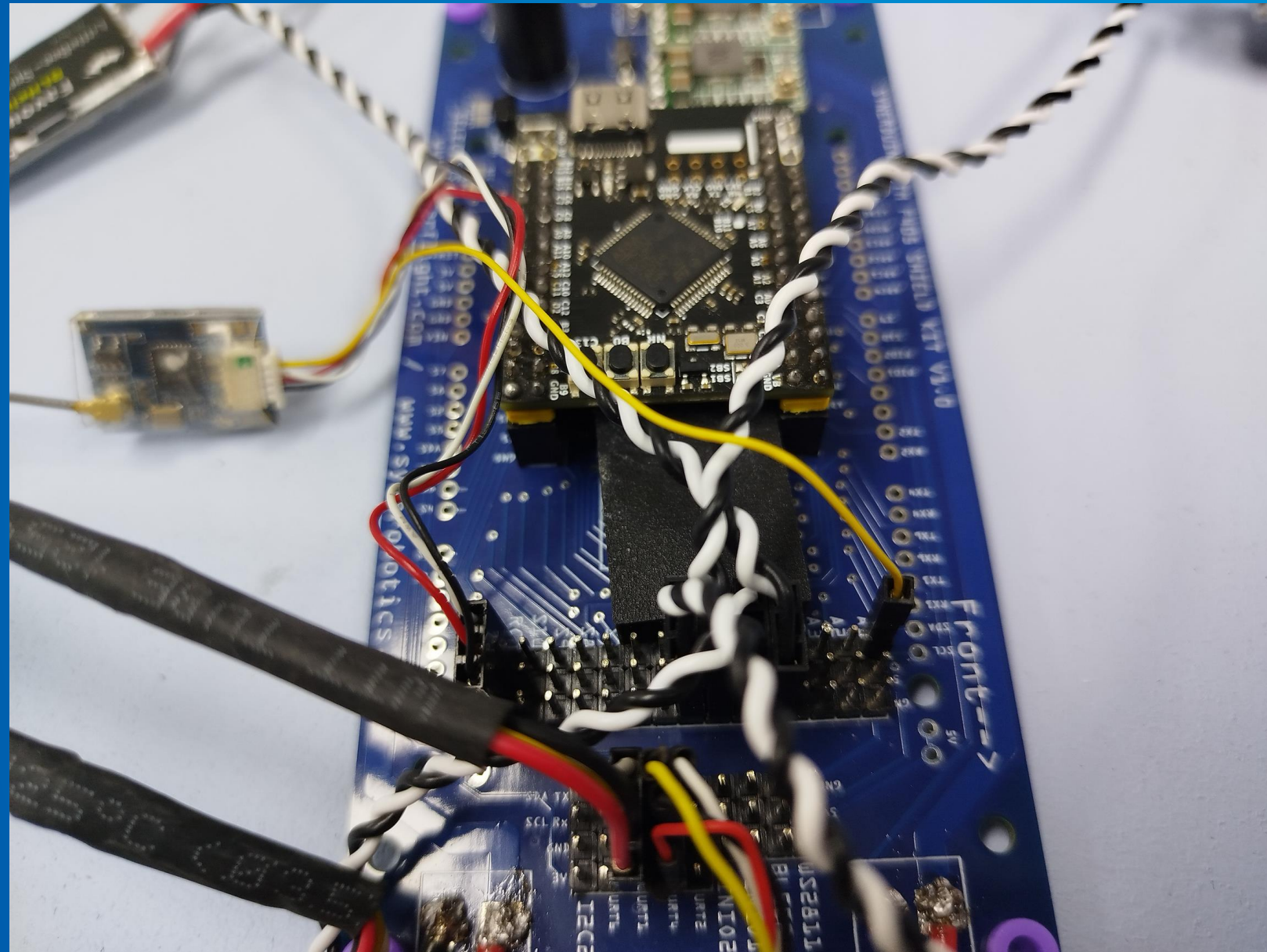


# ASSEMBLY





# ASSEMBLY





# MOTOR, INSTALLATION



Motor is Held in by 4pcs of M3 6mm Bolts and Washer set (be aware the bolt clears the motor's coil)

Bolt thread Must thread lock before installation to ensure it stay on

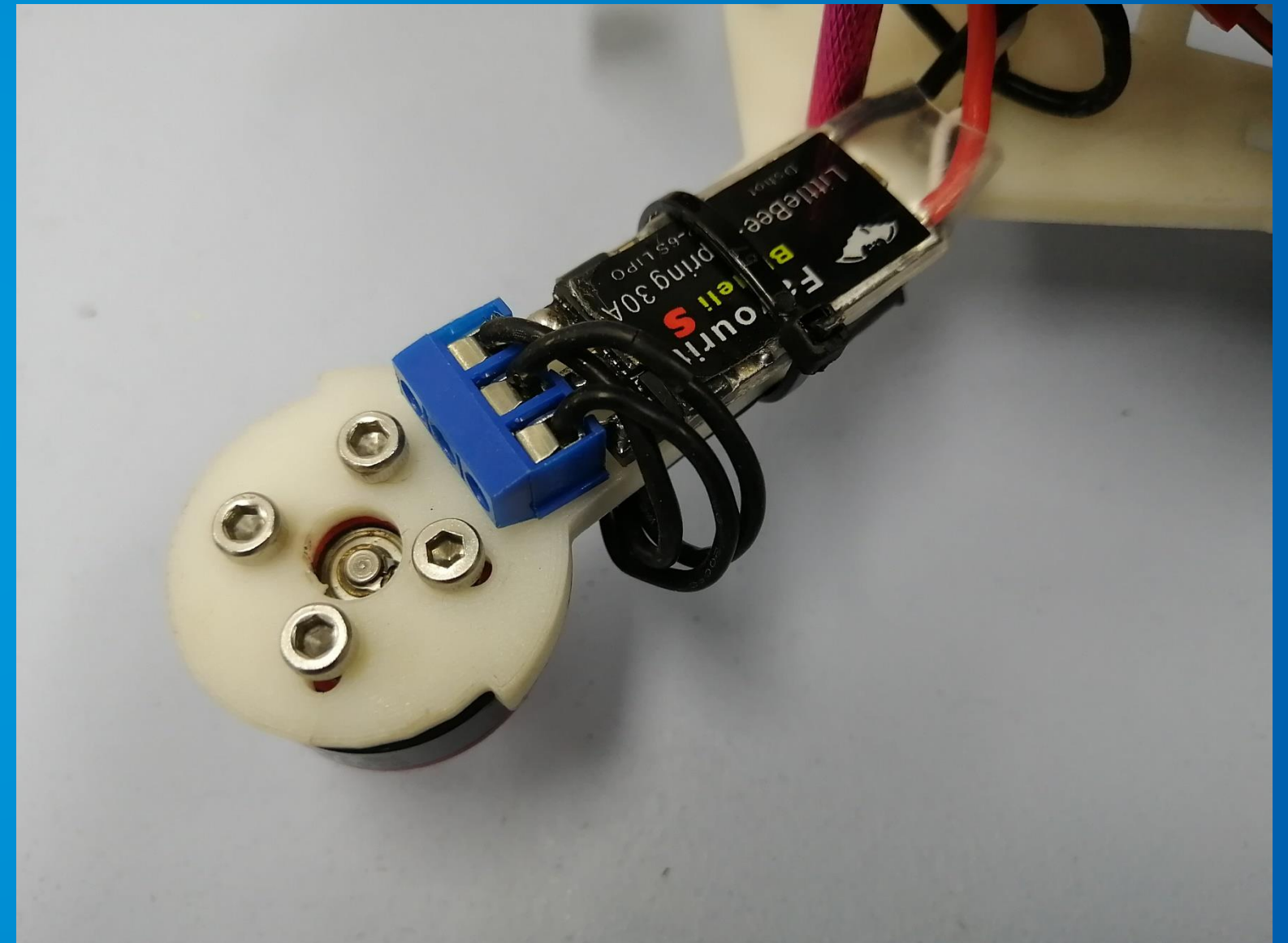
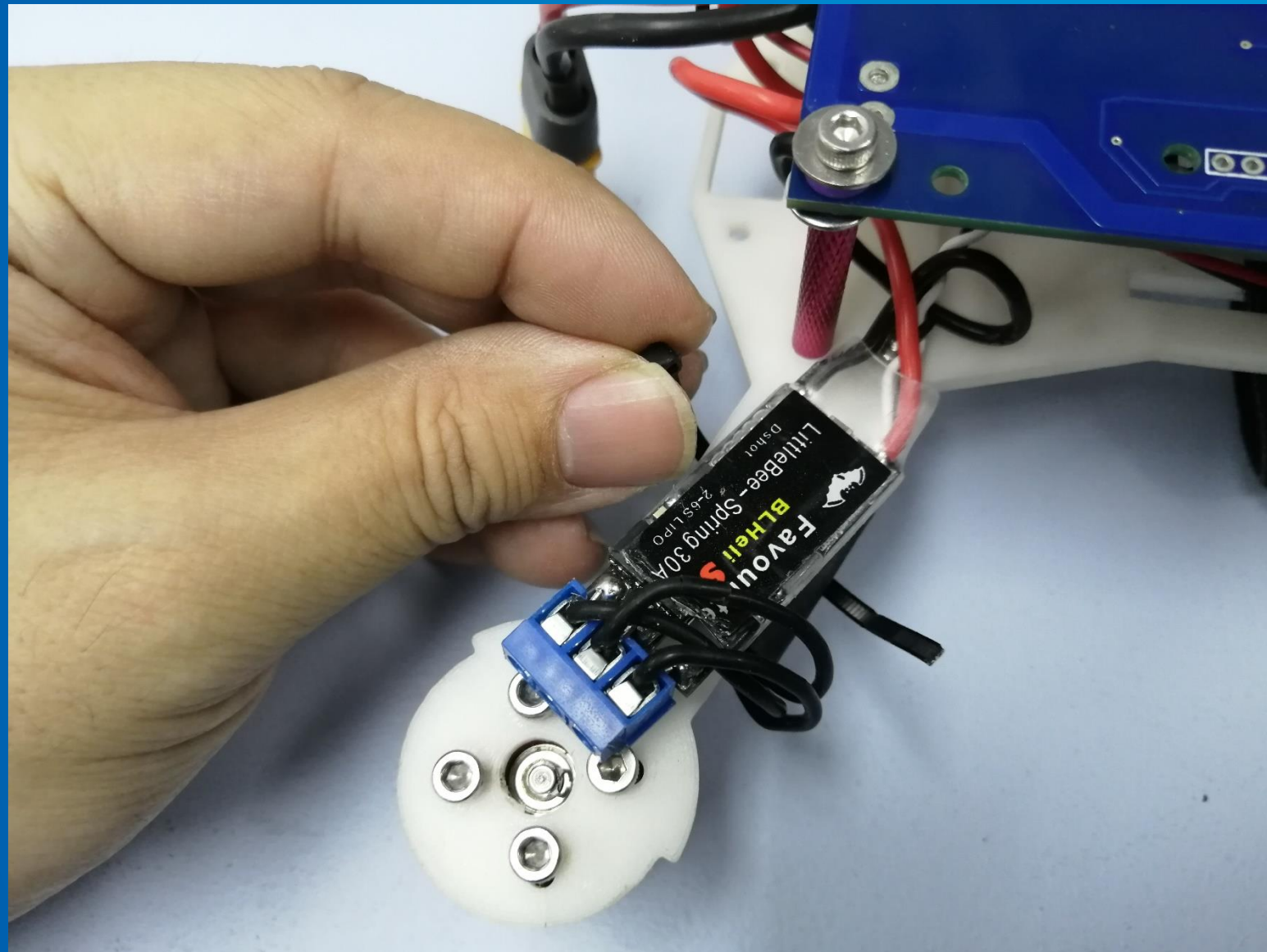
Thread Lock 222 Purple for light loads (must be cured dry before screwing in )

or PVA White Glue (Elmers)



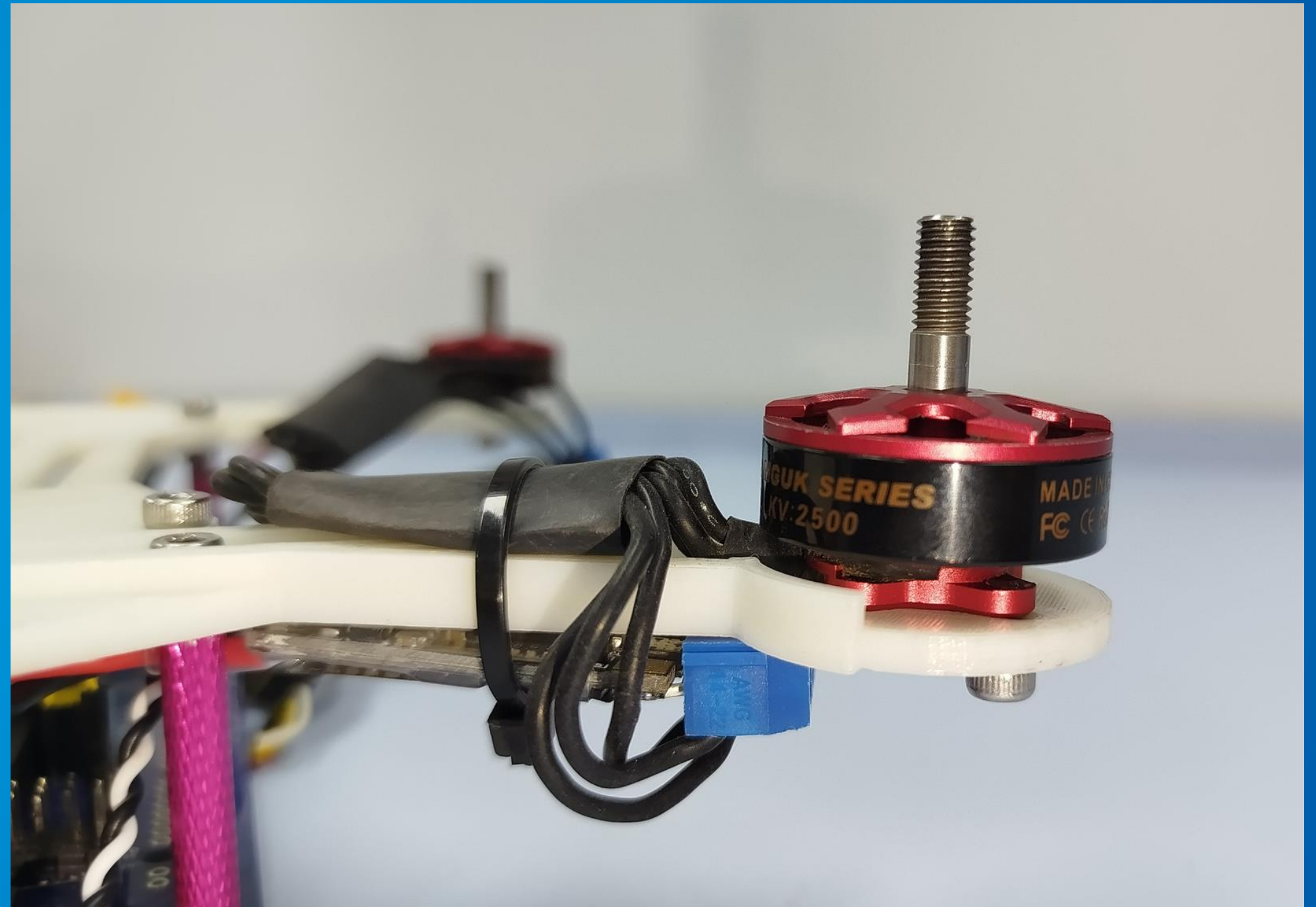
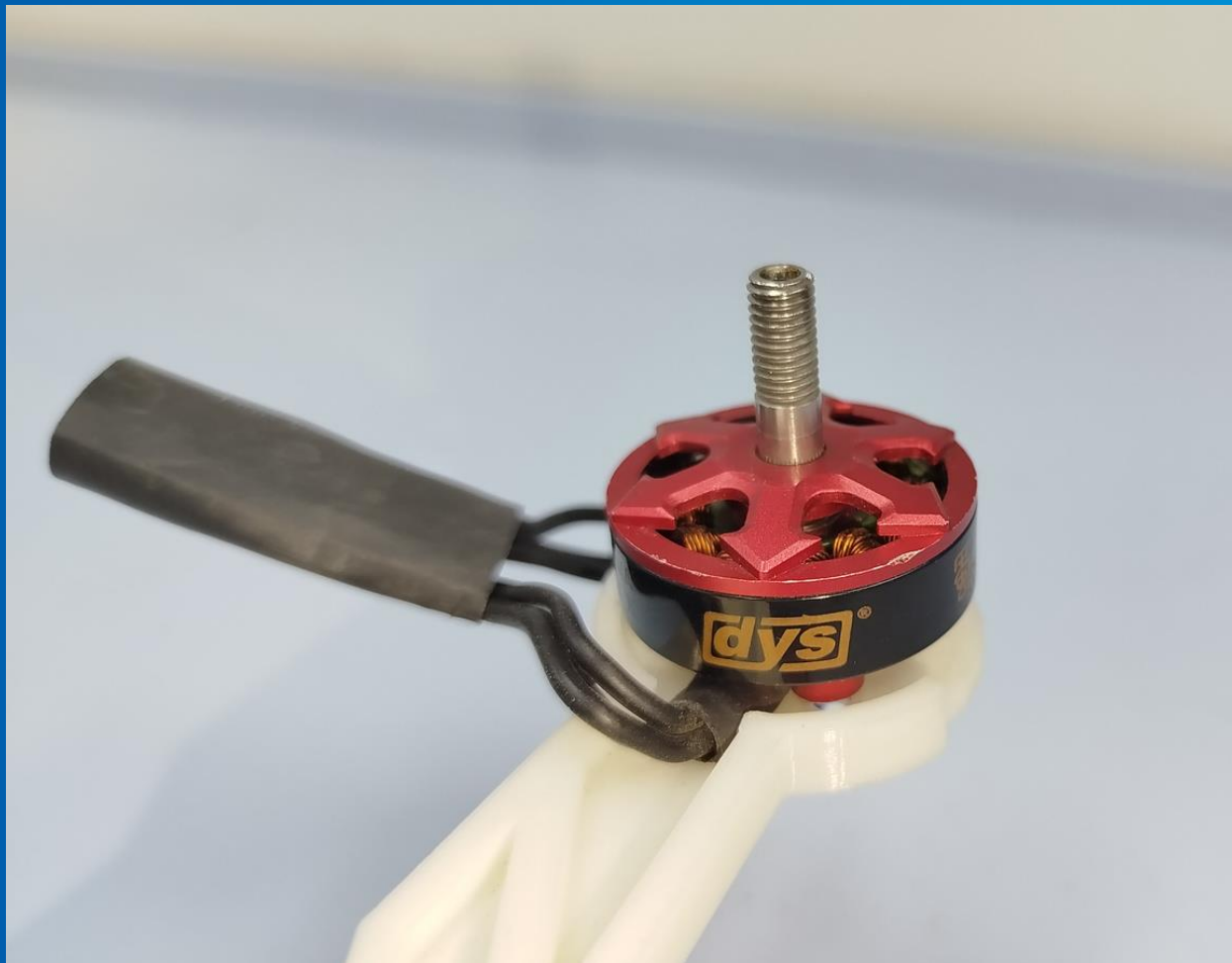


# ASSEMBLY



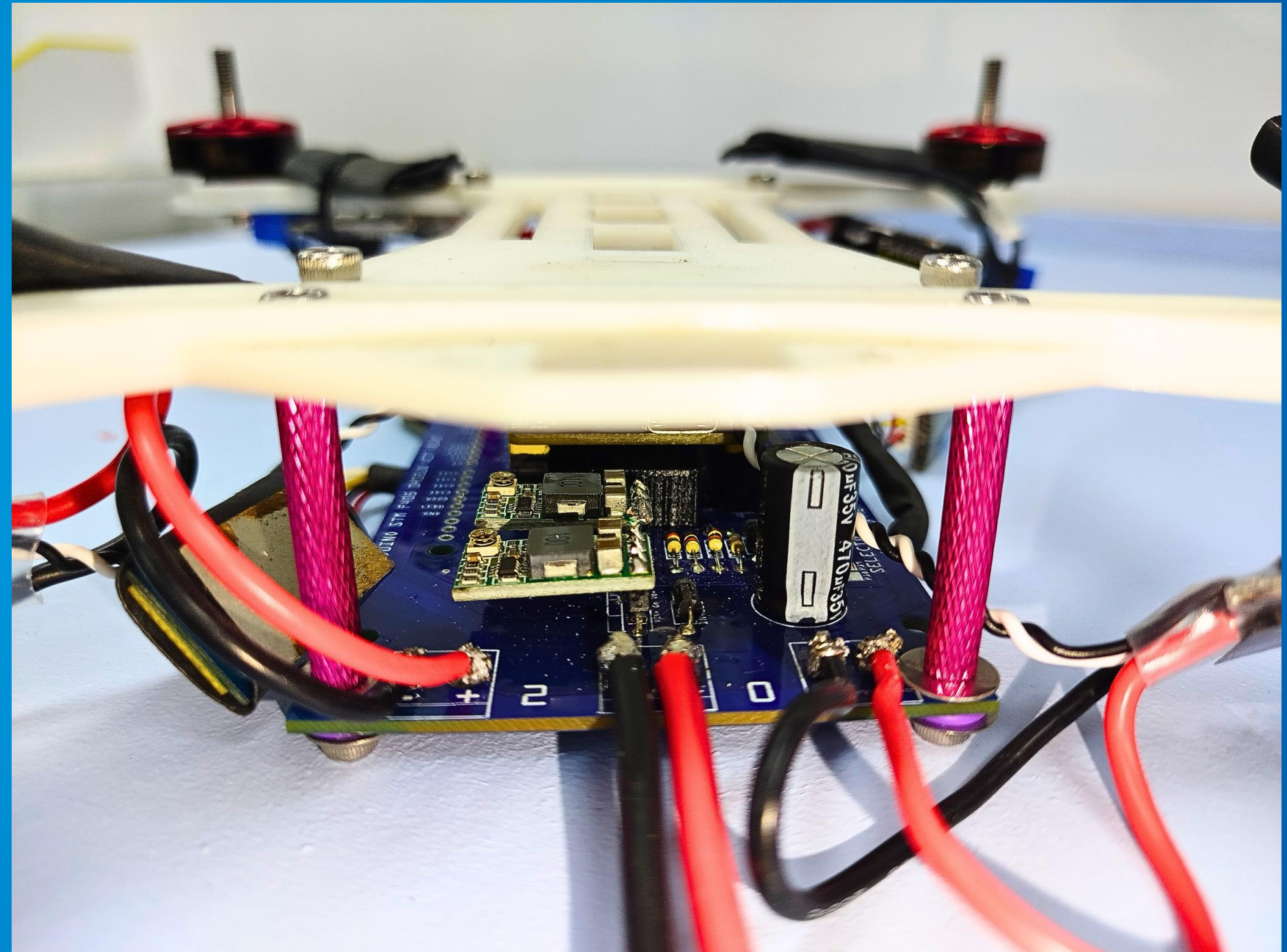
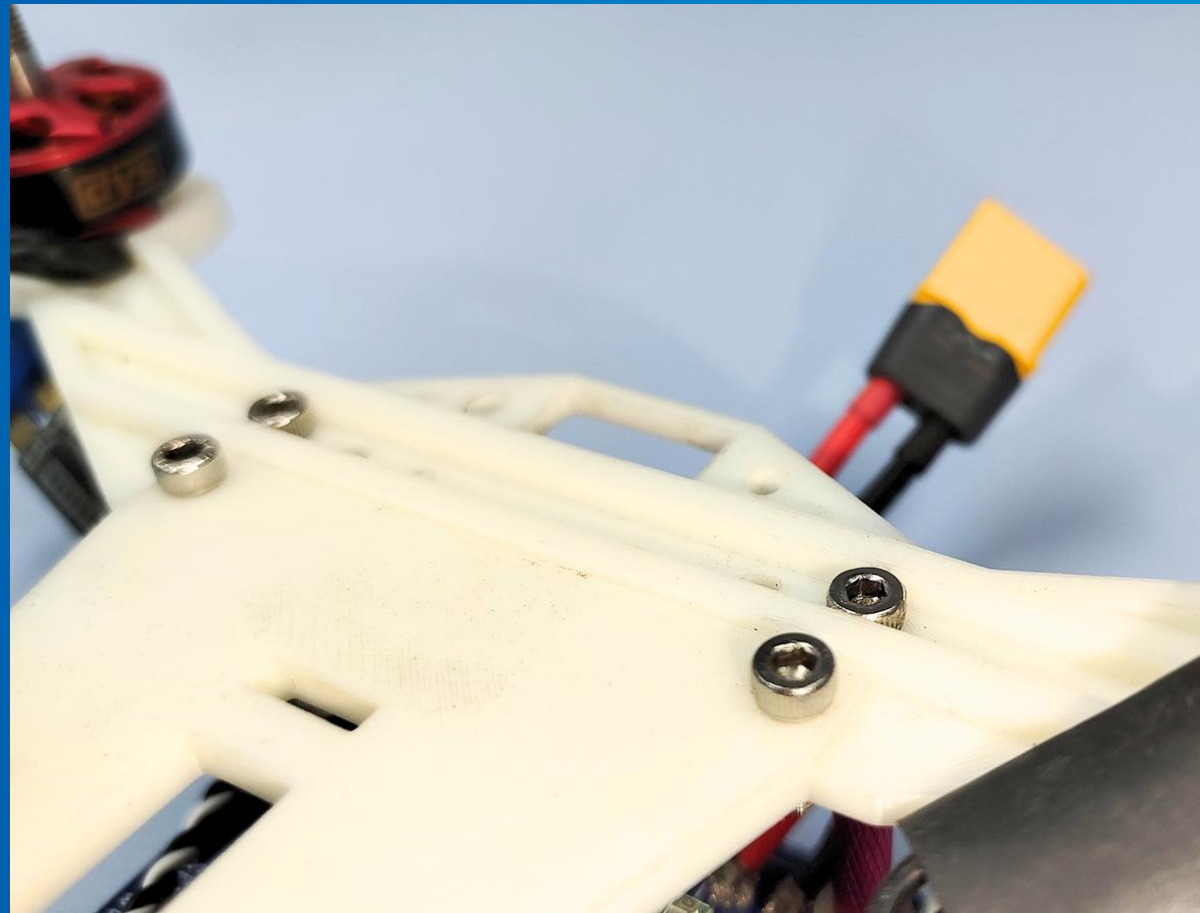


# ASSEMBLY



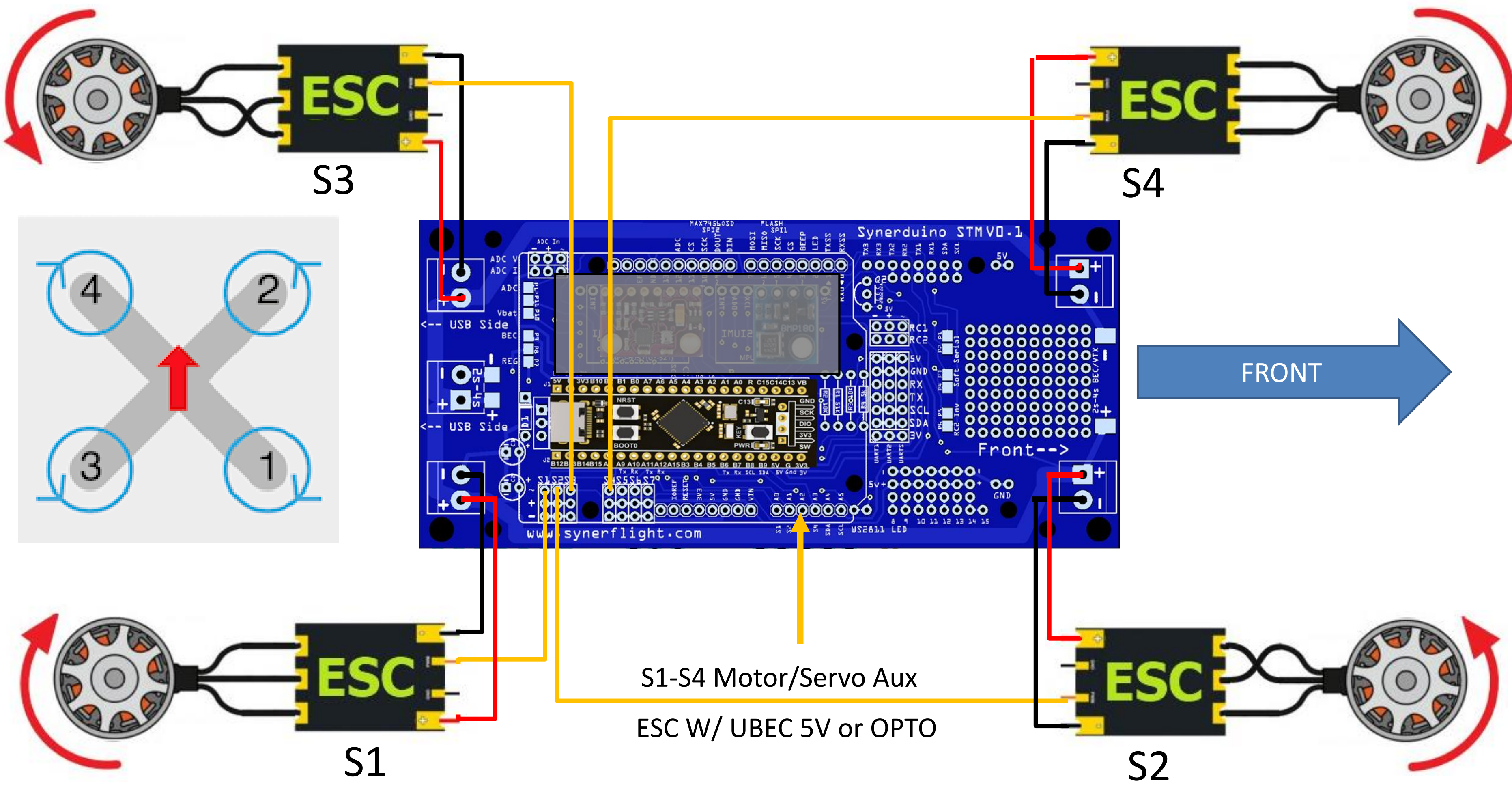


# ASSEMBLY



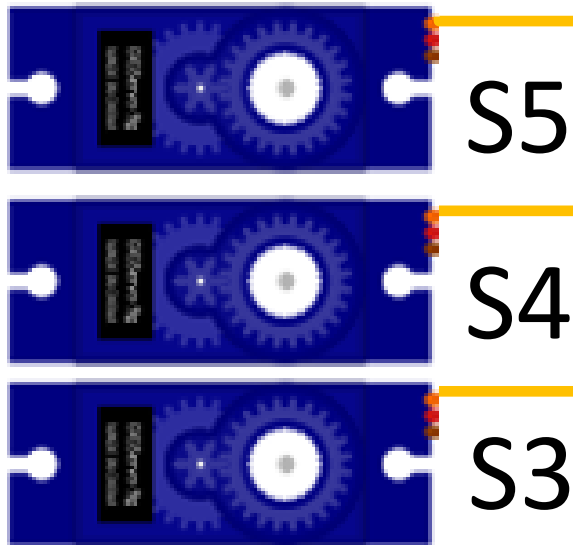
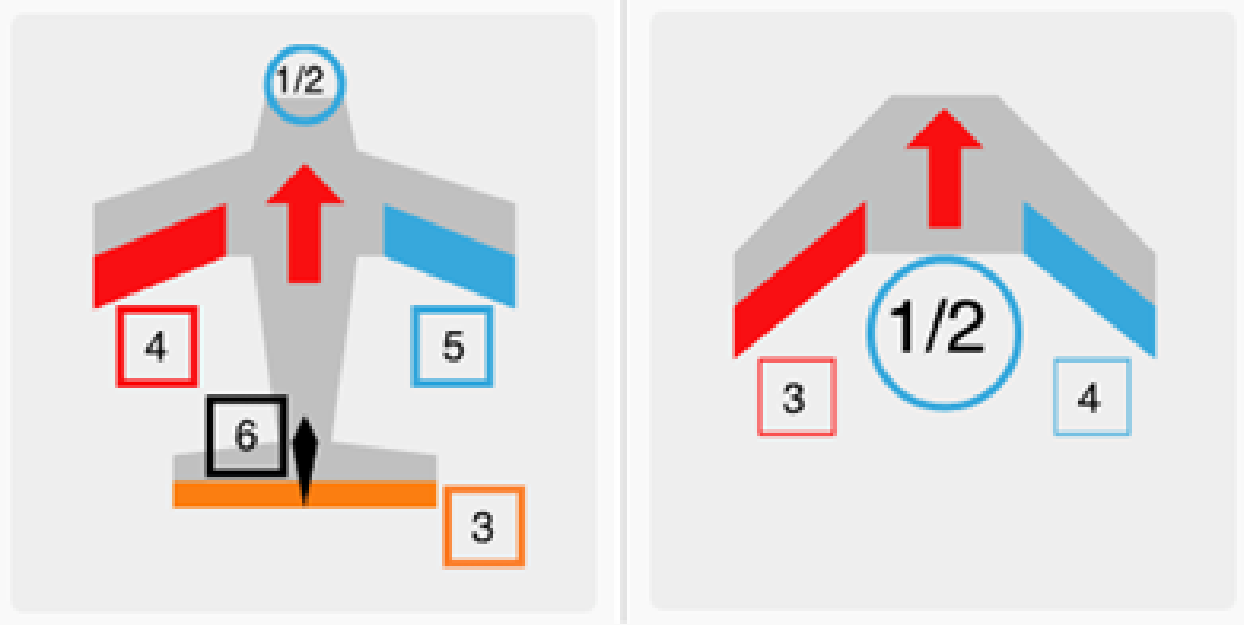


# Multicopter Setup

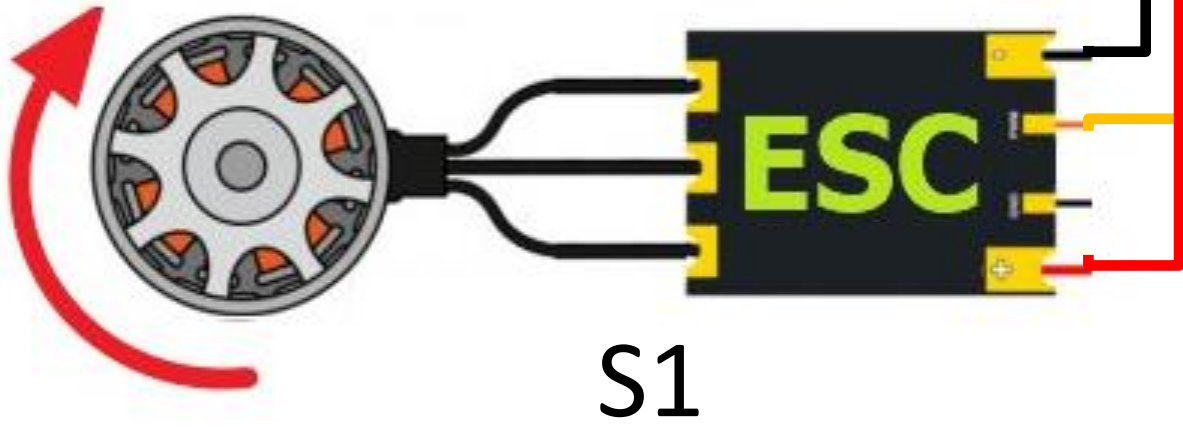




# Fixwing Setup

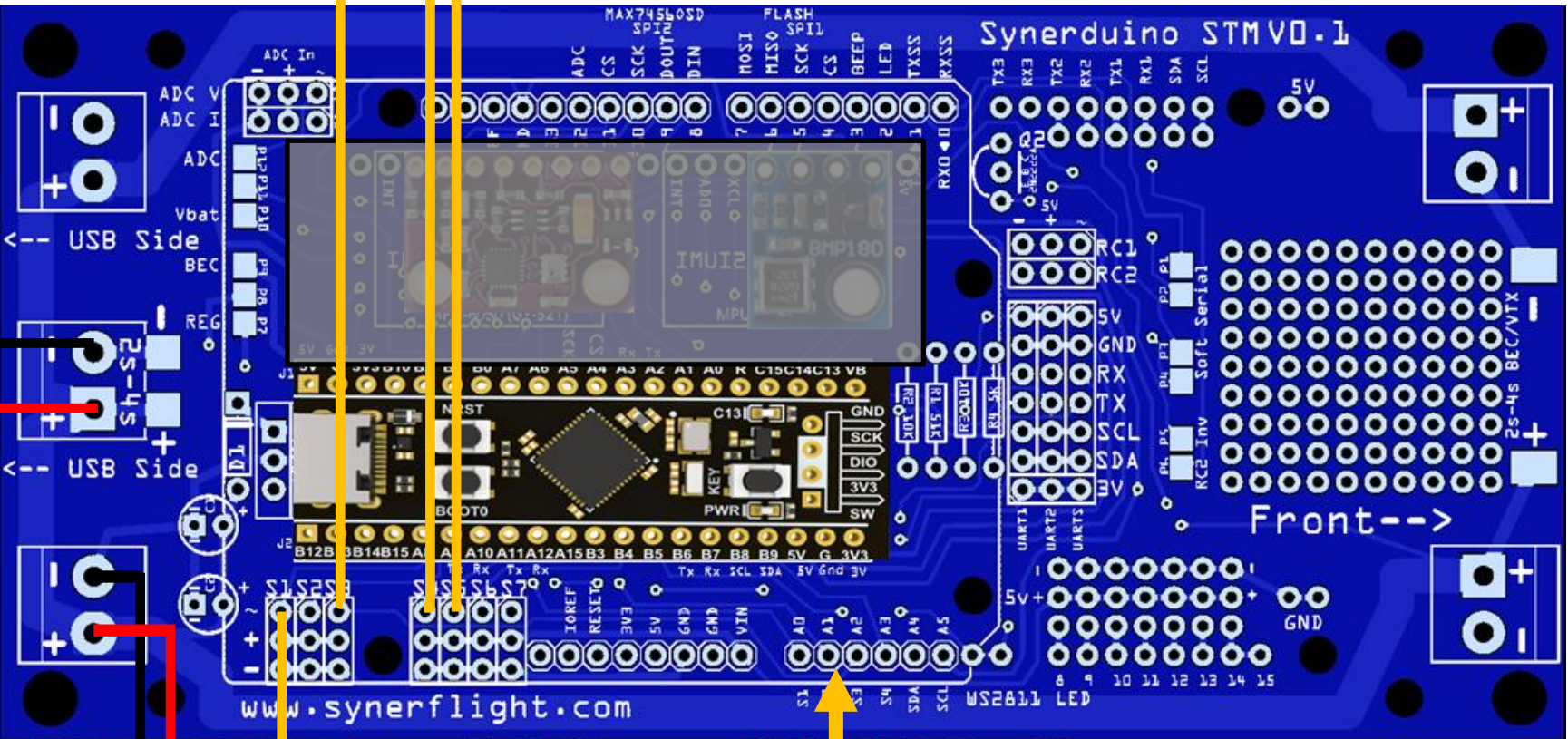


2s 8.2V- 4s 16V



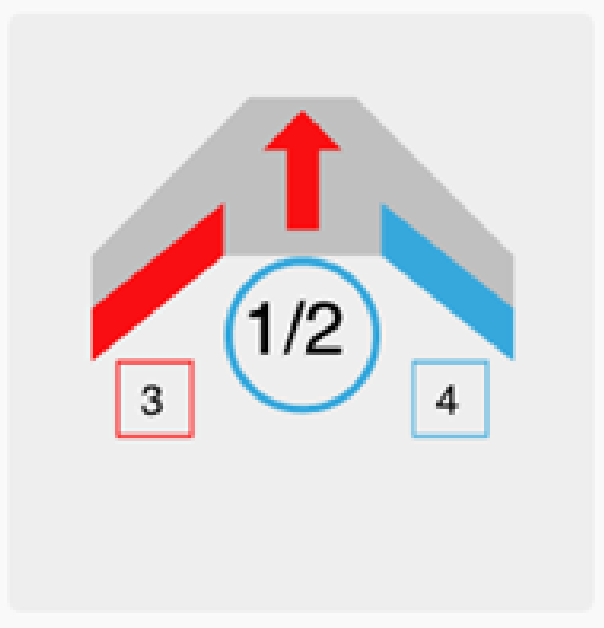
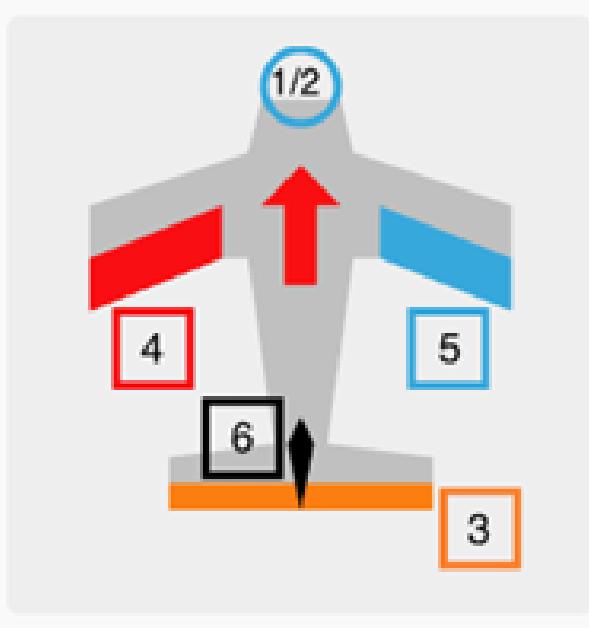
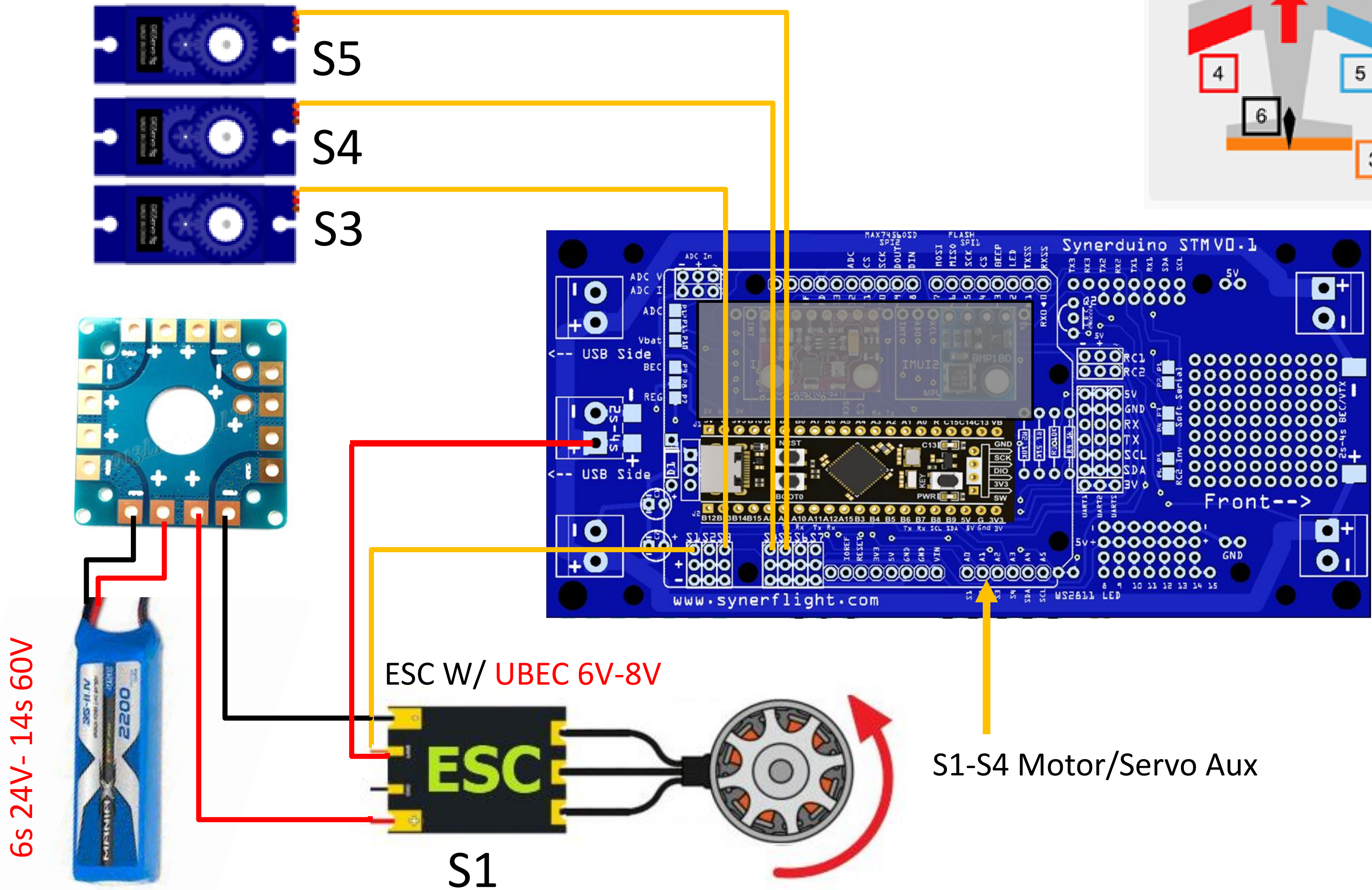
ESC W/ UBEC 5V

S1-S4 Motor/Servo Aux



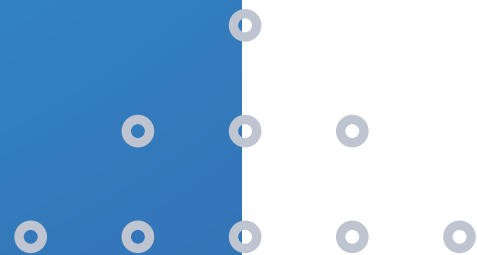


High Power ESC with BEC w/more than 5V (6V-8V)





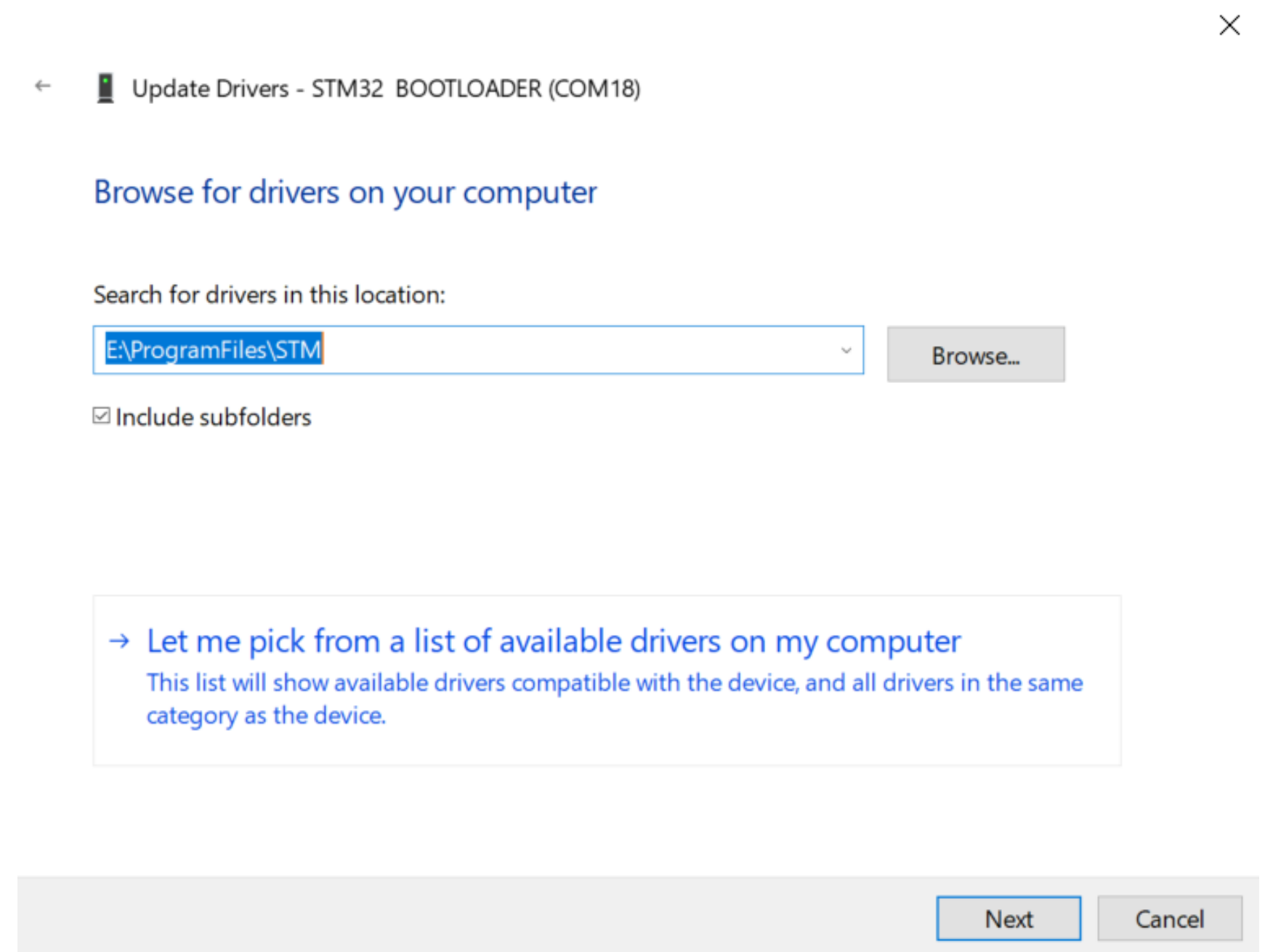
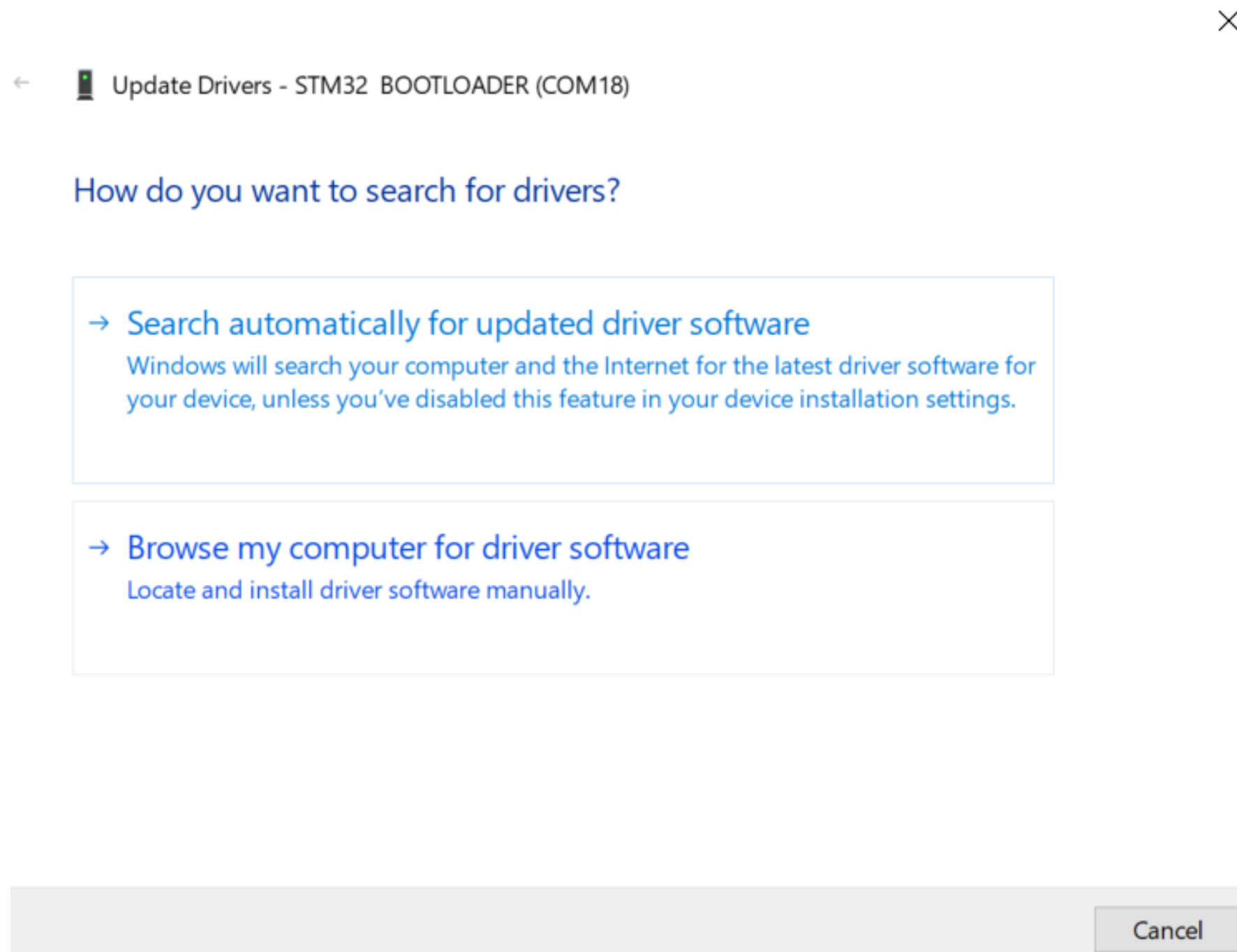
# SOFTWARE SETUP





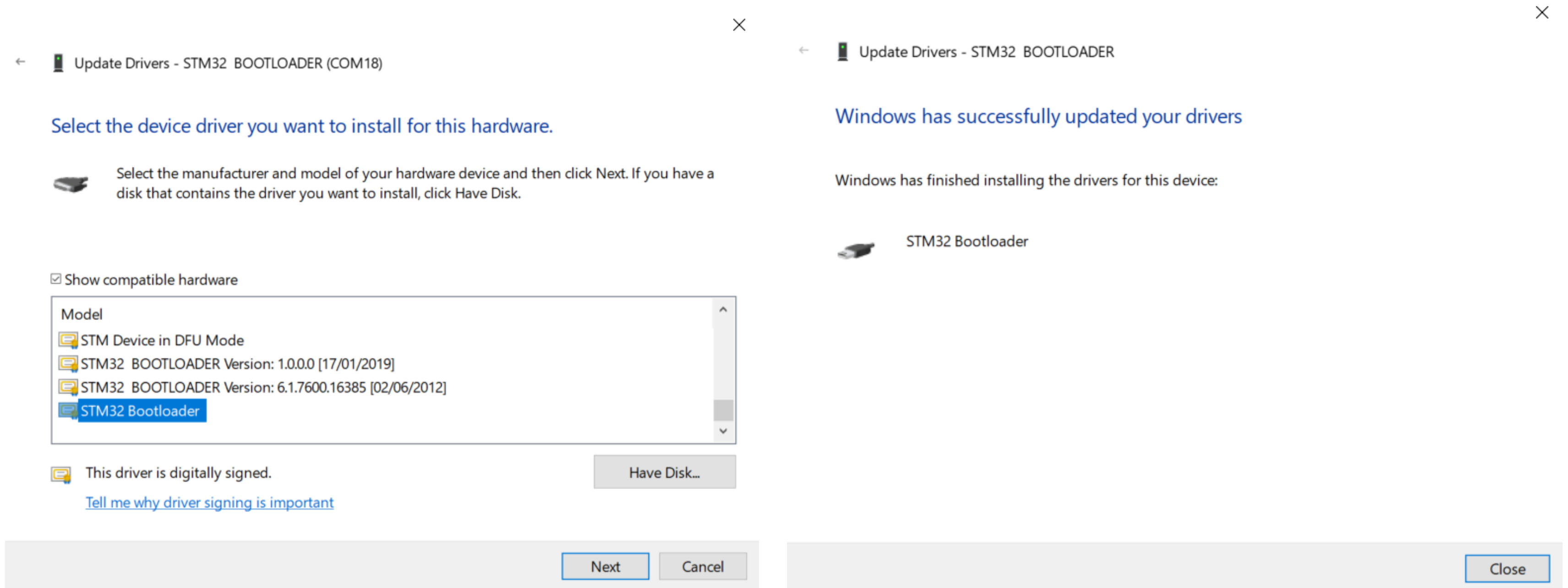
# FIRMWARE INSTALLATION

- Browse my Computer for Driver
- Let Me Pick from List





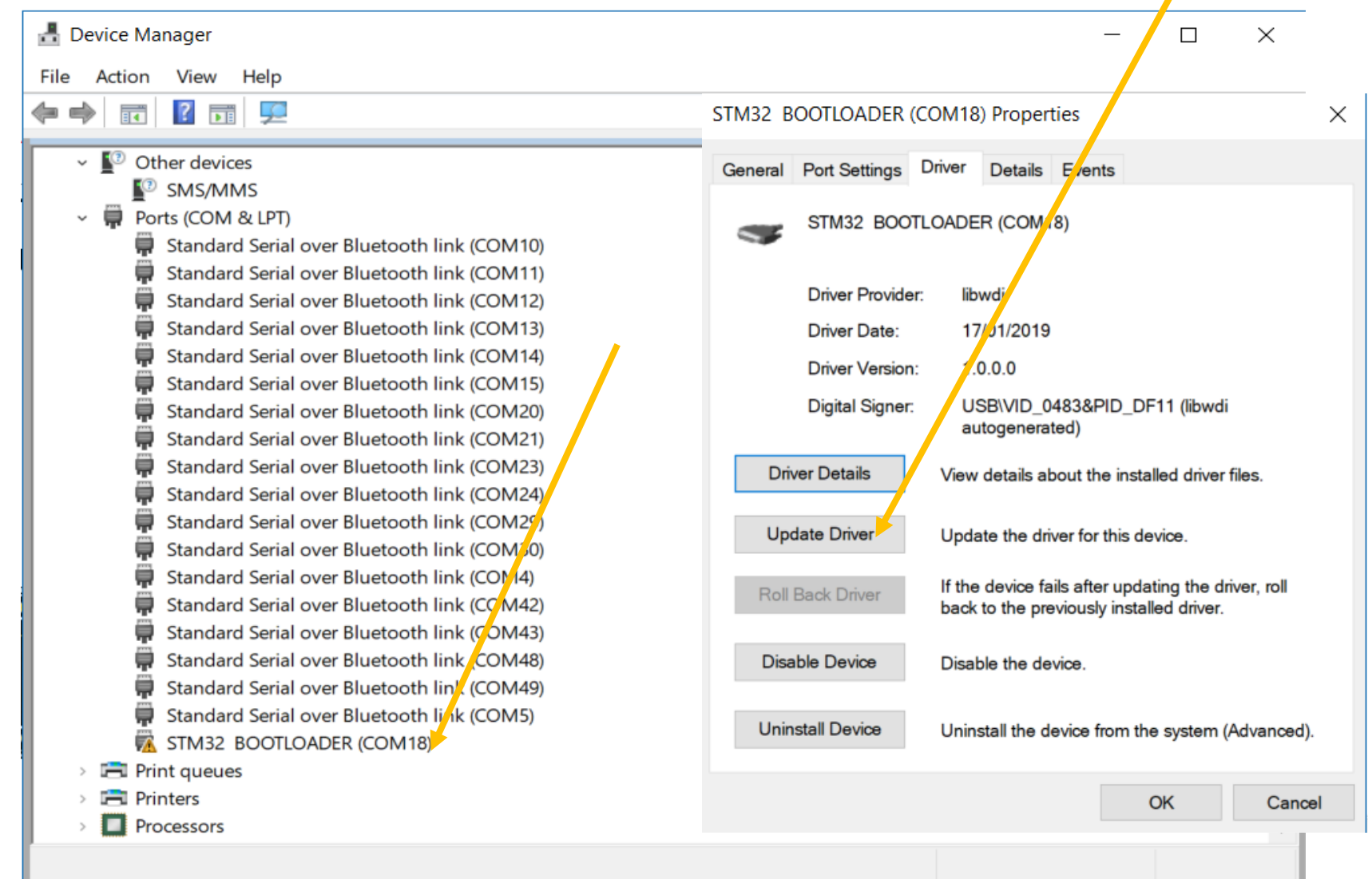
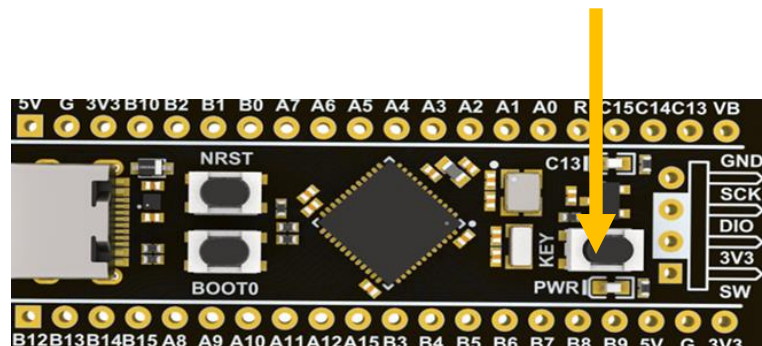
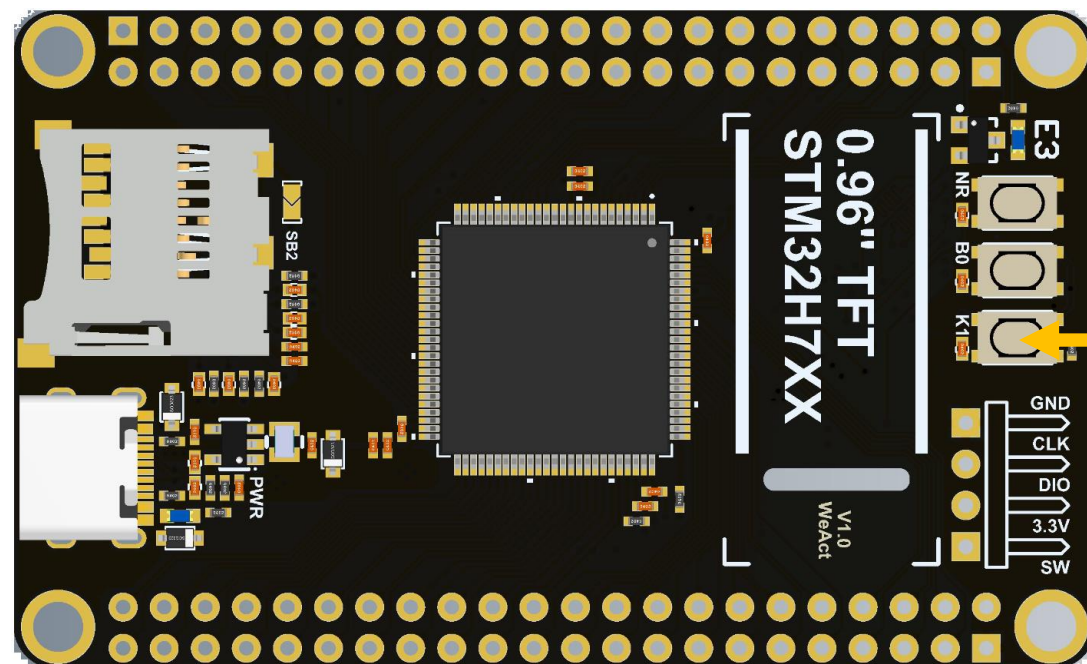
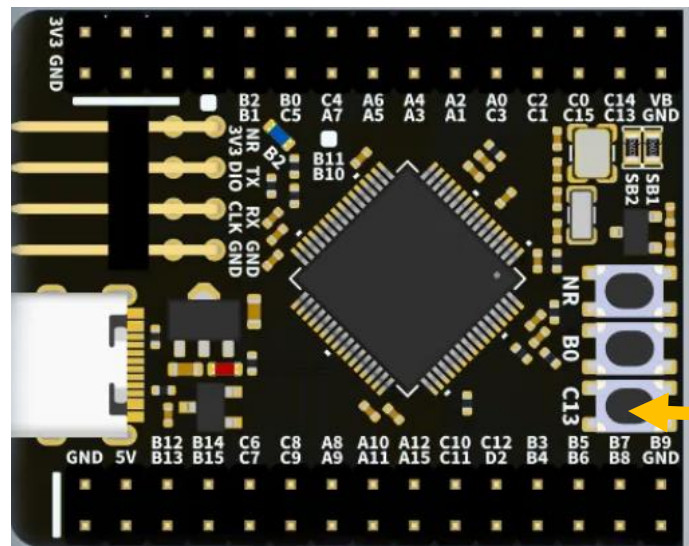
# FIRMWARE INSTALLATION





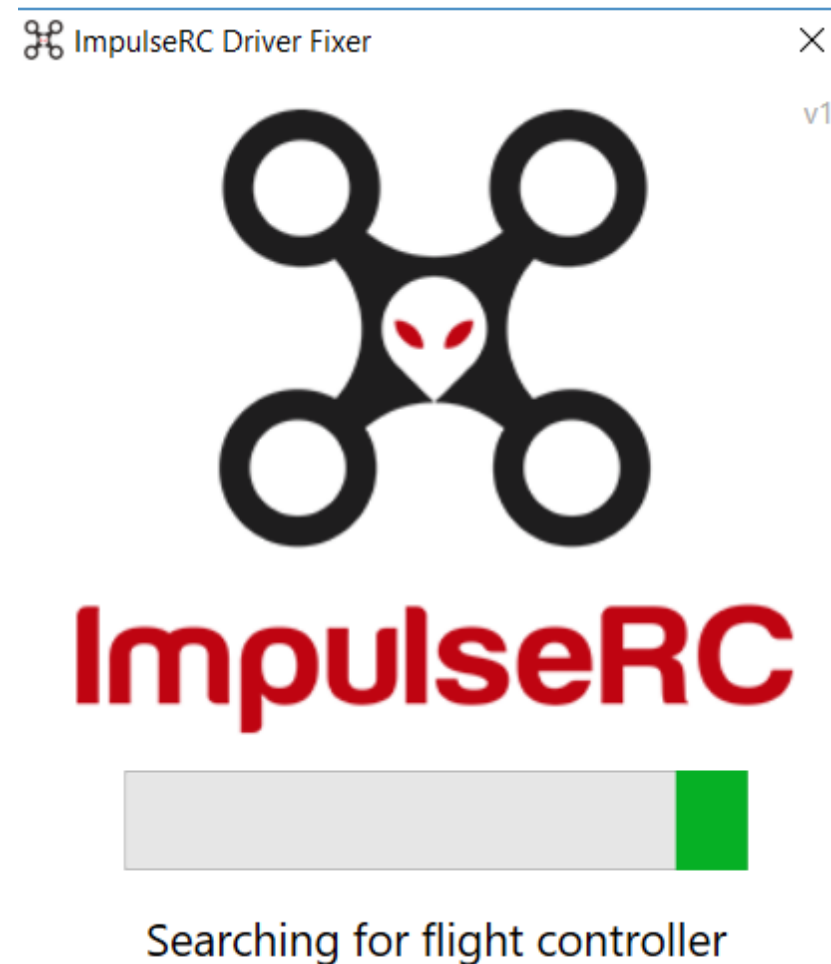
# FIRMWARE INSTALLATION

- Plug in USB you see Blue Led fading in and out
- Hold the Key Button for 3seconds till the blue light flashes and goes out
- In device manager the STM32 Bootloader (Com should show up)
- Note : this is for Brand new boards that were not flash with firmware , skip this for Synerduino package kits as they are preflashed for your convenience





# FIRMWARE INSTALLATION



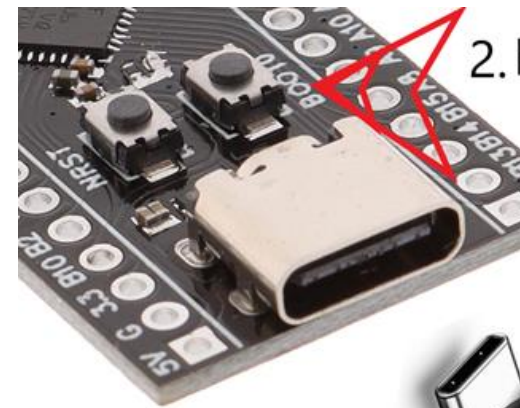
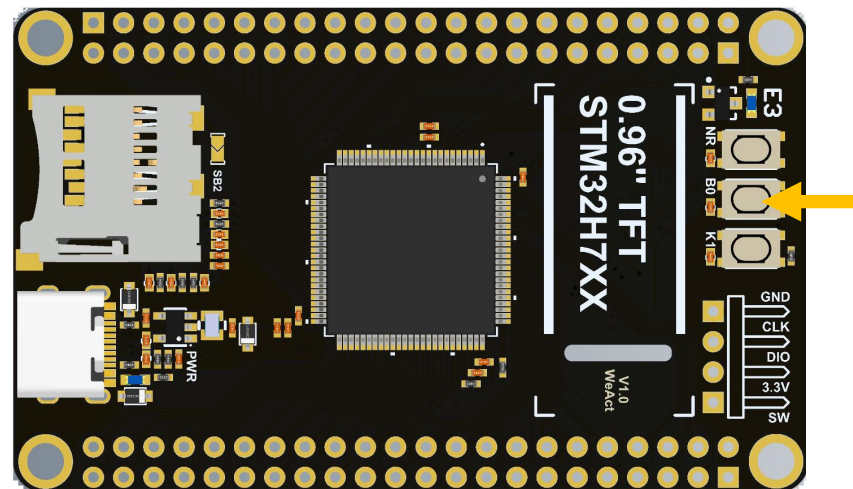
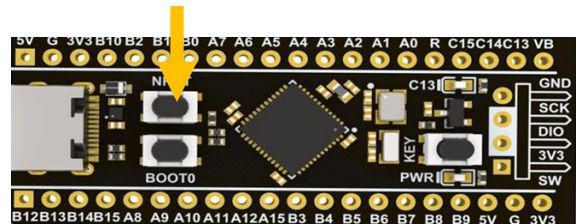
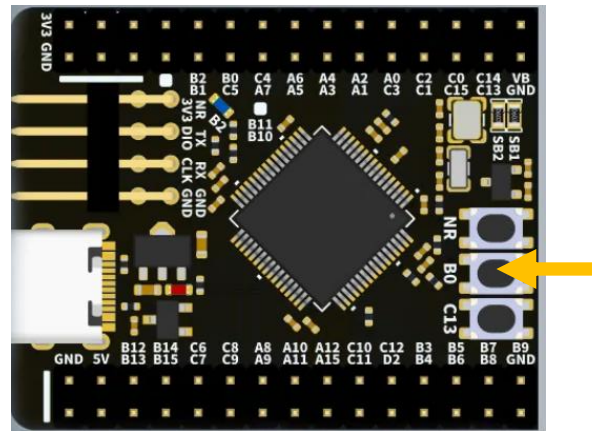
## ImpulseRC Driver Fixer

[https://impulserc.blob.core.windows.net/utilities/ImpulseRC\\_Driver\\_Fixer.exe](https://impulserc.blob.core.windows.net/utilities/ImpulseRC_Driver_Fixer.exe)

- Start ImpluseRC Driver Fixer
- Connect the FC USB to the PC While On DFU mode . (DO NOT power on FC via external 5V or Vbat)
- The ImpulseRC Driver Fixer should then see and load the proper driver

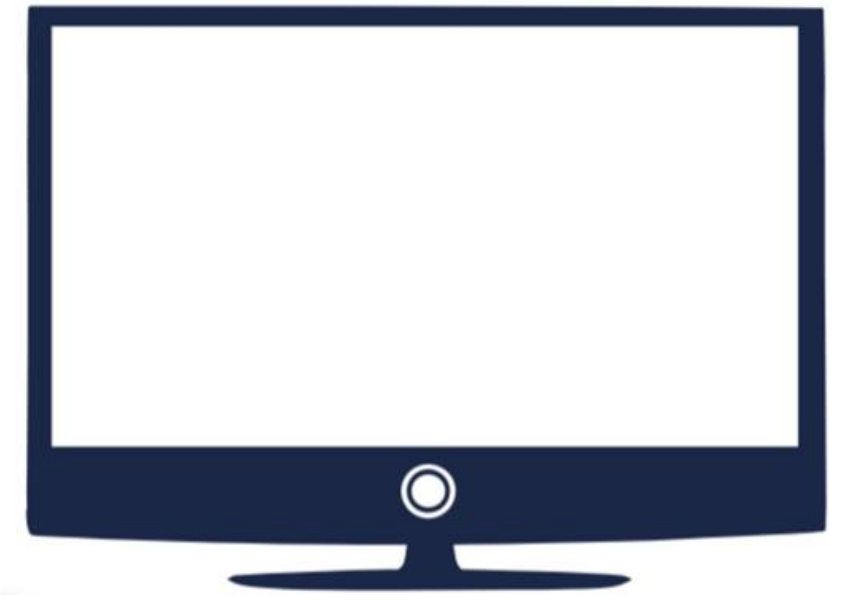


# FIRMWARE INSTALLATION



2. Hold down the boot0 button.

1. Connect TYPE-C  
usb to Board



3. Connect to USB to PC



## After Flashed Processor setup

This can also be done by holding down the boot button while pressing the NRST button to reset the board . This is just like unplugging and plugging the USB  
(only to be use on a pre flashed blackpill)

F411 DFU mode can sometimes take several attempts as Windows may not recognize the device mode  
Its require to preheat heat the chip to 25c with your finger for some Reason.

Synerduino STMF411board a preheat can be made by running the board with the battery for 1 min



# FIRMWARE INSTALLATION



- Start INAV configurator
- Connect the FC USB to the PC while holding the boot button in.
- INAV configurator should show it's connected in DFU mode in the top right corner (DO NOT click the CONNECT button)
- Choose the latest hex file for your FC and then "Load Firmware local". Once loaded, click "Flash Firmware".

Download Configurator for Windows platform (win32 or win64 is present) Extract ZIP archive Run INAV Configurator app from unpacked folder Configurator is not signed, so you have to allow Windows to run untrusted application. There might be a monit for it during first run



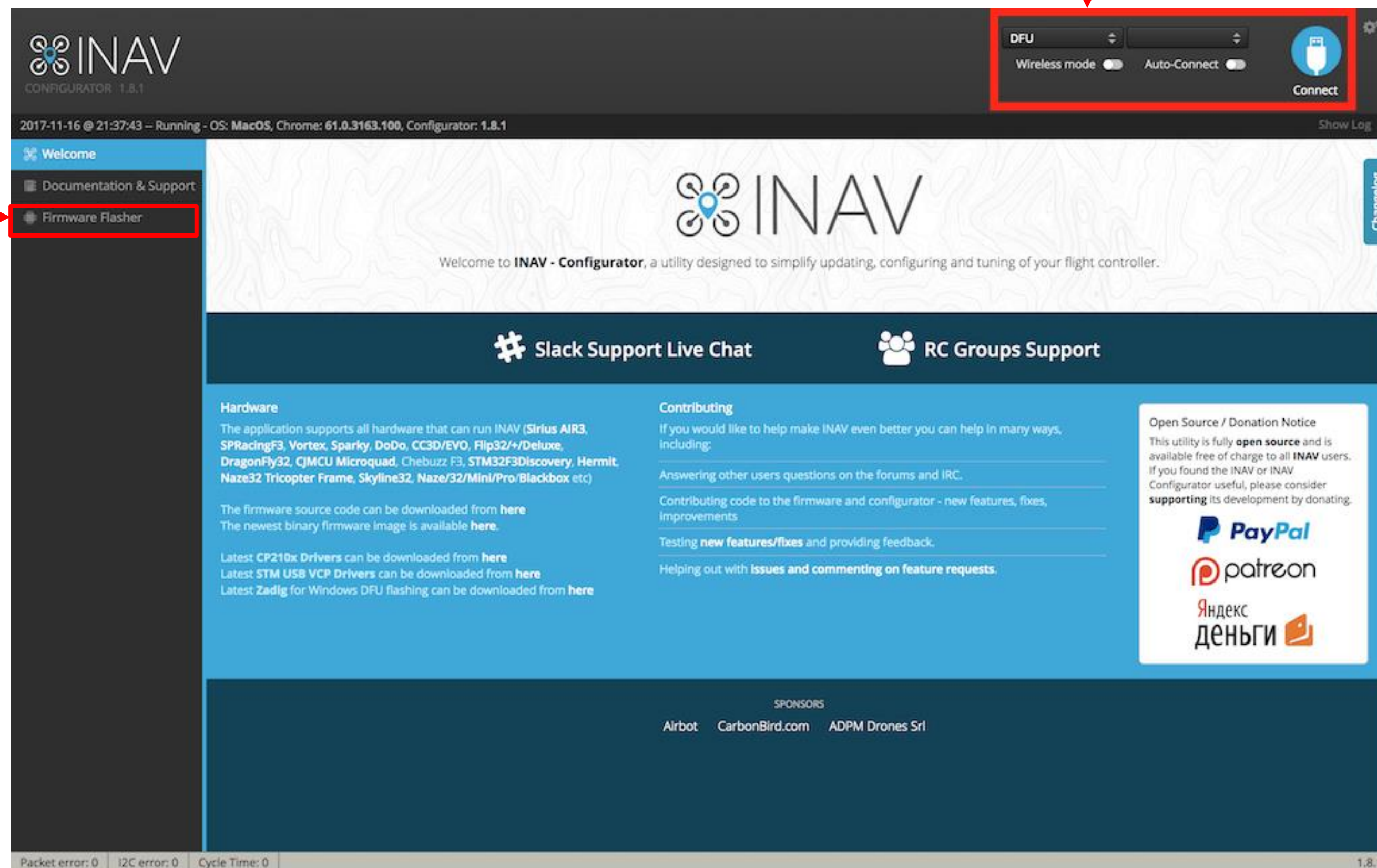
# FIRMWARE INSTALLATION

When you've successfully connected, the Configurator will recognize a device in DFU mode – which will be reflected in the port selection tab at the top. **(Do Not Connect at this point)**

Next, click on the Firmware Flasher tab

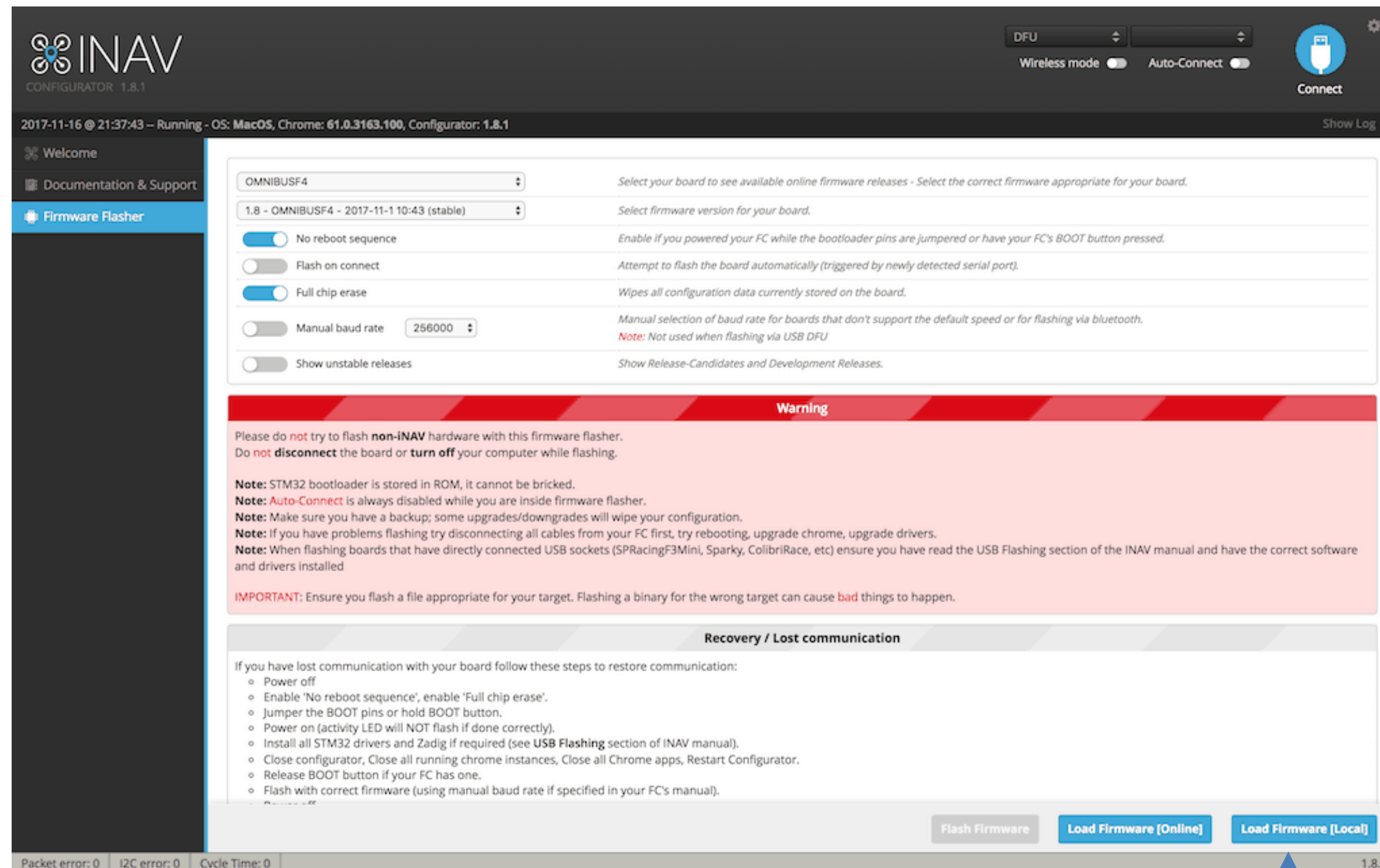
DFU (**Device Firmware Update**) mode is an incredibly useful feature on modern microcontrollers. It allows for quick and easy updates to a device's firmware without the need of extra piece of hardware.

**Typical Boot Button or Jumper** is required to turn on the microcontroller into DFU mode





# FIRMWARE INSTALLATION



Synerduino STM Hex files are available at Downloads Tab

Next, click on the Firmware Flasher tab and select your correct board and the latest release of the firmware, make sure “Full Chip Erase” is selected and click Load Firmware Local and Select the hex File that matches the version of your configurator and Shield Board

Once this process is Done and Rebooted you can now select your Serial Com port and Connect to the Synerduino STM Shield

Load Firmware [Local]

Look for the

INAV 5.1.0 – INAV8.0.0  
SynerduinoSTMF411.hex  
SynerduinoSTMF405.hex  
SynerduinoSTMH743.hex



# SETTING UP YOUR DRONE

## SETUP

After the Firmware installation you may connect normally to the board using the Com and baud assign to it (115600) default baud

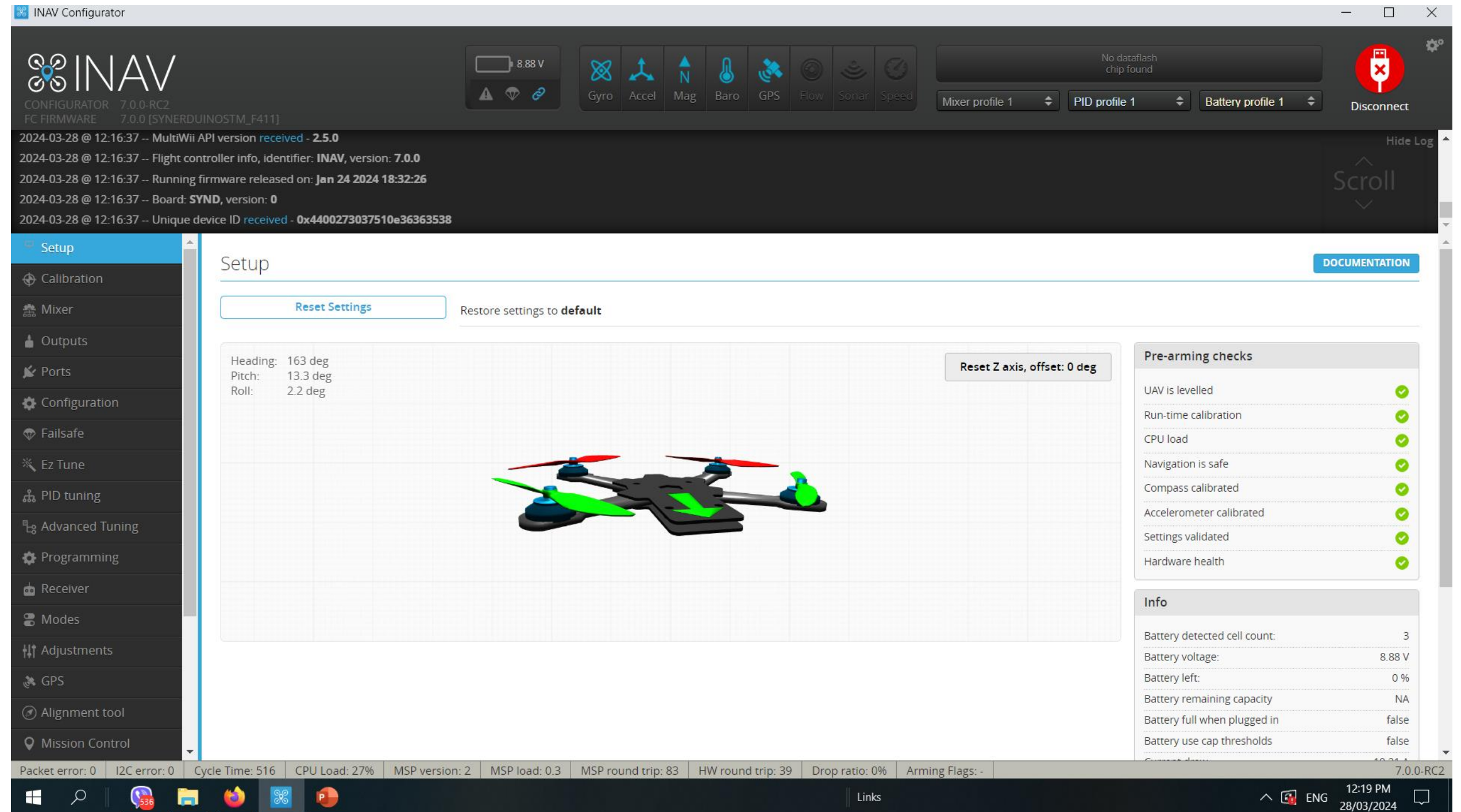
This is where you check the Status of your drone

Frame type ,orientation and other important information

Ensure all Pre-Arming checks are in the Green otherwise pls check the configuration or hardware of issue

The Tab on top indicates the Sensors and status

Red means it has issue  
Blue is Active  
Grey out is not available





# SETTING UP YOUR DRONE

## CALIBRATION

Before the controllers goes into the airframe it has to be first calibrated

The screenshot displays the INAV Configurator software interface. The top bar shows the INAV logo, version 7.0.0-RC2, and flight controller information. A sidebar on the left lists various setup options, with 'Calibration' selected. The main area shows six calibration steps, each with a drone icon and a checkmark indicating completion. Below the steps is a table for 'Accelerometer Values'. On the right, there are sections for 'Calibrate Compass' and 'Optic Flow Calibration'.

**Calibration Steps:**

- Step 1: Gyro calibration (checkmark)
- Step 2: Accel calibration (checkmark)
- Step 3: Mag calibration (checkmark)
- Step 4: Baro calibration (checkmark)
- Step 5: GPS calibration (checkmark)
- Step 6: Flow/Sonar/Speed calibration (checkmark)

**Accelerometer Values:**

|          | X    | Y    | Z    |
|----------|------|------|------|
| Acc Zero | -40  | 16   | -76  |
| Acc Gain | 4098 | 4097 | 4085 |

**Calibrate Compass:**

| Parameter | Value |
|-----------|-------|
| Zero X    | -24   |
| Zero Y    | 33    |
| Zero Z    | -24   |
| Gain X    | 1351  |
| Gain Y    | 1317  |
| Gain Z    | 1249  |

**Optic Flow Calibration:**

After pressing the button you have 30 seconds to hold the model in the air and tilt it to sides without moving it horizontally. Note that optic flow sensor needs to observe the surface at all times.

Scale: 10.5

**Save and Reboot**



# SETTING UP YOUR DRONE

## MIXER (INAV5-6)

Airframe or  
Vehicle type  
Preset and mix  
selection

Load and apply  
when selected  
then Save  
Reboot

- Multirotor
- Airplane
- Tricopter
- Rover
- Boat
- Others

The screenshot displays the INAV Configurator software interface. The top status bar shows a battery level of 8.97V and various sensor icons (Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed, IMU2). The left sidebar contains navigation options: Setup, Calibration, Mixer (selected), Outputs, Ports, Configuration, Failsafe, PID tuning, Advanced Tuning, Programming, Receiver, Modes, Adjustments, GPS, Magnetometer, Mission Control, and OSD. The main content area is titled 'Mixer' and includes a 'Platform configuration' section with a dropdown menu set to 'Multirotor'. Below this is a 'Mixer preset' section showing a 'Quad X' configuration with a diagram of four motors (1, 2, 3, 4) and a red arrow pointing upwards. The 'Output Mapping' section shows a table with columns S1 through S7 and rows for Output and Function. The 'Motor Mixer' section shows a table with columns for Motor, Throttle [T], Roll [A], Pitch [E], and Yaw [R]. The bottom status bar displays system metrics: Packet error: 0, I2C error: 0, Cycle Time: 3246, CPU Load: 90%, MSP version: 2, MSP load: 0.1, MSP round trip: 48, HW round trip: 18, Drop ratio: 0%, and version 5.0.0. The bottom right corner shows the date and time: 6:07 PM, 23/07/2022.

INAV Configurator

INAV  
CONFIGURATOR 5.0.0  
FC FIRMWARE 5.0.0

2022-07-23 @ 17:53:05 -- MultiWii API version received - 2.4.0  
2022-07-23 @ 17:53:05 -- Flight controller info, identifier: INAV, version: 5.0.0  
2022-07-23 @ 17:53:05 -- Running firmware released on: Jun 4 2022 12:14:54  
2022-07-23 @ 17:53:05 -- Board: ST41, version: 0  
2022-07-23 @ 17:53:05 -- Unique device ID received - 0x4400273037510e36363538

Setup  
Calibration  
Mixer  
Outputs  
Ports  
Configuration  
Failsafe  
PID tuning  
Advanced Tuning  
Programming  
Receiver  
Modes  
Adjustments  
GPS  
Magnetometer  
Mission Control  
OSD

Mixer

Platform configuration

Multirotor Platform type  
Multirotor  
Airplane  
Tricopter  
Rover  
Boat  
Other

Mixer preset

Quad X

Mixer wizard Load and apply Load mixer

Output Mapping

| Output   | S1      | S2      | S3      | S4      | S5 | S6 | S7 |
|----------|---------|---------|---------|---------|----|----|----|
| Function | Motor 1 | Motor 2 | Motor 3 | Motor 4 | -  | -  | -  |

Motor Mixer

| Motor | Throttle [T] | Roll [A] | Pitch [E] | Yaw [R] |
|-------|--------------|----------|-----------|---------|
| 1     | 1            | -1       | 1         | -1      |

Save and Reboot

Packet error: 0 I2C error: 0 Cycle Time: 3246 CPU Load: 90% MSP version: 2 MSP load: 0.1 MSP round trip: 48 HW round trip: 18 Drop ratio: 0% 5.0.0

Links ENG 6:07 PM 23/07/2022



# SETTING UP YOUR DRONE

## MIXER Applicable for (INAV5-INAV6)

Note INAV5-INAV6 SynerduinoSTM has Two Firmware with different output arrangement for different vehicle types , (You can get creative in mixing for custom frame designs)

### SYNERDUINOSTM.Hex (Default Loaded)

```
(TIM_USE_MC_MOTOR | TIM_USE_FW_MOTOR), // S1
(TIM_USE_MC_MOTOR | TIM_USE_FW_MOTOR), // S2
(TIM_USE_MC_MOTOR | TIM_USE_FW_SERVO), // S3
(TIM_USE_MC_MOTOR | TIM_USE_FW_SERVO), // S4
(TIM_USE_MC_MOTOR | TIM_USE_FW_SERVO), // S5
(TIM_USE_MC_MOTOR | TIM_USE_FW_SERVO), // S6
(TIM_USE_MC_SERVO | TIM_USE_FW_SERVO), // S7
```

### Vehicle Preset Mix

|             |                                 |
|-------------|---------------------------------|
| QUAD X      | FlyingWing                      |
| QUAD +      | Airplane                        |
| QUAD A-Tail | Airplane No Rudder              |
| Y4          | Airplane V-Tail 2 Aileron Servo |
| Y6          | Airplane V-Tail 1 Aileron Servo |
| Hex X       | Other Stuff                     |
| Hex +       |                                 |
| Hex H       |                                 |

### SYNERDUINOSTMSV.Hex

```
(TIM_USE_MC_MOTOR | TIM_USE_FW_MOTOR), // S1
(TIM_USE_MC_MOTOR | TIM_USE_FW_MOTOR), // S2
(TIM_USE_MC_MOTOR | TIM_USE_FW_MOTOR), // S3
(TIM_USE_MC_MOTOR | TIM_USE_FW_MOTOR), // S4
(TIM_USE_MC_SERVO | TIM_USE_FW_SERVO), // S5
(TIM_USE_MC_SERVO | TIM_USE_FW_SERVO), // S6
(TIM_USE_MC_SERVO | TIM_USE_FW_SERVO), // S7
```

### Vehicle Preset Mix

|                  |                                     |
|------------------|-------------------------------------|
| Quad X W/ Gimbal | FlyingWing Differential thrust      |
| Quad + W/ Gimbal | Airplane Differential Thrust        |
| Single Copter    | Airplane V-Tail Differential Thrust |
| Bi-Copter        | Other Stuff                         |
| Tricopter        |                                     |
| Rover            |                                     |
| Boat             |                                     |
| Camera Gimbal    |                                     |



# SETTING UP YOUR DRONE

## MIXER (INAV7-8)

Airframe or Vehicle  
time Preset and mix  
selection

Load and apply when  
selected then Save  
Reboot

- Multicopter
- Airplane
- Tricopter
- Rover
- Boat
- Others

Mixing is now color  
coded to timer  
availability

The screenshot displays the INAV Configurator software interface. The top bar shows the INAV logo, version 7.0.0-RC2, and various sensor status icons (Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed). The left sidebar contains a menu with options like Setup, Calibration, Mixer (highlighted), Outputs, Ports, Configuration, Failsafe, Ez Tune, PID tuning, Advanced Tuning, Programming, Receiver, Modes, Adjustments, GPS, Alignment tool, and Mission Control. The main area is titled 'Mixer' and contains several sections: 'Platform configuration' with a dropdown for 'Multicopter' and checkboxes for 'Normal motor direction / Props In configuration' and 'PID Profile will use same index as Mixer Profile index'; 'Timer outputs' with a list of five timers (Timer 1 to Timer 5) each with an 'AUTO' dropdown; 'Mixer preset' with a 'Quad X' dropdown and a diagram showing four motors (1, 2, 3, 4) with a red arrow pointing to motor 1; and 'Output Mapping' with a table mapping timer outputs to motor functions.

| Output (timer) | S1 (Timer 1) | S2 (Timer 2) | S3 (Timer 2) | S4 (Timer 2) | S5 (Timer 5) | S6 (Timer 3) | S7 (Timer 3) | S8 (Timer 4) |
|----------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Function       | Motor 1      | Motor 2      | Motor 3      | Motor 4      | -            | -            | -            | -            |

At the bottom, there is a status bar showing system metrics like Packet error, I2C error, Cycle Time, CPU Load, MSP version, MSP load, MSP round trip, HW round trip, Drop ratio, Arming Flags, and a 'Save and Reboot' button. The Windows taskbar is visible at the very bottom.

This allows you to assign motor and servo function to your custom drone frame or payload requirement this eliminates the need to recompile a new firmware for custom frame types

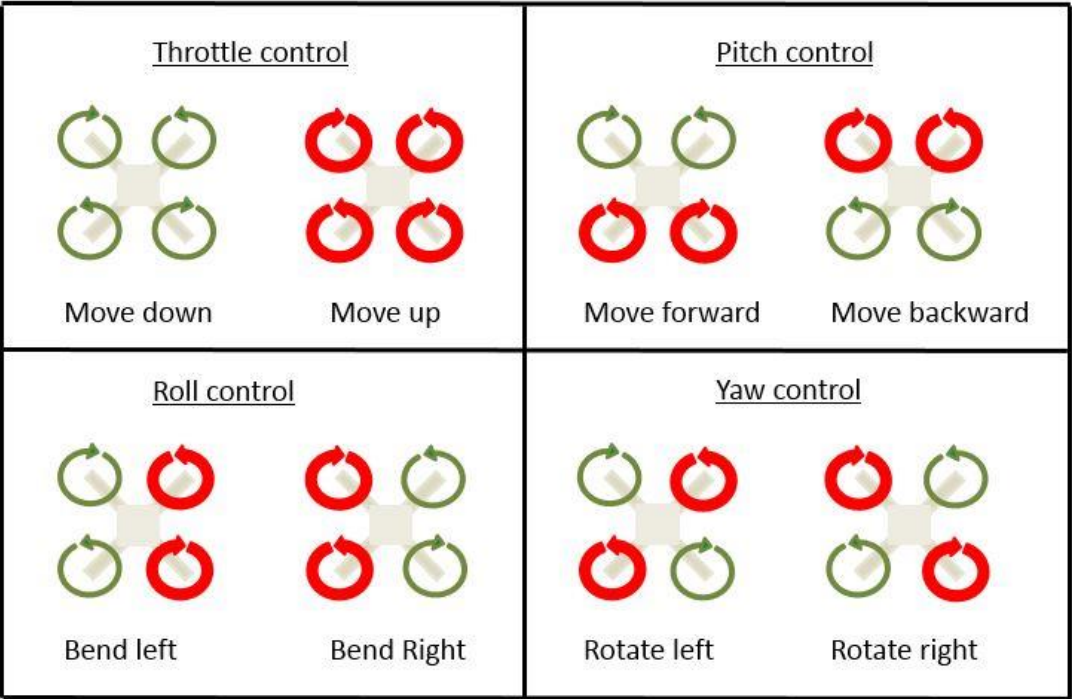


# SETTING UP YOUR DRONE

## MOTOR MIX FOR QUAD X (INAV 5-6)

THROTTLE – SPOOL UP  
AILERON - ROLL RIGHT  
ELEVATOR - PITCH FORWARD  
RUDDER - YAW RIGHT

( - ) REDUCE RPM  
( + ) INCREASE RPM



Normal Speed  
High Speed

| Output   | S1      | S2      | S3      | S4      | S5      | S6 | S7 |
|----------|---------|---------|---------|---------|---------|----|----|
| Function | Motor 1 | Motor 2 | Motor 3 | Motor 4 | Servo 1 | -  | -  |

| Motor | Throttle [T] | Roll [A] | Pitch [E] | Yaw [R] |        |
|-------|--------------|----------|-----------|---------|--------|
| 1     | 1            | -1       | 1         | -1      | Delete |
| 2     | 1            | -1       | -1        | 1       | Delete |
| 3     | 1            | 1        | 1         | 1       | Delete |
| 4     | 1            | 1        | -1        | -1      | Delete |

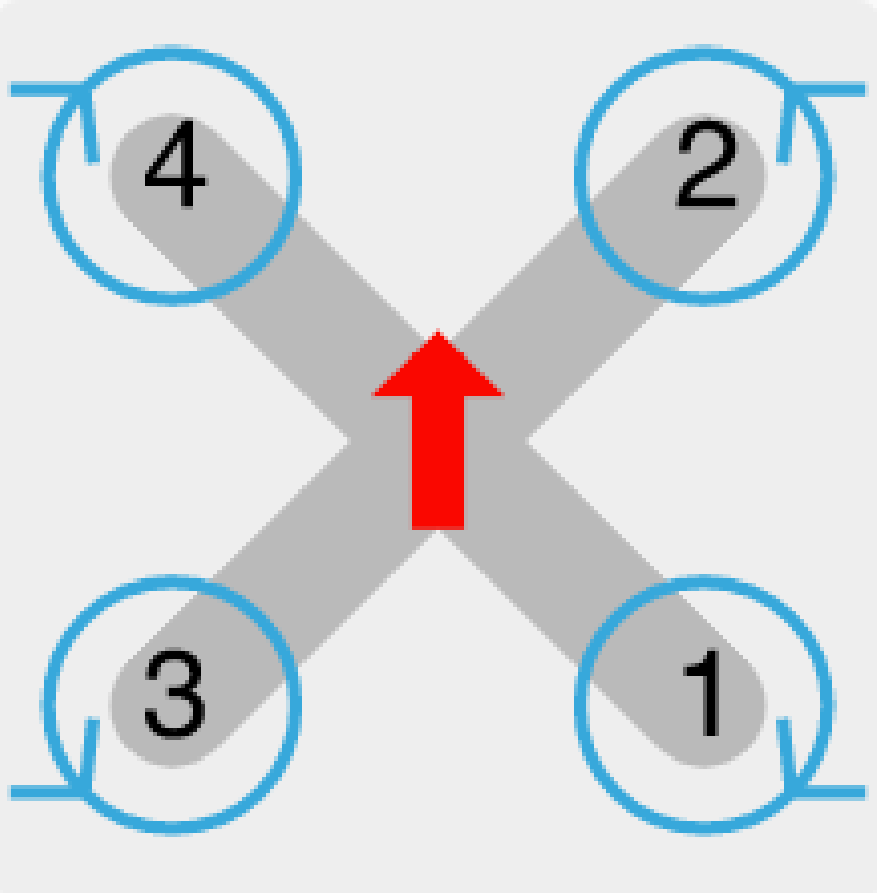
Add new mixer rule

| Servo | Input        | Weight (%) | Speed (10µs/s) | Active |        |
|-------|--------------|------------|----------------|--------|--------|
| 1     | RC Channel 6 | 100        | 0              | Always | Delete |

Logic conditions

Add new mixer rule

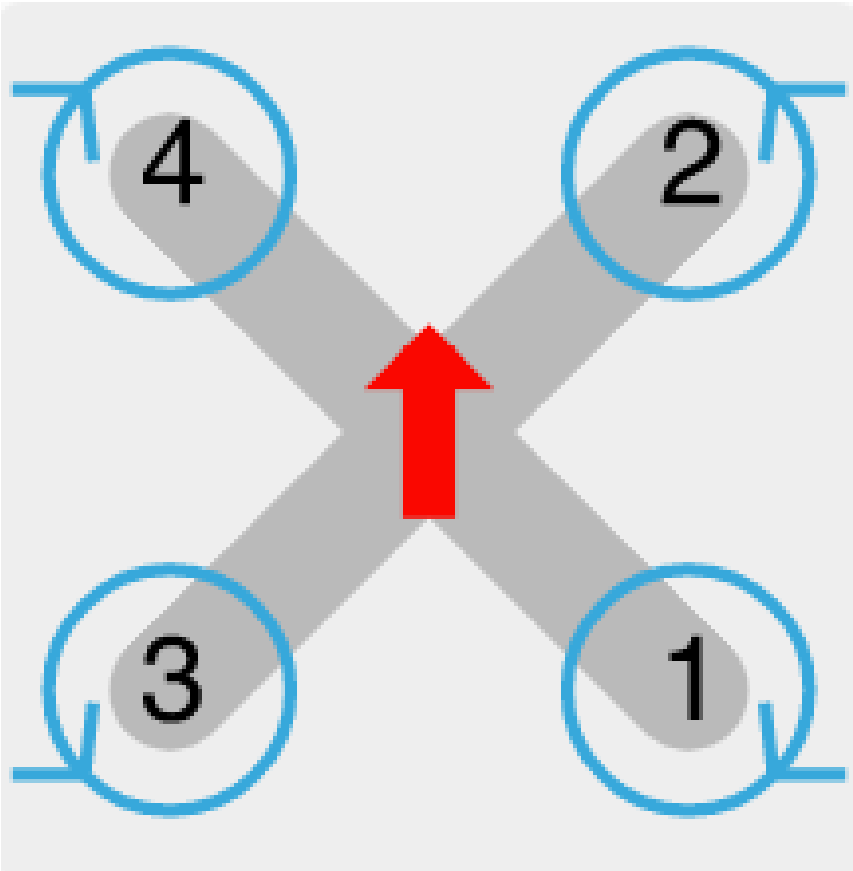




# SETTING UP YOUR DRONE

## MOTOR MIX FOR QUAD X (INAV 7-8)

THROTTLE – SPOOL UP  
AILERON - ROLL RIGHT  
ELEVATOR - PITCH FORWARD  
RUDDER - YAW RIGHT



INAV Configurator

8.93 V

Gyro Accel Mag Baro GPS Flow Sonar Speed

No dataflash chip found

Mixer profile 1 PID profile 1 Battery profile 1 Disconnect

2024-03-28 @ 12:16:37 -- MultiWii API version received - 2.5.0  
2024-03-28 @ 12:16:37 -- Flight controller info, identifier: INAV, version: 7.0.0  
2024-03-28 @ 12:16:37 -- Running firmware released on: Jan 24 2024 18:32:26  
2024-03-28 @ 12:16:37 -- Board: SYND, version: 0  
2024-03-28 @ 12:16:37 -- Unique device ID received - 0x4400273037510e36363538

Setup  
Calibration  
Mixer  
Outputs  
Ports  
Configuration  
Failsafe  
Ez Tune  
PID tuning  
Advanced Tuning  
Programming  
Receiver  
Modes  
Adjustments  
GPS  
Alignment tool  
Mission Control

Output Mapping

| Output (timer) | S1 (Timer 1) | S2 (Timer 2) | S3 (Timer 2) | S4 (Timer 2) | S5 (Timer 5) | S6 (Timer 3) | S7 (Timer 3) | S8 (Timer 4) |
|----------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Function       | Motor 1      | Motor 2      | Motor 3      | Motor 4      | -            | -            | -            | -            |

Motor Mixer

| Motor | Throttle [T] | Roll [A] | Pitch [E] | Yaw [R] |        |
|-------|--------------|----------|-----------|---------|--------|
| 1     | 1            | -1       | 1         | -1      | Delete |
| 2     | 1            | -1       | -1        | 1       | Delete |
| 3     | 1            | 1        | 1         | 1       | Delete |
| 4     | 1            | 1        | -1        | -1      | Delete |

Add new mixer rule

Servo mixer

| Servo | Input | Weight (%) | Speed (10µs/s) | Active |  |
|-------|-------|------------|----------------|--------|--|
|-------|-------|------------|----------------|--------|--|

Logic conditions

Add new mixer rule

Save and Reboot

Packet error: 0 I2C error: 0 Cycle Time: 516 CPU Load: 29% MSP version: 2 MSP load: 0.0 MSP round trip: 387 HW round trip: 41 Drop ratio: 0% Arming Flags: -

7.0.0-RC2

12:20 PM 28/03/2024



# SETTING UP YOUR DRONE

# OUTPUT

This Tab is use to calibrate and Test ESC, Motors and Servos assignment

Enable Motor and Servo Output must be on

ESC Protocol

- STANDARD
- STANDARD
- ONESHOT125
- MULTISHOT
- BRUSHED
- DSHOT150
- DSHOT300
- DSHOT600

Servo Refresh rate

- 50Hz
- 50Hz
- 60Hz
- 100Hz
- 160Hz
- 330Hz

INAV

CONFIGURATOR 5.0.0  
FC FIRMWARE 5.0.0

2022-07-23 @ 17:53:05 -- MultiWii API version received - 2.4.0

2022-07-23 @ 17:53:05 -- Flight controller info, identifier: INAV, version: 5.0.0

2022-07-23 @ 17:53:05 -- Running firmware released on: Jun 4 2022 12:14:54

2022-07-23 @ 17:53:05 -- Board: ST41, version: 0

2022-07-23 @ 17:53:05 -- Unique device ID received - 0x4400273037510e36363538

Setup

Calibration

Mixer

Outputs

Ports

Configuration

Failsafe

PID tuning

Advanced Tuning

Programming

Receiver

Modes

Adjustments

GPS

Magnetometer

Mission Control

OSD

8.96 V

Gyro

Accel

Mag

Baro

GPS

Flow

Sonar

Speed

IMU2

No dataflash chip found

Profile 1

Battery profile 1

Disconnect

Enable motor and servo output

STANDARD

ESC protocol

50Hz

Servo refresh rate

Stop motors on low throttle

For analog protocols, IDLE can be lowered below 10% if motors are working smooth without stuttering. If a drone wobbles after pulling throttle low, try increasing IDLE to tune this behavior out.

15.00

Motors IDLE power [%]

14

Number of motor poles (number of magnets)

Reversible motors mode (for use with reversible ESCs)

Motors

1 2 3 4

0% 0% 0% 0%

4 2 3 1

Acc. noise RMS 0.0030

Current [A] 0.00

Voltage [V] 8.94

Save and Reboot

Save

Packet error: 0

I2C error: 0

Cycle Time: 3517

CPU Load: 102%

MSP version: 2

MSP load: 2.6

MSP round trip: 54

HW round trip: 14

Drop ratio: 21%

5.0.0

Links

ENG

6:09 PM

23/07/2022

# SETTING UP YOUR DRONE

# OUTPUT

This Tab is use to calibrate and Test ESC, Motors and Servos assignment

Calibrate ESC:

**Remove all props**

1. Activate motor Test mode
2. Master throttle up 100%
3. Plug in Battery and wait for the calibration Tune
4. Master throttle down 0%
5. Deactivate motor Test mode
6. Test the motor again by reactivating test motor test mode after the boot up tune start slowly throttling up

The screenshot displays the INAV Configurator software interface. The top bar shows the INAV logo, version 6.0.0-FP2, and flight controller information. The left sidebar contains a menu with options like Configuration, Failsafe, PID tuning, and Motors. The main area is the 'Motors' tab, which shows four motor channels (1, 2, 3, 4) with sliders set to 100%. A 'Master' slider is also present. A 'Motor Test Mode Notice' box is visible, warning that moving sliders will cause motors to spin up and advising to remove all propellers. The bottom status bar shows various system metrics like Packet error, I2C error, Cycle Time, CPU Load, and MSP version. The Windows taskbar at the bottom indicates the time is 12:51 PM on 16/12/2022.



# SETTING UP YOUR DRONE

## Electronic Speed Controller CALIBRATION

Its required that all speed controllers must be calibrated in order the motors to spool up at the same RPM and improve stability of the vehicle and the ease of tuning.

1. Plug Synerduino in with USB and Connect INAV Configurator
2. Go to Output Tab
3. Activate motor Test mode (Remove Props)
4. move Master throttle up 100%
5. Plug in Battery and wait for the calibration Tune
6. After the Program tune completed move Master throttle down 0%
7. Allow ESC to exit Programming mode with a Bleep
8. Test the motor again to ensure all motors start running at the same time and speed
9. Then Deactivate Motor Test mode an Disconnect Battery
10. Calibration complete

🔌 Outputs



**Motor Test Mode Notice:**  
Moving the sliders will cause the motors to **spin up**.  
In order to prevent injury **remove ALL propellers** before using this feature.  
☒ I understand the risks, propellers are removed - Enable motor control.

1 2 3 4

100% 100% 100% 100%

100% 100% 100% 100% Master



1 2 3 4

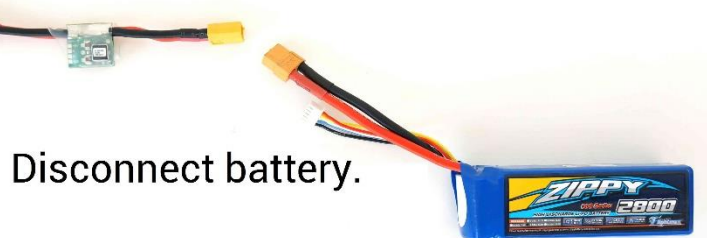
0% 0% 0% 0%

0% 0% 0% 0% Master





Connect battery to power module.



Disconnect battery.

# SETTING UP YOUR DRONE

## PORTS

The Number of Ports is relation to the specification of the Synerduino Board. Pls see data sheet

**Dont Touch USB VCP connection for the STM board . Leave MSP On 115200 (changing this would disconnect the Board and Require Reflashing firmware to fix)**

INAV

CONFIGURATOR 5.0.0  
FC FIRMWARE 5.1.0

5.48 V

Gyro Accel Mag Baro GPS Flow Sonar Speed IMU2

No dataflash chip found

Profile 1 Battery profile 1 Disconnect

2022-10-14 @ 15:06:32 -- MultiWii API version received - 2.4.0

2022-10-14 @ 15:06:32 -- Flight controller info, identifier: INAV, version: 5.1.0

2022-10-14 @ 15:06:32 -- Running firmware released on: Sep 11 2022 13:15:57

2022-10-14 @ 15:06:32 -- Board: SYDU, version: 0

2022-10-14 @ 15:06:32 -- Unique device ID received - 0x4400273037510e36363538

Setup

Calibration

Mixer

Outputs

Ports

Configuration

Programming

Receiver

Modes

Adjustments

GPS

Magnetometer

Mission Control

OSD

Ports

DOCUMENTATION

Note: not all combinations are valid. When the flight controller firmware detects this the serial port configuration will be reset.

Note: Do NOT disable MSP on the first serial port unless you know what you are doing. You may have to reflash and erase your configuration if you do.

| Identifier  | Data                                           | Telemetry     | RX                                            | Sensors         | Peripherals     |
|-------------|------------------------------------------------|---------------|-----------------------------------------------|-----------------|-----------------|
| USB VCP     | <input checked="" type="checkbox"/> MSP 115200 | Disabled AUTO | <input type="checkbox"/> Serial RX            | Disabled 115200 | Disabled 115200 |
| UART1       | <input checked="" type="checkbox"/> MSP 38400  | Disabled AUTO | <input type="checkbox"/> Serial RX            | Disabled 115200 | Disabled 115200 |
| UART2       | <input type="checkbox"/> MSP 115200            | Disabled AUTO | <input checked="" type="checkbox"/> Serial RX | Disabled 115200 | Disabled 115200 |
| SOFTSERIAL1 | <input type="checkbox"/> MSP 57600             | Disabled AUTO | <input type="checkbox"/> Serial RX            | GPS 57600       | Disabled 115200 |

UART1 use for MSP Telemetry as it removes the extra CPU load

UART2 can be use for Serial RC receiver by switching On Serial RX Baud 115200 Telemetry AUTO

SOFT SERIAL 1 / UART3 can be use for GPS (57600) Optical Flow (19200)

Bluetooth (115200) SIK Serial Radio (57600)

Save and Reboot

Packet error: 0 I2C error: 0 Cycle Time: 660 CPU Load: 23% MSP version: 2 MSP load: 0.2 MSP round trip: 56 HW round trip: 16 Drop ratio: 0%

5.0.0

Links ENG 3:06 PM 14/10/2022

BN 880 GPS / Baud 57600

CXFO Optical Flow / Baud 19200

Bluetooth / Baud 115200

SIK Radio / Baud 75600



# SETTING UP YOUR DRONE

## CONFIGURATION

Sensors would depend on the board installation  
Synerduino support the following

ACC – MPU9250 or BMI160

MAG – MPU9250 , HMC5883 or QMC5883

BARO – BMP180 or BMP280

PitotTube – AirSpeed sensor both ADC and i2C

RangeFinder – Ultrasonic and Lidar

Optical Flow - Option installation CXFO Sensor

I2C speed 400hz

Board and Sensor alignment

0.0 Yaw Degrees

CW180 Mag Alignment

Features (Synerduino STM)

Enable CPU based serial ports

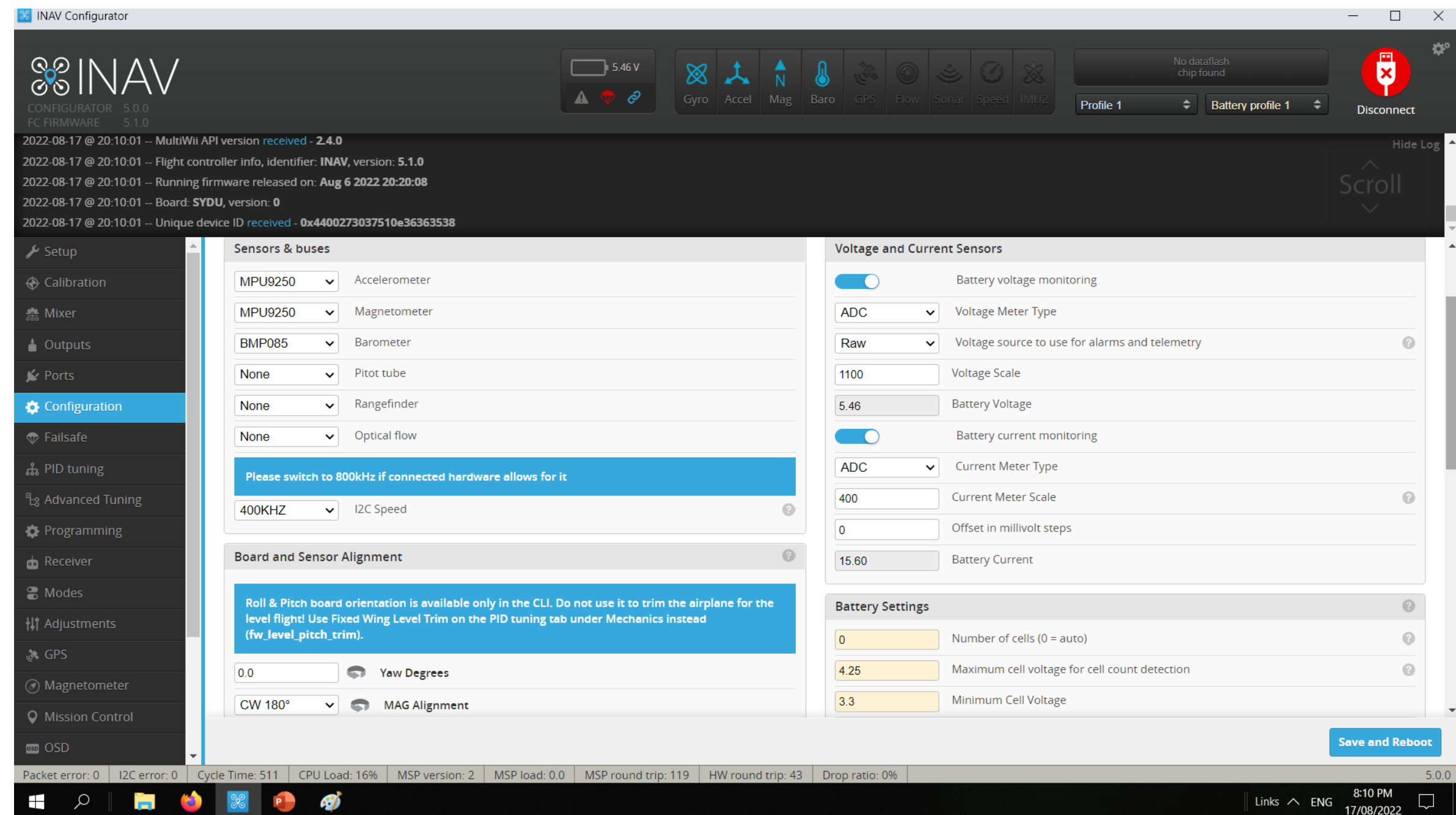
GPS for navigation and telemetry

Telemetry output

Multi-color RGB LED strip support

Enable motor and servo output

This also Contains the Multiplier setting for the Battery Voltage and Current and can be utilize for External ADC sensors applications

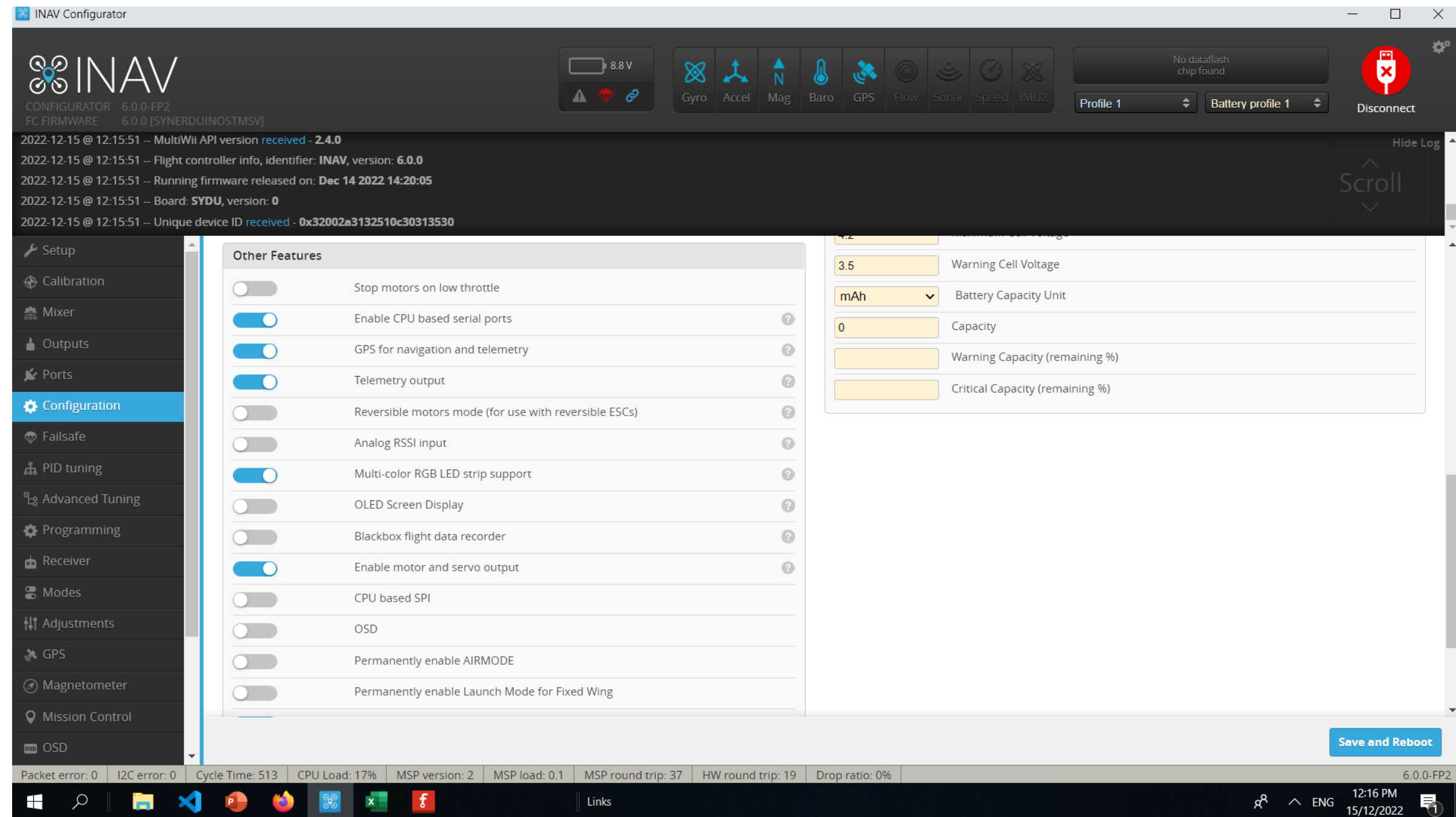


# SETTING UP YOUR DRONE

# CONFIGURATION

## OTHER FEATURES

- **Stop motors on low throttle** – no Idle speed motor is shut off on throttle down
- **Enable CPU based serial ports** – Activate Serial 1 , 2 , Soft serial
- **GPS for navigation and telemetry** – Activate GPS navigation function
- **Telemetry output** – activate MSP protocol for Telemetry use
- **Reversible motors mode** - for use with reversible ESCs)
- **Analog RSSI input** – signal strength of your radio
- **Multi-color RGB LED strip support** – support for WS2811 LED  
Note : it would reduce useable PWM output to 5
- **OLED Screen Display** – small screen support
- **Blackbox flight data recorder** - use with Flash or SD Card SPI to save log flight and sensor data
- **Enable motor and servo output** – activate all PWM pins (Required)
- **CPU based SPI** – to use the CPU to added extra processing to ISP
- **OSD** – Screen Display
- **Permanently enable AIRMODE** - allows motor idle to control the aircraft (Multirotor)
- **Permanently enable Launch Mode for Fixed Wing** – allows to Autolaunch
- **Profile selection with TX stick command** – Stick command profile
- **Throttle voltage compensation** – throttle compensator to power fluctuation
- **Automatic battery profile selection** – Battery Profile setup
- **Continuously trim servos on Fixed Wing** – Automatic Trim to the aircraft Level flight





## SETTING UP YOUR DRONE

# CONFIGURATION

## Voltage and Current sensors

## Battery Voltage monitoring (Vbat)

$$RAW = ADC \text{ V} - \text{Voltage } 0-5V$$

Voltage scale= this is adjusted to calibrate your actual battery voltage to the GUI as identify by the Battery voltage indicator

## Battery Current Monitoring (Current)

RAW = ADC I – Current 0-5V

Current meter scale this is adjusted to calibrate your actual battery Current to the GUI as identify by the Battery Current indicator

## Battery Settings

This is the base battery parameters it should match the specs of your battery

Voltage and Current Sensors

Battery voltage monitoring

ADC

▼

Voltage Meter Type

Raw

▼

Voltage source to use for alarms and telemetry?

450

Voltage Scale

11.66

Battery Voltage

Battery current monitoring

ADC

▼

Current Meter Type

400

Current Meter Scale?

0

Offset in millivolt steps

48.40

Battery Current

Battery Settings?

3

Number of cells (0 = auto)?

4.25

Maximum cell voltage for cell count detection?

3.3

Minimum Cell Voltage

4.2

Maximum Cell Voltage

3.5

Warning Cell Voltage

mAh

▼

Battery Capacity Unit

0

Capacity

Warning Capacity (remaining %)

Critical Capacity (remaining %)



# SETTING UP YOUR DRONE

## PID Tuning

Synerduino Mini Kwad

Proportion Integral  
Derivative tuning  
section to tune your  
drone stability in  
different flight mode  
and sensor feedback  
loop

PITCH  
Proportion 15  
Integral 30  
Derivative 15  
Feedforward 87

ROLL  
Proportion 15  
Integral 30  
Derivative 15  
Feedforward 60

YAW  
Proportion 35  
Integral 80  
Derivative 0

ANGLE/HORIZON  
Strength 40  
LPF Cutoff (Hz) 10  
Transition (Horizon)

INAV

CONFIGURATOR 5.0.0  
FC FIRMWARE 5.1.0

2022-08-17 @ 10:52:07 -- Flight controller info, identifier: INAV, version: 5.1.0  
2022-08-17 @ 10:52:07 -- Running firmware released on: Aug 6 2022 20:20:08  
2022-08-17 @ 10:52:07 -- Board: SYDU, version: 0  
2022-08-17 @ 10:52:07 -- Unique device ID received - 0x4400273037510e36363538  
2022-08-17 @ 10:52:32 -- EEPROM saved: PID Tuning

5.46 V

Gyro Accel Mag Baro GPS Flow Sonar Speed IMU2

No dataflash chip found

Profile 1 Battery profile 1 Disconnect

Setup

Calibration

Mixer

Outputs

Ports

Configuration

Failsafe

PID tuning

Advanced Tuning

Programming

Receiver

Modes

Adjustments

GPS

Magnetometer

Mission Control

OSD

Roll

Proportional 15

Integral 30

Derivative 15

FeedForward 87

Pitch

Proportional 15

Integral 30

Derivative 15

FeedForward 60

Yaw

Proportional 35

Integral 80

Derivative 0

Refresh

Save

Packet error: 0 I2C error: 0 Cycle Time: 511 CPU Load: 17% MSP version: 2 MSP load: 0.0 MSP round trip: 159 HW round trip: 56 Drop ratio: 0%

Show advanced PID controllers

| Name                       | Proportional | Integral | Derivative | FeedForward |
|----------------------------|--------------|----------|------------|-------------|
| Barometer & Sonar/Altitude |              |          |            |             |
| Position Z                 | 50           | 0        | 0          |             |
| Velocity Z                 | 100          | 50       | 10         |             |
| Magnetometer/Heading       |              |          |            |             |
| Heading Hold               | 60           |          |            |             |
| Nav Heading                | 0            | 0        | 0          |             |

| Angle/Horizon | Strength | LPF cutoff (Hz) | Transition (Horizon) |
|---------------|----------|-----------------|----------------------|
| Level         | 40       | 10              | 75                   |



# SETTING UP YOUR DRONE

# ADVANCE PID CONTROLLERS

Synerduino Mini KWAD PID

☒ Show advanced PID controllers

| Name                       | Proportional | Integral        | Derivative           | FeedForward |
|----------------------------|--------------|-----------------|----------------------|-------------|
| Barometer & Sonar/Altitude |              |                 |                      |             |
| Position Z                 | 50           | 0               | 0                    |             |
| Velocity Z                 | 100          | 50              | 10                   |             |
| Magnetometer/Heading       |              |                 |                      |             |
| Heading Hold               | 60           |                 |                      |             |
| Nav Heading                | 0            | 0               | 0                    |             |
| GPS Navigation             |              |                 |                      |             |
| Position XY                | 46           |                 |                      |             |
| Velocity XY                | 40           | 15              | 100                  | 40          |
| Surface                    | 0            | 0               | 0                    |             |
| Angle/Horizon              |              |                 |                      |             |
|                            | Strength     | LPF cutoff (Hz) | Transition (Horizon) |             |
| Level                      | 25           | 15              | 75                   |             |

This is the Main Flight mode tuning

## Barometer & Sonar / Altitude

- Position -Vertical tuning strength
- Velocity - how much responds and the duration of that respond to hold an altitude

## Magnetometer / Heading

- Heading hold
- Nav Heading

## GPS Navigation

- Position XY – this is the strength of the responds to hold position (too tigh it would over correct , too low it would under responds )
- Velocity XY – how fast it would respond to the deviation
- Surface XY – works with optical sensor

## Angle / horizon

- Level – how quick the drone returns to level flight

# SETTING UP YOUR DRONE

# PID TUNING

Filters adjustment for Sensor  
respond rate

The screenshot displays the INAV Configurator interface, specifically the 'Filters' tab. The left sidebar contains a menu with options: Configuration, Failsafe, PID tuning (selected), Advanced Tuning, Programming, Receiver, Modes, Adjustments, GPS, Magnetometer, Mission Control, OSD, LED Strip, Sensors, Tethered Logging, Blackbox, and CLI. The main area shows the following settings:

- Gyro filters:**
  - Main gyro filter cutoff frequency: 110 (slider at ~65%)
  - Matrix Filter Min Frequency: 120 (slider at ~75%)
  - Matrix Filter Q Factor: 250 (slider at ~85%)
  - Unicorn Filter Q Factor: 200 (slider at ~60%)
- D-term filters:**
  - D-term LPF cutoff frequency: 100 (slider at ~65%)
- Gyro RPM filters:**
  - Gyro RPM filter (requires ESC telemetry): ☐ (disabled)
  - Gyro RPM filter min. frequency: 100 (slider at ~65%)

At the bottom, a status bar shows system metrics: Packet error: 0, I2C error: 0, Cycle Time: 2674, CPU Load: 68%, MSP version: 2, MSP load: 0.4, MSP round trip: 96, HW round trip: 30, Drop ratio: 0%. The bottom right corner indicates the version is 5.0.0 and the time is 9:10 AM on 30/07/2022.



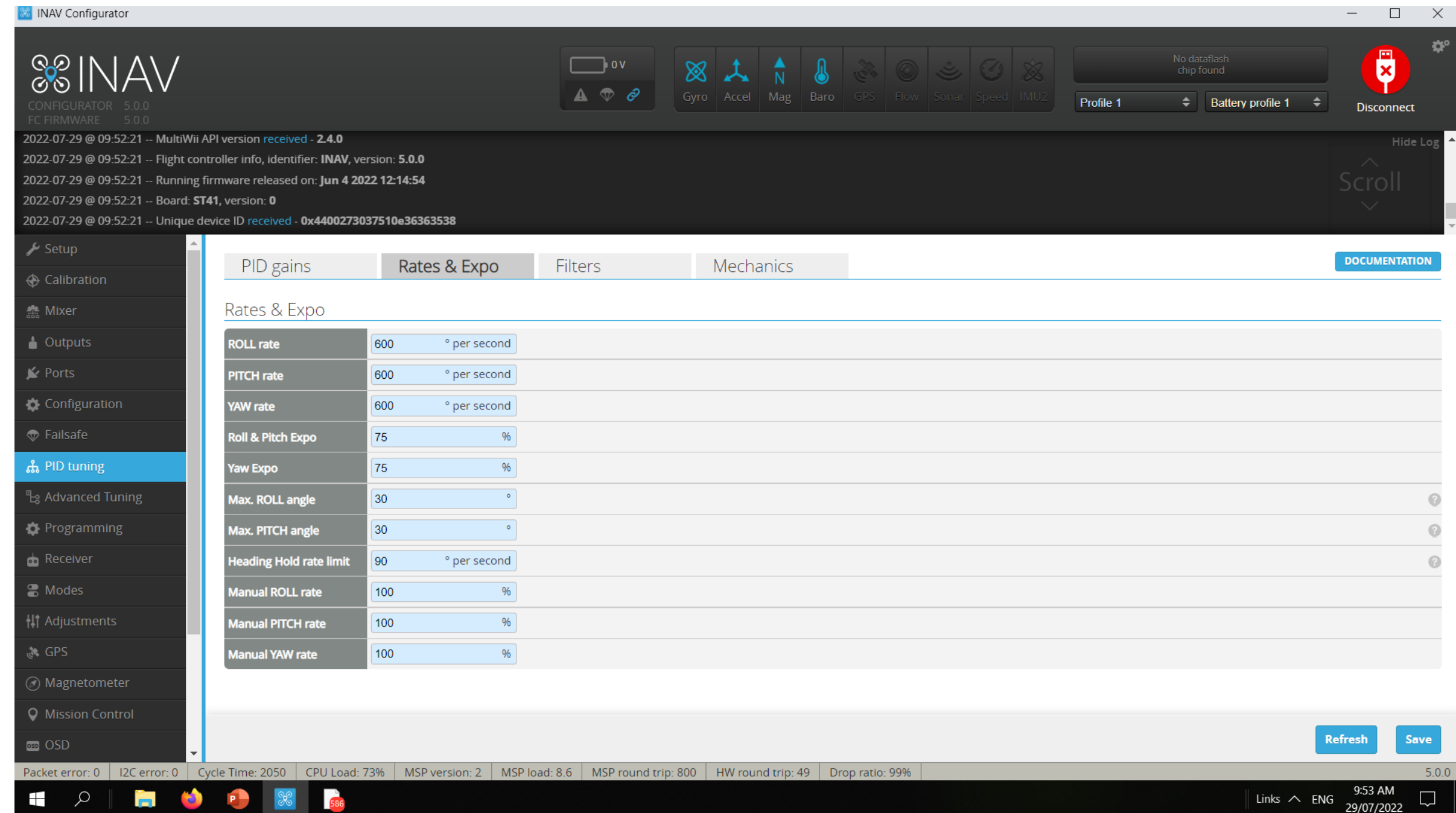
## SETTING UP YOUR DRONE

Rate and Expo pertain to the sensitivity on each behavior and limits set on each flight modes

This can set for Aggressive for sport flying

Or

Relax for beginner training to mission-oriented flight



Roll, Pitch, Yaw Rate = Horizon mode on how fast the drone rotate on its axis (can cause drone to flip mid flight if set too high)

Roll,Pitch,Yaw Manual = this is much basic stabilize mode (none self leveling)

Roll,Pitch,Yaw Angle = in Angle mode sets the max limit on the drone Tilt from level axis (self leveling )

# SETTING UP YOUR DRONE

## EZ PID Tuning

### Synerduino Mini KWAD PID

Introduce in INAV7 allows easier configuration of your PID and Filter function

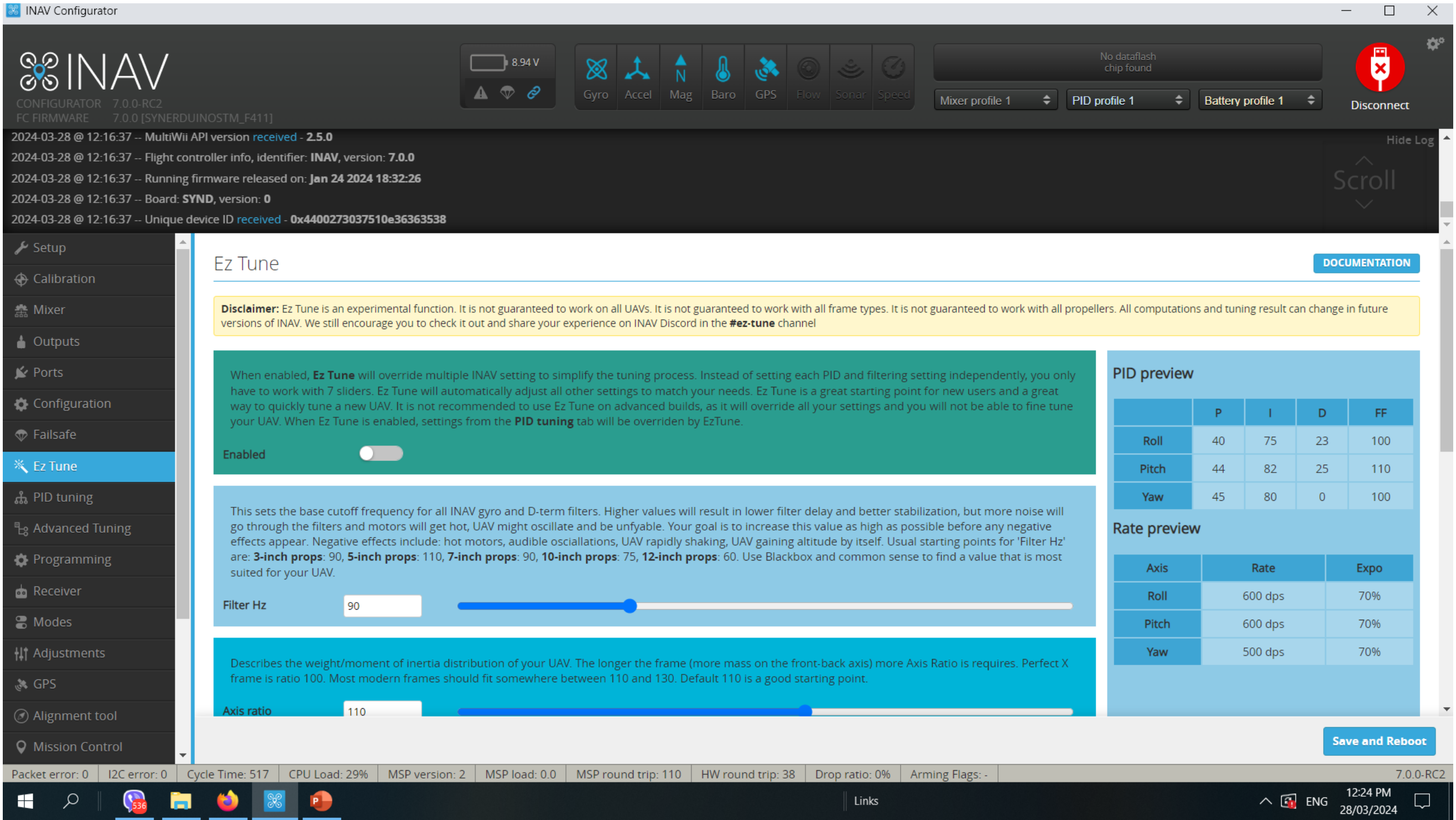
When Enable it automatically override the standard PID process associated to the older INAV 5 and 6

Descriptions are listed

However this is still a work in progress it works well for small drones

Large drones may or may not tune correctly with this , due to wildly varied inertias and weight.

Recommend to use conventional PID tuning method





# SETTING UP YOUR DRONE

INAV

CONFIGURATOR 7.0.0-RC2  
FC FIRMWARE 7.0.0 [SYNERDUINOSTM\_F411]

8.94 V

Gyro

Accel

Mag

Baro

GPS

Flow

Sonar

Speed

No dataflash chip found

Mixer profile 1

PID profile 1

Battery profile 1

Disconnect

2024-03-28 @ 12:16:37 -- MultiWii API version received - 2.5.0

2024-03-28 @ 12:16:37 -- Flight controller info, identifier: INAV, version: 7.0.0

2024-03-28 @ 12:16:37 -- Running firmware released on: Jan 24 2024 18:32:26

2024-03-28 @ 12:16:37 -- Board: SYND, version: 0

2024-03-28 @ 12:16:37 -- Unique device ID received - 0x4400273037510e36363538

Setup

Calibration

Mixer

Outputs

Ports

Configuration

Failsafe

Ez Tune

PID tuning

Advanced Tuning

Programming

Receiver

Modes

Adjustments

GPS

Alignment tool

Mission Control

Describes the weight/moment of inertia distribution of your UAV. The longer the frame (more mass on the front-back axis) more Axis Ratio is requires. Perfect X frame is ratio 100. Most modern frames should fit somewhere between 110 and 130. Default 110 is a good starting point.

Axis ratio110

This setting defines how fast the UAV will react to stick movements and gyro signal. Higher values will result in faster reaction, but also in more overshoots and oscillations. If UAV feels sluggish or has a slow wobble, increase the Response. If it has hot motors, audibly osciallates, overshoots or feels too nervous, decrease the Response. Most modern quads should beefy motors will fly best with Response below 80. Should be tuned together with Damping. It is a P-term equivalent.

Response100

Describes the stengths of a force that opposes any rotation speed change. It dampens roll and pitch acceleration and causes smoother and more stable flight. Your task during tuning is to find out how much you can increase it before any negative symptoms appear: hot motors, audible osciallations, overshoot. Most modern quads should accept 'Damping' up to 150-180. It is a D-term equivalent.

Damping100

Defines long-term stabilization strength. Most modern quads should tolerate 'Stability' even up to 120-130. Usually does not have to be tuned at all. If UAV suffers from heavy propwash during vertical descent, lowering 'Stability' might help. It is a I-term equivalent

Stability100

Defines how fast your UAV will react to fast stick movements. Higher 'Aggressiveness' results in snappier fast manouvers. It does not affect stabilization, only stick feeling. It is a FF-term equivalent.

Aggressiveness100

Yaw

500 dps

70%

Save and Reboot

Packet error: 0 | I2C error: 0 | Cycle Time: 516 | CPU Load: 29% | MSP version: 2 | MSP load: 0.6 | MSP round trip: 110 | HW round trip: 38 | Drop ratio: 0% | Arming Flags: - | 7.0.0-RC2

Windows taskbar

Links

ENG 12:24 PM 28/03/2024

# SETTING UP YOUR DRONE

INAV

CONFIGURATOR 7.0.0-RC2  
FC FIRMWARE 7.0.0 [SYNERDUINOSTM\_F411]

8.94 V

Gyro

Accel

Mag

Baro

GPS

Flow

Sonar

Speed

No dataflash chip found

Mixer profile 1

PID profile 1

Battery profile 1

Disconnect

2024-03-28 @ 12:16:37 -- MultiWii API version received - 2.5.0

2024-03-28 @ 12:16:37 -- Flight controller info, identifier: INAV, version: 7.0.0

2024-03-28 @ 12:16:37 -- Running firmware released on: Jan 24 2024 18:32:26

2024-03-28 @ 12:16:37 -- Board: SYND, version: 0

2024-03-28 @ 12:16:37 -- Unique device ID received - 0x4400273037510e36363538

Setup

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Mixer

Outputs

Ports

Configuration

Failsafe

Ez Tune

PID tuning

Advanced Tuning

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Receiver

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Adjustments

GPS

Alignment tool

Mission Control

Describes the strengths of a force that opposes any rotation speed change. It dampens roll and pitch acceleration and causes smoother and more stable flight. Your task during tuning is to find out how much you can increase it before any negative symptoms appear: hot motors, audible oscillations, overshoot. Most modern quads should accept 'Damping' up to 150-180. It is a D-term equivalent.

Damping100

Defines long-term stabilization strength. Most modern quads should tolerate 'Stability' even up to 120-130. Usually does not have to be tuned at all. If UAV suffers from heavy propwash during vertical descent, lowering 'Stability' might help. It is a I-term equivalent

Stability100

Defines how fast your UAV will react to fast stick movements. Higher 'Aggressiveness' results in snappier fast manoeuvres. It does not affect stabilization, only stick feeling. It is a FF-term equivalent.

Aggressiveness100

Defines how fast your UAV will rotate around roll, pitch and yaw axis. Higher 'Rate' results in faster rotation. Value of 0 is the equivalent of 300dps, 100 is the equivalent of 600dps, 200 is the equivalent of 900dps.

Rate100

Defines expo of the RC input. Lower values result in more sensitive stick in the center. Higher values result in less sensitive center and more rapid response at the end of the stick. Value of 0 is the equivalent of 0 expo, 100 is the equivalent of 0.7 expo, 200 is the equivalent of 1.0 expo.

Expo100

Save and Reboot

Packet error: 0

I2C error: 0

Cycle Time: 518

CPU Load: 28%

MSP version: 2

MSP load: 0.0

MSP round trip: 110

HW round trip: 38

Drop ratio: 0%

Arming Flags: -

7.0.0-RC2

Links

ENG

12:25 PM

28/03/2024



# SETTING UP YOUR DRONE

INAV

CONFIGURATOR 7.0.0-RC2  
FC FIRMWARE 7.0.0 [SYNERDUINOSTM\_F411]

8.91 V

Gyro Accel Mag Baro GPS Flow Sonar Speed

No dataflash chip found

Mixer profile 1 PID profile 1 Battery profile 1

Disconnect

2024-03-28 @ 12:16:37 -- MultiWii API version received - 2.5.0

2024-03-28 @ 12:16:37 -- Flight controller info, identifier: INAV, version: 7.0.0

2024-03-28 @ 12:16:37 -- Running firmware released on: Jan 24 2024 18:32:26

2024-03-28 @ 12:16:37 -- Board: SYND, version: 0

2024-03-28 @ 12:16:37 -- Unique device ID received - 0x4400273037510e36363538

Setup

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Mission Control

PID gains Rates & Expo Filters Mechanics

DOCUMENTATION

Reset PID Controller Select New Defaults Show all PIDs

Roll

Proportional 40

Integral 75

Derivative 26

FeedForward 60

Pitch

Proportional 44

Integral 85

Derivative 28

FeedForward 60

Yaw

Proportional 40

Refresh Save and Reboot

Packet error: 0 I2C error: 0 Cycle Time: 521 CPU Load: 28% MSP version: 2 MSP load: 0.0 MSP round trip: 115 HW round trip: 40 Drop ratio: 0% Arming Flags: -

7.0.0-RC2

Windows Taskbar

Links

ENG 12:25 PM 28/03/2024

# SETTING UP YOUR DRONE

# ADVANCE TUNING

Advance tuning for all  
navigational settings

Recommended changes for  
Synerduino 250mm Quad

300cm/s Nav speed  
1000cm/s Max Nav speed  
500cm/s Max Cruise Speed  
30 Degree Max bank Angle MC

The screenshot displays the INAV Configurator software interface. The top status bar shows a battery level of 5.43 V and various sensor status icons (Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed, IMU2). The left sidebar contains a menu with options: Setup, Calibration, Mixer, Outputs, Ports, Configuration, Failsafe, PID tuning, Advanced Tuning (highlighted), Programming, Receiver, Modes, Adjustments, GPS, Magnetometer, Mission Control, and OSD. The main panel is divided into several sections:

- Multirotor Navigation Settings:**
  - ATTI (dropdown) User Control Mode
  - 300 cm/s Default navigation speed
  - 1000 cm/s Max. navigation speed
  - 500 cm/s Max. CRUISE speed
  - 30 ° Multirotor max. banking angle
  - Use mid. throttle for ALTHOLD (checkbox)
  - 1400 uS Hover throttle
  - Slow down when approaching waypoint (checkbox)
- Multirotor braking mode configuration:**
  - 100 cm/s Min. speed threshold
  - 75 cm/s Braking disengage speed
  - 2000 ms Max. braking duration
  - 100 Boost factor
  - 750 ms Max. braking boost duration
  - 150 cm/s Boost min. speed threshold
  - 100 cm/s Braking boost disengage speed
  - 40 ° Max. bank angle
- Generic settings:**
  - RTH settings:**
    - AT\_LEAST (dropdown) RTH altitude mode
    - 1000 cm RTH altitude
    - 0 cm RTH Home altitude
    - ON (dropdown) Climb before RTH
  - General Navigation Settings:**
    - 200 cm/s Max. Alt-hold climb rate
    - 500 cm/s Max. navigation climb rate
  - Waypoint Navigation Settings**

The bottom status bar displays system metrics: Packet error: 0, I2C error: 0, Cycle Time: 517, CPU Load: 16%, MSP version: 2, MSP load: 1.0, MSP round trip: 115, HW round trip: 42, Drop ratio: 0%, and version 5.0.0. The Windows taskbar at the very bottom shows the time as 8:17 PM on 17/08/2022.



# SETTING UP YOUR DRONE

# ADVANCE TUNING

## Fixwing settings

This is for fixwing application  
Selecting the info button brings  
up the information of each  
setting

### Fixed Wing Auto Launch Settings

|      |    |                     |   |
|------|----|---------------------|---|
| 1000 | uS | Idle Throttle       | ? |
| 0    | ms | Idle Throttle Delay | ? |
| 45   | °  | Max Throw Angle     | ? |
| 500  | ms | Motor Delay         | ? |
| 0    | ms | Minimum Launch Time | ? |
| 100  | ms | Motor Spinup Time   | ? |
| 1700 | uS | Launch Throttle     | ? |
| 18   | °  | Climb Angle         | ? |
| 5000 | ms | Launch Timeout      | ? |
| 0    | cm | Maximum Altitude    | ? |
| 3000 | ms | End Transition Time | ? |

### Fixed Wing Landing Settings

|       |      |                                                        |   |
|-------|------|--------------------------------------------------------|---|
| 35000 | cm   | Final approach length                                  | ? |
| 100   | %    | Modifier for pitch to throttle ratio at final approach | ? |
| 200   | cm   | Initial altitude of the glide phase                    | ? |
| 150   | cm   | Initial altitude of the flare phase                    | ? |
| 0     | °    | Pitch value for glide phase                            | ? |
| 8     | °    | Pitch value for flare phase                            | ? |
| 140   | cm/s | Max. tailwind                                          | ? |

# SETTING UP YOUR DRONE

# ADVANCE TUNING

## Fixwing settings

This is for fixwing application  
Selecting the info button brings  
up the information of each  
setting

| Fixed Wing Navigation Settings     |                                    |                                                            |
|------------------------------------|------------------------------------|------------------------------------------------------------|
| <input type="text" value="1200"/>  | <input type="text" value="uS"/>    | Min. throttle                                              |
| <input type="text" value="1700"/>  | <input type="text" value="uS"/>    | Max. throttle                                              |
| <input type="text" value="1400"/>  | <input type="text" value="uS"/>    | Cruise throttle                                            |
| <input type="checkbox"/>           |                                    | Allow manual throttle increase <span>?</span>              |
| <input type="text" value="0"/>     | <input type="text" value="deci°"/> | Min Throttle Down Pitch <span>?</span>                     |
| <input type="text" value="10"/>    | <input type="text" value="uS"/>    | Pitch to throttle ratio <span>?</span>                     |
| <input type="text" value="6"/>     |                                    | Throttle smoothing <span>?</span>                          |
| <input type="text" value="50"/>    | <input type="text" value="deci°"/> | Instantaneous throttle adjustment threshold <span>?</span> |
| <input type="text" value="35"/>    | <input type="text" value="°"/>     | Max. navigation bank angle <span>?</span>                  |
| <input type="text" value="20"/>    | <input type="text" value="°"/>     | Max. navigation climb angle <span>?</span>                 |
| <input type="text" value="15"/>    | <input type="text" value="°"/>     | Max. navigation dive angle <span>?</span>                  |
| <input type="text" value="7500"/>  | <input type="text" value="cm"/>    | Loiter radius                                              |
| <input type="text" value="RIGHT"/> | <input type="text" value="v"/>     | Loiter direction <span>?</span>                            |
| <input type="text" value="0"/>     |                                    | Control Smoothness <span>?</span>                          |
| <input type="checkbox"/>           |                                    | Soaring Mode Motor Stop <span>?</span>                     |
| <input type="text" value="5"/>     | <input type="text" value="°"/>     | Soaring Mode Pitch Deadband <span>?</span>                 |



# SETTING UP YOUR DRONE

# ADVANCE TUNING

## Multicopter Setting

This is for fixwing application  
Selecting the info button brings  
up the information of each  
setting

## Stick Position on Althold hover

STICK – ideal if your switching  
between manual and althold  
often in flight

MID STICK – Ideal if your  
Controller uses Neutral throttle  
position , with althold being  
active from Arm

HOVER – this uses the set hover  
position regardless of user input  
on throttle stick

### Multicopter Navigation Settings

|                                     |      |                                     |   |
|-------------------------------------|------|-------------------------------------|---|
| ATTI                                | ▼    | User Control Mode                   |   |
| 300                                 | cm/s | Default navigation speed            | ? |
| 1000                                | cm/s | Max. navigation speed               |   |
| 500                                 | cm/s | Max. CRUISE speed                   | ? |
| 30                                  | °    | Multicopter max. banking angle      | ? |
| STICK                               | ▼    | Stick position for althold hover    |   |
| 1300                                | µs   | Hover throttle                      |   |
| <input checked="" type="checkbox"/> |      | Slow down when approaching waypoint | ? |

### Multicopter braking mode configuration

|      |      |                               |   |
|------|------|-------------------------------|---|
| 100  | cm/s | Min. speed threshold          | ? |
| 75   | cm/s | Braking disengage speed       | ? |
| 2000 | ms   | Max. braking duration         | ? |
| 100  |      | Boost factor                  | ? |
| 750  | ms   | Max. braking boost duration   | ? |
| 150  | cm/s | Boost min. speed threshold    | ? |
| 100  | cm/s | Braking boost disengage speed | ? |
| 40   | °    | Max. bank angle               | ? |

# SETTING UP YOUR DRONE

# ADVANCE TUNING

## Multicopter Setting

This is for fixwing application  
Selecting the info button brings  
up the information of each  
setting

| General Navigation Settings |      |                                |   |
|-----------------------------|------|--------------------------------|---|
| 200                         | cm/s | Max. Alt-hold climb rate       | ? |
| 500                         | cm/s | Max. navigation climb rate     | ? |
| 0                           | cm   | Max Altitude for Navigation    | ? |
| ALL_NAV                     | ▼    | Navigation Motor Stop Override | ? |

| Waypoint Navigation Settings |    |                              |   |
|------------------------------|----|------------------------------|---|
| 100                          | cm | Waypoint radius              | ? |
| 100                          | m  | Waypoint safe distance       | ? |
| <input type="checkbox"/>     |    | Load Waypoints on Boot       | ? |
| 0                            | cm | Enforce Altitude at Waypoint | ? |
| 0                            |    | Waypoint Tracking Accuracy   | ? |
| 60                           | °  | Waypoint Tracking Angle      | ? |
| OFF                          | ▼  | Waypoint Turn Smoothing      | ? |
| RESUME                       | ▼  | Restart Waypoint Mission     | ? |



# SETTING UP YOUR DRONE

# ADVANCE TUNING

## Multicopter Setting

This is for fixwing application  
Selecting the info button brings  
up the information of each  
setting

| RTH settings             |    |                                                                 |
|--------------------------|----|-----------------------------------------------------------------|
| AT_LEAST                 | ▼  | RTH altitude mode                                               |
| 1000                     | cm | RTH altitude ?                                                  |
| 0                        | cm | RTH Home altitude ?                                             |
| ON                       | ▼  | Climb before RTH ?                                              |
| AT_LEAST                 | ▼  | Climb First Stage Method ?                                      |
| 0                        | cm | Climb First Stage Altitude ?                                    |
| <input type="checkbox"/> |    | Use Linear Descent ?                                            |
| 0                        | m  | Linear Descent Start Distance ?                                 |
| <input type="checkbox"/> |    | Climb regardless of position sensors health                     |
| <input type="checkbox"/> |    | Override RTH altitude and climb setting with roll/pitch stick ? |
| OFF                      | ▼  | RTH Track Back Mode ?                                           |
| 500                      | m  | RTH Track Back Distance ?                                       |
| RTH                      | ▼  | Safe Home Mode ?                                                |
| 20000                    | cm | Safe Home Max Distance ?                                        |
| <input type="checkbox"/> |    | Tail first                                                      |
| ALWAYS                   | ▼  | Land after RTH                                                  |
| 500                      | cm | Min. RTH distance ?                                             |
| 50000                    | cm | RTH abort threshold ?                                           |
| 0                        | s  | Failsafe Mission Delay ?                                        |

# SETTING UP YOUR DRONE

## RECEIVER

### Serial Receiver as SBUS

Be aware of your radio format

AETR = Futaba format

TAER = JR format

EATR = Walkera Format

This is to check if there is signal coming from the receiver

Also to adjust the Expo rate of your RC controls

The screenshot shows the INAV Configurator software interface. The top bar displays the INAV logo, version 5.0.0, and various system status indicators like battery level (8.96 V) and connection status. The left sidebar contains a menu with options: Setup, Calibration, Mixer, Outputs, Ports, Configuration, Failsafe, PID tuning, Advanced Tuning, Programming, Receiver (selected), Modes, Adjustments, GPS, Magnetometer, Mission Control, and OSD. The main area is divided into several sections. The 'Channel map' section shows a list of channels (AETR, Roll [A], Pitch [E], Yaw [R], Throttle [T], CH 5 through CH 18) with their corresponding values and bar graphs. The 'Receiver mode' section shows the receiver type set to SERIAL, a note about configuring a serial port, and various settings like SBUS, Serial Receiver Provider, Serial Port Inverted, and Serial receiver half-duplex. There are also graphs for Throttle MID, Throttle EXPO, RC Deadband, Yaw Deadband, RC Expo, Manual RC Expo, RC Yaw Expo, and Manual RC Yaw Expo. A 'Save and Reboot' button is at the bottom right. The bottom status bar shows system metrics like Packet error, I2C error, Cycle Time, CPU Load, MSP version, MSP load, MSP round trip, HW round trip, Drop ratio, and the current time (9:28 AM 29/07/2022).



# RECEIVER FORMAT

INAV like most modern Flight controllers now Supports Sbus to reduce the number of wires in build its advice to use Sbus Receiver for Synerduino STM as well

| RX > SBUS input | Futaba Format (AETR) | JR Format (TAER) | Walkera Format (EATR) | SBUS/PPM/PWM Converter may be required if your receiver don't support SBUS<br><br><br><br><br><br><br><br><br><br>Pls Check the output pin from your Radio Rx manual |  |
|-----------------|----------------------|------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Throttle        | Ch3                  | Ch1              | Ch3                   |                                                                                                                                                                      |  |
| Aileron         | Ch1                  | Ch2              | Ch2                   |                                                                                                                                                                      |  |
| Elevator        | Ch2                  | Ch3              | Ch1                   |                                                                                                                                                                      |  |
| Rudder          | Ch4                  | Ch4              | Ch4                   |                                                                                                                                                                      |  |
| Aux1            | Ch5                  | Ch5              | Ch5                   |                                                                                                                                                                      |  |
| Aux2            | Ch6                  | Ch6              | Ch6                   |                                                                                                                                                                      |  |
| Aux3            | Ch7                  | Ch7              | Ch7                   |                                                                                                                                                                      |  |
| Aux4            | Ch8                  | Ch8              | Ch8                   |                                                                                                                                                                      |  |

# SETTING UP YOUR DRONE

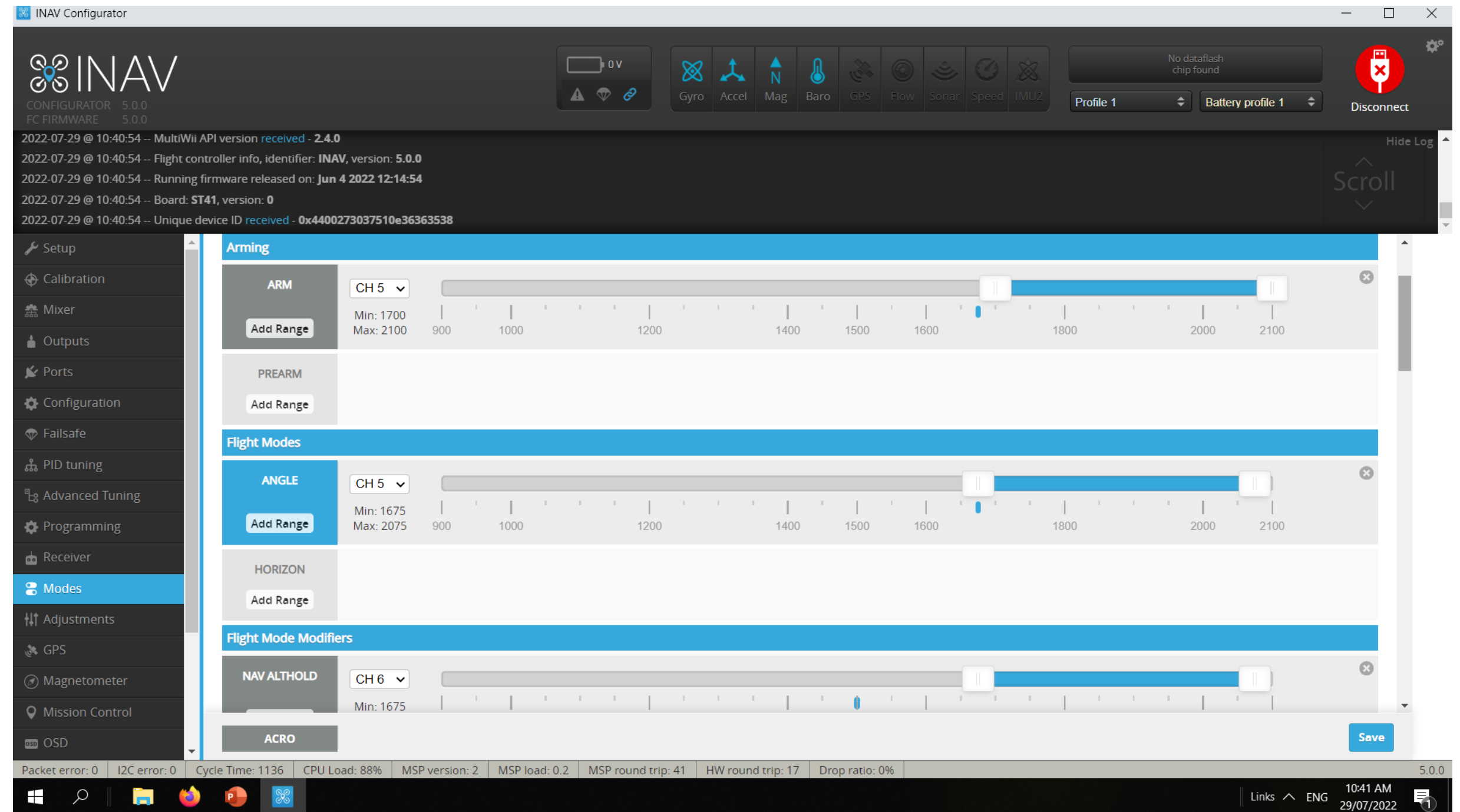
## MODES

### Flight modes

This is where you set the Aux switch on your transmitter commands

For Beginners we advice to have  
Turn **ANGLE Flight Mode** on

- [NAV ALTHOLD - Altitude hold](#)
- [NAV POSHOLD - Horizontal position hold](#)
- [NAV COURSE HOLD - Fixed Wing Heading Hold](#)
- [NAV CRUISE - Fixed Wing Heading + Altitude Hold](#)
- [NAV RTH - Return to home](#)
- [NAV WP - Autonomous waypoint mission](#)
- [WP PLANNER - On the fly waypoint mission planner](#)
- [GCS NAV - Ground control station](#)



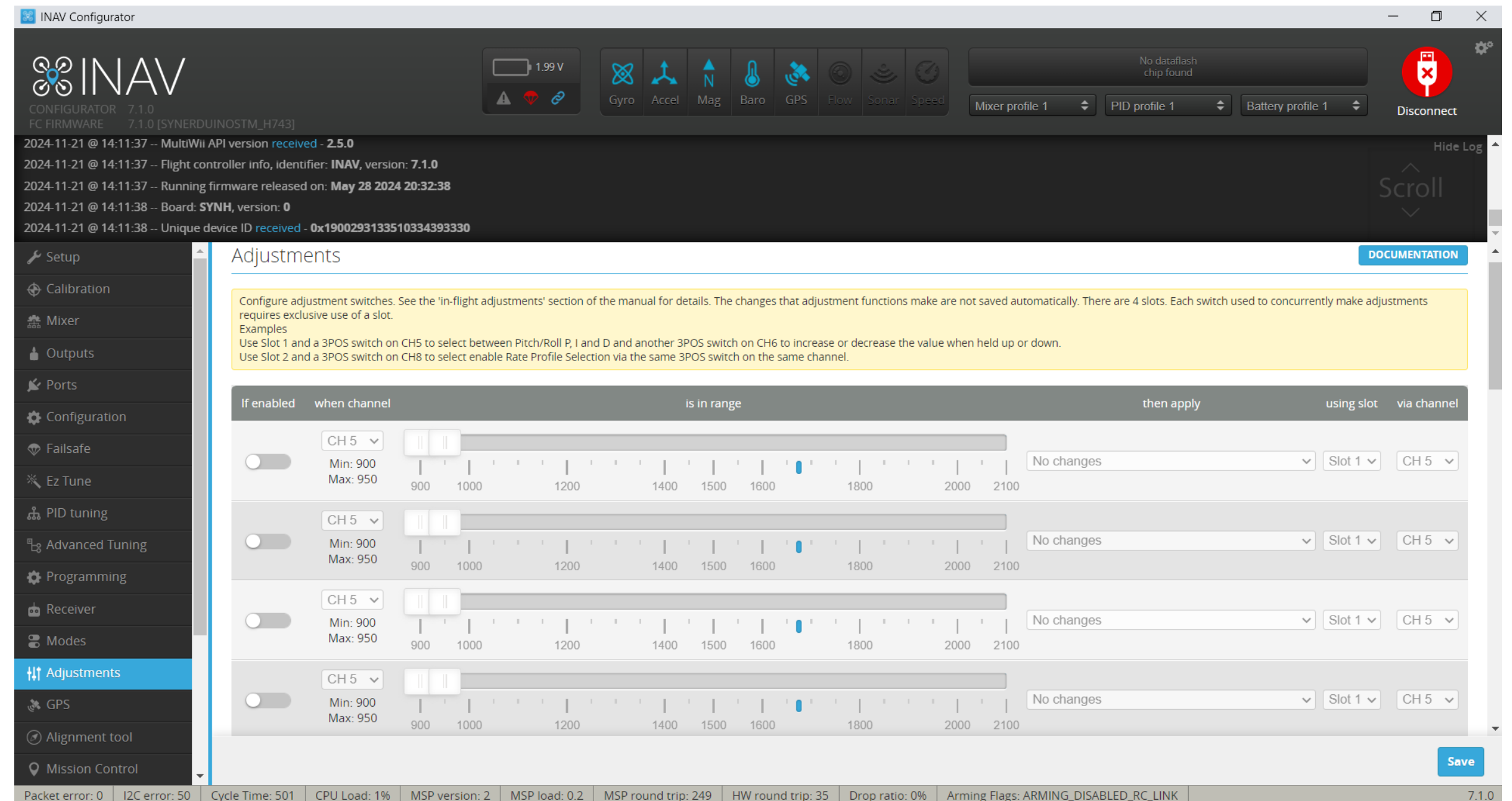


# ADJUSTMENTS

Configure adjustment switches. See the 'in-flight adjustments' section of the manual for details. The changes that adjustment functions make are not saved automatically. There are 4 slots. Each switch used to concurrently make adjustments requires exclusive use of a slot.

## Examples

- Use Slot 1 and a 3POS switch on CH5 to select between Pitch/Roll P, I and D and another 3POS switch on CH6 to increase or decrease the value when held up or down.
- Use Slot 2 and a 3POS switch on CH8 to select enable Rate Profile Selection via the same 3POS switch on the same channel.



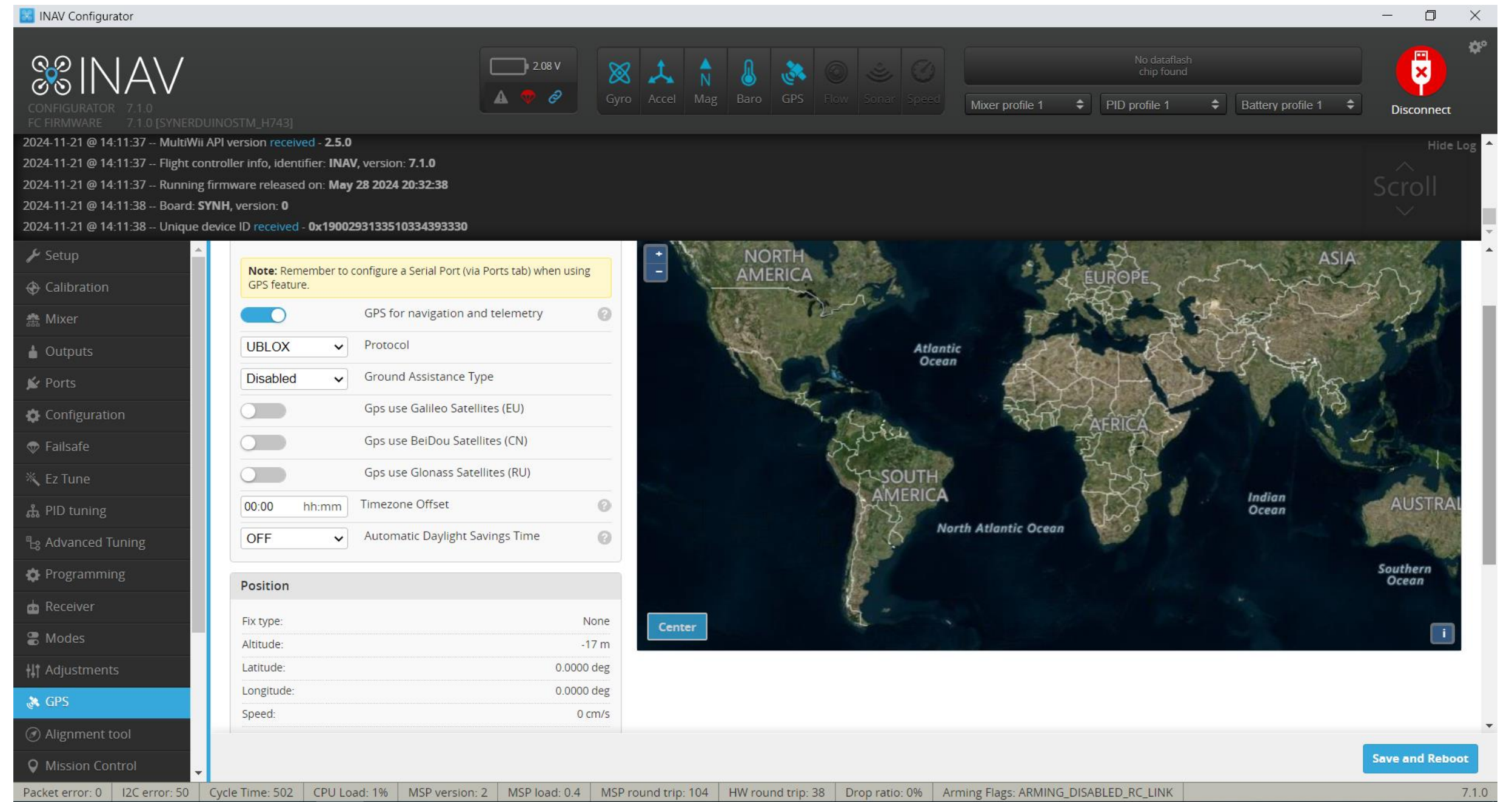
# GPS

## GPS settings

Note: Remember to configure a Serial Port (via Ports tab) when using GPS feature

Here is where you setup your GPS base off the GPS module function.

Its also to check if GPS is working correctly

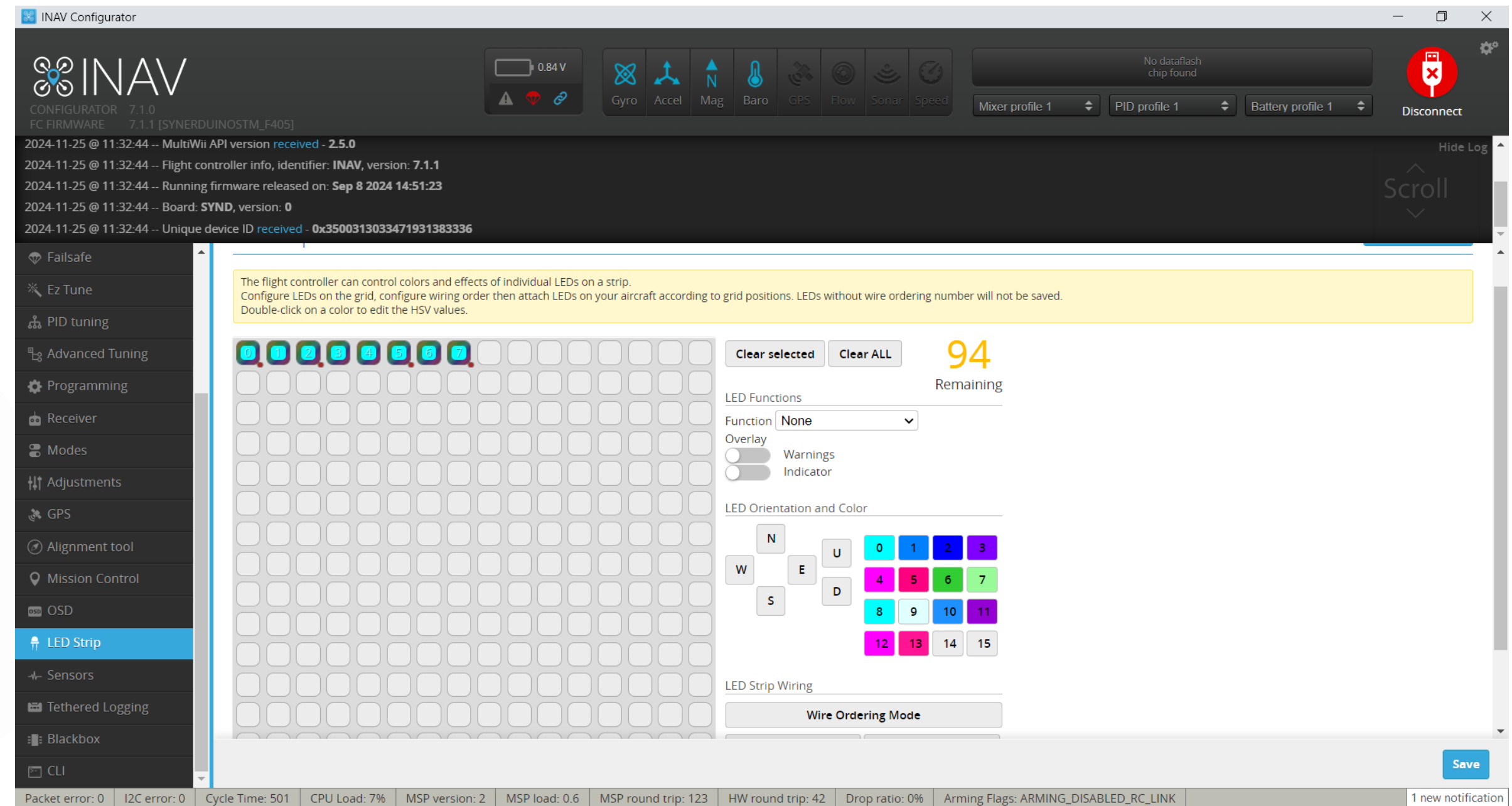
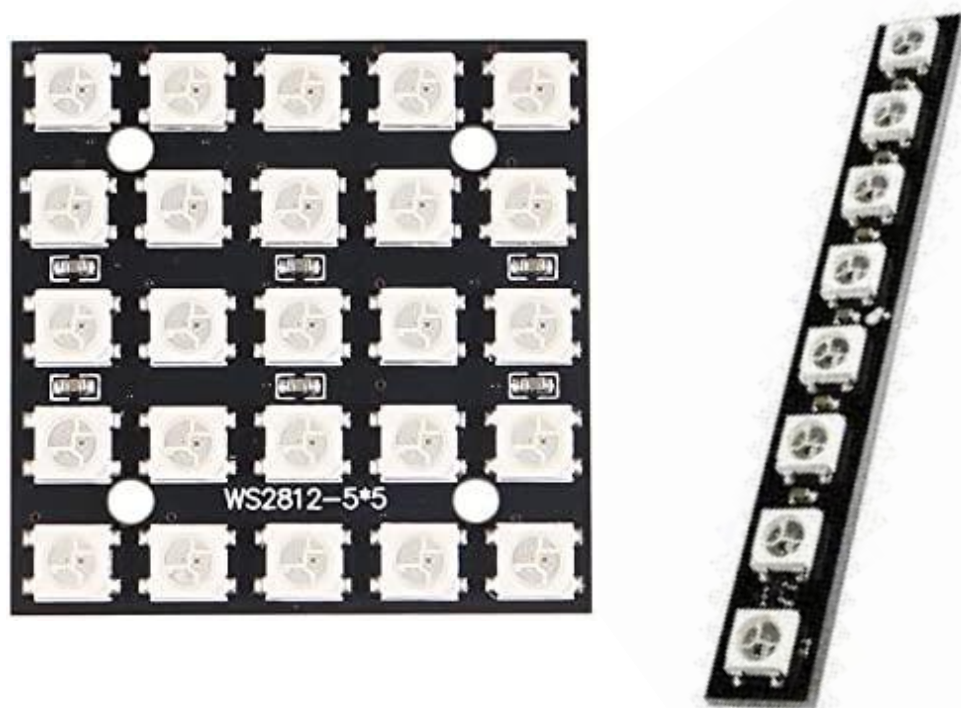




# SETTING UP YOUR DRONE

## LED STRIP

WS2811/WS2812 – Led strip  
programming upto  
32 LEDs F411  
102 LEDs F405 / H743



WS2811 – Led strip this needs to be activated on the Configure Tab before you can use this function

Note: F411 this will reduce the PWM availability to just 5 Pins removes S6 and S7 (this is because it requires 2 Timers to run the WS2811)

# SETTING UP YOUR DRONE

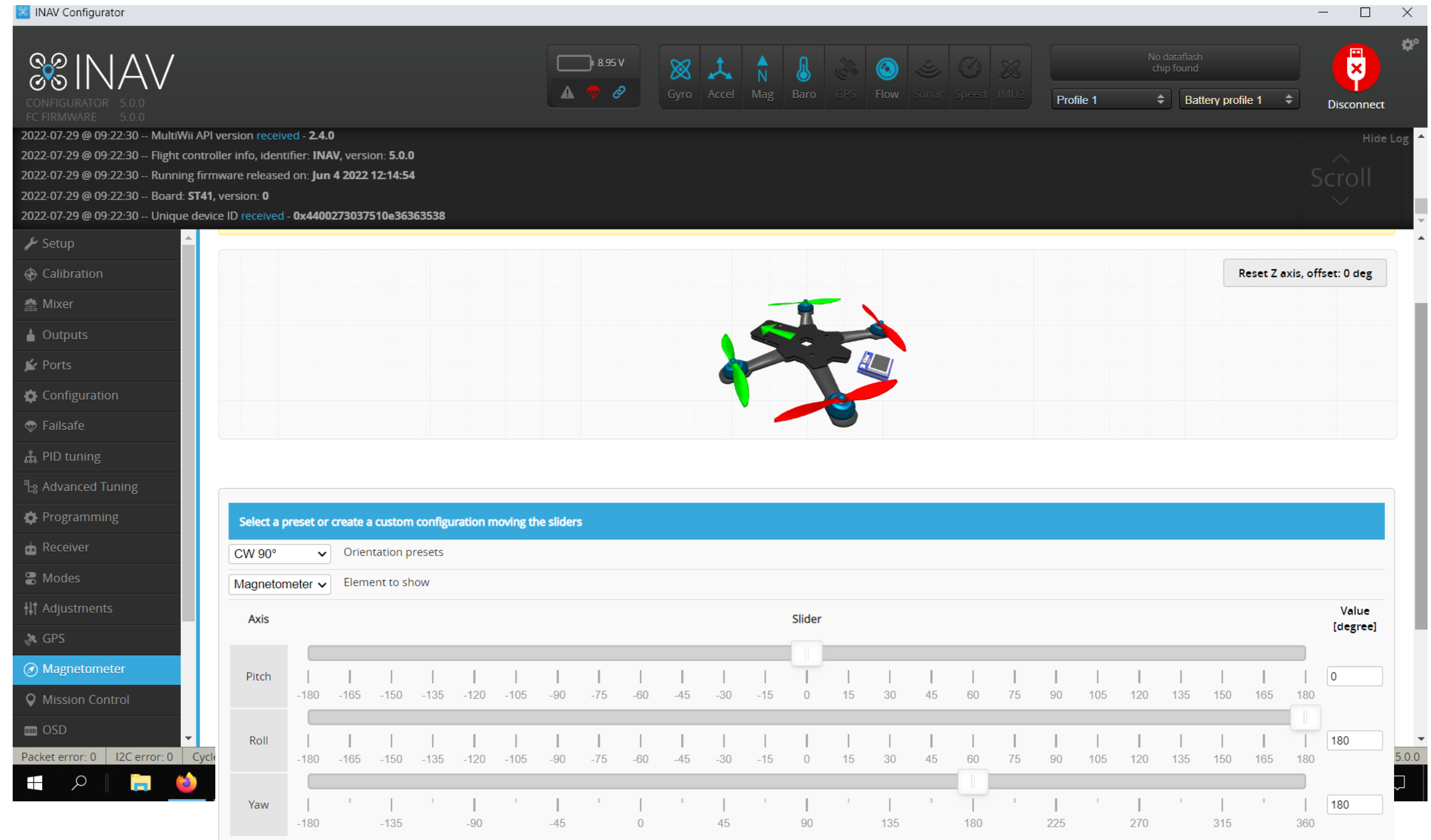
## MAGNETOMETER (INAV5-6)

This is where you set the orientation of your Mag sensor, should you use the GPS with a build in MAG

Also the Mag orientation can vary from flight controller to flight controller. Please be aware of this

This can be verified from the setup tab. Look at heading; it should follow when the drone is pointing toward a heading

0 Degrees = North  
90 Degrees = East  
180 Degrees = South  
270 Degrees = West



Synerduino STM V0.1 uses the HMC5883 orientation is Pitch 0, Roll 180, Yaw 180



# SETTING UP YOUR DRONE

## ALIGNMENT TOOL (INAV7-8)

This replaces the old magnetometer Tab with the addition of Board Orientation

In an situation you needed to Reorientation of the Flight controller to fit your vehicle

This can be verified From the setup Tab look at heading it should follow when the Drone is pointing toward a heading

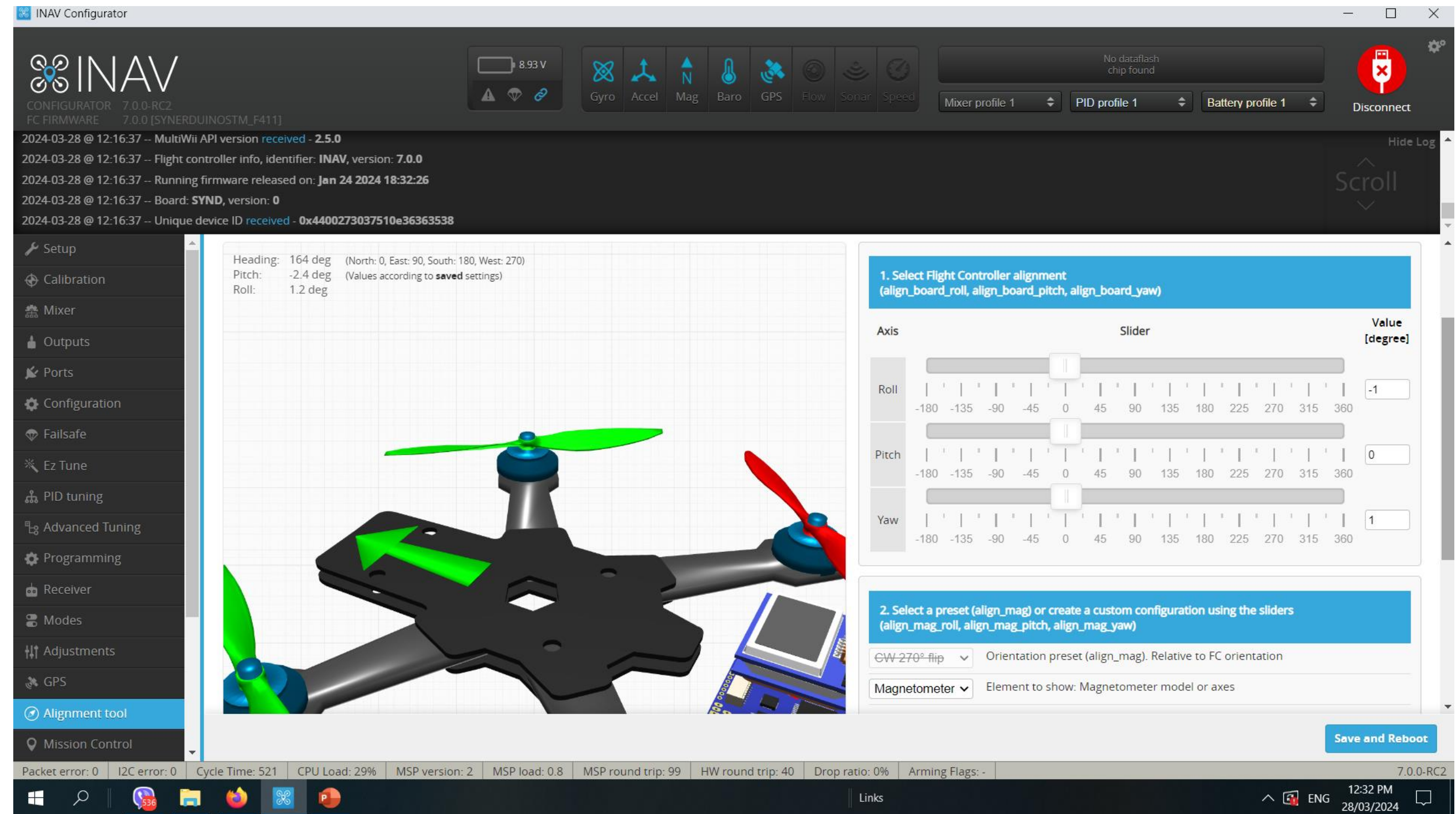
Mag relationship

0 Degrees = North

90 Degrees = East

180 Degrees = South

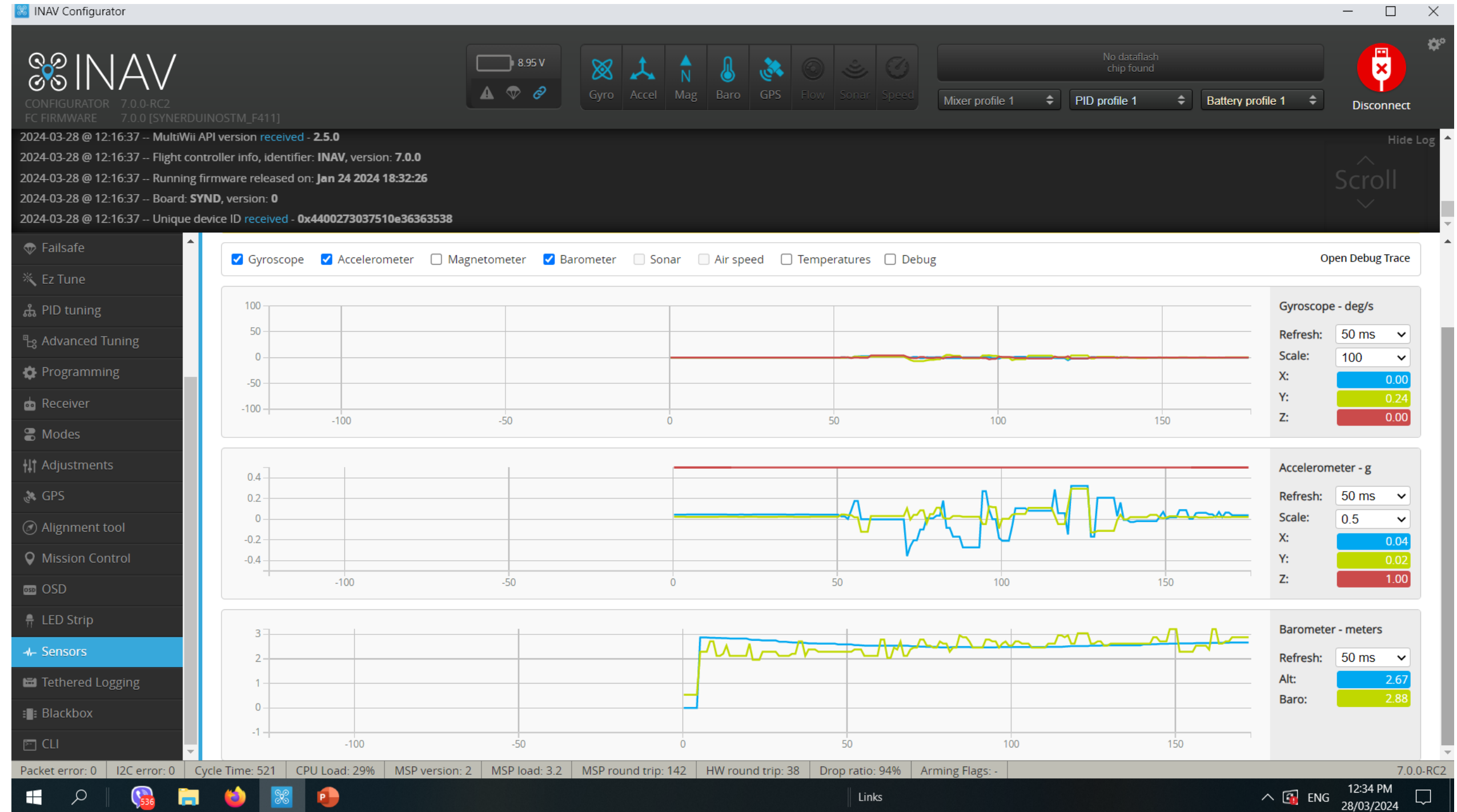
270 Degrees = West



# SETTING UP YOUR DRONE

## SENSORS

This is to visualize your Sensors input and aid for orientation

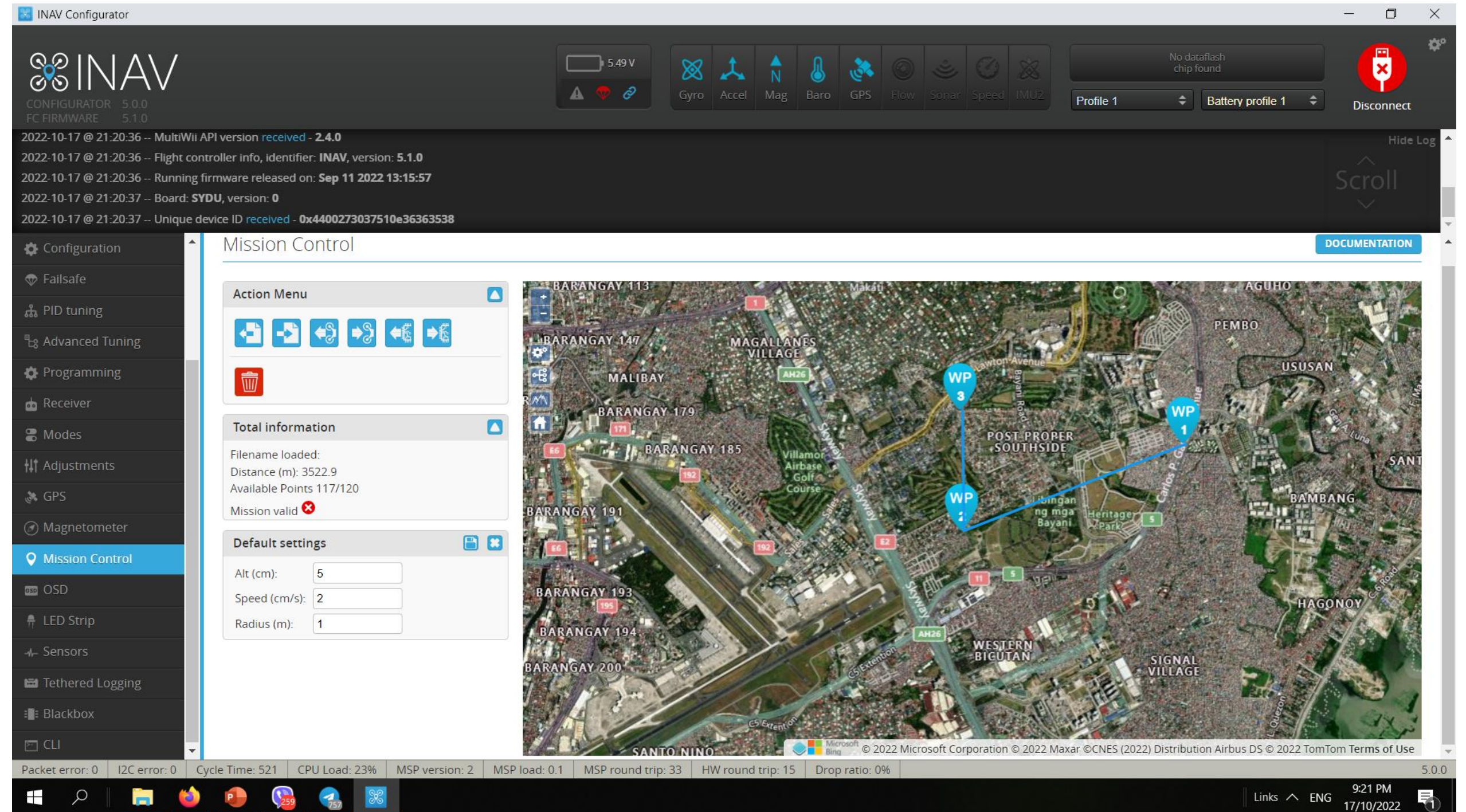




# SETTING UP YOUR DRONE

## MISSION CONTROL

NAV Configurator allows to choose between OpenStreetMap, Bing Maps, and MapProxy map providers. INAV Configurator is shipped **WITHOUT** API key for Bing Maps. That means: every user who wants to use Bing Maps has to create own account, agree to all *Terms and Conditions* required by Bing Maps and configure INAV Configurator by himself.

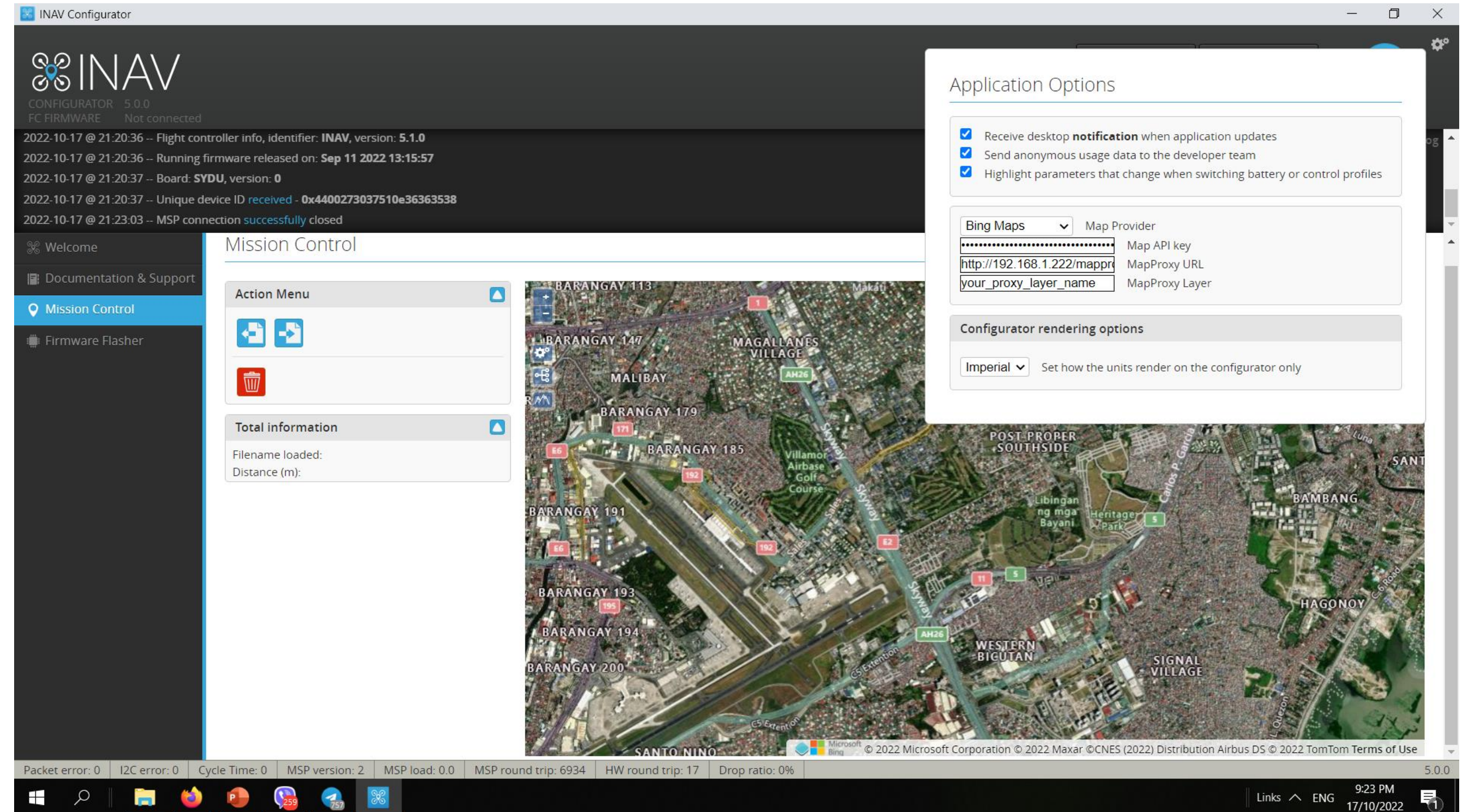




# SETTING UP YOUR DRONE

## How to choose Map provider

1. Click **Settings** icon in the top-right corner of INAV Configurator
2. Choose provider: OpenStreetMap, Bing, or MapProxy
3. In the case of Bing Maps, you have to provide your own, personal, generated by you, Bing Maps API key
4. For MapProxy, you need to provide a server URL and layer name to be used





How to get Bing Maps API key

- 1.Go to the Bing Maps Dev Center at <https://www.bingmapsportal.com/>.
  1. If you have a Bing Maps account, sign in with the Microsoft account that you used to create the account or create a new one. For new accounts, follow the instructions in [Creating a Bing Maps Account](#).
- 2.Select **My keys** under **My Account**.
- 3.Select the option to create a new key.
- 4.Provide the following information to create a key:
  1. Application name: Required. The name of the application.
  2. Application URL: The URL of the application. This is an optional field which is useful in helping you remember the purpose of that key in the future.
  3. Key type: Required. Select the key type that you want to create. You can find descriptions of key and application types [here](#).
  4. Application type: Required. Select the application type that best represents the application that will use this key. You can find descriptions of key and application types [here](#).
- 5.Click the **Create** button. The new key displays in the list of available keys. Use this key to authenticate your Bing Maps application as described in the documentation for the Bing Maps API you are using.

Application Options

☒ Receive desktop **notification** when application updates

☒ Send anonymous usage data to the developer team

☒ Highlight parameters that change when switching battery or control profiles

Bing Maps

OpenStreetMap

Bing Maps

MapProxy

Map Provider

.....

/mappro

your\_proxy\_layer\_name

Map API key

MapProxy URL

MapProxy Layer

Configurator rendering options

Imperial

Set how the units render on the configurator only

# SETTING UP YOUR DRONE

## Programming

This is the definitive feature of INAV combine with the Synerduino Shield .

This PLC function allows you to program upto 8 GVAR and instructions from timer to sensor conditions to trigger a Flight mode action or control action of your Drone

The screenshot displays the INAV Configurator software interface. The top bar shows the INAV logo, version 5.0.0, and FC Firmware 5.1.0. A status bar at the top right indicates a battery level of 5.48 V and a 'No dataflash chip found' warning. The left sidebar contains a menu with options: Configuration, Failsafe, PID tuning, Advanced Tuning, Programming (selected), Receiver, Modes, Adjustments, GPS, Magnetometer, Mission Control, OSD, LED Strip, Sensors, Tethered Logging, Blackbox, and CLI. The main area is divided into two tabs: 'Logic Conditions' and 'PID Controllers'. The 'Logic Conditions' tab is active, showing a table of 8 GVARs. The first seven GVARs are enabled and have various conditions and actions assigned. The eighth GVAR is disabled. The bottom status bar shows system metrics: Packet error: 0, I2C error: 0, Cycle Time: 517, CPU Load: 22%, MSP version: 2, MSP load: 2.0, MSP round trip: 66, HW round trip: 17, Drop ratio: 7%, and version 5.0.0. The system clock shows 9:22 PM on 17/10/2022.

| # | Enabled                             | Operation           | Operand A       | Operand B | Active | Flags                        | Status            |
|---|-------------------------------------|---------------------|-----------------|-----------|--------|------------------------------|-------------------|
| 0 | <input checked="" type="checkbox"/> | Increase GVAR       | Value           | 0         | Value  | 1                            | Always            |
| 1 | <input checked="" type="checkbox"/> | Greater Than        | Global Variable | 0         | Value  | 55                           | Always            |
| 2 | <input checked="" type="checkbox"/> | Set GVAR            | Value           | 0         | Value  | 0                            | Logic Condition 1 |
| 3 | <input checked="" type="checkbox"/> | Set GVAR            | Value           | 1         | Flight | Vbat [centi-Volt] [1V = 100] | Always            |
| 4 | <input checked="" type="checkbox"/> | Greater Than        | Global Variable | 1         | Value  | 545                          | Always            |
| 5 | <input checked="" type="checkbox"/> | Override RC Channel | Value           | 6         | Value  | 55                           | Logic Condition 4 |
| 6 | <input type="checkbox"/>            | True                |                 |           |        |                              |                   |
| 7 | <input type="checkbox"/>            | True                |                 |           |        |                              |                   |
| 8 | <input type="checkbox"/>            | True                |                 |           |        |                              |                   |



# SETTING UP YOUR DRONE

## CLI Command Line – Aircraft Status

This is where you can import PID setting , check status or Adjust parameters

Open the CLI command line. Enter the command below.

**Tasks** – check if everything is with in CPU load should be with in 70%

**Status** – Check if all systems are active , Gyro/ACC/MAG/BARO/GPS or Flow

And to identify errors

The screenshot shows the INAV Configurator software interface. The top bar displays the INAV logo, version 5.0.0, and various system status icons including battery (8.97 V), Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed, and IMU2. A 'Disconnect' button is visible on the right. The main window is divided into a left sidebar with navigation options (Configuration, Failsafe, PID tuning, Advanced Tuning, Programming, Receiver, Modes, Adjustments, GPS, Magnetometer, Mission Control, OSD, LED Strip, Sensors, Tethered Logging, Blackbox, CLI) and a main content area. The CLI tab is active, showing a terminal window with the following output:

```
# taks
### ERROR: Unknown command, try 'help'
# tasks
Task list
0 - SYSTEM 9 12 0 0.5% 0.5% 228
1 - PID 316 66198 176 2092.3% 6.0% 2995
2 - GYRO 3906 66447 232 25954.6% 91.1% 41256
3 - RX 49 63 48 0.8% 0.7% 126
4 - SERIAL 97 102220 4 992.0% 0.5% 199
5 - BATTERY 49 40041 11 196.7% 0.5% 67
6 - TEMPERATURE 98 7 1 0.5% 0.5% 7
7 - BEEPER 98 14 7 0.6% 0.5% 33
8 - GPS 49 154 21 1.2% 0.6% 54
9 - COMPASS 9 197 187 0.6% 0.6% 95
10 - BARO 36 153 136 1.0% 0.9% 411
14 - TELEMETRY 448 25 3 1.6% 0.6% 131
18 - CMS 49 4 2 0.5% 0.5% 3
21 - VTCTRL 4 2 1 0.5% 0.5% 0
22 - PROGRAMMING 9 32 21 0.5% 0.5% 10
24 - AUX 98 10 3 0.5% 0.5% 14
25 - SPORT MASTER 480 12 1 1.0% 0.5% 22
Task check function
Total (excluding SERIAL) 28253.4% 105.0%

# set looptime = 3500
looptime set to 3500
```

Below the terminal output is a text input field labeled 'Write your command here'. At the bottom of the interface, there are buttons for 'EXIT', 'SAVE SETTINGS', 'MSC', 'Copy to clipboard', 'Clear output history', 'Load from file', and 'Save to File'. The status bar at the very bottom shows various system metrics: Packet error: 0, I2C error: 0, Cycle Time: 3028, CPU Load: 90%, MSP version: 2, MSP load: 0.0, MSP round trip: 34, HW round trip: 17, Drop ratio: 0%, and the version 5.0.0. The system clock shows 5:39 PM on 21/07/2022.

| Reason (CLI Mnemonic) | Bit Mask (Hex) | Explanation                                                                                                                                                                                                                                                 |
|-----------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FS                    | 00000080       | The RX is not recognised as providing a valid signal                                                                                                                                                                                                        |
| ANGLE                 | 00000100       | The vehicle is not level as defined by the CLI small_angle setting                                                                                                                                                                                          |
| CAL                   | 00000200       | The pre-arm sensor calibration has not completed. The barometer is somewhat susceptible to lengthy calibration, which may be mitigated by the CLI setting baro_cal_tolerance, e.g. set baro_cal_tolerance = 500 (find a suitable value by experimentation). |
| OVRLD                 | 00000400       | The CPU load is excessive. May be caused by too an aggressive loop time setting.                                                                                                                                                                            |
| NAV                   | 00000800       | Where the CLI setting nav_extra_arming_safety = ON is used, this may be caused by reasons shown in the <u>table below</u>                                                                                                                                   |
| COMPASS               | 00001000       | The compass is not calibrated. Perform the calibration procedure                                                                                                                                                                                            |
| ACC                   | 00002000       | The accelerometer is not calibrated. Perform the 6 point calibration procedure                                                                                                                                                                              |
| ARMSW                 | 00004000       | The arm switch was engaged as the FC booted                                                                                                                                                                                                                 |
| HWFAIL                | 00008000       | A required hardware device has failed / is not recognised (e.g. GPS, Compass, Baro)                                                                                                                                                                         |
| BOXFS                 | 00010000       | A failsafe switch is engaged                                                                                                                                                                                                                                |
| KILLSW                | 00020000       | A kill switch is engaged                                                                                                                                                                                                                                    |
| RX                    | 00040000       | The RC link is not detected (RX not detected)                                                                                                                                                                                                               |
| THR                   | 00080000       | The throttle setting is not a minimum                                                                                                                                                                                                                       |
| CLI                   | 00100000       | The CLI is active (note: you will always /unavoidably see this when in the CLI)                                                                                                                                                                             |
| CMS                   | 00200000       | The CMS menu is active                                                                                                                                                                                                                                      |
| OSD                   | 00400000       | The OSD menu is active                                                                                                                                                                                                                                      |
| ROLL/PITCH            | 00800000       | Roll and/or pitch is not centred                                                                                                                                                                                                                            |
| AUTOTRIM              | 01000000       | Servo autotrim is engaged                                                                                                                                                                                                                                   |
| OOM                   | 02000000       | The FC is out of memory                                                                                                                                                                                                                                     |
| SETTINGFAIL           | 04000000       | A CLI setting is out of range. The erroneous setting should be indicated in a CLI dump. If you can't then reset the offending setting, reflash with full chip erase and reapplying settings from scratch may help.                                          |
| PWMOUT                | 08000000       | PWM output error. Motor or servo output initialization failed. ( cause by insufficient timers available : turn off unused function like LED strip or SPI device)                                                                                            |
| NOPREARM              | 10000000       | PREARM is enabled and timed out                                                                                                                                                                                                                             |

INAV will refuse to arm for the following reasons (e.g. from cli status):

**Type Status on the CLI to find the cause**



# SETTING UP YOUR DRONE

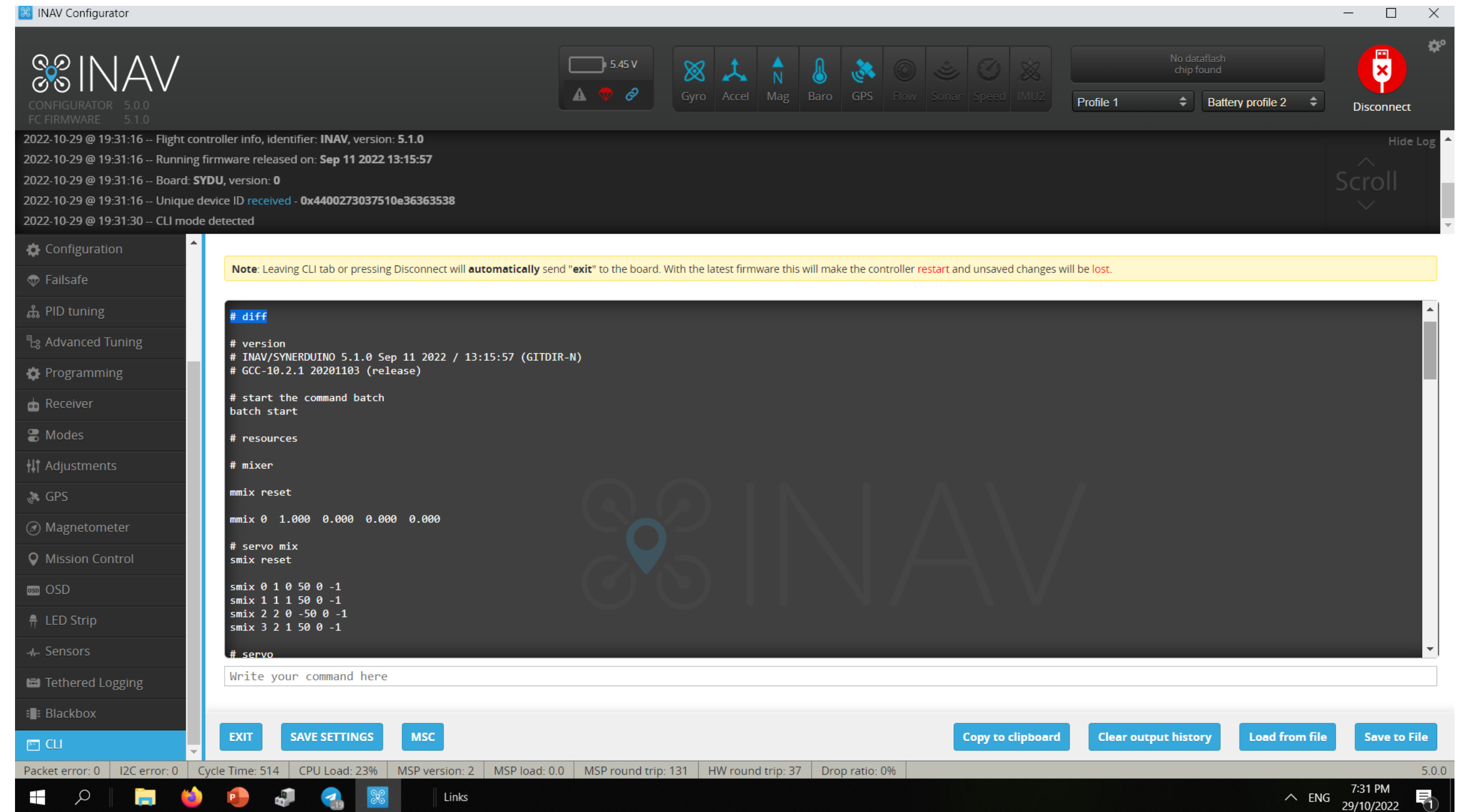
## CLI Command Line Saving and Loading Parameters

You can download the Preset DIFF for the Synerduino STM Synerduino STM page

- DIFF - command to dump only those settings that differ from their default values (those that have been changed).
- DUMP – CLI Dump configuration

Then save the output on a notepad

The same output can be paste on the CLI and press ENTER to upload the Configuration , Save Settings then Reboot



Note: that we offer the Synerduino STM Diff .txt file available for those who wanted to use the pre-set for the 250mm synerduino drone

# SETTING UP YOUR DRONE

Sometimes no matter how well you calibrate

Your aircraft may drift when your on neutral sticks

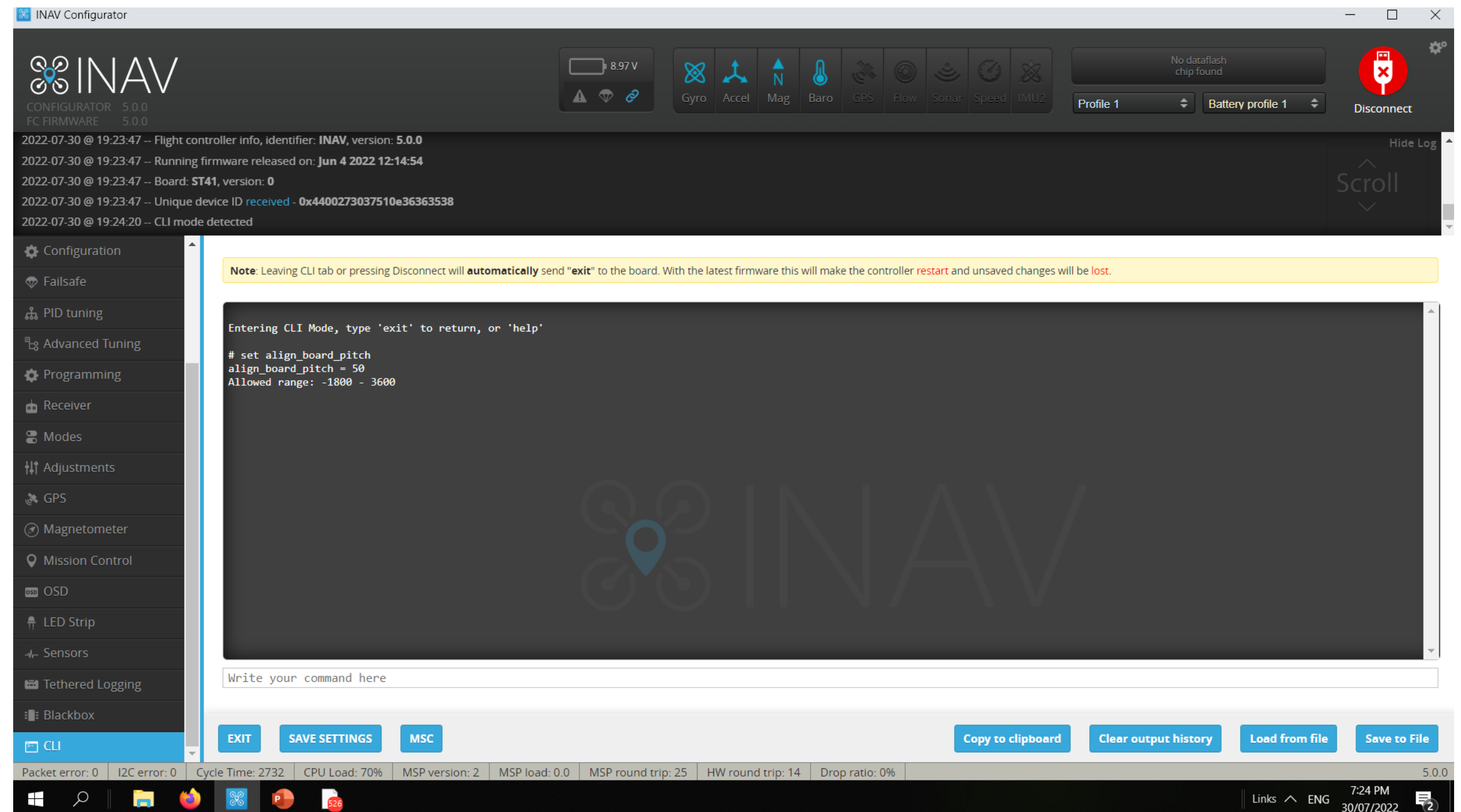
your ACC its not always perfect . You may need to trim your board for a good stability in flight

# set align\_board\_pitch  
set align\_board\_pitch = #  
Allowed range: -1800 – 3600

# set align\_board\_roll  
set align\_board\_roll = #  
Allowed range: -1800 – 3600

Pitch + # is Trim to the Back  
Pitch – # is Trim to the Forward  
Roll + # is Trim Left  
Roll - # is Trim Right

## CLI Command Line Trimming the Roll and Pitch Alignment





# SETTING UP YOUR DRONE

## CLI Command Line Landing setting

What your drone would do when Landing or RTH command is present

### [nav\\_disarm\\_landing](#)

This shuts off the motor after touch down or contact solid . Means drone has no movement for 3 seconds or what ever you set it to

### [nav\\_emerg\\_landing\\_speed](#)

The speed it descends on emergency

### [nav\\_rth\\_allow\\_landing](#)

Should the drone land after reaching RTH

Note: Leaving CLI tab or pressing Disconnect will automatically send "exit" to the CLI

Entering CLI Mode, type 'exit' to return, or 'help'

```
# get landing
```

```
nav_disarm_on_landing = OFF
```

```
Allowed values: OFF, ON
```

```
nav_emerg_landing_speed = 500
```

```
Allowed range: 100 - 2000
```

```
nav_rth_allow_landing = ALWAYS
```

```
Allowed values: NEVER, ALWAYS, FS_ONLY
```

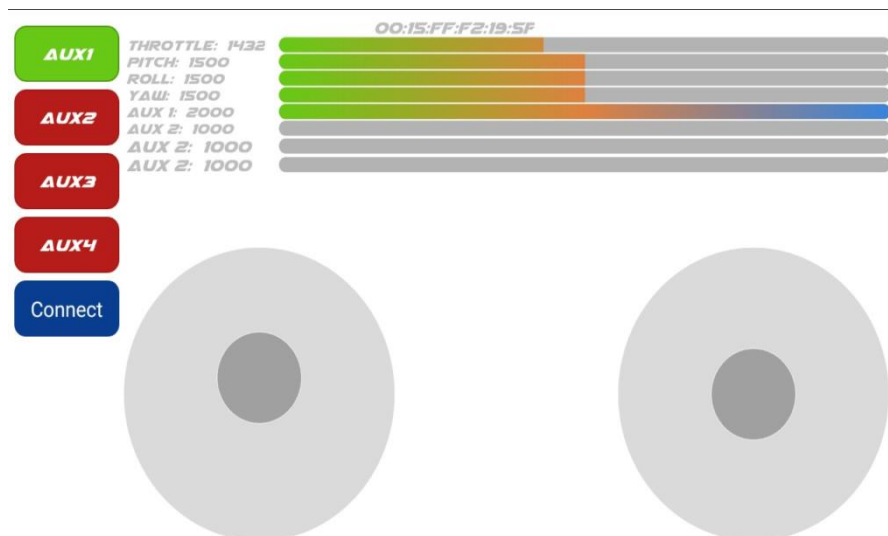
# SETTING UP YOUR DRONE

set rx\_min\_usec = 790

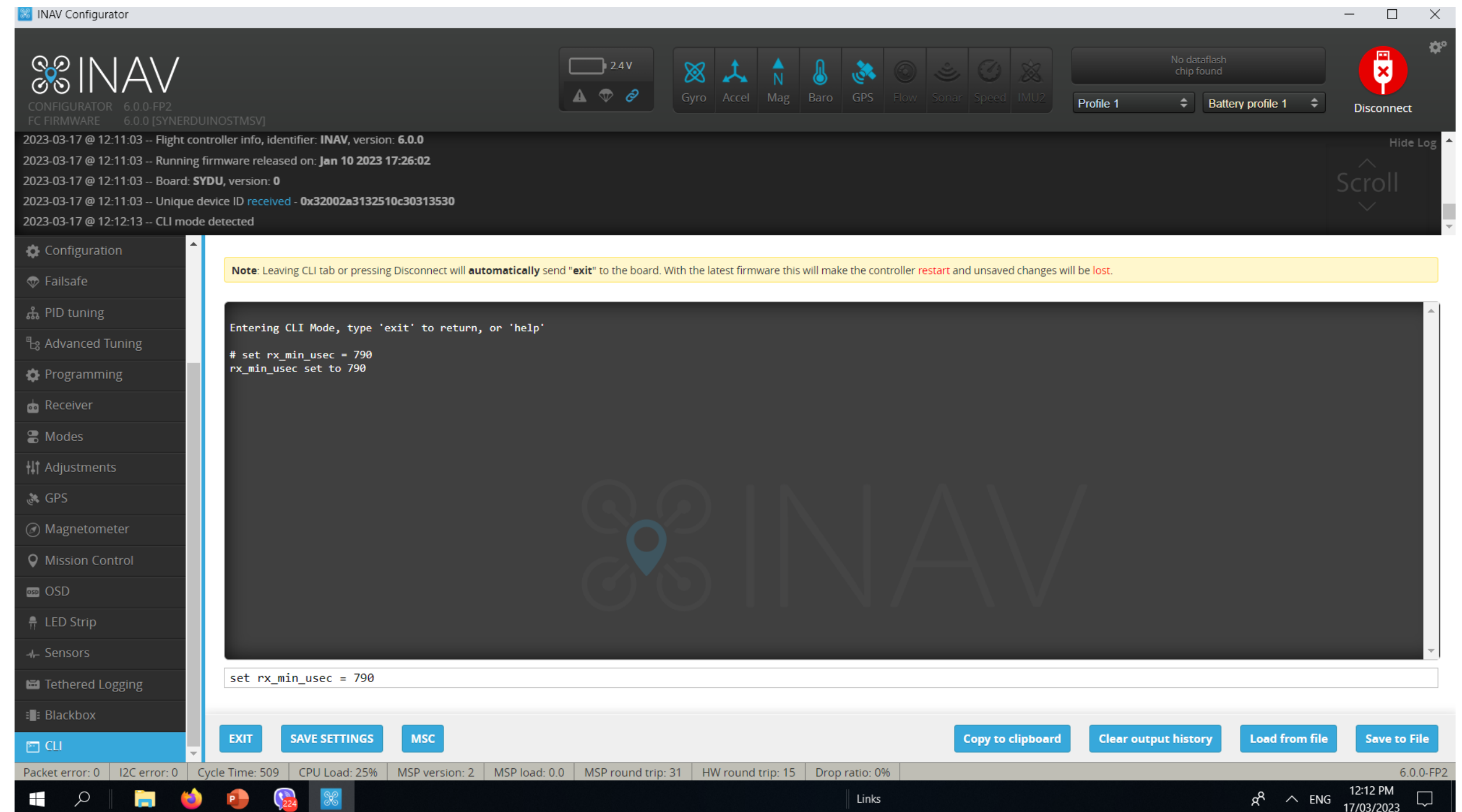
Because the Synerduino App sets RX min as 800 to accommodate Multiwii Serial RC switching

The INAV equivalent is to reduce the RC min to 790 to accommodate this buttons

This allows the use of the AUX buttons on the Left



For users who wish to control this drone using the Synerduino APP





# SETTING UP YOUR DRONE

Its important to set this correctly to ensure proper GPS flights

Set `ahrs_gps_yaw_windcomp = ON`

Set `gps_provider = UBLOX7`

Allowed values: NMEA, UBLOX, UBLOX7, MSP

Set `gps_sbas_mode = AUTO`

Allowed values: AUTO, EGNOS, WAAS, MSAS, GAGAN, NONE

Set `gps_dyn_model = PEDESTRIAN`

PEDESTRIAN – multirotor hover or Slow Flg

AIR\_1G – airplane slow to mid speed

AIR\_4G – airplane fast speed

`gps_auto_config = ON`

Config GPS on bootup

`gps_auto_baud = ON`

`gps_ublox_use_galileo = OFF`

turn on only if GPS supports Galileo in your area

`gps_min_sats = 6`

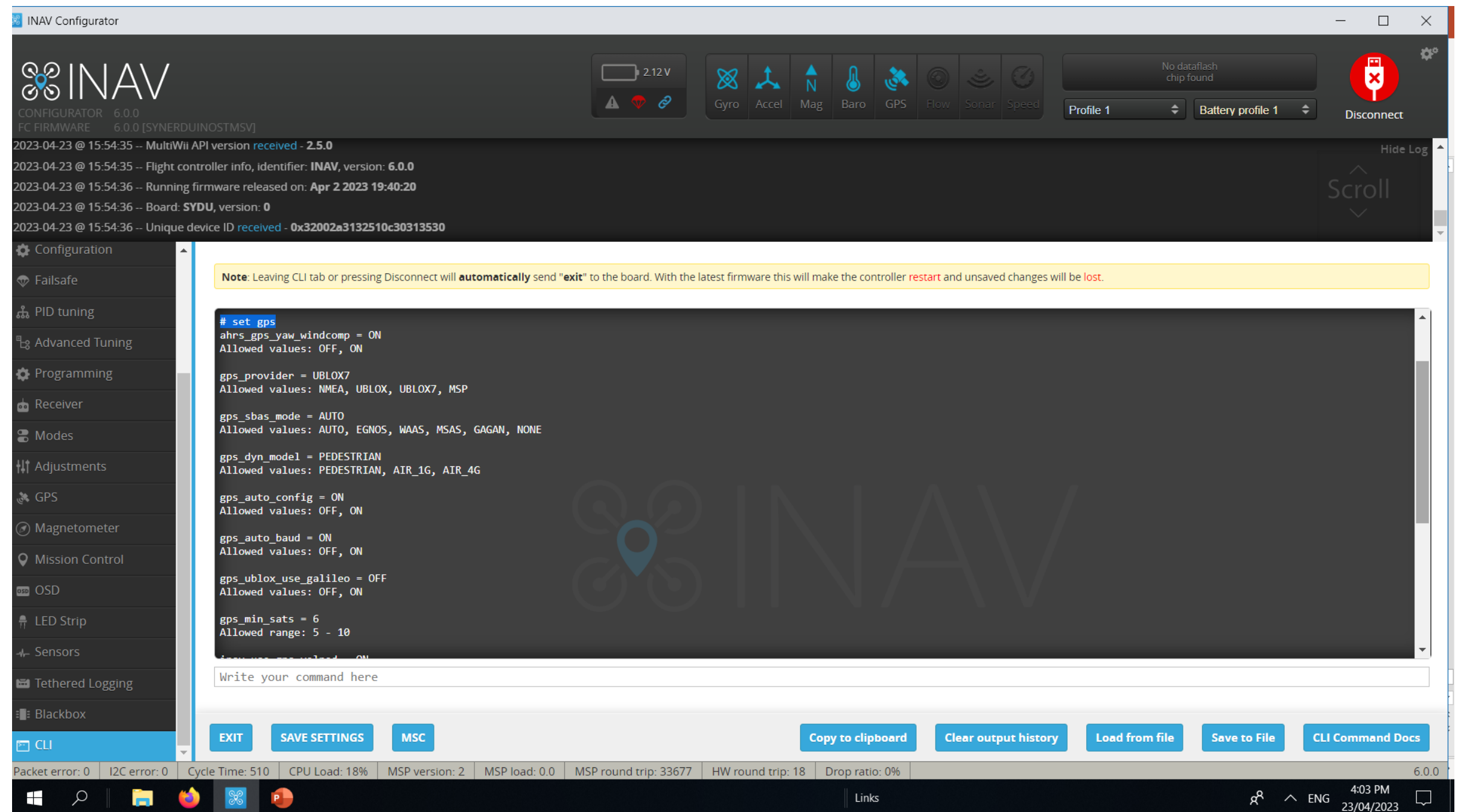
Minimum sats to arm gps flight mode

`inav_use_gps_velned = ON`

`inav_use_gps_no_baro = OFF`

turning this on would make your drone rely on GPS altitude instead of Baro – measure above sea level instead relative to bootup

## CLI Command Line GPS setting

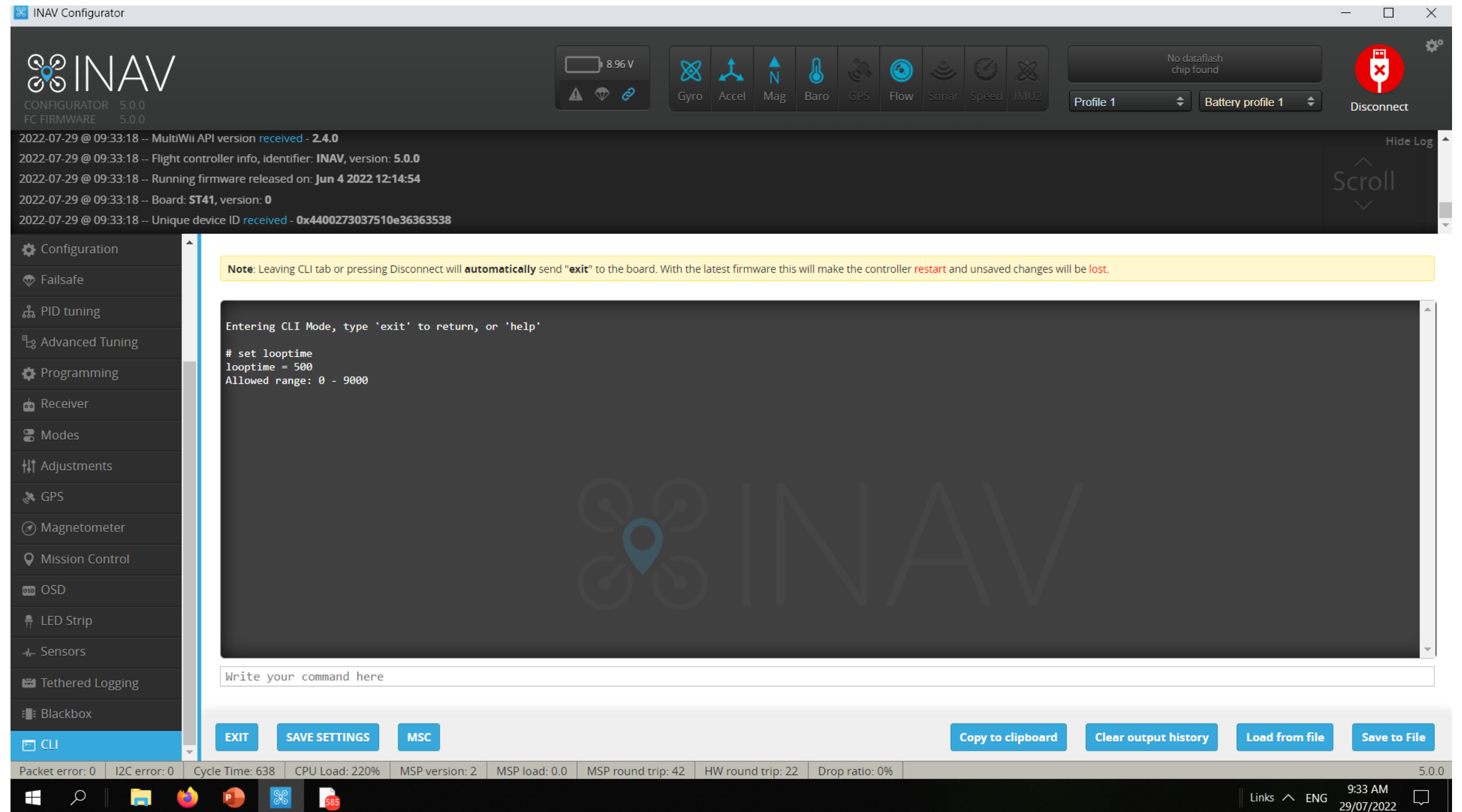


# SETTING UP YOUR DRONE

## CLI Command Line – Looptime and CPU Speed

LoopTime is the speed of processing allocation, this is adjusted depending on the sensors used or the number of peripherals

**Looptime** – Default 500 but you can get as slow as 2000 in worst case scenario





# SETTING UP YOUR DRONE

Open the CLI command line.  
Enter the command below.  
Default: set looptime = 500 or  
Synerduino: set looptime =  
2800 - 3500 this would slow  
down the refresh rate of the  
gyro to give it enough time for  
the cpu to load aswell as  
reduce the sensitivity of Gyros  
to Noise (Vibrations) that can  
cause the drone to flip  
Then save it by typing the  
following command. save

This Adjust the sensor  
Refresh rate to better  
regulate the CPU Load  
Speed , If CPU is above  
100% its overloaded and  
the failsafe would kick in  
. The drone will not Arm

## CLI Command Line – Looptime and CPU speed

The screenshot displays the INAV Configurator application window. The top bar shows the INAV logo and version (CONFIGURATOR 5.0.0, FC FIRMWARE 5.0.0). A status bar at the top right indicates a battery level of 8.97 V and a 'No dataflash chip found' warning. The main interface is divided into a left sidebar with various configuration tabs (Configuration, Failsafe, PID tuning, Advanced Tuning, Programming, Receiver, Modes, Adjustments, GPS, Magnetometer, Mission Control, OSD, LED Strip, Sensors, Tethered Logging, Blackbox, and CLI) and a central area for the selected tab. The CLI tab is active, showing a terminal window with the following text: 'Entering CLI Mode, type 'exit' to return, or 'help'', '# set looptime = 1500', and 'looptime set to 1500'. Below the terminal window is a text input field labeled 'Write your command here'. At the bottom of the CLI tab, there are buttons for 'EXIT', 'SAVE SETTINGS', and 'MSC'. The bottom status bar of the application shows various system metrics: Packet error: 0, I2C error: 0, Cycle Time: 1640, CPU Load: 117%, MSP version: 2, MSP load: 0.0, MSP round trip: 72, HW round trip: 40, Drop ratio: 0%, and the version 5.0.0. The Windows taskbar is visible at the very bottom of the screen.

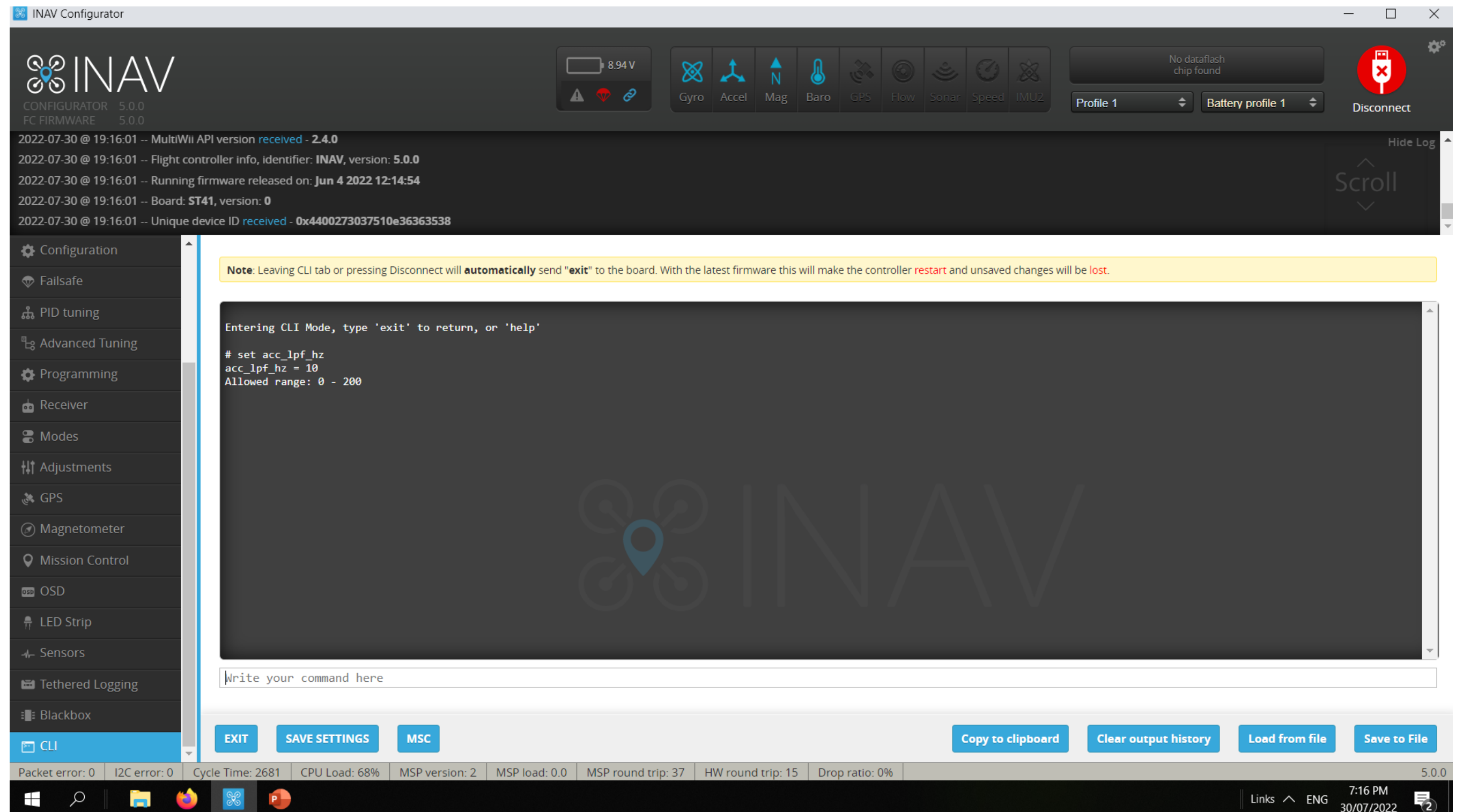
# SETTING UP YOUR DRONE

## CLI Command Line – Low Pass Filter

set acc\_lpf\_hz = 10 –

lower the number the less the sensitivity of the Acc to vibration cause by the motor , this may give a sluggish respond but it would settle the strange hiccups of INAV for Drifting Horizons

set acc\_lpf\_hz = 20 is Default





# SETTING UP YOUR DRONE

Set `nav_mc_althold_throttle = MID_STICK`  
Allowed values: STICK, MID\_STICK, HOVER

Sometimes users preference or Radio Transmitter would determine what constitute an Altitude hold

STICK = this would rely on the hover throttle as set in ADVANCE PID to determine the hover with dead band +/-

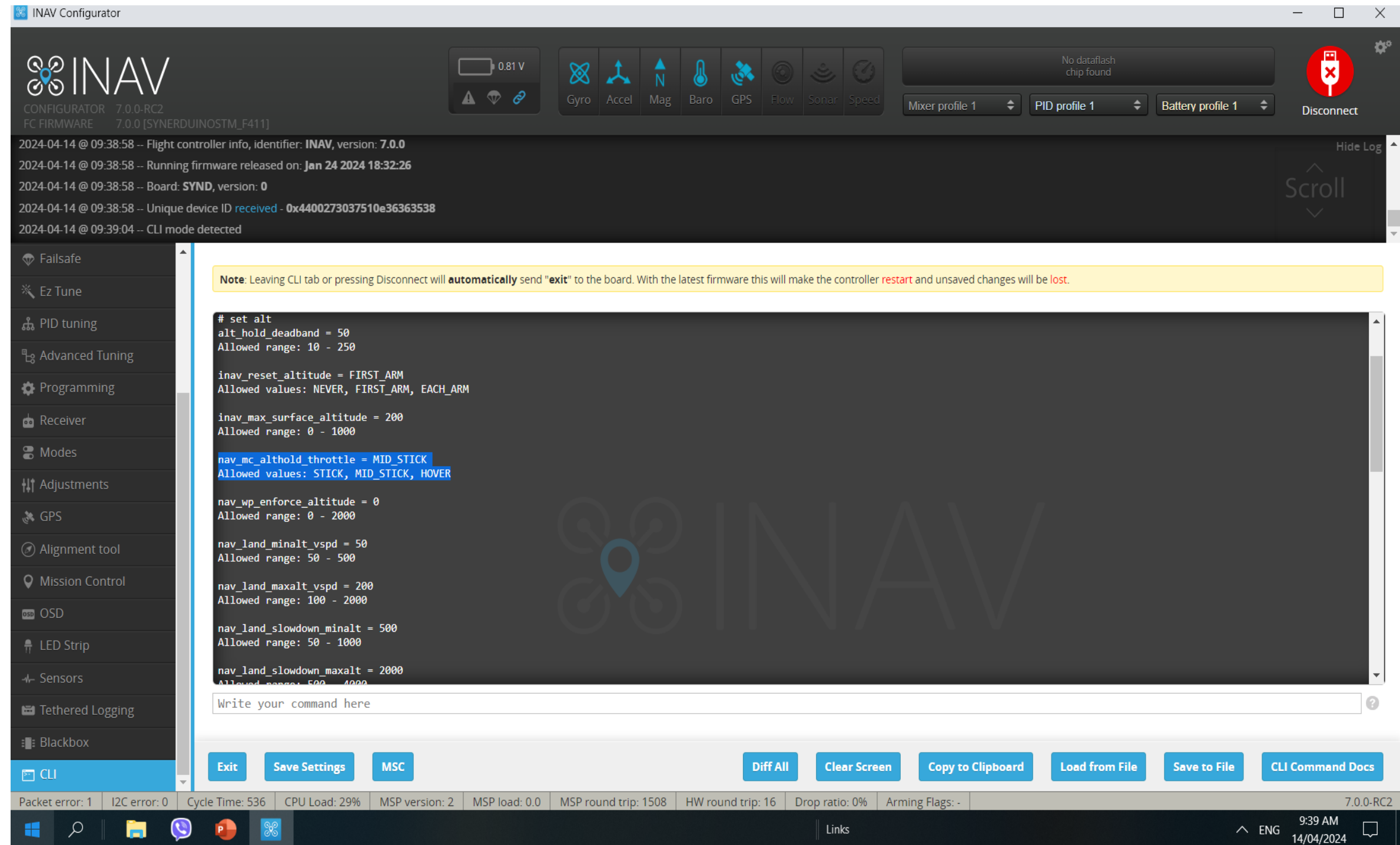
MID\_STICK = this is common for Radios with throttle stick at center position with PWM 1500, means then throttle stick is at the center Altitude hold is active

HOVER = again is is Hover throttle Related

Set `alt_hold_deadband = 50`  
Allowed range: 10 – 250

This is Dead band related it gives a deadregion in your throttle mid stick like 1450 to 1550 as MID stick position

## Altitude hold



<https://github.com/iNavFlight/inav/discussions/8933>

# SETTING UP YOUR DRONE

Finishing Note:

Should you use the Preset DIFF in CLI

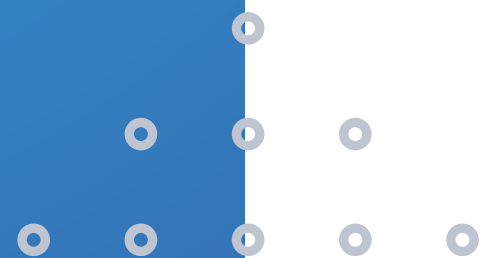
You may need to check again the following

- Calibration
- PID Tuning
- PORTS – if the correct port selected depending on your serial hardware
- Receiver - RC mapping to match your radio
- Modes – Flight modes switch
- Configuration - Sensor Orientation /Mag Orientation
- Magnetometer - Orientation
- GPS – configuration should it match your GPS type
- CLI – Task and Status to make sure you didn't miss anything or having conflict
- INAV is a Active development and should be check for Updates from time to time

[www.Synerflight.com](http://www.Synerflight.com)



# TESTING



# SYSTEM CHECKS

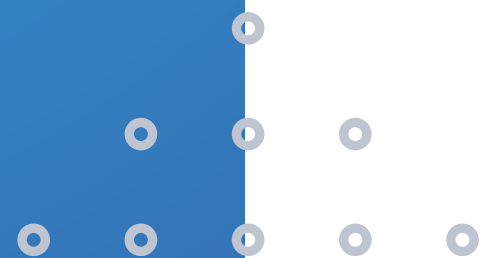
## NOTE:

- Ensure all Pre-Arm checks are in the green
- Sensor Status are Blue
- Heading is Oriented correctly  
0 North 90 East 180 South 270 West
- Pitch and Roll at 0
- Any Error in this should check their Respective Menu
- CLI Terminal type STATUS should show if there are any misconfigurations

The screenshot displays the INAV Configurator software interface. At the top, the INAV logo and version information (CONFIGURATOR 7.0.0-RC2, FC FIRMWARE 7.0.0 [SYNERDUINOSTM\_F411]) are shown. A status bar indicates a battery voltage of 8.88 V and a 'No dataflash chip found' warning. A row of sensor status icons (Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed) is visible, with a blue arrow pointing to them. The main area is divided into a left sidebar with menu items (Setup, Calibration, Mixer, Outputs, Ports, Configuration, Failsafe, Ez Tune, PID tuning, Advanced Tuning, Programming, Receiver, Modes, Adjustments, GPS, Alignment tool, Mission Control) and a main content area. The 'Setup' tab is active, showing a 'Reset Settings' button and a 'Restore settings to default' option. Below this, a table displays sensor status: Heading (163 deg), Pitch (13.3 deg), and Roll (2.2 deg). A 3D drone model is shown in the center. To the right, a 'Pre-arming checks' section lists various checks with green checkmarks indicating they are all passed. A green arrow points from the drone model to this section. Below the checks, an 'Info' section provides details about the battery (3 cells, 8.88 V, 0% left, NA remaining capacity, false full when plugged in, false use cap thresholds). The bottom status bar shows system metrics: Packet error: 0, I2C error: 0, Cycle Time: 516, CPU Load: 27%, MSP version: 2, MSP load: 0.3, MSP round trip: 83, HW round trip: 39, Drop ratio: 0%, Arming Flags: -. The Windows taskbar at the bottom shows the time as 12:19 PM on 28/03/2024.



# PRE-FLIGHT



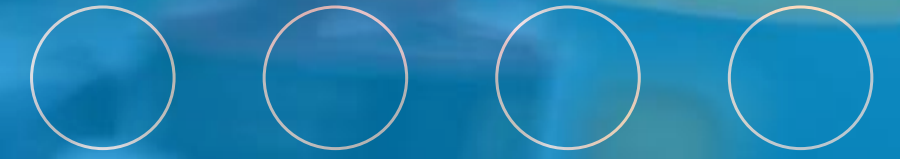
# PREFLIGHT

## NOTE:

- *Check Batteries fully Charge*
- *Motors and Connections in Good shape*
- *Radio Failsafe Active*
- *Communication with Ground station working*
- *Flight modes setup correctly*







QUICK BUILD GUIDE

# SYNERDUINO

STM BOARD