



INAV Guide

Synerduino STM

VERSIONS: F405, F411, H743

For more Information:
www.synerflight.com

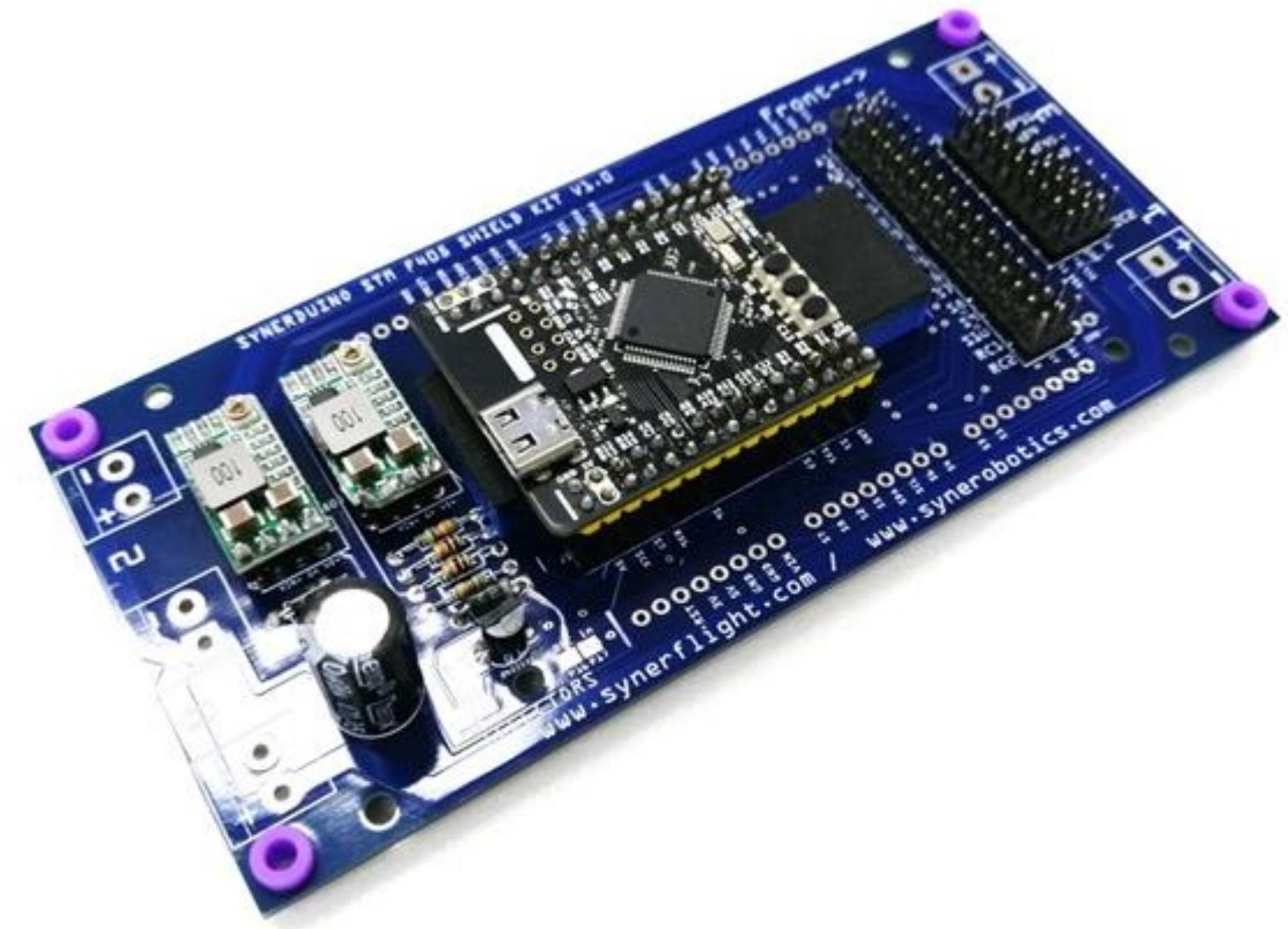


INTRODUCTION

Installation

- Firmware
- Setup
- Configuration

This guide shows the software installation process



FIRMWARE INSTALLATION

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

← Update Drivers - STM32 BOOTLOADER (COM18) X

How do you want to search for drivers?

→ [Search automatically for updated driver software](#)
Windows will search your computer and the Internet for the latest driver software for your device, unless you've disabled this feature in your device installation settings.

→ [Browse my computer for driver software](#)
Locate and install driver software manually.

Cancel Next

← Update Drivers - STM32 BOOTLOADER (COM18) X

Browse for drivers on your computer

Search for drivers in this location: Browse...

Include subfolders

→ [Let me pick from a list of available drivers on my computer](#)
This list will show available drivers compatible with the device, and all drivers in the same category as the device.

Cancel Next

FIRMWARE INSTALLATION

Update Drivers - STM32 BOOTLOADER (COM18)

Select the device driver you want to install for this hardware.

Select the manufacturer and model of your hardware device and then click Next. If you have a disk that contains the driver you want to install, click Have Disk.

Show compatible hardware

Model

- STM Device in DFU Mode
- STM32 BOOTLOADER Version: 1.0.0.0 [17/01/2019]
- STM32 BOOTLOADER Version: 6.1.7600.16385 [02/06/2012]
- STM32 Bootloader**

This driver is digitally signed.

[Tell me why driver signing is important](#)

Have Disk...

Next Cancel

Update Drivers - STM32 BOOTLOADER

Windows has successfully updated your drivers

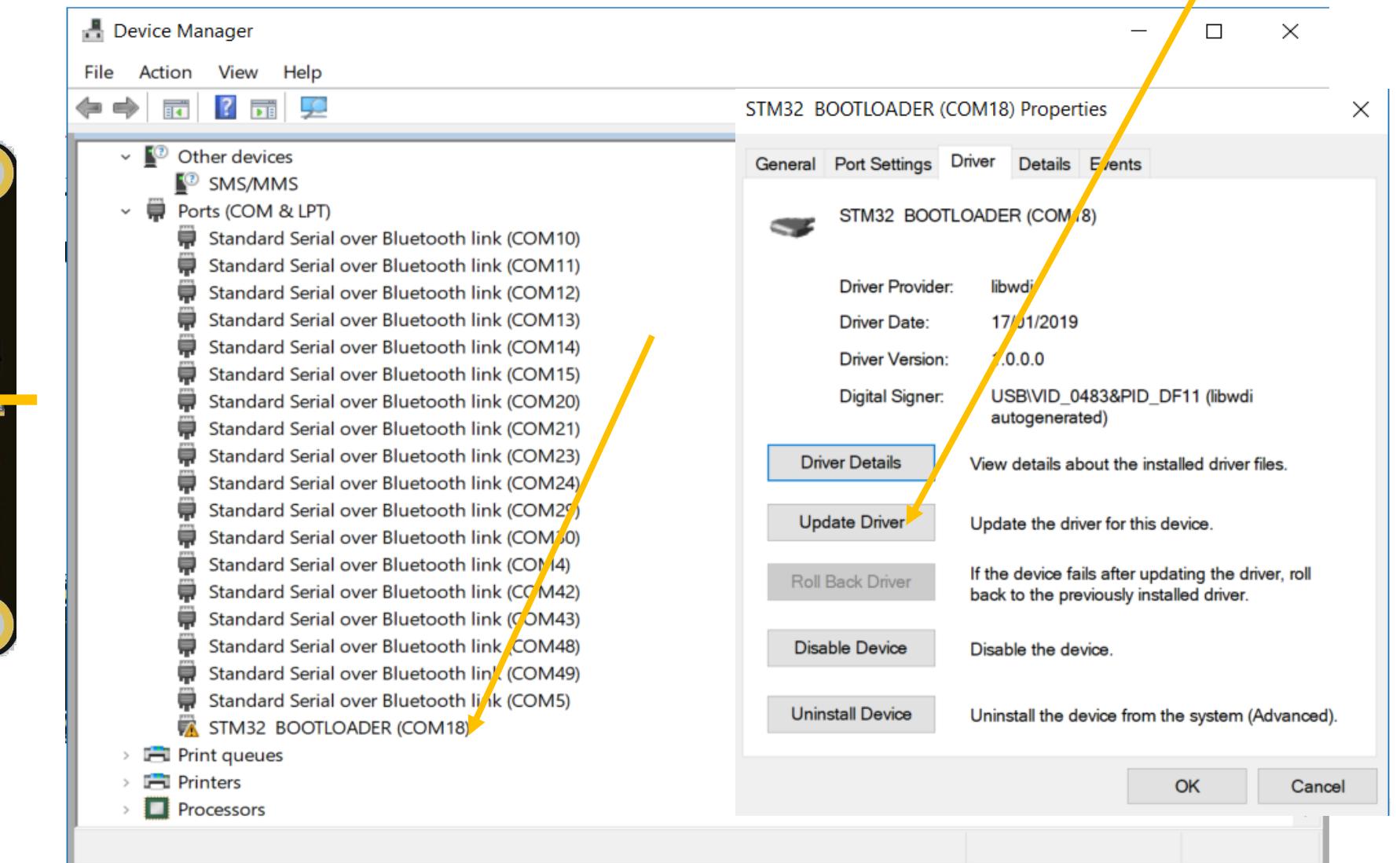
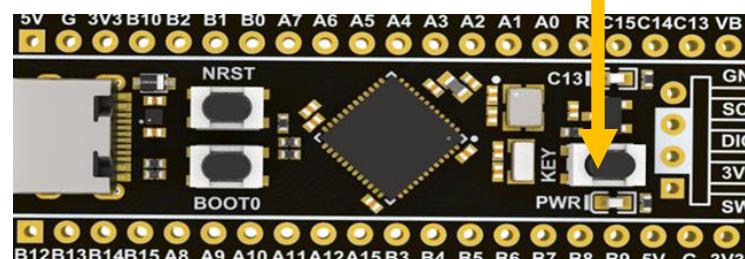
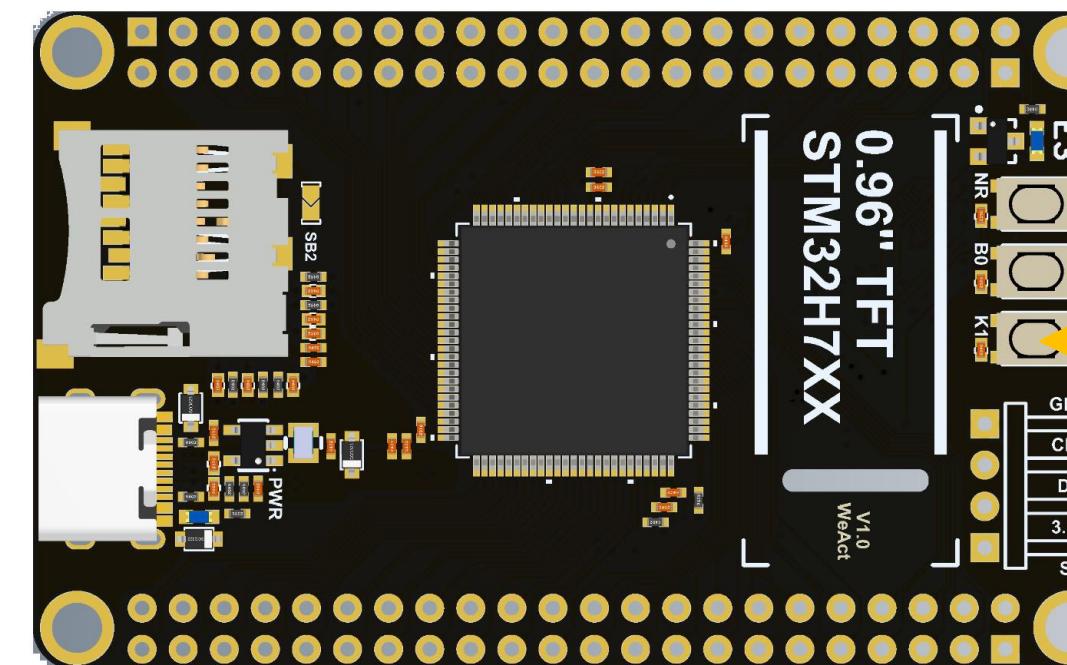
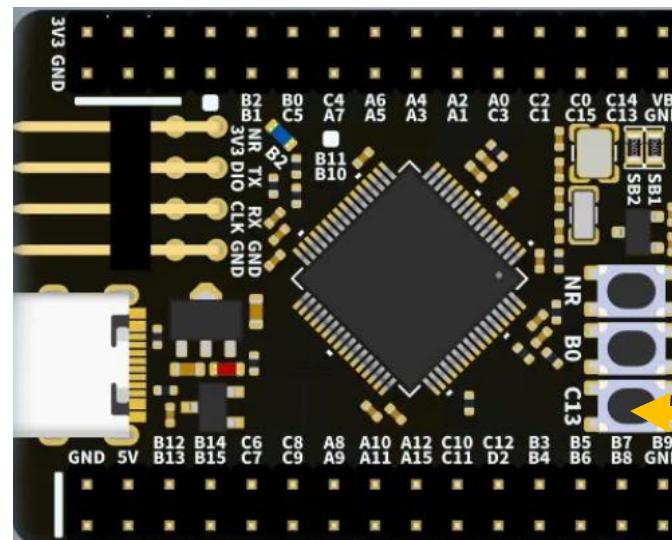
Windows has finished installing the drivers for this device:

STM32 Bootloader

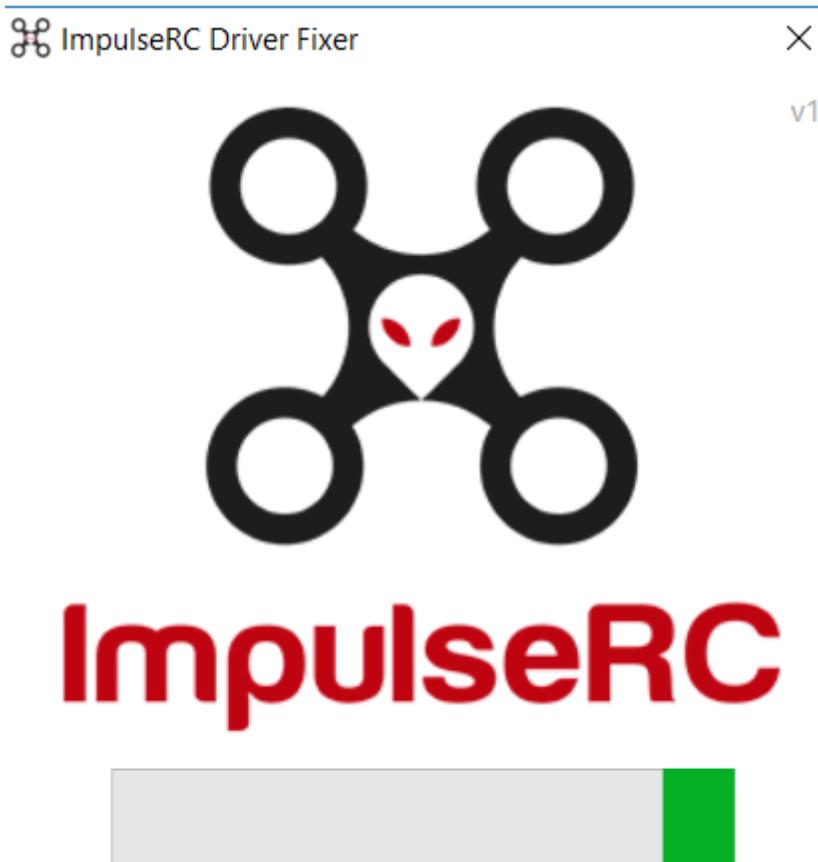
Close

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

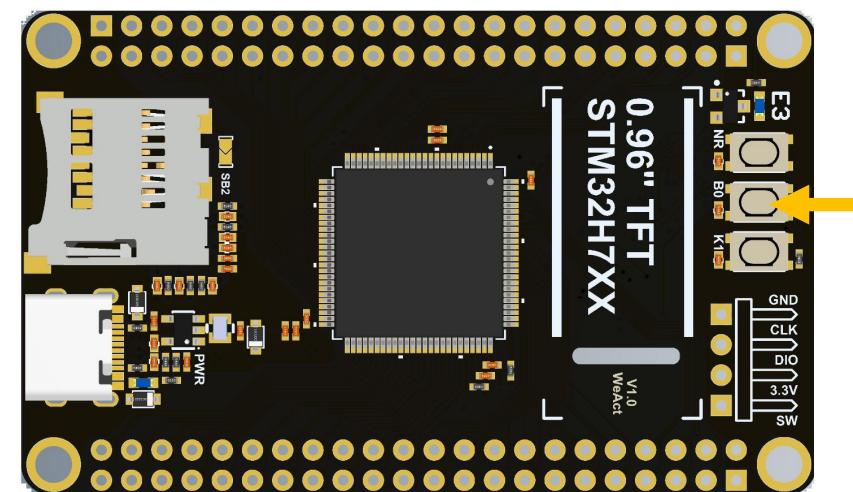
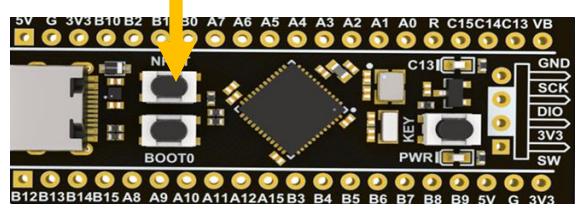
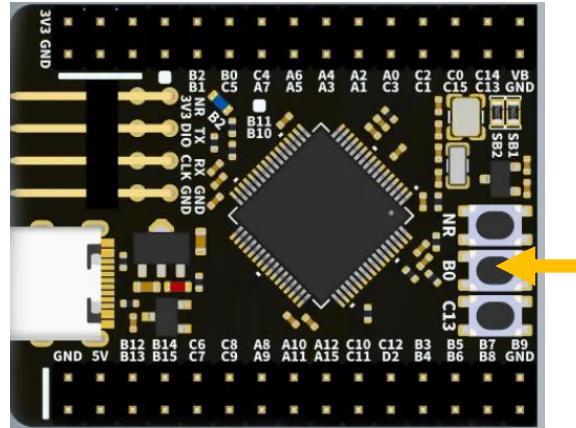


ImpulseRC Driver Fixer

https://impulserc.blob.core.windows.net/utilities/ImpulseRC_Driver_Fixer.exe

- Start ImpulseRC 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 STMF411 board 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

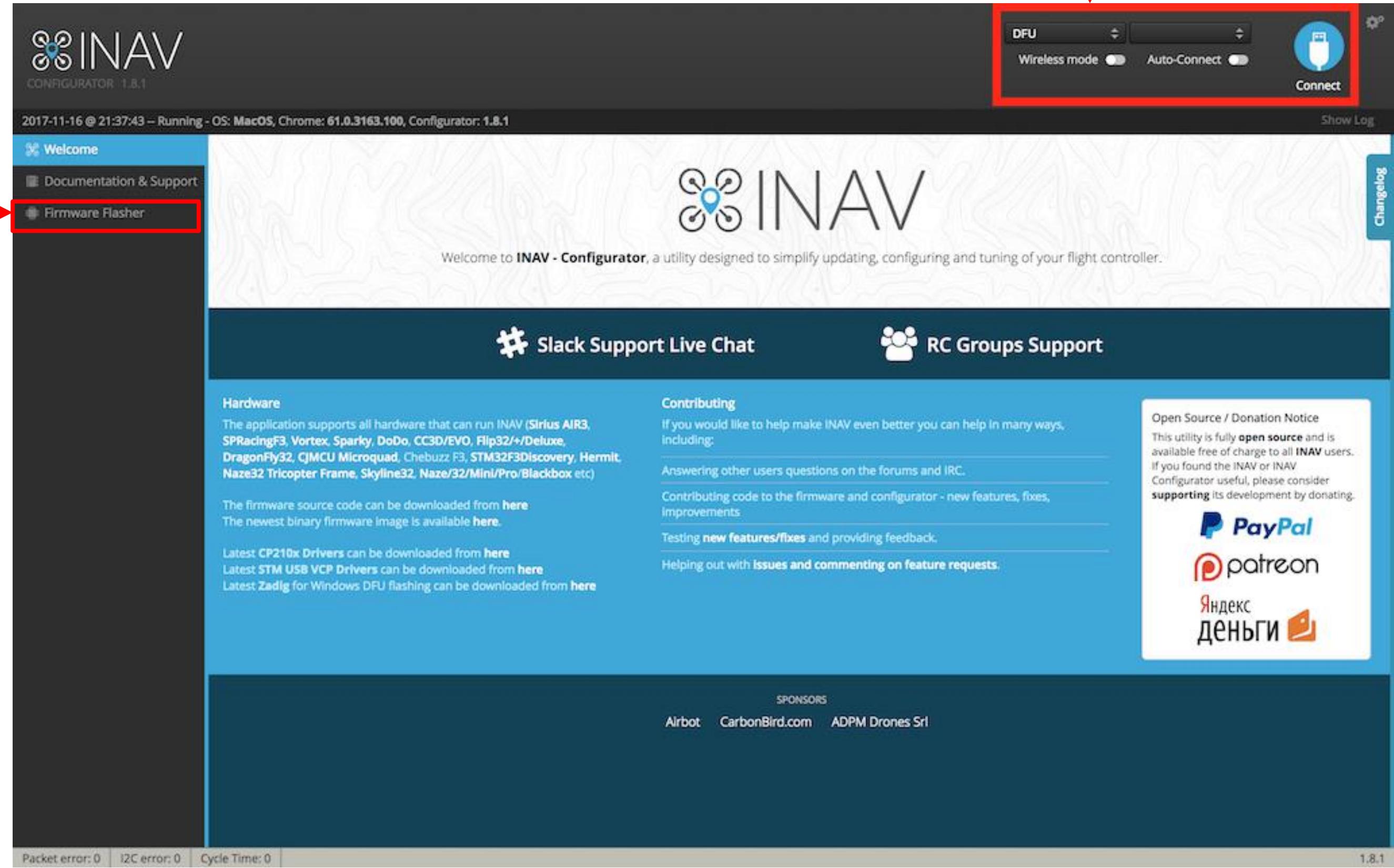
FIRMWARE INSTALLATION

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)**

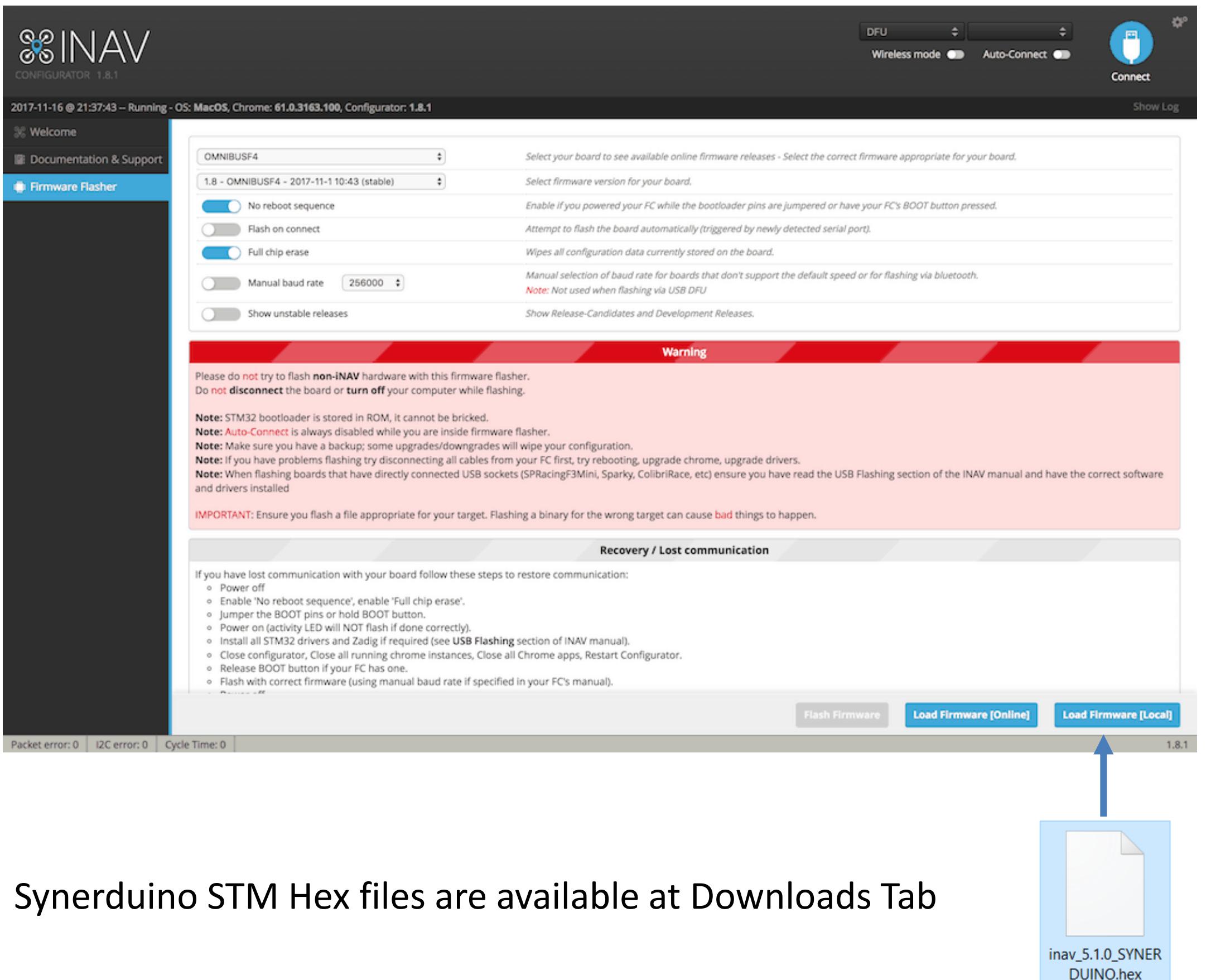
Next, click on the Firmware Flasher tab

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

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

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

SETTING UP YOUR DRONE

SETUP

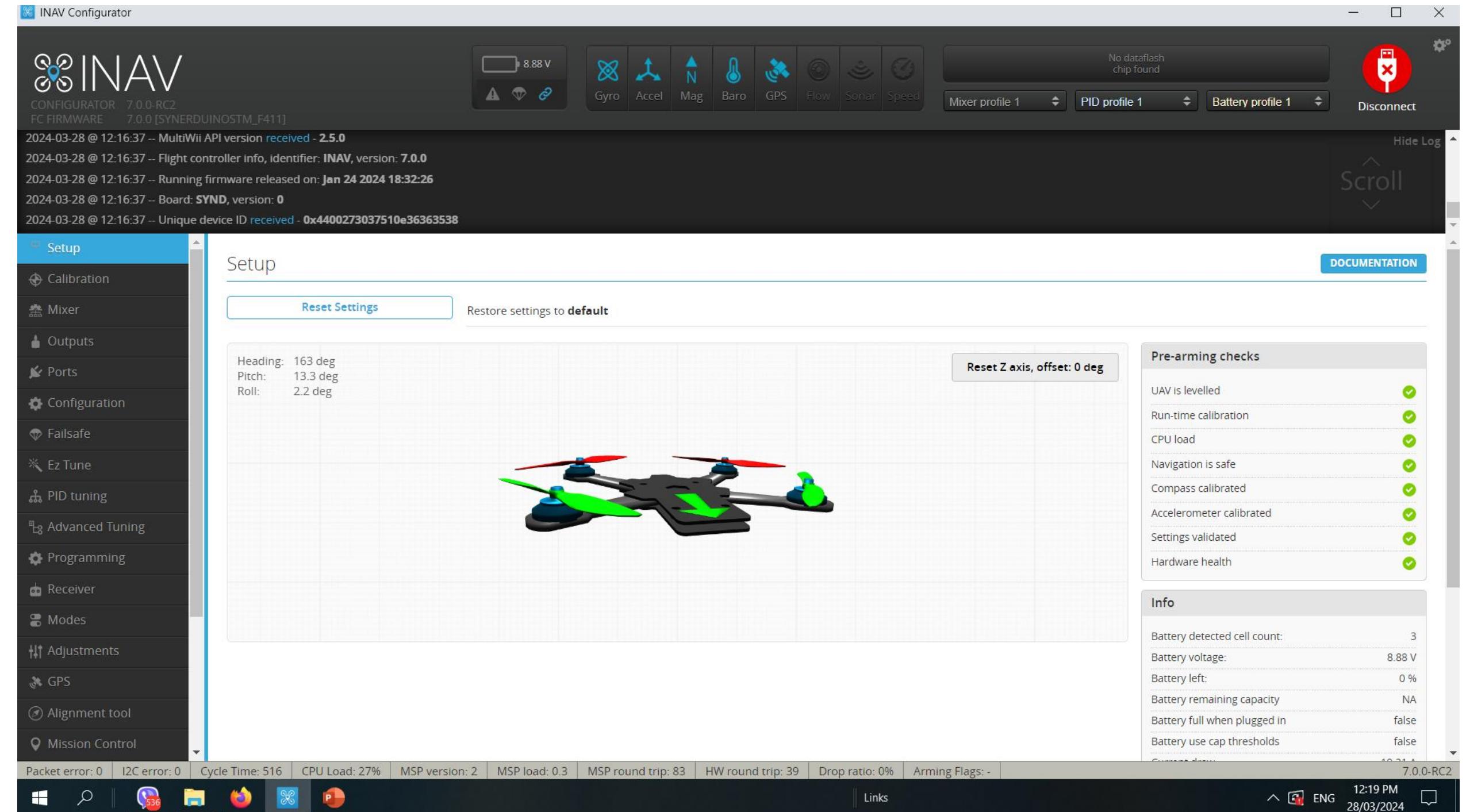
After the Firmware installation you may connect normally to the board using the Com and baud assign to it (115600) default baud

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

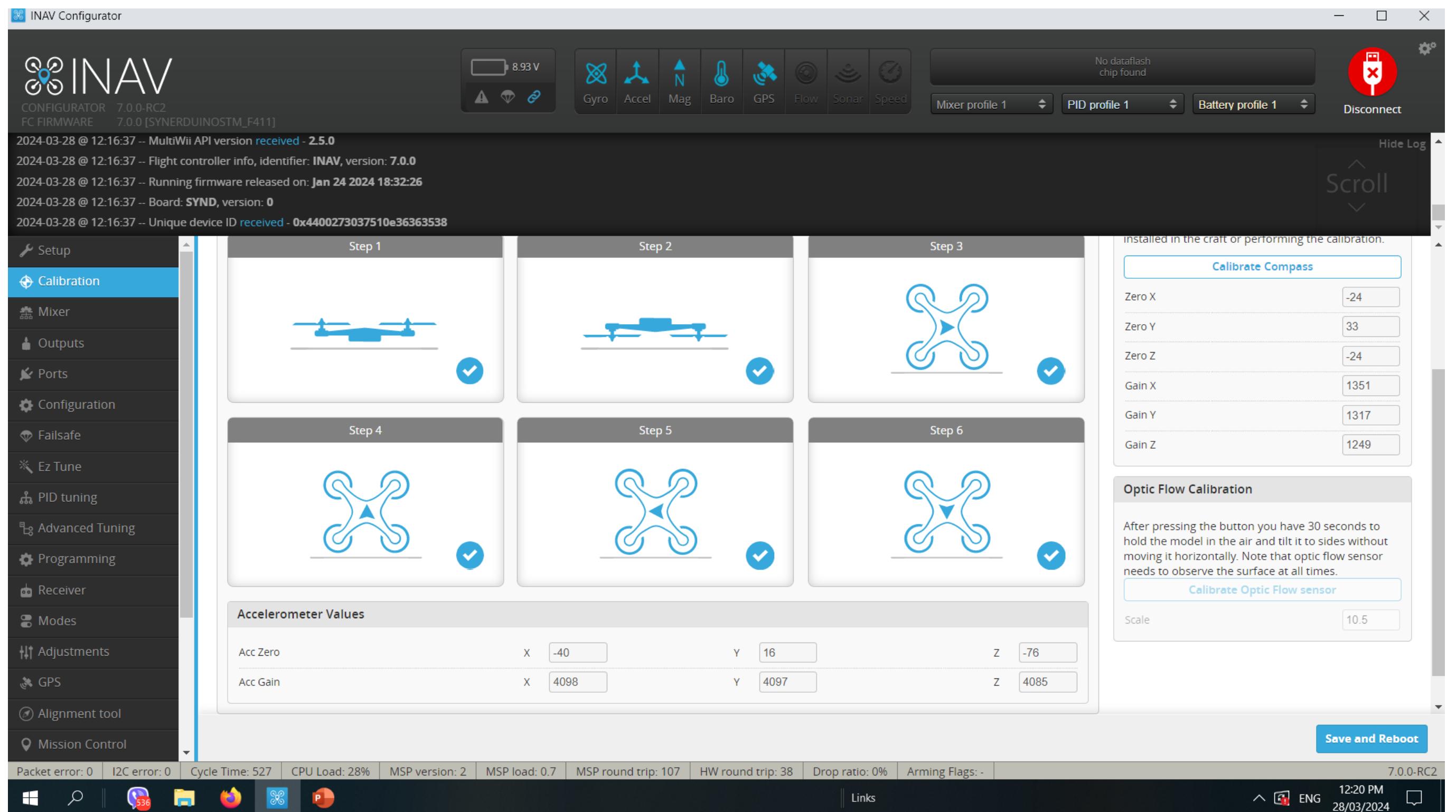
Blue is Active

Grey out is not available

SETTING UP YOUR DRONE

CALIBRATION

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



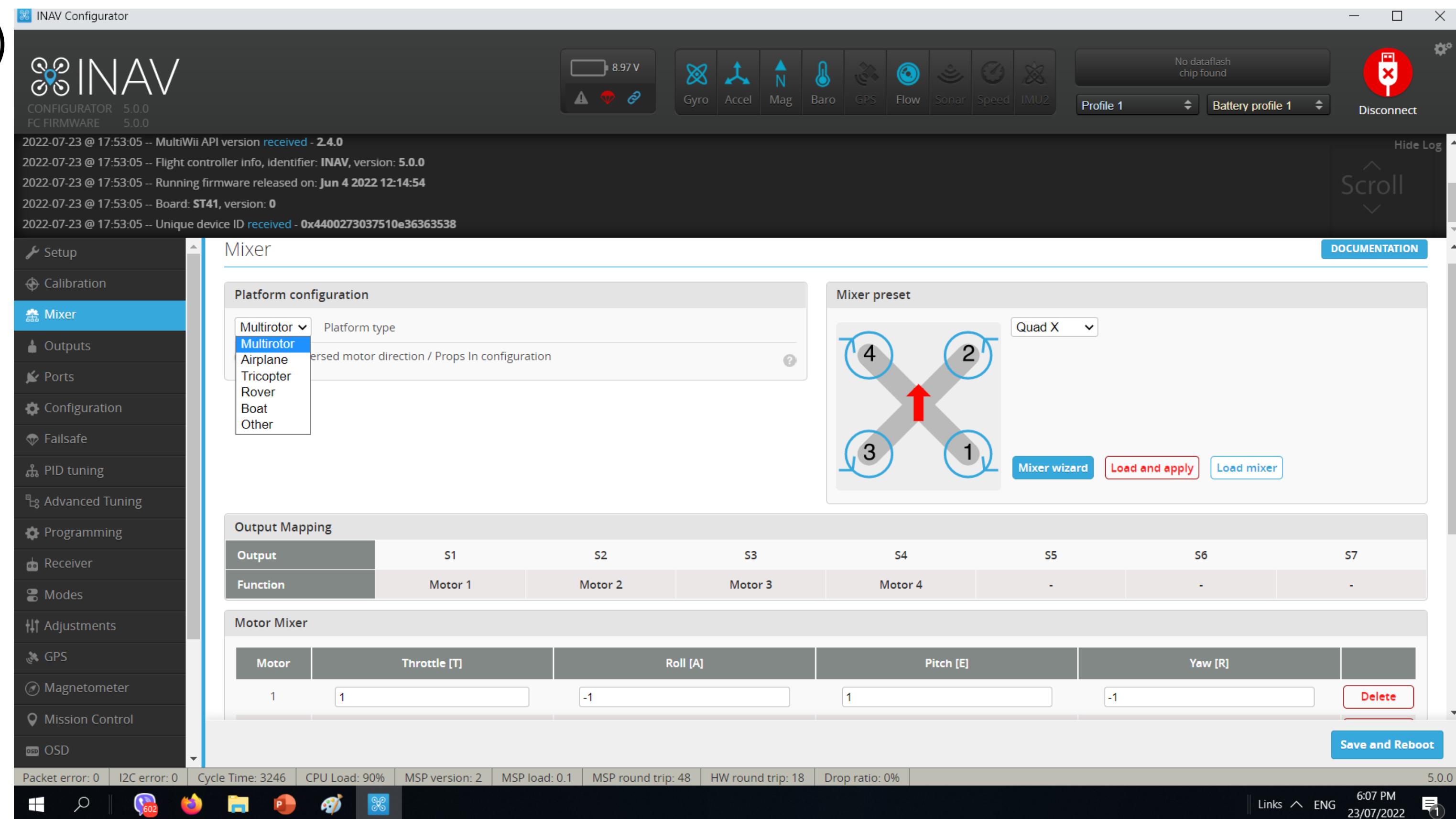
SETTING UP YOUR DRONE

MIXER (INAV5-6)

Airframe or
Vehicle time
Preset and mix
selection

Load and apply
when selected
then Save
Reboot

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



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

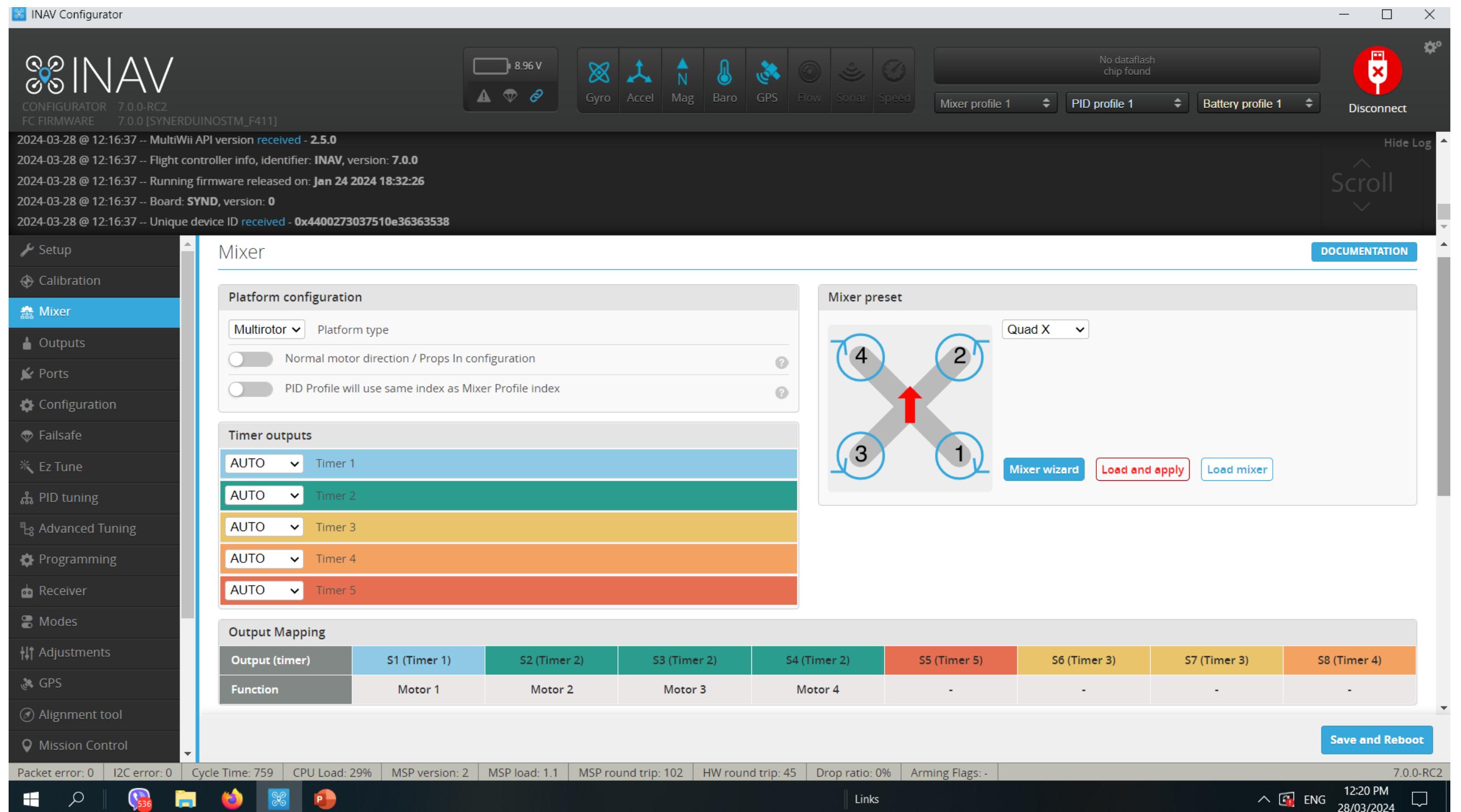
MIXER (INAV7-8)

Airframe or Vehicle
time Preset and mix
selection

Load and apply when
selected then Save
Reboot

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

Mixing is now color
coded to timer
availability



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

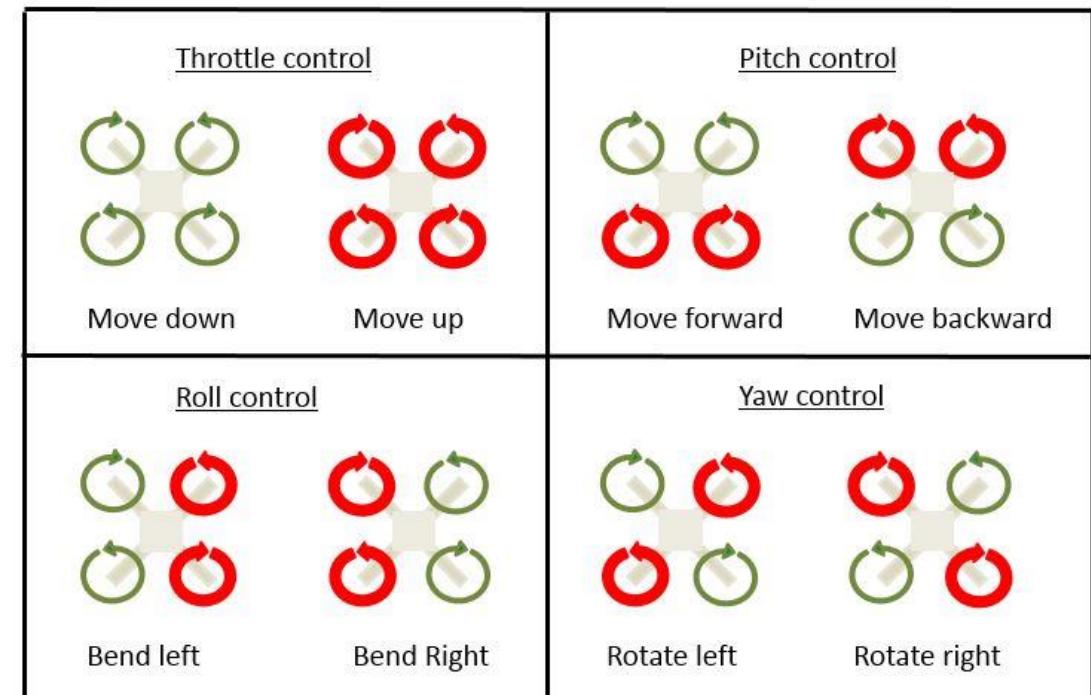
AILERON - ROLL RIGHT

ELEVATOR - PITCH FORWARD

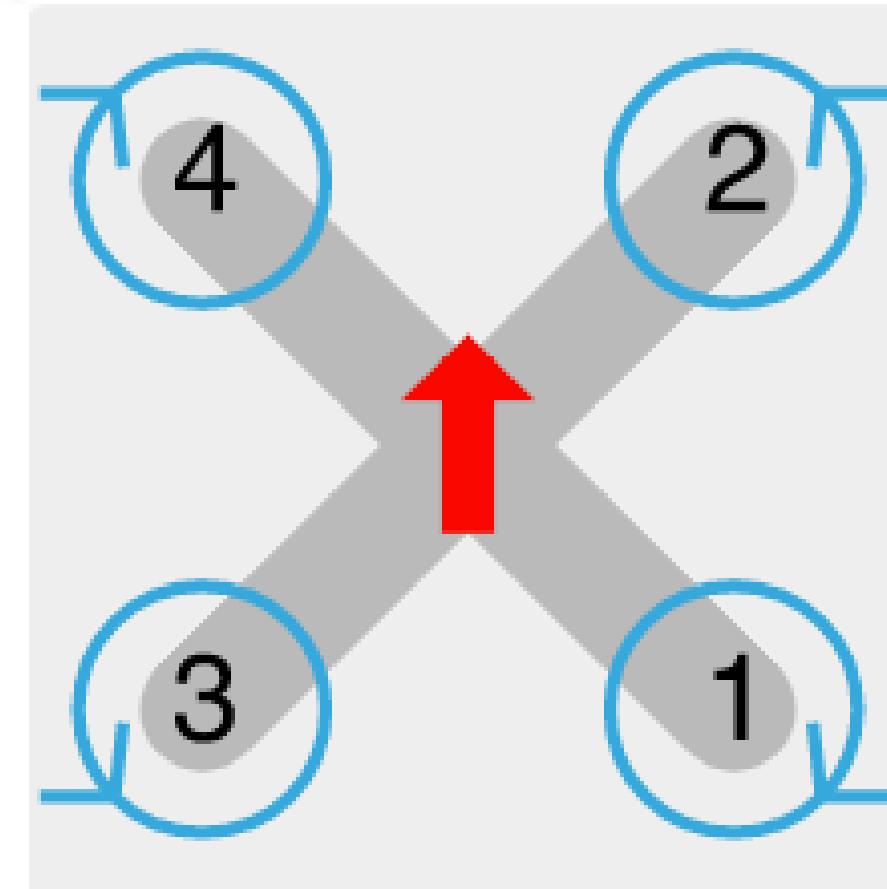
RUDDER - YAW RIGHT

(-) REDUCE RPM
(+) INCREASE RPM

Output	S1	S2	S3	S4	S5	S6	S7
Function	Motor 1	Motor 2	Motor 3	Motor 4	Servo 1	-	-
Motor Mixer							
Motor	Throttle [T]	Roll [A]	Pitch [E]	Yaw [R]			
1	1	-1	1	-1	<input type="button" value="Delete"/>		
2	1	-1	-1	1	<input type="button" value="Delete"/>		
3	1	1	1	1	<input type="button" value="Delete"/>		
4	1	1	-1	-1	<input type="button" value="Delete"/>		
<input type="button" value="Add new mixer rule"/>							
Servo mixer							
Servo	Input	Weight (%)	Speed (10 μ s/s)	Active			
1	RC Channel 6	100	0	Always	<input type="button" value="Delete"/>		
<input type="button" value="Add new mixer rule"/>							
Logic conditions							



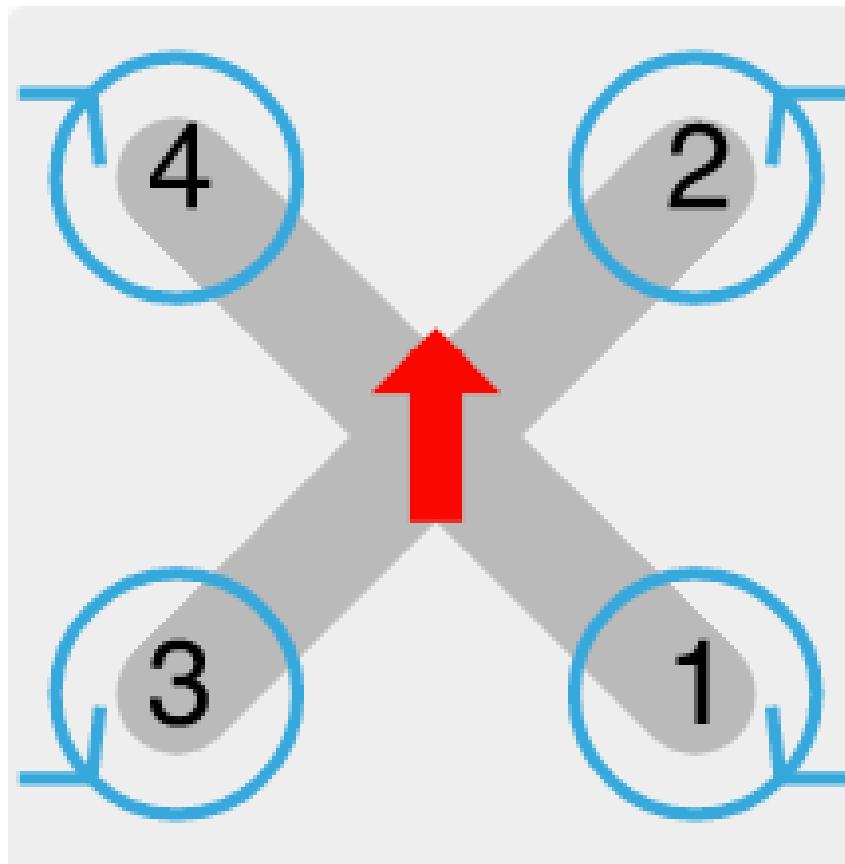
Normal Speed
 High Speed



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 7.0.0-RC2
FC FIRMWARE 7.0.0 [SYNERDUINOSTM_F411]

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

Mixer

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
2	1	-1	-1	1
3	1	1	1	1
4	1	1	-1	-1

Servo mixer

Servo	Input	Weight (%)	Speed (10µs/s)	Active
Logic conditions				

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: -

12:20 PM 28/03/2024

SETTING UP YOUR DRONE

OUTPUT

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

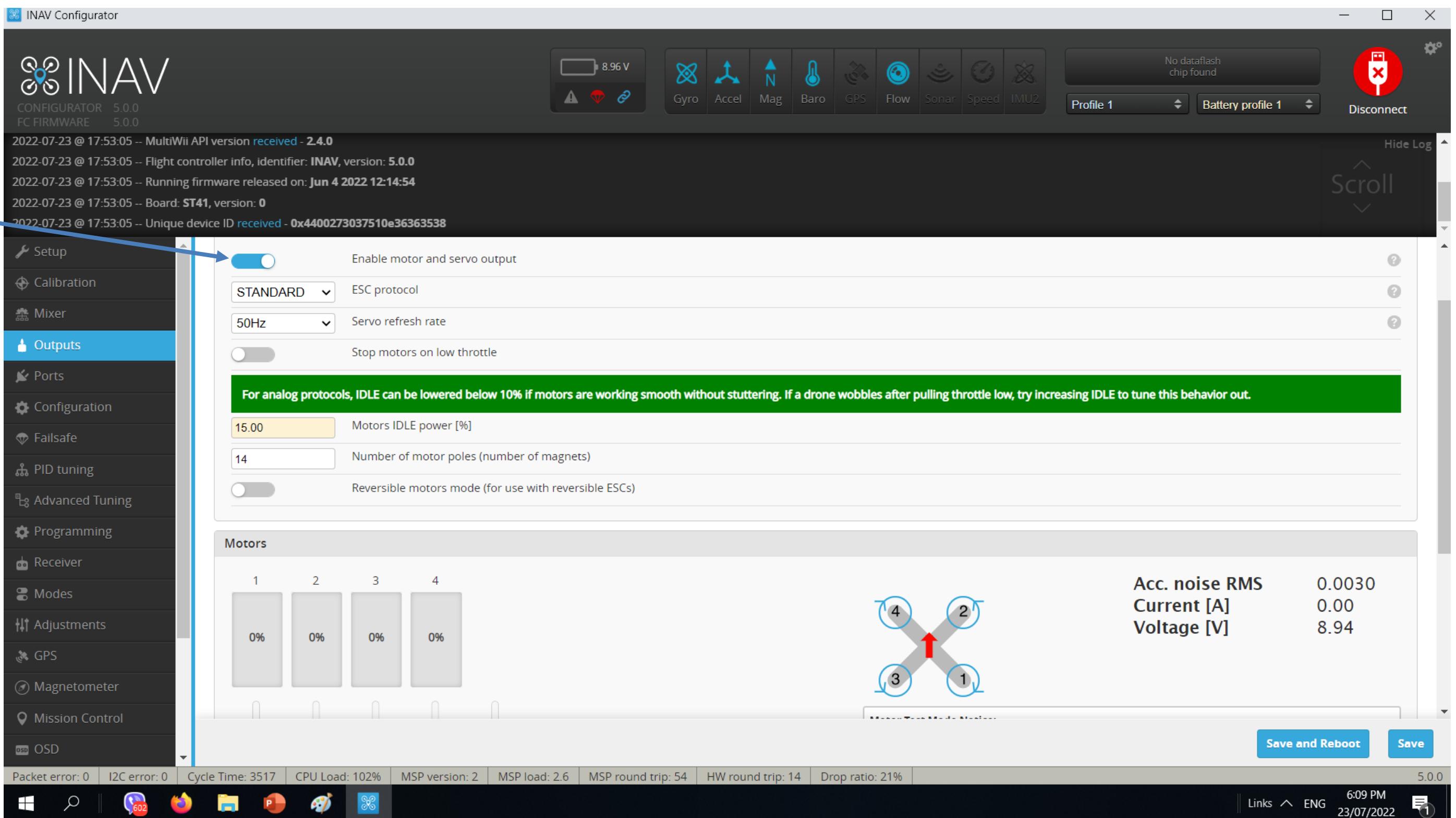
Enable Motor and Servo Output must be on

ESC Protocol

STANDARD
STANDARD
ONESHOT125
MULTISHOT
BRUSHED
DSHOT150
DSHOT300
DSHOT600

Servo Refresh rate

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

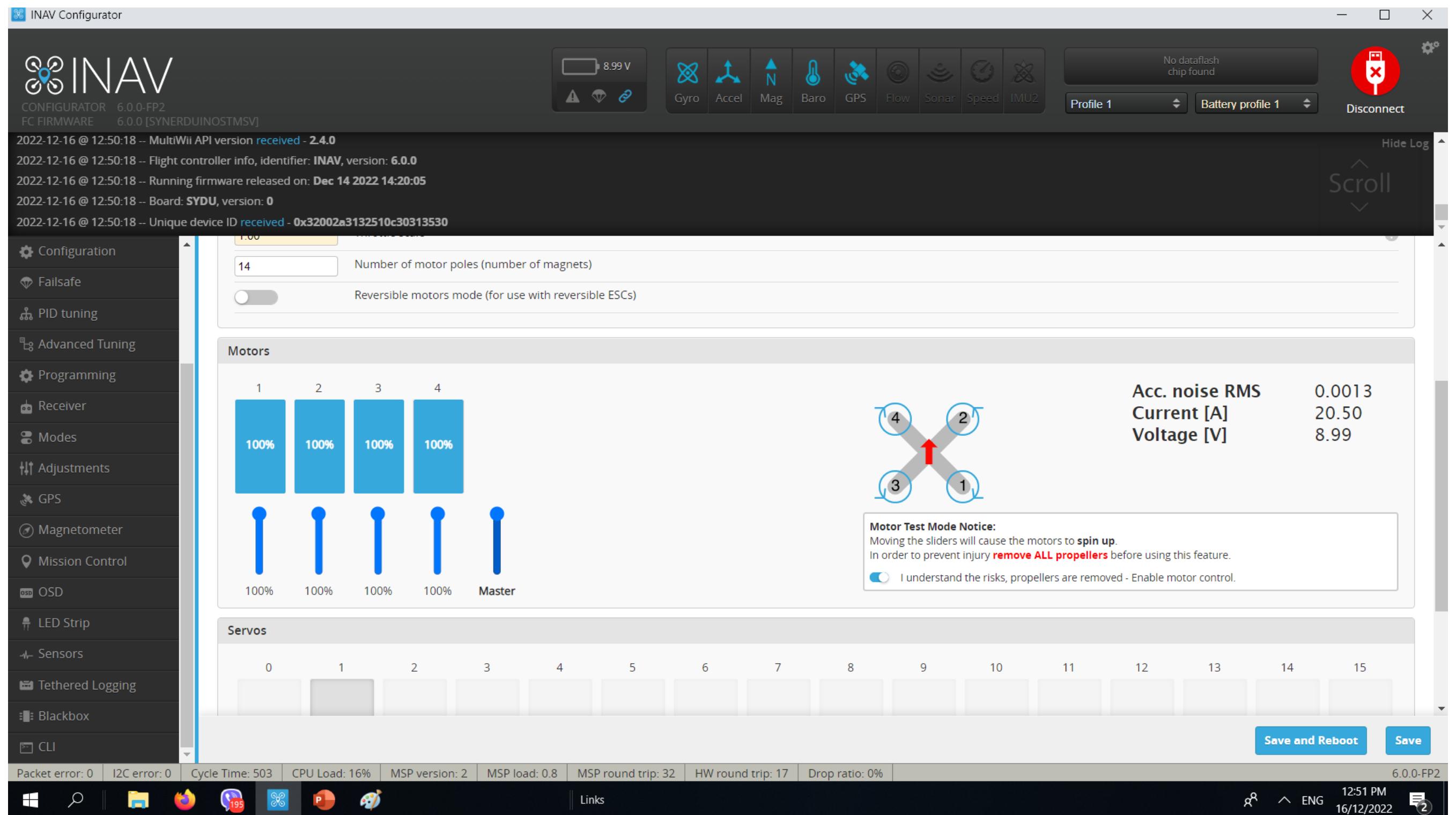


SETTING UP YOUR DRONE

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



SETTING UP YOUR DRONE

Electronic Speed Controller CALIBRATION

It's 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

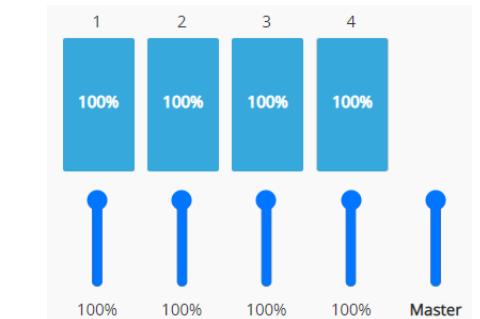
Outputs

Motor Test Mode Notice:

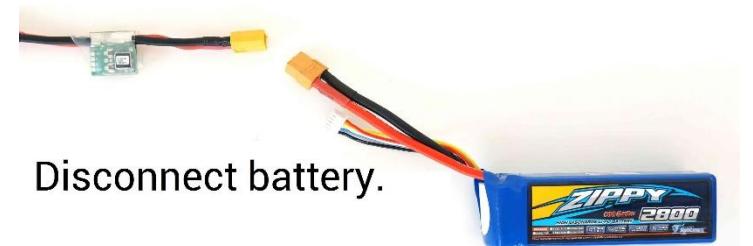
Moving the sliders will cause the motors to **spin up**.

In order to prevent injury **remove ALL propellers** before using this feature.

I understand the risks, propellers are removed - Enable motor control.



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)

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

Bluetooth (115200)
SIK Serial Radio (57600)

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)

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

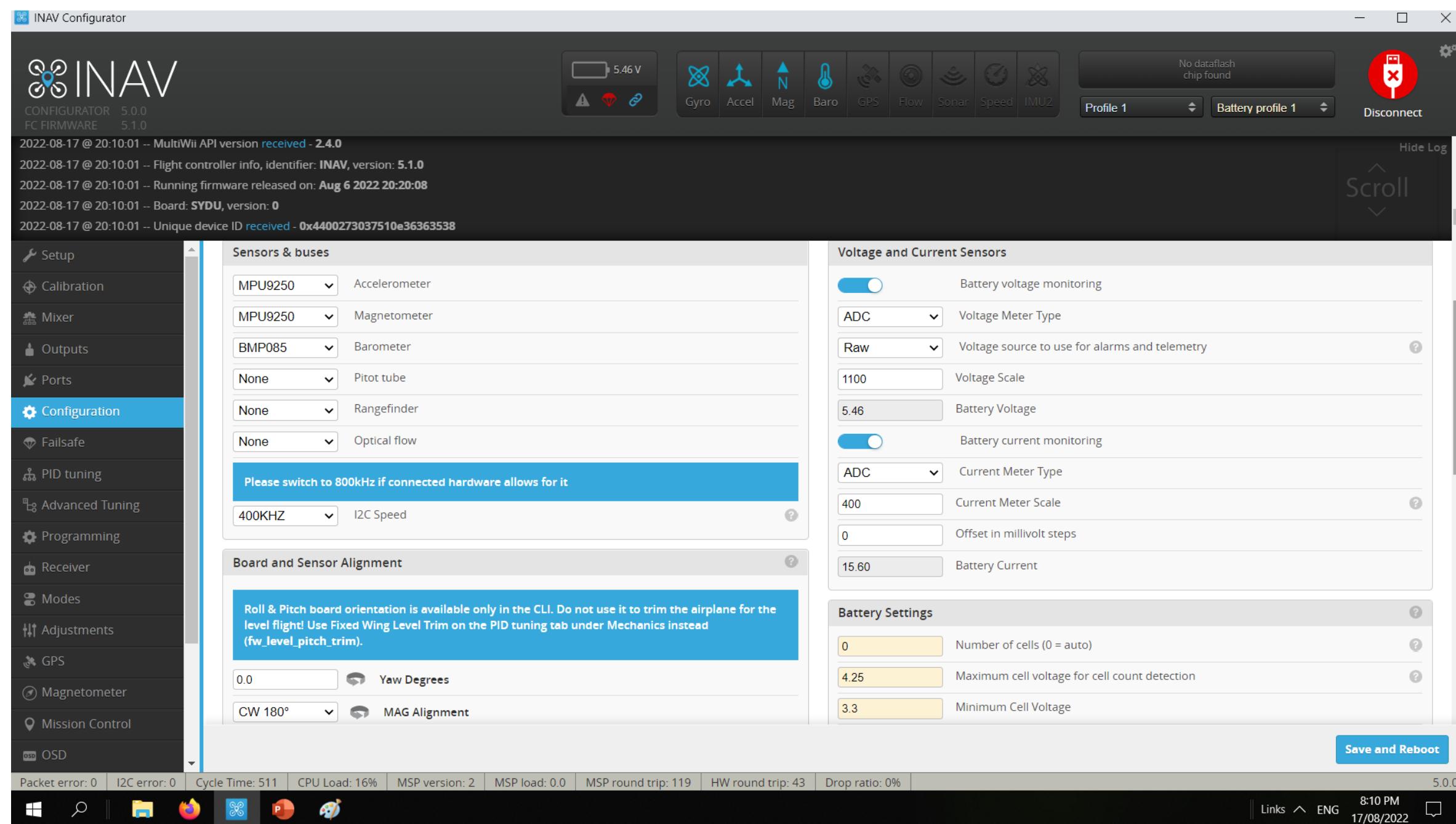
GPS for navigation and telemetry

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

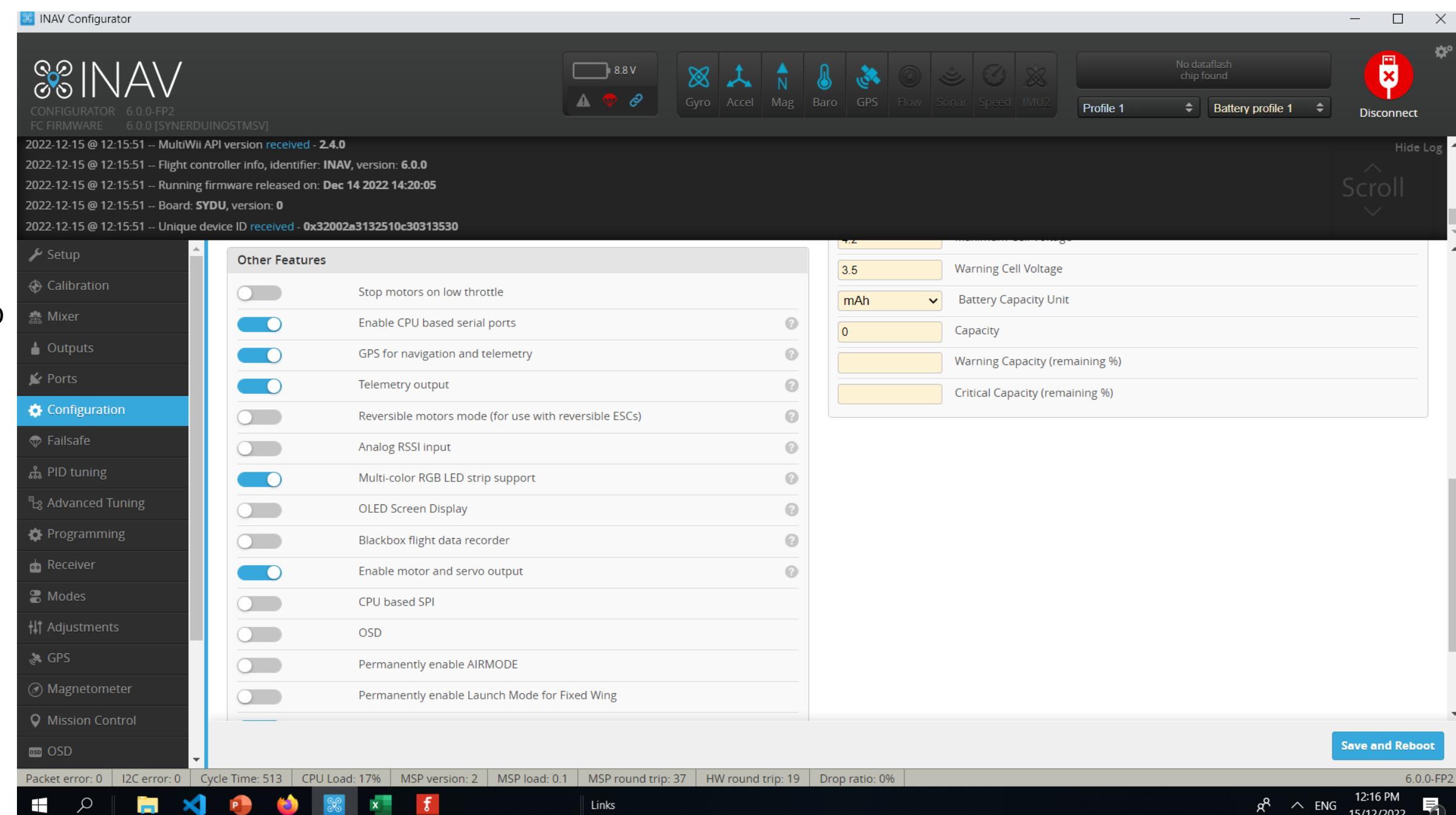


SETTING UP YOUR DRONE

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 V – Voltage 0-5V

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

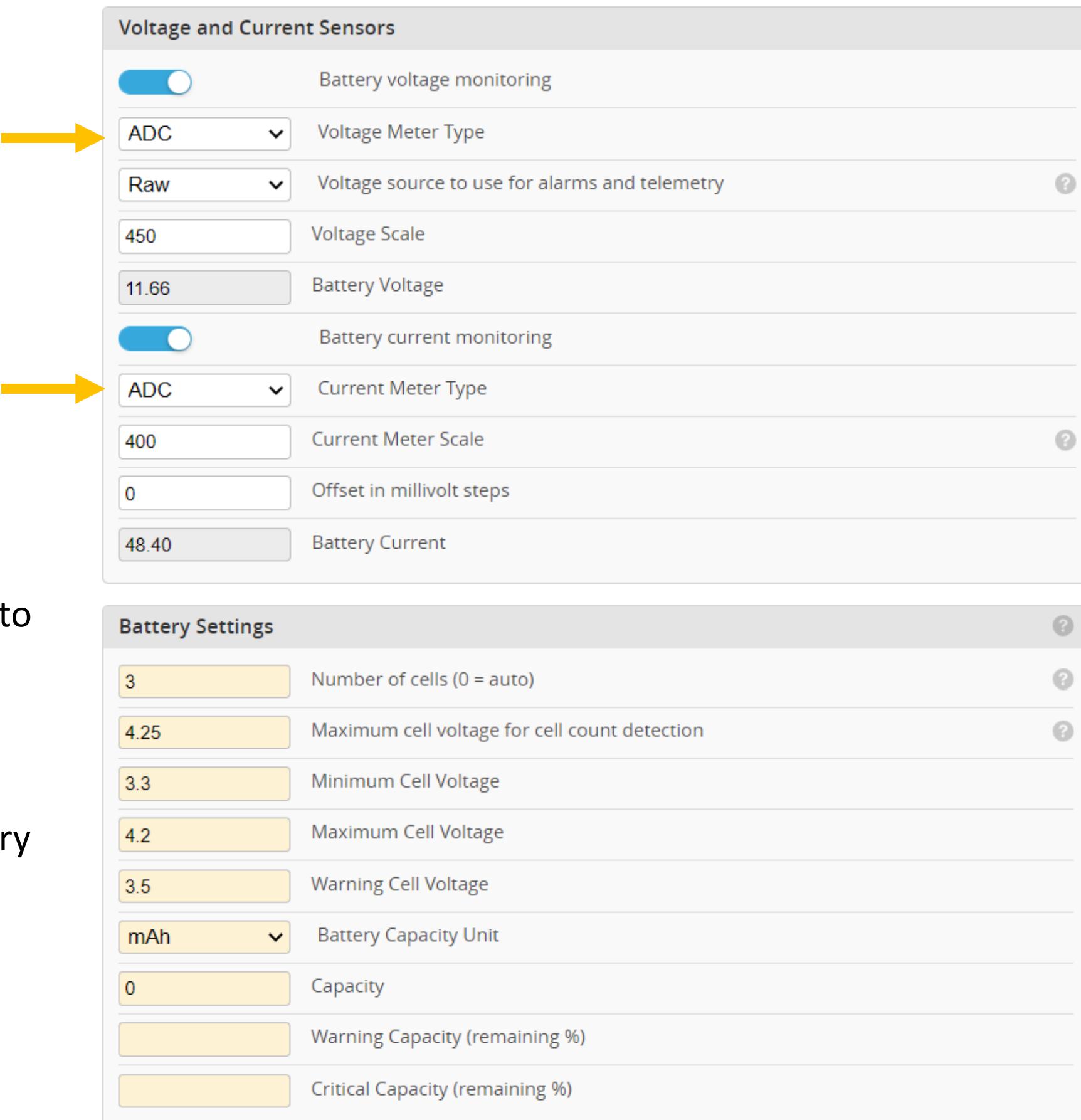
Battery Current Monitoring (Current)

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



The image shows a configuration interface with two main sections: 'Voltage and Current Sensors' and 'Battery Settings'. The 'Voltage and Current Sensors' section is expanded, showing settings for battery voltage monitoring and battery current monitoring. The 'Battery Settings' section is also expanded, showing base battery parameters. Yellow arrows point from the text descriptions in the configuration section to the corresponding settings in the interface.

Voltage and Current Sensors	
<input checked="" type="checkbox"/>	Battery voltage monitoring
ADC	Voltage Meter Type
Raw	Voltage source to use for alarms and telemetry
450	Voltage Scale
11.66	Battery Voltage
<input checked="" type="checkbox"/>	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

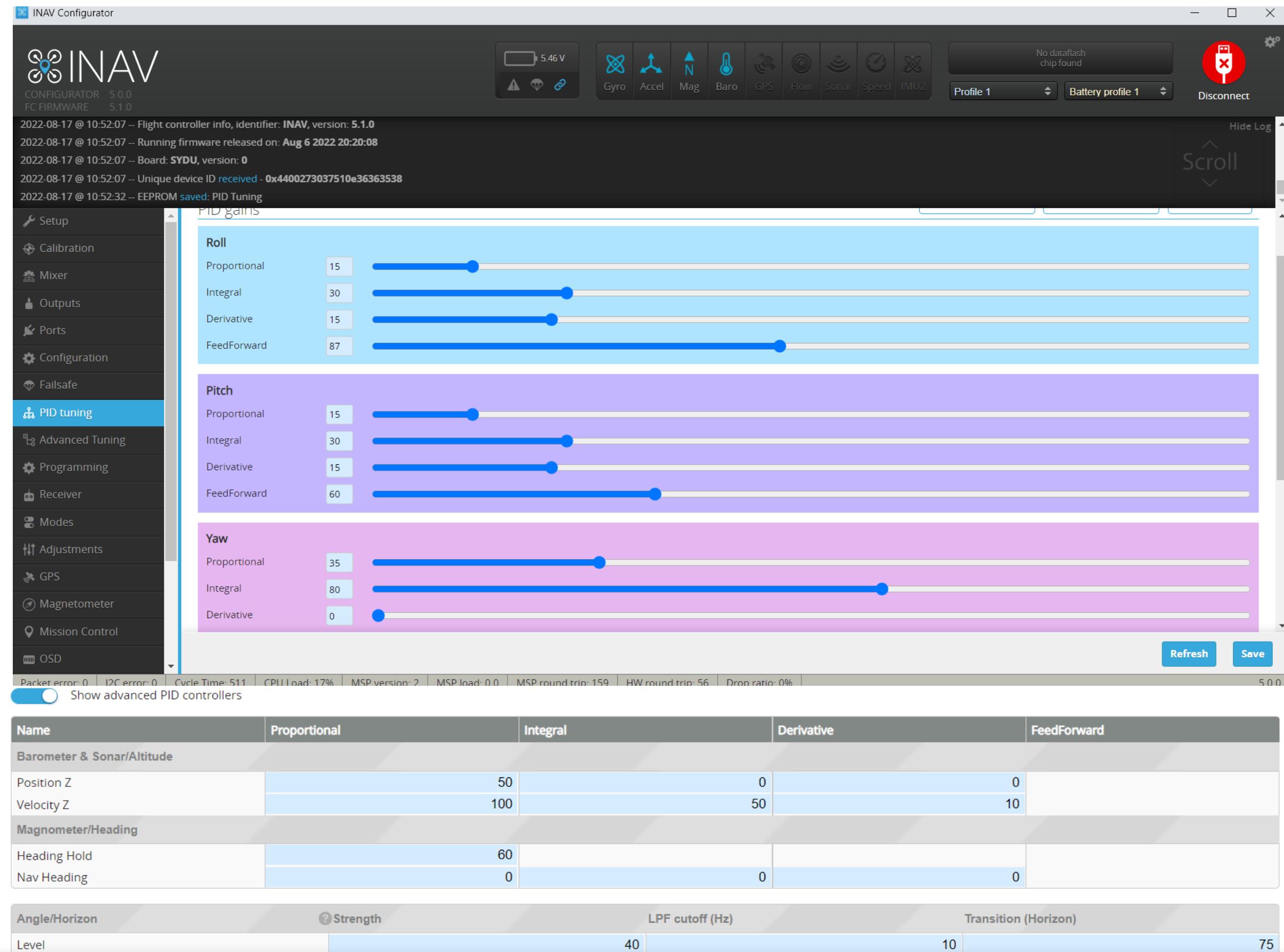
Derivative 0

ANGLE/HORIZON

Strength 40

LPF Cutoff (Hz) 10

Transition (Horizc



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	
Magnometer/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

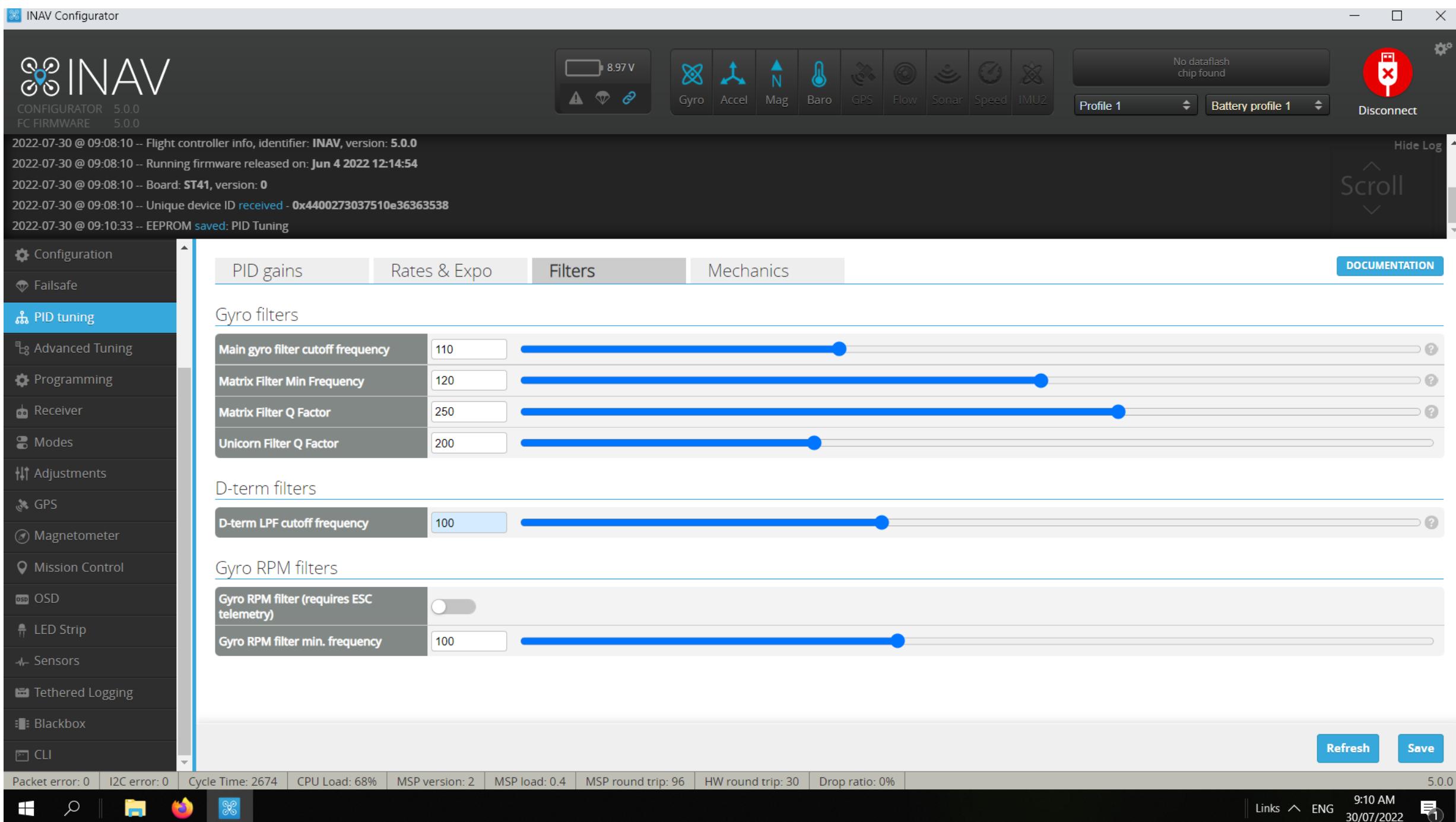
- Position XY – this is the strength of the responds to hold position (too tigh it would over correct , too low it would under responds)
- Velocity XY – how fast it would respond to the deviation
- Surface XY – works with optical sensor

Angle / horizon

- Level – how quick the drone returns to level flight

SETTING UP YOUR DRONE

Filters adjustment for Sensor respond rate



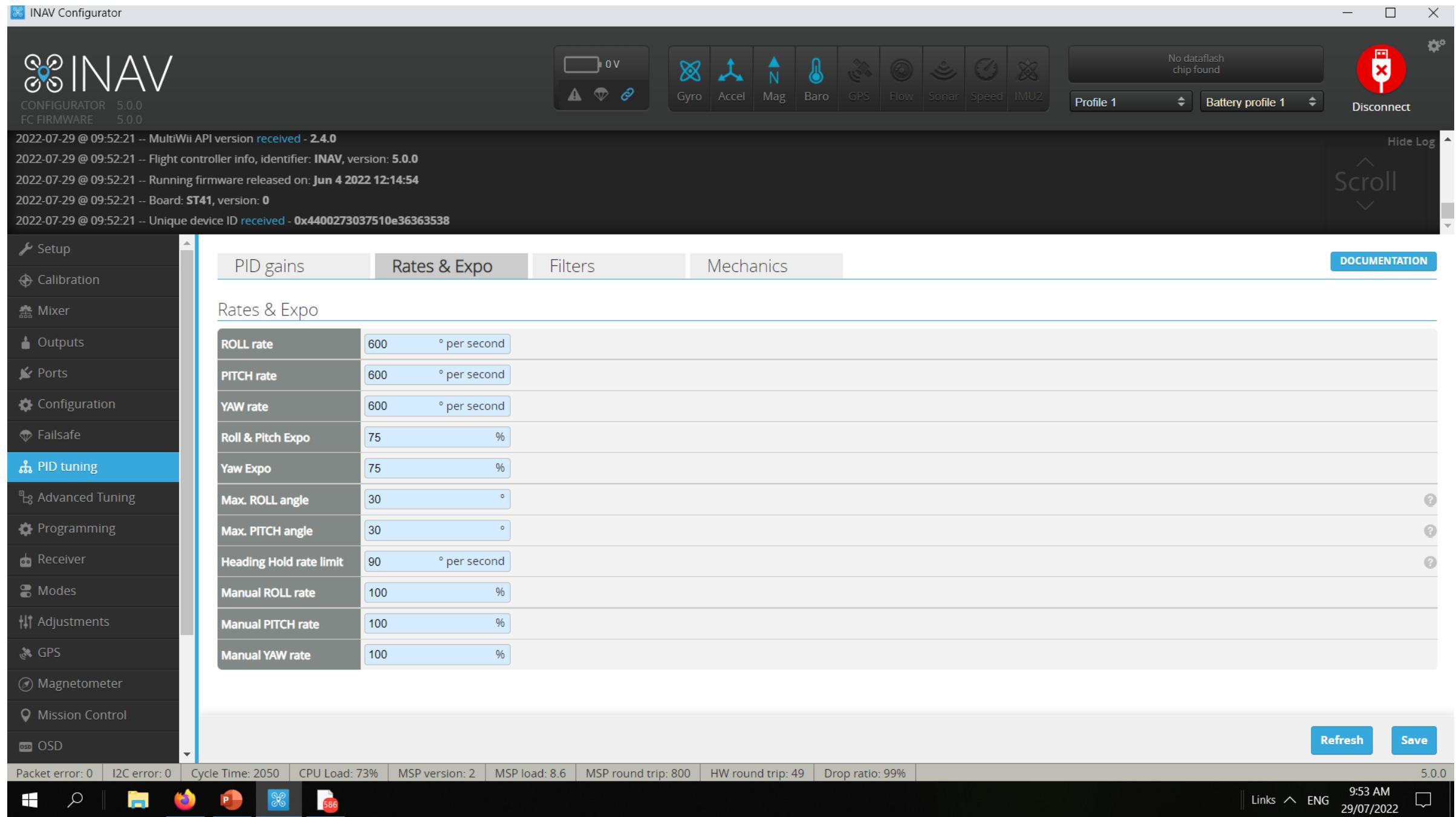
SETTING UP YOUR DRONE

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

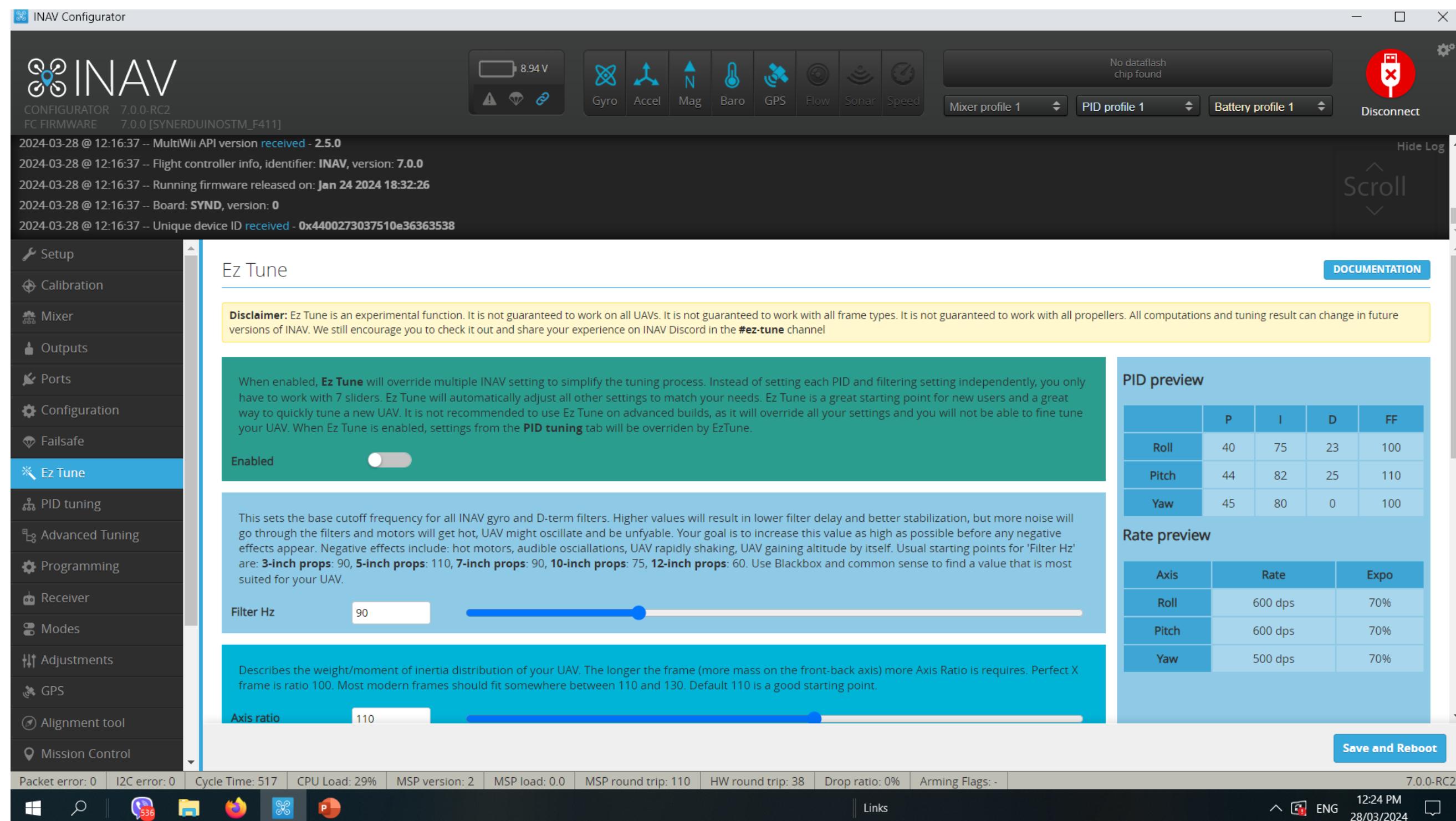
When Enable it automatically override the standard PID process associated to the older INAV 5 and 6

Descriptions are listed

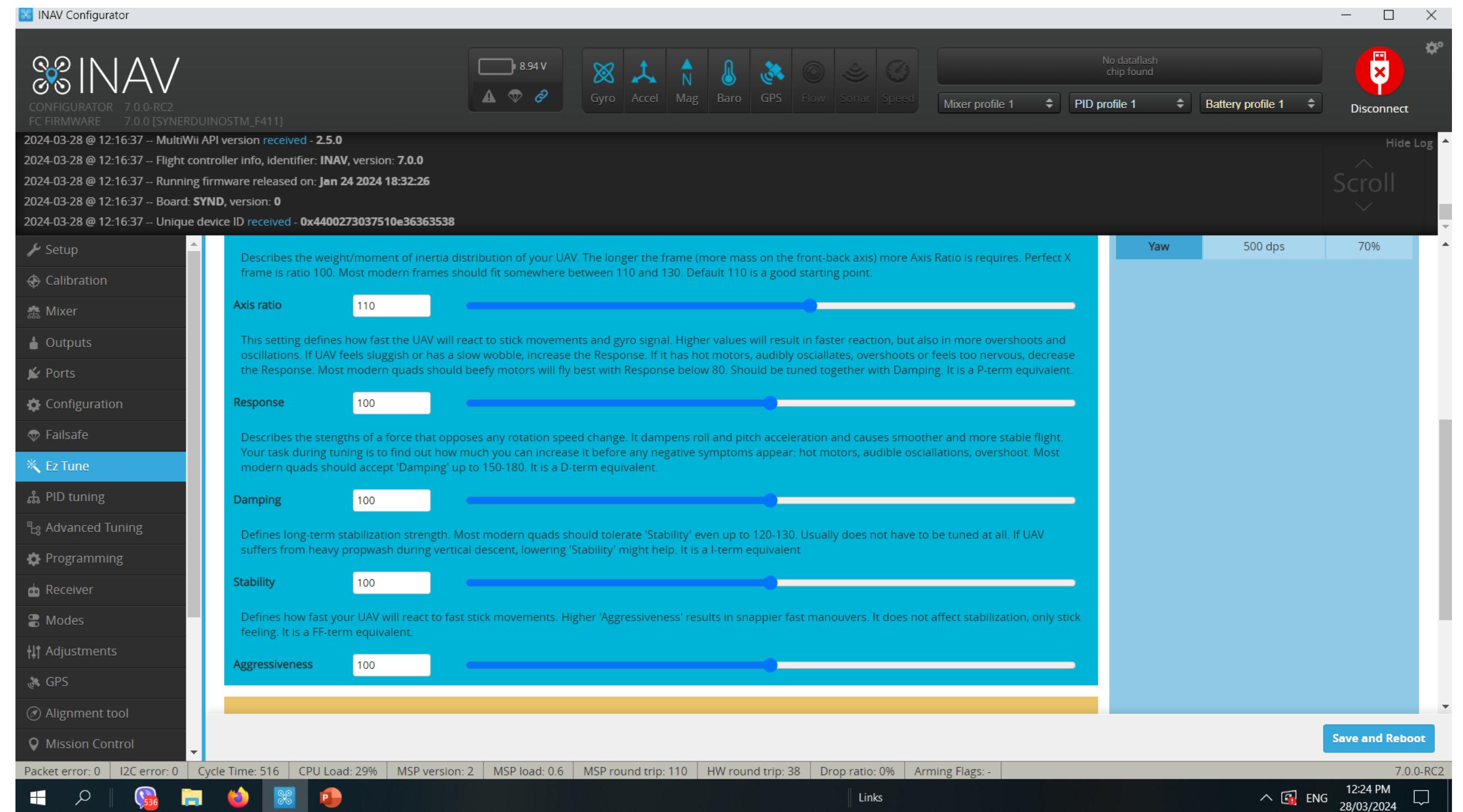
However this is still a work in progress it works well for small drones

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

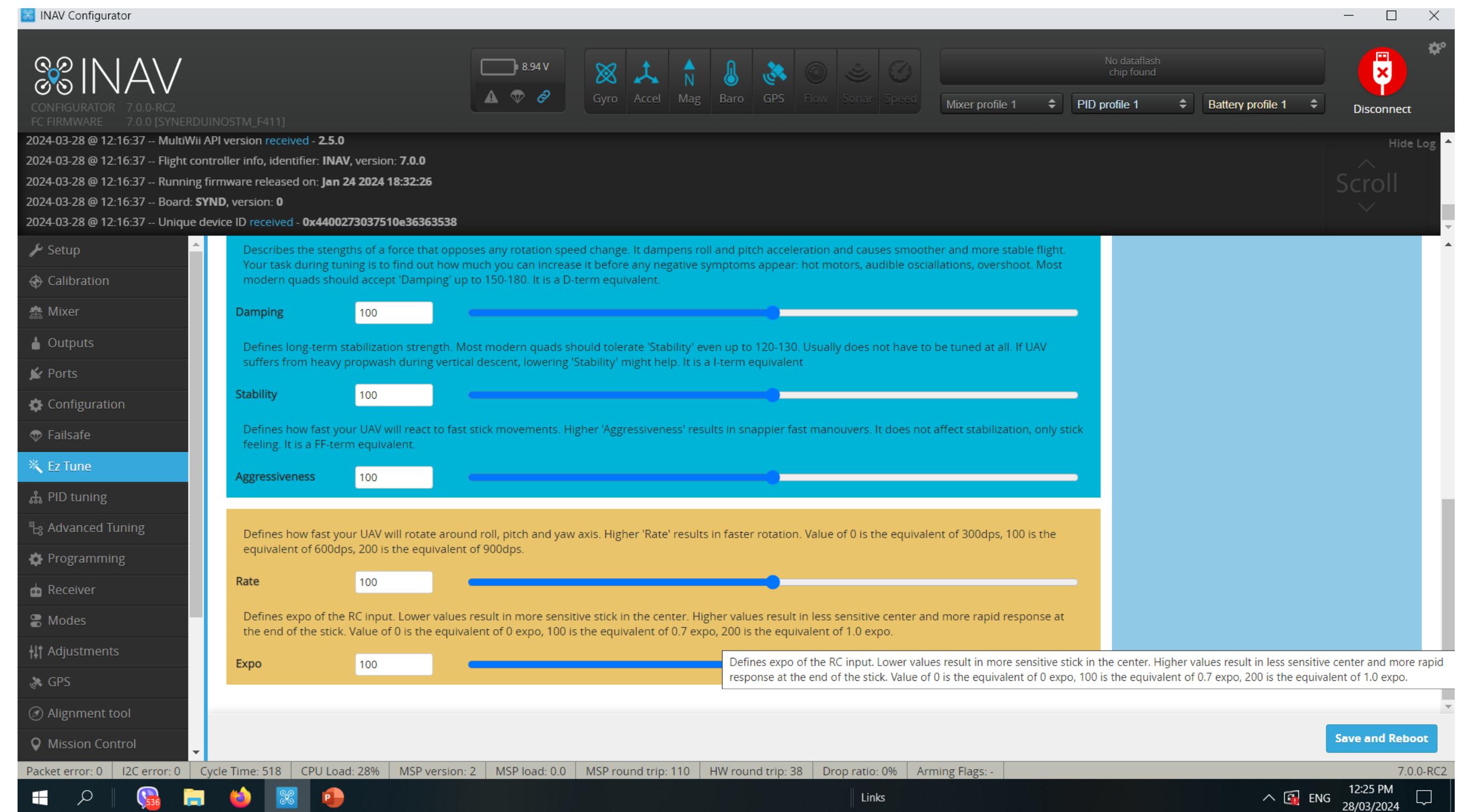
Recommend to use conventional PID tuning method



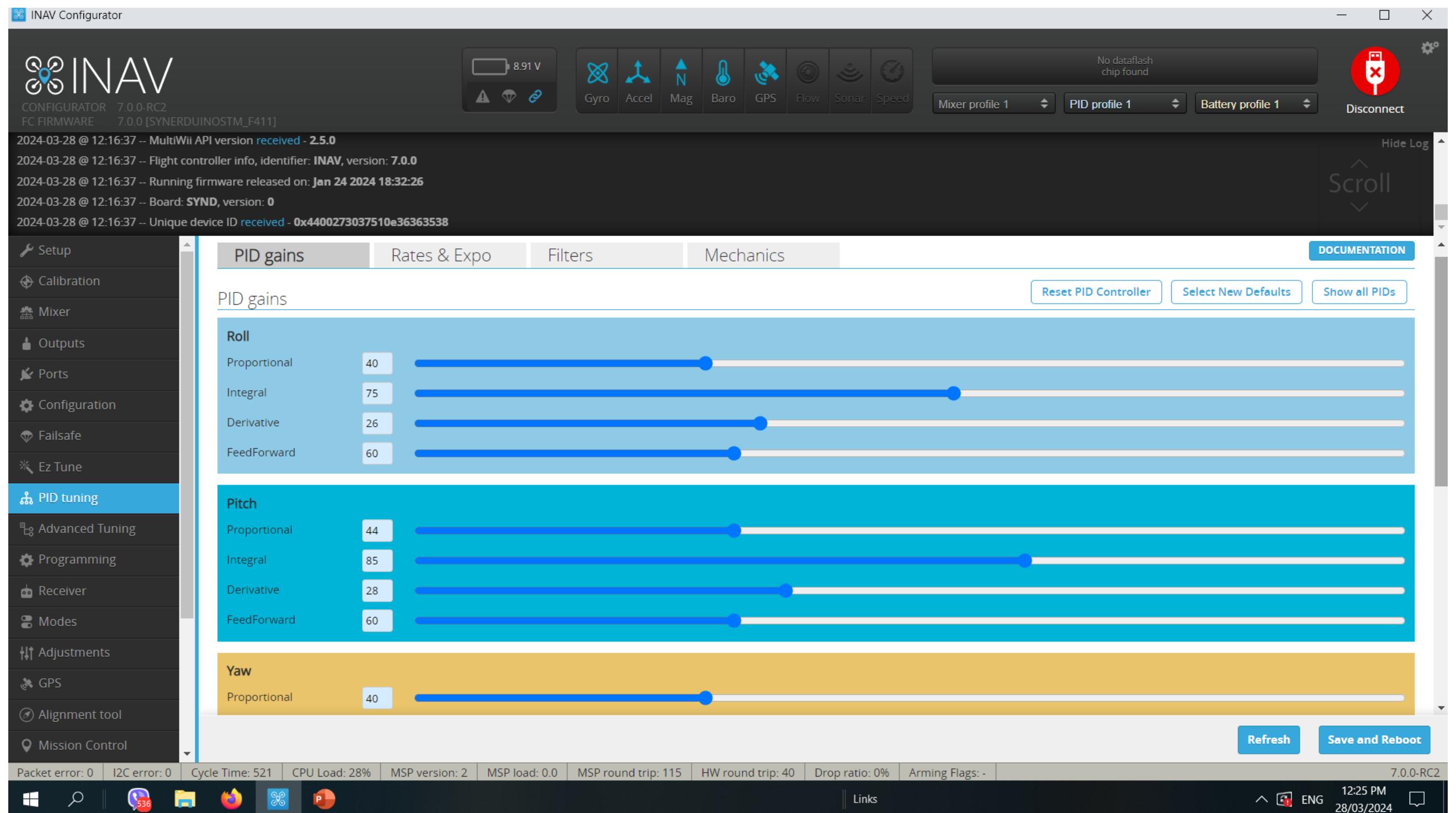
SETTING UP YOUR DRONE



SETTING UP YOUR DRONE



SETTING UP YOUR DRONE



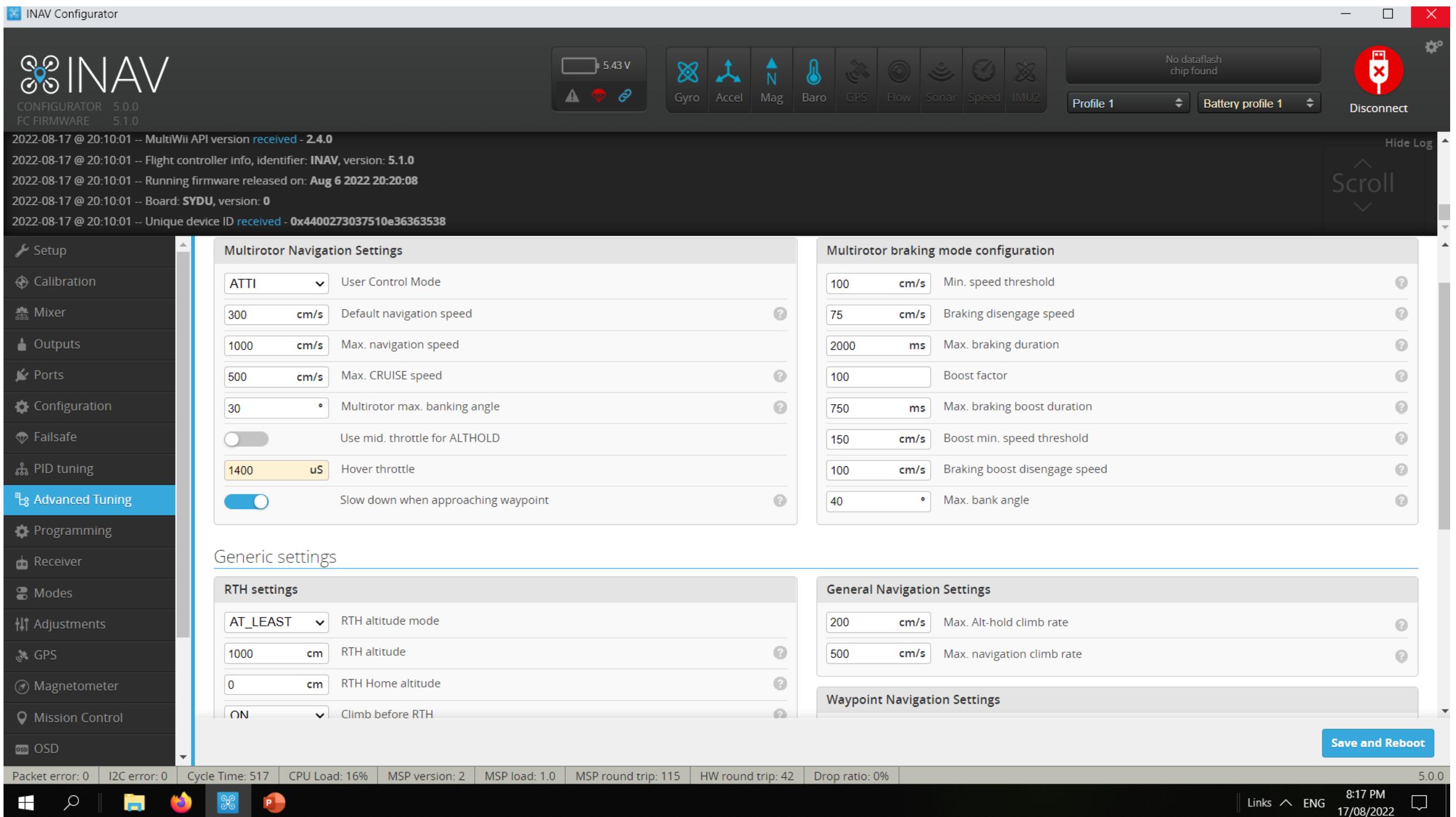
SETTING UP YOUR DRONE

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



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

Fixwing settings

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

Fixed Wing Navigation Settings

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

SETTING UP YOUR DRONE

ADVANCE TUNING

Multirotor 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 you’re 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

Multirotor Navigation Settings

ATTI	cm/s	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
STICK	us	Stick position for althold hover
1300	us	Hover throttle
<input checked="" type="checkbox"/>		Slow down when approaching waypoint

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

SETTING UP YOUR DRONE

ADVANCE TUNING

Multirotor Setting

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

The image shows two panels of a mobile application interface for drone configuration. The top panel is titled 'General Navigation Settings' and contains the following settings:

Setting	Value	Unit	Description
Max. Alt-hold climb rate	200	cm/s	
Max. navigation climb rate	500	cm/s	
Max Altitude for Navigation	0	cm	
Navigation Motor Stop Override	ALL_NAV		

The bottom panel is titled 'Waypoint Navigation Settings' and contains the following settings:

Setting	Value	Unit	Description
Waypoint radius	100	cm	
Waypoint safe distance	100	m	
Load Waypoints on Boot	<input type="checkbox"/>		
Enforce Altitude at Waypoint	0	cm	
Waypoint Tracking Accuracy	0		
Waypoint Tracking Angle	60	°	
Waypoint Turn Smoothing	OFF		
Restart Waypoint Mission	RESUME		

Multirotor Setting

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

RTH settings

AT LEAST	cm	RTH altitude mode
1000	cm	RTH altitude
0	cm	RTH Home altitude
ON	cm	Climb before RTH
AT LEAST	cm	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	cm	RTH Track Back Mode
500	m	RTH Track Back Distance
RTH	cm	Safe Home Mode
20000	cm	Safe Home Max Distance
<input type="checkbox"/>	Tail first	
ALWAYS	cm	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

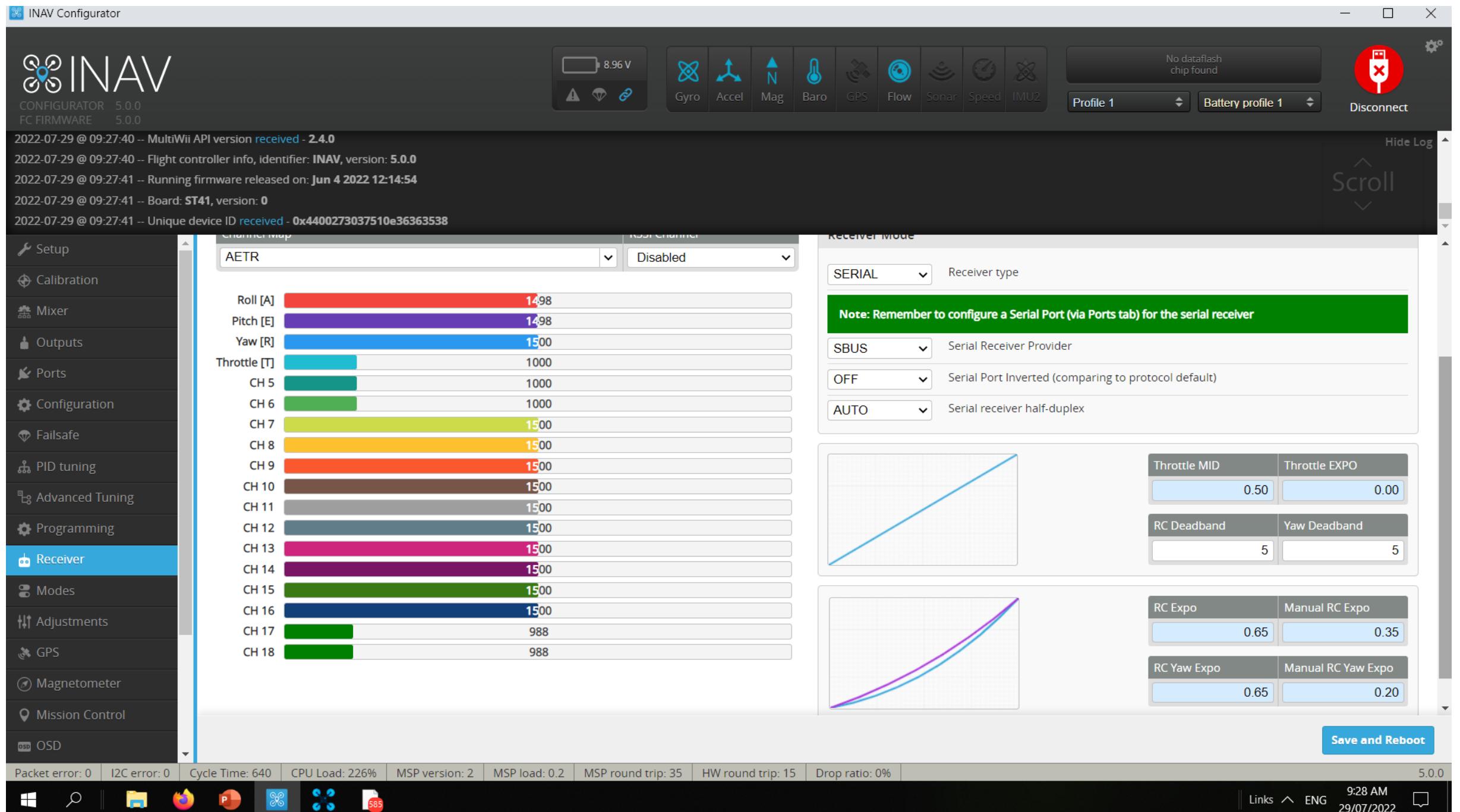
AETR = Futaba format

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



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)	
Throttle	Ch3	Ch1	Ch3	SBUS/PPM/PWM Converter may be required if your receiver don't support SBUS
Aileron	Ch1	Ch2	Ch2	
Elevator	Ch2	Ch3	Ch1	
Rudder	Ch4	Ch4	Ch4	
Aux1	Ch5	Ch5	Ch5	
Aux2	Ch6	Ch6	Ch6	
Aux3	Ch7	Ch7	Ch7	Pls Check the output pin from your Radio Rx manual
Aux4	Ch8	Ch8	Ch8	

SETTING UP YOUR DRONE

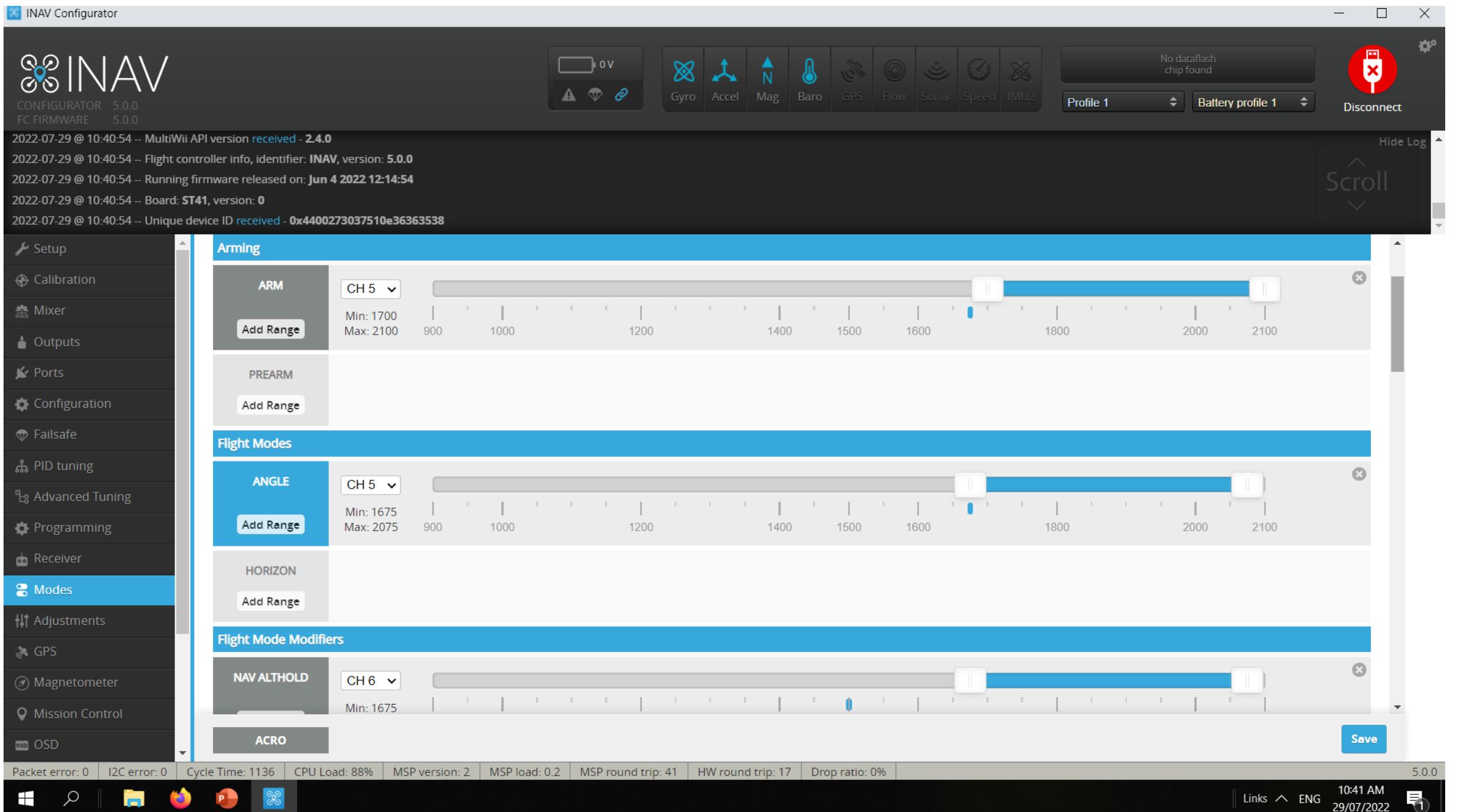
MODES

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](#)

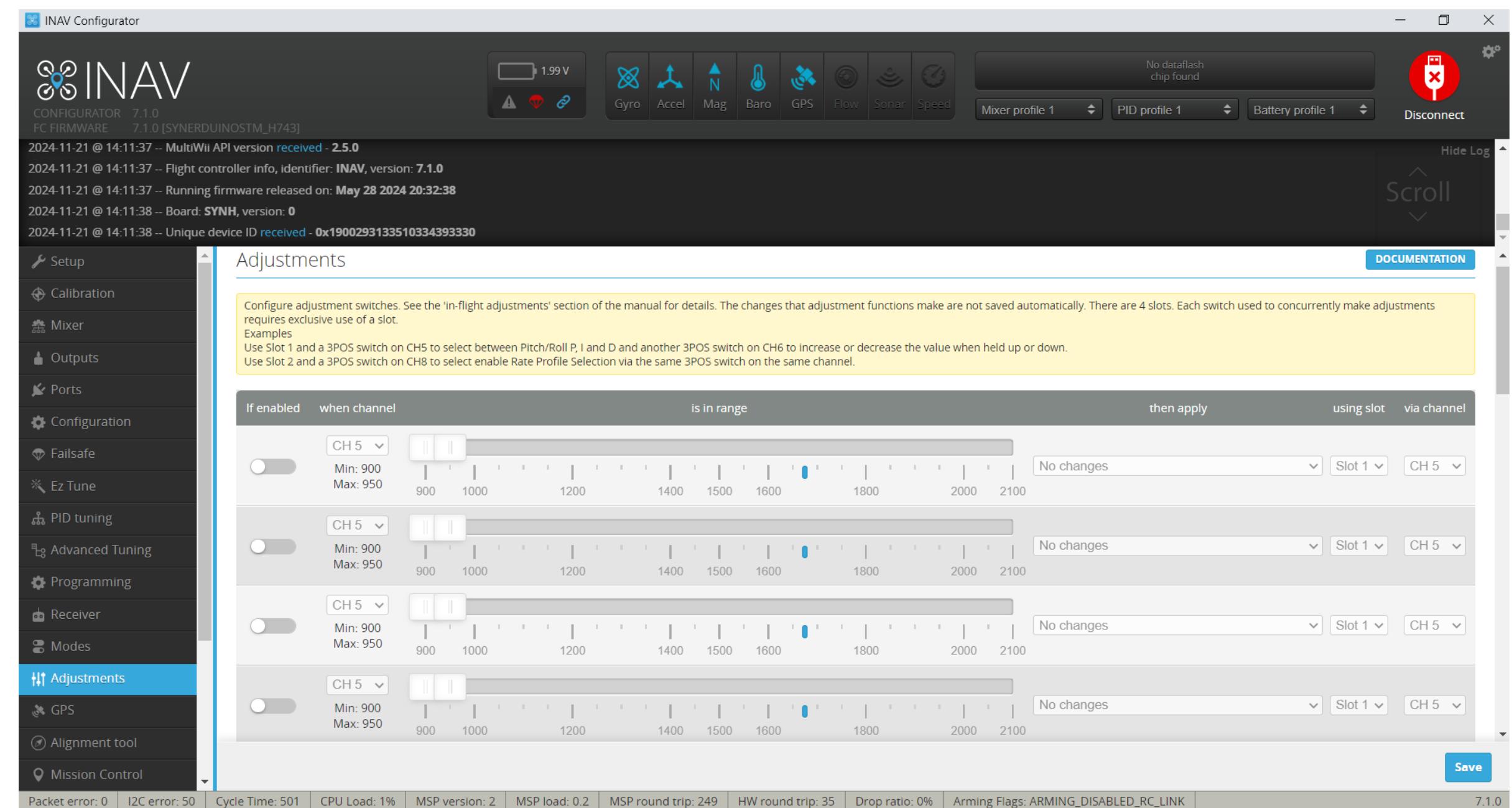


ADJUSTMENTS

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.



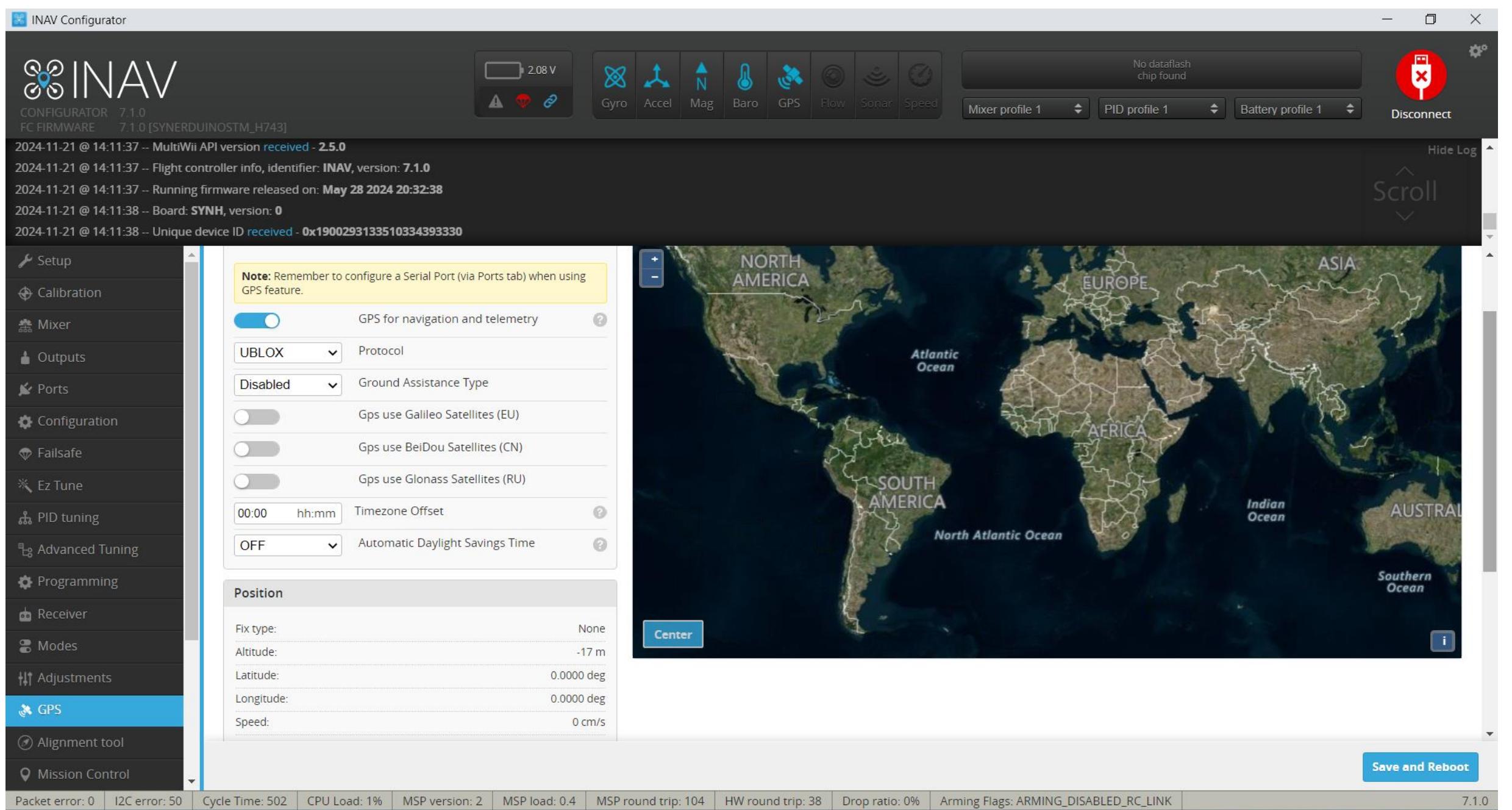
GPS

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.

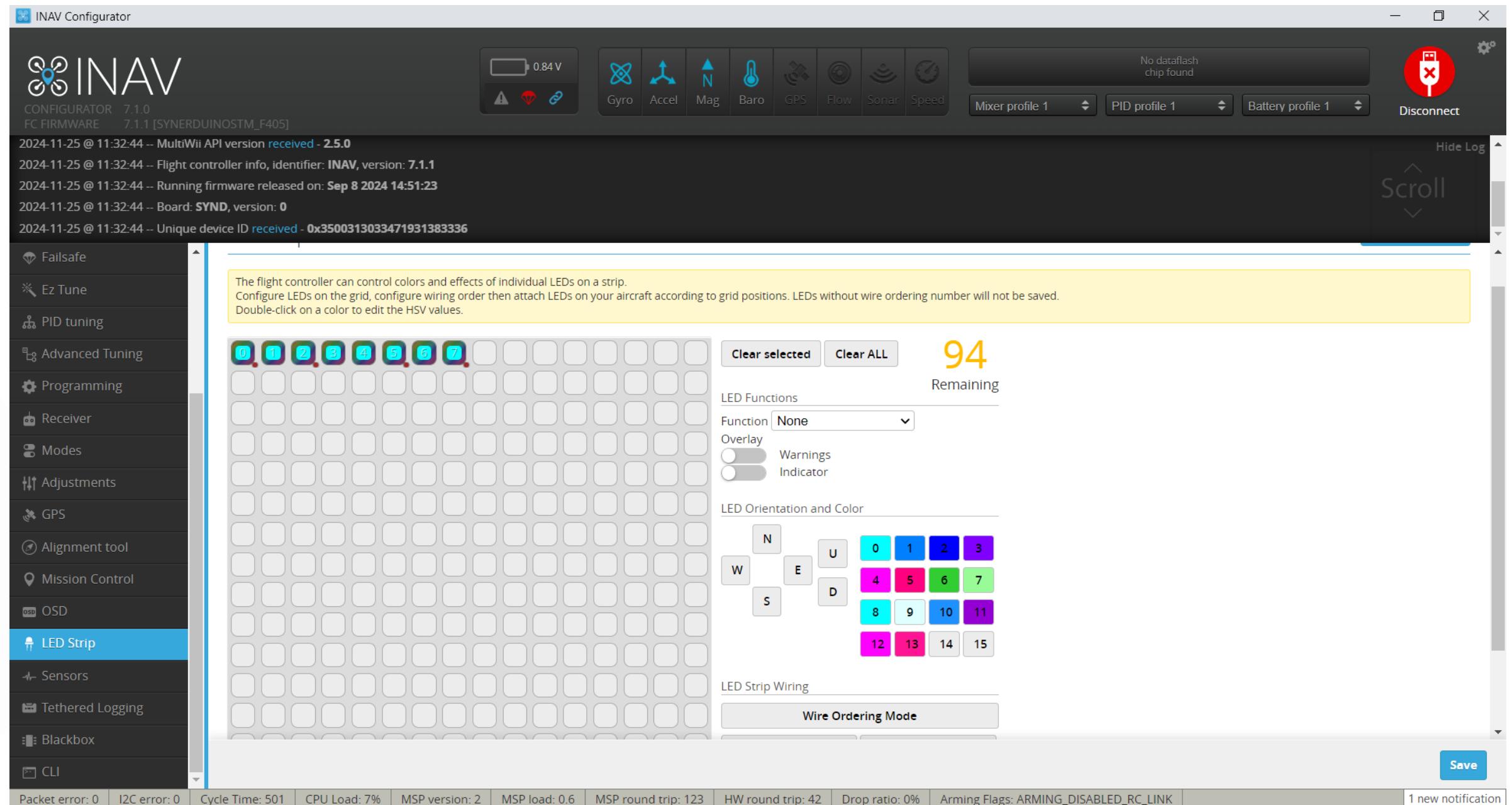
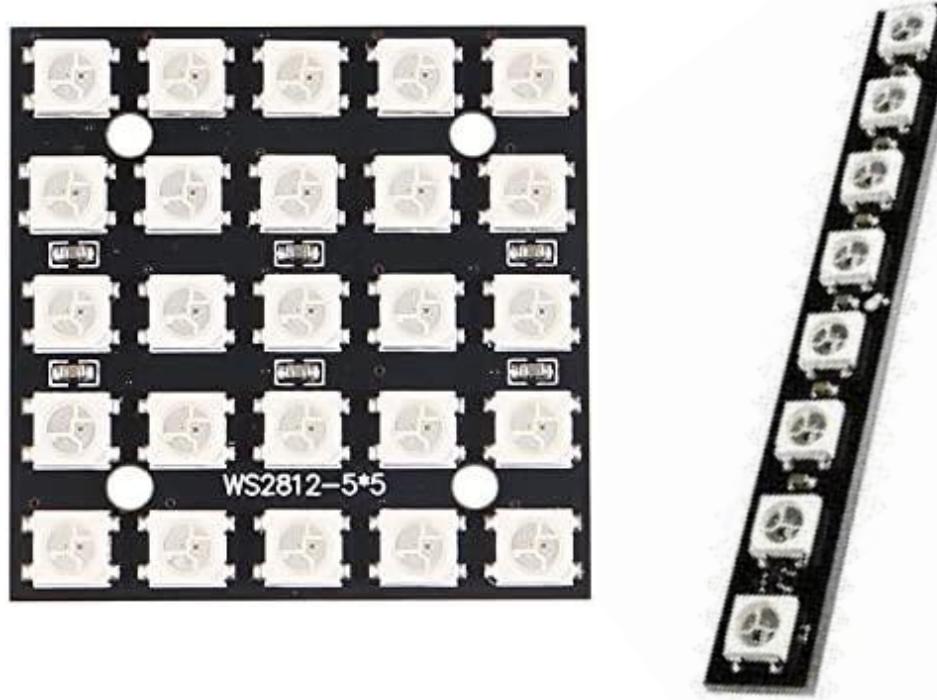
Its also to check if GPS is working correctly



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

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 vari from Flight controller to Flight controller. Pls be aware of this

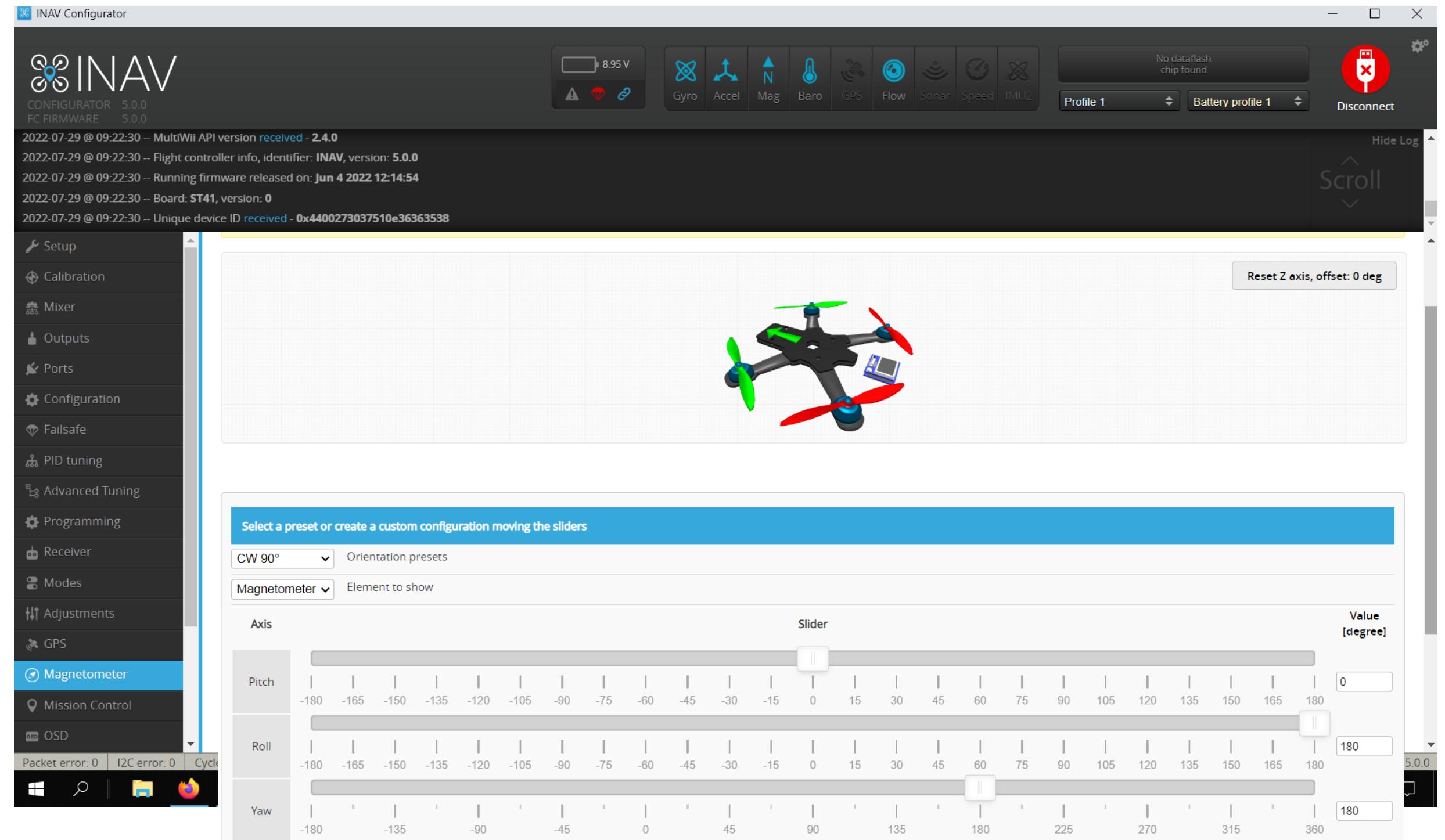
This can be verified From the setup Tab look at heading it should follow when the Drone is pointing toward a heading

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

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

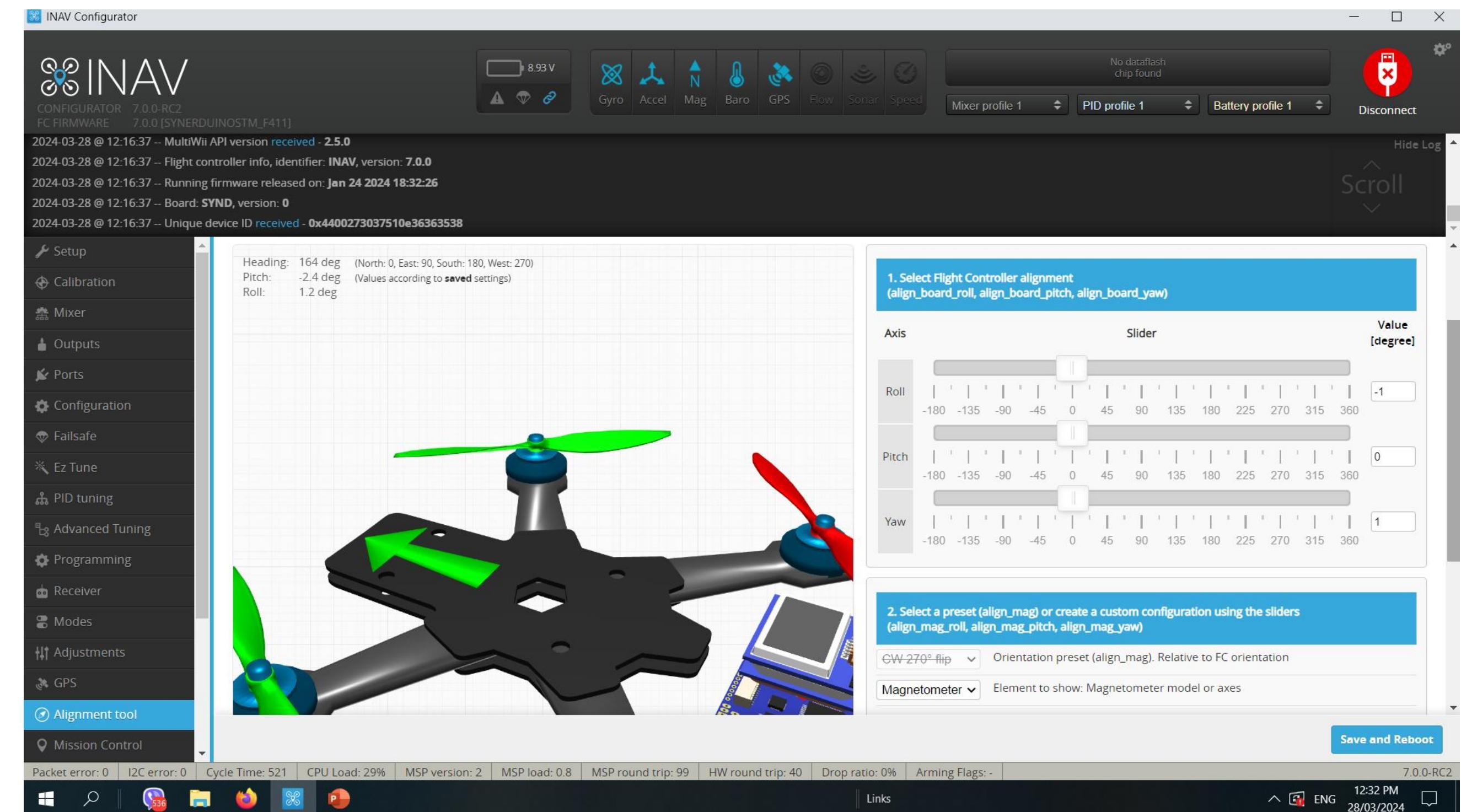
0 Degrees = North

90 Degrees = East

180 Degrees = South

270 Degrees = West

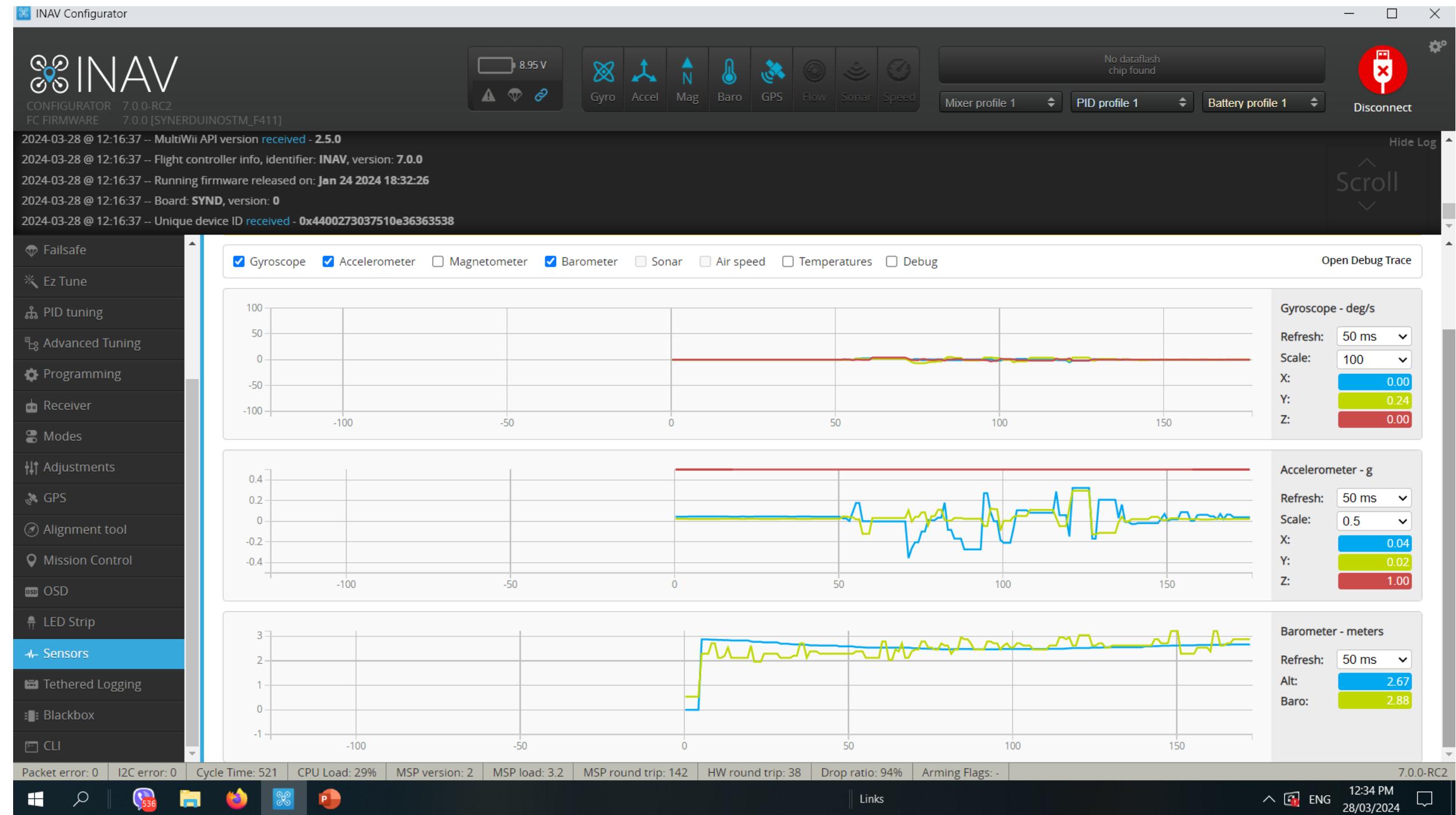
ALIGNMENT TOOL (INAV7-8)



SETTING UP YOUR DRONE

SENSORS

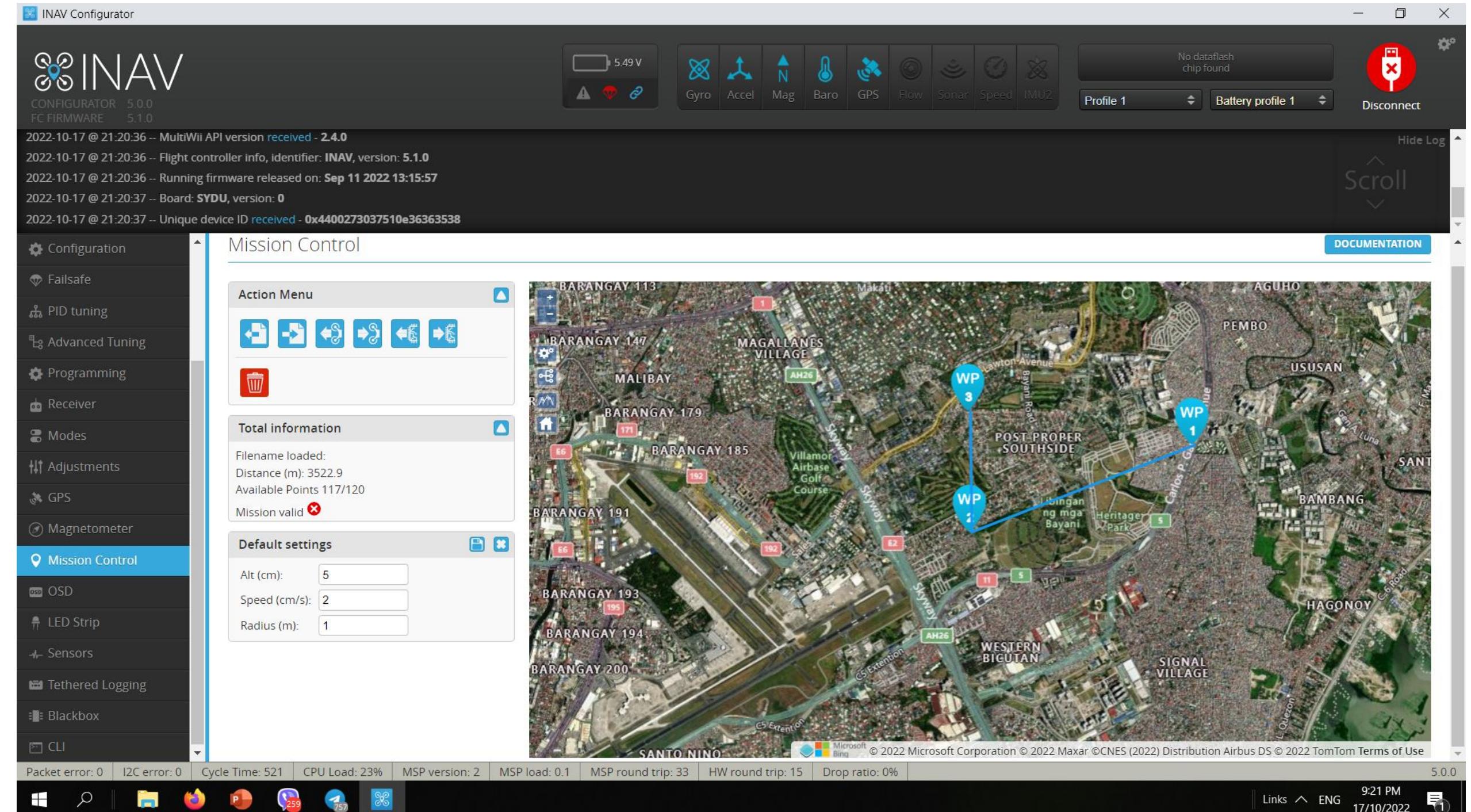
This is to visualize your Sensors input and aid for orientation



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 Configurer by himself.



SETTING UP YOUR DRONE

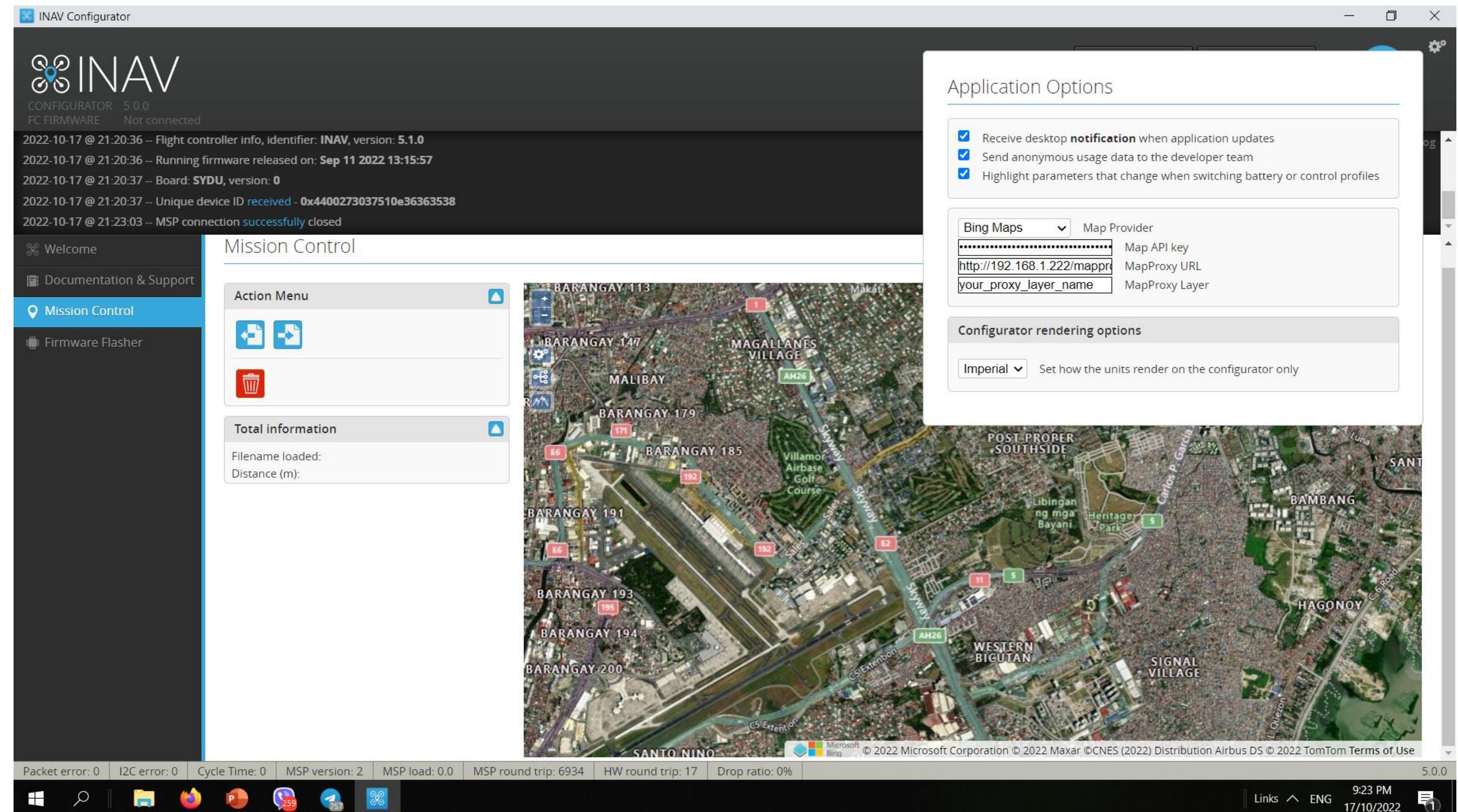
How to choose Map provider

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	Map Provider
OpenStreetMap	Map API key
Bing Maps	MapProxy URL
MapProxy	MapProxy Layer

Configurator rendering options

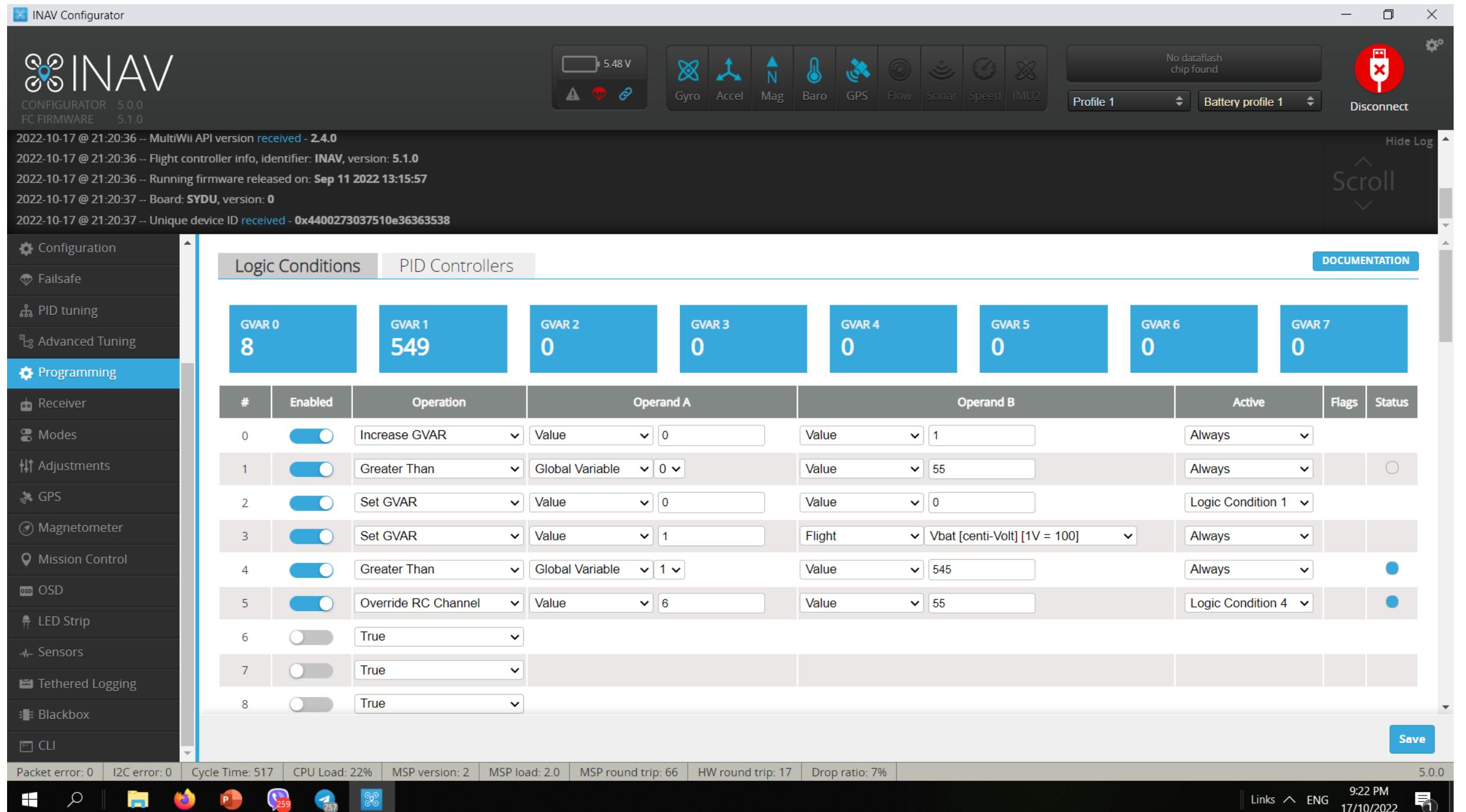
Imperial Set how the units render on the configurator only

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

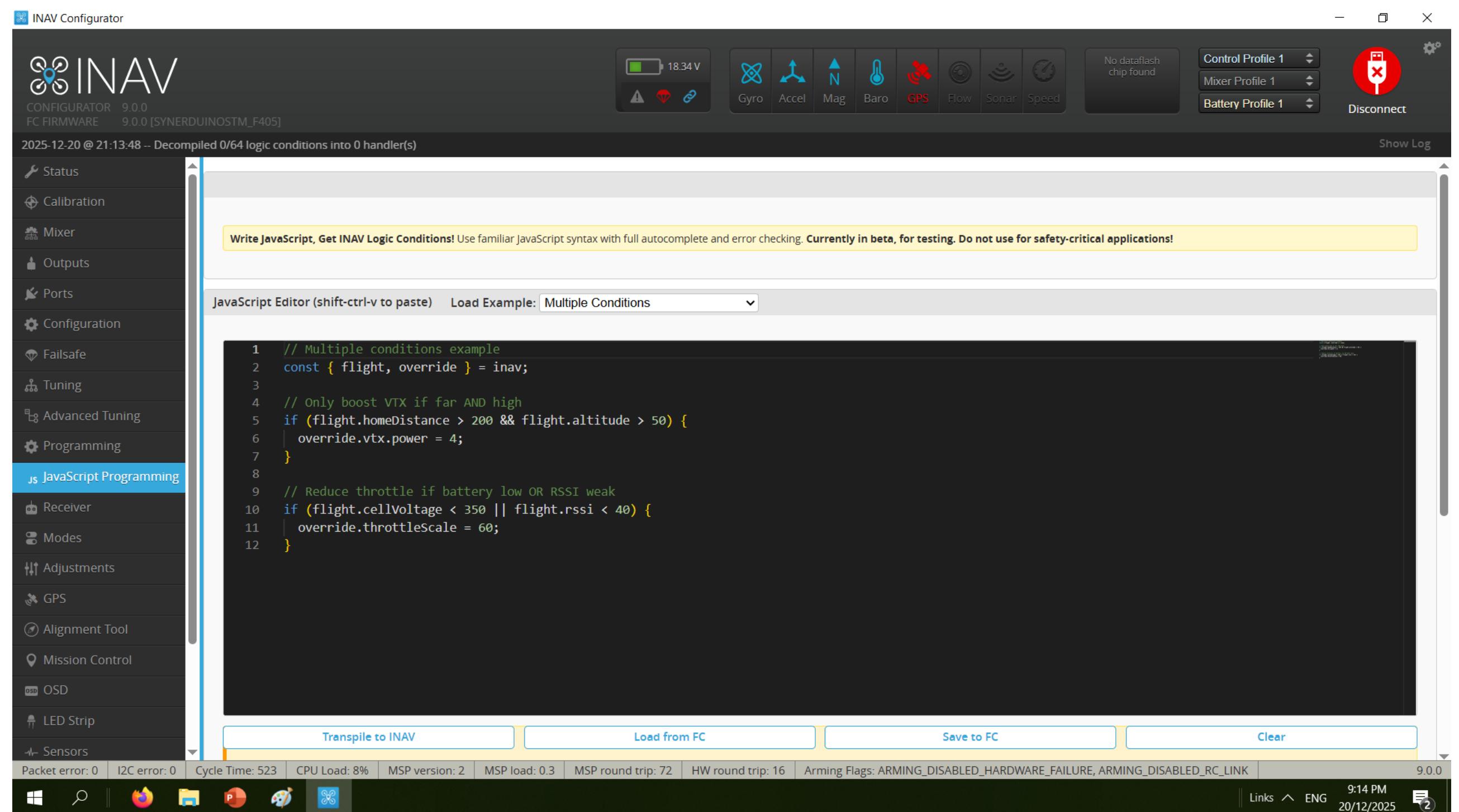


SETTING UP YOUR DRONE

Java Programming

INAV 9

Java script programming this allows one to import export scripts which also reflect the PLC tab of programming



SETTING UP YOUR DRONE

CLI Command Line – Aircraft Status

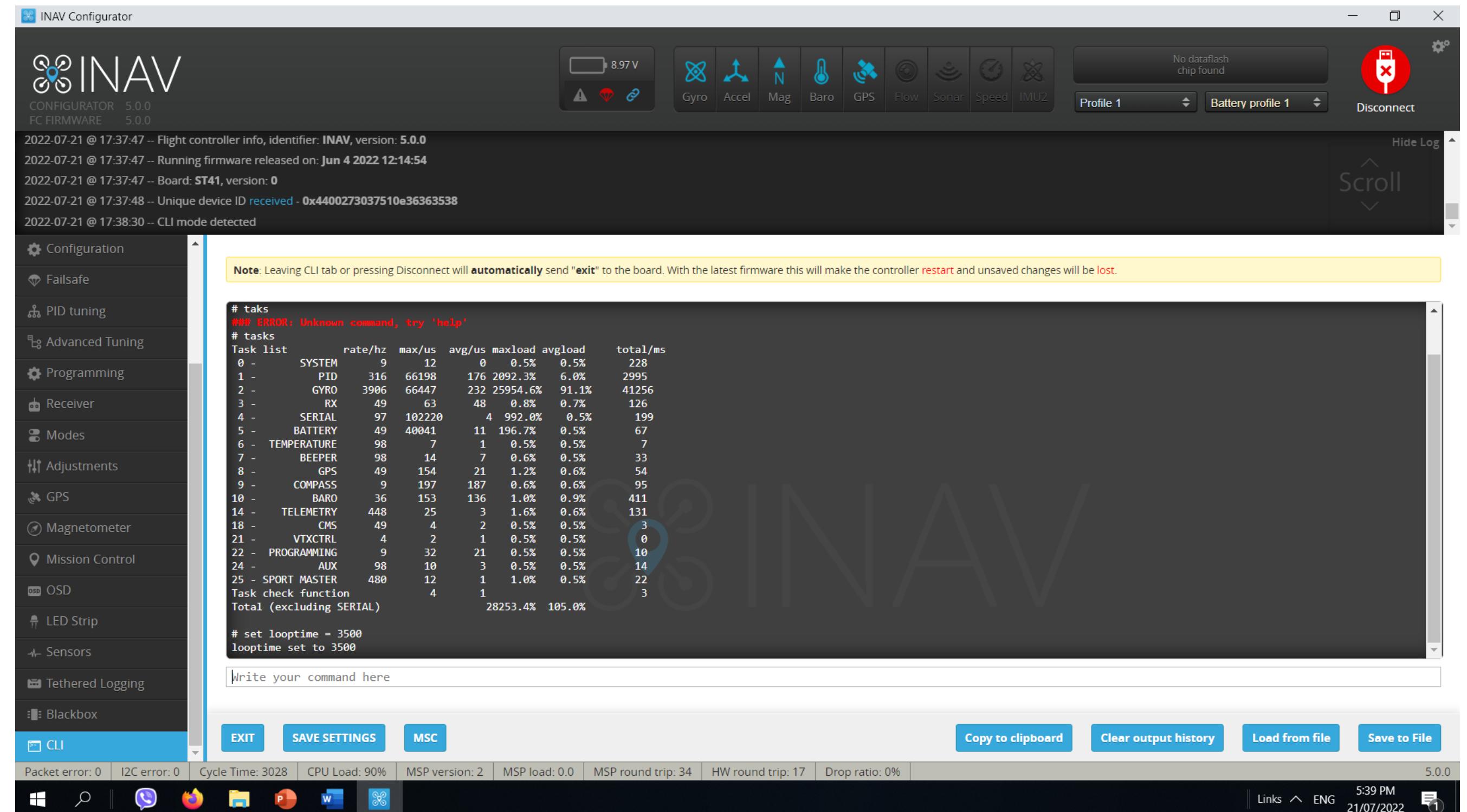
This is where you can import PID setting , check status or Adjust parameters

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



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 table below
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

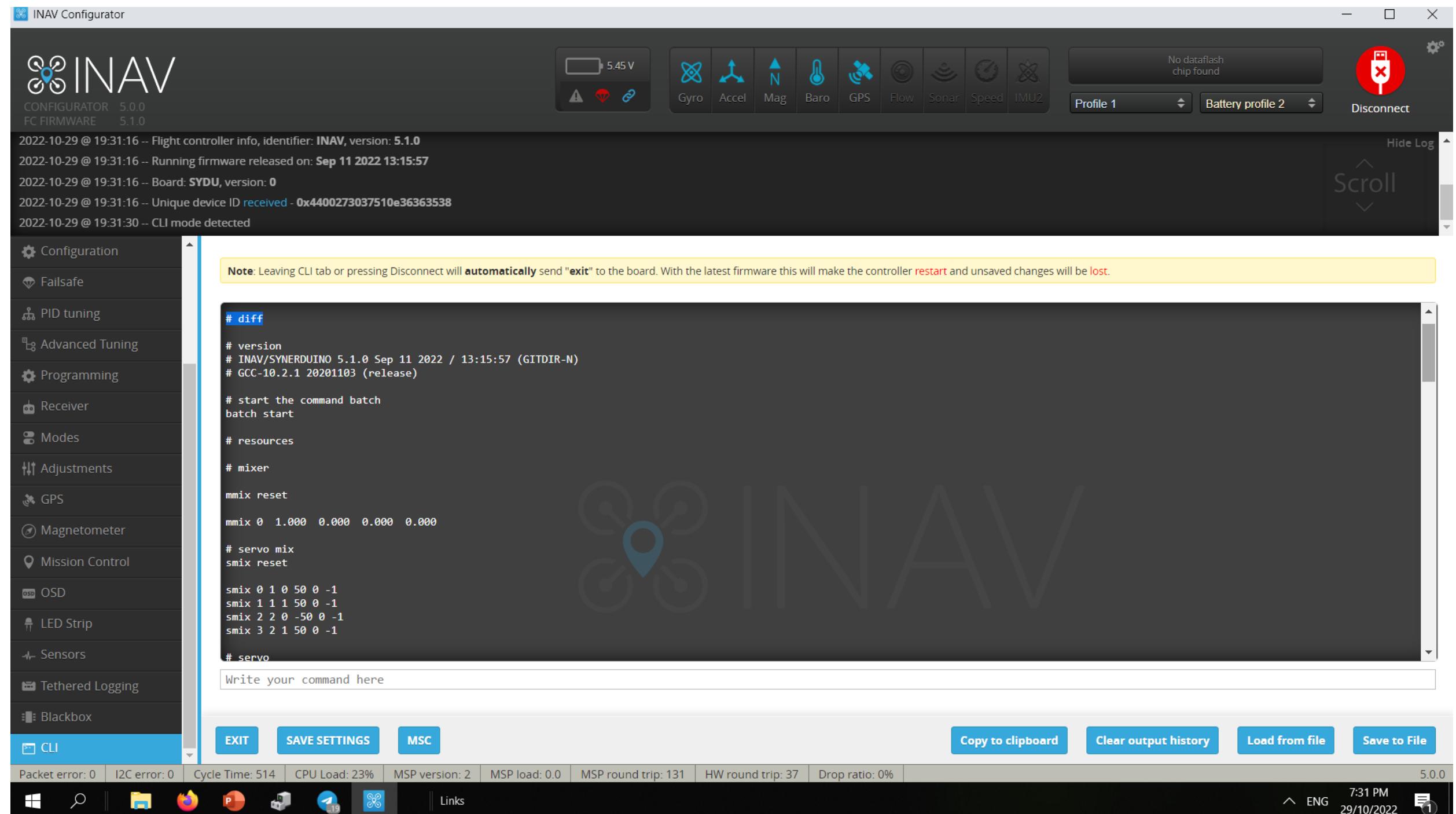
CLI Command Line Saving and Loading Parameters

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

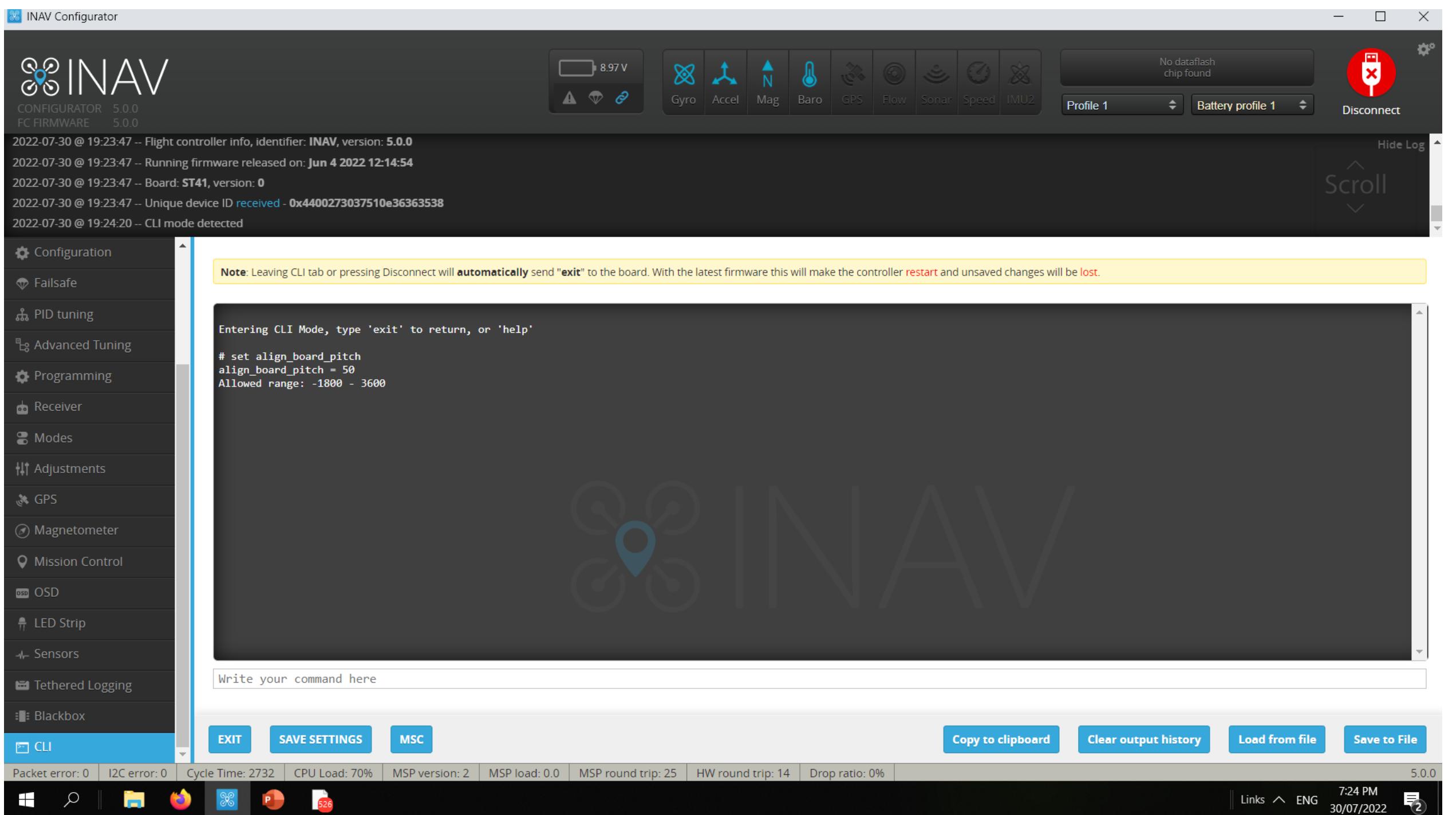
Pitch + # is Trim to the Back

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 drone

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

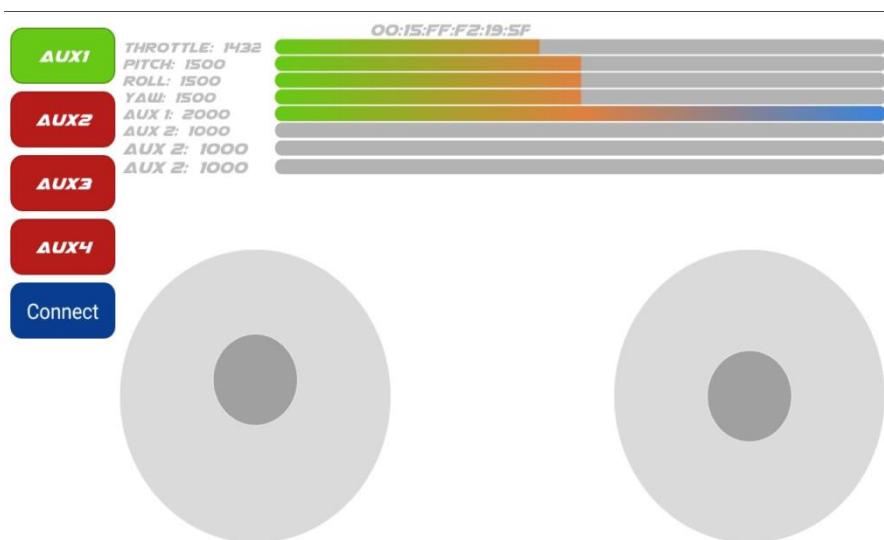
SETTING UP YOUR DRONE

set rx_min_usec = 790

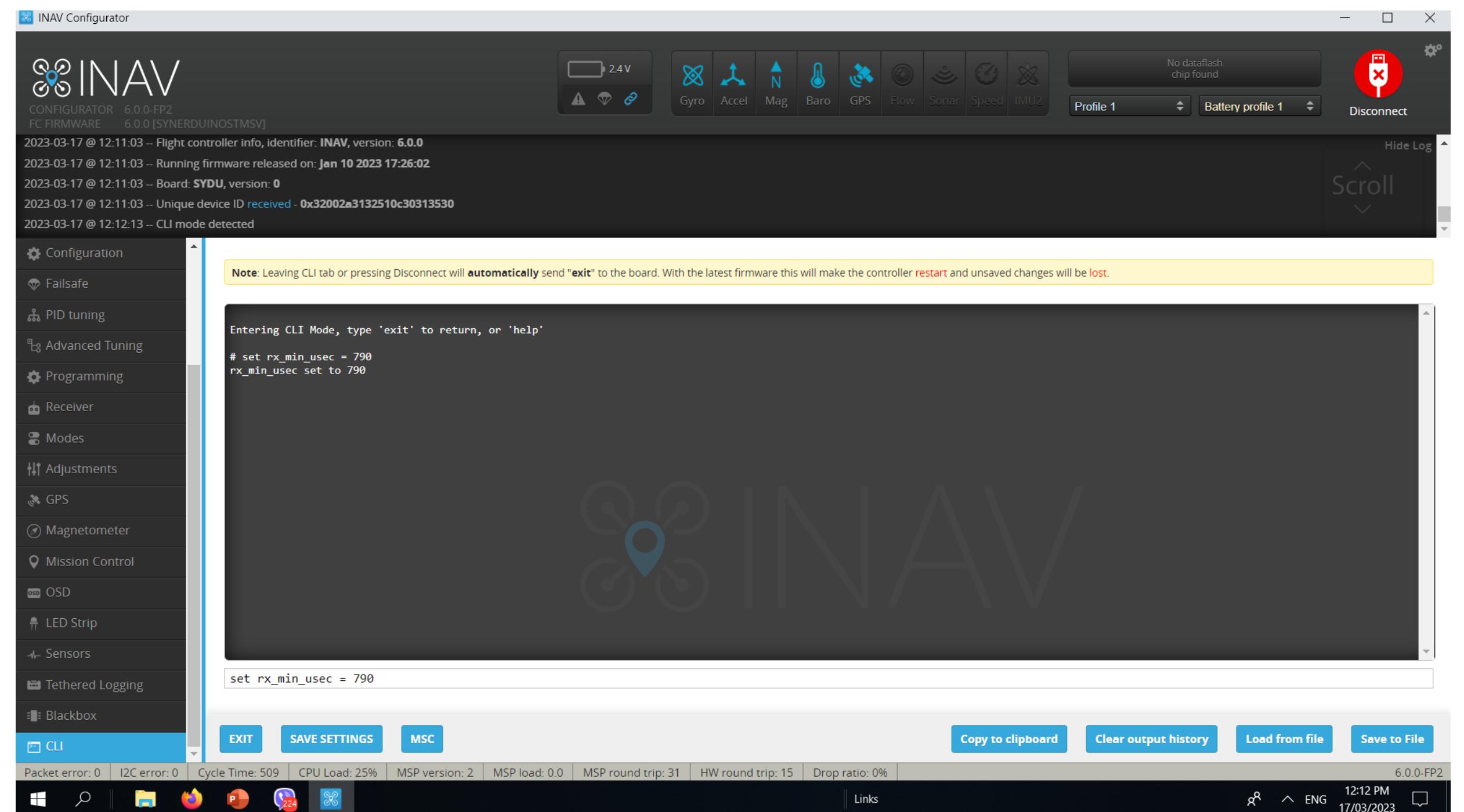
Because the Synerduino App sets RX min as 800 to accommodate Multiwii Serial RC switching

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

It's 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`

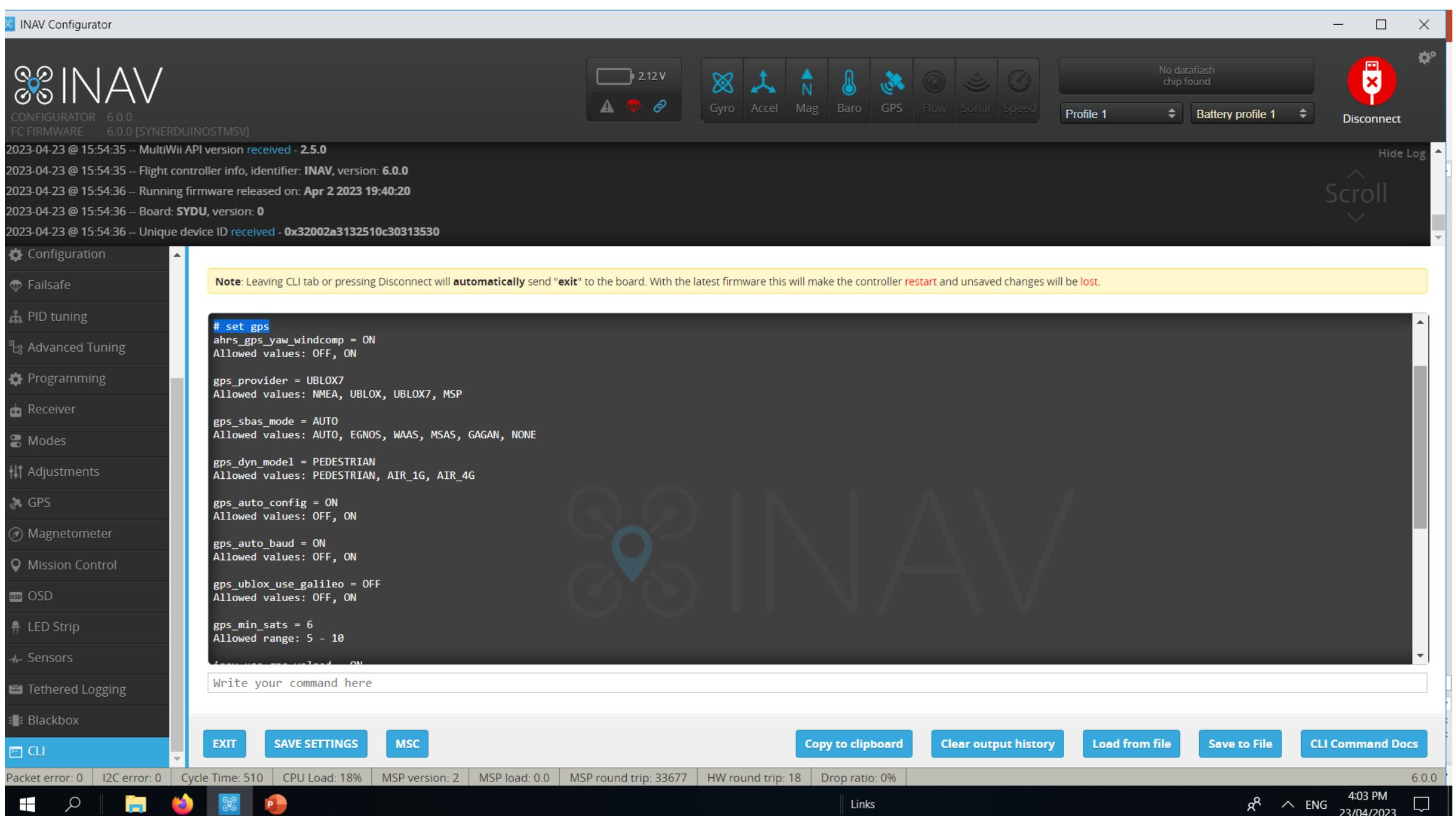
Minimum sats to arm gps flight mode

`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

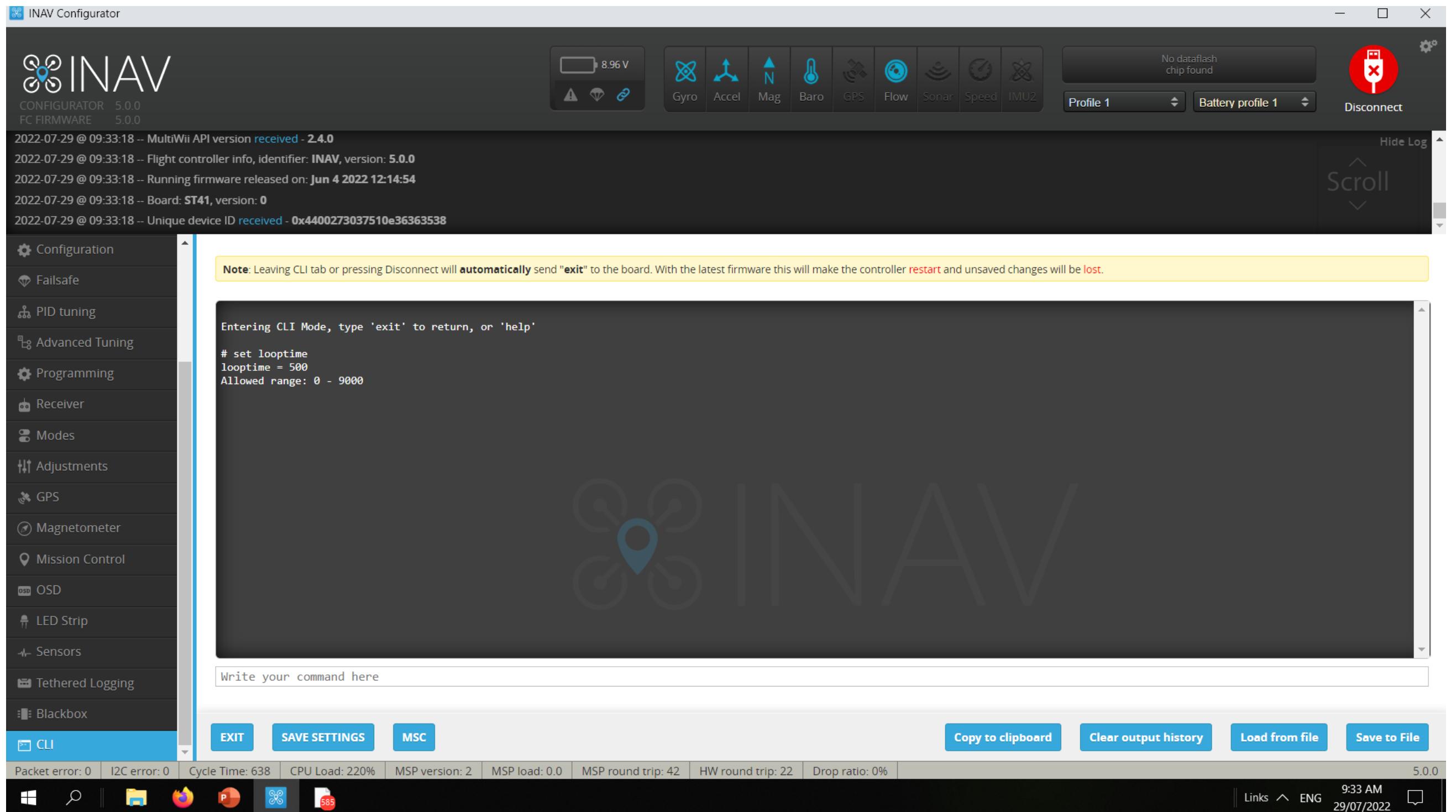


SETTING UP YOUR DRONE

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

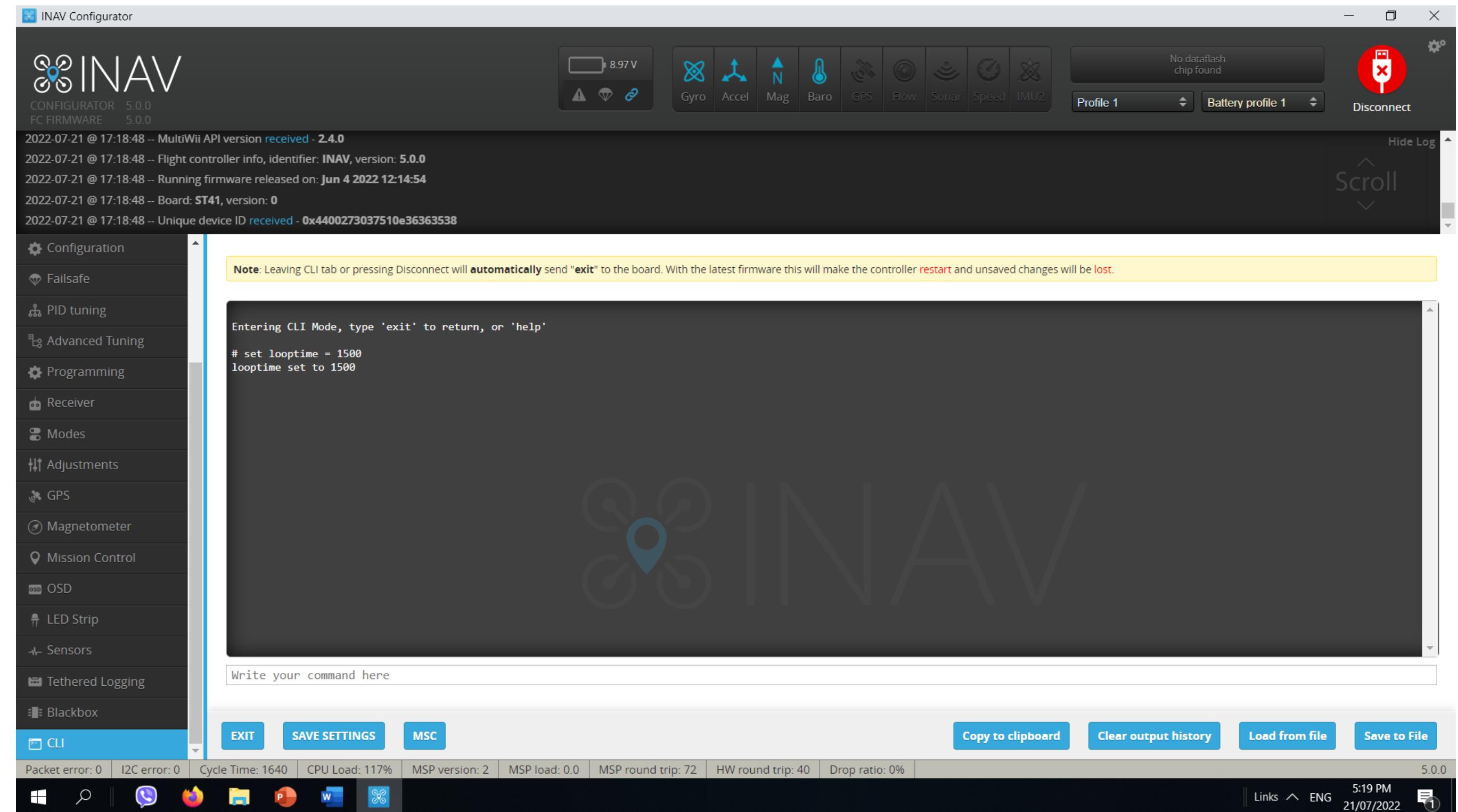


SETTING UP YOUR DRONE

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



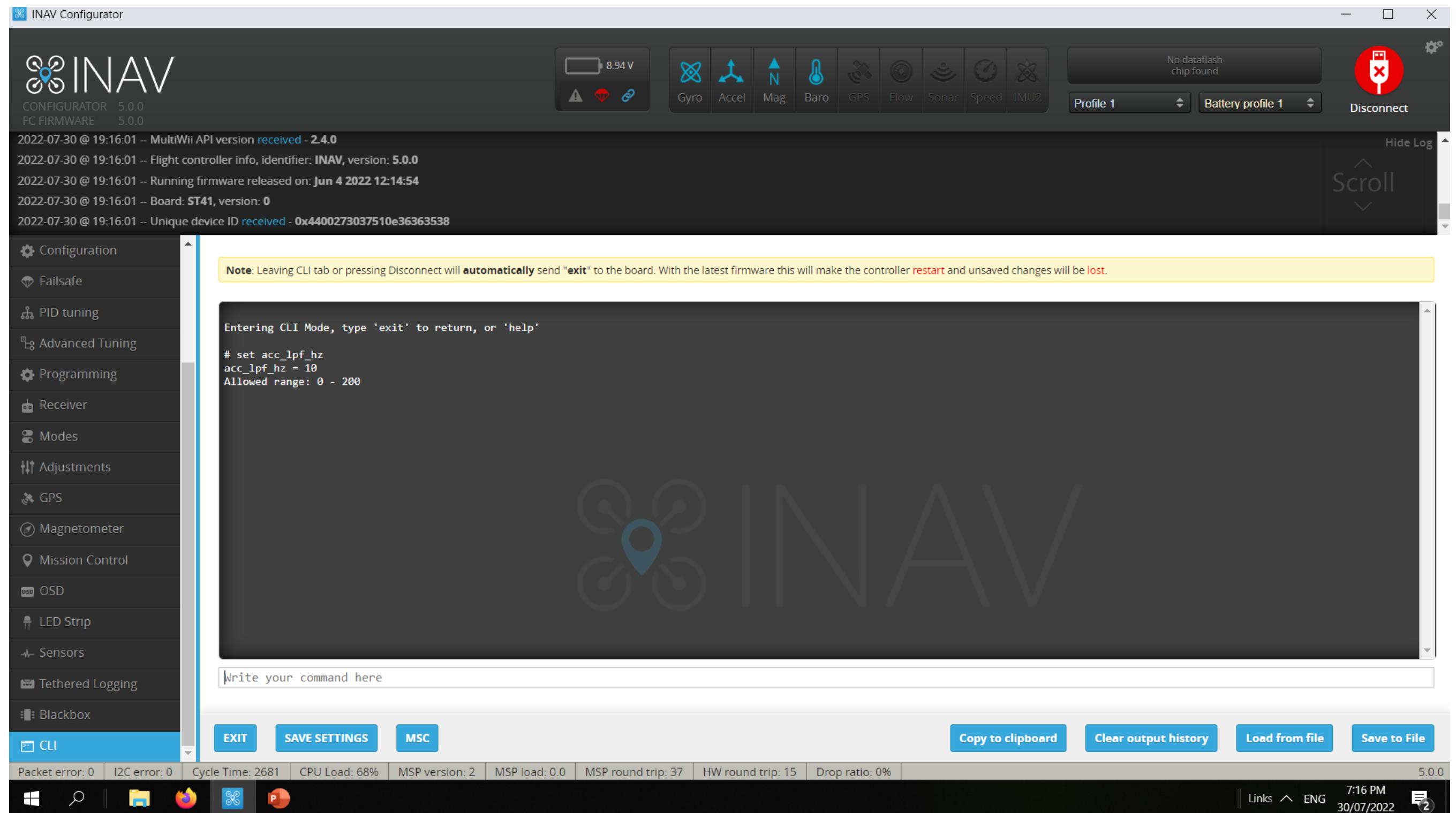
SETTING UP YOUR DRONE

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

Altitude hold

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

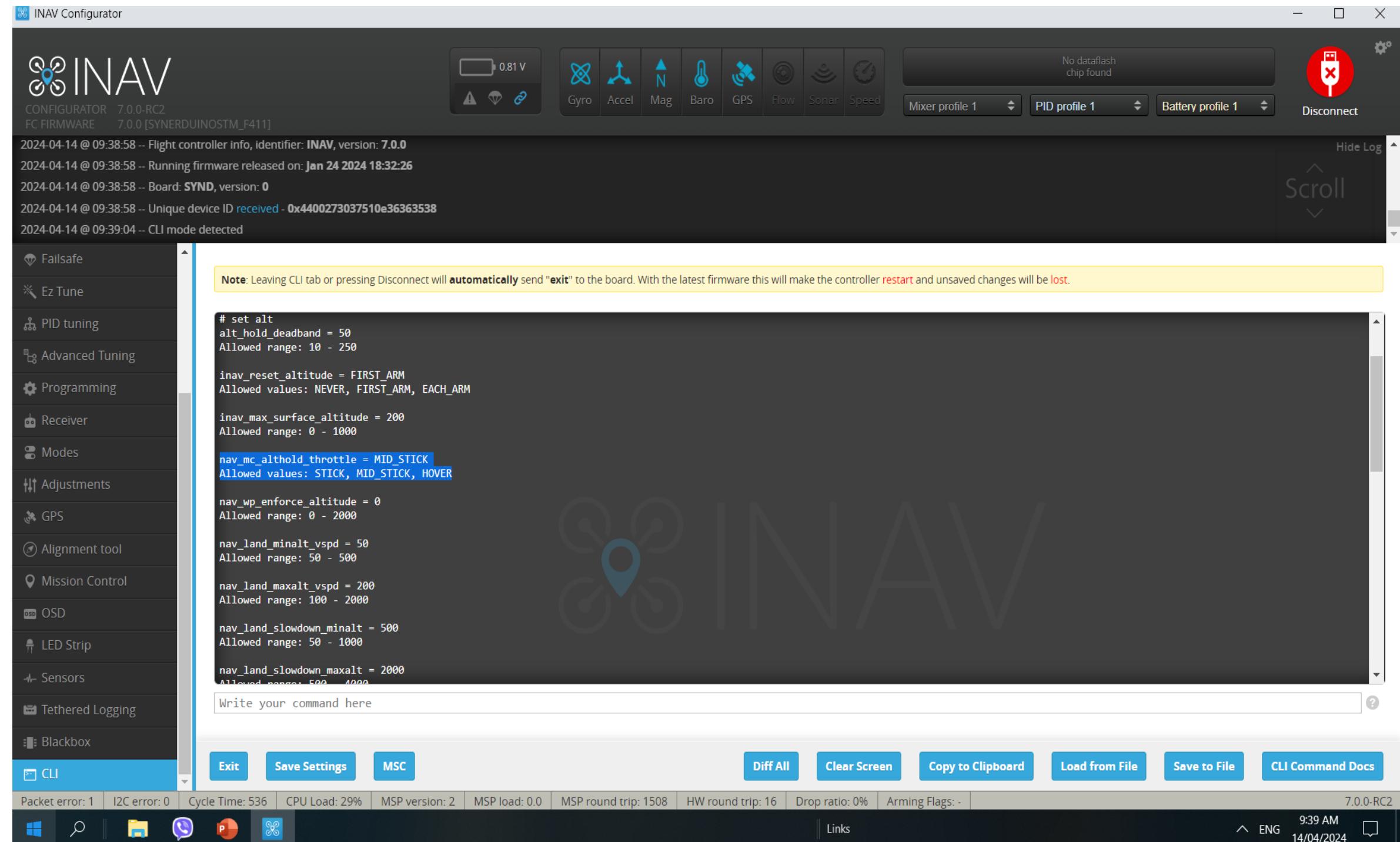
STICK = this would rely on the hover throttle as set in ADVANCE PID to determine the hover with dead band +/-

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 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



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

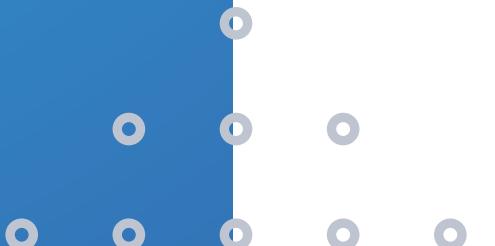
SETTING UP YOUR DRONE

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

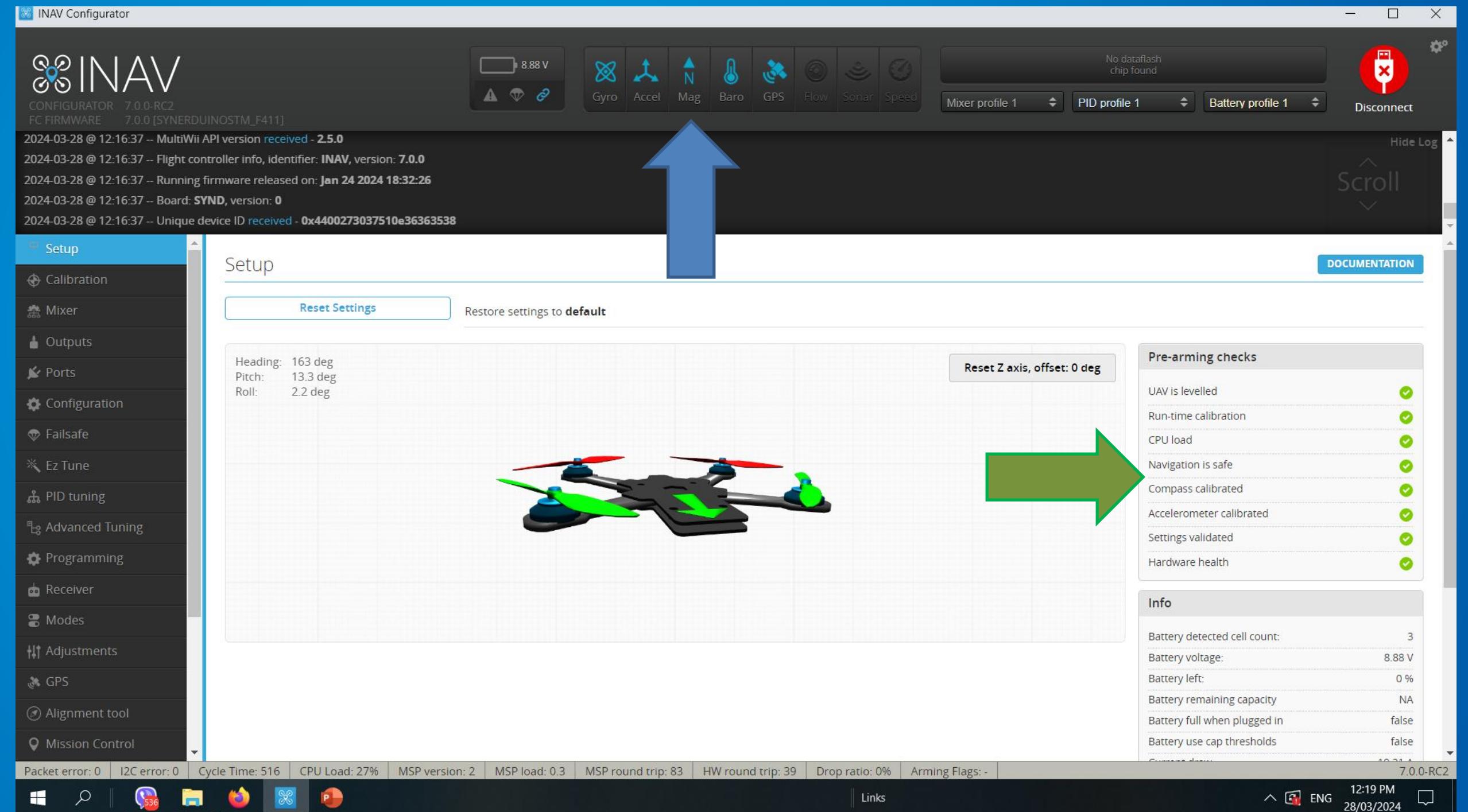
TESTING



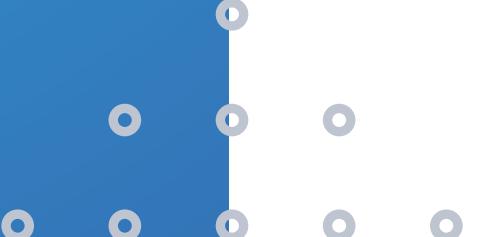
SYSTEM CHECKS

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



PRE-FLIGHT



PREFLIGHT

NOTE:

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

