

INAV Guide

Synerduino STM

VERSIONS: F405, F411, H743

For more Information:
www.synerflight.com

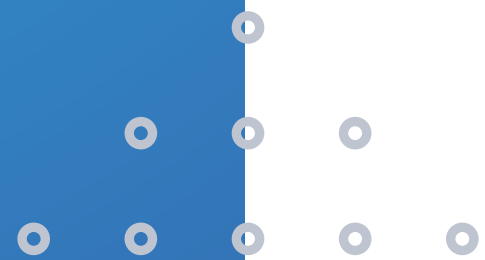


INTRODUCTION

Installation

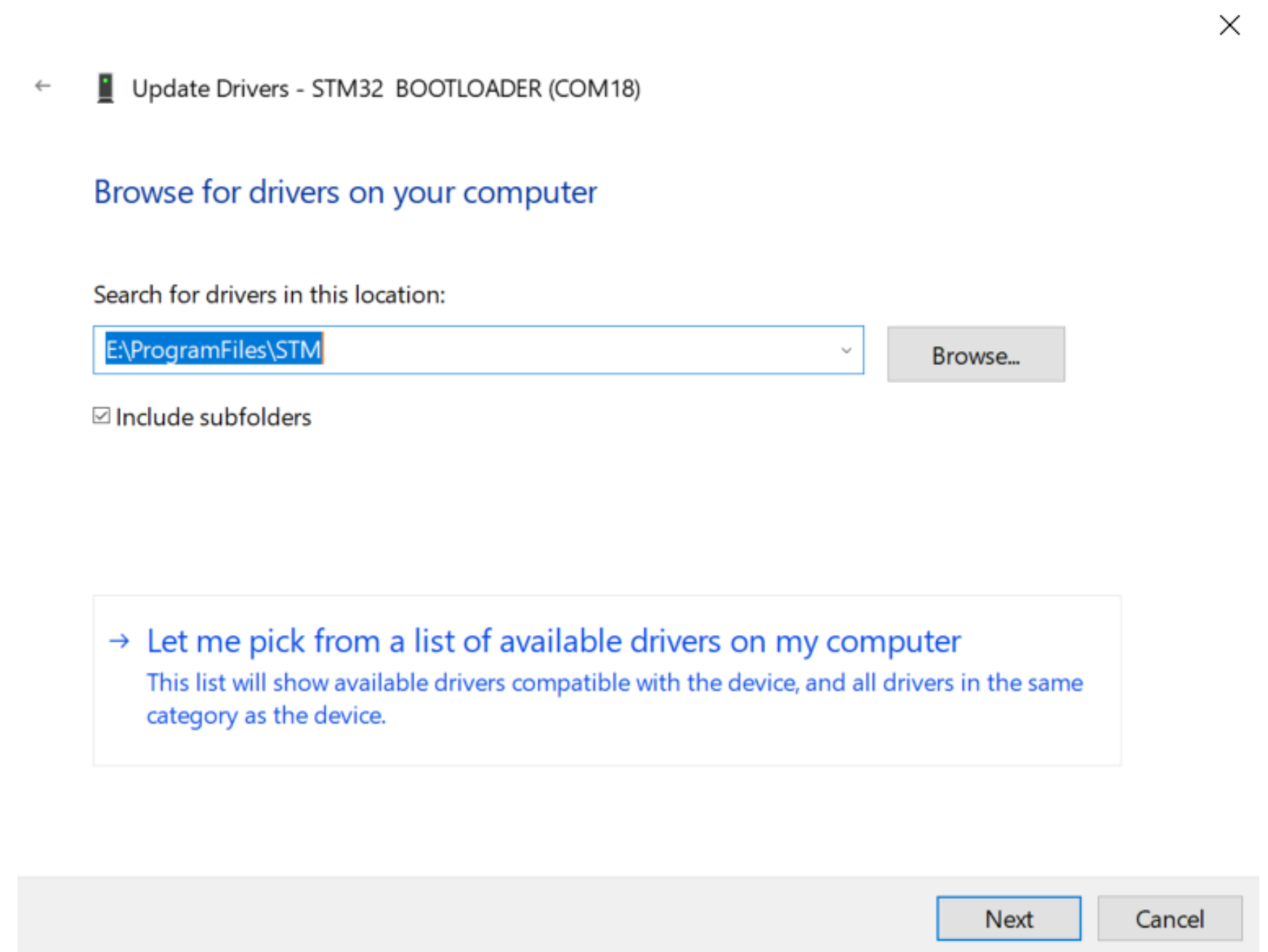
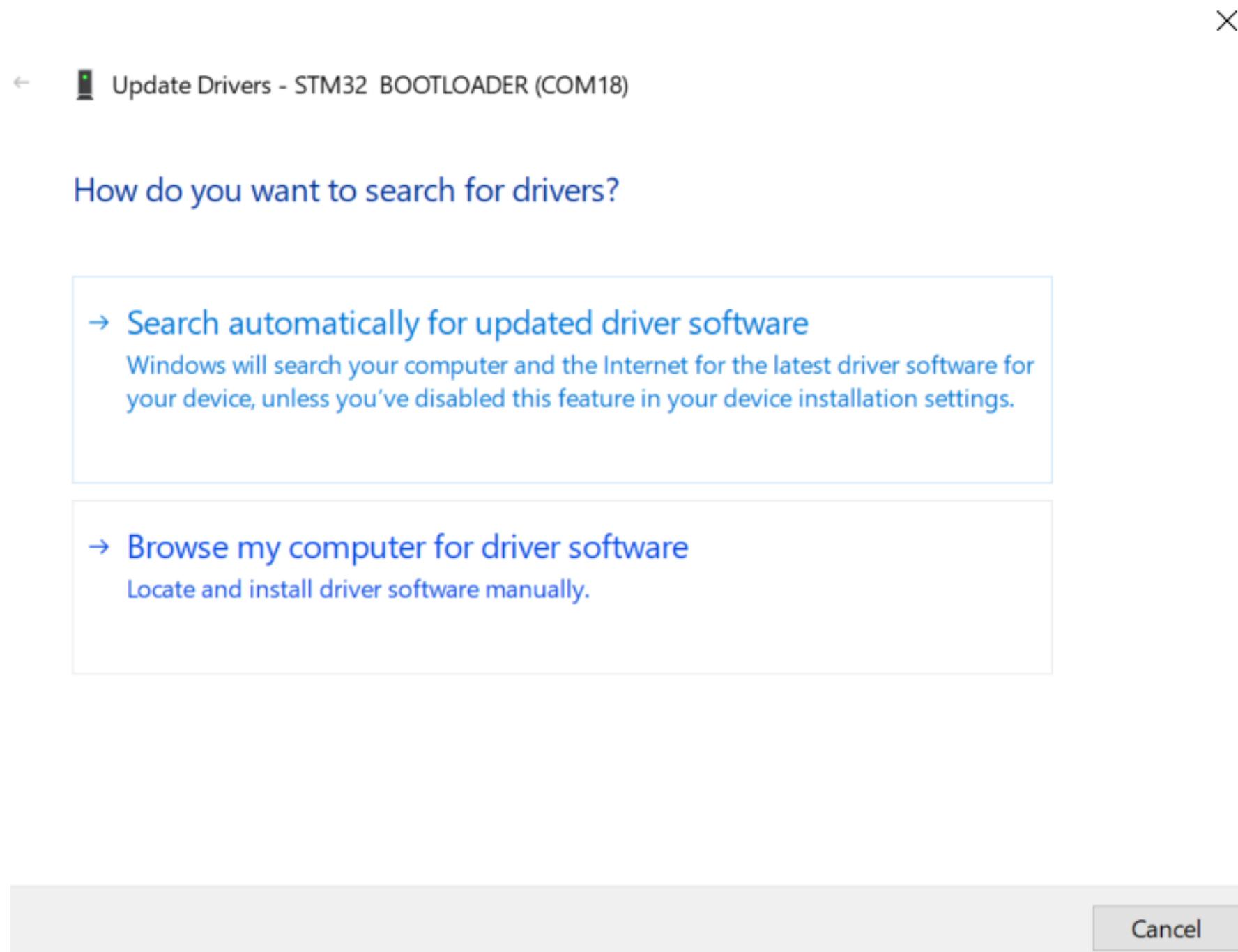
- Firmware
- Setup
- Configuration

This guide shows the software installation process



FIRMWARE INSTALLATION

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



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

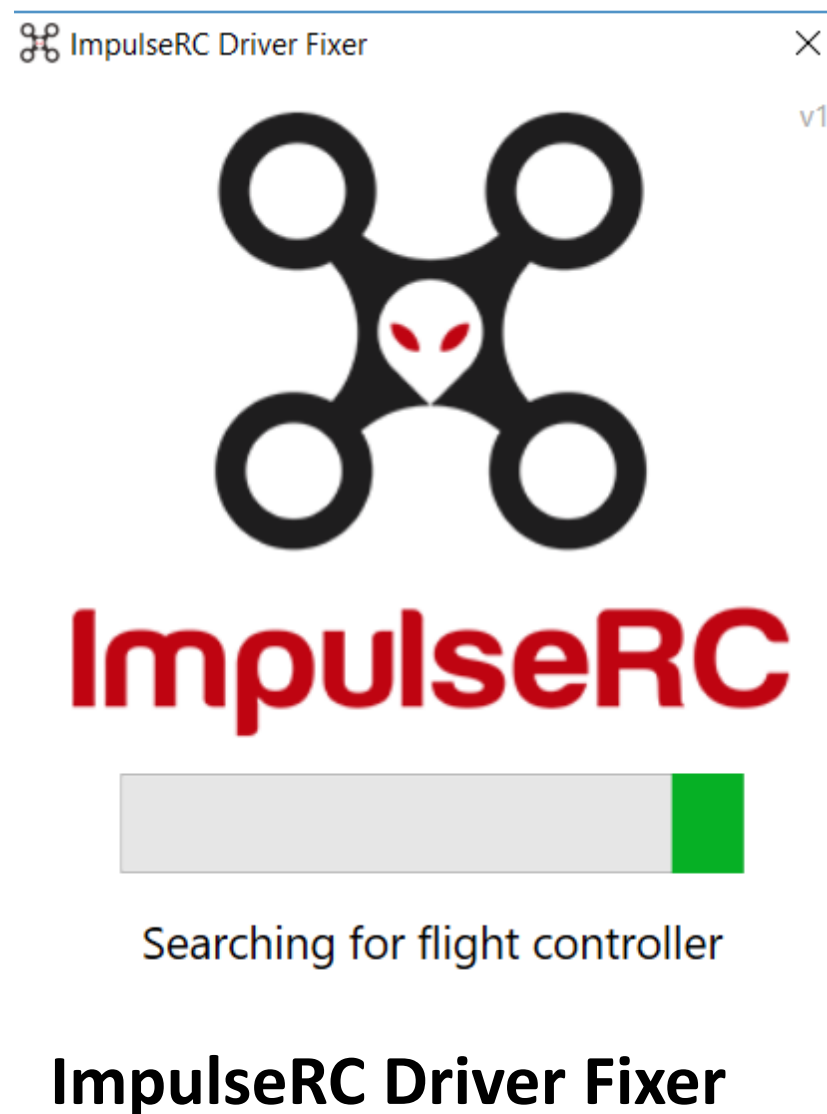
Windows has finished installing the drivers for this device:



STM32 Bootloader

Close

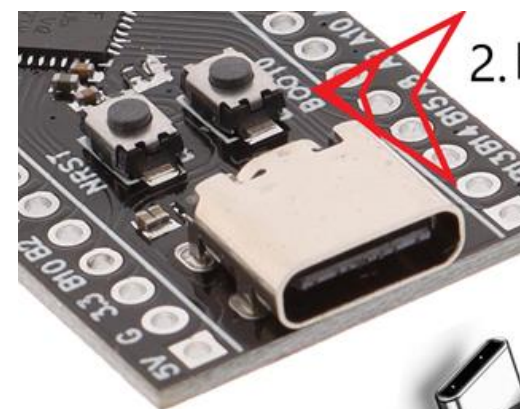
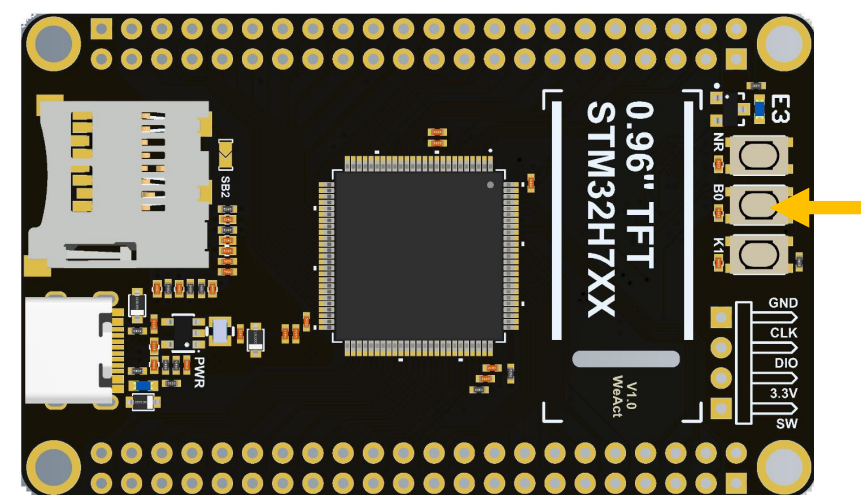
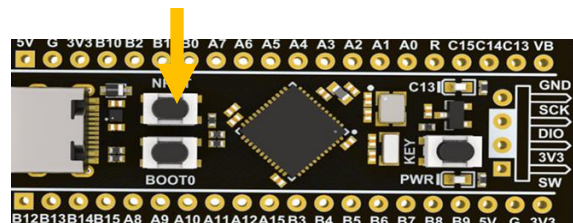
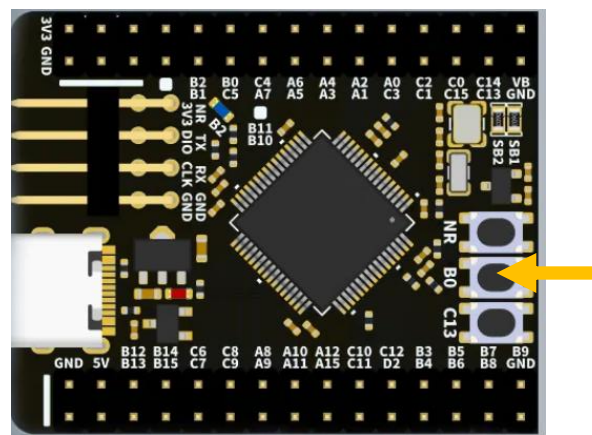
FIRMWARE INSTALLATION



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.

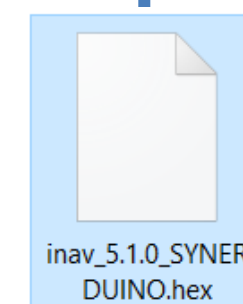
Typical **Boot Button** or **Jumper** is required to turn on the microcontroller into DFU mode

The screenshot shows the INAV Configurator 1.8.1 interface. The left sidebar has three tabs: 'Welcome', 'Documentation & Support', and 'Firmware Flasher', with the latter being selected and highlighted by a red box and arrow. The top right corner features a 'DFU' dropdown menu, 'Wireless mode' and 'Auto-Connect' toggle switches, and a 'Connect' button with a USB icon, all enclosed in a red box with a red arrow pointing to it. The main content area displays the INAV logo and a welcome message: 'Welcome to INAV - Configurator, a utility designed to simplify updating, configuring and tuning of your flight controller.' Below this are links for 'Slack Support Live Chat' and 'RC Groups Support'. The bottom status bar shows 'Packet error: 0 | I2C error: 0 | Cycle Time: 0' and the version '1.8.1'.

FIRMWARE INSTALLATION

Packet error: 0 | I2C error: 0 | Cycle Time: 0

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

The screenshot displays the INAV Configurator software interface. At the top, there's a status bar with a battery level of 8.88 V and a 'No dataflash chip found' warning. Below this, a log shows system messages like 'MultiWii API version received - 2.5.0' and 'Flight controller info, identifier: INAV, version: 7.0.0'. The main 'Setup' page features a 'Reset Settings' button and a central 3D drone model with green arrows indicating orientation. On the right, a 'Pre-arming checks' section lists several items, all marked with green checkmarks, indicating they are active or successful. Below this, an 'Info' section provides details like 'Battery detected cell count: 3' and 'Battery voltage: 8.88 V'. The bottom status bar shows various system metrics such as 'Packet error: 0', 'CPU Load: 27%', and 'MSP version: 2'. The Windows taskbar at the very bottom shows the time as 12:19 PM on 28/03/2024.

SETTING UP YOUR DRONE

CALIBRATION

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

The screenshot displays the INAV Configurator software interface. The top status bar shows a battery level of 8.93 V and various sensor icons (Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed). The main window is titled "INAV CONFIGURATOR 7.0.0-RC2" and "FC FIRMWARE 7.0.0 [SYNERDUINOSTM_F411]". A log window on the left shows system messages, including "MultiWii API version received - 2.5.0" and "Flight controller info, identifier: INAV, version: 7.0.0".

The central area is divided into six steps of calibration, each with a drone icon and a checkmark:

- Step 1: Drone icon with checkmark.
- Step 2: Drone icon with checkmark.
- Step 3: Drone icon with checkmark.
- Step 4: Drone icon with checkmark.
- Step 5: Drone icon with checkmark.
- Step 6: Drone icon with checkmark.

Below the steps is an "Accelerometer Values" table:

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

On the right side, there are two calibration panels:

- Compass Calibration:** Includes a "Calibrate Compass" button and input fields for Zero X (-24), Zero Y (33), Zero Z (-24), Gain X (1351), Gain Y (1317), and Gain Z (1249).
- Optic Flow Calibration:** Includes a "Calibrate Optic Flow sensor" button and a Scale input field (10.5).

At the bottom right, there is a "Save and Reboot" button. The bottom status bar shows system metrics: Packet error: 0, I2C error: 0, Cycle Time: 527, CPU Load: 28%, MSP version: 2, MSP load: 0.7, MSP round trip: 107, HW round trip: 38, Drop ratio: 0%, Arming Flags: -, and the version 7.0.0-RC2. The Windows taskbar at the very bottom shows the time as 12:20 PM on 28/03/2024.

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

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

8.97V

Gyro Accel Mag Baro GPS Flow Sonar Speed IMU2

No dataflash chip found

Profile 1 Battery profile 1

Disconnect

Hide Log

Scroll

DOCUMENTATION

Mixer

Platform configuration

Multirotor Platform type

Multirotor

Airplane

Tricopter

Rover

Boat

Other

reversed motor direction / Props In configuration

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	Delete

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 interface for configuring a drone's mixer. The top status bar shows a battery level of 8.96V and various sensor icons (Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed). The main content area is titled 'Mixer' and includes a 'Platform configuration' section with a 'Multicopter' dropdown and a 'Mixer preset' section with a 'Quad X' dropdown. A diagram of a quadcopter shows motor positions 1, 2, 3, and 4. The 'Timer outputs' section shows five timers, each with an 'AUTO' dropdown. The 'Output Mapping' table at the bottom shows how timer outputs are assigned 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	-	-	-	-

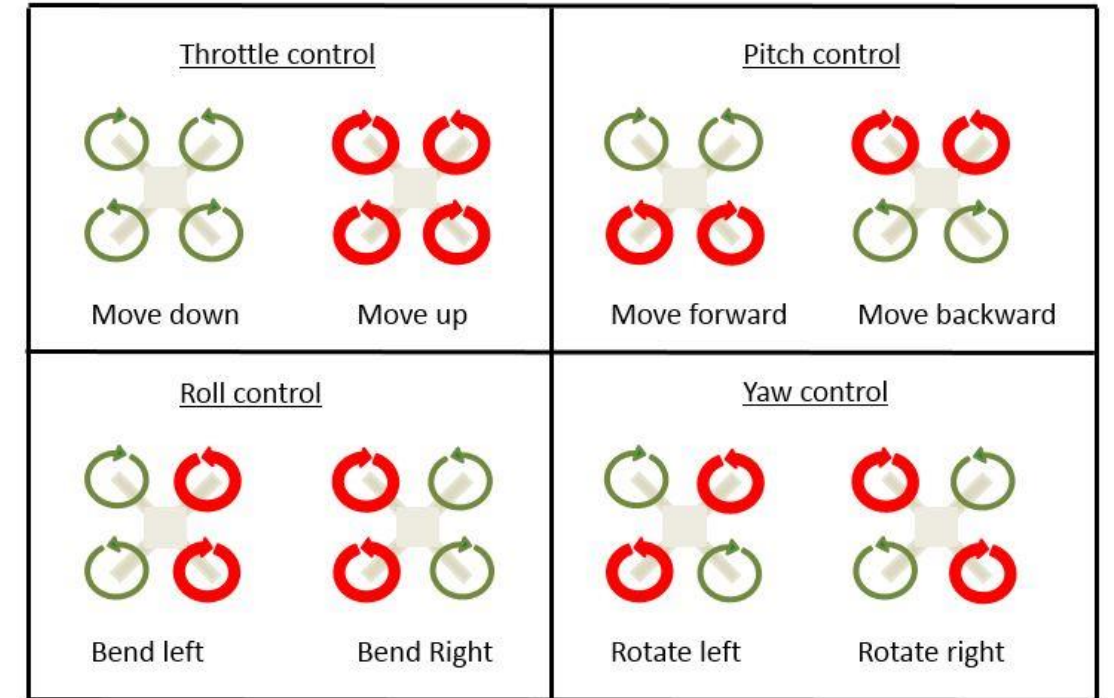
This allows you to assign motor and servo function to your custom drone frame or payload requirement this eliminates the need to recompile a new firmware for custom frame types

SETTING UP YOUR DRONE

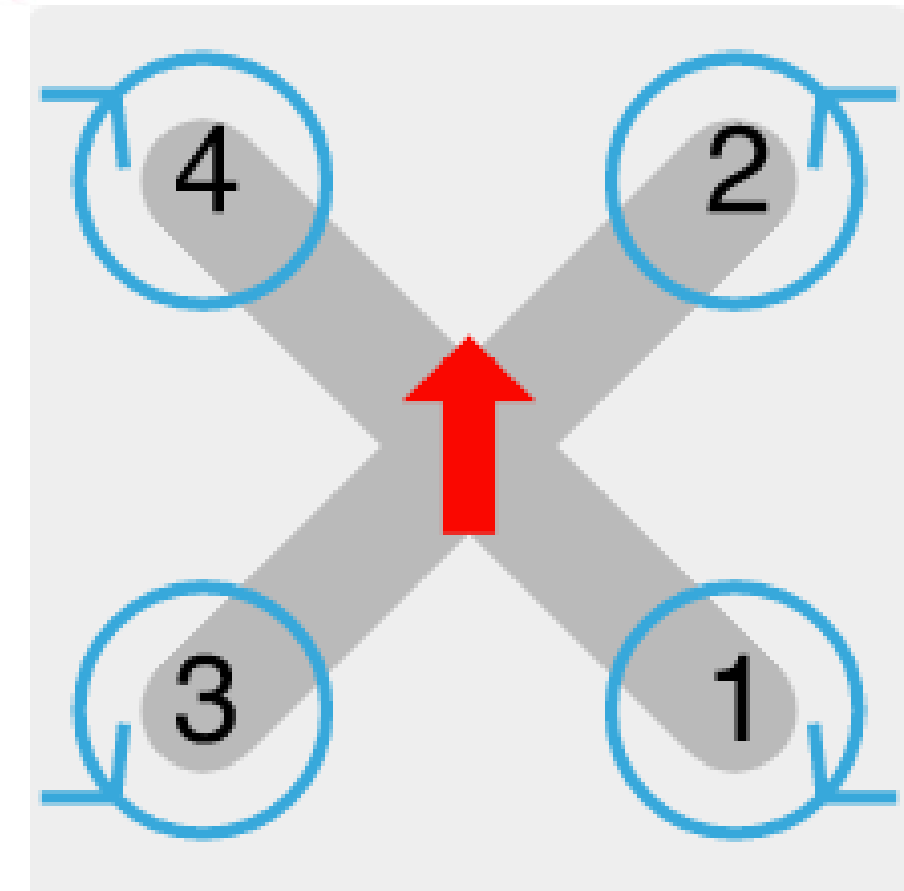
MOTOR MIX FOR QUAD X (INAV 5-6)

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	<input type="text" value="1"/>	<input type="text" value="-1"/>	<input type="text" value="1"/>	<input type="text" value="-1"/>	Delete
2	<input type="text" value="1"/>	<input type="text" value="-1"/>	<input type="text" value="-1"/>	<input type="text" value="1"/>	Delete
3	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	Delete
4	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="-1"/>	<input type="text" value="-1"/>	Delete

[Add new mixer rule](#)

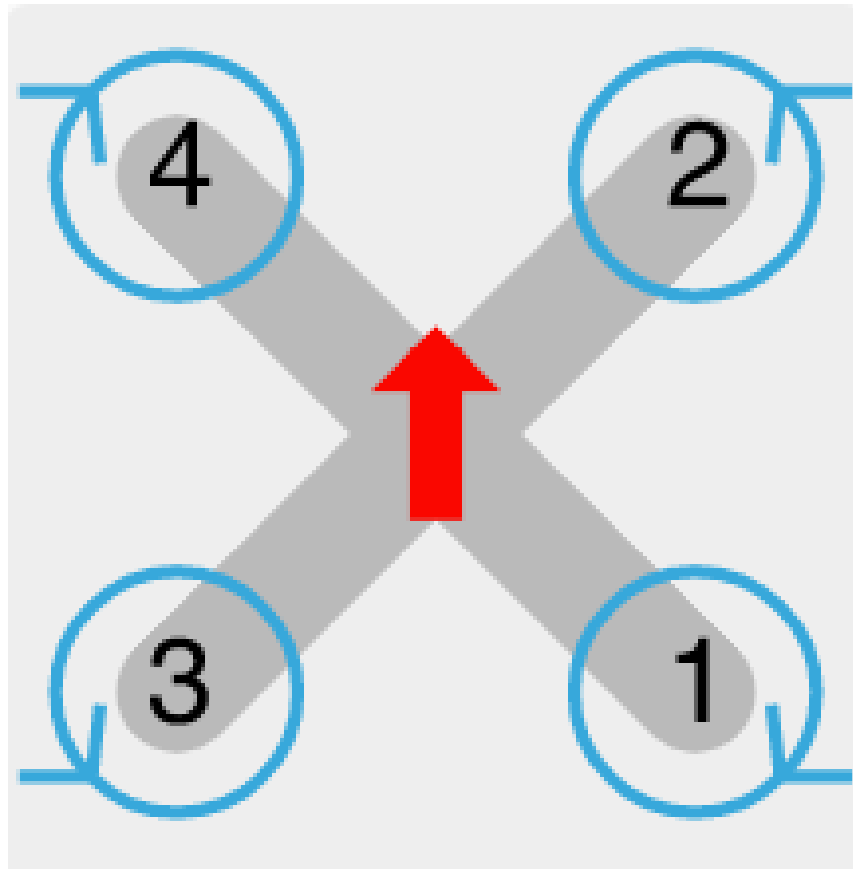
Servo	Input	Weight (%)	Speed (10µs/s)	Active	
<input type="text" value="1"/>	RC Channel 6	<input type="text" value="100"/>	<input type="text" value="0"/>	Always	Delete

[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



The screenshot shows the INAV Configurator software interface. The top bar displays the INAV logo, version 7.0.0-RC2, and various system status indicators like battery voltage (8.93 V) and sensor status (Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed). The main content area is divided into several sections: Output Mapping, Motor Mixer, and Servo mixer. The Motor Mixer section is currently active and shows a table with columns for Motor, Throttle [T], Roll [A], Pitch [E], and Yaw [R]. The table contains four rows of motor configurations. 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, Arming Flags, and the current version (7.0.0-RC2).

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	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

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

The screenshot shows the INAV Configurator interface. The 'Outputs' tab is selected in the left sidebar. The main panel shows the following settings:

- Enable motor and servo output:** (indicated by a blue arrow from the text 'Enable Motor and Servo Output must be on')
- ESC protocol:** STANDARD
- Servo refresh rate:** 50Hz
- Stop motors on low throttle:**
- Motors IDLE power [%]:** 15.00
- Number of motor poles (number of magnets):** 14
- Reversible motors mode (for use with reversible ESCs):**

Below these settings is a 'Motors' section with four motor status indicators (1, 2, 3, 4) all showing 0%. To the right is a drone diagram with motor positions 1, 2, 3, and 4. Further right, a status box shows:

- Acc. noise RMS: 0.0030
- Current [A]: 0.00
- Voltage [V]: 8.94

At the bottom of the interface, there are 'Save and Reboot' and 'Save' buttons. The status bar at the very bottom shows system metrics like Cycle Time, CPU Load, and MSP version.

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 shows the INAV Configurator software interface. At the top, there's a status bar with battery level (8.99 V) and various sensor icons (Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed, IMU2). Below that, a log window shows system messages like 'MultiWii API version received - 2.4.0' and 'Flight controller info, identifier: INAV, version: 6.0.0'. The main configuration area is divided into sections: 'Motors' and 'Servos'. In the 'Motors' section, four motor channels (1, 2, 3, 4) are shown with sliders set to 100%. A 'Master' slider is also present. A 'Motor Test Mode Notice' box is visible, stating 'Moving the sliders will cause the motors to spin up. In order to prevent injury remove ALL propellers before using this feature.' Below the motors, there's a 'Servos' section with sliders for 16 channels. At the bottom, there are 'Save and Reboot' and 'Save' buttons. The system tray at the very bottom shows various system metrics like 'Packet error: 0', 'I2C error: 0', 'Cycle Time: 503', 'CPU Load: 16%', 'MSP version: 2', 'MSP load: 0.8', 'MSP round trip: 32', 'HW round trip: 17', 'Drop ratio: 0%', and the date/time '12:51 PM 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

NO PROPS

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

Connect battery to power module.

1 2 3 4
0% 0% 0% 0%
0% 0% 0% 0% Master

Disconnect battery.

SETTING UP YOUR DRONE

PORTS F411

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

CONFIGURATOR 5.0.0
FC FIRMWARE 5.1.0

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

5.48 V

Gyro Accel Mag Baro GPS Flow Sonar Speed IMU2

No dataflash chip found

Profile 1 Battery profile 1 Disconnect

Hide Log

Scroll

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

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

USB
Telemetry
Sbus RC
GPS / Flow Sensor

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)

BN 880 GPS / Baud 57600

CXFO Optical Flow / Baud 19200

Bluetooth / Baud 115200

SIK Radio / Baud 75600

SETTING UP YOUR DRONE

PORTS F405 & H743

- TELEMETRY
- Sbus RC
- GPS
- Sensors

Identifier	Data	Telemetry	RX	Sensors	Peripherals
UART1	<input checked="" type="checkbox"/> MSP 115200	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
UART4	<input type="checkbox"/> MSP 115200	Disabled AUTO	<input type="checkbox"/> Serial RX	GPS 57600	Disabled 115200
UART6	<input checked="" type="checkbox"/> MSP 115200	Disabled 115200	<input type="checkbox"/> Serial RX	Disabled 115200	Disabled 115200

UART1 use for MSP Telemetry
Bluetooth (115200)
SIK Serial Radio (57600)

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

UART4 can be use for GPS
57600

The rest of the UART can be
any serial sensors

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 115200	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
UART3	<input type="checkbox"/> MSP 115200	Disabled AUTO	<input type="checkbox"/> Serial RX	Disabled 115200	Disabled 115200
UART4	<input type="checkbox"/> MSP 115200	Disabled AUTO	<input type="checkbox"/> Serial RX	GPS 57600	Disabled 115200
UART6	<input type="checkbox"/> MSP 115200	Disabled AUTO	<input type="checkbox"/> Serial RX	Disabled 115200	Disabled 115200
UART7	<input type="checkbox"/> MSP 115200	Disabled AUTO	<input type="checkbox"/> Serial RX	Disabled 115200	Disabled 115200
UART8	<input type="checkbox"/> MSP 115200	Disabled AUTO	<input type="checkbox"/> Serial RX	Disabled 115200	Disabled 115200

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

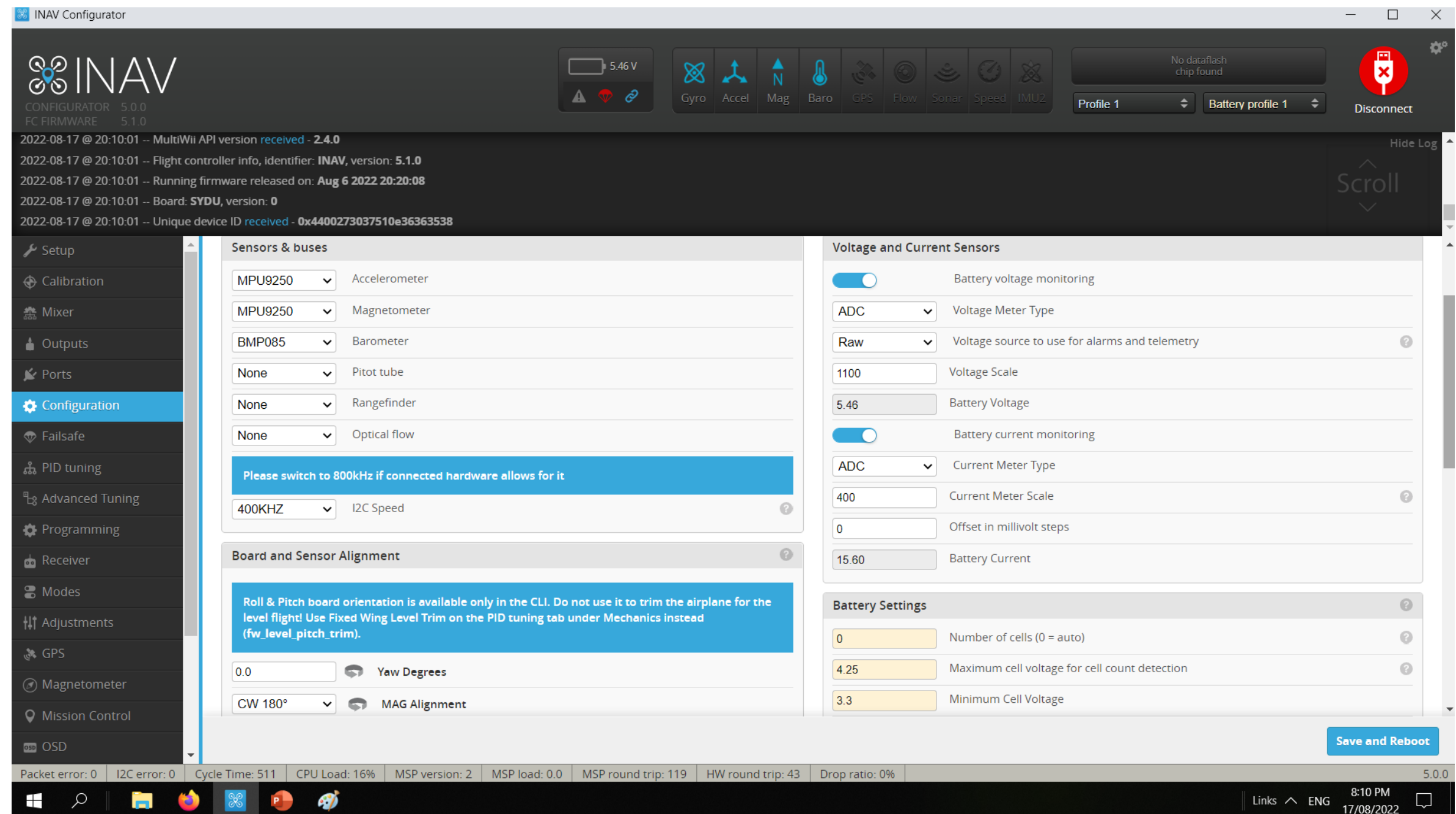
GPS for navigation and telemetry

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

The screenshot displays the INAV Configurator software interface. The top bar shows the INAV logo, version 6.0.0-FP2, and FC FIRMWARE 6.0.0 [SYNERDUINOSTMSV]. The main content area is titled 'Other Features' and contains a list of configuration options with toggle switches:

- Stop motors on low throttle (disabled)
- Enable CPU based serial ports (enabled)
- GPS for navigation and telemetry (enabled)
- Telemetry output (enabled)
- Reversible motors mode (for use with reversible ESCs) (disabled)
- Analog RSSI input (disabled)
- Multi-color RGB LED strip support (enabled)
- OLED Screen Display (disabled)
- Blackbox flight data recorder (disabled)
- Enable motor and servo output (enabled)
- CPU based SPI (disabled)
- OSD (disabled)
- Permanently enable AIRMODE (disabled)
- Permanently enable Launch Mode for Fixed Wing (disabled)

On the right side, there are input fields for 'Warning Cell Voltage' (3.5), 'Battery Capacity Unit' (mAh), 'Capacity' (0), 'Warning Capacity (remaining %)', and 'Critical Capacity (remaining %)'. A 'Save and Reboot' button is located at the bottom right. The bottom status bar shows various system metrics: Packet error: 0, I2C error: 0, Cycle Time: 513, CPU Load: 17%, MSP version: 2, MSP load: 0.1, MSP round trip: 37, HW round trip: 19, Drop ratio: 0%, and the version 6.0.0-FP2. The Windows taskbar at the bottom shows the time as 12:16 PM on 15/12/2022.

SETTING UP YOUR DRONE

CONFIGURATION

Voltage and Current sensors

Battery Voltage monitoring (Vbat)

$RAW = ADC \cdot V - Voltage\ 0-5V$

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)

$RAW = ADC \cdot I - Current\ 0-5V$

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	
<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

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 software is running on a Windows operating system, as indicated by the taskbar at the bottom. The interface includes a top status bar with battery level (8.97 V) and various sensor status icons. The main content area is divided into sections for different filter types:

- Gyro filters:**
 - Main gyro filter cutoff frequency: 110
 - Matrix Filter Min Frequency: 120
 - Matrix Filter Q Factor: 250
 - Unicorn Filter Q Factor: 200
- D-term filters:**
 - D-term LPF cutoff frequency: 100
- Gyro RPM filters:**
 - Gyro RPM filter (requires ESC telemetry): Disabled (toggle)
 - Gyro RPM filter min. frequency: 100

At the bottom of the interface, there is a 'Refresh' and 'Save' button, and a status bar showing system metrics like Cycle Time (2674), CPU Load (68%), and MSP version (2). The Windows taskbar at the very bottom shows the time as 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

Setting	Value	Unit
ROLL rate	600	° per second
PITCH rate	600	° per second
YAW rate	600	° per second
Roll & Pitch Expo	75	%
Yaw Expo	75	%
Max. ROLL angle	30	°
Max. PITCH angle	30	°
Heading Hold rate limit	90	° per second
Manual ROLL rate	100	%
Manual PITCH rate	100	%
Manual YAW rate	100	%

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

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

When Enabled it automatically overrides 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 widely varied inertias and weight.

Recommend to use conventional PID tuning method

The screenshot shows the INAV Configurator software interface. The top bar displays the INAV logo, version 7.0.0-RC2, and various sensor status icons (Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed). The main content area is titled "Ez Tune" and includes a disclaimer, an "Enabled" toggle switch, and sliders for "Filter Hz" (set to 90) and "Axis ratio" (set to 110). On the right, there are "PID preview" and "Rate preview" tables. The bottom status bar shows system metrics like Cycle Time, CPU Load, and MSP version.

Disclaimer: Ez Tune is an experimental function. It is not guaranteed to work on all UAVs. It is not guaranteed to work with all frame types. It is not guaranteed to work with all propellers. All computations and tuning result can change in future versions of INAV. We still encourage you to check it out and share your experience on INAV Discord in the [#ez-tune](#) channel

When enabled, **Ez Tune** will override multiple INAV setting to simplify the tuning process. Instead of setting each PID and filtering setting independently, you only have to work with 7 sliders. Ez Tune will automatically adjust all other settings to match your needs. Ez Tune is a great starting point for new users and a great way to quickly tune a new UAV. It is not recommended to use Ez Tune on advanced builds, as it will override all your settings and you will not be able to fine tune your UAV. When Ez Tune is enabled, settings from the **PID tuning** tab will be overridden by EzTune.

Enabled

This sets the base cutoff frequency for all INAV gyro and D-term filters. Higher values will result in lower filter delay and better stabilization, but more noise will go through the filters and motors will get hot, UAV might oscillate and be unflyable. Your goal is to increase this value as high as possible before any negative effects appear. Negative effects include: hot motors, audible oscillations, UAV rapidly shaking, UAV gaining altitude by itself. Usual starting points for 'Filter Hz' are: **3-inch props:** 90, **5-inch props:** 110, **7-inch props:** 90, **10-inch props:** 75, **12-inch props:** 60. Use Blackbox and common sense to find a value that is most suited for your UAV.

Filter Hz: 90

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 required. Perfect X frame is ratio 100. Most modern frames should fit somewhere between 110 and 130. Default 110 is a good starting point.

Axis ratio: 110

PID preview

	P	I	D	FF
Roll	40	75	23	100
Pitch	44	82	25	110
Yaw	45	80	0	100

Rate preview

Axis	Rate	Expo
Roll	600 dps	70%
Pitch	600 dps	70%
Yaw	500 dps	70%

Save and Reboot

Packet error: 0 | I2C error: 0 | Cycle Time: 517 | CPU Load: 29% | MSP version: 2 | MSP load: 0.0 | MSP round trip: 110 | HW round trip: 38 | Drop ratio: 0% | Arming Flags: - | 7.0.0-RC2

SETTING UP YOUR DRONE

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 level of 8.94 V and various sensor icons (Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed). A log window shows system messages, including the MultiWii API version (2.5.0) and flight controller info (INAV, version: 7.0.0). The main interface is divided into a left sidebar with navigation options (Setup, Calibration, Mixer, Outputs, Ports, Configuration, Failsafe, Ez Tune, PID tuning, Advanced Tuning, Programming, Receiver, Modes, Adjustments, GPS, Alignment tool, Mission Control) and a central content area. The 'Ez Tune' section is active, showing five adjustable parameters: Axis ratio (110), Response (100), Damping (100), Stability (100), and Aggressiveness (100). Each parameter has a text input field and a corresponding slider. Descriptive text explains the function of each parameter. A 'Save and Reboot' button is located at the bottom right of the main content area. The bottom status bar displays system metrics: 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: -. The Windows taskbar at the bottom shows the system clock at 12:24 PM on 28/03/2024.

INAV Configurator

INAV
CONFIGURATOR 7.0.0-RC2
FC FIRMWARE 7.0.0 [SYNERDUINOSTM_F411]

8.94 V

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

Yaw 500 dps 70%

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 ratio 110

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 oscillates, 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.

Response 100

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.

Damping 100

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.

Stability 100

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

Aggressiveness 100

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: -

Links

ENG 12:24 PM 28/03/2024

SETTING UP YOUR DRONE

The screenshot shows the INAV Configurator software interface. At the top, it displays the INAV logo and version information: CONFIGURATOR 7.0.0-RC2 and FC FIRMWARE 7.0.0 [SYNERDUINOSTM_F411]. A battery status indicator shows 8.94 V. A top navigation bar includes icons for Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, and Speed. On the right, there are dropdown menus for Mixer profile 1, PID profile 1, and Battery profile 1, along with a Disconnect button and a 'No dataflash chip found' warning.

The main content area is divided into a left sidebar with navigation options (Setup, Calibration, Mixer, Outputs, Ports, Configuration, Failsafe, Ez Tune, PID tuning, Advanced Tuning, Programming, Receiver, Modes, Adjustments, GPS, Alignment tool, Mission Control) and a central panel for tuning parameters. The 'Ez Tune' section is currently selected and highlighted in blue. It contains four parameters, each with a text description, a numerical input field, and a slider:

- Damping:** 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. Value: 100.
- Stability:** 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. Value: 100.
- Aggressiveness:** 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. Value: 100.
- Rate:** 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. Value: 100.
- Expo:** 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. Value: 100.

At the bottom right of the tuning panel, there is a 'Save and Reboot' button. The bottom status bar shows system metrics: 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: -, and the version 7.0.0-RC2. The Windows taskbar at the very bottom shows the time as 12:25 PM on 28/03/2024.

SETTING UP YOUR DRONE

The screenshot displays the INAV Configurator software interface. The top status bar shows a battery level of 8.91 V and various sensor icons (Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed). The main content area is divided into tabs: PID gains, Rates & Expo, Filters, and Mechanics. The 'PID gains' tab is active, showing settings for Roll, Pitch, and Yaw. Each axis has four parameters: Proportional, Integral, Derivative, and FeedForward, each with a numerical value and a slider. The 'Roll' section has values: Proportional 40, Integral 75, Derivative 26, FeedForward 60. The 'Pitch' section has values: Proportional 44, Integral 85, Derivative 28, FeedForward 60. The 'Yaw' section has a value: Proportional 40. The interface also includes a left sidebar with navigation options like Setup, Calibration, Mixer, and PID tuning. A bottom status bar displays system metrics such as Packet error, I2C error, Cycle Time, CPU Load, MSP version, and Arming Flags. The Windows taskbar at the bottom shows the time as 12:25 PM on 28/03/2024.

Axis	Parameter	Value
Roll	Proportional	40
	Integral	75
	Derivative	26
	FeedForward	60
Pitch	Proportional	44
	Integral	85
	Derivative	28
	FeedForward	60
Yaw	Proportional	40

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 bar shows the INAV logo, version 5.0.0, and FC FIRMWARE 5.1.0. A battery level indicator shows 5.43 V. The main interface is divided into several sections:

- Multirotor 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 Multirotor max. banking angle
 - Use mid. throttle for ALTHOLD (disabled)
 - 1400 uS Hover throttle
 - Slow down when approaching waypoint (enabled)
- 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 RTH altitude mode
 - 1000 cm RTH altitude
 - 0 cm RTH Home altitude
 - ON 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 shows 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 bottom shows the time as 8:17 PM on 17/08/2022.

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 ?

Multicopter Setting

This is for fixing 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	uS	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	?

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

INAV Configurator

CONFIGURATOR 5.0.0
FC FIRMWARE 5.0.0

2022-07-29 @ 09:27:40 -- MultiWii API version received - 2.4.0
2022-07-29 @ 09:27:40 -- Flight controller info, identifier: INAV, version: 5.0.0
2022-07-29 @ 09:27:41 -- Running firmware released on: Jun 4 2022 12:14:54
2022-07-29 @ 09:27:41 -- Board: ST41, version: 0
2022-07-29 @ 09:27:41 -- Unique device ID received - 0x4400273037510e36363538

Channel map

Channel	Value
Roll [A]	1498
Pitch [E]	1498
Yaw [R]	1500
Throttle [T]	1000
CH 5	1000
CH 6	1000
CH 7	1500
CH 8	1500
CH 9	1500
CH 10	1500
CH 11	1500
CH 12	1500
CH 13	1500
CH 14	1500
CH 15	1500
CH 16	1500
CH 17	988
CH 18	988

Receiver mode

SERIAL Receiver type

Note: Remember to configure a Serial Port (via Ports tab) for the serial receiver

SBUS Serial Receiver Provider

OFF Serial Port Inverted (comparing to protocol default)

AUTO Serial receiver half-duplex

Throttle MID: 0.50, Throttle EXPO: 0.00

RC Deadband: 5, Yaw Deadband: 5

RC Expo: 0.65, Manual RC Expo: 0.35

RC Yaw Expo: 0.65, Manual RC Yaw Expo: 0.20

Save and Reboot

Packet error: 0 I2C error: 0 Cycle Time: 640 CPU Load: 226% MSP version: 2 MSP load: 0.2 MSP round trip: 35 HW round trip: 15 Drop ratio: 0%

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 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

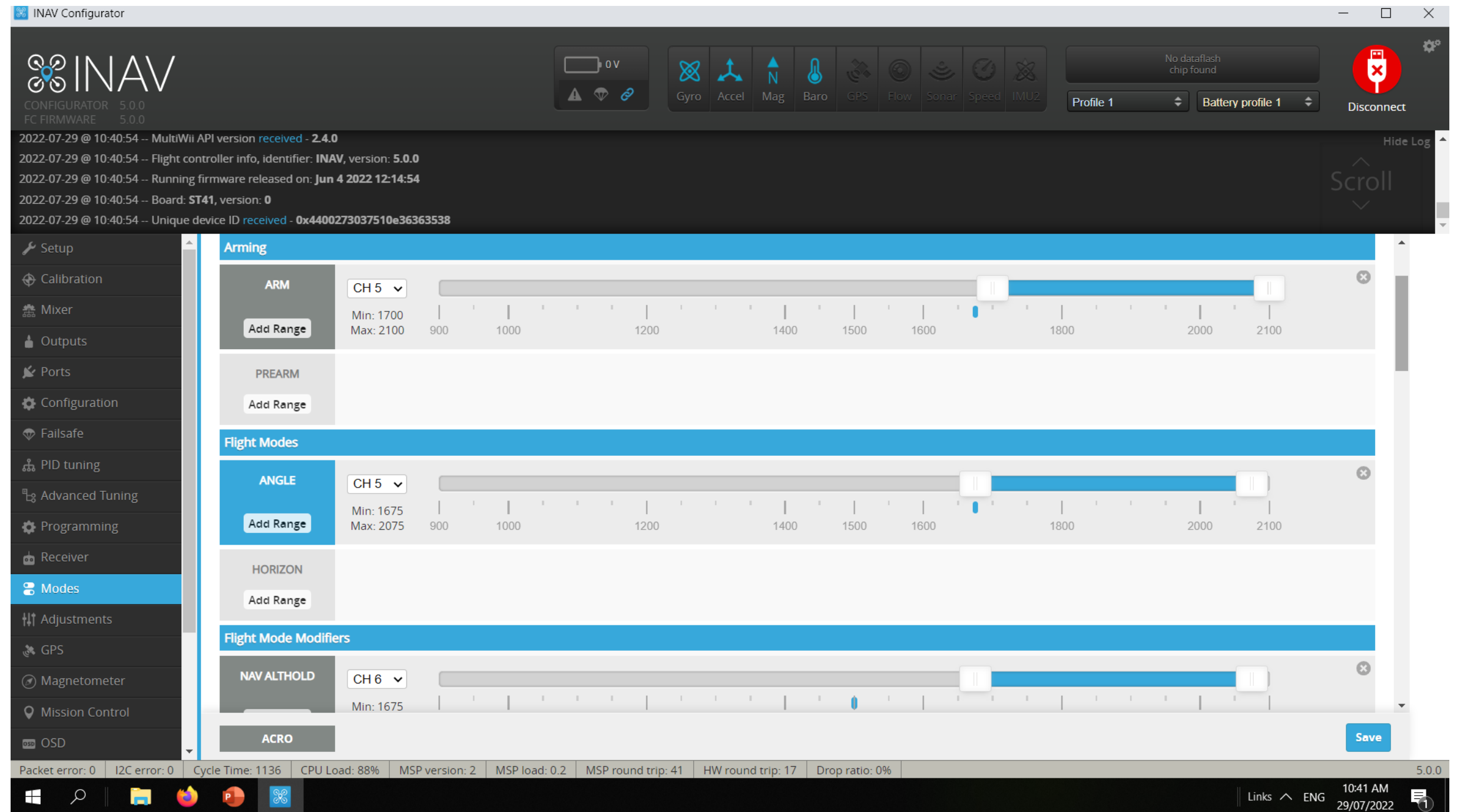
MODES

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 planner](#)
- [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.

The screenshot displays the INAV Configurator software interface. The top bar shows system status including battery voltage (1.99 V) and various sensor icons (Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed). The main content area is titled 'Adjustments' and contains a yellow informational box with the following text: '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.' Below this, there are four rows of adjustment settings, each with a toggle switch, a channel selector (CH 5), a range slider (900-2100), and a dropdown menu (No changes). The bottom status bar shows system metrics: Packet error: 0, I2C error: 50, Cycle Time: 501, CPU Load: 1%, MSP version: 2, MSP load: 0.2, MSP round trip: 249, HW round trip: 35, Drop ratio: 0%, Arming Flags: ARMING_DISABLED_RC_LINK, and version 7.1.0.

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.

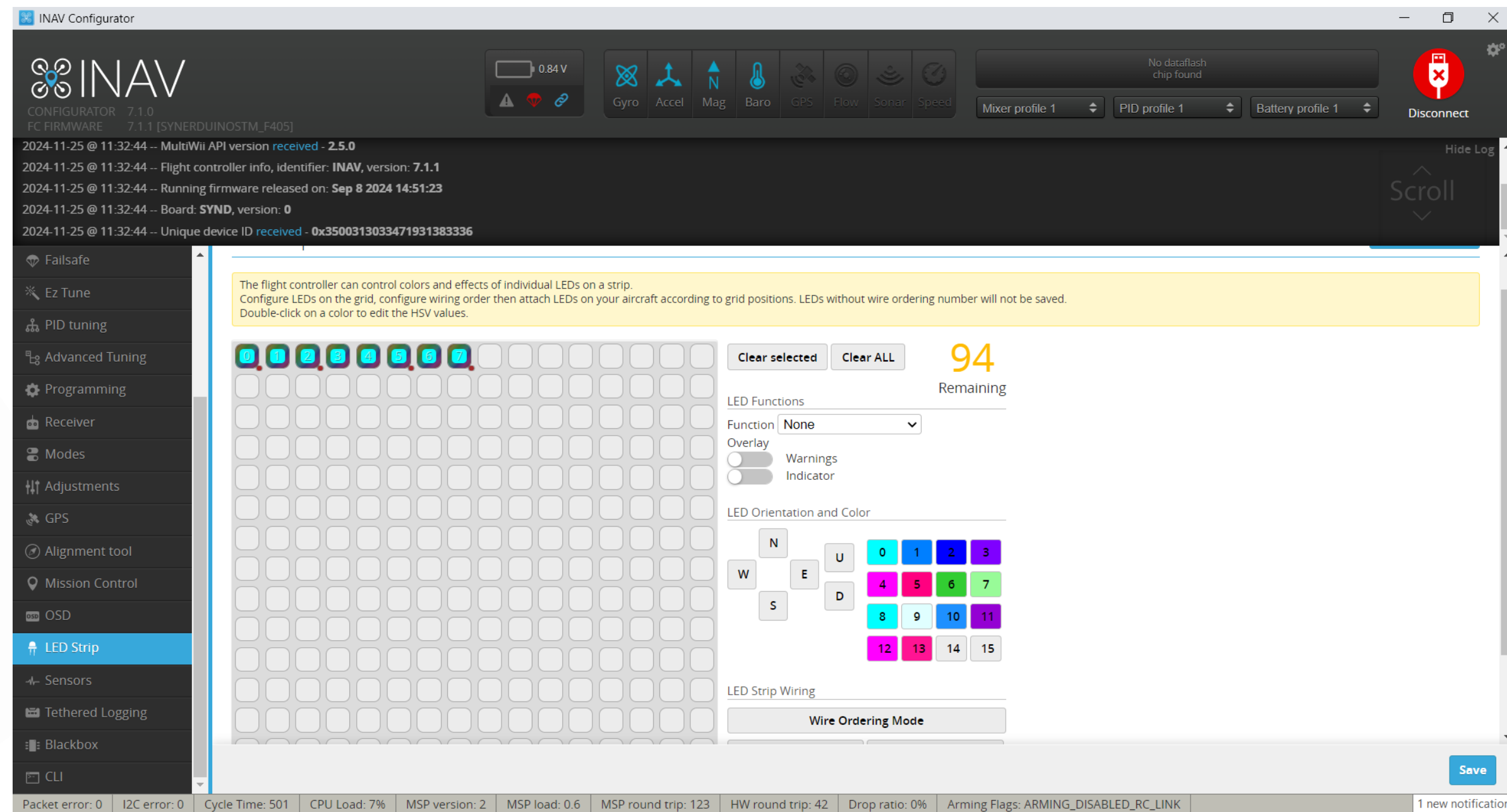
Its also to check if GPS is working correctly

The screenshot displays the INAV Configurator software interface. The top bar shows system status: 2.08 V, Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed, and a 'Disconnect' button. The main content area is divided into a left sidebar with navigation tabs (Setup, Calibration, Mixer, Outputs, Ports, Configuration, Failsafe, Ez Tune, PID tuning, Advanced Tuning, Programming, Receiver, Modes, Adjustments, GPS, Alignment tool, Mission Control) and a central settings panel. The GPS settings panel includes a note: 'Remember to configure a Serial Port (via Ports tab) when using GPS feature.' Below this, there are several configuration options: 'GPS for navigation and telemetry' (checked), 'Protocol' (UBLOX), 'Ground Assistance Type' (Disabled), and four satellite system options (Galileo, BeiDou, Glonass) which are currently unchecked. There are also fields for 'Timezone Offset' (00:00) and 'Automatic Daylight Savings Time' (OFF). To the right of the settings is a world map with a 'Center' button. The bottom status bar shows various system metrics: Packet error: 0, I2C error: 50, Cycle Time: 502, CPU Load: 1%, MSP version: 2, MSP load: 0.4, MSP round trip: 104, HW round trip: 38, Drop ratio: 0%, Arming Flags: ARMING_DISABLED_RC_LINK, and version 7.1.0.

SETTING UP YOUR DRONE

LED STRIP

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



The screenshot shows the INAV Configurator interface. The top status bar displays battery voltage at 0.84V and various sensor icons. The main content area is the 'LED Strip' configuration screen. It features a 10x10 grid for LED placement, with the first row containing 7 colored LEDs. A yellow warning box at the top states: 'The flight controller can control colors and effects of individual LEDs on a strip. Configure LEDs on the grid, configure wiring order then attach LEDs on your aircraft according to grid positions. LEDs without wire ordering number will not be saved. Double-click on a color to edit the HSV values.' On the right, there are controls for 'LED Functions' (Function: None, Overlay: Warnings, Indicator), 'LED Orientation and Color' (a 3x5 grid of color swatches numbered 0-15), and 'LED Strip Wiring' (Wire Ordering Mode). A 'Save' button is at the bottom right. The bottom status bar shows system metrics like Cycle Time, CPU Load, and MSP version.

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

INAV Configurator

8.95 V

No dataflash chip found

Profile 1 Battery profile 1 Disconnect

2022-07-29 @ 09:22:30 -- MultiWii API version received - 2.4.0
2022-07-29 @ 09:22:30 -- Flight controller info, identifier: INAV, version: 5.0.0
2022-07-29 @ 09:22:30 -- Running firmware released on: Jun 4 2022 12:14:54
2022-07-29 @ 09:22:30 -- Board: ST41, version: 0
2022-07-29 @ 09:22:30 -- 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

Packet error: 0 I2C error: 0 Cycl

Reset Z axis, offset: 0 deg

Select a preset or create a custom configuration moving the sliders

CW 90° Orientation presets

Magnetometer Element to show

Axis	Slider	Value [degree]
Pitch	0	0
Roll	180	180
Yaw	180	180

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

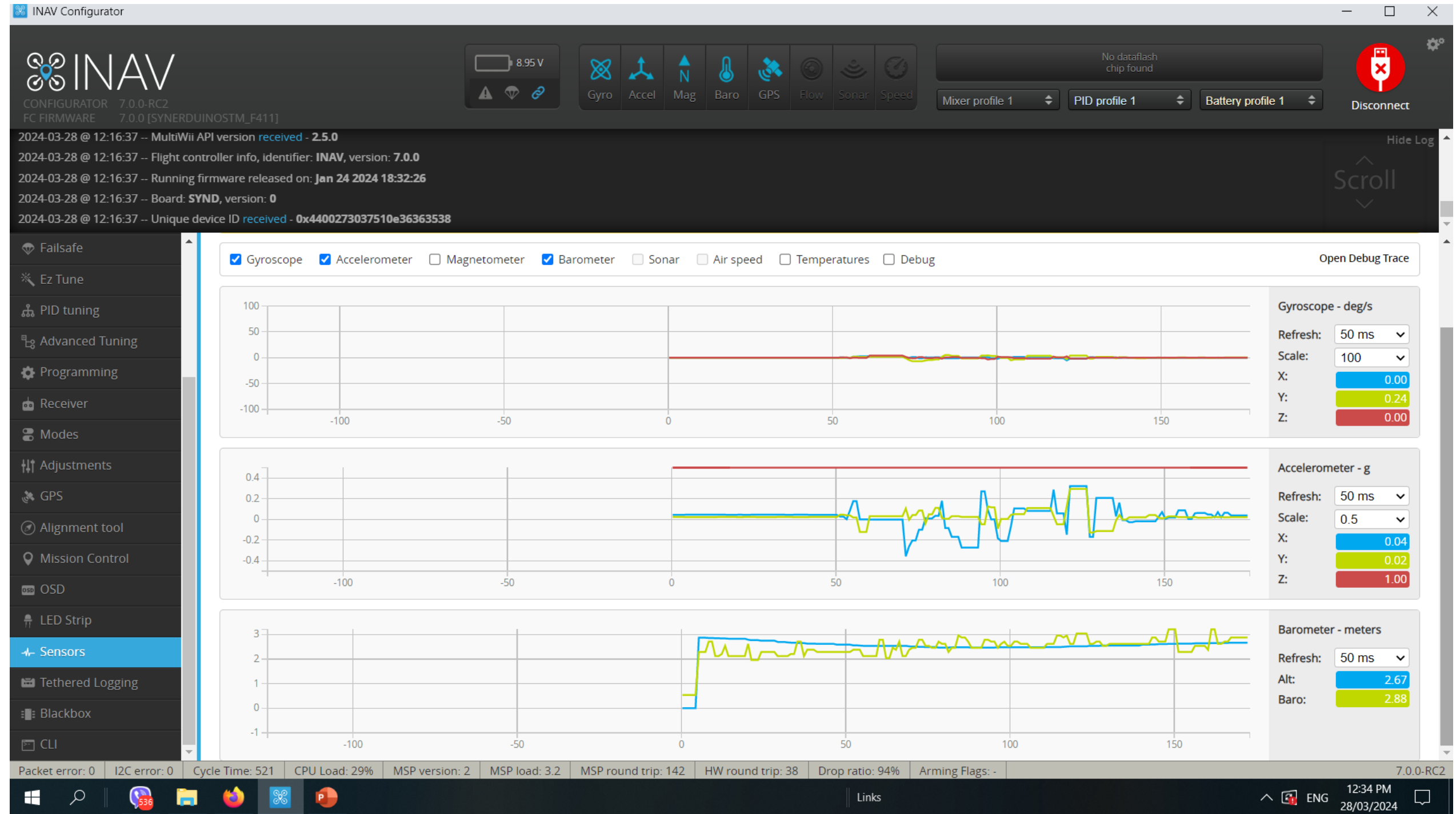
270 Degrees = West

The screenshot displays the INAV Configurator software interface. The top status bar shows a battery level of 8.93 V and various sensor icons (Gyro, Accel, Mag, Baro, GPS, Flow, Solar, Speed). The main content area is titled "1. Select Flight Controller alignment (align_board_roll, align_board_pitch, align_board_yaw)". It features three sliders for Roll, Pitch, and Yaw, each with a scale from -180 to 360 degrees. The Roll slider is set to -1, Pitch to 0, and Yaw to 1. Below the sliders, there is a section for "2. Select a preset (align_mag) or create a custom configuration using the sliders (align_mag_roll, align_mag_pitch, align_mag_yaw)". The preset "CW-270° flip" is selected, and the magnetometer element is set to "Magnetometer". A "Save and Reboot" button is visible at the bottom right. The left sidebar contains navigation options like Setup, Calibration, Mixer, Outputs, Ports, Configuration, Failsafe, Ez Tune, PID tuning, Advanced Tuning, Programming, Receiver, Modes, Adjustments, GPS, Alignment tool (selected), and Mission Control. 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 Arming Flags. The Windows taskbar at the bottom shows the time as 12:32 PM on 28/03/2024.

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.

The screenshot displays the INAV Configurator software interface. The top navigation bar includes a battery level indicator at 5.49 V and various sensor status icons (Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed, IMU2). It also shows the selected profile (Profile 1) and battery profile (Battery profile 1), along with a Disconnect button. The main window is titled 'Mission Control' and features a sidebar with configuration options like Configuration, Failsafe, PID tuning, and Mission Control. The central area contains an 'Action Menu' with file management icons, a 'Total information' section showing a distance of 3522.9m and 117/120 available points, and a 'Default settings' section with input fields for Alt (5 cm), Speed (2 cm/s), and Radius (1 m). The main map area shows a satellite view of a city with several waypoints (WP 1, WP 2, WP 3) marked and connected by a blue line. The bottom status bar provides real-time system metrics such as Packet error, I2C error, Cycle Time, CPU Load, MSP version, MSP load, MSP round trip, HW round trip, Drop ratio, and the current version (5.0.0). The Windows taskbar at the bottom indicates the time is 9:21 PM on 17/10/2022.

SETTING UP YOUR DRONE

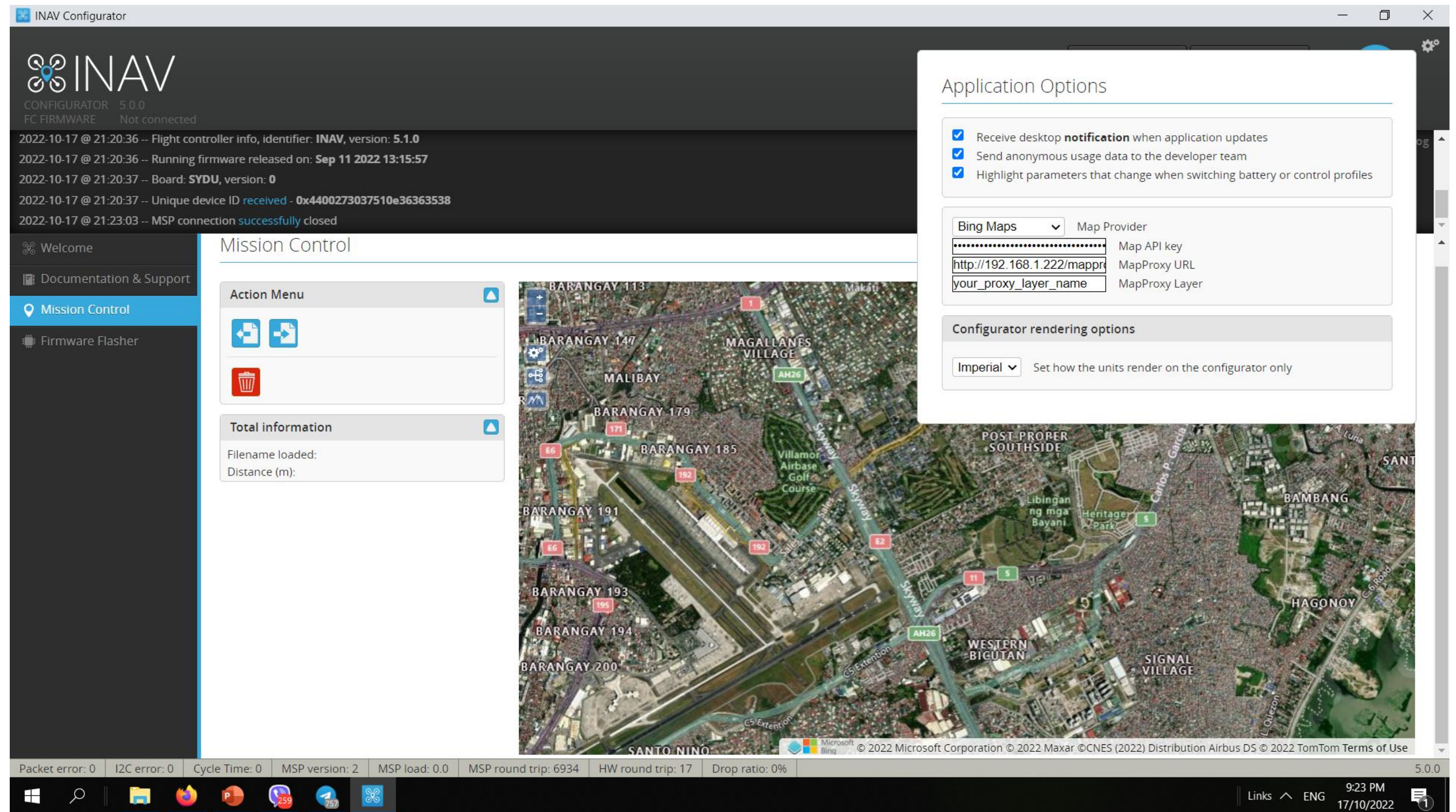
How to choose Map provider

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

The screenshot displays the INAV Configurator software interface. The top bar shows the INAV logo, version information (CONFIGURATOR 5.0.0, FC FIRMWARE 5.1.0), and system status (5.48 V, No dataflash chip found). The main content area is titled 'Logic Conditions' and features a table for configuring 8 Global Variables (GVAR 0-7). Each GVAR has a value displayed in a blue box: GVAR 0 is 8, GVAR 1 is 549, and GVAR 2-7 are 0. Below this is a table with columns for #, Enabled, Operation, Operand A, Operand B, Active, Flags, and Status. The table contains 8 rows of configuration data.

#	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		<input type="radio"/>
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		<input checked="" type="radio"/>
5	<input checked="" type="checkbox"/>	Override RC Channel	Value 6	Value 55	Logic Condition 4		<input checked="" type="radio"/>
6	<input type="checkbox"/>	True					
7	<input type="checkbox"/>	True					
8	<input type="checkbox"/>	True					

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.

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

The screenshot shows the INAV Configurator software interface. The top bar displays the INAV logo, version information (CONFIGURATOR 9.0.0, FC FIRMWARE 9.0.0 [SYNERDUINOSTM_F405]), and a date/time stamp (2025-12-20 @ 21:13:48). A status bar on the right shows a battery level of 18.34V and various sensor icons (Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed). Below the status bar, there are dropdown menus for Control Profile 1, Mixer Profile 1, and Battery Profile 1, along with a Disconnect button.

The main interface is divided into a left sidebar with navigation options (Status, Calibration, Mixer, Outputs, Ports, Configuration, Failsafe, Tuning, Advanced Tuning, Programming, JavaScript Programming, Receiver, Modes, Adjustments, GPS, Alignment Tool, Mission Control, OSD, LED Strip, Sensors) and a central workspace. The JavaScript Editor is active, showing a code editor with the following JavaScript code:

```
1 // Multiple conditions example
2 const { flight, override } = inav;
3
4 // Only boost VTX if far AND high
5 if (flight.homeDistance > 200 && flight.altitude > 50) {
6   override.vtx.power = 4;
7 }
8
9 // Reduce throttle if battery low OR RSSI weak
10 if (flight.cellVoltage < 350 || flight.rssi < 40) {
11   override.throttleScale = 60;
12 }
```

Below the code editor, there are buttons for "Transpile to INAV", "Load from FC", "Save to FC", and "Clear". The bottom status bar shows system metrics: Packet error: 0, I2C error: 0, Cycle Time: 523, CPU Load: 8%, MSP version: 2, MSP load: 0.3, MSP round trip: 72, HW round trip: 16, Arming Flags: ARMING_DISABLED_HARDWARE_FAILURE, ARMING_DISABLED_RC_LINK, and the version number 9.0.0. The Windows taskbar at the bottom shows the time as 9:14 PM on 20/12/2025.

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 like Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed, and IMU2. A battery level indicator shows 8.97 V. 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 - VTXCTRL 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 4 1 3
Total (excluding SERIAL) 28253.4% 105.0%
```

Below the terminal output, there is a text input field labeled "Write your command here" and several buttons: EXIT, SAVE SETTINGS, MSC, Copy to clipboard, Clear output history, Load from file, and Save to File. The bottom status bar shows 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 version 5.0.0. The Windows taskbar at the bottom shows the time as 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 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

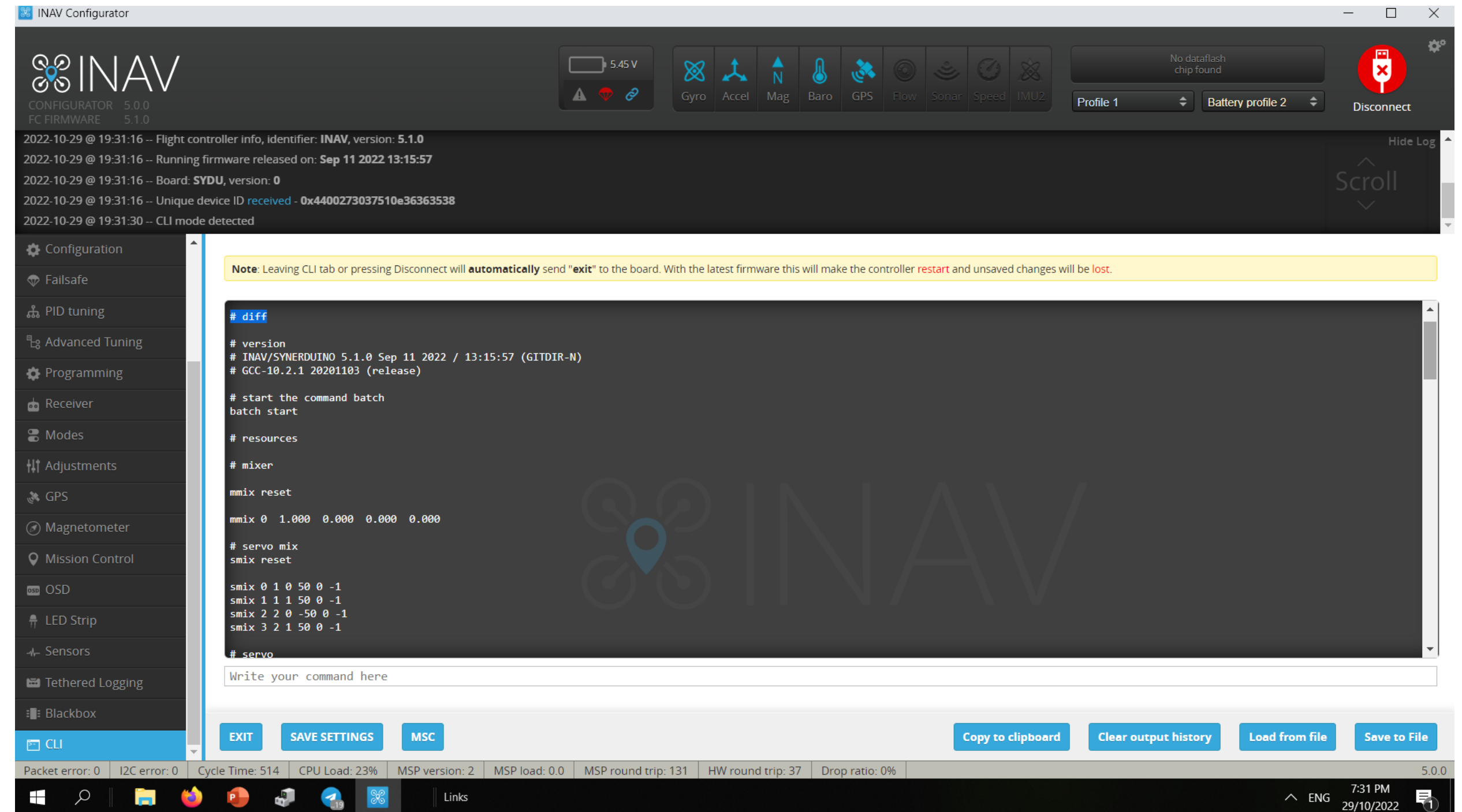
CLI Command Line Saving and Loading Parameters

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



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. The main area is divided into a left sidebar with various configuration tabs (Configuration, Failsafe, PID tuning, etc.) and a central CLI window. The CLI window shows the output of the 'diff' command, which lists the current settings for the drone's mixer and servo mix. A yellow warning banner at the top of the CLI window states: "Note: Leaving CLI tab or pressing Disconnect will automatically send 'exit' to the board. With the latest firmware this will make the controller restart and unsaved changes will be lost." The bottom status bar shows system information such as Packet error: 0, I2C error: 0, Cycle Time: 514, CPU Load: 23%, MSP version: 2, MSP load: 0.0, MSP round trip: 131, HW round trip: 37, Drop ratio: 0%, and the version 5.0.0. The system tray at the bottom right shows the date and time: 7:31 PM, 29/10/2022.

```
# diff
# version
# INAV/SYNERDUINO 5.1.0 Sep 11 2022 / 13:15:57 (GITDIR-N)
# GCC-10.2.1 20201103 (release)

# start the command batch
batch start

# resources

# mixer
mmix reset
mmix 0 1.000 0.000 0.000 0.000

# servo mix
smix reset
smix 0 1 0 50 0 -1
smix 1 1 1 50 0 -1
smix 2 2 0 -50 0 -1
smix 3 2 1 50 0 -1

# servo
```

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

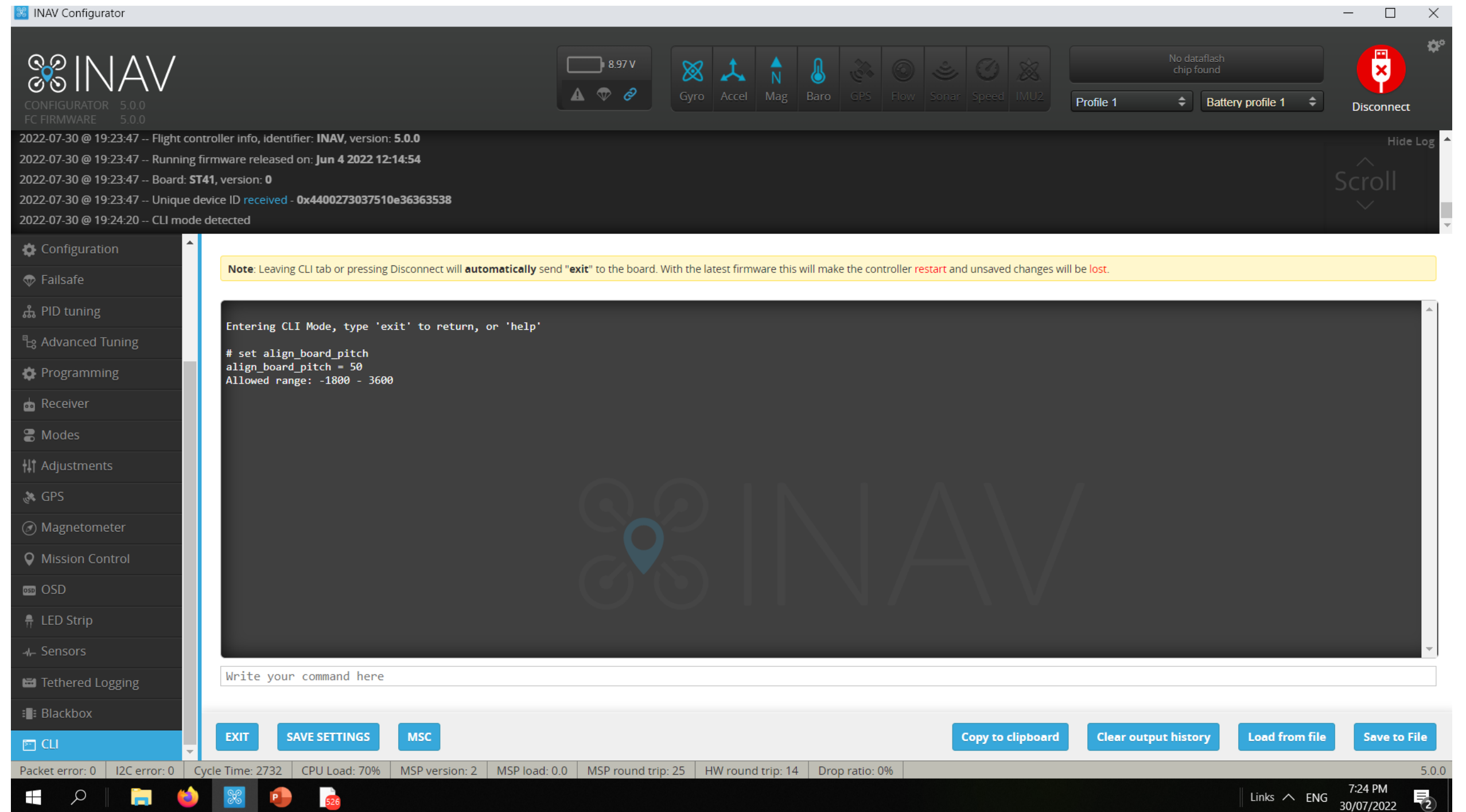
your ACC its not always perfect . You may need to trim your board for a good stability in flight

```
# 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



The screenshot shows the INAV Configurator software interface. The top bar displays the INAV logo, version 5.0.0, and various sensor status icons (Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed, IMU2). 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) and a central CLI window. The CLI window shows the following text:

```
Entering CLI Mode, type 'exit' to return, or 'help'  
  
# set align_board_pitch  
align_board_pitch = 50  
Allowed range: -1800 - 3600
```

Below the CLI window 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 system metrics: Packet error: 0, I2C error: 0, Cycle Time: 2732, CPU Load: 70%, MSP version: 2, MSP load: 0.0, MSP round trip: 25, HW round trip: 14, Drop ratio: 0%, and the version 5.0.0. The system tray at the bottom right shows the date and time: 7:24 PM, 30/07/2022.

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 t

```
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
```

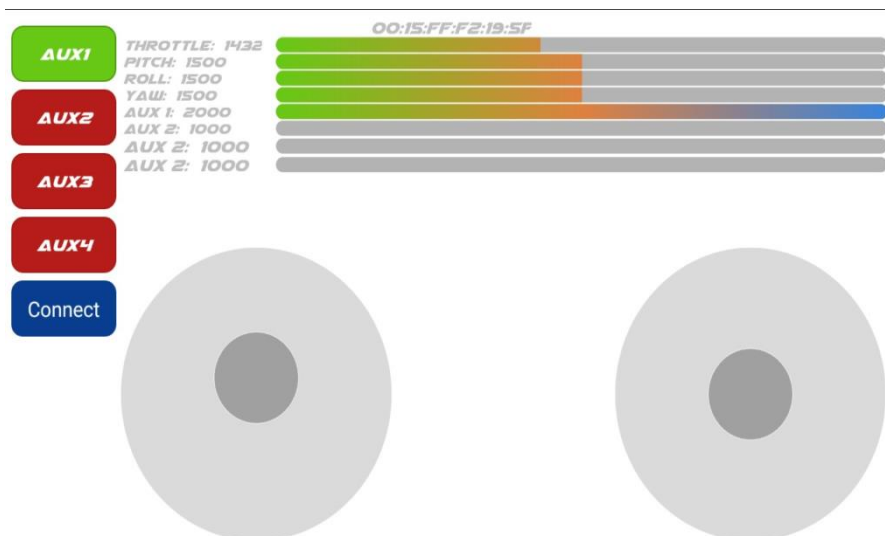
SETTING UP YOUR DRONE

`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

```
INAV Configurator
INAV
CONFIGURATOR 6.0.0-FP2
FC FIRMWARE 6.0.0 [SYNERDUINOSTMSV]
2023-03-17 @ 12:11:03 -- Flight controller info, identifier: INAV, version: 6.0.0
2023-03-17 @ 12:11:03 -- Running firmware released on: Jan 10 2023 17:26:02
2023-03-17 @ 12:11:03 -- Board: SYDU, version: 0
2023-03-17 @ 12:11:03 -- Unique device ID received - 0x32002a3132510c30313530
2023-03-17 @ 12:12:13 -- CLI mode detected

Note: Leaving CLI tab or pressing Disconnect will automatically send "exit" to the board. With the latest firmware this will make the controller restart and unsaved changes will be lost.

Entering CLI Mode, type 'exit' to return, or 'help'
# set rx_min_usec = 790
rx_min_usec set to 790

set rx_min_usec = 790

EXIT SAVE SETTINGS MSC
Copy to clipboard Clear output history Load from file Save to File
Packet error: 0 I2C error: 0 Cycle Time: 509 CPU Load: 25% MSP version: 2 MSP load: 0.0 MSP round trip: 31 HW round trip: 15 Drop ratio: 0% 6.0.0-FP2
```

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 – multicopter 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`

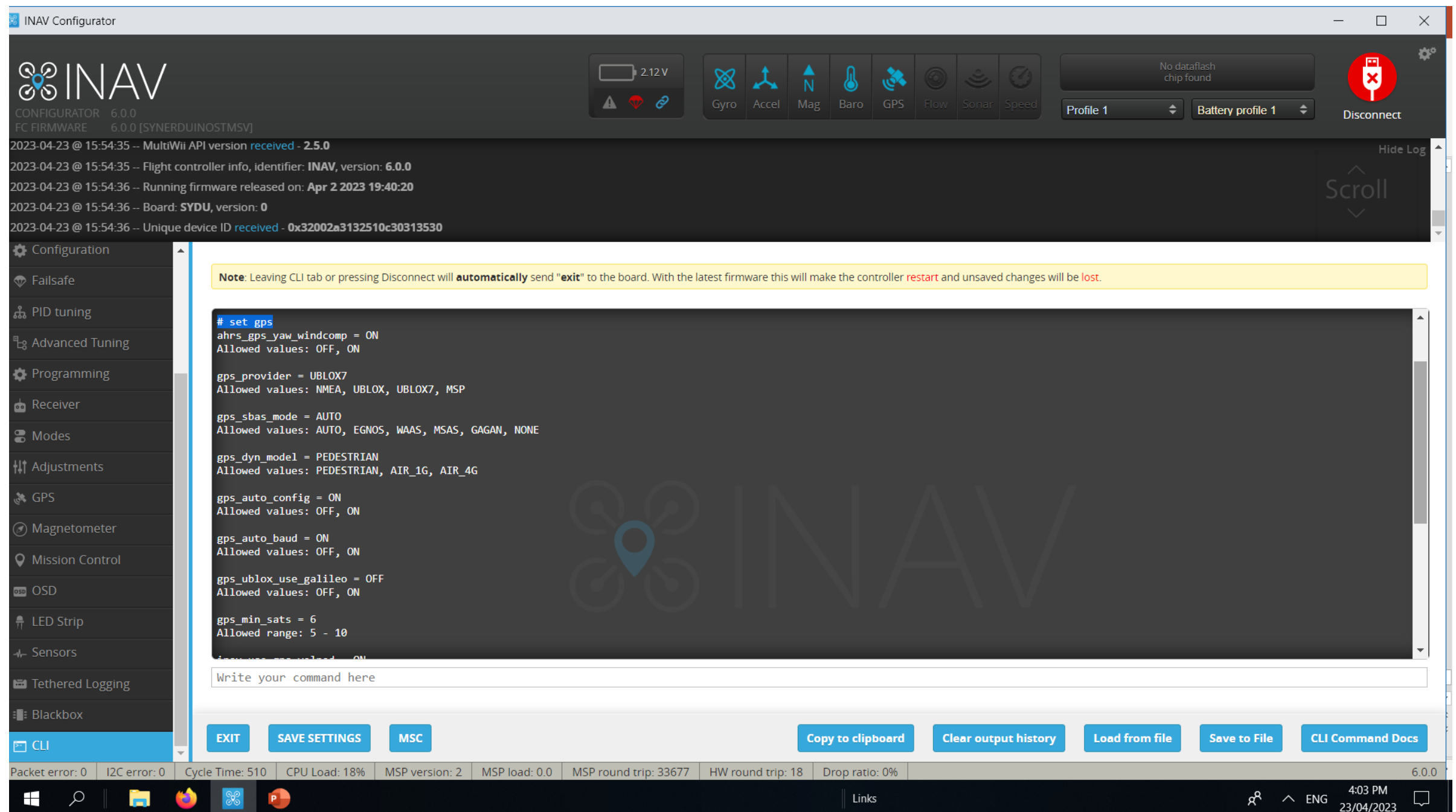
Minimum sats to arm gps flight mode

`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 – meare above sea level instead relative to bootup

CLI Command Line GPS setting



The screenshot shows the INAV Configurator interface with the CLI tab selected. The CLI window displays the following settings:

```
# set gps
ahrs_gps_yaw_windcomp = ON
Allowed values: OFF, ON

gps_provider = UBLOX7
Allowed values: NMEA, UBLOX, UBLOX7, MSP

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

gps_dyn_model = PEDESTRIAN
Allowed values: PEDESTRIAN, AIR_1G, AIR_4G

gps_auto_config = ON
Allowed values: OFF, ON

gps_auto_baud = ON
Allowed values: OFF, ON

gps_ublox_use_galileo = OFF
Allowed values: OFF, ON

gps_min_sats = 6
Allowed range: 5 - 10
```

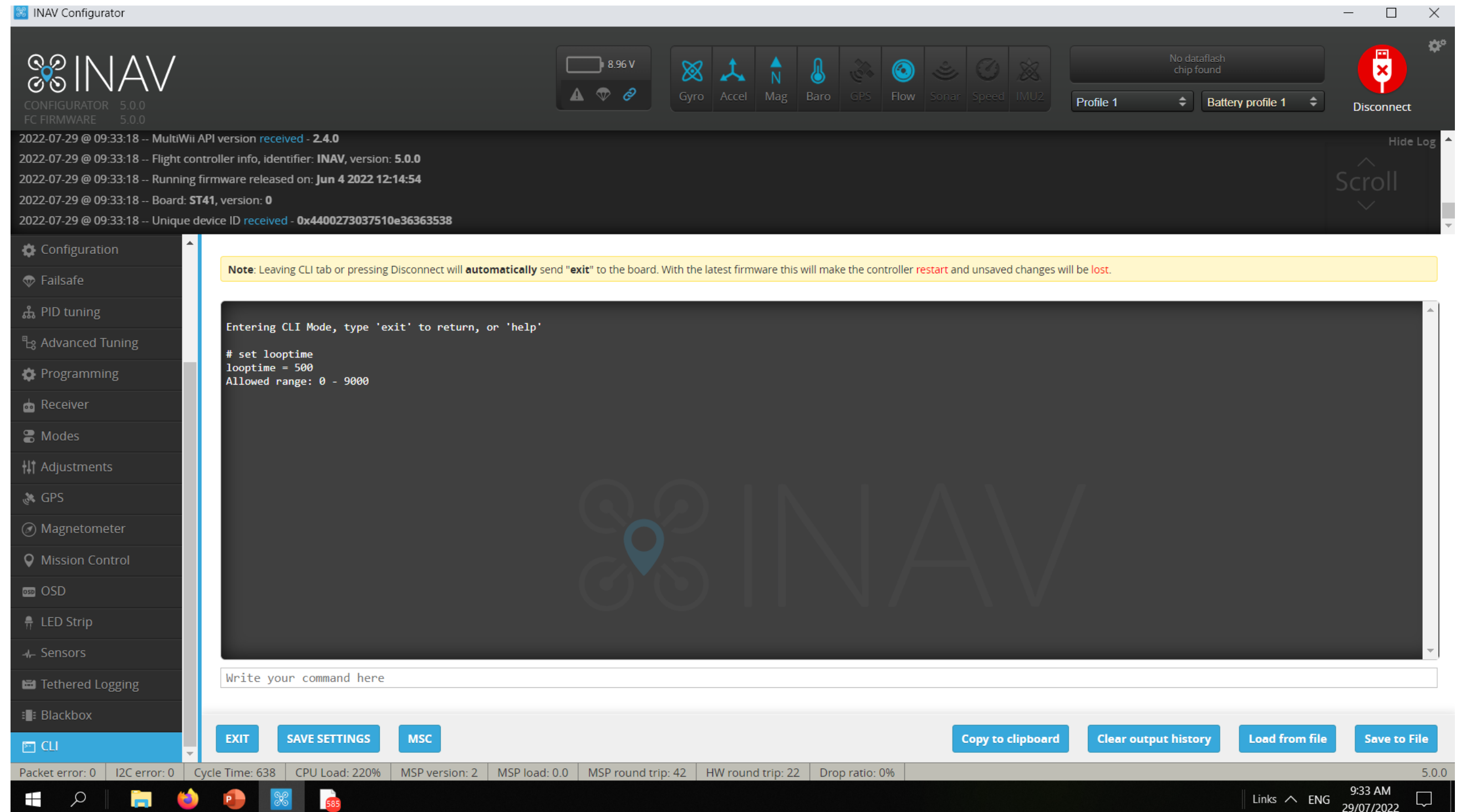
The interface also shows a status bar at the bottom with various system metrics: Packet error: 0, I2C error: 0, Cycle Time: 510, CPU Load: 18%, MSP version: 2, MSP load: 0.0, MSP round trip: 33677, HW round trip: 18, Drop ratio: 0%, and the current time is 4:03 PM on 23/04/2023.

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



The screenshot displays the INAV Configurator software interface. The top bar shows the INAV logo, version 5.0.0, and various sensor status icons (Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed, IMU2). A battery level indicator shows 8.96 V. The main area 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) and a central CLI window. The CLI window shows the following text:

```
Entering CLI Mode, type 'exit' to return, or 'help'  
# set looptime  
looptime = 500  
Allowed range: 0 - 9000
```

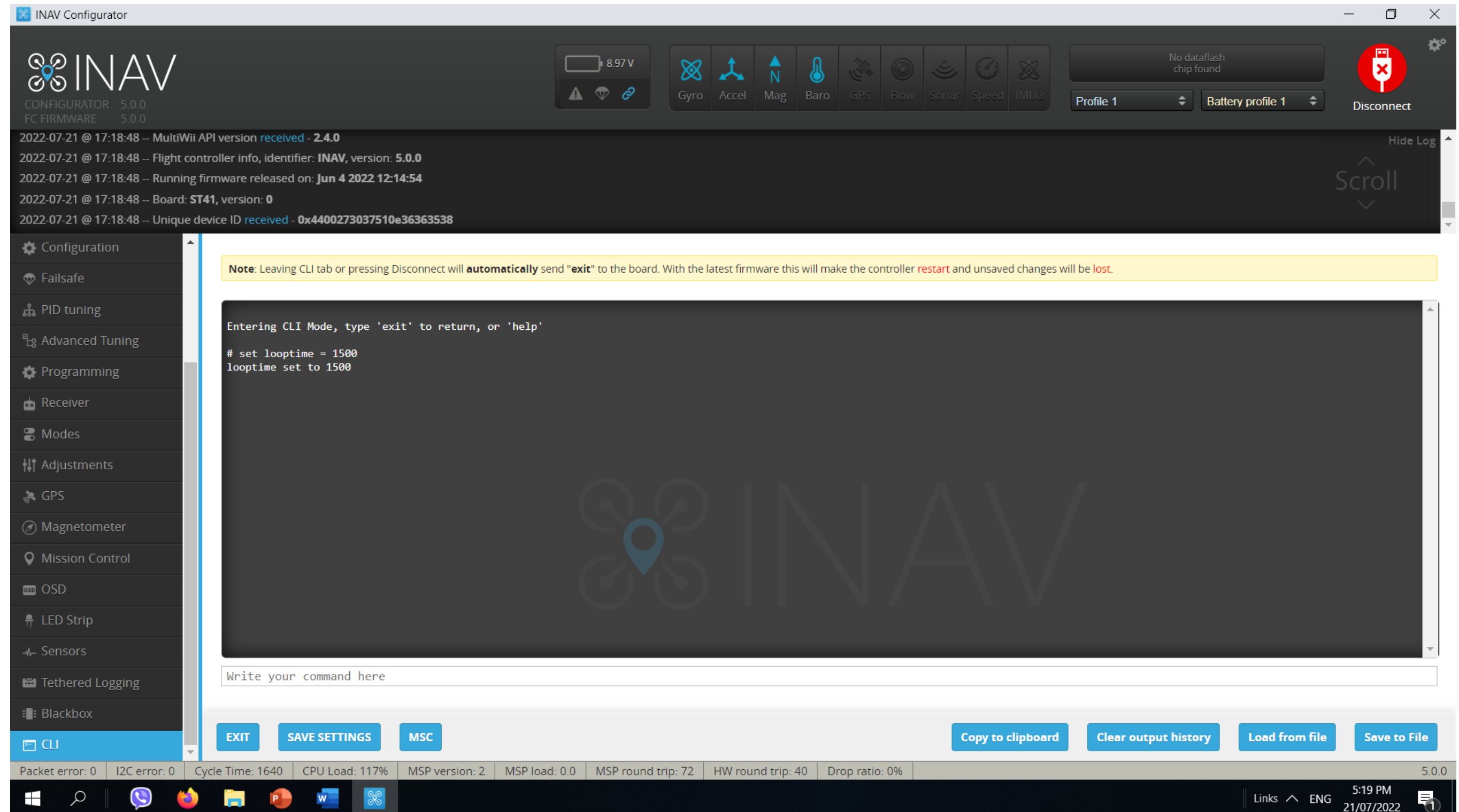
Below the CLI window is a text input field labeled "Write your command here". At the bottom of the interface, there are buttons for "EXIT", "SAVE SETTINGS", "MSC", "Copy to clipboard", "Clear output history", "Load from file", and "Save to File". The status bar at the very bottom shows system metrics: Packet error: 0, I2C error: 0, Cycle Time: 638, CPU Load: 220%, MSP version: 2, MSP load: 0.0, MSP round trip: 42, HW round trip: 22, Drop ratio: 0%, and the version number 5.0.0. The Windows taskbar at the bottom indicates the time is 9:33 AM on 29/07/2022.

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 software interface. The top bar shows the INAV logo, version 5.0.0, and various sensor status icons (Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed, IMU2). A battery level indicator shows 8.97 V. The main area 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 central CLI window. The CLI window shows the following text:

```
Entering CLI Mode, type 'exit' to return, or 'help'  
# set looptime = 1500  
looptime set to 1500
```

Below the CLI window 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 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 version 5.0.0. The system tray at the bottom right shows the date and time: 5:19 PM, 21/07/2022.

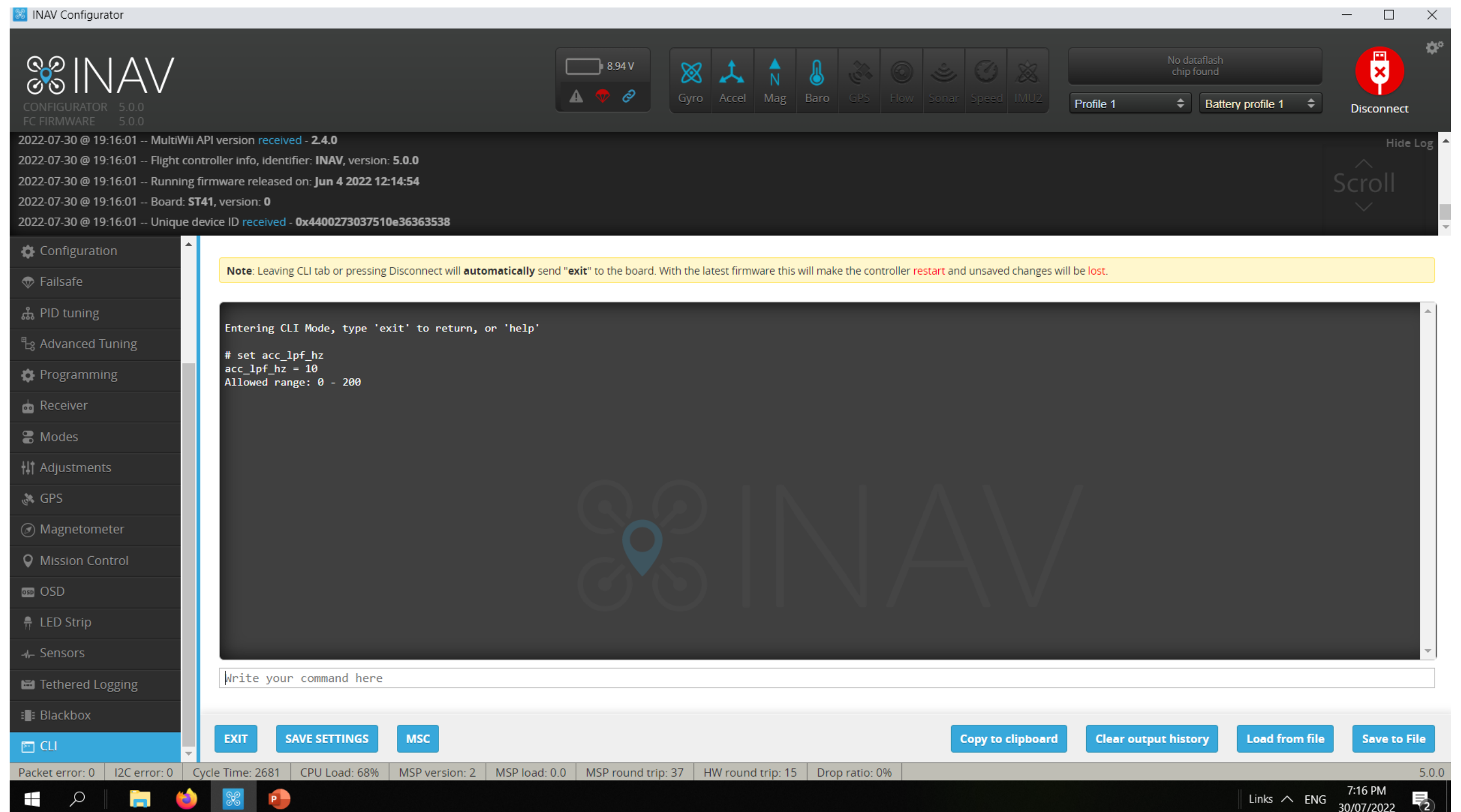
SETTING UP YOUR DRONE

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



The screenshot shows the INAV Configurator software interface. The top bar displays the INAV logo, version information (CONFIGURATOR 5.0.0, FC FIRMWARE 5.0.0), and various sensor status icons (Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, Speed, IMU2). A battery level indicator shows 8.94 V. The main area 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) and a central CLI window. The CLI window shows the following text:

```
Entering CLI Mode, type 'exit' to return, or 'help'  
# set acc_lpf_hz  
acc_lpf_hz = 10  
Allowed range: 0 - 200
```

Below the CLI window is a text input field labeled "Write your command here". At the bottom of the interface, there are several buttons: 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 system metrics: Packet error: 0, I2C error: 0, Cycle Time: 2681, CPU Load: 68%, MSP version: 2, MSP load: 0.0, MSP round trip: 37, HW round trip: 15, Drop ratio: 0%, and the version number 5.0.0. The system tray at the bottom right shows the date and time: 7:16 PM, 30/07/2022.

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

The screenshot shows the INAV Configurator interface. The top bar displays system status: 0.81 V battery, No dataflash chip found, and a Disconnect button. The main content area shows the CLI tab with the following settings:

```
# set alt
alt_hold_deadband = 50
Allowed range: 10 - 250

inav_reset_altitude = FIRST_ARM
Allowed values: NEVER, FIRST_ARM, EACH_ARM

inav_max_surface_altitude = 200
Allowed range: 0 - 1000

nav_mc_althold_throttle = MID_STICK
Allowed values: STICK, MID_STICK, HOVER

nav_wp_enforce_altitude = 0
Allowed range: 0 - 2000

nav_land_minalt_vspd = 50
Allowed range: 50 - 500

nav_land_maxalt_vspd = 200
Allowed range: 100 - 2000

nav_land_slowdown_minalt = 500
Allowed range: 50 - 1000

nav_land_slowdown_maxalt = 2000
Allowed range: 500 - 4000
```

The bottom status bar shows system metrics: Packet error: 1, I2C error: 0, Cycle Time: 536, CPU Load: 29%, MSP version: 2, MSP load: 0.0, MSP round trip: 1508, HW round trip: 16, Drop ratio: 0%, Arming Flags: -, and version 7.0.0-RC2. The system time is 9:39 AM on 14/04/2024.

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

SETTING UP YOUR DRONE

Init Gyro Calibration

set init_gyro_cal = ON

The Flight controller initiate calibration on bootup this requires drone to be on flat surface level

set init_gyro_cal = OFF

Useful when taking off from a moving surface like a Vehicle . Car or Boat , this requires the calibration to be save on level surface first using the using the On calibration and calibration Tab

1. Connect the flight controller to iNav Configurator.
2. Go to the **CLI** tab.
3. Type set init_gyro_cal = OFF and press Enter.
4. Save changes

```
Entering CLI Mode, type 'exit' to return, or 'help'  
#  
# Building AutoComplete Cache ... Done!  
#  
# set init_gyro_cal  
init_gyro_cal = ON  
Allowed values: OFF, ON
```



SETTING UP YOUR DRONE

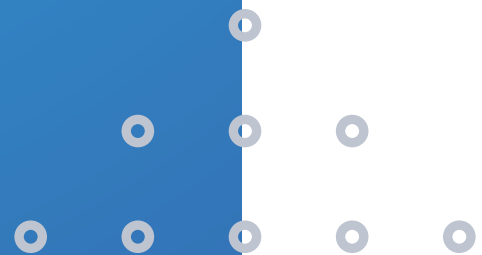
Finishing Note:

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



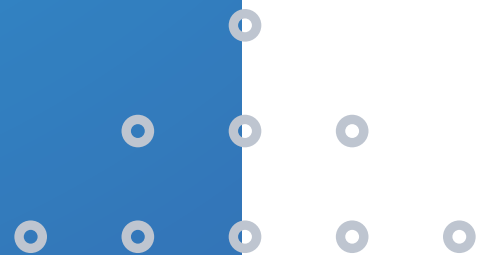
SYSTEM CHECKS

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

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 visible. A battery voltage indicator shows 8.88 V. A row of sensor status icons includes Gyro, Accel, Mag, Baro, GPS, Flow, Sonar, and Speed, all of which are blue, indicating they are active. A blue arrow points to this row. The main area shows the 'Setup' menu with a 'Reset Settings' button and a 'Restore settings to default' option. Below this, a table displays orientation data: Heading: 163 deg, Pitch: 13.3 deg, and Roll: 2.2 deg. A green arrow points to a 'Reset Z axis, offset: 0 deg' button. On the right, a 'Pre-arming checks' section lists several items, all with green checkmarks: UAV is levelled, Run-time calibration, CPU load, Navigation is safe, Compass calibrated, Accelerometer calibrated, Settings validated, and Hardware health. Below this is an 'Info' section with battery-related data: Battery detected cell count: 3, Battery voltage: 8.88 V, Battery left: 0%, Battery remaining capacity: NA, Battery full when plugged in: false, and Battery use cap thresholds: false. The bottom status bar shows various system metrics like 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%, and 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 and Flight board Failsafe Active*
- *Communication with Ground station working*
- *Flight modes setup correctly*
- *Correct motor and Prop Rotation*

