

Standby Attitude Module on a 3.5-inch LCD screen and ESP32 S3 Microcontroller (Implemented as a Mobiflight Community Device)



1. Introduction:

This is a Standby Attitude Module (SAM) for use with Flight Simulation. It is an original implementation inspired by the MD302 and Garmin G5. Of course, it does not have all the functionality of those devices, as this was just developed for fun!

The motivation for this is to have a realistic SAM that can be placed anywhere in the sim panel for home cockpit builders and hobbyists without breaking the bank. This is implemented as a [Mobiflight](#) community device using an ESP32 S3, so it can be used with flight simulators that are supported by Mobiflight (MSFS2020, X Plane) and can be integrated easily.

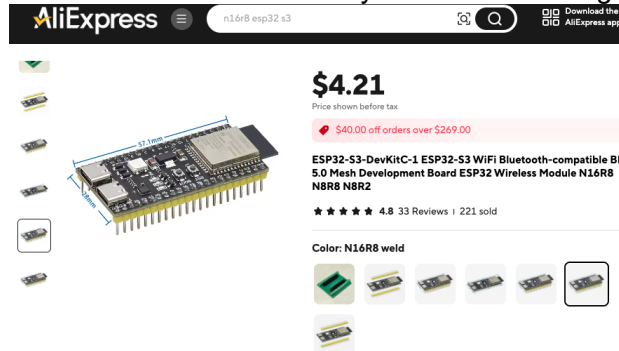
For questions, please join the [Mobiflight Discord](#) server and go to the “custom-devices “ channel.

Most important of all, have fun, and.... Mobiflight rocks!!!

2. Hardware:

- **ESP32 S3 N16R8 variant**

Note: Other variants have not been tested and may not work. Please get this specific variant



For example, you can order the ESP32 S3 N16R8 variant from the following:

- <https://tinyurl.com/at2ubb9a>
- <https://tinyurl.com/46rwnp9p>

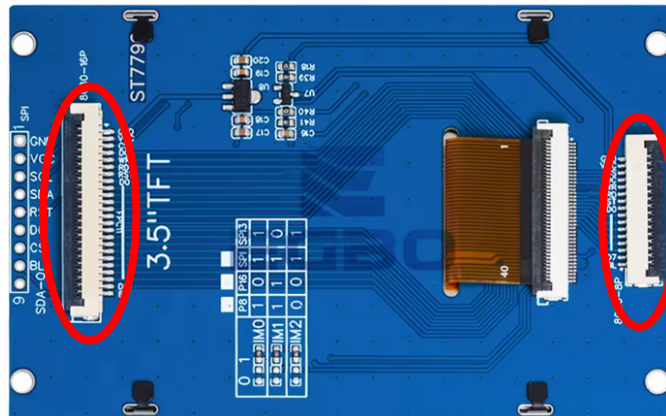
- **3.5-inch LCD screen with the ST7796 or ST7796S driver**

Note: Other LCD screens with a different driver will not work!

For example, you can order the LCD screens from the following:

- <https://tinyurl.com/3z6y7kcw>
- <https://tinyurl.com/3aac2f63>

Currently, this device uses the serial SPI interface, but it is highly recommended to get a 3.5-inch LCD screen that also has a parallel interface option, as this might be implemented in the future. See an example of LCD screen with the parallel interface (encircled in red) below:



- **Other hardware**

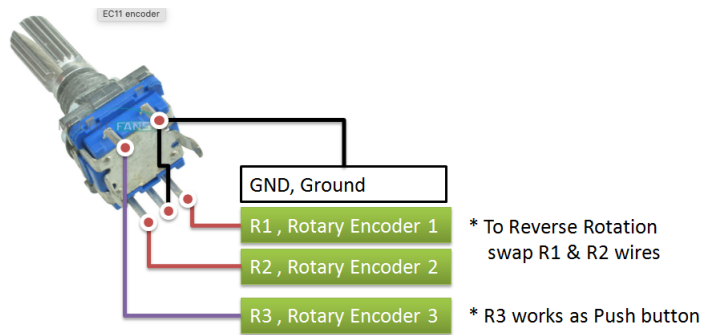
- EC11 Rotary Encoder
- Wires, USB connectors, etc.

- **ESP32 S3 and LCD Screen (ST7796/ST7796S) PIN connections**

Connect the 3.5-inch LCD display pins to the corresponding ESP32 S3 GPIO pins according to the table below:

ESP32 S3 GPIO Pin	3.5-in LCD (ST7796/ST7796S) Pin
3V3	VCC
GND	GND
7	CS
6	RESET
15	DC/RS
17	SDI(MOSI)
18	SCK
13	LED

- **Rotary Encoder (EC11) connections**



Credits to [Dronebots Workshop](https://www.dronebotsworkshop.com/) for the image.

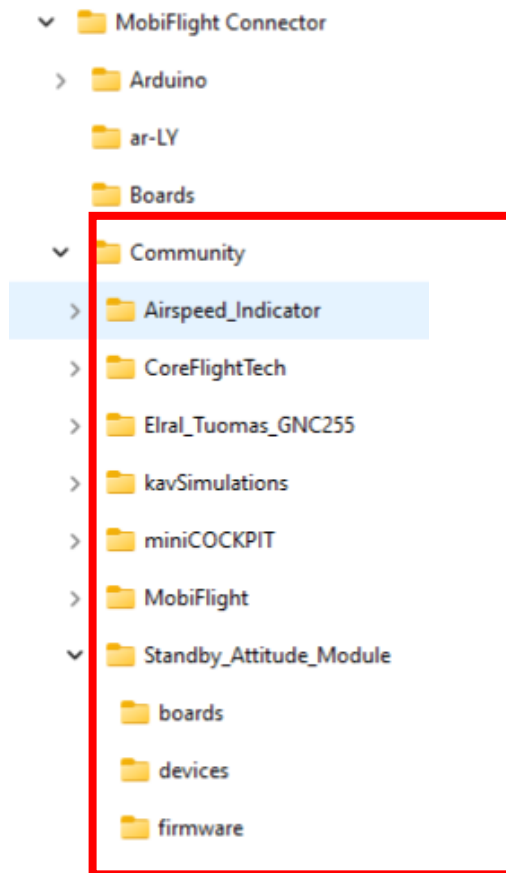
ESP32 S3 GPIO Pin	Rotary Encoder (EC11)
GND	GND
10	R1, Rotary Encoder 1
11	R2, Rotary Encoder 2
12	R3, Rotary Encoder 3 (pushbutton)

3. Software:

- **Mobiflight**
 - <https://www.mobiflight.com/en/index.html>
- **Mobiflight Standby Attitude Module custom firmware**
 - See the instructions below for downloading and installing the custom firmware

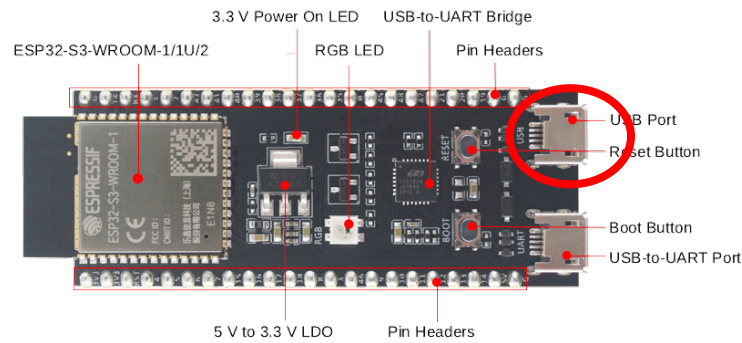
4. Downloading the Mobiflight Standby Attitude Module custom firmware:

- Download the Mobiflight Standby Attitude Module custom firmware from the link below:
<https://github.com/savesabanal01/Mobiflight-StandbyAttitudeModule-ESP32-S3/tree/StandbyAttitudeModule-release>
Go to the folder “firmware” and download [Standby Attitude Module 2.5.2.zip](#)
- Open you Windows Explorer, using Win+E
- In the file path window, paste %LocalAppData%\MobiFlight\MobiFlight Connector\Community
- Extract the [Standby Attitude Module 2.5.2.zip](#) to this folder. The file structure should look like the one below (make sure that the “Standby_Atitude_Module” folder is directly under “Community”):

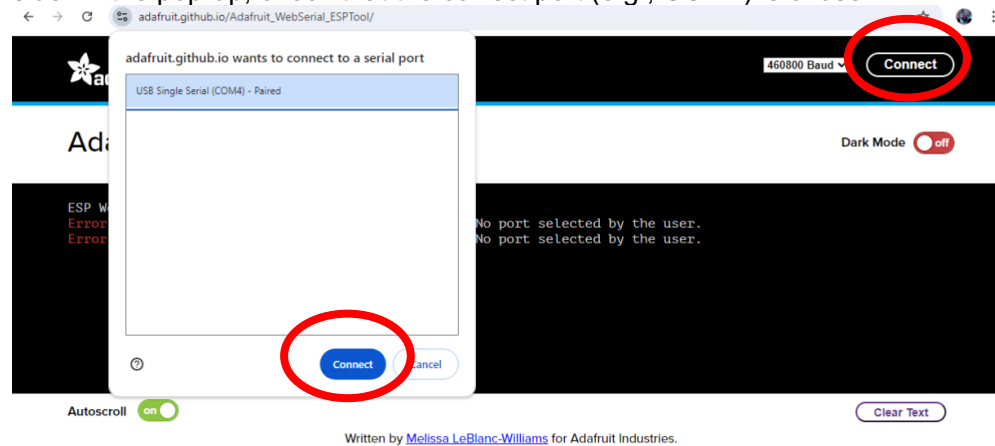


5. Flashing the Mobiflight Standby Attitude Module custom firmware to the ESP32 S3:

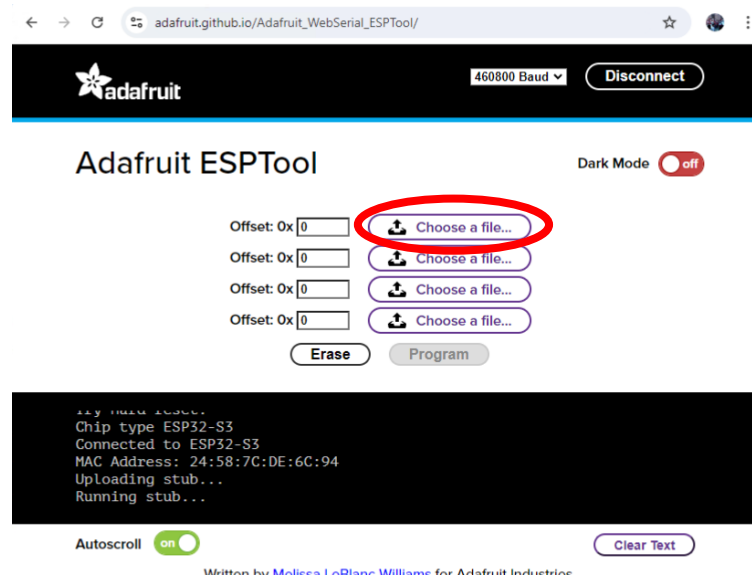
- The easy (and slow) method:
Connect the ESP32 S3 to your PC using the USB port in (highlighted in red) in the picture below:



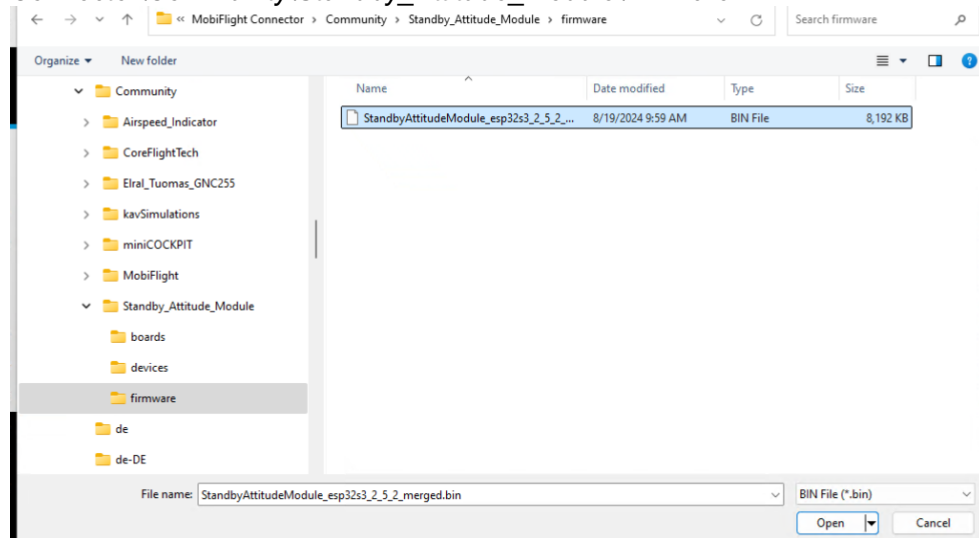
- Open the following URL: https://adafruit.github.io/Adafruit_WebSerial_ESPTool/
- When the webpage is opened, click on the “Connect” button on the upper right-hand side. In the pop-up, check that the correct port (e.g., COM4) is chosen.



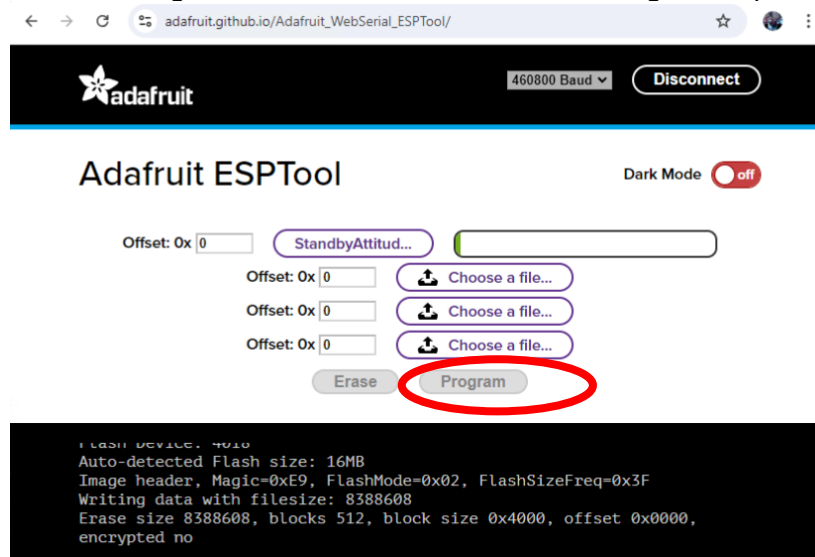
- Click on the correct port and click the “Connect” button in the pop-up
- On the next page, click the first “Choose a file...” button



- When Windows Explorer opens, select the “StandbyAttitudeModule_esp32s3_2_5_2_merged.bin” file, which is in the “Standby_Atitude_Module” -> “firmware” folder that you extracted previously.
Hint: It is under: C:\Users\<username>\AppData\Local\MobiFlight\MobiFlight Connector\Community\Standby_Atitude_Module\firmware



- Click on “Program” and wait for the firmware flashing to complete



- For advanced users**, the faster method is to use the esptool.py tool. You need to install Python and the esptool.py tool. Please see this link for details:

<https://github.com/espressif/esptool>

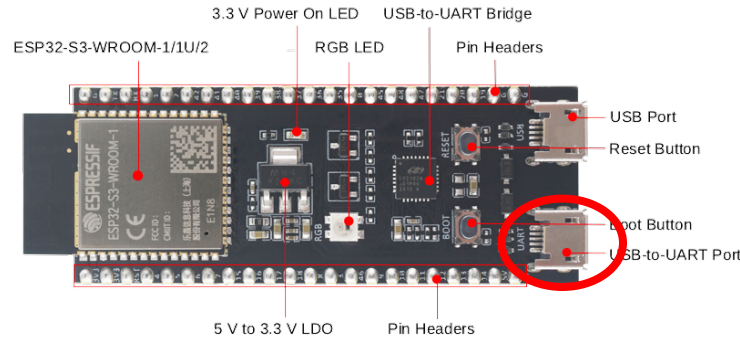
The syntax to use the esptool.py to flash the firmware is:

“StandbyAttitudeModule_esp32s3_2_5_2_merged.bin” is in your current directory:

```
python -m esptool --chip esp32s3 --port=<port No> --baud 460800 --before
default_reset --after hard_reset write_flash -z --flash_mode dio --flash_freq 80m --flash_size
16MB 0x00 <direcoty where firmware is
stored>\StandbyAttitudeModule_esp32s3_2_5_2_merged.bin
```

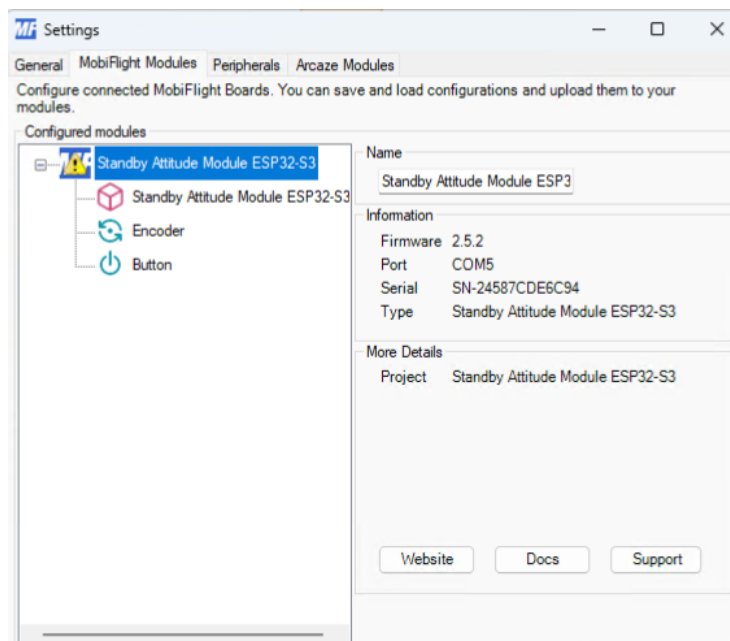
E.g., `python -m esptool --chip esp32s3 --port=COM5 --baud 460800 --before default_reset --after hard_reset write_flash -z --flash_mode dio --flash_freq 80m --flash_size 16MB 0x00 .\StandbyAttitudeModule_esp32s3_2_5_2_merged.bin`

- Once the firmware flashing is completed, reconnect the ESP32 S3 board to your PC using the USB-to-UART port (encircled in red below) and restart Mobiflight.



6. Uploading the Mobiflight profiles

- Download the Mobiflight profiles and save them to your local PC. The profiles can be downloaded from: <https://github.com/savesabana101/Mobiflight-StandbyAttitudeModule-ESP32-S3/tree/StandbyAttitudeModule-release/profiles>. The files are [Standby Attitude Module ESP32-S3.mfmc](#) and [Standby Attitude Module XPlane.mcc](#).
- Start Mobiflight, open “Mobiflight Modules” and upload the Standby Attitude Module ESP32-S3.mfmc file to the “Standby Attitude Module ESP32-S3” device (see below):



- Now, click “Upload config” and wait for it to finish uploading. You will get an “Upload finished with error” pop-up, but this is fine. Just hit “OK”.

Upload configuration X

Upload finished with error.

OK

- Now close the Mobiflight Settings pop-up and you will get the error pop-out below, but this is also ok. Just hit “OK”.

Hint

There are still changes not uploaded to your modules. You will lose these changes if you close the form. Do you really want to continue?

OK

Cancel

- From the Mobiflight main screen, go to Files -> Open, and open the downloaded Standby Attitude Module XPlane.mcc file. You should get the settings for X Plane as shown below:

Standby Attitude Module XPlane.mcc - Mobiflight Connector BETA (10.3.0.1)

File Extras Help

Save Run Test Stop AutoRun Mobiflight Modules Donate Discord HubHop YouTube Exit

Output config Input config

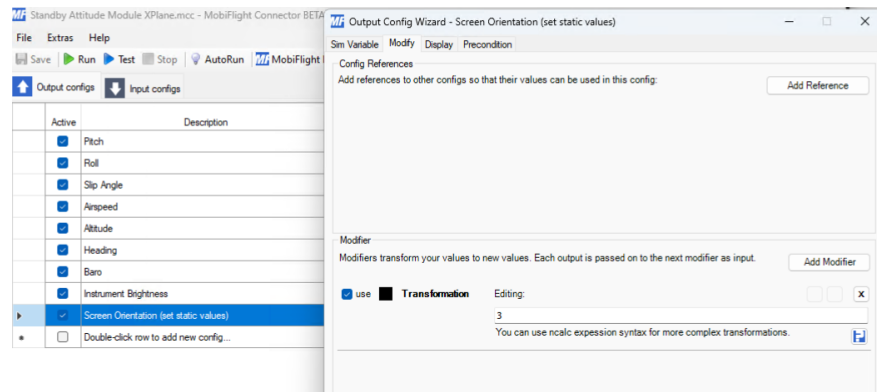
Active	Description	Module	Output	Type	Right Sm Value	Output Value	Edit
<input checked="" type="checkbox"/>	Pitch	Standby Attitude Module ESP32-S3	Standby Attitude Module ESP32-S3				...
<input checked="" type="checkbox"/>	Roll	Standby Attitude Module ESP32-S3	Standby Attitude Module ESP32-S3				...
<input checked="" type="checkbox"/>	Slip Angle	Standby Attitude Module ESP32-S3	Standby Attitude Module ESP32-S3				...
<input checked="" type="checkbox"/>	Airspeed	Standby Attitude Module ESP32-S3	Standby Attitude Module ESP32-S3				...
<input checked="" type="checkbox"/>	Altitude	Standby Attitude Module ESP32-S3	Standby Attitude Module ESP32-S3				...
<input checked="" type="checkbox"/>	Heading	Standby Attitude Module ESP32-S3	Standby Attitude Module ESP32-S3				...
<input checked="" type="checkbox"/>	Baro	Standby Attitude Module ESP32-S3	Standby Attitude Module ESP32-S3				...
<input checked="" type="checkbox"/>	Instrument Brightness	Standby Attitude Module ESP32-S3	Standby Attitude Module ESP32-S3				...
<input checked="" type="checkbox"/>	Screen Orientation (set static values)	Standby Attitude Module ESP32-S3	Standby Attitude Module ESP32-S3				...
<input type="checkbox"/>	Double-click row to add new config...						...

Important Note: I only have X Plane, so I have not prepared configurations for MSFS2020, but the X Plane datarefs can be replaced by MSFS 2020 variables that correspond to them. Please try it!

- Now, start your flight simulator, start Mobiflight and have fun!!!

7. Important Notes and Future Directions:

- You can use the other open pins in the ESP32 S3 for buttons, encoders, etc. Just make sure not to use pins 19, 20, 35, 36, and 37 (they have some limitations).
- If you click on the rotary encoder switch, it will set the barometric pressure setting to the standard “29.92” inHg.
- Turn the rotary encoder left or right to adjust the barometric pressure setting.
- To change the LCD screen orientation, edit the “Screen Orientation (set static values)” config -> Modify – Transformation, and change the value from “3” to “1”. This will flip the screen (see below)



- These are the following improvements I plan in the future:
 - Implement the airspeed limitations (V-speeds) and the vertical climb trend
 - 8-bit parallel interfacing between the ESP32 S3 and the LCD screen
 - Maybe a fancier number scrolling like in the real MD302 or Garmin G5 device?