Speedybee F405 WING APP

User Manual V1.1

Speedybee APP

Installation guide

Facebook

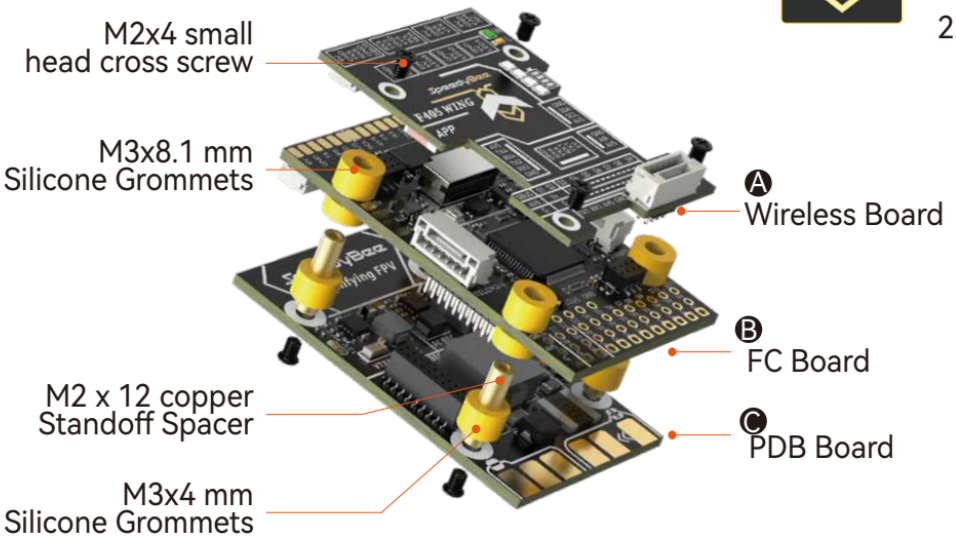
Specification overview

Product Name	SpeedyBee F405 WING APP
TOP Board	SpeedyBee F405 WING Wireless Board
FC Board	SpeedyBee F405 WING FC Board
PDB Board	SpeedyBee F405 WING PDB Board
USB extender	SpeedyBee F405 WING USB extender
Wireless configuration	Supported
LED strip controller	Supported
Battery level indicator	Supported
FC Firmware	INAV / Ardupilot
Power Input	2-6S LiPo
Dimension	52（L） x 32（W） x 19（H） mm
Weight	35g（with USB extender）

Part1 -OverView

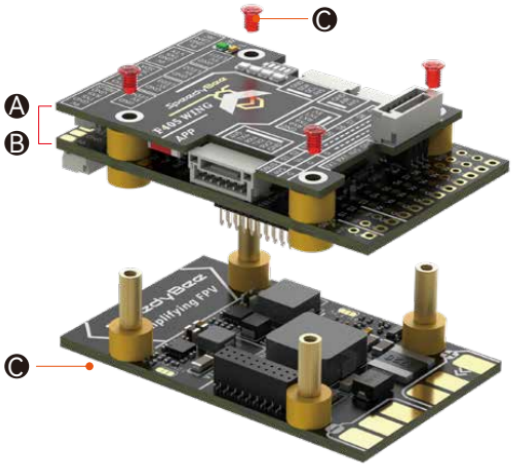
Assembly Instructions

The direction of the arrow is the machine head



Assembly order

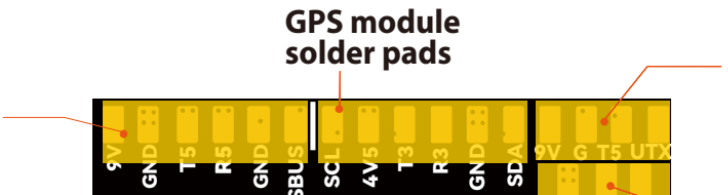
1. Align the pin headers between boards Ⓐ and Ⓑ then press the two boards together tightly.
2. Install both boards Ⓐ and Ⓑ onto board Ⓒ , and tighten the screws.



Part2-hardware description

Layout

FC Board Front



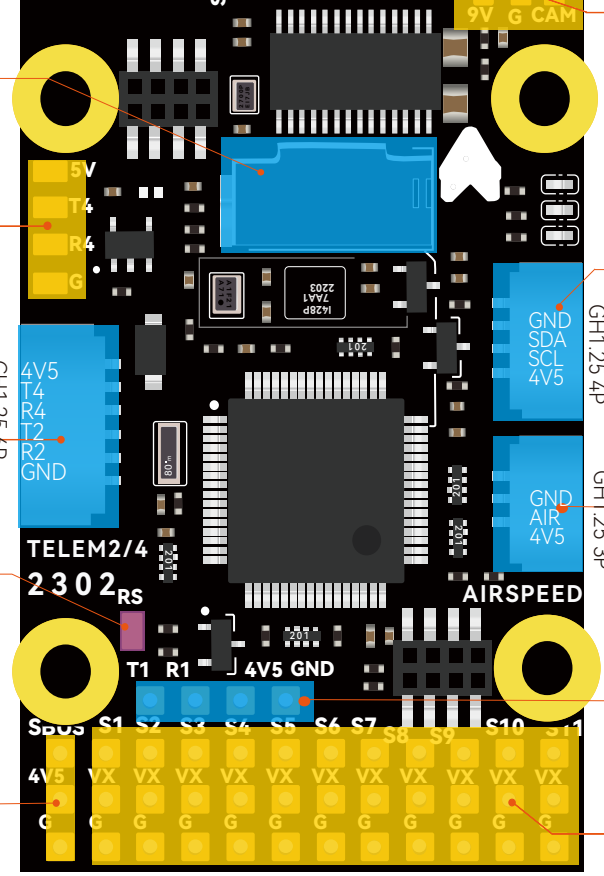
MicroSD card slot

Telemetry module solder pads
R4 and T4 signals are the same asthe Telemetry module connector

Telemetry module connector

RSSI solder pads
Analog RSSI signal input, supports up to 3.3V

SBUS input pin headers
With inversion circuit, connected to RX2



Analog camera solder pads
The default power supply is 9V. If the camera can only be powered by 5V, please connect the power supply to the 5V solder pad.

Digital airspeed sensor connector

Analog airspeed sensor connector
Built-in voltage divider circuit, supports up to 6.6V.

ELRS receiver pin headers
Use these pin headers to connect the ELRS/TBS receiver.

Motor and servo output pin headers
PWM1-11

FC Board Back

Analog VTX connector

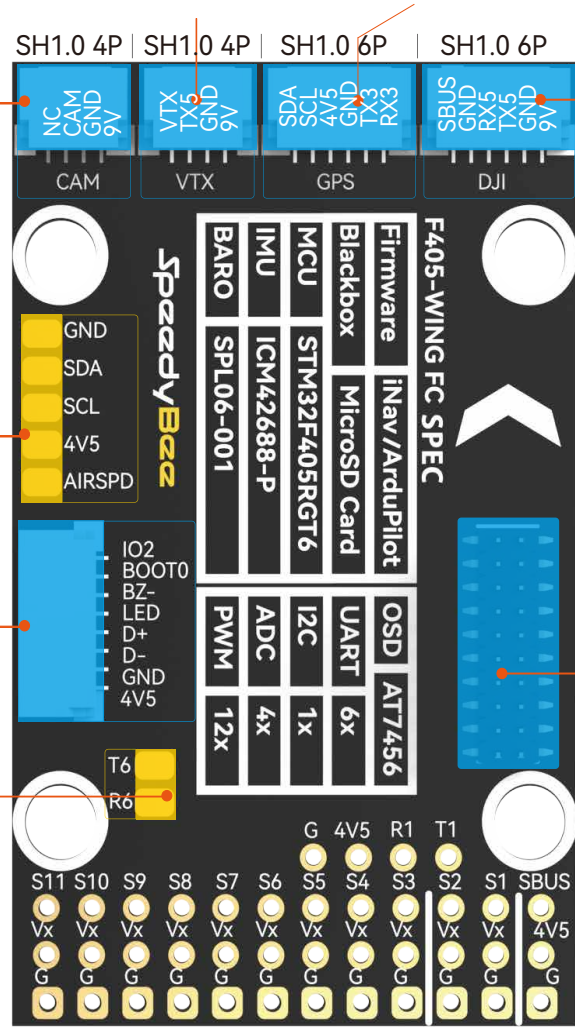
GPS module connector

Analog camera connector

Airspeed sensor solder pads
The signals are the same as the airspeed sensor connector.

USB extender connector

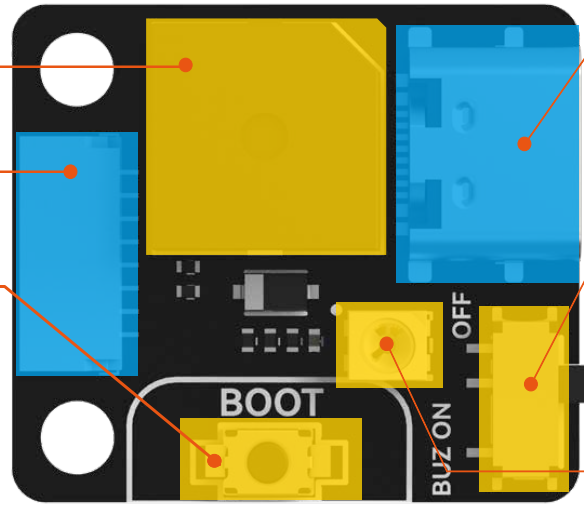
UART6 solder pads



Digital VTX connector

Connect to the PDB board

USB extender front



Buzzer

FC board connector

BOOT button

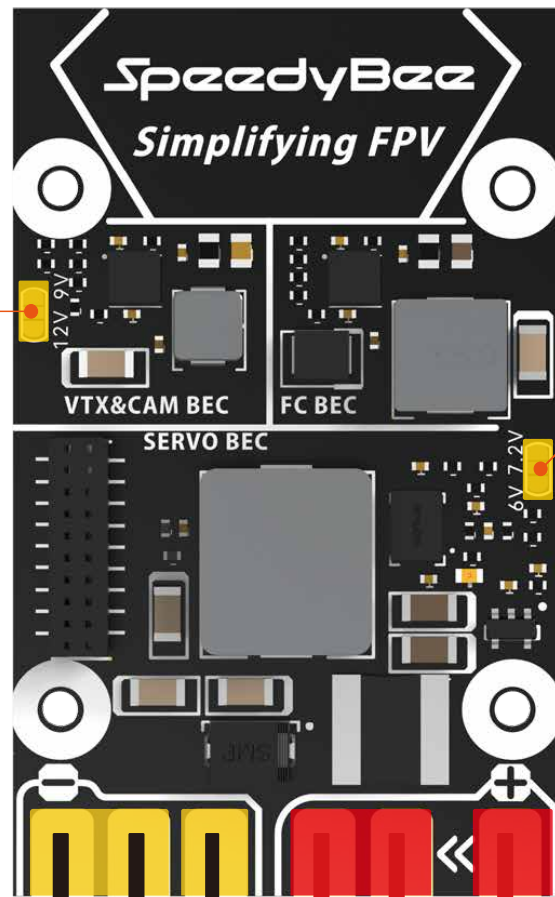
Press and hold the BOOT button while powering on to enter DFU mode for firmware flashing.When the FC is powered on and in operating state, the BOOT button is also used for controlling other functions of the wireless board.

USB TYPE-C Port

Buzzer mute switch

FC RGB status indicator

PDB board Front



VTX BEC voltage selection jumper

- Default 9V output
- 12V output
- 5V output

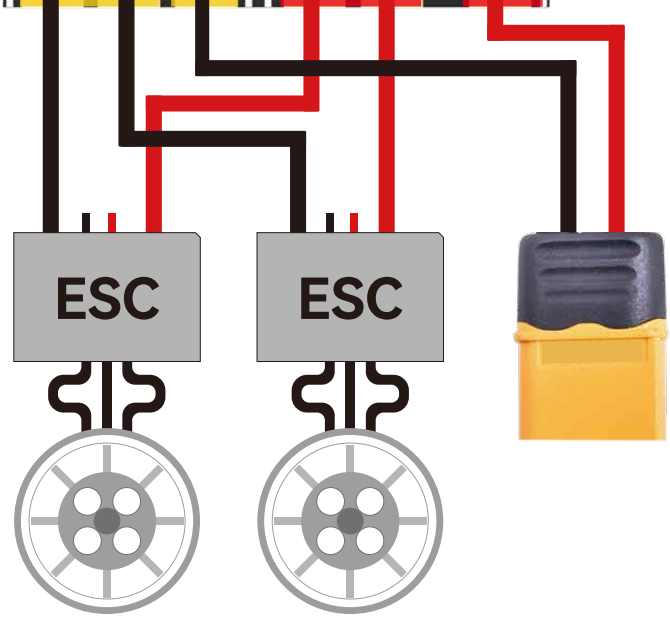
Note: TX800 requires 5V power supply.

Connect as shown in the diagram

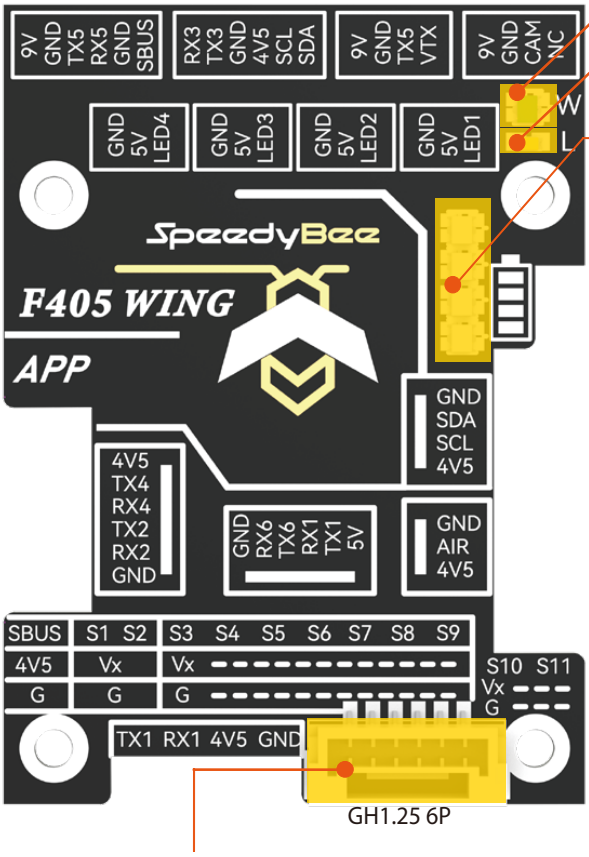
Servo BEC voltage selection jumper

- Default 5V output
- 7.2V output
- 6V output

DO NOT connect ESC BEC output to Vx pad (Red wire in middle of connector).



Wireless board Front



Reserved connector
Note: disconnect the UART6 jumper on the back of the wireless board to use TX6 RX6. TX1 RX1 shares the same signal as the ELRS/TBS receiver pin header.

- Wireless status indicator (RGB LED)
- LED mode indicator(orange LED)
- Battery LED: 4-level battery level indicator.

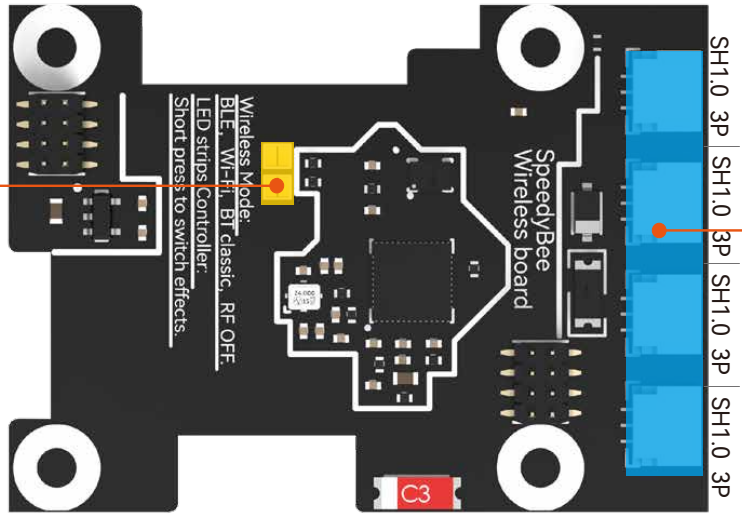
Wireless status indicator (RGB LED)
The wireless board has built-in telemetry function , which includes 4 RF modes: Bluetooth BLE, Wi-Fi, classic Bluetooth SPP, and wireless off mode.
Green slow flashing :BLE not connected
Green solid:BLE connected successfully
White slow flashing :Wi-Fi not connected
White Solid:Wi-Fi connected successfully
Blue slow flashing:Classic Bluetooth SPP not connected
Blue Solid:Classic Bluetooth SPP not connected
RGB LED off: Wireless module turned off

Pressing the BOOT button for 6 seconds can switch between the 4 wireless modes. When the yellow LED flashes rapidly and the board automatically restarts, the switch is successful.

LED mode indicator(orange LED):
Orange light always on:Solid orange LED means the 4 sets of LED strips are in SB_LED mode, controlled by the wireless chip.
A short press of the BOOT button cycles through different display effects when the FC is operating normally.

Orange light is off - Off orange LED indicates FC_LED mode, where the FC controls the 4 sets of LED strips directly.
Press and hold the BOOT button for 3 seconds to switch between FC_LED mode and SB_LED mode.

UART6 jumper



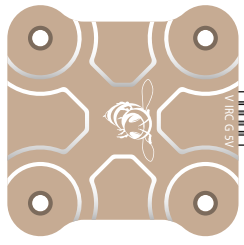
LED strip connector
The maximum power supply for the LED connector is about 5.2V 1.3A. When the power exceeds the limit, the resettable fuse will cut off the power supply. Please reduce the number of light beads appropriately when the power exceeds the limit. Taking SpeedyBee Programable 2812 Arm LED strips as an example, a total of 17 LED strips can be installed, including approximately 68 light beads.

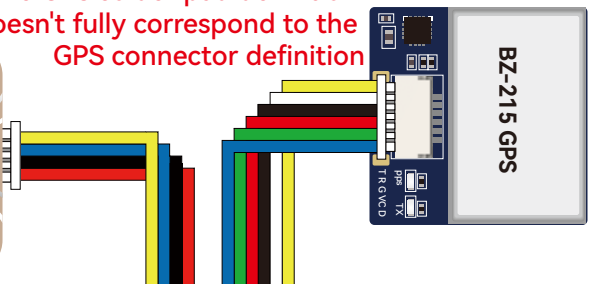
Wiring Diagram

Method 1: Plug and play

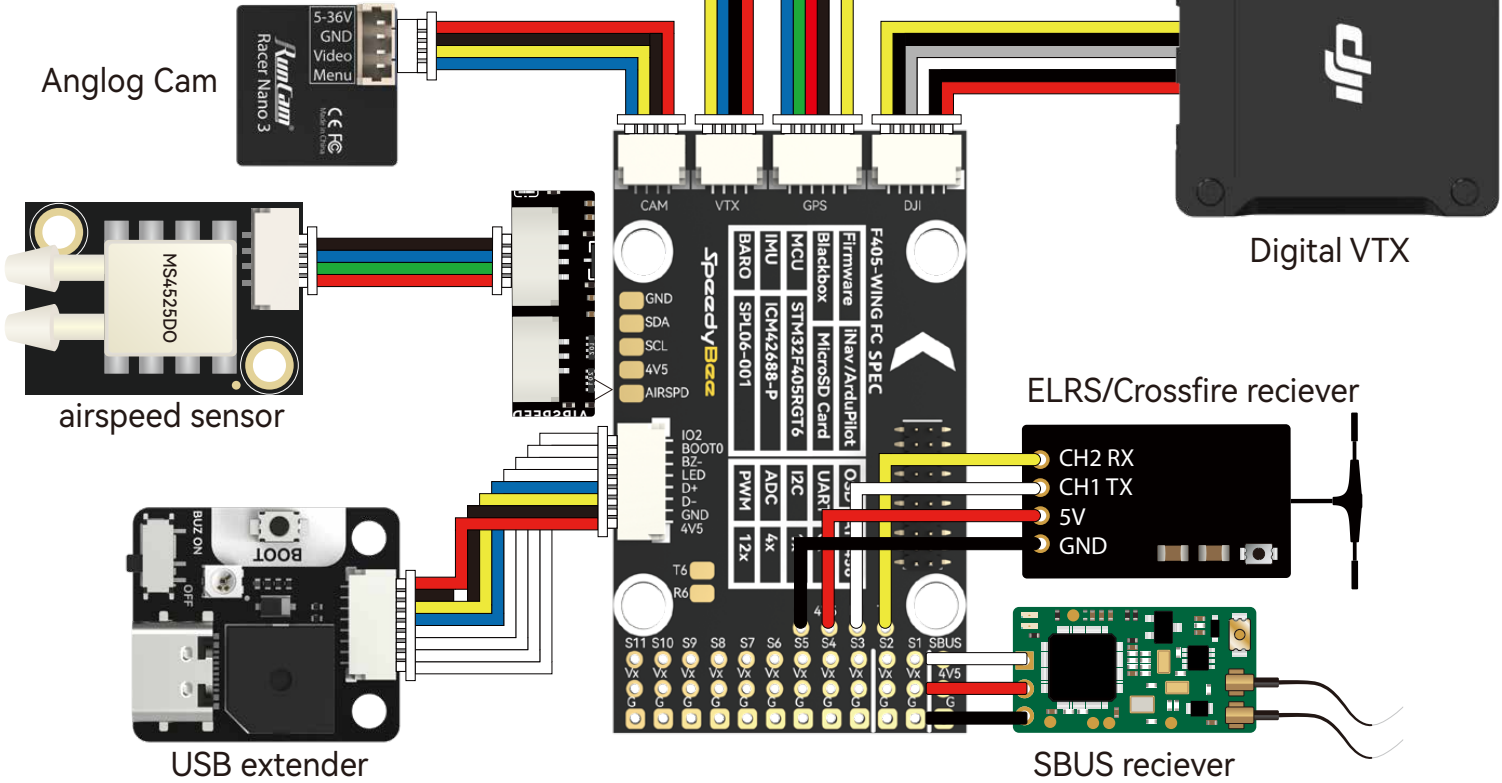
The GPS solder pad definition doesn't fully correspond to the GPS connector definition

Analog VTX

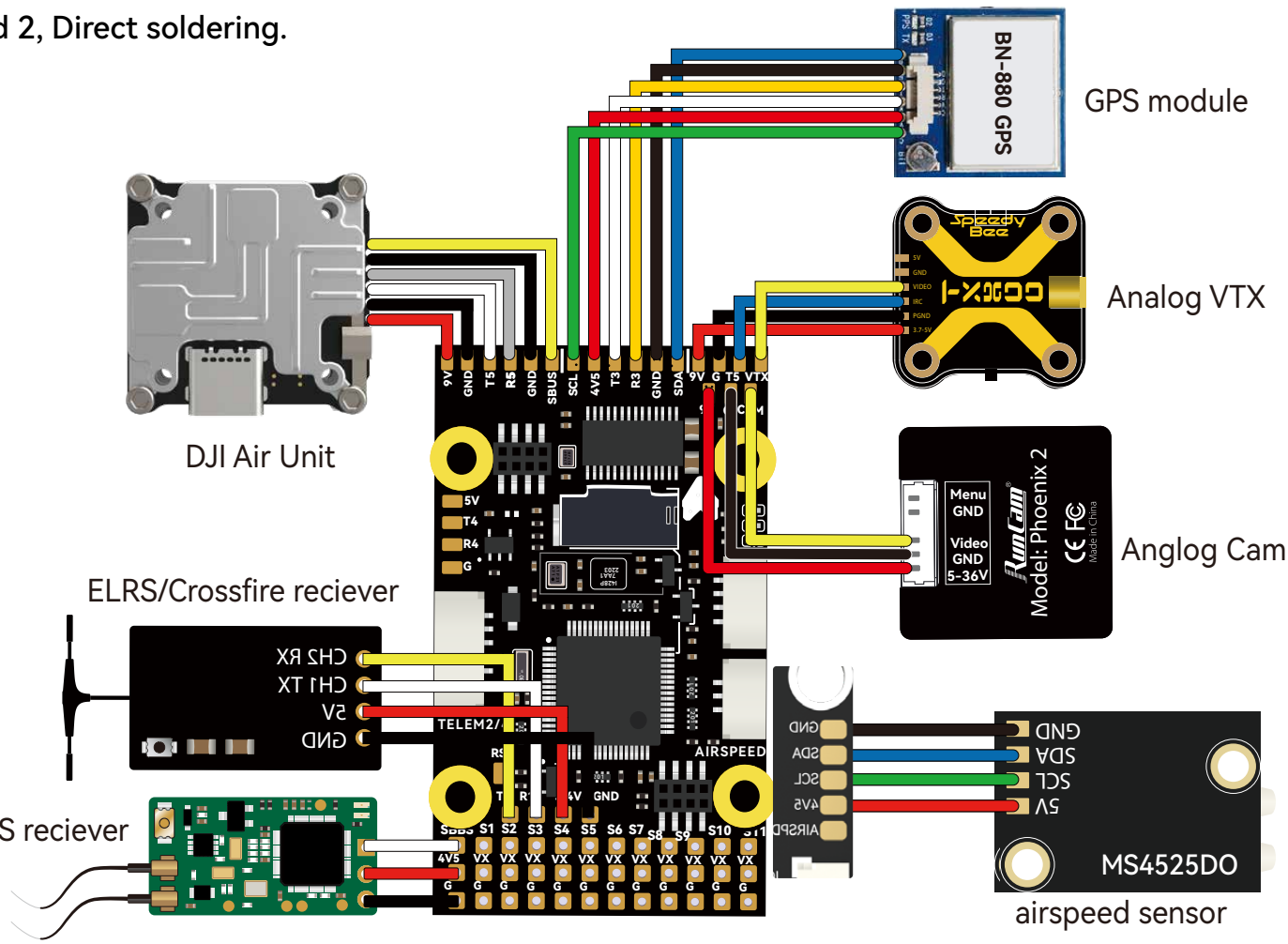




GPS module

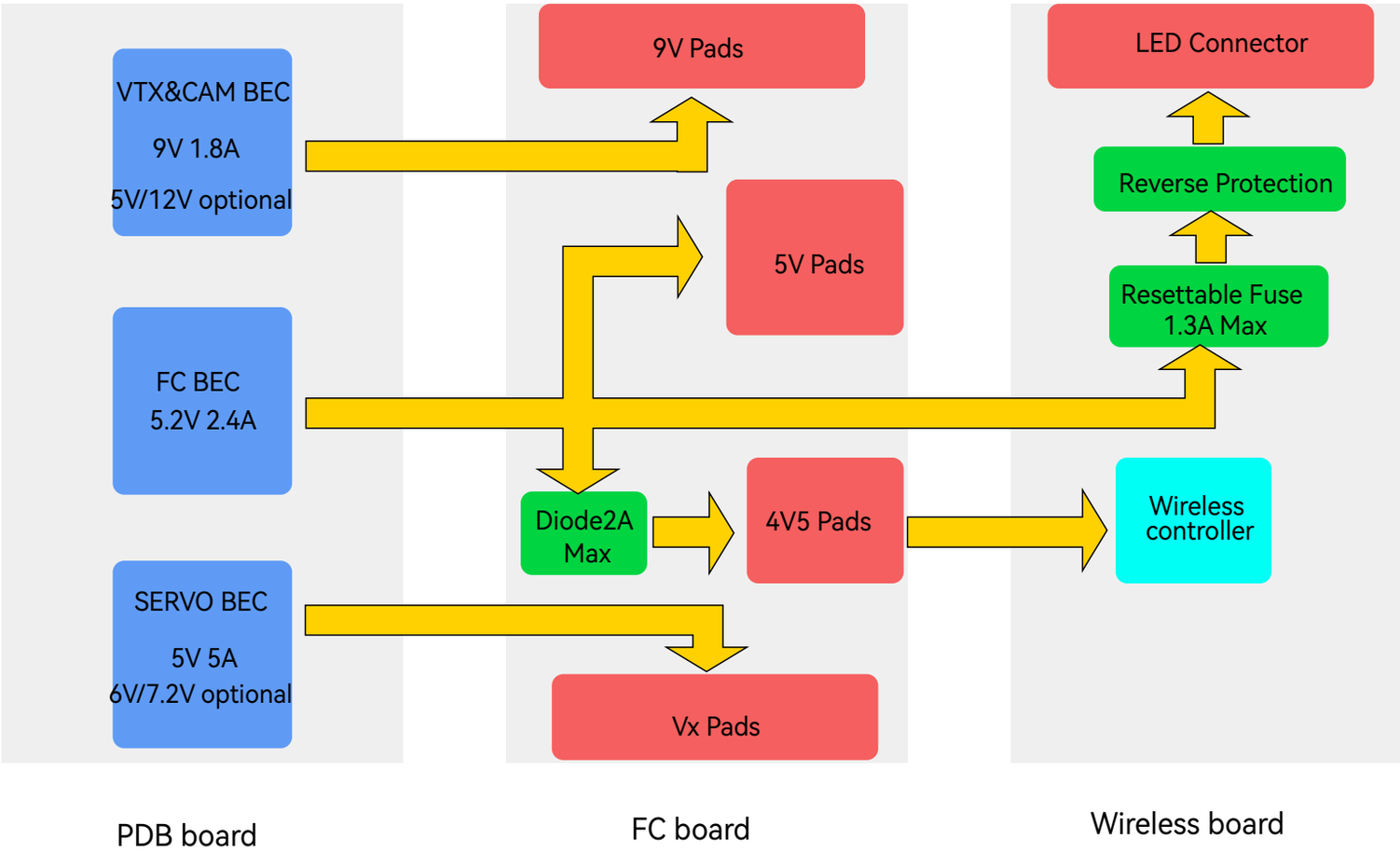


Method 2, Direct soldering.



Power supply

The power distribution logic for the F405 WING APP is as follows:



1、The 9V pad uses a VTX&CAM BEC for power supply. When the VTX&CAM BEC switches to another voltage through the pad jumper, the 9V pad will output the corresponding voltage.

2、The Vx pin headers use a Servo BEC for power supply. When the Servo BEC switches to another voltage through the pad jumper, the Vx pin headers will output the corresponding voltage.

Note: If your ESC supports BEC output, do not connect the ESC BEC red wire to the Vx pin headers, as this may burn the ESC or Servo BEC.

3、The default voltage for the FC BEC is 5.2V, with power output divided into three directions:

- The first path directly outputs to the 5V pad.
- The second path outputs to the onboard chip and 4V5 pad through a diode.
- The third path outputs to the LED connector through a self-recovering fuse and reverse connection protection circuit.

Please note that the FC BEC can provide a continuous current of 2.4-2.5A and a peak current of 3A. The onboard chip requires less than 1A of power, GPS and receivers generally require less than 0.1A, and the wireless controller requires 0.1A.If the LED connector uses a maximum of 1.3A, the 5V pad will have no remaining capacity.If the LED connector is not used, the 5V pad will have a 1.3A surplus.

The limit for the LED connector power supply is approximately 68 pieces of SpeedyBee 5050 LED strip beads. Do not exceed this limit.To test if other brands of LED strips meet the power requirements, you can take the following steps:

- After connecting the LED strip, let the flight controller be powered and idle for 10 minutes. Observe if the color of the LED strip suddenly dims and feel the wireless board with your hand. If it feels very hot, the power supply is insufficient, and you need to reduce the number of LED beads.
- You can also use a multimeter to test the voltage of the 5V pad or the LED strip power pad. If the voltage is below 5V, it indicates that the power supply is insufficient, and you need to reduce the number of LED beads.

Part3-Firmware upgrade and APP connection

Firmware upgrade

SpeedyBee F405 WING APP not supporting wireless firmware flashing, please update the firmware on a computer. Follow these steps:

①Press and hold the BOOT button , and connect the FC to the computer via USB cable.

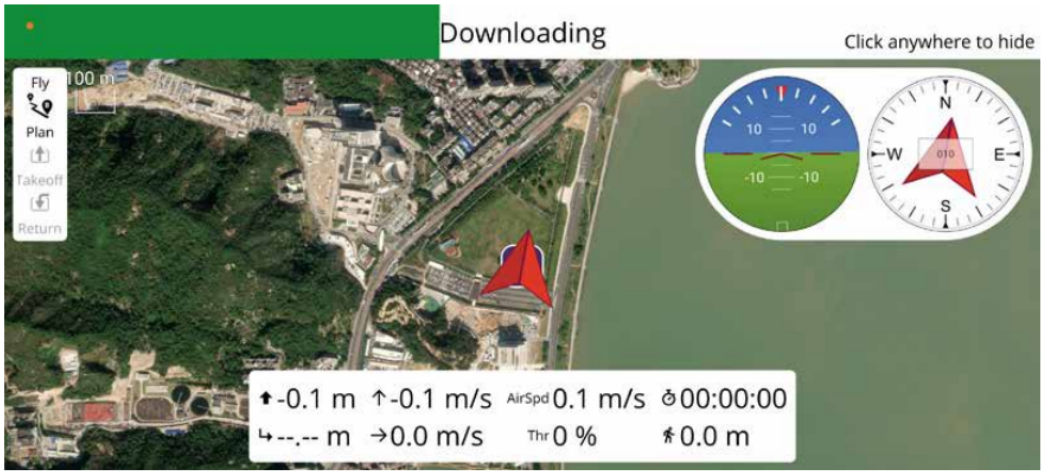
②Open the INAV Configurator on your computer, go to the "Firmware Flasher " page, select the flight controller target as "SPEEDYBEEF405WING", and then flash the firmware.

③To flash Ardupilot firmware, follow the same steps as above, select "Load Firmware [local]", and then flash the firmware.

APP connection

Connecting Ardupilot firmware to QGroundControl app.

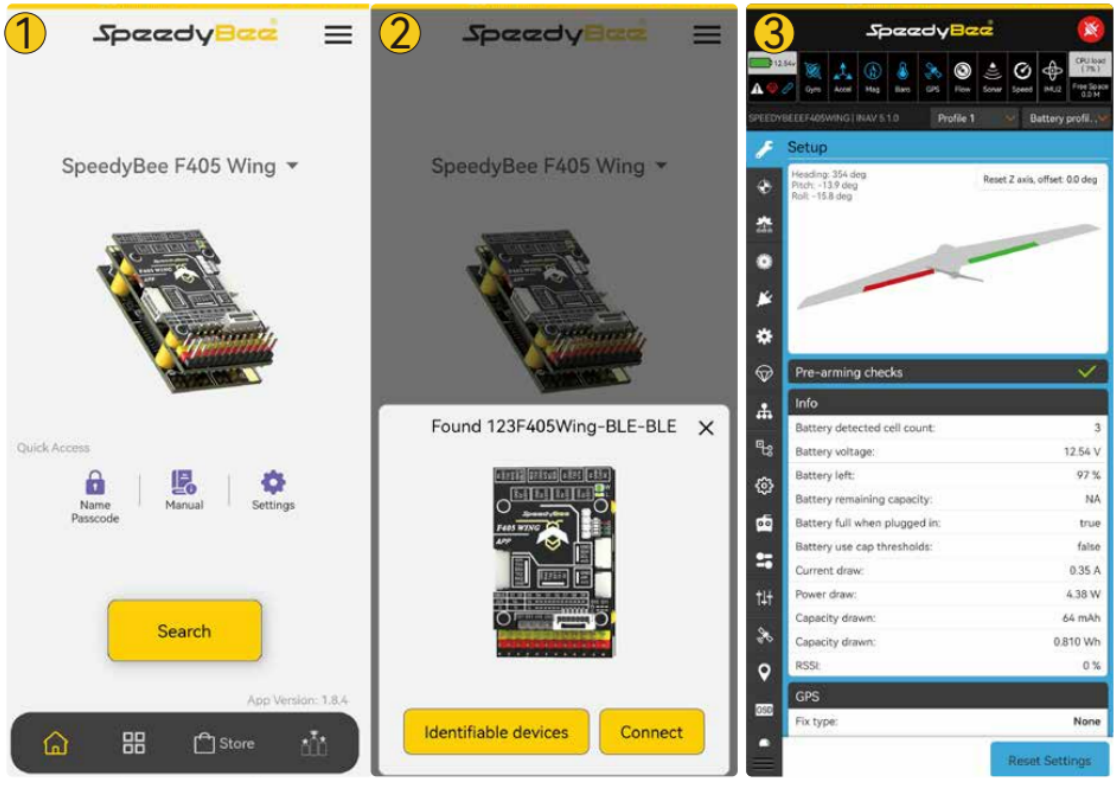
Check the color of the wireless status indicator. If it's not flashing white, press the BOOT button for 6 seconds to switch to white. Then connect to the "Speedybee F405Wing" Wi-Fi and open QGroundControl, it will automatically connect.



APP Connection

Connecting INAV Firmware to Speedybee APP.

Check the color of the wireless status indicator .
If it's slow flashing green, open the SpeedyBee app and follow the steps to connect to the corresponding product.



- Suitable for different flight control firmware and Configurator. The supported apps are listed in the following table. It is recommended to use Bluetooth BLE mode for iNav and WiFi mode for Ardupilot.

	Bluetooth BLE	WiFi(UDP)	Classic Bluetooth SPP
RF Output Power	9dBm	19.5dBm	9dBm
Support Firmware	INAV	INAV/ArduPilot	ArduPilot
Support APP	SpeedyBee APP (IOS& Android)	SpeedyBee APP (IOS& Android) MissionPlanner Android QGroundControl (Android&IOS)	QGroundControl (Android)
Support PC Configurator	iNav Configurator	MissionPlanner QGroundControl	MissionPlanner QGroundControl
Range	10~20m	3~10m	10~20m

Part4-Specifications

SpeedyBee F405 WING FC board

MCU	STM32F405,168MHz,1MB Flash
IMU(Gyro&Accelerometer)	ICM-42688-P
Barometer	SPL006-001
OSD Chip	AT7456E
Blackbox	MicroSD Card Slot
UART	6 sets(USART1, USART2, USART3, UART4, UART5, UART6 (Dedicated for Wireless board Telemetry connection))
I2C	1x Used for magnetometer, digital airspeed sensor
ADC	4x (VBAT, Current, RSSI, Analog AirSpeed)
PWM	12x (11+1“LED”pad)
ELRS/CRSF receiver	Supported,connected to UART1

SBUS	Built in inverter for SBUS input (UART2-RX)
LED	3x LEDs for FC STATUS (Blue, Green) and 3.3V indicator(Red) 1x RGB
RSSI	Supported,Named as RS .
Supported FC Firmware	INAV:SpeedyBeeF405WING(default)ArduPilot: SpeedyBeeF405WING

SpeedyBee F405 WING PDB board

Input voltage range	7~26V (2~6S LiPo)
Battery Voltage Sensor	Connect to FC board VBAT, 1K:10K (Scale 1100 in iNav, BATT_VOLT_MULT 11.0 in ArduPilot)
Battery Current Sensor	90A continuous, 215A peak Connect to FC board Current (Scale 195 in iNav, 50 A/V in ArduPilot)
TVS Protective diode	Yes
FC BEC output	Output 5.2V +/- 0.1V DC Continuous current 2.4 Amps, 3A Peak Designed for FC, Receiver, GPS module, AirSpeed module, Telemetry module, WS2812 LED_Strip
VTX BEC output Output	Output 9V +/- 0.1V DC Continuous current 1.8 Amps, 2.3A Peak Voltage adjustable, 9V Default, 12V or 5V via jumper Designed for Analog Video Transmitter,Digital Video Transmitter, Camera.
Servo BEC output	Output 4.9V +/- 0.1V DC Continuous current 4.5 Amps, 5.5A Peak Voltage adjustable, 4.9V Default, 6V or 7.2V via jumper Designed for Servos.

SpeedyBee F405 WING Wireless board

Wireless Configuration (long press BOOT button for 6 seconds to switch modes)	BLE mode, connect to Speedybee APP
	Wi-Fi mode, connect to QGroundControl APP, Speedybee APP, MissionPlanner, etc.
	Classic Bluetooth SPP mode, connect to QGroundControl APP, MissionPlanner
LED strip controller (short press BOOT button to switch effects, long press 3 seconds to switch modes)	4x WS2812 LED strip connectors, adjustable colors and flashing modes
	Max 5.2V 1.3A, supports around 68pcs 5050 WS2812 LED beads
On-board battery level indicator	4x RGB indicator LED for battery level display by number of lights

Part5-pin mapping

INAV mapping

UART			
USB		USB	
TX1 RX1	5V tolerant I/O	UART1	ELRS/TBS receiver
TX2 RX2 SBUS	5V tolerant I/O	SBUS pad	SBUS receiver, SBUS pad = RX2 with inverter
		TX2	SmartPort Telemetry,enable Softserial_Tx2
TX3 RX3	5V tolerant I/O	UART3	GPS
TX4 RX4	5V tolerant I/O	UART4	USER
TX5 RX5	5V tolerant I/O	UART5	DJI OSD/VTX
TX6 RX6	5V tolerant I/O	UART6	Onboard wireless controller

PWM		TIMER	INAV Plane	INAV MultiRotor
S1	5V tolerant I/O	TIM4_CH2	Motor	Motor
S2	5V tolerant I/O	TIM4_CH1	Motor	Motor
S3	5V tolerant I/O	TIM3_CH3	Servo	Motor
S4	5V tolerant I/O	TIM3_CH4	Servo	Motor
S5	5V tolerant I/O	TIM8_CH3	Servo	Motor
S6	5V tolerant I/O	TIM8_CH4	Servo	Motor
S7	5V tolerant I/O	TIM8_CH2N	Servo	Servo
S8	5V tolerant I/O	TIM2_CH1	Servo	Servo
S9	5V tolerant I/O	TIM2_CH3	Servo	Servo
S10	5V tolerant I/O	TIM2_CH4	Servo	Servo
S11	5V tolerant I/O	TIM12_CH2	Servo	Servo
LED	5V tolerant I/O	TIM1_CH1	WS2812LED	WS2812LED

ADC			
VBAT	1K:10K divider builtin 0~30V	VBAT ADC ADC_CHANNEL_1	voltage scale 1100
CURR	0~3.3V	CURRENT_METER ADC ADC_CHANNEL_2	Current scale 195
AIRSPD	10K:10K divider builtin 0~6.6V	AIRSPEED ADC ADC_CHANNEL_3	Analog Airspeed
RSSI	0~3.3V	RSSI ADC ADC_CHANNEL_4	Analog RSSI

I2C			
I2C1	5V tolerant I/O	onboard Barometer	SPL06-001
		Compass	QMC5883 / HMC5883 / MAG3110 / LIS3MDL
		Digital Airspeed sensor	MS4525
		OLED	0.96″

⬢ ArduPilot mapping

USB	USB	SERIAL0	Console
TX1 RX1	USART1(With DMA)	SERIAL1	ELRS/TBS receiver Serial RC input
TX2 RX2 SBUS	SBUS pad	BRD_ALT_CONFIG 0 Default	SBUS receiver, SBUS pad = RX2 with inverter
	RX2		IBUS/DSM/PPM
	USART2	BRD_ALT_CONFIG 1 SERIAL2	USER
TX3 RX3	USART3	SERIAL3	GPS1
TX4 RX4	UART4	SERIAL4	USER
TX5 RX5	UART5	SERIAL5	DJI OSD/VTX
TX6 RX6	USART6	SERIAL6	Telem1

***If sending highspeed serial data (eg. 921600 baud) to the board, use USART1(Serial1).**

PWM		TIMER		
S1	PWM1 GPIO50	TIM4_CH2	PWM/DShot(DMA)	Group1
S2	PWM2 GPIO51	TIM4_CH1	PWM/DShot(DMA)	
S3	PWM3 GPIO52	TIM3_CH3	PWM/DShot(DMA)	Group2
S4	PWM4 GPIO53	TIM3_CH4	PWM/DShot(DMA)	
S5	PWM5 GPIO54	TIM8_CH3	PWM/DShot(DMA)	Group3
S6	PWM6 GPIO55	TIM8_CH4	PWM/DShot(DMA)	
S7	PWM7 GPIO56	TIM8_CH2N	PWM/DShot(DMA)	
S8	PWM8 GPIO57	TIM2_CH1	PWM/DShot(DMA)	Group4
S9	PWM9 GPIO58	TIM2_CH3	PWM/DShot(DMA)	
S10	PWM10 GPIO59	TIM2_CH4	PWM/DShot(DMA)	
S11	PWM11 GPIO60	TIM1_CH3N	PWM/DShot(DMA)	Group5
LED	PWM12 GPIO61	TIM1_CH1	PWM/DShot(DMA)	

***All motor/servo outputs are DShot and PWM capable. However, mixing DShot and normal PWM operation for outputs is restricted into groups, ie. enabling DShot for an output in a group requires that ALL outputs in that group be configured and used as DShot, rather than PWM outputs. LED, which corresponds to PWM12, is set as the default output for NeoPixel1. Therefore, if you need to use PWM11 as an output, you need to disable the NeoPixel1 function on PWM12.**

ADC				
VBAT	1K:10K divider builtin 0~30V	Battery voltage	BATT_VOLT_PIN	10
			BATT_VOLT_MULT	11.05
CURR	0~3.3V	Current sense	BATT_CURR_PIN	11
			BATT_AMP_PERVLT	50
AIRSPD	10K:10K divider builtin 0~6.6V	Analog Airspeed	ARSPD_ANA_PIN	15
			ARSPD_TYPE	2
RSSI	0~3.3V	Analog RSSI	RSSI_ANA_PIN	14
			RSSI_TYPE	2

I2C				
I2C1	5V tolerant I/O	onboard Barometer	SPL06-001	
		Compass	COMPASS_AUTODEC	
		Digital Airspeed sensor	ARSPD_BUS	0
		MS4525	ARSPD_TYPE	1
		ASP5033	ARSPD_TYPE	15

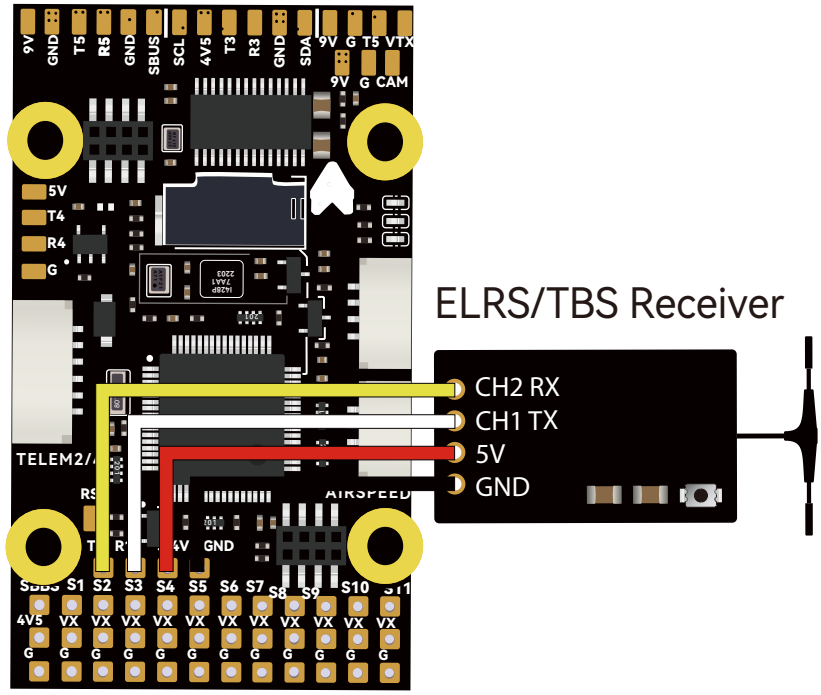
Part6-Standard settings

Receiver Settings

ELRS/TBS Receiver

Hardware Connection：

Solder the receiver using a 4-pin Dupont single-head cable, then plug the Dupont cable into the corresponding pin header.



1 INAV Settings

Detectable with default settings.

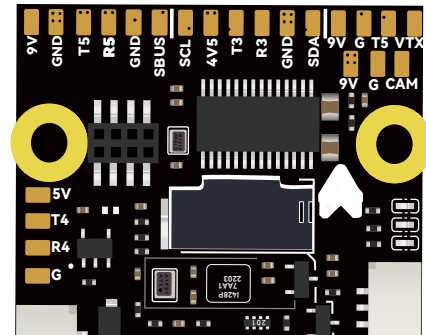
2 ArduPilot Settings

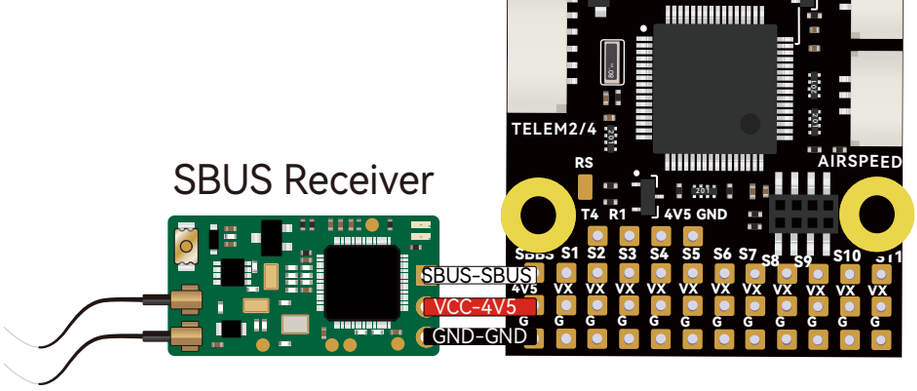
Detectable with default settings.

SBUS Receiver

Hardware Connection:

Use a 3-pin Dupont male-to-male cable and plug it into the SBUS input pin header.





❶ INAV Settings

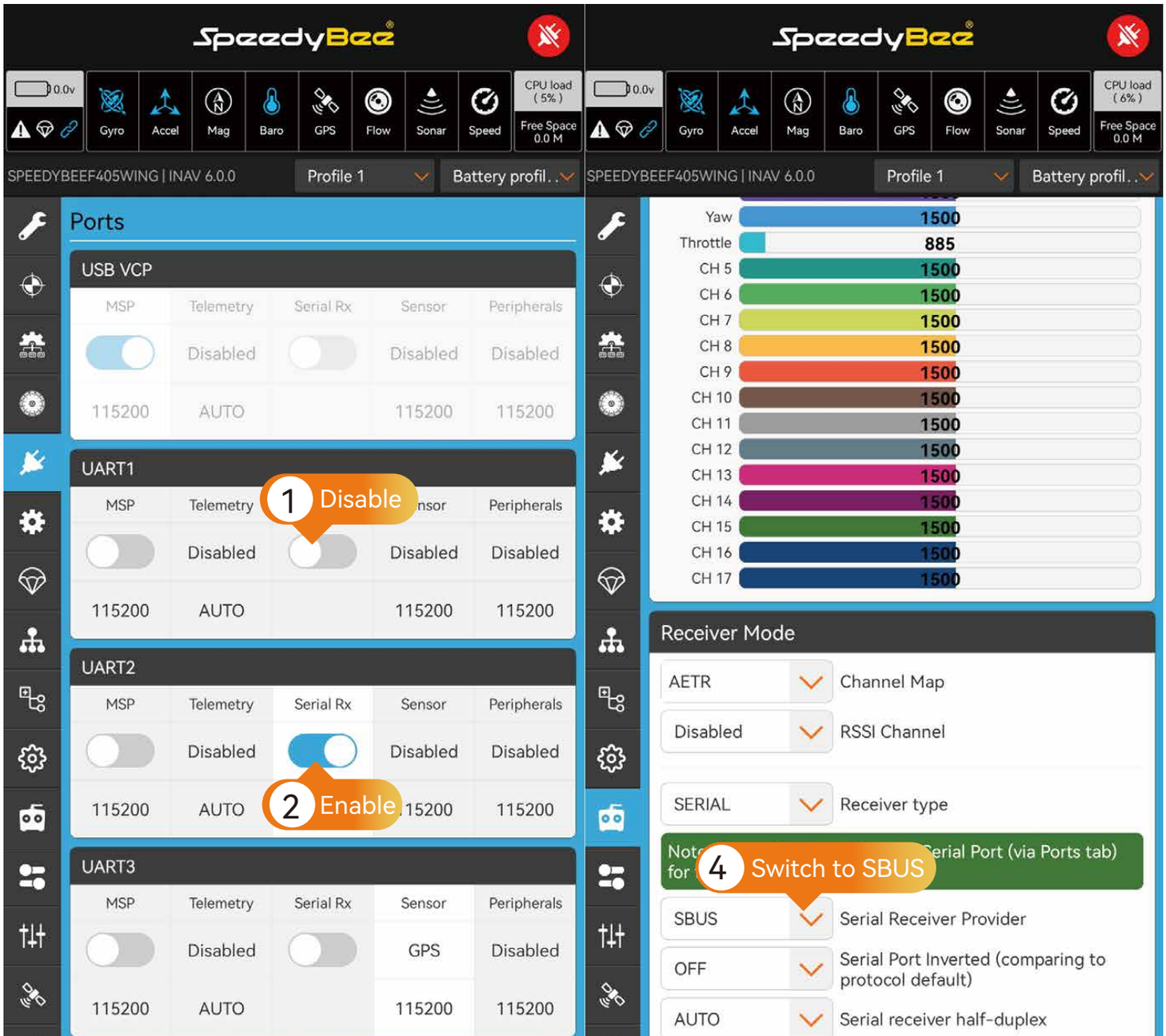
①In the Ports tab, disable Serial RX for UART1, enable Serial RX for UART2, then save and reboot.

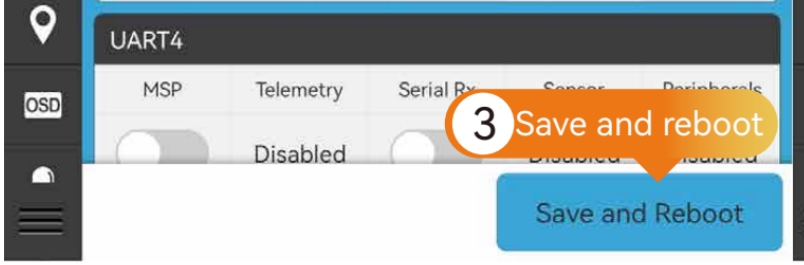
②Switch the CRSF protocol to SBUS in the Receiver tab, then save and reboot.

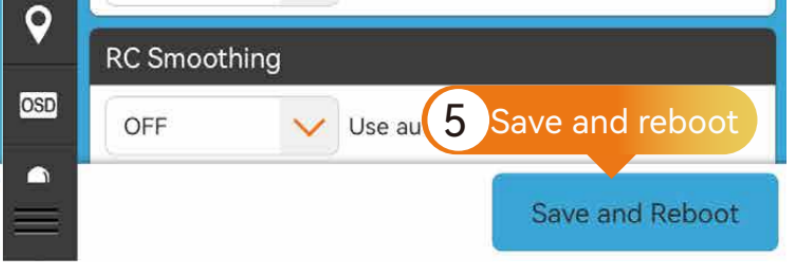
❷ ArduPilot Settings

Detectable with default settings.

INAV Settings





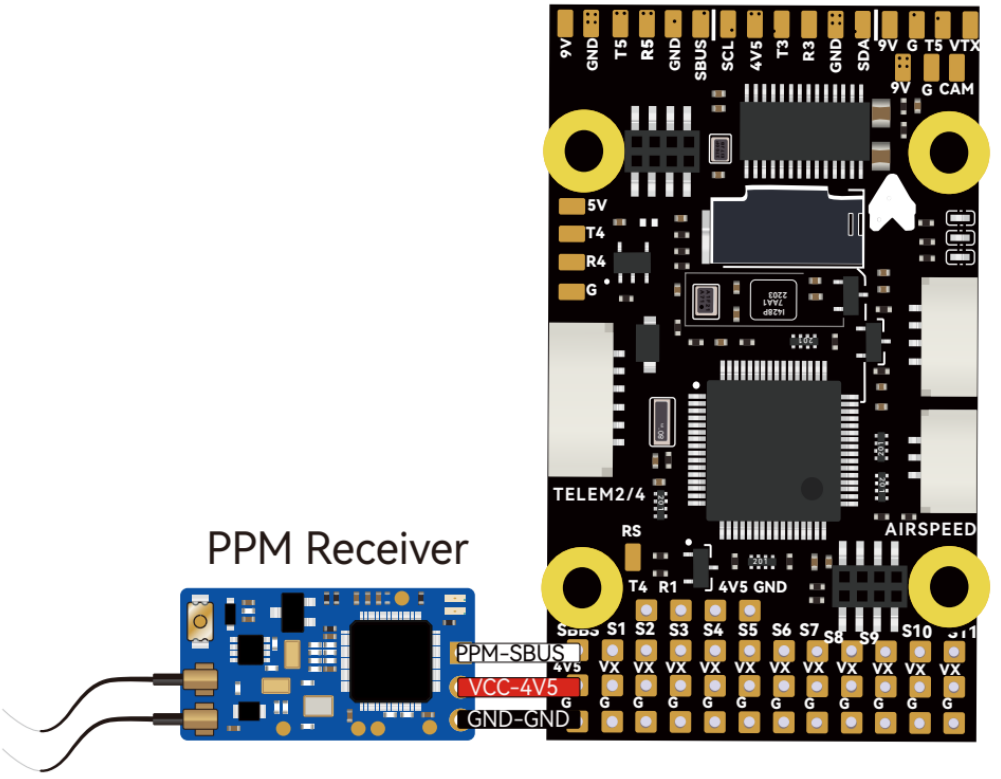


PPM Receiver:

Hardware Connection:

Use a 3-pin Dupont male-to-male cable and plug it into the SBUS input pin header.

PPM receivers only supported in INAV 3.x and below.



❶ INAV Settings

INAV does not support

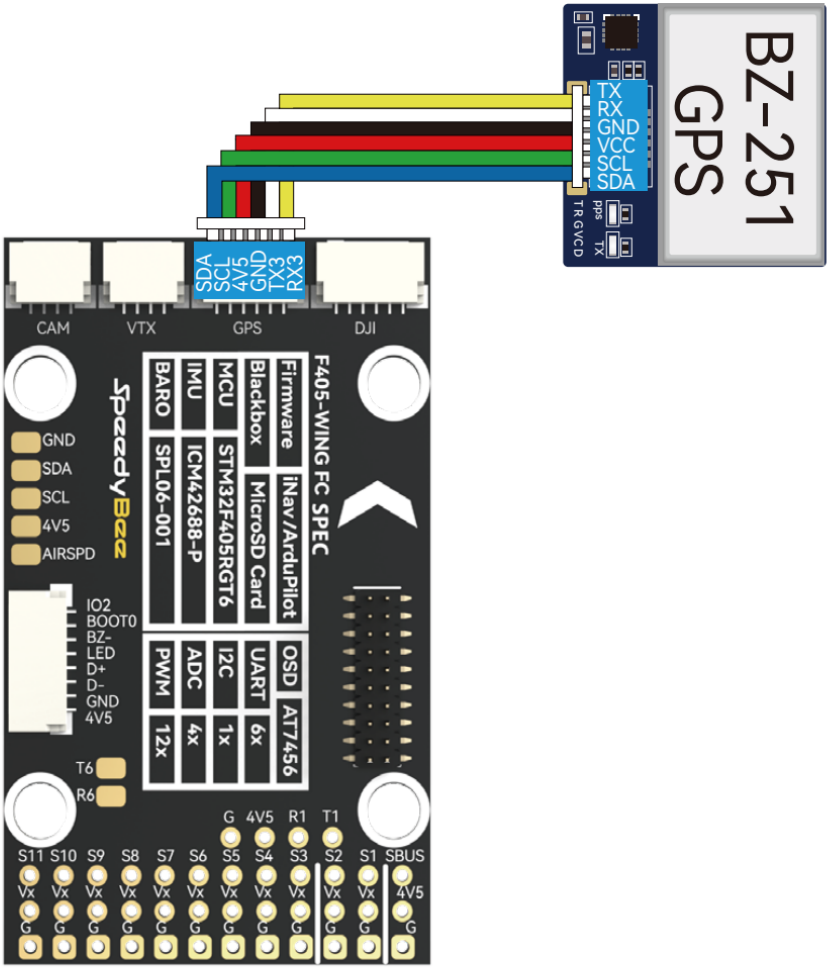
❷ ArduPilot Settings

Detectable with default settings.

GPS Settings

Hardware Connection:

Rearrange the pre-crimped JST SH1.0 cables of the GPS Module Cable according to the GPS module's pin layout. Insert them into the 6-pin JST SH1.0 housing. The BZ-251 GPS module is recommended.



GPS module

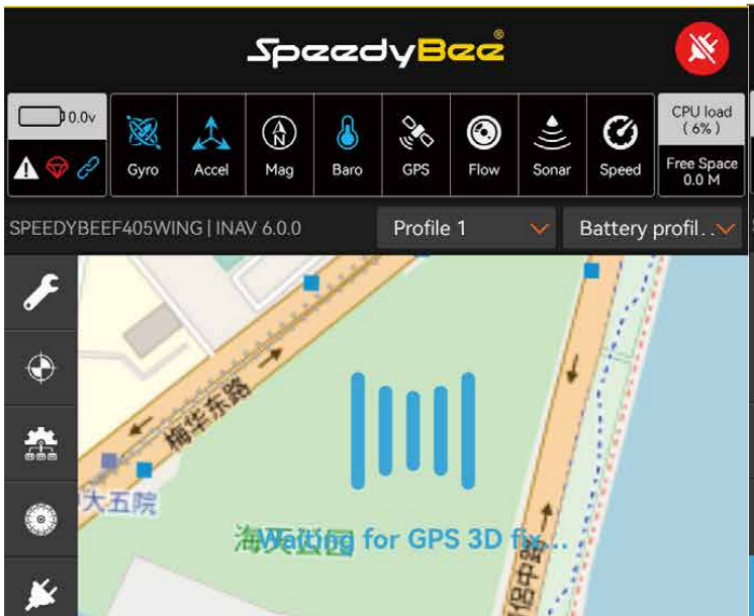
❶ INAV Settings

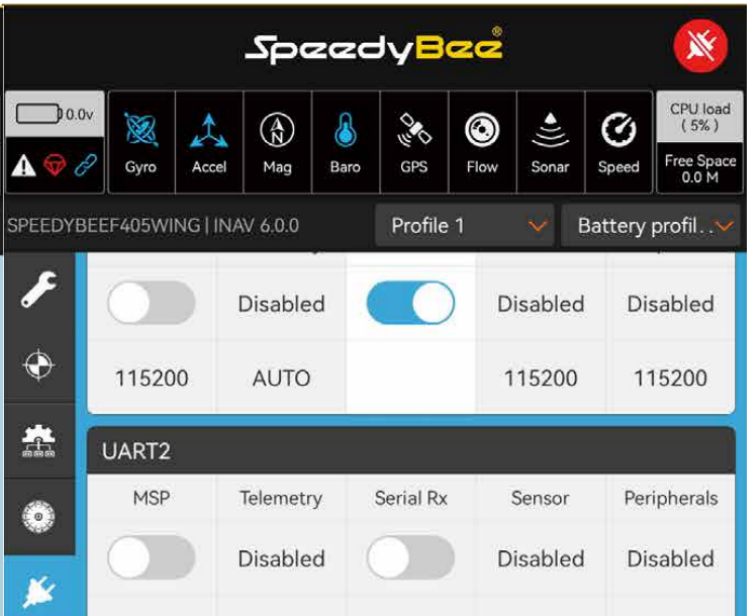
In the GPS tab, enable GPS for navigation and telemetry, then save and reboot. If not using a UBLOX module, refer to the specifications of the corresponding module and select the appropriate baud rate and protocol.

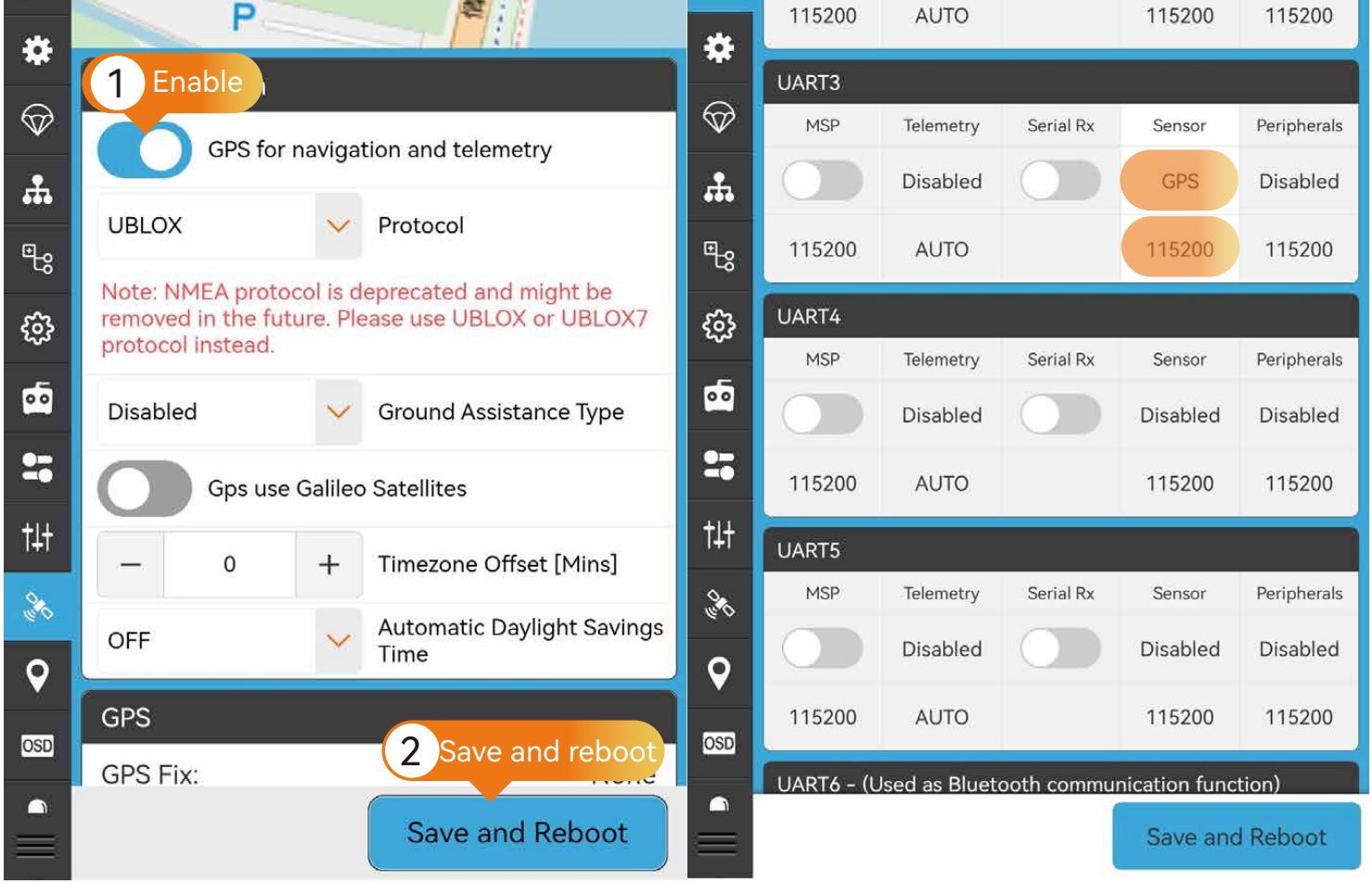
❷ ArduPilot Settings

Supports two types of GPS protocols - UBLOX and NMEA, with UBLOX protocol as the default. UBLOX M8N, M9, and M10 modules are automatically recognized.

INAV Settings







Compass (Magnetometer)Settings

Hardware Connection:

Use the recommended BZ-251 GPS module with an integrated QMC5883 compass. Install the GPS module away from the power supply lines, Motors, ESCs, and hatch magnets to avoid electromagnetic interference.Confirm the signal lines are connected as SDA to SDA, SCL to SCL.

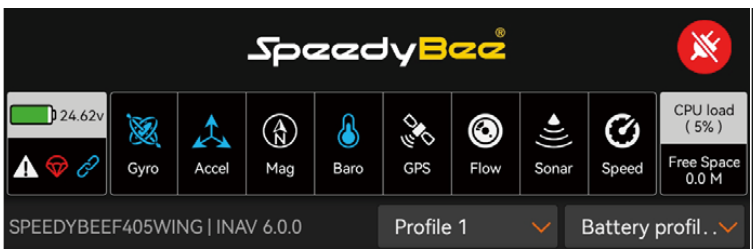
1 INAV Settings

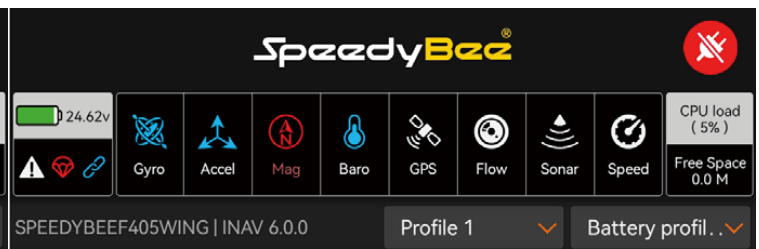
In the Configuration tab, select the appropriate compass option based on the compass model, then save and reboot. Adjust the compass orientation according to the specifications defined in the GPS module's documentation, then save and reboot.

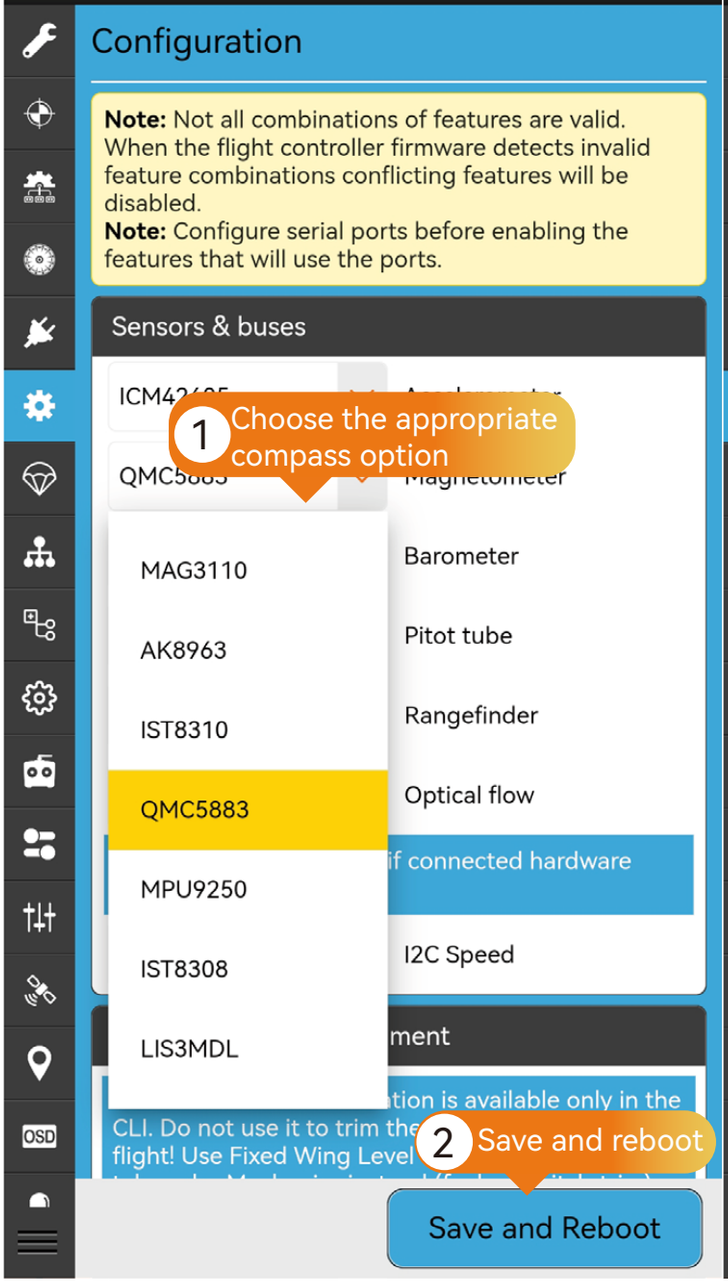
2 ArduPilot Settings

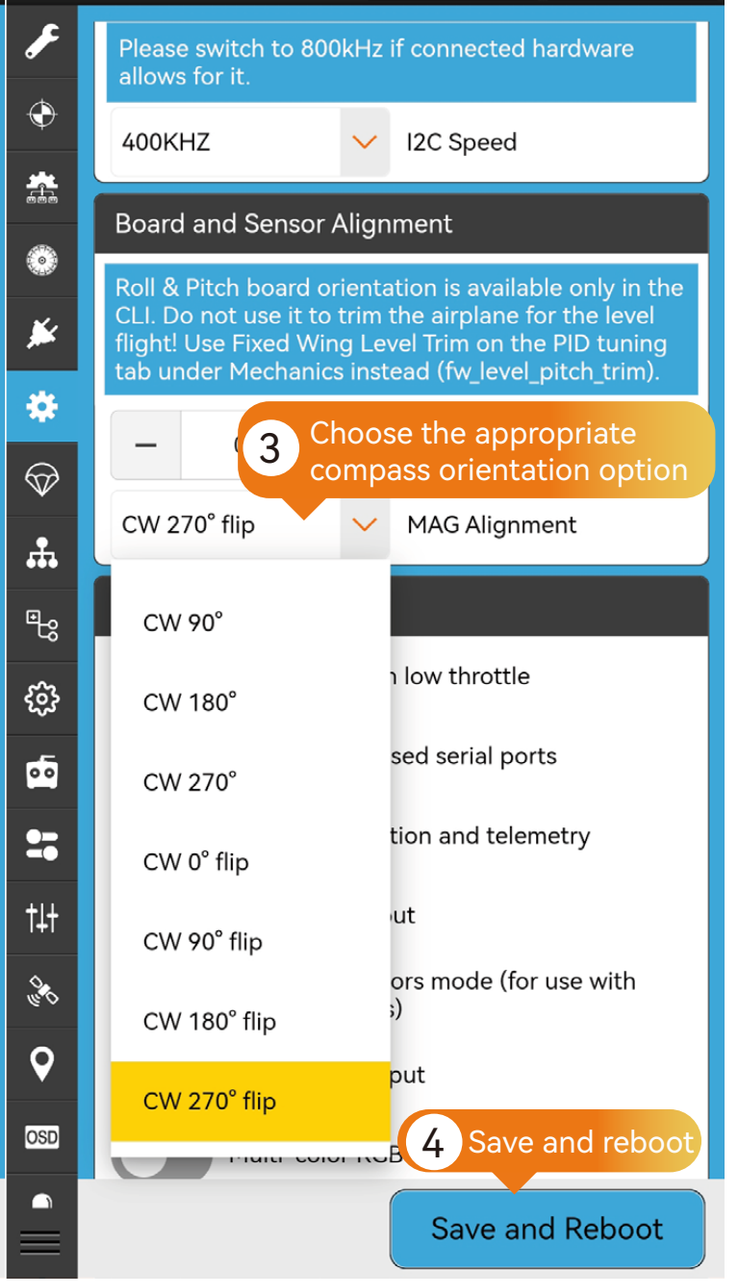
Navigate to the Compass page in the SETUP of MissionPlanner and verify if the compass is correctly recognized. If the compass is properly identified, only enable the "USE Compass1" option.
Onboard Mag Calibration: After securely installing the flight controller and GPS, calibrate the compass. Once calibration is successful, reboot the flight controller as prompted (No need to select compass model or set compass orientation).

INAV Settings

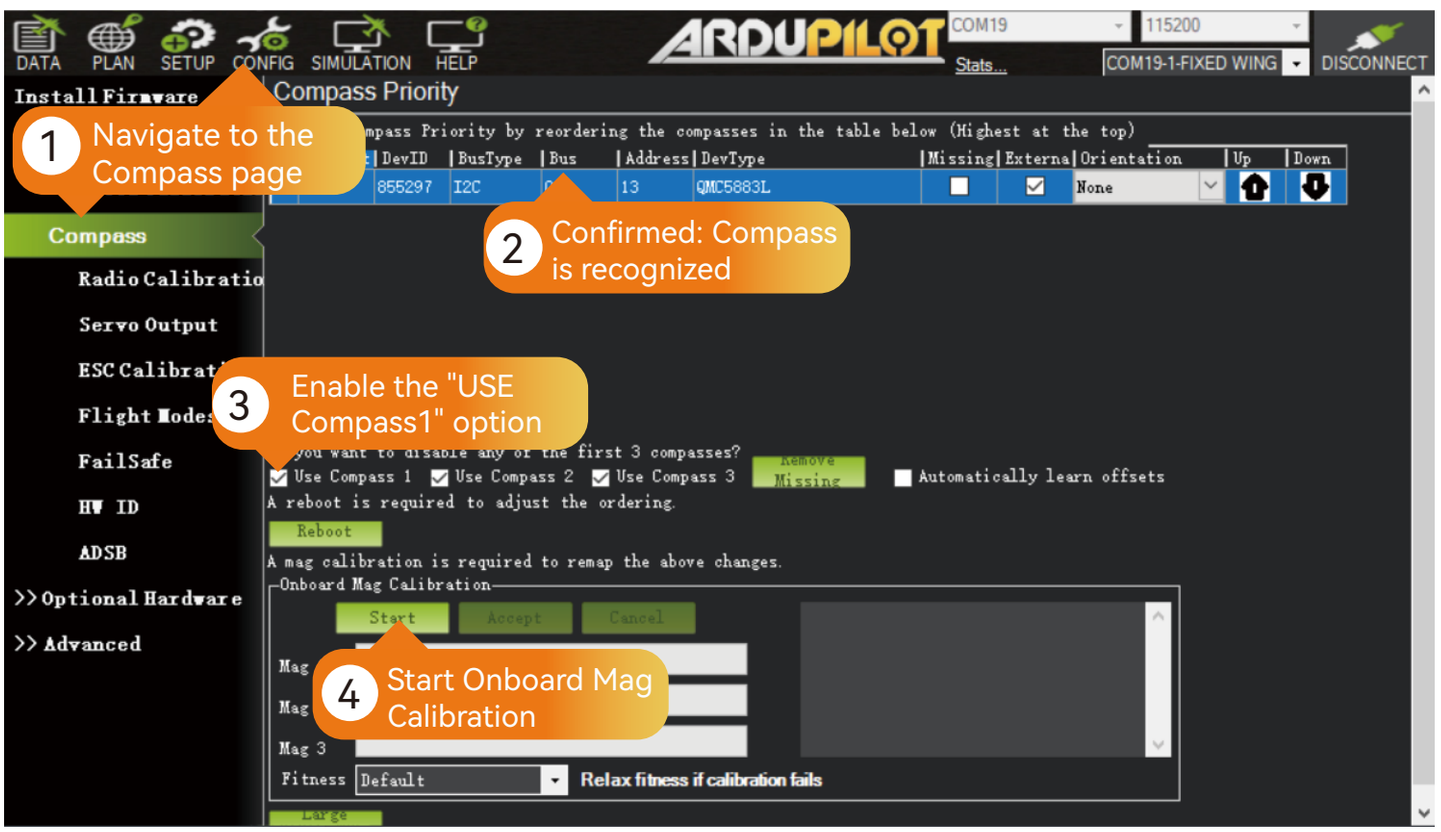








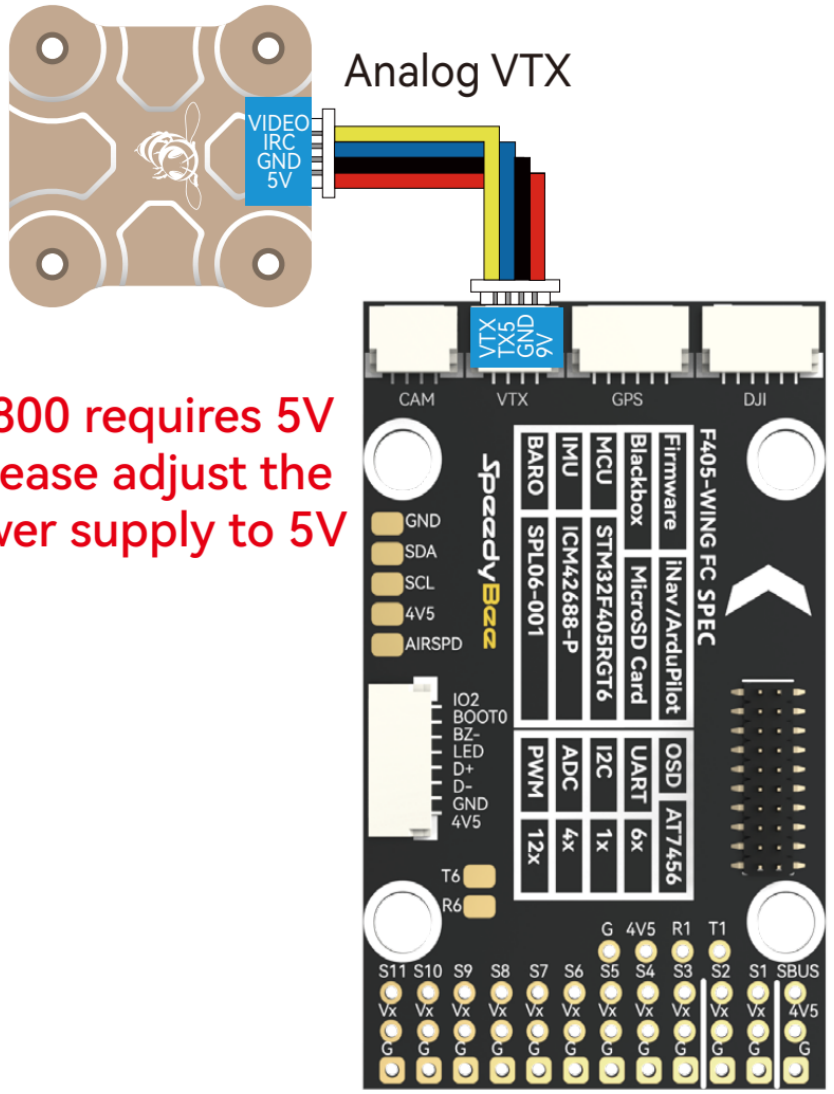
ArduPilot Settings



Analog VTX Settings

Hardware Connection:

Use the Analog VTX cable to connect the Speedybee TX800 VTX. **(The TX800 requires 5V power, so please adjust the VTX BEC power supply to 5V.)**



The TX800 requires 5V power, so please adjust the VTX BEC power supply to 5V

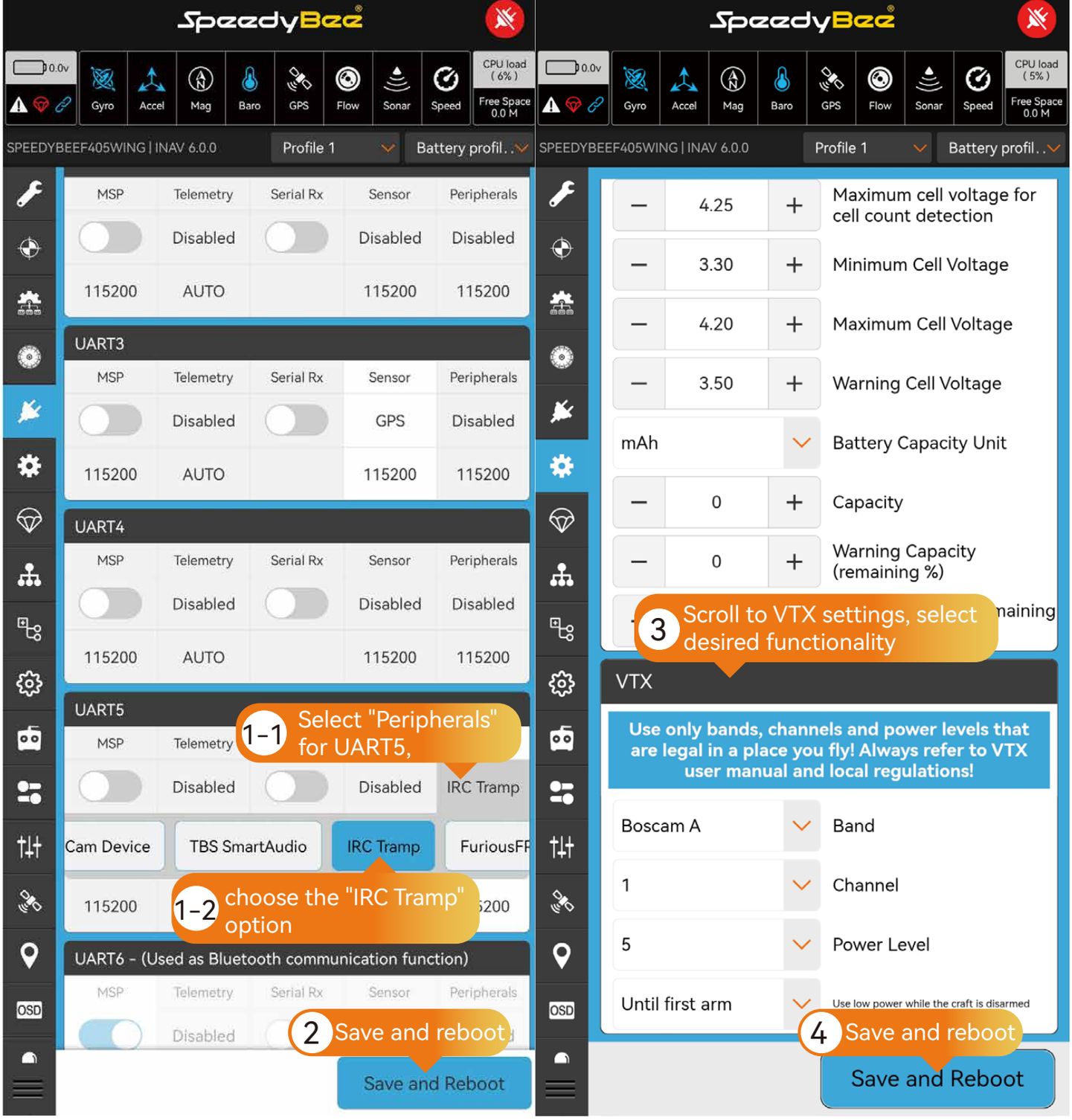
❶ INAV Settings

①In the Ports tab, select "Peripherals" for UART5, choose the "IRC Tramp" option, then save and reboot.
②In the Configuration tab, select the desired VTX options, then save and reboot.

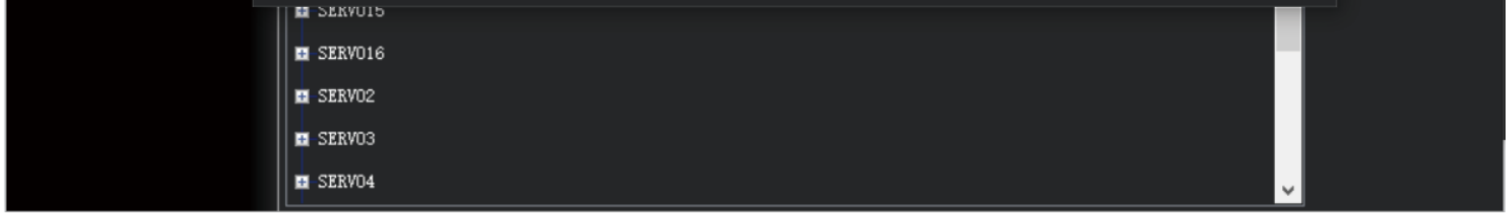
❷ ArduPilot Settings

Enter MissionPlanner's CONFIG settings, locate the Full Parameter Tree, modify the corresponding parameter values, and manually reboot the flight controller.

INAV Settings



● ArduPilot Settings



SERIAL5_BAUD	57	Set serial5 baud rate to 57600
SERIAL5_OPTIONS	4	Set serial5 operating mode to HalfDuplex
SERIAL5_PROTOCOL	44	Set serial5 protocol to IRC Tramp
VTX_ENABLE	1	Enable Analog VTX function. Restart required after settings
VTX_OPTIONS	10	Enable Pitmode to prevent overheating of VTX. （Pitmode until armed and Unlocked）
VTX_MAX_POWER	800	VTX Maximum Power Level

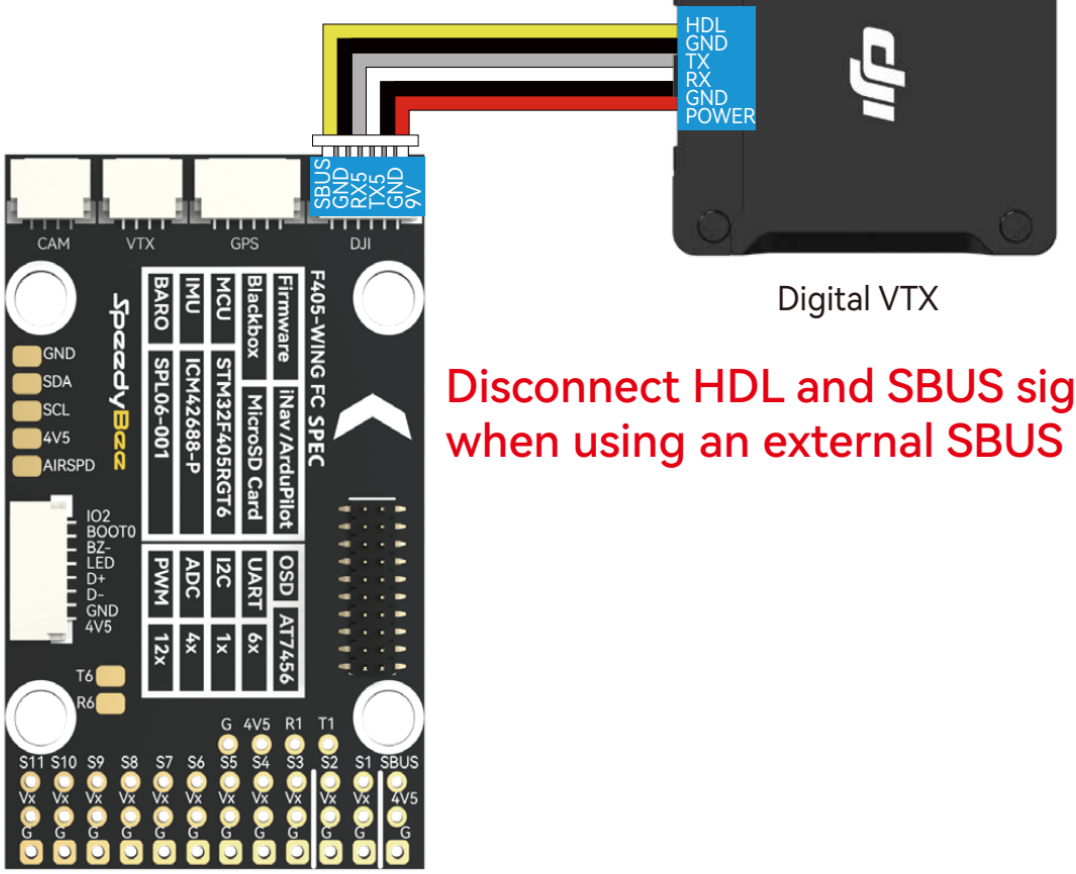
If your VTX supports SmartAudio, the following settings need to be applied:

SERIAL5_BAUD	4	Set serial5 baud rate to 4800
SERIAL5_OPTIONS	4	Set serial5 operating mode to HalfDuplex
SERIAL5_PROTOCOL	37	Set serial5 protocol to SmartAudio

For more detailed settings, please refer to the following link:
https://ardupilot.org/copter/docs/common-vtx.html

● Digital VTX Settings

Hardware Connection:
Use a Digital VTX cable to connect to the Digital VTX.



Digital VTX

Disconnect HDL and SBUS signals when using an external SBUS receiver.

❶ INAV Settings

①In the Ports tab, select "Peripherals" for UART5 and choose the "MSP DisplayPort" option, then save and reboot.

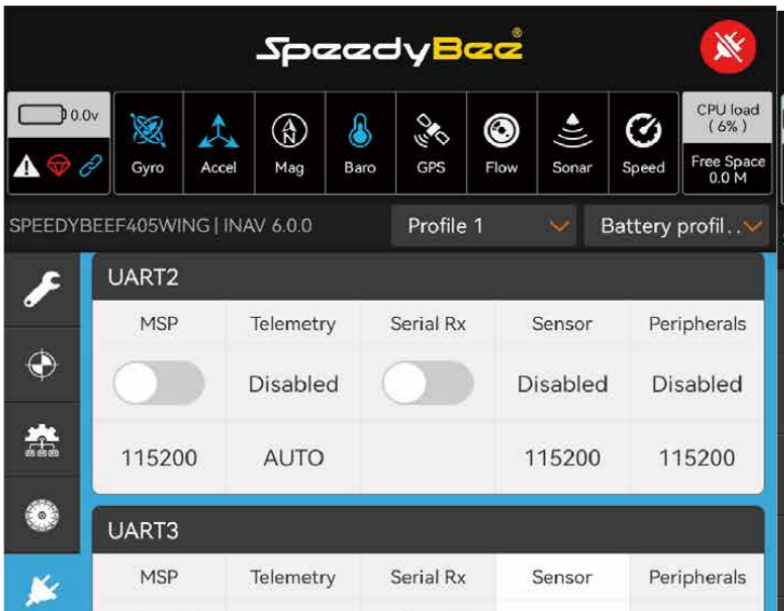
②In the OSD tab, scroll down to the "Video Format" option and select the appropriate option based on the following guidelines.

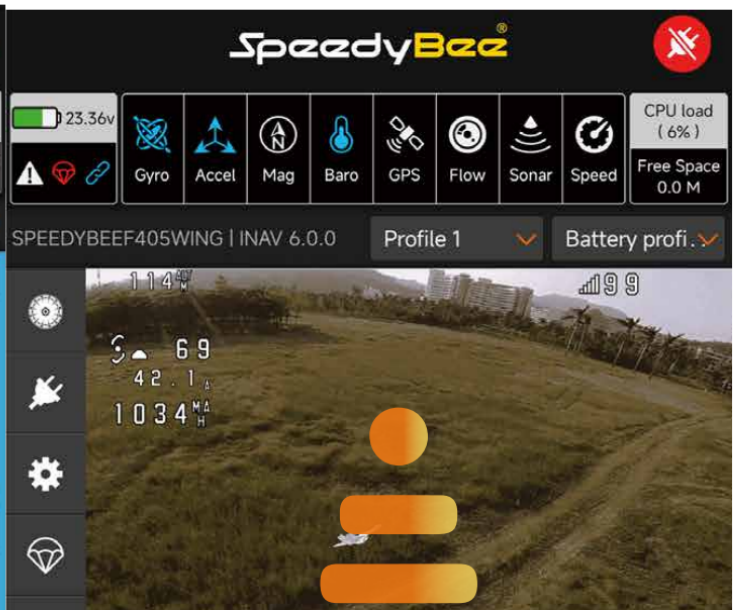
③Save and reboot.

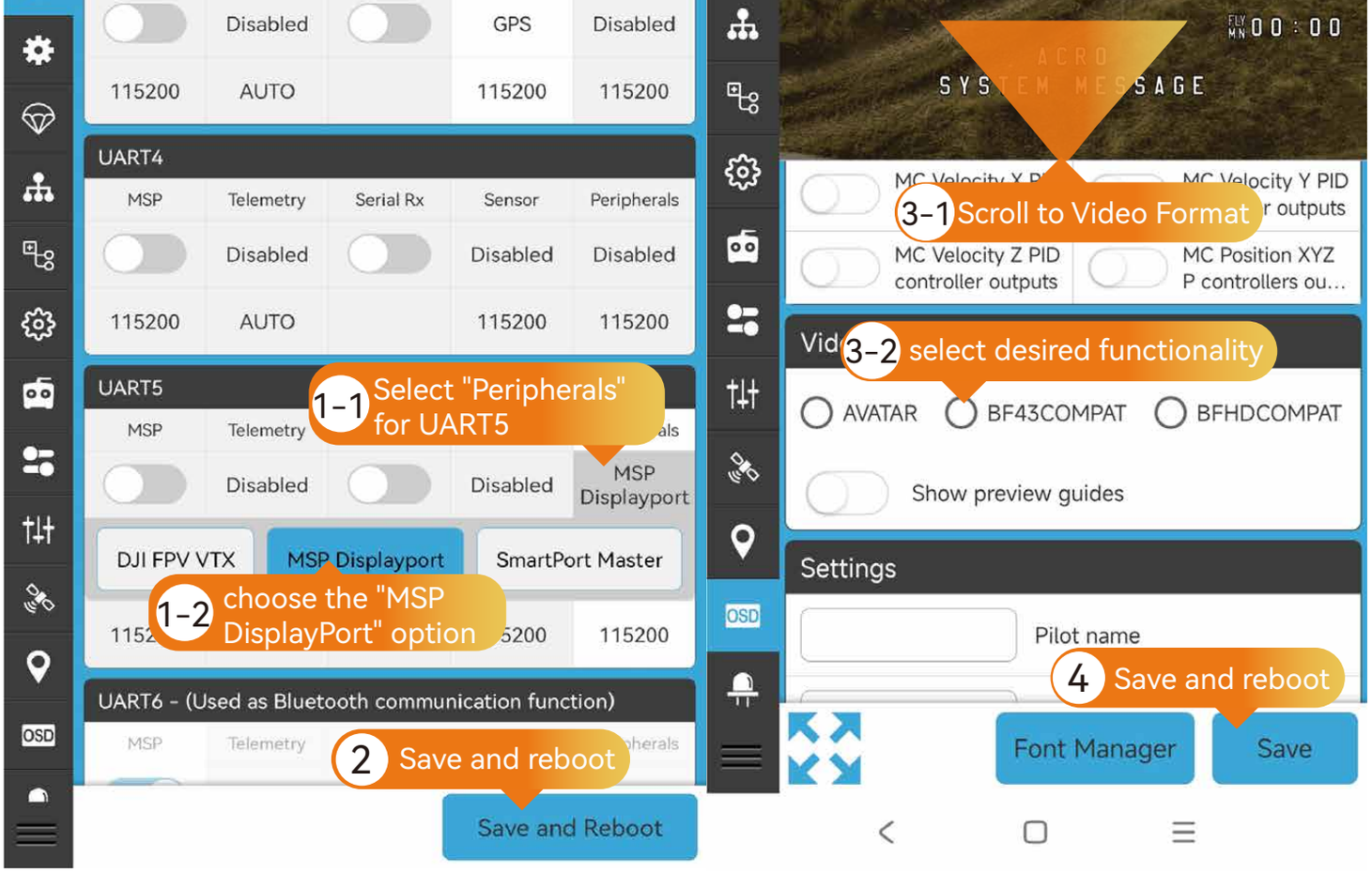
❷ ArduPilot Settings

Enter MissionPlanner's CONFIG settings, locate the Full Parameter Tree, modify the corresponding parameter values, and manually restart the flight controller.

INAV Settings







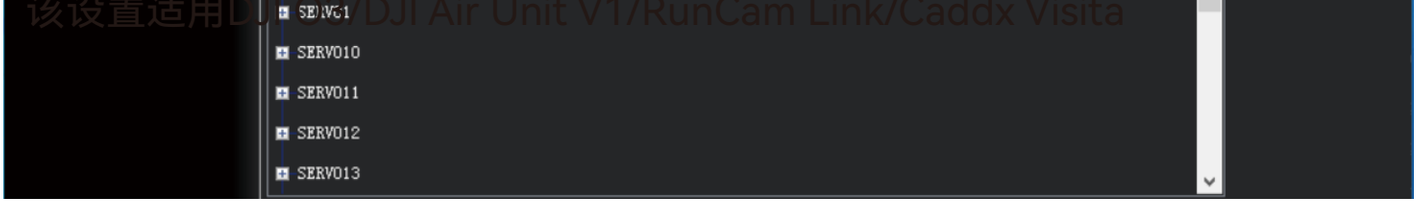
For DJI O3, DJI Air Unit V1 paired with DJI Goggles 2, RunCam Link paired with DJI Goggles 2 , Caddx Visita paired with DJI Goggles 2, select "BFHDCOMPAT" or "BF43COMPAT".

For Caddx WS Avatar, select "AVATAR".

For HDzero, select "HDZERO".

For DJI Air Unit V1 / RunCam Link / Caddx Visita paired with DJI goggles V2 , please go to the Ports tab and select "Peripheral" for UART5. Choose the "DJI FPV VTX" option, then save and reboot.

⬢ ArduPilot Settings



Compatible configurations: DJI O3, DJI Air Unit V1 paired with DJI Goggles 2, RunCam Link paired with DJI Goggles 2 , Caddx Visita paired with DJI Goggles 2, Caddx WS Avatar, and HDzero.

SERIAL5_BAUD	115	Set serial5 baud rate to 115200
SERIAL5_OPTIONS	0	Set serial5 operating mode to default
SERIAL5_PROTOCOL	42	Set serial5 protocol to DisplayPort
MSP_OPTIONS	4	Utilizes Betaflight-compatible fonts
OSD_TYPE	5	Set OSD mode to MSP_DisplayPort

Compatible configurations: DJI Air Unit V1 paired with DJI Goggles V2 , RunCam Link paired with DJI Goggles V2 , Caddx Visita paired with DJI Goggles V2.

SERIAL5_BAUD	115	Set serial5 baud rate to 115200
SERIAL5_OPTIONS	0	Set serial5 operating mode to default
SERIAL5_PROTOCOL	33	Set serial5 protocol to MSP
MSP_OPTIONS	0	polling mode
OSD_TYPE	3	Set OSD Type to MSP

For more detailed settings, please refer to the following link:
https://ardupilot.org/plane/docs/common-msp-osd-overview-4.2.html

● Wireless board with FC settings

Hardware Connection:

Check the alignment and secure fastening of the pin headers and sockets between the wireless board and the flight controller.

For INAV firmware, switch the wireless mode to BLE mode, indicated by a slow flashing green wireless status indicator.

For ArduPilot firmware, switch the wireless mode to WiFi mode, indicated by a slow flashing white wire less status indicator.

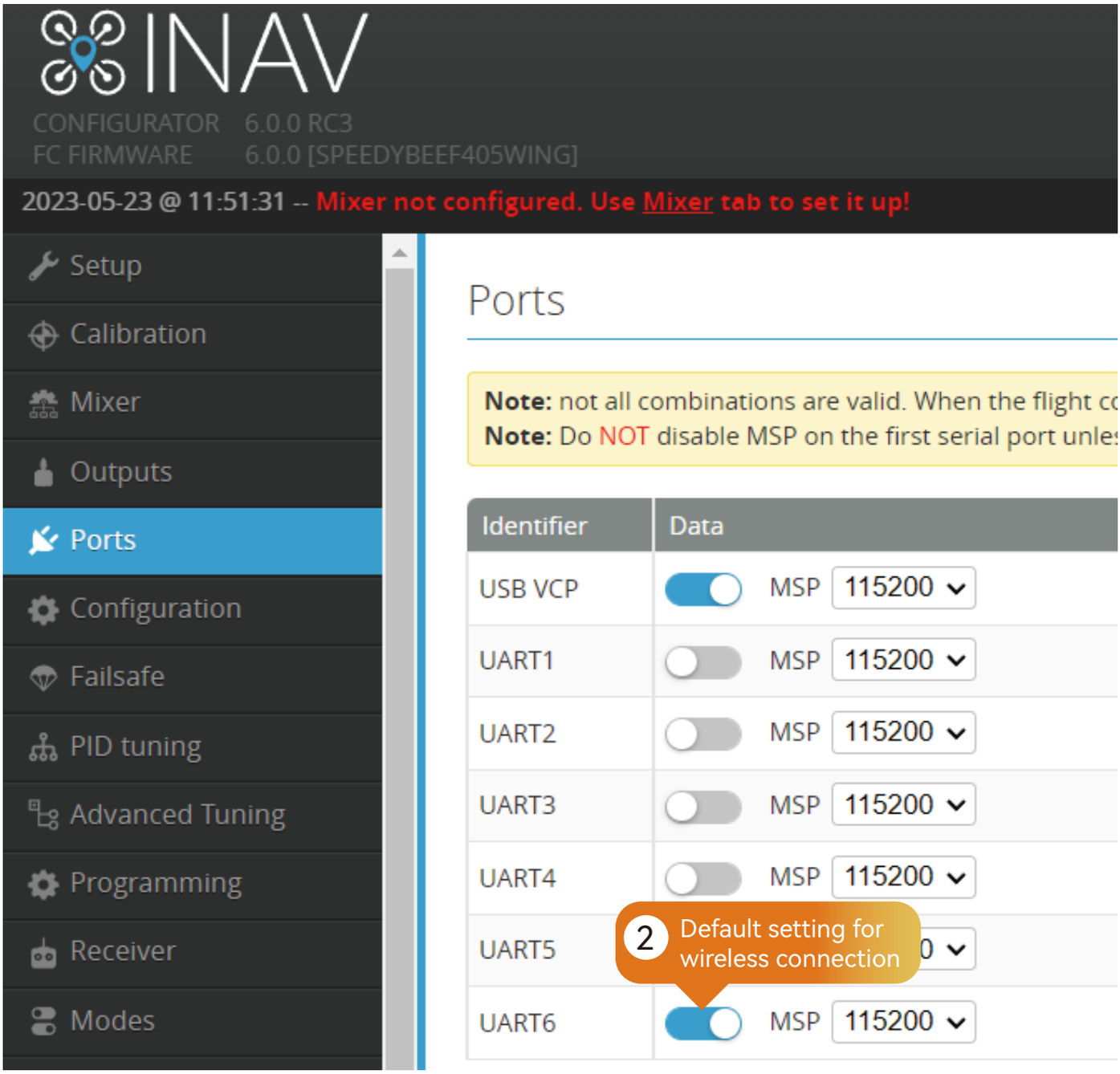
❶ INAV Settings

Default parameters enable direct connection. If wireless connection fails and the battery indicator light shows flowing lights, please check this setting.

❷ Ardupilot Settings

Default parameters enable direct connection. If wireless connection fails and the battery indicator light shows flowing lights, please check this setting.

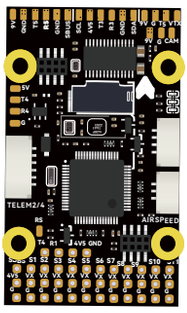
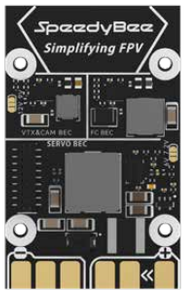
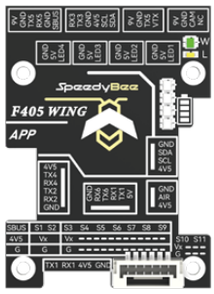
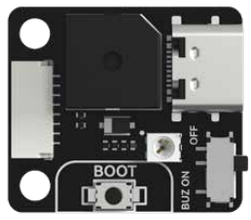
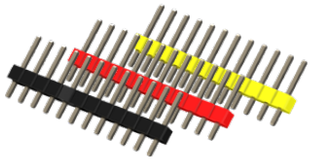
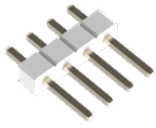
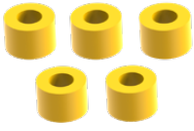
INAV Settings



Ardupilot Settings

SERIAL6_BAUD	115	Set serial6 baud rate to 115200
SERIAL6_OPTIONS	0	Set serial6 operating mode to default
SERIAL6_PROTOCOL	2	Set serial6 protocol to Mavlink2

Part7-Package

 SpeedyBee F405 WING FC board x1	 SpeedyBee F405 WING PDB board x1	 SpeedyBee F405 WING Wireless board x1	 SpeedyBee F405 WING USB extender x1
90 Degree pin Header(3x12) x1	 straight pin header(1x12) x3	 White straight pin header(1x4) x1	M2 x 12 copperStandoff Spacer x5
M2x4 small head cross screw x10	 M3x4 mm Silicone Grommets x5	8pin SH1.0 USB extender Cable (80mm) x1	4pin SH1.0 Analog VTX Cable (250mm) x1
6pin SH1.0 GPS Module Cable without Connector on another end (250mm) x1		6pin Digital VTX Cable (250mm) x1	
4pin SH1.0 to 3+2pin JST1.25 FPV Cam Cable(250mm) x1		6pin GH1.25 Telemetry module Cable(200mm) x1	
4pin Dupont single-head Cable(150mm) x1		Double-sided tape for isolating pins and cables(32x9x1mm) x1	