

## Occus F411-WING

# Matek Systems F411-WING STM32F411 Flight Controller User Manual

Model: F411-WING

## 1. INTRODUCTION

This manual provides comprehensive instructions for the setup, operation, and maintenance of the Matek Systems F411-WING STM32F411 Flight Controller. Designed for fixed-wing RC airplanes, this flight controller integrates essential components for stable and reliable flight control, including an IMU, barometer, and OSD.



Image 1.1: The Matek Systems F411-WING Flight Controller package, showing the main board, mounting hardware, and documentation.

## 2. FEATURES

The F411-WING Flight Controller is equipped with a robust set of features to enhance your fixed-wing RC experience:

- **High-Performance MCU:** 100MHz STM32F411 for rapid processing.
- **Integrated IMU:** MPU6000 accelerometer/gyro (SPI) for precise attitude sensing.
- **Barometric Sensor:** BMP280 (I2C) for accurate altitude hold.

- **On-Screen Display (OSD):** INAV OSD with AT7456E chip for real-time flight data overlay.
- **Connectivity:** VCP & 2x UARTs for peripheral connections.
- **Motor & Servo Outputs:** Supports 2x Motors and 5x Servos.
- **I2C Port:** 1x I2C for external sensors like GPS or compass.
- **Status LEDs:** 3x LEDs for FC STATUS (Blue, Red) and 3.3V indicator (Red).
- **SBUS Inverter:** Built-in inverter for SBUS input (UART1-RX).
- **Flexible Serial Ports:** SoftSerial\_Tx1 on ST1 pad by default, PPM on ST1 pad with softserial disabled.
- **Battery Voltage Sensor:** Integrated 1:10 (Scale 1100) sensor.
- **Peripheral Support:** WS2812 LED Strip and Beeper support.
- **Firmware Compatibility:** Pre-flashed with INAV Flight firmware, Target: MATEKF411.
- **Power Distribution Board (PDB):**
  - Input voltage range: 6.5~30V (2~6S LiPo) with TVS protection.
  - 2x ESC power pads.
  - Current Sensor: 78A, 3.3V ADC, Scale 423.
- **BEC Outputs:**
  - **BEC 5V:** 2 Amps continuous, for FC, Receiver, OSD, Camera, Buzzer, LED Strip, GPS.
  - **BEC Vx:** 3 Amps continuous, voltage adjustable (5V Default, 6V via jumper), for Servos.
  - **BEC 3.3V:** 200mA continuous, for Baro/Compass module, OLED, Spektrum RX.



Image 2.1: Detailed views of the F411-WING flight controller, showing the top and bottom sides with component labels and specifications.

### 3. SPECIFICATIONS

Component	Specification
MCU	100MHz STM32F411
IMU	MPU6000 (accelerometer/gyro)
Barometer	BMP280

Component	Specification
OSD	INAV OSD w/ AT7456E
UARTs	2x (VCP & 2x UARTs)
Motor Outputs	2x
Servo Outputs	5x
I2C	1x
Input Voltage Range	6.5~30V (2~6S LiPo)
Current Sensor	78A (Scale 423)
BEC 5V Output	2 Amps Continuous
BEC Vx Output	3 Amps Continuous (5V Default, 6V via jumper)
BEC 3.3V Output	200mA Continuous
Mounting	24 x 24mm, $\Phi$ 2mm
Dimensions	41 x 28 x 10mm
Weight	7g (Total 12g w/ bottom plate and M2 standoffs)

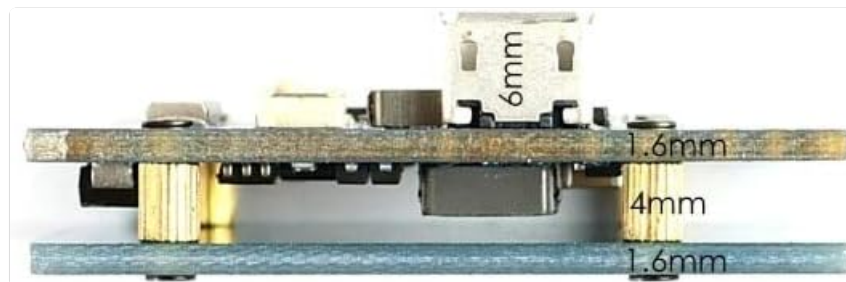


Image 3.1: Side profile of the F411-WING flight controller, illustrating its compact dimensions and mounting stack height.

## 4. SETUP AND WIRING

Proper setup and wiring are crucial for the safe and effective operation of your F411-WING Flight Controller. Always refer to the detailed wiring diagram and ensure all connections are secure before powering on.

### 4.1. Basic Connections

- **Power Input:** Connect your 2-6S LiPo battery to the designated power pads (6.5~30V). Observe polarity.
- **ESCs:** Connect your Electronic Speed Controllers (ESCs) to the motor outputs (M1, M2).
- **Servos:** Connect your servos to the S1-S5 servo outputs. Ensure correct voltage selection for Vx BEC.
- **Receiver:** Connect your receiver (e.g., SBUS, PPM) to the appropriate UART RX pad. SBUS input has a built-in inverter on UART1-RX.
- **GPS/Compass:** If using, connect to the I2C port (SDA, SCL) and a free UART for GPS data.
- **Camera/VTX:** Connect your FPV camera and video transmitter (VTX) to the designated pads for

video input/output and power.

- **Buzzer/LED Strip:** Connect optional buzzer and WS2812 LED strip to their respective pads.

## 4.2. Wiring Diagram

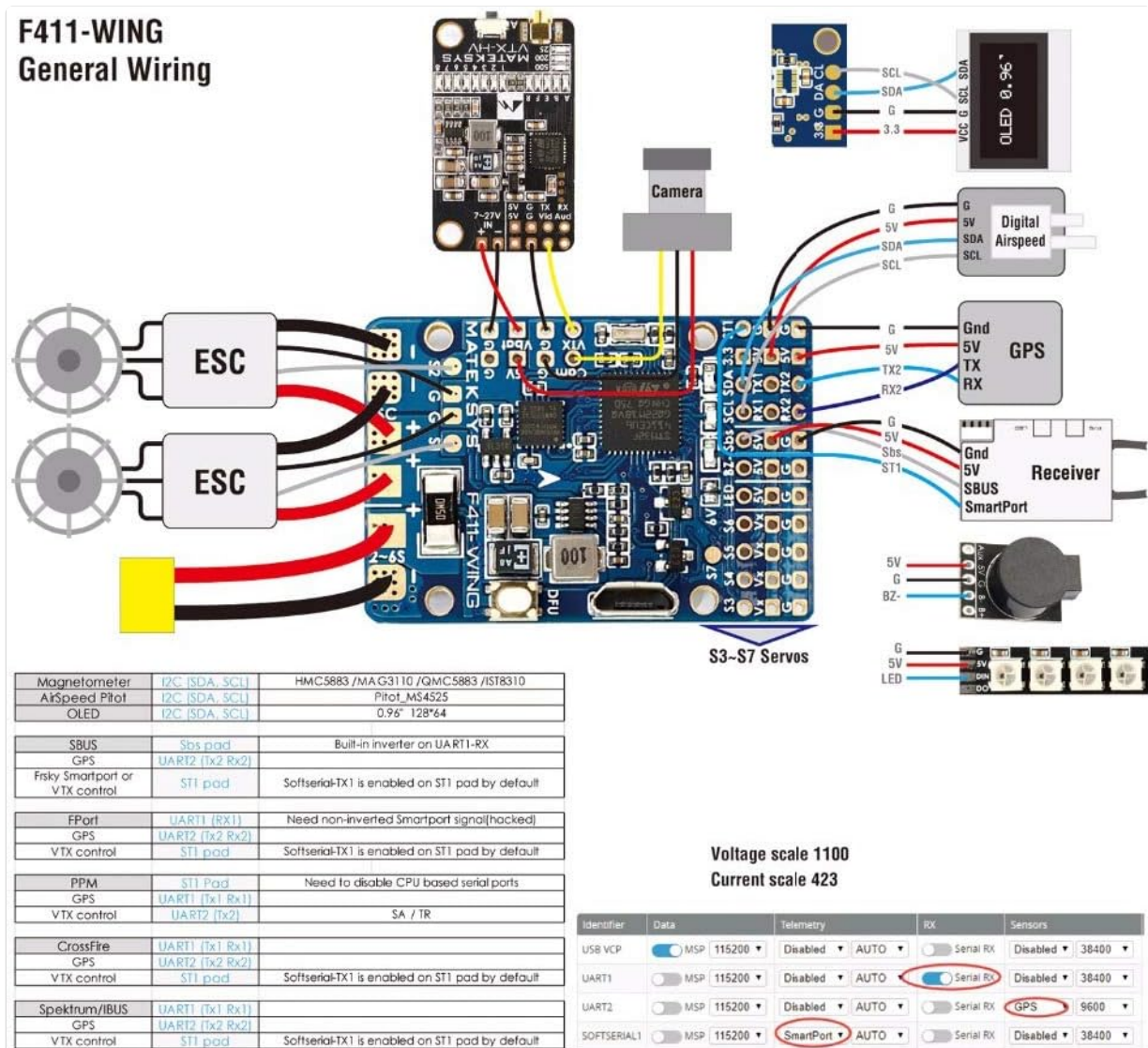


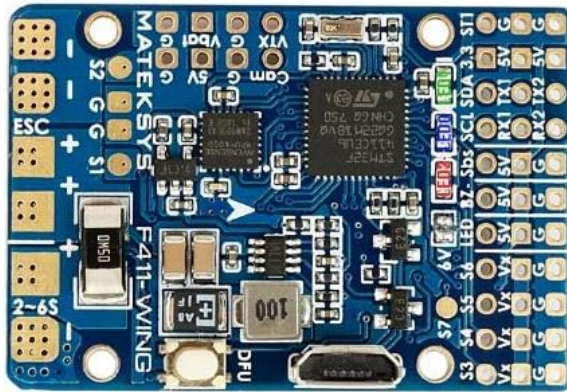
Image 4.1: Comprehensive wiring diagram for the F411-WING, illustrating connections for ESCs, servos, receiver, GPS, camera, and other peripherals.

## 4.3. Board Layout

+ & - : LiPo & ESC power pads, 6.5-30V DC.  
 S1/S2: ESC signal for motor 1 & 2  
 G: ESC signal ground  
 Voltage meter scale: 1100  
 Current Sensor: 78A (Scale 423)

VTX: Video Transmitter Signal  
 Cam: Camera video signal  
 5V: onboard BEC 5V 2A  
 Vbat: LiPo voltage  
 G: Ground

LED0(Blue) & LED1(Green): FC Status indicator  
 LED2(Red): 3.3V indicator



ST1: Softserial\_TX1 w/ CPU based serial ports enabled  
 can be used for PPM input with CPU based serial ports disabled  
 SDA/SCL: I2C for Compass/ Airspeed Pitot  
 compass HMC5883 / MAG3110 / QMC5883 / IST8310  
 Pitot\_MS4525

TX1/RX1: UART1  
 TX2/RX2: UART2

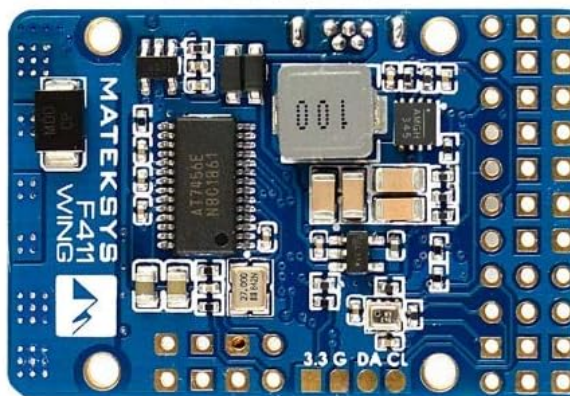
Sbs: Built in inverter of RX1 for SBUS input  
 No voltage on 5V pad when connecting via USB only  
 LED: WS2812 LED signal output  
 Bz- & 5V: General active 5V buzzer  
 Bz-, 5V & G: Matek Dbuz5V

3,3: LDO3.3V 200mA

S3/S4/S5/S6/S7: Servo signal

Vx: onboard BEC 5V/6V 3A cont. for servos. Default is 5V

Button: Boot(DFU) mode button



MCU: STM32F411  
 IMU: MPU6000  
 OSD: INAV OSD  
 Baro: BMP280



Vx= 5V



Vx=6V

[3.3 G DA CL]: I2C for OLED

Image 4.2: Detailed board layout of the F411-WING, highlighting key components, pads, and their functions.

## 4.4. Firmware Flashing

The F411-WING comes pre-flashed with INAV firmware. For updates or re-flashing:

1. Download the latest INAV Configurator from the official INAV GitHub page.
2. Connect the flight controller to your computer via a USB cable.
3. Press and hold the DFU (Boot) button while plugging in the USB cable to enter DFU mode.
4. In INAV Configurator, select the "Firmware Flasher" tab.
5. Choose "MATEKF411" as the target and select the desired firmware version.
6. Click "Load Firmware [Online]" and then "Flash Firmware".
7. After flashing, disconnect and reconnect the FC. It should now appear as a COM port.

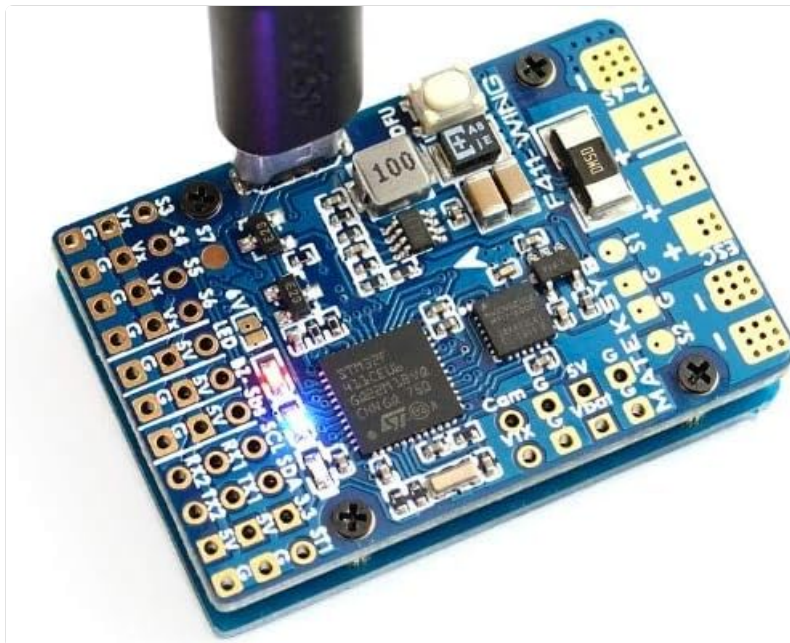


Image 4.3: The F411-WING flight controller connected via USB, with the blue status LED illuminated, indicating power and operation.

## 5. OPERATING INSTRUCTIONS

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Once the flight controller is wired and configured in INAV Configurator, you are ready for operation.

### 5.1. Pre-Flight Checks

- Verify all connections are secure and correct.
- Ensure propellers are removed during initial setup and testing.
- Calibrate accelerometer and compass in INAV Configurator.
- Check motor direction and ESC calibration.
- Confirm control surface movements match transmitter inputs.

### 5.2. Flight Modes

INAV offers various flight modes. Configure these in the "Modes" tab of INAV Configurator and assign them to your transmitter switches:

- **Manual Mode:** Direct control of surfaces.
- **Acro Mode:** Rate mode, no self-leveling.
- **Angle/Horizon Mode:** Self-leveling modes.
- **GPS Hold/Return to Home (RTH):** Requires a GPS module for autonomous flight.

### 5.3. Arming and Disarming

Arming the flight controller activates the motors. Disarming stops them. Configure your arming switch in INAV Configurator. Always arm in a safe area with clear surroundings.

## 6. MAINTENANCE

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Regular maintenance ensures the longevity and reliability of your flight controller.

- **Visual Inspection:** Periodically check for loose wires, damaged components, or signs of overheating.

- **Cleaning:** Keep the board free from dust, dirt, and moisture. Use compressed air or a soft brush.
- **Firmware Updates:** Regularly check for and apply the latest INAV firmware updates to benefit from bug fixes and new features.
- **Connection Integrity:** Ensure all solder joints and connectors remain solid.

## 7. TROUBLESHOOTING

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If you encounter issues, refer to the following common troubleshooting steps:

- **No Power/LEDs Off:**
  - Check battery connection and voltage.
  - Verify power input polarity.
  - Inspect for short circuits.
- **Cannot Connect to INAV Configurator:**
  - Ensure correct USB drivers are installed (e.g., STM32 Virtual COM Port Driver, Zadig for DFU mode).
  - Try a different USB cable or port.
  - Reboot your computer.
- **Motors Not Arming:**
  - Check pre-arm safety features in INAV (e.g., accelerometer calibration, valid receiver input, no stick errors).
  - Verify arming switch assignment in INAV.
  - Ensure ESCs are calibrated.
- **Incorrect Sensor Readings:**
  - Recalibrate accelerometer and compass.
  - Check for vibrations affecting the IMU.
  - Ensure the flight controller is mounted securely and correctly oriented.

## 8. WARRANTY AND SUPPORT

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This product is manufactured by Occus. For specific warranty information, please refer to the terms provided at the point of purchase or contact your retailer. General support for INAV firmware can be found on the official INAV project website and community forums.

For technical inquiries related to the Matek Systems F411-WING hardware, please contact the manufacturer or your authorized dealer.