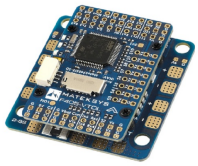

MATEKSYS F405-VTOL Flight Controller Owner's Manual

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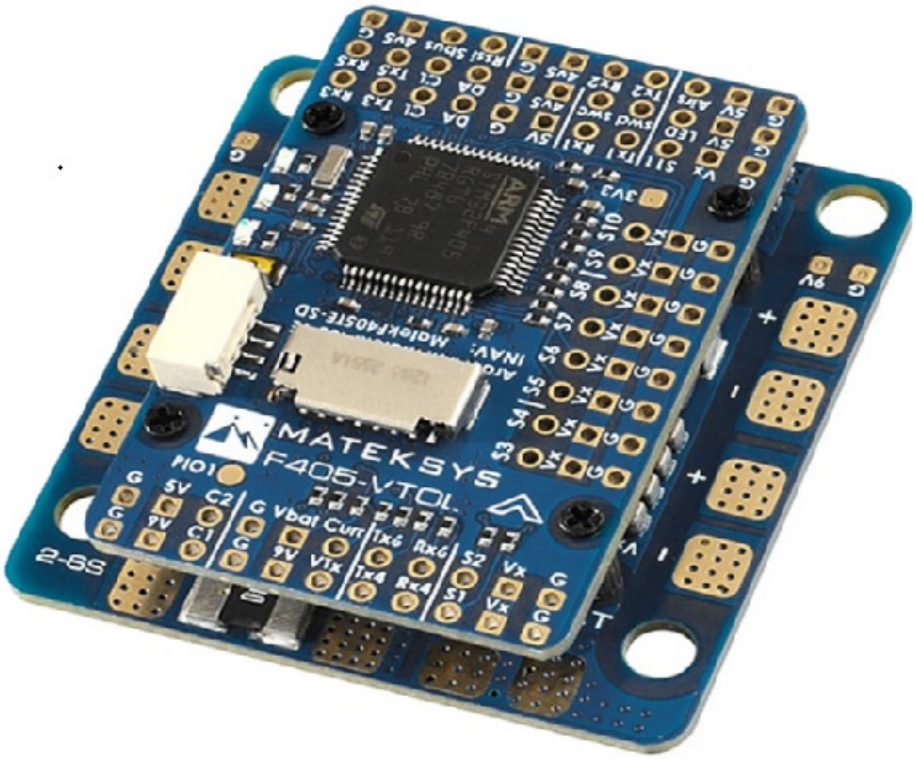
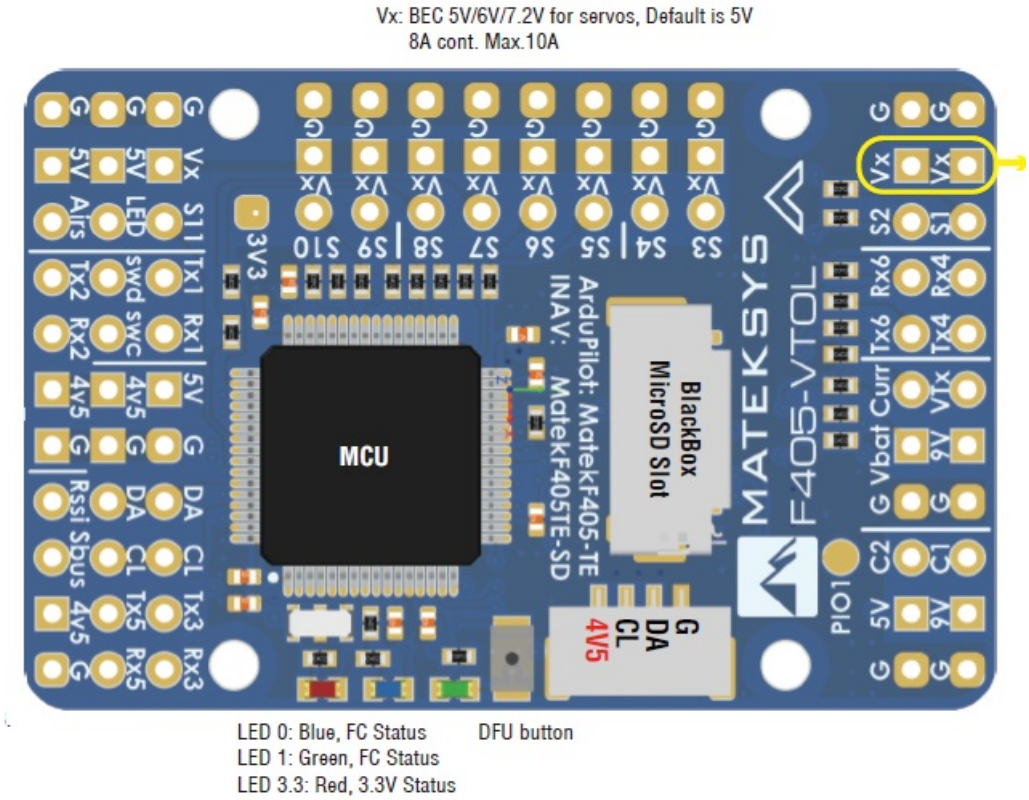
MATEKSYS

MATEKSYS F405-VTOL Flight Controller



LAYOUT



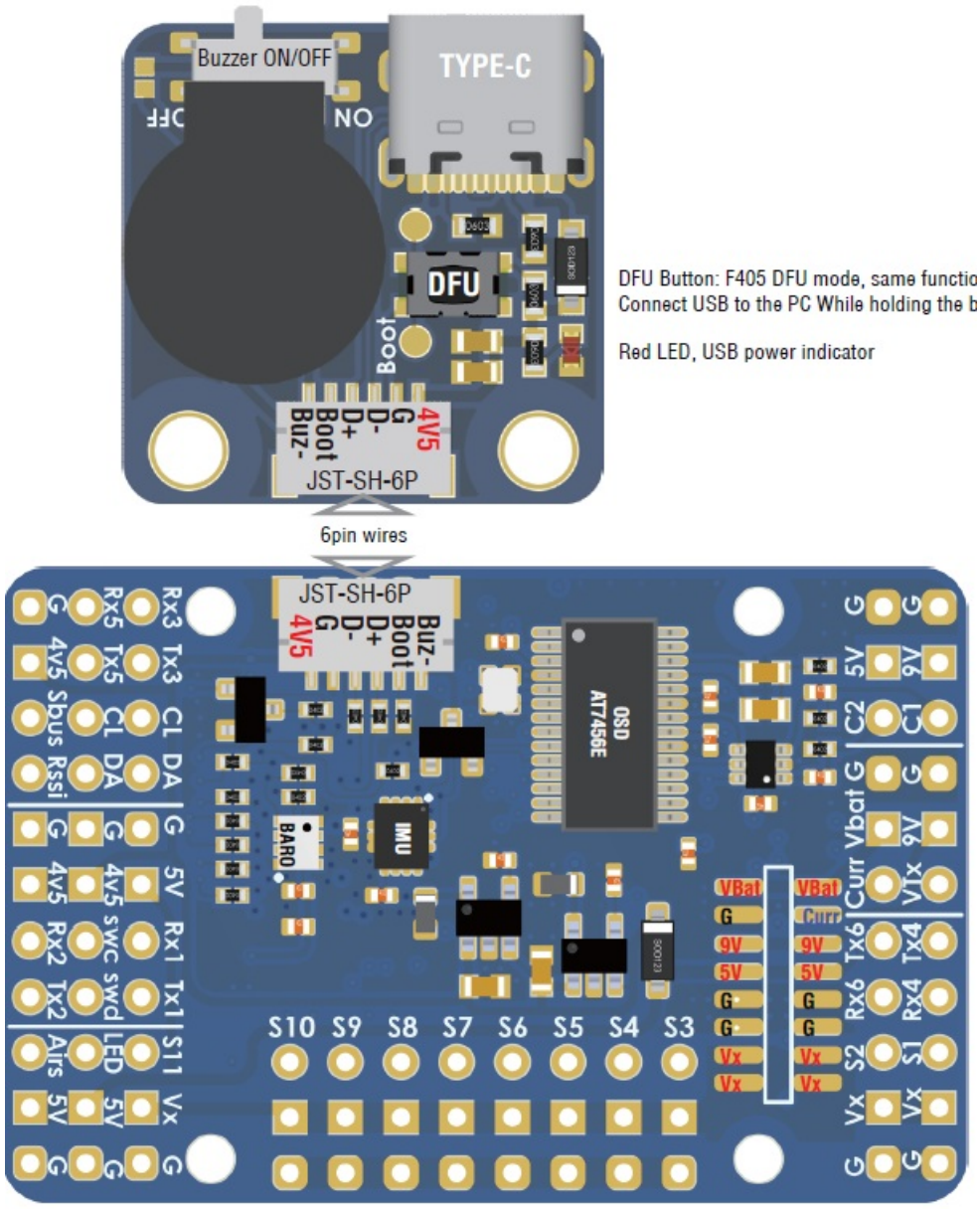
- **AirS:** Analog Airspeed sensor (0~3.3V) no voltage divider built-in

  Rssi: Analog RSSI ADC, 0~3.3V
- **Tx1**/**Rx1:** UART1_Tx/Rx
- **swd**/**swc:** STM32F405RGT6 debug pin
- **Rx2:** UART2-RX for Serial_RX by default
    - PPM is not supported by INAV

- **Tx2:** UART2-TX
  - softserial1_tx is an alternative on Tx2 pad in INAV
- **Sbus:** UART2_RX + inverter for SBUS receiver
- **Tx3**/**Rx3:** UART3_Tx/Rx
- **Tx5**/**Rx5:** UART5_Tx/Rx
- **DA & CL:** I2C_SDA, SCL,
  - for compass/digital Airspeed
- **5V:** onboard BEC 5V 2A cont.
  - 5V is not supplied by USB
- **4V5:** 4.4~4.8V, Max.800mA,
  - 4V5 is also supplied when connecting via USB.
- **G:** Ground

DO NOT connect the ESC BEC output (Red wire in the middle of connector) to Vx pad If Vx rail is powered from bottom PDB.

- **TX6**/**RX6:** UART6_Tx/Rx
- **TX4**/**RX4:** UART4_Tx/Rx
- **Vbat:** Battery voltage
- **onboard battery voltage sense:** BATT_VOLT_PIN 14, BATT_VOLT_MULT 21 INAV scale 2100
- **Curr:** Current signal (0~3.3V)
- **onboard current sense:** BATT_CURR_PIN 15, BATT_AMP_PERVLT 66.7 INAV scale 150
- **9V:** onboard BEC 5V 2A cont. Max.3A
  - 9V will increase to 12V if “12V” jumper on bottom PDB is bridged.
- **5V:** onboard BEC 5V 2A cont. Max.3A
- **G:** Ground
- **VTx:** Video OUT for Video Transmitter
- **C1:** Camera-1 video IN (Default)
- **C2:** Camera-2 video IN
  - C1/C2 can be switched via ArduPilot Relay or Modes/USER2 (INAV)
  - Two cameras should be set with identical video format, both PAL or both NTSC
- **PIO1:** Low/High level switchable via INAV Modes/USER1 or ArduPilot Relay

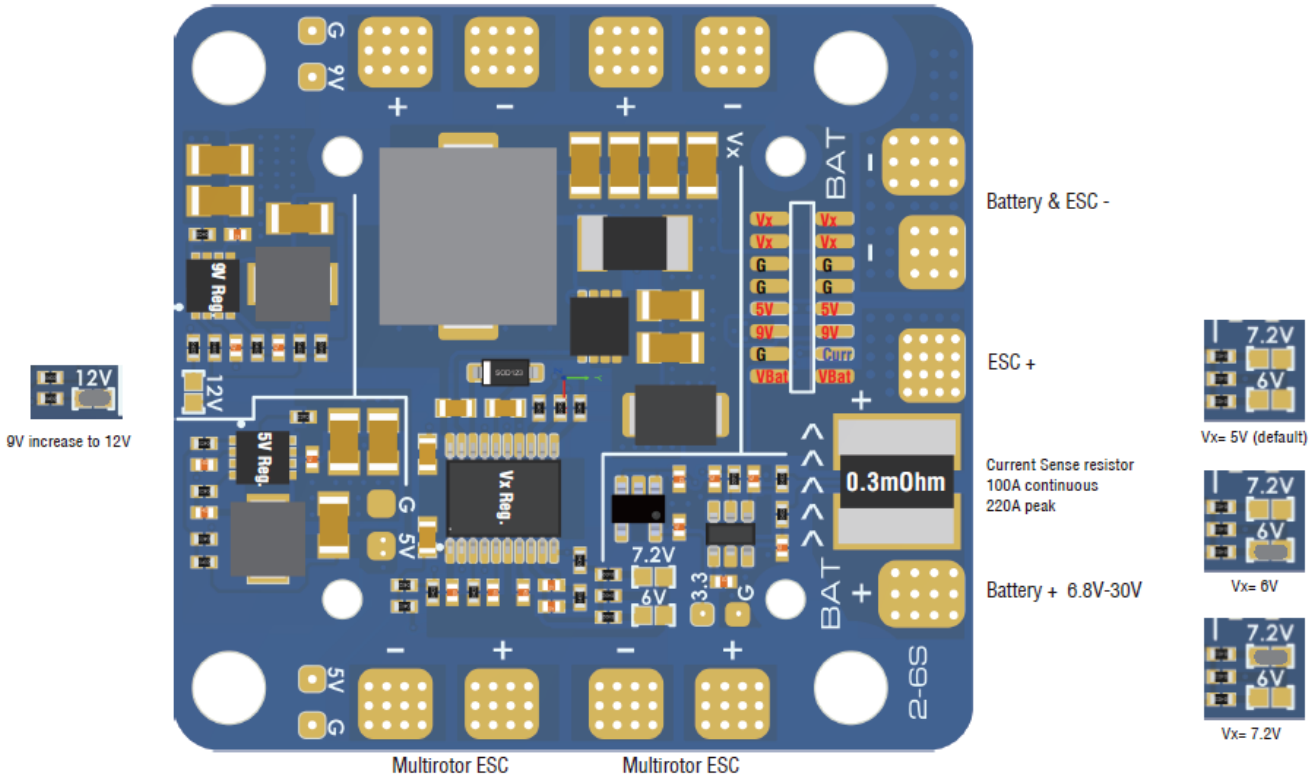


- **DFU Button:** F405 DFU mode, same function as the button on FC board.
- Connect USB to the PC While holding the boot button in.
- Red LED, USB power indicator

	INAV AirPlane	INAV Multirotor	ArduPilot
S1	Motor	Motor	PWM1
S2	Motor	Motor	PWM2
S3	Servo	Motor	PWM3
S4	Servo	Motor	PWM4
S5	Servo	Motor	PWM5
S6	Servo	Motor	PWM6
S7	Servo	Motor	PWM7
S8	Servo	Motor	PWM8
S9	Servo	Servo	PWM9
S10	Servo	Servo	PWM10
S11	Servo	Servo	PWM11
LED	2812 LED	2812 LED	PWM12

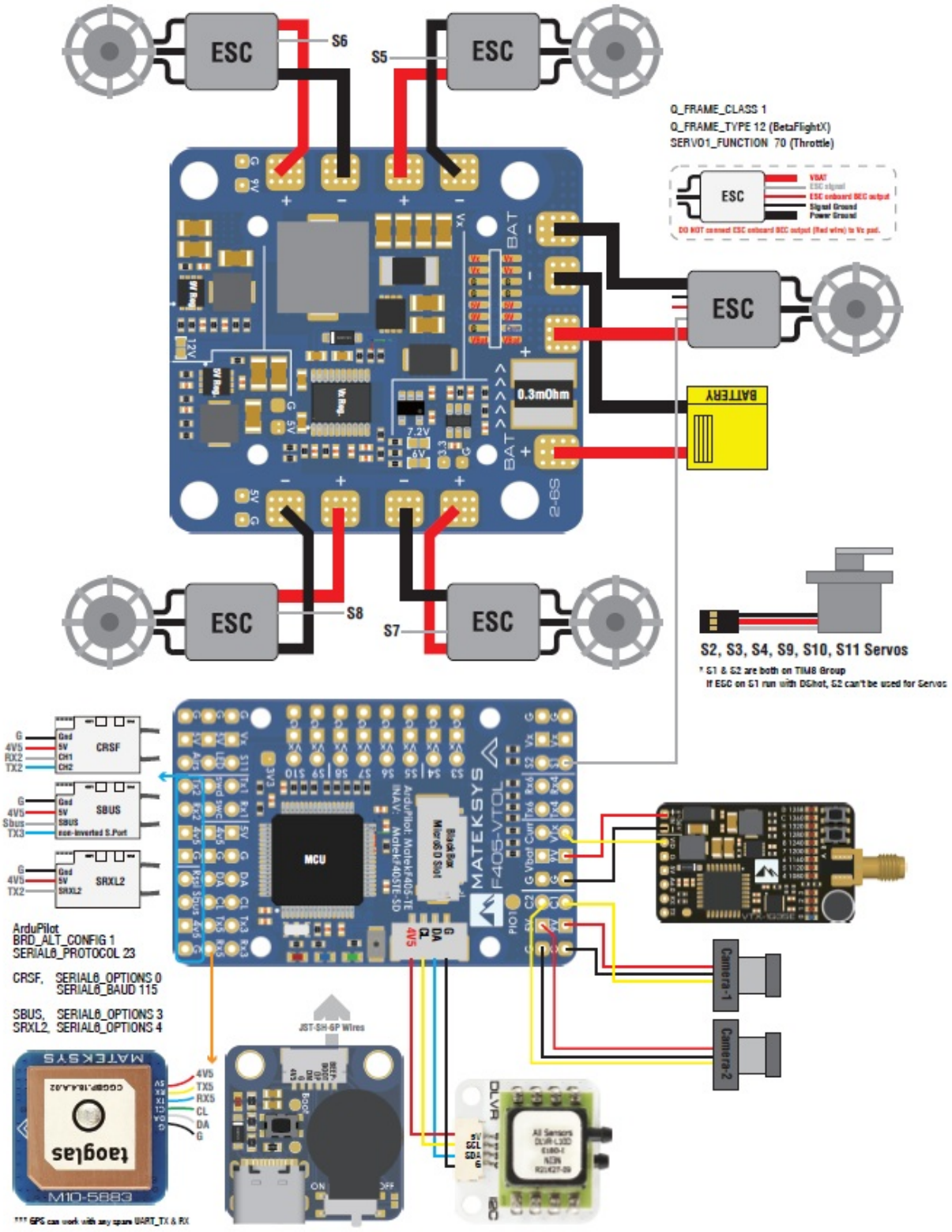
- **Top FC board:** 44x29mm, Holes: 25mm-Φ2mm
- **Bottom PDB:** 45x42mm, Holes: 25mm-Φ2mm, 35mm-Φ4mm
- **Weight:** 25g w/ USB externder

Multirotor ESC



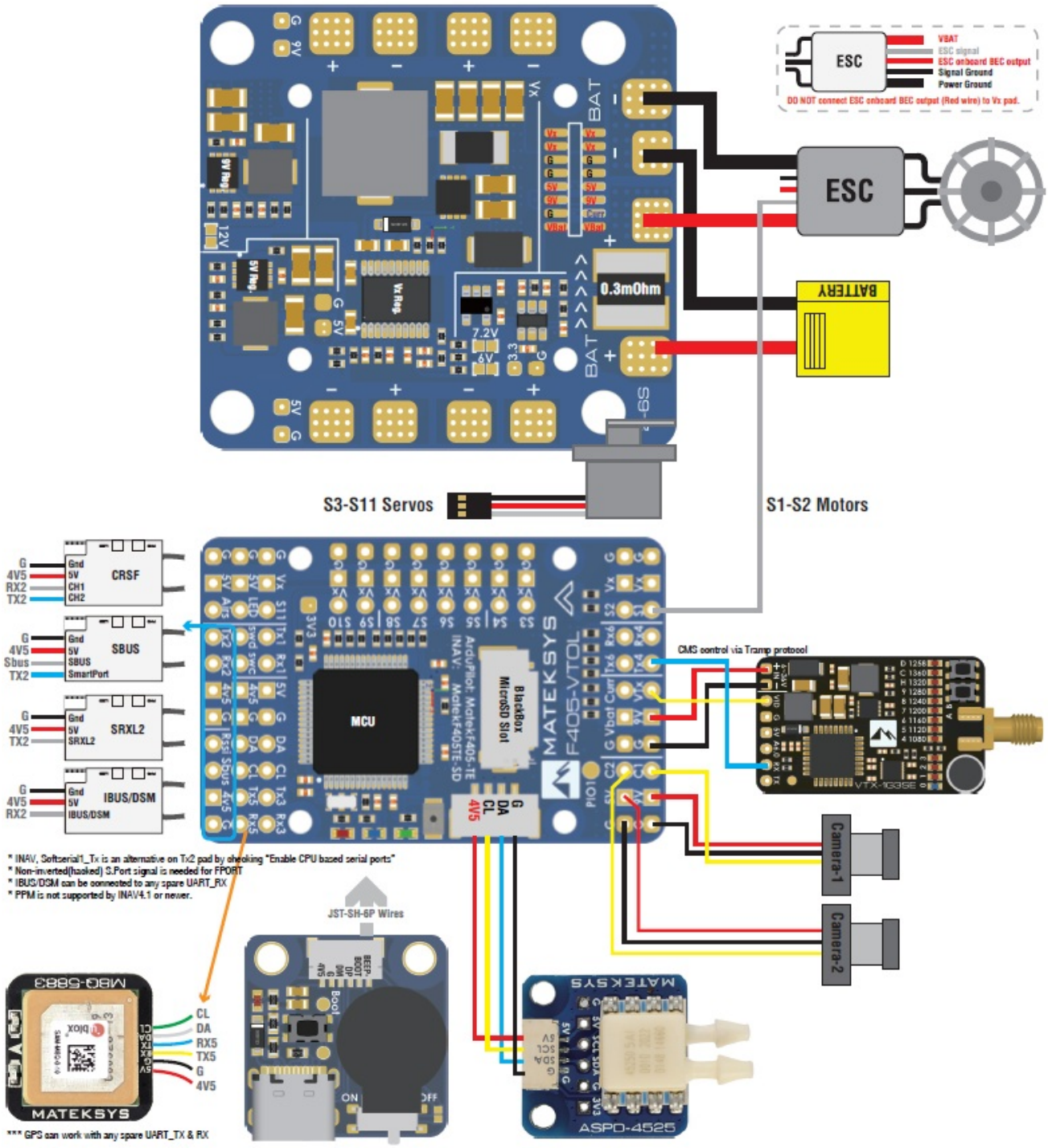
Wiring

ArduPlane fw: MATEKF405-TE

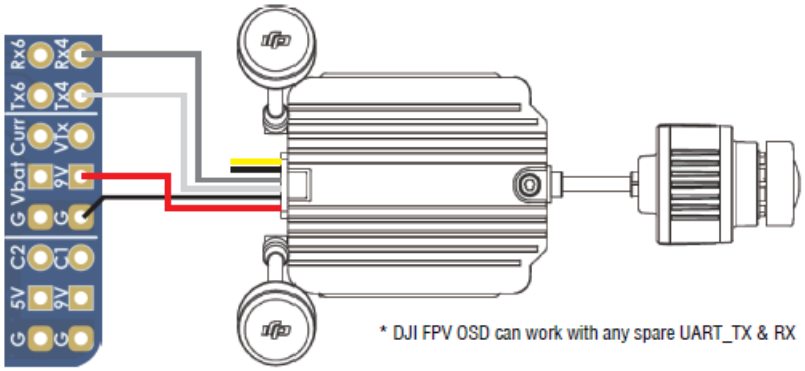


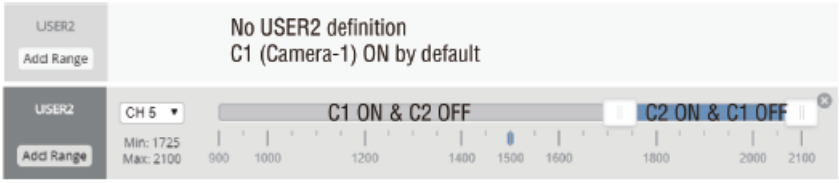
INAV fw: MATEKF405TE_SD

- INAV doesn’t support VTOL, F405-VTOL can be used as a normal fixed-wing flight controller



- DJI FPV OSD can work with any spare UART_TX & RX





I/O Mapping

ArduPilot					
PWM	S1	PWM1 GPIO50	TIM8_CH4	DMA/DShot	Group1
	S2	PWM2 GPIO51	TIM8_CH3	DMA/DShot	
	S3	PWM3 GPIO52	TIM1_CH3N	DMA/DShot	Group2
	S4	PWM4 GPIO53	TIM1_CH1	DMA/DShot	
	S5	PWM5 GPIO54	TIM2_CH4	DMA/DShot	Gourp3
	S6	PWM6 GPIO55	TIM2_CH3	DMA/DShot	
	S7	PWM7 GPIO56	TIM2_CH2	DMA/DShot	
	S8	PWM8 GPIO57	TIM2_CH1	DMA/DShot	

5V tolerant I/O					
	S9	PWM9 GPIO58	TIM12_CH1	NO DMA	Gourp4
	S10	PWM10 GPIO59	TIM13_CH1	NO DMA	Gourp5
	S11	PWM11 GPIO60	TIM4_CH1	NO DMA	Gourp6
	LED pad	PWM12 GPIO61	TIM3_CH4	DMA/DShot	Gourp7
		SERVO12_FUNCTION 120, NTF_LED_TYPES neopixel			

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.

If servo and motor are mixed in same group, make sure this group run lowest PWM frequency according to the servo specification. ie. Servo

supports Max. 50Hz, ESC must run at 50Hz in this group.

ADC	Vbat Pad	1K:20K divider builtin 0~30V	Vbat ADC onboard battery voltage	BATT_VOLT_PIN BATT_VOLT_MULT	14 21.0
	Curr pad	0~3.3V	current sensor ADC onboard current sense	BATT_CURR_PIN BATT_AMP_PERVLT	15 66.7
	RSSI Pad	0~3.3V	RSSI ADC Analog RSSI	RSSI_ANA_PIN RSSI_TYPE	8 2
	AirS /PC0 Pad	no divider built in 0~3.3V	AirS ADC Analog Airspeed	ARSPD_PIN ARSPD_TYPE	10 2
I2C	I2C1	5V tolerant I/O	Compass	COMPASS_AUTODEC	1
			onboard Baro SPL06-001	Address	0x76
			Digital Airspeed I2C MS4525 DLVR-L10D	ARSPD_BUS ARSPD_TYPE ARSPD_TYPE	1 1 9

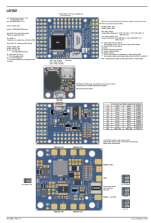
UART 5V toleran t I/O	USB	USB		console	SERIAL0
	TX1 RX1	USART1	with DMA	telem1	SERIAL1
	TX3 RX3	USART3	NO DMA	telem2	SERIAL2
	TX5 RX5	UART5	NO DMA	GPS1	SERIAL3
	TX4 RX4	UART4	NO DMA	GPS2/DJI OSD	SERIAL4
	TX6 RX6	USART6	TX6 with DMA	USER	SERIAL5
	TX2 RX2 S BUS	USART2	with DMA	RC input/Receiver	SERIAL6
		RX2	IBUS/DSM/PPM	BRD_ALT_CONFI G 0 Default	
		Sbus pad	SBUS		
		TX2 & RX2	CRSF		SERIAL6_OPTION S 0
				BRD_ALT_CONFI G 1	

		TX2	uninverted FPort (hacked)	SERIAL6_PROTOCOL 23	SERIAL6_OPTIONS 4
		TX2	SRXL2		SERIAL6_OPTIONS 4

INAV				INAV MultiRotor	INAV Plane
PWM	S1	5 V tolerant I/O	TIM8_CH4	Motor	Motor
	S2	5 V tolerant I/O	TIM8_CH3	Motor	Motor
	S3	5 V tolerant I/O	TIM1_CH3N	Motor	Servo
	S4	5 V tolerant I/O	TIM1_CH1	Motor	Servo
	S5	5 V tolerant I/O	TIM2_CH4	Motor	Servo
	S6	5 V tolerant I/O	TIM2_CH3	Motor	Servo
	S7	5 V tolerant I/O	TIM2_CH2	Motor	Servo
	S8	5 V tolerant I/O	TIM2_CH1	Motor	Servo
	S9	5 V tolerant I/O	TIM12_CH1	Servo	Servo
	S10	5 V tolerant I/O	TIM13_CH1	Servo	Servo
	S11	5 V tolerant I/O	TIM4_CH1	Servo	Servo
	LED	5 V tolerant I/O	TIM3_CH4	2812LED	2812LED
	Vbat Pad	1K:20K divider builtin 0~30V	Vbat ADC ADC_CHANNEL_1	BF scale 210, INAV scale 2100	

ADC	Curr pad	0~3.3V	Current ADC ADC_CHANNEL_2	scale 150
	RSSI Pad	0~3.3V	RSSI ADC ADC_CHANNEL_3	Analog RSSI
	AirS /PC0 Pad	no divider built in 0~3.3V	AirS ADC ADC_CHANNEL_4	Analog Airspeed
I2C	I2C1	5V tolerant I/O	Compass	QMC5883 / HMC5883 / MAG3110 / LIS3MDL
			OLED	0.96″
			onboard Barometer	SPL06-001
			Digital Airspeed sensor	MS4525
			Temperature sensor	
UART 5V tolerant I/O	USB		USB	
	TX1 RX1	5V tolerant I/O	UART1	USER
	TX3 RX3		UART3	USER
	TX4 RX4		UART4	USER
	TX5 RX5		UART5	USER
	TX6 RX6		UART6	USER
	TX2 RX2 SBUS	5V tolerant I/O	UART2	RC input/Receiver
			Sbus pad	for SBUS receiver, Sbus pad = RX2+inverter
			RX2 pad	IBUS/DSM
			TX2 & RX2	CRSF
			TX2 pad	SmartPort Telemetry / enable Softserial_Tx1
			TX2 pad	uninverted FPort (hacked)
			TX2 pad	SRXL2

Documents / Resources

	MATEKSYS F405-VTOL Flight Controller [pdf] Owner's Manual F405-VTOL, Flight Controller, F405-VTOL Flight Controller, Controller

References

- Matek Systems – Advanced Drone Systems