Features

X12 5-IN-1 AIO flight controller built-in 2.4G ELRS V2.0 and OPENVTX
VTX Power up to 400mw
ELRS V2.0 (Default), provide firmware to support ELRS V3.0
EX1103 KV110000 motors
CaddxFPV Ant FPV camera
Smooth and powerful
Compatible for 1S-2S Lipo/LIHV battery
Recommend 2S 450mah/550mah/650mah battery (Not include)

Specifications

Brand Name: Happymodel
Item Name: Mobula8 1-2S 85mm Micro FPV whoop drone
Wheelbase: 85mm
Size: 120mm*120mm*50mm
Weight: 43g

Receiver option

2.4G ELRS SPI(Support ELRS v2.0, provide firmware could compatible with elrs v3.0)
SPI Frsky D8/D16 not compatible with EMAX E6 radio
SPI Flysky AFHDS2A
PNP (without onboard receiver)
TBS version(with external TBS CRSF NANO RX)

Package includes

Item Name	Qty
Mobula8 Frame	1
Option1: X12 ELRS V2.1 flight controller built-in SPI ELRS 2.4G receiver	1
Option2: X12 Frsky V2.1 flight controller built-in SPI Frsky 2.4G receiver	
Option3: X12 Flysky V1.0 flight controller built-in SPI Flysky 2.4G receiver	
Option4: X12 PNP V1.1 flight controller without onboard receiver	
Option5: X12 PNP V1.1 flight controller with TBS CRSF NANO RX	
EX1103 KV11000 brushless motor	4
Gemfan Hurricane 2023 tri-blade propellers(4cw+4ccw)	1
Caddx ANT 1200TVL Camera	1
Onboard 5.8G Openvtx 0mw~400mw VTX	1
Canopy for 14mmx14mm camera	1
Screw driver	1

Bind Procedure

1). Connect Mobula8 1-2S ELRS with computer by Plug USB. Running Betaflight configurator and then move on Receiver tab then hit "Bind Receiver". The Green LED on the flight controller start blinking fast, it means onboard SPI ELRS receiver is in bind mode.
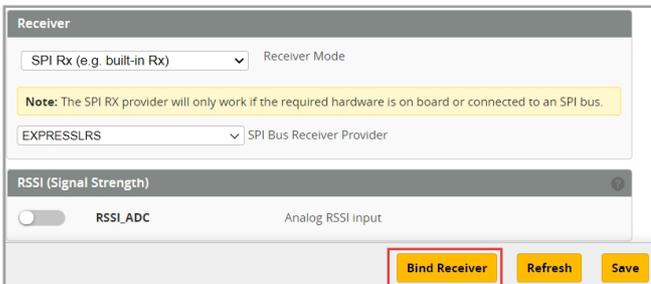
2). Turn on your radio transmitter and running ELRS.LUA v2 version, scroll down the menu and hit [Bind]. The Green LED on the flight controller would get solid first and then start to blinking slowly. It means bind successfully. Re-connect the USB and then you will find link was established.
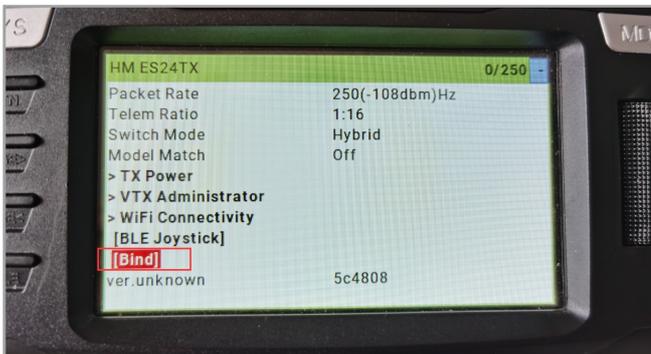
Arm/Disarm the Motor

1)Turn on your radio transmitter and connect the battery to the Mobula8 1-2S ELRS. Then place Mobula8 1-2S ELRS horizontally on the ground.
2)Prepare your goggles, and match the channel with the VTX_table
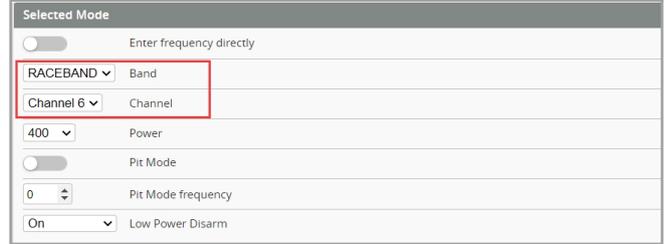
3)The default ARM/DISARM switch was set to "AUX1", usually it's Channel5 of your radio. You can customized a switch for AUX1(Channel5). Then Toggle Aux1 switch to arm the motors, the Red LED at the bottom of the flight controller would get solid once armed, happy flying.
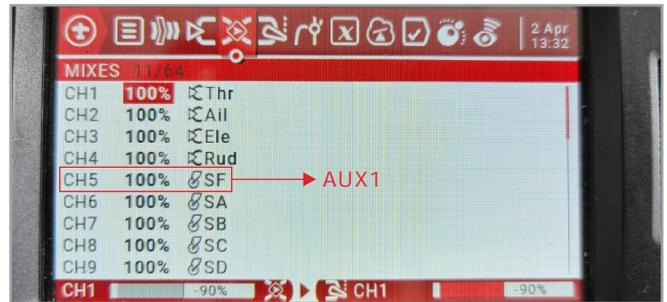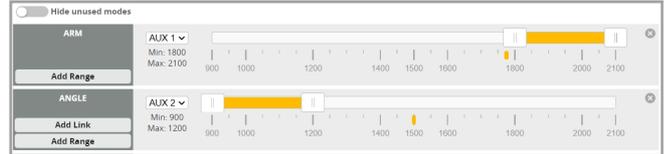
4)Please make sure the MIXES of your radio settings is match the Channel Map of betaflight settings,otherwise it won't be able to armed. The default channel map is "TAER1234", you can also set it to "AETR1234" if necessary.
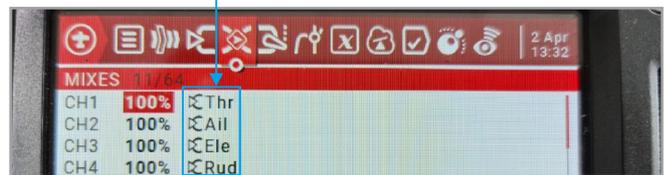
Flight controller connection diagram
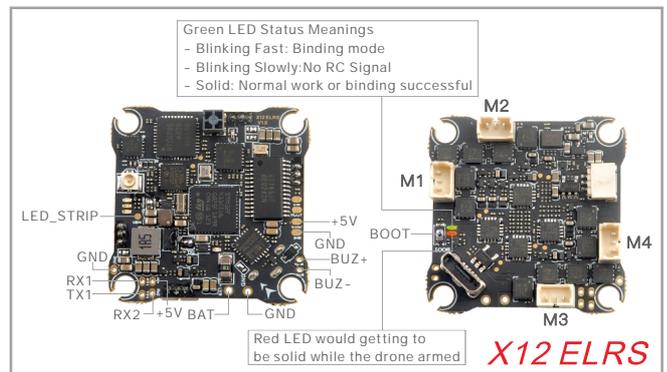
*RX1/TX1/+5V/GND pads could be used for External Serial Based RX like TBS Tracer or CRSF Nano
*Only Enabled Serial RX for UART1 when use external Serial Based RX and choose correct receiver provider based on your receiver description.

Voltage and Currents meter settings

Voltage Meter

		110	Scale
Battery	0.6 V	10	Divider Value
		1	Multiplier Value

Amperage Meter

Battery	0.00 A	470	Scale [1/10th mV/A]
		0	Offset [mA]

Default PID and Filter Settings

	Proportional	Integral	D Max	Derivative	Feedforward
Basic/Acro					
ROLL	53	95	46	43	143
PITCH	56	100	52	48	149
YAW	53	95	0	0	143

Mode:	RPY ▾	Low	Default	High	
Damping: D Gains	1.2				
Tracking: P & I Gains	1				
Stick Response: FF Gains	1				
Dynamic Damping: D Max	0.2				
Drift - Wobble: I Gains	1				
Pitch Damping: Pitch:Roll D	1				
Pitch Tracking: Pitch:Roll P, I & FF	1				
Master Multiplier:	1.2				

	More Filtering	Default Filtering	Less Filtering	
Gyro Filter Multiplier:	1			
D Term Filter Multiplier:	1			

Profile independent Filter Settings — ON

Gyro Lowpass Filters
- Gyro Lowpass 1 — DYNAMIC Mode
  - 250 Min Cutoff Frequency [Hz]
  - 500 Max Cutoff Frequency [Hz]
  - PT1 Filter Type
- Gyro Lowpass 2
  - 500 Static Cutoff Frequency [Hz]
  - PT1 Filter Type

Gyro Notch Filters
- Gyro Notch Filter 1
- Gyro Notch Filter 2

Gyro RPM Filter
- Gyro RPM Filter
  - 3 Gyro RPM Filter Harmonics Number
  - 200 Gyro RPM Filter Min Frequency [Hz]

Dynamic Notch Filter
- Dynamic Notch Filter
  - 3 Notch Count
  - 500 Q factor
  - 150 Min Frequency [Hz]
  - 600 Max Frequency [Hz]

Profile dependent Filter Settings — ON

D Term Lowpass Filters
- D Term Lowpass 1 — DYNAMIC Mode
  - 75 Min Cutoff Frequency [Hz]
  - 150 Max Cutoff Frequency [Hz]
  - 5 Dynamic Curve Expo
  - PT1 Filter Type
- D Term Lowpass 2
  - 150 Static Cutoff Frequency [Hz]
  - PT1 Filter Type

D Term Notch Filter
- D Term Notch Filter

Yaw Lowpass Filter
- Yaw Lowpass Filter
  - 100 Static Cutoff Frequency [Hz]

Board and sensor alignment and frequency settings

Board and Sensor Alignment

0 Roll Degrees	0 Pitch Degrees	0 Yaw Degrees	
First GYRO/ACCEL	CW 90° First GYRO		
Default MAG Alignment			

8.00 kHz — Gyro update frequency

2.00 kHz — PID loop frequency — Recommend 2.00kHz for a better and stable experience.

Motors and ESC settings

Mixer

Quad X

PROP OUT :Mount 2023 propeller on #1 and 4# motors, Mount 2023R propeller on #2 and 3# motors

Motor direction is reversed

ESC/Motor Features

DSHOT300 ▾	ESC/Motor protocol	
⬜ MOTOR_STOP	Don't spin the motors when armed	
⬜ ESC_SENSOR	Use KISS/BLHeli_32 ESC telemetry **over a separate wire**	
⬜ Bidirectional DShot	(requires supported ESC firmware)	
10	Motor Idle (%, static)	

Blujay ESC settings

Common Parameters

1100		Minimum Startup Power (Boost)
1200		Maximum Startup Power (Protection)
140 C	Temperature Protection	
22.5° (MediumHigh)	Motor Timing	
Low	Demag Compensation	
9x	RPM Power Protection (Rampup)	

When using Bluejay ESC firmware , the startup power should set like the picture shows.

VTX Bands and Channels setup

Frequency and channel frequency table:

FR \ CH	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8
BOSCAM_A	5865M	5845M	5825M	5805M	5785M	5765M	5745M	5725M
BOSCAM_B	5733M	5752M	5771M	5790M	5809M	5828M	5847M	5866M
BOSCAM_E	5705M	5685M	5665M	5645M	5885M	5905M	5925M	5945M
FATSHARK	5740M	5760M	5780M	5800M	5820M	5840M	5860M	5880M
RACEBAND	5658M	5695M	5732M	5769M	5806M	5843M	5880M	5917M
LOWRACE	5333M	5373M	5413M	5453M	5493M	5533M	5573M	5613M

There are 2 ways to switch the vtx channels:

Identifier	Configuration/MSP	Serial Rx	Telemetry Output	Sensor Input	Peripherals
USB VCP	115200		Disabled AUTO	Disabled AUTO	Disabled AUTO
UART1	115200		Disabled AUTO	Disabled AUTO	Disabled AUTO
UART2	115200		Disabled AUTO	Disabled AUTO	TBS SmartAuc AUTO
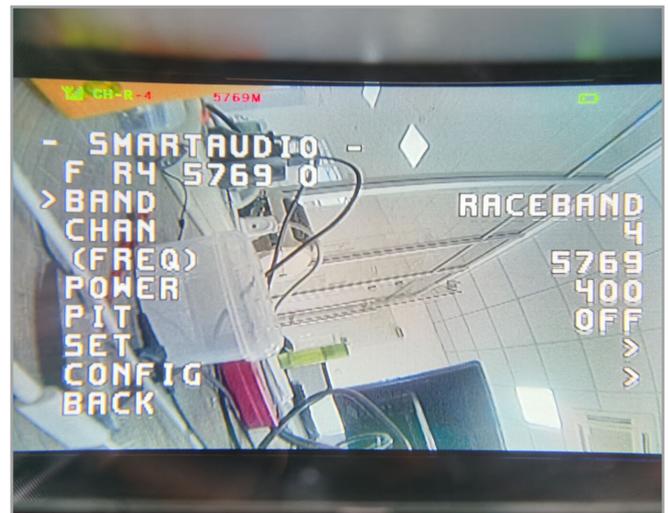
1. Plug USB to Mobula8 1~2S ELRS then we should Go to Betaflight CLI type the command
Set vtx_band=5
Set vtx_channel=4
save
This command will change the vtx channel to 5769
2.Disarm the Mobula8 1~2S ELRS and then move the stick of the transmitter THR MID YAW LEFT PITCH UP to enter OSD Menu Enter to Features then enter to VTX SA to set VTX Band and channel

Flight controller firmware update

1.Install latest STM32 Virtual COM Port Driver
http://www.st.com/web/en/catalog/tools/PF257938
2.Install STM BOOTLOAD Driver (STM Device in DFU MODE)
3.Open Betaflight configurator and choose firmware target "CRAZYBEEF4SX1280", then select the firmware version.
4.There are 2 ways to get in DFU Mode: 1). solder the boot pad and then plug USB to computer 2).loading betaflight firmware and hit "flash", then it will getting into DFU Mode automatically.
5.Open Zadig tools to replace the drivers from STM32 Bootloader to WINUSB Driver.
6.Reconnect the flight controller to the computer after replace driver done , and open Betaflight Configurator, loading firmware and flash.
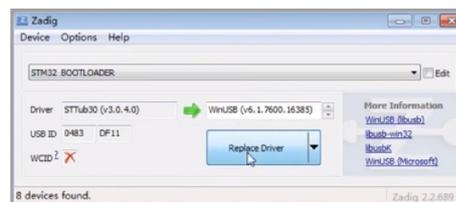
Firmware and diff download