JBARDWELL F7 V2

FLIGHT CONTROLLER

Pilot's Manual

V1.0

For Hardware Revision 1.0

RACEDAYQUADS / JBARDWELL F7 V2

The new JBF7 V2 takes everything great about the original JBF7 and adds a few key features that you asked for. Just like the original, it's got an F7 processor, SD card slot for blackbox logging, and 8 motor outputs. It's got a flexible pad layout that can handle almost any combination of peripherals you could want. Pads are large and heavy--easy for beginners to solder to and reducing the risk of lifted pads. With the new JBF7 V2, we switched to USB-C; we added a vTX pit switch; and we added plugs for all of the major features, and we included pre-made plugs for common peripherals, to allow a no-solder or less-solder build for people using those peripherals. We also added small status LEDs for major components, to make troubleshooting easier. For those who like autonomous flight, the board now includes a barometer.

Input Voltage:	3S to 6S
Processor:	STM32F722
Gyro:	Bosch BMI270
Power Outputs:	5v
	3.3v
	9v
	vBat
Form Factor:	30.5mm square
Betaflight Target:	JBF7V2I
UARTs:	5
Interfaces	4-in-1 ESC plug
	DJI Air Unit plug
	Cam plug
	Receiver plug
	vTX plug
	LED/Buzzer plug

Manual written, and feature set selected by Joshua Bardwell.

Board layout focuses on flexibility and resilience. You can build what you want, how you want, without stress.

4-in-1 plug also has solder pads for those who want to direct-solder.

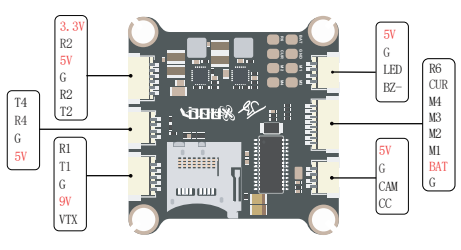
Plug-and-play support for DJI Air Unit. Voltage regulator allows up to 6S input.

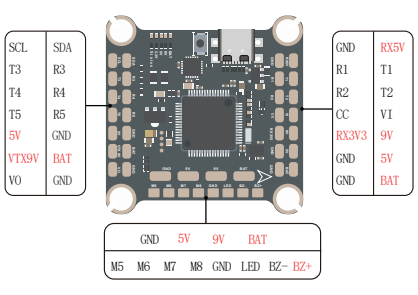
8 motor pads allow for easy resource remapping (or build an octocopter).

SD card for blackbox logging.

Status LEDs for major components

RaceDayQuads JB F7 V2 Wiring Diagram

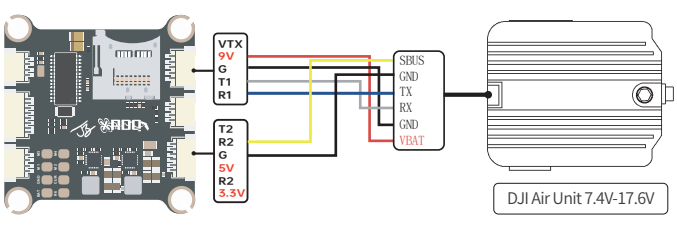


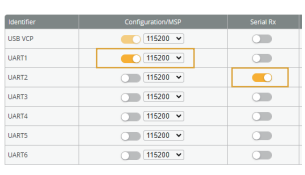


DJI Digital Transmitters

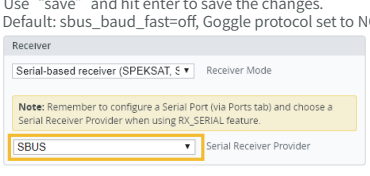
Firmware: JBF7_V2

FC plug&play port and setup compatible to DJI Air Unit and Caddx Vista



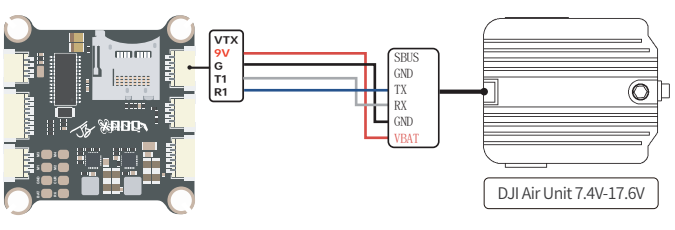


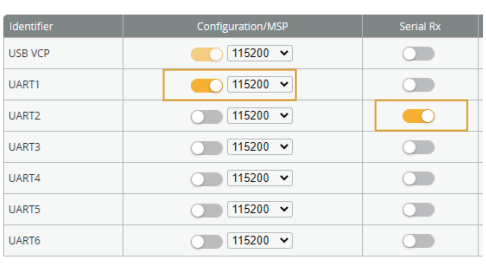
Please check your protocols, otherwise your DJI Radio won't input signals!
DJI Goggle protocol and Betaflight protocol has to match!
For lower signal latency use the SBUS_BAUD_FAST protocol option on both ends.
For Betaflight Copy\Paste "set sbus_baud_fast=on" into your Betaflight Configurator CLI then hit enter.
Use "save" and hit enter to save the changes.
Default: sbus_baud_fast=off, Goggle protocol set to NORMAL

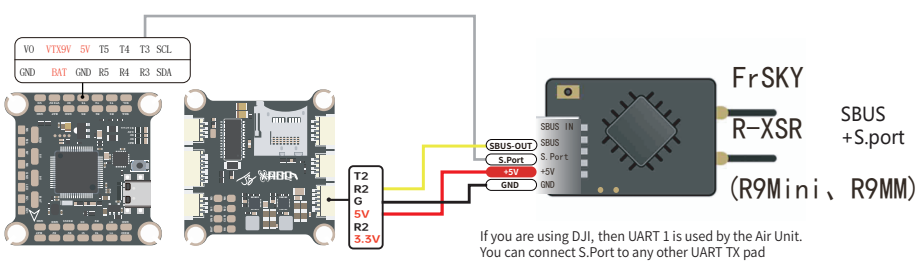


UART1 MSP: OSD passthrough

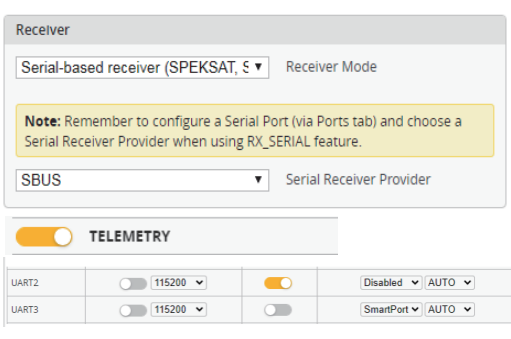
Any other Receiver



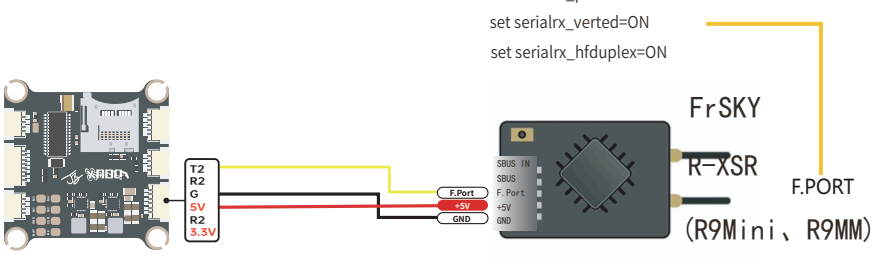


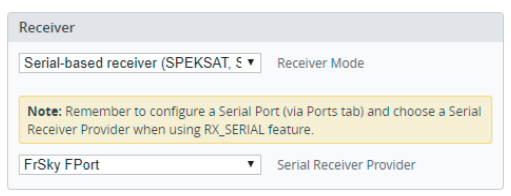


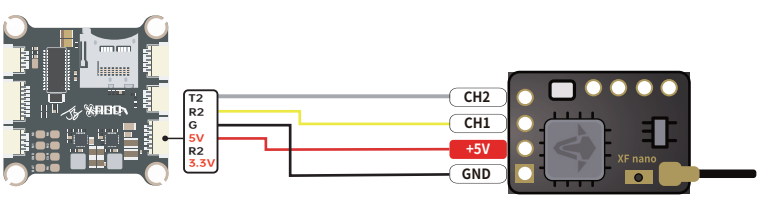
If you are using DJI, then UART 1 is used by the Air Unit.
You can connect S.Port to any other UART TX pad

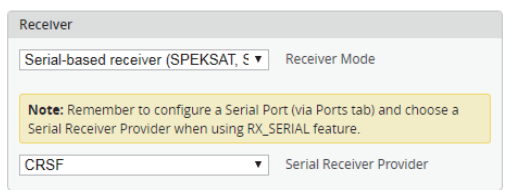


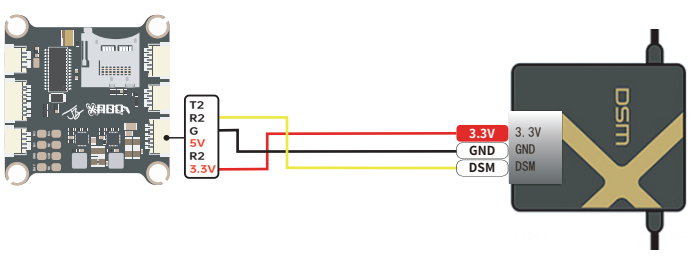
set serialrx_provider=FPORT
set serialrx_verted=ON
set serialrx_hfduplex=ON

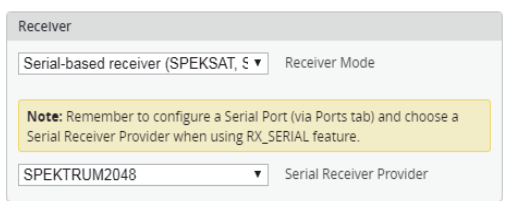


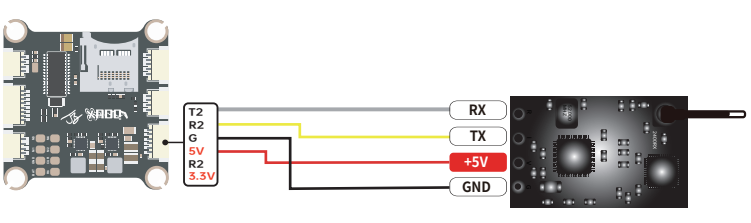


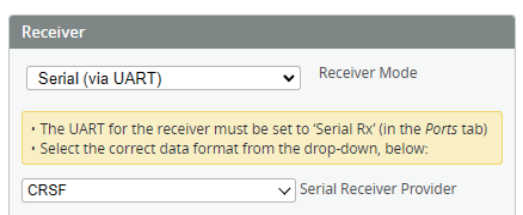


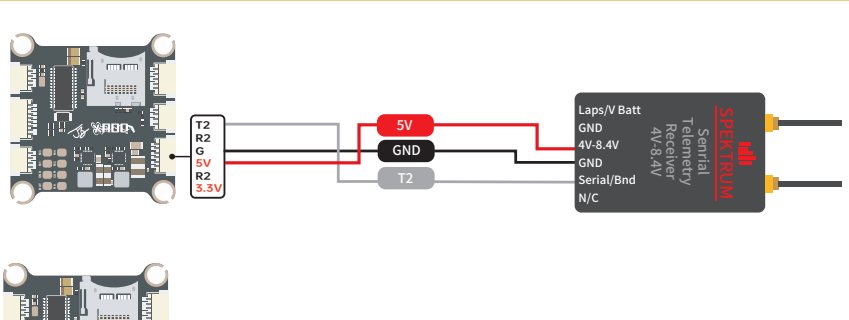


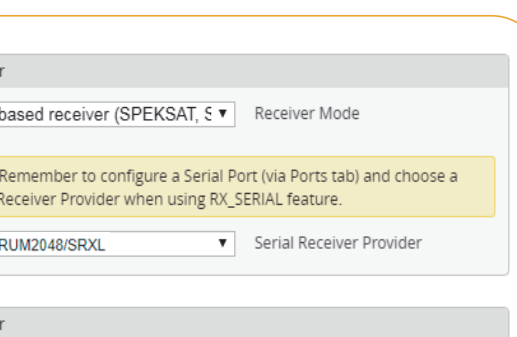


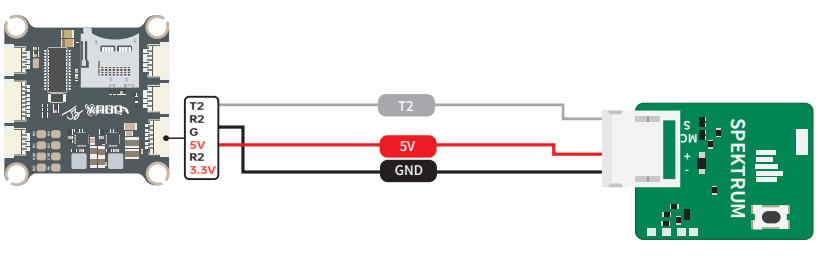


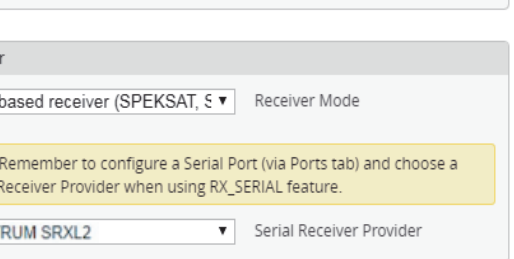












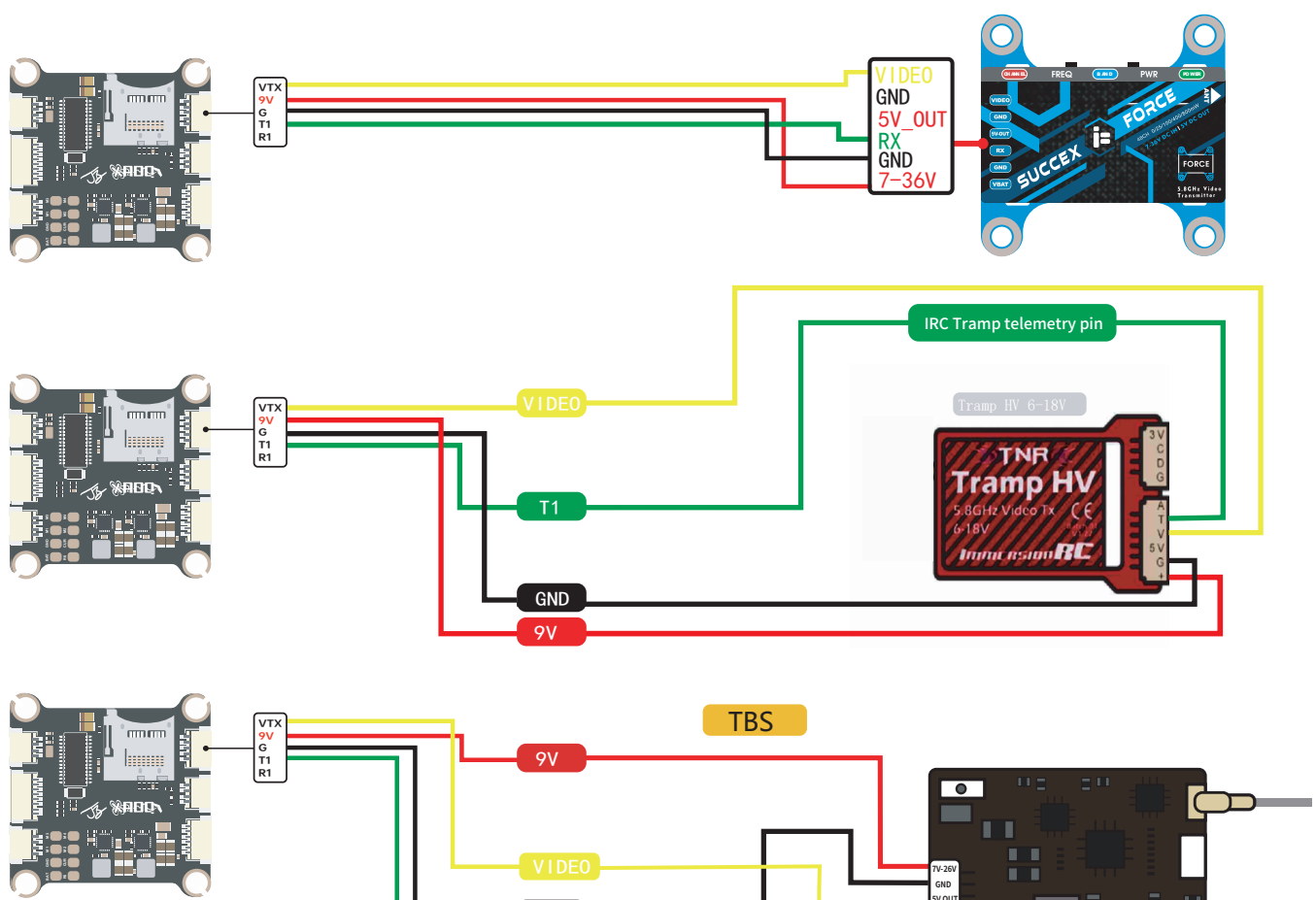
VTX

The video transmitters shown here are all powered from battery voltage. Some VTX will have cleaner video if powered from the 9v pad. If you have video noise, then moving the VTX power from BAT to 9v may help. In addition, a few vTX (most notably the TBS Unify Pro) can only be powered from 5v. Always check your VTX input voltage rating!

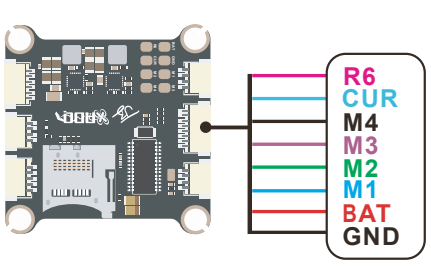
The 9V power output on the solder pad as well as the plug have an additional VTX switch feature which can be accessed with the "User1" custom setting in the Betaflight Modes tab. Setup your radio AUX channel to toggle your VTX power ON and OFF.

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	
UART3	115200		Disabled AUTO	Disabled AUTO	
UART4	115200		Disabled AUTO	GPS 115200	
UART5	115200		Disabled AUTO	Disabled AUTO	Disabled AUTO
UART6	115200		Disabled AUTO	ESC AUTO	Disabled AUTO

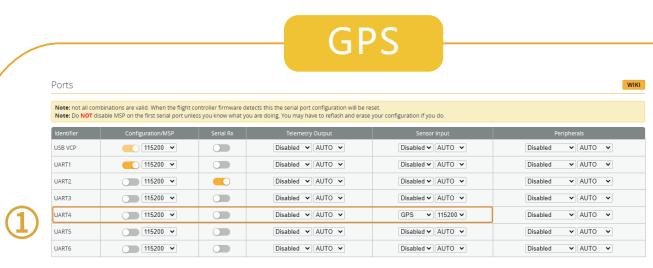
Disabled
Blackbox logging
VTX (TBS SmartAudio)
VTX (IRC Tramp)
Camera (RunCam Protocol)
Benewake LIDAR
OSD (FrSky Protocol)

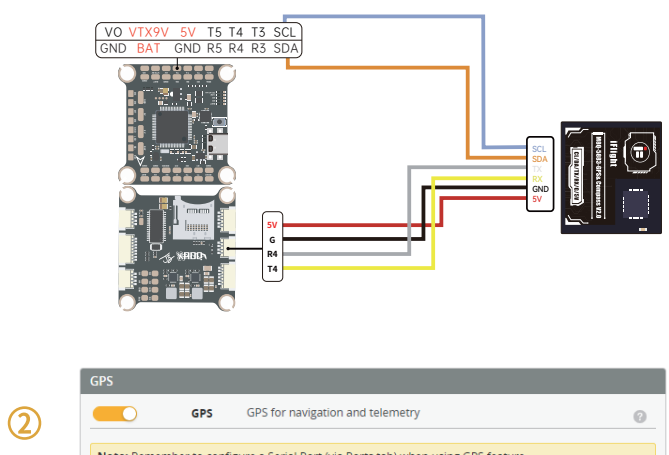


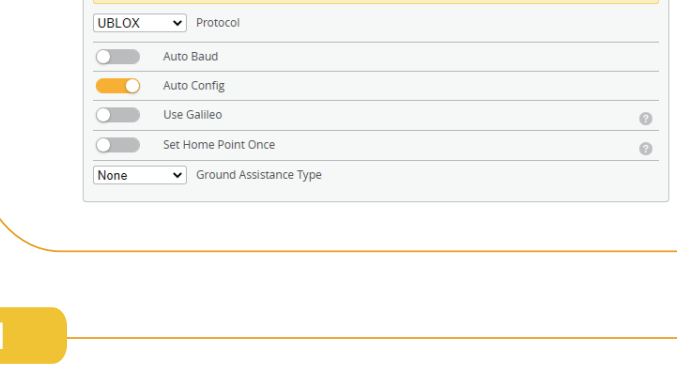
ESC



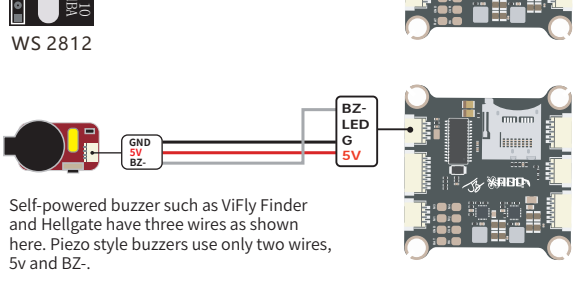
GPS



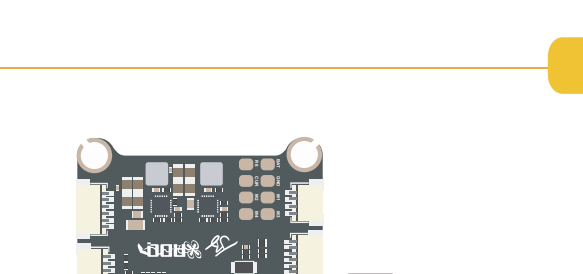




LED/BUZZER

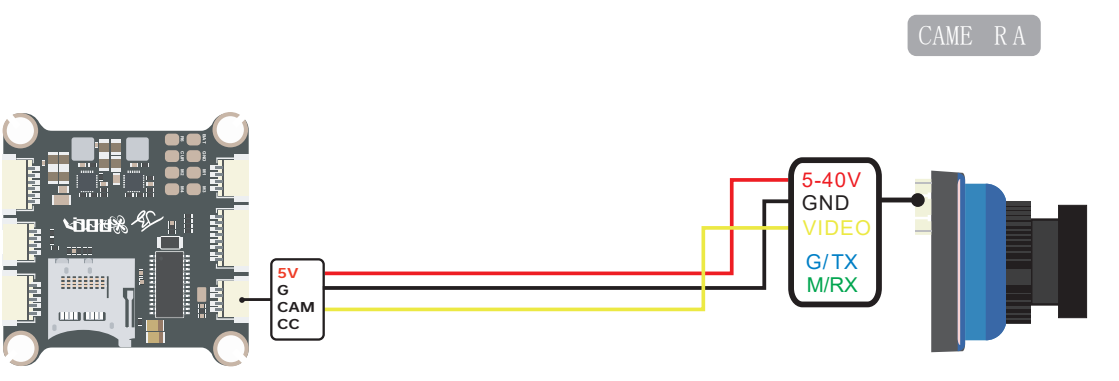


WS 2812



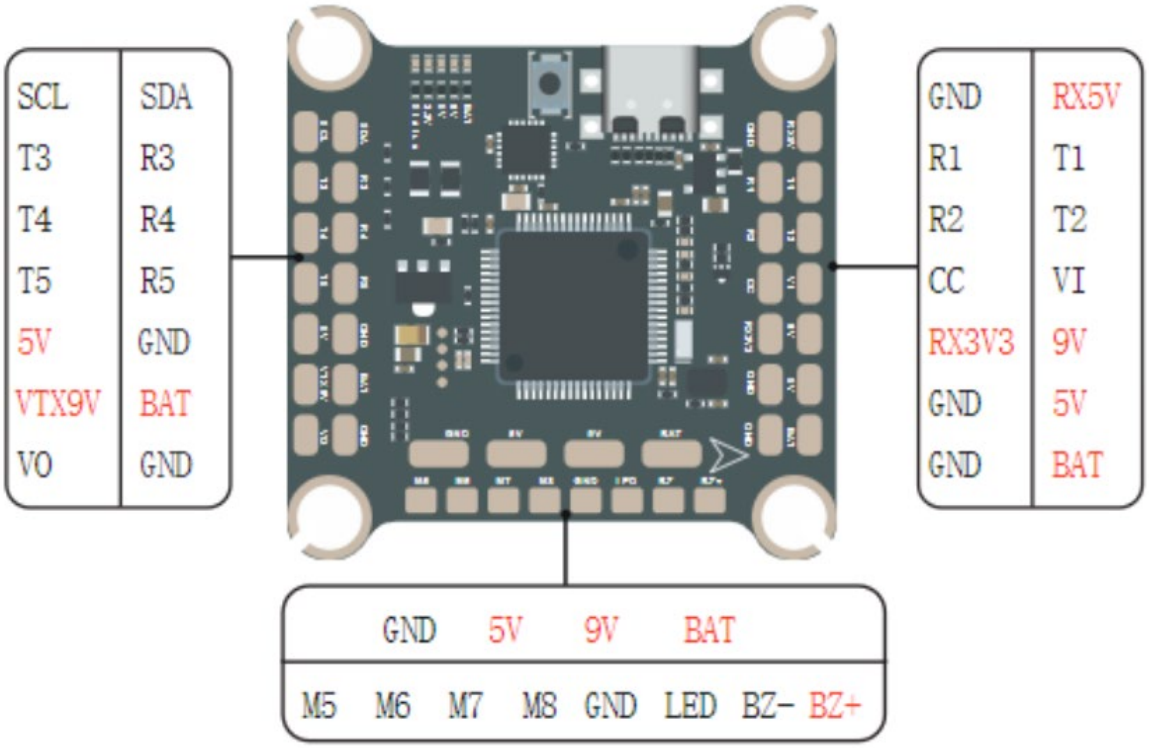
Self-powered buzzer such as ViFly Finder and Hellgate have three wires as shown here. Piezo style buzzers use only two wires, 5v and BZ-.

CAM



BOARD LAYOUT QUICK-REFERENCE

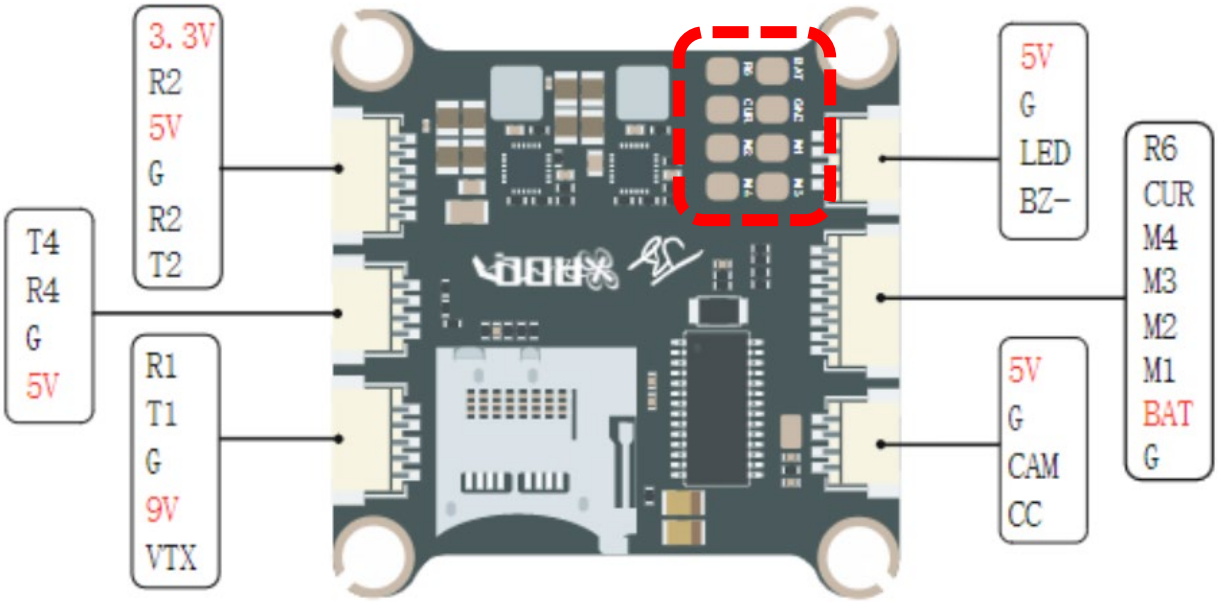
The table below shows the intended purpose of each of the pads on the board. Detailed instructions for wiring up the board are later in the manual.



TOP OF BOARD

RX 5v RX 3V3	5v or 3.3v output for receiver power. This output is active when plugged in to USB. Allows configuring receiver functions without plugging in battery.
GND	Ground
T1 / R1 T2 / R2	UART1 and UART2 connection. Intended for use with receiver and/or Runcam digital camera control. **NOTE: Some receivers will force the board into bootloader mode when on UART 1. If this happens, put the receiver on UART 2, or use a regular 5v pad (not RX5V) so the receiver does not power up from USB.**
VI	Video Input. Video wire from camera.
CC	FPV Camera OSD Menu Remote Control function. Connect to camera OSD input pin. (If Runcam digital camera control is supported by the camera, this is preferred to CC function.)
9v, 5v, BAT, BAT+	9v, 5v, or battery voltage output.
VTX9V	9v output for vTX. Switchable on and off via User1 aux mode in Modes tab.
SDA/SCL	I2C interface pads most commonly for use with compass/magnetometer in GPS unit. **NOTE: You cannot use UART 3 if you use I2C.**
R3/T3	UART3 connection.
R4/T4	UART4 connection/
R5/T5	UART5 connection. Suggested for use with video transmitter remote control (SmartAudio) due to proximity to vTX pads.

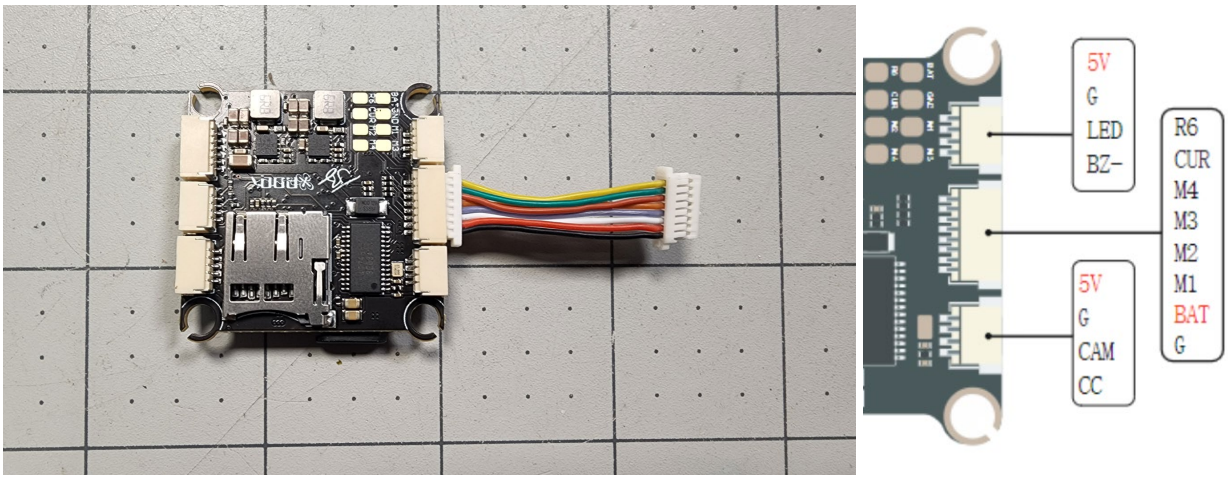
VO	Video output. Video wire to video transmitter.
LED	Programmable LED output pin. Usable with Betaflight LEDStrip feature.
BZ-	Negative leg of piezo buzzer.
BZ+	Positive leg of piezo buzzer. This pad can also be used as a generic 5v output if need be.
VO	Video out to FPV video transmitter.
M5, M6, M7, M8	Motor outputs 5-8. Can be used as spare outputs if a pad lifts, or can be reassigned to different resources, such as servo outputs, if needed. Or you can build a hexacopter or an octocopter if you want.



BOTTOM OF BOARD SOLDER PADS

BAT	Battery voltage input from ESC.
G	Ground
R6	UART6 RX, used for ESC Telemetry from ESC
CUR	Analog current sense input from ESC
M1, M2, M3, M4	Motor outputs 1-4.

4-IN-1 ESC PLUG



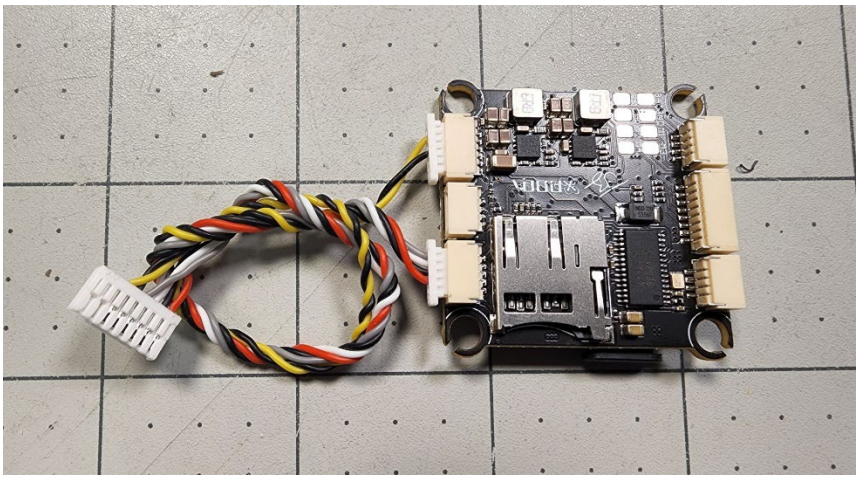
The 4-in-1 plug makes connecting the JBF7 to a 4-in-1 ESC easy. The plug contains connections for power, ground, motor signal 1-4, and analog current sensing or ESC telemetry.

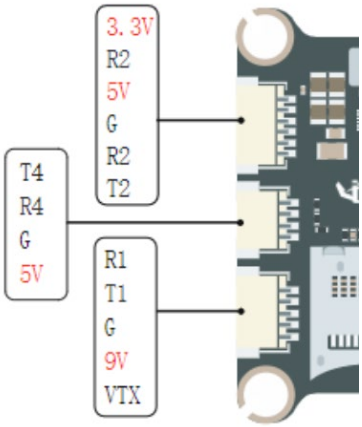
Since there is no universal standard for 4-in-1 ESC plugs, you cannot simply plug your ESC into the JBF7 and assume that everything will work. In fact, you might fry your ESC and/or the JBF7 if you did this! The plug on the JBF7 has been designed to be directly compatible with recent iFlight ESCs, however even if you are using one of these ESCs, **you should manually verify that the pinout is compatible before you plug in the ESC**. Damaging the JBF7 or your ESC by plugging in incompatible ones will not be covered under warranty.

If you need to make your own custom wire harness to connect your ESC to the JBF7, RaceDayQauds sells a pre-crimped wire header set that is perfect. It can be purchased here: https://www.racedayquads.com/products/sh-1-0-silicone-cable-set

The 4-in-1 plug has solder pads next to it in case you damage the socket or if you prefer to direct-solder the wires to the FC.

DJI AIR UNIT / HDZERO VTX PLUG



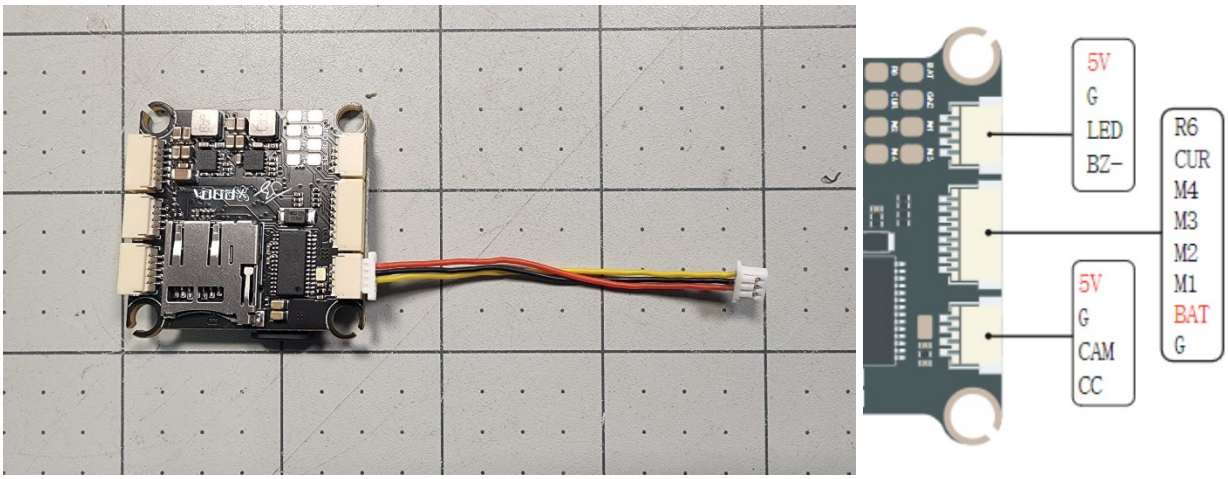


This plug allows easy connection of a DJI Air Unit,Caddx Vista, or HDZero video transmitter. The plug is pre-terminated with locking connector for DJI Air Unit. If used with any other vTX, it may be necessary to cut off the locking connector and direct-solder to the vTX.

On the FC side, the red and black wires give 9v power. The white and gray wires connect to UART 1 for MSP connection. If using the DJI Controller, the yellow and black wires connect to UART 2 for SBUS receiver connection. If not using the DJI controller, these wires can be omitted.

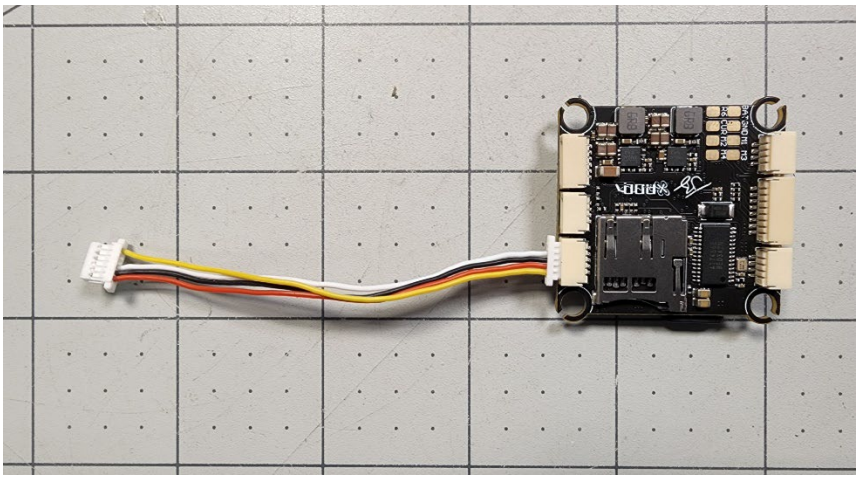
For HDZero vTX that support SmartAudio, there is no pre-made plug. The recommended approach would be to move the yellow wire from the R2 position to the T2 position in that plug and use UART 2 for SmartAudio. In this case, the black wire in that plug could be omitted.

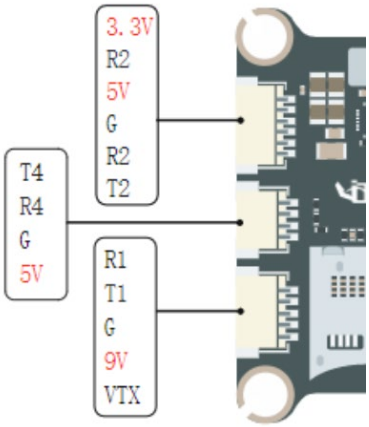
ANALOG CAMERA PLUG



Connect an analog camera using this plug. This plug provides 5v power, which should work for most cameras that would be used with this FC. The FC side of the plug contains a fourth pin for CC function (documented above). The plug does not contain a wire for this function though. You will need to remove the wire from the camera's joystick plug and insert it into this plug to use the CC function.

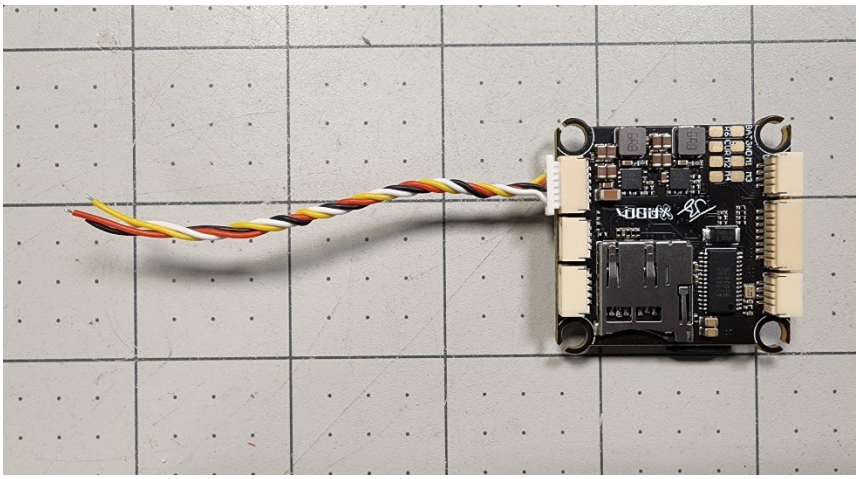
ANALOG VIDEO TRANSMITTER PLUG

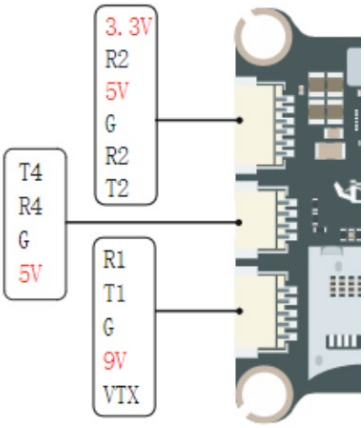




This plug contains 9v power, ground, and analog video input for an analog video transmitter. It also has a wire for UART 1 TX, which can be used for SmartAudio. Please note that the provided cable is not pinned-out the same from end to end. One end goes into the FC; the other end is for the video transmitter. Most vTX will not match the provided plug, and will need to either re-do the plug's pin order or cut off the plug and direct-solder to the vTX.

RECEIVER PLUG

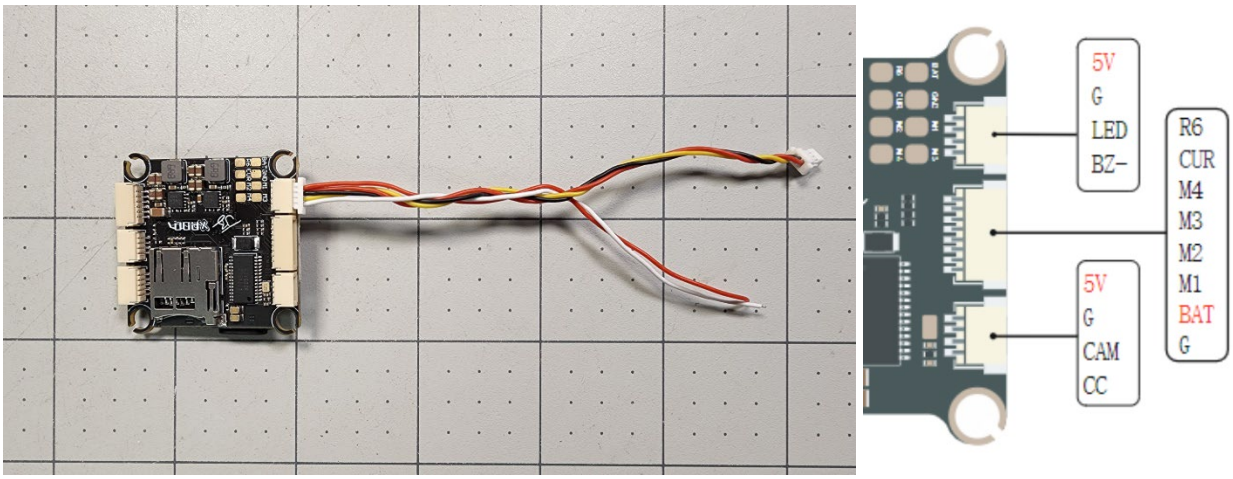




This plug is for connecting your serial receiver. The exact pins that will be used depend on the type of receiver used. The provided wire harness contains 5v, G, and UART 2 TX and RX, which can be used for most receivers.

For some reason, the R2 pin is in this plug twice. None of the FC wiring diagrams show it being used. I have no idea why it's there, and I could ask, but I think it's funnier not to ask and just leave this paragraph here.

LEDSTRIP AND BUZZER PLUG



This plug can be used to connect programmable LED strips and a piezo buzzer. The bare red and white wires are 5v (Buzzer+) and Buzzer-. They can be soldered directly to your buzzer pins. The other three wires are 5v, G, and LEDSTRIP, which can be connected to the DIN pad on your programmable LED.

SOLDERING

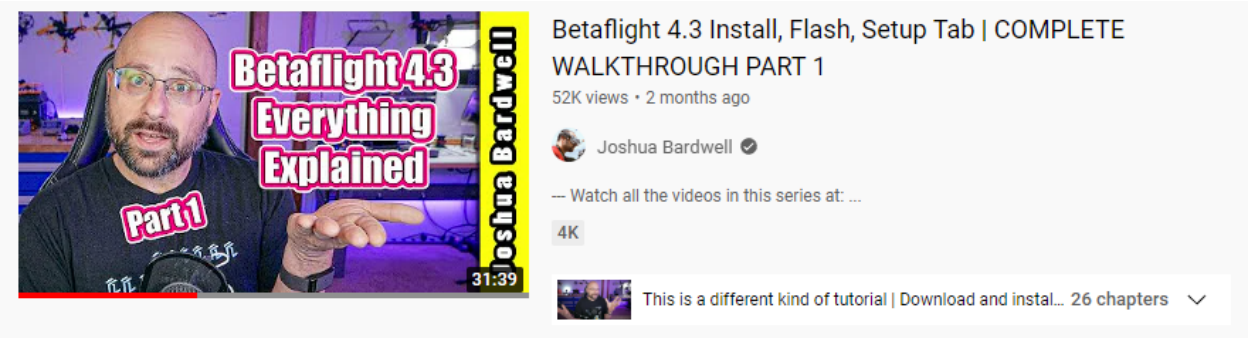
There's an uncomfortable truth in this hobby: a whole lot of us are much better with a transmitter than we are with a soldering iron. We have designed the JBF7 to be resilient, but any board can be damaged if it is soldered on incorrectly. Before you take a soldering iron to your board, here are some tips to help make sure you're not making a call to support, trying to convince them you, "have no idea how that pad lifted off I barely touched it with the iron and it just came off!"

I've made a soldering tutorial that most FPV pilots could probably benefit from watching. The link is:

https://youtu.be/GoPT69y98pY

INSTALLING BETAFLIGHT FIRMWARE

This flight controller has Betaflight firmware on it. To configure the FC, you'll need to install Betaflight Configurator. And eventually, you'll want to flash new firmware to your FC. The video below is the beginning of my *Complete Betaflight 4.3 Walkthrough*, and shows how to download and install Betaflight Configurator.



https://youtu.be/LkBWRiEGKTI

GLOSSARY OF TERMS

Flight Controller (FC) – The "brain" of the quadcopter. It takes commands from the pilot to know what the quadcopter should be doing. It reads data from sensors like the gyro and accelerometer to know what the quadcopter is doing. Then it sends commands to the ESCs and motors to make the quadcopter do what it should be doing. Modern flight controllers often have many non-flight-related functions built in, such as On-Screen Display (OSD).

Gyro – Short for gyroscope. A sensor that detects rotation.

Accelerometer – A sensor that detects acceleration. Often shortened to just "acc". Since gravity manifests as a downwards acceleration, the accelerometer is the main sensor that can tell whether the quad is right-side up or not. The accelerometer is required for autolevel flight modes.

Receiver – Receives RF signals from the transmitter. Translates them into a protocol that the FC can understand and forwards them to the FC.

SBUS, iBus, SpekSat – These are all protocols that different receivers use to communicate the pilot's commands to the FC. SBUS is used by FrSky devices primarily. iBus is used by FlySky devices. SpekSat is used by Spektrum satellite receivers. FrSky, FlySky, and Spektrum are three different brands or families of transmitter and receiver.

Transmitter – Takes control inputs from the pilot via sticks, switches, and so forth. Converts those control inputs to RF signals and transmits them to the receiver.

Telemetry – Allows the receiver to send data about the aircraft back to the transmitter, instead of only receiving commands from the transmitter. Example telemetry data might include battery voltage, battery capacity consumed, motor temperature and RPM, GPS coordinates, and so forth. When the receiver and transmitter support telemetry, it is possible to configure alarms on the transmitter, so that the pilot can know about the aircraft's status (e.g. "battery is low!") and respond to it (e.g. "land now!"). Most RC control systems support telemetry today, however not all receivers within a system support it.

ESC – Short for Electronic Speed Controller. Its function is to make the motors spin. Each motor requires its own ESC. The ESC receives throttle position commands from the FC and makes the motors speed up or slow down to match the commanded throttle position. ESCs may or may not support "ESC telemetry", a feature where the ESC can send data about the motor to the FC.

UART – A serial interface on the FC that is used to communicate with peripheral devices such as the receiver.

vTX (Video Transmitter) – Receivers video signal from the FPV camera and transmits it wirelessly into the air.

vTX Remote Control (SmartAudio, **Tramp Telemetry)** – Allows the FC to change the channel, transmit power, and other settings on the vTX, without the pilot having to touch the vTX directly. This allows the pilot to configure the vTX indirectly, such as through the OSD or the transmitter. SmartAudio and Tramp Telemetry are two different protocols that the FC can use to talk to the vTX. Which one you use will depend on which vTX you have purchased.

OSD – Short for "On Screen Display". Displays important data about the aircraft directly on top of the FPV feed, for the pilot to view in the goggles. OSD is built into most modern flight controllers. The data communicated by the OSD overlaps with that communicated by telemetry, although OSD may provide additional visual information that telemetry does not (e.g. artificial horizon).

FPV Camera – A camera, typically very small, mounted to the front of the quad. Sends a picture to the vTX so that the pilot can see in their goggles what the quad is doing. The JBF7 supports the FPV Camera OSD Menu Remote Control feature, which allows the pilot to adjust the camera's menu settings via the transmitter sticks, without plugging a joystick into the back of the camera.

LED, Programmable – One or more LEDs that can be commanded to change brightness and color by communicating over a digital serial interface. The JBF7 can communicate with programmable LEDs to customize their appearance in response to quadcopter movement, battery status, and other conditions.